ENERGY EFFICIENCY IN LATIN AMERICA AND THE CARIBBEAN: SITUATION AND OUTLOOK





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Project Document

Energy efficiency in Latin America and the Caribbean: situation and outlook











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Contents

Executive Summary 11
Introduction 15
I. Argentina 17
A. Recent advances in policy, regulatory and institutional frameworks 17
B. Key actors in energy efficiency and their effective roles 20
C. Resources and funding mechanisms for energy efficiency programmes 23
D. Results of energy efficiency programmes to date 25
E. Lessons learned 34
II. Barbados 35
A. Recent advances in policy, regulatory and institutional frameworks 35
B. Key actors in energy efficiency and their effective roles 36
C. Resources and funding mechanisms for energy efficiency programmes 39
D. Results of energy efficiency programmes to date 39
E. Lessons learned 40
III. Bolivarian Republic of Venezuela 41
A. Recent advances in policy, regulatory and institutional frameworks 41
B. Key actors in energy efficiency and their effective roles 43
C. Resources and funding mechanisms for energy efficiency programmes 45
D. Results of energy efficiency programmes to date 45
E. Lessons learned 48
IV. Brazil 49
A. Recent advances in policy, regulatory and institutional frameworks 49
B. Key actors in energy efficiency and their effective roles 50
C. Resources and funding mechanisms for energy efficiency programmes 52
D. Results of energy efficiency programmes to date 53
E. Lessons learned 57
V. Chile 59
A. Recent advances in policy, regulatory and institutional frameworks 62
B. Key actors in energy efficiency and their effective roles 67
C. Resources and funding mechanisms for energy efficiency programmes 67
D. Results of energy efficiency programmes to date 68
E. Lessons learned 74

VI. Colombia 75
A. Recent advances in policy, regulatory and institutional frameworks 75
B. Key actors in energy efficiency and their effective roles 77
C. Resources and funding mechanisms for energy efficiency programmes 79
D. Results of energy efficiency programmes to date 79
E. Lessons learned 79
VII. Costa Rica 83
A. Recent advances in policy, regulatory and institutional frameworks 83
B. Key actors in energy efficiency and their effective roles 83
C. Resources and funding mechanisms for energy efficiency programmes 95
D. Results of energy efficiency programmes to date 95
E. Lessons learned 96
VIII. Cuba 97
A. Recent advances in policy, regulatory and institutional frameworks 97
B. Key actors in energy efficiency and their effective roles 106
C. Resources and funding mechanisms for energy efficiency programmes 107
D. Results of energy efficiency programmes to date 107
E. Lessons learned 109
IX. Dominican Republic 111
A. Recent advances in policy, regulatory and institutional frameworks 111
B. Key actors in energy efficiency and their effective roles 114
C. Resources and funding mechanisms for energy efficiency programmes 115
D. Results of energy efficiency programmes to date 116
E. Lessons learned 117
X. Ecuador 119
A. Recent advances in policy, regulatory and institutional frameworks 119
B. Key actors in energy efficiency and their effective roles 120
C. Resources and funding mechanisms for energy efficiency programmes 121
D. Results of energy efficiency programmes to date 121
E. Lessons learned 122
XI. El Salvador 123
A. Recent advances in policy, regulatory and institutional frameworks 123
B. Key actors in energy efficiency and their effective roles 124
C. Resources and funding mechanisms for energy efficiency programmes 126
D. Results of energy efficiency programmes to date 127
E. Lessons learned 128
XII. Grenada 129
A. Recent advances in policy, regulatory and institutional frameworks 129
B. Key actors in energy efficiency and their effective roles 130
C. Resources and funding mechanisms for energy efficiency programmes 130
D. Results of energy efficiency programmes to date 130
E. Lessons learned 131
XIII. Guatemala 133
A. Recent advances in policy, regulatory and institutional frameworks 133
B. Key actors in energy efficiency and their effective roles 134
C. Resources and funding mechanisms for energy efficiency programmes 136
D. Results of energy efficiency programmes to date 136
E. Lessons learned 139
XIV. Guyana 141
A. Recent advances in policy, regulatory and institutional frameworks 141
B. Key actors in energy efficiency and their effective roles 143
C. Resources and funding mechanisms for energy efficiency programmes 143
D. Results of energy efficiency programmes to date 143
E. Lessons learned 144

XV. Haiti 145
A. Recent advances in policy, regulatory and institutional frameworks 145
B. Key actors in energy efficiency and their effective roles 146
C. Resources and funding mechanisms for energy efficiency programmes 147
D. Results of energy efficiency programmes to date 147
E. Lessons learned 148
XVI. Honduras 149
A. Recent advances in policy, regulatory and institutional frameworks 149
B. Key actors in energy efficiency and their effective roles 150
C. Resources and funding mechanisms for energy efficiency programmes 151
D. Results of energy efficiency programmes to date 152
E. Lessons learned 155
XVII. Jamaica 157
A. Recent advances in policy, regulatory and institutional frameworks 157
B. Key actors in energy efficiency and their effective roles 161
C. Resources and funding mechanisms for energy efficiency programmes 164
D. Results of energy efficiency programmes to date 165
E. Lessons learned 169
XVIII. Mexico 173
A. Recent advances in policy, regulatory and institutional frameworks 173
B. Key actors in energy efficiency and their effective roles 174
C. Resources and funding mechanisms for energy efficiency programmes 182
D. Results of energy efficiency programmes to date 184
E. Lessons learned 190
XIX. Nicaragua 193
A. Recent advances in policy, regulatory and institutional frameworks 193
B. Key actors in energy efficiency and their effective roles 194
C. Resources and funding mechanisms for energy efficiency programmes 194
D. Results of energy efficiency programmes to date 195
E. Lessons learned 204
XX. Panama 205
A. Recent advances in policy, regulatory and institutional frameworks 205
B. Key actors in energy efficiency and their effective roles 210
C. Resources and funding mechanisms for energy efficiency programmes 214
D. Results of energy efficiency programmes to date 215
E. Lessons learned 217
XXI. Paraguay 219
A. Recent advances in policy, regulatory and institutional frameworks 219
B. Key actors in energy efficiency and their effective roles 220
C. Resources and funding mechanisms for energy efficiency programmes 221
D. Results of energy efficiency programmes to date 221
E. Lessons learned 221
XXII. Peru 223
A. Recent advances in policy, regulatory and institutional frameworks 223
B. Key actors in energy efficiency and their effective roles 224
C. Resources and funding mechanisms for energy efficiency programmes 225
D. Results of energy efficiency programmes to date 226
E. Lessons learned 227
XXIII. Plurinational State of Bolivia 229
A. Recent advances in policy, regulatory and institutional frameworks 229
B. Key actors in energy efficiency and their effective roles 233
C. Resources and funding mechanisms for energy efficiency programmes 237
D. Results of energy efficiency programmes to date 239
E. Lessons learned 249

XXIV. Suriname 251
A. Recent advances in policy, regulatory and institutional frameworks 251
B. Key actors in energy efficiency and their effective roles 252
C. Resources and funding mechanisms for energy efficiency programmes 253
D. Results of energy efficiency programmes to date 253
E. Lessons learned 254
XXV. Trinidad and Tobago 255
A. Recent advances in policy, regulatory and institutional frameworks 255
B. Key actors in energy efficiency and their effective roles 255
C. Resources and funding mechanisms for energy efficiency programmes 256
D. Results of energy efficiency programmes to date 256
E. Lessons learned 256
XXVI. Uruguay 257
A. Recent advances in policy, regulatory and institutional frameworks 257
B. Key actors in energy efficiency and their effective roles 259
C. Resources and funding mechanisms for energy efficiency programmes 261
D. Results of energy efficiency programmes to date 262
E. Lessons learned 264
Annexes 267
Annex 1 268
Annex 2 271
Annex 3 272
Annex 4 280
Annex 5 282
Annex 6 287
Annex 7 289

Index of figures

Figure 1 Net energy demand: hourly averages 26
Figure 2 Replacement of incandescent lamps by Cfls 31
Figure 3 Replacement of incandescent lamps by Cfls 31
Figure 4 Energy consumption in public lighting 34
Figure 5 Institutional scheme with respect to energy 36
Figure 6 Analysis of energy savings due to procel in 2007 54
Figure 7 Results of labelling efforts by Procel, 2007* 54
Figure 8 Estimated electrical consumption of refrigerators in Brazil 56
Figure 9 Energy efficiency labels used in Brazil for light vehicles and refrigerators 57
Figure 10 Changes in specific consumption in the residential sector 59
Figure 11 Changes in energy intensiveness in the industrial sector 60
Figure 12 Changes in energy intensiveness of the mining sector 60
Figure 13 Changes in primary energy consumption as a proportion of Gdp 61
Figure 14 Budget 68
Figure 15 Breakdown of savings 72
Figure 16 Composition of the sectoral directorate of energy 84
Figure 17 Growth of gross domestic product 98
Figure 18 Efficiency in generating system 103
Figure 19 Institutional scheme with respect to Guyana's energy 143
Figure 20 Total oil imports, 2003-2007 157
Figure 21 Oil consumption by activity, 2003-2007 158
Figure 22 Distribution of Jpsco electricity sales in 2007 160
Figure 23 Operational flowchart 180
Figure 24 Banks' participation in financing of sustainable energy projects 183
Figure 25 Interrelation of objectives 184
Figure 26 Results of conuee programmes reduction in energy intensity 185
Figure 27 Energy consumption growth scenarios 209

Figure 28 Trend of energy indicators 210
Figure 29 Map of actors 234
Figure 30 Power projection 247
Figure 31 Energy sector scheme 252
Figure 32 Organization chart of the energy-efficiency project 258
Figure A6.1 Organization chart of the national energy-efficiency programme 287

Index of tables

Table 1 Energy and peak power savings by region 27
Table 2 Energy efficiency standards, july 2009 27
Table 3 Overview of electrical energy savings in national executive branch buildings with t2 rate january-november 2008/2007 33
Table 4 Overview of electrical energy savings in national executive branch buildings with t3 rate january-november 2008/2007 33
Table 5 Investment and principal impacts of procel program 53
Table 6 Investment and principal impacts of aneel/energy efficiencyprogramme (2000 to 2005) 55
Table 7 Investments and main results of aneel/energy efficiency programme (2006-2007) 55
Table 8 Indicators of conpet activities 56
Table 9 Pproject progress 79
Table 10 Electricity rate, residential sector 102
Table 11 Comparison of available power and peak demand in the last 4 years 108
Table 12 Energy saving opportunities in the water pumping system of el salvador 127
Table 13 Project for the implementation of compact fluorescent lamps in the residential sector 153
Table 14 Istalled generating capacity of generating plants in jamaica 159
Table 15 Efficiency of electrical plants in the jpsco network 159
Table 16 Information on energy efficiency project in jamaica 164
Table 17 Pemex: facts and challenges 182
Table 18 Desirable structure of sustainable energy market 183
Table 19 Results of conuee programmes 185
Table 20 List of audited firms 195
Table 21 Summary of saving on lighting, air-conditioning and application of the seasonal hourly rate 197
Table 22 Summary of saving in lighting and recovery of the investment 198
Table 23 Summary of saving in air-conditioning and recovery of the investment 198
Table 24 Summary of power factor compensation and recovery of the investment 198
Table 25 Saving in us$/month arising from a rate change 199
Table 26 Summary of savings and recovery of the investment 199
Table 27 Modernizations/liberalization of the oil sector 220
Table 28 Categories 236
Table 29 Categories 238
Table 30 Residential bulb replacement programme in the plurinational state of bolivia 246
Table 31 Support for education and outreach programmes 246
Table 32 Delivery of two additional bulbs 246
Table 33 Maximum demand in the sin (2007 and 2008) in mw 247
Table 34 Energy efficiency program: reduction of demand in the sin 248
Table A4.1 Identification of “stakeholders” for the development of energy-efficiency programmes 280
Table A5.1 Standards 283
Table A5.2 Plan 2009 284
Table A5.3 Catalogue of services of the i.c.e. energy-efficiency laboratory 285
Table A7.1 Table of rates in suriname 289

Executive Summary

The purpose of the present study is to analyse the situation and perspectives for actions and instruments associated with energy efficiency in the 26 Latin American and Caribbean countries that are members of the Latin American Energy Organization (Organización Latinoamericana de la Energía, or OLADE).

The study focused on determining the following aspects of each country's national energy programmes: (i) recent advances in policy, regulatory and institutional frameworks; (ii) key actors in energy efficiency and their effective roles; (iii) resources and funding mechanisms for energy efficiency programmes; (iv) results of energy efficiency programmes to date; and (v) lessons learned.

In evaluating ***recent advances in policy, regulatory and institutional frameworks***, it would be unrealistic to compare the results of energy efficiency programmes in Latin America and the Caribbean with those successfully executed in countries that are more highly developed and/or that have a history of energy efficiency policy dating back to the first oil shock in the 1970s. Thus, programmes in Latin America and the Caribbean should not be measured against those of countries like Germany, the Netherlands, the United States, Japan, Australia.

Analysis of the 26 countries shows differences, from one country to another, among the regulatory frameworks associated with energy efficiency. Thus, it is difficult to establish "common denominators" for this parameter in the region. In many of the countries, however, there is a trend toward creating (or, in cases where they already exist, strengthening) national energy efficiency programmes, and providing them with the legal and regulatory support necessary to further the government's policy decisions in this area. These programmes are the result of public leadership, with the degree of private sector participation varying from country to country.

Analysis of the ***key actors in energy efficiency and their effective roles*** shows that public sector activities, projects and programmes for promoting and developing energy efficiency are overseen by ministries, national commissions and/or energy management secretariats, which have varying degrees of visibility and influence, depending on the particular country.

In Brazil, the principal programmes in operation are managed by energy companies (PROCEL-Electrobras and CONPET-Petrobras), though they coordinate their activities to conform to the policies of the country's Ministry of Mines and Energy. Energy regulators in the region responsible for electricity or fuels—with the exception of Brazil's ANEEL—have practically no role in promoting energy efficiency. Moreover, in only a very few cases do energy distribution firms promote energy efficiency among their

clients, and when they do, their efforts are aimed at reducing peak demand. Few firms have a corporate policy that calls for demand management.

The wide range of public and private actors involved in the region's energy efficiency programmes appears to be the result of four main factors: (a) political support from government; (b) continuity of efforts and institutional structures; (c) access to funding; and (d) capacity for promoting and providing information on energy efficiency measures.

With regard to ***resources and funding mechanisms for energy efficiency programmes***, in the vast majority of countries funds for promoting and developing energy efficiency come from national budgets. This means that, except in countries with active energy efficiency policies, there are serious limitations on the mission.

Most of the 26 countries covered in this study face major challenges in obtaining resources to promote energy efficiency. Chile, which recently saw a large increase in the budget of its national programme—the National Energy Efficiency Programme (Programa País Eficiencia Energética, or PPEE)—has been an important exception.

The study also attempts to analyse the ***results of energy efficiency programmes*** to date. For each country, the depth at which the results could be evaluated depended on the quantity and quality of available information. Within those constraints, information from the parties involved, whether direct (from interviews or reports) or from relevant websites, was assumed to be accurate.

Analysis of the available information suggests that the quality of the statistics and performance indicators that make it possible to quantify results is still inadequate (except, with some limitations, in the cases of Mexico and Brazil). Due to these shortcomings in quantity and reliability of information regarding specific results, it is impossible to draw concrete, accurate conclusions (excepting, again, with regard to Mexico and Brazil).

In terms of ***lessons learned***, except for Mexico and Brazil no evaluation documents were found for the countries whose energy efficiency programmes have compiled lessons learned. There has been little systematization—indeed, no institutionalized systematization at all, in some cases—of the lessons emerging from national experiences and initiatives.

Reports and records of consultants' personal experiences working on energy efficiency in the various countries are somewhat haphazard. While these documents provide some indications of the results of the programmes, they do not constitute a well-organized and institutionally reliable set of national statistics. This appears to be one of the weakest points in the countries' institutions, in terms of energy efficiency efforts undertaken within the national policy framework.

One lesson that does emerge clearly from the region's experience is that the mere existence of energy efficiency legislation in no way guarantees that there will be positive effects on (a rational reduction of) energy demand. This will not occur unless energy efficiency activities, projects and programmes that are adapted to national realities are developed and systematically implemented. The State has difficulty monitoring—and, where the law provides, sanctioning—behaviours that do not conform to legal requirements. Economic and cultural barriers in Latin American and Caribbean societies hinder the full enforcement of energy efficiency standards, while a lack of human resources (due to budgetary constraints) means that monitoring and enforcement systems are inefficient.

The present study compiled the following lessons learned. While these do not correspond to specific countries, they are certain to have broad applicability in many of the region's countries:

- Achieving concrete results in rational and efficient energy use requires institutions capable of designing, implementing and operating programmes on a stable, ongoing basis.
- There continues to be great potential for energy saving. Overall, 20-25% of energy consumption could be eliminated, through measures that would rapidly pay for themselves.

- Policy signals have been insufficient to induce energy-saving behaviours and actions among users.
- Capacity building efforts should be undertaken to strengthen institutions that are already operating, before creating new institutions.
- Efforts are needed to promote the development of decentralized institutional capacities (at the state, provincial and municipal levels) for formulating energy efficiency programmes.
- Private funding must be more closely articulated with energy saving opportunities.
- Efforts to educate, train and inform the public should be increased.
- Implementing efficiency standards increases the potential for saving, by providing information to consumers.
- On average, 75% of the refrigerators in use today are approximately half as efficient as new refrigerators entering the market. This represents a great opportunity for energy saving through replacement of these older products.
- Cogeneration for industry and large tertiary-sector facilities has huge potential that has remained unexploited due to the lack of regulatory incentives.
- National energy efficiency programmes require funding mechanisms designed specifically to address and coordinate the massive number of investment decisions required by these programmes.
- It is essential to know how to quantify opportunities, without spending more, in doing so, than is saved in the process.
- Regulatory frameworks are lacking and/or weak.
- There need to be more strategies for providing education—and for building awareness and promoting energy saving—for people in government and in the education and business sectors, as well as for individual users.
- There is a scarcity of national/regional technical personnel dedicated to energy efficiency.
- There is a lack of funding for equipment and project development.
- The market for energy services firms remains under-developed.
- There is little involvement on the part of electricity and fuel providers.
- Programmes for institutional strengthening are lacking.
- Supply-side efficiency has been shown to work: the sector's deregulation created incentives for competition, resulting in drastic reductions in consumption in certain areas.

Preliminary conclusions

The research conducted for this report produced the following provisional conclusions:

- The situation of national energy efficiency **programmes, projects and initiatives varies widely from one country to another** as a result of numerous factors, including the size and form of a country's economic structure, its population distribution, access to technology and information, regional and world integration, access to funding, development of regulatory instruments, and climate-related, cultural and social factors, etc.

- **Regulatory and institutional contexts differ widely**, and because these realities must be tailored to each country's conditions, they cannot be standardized. Thus, it makes no sense for countries to "copy" regulations used in other countries, even if they have been highly successful there. They must instead be adapted to individual circumstances. This, however, does not mean ignoring success stories or missing opportunities to evaluate possible adaptations of other countries' experiences to local realities.
- In a number of the region's countries, there is a critical **lack of continuity in energy efficiency policy**, which has not been integrated, as it should be, with State policy.
- The lack of continuity creates a risk that there will be **insufficient articulation among high-capacity technical teams.** Numerous years of continuous work are required to train national experts to work with energy efficiency programmes.
- Most of the countries studied here have no (or very **few**) **specific domestic sources of funding** for energy efficiency programmes.
- Energy efficiency programmes are still **excessively dependent on international cooperation**, although energy price signals have begun to reflect conditions of scarcity and the growing need for investment as a means of increasing supply. There need to be stronger national initiatives to rationally and efficiently reduce consumption.
- **Lack of knowledge on the part of users** continues to create major barriers to more efficient use of energy.
- The **mere existence of laws, decrees or regulations** making energy efficiency measures mandatory does not guarantee the success of national programmes.
- There are clearly **difficulties in monitoring the results of energy efficiency programmes** in the countries examined. The absence of key indicators of success (or failure) is a major shortcoming of national programmes.

Introduction

The purpose of this study is to analyse the situation and perspectives with regard to actions and instruments associated with energy efficiency in the 26 Latin American and Caribbean countries that are members of the Latin American Energy Organization (Organización Latinoamericana de la Energía, or OLADE).

When this document went to press, substantive information was available on 22 of the 26 countries studied: Argentina, Barbados, Brazil, The Plurinational State of Bolivia, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago and Uruguay. The final version of this report will incorporate studies of the remaining four countries.

The basic aspects of the situation and perspectives for national energy efficiency programmes that the study analysed in relation to each of the countries were: (i) recent advances in policy, regulatory and institutional frameworks; (ii) key actors in energy efficiency and their effective roles; (iii) resources and funding mechanisms for energy efficiency programmes; (iv) the results of energy efficiency programmes to date; and (v) lessons learned. The present document has been structured according to those five basic themes.

A. Recent advances in policy, regulatory and institutional frameworks

On this subject, the aim of the study was to examine recent advances in policy, regulatory and institutional frameworks associated with energy efficiency (legislation, standards, institutions, public and private national programmes, etc.) and to measure these against some benchmark or standard of international best practices, e.g., by comparing them with countries that are internationally recognized for their energy efficiency achievements.

Each country's regulatory and institutional frameworks were examined in relation to energy efficiency, and compared with a programme—considered to be successful—outside the region. The reference programme chosen here was that of Spain's Institute for Energy Diversification and Saving (Instituto de Diversificación y Ahorro de Energía de España, or IDAE).

There are various justifications for comparing Latin American and Caribbean (LAC) experience with that of Spain, not least of which is the cultural affinity between the respective societies.

Indeed, the issue of rational and efficient energy use is closely associated not only with technical issues, but also with the uses and habits prevalent in the societies where energy savings

programmes are being implemented or where efforts in this direction are being made. Aspects of a society's culture are of paramount importance to the success of these programmes.

B. Key actors in energy efficiency and their effective roles

The study attempted to identify the relevant actors, and the role that each plays in activities, programmes, projects and/or institutions designed to promote and carry out energy efficiency activities, with a focus on comparing these with the dynamics seen in the country selected as a benchmark.

The study identifies the principal institutional actors, whether public, private or mixed, and describes their roles in developing national energy efficiency programmes.

C. Resources and funding mechanisms for energy efficiency programmes

The aim here was to identify how countries with such resources finance their energy efficiency activities, programmes and projects; what barriers they confront, and how their situation compares with best international practices in funding energy efficiency, whether this is done through budgetary resources or depends on earmarked international cooperation funds.

D. Results of energy efficiency programmes to date

Here, the effort was to ascertain whether there are statistics and performance indicators to quantify the results of these programmes, to determine whether the countries themselves have evaluated their results, and to bring together the available statistics, performance indicators and evaluations.

Each of the country's results were evaluated. The depth of the evaluation depended on the quantity and quality of information available.

E. Lessons learned

The study attempted to ascertain what worked, what did not work and how to make improvements; what can be learned from the Latin American experience to date in working to improve the formulation, funding and execution of policies, programmes and instruments designed to achieve energy efficiency goals; and what central elements should be incorporated in the new generation of policies, programmes and instruments to maximize the probability of success.

The lessons learned from each programme were analysed, although the analysis was inevitably shaped by the quality and reliability of the information obtained. General conclusions were then drawn.

I. Argentina

A. Recent advances in policy, regulatory and institutional frameworks

This first section reflects policy, regulatory and institutional developments since the first ECLAC study on "Renewable energy and energy efficiency in Latin America and the Caribbean: constraints and prospects" in October 2003. The section examines the advances, actions, activities, ideas and intentions that have emerged, or are emerging, in the institutions responsible for creating and implementing energy efficiency policy in Argentina.

Under the Government of Argentina's current institutional and administrative arrangements, energy policy is principally the responsibility of the Ministry of Planning, Public Investment and Services, of which the Secretariat of Energy (SE) is a part. Other government agencies, such as the Secretariat of Industry, Commerce and Small and Medium-sized Enterprises, the Secretariat of Environment and Sustainable Development, the Secretariat of Domestic Commerce and the Ministry of Foreign Relations, are required to coordinate any initiatives they take in the area of energy so that they converge with those undertaken by the offices of the Ministry of Planning, Public Investment and Services.

Given this institutional structure, examining energy efficiency in Argentina between 2003 and 2009 requires focusing on the activities of the Secretariat of Energy as the relevant policy organ and national programme agency. The text that follows examines government action for energy efficiency on that basis.

After the sudden decline in energy efficiency activity at the Secretariat of Energy with the virtual elimination of the Office of Rational Energy Use in late 1999, and the acute social and economic crisis of late 2001, a small working unit began slowly to be reassembled towards the end of 2002 within the National Promotional Office (the DNPROM–successor to the Office of Rational Energy Use).

One of the new unit's tasks was to restart the cooperation project, which had been launched in July 1999, between the Secretariat of Energy and the German Technical Cooperation Agency (Gesellshaft für Tecnische Zusammenarbeit, or GTZ). The project, which was named Increasing Energy Efficiency and Productive Efficiency in Small and Medium-sized Enterprises (PIEEP), was designed primarily to work with small and medium-sized industrial facilities.

Slowly, thanks to the rehiring of some professional staff whose contracts, due to the crisis, had not been renewed between their expiration at the end of 1999 and mid-2002, initiatives and projects that had been suspended were gradually resumed. A brief survey of these follows.

Through DNPROM, the Secretariat of Energy conducted the PIEEP project in the small and medium-sized enterprise (SME) sector from July 1999 to December 2005, drawing on funds contributed by GTZ. The primary purpose of the project was to improve the factors shaping competitiveness for the country's SMEs by promoting implementation of energy, production and environmental management at industrial plants and other business units.

Despite the situational difficulties, the project produced promising results. Its activities to promote, demonstrate and implement energy, production and environmental efficiency measures through demonstration units, training workshops and studies of firms in different industrial sectors in Argentina made it possible for participating companies to make more efficient use of their energy inputs, improve the quality and efficiency of their industrial processes, become more environmentally sustainable, reduce energy and production costs, and increase profits. For more information on this programme, see www.gtz.org.ar/proyectos/p_bilat_fin2.php.

Another important activity conducted by the Secretariat of Energy along with other Government agencies and some private sector entities was the Programme for the Quality of Energy-Consuming Appliances (PROCAE). The main objective of this programme was to reduce overall electrical consumption by encouraging the use of more efficient electrical appliances through a system of energy efficiency labelling. The National Promotional Office of the Secretariat of Energy joined with other players in the market in a labelling programme that, as a first step, required manufacturers of refrigerators to indicate on their various models what energy efficiency class they belonged to. Later phases of the programme were designed to cover other appliances. (For example, mandatory labelling of air conditioners was implemented in November of 2008 with a view to reorienting the market in order to increase demand for more efficient air conditioners than those available up to that time.).

In late 2003, with technical assistance from a European consultant, work was begun on designing a series of energy efficiency projects that were eventually to be part of a programme eligible for funding from the Global Environment Fund (GEF), with the World Bank functioning as executing agency, under the guidelines of GEF Operational Programme 5.

With PDF-B funds, six preliminary studies were undertaken to define the projects that the Secretariat of Energy would ultimately support with the main GEF funds. They included the following: (1) designing the Argentine Energy Efficiency Investment Fund (FAEE) and formulating a process for evaluating financial institutions; (2) designing a programme for energy efficiency labelling and standards, as well as a programme to promote the development of energy services enterprises; (3) supporting the design of energy efficiency programmes in electrical energy distribution firms; (4) conducting a baseline study on the energy market, the alternative option, the project's incremental cost and the emissions reduction expected from it; and (5) carrying out a study of regulations, tariff signals and economic incentives for efficient energy use.

Finally, in May 2008, after an exchange of views with the World Bank, the Secretariat of Energy decided to continue the programme with three components designed to: (a) develop the Argentine Energy Efficiency Investment Fund (FAEE) and use the donated funds to finance the preparation of a portfolio of energy efficiency projects; (b) develop an Electrical Distribution Firms Programme with a focus on efficient lighting; and (c) strengthen capacity and management.

Another project undertaken by the Secretariat of Energy addressed energy efficiency in public buildings. The Energy Saving and Efficiency in Public Buildings Programme (PROUREE) was designed to develop:

- Methods of studying energy efficiency in public buildings.
- Relevant regulations.

- Technologies appropriate to each of the country's regions.
- Experiments designed for different climate zones, so as to optimize facilities in each zone.

Various public buildings were chosen as demonstration units, and measurements and studies were made to determine what energy savings could be achieved by implementing efficiency measures.

Data on energy bills continue to be recorded and processed for National Government buildings served by the electrical distribution firms ECESUR, EDENOR and EDELAP. (The National Electrical Regulatory Agency, ENRE, collaborates in gathering the information.)

As a final element of this brief survey of energy efficiency action in Argentina, note should be taken of Law 26350, approved on 26 December 2007 and promulgated on 27 December 2007. This law moves the clock from GMT-3 to GMT-2 during the summer months. The change applied immediately to the period between 30 December 2007 and 16 March 2008, and the law authorizes the executive branch to set the beginning and end dates (somewhere between October and March) in subsequent years. The company that administers the wholesale electricity market (Compañía Administradora del Mercado Mayorista Eléctrico, or CAMMESA) is to assess the economic and social impact produced so far, and in the future, by the time change.

The clock change was a part of the new National Rational and Efficient Energy Use Programme (PRONUREE) that the Government implemented through Decree 140/2007 of 21 December 2007. The decree declares rational and efficient energy use to be a matter of national interest and a national priority, and makes it an essential ongoing element of energy policy. The programme is being implemented by the Secretariat of Energy.

The objective of PRONUREE is to improve energy efficiency in the various sectors that consume electrical energy.

Annex I of the decree lists the demand sectors being targeted, and describes the action to be taken, along with expected short-, medium- and long-term results.

Annex II establishes the guidelines for the Rational and Efficient Energy Use Programme (PROUREE) in all public buildings of the nation's executive branch. This programme is being executed by the office of the Head of the Cabinet of Ministers (JGM) in coordination with the Secretariat of Energy, which provides technical support.

PRONUREE includes a series of short- and medium-term initiatives that focus on the public sector. The new plan describes itself as aiming at "permanent energy efficiency". It includes the following short-term measures:

- Large-scale replacement of common incandescent light bulbs by energy-saving lamps in residential housing units. The first step in this process was the State's acquisition of 5 million lamps in 2008. The devices were distributed free of charge through the electrical distribution companies. A second phase calls for replacing 20 million bulbs, an average of two per household.
- Reducing electrical consumption in all National Government buildings. Planned actions include regulating air conditioning equipment to target a temperature of 24° C, turning off electrical equipment after 6 p.m. and eliminating the use of ornamental lights.
- Replacing street lighting with more efficient lamps.

A Provincial, Municipal and Local Energy Efficiency Plan is also being developed by the Secretariat of Energy under Secretariat of Energy Resolution 7/2008 of 23 January 2008. The object of this plan is to optimize the use of electricity in public lighting, traffic lights and public buildings, focusing principally on the municipal level.

According to estimates by the Secretariat of Energy, PRONUREE will make it possible to "reallocate some 2,000 MW of power and to save 17,000 GWh by around 2016, an amount that represents 16% of 2008 energy demand".

B. Key actors in energy efficiency and their effective roles

The main institutional figures in the area of energy efficiency in Argentina are as follows:

1. Secretariat of Energy (within the National Ministry of Planning, Infrastructure and Housing) (http://energia.mecon.gov.ar)

The Secretariat of Energy (SE) is currently divided into two subsecretariats, one dealing with electrical energy, the other with fuels. Issues of energy efficiency and renewable energy are handled by the National Promotional Office, which reports solely to the Subsecretariat of Electrical Energy.

The National Promotional Office in turn includes two coordinating units: (a) the Energy Efficiency Coordination Unit and (b) the Renewable Energy Coordination Unit.

The Energy Efficiency Coordination Unit oversees activities associated with PROCAE, with the Energy Efficiency Programme supported by the World Bank's Global Environment Fund (WB/GEF) and with the Energy Efficiency and Energy Saving Programme for Public Buildings.

As regards the effective role of this unit and its actual importance in promoting energy efficiency, it should be noted that after the unit's "resurrection" between late 2002 and mid-2003, there was a change of Government as a result of the April 2003 election. The new Government took office on May 25 of that year, and there was a major shift of responsibility for energy decisions. Under previous Governments, such decisions had fallen to the heads of the various energy secretariats, but the new Government shifted them to the management units of the Ministry of Planning, Public Investment and Services, of which the Secretariat of Energy is a part. Decisions on energy efficiency policy and measures were shifted largely to the National Promotional Office at the Secretariat of Energy, which includes the Energy Efficiency Coordination Unit.

In this context, the effective role of the Secretariat of Energy in actual implementation of public energy efficiency programmes has suffered substantially from the erosion of its policy authority, and no short-term change seems to be on the horizon. This could change if there is a crisis in the energy supply and demand situation (which already shows weakness), or if there is a sudden reduction in the market supply –either for technical reasons (lack of equipment) or economic ones (higher prices for energy inputs imported primarily from the Bolivarian Republic of Venezuela and from Brazil– leading to a decision to give the Energy Efficiency Coordination Unit more institutional visibility.

2. National Institute of Industrial Technology (INTI) (www.inti.gov.ar)

INTI formally reports to the Secretariat of Industry at the Ministry of the Economy. For issues relating to energy and the environment, INTI has a Department of Energy.

The mission of the INTI Department of Energy is to develop, implement and provide support for techniques that promote the efficient and rational use of different forms of energy in productive processes, in transportation and in the residential, commercial and public sectors, with special emphasis on techniques that increase the energy efficiency of equipment or promote environmental conservation.

Nineteen-ninety-seven saw the signing of the agreement that created the Centre for Research on Rational Energy Use (CIPURE) and made it a permanent fixture. This brought the private sector into the area of strategic energy management. In 1998, the Centre incorporated new partners in a promotional role, and opened its Energy Efficiency Training Centre with support from the Japanese

Government, through the Japan International Cooperation Agency (JICA) and the Argentine Technology Fund (FONTAR).

For training purposes, the Department of Energy regularly holds courses for operators of boilers and steam plants.

As to the effective role of the energy efficiency activities conducted by INTI, they constitute a national frame of reference, and the institution enjoys broad prestige among energy users. However, the fact that it reports to a secretariat within the Ministry of Economy makes its budget subject to the vagaries of the national bureaucracy, although it is partially self-financing through fees that it charges for its technical and professional services.

3. Argentine Standards and Certification Institute (IRAM) (www.iram.org.ar)

The Argentine Standards and Certification Institute, or IRAM (previously known under the same acronym as the Argentine Institute for Rationalization of Materials) is a not-for-profit civil society organization founded in 1935.

Its objectives are set forth specifically in bylaws, and are reproduced here for purposes of general information:

- To promote the rational use of resources and creative activity, and to facilitate the production of, trade in and transfer of knowledge, as a way of improving people's quality of life, welfare and security.
- To study and approve standards, without restrictions within its areas of authority, employing methodology approved by the relevant IRAM organs and set forth in rules issued by them.
- To develop certification services that contribute to technological development, to intensive use of standards, and to ongoing improvement of products, processes and services that benefit consumers, firms and society as a whole.

In the specific area of efficient energy use, IRAM has played a decisive role in developing standards for household electrical appliances. It has succeeded in creating a labelling system for refrigerators based on Secretariat of Industry, Commerce and Mining (SICM) Resolution 319/99 and subsequent resolutions amending that resolution. These provisions were developed by the Fair Trade Office at the SICM in order to create measures that would affect the marketing of certain types of household electrical appliances.

IRAM plays a very visible key role in energy efficiency efforts. It is currently working on labelling standards for air conditioners, compact fluorescent lamps and washing machines. Compliance with the standards that it establishes will encourage a market for energy efficient appliances to gradually replace the less efficient appliances available today. The labelling system will correct the asymmetry of information that is a barrier to energy efficiency in the market.

4. National Technological University (UTN) (www.utn.edu.ar)

So-called Energy Study Groups (GESEs) emerged in 1985 with the signing of an agreement between the National Technological University and the Secretariat of Energy in the context of Decree Law 2247/85. The purpose of the groups was to make energy assessments of SMEs and thereby promote rational energy use. Divisions were established on the UTN regional campuses. Each division included a director who was a professor with major experience in energy issues, as well as two or three engineering professionals and students.

The GESEs (17 initially, and now present at nearly all of the UTN regional campuses) began by providing free energy assessments for industrial firms. Each firm received a report that included an

energy assessment, along with information on how to achieve short- and medium-term savings both with and without investment. The amounts of money needed for the changes were indicated, as were the periods over which investments would pay for themselves on a non-compound basis.

Under national policy and pursuant to the UTN-Secretariat of Energy agreement, the groups were to bill for services that they provided firms starting in 1990, so as to generate significant income and become profitable.

The work that the groups did (and in many cases continue doing) has assisted over 2,000 firms in different technical areas involving energy use. The services that the groups have provided in the industrial sector include energy efficiency analysis of:

1. Steam production, ovens and drying systems
2. Steam distribution systems
3. Electrical systems
4. Air compressors
5. Refrigeration facilities
6. Air conditioning and ventilation equipment
7. Calculations and special projects

The GESEs were very promising from their inception. They provided technical assistance on energy use in small and medium-sized industrial facilities in regions where the UTN campus had a group. They had means of transportation and their own measurement equipment, allowing them to provide services of good technical quality.

However, their activity was affected by the ups and downs accompanying Argentina's social/economic and financial crises. Because of these crises, many of their recommendations were not implemented. Moreover, the government's energy efficiency programmes suffer from some weakness in terms of following up on studies to ascertain what recommendations are actually implemented. With certain exceptions, concrete results can be expected to be disappointing.

Despite these problems, the groups continue to be useful and necessary, especially for SMEs in the country's interior, where sophisticated technical consulting is less available.

5. Obispo Colombres Experimental Agroindustrial Station (EEAOC) in the province of Tucumán (www.eeaoc.org.ar)

Created in 1909, this experimental station provides technical advice on agricultural and industrial activity associated with sugarcane production in the province of Tucumán, which has 16 sugar refineries.

The energy efficiency services that the institution provides are the following:

- Energy assessments with data gathered on-site.
  - On-site measurement of plants' principal operational variables with instruments provided by the Engineering and Agribusiness Projects Section.
  - On-site tests of juice and evaporation.
  - Studies on different alternatives for configuring heating-evaporation-boiling systems so as to reduce the consumption of high-pressure steam; measurements of the process's mass, energy and energy; computer simulation of processes, with software developed and patented by the EEAOC.
  - Optimization of the series of boiler receptacles so as to maximize use of the steam that serves as a heat source.

- Development of a computer program for planning the operational sequence of the boiling area operating with non-continuous boilers, in order to achieve stability in the consumption of heating steam within a narrow band.

- Drying of bagasse.
  - Design of bagasse driers with pneumatic transports, using the gases from the bagasse boiler as a drying agent, and assessment of necessary auxiliary ventilators and cyclone separators.
  - Technical/economic studies of the advantages of drying bagasse in old-style low-pressure boilers.
  - Study on reducing the environmental impact of gas emissions from boilers through drying of bagasse followed by use of multicyclones, utilizing all of the effluent smokestack gases.
  - Preliminary evaluations of particulate material in the output from cyclone dryers and in the chimneys of boilers that do not have dryers (concentrations and granulometry).
- Energy and waste disposal in the sugar industry.
  - Gathering and sampling of sugar refineries' water and effluent systems.
  - Physico-chemical description and volume measurement of refinery effluent, and of the process's various partial effluents; creation of diagrams of water and effluent flows.
  - Evaluation of new alternatives for reusing effluents with and without treatment (cooling system with sprinklers, humidifiers) and for handling their final disposal, in compliance with legal standards on discharges.

The role of the EEAOC in developing energy efficiency projects, though very important at a regional level, is limited to the country's sugar producing area, and is not susceptible to being expanded to other types of industries. The EEAOC enjoys international recognition and advises many firms and institutions involved with the sugar business in Latin America and the Caribbean (LAC).

6. School of Architecture and Urban Planning at the National University of the City of La Plata (UNLP)–Institute for Habitat Studies (IDEHAB)

The Institute for Habitat Studies (IDEHAB) is a research entity at the School of Architecture and Urban Planning of the National University of the City of La Plata. Its activities are oriented to the development of sustainable architecture. Thus the bulk of its day-to-day activity involves efficient energy use in housing and other construction, and research into possible ways of replacing fossil fuels with renewable energy sources.

The Institute is a national and international source of information on these issues, and plays an important role both in applied research and in teaching.

C. Resources and funding mechanisms for energy efficiency programmes

Each of the institutions mentioned in (2) has specific economic resources and mechanisms by which it funds its energy efficiency programmes and projects. Specifically:

1. The Secretariat of Energy reports to the Ministry of Planning, Public Investment and Services, and thus the funds for its salaries, personnel contracts and infrastructure come from the national budget. For developing energy efficiency policies, programmes and projects, it at one time received international cooperation funds. In the relatively recent

past, such sources funded, between 1992 and 1999, the rational energy use programme involving the Republic of Argentina and the European Union (known by the acronyms URE RA/UE) and the PIEEP Project (Increasing Energy Efficiency and Productive Efficiency in Small and Medium-sized Enterprises) supported by GTZ (the project concluded in December 2005).

Of the current projects at the Secretariat of Energy, only one receives international cooperation funds–the WB/GEF Energy Efficiency Project. The cost of this project in Argentina, estimated at US$ 40.3 million in all, is funded by a GEF donation, bilateral donors, the National Government, participating energy firms, commercial sources of financing and others participating in the energy efficiency activities.

2. The National Institute of Industrial Technology (INTI) is formally part of the Secretariat of Industry at the Ministry of the Economy, and hence its general operating budget (salaries, operating costs and so on) is provided for in the national budget. Since it offers technical assistance to the entire industrial sector, however, it receives fees for its services. The activities of its Department of Energy (CIPURE) generate income (varying depending on the market demand) to cover the Department's operating costs.

   Support from the Japanese International Cooperation Agency (JICA) has been essential to the Department. Donations include measurement equipment, a transportation unit, and help in constructing the building that houses the laboratory for testing household electrical appliances (using a calorimeter to measure the efficiency of refrigerators and freezers), as well as facilities with boilers for training operators. These donations have functioned as a replacement for State funds as the country has undergone a series of economic crises, making it possible for CIPURE to continue its activities despite the general economic situation.

3. The Argentine Standards and Certification Institute (IRAM) is a private entity financed by fees that it charges for its various local and international services. The funds so generated finance its work on creating standards for energy labelling of household electrical appliances.

4. The National Technological University (UTN) receives funds from the Ministry of Education for its salaries, infrastructure costs and services associated with its regional campuses.

   The GESEs initially received financial support from the Secretariat of Energy, which served as a channel for monies provided under Decree 2247/85. This funded the acquisition of transportation units and measuring instruments for technical assistance activities (energy audits) at SMEs in each region.

   Initial work took the form of free assessments and audits for industrial facilities. This was designed to change in 1990, for two main reasons: (a) hyperinflation in the Argentine economy, which created imbalances in all of the university's accounts and affected outside donations; and (b) the fact that the industrial beneficiaries of the free services did not sufficiently value them, and paid little attention to the technical reports that the GESEs provided with recommendations on energy saving.
   To help fund their technical services, the groups now charge for them.

5. Obispo Colombres Experimental Agroindustrial Station (EEAOC) in the province of Tucumán.

   The EEAOC finances itself by charging regional agribusiness firms for its technical services. It also receives monies from the province of Tucumán (for more information on this, see www.eeaoc.org.ar/servicios).

6. School of Architecture and Urban Planning at the National University of the City of La Plata (UNLP): Institute for Habitat Studies (IDEHAB).

As a part of the UNLP School of Architecture and Urban Planning, IDEHAB reports to the national Ministry of Education, which covers the Institute's salaries and operating costs (infrastructure and services). Like other technical entities within the university, IDEHAB is required to fund the rest of its expenses by charging for the technical services it provides to third parties, both locally and internationally.

D. Results of energy efficiency programmes to date

It is safe to say that the energy efficiency programmes implemented since the early 1980s have not had the desired impact, for various reasons:

a) Energy in all its forms was traditionally relatively abundant in Argentina, and thus there was never any official policy to control the use of energy resources. Only in 1979 was a unit (the National Office for Energy Conservation) created at the Secretariat of Energy to address the issue of rational and efficient energy use. It had at least the virtue of being a seminal effort, and agencies were eventually created within the Secretariat of Energy that dealt with these issues, with varying degrees of success.

b) The society as a whole received no explicit, specific message that energy resources should be used efficiently. Not even with the evidence of the energy supply crisis (in the last four years) did the Government explicitly recognize the need for more efficient use of energy. Only in the last year were there initial campaigns to inform people about the advantages of compact fluorescent lamps, and about rational use of electricity and gas– and some of these were led by private firms in the energy sector.

c) Rates for public services in Argentina in the past rarely reflected real costs plus a reasonable profit. Today, the presence of enormous sums of cross subsidies makes it very difficult to promote energy efficiency based on reasonable cost-benefit parameters. It should be acknowledged, though, that the Government has recently begun work on restructuring rates to make them more realistic.

d) Excessive dependence on international cooperation has had a paradoxical effect: the more cooperation there was, the less policy-making entities involved themselves in the day-to-day aspects of the issues. This was particularly notable in 1992-1999, when substantial support was provided by the URE RA/UE programme (a collaboration between Argentina and the European Union), which included research and demonstration projects, a number of which were successful. At that time, the National Government and the Secretariat of Energy had been promoting the privatization of the energy sector, and took a laissez-faire attitude to rational energy use. Meanwhile, the principal regulatory frameworks (Law 24.065 covering the electricity market, and Law 24.076 on the natural gas market) made no more than superficial mention of the need for efficient energy use.

e) There was always major difficulty with funding projects associated with energy efficiency in Argentina. This was due to several factors: financial crises recurred between 1980 and 2002; projects did not offer attractive enough economic benefits to repay investments in a reasonable period of time; traditional lending institutions failed to "understand" efficiency projects; lastly, technicians in the energy sector are generally not good at "selling" their own initiatives and getting them funded. The result of all this is that there was no real flow of funds for this type of project. The fact that one of the components of the WB/GEF project is designed to study the possibility of creating a fiduciary fund to finance energy efficiency projects reflects this situation.

Despite the above, it would be a mistake to conclude that efforts have been entirely in vain. Very slowly –due principally to the reasons mentioned in (1) above– a technically adequate structure has been developing in various areas and has helped to gradually increase awareness about rational and efficient energy use by consumers and other energy clients.

For years, attitudes in Argentina generally have reflected notable concern about environmental impacts, and have viewed energy efficiency as an extremely valuable tool for sustainable development. It remains for Argentina to address the problem of its energy rates, which discourage large-scale energy efficiency projects by being artificially low (especially for residential users) as a result of large government subsidies of energy inputs. This has, however, begun to change in the last few months (early 2009).

1. National Rational and Efficient Energy Use Programme (PRONUREE–December 2007)

Results of the seasonal change of the clock

Evaluation of impact on electrical consumption, summer 2008

Law 26.350 mandated a clock change from GMT-3 to GMT-2 for the summer, to begin at 11:59 p.m. on 31 December 2007, and end at the same time on Sunday 16 March 2008. The law also called for an assessment of the effect of the change on electrical consumption between 1 January and 16 March of 2008.

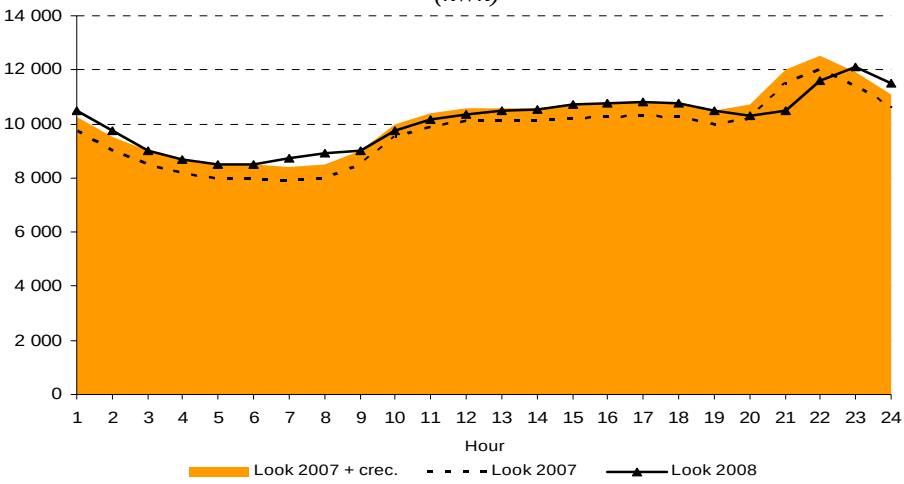
Evaluation of impact on electrical consumption: methodology

The change from GMT-3 to GMT-3 puts sunrise and sunset at a later hour, which leads to changes in consumption, as a result of lighting needs around sunrise and sunset. In order to evaluate the impact of the change on energy consumption and peak power demand, average demand for the period (1 January through mid-March 2008) was compared with consumption during that period of the preceding year, adjusting 2007 demand for representative average growth.

The study examined demand on all electrical distributors in the various distribution regions, except for demand from the major large users. It calculated the effect on energy consumption and on peak power demand, comparing real 2008 values with the corresponding 2007 values adjusted for average growth during the period.

This approach provided a relatively simple way of evaluating the overall impact in each region, although multiple variables play a role (climate, social behaviours, evolving consumption patterns and changes, over time, in all of these factors).

FIGURE 1
NET ENERGY DEMAND: HOURLY AVERAGES
(kWh)



Source: Compañía Administradora del Mercado Mayorista (CAMMESA). Using the method described above, percentages of energy saved and estimated peak demand reduction are indicated for the distributors in the various distribution regions.

TABLE 1
ENERGY AND PEAK POWER SAVINGS BY REGION

Region	Energy savings (%)	Peak energy savings (%)
DIS BAS	-1.0%	-5.0%
DIS CEN	-1.0%	-3.3%
DIS COM	-0.7%	-2.1%
DIS CUY	-0.6%	-1.8%
DIS GBA	-0.8%	-4.5%
DIS LIT	-0.9%	-3.3%
DIS NEA	-0.5%	-1.5%
DIS NOA	-0.9%	-1.7%
DIS PAT	-1.4%	-4.7%
DIS ALL	-0.8%	-3.5%
Total savings (average number of MW)	82	432

Source: Compañía Administradora del Mercado Mayorista–CAMMESA.

Standardization in energy efficiency

Technical standards for energy efficiency

The Energy Efficiency Subcommittee of the Argentine Standards and Certification Institute (IRAM), which was created at the initiative of the National Promotional Office (DNPROM) of the Secretariat of Energy, has been working since early 2004 to develop the technical standards needed to implement the Programme on the Quality of Energy-Consuming Appliances (PROCAE).

The status of the various standards addressed, to date, is as follows:

TABLE 2
ENERGY EFFICIENCY STANDARDS, JULY 2009

IRAM standard	Name	Status
2404-3	Domestic refrigeration devices–label*	Issued - Mandatory
62404 -1	Energy efficiency labelling for electrical lamps used for general lighting purposes: Part 1, incandescent lamps.*	Issued–Mandatory
62404 -2	Energy efficiency labelling for electrical lamps used for general lighting purposes: Part 2, compact fluorescent lamps with integral ballasts.*	Issued–Mandatory
62405	Energy efficiency labelling for three-phase electrical induction motors.	Issued
62406	Energy efficiency labelling for air conditioners.*	Issued - Mandatory
2141-2	Electric washing machines for household use: method for measuring proper functioning	Issued
62407	Energy efficiency of ballasts for fluorescent lamps	Under study

Source: Secretariat of Energy website: http://energía.mecon.gov.ar.
* Devices that must currently comply with mandatory energy efficiency labelling standards to be marketed.

For gas-powered appliances, work began on IRAM standards in late 2008, beginning with portable stoves, with participation by national manufacturers, universities, laboratories and manufacturers associations.

It is urgently important to move forward on other gas appliances, primarily hot water heaters. The pilot lights of hot water tanks and on-demand heaters are lit many hours in the course of a year, and there are now substitute technologies that consume fuel only when hot water is needed. Since ENARGAS licenses manufacturers, an agreement should be made with that company to change the technology used, or else labelling should indicate the difference, with the old devices being at the bottom of the scale (class F or G).

It is also important to make decisions in this area, since average consumption is 0.5m3/day/client, and 60% of this is estimated to be wastage—in other words, amounts unnecessarily consumed by pilot lights, representing approximately 2 million m3/day.

Work has also begun on standards to classify housing units on the basis of their thermal insulation. An IRAM subcommittee is working on a system to require that information on insulation (using existing standards) be posted on housing units/buildings. Representatives of various universities (UBA, UNLAP and UNR) are participating in the process, as well as the Argentine Chamber of Construction (UIA) and associations of manufacturers of red ceramics and insulation products. The system to be used for posting on housing, which is based on measuring heat leaks, has been implemented in a number of countries as one of the initial measures, with more demanding standards to be applied subsequently. Reportedly, the participants are close to reaching consensus on the matter.

To improve insulation in buildings, progress must also be made in posting information about other elements, such as drainage systems, so as to improve their quality and further reduce thermal leakage.

Change in the Fair Trade Act (Law 22.802)

Decree 140/07 instructs the Secretariat of Energy to establish specific energy consumption maximums –or energy efficiency minimums– for energy-consuming machines and appliances that are manufactured in the country, based on relevant technical indicators.

Marketing of products in Argentina is regulated under Law 22.802, the Fair Trade Act, which the Secretariat of Domestic Commerce is responsible for enforcing. The law does not give the Secretariat the authority to establish minimum levels of energy efficiency, as defined by the Secretariat of Energy, for purposes of the marketing of products. Technical staff at the Secretariat of Energy became aware of this problem, and in September and October of 2008 developed a bill to amend the law appropriately.

As a result, the Fair Trade Act was amended through Article 70 of Law 26.422 (21 November 2008), adding an Article 1-bis to the Act. The change gave the Secretariat of Domestic Commerce authority to intervene in this area, and also mandated that energy-consuming machines, equipment and appliances, as well as their energy-consuming components, comply with energy efficiency standards set by the Secretariat of Energy. In addition, it requires the Secretariat to define maximum energy consumption levels and/or minimum energy efficiency standards for all types of standard products, based on technical and economic indicators.

Draft resolution of the Secretariat of Energy to define a minimum energy efficiency standard for household refrigerators

In compliance with Decree 140/07 and Law 22.802 as amended (see above), the Secretariat and its technical staff developed and submitted a draft resolution (file 16.067/0 of 20 January 2009) that defines a maximum level of specific energy consumption (or a minimum energy efficiency standard) for household refrigerators, representing energy efficiency class C as defined under IRAM standard 2404-3:1998.

The refrigerators to which this applies are:

- Refrigerators with two compartments at different temperatures (refrigerator-freezers), including self-defrosting refrigerators.
- Refrigerators with a single temperature setting (including those with low-temperature compartments), and self-defrosting units.

Energy efficiency labelling for lighting

Based on the high proportion of electrical consumption that lighting accounts for in residential use (approximately 32%), DNPROM led a process that culminated in Provision 86/2007 of 12 March 2007, issued by the National Domestic Commerce Office (a section of the Secretariat of Domestic Commerce). This provision mandates energy efficiency labelling for incandescent and fluorescent lamps that are used for general lighting, including compact fluorescent lamps (CFLs), commonly known as "energy-saving" lamps.

Impact of massive introduction of energy-saving lamps

The principal advantage of CFLs is that they use between one quarter and one fifth the power required for incandescent lamps of the same lighting capacity.

However, these devices could not be introduced on a mass scale without evaluating the impact of introducing components that produce harmonic distortion on electrical distribution networks, as well as the environmental impact of the mercury released at the end of these devices' life cycle.

DNPROM commissioned the Energy and Environment Group of the Engineering School at the University of Buenos Aires to research these problems. Engineers Mario Brugnoni and Rosana Iribarne duly produced a document entitled "Impacts on distribution networks and the environment from intensive use of compact fluorescent lamps".

The study concluded that the harmonic content that CFLs would contribute to the distribution network would be minimal, given the lamps' low power requirements and the masking effect produced by the rest of the network's linear loads. It also concluded that the combination of the harmonic components introduced by the CFLs and other electrical appliances produces a compensatory effect at the MT/BT transformer station, mitigating, and in some cases cancelling, a significant portion of the harmonics.

As regards the possible environmental impact of the final disposal of the CFLs, the study concluded that the saving in terms of carbon dioxide, mercury and other greenhouse gases from reducing electrical energy consumption and hence electrical generation would have a greater environmental impact than would the amount of mercury that would reach the environment as a result of improper large-scale disposal of CFLs.

Distribution of energy-saving lamps

A Plan to Create Awareness of and Implement Rational Electrical use by Residential Users is being developed, having been approved by Secretariat of Energy Resolution 8/08 under the parameters set forth by PRONUREE (Decree 140/07). The plan calls for replacing incandescent lamps by CFLs in all of the country's residential housing units. The goal is to distribute 25 million CFLs, two per household, within three years. Through the Argentine Association of Electrical Energy Distributors (ADEERA), the electrical distribution firms are in charge of the replacements in the areas covered by their concessions. The UTN is to audit the programme's progress.

The lamp replacement plan began in January of 2008, and as of January 2009, 5.5 million energy-saving lamps had replaced the same number of incandescents. By September 2009, 8.1 million CFLs had been installed in the National Interconnected System (SIN).

Large-scale educational campaign

This campaign was organized by ADEERA, and is being conducted via television and radio by both the Association and the distributors.

Purchase of compact fluorescent lamps from the Cuban government

Under Decree 140/07 and the Commercial Exchange and Cooperation Agreement between Argentina and the Republic of Cuba, the Government bought 4,043,952 nominal 18-watt compact fluorescent lamps, which arrived in Buenos Aires on 19 December 2008.

As regards the lamps' quality, it should be noted that during the week of 23 January 2008, an Argentine delegation of technical personnel from the Secretariat of Energy and the Argentine Standards and Certification Institute (IRAM) met with Cuban technicians in Cuba, in order to evaluate all the technical documentation and certifications of the quality of the lamps. A sample was also taken, and criteria were agreed on for approval through testing, which was later conducted by recognized and accredited Argentine laboratories. The lamps were tested in accordance with national regulations on electrical safety and energy efficiency, and proved to be of acceptable quality.

The lamps' main technical characteristics are as follows:

- Nominal power: 18 W
- Working voltage: 220V at 50Hz
- Bulb holders: E27
- Energy efficiency class: A
- Temperature/color: 6400º K (cold white)
- Color reproduction index: ≥ 80

International public bidding for purchase of 12.6 million energy-saving compact fluorescent lamps for residential use

In order to move forward with the Plan to Create Awareness of and Implement Rational Electrical use by Residential Users, the Secretariat of Energy issued Resolution 420/08, which instructs CAMMESA to proceed with the acquisition of 12.6 million energy-saving CFLs for residential use through a process of domestic and international public bidding.

The general rules for the bidding and specific conditions, as well as the technical specifications, were developed by technical staff at the Secretariat of Energy during the last months of 2008. Bids are currently being evaluated.

The technical characteristics and certification requirements that products must meet under the requirements include the following:

Technical characteristics:

- Nominal power: 18 W–21 W
- Working voltage: 220 V at 50 Hz
- Minimum lighting yield (as per IRAM standard 62404-2:2006, at 220 V and 50 Hz input): 57 lm/W
- Minimum lifetime: 6000 hours
- Temperature/color: cold white (4000º K)–Daylight white (6500º K)
- Power factor: >0.5
- Energy efficiency class (per IRAM standard 62404-2:2006): A
- Colour reproduction index: ≥ 80

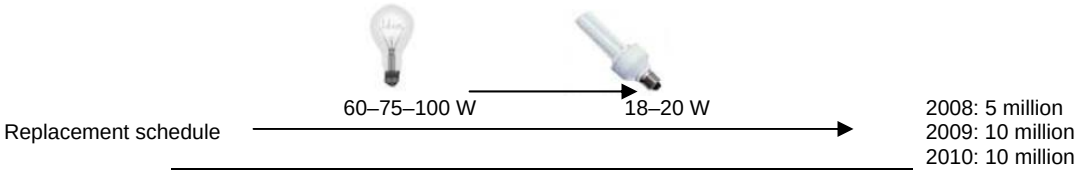
Required certifications:

- Certification under IEC 60968 (Ed. 1.2), pursuant to Resolution 92/1998 of the former Secretariat of Industry, Commerce and Mining, granted by a national certification entity recognized by the DNCI.
- Certification under energy efficiency labelling standards as set forth in Resolution 319/1999 of the former Secretariat of Industry, Commerce and Mining, Provision DNCI 86/2007, Provision DNCI 135/2008 and all relevant supplementary or modifying provisions.

Law 26. 473–Prohibition on importation and marketing of incandescent lamps in the country.

Law 26.473, published in the Boletín Oficial on 21 January 2009, prohibits importing and marketing of incandescent lamps for general residential use throughout Argentina as of 31 December 2010.

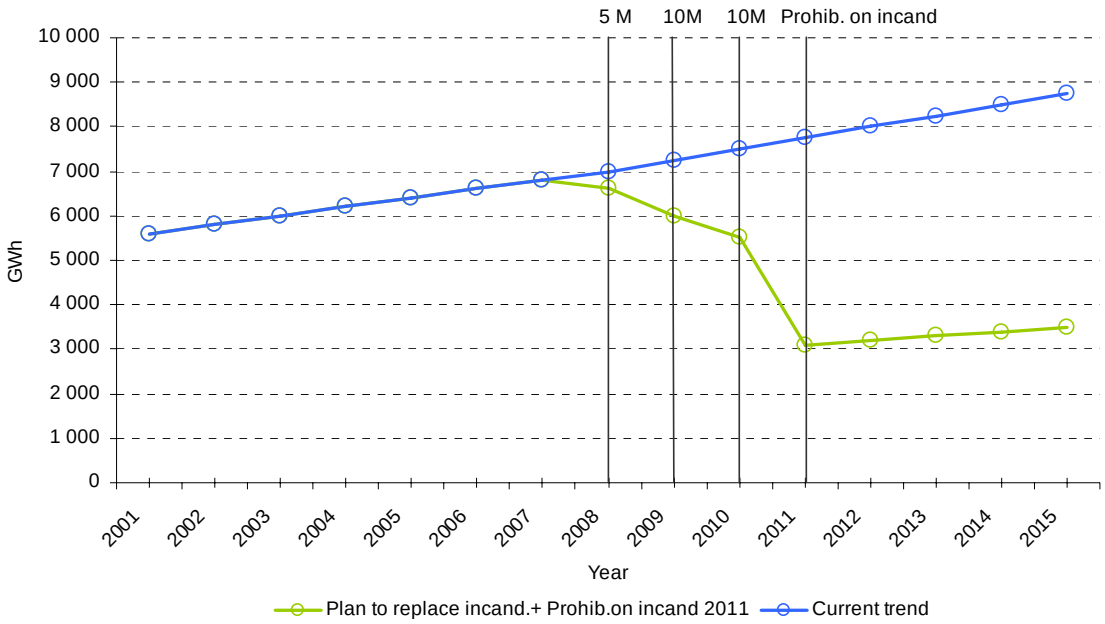
FIGURE 2
REPLACEMENT OF INCANDESCENT LAMPS BY CFLS



Expected results				
Scenarios	Units	2008	2009	2010
Current trend	GWh	7 020	7 257	7 501
Plan to replace incandescent lamps	GWh	6 611	6,028	5 453
Saving	GWh	410	1 229	2 048
Saving	MW	249	748	1 246

Source: National Promotional Office, Secretariat of Energy.

FIGURE 3
REPLACEMENT OF INCANDESCENT LAMPS BY CFLS



Source: National Promotional Office, Secretariat of Energy.

Efficiency in public buildings

Article 4 of Decree 140/2008 instructs the head of the Cabinet to implement the Rational and Efficient Energy Use Programme (PRONUREE) in all public buildings of the executive branch, with coordination and technical support from the Secretariat of Energy. Annex II of the decree establishes guidelines for the implementation.

Replacement of incandescent lamps

PRONUREE initially implemented the programme in national government buildings. Among others, the measures taken included replacing incandescent lamps with CFLs, regulating air conditioners to maintain a temperature of 24º C during the summer, and turning off ornamental lighting at midnight.

Energy-saving lamps (totalling 282,496, replacing the same number of incandescents) had been installed in the great majority of buildings used by government agencies as of 11 February 2009. At an average of 45 watts each, these lamps freed up approximately 12.71 MW. Once the rest of the approximately 10,681 lamps are replaced, the agencies involved will have fulfilled their commitment.

Treatment of annex II of Decree 140/2007

A proposed administrative decision has been developed and is being processed by the office of the Chief of Cabinet. The decision would mandate implementation of the Rational and Efficient Energy Use Programme (PRONUREE) in all executive branch buildings. A working plan agreed upon with the personnel at the office of the Chief of Cabinet will conduct preparatory activities for the implementation.

Energy saving and efficiency recommendations have also been prepared for public buildings, covering:

- Lighting.
- Controlling electrical demand.
- Electrical installations.

Basic studies

Terms of reference have been prepared for a series of studies that are considered basic to the formal launch of the programme. These call for:

- Inventories of the extent to which the services have been installed in the buildings, in order to begin with the initial work involved in the energy efficiency studies. During 2008, lists were prepared for approximately 60 buildings, with the collaboration of staff at the office of the Chief of Cabinet.
- A study of changes in ambient temperature in offices when air conditioning (but not ventilation) is turned off. This involves calculating the time it takes for the temperature to rise from 24º C to the maximum temperature that comfort standards allow.
- The use of knowledgeable and recognized professionals to create a manual with recommendations on air conditioning equipment and boilers in public buildings, including their operation and maintenance.
- A workshop at which representatives of the relevant consulting firms can share views and experiences and move towards implementing uniform methods and standards.

Other activities

Relations are being developed with various ministries (Justice, Security and Human Rights; Defence, Labour and Social Security; Social Development), as well as with the central bank and the Banco de la Nación, in order to begin changing contracts for T2 and T3 rates, as was done in 2007 with the Ministry of the Interior, which produced savings on the order of US$ 400,000/year without any investment.

A final report was provided on the assessments of energy efficiency in public buildings carried out by consultants in the cities of Buenos Aires, San Salvador de Jujuy, Neuquén and San Miguel de Tucumán.

Meetings were held with personnel from various offices of the Ministry of Planning, Public Investment and Services to consider the cost of electricity.

Energy savings in 2008-2007

The following table shows the savings for the January-November period of 2008 in public buildings in Buenos Aires with T2 and T3 rates, in comparison with the previous year.

TABLE 3
OVERVIEW OF ELECTRICAL ENERGY SAVINGS IN NATIONAL EXECUTIVE BRANCH BUILDINGS WITH T2 RATE JANUARY-NOVEMBER 2008/2007

Total for 11 months of 2008	2007	2008	2008-2007 difference	2008-2007 difference
	MWh	MWh	MWh	%
204 buildings (where energy was saved)	11 763	10 597	-1 166	-10%
290 buildings (no saving)	18 284	20 341	2 057	11%
Total, 494 buildings	30 048	30 939	891	3%

Source: National Promotional Office, Secretariat of Energy.

TABLE 4
OVERVIEW OF ELECTRICAL ENERGY SAVINGS IN NATIONAL EXECUTIVE BRANCH BUILDINGS WITH T3 RATE JANUARY-NOVEMBER 2008/2007

Total consumption at peak, off-peak and shoulder periods	2007	2008	2008-2007 difference	2008-2007 difference
	MWh	MWh	MWh	%
287 buildings (where energy was saved)	206 558	188 871	-17 687	-9%
130 buildings (no saving)	84 674	88 690	4 016	5%
Total, 417 buildings	291 232	277 561	-13 671	-4 ,69%

Source: National Promotional Office, Secretariat of Energy.

Note 1: Of the 130 buildings that did not have overall savings, 48 did save at peak demand times, meeting the short-term requirements of Decree 140/07.
Note 2: Not included are 80 buildings belonging to universities and 17 buildings with miscellaneous problems.

PRONUREE project–street lighting

Public lighting–Programme to replace all public lighting with energy-efficient lamps

Under Secretariat of Energy Resolution 7/2008 of 23 January 2008, a Provincial, Municipal and Local Energy Efficiency Plan is being developed. The object is to optimize the use of electricity in public lighting, street lights and public buildings, focusing primarily at the municipal level.

Under the plan, as of September 2009, the Secretariat of Energy had approved 31 investment projects to improve the energy efficiency of public lighting submitted by various municipalities, calling for the replacement of incandescent, mixed and mercury vapour lamps/bulbs with sodium lamps/bulbs. The plan aims to save 30 MW during peak demand in the national interconnected system. The programme will be audited by the National Technological University (UTN).

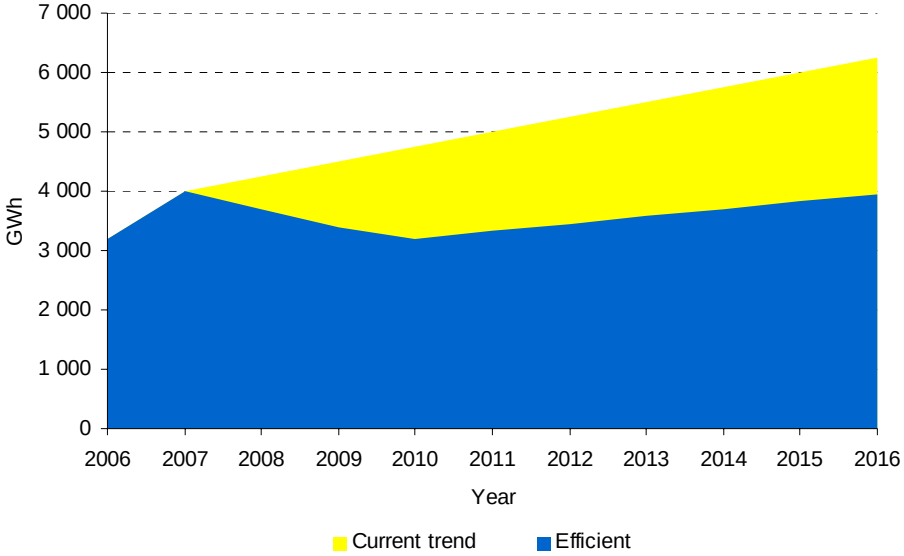
The participating municipalities used their budget savings from one year of these projects to reinvest in other energy-saving measures—in all, 15 projects representing US$ 6.5 million of reinvestment.

This public lighting programme is expected to reduce annual energy consumption by approximately 30% (once all of the current equipment has been replaced by more efficient technology). Estimates call for an average of 300,000 lighting devices to be replaced each year.

Information on procedures for changing municipal public lighting

The reader may find detailed information on the procedures to be followed by municipalities participating in the programme at http://energia3.mecon.gov.ar/home/.

FIGURE 4
ENERGY CONSUMPTION IN PUBLIC LIGHTING



Source: Secretariat of Energy.

E. Lessons learned

Following is a brief overview of lessons learned about energy efficiency programmes, projects and initiatives in Argentina.

For years, efforts have been of a stop-and-go (or, in some cases, "crackdown") nature. The first important conclusion from the results is that *continuity* of policy is essential. It is extremely detrimental for energy policy to be always starting anew.

Energy efficiency programmes and projects in the past have been funded almost exclusively by international technical cooperation (for instance, by the European Union, Japan and Germany), and the activities have been discontinued once the cooperation funding comes to an end. It is essential that the State make a fuller commitment to energy efficiency, allocating funds to promote and encourage efficient use, in order to ensure continuity. PRONUREE today reflects an awareness of the need for the State to play a more active role.

Insofar as possible, a solid technical base of the best possible quality must be maintained to support energy efficiency programmes. Doing this requires improving institutional and organizational frameworks to provide opportunities for personnel to develop technical expertise.

To the extent possible, rates must reflect the real cost of services and not be subsidized (except for social sectors that clearly do not have the resources to pay for them). Under these conditions, investments in energy saving projects will pay for themselves in much shorter time periods, making such projects more attractive and easier to fund.

There is a need for policy that ensures that information is disseminated, so as to reduce information asymmetries in the energy market. Users must know what to do, where to obtain advice, what to purchase and how to finance purchasing, where to buy, where to seek help with projects (energy services providers, consultants), and so on. The State must take an active role in making this information available as a part of sustainable development policy. These lessons are clearly applicable in nearly all the Latin American and Caribbean countries.

II. Barbados

A. Recent advances in policy, regulatory and institutional frameworks

Barbados has a number of regulations and procedures designed to promote energy efficiency, of which the main ones are the following:

- The government grants firms a tax exemption of 150% of investments made in projects associated with energy efficiency.
- The government permits individuals to request tax exemptions for money spent on energy audits commissioned to assess ways of improving energy use in homes or businesses.
- The government permits individuals to request tax exemptions for money spent on retrofitting homes or businesses.

Barbados's energy efficiency policy encourages all attempts to reduce the demand for imported oil.

With regard to explicit policies for promoting energy efficiency, Barbados provides tax exemptions for all energy-saving-related investments.

The government considers it politically prudent to reduce dependence on imported oil, and its general intention is to move towards intensive development of alternative energy sources.

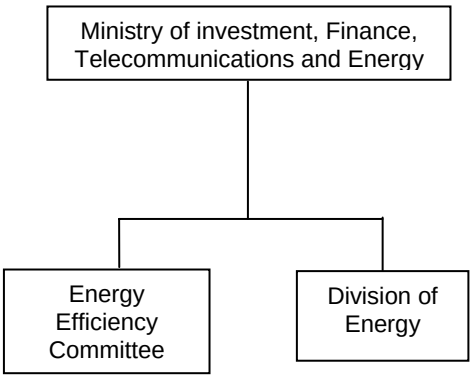
Spending on imported energy reduces the country's financial reserves, and the government considers this issue particularly important because of the recent wide fluctuations in oil prices. High oil—and, thus, thermal electric energy—prices pose a threat, since they have a major impact on local production costs.

Barbados views energy efficiency as a way of reducing the negative environmental impact of greenhouse gases produced by burning fossil fuels.

The government also considers it feasible to evaluate users' response to energy efficiency programmes, once these are implemented.

The institutional position, within the Barbados government, of the office responsible for energy efficiency issues is indicated in the following figure.

FIGURE 5
INSTITUTIONAL SCHEME WITH RESPECT TO ENERGY



Source: Government of Barbados website.

Other initiatives associated with energy efficiency

In March 2009, Barbados launched a sustainable energy framework programme to promote and support energy conservation and sustainable energy programmes, thus encouraging alternatives and minimizing dependence on fossil fuels. The programme was initiated by the Ministry of Finance, Investment, Telecommunications and Energy, and includes energy efficiency initiatives in Caribbean hotels.

The programme is set to receive support from the Inter-American Development Bank (IDB), which will provide the Government of Barbados technical assistance to improve energy use in public buildings, in the residential sector and in small and medium-sized enterprises, as well as to explore opportunities for renewable energy.

A further objective of the programme is to strengthen institutions in the area of energy efficiency, bioenergy, carbon credits and dissemination of successful projects.

The Global Environment Facility (GEF) will also fund pilot energy efficiency and renewable energy programmes, with IDB serving as the executing agency.

B. Key actors in energy efficiency and their effective roles

The main actors in the area of energy efficiency in Barbados, and their effective roles, are as follows:

1. Governmental institutions

Government ministries: A number of ministries have received funds to promote energy efficiency, and some are executing small energy projects to demonstrate to the public the benefits of replicating these experiments.

Energy Committee of the Ministry of Finance, Investment, Telecommunications and Energy: The role of this Committee is to identify and implement energy efficiency projects and to remove bureaucratic barriers that could stand in the way of various projects. The Committee has been operating for one year, with few demonstrable results.

Division of Energy: Some years ago, this division of the Ministry led a major diagnostic exercise to stimulate the industry. This encouraged the commercial sector to follow suit. It has increased awareness on energy use.

2. Regulatory entities

Fair Trade Commission (FTC)

The Commission is currently working with the national electric utility to implement electricity rates that encourage people to install their own generation facilities. The effectiveness of the effort will depend on the actual rates ultimately determined, and on users' ability to create enough installed capacity to sell electricity to the company.

3. Firms

Retailers

A number of vendors produce and sell energy-efficient products in Barbados. There is no explicit plan to encourage the purchase of energy-efficient equipment, beyond the "incentive" provided by the lack of availability of a particular product manufactured by competing companies.

Retailers are not sensitive to the need for energy efficiency, and do not see themselves as playing a role in this regard.

4. Non-governmental organizations (NGOs)

Barbados Association of Energy Professionals (BAEP)

This group is of recent creation, with energy efficiency being its primary raison d'être. It also has other commercial interests for which it seeks to produce an impact on energy efficiency. BAEP has been effective in mobilizing energy professionals in Barbados and throughout the region, and has plans to become more active in research and training in Barbados. However, its economic resources are insufficient for the tasks facing it, since it receives no support from government or from private sector institutions.

5. Universities

University of the West Indies, Cave Hill Campus

This campus houses a group dedicated to energy issues. Faculty members include Professors Leo Moseley, Upindrantah Singh, Osaretin Sunday and S. Popuri.

6. Energy efficiency firms

The following companies in Barbados focus on energy efficiency: Aquasol, Energy Management Solutions, Solar Dynamics and Sun Power.

