



**Asia-Pacific
Economic Cooperation**

**Peer Review on Energy Efficiency
in Chile**

Final Report

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Endorsed by the APEC Energy Working Group

CONTENTS

PREFACE.....	iii
EXECUTIVE SUMMARY	iv
RECOMMENDATIONS	vi
PART 1: BACKGROUND INFORMATION	
1. STATISTICS, FORECASTS AND TRENDS IN ENERGY EFFICIENCY	1
1.1 Energy Demand by Final Consumption Sector.....	1
1.2 Overall Energy Consumption.....	5
1.3 Energy Efficiency Potentials.....	9
2. ENERGY EFFICIENCY INSTITUTIONS, POLICY AND OBJECTIVES	10
2.1 Energy Efficiency at the Institutional Level	11
2.2 Current Institutional Structure in Energy Efficiency	13
2.3 Energy Efficiency Action Plan for 2010-2020 and the Energy Conservation Curve	16
PART 2: REVIEW TEAM REPORT	
1. INSTITUTIONAL CONTEXT.....	18
1.1 Critique.....	18
1.2 Recommendations	20
2. ENERGY EFFICIENCY GOALS, TARGETS AND STRATEGY	20
2.1 Critique.....	20
2.2 Recommendations	21
3. ENERGY DATA COLLECTION AND MONITORING	22
3.1 Critique.....	22
3.2 Recommendations	23
4. POLICY MEASURES – SECTORAL ANALYSIS	23
4.1 Commercial, Public and Residential Sector.....	23
4.2 Industrial and Mining Sectors	24
4.3 Transport Sector	25
4.4 Electricity Sector	27
5. APPLIANCES AND EQUIPMENT.....	29
5.1 Critique.....	29
5.2 Recommendations	30
6. RETROFIT PROJECTS AND PROJECT FINANCING	30
6.1 Critique.....	30
6.2 Recommendations	31
7. EDUCATION, CAPACITY BUILDING AND R&D	32
7.1 Critique.....	32
7.2 Recommendations	32

8.	STRENGTHS, WEAKNESSES AND OPPORTUNITIES.....	32
8.1	Strengths.....	32
8.2	Weaknesses	33
8.3	Opportunities.....	34
9.	CONCLUSION	35
	APPENDIX A: MEMBERS OF THE REVIEW TEAM	36
	APPENDIX B: ORGANISATIONS AND OFFICIALS CONSULTED	37
	APPENDIX C: ACTION LINES PER AREA	39
	APPENDIX D: REFERENCES	48

LIST OF CHARTS

Chart 1	Final Consumption of Energy, 2007	1
Chart 2	Evolution of Energy Intensity in the Transport Sector	2
Chart 3	Evolution of Energy Intensity in the Residential Sector.....	3
Chart 4	Evolution of Energy Intensity in the Industrial Sector	4
Chart 5	Evolution of Energy Intensity in the Mining Sector	4
Chart 6	Evolution of Final Consumption by Economic Sector	5
Chart 7	Evolution of Primary Energy Consumption in Relation to GDP.....	5
Chart 8	Total Energy Consumption Per Capita by World Region, 2006.....	6
Chart 9	National Primary Energy Consumption, 2007	7
Chart 10	Production and Primary Imports of Energy, 1990-2007.....	7
Chart 11	End Consumption of Energy, 1990-2007	8
Chart 12	Forecasts of Final Consumption by Fuel Type	8
Chart 13	Forecast of Energy Demand by Final Consumption	9
Chart 14	Energy Demand Forecast Considering the Impact of Energy Efficiency.....	9
	Measures	
Chart 15	Sector Contribution to Energy Demand Reduction in 2021	10
Chart 16	Current Institutional Structure for Energy Efficiency.....	11
Chart 17	Proposed Future Institutional Structure for Energy Efficiency	12
Chart 18	Structure of the National Energy Efficiency Program (PPEE).....	15

LIST OF TABLES

Table 1	Energy Consumption by Type of Transport, 2007	1
Table 2	Energy Consumption in the Commercial, Public and Residential Sector, 2007....	2
Table 3	Energy Consumption in the Industrial and Mining Sectors, 2007	3

PREFACE

The objectives of the APEC peer review on energy efficiency (PREE), endorsed by APEC leaders at their 2007 meeting, are to:

- share information on energy efficiency performances as well as on policies and measures for improving energy efficiency;
- provide opportunities for learning from other APEC member economies' experiences and for broadening the network among energy efficiency policy experts;
- explore how energy efficiency goals on an overall and/or sectoral basis and action plans could be effectively formulated in each APEC economy under review, taking into account the diversity of possible strategies that could be used, according to the circumstances of individual member economies;
- monitor progress toward attaining energy efficiency goals on an overall and/or sectoral basis and implementing action plans, if such goals and action plans have been already formulated at the time of the review;
- provide recommendations for voluntary implementation on how implementation of action plans could be improved with a view to achieving energy efficiency goals.

Two activities are being undertaken as part of the peer review on energy efficiency, namely:

- individual peer reviews of volunteer member economies; and
- compilation of a compendium of energy efficiency policies of the APEC member economies based on either the APEC voluntary peer reviews or on the energy efficiency aspects of the International Energy Agency in-depth energy policy reviews.

This report presents the results of a peer review on energy efficiency in Chile. Chile volunteered to undergo a peer review and this was the second review of an APEC economy undertaken under the PREE.

The primary accountability for each individual peer review is shared by the APEC economy being reviewed and the review team. The peer review in Chile was undertaken by a review team of eight experts (see Appendix A, page 36) who visited Chile from 16 to 20 March 2009.

The review team considered written material provided in advance of the visit. During the visit, the team attended comprehensive presentations on energy efficiency in Chile given by representatives from various government and private sector organisations (see Appendix B, page 37). The team also had the opportunity to discuss this information with the presenters.

The review team wishes to thank all the people who made presentations and the representatives of the Government of Chile who organised the visit.

EXECUTIVE SUMMARY

The review team was impressed with the broadly-based support for energy efficiency that currently exists in Chile. This support extends from the Minister for Energy who has a strong personal interest in promoting energy efficiency, to the general public who responded positively to an energy efficiency information and education campaign during an energy supply shortage in 2008.

Currently, Chile has a range of government institutions working to achieve increased energy efficiency. The body directly responsible for developing and implementing energy efficiency policy and programs is the National Energy Efficiency Program (Programa País de Eficiencia Energética, or PPEE), a program of the National Energy Commission (Comisión Nacional de Energía, or CNE). In addition, significant policy and program development related to energy efficiency takes place within other government agencies responsible for transport, housing, economic development and technology transfer. These institutions, as well as local government and other bodies, need to work cooperatively to achieve a common energy efficiency vision and objectives.

The Government of Chile has recognised some inadequacies in the institutions currently responsible for energy efficiency. The Government proposes to establish a new institutional structure involving the creation of a Ministry of Energy, an entity that will centralise the functions of developing, proposing and evaluating public policies in this area, including the definition of objectives, regulatory frameworks and strategies to be applied, as well as the development of public policy instruments. In addition, the Government intends to create a Chilean Energy Efficiency Agency (Agencia Chilena de Eficiencia Energética, or ACHEE). This agency is currently designed as a corporation in which the state and the private sector will participate, so that decisions will be shared among the persons or companies that use energy and the authorities in charge of promoting efficient use of energy.

The review team welcomed the proposed new arrangements as a very positive step that will see ACHEE and a proposed new Energy Efficiency Action Plan become the focus of much greater attention on energy efficiency in Chile. However, the team cautioned that direct involvement of the private sector in ACHEE via a public/private governance structure creates a high risk that program design and implementation could be biased or even undermined by the commercial vested interests of private sector organisations represented on the governance board. Consequently, the review team recommended that the Minister of Energy should establish ACHEE with the responsibility for governance of the agency located entirely within the public sector.