Barbados has long been a leader in solar water heaters, and has recently been recognized as one of the five countries in the world with the highest penetration of this technology. Currently, a solar water heater is automatically installed in every new housing unit built. This technology generates a highly significant reduction in peak electrical demand for the local electric company.

7. Consulting firms

E&D Consulting Solutions, Clarke Energy Associates and the Solar Transport Project

These companies offer a range of energy services for government, the local electric utility, and the private and residential sectors.

E&D Consulting Solutions

E&D Consulting was formed in response to the growing need to bring down costs and raise benefits in an increasingly competitive market, as reflected in its motto: "Implementing solutions to create greater efficiency".

E&D provides two main types of services: (a) consulting on the use of conventional energy and the implementation of renewable energy measures for buildings, offices and residential units, along with conducting energy audits as part of an overall energy management programme; and (b) consulting on telecommunications issues.

Eighty percent of the firm's revenue is derived from services that it exports. It has two international contracts, one with the United Nations Development Programme (UNDP), the other with the World Bank. The firm plans to extend its offering of energy services to other Caribbean islands by late 2009.

Clarke Energy Associates (www.clarkeenergyassociates.com)

Clarke Energy is a consulting firm that specializes in developing renewable energy and energy efficiency projects, as well as in energy policy planning and planning for electric companies.

Its president, Dr. Roland Clarke, before forming the firm, was manager of the Caribbean Renewable Energy Development Programme[1] (CREDP) from 2002 to 2008. This programme was conducted under the auspices of the Caribbean Community (CARICOM).

Clarke Energy Associates specializes in consulting, training and the development of renewable energy projects, energy efficiency projects, energy policy and production planning for electric companies.

The technical services that if offers include:

- Feasibility studies.
- Project analysis, including economic/financial analysis, risk analysis, sensitivity analysis and studies on greenhouse gas reductions.
- Avoided-cost analysis, simulation of production costs for electric companies and price forecasting for the electricity market.
- Demand side management (DSM) analysis.
- Energy audits.
- Project management.
- Regulatory strategies for renewable energy and energy efficiency.
- Clarke's principal clients are:
- Natural Resources Canada, RETScreen.
- Renewable Energy and Energy Efficiency Partnership (REEEP).
- The Government of Barbados.
- The Caribbean Community (CARICOM) Secretariat, Caribbean Renewable Energy Development Programme (CREDP).
- The World Bank.

Solar Transport Project

This firm focuses primarily on developing electric vehicles based on solar energy (2005), and on developing solar hot water heaters.

[1] Programme objective: "To reduce barriers to the increased use of renewable energy, thus reducing the dependence on fossil fuels while contributing to the reduction of greenhouse gas (GHG) emissions".

The firm's president, William Hind, also serves, since February 2002, as head of the Energy Efficiency and Renewable Energy Unit, Barbados Ministry of Energy and Environment.

In his governmental capacity, Mr. Hind coordinates the government's energy efficiency and renewable energy programmes; makes recommendations regarding tax policies to reduce the tax burden for generating systems using renewable energy sources, for efficient equipment in housing and for vehicles with low fuel consumption; and develops energy audit policy for the residential sector. He has also developed energy efficiency and renewable energy policies for the Government of Barbados, and has identified funding sources for the country's Renewable Energy Centre.

C. Resources and funding mechanisms for energy efficiency programmes

The government has committed relatively few resources to projects relating to activities by government itself. Other funding sources include the Inter-American Development Bank (IDB), which has an initiative to promote energy efficiency in hotels and to strengthen institutional capacities in areas such as the formulation of appropriate frameworks for the development of sustainable energy sources.

The funding required by energy efficiency programmes depends, to a great extent, on their scope. Conducting preliminary studies, along with the reconditioning of houses and businesses, could require as much as US$ 300,000.

This is due to the age of the facilities, the local environment and other external costs. However, energy efficiency programmes can be introduced gradually, as funds become available, e.g., to encourage the use of energy-efficient lighting throughout the island.

The hotel energy efficiency programme is monitored by the Caribbean Alliance for Sustainable Tourism (CAST), and disbursements are made by IDB.

D. Results of energy efficiency programmes to date

No energy efficiency programmes, in the traditional sense, have been implemented in Barbados. There are a few projects to increase the efficiency of energy use, but these are not widespread or national in scope. Numerous efforts have been undertaken by both the public and private sectors, with varying degrees of success.

Success stories in these sectors include: (a) a government-initiated audit project, headed by Barbados Port Inc., which led to the retrofitting of lighting and air conditioning equipment, along with oversight of the reconditioning of businesses and housing; (b) a government ministry, which conducted a major redesign and improvement of its lighting system; and (c) a number of hotels, which implemented cogeneration and gas compressor systems, with excellent results (energy savings on the order of 50%).

The government commissioned a number of energy audits at its largest facilities in 2007. A few consulting projects are also underway to recondition new buildings for more efficient energy use.

E. Lessons learned

Positive

- Energy efficiency measures generate expectations of reduced cost for owners.
- When funding is available, good returns on investment encourage the implementation of energy efficiency measures.
- Energy efficiency actions align well with environment-friendly initiatives, making it easier to gain acceptance for the former.

Negative

- Obtaining funding is often a challenge.
- The most promising technologies are not readily available.
- Some clients do not seek professional advice before implementing technical energy efficiency solutions, often resulting in wasted resources. This occurs because of lack of knowledge on the part of clients, or as a result of the shortcomings of sales personnel.
- Some solutions are evaluated solely on the basis of their financial benefits, without taking environmental factors into consideration.

III. Bolivarian Republic of Venezuela

A. Recent advances in policy, regulatory and institutional frameworks

1. Economic context

The economy of the Bolivarian Republic of Venezuela is based on exports of crude oil and refined petroleum products. It possesses 13.7% of the world's total proven oil reserves, and is ranked second among the countries with the largest proven reserves, behind Saudi Arabia. It is eighth in the world in terms of proven natural gas reserves, with a share of 3.3% of the total. These figures do not include reserves that remains to be quantified in the Orinoco Oil belt. This situation puts the country in a privileged position in the American and world energy context.

The fact that it also has large reserves of bauxite and iron ore, together with abundant hydroelectric energy, has led to the development of a major aluminium and steel industry in the southern region of the country. A group of related industries operate around these industrial complexes, forming a basic industrial and strategic axis in that region. Venezuela also has a large petrochemicals industry, with two major complexes located in the western centre of the country.

Gross domestic product (GDP) has grown at 5.6% year on year between 2004 and 2008. The sectors contributing most to GDP growth have been oil activity, financial and insurance institutions, communications and construction. In the last year, economic growth of 4.8% was mainly driven by the performance of the oil sector, communications and other areas such as community, social and personal services.

2. Energy context

The Bolivarian Republic of Venezuela has large proven reserves of natural energy resources: oil (172.323 billion barrels); natural gas (175 billion ft^3); coal (1.461 billion tons). National refining capacity is 1.303 million barrels per day, and it has an international capacity, resulting from partnerships with the state-owned Petróleos de Venezuela Sociedad Anónima (PDVSA), of 1.732 million barrels per day, giving total refining capacity of 3.035 million barrels per day.

Oil production in 2008 was 3.26 million barrels per day, and gas 6.9 million ft^3 per day. Exports of oil and refined products totalled 2.89 million barrels per day.

Total final energy consumption by economic sectors amounts to 827 million barrels of oil equivalent (BOE) per day (2006), with industry the largest consumer, accounting for 47%, followed by transport, which consumes 38%. The residential, commercial, services and other sectors consume 121 million BOE per day, representing 15% of total consumption.

The Bolivarian Republic of Venezuela has installed an electric power generating capacity of 23,354.1 MW (2008) distributed as follows: thermal generation, 35% and hydroelectric generation 63%, mostly obtained from the southern zone of the country, where the main hydroelectric complex is located. Up to 2% of our power is obtained from distributed power plants.

The National Interconnected Power Grid (SIN) consisting of lines operating at voltages of 765, 400 and 230 kV cover all of Venezuelan territory, comprising over 10,000 km of lines, which also interconnect with Colombia and Brazil.

The electricity distribution network in the Bolivarian Republic of Venezuela operates at different voltage levels, supplying electricity to 97% of the population.

3. Political and legal context

The National Simón Bolívar Project, which is the governing document for the nation's economic and social policy, in its First Socialist Plan for the period 2007-2013 includes the promotion of rational and efficient energy use as a strategy and policy within the "Venezuela: World energy power" directive.

In response to this policy, the Energy Revolution Mission was created in 2006, which aims to promote efficient energy use in the country, as a strategic public policy to be implemented mainly through practical energy-efficiency programmes as described below.

In addition, the Organic Law on Hydrocarbons, together with the Decree with Force of Organic Law on Gas Hydrocarbons and the Organic Law on the Electricity Service set guidelines for introducing energy efficiency in the activities they regulate.

In terms of the technical regulation of energy efficiency, between 1995 and 2000, the Ministry of Popular Power for Energy and Oil, and stakeholders involved in the manufacture, importation and trade in electrical appliances, together with the country's standardization and certification institution, the main electricity firms and technological research institutes, all worked together to establish standards and labelling, to progressively achieve minimum energy efficiencies for the electrical appliances sold in the country, and to ensure that users take account of parameters such as expected energy consumption in their decisions to purchase such products.

As a result of the work done, the following Venezuelan standards COVENIN (Venezuelan Industrial Standards Commission) were adopted:

- 3193:1999: Refrigerators, refrigerator-freezers and freezers. Energy consumption testing methods and capacity measures.
- 3235:1999: Refrigerators, refrigerator-freezers and freezers. Labelling and energy consumption report.
- 3537:1999: Window type air-conditioners. Testing methods.
- 3538:1999: Air-conditioners Methods for testing cooling capacity, energy consumption and energy efficiency.
- 3560:2000: Window type air-conditioners. Labelling and energy-efficiency report.
- Compliance with these standards is voluntary, but, on 13 November 1998, a Joint Resolution of the Ministries of Popular Power for Trade and for Energy and Oil (former Ministries of Production and Trade and of Energy and Mines) made it compulsory for refrigerators and freezers to display a "Consumption guide" label, indicating their respective energy consumption.

On 20 January 2006, the ordinance on the thermal quality of buildings in the municipality of Maracaibo, Zulia state, entered into force. This ordinance is a legal instrument of mandatory nature, which aims to guarantee that the conditions of design and construction of new buildings satisfy the limits of the value of global thermal transfer of ceilings and walls, established for the municipality of Maracaibo, with the aim of seeking comfortable thermal conditions, reducing electricity consumption through the use of air conditioning.

The Regulation *(Ordenanza)* on the thermal quality of buildings in the municipality of Maracaibo establishes a regime of incentives to stimulate the design and construction of buildings with a thermal quality that exceeds the standard.

In addition, in the framework of cooperation between the ECLAC/European Commission project "Promotion of efficient energy use in Latin America", the Ministry of Popular Power for Energy and Oil of the Bolivarian Republic of Venezuela prepared a draft law to promote energy efficiency (2001), and undertook a study of the Venezuelan legal framework (1999).

B. Key actors in energy efficiency and their effective roles

1. The Ministry of Popular Power for Energy and Oil (MENPET)

The regulation, formulation and monitoring of policies, and the planning, implementation and supervision of national government activities in relation to hydrocarbons, energy in general, petrochemicals, organic chemicals, and other similar or related chemicals, is the responsibility of the Ministry of Popular Power for Energy and Oil (MENPET). Part of its competencies relate to:

- The development, exploitation and control of non-renewable natural resources and other energy resources, together with the electrical, oil and petrochemicals, carbon chemicals and similar or related industries.
- Market research and analysis and price setting for products and services in the area of its competency.
- Prevention of atmospheric pollution caused by energy activities, in coordination with the Ministry of Popular Power for the Environment.

Attached to the Office of the Vice Minister of Energy, are the Directorate General of Electrical Energy and the Directorate General of Alternative Energy.

The functions of the former include:

- Directing, coordinating execution and evaluating policies to be used in regulating the electricity sector.
- Helping to formulate the Electricity Service Development Plan.

Similarly, the functions of the Directorate General of Alternative Energy include:

- Formulating and implementing policy proposals, guidelines and strategies to promote the formation of national capital in alternative energies.

The Electricity Service Development Foundation (FUNDELEC), attached to MENPET, provides comprehensive assistance on the functioning of the electricity sector and the various situations that may arise in relation to the service. Currently, its functions include coordinating, on behalf of the Bolivarian Republic of Venezuela, the Cooperation Project for Comprehensive training of Personnel from Cuba and the Bolivarian Republic of Venezuela, in the domain of rational and efficient use of electricity. It is also implementing the *Sembrando Luz* [Sowing light] programme, aimed at installing photovoltaic systems to supply electricity in the country's indigenous, border and remote areas, and installing water purification plants that use photovoltaic systems.

2. Ministry of Popular Power for Trade

This agency is responsible for formulating, regulating and implementing policies to encourage, promote and vitalize marketing and distribution channels for goods and services.

One of its competences and functions is to design policies and to evaluate, in coordination with other competent bodies and national government entities, the system for setting prices and rates on goods and services, based on the national government guidelines.

Attached to it is the Autonomous National Service of Standardization, Quality, Metrology and Technical Regulations (SENCAMER), which coordinates the process of preparing national quality standards for products, processes and services.

3. Ministry of Popular Power for the Environment

This ministry is responsible for regulating, formulating and monitoring the Venezuelan State's environmental policies. Its mission is to guarantee a better quality of life through crosscutting, governing, executive and regulatory management of the environment, and of the use and conservation and natural resources, promoting participation by society to achieve sustainable development.

4. Ministry of Popular Power for Science, Technology and Intermediate industries

The Ministry of Popular Power for Science, Technology and Intermediate Industries, as part of the Venezuelan State, has a mission to set up and maintain the National Science, Technology and Innovation System. As governing body, coordinator and articulator of the system, it focuses on convening the various agents and institutions to create and consolidate open, flexible networks and integrated and fluid work processes, where knowledge satisfies demands, provides solutions and helps invigorate Venezuela's productive apparatus, to satisfy the population's needs and improve their quality of life.

Agencies attached to the Ministry include the Foundation Institute of Engineering for Technological Research and Development, whose objectives are: research activities, technological development, and providing advisory and specialized services for the country's industry and public sector. It has laboratories to undertake tests of standards of domestic and industrial equipment.

The Industrial Restructuring Fund is also attached to the Ministry of Popular Power for Science, Technology and Intermediate Industries, with responsibility for promoting and ensuring implementation of the international agreements signed by the Venezuelan State in relation to controlling ozone depleting substances (the Vienna Convention and Montréal Protocol and its amendments).

5. Petróleos de Venezuela, S.A. (PDVSA)

Petróleos de Venezuela S.A. is a state-owned enterprise of the Bolivarian Republic of Venezuela with a mandate to explore, produce, manufacture, transport and market hydrocarbons. Its ultimate aim as the engine of the country's harmonious development, and to strengthen sovereign use of resources, empower endogenous development and promote a decent and profitable existence for the Venezuelan people, who own the country's underground wealth, and are the sole owner of this operating enterprise.

It is responsible for the implementation and development of vehicle natural gas (the Autogas project). Given the importance and strategic nature of the use of vehicle natural gas for the State, PDVSA created the Autogas Project Division, with responsibility for laying technical foundations and engaging the social and cultural commitment of all Venezuelan people, vehicle users in general, to contribute to responsible energy use and leverage the new alternative fuel system.

6. National Electricity Corporation (CORPOELEC)

As part of the reorganization of the national electricity sector, and with the aim of improving service quality throughout the country, maximizing efficiency in the use of primary energy production sources, operation of the system and redistribution of the loads and functions of current sector operators, the national government ordered the creation of Corporación Eléctrica Nacional S.A, through Decree law 5330, of 2 May 2007, published in the Official Gazette of the Bolivarian Republic of Venezuela No. 38.736 of 31 July 2007.

The National Electricity Corporation is a state-owned operating enterprise responsible for activities of generation, transmission, distribution and marketing of electric power and energy, attached to the Ministry of Popular Power for Energy and Oil.

CORPOELEC supports the Energy Revolution Mission, by implementing actions to sustain the programme to replace of incandescent lightbulbs with energy-saving bulbs, and to install distributed power generation plants, by constructing batteries of generators.

C. Resources and funding mechanisms for energy efficiency programmes

The expenses involved in paying payroll or contract staff, as well as operating and infrastructure expenses, are generally funded from the national budget.

Under some bilateral energy agreements, the state has allocated resources to implement energy-efficiency projects. An example is the Cooperation Project for Comprehensive Training of Personnel from Cuba and the Bolivarian Republic of Venezuela in Rational and Efficient Electricity Use.

Within this project, CORPOELEC has invested in training, promoting diploma courses on energy efficiency in some of the corporation's branches, sponsored by the Ministry of Popular Power for Energy and Oil, the Electricity Service Development Foundation (FUNDELEC), the Energy Agreement between Cuba and the Bolivarian Republic of Venezuela, and the National Experimental Polytechnic University (UNEXPO).

Currently, CORPOELEC is supporting the Energy Revolution Mission, enabling it to successfully complete the third phase of replacing incandescent lightbulbs with energy-saving lamps, which began in February 2008, and involved the replacement of 11.3 billion bulbs.

Progress has also been made in seeking alternative energy sources, through pilot electrification projects, using non-conventional technologies, such as wind and solar-photovoltaic power, making it possible to supply a sustainable electricity service to remote population groups.

D. Results of energy efficiency programmes to date

1. Strategic energy-efficiency programmes and activities

On 17 November 2006, the President of the Bolivarian Republic of Venezuela announced the start of the Energy Revolution Mission, which aims to promote efficient energy use in the country, as a strategic public policy.

The programmes to develop this mission include the following:

- Programme to replace incandescent lightbulbs with the energy-saving lamps.
- Vehicle natural gas programme, aimed at replacing the use of gasoline and diesel.

- Replacement of obsolete gas infrastructure and expansion of the use of natural gas nationwide.
- Creation of energy-efficiency standards.
- Renewal of the country's electric power generation capacity and conversion of diesel-fired generators to natural gas.
- Installation and renewal of electricity transmission and distribution lines.
- Use of alternative energy sources, including the manufacture and installation of solar panels and wind power turbines.
- Installation of alternative electrical systems in isolated and remote communities.
- Installation of water purification plants in rural communities, using photovoltaic energy sources.
- Installation of distributed generation plants, by constructing batteries of generators throughout the country.
- Implementation of education, information and public-awareness-raising campaigns on the need for efficient energy use.

2. Programme to replace incandescent lightbulbs

The first phase of this project began in November 2006, which focused on replacing 53 million incandescent lightbulbs with energy-saving lamps, with decisive participation by members of the Cuba-Venezuela Youth Brigade.

This phase culminated on 23 April 2007 with the effective replacement of incandescent lightbulbs by energy-saving lamps.

The results were as follows:

- Incandescent lightbulbs replaced, 53,165,181.
- Homes visited, 5,826,221, through participation by 2,950 brigade members on 131 working days.
- Of the total number of homes visited, 1.3% were closed and just 1.4% refused to replace their lightbulbs.
- The National Load Dispatch Management Centre calculated the impact that replacing incandescent lightbulbs with energy-saving lamps had on the demand curve of the national electricity system. The results were as follows:

  (a) Comparing demands over the last three years, there was a reduction of 1,400 MW in maximum demand in the national system during peak hours (8 p.m.).

  (b) There was also a reduction in energy demand for January-April, amounting to 575 GWh.

  (c) These results saving meant a potential saving in energy consumption of 2,486 GWh in 2007.

Phase II of the project consisted of replacing 15,364,793 incandescent lightbulbs with energy-saving lamps in non-residential sectors, such as commerce, industry and government, which produced an additional reduction in the system of 400 MW.

The combined results of phases I and II are as follows:

- Reduction in maximum demand: 1,800 MW.
- Energy-saving: 2,675 GWh.
- Reduction in CO_2 emissions: 3.28 million tons.

- Reduction in electricity bill per home visited: 15%.
- Reduction in the use of liquid fuel: 5.9 million barrels per year.

In addition, CORPOELEC implemented the third phase of the replacement of incandescent lightbulbs with energy-saving lamps, which began in February 2008, and involved the replacement of 11.3 billion lightbulbs, leading to a reduction of 569.7 MW in the load curve, and 1,890,000 families benefited.

3. Autogas project

The Government of the Bolivarian Republic of Venezuela, acting through the Ministry of Popular Power for Energy and Oil, gave Petróleos de Venezuela S.A., the task of implementing and developing vehicle natural gas (GNV) with the aim of promoting the use of this fuel system in the nation's automobile stock.

This project's key objective is to promote the use of natural gas as an alternative fuel to be used in the country's automobiles, by providing supply points and vehicle conversion centres, thus improving environmental quality, increasing exports of liquid fuels and promoting the nation's sustainable development.

Between 2006 and June 2009, a total of 10,609 vehicles had been converted to the GNV system, including government vehicle fleets and private vehicles. There are also are 131 GNV supply points operating in service stations.

4. Programme to replace air-conditioners

The state of Zulia has the highest electricity consumption per person in the Bolivarian Republic of Venezuela and Latin America. High levels of electricity consumption in buildings result from the use of mechanical air-conditioning equipment, which account for roughly 76% of the electricity bill in the residential sector.

The main causes of the high consumption of air-conditioners are excessive size and inefficient equipment; hence the programme to replace air-conditioners, led by the electricity firm C.A. Energía Eléctrica de Venezuela.

The programme consists of replacing inefficient air-conditioning equipment with much more efficient units for residential users of the state of Zulia, whose monthly consumption was between 1,000 and 3,000 kWh.

The programme began in February 2002, and by August 2009 the following results had been achieved:

- Number of air-conditioners replaced: 36,417 units.
- Persons benefited: 153,770 inhabitants (30,151 households).
- Reduction in demand 49,73 MW.
- Annual energy saving: 155.7 GWh/year.
- Annual reduction in CO2 emissions: 0.25 metric tons
- Annual reduction in diesel consumption: 0.51 million barrels.

5. Formation and training:

The Cooperation Project for Comprehensive Training of Personnel from Cuba and the Bolivarian Republic of Venezuela in Rational and Efficient Electricity Use aims to implement actions of education, formation, training, awareness-raising, evaluation and diagnostics on energy issues, based on specific measures to contribute to rational and efficient energy use, and thus safeguard our energy sovereignty, the environment, and future generations.

Achievements since November 2006, when the project began:

- 1 training course on business energy management and load absorption (30 professionals and technicians).
- 7 diploma technology courses on total energy efficient management (TGTEE) (210 professionals and technicians).
- 1 diploma course on energy education for sustainable development (60 teachers).
- Masters degree in energy efficiency (enrolment of 57).

In addition, MENPET has held 18 workshops on energy efficiency for public-sector workers from 53 organizations (550 professionals and technicians).

6. Distributed generation

The Energy Revolution Mission also envisages the installation of 1,000 MW distributed generation capacity throughout the country, with the aim of eliminating rationing in certain places, increasing the quality and reliability of electricity service, reducing losses, setting up mobile generating capacity and a strategic factor in having deconcentrated generating capacity available. This additional capacity includes the installation of power generators.

E. Lessons learned

- In the specific case of the Bolivarian Republic of Venezuela, which is very rich in renewable and nonrenewable energy resources, institutional messages in the past highlighted the abundance of resources without considering the need to use them efficiently. This, together with low energy prices, created a culture of squander and waste, which needs to be met head-on and on sustained and lasting basis.
- As in other countries that have successfully replaced incandescent lightbulbs with energy-saving lamps, to maintain the savings achieved, the measure must be complemented with others to ensure the permanency of the results, together with the availability of technology and the final decision by consumers to prefer high energy-efficient equipment. In this regard, progress is being made in installing a factory in the country making energy-saving lightbulbs, and mass campaigns have been undertaken to stimulate electricity saving. Work is also ongoing to train and form professionals in energy efficiency, which will generate positive synergies in efficient energy use.
- Although the success of the energy-saving measures applied in the Bolivarian Republic of Venezuela speaks for itself, in terms of the importance and profitability of efficient energy use, it is also true that political decisions at the highest level are what makes positive results in energy efficiency achievable — as shown by the fact that the President of the Bolivarian Republic of Venezuela himself has launched the Energy Revolution Mission.
- As is true of other Latin American countries, when Governments become aware of the economic, environmental and social benefits to be obtained from applying energy-efficiency policies, an institutional structure is being defined to ensure the permanency of an intellectual, operating and functional capacity to support the effective application of such policies. Thus far, in the Bolivarian Republic of Venezuela, the Ministry of Popular Power for Energy and Oil has been the agency responsible for the energy-efficiency activities undertaken in the country.

IV. Brazil

A. Recent advances in policy, regulatory and institutional frameworks

Since the first oil crises in the 1970s, the Brazilian Government has taken measures and implemented programmes to minimize energy loss, especially during crises. The federal government's energy conservation programme, instituted in 1981, was the first solid effort to promote energy efficiency in industry. It placed special emphasis on oil derivatives, and included efforts to replace major energy sources. The practice of reviewing industrial and commercial businesses' energy accounts to identify potential ways of reducing energy losses began at that time.

The Brazilian labelling programme (PBE) coordinated by the National Institute of Metrology, Standards and Industrial Quality (INMETRO) began in 1984. It evaluates the functioning of energy-consuming equipment and provides information for consumers, with labelling for a wide range of devices, including household appliances, electric motors, gas hot water heaters and stoves, and solar collectors. The process of evaluating compliance with the relevant standards requires uniform testing procedures and laboratories for the purpose. Since its inception, the programme has included close coordination and cooperation with both producers and providers of products.

The oil crises complicated the situation in the oil sector, and in 1985 the National Electrical Conservation Programme (PROCEL) was created. It is overseen by the Ministry of Mines and Energy and coordinated by ELECTROBRAS. An important additional programme for electrical conservation is the Programme for Energy Efficiency (PEE) managed by the National Electrical Agency (ANEEL) pursuant to Law 9.991/2000. This programme channels a portion of electric utilities income (the wire charge) to energy efficiency measures, providing a significant budget for these activities.

Reflecting a recognition of similar potential for energy savings in the fuel sector, the National Programme for the Rational Use of Oil Products and Natural Gas (*Programa Nacional da Racionalização do Uso de Derivados de Petróleo e Gás Natural*, or CONPET) was launched in 1991. Coordinated by the federal government, it is also managed by the Ministry of Mines and Energy. It includes private initiatives, and draws on technical, administrative and financial resources provided by PETROBRAS. These programmes have had some results (see below), although they are not yet as visible as might be desired, are not accorded the importance they deserve, and are not adequately coordinated.

At the federal level, Law 10.295 (the Energy Efficiency Act) was an important message signalling the importance of energy efficiency. Passed in October 2001, it deals with national policy for energy conservation and rational use, establishing "maximum levels of specific energy consumption (or minimum energy efficiency levels) for energy-consuming machines and devices produced and sold in Brazil". Enforcement is the responsibility of the Energy Indicators and

Efficiency Steering Committee (*Comitê Gestor dos Índices de Eficiência Energética,* or CGIEE), created by Decree 4.059 in the same year as the law. The law was drafted under the guidelines of Brazil's energy policy, set forth in Law 9.578/1995. It was debated extensively, and is an important institutional achievement for energy efficiency in Brazil that should be appreciated and noted.

The instruments progressively implemented under this legislation were used to define minimum performance levels for three-phase electrical induction motors, compact fluorescent lamps, refrigerators, air conditioners, and gas hot water heaters and stoves. Work on similar regulations for a number of other devices is well advanced. This law establishes minimal levels of functioning that are, in practice, mandatory. Thus, it is essentially different from the labelling that classifies the efficiency of devices, which is voluntary.

One important consequence of the improvement in Brazil's energy efficiency programmes – principally in the areas of evaluation procedures and systems of development– is that the nation's energy planning has begun to take account of such impacts. The National Energy Plan 2030, which includes projections for the development of Brazil's energy sector over the next two decades, explicitly assumes impacts of between 4.0 GW and 15.5 GW of savings in electrical generation as a result of energy efficiency programmes.

These savings are projected as a result of an expected 5% reduction in electrical demand due to autonomous technological progress, and another 5% as a result of major energy-saving initiatives. Energy efficiency measures will definitely be important, since energy use in Brazil as a proportion of GDP has been increasing in the past decade, while it is generally stable or declining in other countries.

B. Key actors in energy efficiency and their effective roles

The Ministry of Mines and Energy, through its Secretariat of Energy and Development Planning (specifically, the General Energy Efficiency Coordination Office), is responsible for defining and implementing Brazil's national energy efficiency policy. In addition to managing the two national programmes PROCEL and CONPET, this office has a broad mandate and responsibilities in the area of energy efficiency—in brief, the following:

- Subsidizing the development and coordinating the implementation of energy efficiency policy, projects and programmes, as well as promoting and overseeing them.
- Promoting the systematization of information related with energy efficiency by creating indicators to evaluate energy efficiency programmes.
- Planning, coordinating and conducting action to increase the efficiency of equipment, applications and buildings (especially in activities like CGIEE, as mentioned above).
- Promoting, stimulating and expanding action on rational energy use in different sectors.
- Working with other government agencies to coordinate and integrate national programmes for rational use of electrical energy, oil products, natural gas and other fuels.
- Identifying priorities and proposed guidelines for the use of public resources in energy efficiency projects or actions.
- Funding policy formulation to ensure sound development of the domestic market for energy efficiency, and coordinating participation between financial agents and private initiatives.
- Encouraging technological research and development on energy efficiency, as well as relevant professional skills at all levels.
- Promoting, coordinating and supporting initiatives designed to collect and systematize information on energy demand and information for energy planning.

- Working with other government agencies, representative entities, private and public enterprises, research centres and universities, to encourage the recognition and incorporation of energy efficiency perspectives in public policy affecting industry, human settlements, transportation, environment and other areas, as well as in national energy policy.
- Supporting the Ministry of Mines and Energy by monitoring changes in areas related to energy efficiency, nationally and internationally.

Thus, broadly speaking, the Ministry of Mines and Energy is responsible, at least formally, for overseeing the planning, promotion and evaluation of energy efficiency activities in Brazil. With its small team (less than six professionals devoting full time to energy efficiency) and small budget, however, the Ministry is currently limited in its ability to cover this range of activity—where CGIEE activities are concerned, in particular. Given these constraints, energy efficiency in Brazil is promoted principally by two national programmes, which are described below.

PROCEL

In operation since 1985, the National Electrical Conservation Programme (PROCEL) comprises a number of sub-programmes that are active in industry, sanitation, education, construction, public buildings, municipal action to address energy issues, efforts to develop information, relevant technological areas and the dissemination of information on experiences and successes.[2]

The PROCEL Labelling and Reward programme is coordinated by INMETRO, which, through activity relating to labelling and marketing, is responsible for nearly 70% of the impact achieved by PROCEL. Important in the area of public lighting is a subsidized programme (RELUZ) that replaces incandescent lamps with high-pressure mercury- and sodium-vapour lights, which consume 75% less energy than the conventional lights. PROCEL also gives courses, seminars and talks that help industrial and commercial users, holders of concessions and public-sector entities to reduce energy loss.

CONPET

The National Programme for the Rational Use of Oil Products and Natural Gas (CONPET), which was created by a federal decree in 1991, is basically designed to promote rational use of oil products, and is managed by PETROBRAS, which provides its technical, administrative and financial resources. The PETROBRAS Division of Energy Conservation and Renewable Energy acts as the programme's Executive Committee. It is responsible for creating projects, implementing strategies, fostering institutional coordination and publicizing the programmes' activities.

The Division is associated with the Director of Gas-Generated Energy at Petrobras, who, by virtue of presidential decree, is the CONPET Executive Secretary. Currently, CONPET focuses on freight transport, passenger transportation and fuel issues, as well as activities in the areas of education, marketing and labelling (the Labelling and Reward programme), which have had positive impact in relation to stoves and residential hot water heaters running on liquefied petroleum gas (LPG).

Public utilities

Under changes in wire charge regulations applying to electric utilities (one of the results of energy efficiency research and development and projects, under Law 9.991/2000 and a series of ANEEL resolutions), 0.5% of the utilities' net annual operating profits is to be used to promote the rational use of electrical energy—0.25% for projects in the low-income residential sector. Approximately half of these funds have been used for public lighting projects.

[2] PROCEL. PROCEL 20 años. Rio de Janeiro: Centro de Memória da Eletricidade no Brasil, 2006.

Brazil's utilities are represented by the Brazilian Association of Electrical Distribution Firms (*Associação Brasileira de Distribuidoras de Energia Elétrica*, or ABRADEE), which includes approximately 48 firms accounting for 99% of the country's energy consumption.

Energy services enterprises

Energy services enterprises are specialized engineering firms dedicated to auditing and optimizing energy use. They have the knowledge and skills to improve energy and water systems, and normally apply them in the context of performance contracts (where remuneration is based on savings generated over a defined period of time), which clients use to reduce their risk and commitment.

In 2007, approximately 47 energy services enterprises in Brazil joined to create the Brazilian Association of Energy Services Enterprises *(Associaçã la o Brasileira das Empresas de Serviços de Conservaçã la o de Energia*, or BESCO). This organization represents their interests in discussions of regulatory issues, promotes events and helps to disseminate expertise.[3]

C. Resources and funding mechanisms for energy efficiency programmes

Funding for PROCEL comes primarily from the ELECTROBRAS budget and the Global Reversion Reserve—federal funds in which public utilities have shares proportional to their contributions. In 2007, total investment in PROCEL activities was 52.8 million reales (74 % of this from ELECTROBRAS).

In 1986-2007, total investment in PROCEL was 1.02 billion reales, including the Global Reversion Reserve (628 million reales), ELECTROBRAS (359 million reales) and the Energy Efficiency Programme (in which 37.5 million reales was invested in the joint ELECTROBRAS-GEF initiative). According to PROCEL, this investment was very important, in that it made it possible to postpone investing in new generating stations, which would have cost an estimated 19.9 billion reales during that period.

Another important source of funding for energy efficiency in Brazil is the ANEEL Energy Efficiency Programme, which accounts for 1.4 billion reales between 2000 and 2007, and ensures that some 300 million reales will be spent each year under ANEEL oversight to increase energy efficiency and reduce electrical losses in projects conducted mostly by energy services enterprises. Details of investment in CONPET activities are generally not disclosed, but according to recent information from the Ministry of Mines and Energy, around 4.0 million reales was spent in 2008, primarily from PETROBRAS funds.[4]

Finally, as regards funding, note should be taken of the Programme to Support Energy Efficiency Projects (PROESCO), a funding mechanism created in 2006 by the National Bank for Economic and Social Development (BNDES) to promote and support energy efficiency projects, with preference given to proposals created by or associated with projects executed by energy services enterprises.

PROESCO supports the implementation of projects that contribute to economically efficient energy use. It employs consistent methodology to evaluate projects, with a view to optimizing lighting, electrical motors, industrial processes, compressed air applications, water pumps and other devices. End users of energy for industrial or commercial purposes interested in funding the purchase of efficient equipment or improving existing equipment are eligible.

Basing execution on the same standards that apply to environmental projects (low interest rates and taxes), PROESCO opened a credit facility of 100 million reales to fund up to 80% of the cost of

[3] ABESCO information available at: http://www.abesco.com.br/datarobot/.
[4] REA, op.cit.

projects. No information is available on actual spending by PROESCO, but the facility seems to have been used less than expected.

D. Results of energy efficiency programmes to date

The quality and level of detail of information on energy efficiency spending, outcomes and indicators have been improving in Brazil, gradually reflecting more consistent methods of oversight and verification. However, there is still ample room for improvement, especially in programmes and projects relating to fuel use.

Table 12 presents a summary of PROCES results since 1986. It shows the principal indicators of spending and energy savings, including capacity saved and deferment of investment in new electrical generation facilities. In studying these data, it is important to bear in mind that there have been some important changes in methodology since 2006, as the varying unit cost estimates reflect.

The difference between capacity saved (at the distribution level) and the equivalent electrical power is a function of different load effects. Figure 8 reflects assessment by PROCEL, and shows breakdowns of the overall figures to indicate each sub-programme's contribution to the total energy impact of PROCEL. Appliance labelling is clearly important here. For a breakdown by type of appliance, see Figure 9.[5]

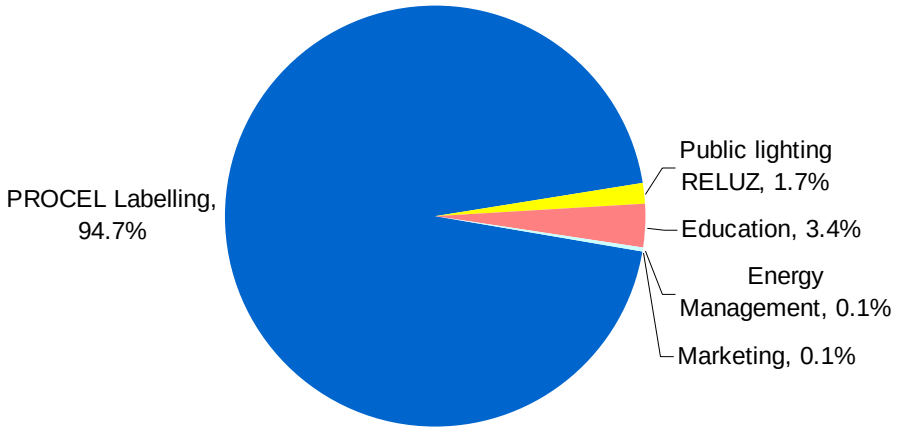
TABLE 5
INVESTMENT AND PRINCIPAL IMPACTS OF PROCEL PROGRAM*

	1986-2003	2004	2005	2006	2007
Expenditures (millions of reales)					
From Electrobras budget	252.01	27.18	37.17	29.24	13.62
From Global Reversion Reserve	412.00	54.00	44.60	77.80	39.16
Energy Efficiency Programme (with GEF)	2.09	12.97	16.23	6.20	-
Total investment (millions of reales)	666.08	94.15	98.02	113.24	52.78
Benefits					
Saved energy (billion kWh/year)	17.22	2.37	2.16	2.84	3.93
Saved capacity (MW)	4.633	622	585	772	1.357
Equivalent postponed power plant (MW)	4.033	569	518	682	942
Postponed investment (billions of reales)	10.65	2.50	1.77	2.23	2.76
Unitary estimated saving cost (reales/kWh)	38.7	39.7	45.4	39.8	13.4

Source: PROCEL, 2008.
Note: *All monetary amounts are in current values.*
*PROCEL, op.cit.

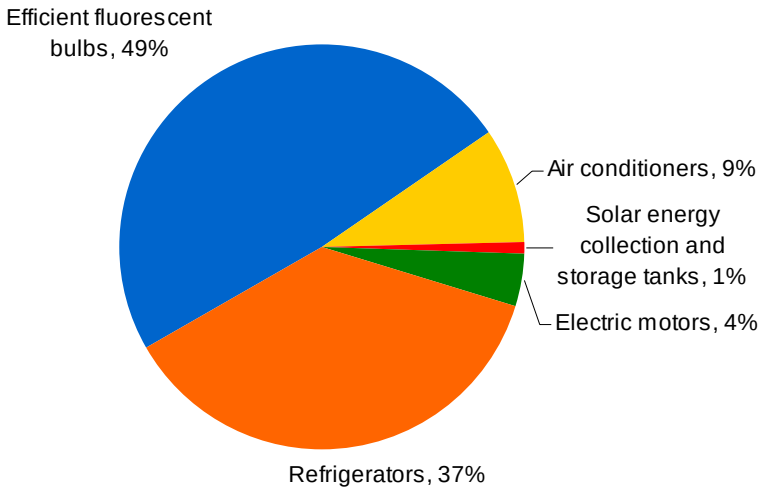
[5] PROCEL, op.cit.

FIGURE 6
ANALYSIS OF ENERGY SAVINGS DUE TO PROCEL IN 2007*



Source: PROCEL, 2008.
*PROCEL, op.cit.

FIGURE 7
RESULTS OF LABELLING EFFORTS BY PROCEL, 2007*



Source: PROCEL, 2008.
*PROCEL, .op.cit.

Tables 6 and 7 show the investment and principal impacts associated with the ANEEL Energy Efficiency Programme, for which public utilities propose energy efficiency projects twice a year. The projects must be approved by ANEEL before they are implemented. Oversight and evaluation have increasingly been conducted by this regulatory agency, improving outcomes and the quality of analysis. In 2006, ANEEL published an ordinance making low-income housing units a priority for the programme. This accounts for the fact that, among the most recent projects, a high percentage (64%) are in the residential sector (see table 6).

Based on the figures in these tables, the estimated unit cost of energy saved averaged 0.33 reales/kWh and 0.58 reales/kWh, respectively, with considerable variation from sector to sector.

TABLE 6
INVESTMENT AND PRINCIPAL IMPACTS OF ANEEL/ENERGY EFFICIENCYPROGRAMME (2000 TO 2005)*

Sector or type of project	Investment (millions of reales)	Saved energy (GWh/year)	Saved capacity (MW)
Public lighting	374.6	797	175
Residential	133.5	930	313
Industrial	96.0	376	59
Public Services	91.3	312	118
Education	80.9	90	25
Commerce and Services	59.5	130	30
Government	34.8	57	14
Solar heating	19.4	n.a.	n.a.
Rural	14.6	83	9
Loss mitigation	12.4	79	17
Municipal energy management	11.5	n.a.	n.a.
Total	928.5	285.4	760

Source: ANEEL.
*Pompermayer, M..L. (ANEEL).

TABLE 7
INVESTMENTS AND MAIN RESULTS OF ANEEL/ENERGY EFFICIENCY PROGRAMME (2006-2007)*

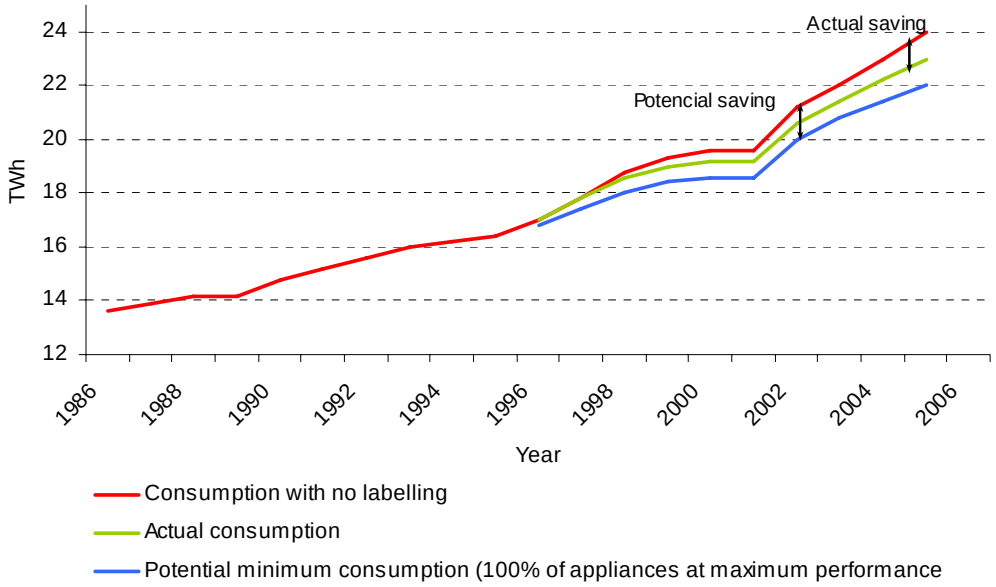
Sector or type of project	Investment (millions of reales)	Saved energy (GWh/year)	Saved capacity (MW)
Residential	304.9	511.5	183.5
Government	55.1	178.7	25.9
Industrial	26.4	38.9	7.7
Public Services	22.4	27.1	6.1
Commerce and Services	58.1	64.8	16.5
Rural	4.6	1.3	1.3
Solar heating	6.4	7.6	3.6
Total	477.9	830.0	244.7

Source: ANEEL.
*Pompermayer, M..L. (ANEEL).

Refrigerators are an example of a type of energy-consuming equipment for which results have been encouraging in terms of efficiency improvements. These appliances are among the greatest consumers of energy in Brazil's residential sector (accounting for 28% of the sector's consumption), and their efficiency is a major factor in household electrical consumption. In recognition of this, the PROCEL labelling has been used on refrigerators and freezers since 1995. The labels indicate which products are best, and guide consumer purchases, as well as promoting improvements in the industry.

As a result of this programme, there has been a notable change in efficiency, reducing energy consumption by 20% between 1995 and 2005. For single-door refrigerators with 300 litres of usable internal volume (the most common type in Brazil), annual energy consumption fell from 400 kWh to 320 kWh in this period. The main measures implemented were to improve compressors, increase the thickness of thermal insulation and improve seal and control systems. Figure 10 shows the estimated impact on electrical consumption resulting from the progressive introduction of more efficient refrigerators in the country.

FIGURE 8
ESTIMATED ELECTRICAL CONSUMPTION OF REFRIGERATORS IN BRAZIL



Source: PROCEL, 2008.
Note: *PROCEL. Avaliação de resultados do Programa Selo PROCEL de Economia de Energia em Refrigeradores e Freezers. ELECTROBRAS/PROCEL/FUPAI. Itajubá, 2006.

As regards the overall results of these two programmes in saving electricity in Brazil from 1986 to 2007, total investment was 2.431 billion reales, for an estimated saving of 32.2 TWH, which represents an estimated unit cost saving of 75 reales/kWh, considerably less than the marginal cost of increasing the country's generating capacity, which is estimated to be over 130 reales/kWh.

Results from CONPET are not regularly available. Only some basic indicators of activity are released from time to time by PETROBRAS or the Ministry of Mines and Energy. Table 15 shows the most important indicators for past years. It should be added that in 2007 the educational sub-programme conducted by CONPET trained 2.3 million students from 3,800 schools in rational energy use, principally as relates to fuels. Another important CONPET activity is the joint support that it provides with INMETRO for studies and efficiency labelling standards for stoves, hot water heaters (which in Brazil mostly use LPG) and light vehicles.

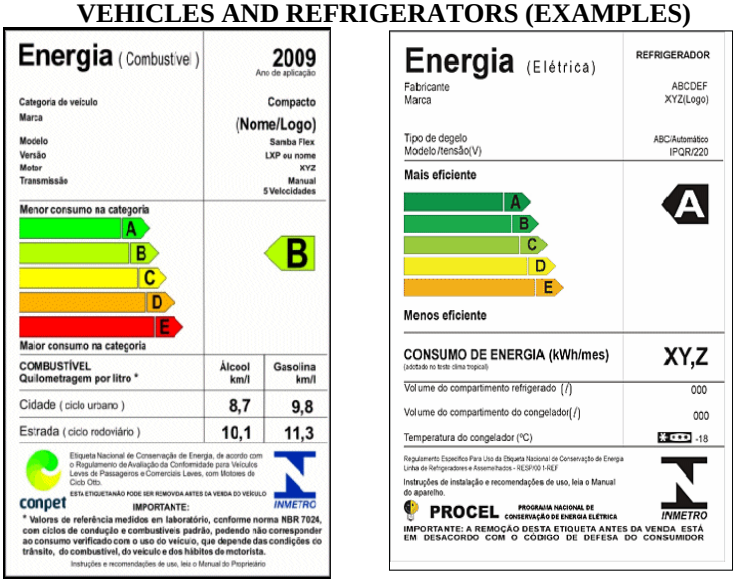
TABLE 8
INDICATORS OF CONPET ACTIVITIES[a]

Indicator	2007	2008
Monitored vehicles (thousands)	130	138
Diesel oil saved (millions of litres)	320	381
CO2 not emitted (thousands of tons)	436	499

Source: CONPET.
Nota [a]: Leonelli, P. Eficiência Energética no Brasil: Perspectivas & Desafios, Federal Council of Engineering, Architeture and Agronomy. Brasilia. 2009

Figure 9 shows the refrigerator labels currently used to indicate energy efficiency in Brazil (in the PROCEL and INMETRO framework) and the labelling used for light vehicles (in the CONPET and INMETRO framework).

FIGURE 9
ENERGY EFFICIENCY LABELS USED IN BRAZIL FOR LIGHT VEHICLES AND REFRIGERATORS (EXAMPLES)



Source: PROCEL–CONPET–INMETRO.

E. Lessons learned

While Brazil has important mature programmes in both alternative energy sources and efficiency, with a strong legal framework (although there is a dearth of new instruments), there is still great unexplored potential in both areas. Thus, objective conditions for progress on these fronts is better than ever.

It is therefore essential to implement monitoring mechanisms and to heed the lessons learned not only from the country's experience, but from international experience, as well. Alternative renewable sources and energy efficiency are not only fields for finding energy options, but also represent strategic approaches that can increase the security of the nation's electrical supply.

These also continue to be the principal fronts on which countries are moving to address climate change. The high degree of complementarity between the different energy sources that Brazil has available for generating electricity makes policies and programmes designed to increase the use of these sources in the nation's electrical network all the more valuable.

What is new and significant in electrical generation is not simply the degree (varying from country to country) to which renewable alternatives are being used, or the extent to which energy efficiency plays a role in national energy systems, but also the increasing global awareness of the need for new patterns of power generation and energy consumption that draw on sources compatible with the development and sustainable use of energy resources.

In this context, policies and programmes to create incentives for the use of alternative sources and energy efficiency gain force and become effective in creating a virtuous circle of energy generation, economic development and environmental sustainability. Both encouraging the use of renewable energy sources and promoting energy efficiency are properly State functions, not mere tasks of government. Brazil's major energy efficiency programmes (PROCEL-ELECTROBRAS and CONPET-PETROBRAS) have generated a series of lessons learned that point to the fact that concrete results in the efficient use of energy depend on institutions that can design, implement and operate programmes in a stable, ongoing fashion, independent of changes of government (in other words, as matters of State). In brief, the lessons learned are as follows:

Lessons learned from PETROBRAS sectoral programmes:

- Training, development of skills, and energy assessment activities do not in any direct way guarantee that energy-saving opportunities will be used to full advantage of.

- An environment propitious for implementing energy-saving recommendations must be created, and all hierarchical levels of the enterprises involved must be involved.
- The specific characteristics of consumer sectors must be known if action there is to be effective.
- Energy efficiency measures cannot be limited to the energy sector, but must be integrated with public policy in others sectors, such as sanitation, housing and education.
- Developing countries must promote research into energy efficiency applications, so as to develop technical skills and a domestic industry.
- Programme focus cannot be exclusively technological, but must take the market into account, since the ultimate aim is to change consumers' habits.
- PROCEL should be recognized nationally as a leader in the question of marketing in a way that encourages rational and efficient energy use.
- Communication measures cannot be conducted in isolation, but should be consistent and integrated with the PROCEL marketing and communication plan.
- The continuity of the communication campaign is essential to keep the issues present in the minds of its recipients. It is important for the message of "fighting energy loss" to be constantly present.
- It is essential to understand consumers' idiosyncrasies.
- Market surveys are of great importance in designing well-focused efforts to encourage energy efficiency.
- In the area of energy efficiency education, the following lesson learned stands out:
- The focus should be placed on training not only students, but teachers, who are multiplying agents of measures to reduce losses of electrical energy.

For continuing to increase the efficiency of consumer devices, the following lessons learned are important:

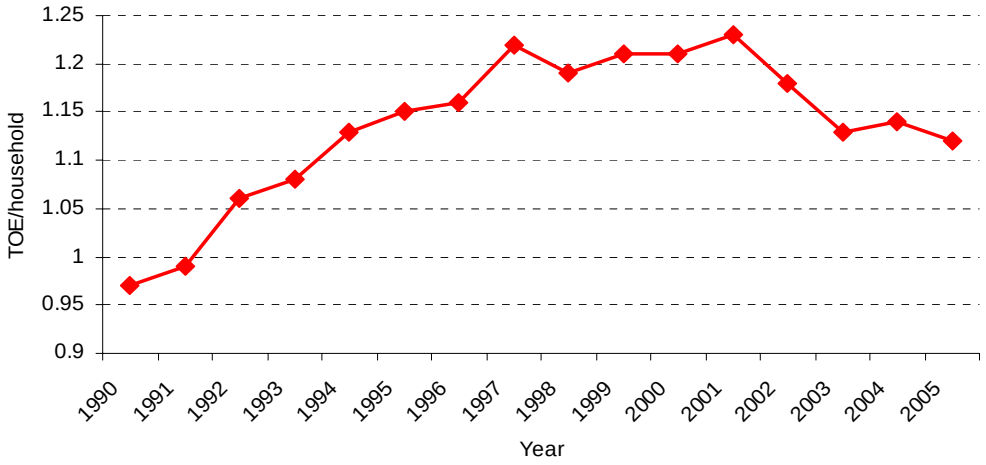
- S&L (standards and labelling) has great potential to improve energy efficiency.
- Labelling should begin as a voluntary activity, and evolve into a mandatory system.
- Step-by-step records of improvement should be kept in the form of indicators.
- Negotiations with manufacturers and professional and business associations play an important role.

V. Chile

Final energy consumption in Chile is largely shaped by four sectors: transportation, industry, mining and the commercial/public/residential sector.[6] The most important of these is transportation, which accounts for 36% of demand (according to 2005 figures). While 99% of transportation needs are met by oil derivatives (diesel and gasoline accounting for over 70%), there are also urban (Metro) and intercity trains, as well as a small number of light vehicles that use natural gas. The energy intensiveness of transportation fell 10% between 1999 and 2003, and has been relatively stable since.

The commercial/public/residential sector accounts for 28% of final energy consumption. The main energy source here is wood, which is used above all for cooking and heating, and represents 47% of the energy consumed by the sector—a situation that creates environmental problems and problems of resource sustainability. End demand for electricity and oil derivatives is close to equal (23% and 20% respectively). Natural gas has played an increasing role, recently representing 9% of final consumption in this sector. The energy intensiveness of Chile's households steadily increased between 1990 and 2001, but has fallen since then.

FIGURE 10
CHANGES IN SPECIFIC CONSUMPTION IN THE RESIDENTIAL SECTOR

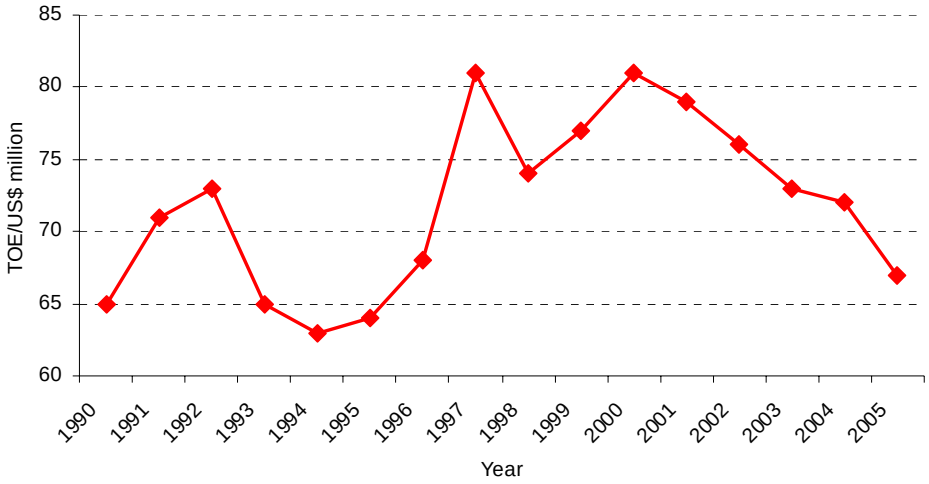


Source: Programa País de Eficiencia energética (PPEE), 2009.

[6] See table in annex 6, "National Energy Balance Sheet 2005"—National Energy Commission (CNE).

The industrial sector accounts for 22% of end energy use. Although it consumes a variety of resources, 83% of its energy comes from three sources: oil derivatives (33%), electricity (24%) and biomass (26%). The mining sector accounts for 14% of end demand, using primarily electricity (50%), and secondarily oil derivatives (46%).

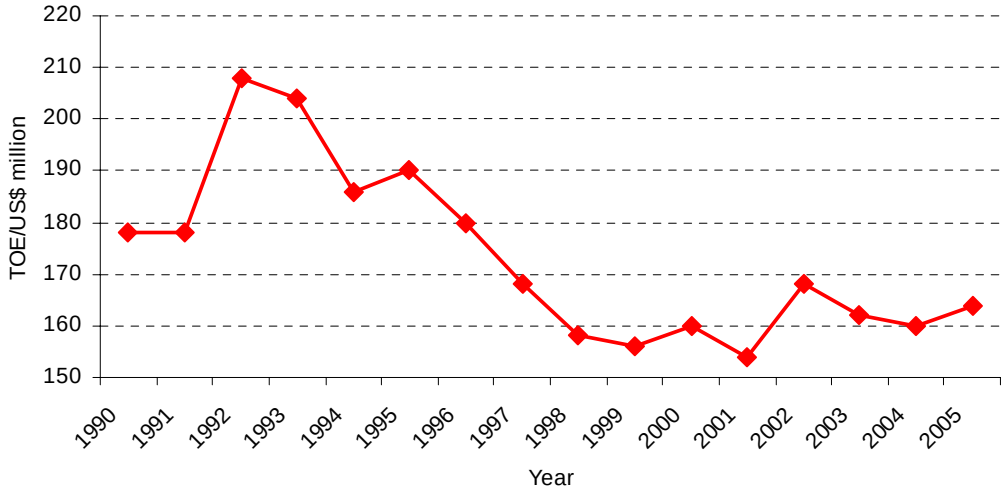
FIGURE 11
CHANGES IN ENERGY INTENSIVENESS IN THE INDUSTRIAL SECTOR



Source: Programa País de Eficiencia energética (PPEE), 2009.

The mining sector showed a clear downward trend in energy intensiveness from the 1990s on, a trend that then reversed itself to rise slightly. Although energy intensiveness in industry varied between 1990 and 2005, the figures for the beginning and end of this period are the same. The mining sector's energy intensiveness has remained relatively constant since 1998.

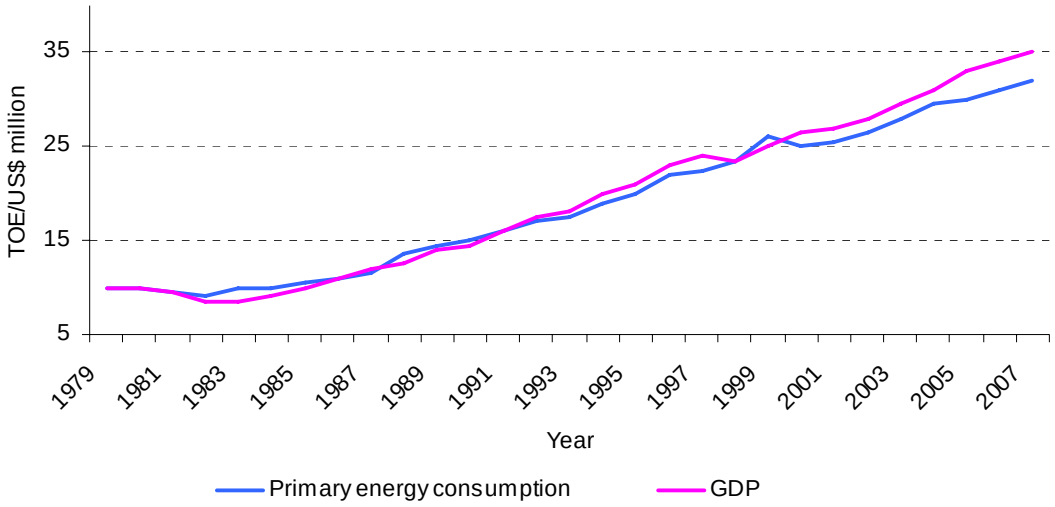
FIGURE 12
CHANGES IN ENERGY INTENSIVENESS OF THE MINING SECTOR



Source: Programa País de Eficiencia energética (PPEE), 2009.

Energy consumption in Chile has increased considerably over the recent decades, especially where electricity is concerned. While end consumption has increased an average of 2.8% annually in the last 10 years, electrical consumption has increased at an average annual rate of nearly 6% over this period. Energy demand has closely paralleled the rise in GDP, as the following chart shows.

FIGURE 13
CHANGES IN PRIMARY ENERGY CONSUMPTION AS A PROPORTION OF GDP
(Index of growth: 1979=100)



Source: Programa País de Eficiencia energética (PPEE), 2009.

In 2007, Chile used 31.4 million tons of oil equivalent (TOE), while consumption in the countries of the Organization for Economic Cooperation and Development (OECD) overall totalled 5.6 billion TOE. On average, an OECD country uses 186.4 million TOE, or 5.9 times more than Chile.

In 2007, Chile's energy intensiveness was 0.166 TOE/US$ 1,000, while the average figure in the OECD countries was 0.175 TOE/US$ 1,000. Since total primary energy supply (TPES) per capita in Chile is relatively low in comparison with more developed regions, total consumption can be expected to rise as income levels rise. The same general trend can be seen with respect to electricity. However, the possibility of increasing efficiency significantly will depend on specifically what the energy is used for.

Hydrocarbons account for over 70% of the nation's primary consumption, excluding secondary net imports, and the majority of that total is imported. Chile's three main sources of energy are wood and other biomass (heating and electricity), which represent roughly 50% of the energy that the country produces with local resources; water (hydroelectric power), which represents 24%; and natural gas from the Magallanes region, which represents 21% of domestic production (average for 2005-2007). The nation's primary consumption between 1990 and 2006 rose at an average annual rate of 4.6%. During that period, average annual growth rates for production, import and export were 4.8%, 13% and 12%, respectively, although the trend was interrupted in 1994. The greater proportion of consumption dependent on imports increased the country's dependence on foreign sources.

The predominance of imported energy sources not only exposes the country to supply risks, but to price increases and volatility on the international market, as well. The dependence on foreign sources is aggravated when a single provider is involved, as is the case of Chile's natural gas, which comes entirely from Argentina—although Chile has now taken measures to incorporate the use of liquid natural gas imported in tankers and reconverted to gas at facilities designed for local distribution. Crude oil imports in 2007 (11.8 million cubic metres) came from South America, Angola and Turkey (in the

respective proportions of 65%, 15% and 14%), while imported coal (5.8 million tons) had four main sources: Colombia, Indonesia, Australia and Canada (34%, 26%, 22% and 11%, respectively).

When gas from Argentina began to be available in Chile, the consumption of natural gas increased from 9% of primary consumption in 1997 to 29% by 2004, replacing primary consumption of coal, biomass and crude oil. With restrictions on gas exports, however, the situation began to reverse itself in 2005, leading to more use of coal, finally reaching the consumption pattern that had been in place before 1998. Final energy consumption grew at an average annual rate of 4.7% between 1990 and 2007, during which period oil derivatives, biomass and electricity represented nearly 90% of final consumption.

According to forecasts, which project rising trends, final energy consumption will increase at an average annual rate of 5.4% until 2030. During this period, the most important energy sources will be diesel, fuel oil, electricity and wood, which together represent 69% of consumption in 2007—a figure that is estimated to rise to 78% by 2030.

A. Recent advances in policy, regulatory and institutional frameworks

Traditionally, initiatives to promote energy efficiency have not been a priority of the Chilean Government, and have not been State policy. Although there have been sporadic attempts to promote energy efficiency (including the Energy Conservation and Rational Use, or CUREN, programme), they have not been long-lasting or had major impact. In this sense, they resemble programmes in other LAC countries, where they have also successively emerged and disappeared as a result of lack of continuity in national energy efficiency policy.

The dominant point of view is that, given the advantages of energy efficiency, the market by itself will make the investments and conduct the activities needed to introduce efficiency measures in the various demand sectors. As in the rest of the world, however, experience contradicts the assumption.

As a result of this situation, the major initiatives have originated in academic institutions (PRIEN at the University of Chile, international organizations such as the German Cooperation Agency (GTZ) and the Economic Commission for Latin America and the Caribbean are examples).

The situation changed in 2005, when the government began to exert more leadership in promoting and developing energy efficiency. Energy efficiency was made a central element of government energy policy, and the Country Energy Efficiency Programme (PPEE) was created and given support.

1. Energy efficiency at the institutional level

Generally, as has happened elsewhere in the world, the systematic, structured quest for energy efficiency in Chile was spurred by the actual needs of the country, in which insufficient electrical supply and a pronounced dependence on oil and gas play important roles. External motivations –such as international agreements and the need to reduce greenhouse gas emissions– have been less important, but this could soon change, given that Chile is in the process of joining OECD.

Beginnings

In its first years, as mentioned above, the PPEE made efforts to bring public- and private-sector actors into the attempt to promote energy efficiency. Areas needing development were defined; in each, various activities were initiated. A national energy efficiency policy is being designed pursuant to the Government's new energy standards. This should be included as one of the macro-scale objectives of national energy policy, and should, at a minimum: (i) create an institutional framework to deal with energy efficiency; (ii) set about constructing an adequate knowledge base for decision-making; (iii) promote energy efficiency in all sectors; and (iv) regulate markets, in particular the electrical market, to provide incentives for the efficient use of energy.

One of the main results of the energy efficiency policy will be the Action Plan for Energy Efficiency 2010-2020, which is to include general and sectoral objectives, spheres of activity, programmes, goals, evaluation tools and funding mechanisms designed with a view to Chile's energy efficiency over the next decade. The plan will be based on existing information, as well as on an ad hoc series of studies. The consulting activity involved in this work has been in progress since September of 2009, and is scheduled to end in December of the same year.

It will define energy efficiency measures and assign them long-term priorities based on their relative cost and their ability to reduce energy demand. The Chilean public sector's organizations and authorities have been a problematic aspect of the country's institutional structure where energy policy is concerned, but the lower house of the Congress has unanimously approved a bill calling for changes in that structure.

The current model

The multiplicity of organizations, the scattered authority, and the scant institutional weight of the National Energy Commission with respect to the other actors in the State structure in this area (see chapter 2) make it difficult to provide a general overview of the sector. The main problems, however, can be indicated:

- Inappropriate allocation of institutional responsibilities. Lack of clear authority on the issues.
- Inconsistent responsibilities and authorities. This is not typical of Chile's public administration, which is generally well designed.
- A focus on economic regulation of the energy sector, to the detriment of public policy development.
- A lack of organizational direction and oversight of the public sector's energy-related entities.
- Problems with the organizational model on which the National Energy Commission is based.
- Lack of formal mechanisms to coordinate environmental policy and energy policy.
- Inability to take action in the energy sector in the country's various regions.

Basis of a new public institutional framework in the energy sector

Experts and international trends have suggested that State entities, in order to effectively exercise their powers and overcome the problems cited above, need to adjust their organization, authorities and mutual relationships based on the following principles:

- Functions should be segmented, and clear roles and objectives defined. For the most part, ministries (central government) should be responsible for developing policy and legislation, and for general monitoring of the sector, while enforcement and technical/economic regulation (setting rates and technical quality standards) should be delegated to specialized agencies (decentralized regulatory agencies).
- Organizations responsible for economic regulation should be specialized and independent, so as to ensure the quality of the processes involved and reduce the risk that they will be dominated by the firms being regulated, or by short-term political interests.
- The technical capacities of the relevant State entities are important. One of the main difficulties these institutions face is asymmetry of information vis-à-vis the business sector. Overcoming this requires a level of technical expertise comparable with that of the firms being regulated. Public policy, economic regulation and execution must be in the hands of stable teams that enjoy a senior position in the hierarchy and are permanently tasked with overseeing the industry to which they are assigned. Governmental entities

must also have the authority to conduct technical audits of regulated firms in order to verify the information provided by these firms.

- There must be independent fora for conflict resolution, to assure all the actors involved that the rate-setting process will conform to the law's mandates.

Thus, a proposed new institutional framework for dealing with energy issues must not only address the points of view and problems arising in the international and domestic energy settings, but must also take these principles into account. Accordingly, the objective of the Chilean proposal – which is in the final stages of legislative approval– is to reorganize the energy sector with institutions that effectively promote safe, efficient and sustainable energy development in the country, and that adequately separate the roles of policy-making, technical/economic regulation and execution.

2. Current institutional structure for energy efficiency: the Country Energy Efficiency Programme[7]

On 24 January 2005, the Chilean Government brought together a group of public and private stakeholders, and tasked the Ministry of Economy, Development and Reconstruction with creating and implementing the Country Energy Efficiency Programme (PPEE). To develop the programme, a commission was created with representatives of the most important government institutions and participants from the private sector, local government and civil society. Performance-based agreements were signed with a number of public entities to operate the programme. In December of the same year, a Supreme Decree was signed by the Ministers of Public Works, Transportation and Telecommunications, Education, Housing and Urban Development, and Mining, and the Minister of Economy, Development and Reconstruction, as well as by the Secretary General of the Presidency. The decree formally created the PPEE Commission.

The mission of PPEE

The main objective of PPEE is to establish energy efficiency as an ongoing element of the country's strategy to ensure its energy supply and contribute to the sustainability of Chile's energy development.

Strategic objectives

1. To establish the institutional basis and regulatory framework for energy efficiency.
2. The create incentives and tools to support energy efficiency.
3. To gather useful and accessible information for public, private, collective and individual decision-making.
4. To incorporate and prioritize energy efficiency at all levels of formal and informal training.
5. To take advantage of international experience and instruments to accelerate the development of energy efficiency and measure reductions in greenhouse gas emissions associated with reduced energy consumption.
6. To strengthen institutional management by improving the processes involved.

The functioning of the PPEE Commission

The institutional structure of the Country Energy Efficiency Programme includes a commission made up of an Advisory Council and an Operations Committee. The Advisory Council consists of representatives of ministries, leaders of industrial associations and distinguished energy efficiency

[7] See organizational chart in annex 6.

experts. It has an Executive Secretary appointed by the Ministry of Economy, who convenes and coordinates the semi-annual meetings and provides guidance on energy efficiency policy to the various ministries whose heads signed the decree creating PPEE. The Operating Committee plays a functional role. It includes representatives of public, private and civil organizations, and provides advice to the programme on both the design side and on operations. It meets monthly to evaluate projects, make presentations and monitor progress in the various sectors. It is responsible for the following activities:

- Monitoring energy efficiency projects formulated or executed in the country.
- Proposing specific activities to promote energy efficiency in the country.
- Promoting the creation of domestic and international relations beneficial to the country's energy efficiency objectives.
- Promoting and providing guidance for creative participation in PPEE activities by public- and private-sector entities, citizens, academics and communicators.
- Creating and implementing energy efficiency measures in the country.
- Achieving the objectives of the programmes' different components.

Spheres of activity by area

Management and support

These areas include all of the programmes' activities:

- Regional activities
- Institutional development
- Management planning and oversight
- Communications
- Administration and finance
- Legal affairs
- International affairs

Public policy

The objective in this area is to create, evaluate and update Chile's Energy Efficiency Action Plan, which is a short-, medium- and long-term (2020) guide to increase the country's energy efficiency. The spheres of activity here include:

- Formulating and evaluating energy efficiency policy.
- Dealing with incentives, instruments and programmes.
- Addressing the regulatory Framework.

Market development

The objective in this area is to facilitate the development of an energy services market in the industrial, transportation, commercial and public sectors. The spheres of activity involved are:

- Creating public instruments to promote energy efficiency in the productive sector.
- Providing information on available energy services for the various business sectors.
- Strengthening the public sector's role as a catalyst for energy efficiency initiatives.

- Implementing energy-saving measures in transportation.

Technological development

The objective in this area is to support the development and introduction of technologies that promote energy saving and efficiency in the country's various social and productive sectors. The spheres of activity include:

- Introducing technologies that promote energy saving and efficiency.
- Creating incentives for the introduction of efficient technology.
- Defining the market for energy-efficient products.
- Evaluating technologies.

Sectoral development

The objective in this area is to promote energy efficiency in ways that are appropriate to the various production and service sectors. Spheres of activity include:

- Organizing energy efficiency fora for interested representatives of sectors (energy efficiency working groups and roundtables)
- Formulating methods for implementing energy efficiency measures in sectors where there is demand for this

Information management

The objective in this area is to provide users with differentiated, up-to-date and well-organized information on energy efficiency. Spheres of activity include the following:

- Information repository.
- Website.
- Information systems.
- Content management.

Education and training

The objective in this area is to educate, train, build awareness and develop energy efficiency skills in the various energy consuming segments of the market, and among the beneficiaries of PPEE projects and incentives. Spheres of activity include:

- Training for the development of an energy efficiency market.
- Training in firms for the implementation of energy efficiency initiatives.
- Promoting energy efficiency initiatives in educational establishments.
- Training professional and technical personnel in energy efficiency.
- Training public employees in energy efficiency.
- Developing energy efficiency manuals for citizens, school teachers and college professors.

B. Key actors in energy efficiency and their effective roles

Chile's institutional framework on energy issues is currently being reformed. A Ministry of Energy is being established to centralize the process of formulating, proposing and evaluating public energy policy. This includes defining objectives, regulatory frameworks and strategies, and developing public policy instruments.

The Ministry of Energy will delegate functions relating to the implementation of policies and instruments to outside entities with which it will maintain close relations.

These executing entities will be responsible for implementing national programmes and specific work plans, as well as for technical regulation, enforcement and other aspects of programme implementation.

Currently, the ministries and public entities responsible for management, economic regulation and oversight in the energy sector are structured as follows:

- The sector is headed by an Executive Council that includes a representative of the Office of the President (the Chair of the National Energy Commission), along with the Ministers of Mining, Finance, Defence, Planning and Cooperation, and the Minister of Economy, Development and Reconstruction, as well as the Secretary General of the Presidency. The Council is headed by the Chair of the National Energy Commission, who has ministerial rank. The Country Energy Efficiency Programme (see section 1.2 for details of its structure and functions) reports to the Chair of the Commission.
- The Ministry of Mining has the authority to define policies, plans and standards relating to hydrocarbons, nuclear energy and geothermal energy.
- The Ministry of Economy, Development and Reconstruction, among other things issues decrees regulating prices of services, grants electricity subsidies and establishes transportation and energy rationing systems.
- The Superintendency of Electricity and Fuels is a decentralized public body charged with overseeing and monitoring compliance with legal, regulatory and technical standards on flammable liquids, gas and electricity. It carries out its functions under the Ministry of Energy.
- The Chilean Nuclear Energy Commission is a decentralized public entity whose legal function consists in developing nuclear science and technology in Chile. It is responsible for production, procurement, transfer and transport, and for the peaceful use of atomic energy. The Ministry of Energy will soon be responsible for overseeing its activities.

C. Resources and funding mechanisms for energy efficiency programmes

The legislative proposal to create the Ministry of Energy also establishes the authority for the Ministry to participate in creating a private law entity whose main responsibilities will be to conduct promotional and informational activities, develop and coordinate research initiatives, and transfer and disseminate economic, technological and experimental knowledge in the energy field.

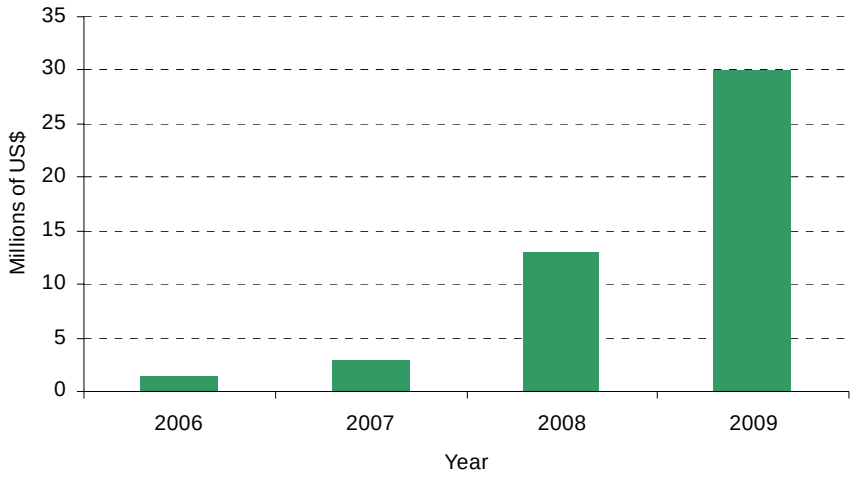
This entity has been conceived principally as a way of creating a Chilean energy efficiency agency with participation by both the State and the private sector. Thus, decisions will be made jointly by people and firms that use energy and by the authorities responsible for promoting efficiency. This public-private participation model is being used in a number of countries (including the United Kingdom and Germany), and it has proved satisfactory. It is based on the fact that State and private-sector actors share a common interest in energy efficiency.

Despite a potential conflict of interest on the part of the private-sector participants, the public-private nature of this future agency is consistent with the agenda for governmental modernization. To prevent conflicts of interest, the majority of the organization's board of directors will be from the private sector, and will include a number of major actors in the area of energy efficiency—a structure that will contribute to efficiency and transparency, both for energy users and for the general public. The organization's functions will focus on areas of activity with comparative advantages, such as technical assistance and the execution of programmes that require logistical skills and operational flexibility.

International experience also shows that for this type of institution to succeed in meeting its objectives, there needs to be a permanent funding source that is not affected by political and economic changes. Funding modalities range from surcharges on electricity bills in the industrial sector (a system used in the United Kingdom) to a system in which firms achieve self-financing by providing advisory services to other firms.

Primarily as a result of the increasing emphasis that political officials have given the issue over the last few years, there is now broad recognition of the need for a new institutional framework for energy efficiency. As the figure below shows, the budget for PPEE has increased by a factor of over 30 in only four years. This clearly demonstrates the priority that has been assigned to making energy efficiency one of the pillars of the nation's energy policy.