The review team also felt that it is important that the ongoing development of energy efficiency policy and regulations by the Ministry of Energy be informed and shaped by the 'real world' experiences and contacts with stakeholders made during the course of ACHEE's development and implementation of energy efficiency programs. That way program implementation experience keeps broader energy policy (and related national policies) closely linked to developments in the marketplace. This feedback also allows policy and program design to be modified on an ongoing basis to maximize the rate of energy efficiency improvement. Therefore, the review team recommended that ACHEE should have a mandate to provide advice to the Ministry of Energy on the development of energy efficiency policy and regulations.

The review team also made a number of other recommendations covering:

- energy efficiency goals, targets and strategy;
- energy data collection and monitoring;
- energy efficiency in the commercial, public and residential sector;
- energy efficiency in the industrial and mining sectors;
- energy efficiency in the transport sector;
- energy efficiency in the electricity sector;
- energy efficient appliances and equipment;
- energy efficiency retrofit projects and project financing; and
- energy efficiency education, capacity building and R&D.

A national election will be held in Chile in December 2009. Because the Chilean Constitution prohibits the President from serving consecutive terms in office, a new President will be elected and is likely to replace most, if not all, the current Government Ministers. Given the broad-based support for energy efficiency in Chile, there is a unique opportunity to develop a long-term energy efficiency action plan with broad political support. This will be necessary if the current high momentum in developing and implementing energy efficiency programs is to be continued following the change of government in Chile.

RECOMMENDATIONS

Institutional Context

Recommendation 1 (page 20). The Minister of Energy should establish the new Energy Efficiency Agency (ACHEE) with the responsibility for governance of the agency located entirely within the public sector. A permanent advisory committee should be established with wide representation from the private sector and civil society to provide the agency with expert advice on energy efficiency program development and implementation.

Recommendation 2 (page 20). The Minister of Energy should ensure that the Energy Efficiency Agency (ACHEE) has a strong legislative mandate to encourage energy efficiency improvement in the Chilean economy. The agency should have as its main function the development, implementation and evaluation of programs that enable end-users in all sectors to increase the efficiency with which they use energy. In addition, the agency should have a mandate to collect relevant energy end-use data and to provide advice to the Ministry of Energy on the development of energy efficiency policy and regulations.

Energy Efficiency Goals, Targets and Strategy

Recommendation 3 (page 21). The Minister of Energy should ensure that an over-arching national energy strategy is developed for Chile, to provide a framework for energy efficiency policy. The strategy should include quantitative energy efficiency goals.

Recommendation 4 (page 21). In developing the Energy Efficiency Action Plan, the National Energy Commission (CNE) should ensure that the Plan:

- supports broader economic, energy and environmental policies;
- does not distract the National Energy Efficiency Program (PPEE) from continuing to implement its existing energy efficiency programs;
- is consistent with international best practice, ie the strategy should address a range of issues including setting clear quantitative energy efficiency targets, allocating responsibility for program implementation, and establishing a robust program evaluation process;
- achieves appropriate levels of stakeholder engagement in both program development and implementation;
- provides direction for the development of energy efficiency programs in areas where there is currently limited activity;
- builds long term, broad-based political support for energy efficiency to ensure it remains relevant during the forthcoming change of government.

Energy Data Collection and Monitoring

Recommendation 5 (page 23). Given that robust energy end-use statistics are a prerequisite for high-quality energy efficiency policy and program design and monitoring, the Minister of Energy should establish, within an appropriate agency, an energy efficiency data and monitoring team with relevant skills. The functions of this team should include:

- establishing data collection systems that address urgent data gaps - particularly for collecting data on residential firewood collection, energy use in residential and commercial buildings and transport energy use;
- conducting regular energy efficiency benchmarking studies for key sectors that gather information on energy end use and factors affecting end use;
- providing relevant information to policymakers on past and current trends in energy efficiency and the potential for future energy efficiency improvements.

Commercial, Public and Residential Sector

Recommendation 6 (page 24). The Ministry of Public Works (MOP) and Ministry of Housing (MINVU) should:

- immediately embark on the development of mandatory energy efficiency standards for commercial and public buildings; and
- advance the review process for existing energy efficiency standards in residential buildings to a 5-year cycle, as practised in many economies.

Industrial and Mining Sectors

Recommendation 7 (page 25). The Minister of Energy should require each large industrial and commercial enterprise with energy demand above a set level (e.g., 1,000 kW) to appoint an accredited energy manager and establish an energy management system.

Recommendation 8 (page 25). The Energy Efficiency Agency (ACHEE) should establish a technical service centre to assist small and medium size enterprises to implement energy efficiency measures in their facilities.

Transport Sector

Recommendation 9 (page 27). The National Energy Commission (CNE) should include in the Energy Efficiency Action Plan a comprehensive, integrated approach to improving transport energy efficiency that:

- systematically prioritises and targets resources on opportunities to improve transport energy efficiency and related sustainable energy outcomes; and
- provides for strong government interagency coordination (around policy development, program design, implementation and resourcing) that recognises their shared interests in maximising benefits from improved energy efficiency.

Recommendation 10 (page 27). Responsible government agencies should give priority to implementing transport energy efficiency (and related) measures that are currently acceptable and cost effective to the individual and organisation - while progressively working to create a physical infrastructure and pricing regime that supports transport energy efficiency over the longer term.

Recommendation 11 (page 27). Government transport and energy agencies should implement MEPS for light-duty vehicles.

Electricity Sector

Recommendation 12 (page 29). The National Energy Commission (CNE) should establish a regulatory regime that decouples the revenue of electricity distribution companies from their sales revenue, thereby removing disincentives for the companies to promote energy efficiency by their end-use customers.

Recommendation 13 (page 29). The National Energy Commission (CNE) should investigate the feasibility of:

- placing obligations on electricity distribution companies to achieve quantitative energy efficiency targets through programs directed at their end-use customers;
- placing a levy on the revenue of electricity distribution companies to be used to fund energy efficiency programs.

Recommendation 14 (page 29). The National Energy Commission (CNE) should investigate the feasibility of requiring electricity distribution companies to undertake integrated resource planning so that demand-side options are considered on the same basis as supply-side options in meeting consumers' energy needs.

Appliances and Equipment

Recommendation 15 (page 30). The National Energy Commission (CNE) should aggressively pursue the implementation of minimum energy performance standards (MEPS) covering electric, gas and wood-burning appliances and equipment. Coverage should span the range of residential and commercial/industrial products and should also include light-duty (and possibly other) vehicles. Prioritisation of products to be covered by MEPS should be based on total energy savings potential as well as cost-effectiveness.

Recommendation 16 (page 30). The National Energy Commission (CNE) should continue its appliance energy labelling program, maintaining or accelerating its current schedule. Beyond the 2009-2010 roster of products, consideration should be given to including commercial and industrial products in the labelling program. Close attention should be paid to the issue of "grade inflation," where the range of available models clusters disproportionately in the highest categories.

Retrofit Projects and Project Financing

Recommendation 17 (page 31). The National Energy Commission (CNE) and the Chilean Agency for Development (CORFO) should continue their efforts to address bank financing as the weak link in energy efficiency retrofit programs. The nascent loan guarantee initiative appears promising, but other initiatives to address the financing barrier, such as accelerated depreciation for project measures and further education of the financing sector, should also be explored.

Recommendation 18 (page 31). The National Energy Commission (CNE) should assist program managers in energy efficiency retrofit programs to learn from their international predecessors and avoid the common failures in retrofit programs:

- low implementation rates of audits, which can be addressed with means such as pre-screening for commitment, higher recipient co-funding, and active follow-up;
- “cream skimming” (i.e., implementing only the fast-payback measure(s) identified in an audit), which can be addressed by requiring comprehensive multi-measure projects (bundling) and minimum payback thresholds.

Education, Capacity Building and R&D

Recommendation 19 (page 32). The Minister of Energy should establish clear priorities to substantially expand the resources (including human capacity) devoted to energy efficiency research and development.

Recommendation 20 (page 32). The Minister of Energy should ensure that sufficient and stable funding for energy efficiency research and development is available. A defined evaluation procedure should be established for R&D projects that have been funded.

Recommendation 21 (page 32). The Minister of Energy should establish a clear plan (securing sufficient and stable funding) to improve the quantity, quality and capacity of specialists at all levels carrying out the design and implementation of energy efficiency projects.

PART 1: BACKGROUND INFORMATION

This part of the report was contributed by Chile and includes basic information on energy consumption and the main institutions associated with energy efficiency in the economy. The main purpose of this part is to provide the reader with the context within which the review team based its recommendations.

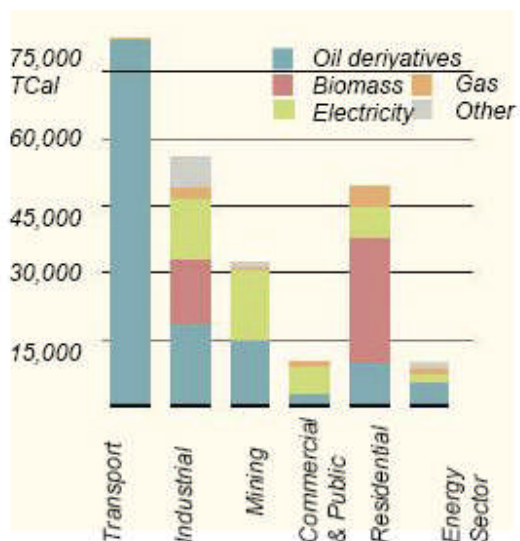
The first section in this part shows energy consumption by sector. The second section includes a description of the energy efficiency institutions, their current policies and objectives and a glance at new institutions that are being proposed to be established in Chile.

1. STATISTICS, FORECASTS AND TRENDS IN ENERGY EFFICIENCY

1.1 Energy Demand by Final Consumption Sector

Final consumption of energy in Chile is determined by four major sectors¹: transportation, industry, mining and commercial,-public-and residential. Consumption distribution for 2007 is displayed in Chart 1.

Chart 1: Final Consumption of Energy, 2007



Source: CNE (2007)

1.1.1 Transportation Sector

The transportation sector demands the most energy, with 35% of final consumption, 99% of which comes from petroleum derivatives (more than 70% is diesel and gasoline). There is also minor electricity consumption from urban trains (Metro) and interurban trains and minor natural gas consumption from a small number of lightweight vehicles. The breakdown by sub-sector is the following:

Table 1. Energy Consumption by Type of Transport, 2007

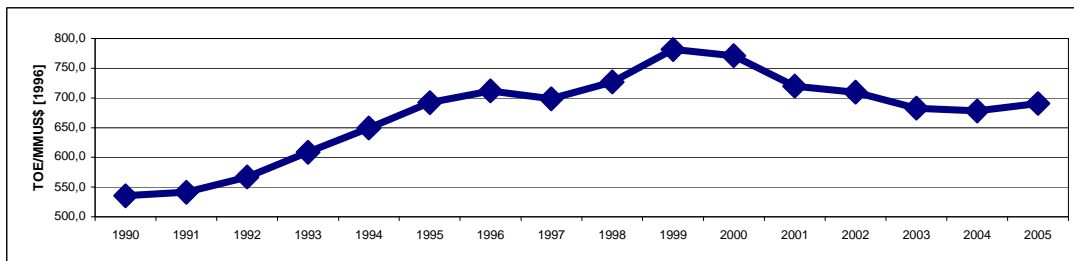
Type of transport	Consumption (Tcal)	%
Road	59,199	69.6
Maritime	19,26	21.1
Air	8,204	9.0
Railroad	255	0.3
TOTAL	86,923	100.0

Source: CNE (2007)

¹ A fifth sector that may be considered within final consumption of energy is the energy sector itself, which corresponds to that sector's own consumption in its energy transformation plants and, therefore, also corresponds to final consumption of energy.

In terms of energy intensity in transport activity, this declined by 10% from 1999 to 2003 and has remained relatively stable since that year (Chart 2).

Chart 2. Evolution of Energy Intensity in the Transport Sector



Source: Prepared by the CNE based on data from the Central Bank (transport GDP) and the CNE (transport sector consumption)

1.1.2 Commercial, Public and Residential Sector

The commercial,-public-and residential sector represents 25% of final consumption of energy. The largest energy source in this sector is firewood, used mostly for cooking and heating, which corresponds to 47% of total energy consumption and creates environmental problems and issues related to sustainable resource management. Electricity and petroleum derivatives are almost equally important in terms of final demand (23% and 20%, respectively). Natural gas has increased in importance, now representing 9% of final consumption in this sector.

The following table shows the breakdown of energy consumption in each of these sectors.

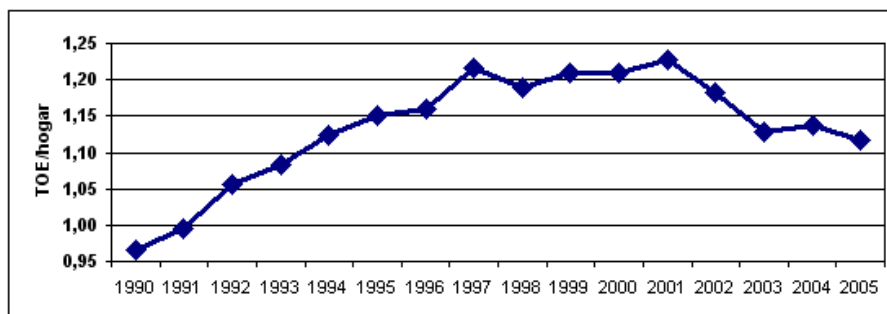
Table 2. Energy Consumption in the Commercial, Public and Residential Sector, 2007

Sector	Consumption (Tcal)	%
Commercial	8,757	14.1
Public	1,925	3.1
Residential	51,585	82.8
TOTAL	62,267	100.0

Source: CNE (2007)

With regard to the energy intensity of Chilean homes, this value showed a sustained increase from 1990 to 2001, when it began to trend downward (Chart 3).

Chart 3. Evolution of Energy Intensity in the Residential Sector



Source: Prepared by the CNE based on data from the National Institute of Statistics (Instituto Nacional de Estadísticas, or INE) on the number of residents and the CNE (energy consumption in the residential sector)

1.1.3 Industrial and Mining Sectors

The industrial sector represents 23% of final consumption. Although this sector requires a variety of resources, 83% of consumption is derived from three sources: petroleum derivatives (33%), electricity (24%) and biomass (26%). The mining sector represents 13% of final consumption. Electricity is the most significant source for this sector at 50% of total consumption. Petroleum derivatives, in turn, constitute 46% of this sector's consumption. The following table shows the breakdown by sector.