FIGURE 14
BUDGET



Source: Programa País Eficiencia energética (PPEE), 2009.

D. Results of energy efficiency programmes to date

The results of PPEE to date can be classified in five broad sectors: education, industry, transportation, residential and energy.

1. Education sector

The education sector is horizontal and includes initiatives to support the different facets of PPEE. The objective here includes: helping develop an energy efficiency market by training workers in energy efficiency; ensuring that PPEE projects are executed appropriately by training the actors involved (both direct beneficiaries and professionals associated with developing the plan); generating and distributing information for the different segments, including educational manuals and guides for citizens; educating the school community on energy efficiency; and building awareness about energy efficiency among children and students between the ages of 8 and 14 through targeted campaigns.

Since 2006, the National Environmental Commission (CONAMA) and PPEE have developed an annual work plan that includes the following activities: training teachers and professors; preparing teachers' guides that incorporate the subject of energy efficiency in primary, middle and secondary school education; creating a pilot project at a teaching institution (the Liceo Confederación Suiza); establishing an energy efficiency section within the Environmental Protection Fund; and providing for environmental certification of educational establishments based on their energy efficiency. Another initiative in this area is a campaign targeting students between the ages of 8 and 13. This project consists of creating a 15-minute animated film, to be projected in a specially equipped bus (a mobile movie theatre for 3D films). The film, whose main message will be the need for energy efficiency, will be shown at 1,000 public schools in a large part of Chile (from La Serena to Puerto Montt).

In the area of higher education, a study is being conducted on "Energy efficiency needs of professionals and technical personnel in construction, industry and transportation". The idea of this is to work with universities, professional institutes and technical training centres in creating energy efficiency training models. Subsequently, there will be a seminar to disseminate the results of the study. Plans are also being made or implemented for various awareness-building and training programmes.

The sections below describe the areas of activity, programmes and goals for each of the country's final consumption sectors. Due to the fact that the energy efficiency policy and plan are still being developed, the objectives cited do not refer to specified results, but rather to evolving processes.

2. The industrial and mining sector

PPEE, in a variety of ways, through its different components, is designed to increase energy efficiency in the industrial and mining sector. At the development level, activities have focused on promoting consulting projects for the industrial sector. These projects are co-financed by public resources, and target over 90% of the country's industrial firms. In the area of voluntary action, the National Clean Production Council, which since 2006 has included an energy efficiency component, has coordinated clean production agreements. The mining sector has been the longest-standing participant in such agreements.

Thus, in 2006, PPEE and the Production Development Corporation (CORFO) created the Programme for Pre-investment in Energy Efficiency (PIEE) to encourage efficient use of energy. This programme allows firms with net annual sales of up to one million *development units (unidades de fomento, or* UF), roughly equivalent to US$ 35.650 million, to hire consultants and conduct assessments to quantify possible energy savings, and to develop a plan to improve efficiency. CORFO covers up to 70% of the consulting fees, with a cap of CLP$ 6 million (US$ 10,100). From 2007 to January 2009, 192 projects were evaluated, of which 67 have already been completed. To improve the programme's reach and impact, a Canadian firm with extensive experience in the subject was hired to redesign the programme, which was recently re-launched.

In July of 2008, the CORFO energy efficiency loan programme went into effect. These loans finance investments of up to 25,000 UF (US$ 890,000), and make it possible for firms to invest in projects that are necessary to optimize energy use. Firms, cooperatives or production associations with annual sales of up to 1 million UF (US$ 35.650 million), not counting value-added tax, can apply. The loans are available for firms in a wide range of sectors, including industry, agriculture, mining, fishing, tourism and health care.

Another initiative in progress is the Programme of Incentives for the Introduction of Efficient Electric Motors. This targets industry and mining, which together represent nearly 38% of final energy consumption. The initiative consists of a subsidy that makes it possible for efficient motors to be competitive with standard motors. The goal is to reduce demand for electrical energy by approximately 13.5 GWh/year.

In 2008, the Global Environment Fund (GEF) approved the project, "Promoting and strengthening an energy efficiency market in Chile's industrial sector", which draws on external co-financing in the amount of US$ 2.637 million.

The project will be conducted in three selected areas of activity to strengthen the energy efficiency market in the industrial sector. The greatest amount of foreign funding will go to the technical assistance component. The activity in this component will be to create a technical assistance centre.

3. The transportation sector

Activities in the transportation sector focus primarily on three segments: freight, light vehicles (private automobiles and collective taxis) and non-motorized transport. In the first case, incentives are created to modernize freight fleets. This will provide not only a considerable reduction in fuel consumption (estimated at 23.6 million litres of diesel a year), but will also help to improve environmental conditions and safety. The programme calls for retiring the oldest trucks through economic subsidies and soft credit for the procurement of new ones. For this sector, PPEE also has a training programme on efficient driving, as well as a technical assistance programme on energy efficiency for representatives of urban and inter-urban freight transport companies. The two initiatives aim to promote good driving practices, mechanical maintenance of vehicles and efficient management of truck fleets to promote fuel efficiency. Given the great number of freight transportation firms in the national market, both programmes are designed to work with associations of truck drivers.

In the light vehicles sector, an incentive has been created for the purchase of hybrid vehicles, and attempts are being made to implement energy efficiency labelling for automobiles. Finally, to promote non-motorized transportation, the programme has worked with the members of the transportation work group to determine where bicycle parking areas could be created, to prepare good commercial models to ensure that the parking areas function properly and to plan promotional campaigns targeting university students. This work is coordinated with the regional government, the Subsecretariat of Transportation, the capital city's Transantiago bus system and a number of bicyclists' organizations.

4. Residential/commercial/public sector

In the residential sector, the main areas of activity are designed to improve the technical quality of existing and new housing, and to increase the efficiency of household electrical appliances. The initiatives to be implemented include periodic review of technical housing standards, and the extension of these standards to other types of construction. Important work has been done in coordination with the Ministry of Housing and Urban Development (MINVU) to implement a number of initiatives, including the certification of housing units, subsidy programmes for improving the thermal insulation of 10,000 existing low-income housing units (2009-2010), and the construction of 400 new low-income units that will exceed current heat-management standards.

In this area, there is also a cooperation agreement (and other collaborative efforts) between German Technical Cooperation (GTZ) and PPEE. The work of GTZ has included, among other things, studies, rehabilitation of housing units and hospital projects.

The National Programme for Changing Light bulbs plays an important role in the effort to increase the efficiency of household electrical appliances. Low-consumption or energy-efficient lamps have been provided to 40% of Chile's low-income households. The objective is to serve 90% of this population by delivering approximately three million lamps, for a saving of approximately 225 GWh yearly—equivalent to the energy produced by a 205 MW power plant. The estimated savings for the families involved is expected to be more than US$ 50 million. This is the first public project designed to reduce greenhouse gas emissions. The programme continues in 2009, and calls for improving the 2008 distribution channels. For example, every low-income unit built will come with low-consumption lamps.

PPEE also coordinates the activities of the National Energy Efficiency Labelling System for household electrical appliances, which is carried out in conjunction with the Superintendency of Electricity and Fuels (SEC), the National Consumer Service (SERNAC), the National Standards Institute (INN), the Fundación Chile and other organizations.

One of the most important initiatives is the creation of the National Energy Efficiency Certification and Labelling Programme (P3E), which began in 2005 with lighting devices and refrigerators. The decision to target these two areas was based on the 2002 census and from a 2005 study by the CNE, according to which these two types of devices were responsible for approximately 60% of electrical consumption in the residential sector. Currently, labelling programmes are working with another series of articles, and are defining the next products to be incorporated. The objective of P3E is to create a market for energy-efficient electrical appliances, encouraging manufacturers to improve their products' energy performance and setting clear objectives for improving product performance. It also seeks to provide tools (information) that help users recognize economically advantageous products for purchase.

As regards the public sector, activity has largely targeted three areas: improving the efficiency of public lighting, promoting the use of energy efficiency criteria in public procurement, and improving energy management in public buildings.

In the area of public lighting, work is being done with the SEC on new regulations that incorporate energy efficiency criteria in projects designed to replace public lighting in low-income municipalities. This project is being conducted in collaboration with the United Nations Development Programme (UNDP). To support these activities, a special telephone line will be set up for municipalities that have public lighting issues. In addition, a programme will begin in 2010 to support the penetration of new efficient technologies in public lighting, with pilot projects in four municipalities. The programme will be executed by UNDP, and PPEE will contribute over CLP$ 1.8 billion.

In terms of public procurement, an expert from Lawrence Berkeley National Laboratory was hired to prepare a manual, a set of instructions, and a series of guidelines outlining energy efficiency criteria for use in governmental procurement. With regard to public buildings, energy use studies have been carried out in key, high-profile buildings, and the measures recommended have been implemented for demonstration purposes. The project being conducted at the Palacio de la Moneda (the seat of the national executive branch) is particularly noteworthy. It will combine the most efficient technologies with the use of renewable energy sources. Similarly, in the context of measures adopted to deal with the energy crisis in 2008, information on energy consumption by governmental units throughout the country is continually being gathered. Analysis of this information will provide guidelines for more efficient energy management.

5. The energy sector

In the last two years, some energy distribution firms (distributors of electricity and natural gas) in Chile have begun to promote energy efficiency and renewable energy among their clients as a part of their commercial activity. This is a notable change from the views that the senior managers of these firms held in the past. The activities they have undertaken include information campaigns, free studies on energy use for clients, sale of efficient electrical appliances, offerings of differentiated rates, renewable energy projects that pay for themselves through savings, and, as mentioned above, support for the distribution of low-consumption lamps as part of the PPEE programme.

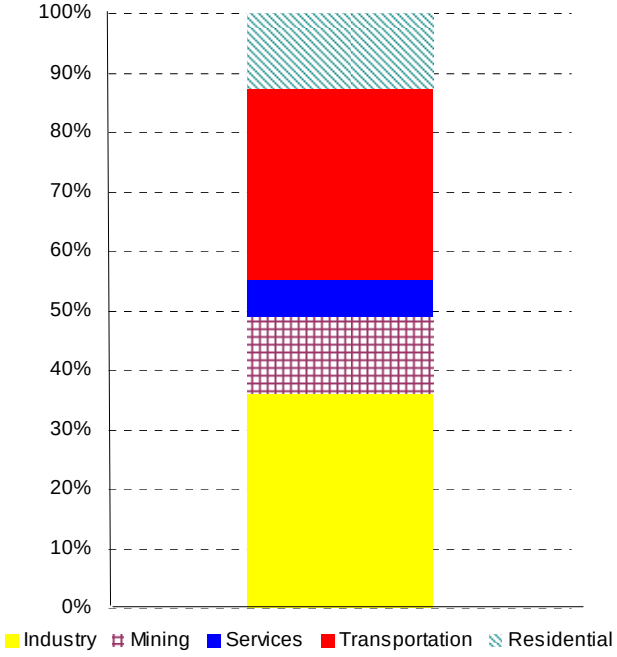
As indicated above, the viability of introducing changes in the regulatory framework is being examined as a way of disassociating energy sales from profits. This will strengthen the role of distributors as channels for promoting and implementing energy efficiency among their clients. In another area of concern, there was a study in 2009 to update information on the country's cogeneration potential, identify obstacles to its development, and propose the measures and changes needed to overcome the problems.

6. Future energy efficiency plans

A recent study by the University of Chile's Programme of Research in Energy (PRIEN) assesses the opportunities for energy efficiency in the country's major consumer sectors, and concludes that if energy efficiency measures are not taken, demand could double between 2007 and 2021. If such steps are taken,

however, demand could be reduced by 20% during that period. The figure below shows the percentage of this reduction for which each sector would be responsible.

FIGURE 15
BREAKDOWN OF SAVINGS



Source: Programme of Research in Energy (PRIEN), University of Chile.

Projections for Chile's electrical needs indicate that in the absence of energy efficiency improvements, the country will need 14,500 MW of additional installed capacity by 2020. A 20% improvement in energy efficiency compared to the 2008-2020 period would reduce this need to 1,600 MW (barely over 11% of the total).

The Chilean Government, recognizing these major challenges, is preparing an Energy Efficiency Action Plan 2010-2020. One of the main tasks of PPEE in 2009 will be to draw up this plan, which will set forth goals, objectives and lines of action for each of the major sectors, along with indicators, funding and evaluation instruments.

Points of reference will be determined for the main energy-consuming sectors, and final energy use in the industrial/mining and residential sectors will be described by constructing an energy conservation curve. Other major sectors of consumption, such as commercial buildings, will be dealt with in subsequent years. Given the complexity of developing an energy conservation curve, prestigious institutions such as the Lawrence Berkeley National Laboratory and the Regulatory Assistance Project were consulted. They provided the technical support needed to determine the appropriate methods for constructing the curve, analyse the policy instruments designed on the basis of the findings, and develop long-term capacity in this area.

Simultaneously with preparation of the plan, the government intends to implement three important actions:

Study on the introduction of energy efficiency through incentives for distribution firms

Current studies are underway to examine initiatives undertaken in Italy and by the state of California, in the United States, to promote energy efficiency by changing the regulations for electrical

distribution firms. A preliminary assessment indicates that these firms could be an effective channel for promoting efficiency. This would require eliminating the incentives present in the current regulatory structure, which increase a firm's profits when it sells more energy.

In contrast to the current rules, regulations should reward firms that reduce energy consumption by their end clients. This approach is one example of how regulatory changes can promote energy efficiency. The study that was commissioned addressed this and other, related issues, taking into account international experience in this area in order to develop solutions that could be applied to Chile.

Minimum energy performance standards (MEPS)

The legislative proposal to create a Ministry of Energy suggests giving the entity authority to establish minimum energy performance standards (MEPS) and additional labelling standards in this area. The introduction of minimum standards would represent a great advance towards the technological change needed to increase efficient energy use.

Finally, given their high consumption of energy, some electrical appliances could be considered a threat to the nation's energy security. Thus, the proposed legislation would authorize the Ministry of Energy to establish minimum energy performance standards that would be determined based on technical criteria and international experience. Such requirements are not new. The state of California has regulated the sale of electrical appliances based on their energy consumption since the late 1970s, and this measure has been widely studied as a successful case of energy efficiency policy. Countries such as Australia and New Zealand have also established minimum energy performance standards as a part of their energy policy. Brazil has set minimum standards of this type for lighting devices and motors since 2001, and is studying the possibility of introducing it for other types of devices.

Measuring the effectiveness of energy efficiency programmes

Formulating the programmes planned by PPEE requires evaluating their impact ahead of time. However, the process for monitoring and verification of the impacts needs to be developed, particularly with regard to how much energy is saved. This is of particular importance in terms of public accountability for the use and impact of resources invested in energy efficiency, and to provide useful information for ongoing work on formulating and implementing public policy.

This will be an important element of the Energy Efficiency Action Plan 2010-2020. Work is being done to determine what strategy should be adopted, taking into account international experience in the sector. As a complement to the activities outlined above, a system of energy efficiency indicators must be created. This work is being coordinated with the National Energy Commission, and draws on the opinions of experts from the International Energy Agency and the Asia-Pacific Cooperation Forum (APEC). Some of the initiatives underway in this area include developing methodologies and benchmarks to measure the effects of energy efficiency labelling for electrical appliances and vehicles.

To this end, the efforts involve close collaboration with the Superintendency of Electricity and Fuels, and with the members of the transportation working group coordinated by PPEE. National regulations require that the number of participants be monitored, and that programmes that transfer resources to the private sector include a detailed list of beneficiaries.

A database with the names of all of the programme's beneficiaries is kept by the National Programme for Changing Light bulbs. Monitoring this database helped to detect problems with the strategy for distributing low-energy lamps, an effort initially carried out by the electricity distributors. A new strategy was developed to solve the problem, incorporating the Ministry of Housing and Urban Development and its social programmes, along with municipal and regional governments, in order to reach the programme's target group more quickly and effectively.

In addition, PPEE and CNE conducted various public awareness campaigns in 2007 and 2008, including the "Ahorra Ahora" ("Save Now") campaign, and the "Thanks for your energy" campaign, as one way of addressing the country's energy crisis. Independent consultants were hired to

evaluate the campaigns and measure their effectiveness. Their work provided important elements for improving the effectiveness of future campaigns.

E. Lessons learned

In introducing the analysis of lessons learned in Chile regarding energy efficiency programmes, it may be worth repeating the very germane text at the beginning of section 1, "Recent advances in the policy, regulatory and institutional framework":

"Traditionally, the Chilean government's initiatives to promote energy efficiency have not been a priority, and have not been a part of State policy. Although there have been sporadic attempts to promote energy efficiency (including the Energy Conservation and Rational Use, or CUREN, programme), they have not been long-lasting or had major impact".

This problem has been a constant in many LAC countries, and lack of continuity is recognized as one of the principal factors responsible for the lack of success of national energy efficiency programmes in the region. As will become clear below, this lesson has indeed been learned by the Chilean Government, especially since 2005.

The main forces that drove the country to create PPEE, as a way of addressing its lack of an explicit national energy efficiency policy, were the sudden reduction in the natural gas supply from Argentina and pressure from international organizations such as OECD. There is a clear lesson learned here: it is a mistake to wait until there is a serious problem in the energy supply to take the bull by the horns and implement a proper programme to promote energy efficiency in all of a country's socioeconomic activities. Implementing a programme of this type is beneficial in and of itself, independent of its origin (internal initiative or response to impacts produced from outside).

Another important lesson learned in Chile is that action associated with how a society uses a strategic resource such as energy for its development cannot be left to market forces alone, and all the more so if domestic resources are insufficient to satisfy demand.

A final interesting lesson learned from the Chilean experience (one that distinguishes Chile favourably from other countries) is that activities designed to improve energy efficiency cannot be based solely on international cooperation, since such cooperation is subject to very precise time and funding limits, and when international cooperation projects end they leave no structure in place to carry on their efforts. This creates a high risk that what has been achieved will gradually be lost.

Thus it was that the Chilean Government, especially from 2005 on, began to play a pioneering role in developing energy efficiency. This was reflected in the inclusion of the issue as a central element of the government's energy policy, and in the creation and support of PPEE.

Like all projects in their initial stages, PPEE faced major difficulties. However, it has overcome these, and has grown considerably over the last three years, confirming the Government's view that energy efficiency deserves to be an essential pillar of the country's energy policy.

Along with the increase in budget –and logically connected with it– there has been a major increase in the availability of personnel to work in PPEE, and increased possibilities of commissioning local and international consultants to do studies that will help future activities optimize resources. Finally, in the last few months, the programme has moved to modern (and energy-efficient) buildings of its own, which will contribute to its success.

Another lesson learned, as the programme's senior managers clearly realized, is that the "game" must be opened up to all institutions, businesses, universities –in short, to all entities representing energy consumers– so as to bring them into the projects. The membership of the programme's Operational Committee (see Annex 6) reflects this.

Meanwhile, the projects developed by PPEE reveal a lack of technical capacity needed to carry out the initiatives. The programme has taken due note of this, and several of the contracts for consulting, to be commissioned between September and December of 2009, are designed to address the problem.

VI. Colombia

A. Recent advances in policy, regulatory and institutional frameworks

One of the most important elements of the Colombian situation in terms of energy efficiency is the passage of Law 697 of October 2001, which encourages rational and efficient energy use, promotes the use of alternative energy sources and establishes other legal provisions. Article 4 makes the Ministry of Mines and Energy responsible for promoting, organizing and ensuring the development and monitoring of programmes for rational and efficient energy use pursuant to the law's guidelines.

Article 5 creates the Programme for Rational and Efficient Energy Use, as well as the Programme for Rational and Efficient Energy Use and Other Forms of Non-Conventional Energy (PROURE), which the Ministry of Mines and Energy is to design as a way of promoting non-conventional energy sources. The objective of PROURE is to gradually implement programmes to ensure that the entire energy chain is uninterruptedly meeting minimum levels of energy efficiency and complying with environmental standards and standards applying to renewable natural resources.

In December 2003, Decree 3683 provided for regulation under Law 697/2001, and the Intersectoral Commission for Rational and Efficient Energy Use and Non-Conventional Energy Sources (CIURE) was created.

In January 2005, Decree 139 partially modified Decree 3683/03, and in June 2006 Resolution 18 0609 defined the subprogrammes that were to be part of the Programme for Rational and Efficient Energy Use and Other Forms of Non-Conventional Energy (PROURE), and set forth other provisions.

Under this latter resolution, PROURE included subprogrammes responsible respectively for the following:

1. culture, research and promotion of rational energy use (REU) and prospective analysis of new energy-transforming technologies related with it;
2. encouraging and developing projects with non-conventional and energy-efficient sources, including clean or renewable energy projects, with priority on areas that are non interconnected;
3. architectural construction and associated equipment for REU;
4. controlling energy loss;
5. climate change and market initiatives relating to methane and carbon sequestration;

6. stimulus strategies and incentives for products and projects that make rational and efficient use of energy, or for the total or partial use of non-conventional energy sources;
7. clean-production and energy-saving projects and activities that require equipment, components and machinery for reducing energy consumption and/or increasing energy efficiency;
8. promoting rational and efficient energy use in the public, business, transportation, residential (including social housing), industrial (small and medium enterprises) and energy services firms;
9. replacement of traditional fuels by potentially cleaner fuels, and specifically the promotion and use of biofuels;
10. updating and/or re-engineering of industrial equipment to improve the rationality and efficiency of energy use.

On 4 July 2007, Presidential Decree 2501 established provisions for promoting practices designed to encourage rational and efficient use of electrical energy. The articles covered the following areas:

Article 1: Objective and field of application

The measures set forth in the present decree to encourage rational and efficient use of electrical energy will be applicable in the following products and processes:

1. Products used for the transformation of electrical energy, whether domestically manufactured or foreign, to be marketed in Colombia:
   (a) Power transformers and electrical distribution transformers
   (b) Electrical generators
2. Products designed for end use of electricity, whether domestically manufactured or foreign, to be marketed in Colombia, in the following processes:
   (a) Lighting
   (b) Refrigeration
   (c) Air conditioning
   (d) Power
   (e) Water heaters for household use
   (g) Heating for cooking
3. Buildings in which governmental organizations carry out activities.
4. Social housing.
5. Public lighting systems.
6. Lighting for traffic light systems.

Article 2: Technical regulation for energy efficiency

The Ministry of Mines and Energy and the Ministry of Commerce, Industry and Tourism will issue the technical standards for the design and dimensions of labels indicating rational and efficient electrical energy use on products relating to the processes specified in Article 1, sections 1 and 2, of this decree.

Article 3: Rational and efficient use of electrical energy in social housing

Beginning in the third year following the date of issue of this decree, as a requirement for receiving subsidies from the national budget, builders of social housing, and builders generally who receive these public resources, must incorporate in their housing designs and construction measures for efficient and rational energy use, as per the technical parameters established by the Ministry of Mines and Energy and the Ministry of Environment, Housing and Territorial Development.

Article 4: Rational and efficient use of electrical energy in street lighting and in lighting for other public spaces.

The Ministry of Mines and Energy shall issue the technical regulations for rational and efficient use of electrical energy in street lighting and in lighting for other public spaces.

Article 5: Rational and efficient use of electrical energy in traffic signals

The Ministry of Mines and Energy shall issue appropriate technical regulations to ensure that, beginning in the fifth year following the date of issue of the present decree, more efficient lighting technologies are used in traffic signal systems, both when installing new equipment and when altering existing equipment.

Article 6: Liability

Civil, criminal and/or tax liability deriving from failure to observe the provisions of the present decree shall be as determined by whatever legal provisions are in force.

Article 7:

To enforce Article 2.9 of the Agreement on Technical Barriers to Trade, adopted by Colombia through Law 170 of 1994, and to enforce decisions of the Andean Community, all draft technical regulations shall be published on the official websites of the Ministry of Mines and Energy, the Ministry of Commerce, Industry and Tourism, and the Ministry of Environment, Housing and Territorial Development, in order to provide an opportunity, at an early stage, for the relevant sectors and stakeholders to comment. International notice of the texts of draft technical regulations related to the subjects referred to here shall also be provided pursuant to Colombian law and international agreements to which Colombia is a party.

Article 8: Entry into effect of the decree.

This decree shall enter into effect as of the date it is published in the Diario Oficial and shall supersede any contrary provisions.

As regards regulations to encourage cogeneration of energy, the Legal and Regulatory Framework in force can be examined in annex 1 (Law 1215 of 2008).

B. Key actors in energy efficiency and their effective roles

One of the key actors in developing the issues related to energy efficiency in Colombia is the Mining/Energy Planning Unit (UPME). This is a national-level Special Administrative Unit for technical issues, which reports to the Ministry of Mines and Energy.

The Unit's mission is to plan for the sustainable development of Colombia's mines and energy sectors, formulating State policy and making decisions for the country by processing and analysing information. Presidential Decree 255 of January 2004 changed the structure of the Unit and established a series of provisions regarding its functions. Chapter I, article 5, item 12 of the Decree (name, legal nature, domicile, objective and functions) states that one of the functions of the UPME is: to encourage, design and establish on a priority basis the plans, programmes and projects related to saving, conserving and making efficient use of energy in all areas of economic activity, and to work on the necessary dissemination of information.

The organizational structure of the UPME includes a General Directorate, to which four Divisions report. The latter include the Energy Division, which has four working groups. One of these groups is the Rational Energy Use and Alternative Sources group, which is made up of four full-time professionals.

The effective role of the Energy Division in promoting energy efficiency activities in Colombia is limited by the scarcity of appropriate human resources required to meet the existing demand for activities of this type.

Other actors in the development of energy efficiency programmes in Colombia are:

The Ministry of Environment, Housing and Development. This ministry has three sections associated directly or indirectly with rational energy use (REU): (1) the Climate Change Unit, (2) Programmes funded with clean development mechanism (CDM) funds; and (3) Housing.

The ministry's attitude on REU is proactive. It is attempting to carry out a programme to retire refrigerators, based on the Montreal Protocol for eliminating refrigerators that use CFCs.

BANCOLDEX (Foreign Trade Bank of Colombia). BANCOLDEX, as an organization, has not channelled significant funds to REU projects.

COLCIENCIAS (Colombian Institute for the Development of Science and Technology). Along with UPME, this institution is one of the potential pillars for the implementation of REU programmes and for the development and dissemination of information on non-conventional energy sources. Although it has an appealing range of lines of incentives, however, the funds it has used so far have been mostly devoted to the biofuels programme.

ICONTEC (Colombian Technical Standards and Certification Institute). The motivation behind this institution is to generate reliable technical information. It studies and establishes standards, as do other entities in the region (such as Argentina's IRAM), based on international standards. It disseminates the standards through the CONOCE programme managed by UPME. It is constrained, however, by the fact that its standards are not mandatory (labelling, for example, is voluntary). The organization grants certification, but is not responsible for regulating quality and efficiency.

ANDI (National Association for Industrial Entrepreneurs of Colombia). A reading of ANDI documents on REU indicates that the association has an interest in this subject. However, the interest is clearly circumscribed, as might be expected, by the industry's particular interests.

CREG (Energy and Gas Regulation Commission). This organization regulates rates. It defines its mission as that of closely reviewing cost components and regulatory issues connected with this sole subject. Thus, it does not favour an active REU policy, since it considers that this would distort price signals and their resource-allocation function. It also considers that a proper definition of costs will lead to rates that give the "correct" signals for REU. Its position on promoting the spread of non-conventional energy sources is similar.

Superintendency of Industry and Commerce. This organization is central in the implementation of REU policy, since it oversees enforcement of quality standards and the correspondence between products sold on the market and their specifications. Thus, it serves a central role in articulating all policies that, in the future, will govern technical specifications for domestic and imported electrical and gas-fueled appliances, in the event that the Superintendency wishes to expand regulation of REU.

Energy providers. Given their place in the spectrum of interests, these firms have relatively little interest in REU policies, which by definition would reduce demand by altering the equation between fixed and variable costs. However, some firms collaborate with official REU policy, and energy-consuming devices and equipment are channelled through them.

C. Resources and funding mechanisms for energy efficiency programmes

PROURE with its subprogrammes is currently being implemented in Colombia, using budgetary funds from the Ministry of Mines and Energy, through the Mining/Energy Planning Unit (UPME). For more information on types of energy efficiency activities and the amounts allocated for them, see Operating Plan document 2008 in the Electronic Annex–Colombia.

An additional funding source for energy efficiency activities in Colombia is FINDETER (Financiera de Desarrollo Territorial, S.A.) (www.findeter.gov.co). FINDETER, along with other sectors, supports the energy sector and finances activities related to all types of energy—traditional, and renewable and non-renewable alternative/non-conventional. It funds:

- Programmes to manage and reduce losses.
- Pre-investment and investment in all stages of the project cycle up to marketing (including cogeneration and self-generation).

The energy sector constitutes the fourth largest category of FINDETER disbursements, and receives 8% of disbursements.

D. Results of energy efficiency programmes to date

According to a fourth-quarter 2007 report by the UMPE, itself, on the progress of different Unit activities, the latest information available showed the status of the component "Encouraging a culture of rational and efficient energy use" as follows:

TABLE 9
PROJECT PROGRESS

Encouraging a culture of rational and efficient energy use	Weight as a share of all objectives: 10%	Execution: 8%
REU strategy, industry	20%	17%
REU strategy, service sector	20%	8%
REU PLAN–non-conventional energy sources	15%	15%
UNDP project 3087/04 CAN Internacional labelling	7%	7%
CONOCE programme	10%	9%
CIURE	10%	10%
"Mérito URE"	8%	8%
REU strategy in transportation	10%	10%

Source: Mining/Energy Planning Unit (UPME).

As may be seen, the various programmes seem to be progressing satisfactorily. There are no updated documents (as of mid-2009) on the progress of energy efficiency projects and programmes in Colombia.

E. Lessons learned

Numerous energy efficiency regulations have been established in Colombia over the last 8 years. They began with Law 697 of October 2001. Decree 3683 of December 2003 was issued to provide for regulation under that law. The Decree created the Intersectoral Commission for Rational and Efficient Energy Use and Non-Conventional Sources of Energy (CIURE). Decree 139 of January 2005 partially

modified decree 3683/03 and Resolution 18 0609 of June 2006, which defined the subprogrammes of the Programme for Rational and Efficient Energy Use and Other Forms of Non-Conventional Energy (PROURE) and set forth additional provisions.

However, the concrete results from creating this major portfolio of REU projects have been rather unsatisfactory. The reasons for this are not easy for an outside consultant to determine or clarify, but on the basis of similar experiences in other societies that are culturally comparable to Colombia (all in Latin America, of course) it might be intuited that the keys to the (relative) lack of success include a lack of continuity in policy implementation by the governmental organizations responsible (the Ministry of Energy and Mining in Colombia's case) and excessive delay in decision-making due to administrative, budgetary and/or bureaucratic reasons, associated with the number of governmental and other entities that have a say in issues of efficient energy use.

This situation is not the result of specific inefficiency in Colombia, but is a very common situation in the LAC countries (to use the geographically and culturally closest known cases). The problem has to do with the difficulty of addressing an issue like energy efficiency, which has technical, economic/financial, cultural, regulatory, communications and other components, thus complicating efforts to promote rational and efficient energy use in the region's societies.

In Colombia, moreover, there is a negative history associated with implementing REU policy. Inter-American Development Bank loan 1035/CO-OC was designed to support implementation of the Colombian Government's sectoral strategy to promote the development of a culture of rational and efficient energy use.

In early 2001, the Office of the Comptroller General issued a progress report on this loan project, stating that "the project's management has been deficient. To date, only 13% of the loan's funds have been executed, too low a percentage, considering that over 68% of the time stipulated for their use has passed. If things continue unchanged and the corrections needed are not made by those responsible under the agreement, the objectives will not be reached. In addition, high administrative costs are being incurred, quite out of line with the results obtained so far. The conclusion, then, is that the management of the funds has not been effective, efficient and economical."

This botched operation took place without a legislative framework on REU and non-conventional energy sources. A framework was provided only in October of 2001 (Law 697). However, it is quite clear that every so often the same issues are revisited, with the same good intentions, but with an evident lack of significant concrete results, and that there are serious institutional obstacles in the way of promoting these important energy policy issues in Colombia.

The main recommendation to the institutional staff responsible for promoting rational energy use in Colombia would be *to ensure that efforts, human resources and adequate budgets for the objectives are continuous, that objectives are realistic, goals clear and results measurable.*

Reinforcing these ideas, section 7 of chapter 5 of the National Energy Plan 2006-2025 ("Objectives and strategies of the national energy plan") summarizes the obstacles that Colombia has encountered in conducting energy efficiency activities, with recommendations to overcome them. (For the complete summary, see annex 1.)

A presentation by UPME in December 2008 puts forth the following conclusions: Currently, in Colombia's business sector, energy management:

- Is oriented to technological change.
- Concentrates on equipment and service Systems.
- Is controlled by consumption indicators.
- Is planned based on historical data & statistics
- Has insufficient measurement.

- Is based on insufficient information on true costs.
- Is allocated and administered by a coordinator.
- Suffers from sporadic financing.
- Is not continuous over time.

In this context, the frequent results of energy management:

- Are costly and intermittent.
- Omit important areas (operations, projects, procurement).
- Are not taken into account as a priority for production.
- Are not taken into account as a priority for maintenance.
- Depend on outsourcing.
- Lead to investments in services and assessments that do not produce clearly quantifiable savings.

VII. Costa Rica

A. Recent advances in policy, regulatory and institutional frameworks

Since 1994, Costa Rica's Law 7447 (Rational Energy Use Regulation) has been in effect, and the regulatory details provided in Decree 25.584 have been in force since 1996. A decree listing equipment that was exempt under Law 7447 was published in 1999.

Technical Regulation RTCR 374-98 MINAE was issued in 2001. Dealing with energy efficiency and labelling for refrigerators and freezers, it followed a 2000 "RTCR" regulation that defined a minimum efficiency standard for straight-line, compact and circular fluorescent tubes.

In 2004, the Costa Rican Metrology Laboratory (LACOMET) and the Costa Rican Accreditation Entity were created, both in the framework of the National Quality System established by Law 8279 of 2002. Finally, Decree 33.880 of August 2007 extended the activities that had been established under the Transitory Provision of Law 8279 to underwrite the functioning of the Costa Rican Technical Standards Institute (INTECO) as the nation's standards entity. The extension was for five years, until 2012.

A number of decrees and guidelines have been issued to promote rational use of energy resources—including, in recent years, DE-041 (the Oil Contingency Plan, an information campaign on fuel saving), DE-33.096 (Vehicle Exemptions, a provision to promote the use of hybrid fuel/electric automobiles), Guideline-017 (Electrical savings in the Public Sector, immediate electricity saving measures), Guideline 22 (New and Renewable Sources), Guidelines 42 and 46 (on seasonal change of schedule for public administration) and Guideline 43 (Ministry of Public Works and Transportation: Use of the "GAM" Train (dealing with launching the Greater Metropolitan Area Train).

B. Key actors in energy efficiency and their effective roles

1. Sectoral Directorate of Energy (DSE) of the Ministry of Environment and Energy (MINAE) of Costa Rica (www.dse.go.cr)

The Sectoral Directorate of Energy (DSE) is responsible for formulating and promoting comprehensive energy planning, through strategic policy and action to ensure the energy supply (over time, and by type) as a form of support for the country's sustainable development. This is the leading organization in comprehensive energy planning for decision-making in the energy sector.

Its general objective is to "formulate and promote comprehensive energy planning", and its specific objectives include:

- Preparing the National Energy Plan, following the lines of the National Development Plan, MINAE guidelines and the initiatives and contributions of public- and private-sector institutions.
- Conducting and coordinating comprehensive energy studies and assessments for decisions related to the sector's planning and development.
- Developing the energy pricing policy to be incorporated in the National Development Plan, through the National Energy Plan.
- Developing and maintaining an information system that supports energy planning and development in the sector.
- Evaluating and enforcing the policies and goals contained in the National Energy Plan.
- Promoting the rational use of energy by creating the mechanisms needed to execute action in this area.

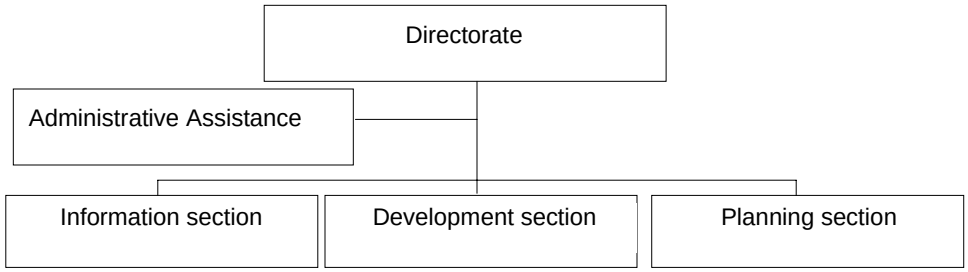
Principal outcomes of the Directorate's activities:

a) Development of the National Energy Plan.

b) Preparation of comprehensive energy studies and assessments for decisions related to the sector's planning and development.

c) Setting of energy pricing policy.

FIGURE 16
COMPOSITION OF THE SECTORAL DIRECTORATE OF ENERGY



Source: Sectoral Directorate of Energy (DSE).

The effective role of the DSE in energy efficiency is potentially a major one, since the issue is important to the country's energy planning. However, the DSE does not have efficiency specialists, which makes it difficult to expand specific energy efficiency projects and activities.

Current energy efficiency activities of the DSE

During 2009, the Sectoral Directorate of Energy (DSE) has been developing a series of energy efficiency initiatives:

A consulting firm is currently working on a "**Technical-economic assessment of technological options for exploiting biomass as an energy source**". The objective is to determine what the best technological options are for exploiting the country's biomass potential, taking logistical and economic factors into account. The final report on this work is expected in late October 2009.

Working jointly with INTECO, research is being carried out to formulate at least three standards for efficient vehicles and cleaner technologies:

The study is called "**Developing energy efficiency and environmental performance standards for internal combustion automobiles**". It involves exploratory research and information gathering regarding other countries' specific energy efficiency and environmental performance standards and regulations for automotive vehicles of under four tons –as well as standards set by international and regional regulatory institutions– with regard to measurement methods, and labelling and other means of providing information on energy efficiency and environmental performance. These standards are expected to be in hand in late November 2009.

The study comprises the following stages:

Stage 1

Research and information gathering regarding other countries' specific energy efficiency and environmental performance standards and regulations for automotive vehicles of under four tons—as well as standards set by international and regional regulatory institutions. The elements to be researched here include:

- Vehicle classifications for the purposes of energy efficiency and environmental performance standards.
- Energy efficiency and environmental performance levels in new vehicles.
- Methods for measuring energy efficiency and environmental performance.
- Treatment of used vehicles (importation and sale/use). Limits on vehicles' useful lifetime. Measures to ensure the adequate renewal of the country's fleet of automobiles. Information for purchasers:
- Energy yield and environmental performance standards and regulations.
- Enforcement of standards and regulations.
- International, regional and national standards are to be researched.
- Due standards, once identified, are to be incorporated

Stage 2: Analysis of the options identified

Once the compilation is complete, the information must be analysed in regulatory and technical terms, so as to assess the potential value of and select options for Costa Rica. The elements to be considered are:

- Standardization: The standards should take account of international, regional and national regimes, since this is integral to good practice in the area of standards and technical regulations.
- The applicability of standards and regulations in Costa Rica must be assessed.

The magnitude of the infrastructure needed should be considered, along with the investment

Stage 3: Proposed Costa Rican standards

Once the compilation and assessment of standards is complete, options must be proposed for Costa Rica. The following should be included:

- Fulfillment of the basic conditions necessary for the standard-setting process.
- Indication of what mechanisms are to be used to implement the standards.
- Selection of standards whose implementation is technically feasible.

- Preparation of draft standards, if necessary.
- Preparation of a plan to turn this information into a set of technical regulations.

Stage 4: Establish Costa Rican standards

Once proposed standards have been defined, the process of developing the nation's standards is to be coordinated with the National Standards Agency, through the following processes:

- Prepare the documentation needed to initiate the standardization process.
- Provide logistical and technical support to the National Standardization Committee.
- Document the Committee's work and the standards developed.
- Prepare the standards documents.
- Submit the standards documents to public response.
- Make the national standards official.

Stage 5: Develop a plan and recommendations to turn the standards into technical regulations

Propose a plan to turn the energy efficiency and environmental performance standards for vehicles into technical regulations, taking account of the following:

- The purpose and objective of the proposed legislation.
- The national and international legal basis for the proposed regulations, pursuant to sections 1.2.3.1 and 1.2.3.2 of the Guidelines for the Development of Technical Regulations.
- Conduct or find the studies needed to comply with the scientific analysis requirements of section 1.2.4.1 of the Guidelines for the Development of Technical Regulations.
- For the purposes of the plan, set out requirements for the enforcement of the regulations–that is, how the technical parameters are to be measured or verified.
- Legislation now in place should be evaluated for possible regulatory improvement and simplification of procedures.
- The plan should call for the regulations to go into effect gradually.

Study of clean and efficient technologies in the domestic market, in four stages:

Stage a: Identifying clean and efficient technologies:

Describe and analyse activities, measures and clean and efficient technologies that improve energy efficiency and reduce emissions, and promote alternative energy sources such as biofuels, natural gas and any other fuels that feasibly could play a role in the market within no more than five years.

The objective is to have a portfolio of technologies, measures and actions for energy saving and efficiency that have been subjected to cost-benefit analysis.

Stage b: Describing the situation in Costa Rica

The objective is to develop a description of the composition of the nation's energy consumption through the available literature (new surveys or processing of databases is not included) and to develop a projection of the nation's future energy demand.

Stage c: Modeling scenarios for the introduction of clean and efficient technologies, replacement of energy sources and actions to promote rational energy use in Costa Rica

Develop at least three scenarios for reducing energy demand and greenhouse gas emissions by adopting clean and efficient technologies, replacing energy sources and implementing rational energy use measures.

Analyse the costs associated with the actions and measures taken in each scenario.

Stage d: Develop a proposed strategy for introducing clean and efficient technologies in Costa Rica

On the basis of the information generated in the previous stages, a proposed strategy is to be developed for recommending measures and activities to be implemented in order to introduce clean and efficient technologies, and measures for rational energy use.

The strategy should include objectives and intended scope, and should indicate how results (improved energy use and emissions) are to be quantified.

Educational software for cycle-III and cycle-IV students

The object here is to follow up on other actions taken in the schools in previous years. A multimedia teaching tool is to be developed for cycle-III and Diversified Education students in Costa Rica. Using computer laboratories available at educational establishments, this should facilitate building and acquiring knowledge on issues related to energy and its production, conservation and rational use, and on climate change and its impact on the environment. This will serve as a complement to the formal curriculum in these areas.

Restricted vehicle use

The restriction was increased from 2.5 km to 25 km. The effects of increasing the zone in which the restriction applied were as follows:

- After the vehicle-use restriction by license plate number was increased, travel time on the routes analysed fell by an average 11%, with the greatest saving (30%) being on the Calle Central route.
- The time saved is equivalent to an annual saving of US$ 3 million.
- Traffic flow improved on all the routes studies.
- Total traffic declined by 12%, a fairly acceptable figure, given the theoretical objective of 20% (the percentage of vehicles being excluded each day).

The objective of the restriction has clearly been achieved. Improvements in travel times within the city are being reported, and traffic congestion is down, which produces fuel savings at both the individual and collective levels. This was confirmed when the restriction was lifted for three weeks and traffic congestion increased very noticeably. The measure was put into effect again on 21 July 2009.

2. Costa Rican Electricity Institute (ICE) (www.grupoice.com)

The ICE Group is made up of the Costa Rican Electricity Institute, the National Power and Light Company (CNFL) and representatives from the telecommunications sector.

The mission of ICE is to "improve the quality of life and economic and social development through electricity service that exceeds expectations of welfare, comfort and progress for all Costa Ricans".

Among its activities to improve energy efficiency among Costa Rica's consumers, ICE provides "advice for saving" on its website, targeting both the residential and business sectors.

The residential suggestions seek to achieve efficient and rational use of electrical energy by changing habits in ways that are advantageous to the family budget without involving sacrifices or deprivation of any kind. The suggestions are very practical. To make them easy to understand and use, they were divided into five sections, each with a link for information:

Sections:

- Saving on electrical installation.
- Saving on cooking.
- Saving with your refrigerator.
- Saving on your lighting.
- Saving with the water heater.
- Technical information.

For the business sector, ICELEC (ICE Electricity) provides a guide with practical advice for saving electrical energy in the commercial and industrial sectors. The Customer Service Unit, through the Energy Conservation Section and its 50 service centres in each of Costa Rica's main urban areas, provides information on energy saving when requested.

The sections, each accompanied by a link, are as follows:

Sections:

- Managing demand.
- Electrical installations.
- Electric motors.
- Lighting.
- Air conditioning.
- Water heating.
- Other equipment.
- Compressors.
- Refrigeration.
- Refrigeration equipment.
- Pump systems.

ICE is working in its laboratories, which are accredited for projects to set energy efficiency standards, to make measurements of efficient equipment (compact fluorescent lamps, household and commercial refrigerators, and air conditioning equipment).

As an organization making measurements to certify compliance with technical standards, the ICE laboratory plays a key role for the entire region, since it is the only such laboratory present.

Recent activities of ICE relating to energy efficiency

Efficient lighting programme: "three for the price of two" promotion of compact fluorescent lamps

This project was executed in February 2008 and targeted the residential sector, which, according to 2007 data, is the country's largest consumer of electricity, accounting for 40.2%. The residential initiative focused on lighting. Drawing on a strategic partnership with importers and distributors, it implemented a "pay for 2, get 3" campaign to distribute compact fluorescent lamps.

The objective was to achieve a 30MW reduction in the National Electrical System (SEN) and avoid investment of close to US$ 30 million in fuel over the useful lifetime of the compact fluorescent. The project data as of February 2009 read as follows:

CFLs sold……. 1,475,224 units

Energy saved…… 11,902 MWh

CO2 emissions prevented… 1,547 tons

The project's strategy included a publicity campaign focusing on the specific subject of lighting, as well as on energy saving in general. The campaign began in December of 2007, and the message that appeared in the various media was designed to foster awareness and encourage personal and family action to make more efficient and rational use of energy.

The campaign had two focuses: general advice on saving energy, and the "three for the price of two" compact fluorescent promotion. The free lamp was paid for by ICE.

The ICE energy efficiency laboratory receives accreditation (November 2008)

The Energy Efficiency Laboratory of the Costa Rican Electricity Institute (ICE-LEE) was accredited by the Costa Rican Accreditation Agency (ECA). The ECA thereby vouches for the validity and reliability of the lab's measurements, which are used as a basis for selecting efficient electrical devices.

The accreditation relates to lighting tests to determine the electrical, chromatic and photometric characteristics of high-pressure sodium lamps and compact fluorescents.

This is of great importance for ICE, since under Law 8279 (the National Quality System Act) **it is the only laboratory of its type in Central America.**

ICE-LEE developed and implemented a quality management system based on INTE-ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories), demonstrating its competence and trustworthiness to clients—both public- and private-sector entities contracting for energy efficiency testing services.

This is the first of the institution's testing laboratories that has achieved ECA accreditation. In 2006, ICE obtained accreditation from the Metrological Laboratory of Electrical Variables for calibration.

The ECA is the national organization responsible for accrediting testing and calibration laboratories, inspection and monitoring entities, certification agencies and the like.

Achievements of ICE-LEE

Experience and knowledge of energy efficiency standards, as well as the fact that it has personnel specialized in testing, have given ICE-LEE a leading role in national and regional energy efficiency standards, as well as in energy saving programmes. Created in 1998, it has conducted studies for Costa

Rican firms as well as firms in other Central American countries, Colombia, Argentina, Mexico and the United States.

The capacities it has developed in the area of measurement strengthen the country's ability to conduct voluntary energy savings programmes, to certify efficient products and to have the technical wherewithal to support Law 7447 (the Rational Energy Use Regulations Act).

In addition, Costa Rica is the fourth country in the Americas to use seals that certify the energy efficiency of energy-consuming devices. The seal goes by the name ENERGICE, and ICE-LEE is the laboratory that makes the measurements required to certify a product for the seal.

Acquiring efficient electrical devices is a matter of great socioeconomic and environmental importance, because they reduce electrical consumption and optimize the country's energy needs, including the use of fuels for electrical generation.

"Annex 5–Costa Rica" shows the catalogue of services that the laboratory provides.

3. National Power and Light Company (CNFL) (www.cnfl.go.cr)

The National Power and Light Company is a State-owned enterprise that distributes electrical energy in the country's most densely populated area—the central region or Greater Metropolitan Areas. Most of the enterprise's capital (98.6% of its shares) was bought by the Costa Rican Electricity Institute (ICE) in April of 1968. From a corporate point of view, CNFL is currently a subsidiary of the ICE Group.

The CNFL includes an Innovation and Electrical Efficiency Department, which provides services of various kinds to citizens who are interested in learning about and implementing energy efficiency programmes. The services range from educational programmes to technical studies that seek ways of conserving energy.

It also provides support and information in other areas of interest to the Costa Rican population, such as the development of new and renewable energy sources, and electrical transportation.

The CNFL has an Efficient Energy Use Department, which provides advisory services and promotes measures for efficient energy use.

In order to promote a philosophy of rational and efficient use of electrical energy in the population, the Promotion and Advisory Services Section of the Innovation and Energy Efficiency Department provides the following types of services:

In the business sector

- Advice for creating energy conservation committees under Law 7447 of 1994.
- Talks on the efficient use of energy in the workplace.
- Advice on creating promotional material for the efficient use of energy resources.
- Electronic bulletins with ideas, messages and advice on electricity use that help readers to identify and respond to the firm's needs and intentions as regards the use of energy resources.

In general

- Informational talks on energy conservation for community groups.
- Electronic bulletins with ideas, messages and advice on energy issues: forms, use, definitions, types, experiments and so forth for the general public.

Finally, through the Energy Efficiency Section of the Innovation and Energy Efficiency Department, the CNFL conducts energy audits to identify the consumption patterns of a firm or

industry. The audits are done directly by the Energy Efficiency Section, which has specialized professional personnel and equipment. The Energy Efficiency Section also offers services such as:

- Power factor studies.
- Energy quality assessments.
- Grounding systems.
- Thermography.

For audits, interested parties must send a letter to the Energy Efficiency Section with the following information:

1. A note signed by the legal representative or other authorized person of the firm or establishment where the audit is to be conducted.
2. Exact address.
3. Telephone and fax numbers.
4. Clear and concise description of the principal activities of the institution or firm (industrial or other).
5. Detailed indication of the problems and the studies requested.
6. Data on service: firm's meter and location number.
7. Name of the person to contact during the audit process.
8. Photocopy of the last electrical bill.

Following the guidelines of ICE, of which it is a part, the CNFL plays a role that complements the policy process defined by DSE.

Recent CNFL activities in the area of energy efficiency

Recently, the CNFL has been carrying out a number of activities especially directed at its clients, such as:

Energy efficiency advisory services

- Talks to business people to promote awareness of the issues
- Advice on creating energy conservation committees

Tele-advisory project

- Development of energy efficiency software for each sector service by CNFL
- Response to questions on energy efficiency sent by e-mail
- Electronic bulletins on energy issues for interested firms on a calendar selected by the recipient (weekly, bi-weekly, monthly)
- Organizing and participating in presentations (information booths) at fairs, conferences, seminars, and in contexts where the CNFL has interest and influence
- Maintenance and development of the DCE (Dirección Conservación de Enegía) websites (intranet and Internet)
- Collaborative delivery of informative material on energy conservation for CNFL offices and sections (branches, press and public relations, social and human development section)

Programme for Energy Efficiency in the Public Sector

The programme's objective is to collaborate with and advise public sector institutions on developing energy saving programmes. A visit to the institution by technical staff provides a level-1 energy assessment, which identifies the principal opportunities for saving. As a complement to these activities, the programme also has communications services.

Efficient lighting project

In this project, the CNFL purchases and installs efficient lighting systems for public-sector buildings. The objective is to replace the current T12 fluorescent lighting systems with more efficient systems. The investment involved is to be charged to the institution subsequent to the installation, through its electrical bills. A prior signed agreement between the parties is required.

Energy efficiency programme - business sector overall

This programme provides advice, measures and tools to help each entity adopt and implement an energy efficiency plan. Given the variety of business activities, it is proposed that each of the entities be studied, so as to provide specific programmes for them. In addition to providing opportunities for saving that relate to each activity, the idea is to define the energy curve and energy indices as a way of finding solutions, in addition to comparing current and past usage and implementing various activities to improve efficiency.

Electrical audits

Electrical audits define clients' current energy use situations and offer solutions to improve them. Specialized technical assistance is provided, and a variety of energy studies are offered. Opportunities for saving energy are identified, along with preventive or corrective measures and suggestion on what equipment to replace.

Large-consumers project

The objective here is to provide personalized service for clients of the CNFL that are large consumers, by implementing a personalized customer service system operated by an interdisciplinary staff dedicated to the ongoing improvement and efficacy of the client services system. This is expected to create short- and long-term relationships, identifying opportunities in the market for CNFL through strategies that are beneficial to the interest of both industry and the CNFL.

Other programmes

Measurement systems for marginal areas

This project is designed to improve indices of energy and financial losses for CNFL in residential areas. The project includes measurement from the air, with remote reading, connection and disconnection mechanisms in marginal areas, since there are high rates of vandalism and violence in such areas, which makes it difficult to read meters. The system also makes it possible to disconnect service for lack of payment.

Advisory services for communication on energy efficiency and electrical savings

The main activity involved here is to review and improve electrical installations in communities where CNFL projects are conducted.

Teacher training programme

This programme seeks to train teachers from throughout the country on energy, energy efficiency and alternative energy sources, so that they incorporate these subjects in their classes.

General objective:

Reinforce educational knowledge and strategy for efficient and rational electrical energy use among primary school teachers, so that they can transmit these to their students.

Specific objectives:

Plan and conduct a training programme for teachers in the different regional sections of the Ministry of Public Education.

Train educators in the nation's educational system on energy, energy efficiency and energy sources.

Goal for 2009:

Hold 316 training workshops for primary school teachers at the national level.

Results of the entire programme as of June 2009:

- Cumulative total of trainees: 18,796
- Programme goal: 25,000
- Remaining to reach the goal: 6,204

Training programme in communities

This programme consists of training on energy efficiency measures in a community. The community's consumption is determined, and activities are conducted for families, children and businesses.

As a part of the support and collaboration provided by Engineering of Generation Projects Department, the training programme is extended to communities in the CNFL area of influence, where it has generating plants.

General objective:

To educate the clients in the communities on energy efficiency, to achieve major savings in consumption in this sector.

Specific objectives:

- Determine clients' training needs
- Address the principal training and information needs relating to energy efficiency of clients in the communities
- Develop training programmes

Goal for 2009:

Address and develop the training project in a community of Tibás area. The programme includes 14 training workshops in the course of the year.

As of 30 June 2009, a total of 4 workshops have been held with 160 attendees (40 per workshop on average).

Results for 2008:

The training project in the Inter-Institutional and Communal Network for the Execution of Social Projects (RICEPS) in Goicoechea was prepared and conducted, as was the same project in the community of Ipis. At the end of the programme in December of 2008, the results were as follows:

Attendance:

- Total RICEPS participants: 207
- Total Ipís participants: 159
- Total educational sector participants: 174
- Total business sector participants: 18
- TOTAL: 558

Average savings due to the programme: 9.47%.

4. Costa Rican Institute of Technical Standards (INTECO) (www.inteco.or.cr)

The Costa Rican Institute of Technical Standards (INTECO) is a legally constituted private non-profit association with its own endowment. It was created in 1987, and in 1995 was recognized by executive decree as the nation's standards agency.

This recognition was consolidated with the passage of the National Quality System Act (law 8279, published in May 2002), under which INTECO became the nation's standards agency for five years, extendable if it satisfactorily carries out the mission assigned it by the law.

By providing standards, certification, training and information services, INTECO is committed to:

- Complying with the provisions of Law 8279 as the nation's standards agency
- Meeting the needs of clients and stakeholders, in addition to fulfilling any other commitments that INTECO makes
- Improve the efficacy of the management system on an ongoing basis

The Association's objectives are as follows:

a) Provide leadership for the development of Costa Rican standards, ensuring that they are appropriate given the country's socioeconomic development, and that they have been designed pursuant to internationally accepted best practices in the field of standards, and that they promote improvement in the processes, products and services designed, manufactured, processed, used and sold in the country, whether of domestic or international origin.

b) Develop and conduct certification activities linked with procedures to assess compliance.

c) Collaborate with the public sector in order to achieve the broadest implementation and use of certification and standards procedures.

d) Promote Costa Rica's participation in international and regional certification and standards organizations, representing the country in those organizations, as appropriate, and assuming the rights and obligations that accompany such representation.

e) Carry out all those activities related with standards and certification that contribute to improving the society's knowledge, use and development of them, that encourage trade and international cooperation and that foster the Association's sustainable development.

In the area of energy efficiency, INTECO is developing a methodology to implement the Energy Efficiency and Labelling Standards Project. The process calls for the following (more information is available at www.comccanor.org/CTN_Eficiencia Energética):

1. Analyse the political, institutional and cultural factors.
2. Establish political legitimacy.
3. Consider regional harmonization.
4. Research information needs.
5. Select products and establish priorities.

INTECO has a dynamic and important role to play in energy efficiency. The process of establishing energy efficiency standards has advanced significantly in the last two years. This can be seen, along with the Work Plan 2009 for Lighting Standards, in "Annex 5–Costa Rica".

C. Resources and funding mechanisms for energy efficiency programmes

The economic resources available to the key actors mentioned in (2) come from their own institutional budgets. Although they are not energy efficiency programmes, but activities to promote the use of renewable energy resources, two recent activities deserve mention here:

- ICE and DSE are conducting the National Rural Electrification Programme, drawing on new sources of energy in areas not covered by the existing network.
- With funds from the Inter-American Development Bank (IDB), ICE has funded an electrification programme with solar panels.
- Also with funding from the IDB and the Multilateral Investment Fund, INTECO is leading a project to establish standards for SMEs.

D. Results of energy efficiency programmes to date

Costa Rica has had no systematic monitoring of the results of energy efficiency efforts. For example, when asked whether there were reports or lessons learned, the National Energy Conservation Programme (PRONACE) answered in the negative. The programme has no set end date, and continues with activities spread across various institutions and businesses.

Results of PRONACE subprogrammes (changes in the scope of which may not be reflected in the following information):

a) National Educational Subprogramme for Energy Conservation
Educational software, pamphlets, teacher training programme (CEPCE) and printed material, among other things.
b) National Subprogramme for Information on Energy Conservation
Information campaigns.
c) National Subprogramme to Improve the Energy Efficiency of Equipment
There is a PRONACE programme coordinated by ICE.
d) National Subprogramme for Energy Conservation by large energy consumers (clients)
ICE and CNFL have technical advisory programmes for their clients.

e) National Subprogramme for Energy Conservation by Producers, Importers and Distributors of Energy.
ICE and CNFL have energy conservation programmes internally and for clients, as indicated by the above items.
f) National Subprogramme for Replacement and for New and Renewable Energy Sources.
g) National policy for the electrical sector continues to mandate a high proportion of electrical generation from renewable sources to supply the national network.
h) To supply isolated areas, ICE and COOPEGUANACASTE are developing a solar energy programme.
RECOPE is developing a National Biofuels Programme that will introduce ethanol-gasoline and diesel-biodiesel mixes.

Recent activities of the Sectoral Directorate of Energy

October 2008 marked the end of the consulting job entitled **"Identifying and assessing promotional instruments for energy efficiency in Costa Rica's automobiles"**. The objective was to identify and assess best practices in technical measures, increase energy efficiency, and reduce greenhouse gas emissions and local emissions from Costa Rica's automobiles.

The consultants' final report proposes a series of measures to improve the performance of the country's automobiles. The measures are of three types:

- Measures to encourage greater energy efficiency.
- Measures to promote the renovation of the country's automobiles.
- Proposals to improve the environmental performance of the country's automobiles.

E. Lessons learned

One of the most interesting lessons learned in Costa Rica's energy efficiency activities, projects and programmes is that the mere existence of a law (in force for nearly 14 years now) –one of very few such cases in Latin America and the Caribbean– in no way guarantees satisfactory results in terms of energy use. In other words, the law in itself does not ensure a positive impact (rational reduction of energy demand).

The main reasons for this are closely linked to the major problems that the State confronts in monitoring –and sanctioning when appropriate– behaviours that diverge from what the law requires. Cultural factors in the society tend to lead to violations, and (for budgetary reasons) human resources are scarce, which makes it difficult to maintain an effective monitoring system.

Thus, the most significant reflection from the lessons learned is the need to generate social awareness by using the communications media intelligently, so that poor use of energy –specifically, waste– comes to be seen in the medium term as a shortcoming and comes in for social sanctions, possibly much more effective than punishment for violation of a law.

An analogy might be drawn with the change in cigarette smoking, which was normal in interior spaces some years ago, though today it is nearly unthinkable to light up a cigarette in an enclosed space. A medium-range view of the problem of rational and efficient energy use may perhaps be usefully informed by this analogy.

VIII. Cuba

A. Recent advances in policy, regulatory and institutional frameworks

1. Economic context

Most of the means of production belong to and are administered by the Cuban Government.

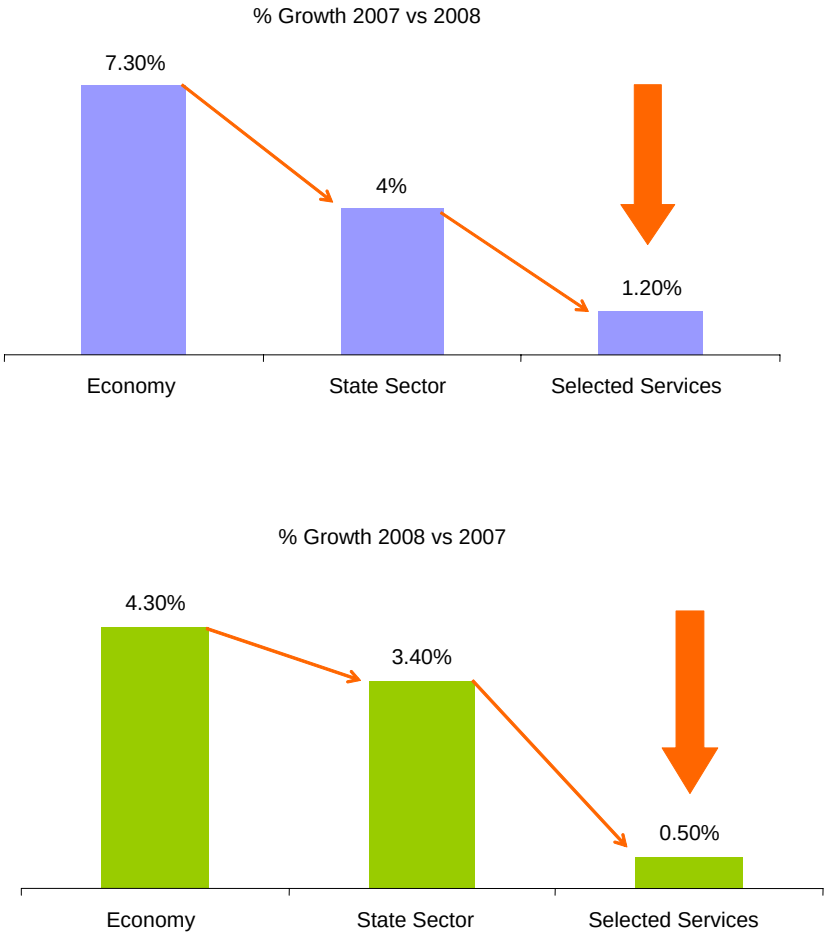
It is well known that Cuba achieved high economic development indices up to the end of the 1980s, thanks to its relations with the Soviet Union and the socialist countries of Eastern Europe. When the socialist bloc dissolved and the USSR disintegrated, the nation faced a severe economic crisis between 1989 and 1993. The Cuban economy resumed a path of uninterrupted growth beginning in the mid-1990s, despite the unfavourable external scenario (which became very severe in some years) and weather-related problems, characterized by prolonged droughts and the rising frequency of devastating hurricanes.

From 1994, when the economic recovery began, to 2006, average annual GDP growth was estimated at just over 4%. In 2006 the growth rate reached 12.5%, the highest ever recorded during the revolutionary era. This reflected the gradual strengthening of the economy that began in 2004, when the growth rate was 5.4%, followed by 11.8% in 2005. The 2006 figure was also the highest in the region, well above the average 5.3% growth rate reported for Latin America and the Caribbean, according to ECLAC.

The growth recorded in recent years is, to a great extent, the fruit of the tremendous effort to promote the Energy Revolution and boost the level of investments that will guarantee basic services and production. It is also a reflection of the development of major social projects, and it is supported by increased levels of activity in practically all sectors of the economy. The year 2008 started out strong, spurred by a 15% growth in tourism during the high season, bringing the growth rate to 6% for the first six months of the year. However, high international prices for food and petroleum during that six-month period were aggravated in the second half of the year by major losses sustained by the country under the onslaught of severe hurricanes, as well as the decline in the price of nickel, Cuba's most important export.

Against this backdrop, Cuba's energy efficiency indicators are positive, as GDP growth exceeded the growth of consumption in the State sector and particularly in the selected services (Large Consumers), as shown below.

FIGURE 17
GROWTH OF GROSS DOMESTIC PRODUCT



Source: National Electricity Union (UNE).

2. Energy context

Electricity production in Cuba is based mainly on fossil fuels. Therefore, increasing oil exploration and extraction, boosting energy production from the gas extracted along with petroleum, drawing more on renewable energy sources and improving energy efficiency are all national priorities.

Up to 1959, the Cuban energy industry was controlled by foreign capital. These services were viewed from a purely mercantile perspective rather than as a public service, so practically all of the oil and oil derivatives were imported, and retail prices of fuel were very high compared to those on the international market. There were many different electricity systems that were not connected to each other; only 56% of the population had electricity, and the rate structure was based on decreasing blocks of prices. This stimulated consumption, since the more a customer consumed, the lower the rate charged per kWh. When the Cuban Government nationalized power companies and other sectors of the economy in the early 1960s, the United States responded by imposing the Economic and Trade Blockade against Cuba. This blockade is still in place, and the country had to begin buying petroleum from the former Soviet Union even though the longer distances raised transportation costs.

Despite the advantageous pricing terms enjoyed by Cuba under its trade agreements with the Soviet Union, energy efficiency has always been a high priority in the Cuban Government's policies, as indicated below:

- In 1975, Law 1287 on electricity was enacted, and one of its regulations makes it mandatory for all consumers to conduct audits of electricity saving and demand management. It also created a corps of State inspectors responsible for approving the audits and overseeing compliance.
- In 1980, the Council of Ministers approved a new electricity rate that eliminated the decreasing block pricing system in the residential sector and converted it to a single-price linear system. In the non-residential sector, time-differentiated rates were introduced to encourage saving and shift usage away from peak times.
- In 1983, the National Energy Commission was created, under which the State Energy Inspectorate was charged with developing a national energy efficiency policy for all consumers.

When the Soviet Union collapsed in 1991, the impact on the Cuban economy was devastating. Oil consumption plummeted sharply. The effect of this crisis was felt immediately in all sectors: transport, industry and agriculture. Fossil fuel imports during that time were cut as much as possible to have the least possible impact on imports of other decisive sectors such as food, to take full advantage of efficiency reserves in the use of energy carriers and to maximize national sources of conventional and renewable energy.

The challenge for Cuba at the time was to achieve greater energy independence by reducing consumption to the absolute minimum and maximize the use of all national energy sources in order to gradually reduce the demand for foreign petroleum, as stated in the Programme for the Development of National Energy Sources.

The Programme for the Development of National Energy Sources was approved by the Executive Committee of the Council of Ministers on 20 May 1993 and by the Cuban Parliament in June 1993. All of the agencies of the Central State Administration contributed to the development of this programme, with the active participation of the provincial governments and hundreds of specialists and technicians.

The programme was able to finance itself with savings derived from its application, quickly making available additional energy sources equivalent to about 2 million tons of conventional fuel.

Change to daylight savings time

The first precedent for daylight savings time in Cuba dates back to 1939, when it was implemented under Presidential Decree #1185. It began on the first Sunday in June and ended the first Sunday in September, remaining on this schedule until the end of the Second World War. In 1963 the Revolutionary Government reinstated daylight savings time under Decree #3324, issued by the Council of Ministers for the purpose of taking full advantage of natural light during that time of year. From then on, daylight savings has been implemented every year, although the beginning and ending dates have varied.

Programme for Electricity Saving in Cuba (PAEC)

In 1997 the Programme for Electricity Saving in Cuba (PAEC) began as part of the electricity industry development strategy. It consisted of a comprehensive scheme that enjoyed full political support from the beginning. The people were given guidance on the application of systematic and practical measures for saving energy in order to reduce consumption and manage demand appropriately during peak hours.

The PAEC launched the first programme to exchange incandescent lightbulbs for compact fluourescent lamps, involving a total of 3 million units. It also conducted audits of equipment inventories and efficiency as a basis for evaluating exchange programmes, and created a corps of electricity regulators in the country. The corps is made up of highly trained energy efficiency professionals who work directly with the principal consumers to collaborate with their technical personnel on improving saving and demand management programmes. The PAEC also developed the first efficiency standards for imported and nationally produced home appliances, as well as a national media campaign to boost energy saving by all consumers. It signed agreements with the Cuban Education Ministry to develop a programme to instil in future generations a culture of saving and environmental awareness.

Thanks to these actions, between 1997 and 2001 the maximum demand of the national system fell by more than 150 MW, while the Cuban economy grew twice as fast as electricity consumption during that period.

Education Ministry Energy Saving Programme (PAEME)

Beginning in the 1997-1998 school year, the Ministry of Education launched a teacher training project to promote energy saving and environmental awareness, called the PAEME.

The overall objective of the PAEME is to enable the National Education System to instil in present and future generations a responsible civic attitude based on an awareness of the current energy situation in the country and in the world so that they will take heed of the need for rational electricity use and saving, which will contribute to the protection of the environment within the framework of sustainable development.

Among the specific objectives are the following:

- Acquaint students, families and communities with saving measures, rational energy use and consumption in household appliances and forms and methods of achieving rational consumption
- Help motivate and spark an interest in science and technology on the part of education professionals, students and families to inspire them to learn about, apply and increase renewable energy sources
- Analyze current regulatory documents with a view to applying them to the energy saving topics covered in the programmes in various teacher training disciplines

To achieve these objectives, the PAEME has not created new subjects in these areas, but has studied all the classes given at different levels of education and inserted these concepts into their curricula as a recurring theme. Thus, students will learn not only the information specific to the subject in question but also the importance of energy in life, the critical need to save energy, the importance of maximizing the use of renewable energy sources and the protection of the environment that can be achieved by behaving responsibly in this way.

However, these measures were not enough to guarantee the service indices that were required. In May 2004 the National Electricity System was beset with recurrent power outages caused by ageing thermoelectric plants and the damage inflicted by frequent severe hurricanes. The result was an energy crisis that took a heavy toll on the national economy and the population. The so-called Energy Revolution in Cuba emerged in the wake of this collapse.

The Energy Revolution in Cuba

The Energy Revolution in Cuba brought about a substantial change in the way the country generates and uses energy. The fundamental objective of this process is a radical transformation in the generation, distribution and final consumption of electricity, with energy efficiency as its main tool.

The effort got off to a quick start in 2005. In view of the magnitude of the project, the National Assembly of the People's Power agreed to designate 2006 the "Year of the Energy Revolution in Cuba".

Situation before the Energy Revolution

The following characteristics stand out from the others:

- Many inefficient electric appliances in Cuban homes
- 85% of the population cooked with kerosene, which was very difficult to provide for all families in the country
- Residential electricity rates did not encourage saving
- Insufficient culture of saving in both the residential and State sectors
- Large, inefficient thermoelectric plants were the mainstays of power generation, averaging 25 years in service, 60% availability, frequent shut-downs and high internal power consumption
- Frequent power outages, especially during hours of peak demand
- High loss percentages in transmission and distribution grids
- In June 2005, demand reached 2,129 MW, and 72% of the electricity to meet that demand came from thermoelectric plants, 8% from gas plants and 2% from hydroelectric plants. There was an 18% deficit

Energy Revolution programmes

In light of the situation described in the previous section, the following initiatives were proposed under the programme:

- Energy saving and efficient use in various types of consumption and end-uses, such as: refrigeration and air conditioning, heating, lighting, water pumping, cooking, water heating and others
- Increased exploration and production of petroleum and gas
- Use of renewable energies: biomass, solar, wind, hydropower
- Increased availability and efficiency of electricity service: Distributed generation system[8] and rehabilitation of electricity supply grids
- Nationwide campaigns, training and education on efficient energy use
- International cooperation based on local experiences

Rational energy use programmes

Residential sector

- Nationwide projects supported, directed and financed by the Government

[8] Benefits from distributed generation: a) low values of internal consumption and fuel consumption indices: 200-200 g/kWh generated; b) greater than 90% availability of power; c) unit power values, which in case of breakdowns do not impact the SEN; d) rapid onset of generating capacity; e) reduction of transmission and subtransmission losses; f) generation in isolated microsystems with reduced risk from catastrophes.

- Door-to-door visits by a group of social workers to replace inefficient appliances

The appliances most likely to be replaced in this sector, according to the statistics, were the following: 2,550,997 refrigerators were replaced, representing 96% of the country's entire inventory; 9,470,710 lights were changed, practically 100% of the total; 265,505 air conditioning units, amounting to 88%; 1,043,709 fans, totalling 100%; 230,504 televisions, 22% of all sets; and 267,568 water pumps, 100% of the total. In addition, appliances that improve energy efficiency, such as rice cookers, pressure cookers, water heaters, etc. were given away.

- Experiments were conducted prior to implementation, and the results were monitored constantly
- The programme had a tremendous social impact, with the possibility of income-based credits for purchasing appliances
- The electricity rate was modified according to the aforementioned plan

TABLE 10
ELECTRICITY RATE, RESIDENTIAL SECTOR

Previous Pesos per kWh	Ranges of kWh consumption	Current Pesos per kWh
0.30	More than 300	1.30
0.20	251 to 1,300	0.80
0.20	201 to 250	0.60
0.20	151 to 200	0.40
0.20	101 to 150	0.30
0.09	0 to 100	0.09

Source: National Electricity Union (UNE).

State sector – national projects

- More than 1,300 inefficient water pumps replaced with efficient ones in public aqueducts and sewerage systems
- More than 800,000 32W fluorescent tubes and electronic ballasts were installed to replace the most commonly used 40W tubes and electromagnetic ballasts. This project includes the recycling of 40W bulbs, which because of their high mercury content are subject to destruction controls
- More than 350 condenser banks were installed for customers penalized for low efficiency ratings

State sector – large consumers

- Special measures for regulating demand and accommodating the load in 1,720 centres that constitute large consumers. (Selected services)
- Implementation of energy-efficient management system in the selected services
- Development and oversight of electricity consumption plans in the selected services
- Training of personnel responsible for managing energy use in these centres and subsequent inspections to evaluate the results
- A total of 342 energy audits with a potential saving of 60 GWh per year

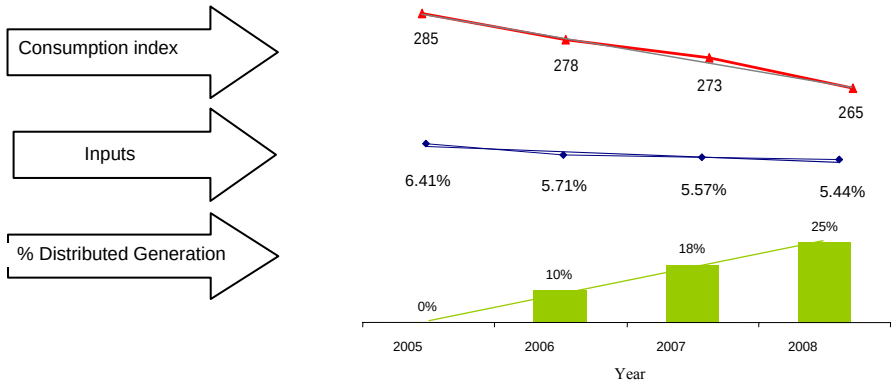
State sector – transport

- Replacing inefficient equipment with efficient units on the railroad, in transport for servicing the electricity grid, urban transit and others
- Engine overhauls of equipment with high fuel consumption
- Reorganization of the country's freight transport system and planning according to physical consumption indices in each sector of the economy

Efficiency in distributed generation

The application of this generation system has resulted in substantial improvements in the efficiency of the electricity generating system. The consumption index has been reduced from 285 g/kWh to 265 g/kWh, and inputs from 6.41% to 5.44%, with the introduction of this technology to replace less efficient thermoelectric systems.

FIGURE 18
EFFICIENCY IN GENERATING SYSTEM



Indicator	Thermal Plants	Distributed Generation (Fuel Engines)
Inputs	7.0-10.0%	2.5-3.0%
Specific consumption	280-320 g/kWh	200-208 g/kWh

Source: National Electricity Union (UNE).

Results of the Energy Revolution

All of these tasks, which were undertaken in conjunction with the Energy Revolution, have had a threefold impact, with three fundamental dimensions: economic, social and energy-environmental. All three are closely interrelated.