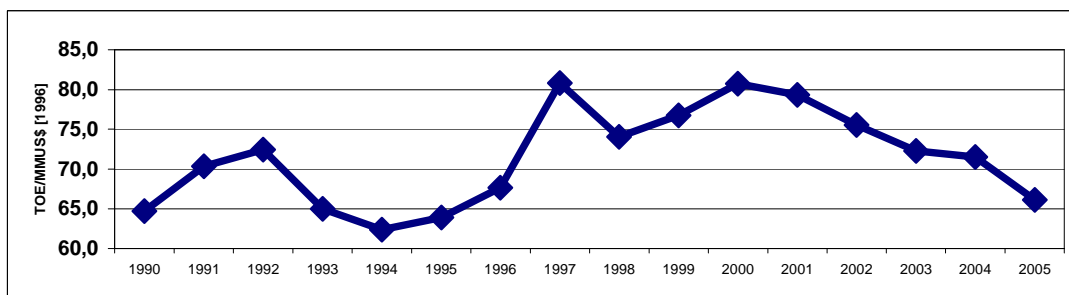
Table 3. Energy Consumption in the Industrial and Mining Sectors, 2007

Industry	Consumption (Tcal)	%
Copper	25,376	27.7
Nitrate	1,204	1.3
Iron	1,020	1.1
Paper and cellulose	19,615	21.4
Steel	4,377	4.8
Petrochemicals	452	0.5
Cement	2,973	3.2
Sugar	869	0.9
Fishing	1,607	1.8
Other industries	28,508	31.1
Other mining	5,746	6.3
TOTAL	91,748	100.0

Source: CNE (2007)

For its part, the industrial sector has varied its energy intensity from 1990 until 2005, but the value is the same for both the beginning and end of that period (Chart 4).

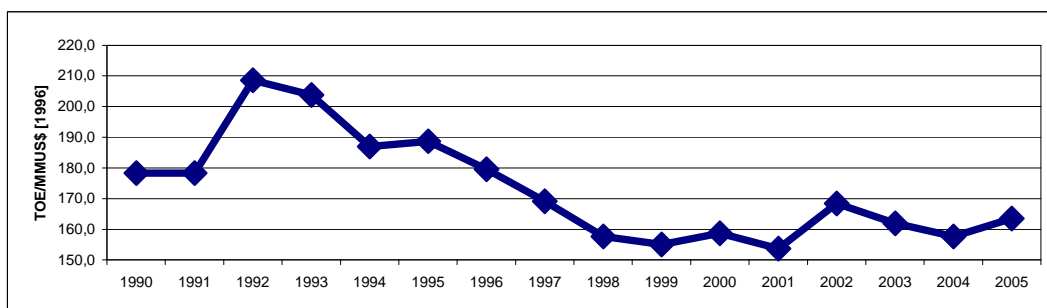
Chart 4. Evolution of Energy Intensity in the Industrial Sector



Source: Prepared by the CNE based on data from the Central Bank (industrial sector GDP) and the CNE (industrial sector energy consumption)

In the mining sector, there was a clear trend toward reduction of energy intensity during the 1990s; subsequently, that trend was reversed and since then, a slight increase has been observed (Chart 5).

Chart 5. Evolution of Energy Intensity in the Mining Sector

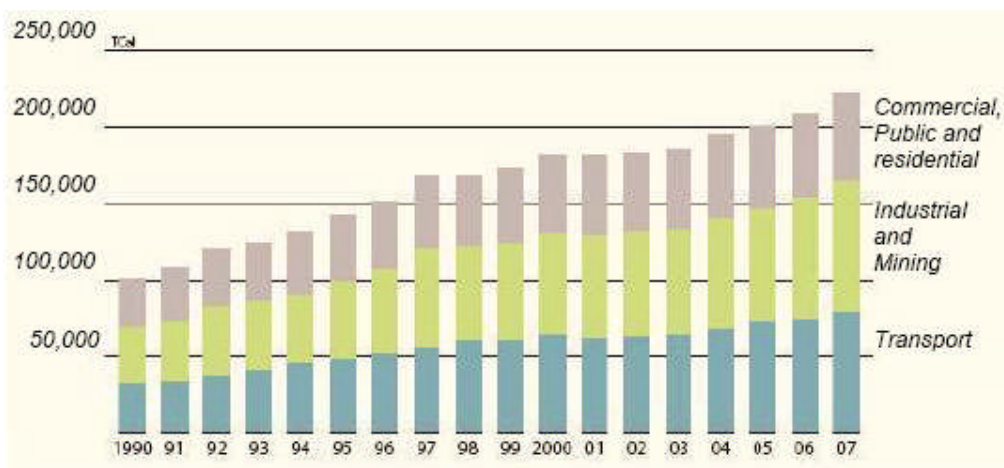


Source: Prepared by the CNE based on data from the Central Bank (mining sector GDP) and the CNE (mining sector energy consumption)

1.2 Overall Energy Consumption

The participation of each sector has remained relatively stable over time, as can be seen in Chart 6.

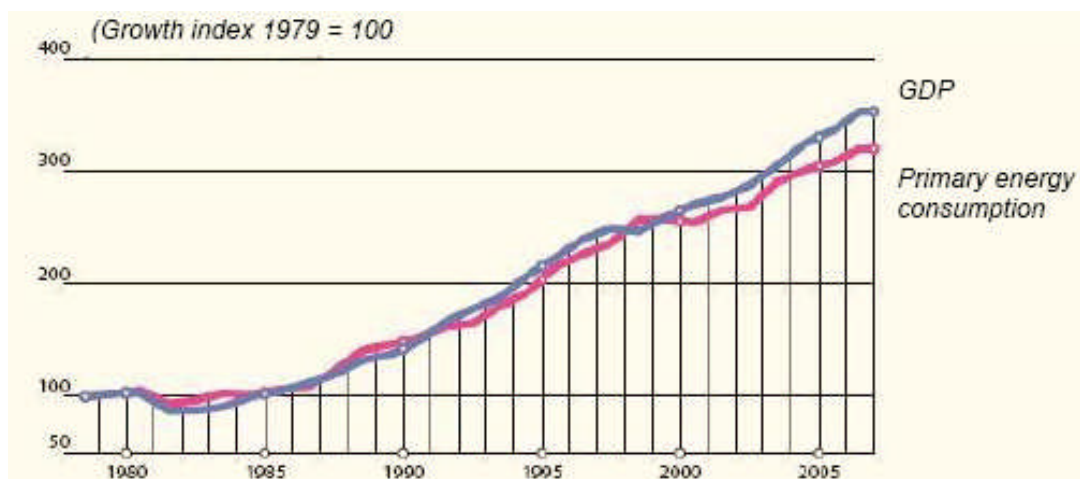
Chart 6. Evolution of Final Consumption by Economic Sector²



Source: CNE (2007)

Chile has experienced significant growth in energy consumption over the last few decades, which is particularly evident in the electricity sector. Final consumption of energy has grown an average of 2.8% per year over the past 10 years while electricity consumption has increased by an annual average of close to 6%. In effect, energy demand has closely followed GDP growth, as seen in Chart 7.

Chart 7. Evolution of Primary Energy Consumption in Relation to GDP³



Source: CNE (prepared by the CNE based on national account data from the Central Bank)

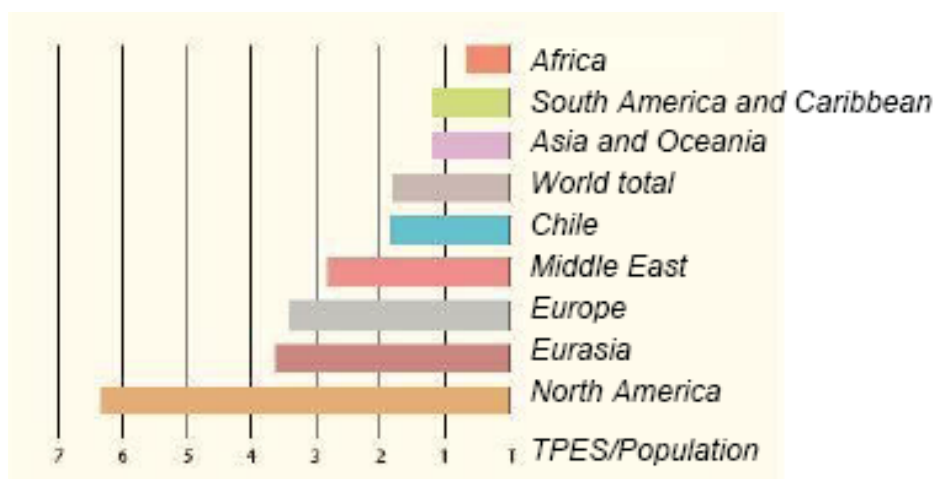
² End-consumption in this chart does not include consumption by the energy sector itself, which corresponds to this sector's own consumption in its transformation plants. Disaggregated figures for consumption by transformation plants and actual energy transformed began to be calculated in 2004.

³ In this chart, primary consumption includes the difference between secondary imports and exports (i.e., it is equivalent to TPES, or total primary energy supply).

In 2007, Chile consumed 31.4 million TOE, while all OECD economies combined consumed 5.591 billion TOE. One could say that, on average, an OECD economy consumes 186.4 million TOE, which is 5.9 times Chile's consumption. In 2007, Chile had energy intensity⁴ of 0.166 TOE/ThUSD, while average intensity for OECD economies was 0.175 TOE/ThUSD.

Chart 8 shows that Chile's total primary energy consumption per capita is relatively low in comparison to more developed regions, which predicts that total consumption will increase as an economy's income levels rise. The electricity sector follows the same general trend.

Chart 8. Total Energy Consumption Per Capita by World Region, 2006



Source: IEA (2008 b).

Hydrocarbons represent more than 70% of total national primary consumption without including secondary net imports⁵, and the majority of this total is imported. Chile has three significant national energy sources: firewood/biomass (heating and electricity), which represents around 50% of all energy produced in Chile with local resources; water (hydroelectric generation), at 24%, and natural gas from the Magallanes region, which makes up 21% of total national production, based on averages for the 2005-2007 period.

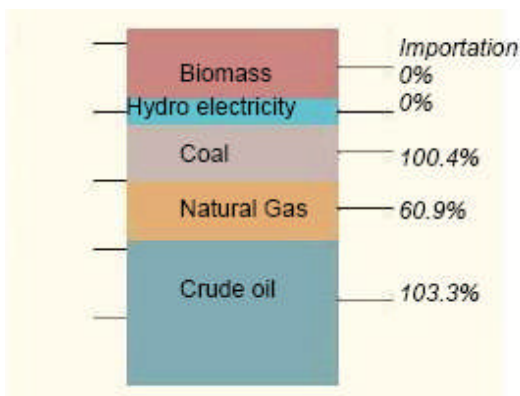
National primary consumption between 1990 and 2006 grew at an annual average rate of 4.6%. During this period (1990-2006), annual average growth of production, imports and exports were 4.8%, 13% and 12%, respectively. Beginning in 1994, a break in this trend is observed.

The growing proportion of consumption made up of imports increased the economy's level of external dependence (Charts 9 and 10). The predominance of imported energy sources exposes the economy to not only supply risks but also to risks related to increases in and volatility of international prices.

⁴ toe/GDP measured in toe/thousands of US dollars from 2000 with purchasing power parity.

⁵ That is, including consumption of natural resources: crude oil, natural gas, coal, hydroelectricity and biomass.

Chart 9. National Primary Energy Consumption, 2007^{6,7}



Source: CNE (2007)

Chart 10. Production and Primary Imports of Energy, 1990-2007



Source: CNE (2007)

This dependence on external sources is exacerbated when there is only one supplier, as is the case with Chile's natural gas, which comes solely from Argentina. Crude oil imports for 2007 (11.8 million m³) came from South America, Angola and Turkey (65%, 15% and 14%, respectively), while coal imports (5.8 million tons) came from four major sources: Colombia, Indonesia, Australia and Canada (34%, 26%, 22% and 11%, respectively).

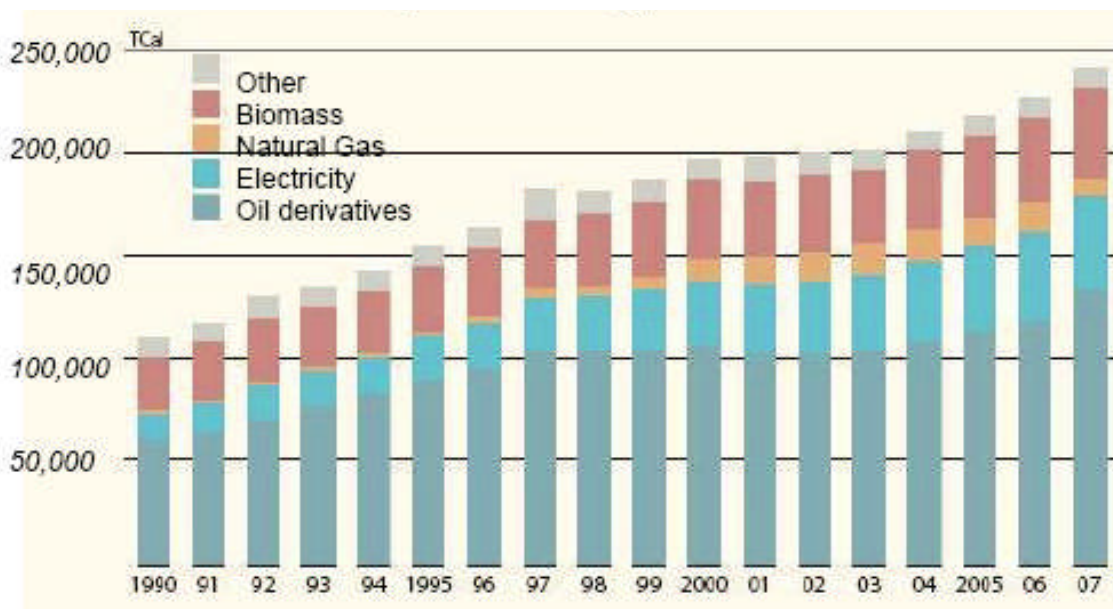
Once gas began to arrive from Argentina, natural gas consumption within the primary energy consumption matrix increased from 9% to 29% between 1997 and 2004, replacing primary consumption of coal, biomass and crude oil. However, beginning in 2005, the situation began to reverse in favor of coal consumption, gradually returning to the pre-1998 consumption pattern, as a result of restrictions on exports of gas from Argentina.

⁶ End-consumption of energy in 2007 was 4.4% greater than in 2006; however, gross primary consumption decreased with respect to 2006. This is due to the fact that petroleum derivatives were imported directly in 2007 (close to 72,000 Tcal), which are not reflected at the primary level. CNE (2007)

⁷ Imports greater than 100% indicate that imports exceeded consumption, which translates into increased inventory of energy sources.

Final consumption of energy grew at an annual average of 4.7% between 1990 and 2007. Petroleum derivatives, biomass and electricity represented on average (during the 2000-2007 period) close to 90% of final consumption (Chart 11).