Economic dimension

Saving electricity in the residential and State sectors has freed up large sums of money that had been spent on electricity and are now available for other social projects, and consequently the amount of fuel used in the country has fallen.

Social dimension

Improved living conditions for Cuban families, lower household electricity consumption and healthier family budgets promote good habits and customs with respect to the rational use of energy carriers.

Energy-environmental dimension

The maximum demand for electricity in the country's generating system has been reduced, postponing the need for new investments in generating plants. The amount of pollutants in the atmosphere has been reduced, thus extending the life of the country's fossil fuel reserve and lessening the environmental impact caused by irrational use of these fuels in electricity generation.

New regulations established during the Energy Revolution

Decision 328 of 2007 of the Ministry of Basic Industry, establishing a System of Energy Carrier Oversight and Control

This decision puts in place an Annual Energy Carrier Consumption Plan for all agencies of the Central State Administration and the Provincial Administration Councils, which is to be approved by the Ministry of Economy and Planning on the basis of scientifically sound Consumption Indices and projected levels of activity. In addition, the decision provides for the creation of Energy Carrier Oversight and Control Directorates and sets forth their obligations and legal authority.

Decision 136 of the Ministry of Basic Industry. Technical Regulations on Energy Efficiency for Consumer Electrical Appliances

The purpose of this Technical Regulation is to establish and monitor the technical requirements for energy efficiency, electricity safety and tropicalization of imported consumer electrical appliances and those that are manufactured or assembled in this country by national or foreign corporations, with a view to promoting the rational and efficient use of electricity and protecting the consumer through the use of appliances with high energy efficiency and quality. This regulation establishes the process of Technical Acceptance, Technical Authorization, Inspection and Control, Violations, Penalties and Energy Efficiency Labelling. It covers refrigerators, air conditioners, fans, energy-saving lightbulbs, microwave ovens, rice cookers, electric pressure cookers, electric coffee makers, electric irons and washing machines.

Cuban Standard. NC 220 buildings. Energy efficient design requirements

Decision 316 of 2008, issued by the Construction Minister, makes it mandatory for all new buildings to adhere to standards that guarantee energy-efficient design. This standard covers the following areas:

- Part 1. Exterior surface of building
- Part 2. Electricity and lighting
- Part 3. Ventilation and air conditioning. Systems and fixtures
- Part 4. Supply of hot water
- Part 5. Energy management

All investments and remodelling projects of a certain magnitude must meet the requirements set forth in this standard in order to be approved. In 2008, all construction companies in the country received training and certification.

Strategy for boosting energy efficiency

- Incorporate new equipment and consolidate a standardization and labelling system.
- Approve the proposed legal framework for promoting rational and efficient energy use in Cuba.
- Modify electricity rates in the State sector.
- Increase the number of selected centres, achieving 45% to 60% control over consumption in the State sector.

- Determine physical consumption indices in high-consumption centres. Create a database for comparing similar centres in Cuba and other countries.
- Strengthen energy service companies and oversight groups.
- Implement automation projects in industry and in the business sector.
- Install condenser banks in customers with low efficiency ratings.
- Replace inefficient engines in industry.
- Make efficient use of air conditioning and refrigeration.
- Increase cogeneration capacity.
- Improve thermal insulation in buildings and industrial facilities.
- Systematize the mandatory application of Quality Standard (NC) 220 in new buildings.
- Certify the energy efficiency of new projects during the investment phase.
- Promote the introduction of energy-efficient appliances in the residential sector. Examples: microwave ovens and solar heaters.
- Strengthen the Energy Directorates of State agencies and territorial governments.
- Complete the energy saving potential map of provinces and regional agencies.
- Implement 10 projects approved under PETROCARIBE and present new projects.
- Achieve partial financing of Clean Development Mechanism (MDL) projects.
- Explore other sources of project financing.
- Continue implementing Total Management and Energy Efficient Technology (TGTEE) in conjunction with universities.
- Participate in exchange and integration of experiences with all Ibero-American countries.
- Implement the National Electricity Saving Prize on the Island.
- Draw up the Energy Efficiency Programme for the country through the year 2020, supported by economic plans.

Communication strategy

The print media, radio, television, billboards, neighbourhood debates, conferences and festivals will be managed and leveraged to reach the entire population, taking into account their participation in society.

Guidelines for promoting and developing renewable energy sources and energy efficiency

Now that the Energy Revolution has been under way for three years in the country, the regulation titled “Guidelines for promoting and developing renewable energy sources and energy efficiency” has been submitted for the approval of the Council of State.

The purpose of this document is to establish general principles for promoting and developing renewable energy sources and efficient energy use at the national level in projects or applications that use renewable energy sources or promote more efficient use of energy. The regulation is based, among other things, on the need to establish a regulatory framework, create the infrastructure and the technological capacities required for the development of national services and production associated with energy efficiency, and facilitate the involvement of foreign investment in projects related to these areas. Any effort to improve the energy demand/supply ratio while protecting the environment is predicated on the essential need to raise energy awareness at all levels, down to the basic building

block of society, the family. These guidelines assign functions to each ministry for achieving the aforementioned objectives.

Energy efficiency programme through 2020

Assuming that investments can be made without major technological modifications and recouped in less than two years, potential electricity savings in Cuba are estimated at 23% of current consumption at the end-user phase, with the State sector accounting for 20% and the residential sector 3%. Consequently, a programme of investments through 2020 has been drawn up to remedy the situation.

The systems to receive attention will be prioritized according to the structure of potential savings, as revealed by studies:

- Electric motors 40%
- Refrigeration systems 20%
- Air conditioning systems 20%
- Lighting systems 10%
- Others 10%

B. Key actors in energy efficiency and their effective roles

1. Political-institutional context

Energy issues are addressed according to the following institutional framework:

The Ministry of Economy and Planning is responsible for defining national energy policies. Provincial and municipal governments and the Agencies of the Central State Administration are ultimately in charge of implementing these policies.

The Ministry of Basic Industry (MINBAS) lays down general energy policy guidelines and approves the schedule and level of rates proposed by the National Electricity Union (UNE), whereupon it is sent to the Council of Ministers for ratification.

Independent electricity producers, which sell energy under licenses or concessions to the UNE, participate in this process subject to minimum-cost centralized planning. There is a uniform rate for the entire national territory, with quality standards that promote energy saving and efficiency.

The National Electricity Union (UNE), under the Ministry of Basic Industry, is the national agency responsible for the generation, transmission, distribution, marketing and rational and efficient use of electricity throughout the country.

The UNE is divided into the following units: (i) the Directorate of Rational and Efficient Energy Use, the National Load Dispatching Office, which is responsible for the operation of generating plants and transmission lines, and (ii) nine Administrative Directorates that oversee various enterprises (projects, construction, etc.). Noteworthy among these are 15 distribution companies located across the Island. Each company has a Rational and Efficient Energy Use Field Unit. These units have a total of 300 specialists interacting directly with the municipalities to implement the country's energy efficiency directives, and 103 energy supervisors who conduct energy audits.

National Energy Efficiency and Saving Group

In 2007 Cuba formed an advisory group for the purpose of coordinating and executing in a comprehensive manner all actions related to energy efficiency in the country. It is made up of specialists from Centralized State Agencies (consumers), Project Enterprises, Energy Service Enterprises, Cuba Energía (a company specializing in managing energy information), equipment testing laboratories, the Electricity Union's Directorate of Rational Energy Use and the Energy Efficiency Network of the Month (comprising all the technical universities in the country).

Subordinate working groups have been formed to specialize in the following areas:

- Air conditioning and refrigeration
- Heat production
- Buildings
- Automation
- Electricity losses
- Power sources (electric motors)
- Lighting
- Residential, commercial and services sector
- Technical inspections and audits
- Industrial sector
- General (communications strategy, training, etc.)

C. Resources and funding mechanisms for energy efficiency programmes

The funds for developing energy efficiency programmes and projects in Cuba come from the National Budget. The Cuban Government has invested several billion pesos in the programmes of the Energy Revolution, based on the conviction that, as Commander in Chief Fidel Castro stated in a speech on 5 May 2006, "Fortunately, we have found something more important, energy saving, which is like finding a huge deposit".

D. Results of energy efficiency programmes to date

1. Programme to revamp the national electricity system

One of the far-reaching conceptual changes inherent in the Energy Revolution is the establishment of diesel and fuel oil generator banks that are synchronized with the National Electricity System (SEN). These are generators that consume little energy, are readily available and easy to install, and have lower per-unit power levels than thermoelectric plants.

The introduction of synchronized generator banks for distributed generation yielded a capacity of 1,320 MW for diesel and more than 800 MW for fuel oil, the latter eventually expected to increase to more than 1,700 MW.

More than 6,000 new emergency banks were installed, yielding 690.2 MW for key consumers such as health clinics, food preparation centres, water pumping and purification units, educational facilities, hotels and centres associated with tourism and other facilities that are vital to the economy.

After the generator banks were brought on line, the number of days with power outages involving more than 100 MW and lasting more than one hour fell from 188 and 224 days in 2004 and 2005, respectively, to 3 days in 2006 and 0 days in 2007 and 2008.

TABLE 11
COMPARISON OF AVAILABLE POWER AND PEAK DEMAND IN THE LAST 4 YEARS

Years	2005	2006	2007	Cumulative. Jun. 2008
Available potential	1 993	2 695	3 263	3 358
Peak demand	2 075	2 245	2 245	2 622
Reserve (+)Shortfall (-)	-142	+450	+646	+736

Source: National Electricity Union (UNE).

Thermoelectric plants covered 61% of the electricity generated as of July 2008, with distributed generation based on fuel oil accounting for 15%, gas turbines 14%, and distributed generation based on diesel 9%. The remaining 1% came from hydroelectric plants.

Future demand (through July 2011) is projected at approximately 2,730 MW, and electricity generation is expected to come from the following sources: 56% fuel oil, 22% gas, 19% thermal and 3% diesel and water.

Measures

Among the most noteworthy measures taken was the sale by the Government of new high efficiency household appliances to 3 million Cuban families.

As a result of this programme, Cuba became the first country in the world to phase in the replacement of inefficient lighting systems. More than 9 million incandescent lightbulbs have been replaced with fluorescent bulbs and the importation of incandescent bulbs is now prohibited.

Energy efficiency campaigns have also dealt with kitchen appliances, and kerosene and LPG are being replaced by electricity.

Strict controls on electricity and fuel consumption have also been established.

Combined cycle power plants fueled by gas and renewable energy sources are also playing a key role in the Cuban electricity system.

The use of wind energy to generate electricity and pump water is on the rise, as is the use of solar termal energy for heating water in homes, social institutions and certain industries. In addition, work is being done on photovoltaic solar energy, biogas, sugarcane and forestry biomass, and other renewable energy sources.

Other priority activities include the rehabilitation of distribution lines to reduce energy loss and boosting national production of petroleum and gas (Cuba already covers 48% of its consumption of petroleum with domestic production).

Quantitative achievements

- Between 2006 and 2008, savings in kerosene and LPG in the residential sector amounted to 651,000 tons of oil equivalent.
- Between 2006 and 2008, fuel saving in electricity generation amounted to 1.052 million tons of oil equivalent.
- Between 2006 and 2007, fuel saving in transportation in the State sector amounted to 662,000 tons of oil equivalent.
- The programmes of the Energy Revolution yielded an overall saving of 2.365 million tons of oil equivalent from 2006 to 2008.

Other economic benefits

The energy-saving measures adopted under the Cuban Energy Revolution avoided the use of 2.365 million tons of oil equivalent.

Among the major advantages of the project is the elimination of kerosene for cooking and the reduction of liquefied gas use in the residential sector.

The nation has an average installed capacity of more than 4800 MW of power, which meets the demand of more than 11 million Cubans. More than 98% of Cubans receive power from different sources.

One of the most far-reaching and socially significant actions was the replacement of more than 9 million incandescent lightbulbs and millions of electrical appliances that used large amounts of electricity, with units that were more efficient and economical.

Another benefit stems from the elimination of 16,294 low voltage zones in the country, 92% of all such zones identified.

The development of renewable energy sources such as wind, biomass, water, solar thermal and photovoltaic power has made it possible to make more and better use of available resources.

In less than one year, more than 1,000 MW of synchronized generator banks were installed.

Good progress has been made on installing emergency generator banks in vital economic and services sectors so that electricity can be provided even during weather-related or other natural disasters that might affect the country.

As part of the integration projects undertaken in conjuction with the Bolivarian Alternative for the Americas (ALBA) and Petrocaribe, or under bilateral agreements, Cuba has shared its experiences with many Latin American countries. Particular emphasis has been placed on the large-scale exchange of incandescent bulbs for energy-saving bulbs and the installation of fuel oil and diesel generator banks for distributed generation.

E. Lessons learned

- The Energy Revolution was born out of necessity as an energy-saving alternative for the country
- Among the accomplishments of the Energy Revolution are the reduction in household electricity consumption and the consequent boost for family budgets
- The population developed a sense of energy solidarity, and this sparked a movement for energy saving, habits and customs that favour the rational use of energy and protect the environment

The Energy Revolution has had a socio-economic and environmental impact and has proven to be feasible and effective, with the active participation of the population and young people in particular, as well as the mobilization of social actors in the community. Different social actors have rallied around the cause of environmental protection and safeguarding the human species.

IX. Dominican Republic

A. Recent advances in policy, regulatory and institutional frameworks

1. Economic context

The Dominican economy is based on four pillars: agriculture, mining, tourism and industrial free zones. Tourism generates over US$3 billion per year, while free zones and tourism are the fastest-growing sectors. Although the service sector has overtaken agriculture as the main job provider, agriculture remains the most important sector in terms of domestic consumption, and the second most important (after mining) in terms of exports. Another mainstay of the economy is remittances sent home by Dominican people living in the United States, which are estimated at about US$2 billion per year. The country's scant industrial production is centred mainly of the agribusiness sector. The Achilles heel of the Dominican economy is its high inflation, which is running at over 10% per year. In 2008, GDP grew by 5.3%.

The Economic Commission for Latin America and the Caribbean (ECLAC) forecast that the Dominican economy, measured by gross domestic product (GDP), will grow by just 1% this year, although it will end the year with a low inflation rate.

For 2009, the central government deficit is expected to be 1.7% of GDP, and a sharp contraction in foreign trade is forecast. Imports have declined by nearly 30%, and exports are down by 24% compared to their 2008 levels.

The crisis could have a major impact on the Dominican economy, according to the Economic Commission for Latin America and the Caribbean (ECLAC), in its study entitled "Enfrentando la crisis. Istmo Centroamericano y República Dominicana: Evolución económica en 2008 y perspectivas para 2009". The most significant feature is the weakening of external demand, as shown by a sharp drop in exports and hence domestic activity and employment levels. Other factors include reduced remittances, foreign direct investment (FDI) and tourism, and access to financing.

2. Energy context

The country's energy balance depends largely on petroleum products, either produced directly ay the Haina refinery (but using imported crude oil), or else processed fuel imports, which are used to cover over 80% of national energy needs.

Despite being an eminently exporting country, the Dominican Republic's balance of payments is clearly negative, since it has to import all of its oil and manufactured industrial products.

Its main trading partner is the United States, followed by countries of the region that have Caribbean coasts (the Bolivarian Republic of Venezuela, Mexico, Columbia), and the European Union.

Electricity theft is a major problem. Just 60% of the island's 8.5 million residents are legally connected to the electricity system. A history of deficient service and high government subsidy has helped foster a culture of non-payment and public scepticism towards the Government and the complaints made by public utility firms.

In total, the Dominican Republic consumes over 7.4 Mtpe (54.32 million barrels of oil equivalent (Mbpe)) of energy per year, with 2.05 Mtpe (15.05 Mbpe) fuelling electric power generation.

For much of the 1990s, electricity demand in the Dominican Republic could never be satisfied, as it was growing much faster than the supply from generation, and the latter in turn was not the result of coherent planning. In later years, owing to a serious economic crisis affecting all sectors of the domestic economy, the proportion of demand that was satisfied shrank steadily, and in 2004 it contracted by 14.7%. Although the electricity market staged a recovery in 2005, the growth trend is somewhat modest, owing to the preventive rationing that is in currently force (demand management), which reduces the supply of electricity to ensure the sector's financial sustainability.

In the Dominican Republic, electric-energy supply involves a generating segment with an installed capacity of over 3,000 MW, of which 85.2% are thermal power units and 14.8% hydroelectric.

The country's generating stock involves both private and state capital. All hydroelectric units belong to the State-owned EGE-HIDRO, which in turn belongs to Corporación Dominicana Empresas Eléctricas Estatales (CDEEE), formerly CDE. The EGE-Haina and EGE-Itabo enterprises are of mixed ownership (50% State, 50% private sector, as is management of their units), while the firms AES Andrés & DPP, Diesel La Vega-Palamara, Seaboard, Monte Río and CEPP belong wholly to the private sector.

3. Institutional context

Institutions of the electricity subsector

The State bodies that govern the specific activities of electricity subsector are the National Energy Commission and the Electricity Superintendency.

The National Energy Commission (CNE)

The CNE is a Dominican State institution with legal status under public law and its own capital, created through the General Electricity Act (LGE), Law No. 125-01, as indicated in Article 7, promulgated on 26 July 2001.

According to Article 12 of the General Electricity Act, No. 125-01, the CNE has the following functions:

- Prepare and coordinate draft laws and regulations.
- Propose and adopt policies and standards.
- Prepare indicative plans to ensure the proper functioning and development of the energy sector, propose them to the Government and ensure their compliance.
- Promote investment decisions in accordance with the established plans and advise the Government on all sector issues.

Electricity Superintendency

This superintendency has legal status under public law, and its own capital and capacity to acquire, exercise rights and contract obligations. It related to the Government through the National Energy Commission.

Department of Industry and Trade (SEIC)

This government institution is responsible for formulating and applying industrial, commercial and mining policy; it also participates in energy policy formulation, in accordance with the Central Government's economic policy and general plans.

In the hydrocarbons subsector

- It formulates policies relating to the fuels market.; and it controls and supervise the application of these policies and fulfilment of standards, regulations and provisions governing the market
- It uses formulas, using the fuel import parity prices approved for such purposes and based on international benchmark prices, to calculate local prices for the domestic market, which are notified to citizens through the mass media
- Through its Hydrocarbons Directorate, it receives, analyses, and recommends, prior to being put into service, all requests for importation, storage, production, canning, refining, purification, mixing, processing, transformation, transport, distribution and marketing of hydrocarbons, ensuring that they fulfil current technical and quality standards, while bearing in mind standards on environmental conservation and ecological protection

In the energy sector

- It participates in the formulation of energy policy
- It promotes research, development and implementation of energy-saving and energy-efficiency projects, and the use of alternative renewable or clean energy sources
- It identifies and implements projects that use alternative energy sources, to the benefit of population segments that lack electricity — emphasizing rural and remote zones

Corporación Dominicana de Empresas Eléctricas Estatales (CDEEE)

This is a holding company resulting from the transformation of the CDE under the General Electricity Act of July 2001.

Its functions consist of leading and coordinating electricity firms, implementing State programmes on rural and suburban electrification on behalf of low-income communities, and the administration and application of electricity supply contracts with independent electricity producers.

The CDEEE finances activities with resources allocated by the Public Expenditure Act, together with loans and other specialist funds assigned to it.

ETED and EGEHID

Empresa de Transmisión Dominicana (ETED) and Empresa Generación Dominicana (EGEHID) are part of the CDEEE holding company. The former is responsible for electricity transmission lines in the systems; the second owns the entire State hydroelectric power generation system, which, under Law 125-01, is owned exclusively by the State.

EDENORTE and EDESUR

Empresa Distribuidora del Sur (EDESUR) and Empresa Distribuidora del Norte (EDENORTE) are energy distribution firms created through the Capitalization Act, operating exclusively in marketing energy. They have been 100% State-owned since the Government bought out the Spanish firm Unión Fenosa.

Rural and Suburban Electrification Unit (UERS)

This programme was created to ensure electrification in suburban and rural zones populated by low-income families. It operates under the direction of CDEEEH and received 20% of the resources entering the capital fund for development.

4. Legal framework

The General Electricity Act

The General Electricity Act, Law No. 125-01, amended by Law No. 186-07, of 6 August 2007. This legislation establishes a new legal and institutional framework governing the activities of the following subsectors: electricity, hydrocarbons, alternative sources and rational energy use_, in other words the energy sector generally.

In terms of energy efficiency, the law creating the National Energy Commission gave it responsibility for regulating and creating energy-efficiency policies, standards and programmes, together with other legal initiatives to promote energy efficiency including exemption from customs duties on compact fluorescent lightbulbs.

Article 14(f) of the aforementioned law states following aim: **"To promote rational energy use".**

Regulation for Implementing the General Electricity Act

No. 125-01, amended by Law No. 186 – 07, issued through Decree No. 555 – 02, of 19 July 2002, amended by Decree No. 749 - 02, of 19 September 2002, and further amended by Decree No. 494 - 07 of 30 August 2007.

Hydrocarbons taxation law

No. 112-00. Enacted on 16 November 2000, considering that the Dominican Republic is a net importer of primary energy, essentially importing all of its demand for oil and oil-based fuels at prices that are the subject to fluctuations on the international market.

Regulation for application of the Hydrocarbons Act

No. 112-00. Decree No. 307 – 01.

Law No. 57-07 on Incentives for renewable energies and special regimes (LIERRE)

Promulgated by the Government on 7 May 2007.

Regulation for Application of the LIERRE

No. 202 – 08, Decree No. 57 -07.

B. Key actors in energy efficiency and their effective roles

The National Energy Commission (CNE) and the Ministry of Industry and Trade (SEIC) are the leading institutional stakeholders on energy efficiency, as described in the institutional context and legal framework.

C. Resources and funding mechanisms for energy efficiency programmes

1. Lines of financing

Financing for energy efficiency

To finance energy-efficiency projects, the CNE strategy needs to be functioning. The funds in question will be used to support government-sponsored programmes, and will include costs incurred for programme development, marketing and monitoring, demonstrations, subsidies/incentives, start-up capital for financing programmes, etc. All financing sources should be explored, including budgetary support, donor grants, the MIC Fuel Surcharge Fund, and other taxes levied on energy users (for example electricity), etc.

2. Financing mechanisms for energy-efficiency projects

The CNE will explore with the main stakeholders a number of way of financing and/or providing incentives to promote and support energy-efficiency activities and projects. These may include the following:

- *Public financing programmes.* As commercial banks are generally cautious in financing energy-efficiency projects, financial backing from certain Governments could be justified as an initial "push" for energy-efficiency projects and financing programmes. Public backing should aim specifically to overcome identified market barriers, such as the banks' lack of familiarity with the technical issues involved in energy-efficiency projects, lack of information on the performance of energy efficiency, ignorance of the way ESCOs operate, and/or project risk profiles, high transaction costs owing to the relatively small scale of energy-efficiency projects, high costs in terms of advance payments for product development, etc. The financing instruments may include revolving funds (the borrowers pay the proceeds of the financing directly, thus replenishing their treasuries and making it possible for the funds to be linked to other efficiency projects), credit schemes and/or other loan guarantee programmes, together with a number of parallel institutions without debt, such as payments for audits and subsidies/incentives for project investments. These institutions should be established on the basis of specific criteria.
- *Tax incentives*. In many countries, an initial push is provided to improve efficiency by granting tax benefits to the consumers and suppliers of energy-efficiency projects. The use of tax incentives requires considerable coordination with the tax authorities, together with a clear understanding of market demand (to measure the effect of the tax benefits on the country's finances). It also requires a clear understanding among taxpayers of the rules governing such incentives, and adequate protection against potential abuses.
- *Reduction of import duties.* An alternative approach to tax incentives involves lowering the tariffs on energy-efficiency products paid by importers and their customers. This approach would seek to avoid the penalties associated with using more efficient equipment and create a more level playing field compared to other products. The tactic is more successful in relation to small items but generally faces challenges in the case of high-priced items.
- *Changing old equipment for new/discount options.* An effective way to encourage consumers to buy energy-efficient equipment and electrical appliances before their existing models have worn out, is to offer discounts when they purchase more efficient products and/or invite customers to replace their old less efficient products with more efficient products at lower cost. For this approach to work, an evaluation is needed of

the equipment and electrical appliances currently available on the market, together with an agreement with the vendors of such products to support energy-efficiency initiatives to encourage consumers to purchase more efficient models.

- *Establishment of energy-efficient loans in banks.* The most sustainable approach to financing energy efficiency has proven to be attracting the right department in established banks to support loans for energy-efficiency projects. In several countries, banks that have set up a small lending business have begun to include small energy-efficient firms.

D. Results of energy efficiency programmes to date

1. Strategic energy-efficiency programmes and activities

Power Outage Reduction Programme (PRA)

The Power Outage Reduction Programme (PRA) is being implemented in conjunction with organizations from poor neighbourhoods to agree on the number of hours per day that they receive energy and the payment that families must make to distributors.

Programme to replace incandescent lightbulbs

This programme to replace incandescent lightbulbs with compact fluorescent lamps was implemented in cooperation with Cuba, and involved replacement of 13 million units.

Pilot project with 23 electrical services and eight state institutions

The CNE undertook a pilot project with 23 electricity services from eight State institutions, whose power factor was improved, thus reducing their bill from 23 million pesos per month to just 17 million pesos. This involved an investment of 38 million pesos, with which the project paid for itself in 10 months, eliminating the surcharge or penalty for the low power factor on the bill, improving the quality of electrical energy and the operation of the electricity system in those institutions and the distributor.

Programmes described in the document "Energy Efficiency Strategy for the Dominican Republic, 2004"

Programmes for young energy professionals

The CNE is collaborating with relevant training programmes in universities and postgraduate studies to set up a programme for young energy professionals. The CNE and other experts in the energy-efficiency field, could then offer opportunities, such as internships, for engineering, law, and journalism students to obtain information on efficiency (technical, financial and social aspects), as part of their training. This programme can be designed as a prestige measure for young professionals entering the energy-efficiency market; while they learn they obtain credits that are recognized for their subjects.

Training/support programme for suppliers of commercial energy-efficiency services.

The CNE (or a consultancy) would identify and determine the potential for suppliers of commercial energy-efficiency services in relevant sectors of the Dominican Republic. The results of the short-term activities will dictate when the CNE should start this work (before, after or during the programme) and in which sectors. An initial market study would be needed to evaluate the opinions and capacities of managers in industry, commerce and municipal domains to understand the opportunities that the

suppliers of commercial services have to identify, develop, implement and maintain energy-efficiency projects, and also to understand the barriers faced by their development. These service providers could include energy service firms (ESCOs), energy audit/engineering companies, suppliers of energy-efficiency equipment and leasing companies.

The CNE should consider the possibility of supporting the energy-efficiency sector on the basis of the results of the market study. Possible types of support include the following: using commercial energy-efficiency companies to undertake audits or demonstration projects in the private or public sectors; providing educational materials on commercial service companies; and offering training on energy performance contracts to potential ESCOs, banks and customers.

The "lessons learned" from international experience with these business models will be essential, particularly in terms of creating a system of sustainable support and backing for those companies from the private sector. The CNE will also work with public service enterprises to identify viable business opportunities for selling (privatizing) existing energy service activities and incorporate them into an ESCO run by a public service firm. Lastly, the CNE will start to identify and evaluate potential sources of financing: Government, donors, commercial banks - for the commercial energy-efficiency sector.

Outcomes

In the programme to replace incandescent lightbulbs with compact fluorescent lamps, undertaken in cooperation with Cuba, 13 million units were purchased.

The energy saving has not been measured, but it is estimated by the CNE at some 20 MW per million 100W lightbulbs replaced with efficient 18W lamps.

The CNE estimates that if the 13 million units purchased were actually used as replacements, there would be a demand reduction (flattening of the curve peak) of approximately 200 MW.

The programme investment totalled US$25 million; in other words US$125 per kW of power reduced.

E. Lessons learned

- In the case of the lightbulbs, a measure needs to be adopted to reduce the entry of incandescent bulbs onto the market, and to sustain the programme through time, because when the lamps installed by the Government get damaged or wear out, people, particularly the most poor, will return to incandescent laps which are substantially cheaper.
- In the case of the pilot project undertaken in public institutions, funds need to be obtained to execute the programme in at least 900 government buildings that have been identified as the largest electricity consumers. A potential saving of 200 MW of electric power has been estimated with an investment of 500 billion pesos, which would give a monthly saving of 54 million pesos, implying investment payback in less than a year.
- Despite problems, no formal energy conservation programme has been undertaken by the Government since the 1980s. The recent creation of the Alternative Energy Sources and Rational Energy Use Division within the CNE, and the very difficult situation currently prevailing in the energy sector, now offer an excellent opportunity for the Government to exploit energy efficiency as a way of alleviating the current energy shortage, reduce Government debt and improve economic and environmental conditions.
- As energy demand, electricity in particular, increases, efficiency measures could fuel major changes in energy-use habits, which would reduce the frequency of outages, improve commercial competitiveness (through lower energy costs) and promote access to energy in markets that previously had no service or were underserved.

- Heavy dependence among the countries of the region on fossil fuel energy sources to meet the needs of transport and to operate electric-power generating plants, makes it essential to change the energy-use paradigm, which, aggravated by recent increases in the international oil price, has put Central American countries in a vulnerable position from the economic and energy standpoint.
- The annual growth in demand for electricity is encouraging environmental and energy authorities to seek cost-efficient opportunities, with a market approach, to help the region's economies reduce energy consumption and increase their competitiveness.

X. Ecuador

A. Recent advances in policy, regulatory and institutional frameworks

In 2007 the Ministry of Energy and Mines split into two parts: the Ministry of Mines and Petroleum and the Ministry of Electricity and Renewable Energy. The latter has since then been responsible for developing and monitoring energy efficiency projects in Ecuador.

The Ministry of Electricity and Renewable Energy was created by Executive Decree No. 475 of 23 July 2007. Article 6 of the decree provides that *"the current Undersecretariat of Electrification and Directorate of Renewable Energy and Energy Efficiency that were part of the Ministry of Energy and Mines shall now be directly under the Ministry of Electricity and Renewable Energy".*

It also stated that *"the budget allocations of the Ministry of Energy and Mines that are currently set aside for the aforementioned entities shall be transferred to the budget of the Ministry of Electricity and Renewable Energy".*

Among the ministry's objectives are:

- Returning the planning function to the State, modifying the energy matrix.
- Expanding electricity coverage.
- Strengthening and transforming State energy institutions.
- Ensuring the reliability and quality of supply, achieving self-sufficiency in 2012.
- Promoting the efficient and rational use of energy through energy efficiency initiatives in all types of consumption (industrial, residential, commercial, public).
- Promoting regional energy integration.

1. Energy efficiency regulations

Public sector institutions will implement the following energy efficiency measures: the agencies and departments of the Central Public Administration must implement energy-efficient technologies and training programmes for all employees on the rational use of energy.

This requirement was imposed by the National Government in Executive Decree No. 1681, signed by the President of the Republic, Rafael Correa, and the Minister of Electricity and Renewable Energy, Alecksey Mosquera.

The decree provides that every government institution must form an Energy Efficiency Committee to assume responsibility for implementing energy-saving measures in conjunction with the Directorate of Energy Efficiency of the Ministry of Electricity and Renewable Energy (MEER).

The Minister of Electricity stated that this provision complies with the Constitution of Ecuador, which states in Article 413, "The State shall promote energy efficiency, the development and use of environmentally clean and healthy practices and technologies …".

Furthermore, Article 414 provides that "the State shall adopt appropriate and comprehensive measures to mitigate climate change by limiting the emission of greenhouse gases …".

The Executive Decree, which entered into force on 4 May 2009 after its publication in the Official Gazette, established a deadline of 12 months for complying with all of its provisions. Accordingly, MEER will issue the technical guidelines necessary for the implementation of energy efficiency programmes.

B. Key actors in energy efficiency and their effective roles

1. Ministry of Electricity and Renewable Energy (www.meer.gov.ec)

The ministry is carrying out various energy efficiency programmes for industry, business and the government sector so that audits can be conducted, making it possible to assess energy consumption levels and identify energy-saving alternatives. Programmes such as Energy Efficiency in Public Buildings provide accurate information on preventive measures and practical consumption recommendations that can be applied to control unnecessary energy usage in public and private buildings throughout the country.

The Mass Project to Replace Six Million Incandescent Bulbs with Energy-Saving Bulbs (the "energy-saving bulbs" project) promoted by the government and the Ministry of Electricity and Renewable Energy is now a reality, as 6 million energy-saving bulbs have arrived in the country and will be distributed free of charge all over the country. The goal is to cut residential electricity consumption for lighting, which represents 24% of total spending.

With respect to their effective role, the number of personnel assigned to the energy efficiency office (seven people) appears to be adequate, but the future operational capacity of this technical unit is not clear or proven. Some of the members of the team had already been working on the Project for the Modernization of the Electricity, Telecommunications and Rural Services Sectors (PROMEC), which was carried out with Global Environment Facility (GEF) funding and with the World Bank serving as the executing agency. This project ended in late 2007, and the results are now being evaluated.

2. College of Electrical and Electronic Engineers of Pichincha (CIEEPI – www.cieepi.ec)

The Government of Ecuador relies on the cooperation of the College of Electrical and Electronic Engineers of Pichincha (CIEEPI) for technical support in developing energy efficiency efforts.

The President of the Republic of Ecuador, with the coordination of the Ministry of Electricity and Renewable Energy (MEER) and the technical support of the College of Electrical and Electronic Engineers of Pichincha, has been working to promote a programme of continuous improvement in the energy efficiency of government buildings.

MEER, CIEEPI and the Office of the President of the Republic implemented an Energy Efficiency in Public Buildings Project. The directors of the Energy Efficiency in Public Buildings Project met on 11 March 2008 with the professionals and interns who had been hired to carry out the project.

To follow up, on 14 March a meeting was held at the Ministry of Electricity and Renewable Energy, where CIEEPI directors and MEER officials explained to representatives of public buildings how the project would be carried out and the benefits it would yield for their organizations.

On 25 March, the Office of the President of the Republic officially launched the Energy Efficiency in 50 Public Buildings Programme, which seeks to put in place energy saving policies that will make for an efficient government.

The Minister of Electricity and Renewable Energy stated that the government's saving target is about 10% to 12% of current consumption. To achieve this target, Minister Alecksey Mosquera said, consumption will be reduced in public buildings and civil servants will be made more aware. For example, computers will be turned off when not in use, the use of electrical appliances will be reduced, and energy-saving lighbulbs will be installed. Moreover, public facilities will be modified to improve energy saving.

The CIEEPI professionals will provide technical advice to participating institutions, based on energy diagnostic studies that they will conduct. For its part, each institution must appoint a Management Committee to realize the potential that public officials have as promoters of energy efficiency. There was also mention of a Certificate of Excellence that will be awarded to the institutions that improve their energy efficiency indicators. The President of the CIEEPI expressed his support and pledged to develop projects further as the country's electricity industry grows and strengthens.

As for the effective role of CIEEPI in energy efficiency projects, because it is a technical entity it is assumed to be up to the task.

3. Advanced Polytechnical Academy of the Army (ESPE) (www.espe.edu.ec)

Experts at this academy have been hired to help conduct energy audits in the industrial sector and in hotels and buildings as part of the PROMEC initiative.

C. Resources and funding mechanisms for energy efficiency programmes

The projects that the Ministry of Electricity and Renewable Energy's National Directorate of Energy Efficiency is beginning to develop are funded out of the regular MEER budget.

- PROMEC was funded by World Bank Loan No. PROMEC-7082-EC and GEF Donation No. 050016-EC, approved in November 2001.
- The PROMEC funds allocated to energy efficiency were:
- PROMEC 7082-EC loan agreement: US$ 508,000; GEF Donation 050016-EC: US$ 1,226,000; private financing: US$ 4,992,000.
- TOTAL: US$ 6,726,000.

D. Results of energy efficiency programmes to date

The final reports evaluating the results of the Power and Communications Sectors Modernization and Rural Services Project (PROMEC), which ended in late 2007, are now being drafted. PROMEC carried out a series of energy efficiency measures in industrial facilities, hotels and public buildings, and in residential and public lighting systems. As indicated, the final evaluation is now under way. However, the World Bank web page on this project indicates that no evaluation documents are available.

Other actions associated with energy efficiency include: a) an Energy Efficiency Plan is in the drafting stage (no information has been provided about how far it has advanced); the Terms of Reference are being drawn up for hiring a consultant to draft an Energy Efficiency and Renewable Energy Bill; c) with respect to Standardization and Labelling, the Ecuadorian Standardization Institute (INEN) has already developed technical standards for light bulbs and refrigerators.

In March 2008, work began on the Programme for Energy Efficiency in Public Buildings, under which energy consumption indices were developed for about 30 buildings for the purpose of identifying saving opportunities.

The results of the audit indicate that it is feasible to reduce electricity costs by about 10% by taking simple steps such as using high-efficiency lightbulbs, setting equipment on energy-saving mode, and others.

The Energy-Saving Light Bulb Project has resulted in the installation of 4.142 million bulbs as of 13 May.

E. Lessons learned

The conclusions of the Power and Communications Sectors Modernization and Rural Services Project (PROMEC), listed on the World Bank web page, are the following:

The overall results of the project were moderately satisfactory, as were the performance of the Bank and the Borrower. The following lessons were learned from the project:

The project encompassed a broad range of components with six different implementing agencies. It could be argued that this breadth proved to be unmanageable, making the job of the project management unit extremely difficult.

In addition, delays were caused by the extensive need for coordination agreements. Every change in government at the national level made it necessary to rebuild relationships and persuade the new leaders of the project's benefits. On the other hand, the involvement of a large number of implementing agencies that saw the usefulness of the project activities meant that the project enjoyed continuing solid support in the government and that the communication emphasis on community participation was highly beneficial and innovative.

These benefits were manifold: a) it helped raise awareness of the project's activities; b) it built a consensus on the approaches taken in implementing the projects; c) it led to capacity-building in communities and individuals who participated in the design and implementation of initiatives; and perhaps most importantly, d) it increased the transparency and accountability of managers and of project activities vis-à-vis institutional actors.

All of these factors contributed to a broadly positive perception of the PROMEC project.

No reports are available yet on the lessons learned so far from the energy efficiency projects sponsored by the Ministry of Electricity and Renewable Energy (MEER), which are now in progress.

XI. El Salvador

A. Recent advances in policy, regulatory and institutional frameworks

On 30 August 2007, the Legislative Assembly of El Salvador issued Legislative Decree No. 404, in connection with the Law Creating the National Energy Council (CNE) that was signed by the President of the Republic on 18 September of that year. The CNE, under the direction of the head of the Economy Ministry (MINEC), "shall be the highest authority responsible for directing and regulating policy and strategy for promoting the efficient development of the energy sector".

The Council was established for the purpose of formulating strategic policies to promote the efficient development of the energy sector, guaranteeing citizens the provision of essential services for the community and promoting proper use and rational consumption of energy sources.

Therefore, the CNE will draw up the guidelines for the comprehensive development of a National Energy Policy. The goal of this effort is to develop a policy that will strengthen the energy sector as well as trade and investment, while respecting free competition and the environment. This policy must contribute to the development of Salvadorans' standard of living and promote the rational use of energy, the optimization of the infrastructure, the expansion of rural electricity coverage and regional integration.

The National Energy Policy should contain the following general elements:

a. Analysis of Energy Demand Trends and the satisfaction of demand over the long run.

b. Promotion of the development of renewable energy sources.

c. Energy efficiency programs.

d. Regional energy coordination.

e. Establishment of policies on subsidies in the energy sector.

One of the principal objectives of the CNE is *"to promote the rational use of energy and all actions necessary to develop and expand renewable energy resources, in keeping with the environmental protection policies adopted by the appropriate entity"*.

The CNE Operating Plan, presented in May 2009 in the document titled "Energy Policy in El Salvador", includes the following references to energy efficiency and renewable energy sources:

- Monitoring implementation of the Law on Tax Incentives for Renewable Energy in Electricity Generation and the associated regulations.

- Managing seed money for renewable energy and energy efficiency projects in international programmes such as the Energy and Environmental Partnership in the Central American Integration System (EEP/SICA).

1. Development of an energy efficiency programme

With respect to energy efficiency and renewable energy sources, the CNE Operating Plan (May 2009) contains the following goals:

- Monitoring the certification and qualification of projects that benefit from the Law on Tax Incentives for Renewable Energy in Generating Electricity.
- Supporting the development of proposals and the management of seed money for renewable energy and energy efficiency projects in international programmes such as the Energy and Environmental Partnership in the Central American Integration System (EEP/SICA).
- Adopting a number of energy efficiency measures (audits, efficient lighting, standard-setting, etc.), including the implementation of pilot projects, the identification of energy demand data needs, developing financial mechanisms and preparing proposals for projects that will form the basis of an energy efficiency programme.

In order to present El Salvador's Energy Efficiency Programme to the Inter-American Development Bank (IDB), the institutional arrangement calls for the the executing agency to be the Ministry of Economy (MINEC), through the Directorate of Electrical Power (DEE), in coordination with the National Energy Council (CNE).

The CNE has a Directorate of Renewable Energy and Energy Efficiency. This directorate will be reinforced through the assistance provided by IDB for the Energy Efficiency Programme.

B. Key actors in energy efficiency and their effective roles

Until the modification mentioned in Section 1, the principal institution responsible for energy efficiency in El Salvador was the Directorate of Electrical Power (DEE).

This is a special technical administrative unit under the Ministry of Economy (MINEC) that was created by Agreement No. 27 in January of 2001 for the purpose of assisting the ministry in carrying out its role as the policy-setting body for the Salvadoran electricity sector.

According to the strategic planning undertaken by the Ministry of Economy, the directorate's mission is to prepare, propose, coordinate and execute policies, programmes, projects and actions designed to ensure efficiency in the generation, transmission and distribution of electricity. Furthermore, all its activities should benefit consumers and customers by achieving an optimum quality of service and reasonable, non-discriminatory rates under conditions and operating rules based on competence and efficiency in the allocation of resources.

The DEE's vision is that it will create a propitious environment for preparing, proposing and executing energy policies, plans and programmes while coordinating government actions and enabling civil servants, investors, market agents and customers to obtain information with clear and precise objectives and rules so that the country can achieve its goal of transforming and modernizing the electricity sector as effectively and competently as possible.

The DEE has been involved in preparing technical cooperation projects related to energy efficiency. For example, supported by funding from the IBD, it conducted an energy efficiency study of municipal water pumping systems in three Salvadoran municipalities.

The preliminary preparations for the Energy Efficiency Programme in El Salvador were completed in July 2008 and the programme was officially presented to IDB for the financing of six components of the programme using Sustainable Energy and Climate Change Initiative (SECCI) funds. The components earmarked for funding are described in Annex 2.

The effective role of the DEE in pursuing energy efficiency efforts in El Salvador can be considered more than acceptable, given the scarcity of human resources devoted exclusively to this subject. However, in light of the changes made by the new President who was elected in 2009, the CNE will have a major influence on the development of clean energy (renewable sources and energy efficiency) initiatives.

1. Other institutional actors

a) The Organization of American States (OAS) and the Salvadoran foundation National Centre for Cleaner Production (CNPML) together are promoting the Energy Efficiency Technical Assistance Programme for Small and Medium Businesses, which is designed to help businesses optimize resources and save energy.

The CNPML of El Salvador and the OAS are trying to help Small and Medium Enterprises (SME) weather the impact of the increase in fuel and electricity prices. With this vision, the CNPML, which was created in 1998, is disseminating information, evaluating plants and providing training for businesses. Records indicate that there are 15,000 SMEs in the country.

Another focus of the CNPML programme is environmental reconversion, which prompted it to apply for financing from the Special Multilateral Fund of the OAS Inter-American Council for Integral Development.

Several Salvadoran businesses have been implementing the programme for several years, among them Agro Industria Lácteos San José. It has managed to cut its energy consumption by about 10% under the programme. The president of the CNPML, Yolanda Salazar, believes that this is a great opportunity for SMEs because they can save between 10% and 20% on their energy bills in some cases. The use of water and recyclable materials helps companies achieve savings under another intiative supported by the Government of El Salvador.

b) MINEC's Production Development Fund (FONDEPRO) facilitates and finances technical assistance. It is a tool created to strengthen the competitiveness, quality, innovation and technology of Micro, Small and Medium Enterprises (MSME) in globalized markets.

This MINEC initiative emerged as part of the effort to take advantage of the trade agreements El Salvador has signed (CAFTA and those with Chile, the Dominican Republic and Mexico) and is about to sign (with Taiwan and Colombia).

FONDEPRO is part of the country's industrial policy, and as such is responsible for cofinancing (through direct subsidies) activities that have a positive impact on the economy, as well as easing the terms of financing (through special lines of credit with the Multisectoral Investment Bank, BMI) for companies that want to boost their competitiveness.

The non-reimbursable cofinancing provided by the fund supports five kinds of activities: market development, quality and productivity, associativity, innovation and technology, efficient production and tourism.

In innovation and technology, the objective is to incorporate new technologies into companies' production processes, either through innovation, by transferring technology or by strengthening research institutions and technological service providers. In the area of efficient production, consultancy fees are covered so that companies receiving environmental reconversion loans can plan investments in more efficient procedures.

In terms of financing, FONDEPRO offers special lines of credit and guarantee programmes to support:

- The expansion and improvement of production capacity: Working capital, machinery and equipment purchases, buildings and facilities, expansion of production processes, control systems and technical studies.
- Environmental reconversion: Investment in cleaner production, modernization and relocation of businesses, compliance with regulations, technical studies, mitigation measures.
- Marketing and sales: Bulking and marketing of raw materials and finished goods, commercial infrastructure (sales outlets), distribution teams, transportation, marketing systems, etc.
- New businesses and entrepreneurship: Startup of new production (seasonal and permanent working capital, provision of machinery and equipment, facilities, buildings).
- The Multisectoral Investment Bank (BMI), to facilitate financing of energy efficiency measures and associated investments.
- The National Science and Technology Council (CONACYT), which sets standards for efficient facilities. It is a non-profit public corporation that is autonomous and decentralized, the country's highest authority in the area of science and technology policy.
- CONACYT is authorized by law to direct and coordinate activities and the implementation of policy on standardization, weights and measures, and verification and certification of quality.[9]
- In the private sector, the Salvadoran Association of Manufacturers (ASI) supports energy efficiency efforts as a service to its members.

C. Resources and funding mechanisms for energy efficiency programmes

Energy efficiency initiatives, activities, projects and programmes in El Salvador are funded out of the regular budget of the MINEC Energy Directorate and receive occasional contributions from international sources.

Among the latter, the Inter-American Development Bank announced in November 2008 the approval of a donation to El Salvador from the Sustainable Energy and Climate Change Initiative (SECCI) Fund in the amount of US$ 666,000 for consulting services and the purchase of goods for energy efficiency pilot projects.

The goal is to design, evaluate and implement a number of energy efficiency measures, including pilot projects, the identification of the necessary information and the preparation of investment plans for adopting efficiency measures. The executing agency will be the Economy Ministry, through its Directorate of Electrical Power, in coordination with the National Energy Council.

[9] See CONACYT Presentation – February 2009, "Application of Technical Standards in Energy Efficiency and Its Effect on Consumers", in the electronic annex for El Salvador.

D. Results of energy efficiency programmes to date

Only in the last few years has a systematic effort been seen in El Salvador to undertake energy efficiency actions, projects and programmes. However, there are precedents in isolated initiatives, some of them very easy to replicate, such as the studies of municipal water pumping systems.

Study to improve energy efficiency in municipal water pumping Systems in El Salvador

The final report on this study enumerates the activities carried out by the Economy Ministry, the Energy Efficiency Committee of the National Water Administration (ANDA), the international consultant and the local consultant, in accordance with the working plan that was drawn up for the study.

The study took place in facilities located in three regions that had been selected for analysis: the Northern Zone System, the Cojutepeque System and the Guluchapa System.

Site visits were made to each of these systems and the parameters of the water system were measured. These measurements helped analysts understand how each system functioned and gave them a frame of reference for devising a plan to improve energy efficiency.

TABLE 12
ENERGY SAVING OPPORTUNITIES IN THE WATER PUMPING SYSTEM OF EL SALVADOR

Saving opportunity area	Situation observed	Actions to study	Potential saving
Efficiency of pumps	A large number of pumps operate at low efficiency levels, particularly at medium and low capacities.	Replacement of existing equipment with more efficient pumps.	12 to 18%
Motor efficiency	A large number of medium- and low-capacity electric motors operate at low efficiency levels.	Replacement of motors with more efficient ones.	1.5 to 3%
Losses in the conduction system	Load losses in exhaust manifolds at booster stations	Improve layout of pipes in these manifolds	0.1 to 0.3%
	Load losses in high-speed conduction lines	Incorporation of new conduction lines	1 to 3%
Hydraulic operation of the system	Much of the system was built many years ago, and it has expanded in a disorderly fashion over the years.	Evaluate some hydraulic operation indicators and look into the feasibility of building a simulation model to study improvement options.	8 to 10%
Water leakage	The age of the system and the chaotic nature of its expansion are factors that usually result in a high rate of leakage.	Evaluate some efficiency indicators and, where applicable, sketch out a proposed campaign to detect and eliminate leaks.	10 to 15%

Source: Study to improve energy efficiency in municipal water pumping systems in El Salvador.

In addition, electrical measurements were taken in all the aforementioned systems and the invoices sent out by distributors were analysed in order to study power and energy consumption patterns and the power factor of each plant over a three-month period.

After compiling the data, the pump and motor systems that make up the pumping systems involved in the study were analysed to identify where ANDA could potentially achieve saving.

The measurements were taken with support from ANDA electromechanical crews and technical staff.

Identification of energy saving opportunities

The accompanying table shows the energy saving opportunities that were identified, leading to specific final recommendations.

In sum, the water pumping systems analysed could save between 30% and 40% of current energy consumption. The subsequent activities of the project will be aimed at developing a portfolio of projects that can achieve these savings.

E. Lessons learned

The following lessons can be learned from the development of energy efficiency initiatives in El Salvador:

a. The need to strengthen the relevant public and private agencies institutionally so that they will be better able to direct energy saving programmes and projects at all socio-economic levels in El Salvador.

b. The need to improve access to financing for investment in energy efficiency projects and programmes.

c. The need to expand efforts to disseminate information on measures and recommendations for the rational and efficient use of energy in households, public services, transportation and industry.

d. The need to boost training and educational activities for energy users in all sectors.

e. The advisability of gradually reducing dependence on foreign cooperation (donors, NGOs, multilateral institutions, etc.) and shoring up local entities that are capable of designing, financing and implementing energy efficiency projects in the country.

f. The advisability of integrating actions and exchanging experiences with other countries in the region. For this purpose, the proper functioning of the Energy Coordination Unit of the Central American Integration System (UCE-SICA)[10] is of great importance.

[10] Central American Integration System.

XII. Grenada

A. Recent advances in policy, regulatory and institutional frameworks

1. The energy context

In 2007, 92% of the energy needs of the transportation, industrial, residential and commercial sectors was supplied by imported oil. Biomass from bagasse, wood and other plant residues represented 8% of the gross energy supply.

In light of this economic, as well as environmental, vulnerability, Grenada has encouraged the capitalization of its natural resources through the use of renewable energy sources such as wind and solar energy.

In the area of biomass-based energy production, the annual bagasse production in 2007 was the equivalent of 3,800 barrels of oil. In addition, residues from nutmeg processing have become a potential energy source, and could be used as fuel in steam turbine plants in the next decade.

Grenada is currently participating in various regional integration efforts, such as PETROCARIBE and CARICOM, in an attempt to strengthen its energy sector.

Nearly 100% of the country's electricity is produced by the private firm GRENLEC, using imported fuel. In 2008, GRENLAC sold 195.9 GWh, with peak demand of 39.4 MW. Projections call for annual growth of 4% in the latter figure. Solar energy in 2008 was responsible for 184,161 kWh.

All vehicles on the road in Grenada, Carriacou and Petite Martinique use diesel or imported gasoline. Neither hybrid nor natural gas vehicles are yet in evidence.

Geothermal feasibility studies have demonstrated the presence of a small solfatara on Mount St. Catherine, with a number of small offshoots in the radial cracks at the centre of the volcano.

The government, along with other stakeholders from across the society, has developed a sustainable energy plan, with the following objectives:

- To maximize energy efficiency and the use of renewable and alternative energy.
- To promote conservation and efficient energy use at all levels of the economy, in order to achieve optimal use of renewable and non-renewable energy sources.

2. The institutional context

The Ministry of Agriculture, Lands, Forestry, Fisheries, Public Utilities and Energy is responsible for renewable energy issues.

The domestic electricity firm GRENLAC provides energy to nearly 90% of the population on the island, as well as servicing Carriacou and Petite Martinique. The company is owned by the Government of Grenada, the firm WRB and company employees and small shareholders.

The Marketing and National Importing Board (MNIB) oversees the energy sector and related policymaking.

The government has placed priority on developing and implementing an energy policy that will contribute to the country's sustainable development. With this objective, an inter-ministerial Energy Committee is to be formed to work jointly with the Division of Sustainable Development on designing and implementing energy conservation plans.

3. The legal context

Although energy efficiency is not the subject of any specific laws in Grenada, it is one of the four principal objectives of the country's Sustainable Energy Policy.

B. Key actors in energy efficiency and their effective roles

The Ministry of Agriculture, Lands, Forestry, Fisheries, Public Utilities and Energy, through GRENLEC, the national electric utility.

This agency has a very limited role in promoting and developing energy efficiency.

C. Resources and funding mechanisms for energy efficiency programmes

The programme to replace incandescent lighting with compact fluorescent lighting was funded with resources from the Petrocaribe programme. These funds were used to pay for technical assistance from Cuba, and to acquire energy-saving lighting.

D. Results of energy efficiency programmes to date

1. Programme to replace incandescent lighting

In 2007, as a part of Cuba's international management scheme, which operates in a number of Caribbean countries (with all members of PETROCARIBE being beneficiaries), 133,253 incandescent bulbs were replaced with energy-saving bulbs.

The results are reflected in the following indicators:

- Incandescent bulbs replaced: 133,253.
- Reduced power per bulb replaced: 38.3 watts.
- Housing units visited: 23,205.
- Per-household energy reduction: 33 kWh/month.

- Reduction in country's maximum demand: 1,891kW (in terms of energy: 10,152 MWh/year).
- The economic benefits obtained from saved generating capacity are on the order of US$ 2,269,669, with the fuel savings totalling 23,440 tons of imported fuel annually, worth US$ 1,182,691, for total annual savings of US$ 3,452,369 (in 2007 dollars).
- In terms of environmental benefits, the replacement reduces CO2 emissions on the order of 6,690 tons/year, valued at some US$ 28,100.
- The country has also developed energy strategies to safeguard its energy security and independence, as well as the environment, through green energy.

2. Energy efficiency programme

With regard to energy efficiency, the Government of Grenada proposes:

- To create an Energy Efficiency Unit within the Energy Division of the Ministry of Agriculture, Lands, Forestry, Fisheries, Public Utilities and Energy.
- To develop and execute a programme for energy efficiency in the public sector.
- To create energy efficiency standards for mechanical ventilation, air conditioning, lighting, and water heating equipment/systems in institutions, businesses and industry. The standards are to apply to building design, as well as interior equipment. Separate standards will apply to residential buildings.
- To implement mandates to regulate vehicle controls, in order to ensure a given level of efficiency.
- To implement labelling for equipment indicating energy efficiency levels.
- To enforce conditions on the efficiency of certain imported vehicles.
- To make energy audits mandatory for large public- and private-sector consumers.
- To recommend economic incentives and penalties for specific sectors: tourism, industry and agriculture.
- To provide tax and economic incentives for efficient energy use.

Although enforcement of these activities will, in itself, produce environmental benefits, Grenada also proposes:

- To promote public transportation as the population's first choice (revise National Transportation Plan).
- To develop a building construction code that includes energy efficiency standards.
- To promote water conservation.
- To promote the use of science and technology as a means of reducing the energy required for different activities.

E. Lessons learned

The savings from replacing incandescent bulbs with energy-efficient bulbs, although promising, require ongoing monitoring by authorities, in order to ensure that the energy-saving bulbs are replaced by similar ones when they reach the end of their useful life. Moreover, measures must be implemented to permit entry into the country of relatively low-cost energy-saving devices, so as to avoid competition between energy-efficient lighting and incandescent lighting.

XIII. Guatemala

A. Recent advances in policy, regulatory and institutional frameworks

1. Economic context

This country has the largest economy in Central America, with a GDP of US$ 34 billion (representing 39.6% of the regional GDP) and a growth rate of 4.6% in 2006. The services sector has grown the fastest, and tourism stands out as a promising economic activity.

2. Energy context

Guatemala is an oil producer. In 2007, net production was 5.58 million barrels, of which 86% was exported and 14% allocated for domestic consumption. However, Guatemala is also a net importer of energy, since its production provides for less than one fifth of internal fossil fuel consumption. Furthermore, oil production is declining in the country. The main consumer products were: Diesel (32.1%); Supreme, Regular and Aviation Gasoline (26.6%); Bunker or Fuel Oil (21.3%); LPG (10.1%); Petroleum Coke (4.0%); Kerosene (2.5%); National Crude (1.9%) and Asphalt (1.5%).

Electricity generation has grown increasingly and significantly dependent on fossil fuels.

- Installed capacity for generating electricity in 2007 was 2,140 MW, and the main sources were, in order of importance: hydroelectric (36%), ICE[11] (31%), sugar refineries (14%), steam plants (9%), gas turbines (7%) and geothermal (2%).
- With this installed capacity, the National Electricity System (SEN) reported 8,756 GWh in National Net Generation for 2007. The Interconnected National System (SIN) was the main supplier, with 93%, followed by self-generators (5.7%) and isolated systems (the remaining 1.3%).
- Electricity imports amounted to 8 GWh, bringing the Gross Domestic Supply to 8,764 GWh.
- However, losses amounted to 13.6%, exports accounted for 1.5% and internal consumption was 2.9%, which reduced the Gross Domestic Supply to 7,179.02 GWh.

[11] ICE: Internal Combustion Engine.

- Of the available 7,179 GWh, among end-users the industrial sector was the largest consumer, with 40.7%, followed by households (32.5%) and businesses and services (26.8%).
- According to the Generation Expansion Guidance Plan for 2008-2022, which was prepared by the National Electrical Power Commission (CNEE), there will be about a 94% growth in the demand over the next ten years, bringing consumption to about 14,000 GWh.

Legislation: ideas under study

Legislation to remove incandescent light bulbs from the market.

Legislation has been proposed to prohibit the sale of incandescent bulbs in Guatemala.

Legislation for daylight savings time.

In 2006, clocks were advanced by one hour between 29 April and 30 September. However, in 2007 daylight savings time was suspended because traffic congestion at the southern entrance to the capital city required commuters in outlying cities to get up too early in order to avoid traffic jams. This year the matter was taken up again, and the plan was to implement the measure between 27 April and 27 September. It was rejected, however, due to questions of safety on the streets; according to the new security cabinet, statistics show that most crimes take place early in the morning.

Legislation to establish a fund to finance energy-saving measures

Along with the bill to prohibit the sale of incandescent bulbs in Guatemala, legislation is being proposed to set up a trust to finance electricity-saving measures.

B. Key actors in energy efficiency and their effective roles

1. Institutional context

Guatemala has a ***Ministry of Energy and Mines*** (MEM) that is responsible for overseeing the energy and mining sectors. In the area of electricity, it is supported by the ***National Electrical Power Commission*** (CNEE), created by Decree 93-96 as a technical body of the MEM with autonomy in exercising its powers.

Other areas are governed by the ***Ministries of the Environment*** (MARN) and ***the Economy,*** the ***Guatemalan Standards Commission*** (COGUANOR), which deals with technical standards designed to improve the competitiveness of Guatemalan businesses and boost the quality of products and services, and the ***National Science and Technology System*** (SINCYT), which promotes the development of science and technology and carries out actions that are to some extent related to those that promote energy saving.

Energy policy actions

The Ministry of Energy and Mines (MEM) has prepared a document titled Energy and Mining Policy 2008-2015 that is intended to provide a general working plan to guide the operations of the energy sector over the short and medium terms and lay the groundwork for appropriate improvements in those operations.

The overall objective is “to contribute to sustainable energy development in the country, ensuring an ongoing and timely supply of quality energy at competitive prices”.

Among the goals defined in the document is that of meeting the need for more energy efficiency by means of the following actions:

- Reach a consensus with the municipalities on eliminating obstacles to the smooth flow of vehicular traffic.

- Promote a permanent and sustainable programme for encouraging the incorporation of efficient lighting.
- Build strategies for reducing losses in the transmission and distribution of electricity.
- Promote the use of alternative fuels such as organic and other types of waste and biodegradable materials.

Responsibility for actions to promote saving and efficient use of energy in Guatemala

There are no agencies or units that have direct responsibility for energy saving or functions oriented in that direction in Guatemala. To fill this gap, a National Energy Efficiency Council (CONEE) has been proposed, with technical assistance from OLADE and financial support from the Canadian International Development Agency (CIDA). The council would be structured as follows:

- **Presidency:** The Minister of Energy and Mines would preside over the CONEE, in permanent consultation with the Director General of Energy and a legal professional.
- **Board of Directors:** The CONEE Board of Directors would be chaired by the Ministry of Energy and Mines, and would include all the public and private organizations listed in the CONEE Governing Agreement. The base of the CONEE would be made up of representatives of the following public and private organizations:
  - The Minister of Energy and Mines (MEM) would serve as president.
  - The Minister of Economy.
  - The Minister of Environment and Natural Resources (MARN).
  - The Minister of Education.
  - The Chairman of the National Electrical Power Commission (CNEE).
  - The Secretary General for Planning (SEGEPLAN).
  - The President of the National Electrification Institute (INDE).
  - The Chairman of the National Science and Technology Council.
  - The Presidents of the three Chambers of Business (Industry, Commerce and Services).
  - A representative of the institutions of higher learning.
  - A representative of civil society: the President of the National Association of Municipalities.
  - A representative of electricity utilities.

The CONEE would have the following executive functions:

- Prospecting. Identification and technical-economic quantification of opportunities and potentials for efficient use and saving of energy.
- Economic incentives and financing. Determination of direct subsidies, tax deductions and/or low-interest financing, and promotion of energy saving performance contracts.
- Standardization and certification of products and systems. Identification of the limitations of certain characteristics of materials, equipment and/or systems that have a direct or indirect effect on energy consumption. Certification for materials, equipment and/or systems associated directly or indirectly with energy consumption.
- Obligations to the public sector. Establishment of energy consumption management systems in facilities and maximization of all opportunities to show profitability, from equipment replacement to complete remodelling of facilities.
- Voluntary private sector commitments. Initiatives by public enterprises to reduce energy consumption by a given amount or percentage over a given period of time. This type of action would be supported by economic incentives, training and information.

- Education and information. Incorporation of activities to educate and inform those who make (or who contribute to) decisions on energy consumption in households, facilities and/or businesses.
- Technological innovation. For practices that make significant improvements in energy efficiency and/or those related to design, production, construction and/or operation of equipment and facilities.
- Coordination of actors. Organization of meetings intended to encourage various individuals and/or institutions that represent the different stakeholders in energy efficiency, regulation, certification and voluntary or mandatory programmes in the private sector to exchange information and views; and introduction of a general culture of energy efficiency.

C. Resources and funding mechanisms for energy efficiency programmes

Official initiatives concerning the development of energy efficiency projects and programmes in Guatemala have been supported economically and financially by the government budget (MEM, MARN and others) and by contributions from international organizations.

An initiative is now under way for the **"design and implementation of a trust to support financing of energy-saving measures".** Under this initiative, mechanisms will be explored to set up a trust either as an operator under the terms of pending legislation (see 1) or as the designer of a proposal through a means other than legislation.

D. Results of energy efficiency programmes to date

1. Current, prospective and future energy efficiency programmes

According to the Energy and Mining Policy 2008-2015, work has been under way on actions aimed primarily at raising awareness and informing the population on the importance of energy saving and efficient use of energy:

- **Campaign for saving and efficient use of energy and fuels:** In 2004 the MEM launched the energy saving information campaign across the country. It included training, press releases, radio and television spots, bumper stickers, flyers and special supplements containing practical tips. The effort was carried out jointly with power utilities and the Secretariat of Social Communication of the Office of the President of the Republic.
- **Plan Centinela:** Under Plan Centinela [sentry], the fuel marketing chain is strictly and constantly monitored to ensure that quality and quantity remain at appropriate levels and that Guatemalans receive services in the context of a free market with fair competition and respect for current laws.
- **Replacement of incandescent bulbs with energy-saving bulbs:** Under the auspices of the Energy Saving Programme, the MEM and the INDE carried out a pilot project in the Municipality of Estor, Department of Izabal, to replace 75W incandescent bulbs with 15W energy-saving bulbs in 660 residences. The project consisted of the distribution of 2,640 light bulbs that would yield a saving of up to 80% compared to the energy consumed by incandescent bulbs.
- **Curriculum on the use of natural resources and saving and efficient use of energy and fuels in Guatemala:** The Ministry of Energy and Mines and the Ministry of Education collaborated on the development of a curriculum for the country's primary

school teachers to use in creating a culture of saving and efficient use of energy and fuels, and to promote the sustainable use of mining and petroleum resources by future generations. This campaign covered nine departments in the Republic.

- **Daylight savings:** In order to reduce the demand for energy and promote saving and efficient use of energy resources in society as a whole, the Government of the Republic implemented daylight savings time for the purpose of taking full advantage of sunlight, shifting energy consumption and keeping power bills down. This action began as of 00:00 a.m. on 30 April 2006, when clocks throughout the entire national territory were advanced by 60 minutes in order to make maximum use of natural light and manage peak demand in the system. This measure was in place until midnight on 30 September 2006.

The action was taken because electricity generation based on the burning of fuel is more expensive than that produced by hydraulic energy. Therefore, during times of highest demand, known as peak hours, between 6:00 p.m. and 10:00 p.m., thermoelectric plants are the last ones the Interconnected National System will draw upon. By delaying the operation of thermal plants, not only is there a reduction in the consumption of fossil fuels for generating electricity and the resultant environmental pollution, but less foreign currency has to be purchased for that purpose.

A study of the load curve and the consumption curve of the National Interconnected System between May and September revealed that daylight savings time helped bring down peak demand by an average of 41.35 MW. Moreover, peak demand began an hour later but subsided at the usual time. In addition, electricity consumption for the May-September period fell by 28.8 GWh.

The programmes described below were all carried out in Guatemala:

- **Studies of potential savings:** IDB has conducted studies to determine potential electricity savings that can be derived from lighting systems. According to the study carried out in 2007, replacing incandescent bulbs with compact fluorescent ones could yield a saving of approximately 14% in energy consumption for household lighting.
- **Energy saving and efficiency plan in the electricity sector:** The programme is in the design stage, and it is intended to significantly reduce electricity consumption and thereby reduce fossil fuel consumption and GHG emissions. It calls for replacing more than 9 million incandescent bulbs with compact fluorescent lamps (CFL) in the residential sector, taking into account that there are 2,028,000 residential consumers at the national level. The programme will take the form of home visits to substitute energy-saving bulbs of equal lighting power for the incandescent bulbs currently in use in every household.

In the nation's public lighting system, 300,000 mercury-vapour lamps will be replaced by sodium-vapour lamps in order to reduce electricity consumption and lower municipal public lighting bills.

- **ESCOs in public lighting:** According to interviews conducted in Guatemala, consideration is being given to the idea of realizing this potential through the Energy Service Company (ESCO) scheme. These are companies that provide know-how and financing for the development of energy efficiency projects with economic benefits, at no cost to the user.
- **Publicity campaigns:** The MEM plans to carry out a national energy saving campaign through stickers and banners bearing the slogan "Apaga un foco/ahorra un poco" [cut the light/cut the cost] to promote energy efficiency in public buildings.

At the same time, "Energy Efficiency Day" will be promoted. This activity was held for the first time on 28 May 2008, when the National Electrical Power Commission issued press releases to encourage everyone to turn off the lights for 30 minutes between 8:00 p.m. and 8:30 p.m.

- **Legislation to remove incandescent light bulbs from the market:** Legislation has been proposed to prohibit the sale of incandescent bulbs in Guatemala.
- **Legislation for daylight savings time:** In 2006, clocks were advanced by one hour between 29 April and 30 September. However, in 2007 daylight savings time was

suspended because traffic congestion at the southern entrance to the capital city required commuters in outlying cities to get up too early in order to avoid traffic jams. This year the matter was taken up again, and the plan was to implement the measure between 27 April and 27 September. It was rejected, however, due to questions of safety on the streets; the new security cabinet says statistics show that most crimes take place early in the morning.

- **Legislation to establish a fund to finance energy-saving measures:** Along with the bill to prohibit the sale of incandescent bulbs in Guatemala, legislation is being proposed to set up a trust to finance electricity-saving measures.

In addition to these activities – which can be improved and/or strengthened – in the future it is suggested that the following programmes be considered:

- **Establishment of a package of technical standards for energy efficiency, in support of COGUANOR**: Based on the reasoning that COGUANOR is responsible for developing standards but it is up to the MEM (and, in this case, the Unit) to promote energy efficiency, it is felt that the Unit should put together a package of technical standards for COGUANOR to develop, but with administrative support from the Unit.
- **Design and implementation of a trust to support financing of energy-saving measures:** Under this initiative, mechanisms will be explored to set up a trust either as an operator under the terms of legislation or as the designer of a proposal through a means other than legislation.
- **Programmes to train vehicle operators and administrators of vehicle fleets:** Following up on activities that have been carried out successfully with the National Energy Saving Commission (CONAE) of Mexico, a similar programme is planned for permanent implementation for the purpose of training operators of vehicles and fleets in Guatemala.
- **Formation of thematic working groups to analyse technologies associated with transportation or with the use of fuels and electricity:** Given the wide variety of technologies associated with energy saving and efficient energy use in the market, and the rapid pace at which they are developing, it would be useful to establish analysis groups that would facilitate the application and promotion of these technologies in Guatemala.

2. Expected results

According to a report from the Inter-American Development Bank (IDB):[12]

- If Guatemala improved its energy efficiency by 10% over the next 10 years, it would save the equivalent of 1,100 GWh of electricity per year by 2018. Compared with electricity consumption in 2007, the saving would be 15.32%.
- The cost of achieving that level of efficiency (based on investments in efficient lamps and motors, among other measures) would be approximately US$ 123 million during that same period (in 2008 dollars). Guatemala's energy bill was US$ 2.7 billion in 2007, which means the investment in energy efficiency would amount to 4.56%.
- However, if energy demand continues to rise at the anticipated rate of 3.5% annually in Guatemala, and if the country does not improve its energy efficiency, it will need to install the equivalent of two open-cycle gas turbines (250 MW each) to generate the same 1,100 GWh of electricity.

[12] IBD, 2008. How to save US$ 36 billion on electricity (without turning out the lights). A map of energy productivity in the Americas.

- Based on current prices, the installation of these plants alone would cost approximately US$ 390 million, without counting operating and fuel costs.
- In turn, it is estimated that carrying out a national energy saving programme could cut Guatemala's energy bill by nearly US$ 270 million, at 2007 average prices.
- According to the logic of the Guatemalan proposal, this reduction would improve the national economy's competitive edge, and would also mitigate the environmental impact of burning fossil fuels.

E. Lessons learned

- The first step in consolidating initiatives aimed at applying energy-saving measures is to establish an entity within the structure of public institutions that will make all the initiatives feasible, from planning, defining actors and determining sources of financing and resources, to following up, quantifying, publicizing accomplishments and providing appropriate feedback so that the accomplishments can be solidified and current and future actions can be institutionalized. Guatemala is now in the process of forming its National Energy Efficiency Council.
- Some energy-saving measures necessarily imply follow-up actions that are sustainable over time. Thus, awareness campaigns, education programmes and the participation of several different actors must be maintained until a culture can be created and energy users' habits can be changed radically. In addition, the achievable outcomes will become measurable over the medium and long terms.
- Political decisions such as the replacement of incandescent bulbs with energy-saving bulbs in the residential sector yield obvious short-term results without major inconveniences. They are even less costly than publicity campaigns. However, these initiatives require follow-up in order to be sustained over the long term.
- Substituting energy-saving bulbs for incandescent bulbs has comparative advantages, particularly in cities where lighting accounts for a major share of maximum demand, since not only is there energy saving but peak demand on the power grid is also reduced.
- Carrying out energy efficiency measures at the national level requires a comprehensive analysis that includes other institutions. At first sight, these institutions, such as those responsible for vehicular traffic and public safety, may not appear to play a major role in energy policy.
- Like any public or private initiative, energy-saving measures require the allocation of sufficient economic resources.
- Saving energy is profitable for the State, especially in countries like Guatemala that must import fuel to meet domestic demand.

XIV. Guyana

A. Recent advances in policy, regulatory and institutional frameworks

While there are no regulations, standards or laws to promote energy efficiency in Guyana, certain actions implicitly promote more efficient energy use. These include:

- Replacement of incandescent bulbs with energy-efficient bulbs.
- Disconnecting electrical and electronic equipment when not in use.
- Issuing a brochure with tips on saving energy in household electrical appliances, building designs, private vehicle use and lighting.

Energy policy (including energy efficiency policy) is defined and determined by Guyana's Energy Agency. The guidelines set forth in the 1994 document "Energy Policy in Guyana", which can be viewed on the Agency's website, are still in force. Currently, a study on investment strategy and policy for Guyana's electricity sector is being prepared.

The Agency has a Division of Energy and Energy Statistics, whose activities include managing the agreement with Petrocaribe, analysing oil imports on an ongoing basis, overseeing the database and managing the energy sector's economic activities. The Division serves as the link with the National Energy Information System (Sistema de Información Energética Nacional, or SIEN) of OLADE, and with the Caribbean Energy Information System (Sistema de Información Energética del Caribe, or CIES), and it participates in projects executed by both.

The Division's functions and responsibilities include:

- Managing the agreement between Guyana and Venezuela (Petrocaribe).
- Overseeing the agreement between Guyana and Trinidad Oil, as well as all other types of agreements.
- Monitoring the importation of oil products under these agreements, as well as of other imports not covered by the provisions of these agreements.
- Providing information to the Ministry of Finance on the Guyana-Venezuela agreement (Petrocaribe).
- Communicating with Petróleos de Venezuela supervisors in Guyana regarding the arrival of products, pursuant to the Petrocaribe agreement.

- Collecting, compiling and storing all energy-related information, including information on:
  - Wholesale prices.
  - Retail prices.
  - Monthly FOB/CIF price reports.
  - Price integration reports.
  - Oil company stocks.
  - Estimated and real values and volumes under the Petrocaribe agreement.
  - Other mandated energy reports.
  - Preparing and analysing information on energy supply and demand in Guyana.
  - Communicating with SIEN and CIES on energy issues and on participation in projects executed by those two organizations.
  - Facilitating payment for oil imports.
  - Researching energy technologies at the local and international levels.
  - Developing a database of renewable energy technologies and disseminating information, as appropriate.
  - Developing energy conservation programmes.
  - Conducting relevant studies on renewable energy in order to compile information and recommend the most appropriate project designs.
  - Monitoring activities related to energy efficiency and energy optimization in government agencies and private sector entities.
  - Joining actively with other agencies to promote renewable energy sources, such as clean technologies, capable of contributing to a reduction in greenhouse gas emissions.
  - Collaborating with other agencies to reduce the effects of climate change and provide assistance in developing mitigation and adaptation plans.
  - Developing renewable energy projects and generating reports to attract investment and funding.

Energy efficiency initiatives receive government support. Information on activities with energy-saving potential is published through four agencies: the Guyana Energy Agency (GEA), Guyana Power & Light (GPL), the Office of the Prime Minister (OPM) and the Environmental Protection Agency (EPA).

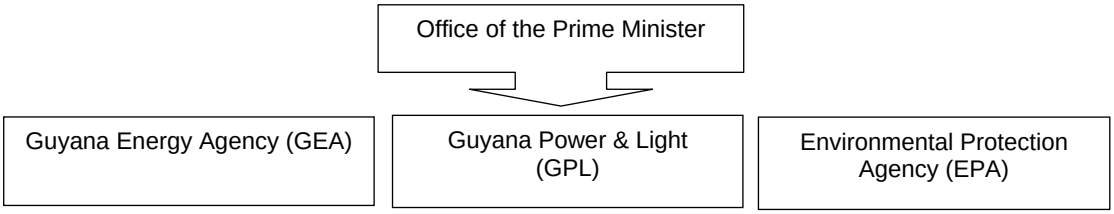
There is a bagasse-based cogeneration project for producing approximately 20 MW.

According to the GEA, the design of an energy efficiency programme should take into account the country's socioeconomic characteristics and conditions. Generally, economic resources are not available to subsidize the purchase of energy-efficient equipment. Thus, it is a challenge to ensure access to such equipment.

Public awareness campaigns have been conducted to highlight the importance of rational energy use and to provide information on ways to accomplish this. The campaigns have employed newspaper, radio and TV ads, as well as press conferences and pamphlets.

Energy efficiency activities within the GEA come under the institutional scheme outlined in the figure below.

FIGURE 19
INSTITUTIONAL SCHEME WITH RESPECT TO GUYANA'S ENERGY



Source: Guyana Energy Agency (GEA).

B. Key actors in energy efficiency and their effective roles

Government agencies: Guyana Energy Agency (GEA). Programmes to disseminate information and promote public awareness on energy efficiency.