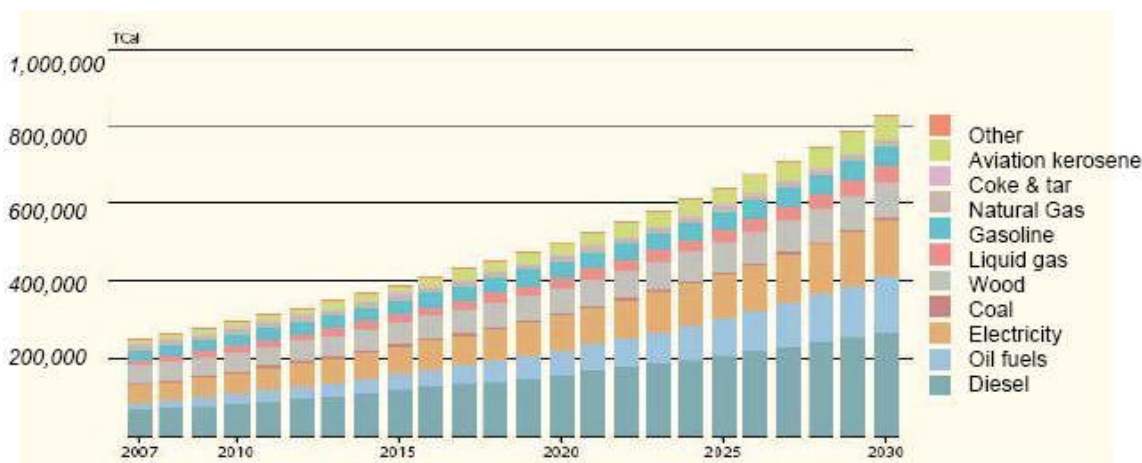
Chart 11. End Consumption of Energy, 1990-2007



Source: CNE (2007)

Forecasts for final consumption of energy predict upward trends, with an average annual increase of 5.4% until 2030. During this period, the most important energy sources will be diesel, fuel oil, electricity and wood, together representing between 69% (for 2007) and 78% (for 2030) of the total. As shown in Chart 12, relative consumption of diesel and fuel oil increases as electricity and biomass decrease.

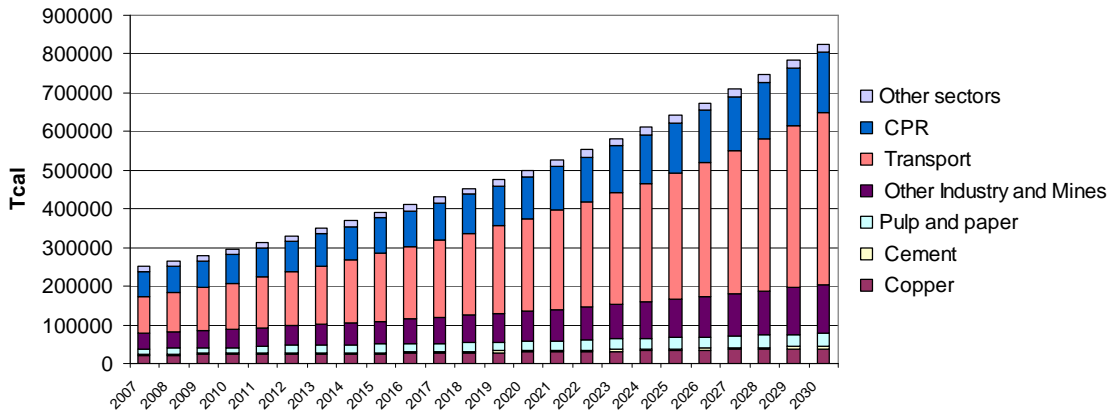
Chart 12. Forecasts of Final Consumption by Fuel Type



Source: Environmental Management and Economics Program - University of Chile, PROGEA-UCH (2008 b).

Chart 13 shows the forecasts for energy demand by end-use, and what stands out is strong growth in the transport sector.

Chart 13: Forecast of Energy Demand by Final Consumption

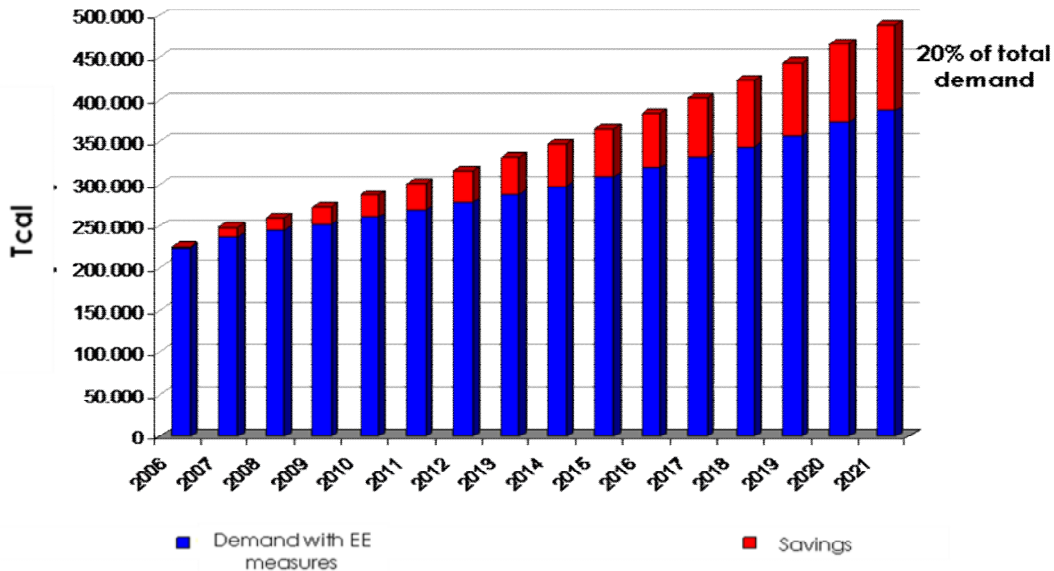


Source: PROGEA-UCH (2008 b)

1.3 Energy Efficiency Potentials

A recent study by the Energy Studies and Research Program (Programa de Estudios e Investigaciones en Energía, or PRIEN) at the Universidad de Chile¹⁰, estimated the potential for energy efficiency in the largest consumption sectors in the economy. As Chart 14 shows, without energy efficiency measures, demand could double in the period from 2007 to 2021.

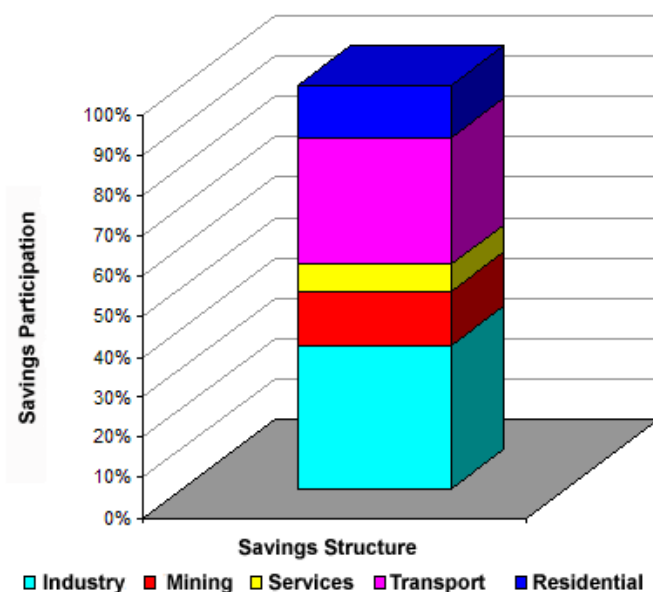
Chart 14: Energy Demand Forecast Considering the Impact of Energy Efficiency Measures



Source: PRIEN (2008)

However, if energy efficiency measures are incorporated, this demand could be reduced by approximately 20% by the end of the indicated period. Chart 15 shows the participation of each sector in demand reduction in 2021.

Chart 15: Sector Contribution to Energy Demand Reduction in 2021



Source: PRIEN (2008)

For Chile's electricity requirements alone, projections indicate that without energy efficiency, by 2020 the economy will need an additional 14,500 MW of installed capacity. Reducing incremental consumption by 20% in the 2008-2020 period will reduce the additional installed capacity needed by 1,600 MW (or slightly more than 11% of the total).

2. ENERGY EFFICIENCY INSTITUTIONS, POLICY AND OBJECTIVES

Historically, the Chilean government's efforts to promote energy efficiency have not been a priority, nor have they been included in state policies. While there were some sporadic attempts to promote energy efficiency (e.g., the Conservation and Rational Energy Use Program, known as CUREN), these only lasted a short time and did not have a major impact. The predominant perspective was that given the advantages of energy efficiency, the market would undertake, on its own, the actions and investments necessary to incorporate energy efficiency into the various sectors of demand. Practical experience has shown, just as in the rest of the world, that this is not the case. Because of this, the principal actions have come from academic centers (e.g., PRIEN at the Universidad de Chile, international organisms (e.g., GTZ and ECLAC), some energy-intensive companies (e.g., CODELCO) and other institutions.

However, the scenario changed in 2005, when the government began to take on a leadership role in promoting and developing energy efficiency. This was reflected in the inclusion of energy efficiency as one of the central elements of the government's energy policy, and as will be shown later in this document, in the creation and strong backing for the National Energy Efficiency Program (PPEE).

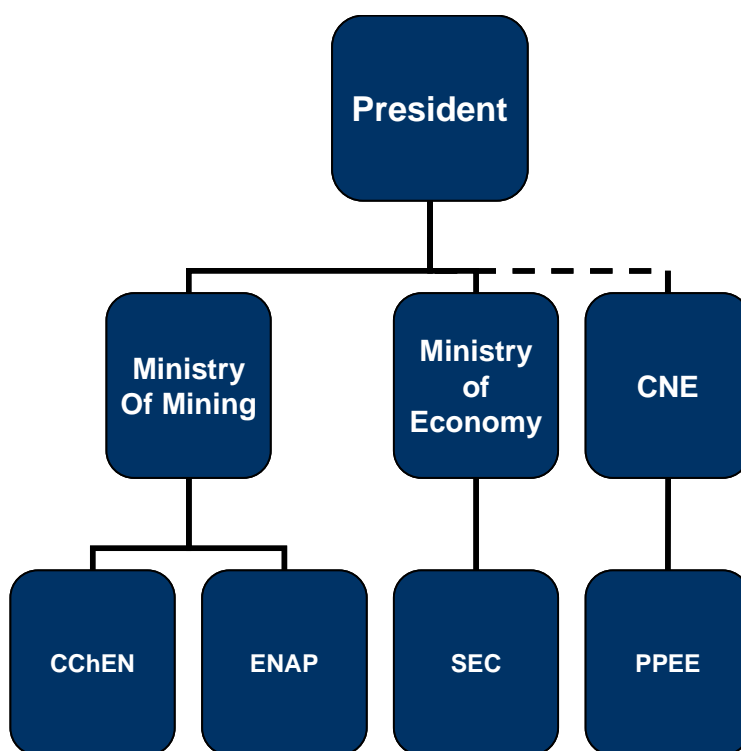
2.1 Energy Efficiency at the Institutional Level

In general terms, and consistent with the international reality, the systematic and structured pursuit of energy efficiency in Chile has its origins in the economy's real needs, which are characterized by the lack of electric supply and a heavy dependence on oil and gas. External motivations, such as the need to reduce greenhouse gases and international accords, have been less relevant, but this could change in the near future as Chile seeks to become a member of the Organization of Economic Cooperation and Development (OECD).

2.1.1 Existing Institutional Structure

The Ministries and public services which are responsible for the direction, economic regulation and oversight of the energy sector are structured as shown in Chart 16.

Chart 16: Current Institutional Structure for Energy Efficiency



National Energy Commission (CNE): This is a decentralized public service whose function is to “create and coordinate plans, policies and regulations that are necessary for efficient operation and development of the economy’s energy sector, as well as making sure that all of the matters related to energy are complied with and to advise the government on all energy-related matters”. It is led by an Executive Committee, composed of a representative of the President of the Republic (President of the National Energy Commission) and the Ministers of Mining; Economy, Development and Reconstruction; Treasury; National Defense; the Secretary General of the Presidency; and Planning. The President of the Commission holds the rank of a Minister of State. Within the National Energy Commission structure, and subordinate to the Minister-President, is the National Energy Efficiency Program (PPEE), whose structure and functions will be detailed later in this document.

Ministry of Mining: This Ministry is authorized to define policies, plans and standards on matters related to hydrocarbons and nuclear and geothermal energy.

Ministry of Economy, Development and Reconstruction: In electricity matters, this Ministry dictates decrees on service prices, grants concessions, and determines energy transport and rationing systems, among others.

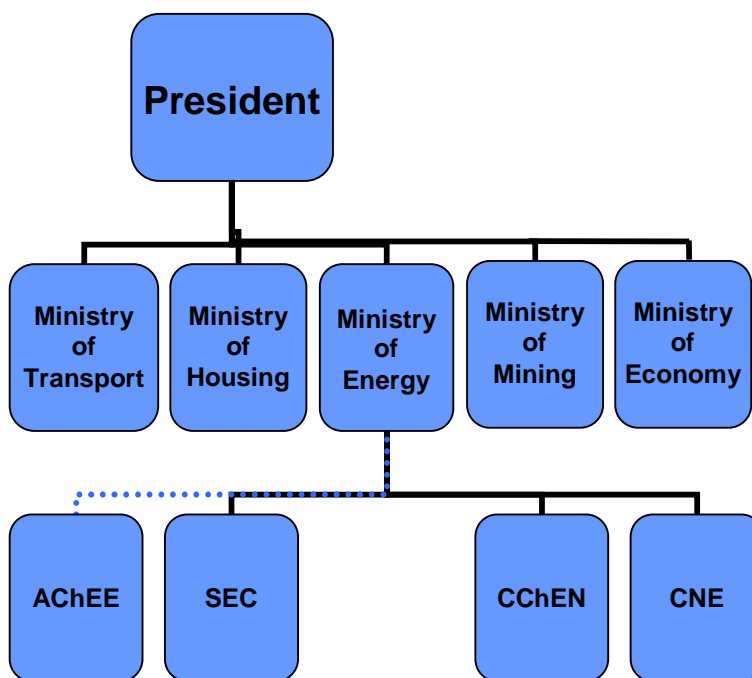
Superintendence of Electricity and Fuels (SEC): This agency is a decentralized public service whose function is to supervise and oversee compliance with legal, regulatory and technical standards on liquid fuels, gas and electricity. It is overseen by the Ministry of Economy, Development and Reconstruction.

Chilean Nuclear Energy Commission (CChEN). This is a decentralized public service whose legal function is development of nuclear science and technology in Chile. It is in charge of production, acquisition, transfer, transport and peaceful use of atomic energy. It is overseen by the Ministry of Mining.

2.1.2 A New Institutional Framework

The Chilean institutional framework in energy matters is undergoing a process of reform which is oriented largely toward the creation of the Ministry of Energy, an entity that will centralize the functions of developing, proposing and evaluating public policies in this area, including the definition of objectives, regulatory frameworks and strategies to be applied, as well as the development of public policy instruments. At the same time, this entity, which is responsible for developing directives and policies, will delegate the functions related to implementation of policies and instruments to other organisations which are not directly subordinate to the Ministry of Energy but are closely linked to it (Chart 17). These executing organisations will be responsible for implementing national programs and specific work plans, technical regulation, enforcement and other functions related to implementation.

Chart 17: Proposed Future Institutional Structure for Energy Efficiency



The legislative proposal which will create the Ministry of Energy contemplates authority for the Ministry to participate in the creation of a private law corporation whose fundamental purpose is promotion, information, development and coordination of research initiatives, and the transfer and distribution of economic, technological and experiential knowledge in the energy arena. This entity has been conceived principally for the creation of what will be the Chilean Energy Efficiency Agency (Agencia Chilena de Eficiencia Energética, or ACHEE). This agency is designed as a corporation in which the state and the private sector will participate, so that decisions will be shared among the persons or companies that use energy and the authorities in charge of promoting efficient use of energy. This type of public-private participation model is used in various economies around the world (such as the United Kingdom and Germany) where the experience has been successful. It is based on the existence of a common interest of the state and private parties in energy efficiency.