Regulatory entities: Environmental Protection Agency (EPA). This agency has no direct relation to energy efficiency; its only link with this issue is with regard to emissions reductions generated by energy savings projects.

Firms: Guyana Power and Light Inc., the electric utility, has programmes to promote awareness of efficient and rational use of electricity.

C. Resources and funding mechanisms for energy efficiency programmes

Energy efficiency efforts receive financial support from the government and from the Inter-American Development Bank—the latter for rural electrification projects.

The GEA estimates that developing an energy efficiency programme of national scope would require approximately US$ 100,000.

Three institutions are currently managing funds: the Office of the Prime Minister (OPM), Guyana Power & Light Inc. (GPL) and the Guyana Energy Agency (GEA).

The programmes are monitored by the Office of the Prime Minister through its Ministry of Finance, which controls disbursements.

D. Results of energy efficiency programmes to date

Reduction of demand, as a result of replacing incandescent bulbs with compact fluorescent bulbs. [Editor's note: quantification of demand reduction not given.]

E. Lessons learned

Positive:

- Good results from the light bulb replacement effort mentioned in section 4, above ("Results...").
- Disseminating information provides an opportunity to commit the society to energy efficiency initiatives.
- An improvement in user awareness has provided users better options for the purchase of household electrical appliances.

Negative:

- Disseminating information on how to improve efficiency in the society is expensive.
- The society lacks sufficient resources to make the change to more energy-efficient equipment in households and with respect to private vehicles, although there is recognition of the long-term benefits of such changes.
- There are no incentives for energy efficiency projects.

XV. Haiti

A. Recent advances in policy, regulatory and institutional frameworks

1. Energy context

In 2007 total energy production in the country was 51,430 BOE, and daily consumption amounted to about 12,400 barrels of oil. The largest end-user of energy is industry, followed by agriculture and transport. The share of the latter is 14%.

The primary sources of fuel for end-users are coal and wood, at 75%, followed by fossil fuels (15%) and electricity (4%). By sector, industry uses 19%, transport 12%, residences 65% and commerce 4%. The residential sector consumes 80% of the coal and wood for cooking on extremely inefficient open stoves.

In Port-au-Prince, the nation's capital, 90% of households use coal.

Haiti does not produce any petroleum or have any refining capacity. Therefore, all of its fossil fuel needs are met with imports.

Between 15% and 25% of this energy is used for generating electricity. LPG is also used in the residential sector, but it accounts for less than 2% of total final energy consumption.

Haiti is conducting research on its coal and petroleum supplies for domestic purposes under the aegis of the Energy Bureau.

In the past decade, the Peligre Hydroelectric Plant (CHP) has contributed nearly half the energy distributed by the State power company Haiti Electricity (EDH). To meet the rest of the nation's demand, EDH relies on thermoelectric generators fuelled by diesel.

The dam where the CHP is located also regulates the level of water in the Artibonite Valley, Haiti's main farming region. The plant, which has been operating since 1971, has three turbines with a total generating capacity of 54 MW.

However, sedimentation and the deterioration of electromechanical equipment have reduced the volume of water in the reservoir, and at present the CHP is producing only half the energy it could generate under optimum conditions.

There are other, smaller hydroelectric plants, such as Guayamouc (2 MW). The main sources of thermoelectric power are Varreux (42 MW), Carrefour (38 MW) and Artibonite (16 MW). As of 2007, their installed capacity was 244 MW, and national electricity production amounted to approximately 779,000 MWh.

Due to technical problems, available capacity tends to be less than installed capacity.

All of the country's four regions have small hydroelectric plants and several thermal plants that provide energy to a local distribution system. Total losses are high, because not all users are formal customers with meters.

Although there is no updated map of the country's wind-energy potential, previous studies indicate that Haiti has major potential in the north, east and northeast of the country.

In order to draw up a wind-power map, the Bureau of Mines and Energy, with technical and logistical support from OLADE, installed two anemometers in the area of Planie du Cul de Sac in 1989, one in Lathan and the other in Fonds Parisien, near Lac Azuei. Record-keeping was suspended due to political problems, however.

Because of its location, Haiti also has abundant solar radiation that could be used for energy purposes. No relevant studies have been conducted. There is isolated use of solar power for lighting and water heating.

Because of the sugar industry, bagasse is an important potential energy source for Haiti, although it is also threatened by reduced sugar production. Of the total amount of bagasse available annually, approximately 140,000 tons, only 15% is utilized.

Only 10% of Haiti's 9.8 million inhabitants have access to electrical utilities.

2. Institutional context

The Ministry of Public Works, Transport and Communications (MTPTC) is in charge of managing mineral resources, the exploration and exploitation of energy resources, and hydroelectricity.

In particular, it is the government agency responsible for all policies related to water and energy in Haiti.

The MTPTC has been executing the National Electricity Sector Development Plan for the period from 2007 to 2032.

Haiti Electricity (EDH) was established in 1971 as a government enterprise with a totally vertical integration. It is responsible for the generation, distribution and marketing of electricity throughout the country. EDH reports to the MTPTC.

And finally, there is the Bureau of Mines and Energy, which serves as the coordinator of initiatives and international support for energy issues.

3. Regulatory context

Haiti does not have any legislation or regulations supporting efficient energy use, nor is any draft legislation on this subject known to be under study.

B. Key actors in energy efficiency and their effective roles

The main energy actor in Haiti is the Ministry of Public Works, Transport and Communications (MTPTC), but it is not involved in energy efficiency issues.

The Bureau of Mines and Energy, which serves as the coordinator of initiatives and international support for energy issues, is the other key actor.

C. Resources and funding mechanisms for energy efficiency programmes

In 2008 the Inter-American Development Bank approved a donation of US$ 12.5 million to Haiti to support the rehabilitation of the Peligre Hydroelectric Plant (CHP) and improve the reliability of the energy supply for the capital, Port-au-Prince.

To prepare for the programme, studies were undertaken with financing from the IDB Infrastructure Fund (InfraFund) and the Sustainable Energy and Climate Change Initiative (SECCI). The latter is also financing an energy efficiency plan for Haiti and the development of proposals related to biofuels and other renewable sources.

The programme, which will take five years to complete, will be under the direction of the Ministry of Public Works and EDH. It is expected that the rehabilitation of the CHP will enable Haiti to increase the generation of renewable energy at low cost and to save on imports of fossil fuel, which emits greenhouse gases.

The International Finance Corporation (IFC) is providing a loan of US$ 16 million and an additional US$ 14 million in a syndicated credit with the the Dutch development bank FMO. Two local banks, Sogebank and BNC, are providing US$ 14 million in cofinancing. All of this funding will make it possible for Haiti Electricity (EDH) to purchase energy under a 15-year agreement and supply electricity at a more competitive rate than the current one.

PETROCARIBE is also contributing funding.

D. Results of energy efficiency programmes to date

1. Programme to replace incandescent bulbs

In 2007 Haiti participated in Cuba's international effort in various Caribbean countries (all of them members of PETROCARIBE) to replace 2,366,768 incandescent bulbs with energy-saving bulbs.

The results were the following:

- Incandescent bulbs actually replaced, 2,366,768.
- An average reduction in power per replaced bulb of 70.4 W.
- Homes visited, 965,594.
- Reduction in energy consumption per household, 18 kWh per month.
- Reduction in maximum demand in the country, 86.3 MW; in energy terms, 334,186 MWh/year.
- The economic benefits from generating less power are approximately US$ 103,591,277, and the 112,621 tons of fuel imports saved each year amount to US$ 48,089,104. This makes for an annual total of US$ 151,680,381 in 2007.
- In environmental terms, the substitution of bulbs cut CO2 emissions by about 220,229 tons per year, valued at about US$ 924,961.

In addition, Haiti's objectives for its energy sector can be summed up as follows:

- Recapitalize troubled enterprises such as Haiti Electricity.
- Improve and modernize the administration of public enterprises, including EDH.
- Improve the production and distribution of electricity in the country.
- Promote alternatives to wood as a fuel, and promote alternative energy sources.
- Prepare and implement the necessary reforms to create a favourable atmosphere for domestic and foreign investment.

E. Lessons learned

There are emerging needs in the energy sector that require priority attention on all fronts: institutional, financial, legal and regulatory.

Improving the efficient use of wood in the residential sector reduces the pressure of desertification, which brings with it serious environmental problems. The switch to LPG as a replacement fuel should be promoted in the residential sector, accompanied by the installation of efficient cooking applicances.

Increasing the use of bagasse for energy purposes, particularly in cogeneration, can open up immediate opportunities for reducing the country's dependency on imported fossil fuels and its vulnerability to changes in international fuel prices.

Haiti needs to diversify its sources of energy, giving priority to those derived from renewable natural resources such as wind and the sun. This effort and energy efficiency programmes will yield benefits not only for the environment, but also for sustainability.

Support is needed for the development of appropriate technologies at the local level, such as small wind turbines that are appropriate for the context of Caribbean islands, in that they do not mar the landscape and can be dismantled quickly and easily during cyclones.

Incentives for energy saving must be created in the industrial and residential sectors.

The important savings achieved by replacing incandescent bulbs with energy-efficient ones must be accompanied by ongoing follow-up activities by the authorities to ensure lasting savings once the energy-saving bulbs reach the end of their useful life. At the same time, measures must be taken to facilitate the entry into the country of these and other energy-saving devices at relatively low prices so that they can compete with traditional devices.

XVI. Honduras

A. Recent advances in policy, regulatory and institutional frameworks

1. Economic context

Honduras has a diversified economy based on international trade in agricultural and manufactured products. In 2008 its exports and imports amounted to 129% of gross domestic product (GDP), but the world economic crisis, and particularly that of the United States of America, led to an economic contraction in 2009. Migrants' remittances have declined, as have exports from the maquiladora plants. It is estimated that GDP will shrink by 2% this year.

2. Energy context

Honduras is highly dependent on imported fuels. Indeed, imported petroleum derivatives account for nearly 43% of final energy consumption. In the residential sector, the most common fuel is wood, which amounted to 86.9% of consumption in 2003, followed by electricity.

The country is an importer of petroleum derivatives, most of which are consumed in their entirety. Sometimes there are surpluses of LPG and other products that are exported. Import volumes in 2006,[13] in barrels, were: Diesel 4.616 million, gasolines 2.881 million, fuel oil 6.775 million, LPG 1.747 million, kerosene/jet fuel 521,000, others 50,000. The total comes to 16.09 million barrels, of which 14.981 million were consumed.

Electricity generation[14] has grown increasingly and significantly dependent on fuels derived from petroleum. In 2008, thermal generation, including both the public and private sectors, reached 67.2%.

- Installed capacity for generating electricity in 2008 was 1,592 MW, and the main sources were, in order of importance: thermal, based on diesel engines and gas turbines (62.1%), hydroelectric (32.8%) and biomass (5.1%).
- For the same year, 6,537 GWh of energy was generated and distributed through the National Interconnected System (SIN). The main supplier was the private sector, with 69.3%.
- A total of 11.7 GWh of international energy sales were recorded.

[13] OLADE Energy Economic Information System.
[14] National Electrical Power Enterprise, ENEE.

- On the other hand, losses amounted to 20.8%, 7.3% less than in 2007.
- Of the 6,537 GWh available, the end-user residential sector accounts for the largest share of demand with 41%, followed by the commercial sector (24.5%) and the industrial sector (12%).
- According to the 2008-2020 Generating Expansion Plan prepared by the National Electrical Power Enterprise (ENEE), installed capacity will be both incorporated and retired. In 2014, 358 MW is to be incorporated.

3. Energy policy

Various isolated initiatives have been undertaken in Honduras over the years to formulate and implement policy guidelines. Thus far, they have not met their objectives because they have run into obstacles, especially those associated with political will. Everything has revolved around government policies implemented by executive decree.

The initiative to reform the overall energy policy in Honduras through the Programme of Energy Policy for Sustainable Development entails gathering together, influencing and combining in a logical and appropriate manner all policies and actors, whether political or not, which are oriented towards the energy sector. Until now they have been scattered and have lacked a comprehensive, integrating vision.

The goal is to influence the responsible actors so that they will formulate and implement a comprehensive national energy policy that will serve as a legal frame of reference for planning and decision-making over the long term in a responsible and sustainable manner within the limits of the country's resources.

Honduras has a **rational energy use bill** pending that is designed to regulate programmes for energy efficiency or rational energy use. This bill has not yet come into effect, but is in the process of being approved by the National Congress of the Republic.

It will guarantee the creation of the **Institute for the Rational Use of Energy (IURE)** and the implementation of energy policies for the rational use of energy and the planning, development, follow-up and evaluation of projects.

Energy efficiency standards are under the direction of the Honduran Standardization Agency (OHN) and involve the government and the private sector. Among other actions, a Standard for Compact Fluorescent Lamps is being developed and will take effect in 2010. It is oriented towards restricting the importation, manufacture and marketing of incandescent light bulbs.

In the future, the following standards will be developed:

- electric Motors;
- refrigerators;
- household appliances.

B. Key actors in energy efficiency and their effective roles

1. Institutional context

Secretariat of Natural Resources and Environment (SERNA).

This is the government institution responsible for energy efficiency, which it oversees through the ***General Directorate of Energy (DGE).***

National Electrical Power Enterprise (ENEE).

This is an autonomous agency in charge of the production, marketing, transmission and distribution of electricity in Honduras. It has directed important projects, such as the ***Autonomous Generation and Rational Use of Electricity Project (GAUREE)***

Inter-institutional Group for Rational Energy Use (GIURE).

It was created on 2 August 2007 as a result of an initiative by the General Directorate of Energy, the National Electrical Power Enterprise, the National Autonomous University of Honduras and the Honduran Private Enterprise Council.

The GIURE's objective is to strengthen projects for the rational and efficient use of energy in different sectors.

Institutions that make up the GIURE:

1. Secretariat of Natural Resources and Environment (SERNA).
   - General Directorate of Energy (DGE).
   - Department of Rational Energy Use.
   - Clean Development Mechanism Unit.
2. National Autonomous University of Honduras (UNAH).
   - Energy Section of the Department of Physics.
   - Central American Postgraduate Programme in Economics and Development Planning (POSCAE).
3. National Electrical Power Enterprise (ENEE).
   - Autonomous Generation and Rational Use of Electricity Project (GAUREE II).
4. Secretariat of Education.
5. College of Mechanical Engineers, Electricians and Chemists of Honduras (CIMEQH).
   - Energy Efficiency Commission.
6. Honduran Private Enterprise Council (COHEP).

Collaborating institutions:

- Honduran Council on Science and Technology (COHCIT)
- Project for Energy Efficiency in the Industrial and Business Sectors (PESIC)
- National Energy Commission (CNE)

C. Resources and funding mechanisms for energy efficiency programmes

Support for energy efficiency initiatives and projects in Honduras comes from government budget allocations, ENEE funds and international cooperation funds, depending on the project.

In addition, within the framework of **the Project for Energy Efficiency in the Industrial and Business Sectors (PESIC)** (see the next item), one of the assigned tasks is the Financial Mechanism (FOPESIC). The purpose of the FOPESIC is to enable businesses to finance energy efficiency projects.

The FOPESIC has two investment categories:

- The first will serve to finance the execution (construction or implementation) of EE projects in the beneficiary companies. It will be called the Project Execution Guarantee Fund (FAEP), and will be used to provide partial guarantees (maximum 50%) of bank loans.
- The second will provide direct loans for pre-investment activities and technical assistance. It will be called the Technical Assistance Fund (FOPAT), and will be funded exclusively with resources from the FOPESIC.

D. Results of energy efficiency programmes to date

1. Energy efficiency projects

Autonomous Generation and Rational Use of Electricity Project (GAUREE). Of the ENEE: in general terms, it is oriented towards promoting the rational use of electricity.

GAUREE II Project. This module is carrying out concrete actions for improving the load curve (demand management) and optimizing the Rational Use of Electricity (UREE).

Problems to solve:

- The low load factor of the National Interconnected System (SIN)
- Dependence on generating plants with high variable costs
- A general culture of wasting electricity

Activities of GAUREE II Project:

- Definition of operating procedures
- Optimization of electricity consumption in buildings
- Optimization of electricity consumption in industry
- Optimization of pumping systems and consumption by the consumer in service companies
- Purchase and installation of equipment
- Follow-up and evaluation of results
- Training/information and promotion campaigns

Expected results

- 3% improvement in the load factor of the National Interconnected System, from 63% to 66%, and promotion of efficient and rational use of electricity
- Optimization of electricity consumption in buildings, industry and commerce

In order to promote energy efficiency and reduce production costs in Honduran industries, energy audits have been conducted in a number of companies in the country.

More than 20 audits have been carried out in the food industry, hospitals, hotels, public buildings, etc.

The energy audit consists of measurements to verify and corroborate that the ENEE meter is correctly recording energy use.

Synergies with other projects

The work of the Project for Education Development in Urban-Marginal Communities of Honduras (DECUMN) is being leveraged, and benefits are being derived from the efforts and experiences of the Project for Energy-Efficiency Measures in the Industrial and Business Sectors of Honduras (PESIC).

Project for the Implementation of Compact Fluorescent Lamps in the Residential Sector. Six million CFLs were delivered to replace existing bulbs in the homes of ENEE customers over a short period of time. Of that total,

- Four million compact fluorescent lamps came from the programme of purchases and cooperation with Cuba.
- Two million were subject to a bidding process involving private companies in Honduras.

Public school students pioneered the implementation. The light bulbs were distributed free.

TABLE 13
PROJECT FOR THE IMPLEMENTATION OF COMPACT FLUORESCENT LAMPS IN THE RESIDENTIAL SECTOR

Bulbs replaced	6 000 000
Energy saved	480 MWh/day - 175.20 GWh/year
Power shifted	119 MW at peak nighttime hours
Amount	$ 8 700,00
Emissions avoided	113 880 tCO2e

Source: National Electrical Power Enterprise (ENEE).

National Campaign "Learning the Rational Use of Electricity (AURE)". Under an inter-institutional agreement among SERNA, ENEE and the Secretariat of Education, carried out as part of Project GAUREE II.

This is an education campaign to teach the rational use of electricity. It is taking place in the National Education System, in which students in at least 250 primary and secondary schools are carrying out activities designed to implement electricity-saving measures in their homes.

In the main cities of the country, training seminars have been conducted for programme facilitators or monitors. More than 300 teachers have received training to coordinate the campaign at the educational centres where they work, and they are now coordinating the activities developed by the young instructors.

Project objectives:

- Promote the AURE Campaign in the national education system through practices that contribute to the rational and efficient use of electricity and the sustainable development of the country.
- Instil new electricity consumption habits in a new generation of Hondurans.
- Reach 100% of students through their teachers in a multiplier effect.

Actions:

- Train teachers in the three levels of education in the rational use of electricity.
- Provide incentives for fairs promoting the rational and efficient use of energy.
- Follow up on the actions of the trained teachers.
- Involve public school students in the activities of the project to implement compact fluorescent lamps in the residential sector.

Expected results:

- Promotion of key teachers in the different levels of education as disseminators of information on the rational use of electricity throughout the country.
- Verification and measurement of the multiplier effect among the nation's students of the promotional effort in the national education system.
- Greater awareness and publicity about the efficient use of energy among the population in general through the training of public school students.

Strategy of the National Campaign for the Rational Use of Energy. In the government sector:

- Implement energy-saving measures in all government institutions.
- Sensitize public employees to energy efficiency.
- Analysis of electricity consumption in all institutions by the ENEE, through GAUREE.
- Government vehicles participate in the "No Driving Today" energy-saving measure.
- Evaluate each government institution to verify the energy savings agreed upon in the Council of Ministers.

Project for Energy Efficiency in the Industrial and Business Sectors (PESIC). This is a lesser project compared to the one described above, but it is still very important. It is tasked with promoting energy efficiency in the aforementioned sectors and creating a trust for investment in private enterprise. It is being carried out by the Honduran Business Council for Sustainable Development (CEHDES), under the supervision of the United Nations Development Programme (UNDP) and a multi-sectoral committee comprised of representatives of government agencies such as the Secretariat of Natural Resources (SERNA) and the Technical Secretariat for Cooperation (SETCO), as well as donor institutions such as the Global Environment Fund (GEF) and the Canadian International Development Agency (CIDA).

It began operations in mid-2005 and gained momentum as an initiative in the Honduran public and private sectors because of the increasing dependence on fossil fuels for electricity generation.

Its objective is to provide technical assistance and develop institutional capacities in order to remove existing barriers to the increased commercial use of high-efficiency equipment. It is also responsible for promoting the application of improved energy efficiency practices and measures in the Honduran industrial and business sectors in order to cut GHG emissions and boost businesses' competitiveness and overall sustainability.

PESIC is a nationwide project whose strategy calls for the promotion of investments in efficient equipment and improved practices to achieve energy efficiency. The following areas being developed:

- Project Financing.
- Implementation of pilot projects.
- Policy and legislation.
- Increased technical capacity.
- Reporting and dissemination of results.
- Monitoring GHG emissions.

Thanks to these actions, there is greater awareness and interest on the part of potential investors and the financial community in supporting energy projects in the country.

E. Lessons learned

- The adoption of innovative and comprehensive policies is key to the successful implementation of energy efficiency programmes that spur economic growth and maintain and increase competitiveness. Honduras, with its limited policies and standards on the issue, will necessarily have to complete the process of formulating a comprehensive national energy policy to ensure that it is feasible and yields the expected results.
- The actions undertaken through the PESIC Project show that the participation of the private sector is of fundamental importance for developing energy efficiency, but it must be coordinated with State authorities in order to have an impact on the entire national energy sector.
- One of the principal barriers to energy efficiency projects is the lack of information and awareness of the importance and advantages of making efficient use of energy, a culture that must be developed both among consumers and among the relevant public agencies. Strategies have been developed to heighten awareness and disseminate information with a view to creating a sustainable market for energy efficiency and promoting a culture of energy saving in Honduras, but efficient technologies still need to be incorporated.
- Because Honduras is dependent on imported fuel for generating thermal energy, the development of energy efficiency is critical for economic reasons, reliability of fuel supplies, economic competitiveness, increased prosperity and environmental sustainability. However, the main hindrance to the energy efficiency campaign is deficient organizational and institutional systems.
- The implementation of compact fluorescent lamps in the residential sector is an energy efficiency measure that has been replicated in different countries of the region, and the results have been successful.
- Energy efficiency should be viewed as a profitable resource and a decisive contribution to the well-being of the population and environmental preservation. At the same time, consideration should be given to reducing dependency on imported energy by making better use of the country's natural energy resources by cultivating dendro energy planations, for example, and continuing the different programmes that have yielded favourable results.
- The most recent programmes undertaken in Honduras have required long preparation periods, but they present a realistic alternative for reducing consumption. In addition, the positive outcomes produced by this type of project are advantages that attract investment.
- Given the prevailing culture in Latin America, and particularly in Honduras, it will always be necessary for institutions or enterprises to achieve success in energy efficiency endeavours for others to take an interest. In this regard, future plans should include provisions for publicizing achievements and benefits.

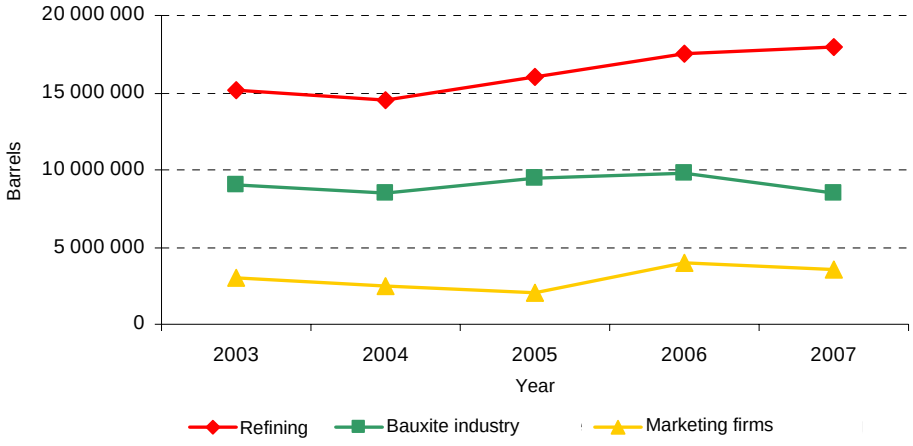
XVII. Jamaica

A. Recent advances in policy, regulatory and institutional frameworks

1. Fossil fuels

Imports are needed in order to meet Jamaica's fossil fuel needs, and the country depends almost entirely on oil. Due to a lack of domestic refining capability, over 50% of oil derivatives must be imported. Oil imports in 2007 totalled 29,900 million barrels, 3% less than the previous year. Of these, a total of 8,600 million barrels, valued at US$ 445 million, were used by the bauxite industry, whose electrical plants consume vast amounts of energy.

FIGURE 20
TOTAL OIL IMPORTS, 2003-2007



Source: Ministry of Energy, Mining and Telecommunications (MEMT), 2008.

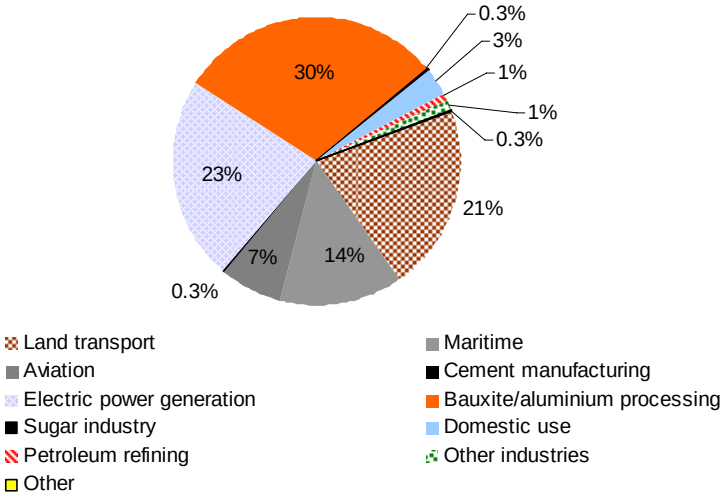
The price of oil derivatives products has also risen considerably in recent years as a result of the deterioration of Jamaica's currency against the dollar. The nominal prices of all oil derivatives were more than 10% higher in 2007 than in 2006.

When world oil prices peaked in mid-2008, one litre of unleaded gasoline sold for over J$ 70, or around US$ 1 per litre. The decline in oil prices seen since then will reduce pressures on Jamaica's energy market, but forecasts call for continuing upward movement as the world economy recovers and resources become scarcer.

Driven by the interest in saving energy, as well as by the economic slowdown, oil consumption fell from 27.68 million barrels of oil equivalent (BOE) in 2006 to 27.62 million in 2007 (a drop of 0.2%). Thus, annual per capita consumption totals approximately 10 barrels, or around 1,600 kilowatt hours. Fuel oil continues to be the oil product most consumed. The 2007 volume of 17.5 million barrels represents an increase of 2.9% over the previous year.

Extraction and processing of bauxite and aluminium are energy intensive, and the energy used accounts for approximately 30% of the island's oil derivatives consumption (see figure 21).

FIGURE 21
OIL CONSUMPTION BY ACTIVITY, 2003-2007



Source: Ministry of Energy, Mining and Telecommunications (MEMT), 2008.

Electric power generation for the public grid (i.e., for all users except those with their own generating capacity, such as bauxite firms) is responsible for 23% of oil consumption, while highway transportation, the second largest consumption category, accounts for 21%. Transportation overall (roads, railways, maritime and air) represents approximately 42% of the demand for oil.

2. Electricity

In April **2001, following a reform of electricity legislation**, a new license was granted to Jamaica Public Service Company Limited (JPSCo), which has been the island's largest provider of electricity since it was established in 1923. The new license was granted for 20 years (until 2020). Under this policy, JPSCo is required to provide reasonably priced service that is sufficient, secure and efficient, by modern standards, to all areas of Jamaica, meeting demand and contributing to the country's economic development. Although the company continues to have a monopoly on electrical transmission and distribution, the production regime has been liberalized to permit private parties to generate electricity for themselves or for the public grid.

The portion of Jamaica's **generating capacity** that constitutes the public supply of electricity is on the order of 1,000 megawatts (as of 2008), including nearly 200 megawatts provided by independent

producers (see table 1). Bauxite producers, sugar refineries and some industrial firms of other types operate their own generating facilities, feeding their surpluses into the JPSCo transmission network.

TABLE 14
INSTALLED GENERATING CAPACITY OF GENERATING PLANTS IN JAMAICA

Entity	Approximate Generating Capacity	
	MW	%
JPSCo	621.0	61.0
IPPs	205.0	20.1
Bauxite Companies	150.0	14.7
Sugar Companies	23.0	2.3
Other industries, Hotels	18.0	1.9
Total	1 018.0	100.0

Source: Ministry of Energy, Mining and Telecommunications (MEMT), 2008.

The JPSCo electrical system includes **24 generating plants**. Over 50% of its production facilities have been in operation for over 30 years, and their efficiency level is therefore low. Except for 5% of the renewable energy generated in Jamaica (3% of which is hydroelectric, 2% wind-generated), electrical production relies on imported oil (of which 63% is heavy fuel oil and 32% is diesel, in the case of JPSCo). The company produces electricity almost entirely at thermal plants, with only 20% of its production being hydroelectric. The two main independent producers operate only thermal plants. The increase in maximum demand in the public system has flattened in recent years, and between 2007 and 2008 there was even a downward curve (-622 megawatts).

Specific heat consumption has seen some improvement since the oldest units were retired in 2003 and 2004, but it continues to be high, at an average of 10,215 kilojoules/kilowatt hour, or 9,560 BTUs/kilowatt-hour in 2008, in both JPSCo facilities and those of independent producers, putting efficiency at 35%. Specific heat consumption at JPSCo was 11,257 kilojoules/kilowatt hour (32% efficiency), while the figure for independent producers was 8,136 kilojoules/kilowatt-hour (44.4% efficiency).

Of particular note is **the low yield of JPSCo's oldest oil-fuelled steam turbine plants**, whose efficiency is only 27%, as compared with similar plants in the United States, which operate at 36% efficiency. Modern combined-cycle electric plants can achieve efficiencies of more than 55%, and even new large coal-fired plants operate at well over 40%. Much greater overall efficiency can be achieved through cogeneration, which uses some or nearly all of the residual heat from other processes.

To reduce specific heat consumption even further, the Office of Utilities Regulation (the public utilities regulator) would be well advised to establish more stringent standards. In the Philippines, electricity sector regulations were established requiring operators to ensure that their specific heat consumption was below 10,850 BTUs/kilowatt hour (31.5% efficiency) at oil-fired plants, and below 9,773 BTUs/kilowatt hours (35% efficiency) at coal-fired plants. JPSCo has proposed a reduction to 10,700 kilojoules/kilowatt hour (10,111 BTUs/kilowatt-hour), to occur between July 2009 and June 2014.

TABLE 15
EFFICIENCY OF ELECTRICAL PLANTS IN THE JPSCO NETWORK

Entity	Efficiency	
	BTU/kWh	(% of Energy Input)
Oil-fired steam	12 723	26.8
Combined cycle	8 390	40.7
Gas turbines	13 972	24.4
JPSCo low-speed diesel	9 122	37.4
JPPC low-speed diesel	7 937	43.0
JEP Medium-speed diesel	8 135	41.9

Source: Ministry of Energy, Mining and Telecommunications (MEMT), 2008.

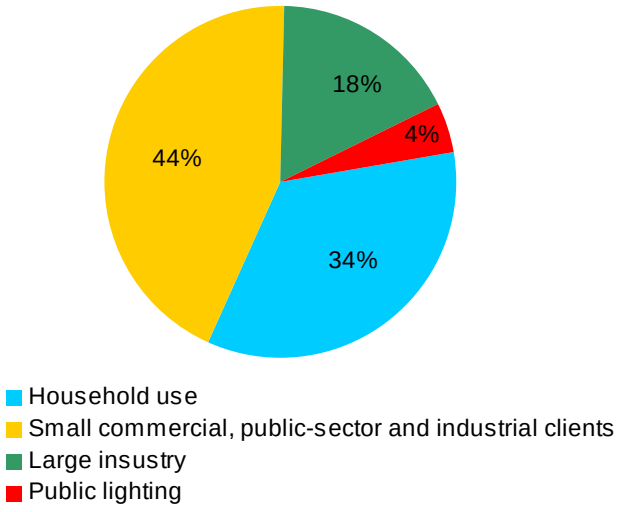
Fuel is the greatest cost item for JPSCo, totalling J$ 47,500 in 2008. Oil prices rose 52% in 2005, 20% in 2006 and 70% in 2008. Reducing average specific heat consumption by 100 BTUs/kilowatt-hour would produce an annual saving of some 66,500 barrels of oil. Put in different terms, each 100-kilojule/kilowatt-hour reduction would produce an annual saving of approximately US$ 3,500 at today's oil prices.

Net electric power generation for the public grid increased slightly from 2007 to 2008, as well as over the last five years generally. The rise is even more clearly reflected in electricity sales, which grew only 1.1% annually in the 2004-2008 period. Total production (net generation) was approximately 4,111 gigawatt hours in 2008, of which 30% came from sources other than JPSCo. At the beginning of 2009, the company's officials predicted that net generation of electricity for public use would fall in 2009 (by 4.7%) and in 2010 (by 2%), and would then rise to 4,073 gigawatt hours by 2014, when 3,328 gigawatt hours would be sold. The residential sector buys 38% of the electricity generated (under the residential rate, or "rate 10"). This projection is much more conservative than previous ones, such as the considerably higher 2007 projection produced by Acres Management Consulting.

As of the end of 2008, JPSCo had approximately **590,000 clients**, of which 525,000 (approximately 89%) were residential customers. Around 63,000 clients were small business, public-sector and industrial consumers with relatively low levels of electricity consumption. Only 116 industrial and other clients are large consumers.

Most electricity in 2007 was consumed by small commercial, public-sector and industrial clients (1,400 gigawatt hours), followed by residential users (1,100 gigawatt hours) and large industrial clients (560 gigawatt hours). Residential (rate 10) use accounted for approximately 34% of annual consumption, while large-scale (rates 40 and 50) users accounted for 18%. The cement sector consumed 3% of the total. It should be noted that industry is by far the largest consumer of electricity in Jamaica, if one includes self-production from mining sector generation.

FIGURE 22
DISTRIBUTION OF JPSCO ELECTRICITY SALES IN 2007



Source: Ministry of Energy, Mining and Telecommunications (MEMT), 2008.

Between 2002 and 2007, average electricity consumption per household was between 2,050 and 2,500 kilowatt hours per year. This figure is based on electricity sold. Given that electricity theft has increased, actual average consumption would appear to have declined in the last few years. Jamaica's inhabitants paid an average of J$ 19 per kilowatt hour in 2007, or US$ 0.277. In mid-2008, as the result of a higher fuel surcharge, the average domestic rate rose to an unprecedented level of US$ 0.38 per

kilowatt hour, then declining as the world oil market stabilized. The average electricity rate for all client groups in 2008 was US$ 0.306, of which US$ 0.204 was due to fuel costs, with US$ 0.102 attributable to other costs. Thus, at the peak, the fuel (i.e., the flexible) component accounted for two thirds of the cost to the consumer.

Jamaica's rates are still at the low end of rates in Caribbean island nations, although they are much higher than in Trinidad and Tobago and in countries like the United States and Mexico.

B. Key actors in energy efficiency and their effective roles

1. Ministry of Energy, Mining and Telecommunications

The Government of Jamaica (GOJ) has recognized that the country's imported-energy bill can be reduced by a combination of energy-efficient practices and renewable energy technologies. In addition to establishing an official energy policy in 1996, the Ministry of Energy, Mining and Telecommunications (MEMT) has, in recent years, promoted these concepts through public education programmes, including:

- coordinating discussion of programmes in educational institutions and communities;
- disseminating information in the media;
- distributing pamphlets with energy saving advice; and
- distributing an energy-saving manual.

In addition, MEMT has established energy efficiency activities within its own departments, in connection with creating and running the Demand Side Management (DSM) Programme operated by JPSCo, the country's principal energy utility company. Under the DSM, which dates back to 1994, a number of GOJ properties associated with ministries and other public agencies have undergone energy audits, to determine ways of saving energy through retrofitting. Some of the audited properties (e.g., those of the Ministry of Finance) have begun the retrofitting process, but lack of funding has limited the success of the initiative.

In an effort to provide better information on the amount of energy wasted in Jamaica's public buildings, two case studies were evaluated and presented, both based on energy audits conducted under the DSM programme. The first covers the buildings in the Ministry of Finance complex, while the second concerned Bustamante Children's Hospital.

DSM energy audits are designed to:

- Identify current energy consumption trends in the principal facilities.
- Investigate and identify possible inefficiencies in energy use.
- Recommend possible energy efficiency measures to reduce operating costs and improve the efficiency of energy-consuming equipment.

2. Jamaica Public Service Company Limited (JPSCo)

JPSCo has been the country's principal electricity provider since it was established in 1923, and in 1978 it received an exclusive 39-year license to provide electricity to the entire island. The enterprise was privatized in 2001, when a United States company acquired 80% of its equity, with nearly 20% remaining in the hands of the government. In 2007, the private-sector shares were sold to Marubeni Caribbean Power Holdings, Inc., a subsidiary of the Japanese firm Marubeni Corporation. In March 2009, Marubeni officials signed an agreement to transfer 50% of that company's Caribbean shares, including JPSCo, to the Abu Dhabi National Energy Company (TAQA).

3. Petroleum Company of Jamaica (PCJ)

In an effort to consolidate and strengthen the government's work on energy efficiency—in particular, the DSM programme, which operated from 1994 to 2001—PCJ created a National Energy Efficiency Unit (NEEU) in September 2003. NEEU was given a broad mandate that included developing and coordinating the government's energy efficiency programme and encouraging private investment in renewable energy. The unit's efforts focus on six main programmes, which are described below.

Residential-sector programme

The main thrust of the residential programme is to promote solar water heaters, proper installation and efficient use of electrical appliances, and wider use of compact fluorescent bulbs. One of the principal objectives of this component of the programme is to facilitate the installation, and more widespread use, of solar hot water heaters in residential buildings to replace electric water heaters. There are currently only 7,000 installed solar hot water heaters in Jamaica, compared with over 40,000 in Barbados.

Small businesses programme

The commercial component of the NEEU programme targets hotels, office buildings, banks, supermarkets, etc. A major portion of the energy that these businesses consume is used for air conditioning and lighting. Thus, the use of electronic "ballasts" and high-efficiency fluorescent bulbs is being encouraged. The emphasis with regard to air conditioning is on timers, which can reduce the amount of hours the systems are in operation. Retrofitting is also being promoted as a means of reducing power from refrigeration, along with correcting deficient systems designs and improving installation practices.

Programme for industrial and commercial users

Many large industrial facilities in Jamaica consume both electricity and heat. These are outstanding candidates for cogeneration. Cogeneration technology is now being encouraged, particularly for small users (under 2 MW).

Public-sector and government programme

Details of electrical spending by government in public-sector buildings show that 47% of this expenditure is by the National Water Commission (NWC), while 14% is for public lighting and 9% for hospitals. The public sector programme therefore focuses on these major users, with special emphasis on lighting and water heating for air conditioning, steam generation and (in the case of the NWC) pump water.

Energy fund (proposed)

The PCJ National Energy Efficiency Unit (NEEU) has been conducting a public awareness and education programme, as well as helping to establish an Energy Efficiency Fund. The hope is that the fund, which is still under discussion, will be able to provide special low-interest funding for users and private-sector operators.

Public education

In an effort to cover several areas that have been identified as vital to creating public awareness of energy efficiency issues, the National Energy Efficiency Unit launched a number of radio and TV initiatives under the motto "Conserve today or tomorrow we pay". Seminars held on energy

conservation between May 2004 and May 2005 trained 102 science professors from 53 tertiary technical institutions. The NEEU recently initiated a new public education campaign at the national level to promote energy efficiency.

4. Jamaica Bureau of Standards (JBS)

The JBS is currently involved in two main areas of energy efficiency:

- Use and labelling tests.
- Finalizing and publicizing the Energy Efficient Building Code (EEBC).

A solar energy laboratory was established in the mid-1980s as part of a joint programme involving the United States Agency for International Development (USAID) and the Government of Jamaica. Drawing on participation by a large number of government agencies, the objective was to improve the country's capacity to develop energy efficiency and renewable energy projects. The laboratory was designed to be able to evaluate the functioning of most components, including the collectors and storage tanks associated with solar water heaters. After the laboratory was put into operation, the JBS conducted random tests of the water heaters of local manufacturers and distributors, and then made recommendations.

The EEBC was established in 1994 by JBS as a national professional code. It was prepared primarily by JBS, though it reflected the views of numerous local and international experts on the conceptual design of low energy-consumption buildings.

5. University of the West Indies (UWI)

Most of the UWI's work in energy efficiency and renewable energy technology is carried out in the School of Engineering at the Trinidad campus. The School of Pure and Applied Sciences, at the Mona campus, has been a leader in persuading other schools and entities at the university to not only recognize the need for energy efficiency, but also to implement their own measures to make their equipment and lighting systems energy efficient. The most recent initiative by the School of Pure and Applied Sciences will create a new graduate programme on energy efficiency and renewable energy.

6. University of Technology, Jamaica (UTech)

This institution has been offering training in energy-related areas for a considerable time at its Energy Centre, which was established in 1983 when the university was still a college. The School of Engineering has a limited number of options for undergraduate electrical and mechanical engineering students who wish to take energy-related courses. In mechanical engineering, a course entitled "Energy Production Systems" offers a 60-hour module, of which approximately 50% is devoted to renewable energy and energy conservation. Interest in all of these areas has diminished recently with the decline of the Centre.

7. University Centre for Environmental Development (UWICED)

The Centre was created in the early 1990s by the University of the West Indies (UWI), as a response to growing concerns in the global community about threats to the world's environment. UWICED is funded in part by UWI, but revenues are used to maintain it, using subsidies and loan funds for projects approved by international and regional bilateral agencies. UWICED has assumed a leading role in the region in promoting energy research. Its links with regional energy-related organizations such as OLADE, the Caribbean Programme of Action for Climate Change (CEPACC) and the Caribbean Energy Information System (CIES) have allowed it to play a role in designing and executing many regional projects.

8. Ministry of Transport and Works

The Ministry's initiatives include:

- Incorporating energy efficiency and environmental management in a corporate plan for the Ministry.
- Planning for energy audits in its buildings.
- Initiating a plan to retire old and inefficient buses from service—limited, so far, by the logistical problems of disposing of the old vehicles.

9. Ministry of Agriculture

This Ministry's initiatives include:

- Oversight of lighting and air conditioning systems.
- Retrofitting used irrigation pumps to achieve the highest possible level of efficiency in irrigation systems.
- Special debit cards to reduce gasoline purchases for Ministry vehicles.

10. Ministry of Environment and Territory

This Ministry's initiatives include:

- An Environmental Management Guide developed for the Ministry by the Environmental Action Programme (ENACT), including material on energy efficiency.
- Development of new measures to combat climate change.

C. Resources and funding mechanisms for energy efficiency programmes

The Inter-American Development Bank recently (12 June 2009) approved a non-reimbursable technical cooperation project designed to support the Jamaican government in developing energy efficiency projects, and to provide it with technical assistance in preparing a loan request for this purpose. The principal features of the operation as it is now being carried out are summarized below.

TABLE 16
INFORMATION ON ENERGY EFFICIENCY PROJECT IN JAMAICA

Project description:	Support for the Government of Jamaica to improve energy efficiency, and technical assistance for preparing a loan request for an energy efficiency project in Jamaica.
Stage:	
Financial information	Total cost—historic: US$ 437,500 Country counterpart financing—historic: US$ 87,500
IDB financing	Financing type: non-reimbursable technical cooperation. Fund: MSC Reporting currency: USD (United States Dollar). Reporting date: 30 June 2009. Approved amount—historic: US$ 350,000. Cancelled amount—historic: US$ 0. Undisbursed amount—historic: US$ 350,000 Disbursed to date—revalued: US$ 0.
Roles and responsibilities	Executing agency: Ministry of Energy and Mining.

Source: Inter-American Development Bank (IDB), 2009.

Early this year (March 2009), the Inter-American Investment Corporation (IIC)[15] launched the GREENPYME programme, about which the following information is available:

GREENPYME promotes the adoption of energy efficiency measures, the use of renewable energy and clean technologies in small and medium-sized enterprises (SMEs) in Latin America and the Caribbean.

On 9 March 2009, the Inter-American Investment Corporation (IIC), which is the only multilateral development institution with a mandate to support and fund Latin American and Caribbean SMEs, announced a technical assistance programme in the area of energy efficiency and renewable energy in those countries where there is major potential for energy savings in such firms.

The purpose of the programme is to provide knowledge, tools and technical and financial support for SMEs, so that they can implement energy efficiency measures and adopt clean technologies and, by thus lowering their energy costs, improve their competitiveness and sustainability while improving their environmental impact.

Firms working with GREENPYME can receive assistance in conducting energy audits, and can obtain consulting services and technical viability analyses. Participation in the programme can also facilitate access to funding from IIC in the form of loans and capital investments. According to the Chief of the organization's Technical Assistance and Strategic Partnerships Division, "there is a real need for this innovative technical assistance programme because SMEs in Latin America and the Caribbean still consume a large amount of high-cost energy inefficiently. That cost can be key to business viability."

GREENPYME receives financial support from various donors, in particular the Korea-IIC Development Trust Fund to assist SMEs. These resources make possible a range of activities in collaboration with local strategic IIC partners (commercial banks, universities, chambers of commerce and business groups) and are also used to promote the sustainability of SMEs through energy efficiency and the use of renewable energy.

In November 2008, GREENPYME entered the scene with three training seminars on energy efficiency in Jamaica and Belize, co-sponsored by IIC and Scotiabank. Two more workshops were held in the Bahamas with co-sponsorship from the Royal Bank of Canada and the Bahamas Hotel Association, and one in Trinidad and Tobago, co-sponsored by Scotiabank.

D. Results of energy efficiency programmes to date

1. Electricity loss

Loss of electricity increased considerably, to a peak of 23.2% in 2007, then declining to the still-high level of 22.9%. Although 9.9% of this is attributable to technical losses, the remaining 13% is due primarily to an increase in illegal connections or unpaid bills (non-technical losses), most likely a consequence of the increase in electricity rates and the growing number of low-income households. The decline in residential (rate 10) sales in the last two years is further confirmation of this situation.

Some of the negative growth may also be attributable to more sensible and rational use of electricity. In 2007, non-technical losses totalled J$ 4.8 billion (US$ 70.6 million), of which only

[15] The Inter-American Investment Corporation is a multilateral financial institution and a member of the Inter-American Development Bank (IDB) Group. It provides financing (in the form of capital investments, loans, guarantees and other instruments) and consulting services to private enterprises of Latin America and the Caribbean. In 2008, CII had US$ 1.5 billion in assets and approved 64 operations, channelling US$ 300.55 million to small and medium-sized enterprises in the region. The mission of ICC is to promote the economic development of its member countries in the region, stimulating the formation, expansion and modernization of private enterprises, particularly those of small and medium size.

J$ 2 billion (US$ 24.4 million) could be recovered through rates. To further reduce the loss of revenue, JPSCo management has decided to take additional measures to prevent electricity theft.

Accordingly, the company is implementing **advanced metering infrastructure for commercial clients determined to be in a high-priority category**. The first phase, completed in April 2008, installed 1,700 smart meters, along with the necessary infrastructure, at a cost of approximately J$ 100 million (US$ 1.4 million). The second phase, which is to be completed in the next two years, calls for installing 4,300 additional meters. This will provide automatic metering for JPSCo's 6,000 largest commercial clients, which account for approximately half of the energy consumption. These measures will improve the company's ability to monitor clients' consumption on the national grid in real time, and thus increase the ability to detect non-technical losses

JPSCo officials anticipate that the implementation of various initiatives will reduce losses to 18.3% by June 2014, with a reduction of 3.2% in non-technical losses and 1.4% in technical losses. Given average specific energy consumption of 10,000 BTUs/kilowatt hour, a 1% reduction in (technical) losses (equivalent to 40 gigawatt hours) would produce an annual saving of 74,000 barrels of oil. Eliminating non-technical losses assumes, primarily, an improvement in the "sales" component of the equation, but not major reductions in energy consumption.

2. Efficiency standards and labelling of appliances

Most imported energy-consuming appliances sold in Jamaica are not as energy-efficient as they might be. Consumers are often unaware of long-term operating costs and differences in energy consumption between models of similar size with similar features.

Salespeople also lack the information and skills needed to help customers choose an electrical appliance not only on the basis of its design and functions, but also for its specific energy consumption. Current policy does not prevent low-efficiency appliances from entering the country, nor does it provide incentives or measures to promote the purchase of items that consume less energy.

Jamaica's Bureau of Standards (BSJ) introduced mandatory labelling for refrigerators in 1990. In practice, the label, which is similar to that used in the United States, is almost never used, and consumers are unaware of its significance. In a relatively small country that does not produce its own appliances, it is nearly impossible to create the facilities needed to test appliances and certify them under national labelling standards or to enforce minimum energy performance standards, given that the country's market is highly dispersed and includes a wide range of items. A further problem is that the labels and minimum efficiency performance standards (MEPS) have not been made uniform. Even if the standards were to require certain items to carry labels or meet certain energy consumption standards, effective customs controls would be nearly impossible.

One possible solution to the dilemma brought about by the small size and dispersion of the market—and by the fact that BSJ has limited testing capacity—would be a unified regional effort, perhaps in the framework of the Caribbean Community (CARICOM), taking an approach similar to that used for the region's common labelling standards for pre-packaged products. The appliance markets of the various CARICOM countries are nearly identical, since they depend almost entirely on imports from foreign manufacturers.

3. Lighting

Lighting accounts for a **large proportion of electrical consumption** in many sectors. In most Jamaican households, lighting is the second largest category of electricity consumption after refrigeration. In many offices, the energy consumed for lighting is comparable to that used for computers and other office equipment, and is exceeded only by the amount of electricity used in air conditioning. According to World Bank estimates, the demand for electrical lighting in the developing countries increased at an annual rate of 3.6% over the last decade.

New construction and growing levels of lighting will contribute to further increases in countries such as Jamaica. Most Jamaican homes and many small stores still use tungsten filament incandescent bulbs or halogen bulbs, due to their low purchase cost. However, these methods convert less than 10% of the electrical energy into light, while the remaining portion is converted to heat. Although the efficiency of incandescent lamps (tungsten filaments) varies, it is generally lower than that of compact fluorescent bulbs (also known as "energy saving" lights) that can be used instead.

A compact fluorescent bulb can provide 6,000 to 20,000 hours of lighting, at least five times more than a traditional bulb. Thus, its lifetime cost is lower, especially where, as in Jamaica, the price of electricity is high.

Most offices and service-sector storefronts in Jamaica use linear (tubular) fluorescent bulbs, but these are often not the most efficient bulbs of their type. The 40-watt T12-model tubes can be replaced by 36-watt T8s or T5 bulbs, and the associated fixtures can be replaced with equipment that reflects most of the light and directs it to places where it is required for work, or where objects are being displayed. Magnetic regulators also are not optimally efficient and could be replaced with electronic devices.

Improving the quality of compact fluorescent bulbs

There have been efforts in recent years to encourage the use of compact fluorescent bulbs in various funding programmes around the world. In 2008, the Cuban government distributed bulbs of this type to Jamaica's poorest households. Despite the efforts, many such initiatives have not been sustainable. Many clients have expressed disappointment with low-quality compact fluorescents, which provide less intense light after being used a short time, or fail long before fulfilling their expected lifetime.

Once compact fluorescents have gained a significant share of the market, the Jamaican government should consider a total prohibition on importing incandescent bulbs. This idea was first proposed in Australia, and has been adopted by the Government of Ireland. In 2006 and 2007, Cuba implemented a complex programme for the gradual elimination of incandescent bulbs, which consisted of prohibiting their sale and replacing installed incandescent bulbs with compact fluorescents.

Outdoor public lighting

Public lighting can also be a source of concern, since it constitutes a drain on public budgets. In 2007, 90,000 bulbs used for public lighting in Jamaica consumed 66 gigawatt hours of electricity. In cooperation with JPSCo, the government is reducing energy consumption by replacing mercury vapour bulbs with more energy-efficient types of lighting.

4. Transportation

In 2005, Jamaica's transportation sector (including maritime and air transport) used on the order of 9.5 million barrels of oil—one third of the country's total consumption. The amount of oil used for road and rail transport is comparable to the volume used to generate electricity for the public grid (i.e., excluding self-generation by the bauxite and other industries). The demand for oil is constantly rising.

Between 2004 and 2005 there was a particularly pronounced increase of nearly 1.5 million barrels. Almost two thirds of the total was used for road and rail transport, although rail plays a secondary role in this regard. The remaining amount was divided equally between air and maritime transport.

The road sector's consumption is divided almost equally among 87-octane unleaded gasoline, 90-octane unleaded gasoline and diesel, which is used primarily for buses and trucks, since there are relatively few diesel passenger cars. Reliable statistical information is not yet available to show how the transportation sector and fuel consumption were affected by the marked increase in oil prices before and during the first half of 2008. Preliminary data suggest that oil consumption fell approximately 10%.

It can be assumed that Jamaican drivers, like drivers in most industrialized countries, reduced the distances they drove. In the last quarter of 2008, prices at the refinery declined from more than J$ 70 per litre (for 90-octane gasoline) to a mere J$ 50 per litre.

The vehicle fleet

In March 2006, some 537,000 vehicles of all types were registered in Jamaica. This included 374,000 automobiles and 128,000 trucks. In 2005, over 74,000 vehicles were registered for the first time. Barely one quarter of all the automobiles and light commercial vehicles (including pickup trucks and sport utility vehicles) were new, while the rest were second-hand imports, primarily from Asia. The number of used-vehicle imports dropped considerably in the late 1990s, when standards were established to limit maritime shipping of older automobiles, and import tariffs were increased.

A new import policy, which has been in effect since July 2004, further limited the age of vehicles imported (three years for automobiles and four years for light commercial vehicles). Despite high import duties for automobiles with large engines, Jamaican buyers do not necessarily turn to smaller automobiles, and they place less importance on engine size and fuel consumption than on other features. The cost of annual licensing also depends on engine size and does not take fuel consumption into account. Small automobiles with average specific consumption of under 6 litres per 100 kilometres are still uncommon. The average consumption of passenger automobiles overall is 10 litres or more per 100 kilometres.

Rail system

Although Jamaica has 334 kilometres of track operated by the Jamaica Railway Corporation (JRC), only 92 kilometres are currently being used—for the bauxite industry—and no passenger trains are in service. The system has the capability of using 292 kilometres, with the longest route being the 181-kilometre stretch between Kingston and Montego Bay. The second major line, between Spanish Town and Port Antonio, would require extensive work to be returned to service, and the Bog Walk Junction to Port Antonio section (87 kilometres) would need to be rebuilt. In addition to the public rail system, some bauxite industry firms operate their own railway systems, which total roughly 100 kilometres.

It may not be economically viable or reasonable to restore the entire railway system to service for regular passenger transport. Given Jamaica's relatively short distances, a modern bus-based system could be as rapid and efficient as railways and have greater flexibility.

5. Energy efficiency in buildings

The construction sector is one of the principal end users of energy in Jamaica. This is markedly true in the case of commercial buildings and service facilities that have refrigeration systems and major artificial daytime lighting needs. Taking into account climatic factors during the designing and building process could contribute greatly to reducing the electricity needed for refrigeration and lighting, and thus decrease energy consumption.

Since Jamaica's average temperature is relatively high and solar radiation is intense, pleasant interior conditions can be achieved, in part, through architectural solutions that exploit building design, selection of materials and use of natural ventilation and light-control devices. In most cases, however, additional technical measures are needed to produce satisfactory interior conditions for all climatic situations.

Jamaica's Energy Efficiency Building Code (EEBC)

Jamaica's national standards agency introduced an initial Energy Efficiency Building Code (EEBC) in 1994, following the model of the American Society of Heating, Refrigerating and Air-

Conditioning Engineers (ASHRAE). The code is a voluntary set of guidelines, and there is no mandate that its requirements be met as a condition for obtaining a building permit.

Annual energy saving from compliance with the EEBC was estimated at 30% for large office buildings and up to 36% for smaller buildings. The estimated reduction of the maximum refrigeration burden was 24% and 29% of the reference figures, respectively.

In cases where the strongest efficiency measures are implemented, improvements could save more than 50% of the reference figures, exceeding even the EEBC requirements. The EEBC standards were highly effective in terms of cost at the time the Code was published, when 1.2 years was the period projected for recovering the investment involved in implementation for the largest office buildings, with 2.6 years being the corresponding time period for smaller office buildings. Compliance with EEBC standards is ensured in a number of ways, including the following:

- The regulatory approach: All elements of a building, including the exterior, natural and artificial lighting, air conditioning and ventilation, electric power and water heating, must meet specific standards. The code also offers the alternative of using system performance criteria for the building exterior, based on overall thermal transmission values, which are separate for roofs and walls, allowing for some flexibility in design.
- The energy budget or cost of energy approach: The consumption or energy costs are calculated for the entire building, with each value required to be below a specified maximum.

Both methods require extensive knowledge on the part of architects, builders and the agencies responsible for granting building permits and enforcing compliance. Given an absence of greater detail, it may be assumed that the EEBC has contributed, in the best cases, to promoting awareness among architects and engineers. However, this has had little impact, to date, on actual building and remodelling processes. The agencies responsible for permits lack the personnel and knowledge needed to evaluate the energy consequences of architectural designs.

The National Standards Office has begun the process of updating the EEBC, based on the stricter standards promulgated by ASHRAE in the United States in 2004. This update will apply to all commercial buildings and the largest service facilities consuming energy for air-conditioning and lighting, but will not establish standards for residential construction.

E. Lessons learned

It is clear that disseminating more specific information for professionals (e.g., in the form of manuals or guides) and for the general public (in the form of one-page fliers) could be useful in achieving greater energy savings on lighting in Jamaica. Consumers should be informed of the different types and qualities of compact fluorescent bulbs available on the market, and on how to dispose of them properly when they are discarded. Given that these devices contain small quantities of mercury, a reliable system for collecting and recycling them should be in place.

Architects, lighting designers and other professionals should be informed of the tools and means available for effectively designing lighting systems that consume the least amount of electricity possible. All government and community entities should set a precedent by purchasing only high-quality compact fluorescents for lighting. As in other sectors of consumption, major sustainable results could be achieved by combining different measures within the framework of a programme focused on medium-term savings and clear objectives, such as a 20% reduction in the electricity used for lighting from the reference value in a given period.

These measures could include regulatory initiatives, voluntary projects and promotional activities directed at households, the commercial and services sectors and public institutions. An analysis should be conducted on exempting compact fluorescent lamps from import tariffs and other taxes. Through competitions to spotlight the best implementations, and with the dissemination of

accompanying information, public and professional attention would be focused on different aspects of large-scale lighting.

Specific training courses, possibly in collaboration with the University of the West Indies or Jamaica's University of Technology, could promote the training of architects, planners, technical personnel, those in charge of energy resources research and large consumers of electricity (including hotel managers). The government, and perhaps JPSCo, could encourage the marketing of energy-efficient bulbs by purchasing them in large quantities, which would allow them to obtain lower prices for end consumers (particularly public institutions). The Green Light programmes in Europe, and similar programmes in Australia and New Zealand, are notable models in this respect.

In 2005, the Jamaican government published the draft of a national transportation policy that included a chapter on energy saving and environmental protection. Although most of the policy recommendations regarding more energy-efficient transportation are good, they have yet to be implemented. Despite some past progress, it is clear that the public transportation system needs improvement and strengthening.

Broader acceptance by users and by owners of private vehicles can only be achieved through modernization of the transportation fleet, providing daytime and night-time service that functions regularly in metropolitan areas, unified bus routes, a common ticketing system that allows for transferring between different lines, preferential treatment via separate road lanes in places where there is traffic congestion, and priority signal controls at traffic lights.

Buses must be comfortable, safe and easily accessible to users of all ages, the disabled, and those travelling with small children or baggage. Many buses used in Kingston today are more suited to travel in outlying areas than to urban service. A stronger relationship between passengers and the public transportation system can be promoted through prepaid monthly or annual passes, which are especially attractive for people who use the same route to travel to work on a regular basis.

Passes that are purchased by companies or employers, which then sell them to their staff at preferential prices, have been successful in some European countries. Altering traffic patterns, especially in congested urban areas, also necessitates discouraging the use of private vehicles, e.g., by reducing the amount of parking available and by charging for parking on public streets within the city centre. Since the current system of import duties and licenses is not having any visible effect in turning consumers away from large vehicles that clearly are intensive energy consumers, tariffs should be revised and increased for the most expensive segment of vehicles, while offering greater incentives for purchasing smaller and more efficient models.

This objective could also be achieved by increasing fuel taxes (currently J$ 7.7 per litre for 90-octane gasoline) to favour automobiles that consume less fuel. Fuel prices in Jamaica are mid-range for the region's countries. In November 2006, the average retail price of gasoline was US$ 0.82 per litre, as compared with US$ 0.63 in the United States, US$ 0.70 in Panama, US$ 0.89 in Grenada and US$ 1.11 in Barbados.

Since engine size is only an approximate indicator of fuel consumption, the government could also evaluate the possibility of implementing duties based on emissions of anhydrous carbon dioxide—at least for all imported vehicles—since these emissions are directly related to fuel efficiency. Consideration could also be given to exempting highly efficient automobiles (e.g., those that consume less than 120 grams of anhydrous carbon dioxide per kilometre, equivalent to a yield of 5 litres per 100 kilometres) from licensing fees for a set period, in order to promote the introduction of this type of automobile to the market.

On the other hand, the oldest and most inefficient automobiles could be prohibited from using the streets, with incentives to encourage their gradual elimination (scrapping) through a single payment, perhaps in combination with a preferential pass for public transportation. Automobile dealers should provide their clients information on fuel consumption and anhydrous carbon dioxide emissions for new and used automobiles. Moreover, customs officials should require that this

information be provided with all automobiles entering the Jamaican market. Most automobile manufacturers in the world market already have this information and apply standard sets of tests (such as those in use in the European Union).

It is also advisable that the government (or government agencies) report vehicles' fuel consumption through targeted campaigns that cite data widely available on the Internet, and that they compel automobile dealers and importers to provide equivalent data in all of their marketing activities.

The European Union anticipates that labels for automobiles, similar to those on household electrical appliances, will lead to a reduction in fuel use of between 4% and 5% as consumer awareness increases. As a later step, the Jamaican government, preferably in coordination with other countries in the region, could consider introducing its own automobile label citing comparisons, e.g., comparing a vehicle's anhydrous carbon dioxide emissions with the average for similar vehicles on the market. This could increase consumer awareness of the environmental impacts of automobile use.

Poorly functioning engines use more fuel and produce unnecessary emissions that pollute the air. Thus, certified facilities should inspect vehicles periodically—more often for old vehicles than for new. Some case studies in Brazil have shown that simply changing air filters in bus engines considerably reduces fuel use.

Jamaica's Transport Authority, which is responsible for the functioning of a fleet of over 20,000 buses used in public transportation, should continually monitor each vehicle's fuel use and purchase only new, highly energy-efficient buses equipped with modern fuel-saving technology. Investment plans could help to select the buses to replace, based on excessive fuel costs that make them uneconomical compared with new vehicles.

Public awareness campaigns on energy efficiency in transportation, as well as driver training programmes, can promote more conscious behaviour and better understanding of the issues, but, compared to regulation, these measures are merely cosmetic in nature. Adding ethanol to gasoline, to replace the octane enhancer MTBE, has more to do with diversifying resources than with boosting energy efficiency. Initially, ethanol will be imported primarily from Brazil, until the domestic sugar industry is able to produce sufficient quantities at reasonable and competitive prices.

The effect of this on consumer prices will be minimal, especially if oil prices remain around US$ 50/barrel or less. A significant effect on the national economy can only be expected with higher oil prices, and with the introduction of much larger quantities of ethanol, preferably from local production. Moreover, nearly one half of fuel consumption in the transportation sector is attributable to diesel vehicles. This segment includes trucks, buses and, reportedly, a high percentage of ships. The percentage of consumption in the form of diesel could even increase if government policy induces a rise in the number of diesel automobiles imported into the country.

Thus, the government must also address the fuel consumption of diesel engines, especially in vehicles used for public transportation (passenger traffic) and for transporting products. The introduction of biodiesel from domestic production is still at a very early stage, and much research and preparatory work will be necessary before substantial quantities can be placed on the market. In addition to measures targeting the vehicle fleet, infrastructure improvements could reduce the energy intensiveness of the transportation sector.

This includes improving the pavement of streets and highways (especially in rural areas and outlying urban areas) to make roads safer for smaller vehicles, and changing urban planning schemes, which should favour intra-urban development with short-distance roads over new shopping centres and housing in peri-urban areas, which often are accessible only by individual modes of transportation. The possibility of introducing higher parking fees in the central areas of cities, and restricting the space available for parking, in order to further encourage the use of public transportation could also be assessed.

The ideal option would be to establish general energy performance standards for buildings, with energy consumption indicators that apply to building exteriors and to certain technical equipment

used for providing energy, since this would give designers more freedom to choose among different ways of meeting the requirements. Currently, it is preferable to set standards in terms of individual efficiency requirements (normative values) for each of the main components of a building. Applying energy efficiency standards to all types of buildings in Jamaica is problematic. Strict enforcement would require the minimum EEBC standards to be legally binding and mandatory.

Given the complexity of the code, compliance at this stage can only be ensured by building designers, and effective pre-construction controls by local authorities is not feasible. Energy inspection of a building, once finished, is useful only with regard to the most visible elements, since failures in insulation generally cannot be detected. A more flexible alternative could be to select the largest and most energy consuming buildings for more thorough inspection, and to designate inspectors (or private independent auditors) at the national level to carry out the inspections.

A more promising approach could be to reward buildings whose energy performance significantly exceeds the minimum standards required by the EEBC (which could be verified through certification by independent experts). This would be a strong incentive with respect to buildings of high public value, such as tourist complexes, hospitals, educational institutions, etc. Construction of such buildings could also be encouraged by facilitating easier access to credits (and perhaps lowering the cost of credit for such cases). Best practices and demonstration buildings should also be encouraged, and should receive extra financial and promotional support to increase the chances of their appearing on the market. The modified version of the code should include provisions on solar water heaters—an element absent from the 1994 version.

Consideration should also be given to making installation of these heaters mandatory, in order to ensure that a specified amount of solar water heating is present in all facilities with significant hot water use, such as hotels, restaurants, hospitals, sports centres and certain industrial facilities. Mandating solar hot water heaters is a common practice in Spain (where it is required for new residential buildings), Israel, Mexico City and in other countries and regions. To prevent poorly functioning, low-cost equipment from entering the market, complete solar radiation collectors or complete systems (including equipment for the storage phase) should be certified under international standards.

A similar approach could be adopted for air conditioning systems powered by solar energy, if such equipment proves reliable and cost-competitive. Moreover, new-building designs should always allow for subsequent installation of solar systems on flat or sloped roofs, and should provide for adequate hot or cold water pipes inside the building.

During a certain period, decentralized cogeneration systems for buildings that generate heat and electricity could be an attractive option, especially if the security of the energy supply requires a degree of independence from the central network. The heat from the exhaust gases could be used directly to produce hot water or for air conditioning systems. More attention must be given to existing buildings, particularly with respect to roof insulation, use of hermetically sealed windows, additional measures for light control, greater use of natural lighting and seals to prevent loss of air (where air conditioners are present).

In this context, it would be useful to evaluate the possibility of conducting mandatory studies on energy use (audits of buildings), at least for constructions with significant electricity or other energy consumption. Improvement can be encouraged by preferential loans and information campaigns on all energy-related aspects of building.

XVIII. Mexico

A. Recent advances in policy, regulatory and institutional frameworks

In November 2007, the Government of Dr. Felipe Calderón, through the Secretariat of Energy of the Mexican Government (SENE), published the 2007-2012 Sectoral Energy Programme. In chapter III (Energy efficiency, renewable energy sources and biofuels), item III.1 (Energy efficiency), it sets forth as an objective the promotion of efficient energy use and production. It also incorporates electricity saving indicators and saving targets (in gigawatt-hours) for the year 2012, doubling those recorded in the base year of 2006.

The objectives listed in item III.1 of chapter III in the Programme include eight strategies and the corresponding guidelines: 1) Propose financial mechanisms and policies for accelerating the adoption of energy efficient technologies by the public and private sectors; 2) Encourage the offices and agencies that make up the Federal Public Administration to optimize their energy supplies and the use of energy; 3) Expand coordinated actions involving the public, social and private sectors in order to promote efficient energy use by the population; 4) Support the reduction of energy consumption in the residential sector and in all buildings; 5) Promote the efficient generation of electricity through cogeneration and on-site production; 6) Integrate public policy proposals that encourage realization of the potential of efficient cogeneration; 7) Advance a set of provisions that will allow the Energy Regulation Commission (CRE) to expand and reinforce its powers to regulate and promote efficient cogeneration; 8) Support research on boosting efficiency in electricity generation, distribution and consumption.

The full document can be obtained at: www.sener.gob.mx, link "Planeación estratégica", Undersecretariat of Energy Planning and Technology Development.

As of 28 November 2008, when the Law on the Sustainable Use of Energy[16] was published, the National Commission for Efficient Energy Use (CONUEE) was officially established. Under this law, all human and material resources previously assigned to the National Commission on Energy Saving (CONAE) are now allocated to the new Commission.

[16] See electronic annex to this report. "Opinion of the Energy and Legislative Studies Committees at the request of the National Action Party on sustainable use of energy".

In addition, the opinion of the Energy Committee on the summary of the draft decree enacting the Law on the Use of Renewable Energy Sources and the Financing of the Energy Transition[17] was published on 28 October 2008.

B. Key actors in energy efficiency and their effective roles

The main actors involved in energy efficiency in Mexico are the following:

1. National Commission for Efficient Energy Use (CONUEE) (formerly the National Commission on Energy Saving, CONAE) (www.conuee.gob.mx)

The National Commission for Efficient Energy Use (CONUEE) (formerly the National Commission on Energy Saving, CONAE) is a decentralized administrative agency of the Secretariat of Energy of the Mexican Government that enjoys technical and operational autonomy. Its objective is to be available to the offices and agencies of the Mexican Federal Public Administration, as well as state and municipal governments and private parties, for technical consultations on the efficient use of energy and the utilization of renewable energy sources.

The CONUEE's responsibilities include:

Regulatory activities

1. Implement the register of individuals or institutions that have obtained a certificate as a responsible energy user;
2. issue binding opinions for offices and agencies of the Federal Public Administration concerning best practices in sustainable energy use;
3. make recommendations to states, municipalities and private parties concerning best practices in sustainable energy use;
4. develop a programme targeted to private entities for the purpose of promoting the certification of processes, products and services and overseeing the execution of voluntary processes for improving energy efficiency;
5. order on-site inspections, require the submission of information and oversee persons carrying out activities related to the sustainable use of energy in order to enforce the applicable legal provisions, within the area of their expertise.

Public policies on sustainable energy use

1. Promote the optimal use of energy, from extraction to consumption;
2. formulate and publish methodologies for quantifying GHG emissions caused by the extraction, production, transformation, distribution and consumption of energy, as well as emissions avoided by incorporating actions for the sustainable use of energy;
3. formulate and publish methodologies and procedures for quantifying energy use and determinating the economic value of consumption, as well as that of processes avoided because of the sustainable use of the energy consumed.

[17] See the electronic annex to this report. "Opinion of the Energy Committee on the summary of the draft decree enacting the Law on the Use of Renewable Energy Sources and the Financing of the Energy Transition".

Promotion and publicity:

1. Prepare and publish books, catalogues, manuals, articles and technical reports on the work of the Commission;
2. publish in scientific publications the results of projects and studies carried out to promote the sustainable use of energy;
3. provide technical advice on the sustainable use of energy in offices and agencies of the Federal Public Administration, and provide similar advice to state and municipal governments that request it, signing the appropriate agreements;
4. participate in the dissemination of information among production, government and social sectors.

Information and evaluation:

1. Implement the National Subsystem of Information for Sustainable Energy Use;
2. implement and update the information on sustainable energy use funds and trusts that have been set up by the Federal Government, receive federal funds, or are guaranteed by the Federal Government.

The mission of the CONUEE is to coordinate, promote and support the development of markets and systems that make possible the sustainable use of energy resources in Mexico. Among its basic functions are: a) to draft, update and enforce the Mexican Official Standards on energy efficiency and renewable energy sources; b) to grant technical assistance; c) to promote projects for energy efficiency and renewable energy sources; and d) to design national programmes for energy saving, efficient energy use and the utilization of renewable sources.

The CONUEE is developing the following programmes:

For state, federal and municipal governments:

2009 Programme

Protocol of activities for implementing energy efficiency measures in buildings, vehicle fleets and facilities of the Federal Public Administration.

State and municipal governments

The CONUEE's strategy for assisting states and municipalities involves developing institutional capacities for identification, analysis and implementation of programmes, projects and actions on energy efficiency and the utilization of renewable energy sources at the state and municipal levels.

Other CONUEE programmes include:

- Large corporate entities
- Small and medium enterprises
- Efficient transportation
- Cogeneration
- Standardization (issuing and enforcing energy efficiency standards)

All of these can be researched quickly on the CONUEE website.

The effective role of the CONUEE (formerly the CONAE) has been and continues to be very significant. From the beginning of its activities (1989), it has played a fundamental role in the development of energy saving programmes and projects in all of the country's socio-economic activity sectors.

2. Secretariat of Energy of the Mexican Government (SENER) (www.sener.gob.mx)

The mission of the Secretariat of Energy of the Mexican Government (SENER) is to direct the country's energy policy within the current constitutional framework in order to guarantee a competitive, adequate, high-quality, economically viable and environmentally sustainable supply of energy for the development of national life in Mexico.

Its vision encompasses firm support for the efficient use of energy and for technological research and development, with strong backing of alternative energy sources and reliable energy supplies.

As indicated in 1) "Recent advances ...", the SENER has prepared the 2007-2012 Sectoral Energy Programme[18] with objectives and strategies for promoting energy efficiency.

The effective role of the SENER with respect to energy efficiency is to take the lead in energy policy decisions, allowing the operational actors to develop specific projects.

The Mexican Government, through the President and the Secretariat of Energy (SENER), launched the pilot programme "Let Us Save Energy to Live Better" on 1 July 2008 with the goal of replacing low-efficiency, obsolete refrigerators and air conditioners. During the experimental phase, this programme was implemented in 11 municipalities in three different states: Quintana Roo, Sonora and Sinaloa, where 11,000 refrigerators and an equal number of air conditioners were replaced, and 152,000 energy-saving bulbs were installed.

This programme led to the subsequent initiative "Programme for the Replacement of Household Appliances to Save Energy".

On 7 January 2009, the President of the Republic, Felipe Calderón Hinojosa, during the presentation of the *National Accord to Benefit the Economy and Employment*, mentioned the replacement of household appliances in order to support low-income families.

The Programme for the Replacement of Household Appliances to Save Energy seeks to replace refrigerators or air conditioners that are ten or more years old with new energy-saving appliances. In this way, the Federal Government will help low-income Mexican families save energy, spend less on electricity and obtain new appliances.

The programme announced by President Calderón confirms the Federal Government's commitment to healthy family budgets.

To obtain information on the Programme for the Replacement of Household Appliances to Save Energy "Trade Your Old One for a New One" in your location, go to the Internet portal: www.energia.gob.mx.

Information can be obtained there on the following topics:

- Types and amounts of support provided by the programme
- Features of the refrigerators and/or air conditioners that can be purchased
- List of items and prices
- Stores participating in the programme

[18] See document in electronic annex - Mexico.

Customers of the Federal Electricity Commission (CFE) or Central Light and Power who have refrigerators or air conditioners in their homes that are ten or more years old may go to the participating store of their preference to find out if they qualify for the programme.

The Programme for the Replacement of Household Appliances to Save Energy, which is one of the commitments made in the National Accord to Benefit the Economy and Employment, has already benefited more than 25,000 families.

The programme provides the following support or assistance:

Type of support

There are two types of support, direct and financial:

- Direct support consists of a free voucher to be used to cover the price of the appliance and the costs of transporting, storing and destroying old appliances.
- Financial support consists of a low-interest loan over a four-year term on which customers will make payments in their electricity bills.
- A customer may receive both direct and financial support or just financial support, depending on the level of consumption.
- Under no circumstances is a customer required to accept financial support.

Information on support

- Amounts.
- Features of refrigerators that can be purchased.
- Features of air conditioners that can be purchased.

3. Trust for Saving Electricity (FIDE) (www.fide.org.mx)

The mission of the Trust for Saving Electricity (FIDE) is to encourage the saving and efficient use of electricity so as to contribute to economic and social development and the preservation of the environment. For this purpose, it applies a strategy aimed at overcoming barriers that hinder the integration of innovative technology and market transformation, with a view to creating a ntural market for appliances, services and financing that promote the saving of electricity.

The objectives of the FIDE are:

1. Participate with the Federal Government and the electricity sector in achieving the objectives of the National Development Plan and the National Climate Change Strategy.
2. Promote the Residential Electricity Saving Finance Programme at twice the level of its initial phase.
3. Provide technical and financial support for industry and SMEs representing 60% of national electricity consumption.
4. Contribute to the SENER-SEMARNAT project to replace conventional light bulbs with CFLs on a large scale by 2012, with FIDE Seal specifications and a CFE-NAFIN financing model, and support the authorities in defining the necessary methodology.
5. Promote the Model Municipality Programme for energy efficiency in order to improve municipal lighting, pumping and utility systems.

6. Collaborate with the National Worker Housing Fund Institute (INFONAVIT) – Green Mortgage on a pilot programme for building sustainable low-income housing.
7. Develop an incentive programme for high-efficiency electric motors, commercial and building lighting (10% market share, 80,000 motors, 3 million linear lamps).
8. Register electricity-saving projects and programmes in the Clean Development Mechanism through the Mexican authorities.
9. Participate in a National Energy-Saving and Environmental Improvement Campaign directed by the Federal Government.
10. Contribute to the development and updating of the Mexican Offical Standards (NOM) required for energy efficiency in lamps, air conditioners, refrigerators and motors.

The FIDE is developing the following programmes:

Pilot programmes

These are programmes designed to demonstrate the technical feasibility and profitability of widely implementing electricity-saving measures for environmental protection by using efficient technologies, with the participation of the main agents involved in this field, including manufacturers, distributors, chambers, organizations and housing developers.

There are two pilot programmes: the LED Programme and the Residential Programme.

The Light Emitting Diode (LED) Programme promotes the use and marketing of these products, evaluating promotion mechanisms so that a nationwide programme can be designed and implemented.

At present, the FIDE is supporting the Programme to Introduce the Use of Light Emitting Diodes (LED) in order to optimize lighting systems. Not only is this a good investment, but it guarantees a high level of reliability and low operating costs. It should be noted that LEDs yield savings of up to 90%, and they last between 60,000 and 100,000 hours. In addition, they benefit users financially by reducing costs.

The programme is targeted exclusively at the Business and Services Sector and is open to all manufacturers and distributors of LEDs and customers who want to replace inefficient lighting technologies with LEDs in a technically and economically viable manner.

The Residential Programme has four subprogrammes or branches: Sustainable Housing, Electricity-Saving Measures, Sustainable Housing Support Programme, and Ecological Housing Programme (Green Mortgage).

The objectives of the Sustainable Housing Support Programme are:

- Build dwellings according to electricity saving criteria so as to provide better quality and comfort for Mexican families with minimum electricity consumption through the use of high-efficiency appliances.
- Apply energy-saving measures in new housing by installing high-efficiency lights, refrigerators and air conditioners, as well as thermal insulation for home roofs.
- Persuade and support Housing Developers to build homes with electricity-saving appliances and systems as an integral part of construction. Encourage the participation of institutions, chambers and organizations that promote housing construction.

Energy-saving lamp programme

The FIDE and the CFE have jointly developed the Energy-Saving Lamp Programme in the National Housing Sector. Accordingly, they have replaced 26.3 million incandescent light bulbs with Compact

Fluorescent Lamps (CFL), for the benefit of 4.5 million customers. This action has resulted in a saving of up to 70% in household electricity consumption for lighting.

The CFLs distributed under the FIDE-CFE programmes for the past 16 years meet specifications that give them a useful life of up to 10,000 hours, assuring our customers of the highest-quality products bearing the FIDE Seal.

The principal manufacturers have increased the number of models of CFLs bearing the FIDE Seal to guarantee their customers the highest standards of quality in the products they purchase.

My Tortilla Programme

The general purpose of this programme is to support the modernization of the cornmeal and tortilla industry so that high operating costs will not raise the price of the final product.

Motivations for implementing the programme

- Outdated technology: high consumption of energy, water and gas
- Limited technological innovation or development
- Little value added and concentration on a single product
- Unhealthy and unattractive facilities
- Limited banking activity and financing of the industry
- Persistence of the informal economy
- Low administrative and business management capacity
- Poorly trained personnel

Specific objectives

- Achieve a modern, well-organized industry
- Increase the profitability of making tortillas, cutting production costs by adopting new technologies
- Produce a high-quality, nutritious and healthful product that complies with regulations, standards and best practices
- Prevent pollution by reducing the consumption of electricity, thermal energy (gas) and water
- Adopt an approved image

These objectives are multidimensional and all-encompassing, since they include technological development, market organization, energy saving, reduction of polluting emissions, an improved image and compliance with health practices. The success of this programme will have a positive impact on competitiveness and innovation in the industry.

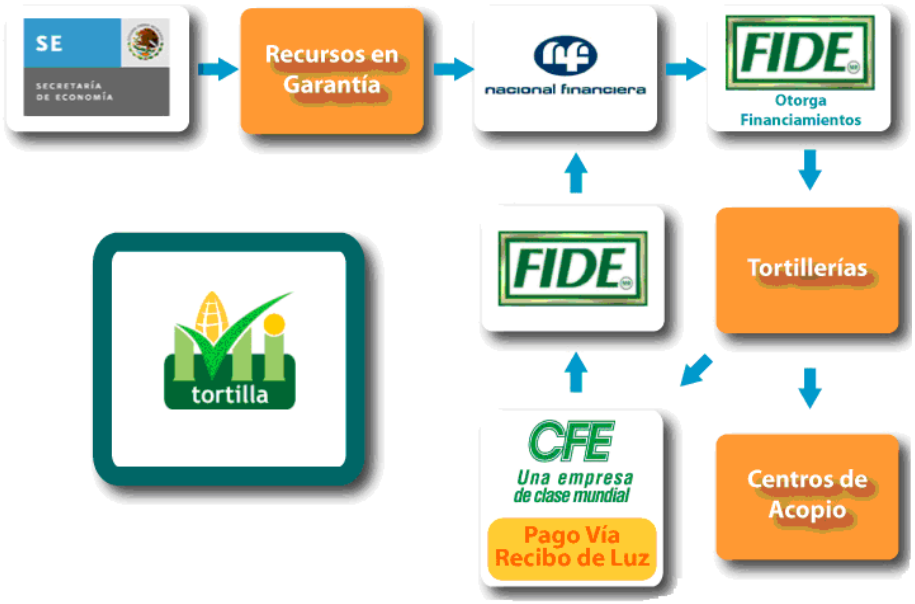
Programme strategy

The strategy for modernizing the cornmeal and tortilla industry is threefold, encompassing administrative, commercial and technological modernization. Two support mechanisms have been put in place to implement this strategy:

- **Management training:** business owners will participate in group training and "in situ" consultations. These methodological procedures will give business owners participating in the My Tortilla Programme competitive intelligence tools that will enable them to make more informed decisions in adopting the administrative, business and technological improvements that will enhance the profitability and competitiveness of their businesses.

- **Access to preferential financing:** The My Tortilla Programme provides access to financing for business owners who need to replace obsolete equipment with energy-saving devices in order to reduce emissions and improve their cost structure.

FIGURE 23
OPERATIONAL FLOWCHART



Source: Presentation of the FIDE programme, "Modernization of the Cornmeal and Tortilla Industry, 'My Tortilla'".

The FIDE has four main programmes aimed at four other sectors: a) Industry, b) Business and Services, c) Municipalities and d) Technology Applications.

The financing offered by the FIDE has different characteristics, depending on the sector involved:

a) The financing offered by the FIDE is oriented towards replacing inefficient equipment with high-efficiency equipment and carrying out projects for automation, demand management, remote monitoring, implementation of energy-efficient equipment or machines and optimization of processes.

b) FIDE financing for the Business and Services Sector is aimed at replacing inefficient equipment with energy-efficient equipment that will reduce the costs of billing for electricity and boost companies' productivity and competitiveness. This credit can be used to replace inefficient equipment in currently operating facilities, purchase efficient equipment for new facilities and replace chiller-type cooling systems.

c) In the Municipalities Sector, technical advice is provided for the application of "New Technology". Participating municipalities receive information on negotiating for and purchasing efficient products and obtaining financing for contracts to supply and install energy-saving equipment for pumping potable water, public lighting, traffic lights with LEDs, and municipality-owned premises, properties and buildings.

d) In the Technology Applications Sector, the FIDE supports the development of technology applications that make it possible to identify new technologies that promote electricity saving and efficiency. It encourages the use of these technologies and finances projects

with a major impact on the national market. Support for such projects can be obtained by industries, businesses, services and municipalities.

More information on the institution, the development of programmes, financing policies for electricity-saving projects, statistics and so forth can be obtained at www.fide.org.mx.

The effective role of the FIDE has been and is absolutely critical for the development and sustainability of a market for efficient electrical equipment in Mexico, with the accompanying technical, economic and environmental benefits.

4. Petróleos Mexicanos (PEMEX) (www.pemex.com)

Petróleos Mexicanos is the largest enterprise in Mexico and Latin America, and the country's greatest source of revenues. It is one of the few oil companies left in the world that is involved throughout the chain of production, from exploration to distribution and marketing of final products.

PEMEX operates through a corporation and four subsidiary entities:

- PEMEX Exploración y Producción [exploration and production].
- PEMEX Refinación [refining].
- PEMEX Gas y Petroquímica Básica [gas and basic petrochemicals].
- PEMEX Petroquímica [petrochemicals].

Since the beginning of this century, PEMEX has received the cooperation of first the CONAE and then its successor the CONUEE in designing and developing energy efficiency programmes. PEMEX has an Institutional Programme for the Efficient Use and Saving of Energy which has been in place since 2001. It has achieved important outcomes in terms of reducing electricity, water and fuel consumption, with the consequent reduction of GHG emissions.

The programme includes a Permanent Campaign for the Efficient and Rational Use of Energy, whose goal is to systematically reduce the Energy Consumption Index (ECI) in PEMEX's processes and business units.

Since 1999 PEMEX has been in the vanguard of the world petroleum sector in publicly acknowledging the phenomenon of climate change and the preponderant role of fossil fuel consumption in that phenomenon, and in emphasizing the need to take action. Today Petróleos Mexicanos is convinced that climate change is the principal development challenge facing the world.

As part of PEMEX's public mandate to meet the country's demand for fuel, it is striving to make the energy supply less GHG-intensive. For this reason, in 2008 PEMEX continued the implementation of a variety of projects designed to reduce emissions, the most noteworthy of which are those pursuing energy efficiency, cogeneration, methane emission reduction, improved CO_2 recovery and reduced gas burn-off.

Some of these projects are being carried out under the aegis of the Clean Development Mechanism (CDM). Their implementation will yield important reductions in GHG emissions into the atmosphere.

PEMEX believes it is also necessary to take action to reduce emissions in its supply chain and in the final consumption of our fuels, which is why it will be initiating activities for this purpose in 2009.

By the same token, it is necessary to develop a new mechanism for evaluating projects that incorporates the cost of the carbon emitted by their operations. This will make it possible to allocate resources for the best reduction alternatives in a cost-effective manner.

In 2008 there was an increase in PEMEX's GHG emissions, mainly because of the burn-off of natural gas with a high nitrogen content in offshore operations. PEMEX has an ambitious

investment programme that incorporates initiatives aimed at significantly reducing the emissions produced by that burn-off.

Cognizant of the role consumers have to play in efforts to reduce emissions in the transportation and residential sectors, PEMEX has worked to promote more awareness of climate change. On its website it provides the public with tools such as a residential ecological footprint calculator.

PEMEX sees in the current economic situation a good opportunity to confront climate change by exploring initiatives for optimizing energy consumption and promoting more responsible energy use among its customers.

PEMEX has identified the best way to coordinate mitigation and control activities in order to have a positive impact on the environment.

TABLE 17
PEMEX: FACTS AND CHALLENGES

Facts	Challenges
PEMEX generates nearly 8.2% of the country's GHG emissions.	Implementing initiatives to mitigate GHGs that produce climate change in conjunction with new environmental legislation.
CO2 emissions rose 20% over the 2007 figure because of increased burning of gas with a high nitrogen content at Cantarell.	Optimizing the use of energy in the company's production processes.
64% of GHGs come from combustion and 31% from burners.	Reducing CO2 emissions in the burn-off of sour gas with a high nitrogen content at gas deposits.
80.7% of the energy consumed was derived from natural gas, 11.9% from fuel oil and 2.4% from diesel, primarily.	Continuing efforts to reduce GHGs and implement mitigation policies and strategies.
When the new PEMEX cogeneration plants come on line, reductions will amount to an estimated 940 Mt of CO2 per year.	Continuing the marketing of Emission Reduction Certificates generated by CDM and Methane to Markets projects.
Various CDM projects will result in an estimated reduction of just over 3.3 MMt of CO2 per year.	
PEMEX chairs the Climate Change and Energy Efficiency Committee of the Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL) and co-chairs the Petroleum and Gas Subcommittee of the Methane to Markets Initiative, together with Russia and Canada.	

Source: Pemex.

C. Resources and funding mechanisms for energy efficiency programmes

The CONUEE website contains the following information about financing for sustainable energy projects (energy efficiency and renewable energy):

1. Links to financing for energy efficiency and renewable energy projects

Current situation and ideal scenario for developing sustainable energy sources in Mexico

The following paragraph describes the CONUEE's vision regarding the desired structure of the sustainable energy market:

1. Currently the sustainable energy market consists of isolated blocs of stakeholders (regulators, the private business sector and SMEs, the financial sector and ESCOs) whose decisions are not synchronized. Consequently, the maximum development potential of

this market has not been achieved. However, despite this difficulty, business and development opportunities are waiting to be seized by all participants (win-win situation). The potential benefits of developing a dynamic sustainable energy market are outlines for each stakeholder.

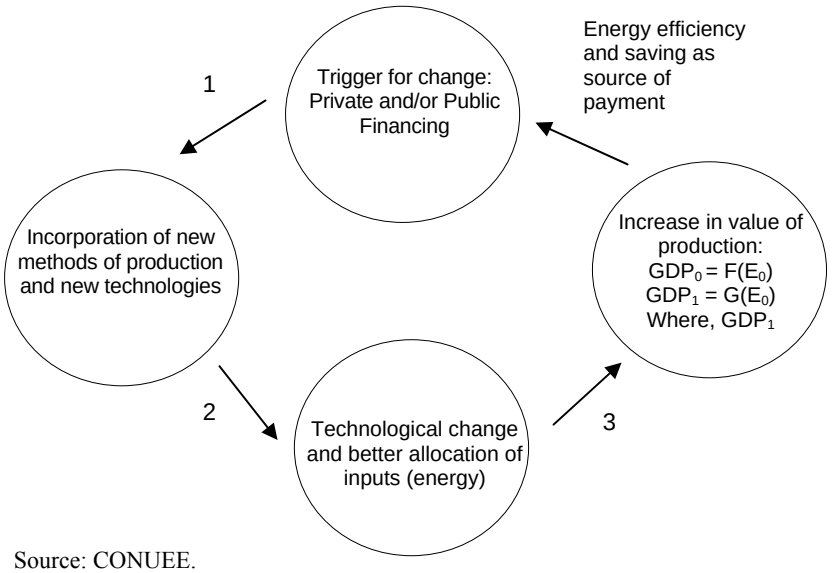
TABLE 18
DESIRABLE STRUCTURE OF SUSTAINABLE ENERGY MARKET

Energy policy managers and regulators: SENER, CRE, CONAE, Federal Government	Credit and financial institutions: Development banks and commercial banks
Improved energy use Less environmental deterioration Reduction of CO2 emissions Reduced dependency on fossil fuels and greater energy security	Creation of new businesses with high financial margins (commissions and lending rates) vs. traditional banking operations Elimination of a market defect and development of new markets
Companies	**ESCOs**
Significant savings in energy-intensive industries Improved production processes and reduced energy consumption and emissions Increased competitiveness Incorporation of technological change	High-quality energy efficiency training and technical support for industrial facilities in order to achieve substantial energy saving and clean production Creation of high-quality employment (relatively well-remunerated technical jobs) Implementation of academic programmes linked to the country's universities

Source: CONUEE.

2. CONUEE envisions participating with the banking sector (commercial and development banks) by financing projects for energy efficiency and renewable energy sources as a trigger for the development and growth of the sustainable energy market in Mexico.

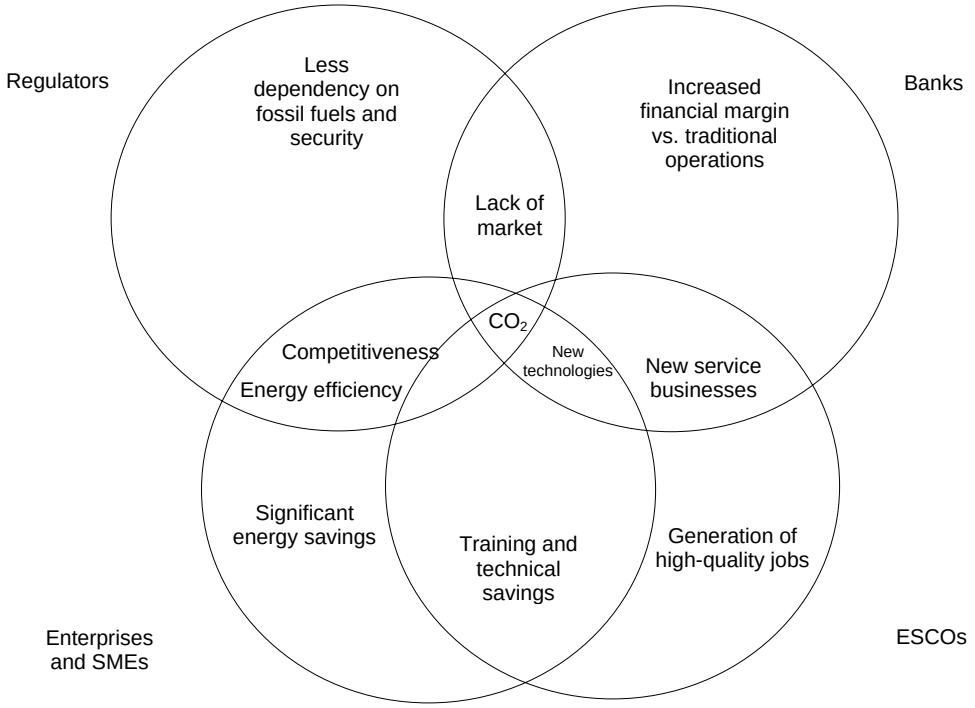
FIGURE 24
BANKS' PARTICIPATION IN FINANCING OF SUSTAINABLE ENERGY PROJECTS



Source: CONUEE.

3. Finally, the objectives and decisions of each participant would be coordinated and the sustainable energy market in our country would function properly, yielding the desired economic and environmental benefits.

FIGURE 25
INTERRELATION OF OBJECTIVES



Source: CONUEE.

All of the energy efficiency programmes currently under way in Mexico are financed by the respective operating budgets of the public entities mentioned in 2) "Key actors ..."

In the case of the FIDE, technical and economic assistance was also received from the Inter-American Development Bank to develop the Energy Efficiency Project in Mexico (ME-0204) between 1997 and 2005. The IDB furnished a loan of US$ 23,400,000, and the local partner contributed a like amount. The purpose of the project was to develop the market for energy-efficient equipment (motors, compressors, energy-efficient lamps, air conditioning, etc.). The final report of the project and the evaluation of its results can be found on the IDB website (www.iadb.org).

The IDB is currently involved in developing a technical cooperation scheme for the Modernization of the Cornmeal and Tortilla Industry Programme – My Tortilla.

D. Results of energy efficiency programmes to date

1. National Commission for Efficient Energy Use (CONUEE) (formerly CONAE) (www.conuee.gob.mx)

The CONUEE website provides information on the principal results of its activities.

- The CONUEE oversees 18 Mexican Official Standards on energy efficiency.
- It follows up on energy consumption in more than 1,500 buildings that are registered with the Energy Saving Programme of the Federal Public Administration.
- It coordinates the National Network of State Energy Commissions.
- It represents Mexico internationally on energy efficiency issues.

- Each year it awards the National Energy Saving and Renewable Energy Prizes.
- Its portal provides specialized information on energy efficiency and renewable energy.

On the CONUEE website at the link "Normas Oficiales Mexicanas, Sitios de Interés" [Mexican Official Standards, sites of interest] there is a document in table format showing the estimated savings from the application of Mexican Official Standards on Energy Efficiency from 1995 through 2006.

In 2007 the CONUEE's activities resulted in energy savings amounting to 21 million BOEs.

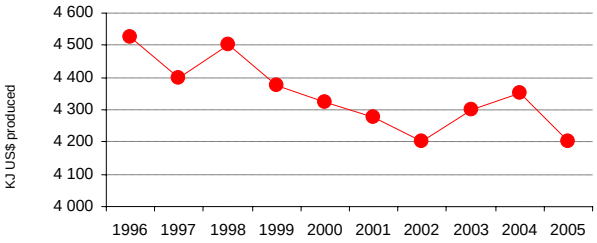
TABLE 19
RESULTS OF CONUEE PROGRAMMES

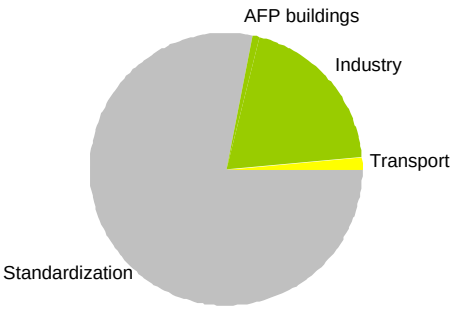
			2007	
	Results (thousands of BOE)		Equivalent (millions of pesos)	Emissions prevented (thousands of tons of CO_2)
Programme	2001-2006	2007		
Standardization	66 039	16 314	9 870	6 591
APF buildings	544	136	82	55
Public industry	23 654	3 131	1 894	1 265
Private industry	3 200	1 007	609	407
Transport	747	298	180	120
TOTAL	94 184	20 886	12 635	8 437

Source: CONUEE.

Note:
Average price per BOE = 605.00 pesos (US$ 55.00)
Emission factor = 404 Kg CO2/BOE

FIGURE 26
RESULTS OF CONUEE PROGRAMMES REDUCTION IN ENERGY INTENSITY





- Capacity avoided: equivalent to more tan two times the capacity of the Laguna Verde Nuclear Plant.
- Electricity consumption avoided: 7% of total sales of electricity in the National Electricity System.
- Consumption of thermal energy avoided.
- 50 million BOEs, more tan 15 days of national production.

Source: OLADE Presentation: Latin American Parliament, XII Meeting of the Energy and Mines Commission Report on the Energy Efficiency Policy in Latin America and the Caribbean – 9 July 2009.

The best source of detailed information on activities of the CONAE-CONUEE programmes is the annual activity reports, in this case the 2007 Activity Report[19] (the latest one available on the website).

2. Secretariat of Energy of the Mexican Government (SENER) (www.sener.gob.mx)

The SENER has launched a pilot programme titled "Replacement of Household Appliances to Save Energy", whose results have not yet been evaluated.

3. Trust for Saving Electricity (FIDE) (www.fide.org.mx)

The energy saving and efficient use of energy actions financed by the FIDE yielded savings of 491 GWh in consumption and 6.8 MW in demand as of March 2009. Thus, the consumption of 778,000 BOEs and the emission of 399,000 tons of CO_2 were avoided, thereby contributing to the elimination of global warming.

By March 2009, the cumulative savings yielded by the permanent measures was 16,363 GWh in consumption and 1,821 MW in demand, without including daylight savings time (which produced additional savings of 1,100 GWh and 850 MW in consumption and demand, respectively, in 2008).

Projects supported by the FIDE

The FIDE has provided (and continues to provide) support for energy consumers with a variety of financing plans for:

- Conducting energy audits and applying corrective measures in industrial, business and service enterprises, as well as public lighting and potable water and waste pumping in municipalities.
- Developing electricity-saving projects in micro- and small enterprises.
- Conducting energy audits in residential and commercial facilities.
- Purchasing and installing high-efficiency equipment, machinery and devices in new facilities or as a replacement for existing inefficient equipment.
- Replacing and optimizing chiller-type cooling systems, thanks to a donation from the Protocol of Montreal granted through the World Bank.

In the first quarter of 2009, 25 projects were arranged: 11 in the Industrial Sector, 3 in the Business and Services Sector, 3 in Municipalities and 8 in Small Businesses.

During that time, 1,056 energy audits were conducted in the Residential and Micro and Small Business Sectors. As of March 2009, a total of 29,793 audits had been conducted in these sectors.

As a result of the projects, for every US$ 1 million invested by the FIDE, businesses have invested an average of US$ 3.5 million of their own funds or with third-party financing.

Pilot housing programme

Within the Sustainable Housing Programme, the National Housing Commission (CONAVI), PROMEXICO and the FIDE are developing a pilot programme to build sustainable houses and are installing photovoltaic cells in low-income housing. A total of 50,000 homes are scheduled to benefit from this technology.

[19] See document in electronic annex - Mexico.

The Sustainable Housing Programme is still being promoted among developers with a view to incorporating electricity-saving measures in housing construction by installing:

- Compact fluorescent lamps
- High-efficiency air conditioners
- Thermal insulation in roofs and walls
- Double-pane or reflective-film windows
- All of the above is intended to support the INFONAVIT's Green Mortgage Programme.

Under the Green Mortgage Programme that is being carried out with the INFONAVIT, studies are being conducted to verify the 793 homes provided in the programme and to evaluate and quantify the savings generated.

LED pilot programme

- As part of the programme's efforts to introduce the use of Light Emitting Diodes (LED), early in the year loans were made to Astral Freaks S.A. de C.V. and Mega Astral S.A. de C.V., but because of market instability the two companies asked for the cancellation of the lines of credit at the end of March.
- It is important to mention that work is continuing with the meat packing company Procesadora y Empacadora de Carnes del Norte S.A. de C.V. The necessary procedures are under way, and a notarized copy of the shareholders' minutes is being obtained.
- It is also reported that two other projects have been authorized and are being formalized, one with Grupo Arkane and one with American Beef.

Large-scale programmes

Electricity-Saving Finance Programme (PFAEE)

- A line of credit with IXE Banco has been arranged so that the second stage can be launched. After the programme has been launched, a parallel effort will begin to securitize the revolving fund. Negotiations are under way with Fitch Ratings for this purpose.
- By the end of the quarter, 3.965 billion pesos in interest-free capital had been amassed, out of a total of 5.002 billion pesos.

Energy-Saving Lamp Programme

- This programme is one of a series of efforts that have been developed by FIDE-CFE, such as the Incentive, Ilumex and Discount Programmes. It is intended to market energy-saving lamps in bulk, forging alliances with chambers of industry and business, business and services associations, state governments, housing developers (the INFONAVIT Green Mortgage Programme that is being promoted at the national level) and corporations to multiply the locations where consumers can find sales and service.
- The FIDE and the CFE together have promoted the Energy-Saving Lamp Programme at different Savings Expos held throughout the country. In the first quarter, 12,504 energy-saving lamps were distributed to 4,168 users to promote a culture of electricity saving.
- In the states of Chihuahua, Coahuila, Nuevo León, Tamaulipas and Veracruz, energy-saving lamps have been promoted through businesses that serve the population in the most important cities of these states. As a result, 49,361 lamps were dispensed in the first quarter.

- The FIDE has supported the INFONAVIT Green Mortgage Programme being carried out with the country's developers by supplying 73,356 lamps so that the 8,150 homes in that programme can save electricity and derive economic benefits.
- Industry is participating in the effort to save electricity as well. For example, companies such as Bachoco have purchased 5,508 energy-saving lamps and will achieve substantial electricity savings.
- Institutions such as the Secretariat of Public Education (SEP) in Veracruz and the Gilberto Association in Querétaro have been supported in their efforts to promote electricity saving in government and non-government institutions, with the provision of 1,040 energy-saving lamps.
- In the FIDE regional offices, consumers' needs have been met in the following states: Aguascalientes, León, Guanajuato, Querétaro, Puebla and Torreón, with 2,381 lamps.
- In the first quarter of 2009, 144,150 lamps were distributed, achieving a saving of 2.27 GWh in consumption for that quarter. Annualized savings are estimated at 9.2 GWh and 3.6 MW in consumption and demand, respectively.

Programme for the modernization of the cornmeal and tortilla industry, "My Tortilla"

In keeping with the presidential initiative, the Secretariat of the Economy, Nacional Financiera and the FIDE began designing and structuring the "My Tortilla" programme to support this sector by financing improved technology for equipment. The result will be a reduction in electricity and gas consumption.

Training has begun in the cities where the initial phase of the programme will be launched (in Chiapas, Guanajuato, Michoacán, Sinaloa and Tabasco).

To date, 27 files have been received in the state of Michoacan, and the process is expected to continue in the coming months.

Incorporating new technology

New technology

Various equipment suppliers and users have been targeted with projects to promote LED lighting, electromagnetic induction and air conditioning with environmentally-friendly refrigerants.

Micro cogeneration

The following projects were concluded during the quarter:

Electricity generation projects in the TIF Cuautitlán slaughterhouse, located in the state of Mexico, using six biogas motor-generators. Financing amounted to 2,297,224 pesos, and expected savings are 386,974 kWh/year and 844,772 pesos in electricity bills. The investment will be recouped in 2.72 years.

Analysis of electricity generation with biogas on pig farms in the state of Guanajuato.

Follow-up on prospects for generating electricity with biogas on pig farms in the states of Chiapas, Colima and Sonora, in order to obtain FIDE financing.

Renewable energy sources

The project for generating electricity using photovoltaic panels in the residential sector of Mexico City was completed. Financing amounted to 110,797 pesos; expected savings in consumption are 1,461 kWh/year and in electricity bills 2,678 pesos; the investment will be recouped in six years.

Solar energy is being promoted in the facilities of the Corporación Interamericana de Entretenimiento S.A. de C.V (CIE Group), and meetings were held with suppliers of photovoltaic cells to inform them of FIDE support.

Energy-saving equipment certificates

Evaluations resulted in satisfactory results for 25 Mexican companies with 926 product lines, including CFLs, commercial refrigerators, T8 linear lamps with energy-efficient ballasts, household refrigerators, attenuation devices for HID lamps, sensors, double-pane windows, building insulating materials, clothes washing machines, tri-phase motors and single-phase fractionators.

Training

As part of specialist training activities, five workshop-courses were conducted for personnel promoting electricity-saving projects in the cities of Chetumal, Quintana Roo; Puebla, Puebla; Acapulco, Guerrero, and two in Mexico City. A total of 203 professionals working in the electromechanical sector participated in the workshop-courses.

Certification of businesses

A proposal was drawn up to recognize the energy efficiency experience of service businesses and consultants that do not have certification from the National Chamber of Consulting Businesses (CNEC).

As part of the certification efforts, five businesses were evaluated: Eficiencia Operacional, SA de CV.; Soluciones Eléctricas S.A. de C.V.; Rodríguez Chavarría Jesús, Sistemas Eléctricos Industriales de Culiacán and Applied Technology Center de México, S.A. de C.V.

d. Petróleos Mexicanos (PEMEX) (www.pemex.com.mx)

Thanks to technical assistance from the CONUEE, PEMEX has been able to identify potential savings amounting to 15% as well as types of actions it can take to benefit from those savings. These actions can then be incorporated into large-scale programmes by developing technological tools and innovative administrative schemes.

More information can be obtained at http://desarrollosustentable.pemex/portal/index, where the 2008 Sustainable Development Report is posted.

e. Programme for Promoting an Energy-Efficient Public Sector (PEPS)

The Programme for Promoting an Energy-Efficient Public Sector (PEPS) has been operated in Mexico since 2004 by ICLEI-Local Governments for Sustainability in conjunction with the CONAE, Lawrence Berkeley National Laboratory (LBNL), the United States Department of Energy and the United States Agency for International Development (USAID). ICLEI has been working on issues of sustainable development and climate change in Mexico since 2002.

The PEPS programme is intended to create a worldwide movement of local governments that will adopt policies of buying energy-saving products, help reduce municipal energy consumption, which will yield major economic benefits, and reduce GHG emissions by improving urban sustainability.

The PEPS programme has been operating for more than two years in some Mexican cities, which have already implemented their purchasing policies in accordance with the programme's recommendations. These include buying lighting systems for public areas and buildings with the FIDE Seal, office equipment with the Energy Star Seal, and motors with the NEMA Premium Seal. The CONUEE is joining forces with the programme to reinforce the work already done and explore ways of implementing it on a federal and state level.

Results obtained in 2006

Among the results obtained are the following:

1. Number of cities participating in the PEPS as of October 2004: 8.
2. Number of cities participating in the PEPS as of October 2006: 28.
3. Number of cities expected to work in the PEPS as of January 2007: 50.
4. An international congress and seven national events have been held (ICLEI has put on three climate change events), and more than 50 workshops have been presented.
5. USAID has provided a total of US$ 43,500 in five mini-donations to implement demonstration projects in the cities participating in the program
6. The municipalities receiving the financing have contributed 25% of the funding for the implementation of these projects, approximately US$ 10,875.
7. About 5,000 municipal and state officials were trained during that period (10,000 over the four years ICLEI has been active in Mexico).
8. Energy savings of more than 12,098 MWh have been achieved.
9. Economic savings amount to nearly 20 million pesos.
10. More than 8,300 tons of CO2 equivalent emissions have been prevented (under the Clean Development Mechanism this represents a potential sale of about US$ 85,000 in carbon bonds).
11. Energy-efficient products valued at more than 38 million pesos have been purchased.

E. Lessons learned

The lessons learned during the development of energy efficiency projects in Mexico can be summed up with following concepts, which are general in nature and do not refer to any of the aforementioned institutions in particular:

- To achieve concrete results in efficient energy use, there must be institutions to design, implement and operate programmes in a stable and continuous manner.
- The potential for benefits continues to be high.
- The institutions already operating should be reinforced.
- The development of decentralized institutional capacities (states, municipalities) must be promoted.
- The coordination of private financing for energy saving opportunities must be improved.
- A greater effort should be made to provide training and information.
- More than 20% of Mexico’s energy consumption could be avoided through measures that would pay for themselves.
- The implementation of efficiency standards has increased potential savings.
- 75% of existing refrigerators are about half as efficient as the ones now coming on the market.

- Cogeneration has potential of 10,000 MW that has not been realized because of unfavourable regulations.
- The amounts paid for surpluses made available to the grid are limited and uncertain, which discourages investments in cogeneration.
- Energy consumption takes place at millions of service points, but energy is saved "one light bulb at a time"; an effort should be made to reach every single consumption point.
- Seizing opportunities therefore involves an even greater number of decisions – millions of daily decisions on operation and investment.
- Investment decisions mean spending today what might otherwise be spent over several months or years, so financing is necessary.
- It is necessary to learn how to quantify opportunities in a way that does not cost more than seizing those opportunities...
- Regulatory frameworks have been found to be either missing or weak.
- There is a need for education, awareness and promotion strategies (government officials, educational institutions, businesses, consumers).
- Few technical personnel are available at the national and regional levels.
- There is a lack of financing for equipment and project development.
- The market for energy service enterprises (ESEs or ESCOs) is underdeveloped.
- Power companies are not very involved.
- Programmes are needed to strengthen institutions.
- As a result of the reforms of the 1990s in the region, programmes for efficient energy use suffered from budget reductions and a lack of interest, since there was no political will to pursue them.
- Supply-side efficiency has been demonstrated with the boost to competition provided by the opening of the sector.

XIX. Nicaragua

A. Recent advances in policy, regulatory and institutional frameworks

In recent years, the Government of Nicaragua has intensified actions to promote efficient energy use, within the existing regulatory framework, with the aim of mitigating the effects of fluctuating international oil prices on the domestic economy. These actions have been based on the following legislation:

- The Electricity Industry Act (Law No. 272), which sets forth policy guidelines to promote energy saving and efficient energy use (Article 2, Section 5).
- Decree 1304, of 2 March 2004.

As the mandate of the National Energy Commission (CNE) includes providing leadership to energy-efficiency initiatives, actions and projects in Nicaragua, it began the process of designing and preparing the energy-efficiency programme that is currently being implemented, receiving economic support from the Inter-American Development Bank (IDB) which will be expanded in the future.

When the new government, headed by Commandant Daniel Ortega, took office on 10 January 2007, institutional changes were made particularly in the energy area. These were ratified on 24 January 2007, when the National Assembly of the Republic of Nicaragua passed Law No. 612, reforming and extending Law No. 290, the Government Organization, Competency and Procedures Act, Article 12 of which lists the different ministries, including the Ministry of Energy and Mines.

Article 4 of that law adds Article 29 bis, which, among other issues, mentions that the ministry's brief includes "reviewing, updating, and periodically evaluating the strategic plan and public policies of the energy sector — in particular, aspects of energy balance, supply, demand, energy conservation, electricity service pricing and subsidy policy, policies on service coverage throughout the country, including rural electrification, together with energy-sector policies, strategies, financing and investments.

To implement the provisions of Law No. 612, the Ministry of Energy and Mines (MEM), acting through its Directorate General of Electricity and Renewable Resources, formed the Department of Energy Efficiency, with new staff committed to successfully fulfilling tasks and actions aimed at enhancing energy efficiency, and thus contribute to energy-saving with the different sectors of the economy, to improve the country's energy intensity.

On 30 January 2008, the Government published Decree 2-2008, "Organization of Energy Use" to order a number of energy saving actions in the different energy consuming sectors of the economy, based on the following fundamental principles:

- Minimize prolonged rationing of the supply of electricity and fuels.
- Minimize damage to the country's economic activities, particularly production and employment.
- Promote efficient and rational use of the various forms of energy, to help strengthen the competitiveness of economic activity and improve the population's quality of life.

In addition, to continue promoting energy-efficiency actions, the Government published Decree 2-2009 in January 2009, "Austerity and energy saving measures in public budgeted and unbudgeted institutions, within the government domain". This aims to implement a set of austerity measures to generate energy savings in public institutions, and thus address the impact of the international financial crisis on the general budget of the Republic of Nicaragua.

B. Key actors in energy efficiency and their effective roles

In the public sector, the only official agency that acts on energy efficiency is the Ministry of Energy and Mines (MEM), which, through the Energy-Efficiency Department, undertakes various activities in all sectors of national energy consumption. These include promoting energy audits and demonstration projects in the industrial and commercial sectors; advising the general sector (consisting of the Government, hospitals and schools) on ways to reduce electricity consumption; promoting improvements in lighting and air-conditioning, and helping to select appropriate electricity rates for the different work functions; defining regulations that give incentives for introducing energy-efficient electrical equipment in Nicaragua, to assist with national energy-saving policies; and promoting training, orientation and information campaigns for all sectors, particularly the residential sector, with a view to promoting the labelling system in electrical appliances and production equipment, to enable end-users to ascertain the energy efficiency of the appliances they purchase.

The department also supports the creation of private enterprises specializing in energy efficiency, with a view to developing energy-saving projects. Acting within its technical and economic resource constraints, it undertakes technological research, development, modernization and dissemination aimed at fostering effective energy consumption, through choice of equipment, operating methods, maintenance and the type of energy to be used.

The department also participates in other public and private activities to seek to promote energy efficiency, planning and participating in seminars and demonstration projects.

C. Resources and funding mechanisms for energy efficiency programmes

Nicaragua is currently using its own resources and funds donated by friendly Governments to implement major energy-efficiency programmes and actions, including the following:

1. Energy-efficiency Development Programme in Nicaragua
2. Energy Efficiency in the Industrial and Commercial Sectors
3. Other actions

The Energy-efficiency Development Programme in Nicaragua is funded with grant from the Japanese Special Fund (JSF), managed by the Inter-American Development Bank (IDB), and a Government contribution.

The Energy Efficiency in the Industrial and Commercial Sectors programme is financed by the Global Environment Facility (GEF) and implemented by the United Nations Development Programme (UNDP), which is executed by BUN-CA, a non-governmental organization based in Costa Rica.

In addition, with its own resources and collaboration from other public institutions, MEM has been implementing the following energy-efficiency activities:

4. Design of a public street-lighting programme.
5. Definition of a fuel saving programme for the transport sector.
6. Studies aimed at strengthening the country's energy efficiency, including the identification of baseline elements, and the financing of projects and strategies, in collaboration with the PA Consulting Group.

Non-governmental contributions (JSF) amount to US$726,350.00. The total cost of the technical cooperation is US$916,350.00, of which 20% (US$190,000) will be provided as local counterpart by the Ministry of Energy and Mines of Nicaragua.

D. Results of energy efficiency programmes to date

Although the results achieved by energy-efficiency actions suffered a period of decline, since then, over the last three years since the new Government took office, and with the earlier actions of the National Energy Commission on this issue, the development of efficient energy use has been boosted through the Energy-efficiency Development Programme, which has six components:

Component 1: Energy audits in the industry, commerce, and services sectors, and support for implementing pilot projects

A consultancy consortium formed by *PA Consulting Group - Multiconsult Cía. Ltda.* was hired to prepare the energy audits in this component. In the first half of 2009 it performed the first 15 energy audits, and is currently working on others to make a total to date of 26 firms, as listed below:

TABLE 20
LIST OF AUDITED FIRMS

Start	Name of Firm
1	Industrias Comercial SAN MARTIN
2	ENITEL Villa Fontana
3	NUEVO CARNIC S.A
4	MOLINOS DE NICARAGUA, S.A.
5	HOLCIM (NICARGUA) S.A
6	Hotel Las Mercedes "INTUCASA"
7	Industrias Fátima S.A
8	PROINCO
9	ENITEL Las Piedrecitas
10	DELICARNES S.A

(Continued)

TABLE 20 (Concluded)

11	INDUSTRIAS TORO S.A
12	Empresa El Triunfo
13	ENACAL - Estación de Bombeo Masaya
14	ENACAL - Estación de Bombeo Carazo
15	ENACAL - Estación de Bombeo Managua
16	INCASA
17	PITURA SUR S.A
18	AGROSA
19	HARINISA
20	INDEGRASA
21	OCAL. S.A
22	ROLTER
23	AGRICORP
24	PROLACSA
25	ABRASA
26	COCA COLA

Source: Energy Efficiency Department, MEM, Government of Nicaragua.

These audits identified opportunities for energy saving in the following areas:

- Change the electricity rate
- Improvement in steam lines.
- Replacement of engines.
- Relocation of cooling equipment.
- Improvements in productive processes.
- Construction of biodigesters.
- Implementation of new technologies.

Actions are ongoing in coordination with the Chamber of Industry and Commerce to identify firms interested in undergoing energy audits, to enable them to identify and exploit energy-saving opportunities and thus complete the 30 audits to be performed in this sector in 2009.

Component 2: Efficient lighting for the residential and general sectors (Government, hospitals and schools), street lighting and support for the implementation of pilot projects

The consultants *Multiconsult & Cía. Ltda.*, in conjunction with the MEM Energy-efficiency Department, performed energy audits in 20 institutions in the general sector, consisting of government institutions, hospitals and schools, identifying the following key energy-saving measures:

- Replacement of conventional lighting with energy-saving lighting.
- Replacement of air-conditioning units with an energy-efficiency ratio (EER) of 12 or lower, with units that have an EER of 13.
- Installation of smaller units with an EER of 13, in areas where the existing units are too large.
- Installation of roof insulation.

- Application of a seasonal hourly rate or other type of rate, for all institutions where this would be profitable.

The following table shows the potential saving, in both kWh and monetary terms, to be obtained from the following measures:

TABLE 21
SUMMARY OF SAVING ON LIGHTING, AIR-CONDITIONING AND APPLICATION OF THE SEASONAL HOURLY RATE

Institution	Lighting		Air-conditioning		Application of seasonal hourly rate	TOTAL			
	Saving kWh/ month	Saving US$/ month	Saving kWh/ month	Saving US$/ month	Saving US$/ month	Saving kWh/ month	Saving US$/ month	% saving wrt. total consumption kWh/ month	% saving wrt. monthly invoicing US$/ month
INIDE	1 678	359	9 066	1 939	n/a	10 744	2 298	37.21%	26.78%
MITRAB	1 469	258	6 369	1 116	NA	7 838	1 374	27.27%	17.40%
MINED	1 119	217	6 937	1 345	3 316	8 056	4 878	30.85%	96.36%
MIFIC	1 734	327	12 903	2 434	4 240	14 637	7 001	43.24%	46.22%
MTI	2 967	560	17 783	3 354	8 812	20 750	12 726	29.02%	42.70%
INETER	827	150	4 283	778	2 436	5 110	3 365	40.66%	56.39%
MARENA	1 327	256	8 082	1 560	3 563	9 409	5 379	40.47%	48.38%
MIFAMILIA	3 876	734	17 956	3 400	5 933	21 832	10 067	67.54%	69.37%
MHCP	3 965	765	35 252	7 605	NCb	39 217	8 370	44.64%	32.16%
MINGOB	7 536	1 427	20 610	4 703	6 197	28 146	12 327	42.44%	48.27%
National Police Plaza El Sol (whole complex)					6 388.33		8 537		19.38%
Police	580	109	10 811	2 039		11 391	2 148	37.20%	37.20%
UPOLI	2 557	482	15 794	2 979		18 351	3 461	44.46%	44.46%
UNI (whole complex)					2 875.04		4 335		5.75%
UNI	824	155	6 916	1 304		7 740	1 460	35.95%	35.95%
UNAN (whole complex)					9 138.42		11 541		10.73%
UNAN	2 355	444	10 386	1 959		12 741	2 403	24.26%	24.26%
MINREX	1 369	287	8 931	1 872	NA	10 300	2 159	13.48%	9.06%
Divino Pastor	135	26	288	56	23c	423	105	39.65%	42.13%
MIDEF	1 012	192	6 374	1 208	NA	7 386	1 399	52.45%	39.34%
La Mascota	6 024	836	33 191	4 605	3 039.11	39 215	8 480	20.04%	17.63%
C. Palacios	13 835	1 919	41 267	5 725	13 389.59	55 103	21 034	26.25%	34.32%
Lenin Fonseca	11 618	1 612	n.a.	n.a.	n.a.	11 618	1 612	5.58%	3.48%
Total audited	66 807	11 116	273 200	49 979	50 949.24	340 006	112 044	26.93%	31.07%
Total whole complex					69 351		130 446	18.50%	21.46%

Source: Energy-Efficiency Department, MEM, Government of Nicaragua.

Note:

[a] Rate change not applicable.

[b] Rate change not beneficial.

[c] In this institution, the applicable rate would be T1A if demand dropped by 2.5 kW.

[d] Air-conditioning not applicable.

- The energy saving obtained from efficient lighting varies between 135 - 13,835 kWh/month, and as a result of the use of air-conditioners with minimum EER of 13, varies between 288 - 41,267 kWh/month, in the institutions studied maintaining current working hours.

- These savings represent an average of 18.5% of the monthly consumption of the institutions in question, and 21.5% of the monthly bill.
- The lighting measures represent a 38.15% saving on consumption in this category, and 3.1% of monthly invoicing in the area audited, for investments totalling US$191,292, which would be recovered in 1.5 years, as shown in the following table:

TABLE 22
SUMMARY OF SAVING IN LIGHTING AND RECOVERY OF THE INVESTMENT

Lighting				
Institution	Saving kWh/month	Saving US$/month	Investment US$	Investment recovery period (years)
TOTAL	66.807	11.116	191.292	1.43

Source: Energy-Efficiency Department, MEM, Government of Nicaragua.

The air-conditioning measures, which involve replacing inefficient units, the installation of smaller units and roof insulation, represent a 41.52% saving in consumption in this category, and 13.86% of monthly billing in the area audited. The investment amounts to US$1,544,227.00, which would be recovered in almost 2.6 years, as shown in the following table:

TABLE 23
SUMMARY OF SAVING IN AIR-CONDITIONING AND RECOVERY OF THE INVESTMENT

Air-conditioning				
Institution	Saving kWh/month	Saving US$/month	Investment US$	Investment recovery period (years)
Total	273 200	49 979	1 544 227	2.57

Source: Energy-Efficiency Department, MEM, Government of Nicaragua.

TABLE 24
SUMMARY OF POWER FACTOR COMPENSATION AND RECOVERY OF THE INVESTMENT

Power Factor Compensation					
Institution	Current power factor	Compensation needed (kVAR)	Saving US$/month	Investment US$	Investment recovery period (years)
INIDE	0.84	34	72.00	1 200	1.39
Police	0.84	89	318.45	3 341	0.87
La Mascota	0.85	93	419.84	3 483	0.69
Total	-	-	810.29	8 024	0.83

Source: Energy-Efficiency Department, MEM, Government of Nicaragua.

Application of the seasonal hourly rate in institutions where this is appropriate, has investment recovery periods of no longer than one month.

TABLE 25
SAVING IN US$/MONTH ARISING FROM A RATE CHANGE

No.	Institution	Saving US$/month	Investment US$
1	MINED	3 316.37	600
2	MIFIC	4 240.19	200
3	MTI	8 812.49	200
4	INETER	2 435.89	600
5	MARENA	3 562.96	600
6	MIFAMILIA	5 932.60	200
7	MINGOB	6 197.04	200
8	Police	6 388.33	200
9	UNI	2 875.04	200
10	UNAN	9 138.42	200
11	Divino Pastor[a]	23.00	-
12	La Mascota	3 039.11	200
13	C. Palacios	13 389.59	200
Total		69 351	3 600

Source: Energy Efficiency Department, MEM, Government of Nicaragua.

[a] In this institution, the rate to be applied would be T1A if demand were reduced by 2.5 kW. The saving would be US$23 per month.

TABLE 26
SUMMARY OF SAVINGS AND RECOVERY OF THE INVESTMENT

Institution	Lighting and air-conditioning				Lighting, air-conditioning and change of seasonal hourly rate		
	Saving kWh/month	Saving US$/month	Investment US$	Investment recovery period (years)	Saving US$/month	Investment US$	Investment recovery period (years)
INIDE	10 744	2 298	77 844	2.82	2 298	77 844	2.82
MITRAB	7 838	1 374	91 866	5.57	1 374	91 866	5.57
MINED	8 056	1 561	67 674	3.61	4 878	68 274	1.17
MIFIC	14 637	2 761	80 468	2.43	7 001	80 668	0.96
MTI	20 750	3 913	129 138	2.75	12 726	129 338	0.85
INETER	5 110	929	41 420	3.72	3 365	42 020	1.04
MARENA	9 409	1 816	81 418	3.74	5 379	82 018	1.27
MIFAMILIA	21 832	4 134	100 635	2.03	10 067	100 835	0.83
MHCP	39 217	8 370	112 449	1.12	8 370	112 449	1.12
MINGOB	28 146	6 130	136 610	1.86	12 327	136 810	0.92
Police	11 391	2 148	49 858	1.93	8 537	50 058	0.49
UPOLI	18 351	3 461	61 151	1.47	3 461	61 151	1.47
UNI	7 740	1 460	30 013	1.71	4 335	30 213	0.58
UNAN	12 741	2 403	88 467	3.07	11 541	88 667	0.64
MINREX	10 300	2 159	61 769	2.38	2 159	61 769	2.38
Divino Pastor	423	82	2 550	2.59	105	2 550	2.03
MIDEF	7 386	1 399	31 983	1.90	1 399	31 983	1.90
La Mascota	39 215	5 441	185 582	2.84	8 480	185 782	1.83
C. Palacios	55 103	7 645	282 001	3.07	21 034	282 201	1.12
Lenin Fonseca	11 618	1 612	22 624	1.17	1 612	22 624	1.17
TOTAL	340 006	61 095	1 735 519	2.37	130 423	1 739 119	1.11

Source: Energy Efficiency Department, MEM, Government of Nicaragua.

The saving to be obtained by implementing all of these measures represents 27% of the monthly consumption of the institutions in question, and 21.5% of the monthly bill in dollars, equivalent to roughly US$130,500 per month.

Component 3: Feasibility of a trust fund for the purchase of energy-efficient equipment and systems

Consulting services are currently being hired in accordance with the programme's procurement plan.

The aim of these services is to assess the need for, and the scope and feasibility of, creating new and innovative financial instruments to speed up financing for energy-efficiency projects, in particular the possibility of creating a trust fund.

Component 4: Expansion and optimization of the current school education programme on energy efficiency in the residential sector

The Energy-Efficiency Department has successfully implemented an education campaign among primary school pupils with the aim of promoting cultural change towards efficient energy use; and, to continue with this programme, it has improved campaign material with technical assistance from this component. The new didactic material will be used in the next educational campaign, entitled "Efficient Energy Use", which targets the residential sector with support from primary school pupils, and also serves as a basis for establishing energy efficiency as a school subject that cuts across the normal school curriculum.

This new version of the Efficient Energy Use educational campaign will target 400,000 primary school pupils, representing 30% of the student population nationwide. The content of the campaign is as follows:

1. Textbook for teachers, entitled *"Aprendamos a hacer uso eficiente de la Energía"* [Let's learn to use energy efficiently] (letter-size format).
2. Information cards (bundled with the textbook for teachers).
3. Interactive cards (bundled with the textbook for teachers).
4. Triptychs promoting efficient energy use
   - "*Ahorremos energía para salvar al planeta*" [Save energy to save the planet] (letter-size format).
   - "*Ahorremos para que en Nicaragua a nadie le falte la energía*" [Save energy to make sure no-one in Nicaragua goes without it] (letter-size format)
   - Energy Saving Committees formed by school pupils (Double letter format)
5. Posters advertising the education campaign (All ½ pliego format).
   - Calendar with 12 rules for saving energy and money in the residential sector.
   - National Energy Saving Day, proposed for homeland week (Semana Patria).
   - Motivational energy-saving wall chart for classrooms.
6. Educational activities and games:
   - Dice game: "The path of energy efficiency" (½ pliego format).
   - Five interactive computer games for use in schools and to be available on the Ministry of Energy and Mines website.
7. Entry and exit test for the 2009 education campaign:
   - Preschool.
   - 1st and 2nd grades.
   - 3rd and 4th grades.

- 5th and 6th grades.

8. Annexes:

- Annex A: Teacher training workshops.
- Annex B: Efficient energy use committees formed by school pupils
- Annex C: Training seminar for press, radio and television journalists.
- Annex D: Demonstrations on efficient energy use through interactive modules.
- Annex E: National Energy Saving Day
- Annex F: Monitoring and evaluation activities.
- Annex F1: Monitoring card.
- Annex F2: Entry and exit test.

Component 5: Characterization of the demand curve and final use of energy in the city of Managua

With IDB approval, the consulting firm CH Consultoria em Engenharia Ltda. was hired for this study, to characterize the energy demand curve of the city of Managua, the country' main electricity consumption zone; and to analyse final energy use in each sector and consumption bracket, for use in the development of potential energy saving projects in Nicaragua.

These results are scheduled for late March 2010 and are expected to guide the development of energy efficiency in the country.

Component 6: Preparation of loan proposals for project financing

This consulting service is currently at the hiring stage, with the aim of promoting the development of potential loan proposals identified in the activities of components 1 to 5, with participation and feedback from the main public- and private sector stakeholders. The results of this study will be finalized in February 2010.

Other energy-efficiency activities:

Standardization

With regard to Standardization in Energy Efficiency for Electrical Appliances, Article 5 of Presidential Decree 2-2008 "Organizing Energy Use" requires the Ministry of Development, Industry and Trade (MIFIC) to publish and implement the Nicaraguan Mandatory Technical Standards (NTON), relating to the importation of electrical appliances of highest energy consumption.

In its preamble, the Decree calls on the **Ministry of Energy and Mines (MEM)** to coordinate and implement standards, resolutions and administrative provisions for rational and efficient energy use, with support from by other state institutions.

To contribute to this measure, the Ministry of Energy and Mines invited the public at large to make comments on the energy-efficiency standards, by sending their comments to the Executive Secretariat of the National Commission on Technical Standardization and Quality, of the MIFIC, or to the Ministry itself.

The following Nicaraguan Mandatory Technical Standards are currently being implemented:

1. Compact self-ballasted fluorescent lamps.

- Efficiency requirements.
- Classification and labelling.

2. Incandescent lamps for domestic use and similar.
   - Specifications and labelling.
3. Self-contained commercial refrigerators
   - Limits on consumption values.
   - Testing method.
   - Labelling.
4. Domestic refrigerators and freezers.
   - Maximum energy consumption limits.
   - Labelling http://www.mem.gob.ni/media/file/ELECTRICIDAD Y RECURSOS /NTON EFICIENCIA ENERGETICA refrig y congel electrod etiquet 05.pdf.
   - Method
5. Squirrel cage, Alternating current (AC), tri-phase induction motors, with a nominal power of 0.746 to 373 KW.
   - Testing and labelling methods http://www.mem.gob.ni/media/file/ELECTRICIDAD Y RECURSOS/NTON EFICIENCIA ENERGETICA motores trif metod ensayo y etiquet.pdf

Procedure for preparing standards

The MEM Energy Efficiency Department participates on the Technical Standardization Committee in developing standards to promote the energy-efficiency culture in Nicaragua.

The National Energy Efficiency Standardization Committee consists of representatives from institutions that play a key role in developing energy efficiency, and is co-ordinated by the MIFIC Standardization Department.

The National Energy Efficiency Standardization Committee, which has participated in preparing the standards, consists of:

- Ministry of Energy and Mines (MEM)
- Ministry of Industrial Development and Trade (MIFIC).
- Directorate-General of Customs (DGA).
- Nicaraguan Energy Institute (INE).
- National Engineering University (UNI).
- Nicaraguan Industries Chamber (CADIN).
- Nicaraguan Chamber of Commerce (CACONIC).
- Nicaraguan Hardware Association (AFENIC).
- The Cleaner Production Centre (CPmL-N).
- Multiconsult & Cía. Ltda.
- BUN-CA.
- FOGEL de Nicaragua.
- AYRE.
- SIEMENS.

- Casa Mc Gregor S.A.
- BOMONSA
- Compañía de Productos Atmosféricos (COPA).

In the government sector

Energy Coordinators and Energy-Efficiency Committees have been set up in ministries, decentralized bodies, State enterprises, and other government institutions, through the Energy Management Seminar in the government sector.

Methodological guidelines have been provided to help institutions prepare their energy-saving plans. Thus far, most of the institutions have identified measures involving zero, minimal or low levels of investment which, according to their own Energy-Saving Plan will be implemented to reduce energy consumption.

The government sector is being supported with demonstration projects on lighting, to promote efficient and rational energy use in the sector. The demonstration projects will introduce 1,100 units of 2x32 watts T-8 and 500 units of 3x32 watts T-8, into the office lighting system, representing an annual saving of 294,000 kWh/year, or US$57,000.

The government sector has also attended seminars aimed at strengthening initiatives to promote efficient and rational energy use. The following seminars were held in August-September 2008:

- Efficient lighting in the government sector.
- Appropriate selection of the electricity rate.
- Efficient maintenance and operation of air-conditioning systems.
- Efficient and rational fuel use in the transport system.

For the street lighting sector

In the municipal sector, a plan for energy-saving in street lighting was prepared, with collaboration from INIFOM, the National Police, INE and the DISNORTE/DISSUR electric power distribution companies. Funding is currently being procured from domestic and foreign private organizations to implement the recommendations or measures that are put forward as most appropriate for energy-saving in the sector.

For the transport sector

With collaboration from sector institutions (MTI, Municipality of Managua, National Police, local government, etc.) a fuel saving programme was prepared for the transport sector, with a number of actions identified to promote fuel saving.

The programme's goal is to reduce fuel consumption (gasoline and diesel) by 7.5% nationally, which is equivalent to a saving of 16,000,000 gallons, or US$80 million per year.

The key measures include:

- Replacement of 100 buses with more efficient vehicles.
- Downsizing of the taxi fleet.
- Greater control over vehicle mechanical inspections.
- Synchronization of traffic lights.
- Use of light emitting diodes (LEDs) in the traffic light network.

- Longer distance between bus stops.
- Elimination of speed reducers, etc

For the residential sector

An information campaign for this sector involved the distribution of leaflets, providing information on the energy consumption of appliances and suggesting measures or actions that can be taken to save energy.

Collaboration with the sector also involved the distribution of 1.8 million compact fluorescent lamps; and plans are currently under way to distribute a further 2 million and totally replace incandescent lighting.

E. Lessons learned

One of the key observations to be drawn from the experience of energy-efficiency projects and programmes in Nicaragua, is the lack funds allocated to continue with energy-efficiency actions. This has partly been overcome with support from the Inter-American Development Bank (IDB) and the United Nations Development Programme (UNDP). The Government is currently also making efforts to secure funding to complete ongoing energy-efficiency programmes. Nonetheless, greater coordination is needed with other public and private organizations that help implement and empower activities to reduce the National Energy Grid's predominantly fossil-fuel consumption.

The results of energy-efficiency actions thus far have been satisfactory, including expansion of the scope of activities such as the education campaign, lightbulb replacement, importation of efficient equipment, implementation of energy audits and the creation of energy-efficiency committees in public institutions.

Lessons learned in the projects and programmes include the need to:

- Strengthen the current legal framework with enforcement instruments.
- Establish policies, programmes and incentive mechanisms to promote energy efficiency.
- Strengthen technical capacities in the MEM, since it has new staff, and in institutions that collaborate on energy efficiency.
- Promote research into energy-efficiency applications to boost competitiveness in the various sectors of the economy.
- Promote energy-efficiency actions throughout the electrical industry chain and in the main energy-consuming sectors, such as transport, education, housing, and others.
- Design and continually implement communication campaigns to provide information on energy-saving measures and opportunities, taking account of the consumption habits and idiosyncrasies of the target population.
- Define and establish indicators to evaluate the impact of the energy-efficiency measures implemented.

XX. Panama

A. Recent advances in policy, regulatory and institutional frameworks

1. Political-regulatory-institutional framework for energy efficiency

Creation of the National Energy Secretariat, under Law 50 of 30 July 2008, to gather data, analyse, coordinate and give orientation to Panama's energy planning and policy, is the culmination of the historical development of the political, regulatory and institutional framework in the energy sector. This, in turn, has responded to various national and international economic/energy situations, that affected or could affect the country's energy supply and demand.

The energy guidelines as defined included to issue of efficient energy use, as indicated in the following points:

- Decree No. 20 of 4 September 1980: To some extent influenced by the experience of the oil crisis of the 1970s, the National Energy Commission (CONADE) was set up as a Government advisory body, to formulate, give orientation to, coordinate and evaluate a National Energy Policy aimed at promoting national development, attached to the State electric power company, *Instituto de Recursos Hidráulicos y Electrificación* (IRHE). Article 3, paragraph c, states that the activities of CONADE include "promoting rational energy used through the pricing structure and other mechanisms as deemed appropriate."
- Given the energy sector's high debt scenario and the need to obtain financial resources to respond to the growing energy demands of the country's development, the electric power sector was restructured to allow for private-sector participation. Law 6, of 3 February 1997, established the regime governing the activities of electric power generation, transmission, distribution and marketing, with the aim of providing a public electricity service, together with regulatory and coordination activities for planning the expansion and integrated operation of the National Grid System, along with economic regulation and inspection. Article 7 created the Energy Policy Commission (COPE), attached to the Ministry of Planning and Economic Policy, with the aim of formulating global policies and defining the energy sector strategy. Article 16, paragraph 9, indicates that the attributions and functions of COPE include: "establishing energy-saving and rational energy-use programmes".

- In the first decade of the twenty-first century, the price of oil is again rising on world markets, and thus raising costs throughout the Panamanian economy, including the transport and electricity services. By the middle of the decade, the international oil price had doubled compared to the per barrel price in 2000, and it was still rising.

  Accordingly, the National Government introduced special working hours for public State entities, and instructed the Ministry of the Presidency, in coordination with the Ministry of Commerce and Industry and the Ministry of Economy and Finance, to implement an energy-saving programme throughout the country.

  This gave rise to Cabinet Decree 14 of 26 May 2004, which was followed by Cabinet Decree 27, of 21 September 2005. The latter created the National Energy Saving Commission (CONAE), chaired by the Auditor General of the Republic and consisting of the Minister of Trade and Industry, the Minister of Economy and Finance, the Minister of Governance and Justice, and any other institution designated by the Auditor General, together with representatives from private industry and worker organizations in Panama. The committee's purpose is to implement an energy-saving programme in public offices.

- In 2006, CONAE made an analysis of the energy situation and defined measures to seek the best prices for the consumer, optimize the use of energy resources and ensure energy availability, as ratified through Cabinet Resolution 22, of 29 March 2006.

- Between 2007 and 2008, energy prices continued to rise steadily, contrary to the wishes and concerns of energy consumers. In response to this, the Energy Secretariat was created (Cabinet Resolution 22 of March 29, 2006), to ensure operational consistency in the State's energy policy between the Energy Policy Commission, the National Energy Saving Commission and the National Hydrocarbons Directorate.

- The government order in question was followed by legislation, whereby Law 52, of 30 July 2008, created the National Energy Secretariat of Panama, as a government agency attached to the Ministry of the Office of the President.

The creation of a secretariat attached to the Ministry of the Office of the President gives it greater weight in acting on the policy and strategies of Panama's energy sector. In 1980, the National Energy Commission (CONADE) was a government advisory body, attached to one of the important institutions in the energy sector, *Instituto de Recursos Hidráulicos y Electrificación* (IRHE). This placed it very close to the electric power planning and management system, but far from the hydrocarbons subsector. As part of electricity sector restructuring (1998), CONADE became the Energy Policy Commission (COPE), attached to the Ministry of Planning and Economic Policy, which subsequently became the Ministry of Economy and Finance. Nonetheless it still remained an advisory unit, and its voice reached the cabinet through a minister or director of a public agency.

The current secretariat has a full and comprehensive scope of action in the energy sector (electricity subsector, hydrocarbons subsector and alternative energies), and now has a more important place in the Government, since Article 5 of the law states that the head of the secretariat will be a Secretary of State with ministerial rank.

Panama's energy policy is the responsibility of the Secretariat, as indicated its objectives, which are set out in Article 3 of the law. Namely,

- Formulate, strategically plan and establish the policies of the energy and hydrocarbons sector.
- Oversee compliance with the energy policies established in the energy sector.
- Advise the Government on issues within its jurisdiction.
- Propose legislation as needed for the adequate implementation of energy policies and execution of the strategy.

Until the Secretariat was created, the country's energy policy was designed by CONADE and subsequently COPE. But the energy sector studies and plans for that purpose were separated by area of competency.

For the electric power subsector, development plans were produced by IRHE, and subsequently by the transmission company *Empresa de Transmisión Eléctrica, S.A.* (ETESA), whereas issues relating to the hydrocarbons subsector were the responsibility of the National Hydrocarbons Department within MICI. Planning aimed to guarantee supply to meet the country's energy needs; and the issue of efficient energy use involved studies to evaluate potential and lines of action, but did not form part of energy plans.

As indicated in Article 4, the Secretariat took over the functions and attributions of the Energy Policy Commission, as listed in Article 16 of Law 6, of 3 February 1997, and also those of the Directorate General of Hydrocarbons and Alternative Energies and the Energy-Saving Commission.

Article 16 of Law 6, of 3 February 1997, lists the attributions and functions inherited from COPE, of which Nos. 1 to 9 refer to efficient energy use.

- Study and analyse alternatives for national policy on electricity, hydrocarbons, rational energy use, and the comprehensive exploitation of natural resources and all of the country's energy sources, in accordance with general development plans;
- Establish programmes for energy saving and rational energy use;
- Sign contracts and formalize all related administrative instruments, as needed to fulfil their objectives;
- Undertake all acts and operations needed to fulfil the objectives set out in this law.

2. The 2009-2023 energy policy targeted on energy efficiency

In the period 2002-2008, Panama's GDP grew at an average rate of 8.8% per year, which was exceptional compared to the performance of the region as a whole. This pace of growth also required greater energy consumption, however; electricity consumption and demand grew by an annual average of 4% in the same period. The national energy balance relies heavily oil, which accounts for between 65% and 85% of the country's total energy consumption. The situation has become steadily more worrying, given the surprising rise in the oil price from US$44 per barrel in 2002 to US$145 in 2008, which was passed on to the consumer through price increases in energy, services and products.

This situation led to the study and application of immediate measures, and the preparation of short-, medium- and long-term energy strategies. The institutional administrative structure was reorganized, and a National Hydrocarbons Policy was put in place through Cabinet Decree 36 of 17 September 2003. Strategic guidelines were defined in 2006, and these were brought together in an Energy Policy for the Electricity Sector.

In view of the energy policy and strategic guidelines for the electricity, hydrocarbons and alternative energy sectors, the National Energy Plan 2009-2023 was prepared with the following aims:

- **Seek to diversify the energy mix**

  Petroleum products currently account for 85.4% of the national energy balance, while hydraulic energy contributes 14.4%. The various scenarios include participation by coal, hydraulic, wind power, and plant residues.

- **Make energy supply more competitive**

  Regulations on bidding and contracting, the granting of concessions and permits, and market rules are expected to be reviewed. The review process will also cover electricity interconnection with Central America (the SIEPAC) project, and interconnection with Colombia (the Andean Pact), which requires increase in the number of participants in the generating segment.

- **Improve energy prices for certain low-income sectors.**

  These segments of the population receive subsidies for electricity consumption (Law 37 of 10 July 2001; Law 15 of 7 February 2001; and Price Stabilization Funds). The subsidy on 25-pound liquefied petroleum gas (LPG) tanks was also maintained.

- **Increase the share of clean energy sources**

  The various energy scenarios include introducing or increasing the share of clean energy sources (solar, wind, biomass, hydraulic), exploiting clean development mechanisms (CDMs), pursuant to the guidelines of the Climate Change Convention and the Kyoto Protocol.

  The implementation of local mechanisms (tariffs, tax benefits, financing facilities, etc.) is also analysed, which promote the development of energy projects using clean energy sources, as called for in Law 45, of 4 August 2004.

- **Promote efficient energy use**

  Various studies of final energy use in Panama characterize the load by consumption sector and final use. The different opportunities for efficient energy use with high potential for participation in energy consumption and demand were identified and evaluated. Efficient energy use is thus recognized as an energy policy alternative that needs to be considered and included in the country's various energy scenarios.

The various scenarios set out in the Plan aim at promoting supply diversity and competitiveness to ensure future energy availability at the best prices. But the most important and influential feature of the scenarios is efficient energy use. For the first time, the country's energy plan recognizes the possibility of a positive contribution from efficient energy use as an energy-planning alternative. Demand side energy planning is proposed to reduce energy requirements and cut demand, without compromising energy needs (comfort, production and/or services), and without neglecting the importance of environmental issues.

The most recent study to characterize final uses and quantify the potential of energy efficiency was undertaken in 2002 by COPE, through the Electric Energy Saving Trust Fund (FIDE), under a consulting services contract signed between UNDP and FIDE.

The study in question collates experiences and uses new energy surveys to update the characterization of consumption sectors by final energy use; and it recognizes the possibility of a positive contribution from energy-efficiency in the 2009-2023 Energy Plan's moderate and optimistic scenarios, targeting final uses that display greater involvement in potential energy saving, namely: air-conditioning, refrigeration, lighting, and electric motors. Even the benchmark scenario accepts a positive influence of energy efficiency in the country's energy consumption.

- **Benchmark scenario:** This assumes a continuation of the trend with minimal State intervention. The Government's role is limited to regulating and monitoring compliance with decisions taken. Savings campaigns already under way are continued, such as *Operación Bombillo* to replace 3 million incandescent lightbulbs with compact fluorescent lamps in the residential sector, which began in 2008; installation of energy-efficient lamps in public organizations; and continuation of the energy-saving campaign in public agencies. Electric power integration with Central America and Colombia is as expected to be continued.
- **Moderate scenario:** All benchmark scenario actions are implemented. The institutional structure is redefined, the institutional structure is improved and strengthened — mainly the National Energy Secretariat, which facilitates appropriate implementation of actions leading to efficient energy use.

The main tasks in this area are as follows:

- Enactment and implementation of a Law on Rational Energy Use (REU);
- Creation of a reimbursable fund for the implementation of REU projects;

- Definition of efficiency standards for domestic electrical appliances and electrical equipment;
- Design of educational programmes to promote REU in schools;
- Drafting of legislation to provide tax benefits or special rates for the purchase of energy-efficient equipment; and
- Definition and implementation of rules governing the purchase of energy-efficient equipment in public offices.

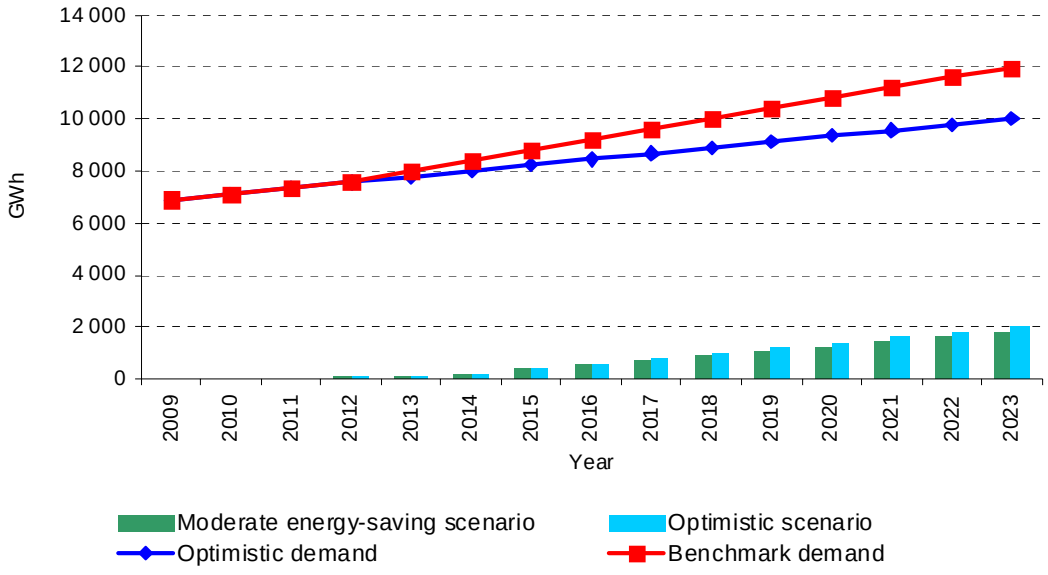
- **Optimistic scenario:** All the efficient-energy-use actions of the previous scenarios will be implemented, and other energy-saving programmes and projects will be undertaken such as: definition of a Standard on Housing and Building Construction, and preparation of a programme to finance the purchase of energy-efficient equipment by low-income consumers.

  Greater efforts will also be made to diversify the energy mix, by enacting a Biofuels Law, promoting at least a 10% of ethanol and biodiesel in fuels used in the transport sector. This includes the introduction of an electric-powered mass-transit system. In addition, the standard on alternative energy sources will be revised, which currently does not guarantee firm power, to increase its participation in energy supply.

These savings would lead to lower energy demand in the two scenarios that involve strong application of energy efficiency, compared to the benchmark energy demand scenario. This would allow for a welcome postponement of the entry of new power generating plants, which were required to come on stream in 2019 (30 MW hydroelectric plant at Bonyic and 60 MW hydroelectric plant at El Alto), and in 2020 (coal-fired plant of 250 MW).

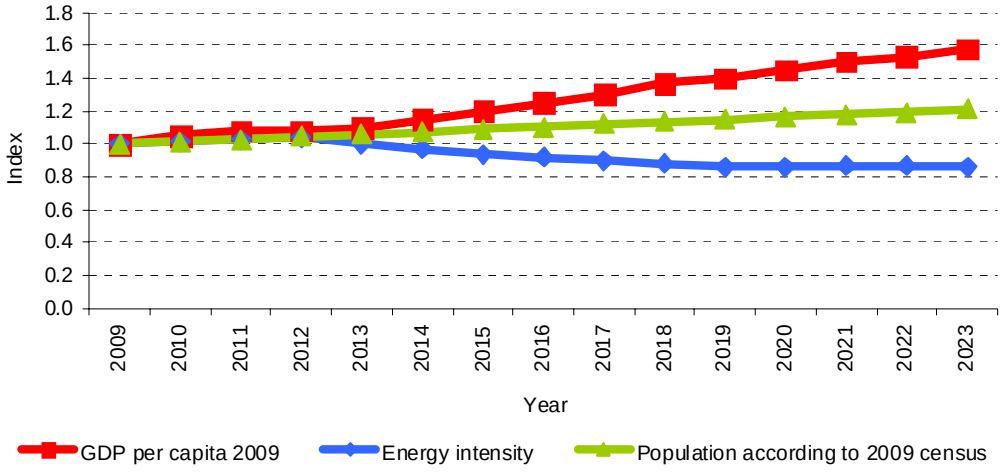
Projection to 2023 foresees lower energy growth in Panama in the scenarios involving energy-efficiency actions. The rise in the energy consumption per person, could well be justified by the expected continuation of economic growth, but lower consumption of energy per monetary unit of production suggests that energy is being used more efficiently to achieve better comfort, production and services.

FIGURE 27
ENERGY CONSUMPTION GROWTH SCENARIOS



Source: National Energy Secretariat.

FIGURE 28
TREND OF ENERGY INDICATORS



Source: National Energy Secretariat

B. Key actors in energy efficiency and their effective roles

1. National Energy Secretariat

The National Energy Secretariat was created under Law 52, of 30 July 2008, as a government agency with functions pertaining to planning, research, direction, supervision, inspection, operation and control of global policies; and it defines the sector's operating strategies, for the purpose of formulating energy policies in the Republic of Panama.

Under its top authority, the Secretary, there is a Department of Hydrocarbons and Alternative Energies, and the Department of Electricity and Rates, each with functions pertaining to their areas of jurisdiction. Following the recent change of Government on 1 July 2009, involving a new Secretary and Directors, and the appointment of new senior authorities in government agencies (ETESA, EGESA, ASEP and ANAM) forming part of the Consultative Committee (advisory unit) of the Secretariat, a review was made of experiences, pending issues, energy policy and requirements for institutional strengthening of the Secretariat and other government dependencies that will play an important role in the country's energy policy.

CONADE (1980-1998) undertook studies on energy-efficiency issues which formed the basis of COPE (1999-2008); and now the Secretariat, as the functional continuity of the two previous organizations, draws on their experiences and outputs, in recognizing the important role that energy efficiency could play in Panama. The guidelines of the 2009-2023 National Energy Plan have been reviewed for implementation, which means that energy efficiency is seen as an alternative for satisfying the country's future energy requirements.

The Secretariat makes the necessary arrangements to act as the central coordinator of activities to be undertaken to fulfil the country's energy policy. And now, in addition to serving as the Government Advisory Unit, the Secretary has ministerial rank. One could therefore say that progress has been made towards a future Ministry of Energy — something has been talked of since the days of CONADE, with a view to having greater influence on decision making and implementation of the country's energy policy.

2. National Environment Authority

In the 1980s, there was an administrative unit within IRHE that oversaw environmental conservation in relation to electricity projects. Since the 1990s, the implementation of energy projects under a sustainable development framework has become more important, to minimize impact on the environment and reduce greenhouse gas emissions, under the guidelines set forth in the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

These initiatives led to Decree Law 41 of 1 July 1998, creating the National Environment Authority as the State's governing body for natural resources and environment, to ensure compliance with and application of the laws, regulations and national environment policy. Article 88 of that law provides that the State will promote and prioritize non-polluting energy projects, based on the use of clean and energy-efficient technologies.

Executive Decree 35, of 26 February 2007, approved the National Climate Change Policy, and recognized the National Environment Authority (ANAM) as the government agency responsible for preparing, coordinating and supervising the execution of national climate change policy. Its objectives include the following:

- creation of a permanent technical unit in ANAM, dealing with climate change issues;
- implementation of development projects to reduce greenhouse gases, including energy-efficiency projects;
- preparation and application of education, awareness-raising and training programmes.

The importance of energy efficiency goes beyond optimizing energy resources, because it is now valued and promoted as a State environmental strategy on climate change. Hence the ANAM Climate Change Unit is implementing a publicity campaign through pamphlets, posters and talks on energy efficiency and the environment, targeting its staff and the community at large.

3. National Public Services Authority (ASEP)

Decree Law 10 of 22 February 2006 restructured the public services regulatory body and renamed it the National Public Services Authority — an autonomous state institution, with jurisdiction to regulate and control provision of the public services of drinking water supply, sewerage, telecommunications, electricity, radio and television, and the transmission and distribution of natural gas. Article 4 paragraph 3 of Law 6, of 3 February 1997, provides that the State will intervene in public electricity services to ensure efficient, continuous and uninterrupted service provision, except in situations of force majeure.

Article 21 paragraph 8 of that law includes the issuance of specific regulations for efficient energy use by consumers among the regulatory body's functions in relation to the electricity sector,.

It could therefore be said that ASEP can regulate consumer behaviour to fulfil energy efficiency on the demand side; but it also participates in approval of the Electricity Expansion Plan, and in regulating energy supply, which could well be affected by the energy-efficiency policy. Accordingly, ASEP could play an important role in steering, monitoring and controlling the application of efficient energy use measures.

An example of its potential participation in the practical regulation of energy efficiency was Resolution AN No. 1631-Elec of 21 April 2008, on measures concerning air-conditioner use and business hours in public bodies, together with Resolution AN No. 1632-Elec, which establishes the hours in which luminous signs can be used.

4. Directorate General on Industrial Standards and Technology - MICI

Article 93 of Title II of Law 23, of 15 July 1997, states that the Directorate General on Industrial Standards and Technology (DGNTI) of the Ministry of Commerce and Industry, is the national

organization governing technical standardization, conformity assessment, quality certification, metrology and conversion to the international units system (SI).

The legislation gives this administrative unit an important role in terms of technical standardization, accreditation and certification — a topic that is gaining importance with a view to guiding and educating technical groups and consumers to achieve greater and effective participation in energy efficiency in Panama's energy sector. In this regard, the following needs had been raised within its jurisdiction:

- Regulation of the manufacture and/or importation of more energy-efficient equipment
- Regulation for efficient building
- Certification of efficient equipment
- Conformity seal and equipment labelling
- Accreditation of equipment testing and trialling organizations
- Inspection and supervision to promote energy efficiency
- Education and dissemination of the topic to improve the quality of products and services

In the energy-efficiency area, work has been done on the technical standard of compact fluorescent lamps; and other standards are pending that have been identified as important, such as air-conditioning, refrigeration and electric motors.

Bearing in mind the outstanding tasks and the importance of this administrative unit's functions concerning the existence and adoption of standards for the future of energy efficiency in Panama, institutional strengthening is necessary to increase its operational capacity, and build capacity to convene all entities, technicians or associations that could or should participate in preparing the standards.

5. National Science and Technology Secretariat

The National Science, Technology and Innovation Secretariat (SENACYT) is an autonomous agency with a mission to harness science and technology as sustainable development tools in Panama, to raise productivity, competitiveness and modernization in the private sector, Government, academic-research sector, and among the population at large.

The Secretariat was created by Law 13 of 15 April 1997, and it fulfils its activities within the framework of the National Strategic Plan for the Development of Science, Technology and Innovation (Cabinet Resolution 104, of 21 December 2005).

SENACYT has a number of departments that can and do foster expectations for increasing the importance of energy efficiency, to increase productivity and competitiveness, namely:

- **Science and Technology Management:** This department provides a platform to support the country's scientific base, by training human resources, linking study and research centres and coordinating with actors that form the country's science and technology system.
- **Business Innovation:** This department facilitates the generation of new practices, products and services for sustainable socioeconomic development.
- **Research and development:** This department strengthens national capacity to undertake scientific research, generate knowledge and facilitate technology transfer, to promote human development in Panama.

This government agency can support human resource formation and technological research and development to implement energy efficiency, as identified in a various papers or studies undertaken with the Technological University of Panama (UTP), the University of Panama, the Santa María la Antigua University, the MICI Directorate General on Industrial Standards and Technology, and the National Energy Secretariat.

This is borne out by the fact that there are various students and researchers from the UTP, benefiting from scholarships and research funds to pursue Masters and PhD studies on energy-efficiency issues, in both European and Latin American countries. Moreover, SENACYT also provides scholarships to support university students at the UTP on masters programmes and postgraduate studies in renewable energies and the environment, which include subjects related to energy efficiency.

6. Technological University of Panama (UTP)

The UTP was created by Law 17, of 9 October 1984, to provide higher-level science and technology education; it undertakes and publishes theoretical and applied research of relevance to the country's technological development. It organizes and provides courses leading to professional qualifications at the technical, first degree and postgraduate levels and any other higher education level.

The university has a Vice Rectorship for research, Postgraduate Studies and Extension, and a number of research centres. Since the 1990s, it has conducted studies and research on energy-efficiency issues, through the following masters and postgraduate study programmes:

- Masters degree in electrical engineering
- Masters degree and postgraduate studies in renewable energies and the environment
- Masters degree and postgraduate studies in plant engineering or plant maintenance specializing in energy management and environmental protection

Energy-efficiency activities have also been undertaken through the Centre for Energy and Environmental Studies, and the Energy-Saving Unit, which have performed case studies, given talks and seminars, and conducted energy audits.

The UTP serves on various technical committees and the consultative groups of government agencies relating to energy planning and efficiency. Its short-term plans include the creation of an energy-efficiency laboratory, to undertake trials for energy efficient equipment certification in lighting, air-conditioning, refrigeration and electric motors. This laboratory project requires an investment of US$2 million.

7. Electricity distribution firms

Panama's electric power distribution firms (EDEMET, EDECHI and ELEKTRA-NORESTE) run campaigns to give customers guidance on rational energy use, through:

- Talks given to schools and consumer associations
- Information on the Internet
- Publicity campaign (radio, television and press)
- Several cases of personalized guidance for customers

The specific monitoring of residential and commercial customers has shown that customers can achieve a 10 to15% reduction in their monthly electricity consumption, by applying measures to change energy-use habits with very little investment in technological change, and savings of up to 30% can be expected if significant technological change measures are applied.

8. Panamanian Engineers and Architects Association

The Panamanian Engineers and Architects Association (SPIA) is a non-profit professional grouping with his own legal status, which encompasses Panama's professional engineers and architects. Its activities include:

- Promoting, studying and debating issues within its jurisdiction

- Acting as a consultant on State engineering and architecture issues
- Informing public opinion
- Holding congresses and seminars to keep their members up-to-date

Contributions have been made and opinions have been given on efficiency on several occasions; but the association could participate more in supporting and contributing to the pending tasks and future energy-efficiency issues.

9. Ministry of Education

To date, the Ministry of Education has not included energy efficiency or environmental issues within its teaching plans. Nonetheless, the expected importance of energy efficiency in the country's energy sector in the short and long-term, mean that the benefits of energy efficiency need to be taught through study plans starting at primary school, to create citizen awareness.

C. Resources and funding mechanisms for energy efficiency programmes

The development of energy-efficiency studies and programmes, which began in Panama in the early 1980s, has had government involvement, supported by international organizations. In contrast, private participation has been virtually non-existent. Resources have been allocated through grants, technical co-operations, loans and the State budget. The chronology in this area has been as follows:

- Preliminary study for the exploitation of renewable energy resources in Panama (1980), Grant project USAID-IRHE No. 525-0202. Although this project did not aim to identify energy efficiency, it developed the first energy survey that allowed for a sector-level characterization of energy consumption by final use.
- Energy planning and conservation study ordered by CONADE with financial support from the International Bank for Reconstruction and Development (IBRD), 1981. This initiative included energy audits and, for the first time, defined the country's energy saving potential. This study was assigned to the French firm TRANSENERG.
- Projected Energy Needs until 2000, Rationalization of Final Energy Use, October 1987. Sponsored by the São Paulo electricity company (*Companhia Energética de São Paulo* - CESP) and OLADE, it evaluated energy saving actions and potential.
- Proposal for the development of an Energy Conservation Programme, 1990, undertaken with support from technicians from CESP. Possible lines of action were identified for the programme.

  The ENERFRIP project (1996) aimed to promote efficient use of electric energy in cooling and air-conditioning systems. It was implemented through a technical collaboration agreement between Panama and the European Commission.
- Project to Manage the Demand for and Efficient Use of Electrical Energy in the Central American Isthmus (December 2000), implemented by OLADE in partnership with EDEMET-EDECHI, financed by the European Commission. Load characterization in Panama City, definition of potential saving and a long-term energy-efficiency plan.
- Project to study energy uses and efficiency (May 2001), undertaken by FIDE through a contract signed with UNDP, supervised by COPE.

In all of these projects and studies, the Government provided contributions through the State budget, and supplied logistical and technical support.

The Republic of Panama currently has a non-reimbursable international technical cooperation agreement (ATN/MC-11323-PN) with IDB, to support the programme to strengthen the National Energy Secretariat of Panama and prepare action plans on sustainable energy and energy efficiency. In the same context, the National Energy Secretariat has signed an agreement with UTP to support energy audits in government entities.

The UTP Faculty of Mechanical Engineering receives support from the National Science, Technology and Innovation Secretariat (SENACYT), in the form of funding for scholarships to pursue Masters degrees in mechanical engineering sciences, and for research on specific issues aimed at technological innovation, including energy efficiency. SENACYT funds come from the State, and international organizations.

The National Environment Authority (ANAM) undertakes activities to promote energy-efficiency measures as an environmental climate change strategy, using funds from the Government and international organizations related to the environment such as Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC), the United Nations Environment Programme (UNEP), the Global Environment Facility (GEF), etc.

Despite the need for investment or expenditure to develop an energy-efficiency project, there have been few initiatives in this area from consumers or the business sector. Firms generally use their financial resources to develop projects that increase production capacity; but few of them choose to implement an energy-efficiency project resulting from an energy audit. Although local banks do not have a specific modality for financing energy-efficiency projects, they do have regular financing facilities (loans or leasing) that could be used, such as the commercial credit unit of Banco General de Panamá and HSBC.

D. Results of energy efficiency programmes to date

1. Energy-saving programmes in the government sector

Energy consumption reduction programmes have been developed in response to threats of energy crisis or situations needing a reduction in government spending:

- **OMEGA Plan (September 1983-August 1984):** The Expenditure Organization and Improvement Plan (OMEGA) was implemented in government agencies to reduce public spending; and, within this aim, an objective was set of achieving a 25% reduction in electricity consumption. The plan lasted for one year, and a number of entities partially or totally managed to reduce electricity consumption, cutting consumption by 7.1% (3.9 million balboas) by the end of a year;
- **CORAGAP Plan (1985):** Given the good results achieved by the OMEGA Plan, but which only lasted one year, the Public Expenditure Control and Rationing Plan (CORAGAP), was set up with the same purpose and operational plan. Nonetheless, the expected results were not achieved, and they did not even succeed in avoiding the annual trend growth of consumption in the government sector, owing to the lack of effective implementation, monitoring and control of the application of measures and evaluation of results.
- **Energy Conservation Plan (1990):** This plan arose in response to worries about a possible undersupply and/or rise in prices of petroleum products, as a result of the Persian Gulf War. The Plan had private-sector participation for the first time (automobile fuel distributors), but as soon as the threat of energy crisis subsided, the energy-efficiency measures were discontinued.
- **Energy Saving Plan (2007):** This Plan was introduced in response to a critical electricity supply situation, which was overcome in May 2008. Although the programme is still in

force, its actions have not been continued, nor have the monitoring and control of application of the Plan's energy-efficiency measures.

The lack of positive results in this regard stems from the need to monitor and control the energy-efficiency measures identified, and where necessary, retarget them.

2. Campaigns to publicize government energy-saving measures

Publicity campaigns have been implemented during the lifetime of energy-efficiency programmes to disseminate their energy-efficiency measures, but they require continuity in their execution. Measures to monitoring and control the application of measures and evaluate results also need to be maintained, since these programmes need to be dynamic, eliminating or adjusting measures according to the results achieved.

3. Proposals of the National Energy-Efficiency Plan

During the period 1980-2009, three studies were undertaken indicating the potential for energy saving, and identifying measures that would need to be applied continuously to achieve positive energy-saving results. Nonetheless, no real and continuous decision has been taken to implement a National Energy Efficiency Plan. Given the findings of the National Energy Plan 2009-2023, prepared by the National Energy Secretariat, which highlighted the major importance of energy efficiency as a planning alternative, there is a positive attitude with potential for effective application.

Operación Bombillo

This project, which began in late 2008, resulted in the replacement of 3 million incandescent lightbulbs with compact fluorescent lamps in the residential sector. The positive results in terms of reducing energy consumption should be real, because the lamps were distributed throughout national territory. Nonetheless, one should not expect replacement to affect maximum daily demand, since this occurs during the daylight hours, while lamps in the residential sector are used at night-time. Although there should be a real reduction in electricity consumption, calculating the percentage is difficult, since total electricity consumption fluctuates for different reasons. Calculating the real effect would require individual monitoring of each home in which lamps were changed, and for them to be actually in use.

4. Campaign to install efficient lighting in public bodies

This project will produce positive results in terms of reducing consumption and maximum daily demand, because the business hours of public agencies are mostly during the peak daytime period. Nonetheless, as each government body has to change its lamps out of its annual budget, effective implementation of the measure in all agencies could be uncertain.

5. Vehicle fuel energy-efficiency campaign

Although the transport sector accounts for a large proportion (45%) of the total consumption of petroleum products, fuel distributors have not signed up to the aim of improving the environment. An energy-saving campaign in vehicle fuels could therefore be useful. Thought could also be given to regulating vehicle performance, or, at least, implement a publicity campaign in this area.

E. Lessons learned

- Since the 1980s, energy efficiency has been a topic of major interest in Panama; and there have been several government administrative units dealing with the subject, namely:
  - 1980-1998 - National Energy Commission (CONADE).
  - 1999-2007 - Energy Policy Commission (COPE).
  - 2008 to present - National Energy Secretariat.
- Various related studies have defined energy-efficiency potential in Panama, by sector, final use and energy-saving opportunities; and guidelines have been produced for the actions needed to achieve the energy saving proposed.
- The Government has implemented a variety of energy-efficiency programmes (1983, 1985, 1990 and 2007) targeting government agencies, where there is clearly a major potential for energy saving. But some of these programmes clearly failed to achieve their objectives owing to a lack of monitoring, control, evaluation and feedback of the plan.
- Although possibilities for energy efficiency have been identified, there has been little private initiative for investment in projects of this type; and although local banks can consider commercial loans for new technologies, available funds are generally used for other types of project.
- There is a need to more widely disseminate the benefits of energy efficiency, while promoting specific energy studies and creating an appropriate financial structure (attractive loan funds) to develop energy-efficiency projects.
- The current National Energy Secretariat, through the proposal of the National Energy Plan which has appropriately highlighted energy efficiency, shows that clear lines of action are needed to achieve the proposed energy scenarios.
- The National Energy Secretariat will require further technical and institutional strengthening to ensure the fulfilment of an energy-efficiency policy.
- Ensuring that the objectives set forth in the National Energy Plan are achieved requires proper implementation and the corresponding monitoring, control, evaluation and feedback.
- The main lines of action for energy efficiency considered in the National Energy Plan include the following:
  - Standard for the manufacture and/or importation of efficient equipment
  - Energy-efficient building standards
  - Certification of energy-efficient equipment
  - Dissemination campaign
  - Energy efficiency education programme
  - Energy-saving campaign in government bodies

XXI. Paraguay

A. Recent advances in policy, regulatory and institutional frameworks

There is currently no specific Government programme on energy efficiency in Paraguay. Nonetheless, the latest institutional developments alluded, albeit tangentially, to issues of rational and efficient energy use in that country.

Such developments include the Energy Sector Strategic Plan (PESE), which was the final outcome of a project undertaken with international technical and financial cooperation through Assistance for Pre-investment Programmes, and participation by numerous public institutions and private enterprises. The Ministry of Public Works and Communications (MOPC), acting through its Vice Ministry of Mining and Energy (VMME) served as technical counterparty in preparation of the PESE, in coordination with the Technical Planning Secretariat (STP).

The main objective of the project was to design a strategic plan for the energy sector, together with a supporting obligatory framework.

To achieve this objective, the study made an analysis of existing statistical and documentary information, which was sufficiently detailed to be able to make a diagnosis and, above all, identify constraints on the development and functioning of the energy sector in Paraguay. The statistical and documentary analysis was supported with opinions from agents and experts involved in the economy, particularly in the country's energy sector.

In January 2005, the design stage of PESE was completed, which was evaluated by the VMME technical team, supported by specialists from other national institutions and organizations. The assessment found that the programme was appropriate and consistent with the national government's development policy and the general guidelines set for the energy sector.

Following its completion, PESE became a key indicative reference for the coordination and design of actions and implementation deadlines to ensure the fulfilment of energy sector guidelines, measures and actions for the period 2005-2013, particularly in relation to the mission and vision, strategic objectives, lines of action and measures proposed.

In accordance with its functions, the MOPC acting through the VMME, coordinates the review, updating and periodical adjustment of lines of action, measures and timetables contained in

the PESE, which it does in conjunction with other institutions, firms, and actors involved in the development of the National Energy Sector. These functions also form part of the expansion of projection horizons, in terms of years, corresponding to the national economic and social dynamic, and changing realities of the regional and international setting. The MOPC, acting through the VMME, makes PESE available to the public through its website (www.mopc.gov.py).

The table below sets out the strategic objectives of PESE. In terms of energy efficiency, Objective 3 compares lines of actions relating to energy efficiency and saving with those corresponding to security of supply.

In fact, point 2, sub-item 3 "Modernization/liberalization of the oil sector" mentions actions proposed to raise awareness on rational fuel use, in Chapter IX.4.3.

TABLE 27
MODERNIZATIONS/LIBERALIZATION OF THE OIL SECTOR

Objective	Lines of action
1. Institutional coordination	1. Integration of energy competencies, autonomy and institutional coordination
2. Security of supply	3. Modernization/liberalization of the oil sector
	4. Development of natural gas
	5. Modernization of the activity sector
	6. Introduction of renewable energies
3. Energy efficiency/saving	This objective is achieved through the same actions envisaged for the supply security objective.
4. Extension of energy coverage.	This objective is pursued mainly through lines of action 5 (Modernization of the electricity sector) and 6 (Renewable energies). The introduction of natural gas will also facilitate extension of energy coverage.
5. Development of the regulatory framework	7. Improvement of the regulatory framework
6. Integration in MERCOSUR	Institutional actions, modernization/development of the oil, gas and electricity sectors, introduction of renewable energies.

Source: Energy Sector Strategic Plan (PESE).

Insufficient emphasis seems to be placed on developing energy-efficiency measures through this mechanism.

B. Key actors in energy efficiency and their effective roles

Although there is currently no energy-efficiency programme in Paraguay, either in the design phase or in development, should it be decided to implement one, the key stakeholder would be the Vice Ministry of Mining and Energy (VMME) of the Ministry of Public Works and Communications (MOPC).

Article 25 of Law 106 27/93 makes the VMME of the MOPC responsible for establishing and directing policy on the use and management of energy resources, and for studying technical, economic, financial and legal issues to promote its exploitation. To efficiently fulfil its functions, the VMME needs technical and human capacities in the energy planning area corresponding to its functions.

Nonetheless, according to the VMME itself, the Vice Ministry does not have adequate tools to efficiently fulfil its functions in the energy planning area (which would include energy-efficiency programmes, if they existed).

In the recent past, and as a result of the sector policies implemented, new areas were created in the VMME (Hydrocarbons Directorate, Biofuels Department and Environment Department). As these have been created only recently, the lack of the necessary tools is even more acute.

Given the lack of technology and adequate tools, the technical capacity of staff in managing them is also limited.

As mentioned above, and as can be inferred from point (1) above, there are no key stakeholders, either institutional, or business, or of any other category, which are currently pursuing energy-efficiency initiatives in Paraguay.

Accordingly, there is no effective role being played in this area by energy-efficiency stakeholders related to.

C. Resources and funding mechanisms for energy efficiency programmes

As no energy-efficiency programmes are currently being implemented, there are no resources allocated to this issue. The lines of action mentioned in the table of point (1) above, are financed from government funds assigned to development of the PESE.

D. Results of energy efficiency programmes to date

As there are no energy-efficiency programmes currently being implemented (or being designed) there are no outcomes to evaluate.

E. Lessons learned

As there is no energy-efficiency programme currently being implemented, the analysis of lessons learned does not apply. Nonetheless, on this point, attention should be drawn to the obstacles preventing this type of initiative, referred to by VMME as “weaknesses”, namely: (a) restrictions on the financial resources of public institutions to undertake campaigns and policies in the area of sustainable energy use; (b) low level of development in projects related to reducing polluting gas emissions; (c) high cost of energy-efficient equipment; and (d) low level of knowledge among final consumers on the importance and advisability of efficient energy use (as a necessary consequence of point (a)).

XXII. Peru

A. Recent advances in policy, regulatory and institutional frameworks

Peru implemented very intensive energy-efficiency activities between 1995 and 2001, owing to the deficit in the supply of electric power generation, and demand was cut by 10%. In addition, Law 27345 Promoting Efficient Energy Use was promulgated in 2000, to foster the formation of an energy-efficiency market, by providing information and promoting a culture of efficient energy use in all sectors of consumption.

In 2006, when the new Government took office, the Ministry of Energy and Mines (MIMEM) decided once again to prioritize energy-efficiency programmes, and in 2007, through Supreme Decree (DS) 053-2007-EM it issued regulations for the law promoting rational energy use (REU), which institutionalizes energy-efficiency actions in four consumption sectors: residential, production and services, the public sector and transport, which had implemented the Peru's Energy Saving Programme (PAE) until 2001.

In the same year, DS 031-2007-EM approved the regulation governing the organization and functions of the Ministry of Energy and Mines, and delegated to the Directorates General of Electricity and Hydrocarbons, actions relating to the promotion and dissemination of rational energy use, renewable energies and energy efficiency.

On 13 December 2007, Ministerial Resolution 560-2007-MEM/DM created the "Commission for the Fulfilment of Transitory Provisions of the Regulation to the Law Promoting Efficient Energy Use", thereby initiating the application of that legislation.

To embark on the first energy-efficient actions, in 2008, it approved a Short-Term Energy Efficiency Plan, which defined actions for the residential, public, productive and services sector, and is currently still being implemented.

DS 034-2008-EM of 2008, provided for modernization of lighting in government buildings, involving the replacement of: fluorescent lightbulbs, electromagnetic ballasts, prohibition on the purchase of incandescent lamps, and the requirement for efficiency labelling on lighting equipment purchased by public-sector entities.

Peru also has a co-generation regulation in force (DS 037-2006-EM and its amendments).

Through DS 009-2009-MINAM, the Ministry of the Environment defined eco-efficiency measures for the public sector, which include mandatory energy-efficiency actions.

The long-term Benchmark Plan for Efficient Energy Use 2009-2018, which was prepared as required by the Law Promoting Efficient Energy Use, was approved in September 2009 by the country's 25 regions. The administrative process is currently proceeding, and it should be officially approved in the next two months.

In June 2009, the Ministry of Energy and Mines announced a policy decision to set up an Energy Efficiency Centre to support these activities in the country. Its design and implementation are currently underway.

B. Key actors in energy efficiency and their effective roles

MIMEM is the central agency governing the energy and mining sector, with the functions of formulating and evaluating national policies for sustainable development of mining-energy activities, in keeping with the Government's general policy and plans, and national policies for the sustainable development of mining-energy activities.

According to the Law Promoting Efficient Energy Use, MIMEM is also the competent State authority for the promotion of energy-use efficiency, with authority to design, promote, coordinate and implement programmes and projects with other sectors of public entities, and to co-operate with consumer organizations and business entities.

The line agency that is developing energy-efficient actions in Peru is currently the General Electricity Directorate (DGE).

The Benchmark Plan on Efficient Energy Use identifies the following key stakeholders for its implementation, and it is already working with some of them to that end:

The main public-sector stakeholders are:

- Ministry of Education (formation of an energy-efficiency culture)
- Ministry of Production (industrial sector)
- National Institute for the Defence of Competition and Protection of Intellectual Property (INDECOPI), with which it is developing energy-efficiency standards for energy consuming equipment
- Development Finance Corporation (COFIDE)
- Ministry of the Environment
- Ministry of Transport
- Ministry of Housing
- Regulatory agencies in the energy and mining sector (OSINERGMIN)
- Regional Governments
- Local Governments
- State social support programmes
- Peruvian Agency for International Cooperation (APCI)

The leading academic stakeholders are:

- State and private universities

- Technological institutes

The leading private-sector actors are:

- Energy efficiency consulting firms and energy-efficiency service providers -EMSEs (ESCOs)
- Suppliers of efficient equipment
- Electricity distribution firms
- National Society of Industries
- Peruvian Consumers and Users Association (ASPEC)
- The banking system
- Non-profit organizations:
  - National Centre for Energy Conservation and the Environment (CENERGÍA)
  - National Environment Fund (FONAM)

The two latter private-sector entities implement permanent activities to promote efficient energy use.

CENERGÍA is a pioneer in promoting these actions in Latin America, and in developing renewable energies.

FONAM also implements energy-efficiency actions since one of its missions is to reduce environmental emissions, which are directly related to this type of activities.

The Benchmark Plan for Efficient Energy Use defines a number of stakeholders, describing their contribution and rating the importance of each one. Annex 4 of this document contains a table with these definitions.

C. Resources and funding mechanisms for energy efficiency programmes

For 2008, at the State allocated roughly US$2.8 million for the campaign to promote efficient energy use in the residential, public and productive sectors. For the current year, US$3.3 million has been earmarked.

In addition, in 2008, Banco BBVA, a member of Peru's private banking sector, acting on behalf of IFC-World Bank, invested US$30 million in energy-efficiency projects through loans to firms in the productive sector under the leasing format. The fund in question was fully subscribed in that year, and was considered a successful experience. Other local banks have been managing funds for clean production, which includes energy-efficiency projects.

In August 2008, an energy-efficiency campaign was launched for small and medium-size enterprises, financed by the IDB. The executing agency is the National Environment Fund (FONAM), and it has US$1.5 million available for three years.

With the aim of financing energy-efficiency programmes in the productive sector, COFIDE is coordinating a loan from RWE bank (Germany) for €50 million, which is currently in the final procedural stages.

Also, in 2009 a specific project has been implemented to replace 200,000 kerosene cookers with gas cookers, and 25,000 traditional wood-burning cookers for improved cookers, for which there is an approved budget of US$15 million.

The Benchmark Plan for Energy Efficiency is estimated to require an annual budget of at least US$3 million at the start. This amount only covers promotion and invigoration of the energy-efficiency market in all sectors, for the stakeholders themselves will make the investments since the energy-efficiency actions they implement will be paid for out of the savings they obtain.

D. Results of energy efficiency programmes to date

Between 2003 and 2006, the activities of the Energy Saving Programme (PAE) of the Ministry of Energy and Mines (MEM) were halted, except for the preparation of technical efficiency standards by INDECOPI, in which MIMEM participated as technical secretariat, along with producers and distributors of equipment, academic entities and user associations. Technical standards and labelling has been developed for following types of equipment: lighting, refrigeration, water heaters, motors, boilers.

Between 2006 and 2007, with IDB financing and through non-reimbursable Technical Cooperation Agreement ATN/JF - 7040 - PE, "Consolidation of the institutional and regulatory framework for sustainable energy-efficiency services", three diagnostic studies were undertaken, together with an evaluation of the main obstacles faced by energy efficiency, and promotion work to form ESCOs. By July 2008 two consulting firms interested in becoming ESCOs had been identified.

The following activities have been undertaken since 2008, as part of the implementation of the Regulation on Efficient Energy Use:

- Preparation of energy consumption standards and guidelines for energy-efficiency labelling for: straight fluorescent lamps, circular fluorescent lamps, compact fluorescent lamps, refrigerators and freezers, electrical water heaters of the accumulator type, gas and water heaters, electric motors and boilers.
- Monitoring methodology and energy indicators.
- Implementation of an interactive energy efficient use system, that can be viewed at http://peruahorraenergia.minem.gob.pe.
- Short-term Energy Efficiency Plan and the Benchmark Plan for Efficient Energy Use 2009-2018.

In addition, over the last two years, MINEM has also implemented the following actions:

1. Residential sector

- A publicity campaign to raise public awareness of the need to improve their energy consumption habits and encourage them to replace incandescent lamps with compact fluorescent lamps (CFLs). Last year 14 million CFLs were sold.
- In addition, a programme is underway to distribute 1.5 million CFLs free to lower-income households in all regions except the national capital. A total of 500,000 such lamps had already been distributed as of August 2009.
- An information and demonstration campaign has been undertaken in schools and among the population at large.
- A survey of consumption habits and possession of domestic appliances has been undertaken in seven of the country's cities, which will help define the baseline for the residential sector.
- In addition, a specific project was implemented in 2009, which has started to replace 200,000 kerosene cookers with gas cookers, and 25,000 traditional wood-burning cookers with improved units. The process should be completed in 2010.

2. Public sector

- Supreme Decree 034-2008-EM was issued on 19 June 2008, to modernize lighting in the public sector by replacing fluorescent T12 lamps with T8s, and electromagnetic ballasts with electronic ones, and a ban on purchasing incandescent lamps. This regulation also requires government agencies to refrain from purchasing lighting appliances that do not display the energy-efficiency label.
- An energy-efficiency course was held for maintenance chiefs and technicians in public agencies.

3. Productive and services sector

- Courses were held for maintenance chiefs and technicians in the productive and services sector in Lima and other regions.
- Guidelines were produced for implementing energy-efficiency programmes for various productive and service activities.

In addition:

- CENERGIA and the Energy Diversification Institute of Spain (IDAE) have been providing training on issues of co-generation and renewable energies, together with co-generation viability studies in for Peruvian firms, as part of the project "*Selected Renewable Energy and Energy Efficient Technologies for CDM opportunities in Latin American Countries*", financed by the European Community (EC). It is also undertaking feasibility studies to implement a co-generation plant in a textile firm.
- The National Environment Fund (FONAM) and the Inter-American Development Bank (IDB/MIF) have been promoting energy efficiency through training actions and technical assistance, under agreement ATN/ME-10711-PE "Promotion of market opportunities for clean energies and energy efficiency in Peru". Activities included energy pre-audits on 30 small and medium-sized enterprises (SMEs), 25 of which have been selected for full audits.

E. Lessons learned

In terms of the usefulness of energy-saving programmes, it has been shown that not only are they feasible and beneficial at times of energy crisis, but they should also be a permanent activity to ensure low-cost energy supply to the country, and therefore should be included in national energy plans. In addition, energy-efficiency improves competitiveness, provides surplus energy for the country to use or export, postpones the need for investments, reduces environmental emissions, and contributes to sustainable development practices.

On organizational matters, countries need to have a government unit working specifically on this activity, with specialized staff. Moreover, such a unit needs to have an important place within the sector organization, because to conduct a multi-ssector activity, it needs to have capacity to convene other sectors and be able to take rapid decisions to lead or assume commitments.

One of the most important tasks in promoting an energy-efficiency culture is to target schools, mainly in the early years of education, since this is the stage of life in which the consumption habits that will accompany us throughout life are formed. To fulfil that objective, the effort needs to be institutionalized with the Ministry of Education, through long-term agreements covering training of a whole new generation (12 years).

Publicity campaigns are powerful tools to induce a change of habits among adults and the use of efficient equipment; but they need to be designed by communication specialists. Given their temporary effects, they also need to be repeated annually.

The main argument normally used to justify energy-efficiency campaigns, is monetary saving; but motivation based on solidarity and, especially, environmental protection, gives excellent results.

A very important issue concerns the information that should be available to consumers to guide them when purchasing appliances or energy-consuming equipment. As this decision will affect energy consumption during the equipment's useful life, compulsory labelling is very important to guide the population in making the best purchase decision, considering efficiency aspects.

In relation to financing for energy-efficiency programmes in the industrial and services sector, although private-sector banks can make loans for this purpose, one of the obstacles is the complex process of verifying such projects. As banks prefer simple procedures, it will probably be necessary to standardize bankable energy-efficient "products". Working closely with the financial sector, and providing it with technical support to implement procedures, is an issue that will need to be given priority.

When implementing national energy-efficiency programmes it is important to measure results, because as government funds are involved, ex post audits are always performed to check whether the money invested has produced results. In some cases, the measurements may be simple, but others require more elaborate and complex methodologies, such as in school campaigns were the results are seen over the long term. Some projects can make use of methodologies being approved by the Executive Board of the United Nations Clean Development Mechanism to value carbon certificates; but others will need to use econometric studies requiring the generation of data to make this type of evaluation possible.

Ex ante and ex post measurement of sector energy indicators and by types of economic activity provide some the most important data showing the evolution of the effects of energy-efficiency programmes. It is also important to periodically calculate the national usable energy balance.

The possibility of regulatory amendments should be considered, to ensure that distributor firms participate in energy-efficiency programmes on the demand side, since it is they that best know their customers' consumption characteristics. If it were possible to isolate profits from sales, energy distributors could even sell energy-efficient equipment, since this could be paid for with the savings generated by it in the monthly bill.

XXIII. Plurinational State of Bolivia

A. Recent advances in policy, regulatory and institutional frameworks

Bolivia's GDP growth rate at constant prices was 4.56% in 2007, less than that of 2006 (4.8%).

In real terms, the GDP growth rate has been about 4.5% since 2005, which shows that the Bolivian economy has performed well in real terms. However, there are underlying factors in this performance that should be emphasized; high international prices of minerals and petroleum have played a key role, which means that strong short-term growth may not hold up over the long term. GDP appears to have fallen in 2008, precisely because of the heavy reliance on international prices for petroleum and hydrocarbons.

In 2007 the hydrocarbons, manufacturing, construction and mining sectors fared well. Electricity and water grew at a rate of 4.3%. Agriculture fell by about 4%.

Inflation has risen steadily since 2005, resulting in a cumulative inflation rate of 4.95% for 2006. Despite the increase in prices recorded for the 2006-2007 period (11.73%), the inflation rate is still within the range projected by the Central Bank of Bolivia (BCB), though it is above the intermediate target of 4%. This inflation is explained in part by the large currency issue (2005-2006) and demand factors (increased consumption) as well as supply factors (weather phenomena) in the 2006-2008 period. Cumulative inflation for 2008 was 11.85%.

The rate of extreme poverty (the percentage of persons living in extreme poverty as a proportion of the total population) in 2006 was 37.7%, and a significant difference between rural and urban extreme poverty was evident (62.2% and 23.4%, respectively). These figures show that the extreme poverty rate has declined since 2005 (38.2%), but not by enough to meet the first Millennium Development Goal (MDG). Therefore, it is necessary to redouble efforts to improve income-generating capacity, especially in the population that is considered vulnerable.

The unemployment rate for 2006 was 8%, and in 2007 there was an improvement of 2.5 percentage points. In 2008 the jobless rate was 7.66% (according to government statistics), but according to the Centre for Labour and Agrarian Development Studies (CEDLA), the actual figure is closer to 10.2%.

Information on energy consumption by sector is not been available for recent years, which makes it impossible to analyse GDP for certain indicators such as energy productivity, but information from prior years gives a general idea of the socio-economic context.

1. Energy context

The Plurinational State of Bolivia is one of the few countries in South America that is self-sufficient in energy, although certain amounts of oil and diesel must be imported to supply the domestic market because there is not enough heavy crude to refine into products with a high specific gravity.

Hydrocarbon reserves, particularly those of natural gas, have grown exponentially, and therefore the Plurinational State of Bolivia now has great potential for hydrocarbon exports.

The electricity sector in the Plurinational State of Bolivia

The three stages of the energy subsector (generation, transmission and distribution) are managed by two electricity systems recognized under the Electricity Law of the Plurinational State of Bolivia: the National Interconnected System (SIN), which supplies electricity simultaneously to the largest cities in the country; and the Isolated and Self-Producing Systems, which supply electricity to smaller cities and companies that are not part of the SIN.

The total installed capacity at the national level was 1,499.3 MW in 2007, according to official data of the Superintendency of Electricity, of which 1,162.4 MW corresponded to the SIN.

The installed capacity of the electricity sector currently supplies the domestic market adequately (with a reserve of approximately 14%), but as demand grows in the medium term, it is unlikely that the supply will keep pace.

The National Interconnected System (SIN) has generating, transmission and distribution facilities to supply electricity for the departments of La Paz, Oruro, Cochabamba, Santa Cruz, Potosí and Chuquisaca. The Interconnection Trunk System (STI), which consists of 230 kW, 115 kW and 69 kW high tension lines and the associated substations, is the heart of the SIN.

The generating capacity of the National Interconnected System at generator terminals was 1,162.4 MW by the end of 2008, of which 478.3 MW (41.1%) came from hydroelectric plants and 684.1 MW (58.9%) from thermoelectric plants. It should be mentioned that the 2008 generating capacity data for the isolated and self-producing systems are not yet available, so only SIN data are provided. At any rate, they account for approximately 90% of total demand in the country.

Bolivian national energy legislation

In 1985, the Plurinational State of Bolivia launched a process of economic liberalization in the form of the so-called first generation reforms of Supreme Decree (D.S.) No. 21060. Law No. 1333 of 27 March 1992, the Environmental Law, was also a major milestone for the environment and sustainable development.

The second generation reforms that had a direct impact on the energy sector began in 1994 with the promulgation of the Capitalization Law (21 March 1994), the Sectoral Regulation System Law (28 October 1994) and, primarily, the Electricity Law (No. 1604 of 21 December 1994), which replaced the Electricity Code. And finally, the Hydrocarbons Law (No. 1689 of 30 April 1996) was also important.

Law No. 3351 of 21 February 2006, on the Organization of the Executive Branch, D.S. No. 28631 of 8 March 2006, and the Regulations for the Law on the Organization of the Executive Branch all established rules governing the organization and functioning of the Executive Branch and the Ministry of Hydrocarbons and Energy. These rules determined the structure and jurisdiction of these entities in accordance with the functions and powers that pertain to this sector. Under D.S. No. 29221 of 8 August 2007, the Vice Ministry of Electricity and Alternative Energy Sources (VMEEA) was incorporated into the structure of the Ministry of Hydrocarbons and Energy, along with all the specific programmes and projects involved in energy issues or related activities.

D.S. No. 29272 of 12 September 2007 put forth the National Development Plan called "Bolivia Proud, Sovereign, Productive and Democratic to Live Well" with strategic guidelines for the 2006-2011 period. The National Development Plan (PND) calls for implementing projects that incorporate different alternative energy sources in order to improve the the rural population's quality of life and income.

Under D.S. No. 29466 of 5 March 2008, the National Energy Efficiency Programme was approved for the purpose of identifying political actions and executing projects intended to optimize the rational, efficient and effective use of energy.

The New Political Constitution of the State (NCPE) of Bolivia was approved by referendum on 25 January 2009 and promulgated on 7 February 2009.

On the same date, D.S. No. 29894, "Organizational Structure of the Executive Branch of the Plurinational State", was also approved. This decree changed the structure of the Executive Branch to respond to the challenges posed in the NCPE and therefore repealed D.S. No. 28631.

They are listed below in order of their relevance to this narrative rather than any chronological or hierarchical order, beginning with the National Development Plan (2007) and followed by the NCPE (2009), D.S. No. 29894 (2009), Electricity Law No. 1604 (in effect since 1994), the New Organizational Structure of the Executive Branch (D.S. 29894, 2009), and specifically the National Energy Efficiency Programme (2008), with respect to energy efficiency.

2. National Development Plan of Bolivia

In the National Development Plan (p. 171), the issue of energy efficiency is mentioned only in the context of environmental services and the reduction of greenhouse gas (GHG) emissions. The corresponding measures are identified as "changes in the energy matrix and efficiency in energy use".

3. The New Political Constitution of the State

The New Political Constitution of the State (NCPE) refers to the energy and/or electricity sector in several different articles.

Article 378 provides that access to energy will be governed by the principle of efficiency, among others.

The NCPE indicates that "The State has exclusive authority over the development of the energy production chain in the stages of generation, transmission and distribution, through public and mixed enterprises, non-profit institutions, cooperatives, private companies, and community and social enterprises with social control and participation". Furthermore, the NCPE imposes limits on private investment in the electricity market, stipulating that "the energy productive chain shall not be subject exclusively to private interests".

The term "social control and participation" has not yet been defined in regulations, which gives rise to doubts and uncertainty. The Supreintendency of Electricity and a commission are working on a new Electricity Law that will reflect the guidelines, principles and values contained in the NCPE, but no details have been revealed.

The Organizational Structure of the Executive Branch of the Plurinational State under D.S. No. 29894

As far as jurisdictions are concerned, the Ministry of Hydrocarbons and Energy and its four Vice Ministries are responsible for establishing and modifying the current legal frameworks in the sector. Since 8 May 2009, they have also been tasked with regulating activities in the energy industry. The superintendencies were replaced with "Social Control and Oversight Authorities". The new hierarchical structure was approved on 7 February 2009. Within the Ministry of Hydrocarbons and Energy, article 57 (chapter X) establishes the following Vice Ministries and the respective Directorates:

Vice Ministry of Hydrocarbons Exploration and Exploitation

- General Directorate of Hydrocarbons Exploration and Exploitation.

Vice Ministry of Hydrocarbons Industrialization, Marketing, Transportation and Storage

- General Directorate of Industrialization and Refining
- General Directorate of Marketing, Transportation and Storage

Vice Ministry of Energy Development

- General Directorate of Energy Planning and Integration
- General Directorate of Socio-Environmental Management

Vice Ministry of Electricity and Alternative Energy Sources

- General Directorate of Electricity
- General Directorate of Alternative Energy Sources
- General Directorate of Control and Oversight

Among the powers of the Vice Ministry of Energy Development, those related to energy efficiency are the following:

- Formulating and evaluating the country's energy policy, ensuring the efficient use of energy resources.
- Coordinating with the respective Vice Ministries to develop energy efficiency policies for the use of renewable and non-renewable sources to either replace or supplement existing ones.

At present, the jurisdiction of this Vice Ministry is still being defined.[20]

The Electricity Law and its regulations

The most important characteristics of the Electricity Law (No. 1604) are:

- It regulates the activities of the electricity industry.
- It divides the activities of the electricity industry into generation, transmission and distribution.
- It establishes principles for setting prices and rates.
- It transfers the activities of the electricity industry to the private sector.
- It introduces competition in power generation.

As mentioned in the document "Energy Efficiency: A Worldwide Review" of the World Energy Council (WEC),[21]

> *"The liberalization of electricity markets and the vertical separation that has been taking place in the sector have had various consequences for the development of energy efficiency in the 26 member countries of the Latin American Energy Organization (OLADE).*
> *The first consequence observed in the region's countries is the impact on energy prices. Generally speaking, it can be noted that subsidies tend to disappear and consumers therefore receive the correct price signals.*

[20] See: http://www.hidrocarburos.gov.bo/Noticias/Boletines/20090204Mision%20oficial%20de%20Bolivia%20viaja%20a%20Rusia.php

[21] World Energy Council (WEC), 2004, p. 112.

Nevertheless, even if these price signals make efficiency measures profitable, it is not enough for the large majority of consumers who are not in a position to conduct an economic analysis justifying these measures. (…) the responsibilities for developing energy efficiency currently are too widely spread out among at least all of the following: power generation, transmission and distribution utilities, and in certain cases another player, the marketer.
The benefits for a vertically integrated utility do not seem to be obvious for some of the new players".

ALBA Energy Treaty

On 29 April 2007, at the Fifth Summit of the Bolivarian Alternative for the Americas (ALBA), a treaty was signed for the purpose of guaranteeing that each Party (the Bolivarian Republic of Venezuela, the Plurinational State of Bolivia, Cuba and Nicaragua) is able to maintain its present balanced energy framework by building an ALBA energy framework based on the rational use of energy so that maximum saving and energy efficiency can be achieved. Another goal of the treaty is to develop alternative energy sources in each Party.

In the specific case of "Energy Saving", the Parties agreed to establish programmes for replacing devices that consume large amounts of energy with more efficient appliances, replacing incandescent bulbs with energy-saving ones, and replacing electric generators that use liquid fuels in large quantities with high-efficiency, combined-cycle gas systems. They will also carry out industrial reconversion programmes as a complement to their economies, taking full advantage of the availability of existing energy resources in their territories.

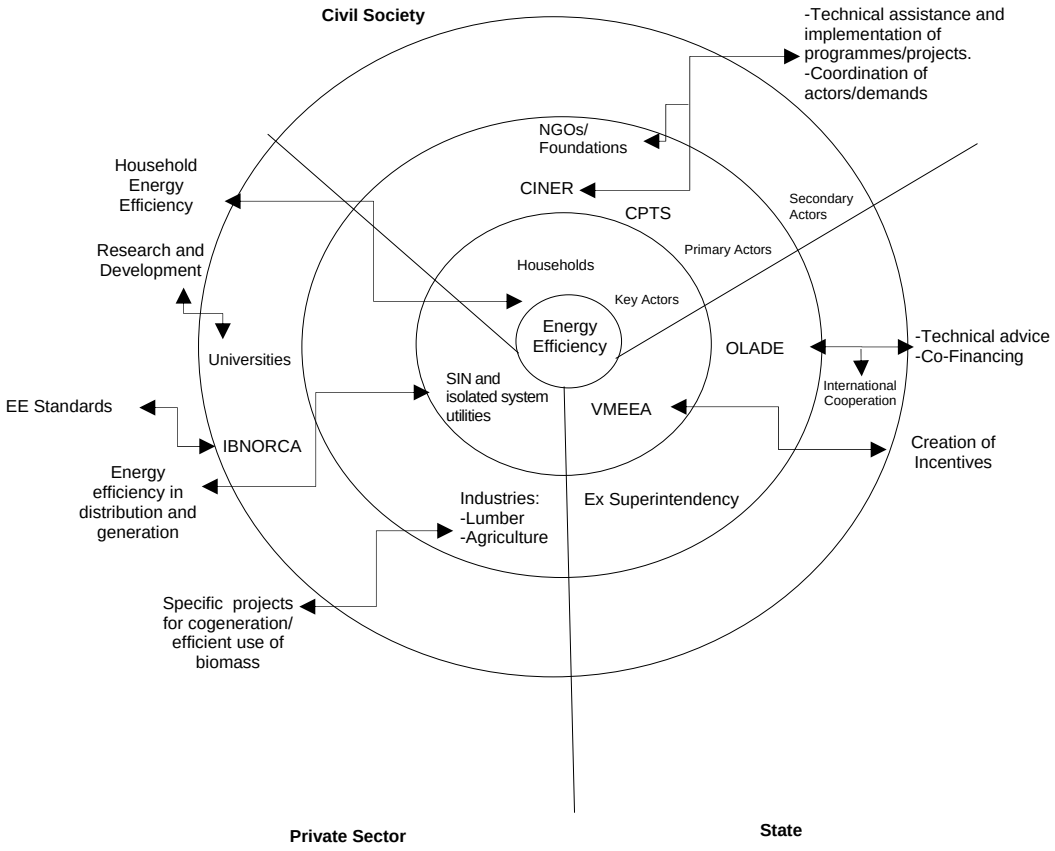
The Parties will introduce programmes to substitute natural gas for liquid fuels in their respective vehicle fleets in order to promote the use of mass transit. The energy treaty also mentions the "need to establish a rational consumption pattern for energy use in order to preserve already scarce energy and natural resources, to preserve forests, water and land"; it advocates policies to curb the wasteful energy use that characterizes the predatory production methods of capitalism.[22] It is in this context that the National Energy Efficiency Programme of Bolivia has emerged. The programme will be analysed further below.

B. Key actors in energy efficiency and their effective roles

Figure 19 shows an overall view of the entire field of actors involved and allows for an initial formulation of considerations and hypotheses regarding the degree of influence each actor has on energy efficiency. It also enables us to see the links and interdependencies that exist among the public sector (the State), civil society and the private sector.

[22] Bolivia, Venezuela Cuba and Nicaragua: ALBA Energy Treaty. 2007.

FIGURE 29
MAP OF ACTORS



Source: Renewable Energy Information Centre (CINER), based on official information.

1. Ministry of Hydrocarbons and Energy – Vice Ministry of Electricity and Alternative Energy Sources

The Ministry of Hydrocarbons and Energy is an agency of the executive branch whose mission is to formulate, evaluate, control, regulate, oversee and direct government policies on hydrocarbons and energy so that the sector can generate surpluses and provide resources for national development within a framework of national sovereignty and dignity, with honesty and transparency.

Of the four Vice Ministries, two do not have a chief at this time. One of the leaderless Vice Ministries is that of Energy Development, which will work on energy efficiency. The Vice Ministry of Electricity and Alternative Energy Sources, through the General Directorate of Electricity and Alternative Energy Sources, is responsible for implementing the National Energy Efficiency Programme.

Relevant information was requested from Mr. Rafael Alarcón, former Vice Minister of Electricity and Alternative Energy Sources, and from Mr. Ramiro Becerra, current Director General of Electricity and Alternative Energy Sources. They provided the information contained in the point titled “National Energy Efficiency Programme”.

2. Centre for the Promotion of Sustainable Technologies (CPTS)

The Centre for the Promotion of Sustainable Technologies (CPTS) is a specialized technical office that belongs to the National Chamber of Industries. Its mission is to promote Cleaner Production (CP) practices, to introduce environmental management systems and to provide technical assistance in related fields, all for the purpose of supporting the development of different sectors of the Bolivian economy.

It should be noted that energy efficiency is one of the important cross-cutting issues of CP, but it is not the only one. At present the CPTS is undertaking these initiatives to propose solutions to energy efficiency problems in the nation's industrial sector. The CPTS has financing from the Chamber itself, from USAID (the development agency of the United States), Danish International Development (DANIDA) and the Economy Secretariat (SECO).

It was selected to provide technical assistance on rational energy use, to introduce energy saving measures and to establish practices in economic activity that will prevent and limit pollution. The CPTS is educating government officials, private sector personnel and civil society on energy efficiency (EE) and pollution prevention by providing information and publicizing services as needed. It is allied with other national and international institutions that are active in EE and pollution control. These activities are supported by USAID and the Danish Government.

A meeting was held with Mr. Antonio Ruiz, director of the CPTS. It opened with a presentation on the possibility of working on EE issues in the Plurinational State of Bolivia, citing the work carried out by ESMAP and the Environmental Pollution Prevention Project (EP3) with the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

Mr. Ruiz explained the birth of the CPTS as an NGO and its work areas (these documents have already been drawn up, according to the web page).

He stated that in the projects it has undertaken with different industries, EE is usually addressed by focusing on thermal energy and the use of electricity (this issue can be seen in the CPTS guide) in various processes within a given industry. With respect to cogeneration, he said that projects have been developed for the sugar refineries (Guabirá and Unagro). Guabirá is already operating with an installed capacity of 16.6 MW.

They are working in business activities, but they do not see a great deal of potential for EE on the industrial side. It is part of something broader that should encompass electricity generation and distribution. Of the industries in which this work is being done, 95% are small and medium enterprises (SME) and only 5% are large companies in the cement, beverage, textile and sugar sectors. The issue of industrial EE may be of interest to the latter. Because of the number of industries involved, there is not very much potential.

EE projects in industries will only be successful if they show an impact in monetary terms. EE alone cannot yield saving, and must be accompanied by Cleaner Production (water, 3rs, etc.). Any industrial EE project should include CP, or else it will be very difficult to implement without a strong commitment to social responsibility on the part of upper management, and that is a little difficult.

There are no incentives for industries to use energy more efficiently.

It should be mentioned that there is great potential for EE projects **in the transport sector**. This goes hand in hand with increased use of natural gas vehicles (NGV).

EE actions that have been carried out include:

- Technical assistance for Cleaner Production (CP) projects
- Research and development
- Principal work on thermal energy (Ref. Project Guide, web page)

Important issues - summary

- Analyse EE from the standpoint of demand, not just supply. Small measures can have a great impact (for example, electric showers during morning hours). Activities to raise awareness and sensitivity should be undertaken along with executed projects. Greater use of natural gas in households.
- Study the energy framework to identify EE potential.
- Work on EE incentives at the level of the central government.
- Use of biomass for EE projects.

Results of the CPTS

TABLE 28
CATEGORIES
(November 2007)

Project	NG (reduced consumption) Mcf/year	Electricity (reduced consumption) kWh/year
Asphalt pavement production plant	900	
Metaltech SRL	700	13 320
San Lorenzo tannery	500	
TUSEQUIS farming company	700	12 000
Boliviano meat processing plant	111	320
Pollo Rico poultry company	260	
Dairy Producers Association		8 095
Taquiña	12 170	80 600
Sami	150	Pot. 9 kW
Andean Valley (quinoa)	LPG 10,600 kg/year	25 000
CIACEN (coffee)		610
Chimate (tea)		5 017
Prosalud (buildings)		5,000 (two different buildings)
Ritz		14 500
TOTAL	15 491	164 462

Source: Centre for the Promotion of Sustainable Technologies (CPTS), 2007.

Rough figures:

Officially (according to the CPTS supplement), the following results had been achieved as of March 2008:

- Reduction of natural gas consumption by 18,000 Mcf/year
- Reduction of electricity consumption by 164,462,000 kWh/year
- Number of projects with CP: 109
- Number of projects with EE in CP: 17 of the 30 described in the publication

Areas in which EE was observed: Agriculture and food and beverages, mainly (70%)

FUNDA-PRO (Foundation for Production)

- Efficiency in the use of firewood, partially replacing it with bagasse, and in the production of chancaca molasses.
- Substitution of natural gas for wood in plaster manufacturing.
- Improved processes for making wines and grape brandy.
- Substitution of photovoltaic panels for batteries, candles or burners for lighting.

Bolivian Institute of Standardization and Quality (IBNORCA)

Since 2006, only the following documents have been approved as standards.[23]

- NB 87001:2006: Energy efficiency – Incandescent bulbs – Specifications and labelling.
- NB 87002:2006: Energy efficiency – Circular and tubular compact fluorescent bulbs – Specifications and labelling.

EQNB 87003 (Energy efficiency – Refrigerators, freezers and refrigerator-freezers – Specifications and labelling) and EQNB 87004 (Energy efficiency – Air conditioners – Window type – Specifications and labelling) all remained at that stage and did not become Bolivian standards.

Office of Clean Development (ODL)

The Plurinational State of Bolivia ratified the 1992 United Nations Framework Convention on Climate Change (UNFCCC) in 1994. In this context, the Kyoto Protocol signed in 1997 requires countries to establish a Designated National Authority (DNA) for the Clean Development Mechanism (CDM), the main function of which is to approve projects proposed for the CDM in accordance with the development objectives and sustainability criteria.

At present, the DNA in the Plurinational State of Bolivia is the Vice Ministry of Environment, Biodiversity and Climate Change, under the authority of the Ministry of Environment and Water. Previous administrations had created the Office of Clean Development (ODL) as an operational arm of the DNA. The National Climate Change Programme (PNCC) had also been created with a mandate to develop plans and programmes to mitigate GHG emissions, among other tasks.

However, the ODL and the PNCC were suspended a few months ago. The ODL was closed at the end of January 2009, and the team of professionals who had been working over the past decade was disbanded. In an interview with "Los Tiempos", the vice minister of environment, biodiversity and climate change explained, however, that there were no plans to eliminate the CDM, that it would not be a transition process and the PNCC would be strengthened.

To date no agency has been designated to take over the functions formerly carried out by the ODL.

C. Resources and funding mechanisms for energy efficiency programmes

In an effort to eliminate financial barriers to EE and pollution control efforts, the World Bank Energy Sector Management Assistance Programme (ESMAP) and the Foundation for Production (FUNDA-PRO)

[23] Source: IBNORCA, Gonzalo Dalence.

created the Biomass Fund in 2000. The fund has US$ 1 million, and has financed 53 biomass projects for a total of $389,000.

The financial intermediary has yet to approve 93 projects totalling US$ 511,115. In 2001 the Biomass Fund decided to include EE and pollution control projects among those eligible for financing, and they are included in the sum of projects that have received technical assistance from ESMAP II.

1. Biomass Fund and Cleaner Production

- Formed in November 2000.
- In June 2002 the World Bank International Development Association (IDA) turned over this responsibility to the National Chamber of Industries (CNI).
- The agreement expired in June 2005.
- It will continue as a product of FUNDA-PRO.
- The objectives of the projects will be:
- To reduce the consumption of energy, water, materials and other inputs, and
- To reduce the production of effluents, pollutants or hazardous waste.
- Both objectives will lessen the negative impact on the environment.
- Terms of financing:

TABLE 29
CATEGORIES
(November 2007)

Terms	BIO-PRO	ICI
Amount	S/g. FUNDA-PRO Policy	Maximum US$ 100,000.
Time period	Up to 5 years	Depends on project
Rate	Market	Depends on ICI costs
Guarantee	Institutional	Depends on ICI's policy
Purpose	Financing of CP projects, including EE and replacements	Financing of CP projects, including situation and EE
Special requirements	Support for a programme or project	Technical justification

Source: Centre for the Promotion of Sustainable Technologies (CPTS), 2007.

2. Intermediary Credit Institutions (ICI) of FUNDA-PRO:

- Banks: Económico, Solidario and Los Andes.
- Private Financial Funds (FFP): PRODEM, FIE, Ecofuturo, Fortaleza, Fassil.
- Credit and Savings Cooperatives (CAC): Magisterio Rural, Pío X, Comarapa, Quillacollo.
- NGOs: Agrocapital, Cidre, Fades, Idepro, Funbodem, Fondeco, Crecer, ANED.
- Others: Bisa Leasing.

Procedure:

1. A programme (series of projects) or a project that fulfills the aforementioned characteristics and general conditions can be submitted to a financial entity of FUNDA-PRO, which may or may not be an ICI.

2. The ICI evaluates the demand and can choose to meet that demand with its own funds or turn to FUNDA-PRO.
3. FUNDA-PRO evaluates the request; if the financial entity is an ICI and meets the requirements, it proceeds with financing.
4. If it is not a FUNDA-PRO ICI and the entity decides to be authorized as an ICI, an institutional evaluation is conducted and it is authorized as an ICI. Then financing is granted.

D. Results of energy efficiency programmes to date

1. Programmes

Initiatives to implement EE programmes in Bolivian industries have been carried out since 1996. One such initiative was undertaken by the National Secretariat of Energy (now the Vice Ministry of Electricity and Alternative Energy Sources) with backing from the ESMAP. It began with a pilot project that consisted of conducting energy audits in 14 industries for the purpose of evaluating the potential for saving energy in the country's industrial sector.

The EE actions carried out in the 1990s in the Plurinational State of Bolivia were focused on the Energy Efficiency Programme, which was developed by the Bolivian Government with support from the World Bank ESMAP. At present, the CPTS is continuing these and other complementary actions.

ESMAP Bolivia Programme

Programme Description

The ESMAP Bolivia Programme Phase II had two principal components: Rural Energy (RE) and Energy Efficiency (EE). The activities under these components were designed to help the government consolidate the achievements of Phase I and make further progress in the following ways: (a) strengthen the government's capacity to ensure the sustainable development of rural energy and energy efficiency activities; (b) create incentives for energy efficiency and the use of renewable energy sources; (c) ensure the effectiveness of technical assistance and financing mechanisms designed to develop rural energy and energy efficiency; and (d) develop projects to demonstrate the penetration of rural energy and the application of energy efficiency measures.[24]

Interactions among the local team and the ministries, donors, the prefectures and municipalities, the Centre for the Promotion of Energy Efficiency (CPTS-CPEE), the local NGOs, chambers of commerce and the associations representing the economic sectors and enterprises, and the final users were extremely time consuming. In addition, the implementation arrangements involved the administration of an unusually large number of contracts, which created a heavy administrative burden on Bolivia and the Bank and contributed to project delays.

The Rural Electrification and Energy Efficiency components were both financed with a Netherlands grant equivalent to US$ 1.6 million. About US$ 1.3 million was disbursed by the time the grant closed on 31 December 2001, and the remaining US$ 276,585 was reimbursed to the Netherlands.

The energy efficiency component carried out four main activities: (a) the execution of energy efficiency pilot projects; (b) study of electricity demand-side management (DSM); (c) cogeneration of electricity by various enterprises; and (d) the design of mechanisms supporting energy efficiency.

In the ESMAP-World Bank "Energy and Energy Efficiency Report on Operational Activities", the following seven companies are cited for achieving significant energy saving: Cervecería Ducal (beer, Santa Cruz), Cervecería Sureña (beer, Sucre), Embotelladora Embol (soft drinks, Santa Cruz),

[24] The data cited in this chapter can be found in Covarrubias et al., 2005, pp. vii-xiii, 1-2, 41-44.

Frigorífica Frigor (food, Santa Cruz), Tusequis (food, La Paz), Universaltex (textiles, La Paz) and Quimbol Lever (chemicals, Cochabamba). The document does not provide quantitative data, and it even mentions that the economic crisis has reduced demand, masking the effect of some of the energy-saving measures. As a result, companies have suspended their EE investments.

The study analysed the structure of the daily electricity load curves of the Santa Cruz Rural Electricity Cooperative (CRE) and the Compañía Eléctrica de Sucre S.A. (CESSA), and proposed changes on the consumer side aimed at flattening these curves. It also surveyed and determined the operating parameters of the electrical appliances available in Santa Cruz and Sucre.

Four energy-saving measures were recommended:

- For illumination: switching from incandescent bulbs and fluourescent lamps with electromagnetic reactance to fluorescent lamps with electronic reactance. This measure would decrease electricity consumption by 70% to 80% in the first case and 20% to 30% in the second case, thus significantly reducing the evening peak.
- For refrigeration: replacing old refrigerators with new ones, which consume about 50% less electricity.
- For water heating: use natural gas instead of electricity.
- For air conditioning: improving the design and construction of houses and buildings by adding thermal insulation in walls and roofs. This measure would decrease electricity consumption by about 70%.

The study estimated that installation of these energy-saving measures would cost about US$ 23.7 million in Santa Cruz and US$ 2.9 million in Sucre. The measures would save about US$ 26.3 million for residential consumers in Santa Cruz and US$ 3.2 million for residential consumers in Sucre over a 10-year period. During the same period, the power utilities would achieve investment savings in power generating facilities of about US$ 90 million in Santa Cruz and about US$ 16 million in Sucre.

The study also identified financial, regulatory and technical barriers to DSM, and the following measures to remove them:

- Financing mechanisms to enable residential consumers to pay for energy-saving devices.
- The use of natural gas or liquefied petroleum to heat water for bathing and other household needs.
- Longer billing cycles.

Studies of electric load curves of power distribution utilities could be replicated by each power utility, and would help the utilities, consumers and the regulatory agency to identify DSM measures and the regulatory changes that would make them possible. Such studies could also identify technical and financial barriers to energy efficiency and ways to remove them.

Another activity studied the potential for energy savings in the sugar industry and the feasibility of the sale of electricity surpluses generated by sugar processing. Two sugar refineries, Ingenio Azucarero "Roberto Barbery Paz" of the UNAGRO cooperative (located in Mineros, Santa Cruz) and Ingenio Azucarero GUABIRÁ (located in Montero, Santa Cruz) participated in the study. The energy audits carried out in these two enterprises measured the energy input to the production processes (crushing the sugar cane, production of waste in the form of bagasse, crystallization of the sugar) and the output of electricity surplus.

Findings

- The competition introduced by cogeneration could, in the long term, contribute to decreasing prices paid for electricity by power distribution utilities and, consequently, by retail consumers.
- There are no regulations for setting a price for bagasse, used as fuel for electricity generation.
- UNAGRO showed great interest in the results of the study and carried out its own feasibility study with the support of the National Climate Change Programme (PNCC) and the Swiss Government. The enterprise has also identified European and American institutions as potential partners for implementing the project recommended by the ESMAP-financed cogeneration study.

Chronological summary

1986-1992, National Energy Plan:

Policies: (a) ensure an economical and reliable supply of energy for the domestic market through the Bolivian Government Petroleum Reserves (YPFB) and the National Electricity Enterprise (ENDE) as well as the private company BPC; (b) promote the rational use of energy to preserve the country's resources and reduce the amount of investment required; (c) help with public finances by boosting energy sales; and (d) preserve the environment.

The government tried to implement these policies, but it had limited success. It decentralized decision-making, increased investment in the sector and promoted EE in energy production and consumption, giving priority to the development and use of natural gas. It also promoted the commercial distribution of energy in rural areas at affordable prices. Since the National Energy Plan did not focus on energy for the rural sector, ESMAP conducted studies of energy supplies and aspects of consumption in rural residences.

1989–1991:

ESMAP carried out a study for the purpose of improving the rational use of energy in critical sectors of the economy and promoting balanced development. That study gave rise to the Energy Strategy for Rural Residences, which proposed to: (a) reduce the cost and improve the quality of lighting in rural dwellings; (b) develop small hydroelectric projects with cost efficiency; and (c) improve the rational use of energy in cooking.

1993-1996. Rural Energy and Energy Efficiency Action Plan (Phase I of the ESMAP Country Programme):

The plan made a significant contribution to the plan of policies and actions focused on rural energy and energy efficiency. The achievements of the RE component included: (a) the definition of a National Rural Electrification Strategy; (b) the approval of a general regulatory framework for rural electrification; (c) the laying of a foundation for developing the National Rural Electrification Programme (PRONER); (d) the identification of basic problems related to the use of biomass as an energy source; and (3) the National Biomass Programme. In the area of EE, the achievements were: (a) the creation of a report on the situation of final energy consumption and the obstacles hindering the application of EE measures; (b) the definition of an EE Strategy; (c) the development of the initial experiences in conducting energy audits in industrial companies and the hotel sector; and (d) the training of the first Bolivian energy audit technicians.

1994–1997:

During these years, ESMAP helped with the design and implementation of the structural reform of the energy sector, which took place in the context of a relatively underdeveloped energy market. The effort included actions such as opening up the sector to private agents and capitalizing

YPFB and ENDE. The economic reform also included the creation of the Sectoral Regulation System (SIRESE). However, the reforms focused primarily on cities where the nascent energy market was strong enough to attract mainly private investment. It was noted that the structural changes in the energy sector were not enough to provide energy to most of the population (especially in rural areas) or to allow them to participate in the energy market.

1997-2001, ESMAP Phase II (ESMAP II):

ESMAP attempted to address the problems related to support for energy and consumption that had been identified during Phase I. This was considered to be a crucial step because of the impact energy has on other sectors and the strong links between this sector and efforts to reduce poverty, enhance industrial competitiveness and preserve a clean environment. Sustainability and impacts with respect to:

- Support for the Vice Ministry of Electricity and Hydrocarbons
- Mechanism for technical assistance through the CPTS
- Financial mechanisms
- Energy efficiency in industry
- Demand-side management (changes to reduce consumption in the load curve)
- Cogeneration in the sugar industry

Information on the second phase of Cooperation for the Programme to Implement Cleaner Production in the Industrial Sector will come in two stages during the 2006-2010 period.

The first will last three years, then there will be a review, and the second stage will follow over the next two years. The total cost of the five-year programme will be US$ 5.6 million, financed by DANIDA: US$ 3.85 million – USAID: US$ 1.6 million – Economy Secretariat (SECO) US$ 0.1 million – National Chamber of Industries (CNI): US$ 0.1 million.[25]

National Energy Efficiency Programme

Programme Description

On 5 March 2008 the National Energy Efficiency Programme (PNEE) was approved by means of Supreme Decree (D.S.) No. 29.466, in the context of the programme called "Electricity to live with dignity", for the purpose of identifying political actions and executing projects intended to optimize the rational, efficient and effective use of energy.

Energy efficiency was defined in D.S. No. 29.466 as reducing energy consumption while maintaining the same energy services, without reducing the quality of life, and protecting the environment, guaranteeing the supply of energy and promoting sustainable energy use.

The two approaches that can be taken to EE are supply-side (Improvements in Operations, Better Ways of Producing, Alternative Sources) and demand-side (Rational Use of Energy, Energy Conservation and Energy Management). Along those lines, there are four basic areas in which sustainable development benefits will be seen: energy independence and sovereignty, economic benefits, environmental benefits and social benefits.

[25] http://www.ask.com/bar?q=MInisterio+de+Hidrocarburos+y+energ%C3%Ada&page=1&qsrc=121&ab=0&u=http%3A%2F%2Fwww.hidrocarburos.gov.bo%2F.

Objective

The objective of the programme is: To build and strengthen a National Energy Efficiency Programme in the Plurinational State of Bolivia, with the active participation of all national actors involved. The development of the National Energy Efficiency Programme is a multi-sectoral process, and it must be undertaken with all sectors interacting and contributing in parallel fashion.

Strategic principles

- Commitment to long-term, coordinated action with all actors.
- Coordinated actions by all actors, with initiatives and projects to be implemented simultaneously to create enough synergies to achieve the necessary changes in management, technology and culture.
- High-level political-technical coordination.
- Integration of economic, energy, environmental and social objectives.
- Combination of regulatory, promotional and educational instruments.

Policy guidelines

- Apply EE criteria in electricity supply and demand.
- Develop a framework of standards and regulations for the National Energy Efficiency Programme.
- Implement an EE certification system.
- Develop instruments to promote EE and provide economic, tax and financial incentives for EE.
- Develop mechanisms for educational outreach to create a culture of EE.
- Develop an EE programme in the housing, building and construction sectors.
- Implement a national EE monitoring and oversight system.
- Design EE policies and programmes for transport.
- Develop a sectoral EE programme for industrial energy use (mining, agriculture and business).
- Develop an EE programme for the energy conversion sector.
- Develop an EE programme for the public sector.
- Promote technological innovation for EE.
- Incorporate international EE mechanisms.

Multisectoral participation

After the EE programme has been initiated, it must be complemented with the participation of all sectors involved in order to generate a nationwide multisectoral product.

The National Energy Efficiency Programme requires all sectors involved to coordinate and participate in setting policies. All actors have an essential role to play in this process, not just government institutions such as ministries, vice ministries, superintendencies and other institutions related to matters of energy efficiency, the environment and consumer protection.

Cross-cutting activities

Cross-cutting activities of great importance to the PNEE are:

- Discussion of a Law on Energy Efficiency
- A programme of EE regulations and standards
- Certification in different spheres
- Public information and networks of actors
- Reconversion of the nation's buildings and industrial facilities
- Technological innovation
- Training, education and sensitivity at all levels

Programme policies

- Apply EE criteria in electricity supply and demand.
- Develop a framework of standards and regulations for the National Energy Efficiency Programme.
- Implement an EE certification system.
- Develop instruments to promote EE and provide economic, tax and financial incentives for EE.
- Develop mechanisms for educational outreach to create a culture of EE.
- Develop an EE programme in the housing, building and construction sectors.
- Implement a national EE monitoring and oversight system.
- Design EE policies and programmes for transport.
- Develop an EE programme for the industrial sectors (mining, agriculture and business).
- Develop an EE programme for the energy conversion sector.
- Develop an EE programme for the public sector.
- Promote technological innovation for EE.
- Incorporate international EE mechanisms.

Programme implementation

Conditions and requirements for programme implementation

To implement the programme, a variety of actions are necessary. The Vice Ministry of Electricity and Alternative Energy Sources proposes to carry out this implementation in phases, which will be identified later, but the first step is to manage demand:

- Electricity consumption in the residential sector
- Electricity consumption in the industrial sector
- Maximum coincident demand

Actions implemented

With respect to demand management, the first phase involves a campaign called "Use Electricity During Off Hours", which was launched in coordination with the Superintendency of Electricity and the power utilities. The purpose of the campaign is to inform the public that

simultaneously using different electrical appliances at certain times can be bad for the economy and the environment, and it is easy to avoid.

Replacement of incandescent lamps (bulbs) with compact fluorescent lamps (energy-saving)

The President of the Republic, Evo Morales Ayma, launched the National Energy Efficiency Programme on 10 March 2008 in the cities of El Alto, Cochabamba and Santa Cruz, beginning with the free replacement of incandescent bulbs with compact fluororescent ones.

The campaign covered the entire country, with Community Social Workers going door to door to provide free replacement bulbs and instil EE habits in the population. There was a mass media campaign involving television and radio spots as well as printed material in the press and brochures.

As of April 2009, the following results had been achieved:

- 8,509,691 incandescent bulbs have been replaced in 1,299,066 households that were contacted.
- A total of 1,488,387 5W and 8W energy-saving bulbs were donated in support of the education and outreach programmes.
- In addition, two reserve bulbs, 14W and 18W, were given to some households, bringing the total to 3,000,228 for the entire country.

The bulbs are manufactured in China and were financed by the Peoples' Trade Agreement – Bolivarian Alternative for the Americas (TCP-ALBA).

A publicity and education campaign was carried out in various media outlets through television spots, radio announcements and brochures distributed all over the country.

Actions to implement

Natural gas and/or solar heating systems will be substituted for electric heaters.

Results of bulb exchange effort

In this regard, the most important accomplishment of the VMEEA thus far has been the replacement of incandescent bulbs with energy-saving bulbs in order to reduce energy consumption and ensure the supply of electricity. According to data reported by power plants, electricity rationing (energy crisis) might be on the horizon because generators were operating at near full capacity. As a palliative measure, 8,509,691 incandescent bulbs were replaced with energy-efficient bulbs (including 3,000,228 reserve bulbs) in households and 1,488,387 bulbs to support education and outreach programmes.[26]

This helped prevent electricity rationing. To meet this need, different thermoelectric and hydroelectric generating plants are planned for construction.

The official figures of the National Load Dispatching Committee (CNDC) indicate that the bulb replacement programme resulted in a reduction in demand of 96.3 MW and a reduction in energy of 81 GWh. These are partial figures, because they correspond to 2008 and the campaign lasted until March 2009. It should be emphasized that this information refers only to the SIN, and that isolated systems in which the campaign also took place do not report data to the CNDC.

This is the only measure implemented under the sector's EE policy. There are also plans to provide labelling of energy-saving electrical appliances, among other measures.

[26] Source: DGEE/VMEEA, interview with Ramiro Becerra Flores, Director General of Electricity and Alternative Energy Sources.

TABLE 30
RESIDENTIAL BULB REPLACEMENT PROGRAMME IN THE PLURINATIONALSTATE OF BOLIVIA

Departments	Potential households	Number of homes where bulbs were replaced (cumulative)	Bulbs replaced (cumulative)
La Paz	488 751	457 153	3 592 453
Cochabamba	290 637	261 036	1 608 830
Santa Cruz	380 496	258 756	1 203 747
Tarija	69 493	61 409	491 014
Chuquisaca	65 376	59 406	449 229
Oruro	71 514	69 041	504 166
Potosí	87 228	86 341	523 908
Beni	47 980	38 762	105 516
Pando	7 400	7 162	30 828
Total	1 508 875	1 299 066	8 509 691

Source: DGEE/VMEEA.

TABLE 31
SUPPORT FOR EDUCATION AND OUTREACH PROGRAMMES
(Donation of 5 W and 8 W Bulbs)

Departments	5W	8W	Total
La Paz	162 958	316 760	479 718
Cochabamba	158 316	65 651	223 967
Chuquisaca	4 500	6 000	10 500
Santa Cruz	181 805	567 881	749 686
Oruro	5 004	9 696	14 700
Potosí	504	9 312	9 816
Total	513 087	975 300	1 488 387

Source: DGEE/VMEEA.

TABLE 32
DELIVERY OF TWO ADDITIONAL BULBS

Departments	Households receiving 2 reserve bulbs	14 W	18 W	Total
La Paz	562 648	330 092	795 204	1 125 296
Cochabamba	311 483	82 844	540 122	622 966
Santa Cruz	208 382	47 775	368 989	416 764
Tarija	76 275	43 777	108 772	152 549
Chuquisaca	89 633	37 580	141 686	179 266
Oruro	68 315	44 979	91 651	136 630
Potosí	91 368	53 203	129 533	182 736
Beni	84 849	38 762	130 935	169 697
Pando	7 162	7 162	7 162	14 324
Total	1 500 114	686 174	2 314 054	3 000 228

Source: DGEE/VMEEA.

Influence of PNEE on the SIN

In 2008, demand for power in the National Interconnected System rose only 3.3 MW (0.4%), representing the smallest increase in the last six years.

The reason is that the EE programme undertaken by the VEEA, consisting of replacing incandescent bulbs with energy-saving bulbs, reduced demand for power during peak hours. However, the demand for energy has risen because of consumption by the Minera San Cristóbal mining company, the opening of Minera San Bartolomé, and strong growth in mining industry consumption through September 2008. As a result, the demand for energy grew at the highest rate in the last 12 years.

SIN demand was projected at 5,353 GWh for 2008, whereas actual demand was 5,138 GWh. The main reason for the decline, as indicated above, was the implementation of the central government's EE programme in all departments of the country.[27]

TABLE 33
MAXIMUM DEMAND IN THE SIN (2007 AND 2008) IN MW

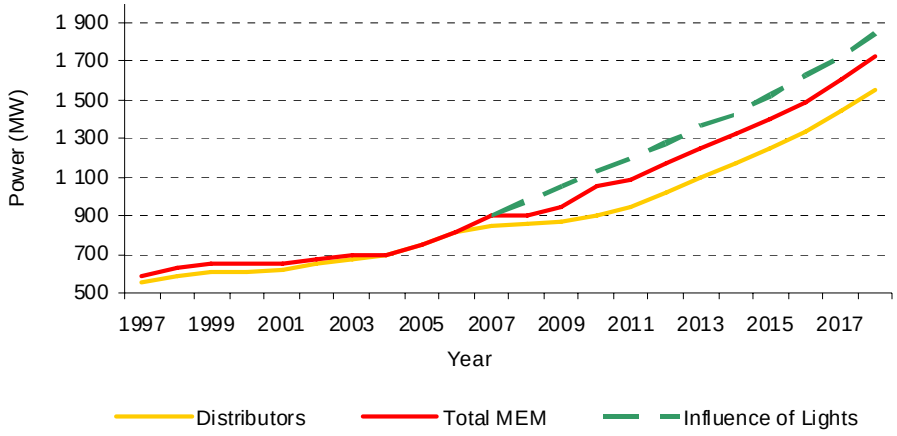
Consumers	Management		% Change
	2008	2009	
Santa Cruz	327.6	316.6	3.5
La Paz	261.2	263.1	-0.7
Cochabamba	146.8	150.1	-2.2
Oruro	65.3	60.7	7.5
Sucre	35.7	30.4	17.4
Potosí	33.2	25.8	28.7
Punutuma – Tupiza	15.7	15.6	0.6
Non-regulated	68.5	63.6	7.8
Others	13.1	11.9	10.1
Total coincident demand	898.7	895.4	0.4

Source: CNDC 2008, p. 7.

One of the main results of the Bolivian Government's EE programme of bulb replacement was a significant reduction in the demand for electricity in the SIN, in terms of both power and energy.

In 2008, the programme resulted in a decline of 96.3 MW in the demand for power and 81 GWh in energy. The possible projections of demand in the SIN are shown below.

FIGURE 30
POWER PROJECTION



Source: Worksheets based on CNDC data.

[27] Source: CNDC Report, 2008.

The figure shows the influence of light bulbs in the projection of power for the SIN, as power and the demand for energy would fall in the residential sector. However, this projection is based on the assumption that the beneficiaries of this campaign will voluntarily replace the energy-saving bulbs at their own expense.

Results and impacts

As of March 2008, consumption had declined as a result of the efforts of the CPTS:

- by 164,462 kWh of electricity per year and
- by 18,000 Mcf/year (1,000 cubic feet per year).[28]

Influence of PNEE on the SIN

One of the main results of the Bolivian Government's EE programme of bulb replacement was a significant reduction in the demand for electricity in the SIN, in terms of both power and energy.

Calculations as of April 2009, provided by the DGEEA, yield the following national results:

- 8,509,691 incandescent bulbs have been replaced in 1,299,066 households, and 1,488,387 energy-efficient 5W and 8W bulbs were donated for education and outreach programmes. A total of 9,998,078 energy-efficient light bulbs were installed in the country's nine departments.
- In addition, 3,000,228 replacement bulbs have been provided to some households.
- The average reduction in power per bulb is 67.6 W.
- The reduction in maximum demand has been estimated at about 240 MW.
- The reduction in average monthly consumption per household is estimated at 49.2 kWh.

For 2008, the CNDC reports a decline of 96.3 MW in the demand for power and 81 GWh in energy as a result of the programme. These are partial figures, because they correspond to 2008 and the campaign lasted until March 2009.

It should be emphasized that this information refers only to the SIN, and that isolated systems in which the campaign also took place do not report data to the CNDC. The possible projections of demand in the SIN are shown below:

TABLE 34
ENERGY EFFICIENCY PROGRAM: REDUCTION OF DEMAND IN THE SIN

Year	PowerMW	Energy GWh
2008	96.3	81
2009	101.0	179
2010	108.7	189
2011	108.7	189
2012	108.7	189

Source: Worksheets based on CNDC data.

In 2008, demand for power in the National Interconnected System rose only 3.3 MW (0.4%), representing the smallest increase in the last six years. Demand for electricity in the SIN was projected at 5,353 GWh for 2008, whereas actual demand was 5,138 GWh. However, the demand for energy has risen because of consumption by the Minera San Cristóbal mining company, the opening of Minera

[28] A. Covarrubias, E. Birhuett, A. Ruiz, F. Baumgardt (2005, May): Bolivia Country Program Phase II: Rural Energy and Energy Efficiency Report on Operational Activities.

San Bartolomé, and strong growth in mining industry consumption. As a result, the demand for energy grew at the highest rate in the last 12 years.

The VMEEA has estimated a reduction of 240 MW in the demand for electricity throughout the country by 2009, whereas the reduction reported by the CNDC for 2008 alone was 96.3 MW. The difference between the two is quite large, and can only be reconciled as future measurement reports come in from the CNDC and/or the VMEEA.

E. Lessons learned

The results and experiences derived from this study in the Plurinational State of Bolivia yield the following "lessons learned":

- To a great extent, it was the international cooperation organizations that provided the impetus for energy efficiency in the Plurinational State of Boliva.
- In addition, the central government has been actively involved through its National Energy Efficiency Programme, which began with the replacement of incandescent bulbs with energy-saving bulbs.
- The cost-benefit ratio should be positive for private parties. For example, in the sugar industry, cogeneration has been shown to boost EE; and additional examples can be found in private firms in the case of ESMAP and CPTS.
- With respect to legislation and standards, more vigorous work needs to be done in promoting EE policies throughout the country, including incentives for a more enduring policy.
- The country's industrial sector is relatively small compared to those of other Latin American countries, so the quantitative values of EE measures may be quite low in relation to other countries' data. However, in qualitative terms they are significant for industries of this size in the Plurinational State of Bolivia.
- The real incentive for the government to implement EE is largely dependent on needs and/or the balance between supply and demand, that is, generating capacity versus consumption. The government appears to view EE from the perspective of the need to meet demand with existing installed capacity, rather than a strategic, long-term vision.
- However, some strong actors are involved in EE issues, and they need to achieve their potential for growth. Moreover, the concept of EE needs to be promoted to the full extent and with greater vigour.
- The concept of Cleaner Production that the CPTS is promoting is very broad and includes EE among other environmental-industrial issues. Therefore, the values involved may not be significant in terms of electricity, but in other aspects of production the benefits to companies are very noteworthy.
- Although the government has launched its EE programme, the closure of the Clean Development Office (ODL) is one of several incidents that have sent a different message. The ODL could have provided additional impetus for EE measures. In that regard, the lesson to be learned is that there could be a loss of complementarity of actions and inter- and intrasectoral coordination to leverage synergies or mechanisms that generate incentives in the areas of climate change and the Clean Development Mechanism (CDM).

XXIV. Suriname

A. Recent advances in policy, regulatory and institutional frameworks

There are no standards, regulations or laws on efficient energy use in Suriname, nor are there explicit mechanisms to promote energy efficiency programmes or projects. Implicit policies that encourage energy efficiency include:

- Purchasing more hydroelectric energy from the aluminium company Suralco when it is available.
- Using heavy fuel oil or heavy vacuum gas oil from the national oil company to generate electricity when the aluminium company cannot provide hydroelectric power.
- Installing efficient bulbs in the residential sector (this, however, was a one-time project underwritten by Cuban cooperation).
- Encouraging the installation of electricity from renewable sources in rural villages.

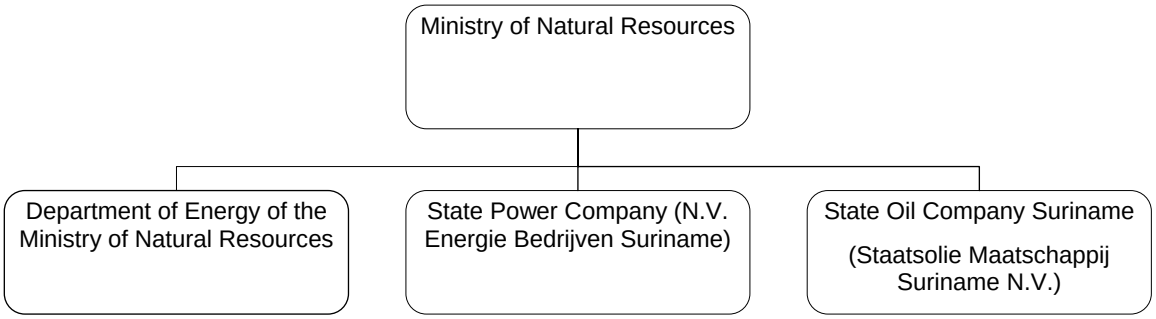
In terms of explicit energy efficiency policy, the government has determined that only automobiles that are less than five years old may be imported, since these consume less fuel and therefore generate less greenhouses gases.

In periods of extremely high oil prices, the Suriname government was unable to continue justifying the subsidies given to the public electric utility (the State Power Company—N.V. Energie Bedrijven Suriname) or those provided for the transportation sector.

The operative policy was that if diesel could not continue to be provided free of charge to rural villages, due to high fuel purchase and transportation costs, inhabitants would have to pay market prices or contend with fewer hours of electricity.

There is no official agency in Suriname responsible for energy efficiency issues. The institutional scheme is outlined in the figure below.

FIGURE 31
ENERGY SECTOR SCHEME



Source: Government of Suriname.

The three entities reporting to the Ministry of Natural Resources (two public enterprises and an office in the Ministry of Natural Resources) have their own energy efficiency programmes, which are approved by the Ministry.

B. Key actors in energy efficiency and their effective roles

1. Governmental institutions

Ministry of Natural Resources: responsible for overall energy policy. The Ministry coordinated the one-time project of installing efficient bulbs donated by Cuba.

Department of Rural Electrification of the Ministry of Natural Resources: responsible for supplying electricity to rural villages in the country's interior, which have their own energy efficiency programmes.

2. Companies

State Power Company (NV-EBS)

This company is solely responsible for supplying electricity and gas in the cities. It has its own policy to promote energy efficiency, including, for example, replacing the diesel used in electric generators by heavy gas oil. There are also programmes to reduce losses in transportation and distribution systems.

As mentioned above, when a surplus of hydroelectric power is available from the aluminium producer Suralco, it is purchased.

State Oil Company

This company is single-handedly responsible for exploring and exploiting oil in Suriname. It has a crude oil refinery that produces diesel, heavy fuel oil and bituminous asphalt. It is expanding, with a view to producing light fuels for automobiles and thus reducing imports.

The company also has a license to produce electricity, an arrangement under which it is required to sell it to the electric company NV-EBS. The refinery's generators use their own heavy fuel oil.

3. Non-governmental organizations

DRESS: This organization is promoting the use of renewable energy by developing a plan to install 15 MW of small hydroelectric plants to supply electricity to the mining (gold) industry in the country's interior.

Other NGOs are installing photovoltaic systems in rural villages. These include the Catholic organization Pater Ahlbrinck Stitching (PAS), environmental organizations, and service clubs such as the Rotary Club. The main use for this electricity produced from photovoltaic panels is for lighting and water pumps.

4. Universities

Anton de Kom University of Surinam: This institution is involved in designing and developing renewable energy projects for the rural sector. It also provides assistance to public enterprises in the fields of electricity, oil, etc., for studies such as those designed to minimize losses in electric power generation, transportation and distribution. It also assists NGOs with renewable energy projects.

5. Consulting firms

There are a number of consulting firms, but none is devoted exclusively to developing energy efficiency projects.

There are no regulatory entities or energy services companies (ESCOs) in Suriname.

C. Resources and funding mechanisms for energy efficiency programmes

The funds available in Suriname from international entities (United Nations Development Programme, the European Union, the Inter-American Development Bank, the Organization of American States) are primarily associated with supporting the development of renewable energy projects—with an emphasis on reducing greenhouse gas emissions—and economic development projects focused on reducing poverty in rural areas.

In 2008, a study was conducted to evaluate Suriname's electricity sector and to examine alternatives for modernizing it. The study was conducted at the request of the Ministry of Natural Resources and was sponsored by IDB.

The energy companies, State Power and State Oil, are using loans from financial institutions such as the Royal Bank of Trinidad & Tobago (RBTT) and from the Surinam government, as well as from the Government of India.

Since there is no national energy efficiency programme in operation or being designed, it is impossible to determine what quantity of resources would be required to develop such a programme.

The Ministry of Natural Resources manages the funds used for energy efficiency purposes. In some cases, the Ministry of Planning and Development Co-operation participates. The Energy Department of the Ministry of Natural Resources monitors energy efficiency projects. Disbursement of loans is overseen by the Ministry of Finance, but daily monitoring is handled by the Ministry of Resources finance department.

D. Results of energy efficiency programmes to date

The Cuban-sponsored programme of replacing bulbs reduced energy consumption in some residential areas by 10%. (Editor's note: explanation of how this result was measured is not provided).

E. Lessons learned

Positive:

- The use of electrical generators operating on heavy fuel oil instead of diesel has been highly successful, and all new generators ordered are of this type.
- The programme of replacing incandescent bulbs with compact fluorescents in the residential sector is considered to have been a success.
- Suriname believes that the large-scale use of hydroelectric energy has made it possible to avoid major problems in times of high oil prices.

Negative:

- Lack of coordination of energy efficiency programmes between companies and the Energy Department of the Ministry of Natural Resources.

The project for replacing incandescent bulbs with efficient bulbs, conducted with Cuban assistance, was not sustainable, due to the fact that it did not include any national energy efficiency programme.

XXV. Trinidad and Tobago

A. Recent advances in policy, regulatory and institutional frameworks

In Trinidad and Tobago, no energy efficiency programme is in operation or being designed, nor are their any specific—let alone binding and mandatory—laws or regulations to promote rational energy use.

The country believes that developing substitutes for conventional energy sources is not a matter of urgency, since there is no threat of a supply shortage. It has left the development of renewable energy initiatives to the private sector.

However, the government has agreed to incorporate the issue in its sustainable development goals in the medium term.

B. Key actors in energy efficiency and their effective roles

Trinidad and Tobago has a Ministry of Energy and Energy Industries (www.energy.gov.tt), which is the government agency responsible for managing and developing the country's oil and mining resources.

The Ministry's website describes its principal activities, none of which are related to actions, projects and/or programmes for efficient energy use in the country. The website also describes the Ministry's strategic objectives, none of which include energy efficiency or rational use of resources.

The ministry has 16 divisions or units, of which only one—the Department of Energy Planning and Research—makes reference (as a research issue) to seeking opportunities for the development of renewable energy. There is no mention whatsoever of energy efficiency in the Energy Planning area.

There is very little development of non-conventional energy in Trinidad and Tobago—only some incipient work on thermal solar energy, biomass and wind energy. Electrical production from renewable sources does not yet play any role in the country's energy balance sheet.

C. Resources and funding mechanisms for energy efficiency programmes

Since there are no energy efficiency programmes either in operation or being designed, no funds are allocated for such purposes.

D. Results of energy efficiency programmes to date

There are no national energy efficiency programmes in Trinidad and Tobago.

E. Lessons learned

Not applicable, since there have been no energy efficiency programmes.

XXVI. Uruguay

A. Recent advances in policy, regulatory and institutional frameworks

Uruguay has defined four fundamental strategic pillars for its energy policy. Energy efficiency is one of the fundamental components that have been formally identified by the National Directorate of Nuclear Energy and Technology of the Ministry of Industry, Energy and Mines:[29]

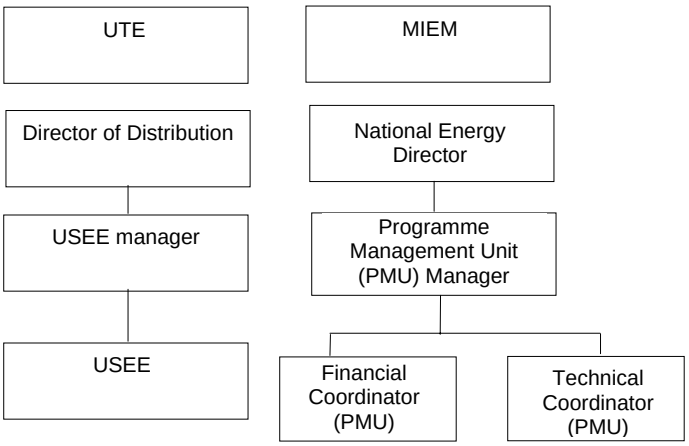
- Leading role of the State. Leadership of energy policy, promoting and coordinating participation by public and private stakeholders.
- Diversification of sources and suppliers, as a means to increase the security of supply, or reduce dependency on imported energy, by incorporating indigenous renewable energy sources, exploiting and developing national productive capacities to improve the country's productivity.
- Energy efficiency in all sectors of activity, as a long-term policy tool, generating a culture of efficient energy use.
- Assured access to energy for all social sectors, making energy a right and an element of social integration.

With a view to incorporating energy efficiency as one of the components of energy policy, the Energy Efficiency Project has officially been underway in Uruguay, since August 2004,[30] with financial support from GEF funds channelled through the World Bank[31].

Project financing is structured as follows:

[29] The strategic guidelines can be obtained at www.miem.gub.uy.
[30] The programme's components are described briefly in Annex 3-3.1.
[31] www.eficienciaenergetica.gub.uy.s.

FIGURE 32
ORGANIZATION CHART OF THE ENERGY-EFFICIENCY PROJECT



Source: Energy-Efficiency Programme Management Unit.

Where:

- MIEM: Ministry of Industry Energy and Mines of the Government of Uruguay
- UTE: State-owned thermal power plant
- UGP: Programme management unit
- USEE: UTE Energy-Efficiency Services Unit

Although the project is already under way, its completion is scheduled for 2011, for which reason there is a commitment to provide an institutional legal framework making it possible to establish energy efficiency as a component of long-term policy. To that end, on 16 June 2008, a draft Energy-Efficiency Law was submitted to the Council of Ministers and subsequently to the Legislature, where it has now been approved and is in the promulgation process.

The new law will make it possible to consolidate institutional legal framework for energy efficiency, making this a component of the country's energy policy, providing an institutional structure and the financing sources necessary to undertake energy-efficiency activities nationwide. The Energy-Efficiency Unit was set up within the structure of the Ministry of Industry, Energy and Mines, and the Uruguayan Energy Saving and Efficiency Trust Fund to provide specific funding for energy efficiency. The text of the draft law approved by Parliament is contained in Annex 3 - 3.2 - Uruguay, and can be consulted at www.eficienciaenergetica.gub.uy/documentos/ under "Proyecto Ley Eficiencia energética Junio 2008 Revisión Final."

Other specific energy-efficiency regulations implemented through Government Decrees to overcome specific barriers to energy efficiency are as follows:

Decree providing incentives for energy measurement and efficiency in public lighting

To encourage energy efficiency in public lighting in the municipalities, the energy actually used needs to be measured, because public lighting systems normally do not measure the energy consumed. On 21 August 2008, Decree 408/008 entered into force, creating subsidies through the Fund for Inland Development of the Office of Planning and Budget, UTE and DNETN for public

lighting measurement and efficiency projects. A clear example of the scope of this instrument is that some departments already have had nearly all of their public lighting systems measured.

Decree on energy efficiency in the public sector

Of 29 October 2008, Decree 27/008 entered into force, making it mandatory for all public agencies to have an institutional energy plan in place, and prohibiting government bodies from purchasing incandescent lamps as from 2010.

Decree on energy-efficiency labelling

On 22 September 2009, decrees entered into force making energy-efficiency labelling compulsory for electrical and gas equipment. Labelling becomes mandatory and a requirement for marketing within Uruguay once the transitory periods have been fulfilled as established in the specific decrees.

Decree on tax benefits for renewable energies and efficient energy use

This decree enables firms related to the promoted activities to obtain significant tax incentives.

In terms of the development of a suitable legal framework to promote investments in energy efficiency and renewable energies, the following laws have been inactive:

Investment Promotion Act

The Investment Promotion Act provides incentives for investments that save energy, considering them as cleaner production.

Thermal solar energy Act

The law to promote thermal solar energy was approved by Parliament and is currently being promulgated by the Government.

B. Key actors in energy efficiency and their effective roles

The key official stakeholder for issues relating to energy-efficiency policy is the Ministry of Industry, Energy and Mines, acting through the National Energy Directorate. The Energy Efficiency Project Management Unit (UGP), mentioned in (1) “Progress...” operates out of the headquarters of this directorate.

The MIEM National Energy Director has general responsibility for executing the Energy Efficiency Project, and, in the framework of the Energy Efficiency Act, the Energy Efficiency Unit forms part of the functional structure of the National Nuclear Energy and Technology Directorate. The Project Management Unit, headquartered in the Ministry of Industry, Energy and Mines is responsible for executing and coordinating the activities of the Energy Efficiency Project.

The component led by the UTE is implemented by the Energy Efficiency Services Unit (USEE).

The energy-efficiency project integrates other energy-efficiency stakeholders through the following mechanisms.

- The Energy Efficiency Committee
- Workgroups
- Stakeholder meetings

- Open forums

Energy Efficiency Committee

This is a consultative committee, consisting of multiple groups of stakeholders linked to the project, both public and representatives of the private sector and citizens at large.

The members of the Energy Efficiency Committee are:

State agencies

- National Public Education Administration (ANEP)
- National Alcohol Fuels and Cement Administration (ANCAP)
- National Electric Power Plant and Transmission Administration (UTE)
- Banco Hipotecario del Uruguay (BHU)
- National Environment Directorate (DINAMA)
- National Housing Department (DINAVI)
- Ministry of Industry, Energy and Mines (MIEM)
- Ministry of Transport and public Works (MTOP)
- Ministry of Economy and Finance (MEF)
- Office of Planning and Budget
- Energy and Water Services Regulatory Agency (URSEA)
- University of the Eastern Republic of Uruguay (UdelAR)

Private sector organizations

- Association of Manufacturers of Electrical and Electronic Articles (AFAEE)
- Association of Large Industrial Energy Consumers (AGCEI)
- Uruguay Chamber of Construction (CCU)
- Uruguay Chamber of Industries (CIU)
- Uruguay National Chamber of Commerce and Services (CNCSU)
- GASEBA Natural S.A. (GASEBA)

Civil society organizations

- Energy Union Coordinator (PIT-CNT)
- Uruguayan Consumer Protection League (LIUDEC)
- Uruguayan Network of Environmentalist NGOs (REDURAM)

Workgroups

The UGP organizes project activities in workgroups consisting of public agencies and private-sector stakeholders or representatives from the general public. Participation in workgroups is on an unpaid basis

The workgroups organized by sectors are as follows:

- Group 1: Public sector
- Group 2: Productive sector and energy service firms
- Group 3: Residential sector

Stakeholder meetings

At the request of stakeholders, the UGP organizes meetings between suppliers and demanders of technologies and/or advisory services for improving energy efficiency.

Open forums

The UGP organizes forums, seminars and training courses on energy efficiency, to disseminate project results and advise on efficient energy use.

C. Resources and funding mechanisms for energy efficiency programmes

Drew the lifetime of the Uruguay Energy-Efficiency Project, energy-efficiency activities are financed through a GEF Grant (Global Environment Facility) through the World Bank, which contributes US$6,875,000 and with counterpart funding from the Ministry of Industry and Energy and UTE, who jointly will contribute US$8.2 million.

The GEF provides funds to implement the Energy Efficiency Project in Uruguay through a grant to the Uruguayan State, the Ministry of Industry, Energy and Mines, channelled through the International Bank for Reconstruction and Development (IBRD) (the World Bank).

The Ministry of Industry, Energy and Mines and the UTE contribute the remaining funds for implementing the project, as local counterpart.

Once the Energy-Efficiency Law is in force, energy-efficiency activities will be financed by the Uruguayan Energy-Efficiency Trust Fund, which manages monies collected from the fee charged on energy sales (electricity and fuels) and of the installation of new power plants based on fossil fuels.

1. Energy-Efficiency Trust Fund

In October 2008, a contract was signed between the Ministry of Energy and Mines (MIEM) and the National Development Corporation (CND) to set up the Energy Efficiency Trust Fund (FEE). On 12 December 2008, the line of financing was officially launched. In January 2009, grant funds were disbursed to capitalize the FEE, US$2.5 million to set up the trust fund of guarantees to form the National Guarantees System (SNG). Once the initial contracts had been signed with market financial institutions, the process of granting the first credits for energy diagnostics began.

D. Results of energy efficiency programmes to date

Since 2005, electrical energy saving plans have been developed in the public sector, and the crisis in the sector has made it possible to generate significant structural changes in energy efficiency. The reports on the results of such programmes can be found at www.eficienciaeergetica.gub.uy/ documentos.asp in the PAEE folder. This also contains status reports and an evaluation of the results of the 2006 and 2008 plans.

The same folder also contains documents and state as reports of the GEF/WB energy-efficiency project.

A very important component of the energy-efficiency project is to generate success cases; thus far several pilot energy-efficiency projects have been evaluated and implemented, involving a cumulative energy saving to date of 4,822 tep and a reduction in emissions estimated at 15,593 tons of CO_2 equivalent. Further information can be obtained on the programme's website (www.eficienciaenergetica.gub.uy/documentos - see "Casos exitosos").

The plan to replace incandescent lamps with labelled low consumption lamps covered 14% of the residential lighting stock (roughly 1.6 million), which on the basis of this initiative has meant a saving of over 12 ktep and has avoided emissions totalling 2,760 tonnes of CO_2.

Since 2005, a total of 1,000 people have received some type of training in energy efficiency; a total of roughly 42,000 seconds per year are invested in open television and radio with awareness-raising campaigns on energy efficiency; and 25,000 books have been supplied on energy efficiency in primary school.

1. Standard projects to improve energy efficiency

- Control of peak demand.
- Optimization of the air-conditioning of classrooms.
- Boiler efficiency optimization of steam generation.
- Optimization of the air-conditioning system; Control of the luminous flow of outside lighting (parking).
- Energy efficiency project (Replacement of fuel oil heating by solar energy).

2. Other energy-efficiency actions

Energy efficiency and efficient technologies labelling

Plan to replace incandescent lightbulbs with contact fluorescent lamps- "A todas Luces"

Delivery of the fluorescent lamps acquired by UTE in coordination with the DNETN began on 28 August 2008. To date, a total of 1,589,830 lamps have been supplied, implying a saving of 75% of the energy consumed by each lamp replaced. This is the first milestone of the equipment labelling programme, achieving replacement of a high percentage of the residential incandescent lamp lighting stock with fluorescent compact lamps of class A according to the UNIT standard.

Energy efficiency labelling

Decrees are in force implementing the energy-efficiency labelling programme for accumulation water heaters and compact fluorescent lamps, which is voluntary in the first phase but will become compulsory once the transitory regime periods have been completed.

Testing laboratories

On 2 October, the energy-efficiency laboratory for accumulation water heaters was inaugurated. As the country's first efficiency-testing facility, this laboratory, together with another two that are currently being adapted, will form part of the National Laboratory Network in this area.

Efficient Technologies Fair

In September 2008, the Efficient Technologies Fair was held in cooperation with the Uruguayan Centre of Appropriate Technologies (CEUTA) with the aim of promoting the various efficient technologies and activities of energy service firms.

3. Education, dissemination and cultural change

Primary school book

On 20 October 2008, the book "Energy is incredible" was presented, for distribution in all public schools in the country and in private schools in the Department of Montevideo, totalling 2,112 schools and 24,473 books delivered. The launch was made by the President of the Republic Tabaré Vázquez, in an event held in the presidential residence, where copies of the book were given to students from public school N 5 14 of Montevideo , and a puppet show was provided on energy.

Didactic exhibition on energy efficiency

Through a contract signed with "Ciencia Viva", 18 didactic models were developed to demonstrate energy efficiency and the different energy sources. The exhibition is itinerant although it has permanent headquarters at the Municipal Planetarium of Montevideo, in the "Ciencia Viva" [Living Science] exhibition. Its presence has already been confirmed in Rivera, Tacuarembó and Maldonado.

Puppet show in schools

Between July and December 2008, 95 presentations of a puppet show on energy were held for of primary school 4th to 6th grade students, totalling 12,431 schoolchildren from 80 public schools in Montevideo, Canelones and San José. In 2009, 90 performances were given in Montevideo and elsewhere in the country.

Media campaigns

Since April 2008, mass media campaigns have been undertaken between DNETN and UTE on the efficient use of electrical equipment, rating the effects of responsible energy use on external energy dependency and climate change.

Training courses

Since the start of the project, a total of 11 training courses have been held, for a total of 236 people trained on issues related to energy efficiency.

Emissions calculator

A greenhouse gas emission calculator has been posted at the website: www.eficienciaenergetica.gub.uy, measure household and transport energy consumptions.

4. Activities scheduled and under way

The following studies are being undertaken or scheduled for the immediate future:

Solar heating potential

Calculation of a national solar map and identification of capacity to exploit this energy source for water heating. This study and has been under way since August 2008

Co-generation potential

A national study to calculate co-generation potential in the industrial, commercial/services and energy sectors. In other words, a simultaneous generation of electrical and usable thermal energy from processes based on the same primary energy source. The study began in September 2009.

Energy-saving potential

Calculation of the potential energy efficiency obtainable by Uruguay in the residential, industrial, commerce and services sector, to identify energy-efficiency targets nationwide and incorporate them into medium- and long-term planning.

The following courses, and dissemination and awareness-raising activities are being implemented or will be implemented the immediate future:

Courses

Programme of courses including 10 training events on energy-efficiency issues. The number of people trained is expected to double in two years.

Technical talks

During Energy Efficiency Week 2009, a technical talks cycle was launched, and this continues to provide fortnightly talks provided by universities, efficient technology provider firms, ESCOs and energy-sector professionals.

National Energy Efficiency Award 2009

This award aims to promote energy-efficiency nationwide through projects aimed at improving the use of energy resources and promoting cultural change in the way energy is used, thus contributing to an improvement in national economic competitiveness and reduction in greenhouse gas emissions. The announcement was made on 1 June 2009, and the award ceremony was held on 30 September.

E. Lessons learned

Goodwill and political support from all government agencies involved, together with all other non-governmental stakeholders is critical; these processes require time and “negotiations” to build awareness and alignment with the various interest groups. In addition, the permanency and stability of these agreements various government terms, because it is not possible to generate networks of this type quickly. A frequent error is to believe that these processes are achieved simply through isolated actions and decisions; once political will and support is in place, this has to permeate through the various structures, and networks must be generated, which takes time.

Policy instruments must therefore be designed with an agenda that firstly addresses the less complex actions in the institutional arrangement that achieve tangible results more quickly. This has a very high dissemination and awareness-raising effect, and facilitates future actions in more complex structures, although they often end up as a trial-and-error exercise.

As one of the lessons learned, the Uruguay Energy-Efficiency Programme has found that it is harder to undertake energy-efficient actions in sectors that have multiple stakeholders and interests that are often in conflict with energy efficiency; failure in the initial stages of implementation of complex actions can discredit all future programmes, so tasks need to be clearly planned with real deadlines that take account of institutional complexity, and firstly tackle minor actions with a tangible and visible impact that help to generate awareness, involvement, and replicability. Experience has shown that the sequencing of the implementation of energy-efficiency tools goes beyond cost-effectiveness case studies and requires an in-depth analysis of the complexity of the institutional setting in which the measures will be implemented.

The programme implementation agenda must focus first on specific actions that achieve visible results at a "reasonable" cost, leaving complex projects with multiple stakeholders for later phases. Multiple complex projects should not be undertaken all at the same time, because at least one of them will be doomed to failure.

Clear examples of the country's experience of energy-efficiency actions with a complex institutional framework are energy-efficiency actions in the transport sector, which have multiple stakeholders (National Government, departmental governments, business chambers, the public at large, etc). There are also disincentives for energy efficiency, since municipal tax rates do not encourage replacement of the automobile fleet and revenue is collected autonomously in each municipality, so stakeholders do not have a clear understanding of the benefits of energy efficiency.

Another important lesson learned is that it is inadvisable to replicate external models. Actions that aim to influence demand and attempt to generate a culture have much to do with individual and social behaviour, which differs between countries and often between regions. There are no recipes for this discipline, and priority areas are not identified in a generic international manual.

While it is crucial to draw on the experiences of other countries, each society has different characteristics regarding key factors affecting the situation, such as: consumer behaviour, the reality of the energy sector and resource availability, institutional frameworks, the dominant economic sectors, the role of domestic industry and commerce, and so forth.

A clear example of this the energy-efficiency programme's attempt to replicate the energy-service firm (ESCO) scheme. There is no local business culture of letting foreign firms participate - as a firm - in their income, and no "tradition" entering into complex contracts.

This is justified by the capital composition of the firms in question, the level of training and professionalism of decision-makers, etc. Thus, the idea of forcing the implementation of performance contracts has been rejected, and efforts are focusing on promoting the creation of firms specializing in efficient energy use, that identify and implement opportunities for improvement. The contractual mode is seen as a vehicle for commercial relationship, but is not an objective. The objective is for energy-efficiency projects to be developed, and for firms to make use of expert knowledge.

Another lesson learned throughout project implementation is the effect of the "history" of energy-sector professionals. We have a large group of professionals who undertook training and pursued careers in firms of the sector that had a single vision: energy supply**.** As a result, the less "technical" nature of actions on demand tend to be underestimated, while the role as sellers of energy is overvalued. This becomes crucial, because cultural change must always flow from inside the energy sector, with a conviction of its social responsibility, and be projected outside. Often public awareness needs to raised internally as much as externally. This barrier, although identified at the start of the programme, perhaps was not given enough importance, and it became necessary to intensify specific awareness-raising actions targeting intermediate technical personnel not linked directly to energy efficiency. Awareness-raising and conviction events are also needed in other areas which often are not related to the energy sector, but affect decision-making. Here international studies are essential to provide conceptual backing support for energy-efficiency tools.

A major barrier was the lack of a suitable institutional legal framework for energy efficiency, and the lesson learned on this point was that, although developing the institutional legal framework formed part of the programme's objectives and targets from the outset, it should not be the first step. Time must be given to enable energy efficiency to enter the national debate, first-order economic barriers are broken down, and then the cultural change process starts to implement an adapted legal framework which is applicable.

To be even more successful in terms of specific programme results, a long-term institutional framework for energy efficiency needs to be created; and this is a fundamental issue that must transcend individual governments.

Annexes

Annex 1

Colombia

National energy plan 2006-2025

Chapter 5 - Topic 7

In Colombia, as a result of the model implemented and with energy supply and demand in balance, little attention has been paid to developing successful policies to include non-conventional energy sources in the energy basket, or energy-efficiency programmes aimed at more efficient exploitation of available energy resources.

The country has a significant volume laws that has been in force over the last five years, including, firstly, Law 697 of 2001. Nonetheless, the specific results in terms of the development of rational energy-use (REU) projects and the inclusion of non-conventional energy sources in the energy matrix have not been satisfactory.

Like other developing countries, and in the Latin American context, the reason is the existence of various types of barrier such as inappropriate institutional frameworks, discontinuous implementation of public policies and pricing and fiscal policies, both for electric energy and for fuels, which impact energy efficiency and the penetration of non-conventional energy sources in different ways.

These barriers can be classified as technical, economic, financial, legal and institutional, with the economic, financial and institutional ones seeming to have the greatest influence on results to date. In the economic domain, is unlikely that non-conventional or alternative energies could replace traditional energy sources for electricity generation and be competitive in a liberalized energy market, where the investment and average cost of generation are the only factors of comparison between technologies that use fossil fuels and those that use renewable sources.

The financial barriers are linked to the functioning of markets and the need to establish clear and stable mechanisms through the regulatory framework that reduce the financial risks firms are required to assume.

Another of the reasons may stem from the difficulty in investing international funds for the co-financing of REU projects and non-conventional energy sources, because of the complexity and time it takes to prepare proposals. The institutional barriers stem from a lack of government intervention in defining clear and precise policies for the development of REU projects and broad use of non-conventional energy sources and their integration into Colombia' energy-sector development.

One such barrier is the perception that markets alone are sufficient mechanisms for efficient resource allocation, so will give appropriate signals to promote the country's sustainable development. Obviously, this approach to non-conventional energy sources and rational energy use is not used in developed countries, which also operate under rules of efficient allocation based on price signals but are willing to strengthen them through market mechanisms.

The situation is also explained by a failure to promote demand-side management programmes, particularly owing to a lack of interest among energy vendors, whose rationale is profit maximization.

Related to this is the weakness of voluntary labelling programmes and the conflicting interests of suppliers and importers of equipment, which operate under market arrangements; compounded by the fact that lack of income among many sectors of the population causes them to purchase inefficient equipment. Similarly, the weakness of controls implemented by the Superintendency of Industry and Trade produces a situation in which products appear on the market with different characteristics than those declared in the technical standards.

To provide strategic guidance, both in the case of REU and non-conventional energy sources or renewable energies, it is necessary to separate policy actions and instruments in each case. It is advisable to prepare convergent, but at the same time autonomous and independent, instruments and actions since this involves domains that have very different technological characteristics and economic and social impacts, and above all because modes of intervention and public policy formulation are different.

In addition, the objectives and strategic stakeholders on which these policies need to exert a positive and timely impact, are completely different. Non-conventional energy sources include and affect energy generation and the replacement of conventional sources, involving very specific stakeholders and interests, such as generating firms.

In contrast, actions that aim to achieve optimal exploitation of resources involve conservation measures and a opportunity for economic saving. But there is also a need, and even an obligation, to invest in more efficient equipment, with the twin aim of saving energy and lowering costs — of production in the case of industry, operating costs in the commercial services sector, or expenses in the residential sector.

REU measures typically require specific promotion actions among industrial and service stakeholders in the country, and in the case of families and citizens at large, special treatment to ensure that, in the long run, they can take adopt the instruments and actions that create REU awareness.

In this area there are many crosscutting issues and the need for detailed financial architecture, supported by public and private interagency coordination to ensure that REU becomes a reality through specific programmes.

Co-generation

Legal framework

Law 1215, of 2008: *"Por la cual se adoptan medidas en materia de generación de energía eléctrica" [Adoption of measures on electric power generation]*

- This defines the co-generation process as combined production of electrical energy and heat energy, forming an integral part of its productive activity.
- It provides that the co-generator can sell surplus electricity to energy marketing firms.
- The excess energy sold is subject to a tax of 20% (89.1 and 89.2 Law 142).
- The co-generator is exempt from paying the 20% on its own energy consumption obtained from its co-generation process.

Law 1215, of 2008: *"Por la cual se adoptan medidas en materia de generación de energía eléctrica" [Adoption of measures on electric power generation]*

The Energy and Gas Regulation Commission (CREG)

- The technical requirements and conditions to be fulfilled by combined electrical and heat energy production processes to be considered a co-generation process.
- The methodology for paying for the support provided to co-generators by the National Grid System, which should reflect the costs generated by such support.
- Other issues deemed necessary by the CREG.

Registry framework

CREG Resolutions:

- CREG – 085 / 1996.
- CREG – 107 / 1998.

- CREG – 032 / 2001.
- CREG – 039 / 2001.

Supporting:

- CREG – 082 / 2002.
- CREG – 097 / 2008.

Resolution CREG–085-1996: *"Regulation of the activities co-generators connected to the National Grid System (SIN)"*

Definitions:

Co-generation: Process of combined production of electric and thermal energy, forming an integral part of a productive activity, for self- or third-party consumption and destined for industrial or commercial processes.

Co-generator: The individual or legal entity that produces energy using a co-generation process, which may or may not be the owner of the co-generation system.

Resolution CREG–085-1996: *"Regulation of the activities co-generators connected to the National Grid System (SIN)"*

- This provides that the co-generator may be a regulated or unregulated user depending on the power limit in question.
- Establishes conditions for connection to the SIN and access to back up.
- Establishes conditions for access to back up, and for its use and remuneration.
- Sale of energy surpluses.
- The co-generator may sell its surplus electric energy provided it satisfies a number of requirements.
- Provides that audits may be requested to ensure compliance with the regulations.

Resolution CREG-107-1998 (partially amended by Resolutions 32 and 39 of 2001):

- Clarifies the term "Surplus energy with guaranteed power".
- Applies the classification of smaller plants to co-generation plants with energy
- Surplus with guaranteed power.
- Defines a maximum annual load.
- The maximum power required during the connection study may be re-evaluated if it is not used.

Annex 2

El Salvador

List of projects in the energy-efficiency programme in El Salvador

1. Energy audits in the industry, commerce and services sectors, and support for the implementation of demonstration projects.
2. More efficient lighting for the residential sector and general sector (hospitals, government offices and schools), street lighting, and support for the implementation of demonstration projects.
3. Feasibility of implementing a trust fund for the purchase and implementation of energy-efficient equipment and systems.
4. Study of energy consumption in the transport sector.
5. Updating of previous studies characterizing electricity demand and analysis of final use of electricity, applied to the development of energy-efficiency projects.
6. Preparation of loan proposals for energy-efficiency projects.

Annex 3

Uruguay

Components of the energy-efficiency project in Uruguay

The project has two components: one is implemented by the National Directorate of Nuclear Energy and Technology (DNETN), and the other is implemented by UTE (State thermal power plants).

Participation by the National Energy Directorate has the following objectives and scope:

a. To review current standards and regulations and incorporate regulatory changes that stimulate investment in energy efficiency.

b. An energy-labelling and standards programme including an efficiency seal for domestic equipment and materials (houses).

c. Programmes of energy-efficiency training and dissemination in universities, UTU and primary and secondary schools.

d. Creation of standard contractual instruments to support projects executed by energy service firms (ESCOs) and support the creation of an ESCO market.

e. Creation of an Energy-Efficiency Trust Fund to finance energy-efficiency projects. This fund will finance energy audits and investments needed to improve energy use.

The energy-efficiency services unit(USEE) is created in the **UTE,** with five pilot projects in the pipeline:

a. Advice and financing for energy-efficiency measures for UTE customers in the industrial, commercial, services and government sectors. The financing would be paid for out of part of the savings obtained by the project.

b. Financing for municipal governments to replace inefficient public street lighting with sodium lamps. The lamps would be paid for by sharing the savings generated.

c. Financing of efficient electrical appliances for customers of in the residential sector (water heaters and compact fluorescent lamps). A pilot project will be implemented in Ciudad de la Costa.

d. Project to provide advice and assistance to families in settlements, to use energy efficiently. The project included investments in networks, the hiring of managers to help local people in energy use, and courses on the construction of efficient low-cost technologies for cooking and water heating.

e. Rural electrification programme in populations isolated from the electricity network, using photovoltaic panels.

Draft law on efficient energy use

Chapter I

Object and definitions

Article 1.- It is in the national interest to make efficient use of energy to contribute to the competitiveness of the national economy, the sustainable development of the country, and reduce greenhouse gas emissions under the terms established by the United Nations Framework Agreement on Climate Change, approved under Law 16.517, of 12 July 1994.

Article 2 .- For the purposes of interpreting and applying this law, the following definitions shall apply:

a. **Efficient energy use** means all changes leading to an economically beneficial reduction in the amount of energy needed to produce a unit of product, or to satisfy the energy requirements of services required by persons, ensuring equal or higher level of quality and a reduction in negative environmental impacts, covering energy generation, transmission, distribution and consumption. The concept of efficient energy use also includes the replacement by energy users of appliances using traditional energy sources, with non-conventional renewable energy sources, thereby making it possible to diversify the energy matrix and reduce pollutant gas emissions.

b. **Traditional energy sources** means fossil fuels and large-scale hydroelectricity.

c. **Non-conventional renewable energy sources** means indigenous renewable sources, such as wind power, thermal solar and photovoltaic energy, geothermal energy, wave energy, and energies obtained from the use of various types of biomass.

d. **Wasteful energy use** means indiscriminate use of energy that directly harms the environment or domestic economy, as a result of the use of nonrenewable energy sources that does not contribute perceptible benefits to society, in terms of an improvement in production, safety levels, comfort or internationally accepted attributes of product and service quality.

Chapter II

Competencies and plan

Article 3.- The Government shall establish the policy, regulations and infrastructure needed for thorough fulfilment of this law, creating the regulation, technical, economic and financial structure needed for the development of economically and environmentally viable short, medium and long-term policies, ensuring sustainable development, knowledge and awareness among the whole population on efficient energy use and the benefits associated with responsible resource use, together with the dissemination of information on available energy sources and the impacts associated with their use.

For that purpose, the Ministry of Industry, Energy and Mines (MIEM) is called upon to create the Energy-Efficiency Unit (UEE) within the National Nuclear Energy and Technology Directorate (DNETN), with the responsibilities and competencies described in this Article.

Article 4.- The Ministry of Industry, Energy and Mines (MIEM) will prepare the National Energy-Efficiency Plan for approval by the Government.

The National Energy-Efficiency Plan will be prepared in coordination with ministries and related institutions,; it will have a projection of 15 years counted from the approval of this law and will be reviewed and evaluated every five years at least.

The National Energy-Efficiency Plan will include the following specific aspects at least:

a. Mechanisms to guarantee the provision of reliable information to the consumer in relation to the energy consumption of equipment, appliances and vehicles (hereinafter referred to as equipment) that require energy consumption to function.

b. Plans of development, promotion and education on efficient energy use, including the relevant targets, together with research and development of national technologies in areas of knowledge that contribute to efficient energy use.

c. Mechanisms to ensure efficient energy use in central government agencies and public entities generally.

d. Plan to incorporate energy-consuming equipment in the labelling system pursuant to Article 12 of this law, and energy efficient use standards to be required for equipment, vehicles and buildings.

e. Establish maximum target levels for specific energy consumption or minimum energy efficiency, of energy consuming equipment, when justified reasons and favourable market conditions exist.

f. Energy-saving weighting criteria for the issuance of energy-saving certificates created under Article 16 of this law. The weighting system may encourage saving generated in products that use non-traditional energy sources, employment and optimization of non-traditional indigenous energy resources, implementation of efficient energy use in the transport sector, creation of domestic employment and value added, generation of local development or technological innovation and access to efficient energy use for low-income sectors.

g. Criteria for characterizing a project as efficient energy use, pursuant to Article 2 of this law.

h. The energy avoidance target for the lifetime of the National Energy Efficiency Plan and the annual energy avoidance targets for fulfilment of the general target for the period.

Article 5.- The following subparagraph shall be incorporated into Article 1 of Law 17.598, of 13 December 2002:

i. Those relating to efficient energy use, as stipulated in the corresponding regulations."

Article 6 .- The following subparagraph shall be incorporated into Article 2 of Law 17.598, of 13 December 2002:

j. Efficient energy use."

Article 7 .- The following subparagraph shall be incorporated into Article 15 of Law 17.598, of 13 December 2002:

k. In terms of efficient energy use:

1. Ensure compliance with the law on efficient energy use, pursuant to the respective legislation."

Article 8.- The aims of this law should be taken account of and included in the design of national sector policies, particularly the cases of housing, transport and industrial development policies.

Article 9.- To fulfil their responsibilities, government departments will establish minimum requirements for efficient energy use in new buildings constructed, and for public transport and street lighting, following the energy-efficiency and environmental guidelines and standards established regionally and coordinating with the Ministries of Industry, Energy and Mines and of Transport and Public Works, respectively.

Chapter III

Information to the public

Article 10.- Pursuant to the regulations, public and private energy-service providers shall promote efficient energy use among their customers, informing them of concepts and good use practices, and helping them to understand the energy consumption of their equipment, as established in Article 12 of this law.

Article 11.- Energy-service providers can supply equipment that consumes energy, for domestic or commercial use, using instruments or commercial promotions associated with the billing of energy services, such as direct sale or through third parties, exchange, grant, or any other scheme that involves the supply of energy-consuming equipment, provided the equipment included in the

aforementioned commercial practices is efficient as established by the National Technical Standards on Efficient Energy Use, or, otherwise, recognized internationally and accepted for national application by the Ministry of Industry, Energy and Mines (MIEM).

Energy service providing firms shall notify the Ministry of Industry, Energy and Mines (MIEM), prior to implementation, of all commercial practices that involve the supply of energy-consuming equipment to their customers. The Ministry of Industry, Energy and Mines (MIEM) may request amendment or not authorize the implementation of commercial practices that supply energy-consuming equipment, should it be considered that it does not contribute to efficient energy use among the service provider's customers.

Invoices containing credits for equipment purchase will be designed so as to ensure the divisibility and independence between the obligations associated with such credit and those relating to energy supply. In no circumstances shall non-compliance with the former alone lead to supply being cut off.

Article 12.- Energy-consuming equipment can only be sold in the country if it includes standardized information of national application relating to energy consumption and performance, through energy-efficiency labels or seals. The energy labelling or efficiency seals must be incorporated into the equipment at display points, on packaging and on publicity material at sales outlets.

The Ministry of Industry, Energy and Mines (MIEM) shall establish modalities and deadlines for applying energy-efficiency labelling ,depending on the type of equipment and bearing in mind the objectives of this law. The information provided to consumer on the equipment's energy consumption and performance will be based on energy-efficiency standards, according to national technical standards or else those issued by international standardization organizations, and included in the national regulation.

Article 13.- For all energy consuming equipment sold in the country, the Government may set differential domestic tax rates, or minimum energy-efficiency levels, based on minimum performance levels in relation to the relevant technical indicators, pursuant to Article 4 (e) of this law. For that purpose, account shall be taken of the socioeconomic impact of the instruments, adaptation of national production to more efficient technologies, and accessibility by the population to more energy-efficient technologies.

Article 14.- The following subparagraph is added to Article 1 of title 11 of the annotated text of 1996:

"20) Equipment and appliances of low energy efficiency, as determined by the Government: 180%. "

The Government is authorized to amend subparagraph 11th of Article 1 of Title 11 of the annotated text of 1996, as classified by energy-efficiency indices and the use of alternative energies for the different types of vehicles.

Any change in tax rates arising from the application of this Article may only enter into force after 180 days following its approval.

Article 15.- The Energy and Water Services Regulatory Agency (URSEA) will oversee compliance with the provisions of Article 12 of this law, and may order withdrawal from the market of equipment that does not fulfil the corresponding rule, having previously notified the equipment vendor.

Failure to fulfil the obligation specified in Article 12 of this law, shall result in the application of fines, pursuant to the regulation, of up to 100% of the sale price of the equipment in question. The inspection and eventual use of sanctioning power will be the responsibility of the Energy and Water Services Regulatory Agency (URSEA), following the procedure set out in the regulatory decree.

Chapter IV

Mechanisms for the certification, promotion and financing of efficient energy use

Article 16.- The Ministry of Industry, Energy and Mines (MIEM) shall issue energy-efficiency certificates to all energy-efficiency projects presented that fulfil the requirements to be considered energy-efficiency, as established in the regulation.

The energy-efficiency certificate shall have a value in terms of energy units and will be equivalent to all weighted units avoided in the lifetime of the project, calculated as the sum total of energy-saving estimated throughout the project's life, based on the relevant technical parameters and the weighting of energy avoided, as defined by the Ministry of Industry, Energy and Mines (MIEM) for each type of project considered, pursuant to Article 4 (f) of this law.

Energy-efficiency certificates shall be obtainable by all energy users or suppliers of energy services that present efficient energy use projects, implemented for at least one year prior to the application for the certificate and for which the initial annual evaluation of results has been undertaken by an agent certifying effective energy savings, as established in the regulation.

Article 17.- The Ministry of Economy and Finance (MEF) and the Ministry of Industry, Energy and Mines (MIEM) are called upon to create the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), for the purpose of financing technical assistance in energy efficiency, promoting energy-efficiency nationwide, financing energy-efficiency investment projects, promoting research and development in energy efficiency and acting as a contingency fund for situations of crisis in the sector.

The Ministry of Industry, Energy and Mines (MIEM) shall prepare the operating manual of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), which will form an integral part of the regulation is established in Article 28 of this law.

Article 18.- The National development Corporation (CND) shall administer the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), in its capacity as fiduciary agent authorized by the Central bank of Uruguay (BCU).

The Energy-Efficiency unit (UEE) is called upon to act in representation of the Ministry of Industry, Energy and Mines (MIEM).

Article 19.- The Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE) is assigned the following specific competencies:

a. Administer transactions in energy-efficiency certificates, pursuant to the directives established by the Government, and ensure transparency in the energy-efficiency certificates market, pursuant to specific guidelines to be laid down in the operating manual of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE).

b. Serve as a guarantee fund for credit lines destined for energy-efficiency projects through the Energy-Efficiency Trust Fund set up under the framework of the National Guarantees Fund.

c. Finance research and development activities in energy efficiency and the promotion of renewable energies.

d. Provide financing for the development of energy diagnostics and studies for the public and private sectors.

e. Administer and obtain grant funds and loans from international organizations or other sources to promote energy efficiency and reduce greenhouse gases in the energy sector.

f. Finance campaigns of cultural change, education, promotion and dissemination of energy efficiency, targeting all energy users.

g. Finance activities to control and monitor energy-efficiency labelling on equipment nationwide.

h. Finance the upgrading and equipping of national laboratories to ensure the necessary testing capacities to promote and develop energy-efficiency in the country.

i. Finance the costs associated with operating the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), audit and control of energy-efficiency certificates issued by the Ministry of Industry, Energy and Mines (MIEM), pursuant to Article 16 of this law, and the activities of planning, control, monitoring and training of specialized technical staff of the Energy Efficiency Unit (UEE) pursuant to Article 3 of this law.

j. Administer a contingencies fund to act in situations of energy supply crisis, the main function of which will be to finance energy-saving plans by users and emergency operations in the energy market to ensure continuous supply.

Article 20.- The Ministry of Industry, Energy and Mines (MIEM) will establish the annual energy avoidance target as determined in Article 4 (h) of this law, and will define the annual programme of market operations and benchmark prices for transactions in energy-efficiency certificates by the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), allowing for fulfilment of the annual energy avoidance target set in the National Energy-Efficiency Plan.

Article 21.- Agents acting directly in the energy market, who influence energy resource demand and supply, will be required to make the contributions as needed to constitute and operate the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), pursuant to Article 16 and 17 of this law.

The capital of the Uruguayan Energy Saving and Efficiency Trust Fund (FUDAEE) will be obtained from:

a. The obligation for energy service providers to make an annual contribution of 0.13% of total domestic market energy sales in the previous year, before taxes, excluding energy sales between suppliers themselves. Following a five-year period to evaluate the functioning of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), the Government may increase this percentage to a maximum of 0.25%, for justified reasons and according to the circumstances of the energy sector. Energy service providers can deduct this annual contribution up to a maximum of 30% in respect of energy-efficiency certificates obtained in previous years. Energy service providing firms must pay the annual contribution in the form of monthly advance payments on projected annual sales.

b. The requirement for public or private electric power generators that invest in new electrical generation capacity or the expansion of existing capacity, for the purpose of marketing most of the energy generated to third parties, using the transport and distribution networks of the National Electricity System, and which in turn is obtained from the use of fossil energy sources, excluding co-generation projects, to make a one-time payment and as a condition precedent to the start of operations of the facilities in question, equivalent of 1% of the total declared investment.

c. Contributions made by the Ministry of Industry, Energy and Mines (MIEM) from the fines imposed on energy users for inefficient and wasteful practices, pursuant to Article 27 of this law.

d. Funds obtained from grants or loans from international organizations or other external sources, exclusively destined for the promotion of energy efficiency and the reduction of greenhouse gases in the energy sector.

e. Budgetary appropriations determined by the Government for the promotion, saving and efficient and responsible energy use.

f. Funds obtained from differential rates imposed on inefficient equipment, as detailed in Article 13 of this law.

Article 22.- Whenever the energy service provider shows the Ministry of Industry, Energy and Mines (MIEM) that compliance with Article 21 of this law represents an increase in its operating costs, it will activate the relevant mechanisms to transfer the costs resulting from compliance with this law to the user charge.

The regulation will establish deadlines for the entry into force of the annual energy avoidance target and deadlines for capitalization of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), pursuant to Article 21 of this law.

Article 23.- The trust funds obtained from incomes under subparagraphs (a), (c), (e) and (f) of Article 21 of this law, will be allocated in the annual budget subject to the following restrictions.

a. 60% for compliance with the annual energy saving target, pursuant to Article 19 (a) of this law.

b. Up to a maximum of 7% for fulfilment of the purposes established in Article 19(b) of this law.

c. Between a minimum of 3% and a maximum of 5% to defray the costs associated with activities covered in Article 19(g) of this law.

d. Between a minimum of 7% and a maximum of 10% to defray the costs of activities covered by Article 19(i) this law.

e. Up to a maximum of 15% to cover the costs of other activities covered in Article 19 of this law, to promote the Energy-Efficiency Unit (UEE) nationwide.

The monies of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE) allocated for each fiscal year, obtained from the contributions mentioned in Article 21(a) of this law, which are not executed during the same fiscal year shall be discounted from the following year's contributions, in proportion to the contributions made by each energy services provider under Article 21(a) of this law.

The income of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), pursuant to Article 201(b) of this law, may be distributed proportionately in the budget of the year in which the contribution is recorded and in the budgets corresponding to the following nine fiscal years. Appropriation thereof will be subject to the same criteria as established in (a) and (e) of this Article.

Annually, and one month prior to the end of each fiscal year, the Ministry of Industry, Energy and Mines (MIEM), in coordination with the trustee of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), and pursuant to the procedure to be established in the operating manual of the Uruguayan Energy-Saving and Efficiency Trust Fund (FUDAEE), shall define the annual detailed budget according to the circumstantial needs of the energy sector and in compliance with the general allocation criteria specified in this law.

Chapter V

Overcoming tax and administrative barriers to energy efficiency

Article 24.- In the framework of the National Energy Efficiency Plan established in Article 4 of this law, the Government will ensure that the tax structure promotes sustainable and efficient use of energy resources.

Article 25.- The following subparagraph is incorporated in to Article 33 of section 2 of Chapter III of the annotated text on Accounting and Financial Administration (TOCAF):

"X) Contracts with public or private energy service enterprises that are registered in the Ministry of Industry, Energy and Mines (MIEM) and developed under the performance-based contract scheme, in which the investment is wholly or partly financed by the energy services firm."

Article 26.- The following Article is added to section 2 of Chapter III of the annotated text on Accounting And Financial Administration (TOCAF):

"Article 67bis.- In public contracts for the purchase of equipment of intensive energy use, the Central Government, municipal governments, autonomous bodies and decentralized services shall consider, when evaluating proposals, the cost associated with the product life cycle, including for such purposes not only the direct cost associated with the provision of the equipment, but also the cost associated with its operation during its useful life and with its final disposal. ... the regulation will specify the calculation formula to be used for quantifying the benefit."

Article 27.- Energy users that make inefficient and wasteful use of energy in situations of energy supply crisis shall liable to the following sanctions, the application of which may be cumulative:

1. Reprimand;
2. Fines in amounts to be set annually by the Government between 1 UR (indexed unit) and 50 URs.

This regime of administrative sanctions shall be applicable to all natural or legal persons, whether national or foreign, private or public, and in the latter case State or non-State, who, in the exercise of their functions, violate this law.

The Ministry of Industry, Energy and Mines (MIEM) is the competent administrative authority for determining and applying the corresponding sanctions.

Article 28.- The Government shall regulate this law within 180 days following its promulgation.

Annex 4

Peru

TABLE A4.1
IDENTIFICATION OF "STAKEHOLDERS" FOR THE DEVELOPMENT OF ENERGY-EFFICIENCY PROGRAMMES

Stakeholders	Resources that give power or value to the stakeholder	Importance of the Stakeholder
1. Government entities:		
Ministry of Production Ministry of Transport Ministry of the Environment Ministry of Education Ministry of Agriculture Regional Energy and Mining Directorates OSINERGMIN Regional Governments Local Governments State social support programmes Other sectors	Economic resources and financial support, national and international co-operation relations.	Entities that approve legal provisions, have budgetary resources and access to international technical cooperation, and the benefits of fulfilment of their functions that could substantially improve if they jointly address the issue of energy efficiency, and implement it in their own programmes.
2. Associations related to, or representative of energy consumers		
ASPEC National Industries Association - National of Mining, Petroleum and Energy Association CONFIEP National Agrarian Association ADEX - Public transport, freight and taxi associations - Other producer and services associations	Databases, economic resources, convening power.	Associations that maintain strong links with their affiliates, are spokespersons for them and can serve as channels of interaction to invigorate implementation since they will be the direct beneficiaries.

(Continued)

TABLE A4.1 (Concluded)

3. Suppliers of efficient equipment		
Firms selling equipment and equipment services: electric motors, boilers, illumination, refrigeration, domestic electrical appliances, vehicles, transit systems and others.	Technology and human resources	They know the demand and supply and mechanisms for developing the market.
4. Consulting firms and EMSEEs	Knowledge of users and mastery of efficiency technology	They know the energy-efficiency market and maintain relations with suppliers and financial entities
5.Peruvian Engineers Association, CENERGIA, FONAM and other private non-profit civil associations involved in to energy use.	Specialized human resources, databases, technology, equipment.	Institutions with recognized national prestige for the role they play in promoting energy efficiency, ensuring its energy and quality, and support for improving energy-efficiency programmes through carbon certificates.
6. Financial system (banks, COFIDE and others).	Economic resources.	Capacity for financing energy-efficiency equipment and products and customer service infrastructure.
7. Universities and technological institutes - National University of Engineering - Catholic University - Mayor de San Marcos National University - National Agrarian University La Molina and others. - SENATI, TECSUP and other technological institutes	Human resources, laboratories, equipment, capacity and experience in scientific technological research and development, cooperation relations on scientific, technical and information access.	Universities with recognized international prestige for their research in various areas of science, technology and innovation, together with middle-ranking institutions that can empower the multiplier effect of the programmes.
8. Energy producing firms, energy generators, transmitters and distributor firms.	Databases on the consumption characteristics of their customers and network behaviour.	They maintain permanent relations with their customers, but may oppose energy-efficiency programmes as a result of lower sales; nonetheless if they could become partners, the success of EE campaigns would be assured.
9. International technical cooperation (bilateral and multilateral)	Technology, economic resources.	They have access to entities or firms that are interested in implementing programmes in developing countries to promote new technologies, obtain carbon bonds, or finance programmes with economic or social benefits.
10. Communications media	Information and dissemination power	Opinion formers among large target groups through printed media, TV, radio and virtual networks.

Source: Energy Efficiency Benchmark Plan 2009-2018 – Ministry of Mining and Energy, Government of Peru.

Annex 5

Costa Rica

Energy-efficiency activities of the Costa Rican Technical Standards Institute (INTECO)

The energy-efficiency standards in force in Costa Rica are listed below, coordinated by the National Energy-Efficiency Committee.

- INTE 28-01-01-08 Energy efficiency for commercial self-contained refrigeration equipment – limits on consumption values.
- INTE 28-01-02-08 Energy efficiency for commercial self-contained refrigeration equipment – labelling.
- INTE 28-01-03-08 Energy efficiency for commercial self-contained refrigeration equipment – testing method.
- INTE 28-01-04-08 Energy efficiency of domestic refrigerators and freezers – maximum energy consumption limits.
- INTE 28-01-05-08 Energy efficiency of domestic refrigerators and freezers – labelling.
- INTE 28-01-06-08 Energy efficiency of domestic refrigerators and freezers- testing methods.

The last three standards (domestic refrigerators and freezers) were reviewed this year and the maximum consumption limits and labelling were altered.

- INTE 28-01-07-08 Energy efficiency of compact and circular fluorescent lamps. Ranges of performance.
- INTE 28-01-08-08 Energy efficiency- of compact and circular fluorescent lamps. - labelling.
- INTE 28-01-09-08 Energy efficiency- testing method to determine electrical and photometric measurements of compact Fluorescent lamps.
- INTE 28-01-10-08 Energy efficiency of alternating current, tri-phase induction motors, squirrel cage type, in nominal power of 0.746 kW to 373 kW - efficiency limits.
- INTE 28-01-11-08 Energy efficiency of alternating current, tri-phase induction motors, squirrel cage type, in nominal power of 0.746 kW to 373 kW – labelling.
- INTE 28-01-12-08 Energy efficiency of alternating current, tri-phase induction motors, squirrel cage type, in nominal power of 0.746 kW to 373 kW – testing methods.
- INTE 28-01-15-08 Energy efficiency behaviour of air-conditioners and heating pumps without ducts- testing and classification methods.
- INTE 28-01-14-08 Energy efficiency behaviour of air-conditioners and heating pumps without ducts - labelling.
- INTE 28-01-13-08 Energy efficiency behaviour of air-conditioners and heating pumps without ducts - efficiency limits.

The standards prepared by the National Electrotechnical Committee INTE CTN 20-Subcommittee SC 04 are listed below.

TABLE A5.1
STANDARDS

SC 04. Lighting								
REPORT PERIOD 2008								
INTE code	Draft standard	Background	Stage of standard[1]					
			1	2	3	4	5	
PN INTE 20-06-03-08	Electrical products - lighting - ballasts for fluorescent lamps - testing methods	n.a.					X	
PN INTE 20-06-06-08	Electrical products - lighting - ballasts for fluorescent lamps - testing methods to determine the safety of the ballasts.	n.a.					X	
PN INTE 20-06-04-08	Double-shell fluorescent lamps. Operating requirements.	IEC 60 081:1998					X	
PN INTE/IEC 60598-1: 2008	Lamps – Part 1: General requirements and testing	IEC 60598-1:2008		X				
PN INTE/IEC 60598-2-1	Lamps - Part 2: Specific requirements - Section 1: Fixed lamps	IEC 60598-2-1	X					
PN INTE/IEC 60598-2-2	Lamps - Part 2: Specific requirements - Section 2: Fitted lamps.	IEC 60598-2-2	X					
PN INTE/IEC 60238	Edison screw lampholders.	IEC 60238:2004	X					
PN INTE 20-06-05-08	Single shell fluorescent lamps. Operating requirements.	IEC 60 901 ANSI 78.901	X					
PN INTE 20-06-10-08	Electrical products - Ballasts – Low-loss ballasts for lamps of high intensity discharge for use in public lighting. Specifications.	NMX-J-510-ANCE	X					
PN INTE 20-06-07-08	Ballasts for laps of high intensity discharge and low pressure sodium vapour lamps (multi-voltage type). Specifications.	ANSI C82.4-2002	X					
PN INTE 20-06-08-08	Electric lamps - guidelines for low-pressure sodium lamps.	ANSI C78.41-2001,	X					
PN INTE 20-06-09-08	Electric lamps - guidelines for high-pressure sodium lamps.	ANSI C78.42-2001	X					
PN INTE/IEC 60238	Edison screw lampholders.	IEC 60238:2004	X					

(Continued)

Table A5.1 (Concluded)

PN INTE/IEC 60968	Self-ballasted lamps for general lighting services - Safety requirements.	IEC 60968	X
PN INTE/IEC 60969	Self-ballasted lamps for general lighting services - Performance requirements.	IEC 60969	x

Source: Central Committee CTN 20.
Note:[1] Stages coding system:
1) The decision has been taken to prepare the standard but the technical work has not begun.
2) The technical work has begun but not the period for presenting comments.
3) The period for presenting comments has begun but has not ended.
4) The period for making comments has ended but the standard has not yet been adopted.
5) The standard has been adopted.

TABLE A5.2
PLAN 2009

SC 04. Lighting			
INTE Code	Draft Standard	ICS Code	Background
PN INTE/IEC 60598-1: 2009	Lamps - Part 1 General requirements and tests	29,140	IEC 60598-1:2008
PN INTE/IEC 60598-2-1:2009	Lamps - Part 2: Specific requirements - Section 1: Fixed lamps	29,140	IEC 60598-2-1: 1997
PN INTE/IEC 60598-2-2:2009	Lamps - Part 2: Specific requirements - Section 2: Fitted lamps	29,140	IEC 60598-2-2: 1987
PN INTE 20-06-11-09	Electric bulbs with tungsten filament for domestic and similar general lighting uses		NTC 189
PN INTE 20-06-10-09	Electrical products - Ballasts – low-loss ballasts for high intensity discharge lamps for use in street lighting. Specification	29,140	NMX-J-510-ANCE
PN INTE 20-06-07-09	Ballasts for high intensity discharge labs and low-pressure sodium vapour lamps (multi-voltage type). Specifications.	29,140	ANSI C82.4-2002
PN INTE 20-06-08-09	Electric lamps - Guidelines for low-pressure sodium lamps.	29,140	ANSI C78.41-2001,
PN INTE 20-06-09-09	Electric lamps - Guidelines for high-pressure sodium lamps.	29,140	ANSI C78.42-2001

(Continued)

Table A5.2 (Concluded)

PN INTE/IEC 60968	Self-ballasted lamps for general lighting services - Safety requirements	29,140	IEC 60968
PN INTE/IEC 60969	Self-ballasted lamps for general lighting services - Performance requirements	29,140	IEC 60969

Source: Central Committee CTN 20.

TABLE A5.3
CATALOGUE OF SERVICES OF THE I.C.E. ENERGY-EFFICIENCY LABORATORY

Accredited tests	Estimated duration	Cost
HID bulbs		
Maturity	100 hours (4.5 days)	$10 each
Electrical characteristics: Operating current Operating voltage Real power (W) Efficiency (lm/W) Photometric characteristics: Initial luminous flow (lumen) Colour yield index (CRI) Colour temperature Chromatic coordinates (x,y)	40 minutes per bulb	Photo and Elec. Only photo *(1-10): $60 each $40 each *(11-20): $30 each $20each *(21-more): $15 each $10 each If the benchmark ballast is not used, multiply the aforementioned prices by 0.7. Tell the customer to supply the correct ballast. *(Equal number of samples in model brand and power)
Compact fluorescent lamps with ballast incorporated		
Maturity	100 hours (4.5 days)	$10 each
Electrical characteristics: Operating current Operating voltage Real power (W.) Efficiency (lm/W) Total harmonic distortion in current (THDi) Power factor (FP) Photometric characteristics: Initial luminous flow	40 minutes per bulb	Photo and Elec. Only photo *(1-10): $42 c/ $28c *(11-20): $21 c/ $14c *(21 - more/plus): $10.5 c/ $7 c *(Equal number of samples in model brand and power)

(Continued)

Table A5.3 (Concluded)

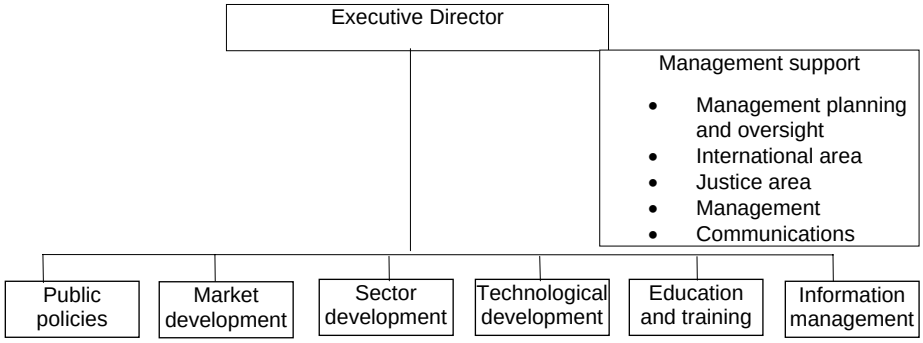
Colour yield index (CRI)		
Colour temperature		
Chromatic coordinates (x,y)		
Non-accredited tests	Estimated duration	Cost
Fluorescent tubes		
Maturity	100 hours (4.5 days)	$10 each
Electrical characteristics:	40 minutes per bulb	Photo and elec. Only photo
Operating current		
Operating voltage		First sample $101 $70
Real power (W)		
Efficiency (lm/W)		Additional samples
		of the same type
Photometric characteristics:		(models, power, brand)
Initial luminous flow (lumen)		$40each $27
Colour yield index (CRI)		If the benchmark ballast is not used, multiply the aforementioned prices by 0.7. Tell the customer to supply the correct ballast.
Colour temperature		
Chromatic coordinates (x,y)		
Fitting- ballast		
Start-up current	1 hour per lamp.	Each parameter: $11 each
Operating current		
Entry voltage		
Real power		
Apparent power		
Power factor		
Fitting losses at nominal voltage		
Fitting losses at nominal current		
Crest factor		
THD-current (harmonic distortion)		
Note: Unless otherwise specified, a benchmark bulb will be used		
Ignitor test	120 hours continuous	$50 each
Photo controls		
On and off test	8 h (10 u)	$80 (10 u)
Determination of zero cross point	30 min each	$3 each
Domestic refrigeration		
Energy consumption	15 days	$500.00
Commercial refrigeration vertical coolers		
Energy consumption	15 days	$500.00

Source: ICE Laboratory.

Annex 6

Chile

FIGURE A6.1
ORGANIZATION CHART OF THE NATIONAL ENERGY-EFFICIENCY PROGRAMME



Source: National Energy-Efficiency Programme (PPEE).

PPEE Commission

Operating Committee and Consultative Council

The institutional framework of the National Energy-Efficiency Programme consists of a commission consisting of the Operating Committee and the Consultative Council. The former monitors the implementation energy-efficiency projects in the spheres of housing and construction, transport, industry and mining, domestic appliances, public sector, education and regions. The latter advises the PPEE and public institutions on energy-efficiency policies.

The **Operating Committee** consists of representatives from public institutions, the private sector and civil society. It meets once a month to evaluate projects, make presentations and report on the progress of each sector. The projects implemented by these stakeholders complement PPEE actions.

The monthly meetings are used to support the regulatory and development framework, project evaluation and execution, and the organization of specific activities such as workshops and seminars. Each session receives project status reports, and presentations on programmed events or the results and relevant sector studies.

The Consultative Committee consists of ministries, directors of industrial associations and leading energy-efficiency experts. It has an executive secretary appointed by the Ministry of the Economy who convenes and coordinates meetings of the Council twice a year.

In addition, the Council has a mission to support government ministries, whose ministers signed the Decree creating the PPEE, giving guidance on their respective energy-efficiency policies.

Operating Committee

1. Ministry Economy Development and Reconstruction
2. Ministry of the Office of the Secretary-General of the Presidency
3. Ministry of Public Works
4. Ministry of Housing and Urban Development

5. Ministry of Education
6. Ministry of Mining
7. Ministry of National Defence
8. Ministry of Agriculture
9. Ministry of Health
10. National Energy Commission
11. Superintendency of Electricity and Fuels
12. Undersecretariat for Transport and Telecommunications
13. Undersecretariat for Regional Development
14. National Environment Commission
15. Production Development Corporation
16. Budget Department
17. National Consumer Service
18. National Clean Production Council
19. Chilean Municipalities Association
20. National Standardization Institute
21. Chilean Chamber of Construction
22. Confederation of Production and Commerce
23. Manufacturing Association
24. Sustainable Chile Programme
25 International Copper Association
26. German Technical Cooperation
27. Chilean-German Chamber of Trade
28. International Cooperation Agency
29. Interministerial Transport Planning Secretariat

Consultative Council

1. Chair: Minister of Economy, Development and Reconstruction
2. Minister Secretary General of the Presidency
3. Minister of Public Works
4. Minister of Education
5. Minister of Housing and Urban Development
6. Minister of Transport and Communications
7. Minister of Mining
8. Chairperson of the National Energy Commission
9. President of the Chilean municipalities Association
10. President of the Chilean Chamber of Construction
11. President of the Confederation of Production and Commerce
12. President of the Manufacturing Association
13. Director of the Sustainable Chile programme

Annex 7

Suriname

TABLE A7.1
TABLE OF RATES IN SURINAME

Sector (2007)	Rates. Average in US$/kWh.
Residential (103,651 clients); total consumption 3.733 kWh /year. Max. 25 KVA.	0.055, including reduced rates for those paying flat rates.
Small businesses, churches, social institutions (10,946 clients); consumption 13,094 kWh /year). Max. 25 KVA.	0.084 including reduced rates for those paying flat rates.
Large businesses, industry (1,127 clients); consumption 234,899 kWh/year. Max. > 25 KVA or high voltage connections.	0.078 including surcharges per KVA, low power factor and reduced rates for those paying a flat rate.
Note: For more information, see: www.nvebs.com	

Source: NV-EBS (NV Energie Bedrijven Suriname—Electric Energy Company of Suriname).