The public-private nature of this future agency is consistent with what is proposed in the government modernization agenda. Its structure is proposed to include a board of directors with various important stakeholders in the area of energy efficiency, thus contributing to efficiency and transparency both for energy users and for the general public. Its functions will be centered on activities with a comparative advantage, such as technical assistance and the execution of programs which require logistical expertise and flexibility of action.

International experience also demonstrates that in order for this kind of institution to successfully meet its objectives, a permanent source of financing is required that does not depend on political or economic changes. The forms of financing for these initiatives range from a surcharge on electricity bills for the industrial sector (as in the United Kingdom) to requiring that companies self-finance them, by providing consulting services to other companies.

The need for a new institutional framework for energy efficiency derives mainly from the fact that there has been strong support from the political authorities for energy efficiency in recent years. The budget allocated to PPEE has grown from USD1 million to more than USD30 million in just four years, which demonstrates the strong support for making energy efficiency one of the pillars of the economy's energy policy.

2.2 The National Energy Efficiency Program (PPEE)

On January 24, 2005, the Chilean government organized and brought together a group of public and private stakeholders and put the Ministry of Economy, Development and Reconstruction in charge of starting up and implementing the National Energy Efficiency Program (Programa País de Eficiencia Energética, or PPEE). Currently, PPEE is the main mechanism whereby the Government of Chile's energy efficiency policy and programs are developed and implemented. To develop PPEE, a committee was created that included representatives from the most relevant state institutions, the private sector, local governments and civil society. For its operation, a series of performance agreements with various public services were signed.

In December of that year, the PPEE Commission was created by a supreme decree signed by the ministers of Economy and Energy; the Secretariat General of the Presidency; Public Works; Transport and Telecommunications; Education; Housing and Urbanism; and Mining.

2.2.1 Mission of the PPEE

To consolidate energy efficiency as a source of energy that contributes to Chile's sustainable energy development.

2.2.2 Strategic Objectives

- Establish the institutional foundations and regulatory framework for energy efficiency.
- Develop incentives and support tools for energy efficiency.
- Develop useful and accessible information for making public and private decisions, as well as collective and individual ones.
- Position and introduce energy efficiency in all levels of training, both formal and informal.
- Take advantage of international experiences and instruments to accelerate the development of energy efficiency and measure the reduction in generated emissions.
- Strengthen institutional management through process quality.

2.2.3 Function of the PPEE Commission

To operate, the PPEE functions with an Executive Secretary, an Assessment Council and an Operating Committee.⁸ The Assessment Council includes ministerial representatives and high-level representatives from the private sector, and meets two times each year. It provides continuous counsel to those state ministries which are most important for energy efficiency issues, regarding orientation of their policies related to energy efficiency matters. The Operating Committee has a functional role and is comprised of representatives from various public sector, civil society and private sector institutions. This committee provides guidance to the PPEE in terms of its own formulation and functioning, and meets periodically.

Specifically, the Committee is in charge of the following:

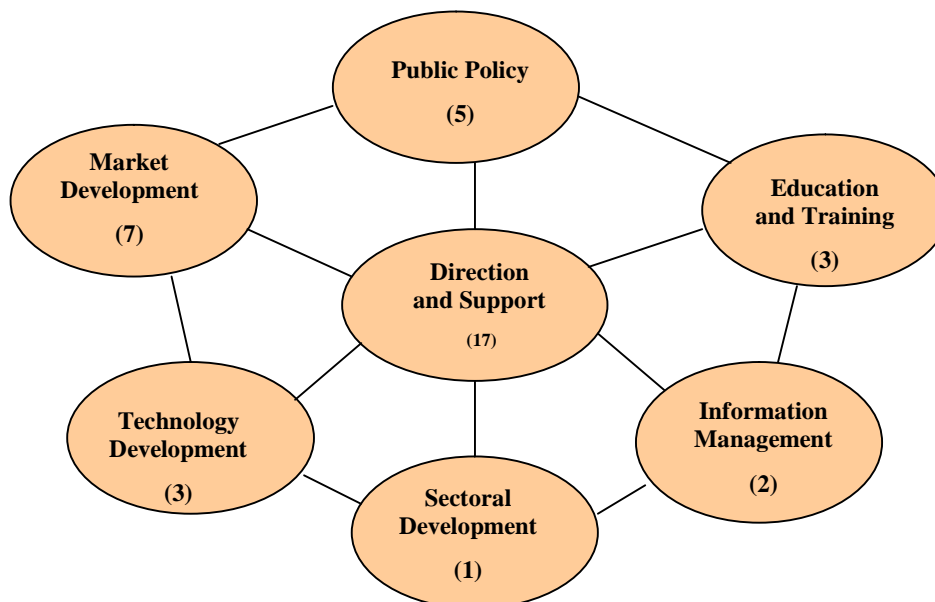
- Tracking energy efficiency projects being designed or executed in the economy.
- Proposing specific actions for developing energy efficiency in the economy.
- Promoting the development of national and international relations which are beneficial for the development of energy efficiency in the economy.
- Promotion and channeling the creative participation of public and private stakeholders, citizens, academics and communicators in PPEE activities.
- Generation and implementation of energy efficiency actions in the economy.
- Fulfillment of the objectives proposed for the various parts of the program.

⁸ Supreme Decree, December 14, 2005.

2.2.4 PPEE Structure

The current structure of PPEE is shown in Chart 18.

Chart 18: Structure of the National Energy Efficiency Program (PPEE)



Direction and Support

Includes areas that cut across all of the work of the PPEE:

- Regional Activities
- Institutional Development
- Management Planning and Oversight
- Communications
- Administration and Finance
- Legal
- International Affairs

Public Policy Area

Purpose of the Area: Generate, evaluate and update the Action Plan in Energy Efficiency for Chile, which serves as a short-term, medium-term and long-term (2020) guide for maximizing the execution of the economy's energy efficiency.

Market Development Area

Purpose of the Area: Facilitate the development of an energy services market in the industrial, transport, commerce and public sectors.

Technological Development Area

Purpose of the Area: Support the development and introduction of technologies that promote energy savings and efficiency in the economy's different productive and social levels.

Sectoral Development Area

Purpose of the Area: Promote energy efficiency in accordance with the characteristics of the diverse productive and service sectors.

Information Management Area

Purpose of the Area: To provide users with energy efficiency information that is differentiated, updated and organized.

Education and Training Area

Purpose of the Area: To educate, train, create awareness and implement energy efficiency competencies in the various energy consumption segments and/or among those who benefit from the projects and incentives promoted by the PPEE.

See Appendix C (page 39) for a description of action lines per area.

2.3 Energy Efficiency Action Plan for 2010-2020 and the Energy Conservation Curve

One of the primary tasks of the National Energy Efficiency Program during 2009 will be the development of the Energy Efficiency Action Plan for 2010-2020, which will establish goals, objectives and lines of action for each of the relevant sectors, with their corresponding indicators, financing and evaluation instruments.

As an input for this plan, the baselines for the main energy consumption sectors will be determined. To do this, we will deliver a description of the end use of energy in both the industrial/mining and residential sectors, together with an energy conservation curve for these sectors to guide policies. Other important consumption sectors, such as commercial buildings, will be described in the following years.

Given the complexities involved in developing an energy conservation curve, we started working with the Lawrence Berkeley National Laboratory with the goal of them providing us with the necessary technical support to develop the methodologies for the construction of the curve, the analysis of public policy instruments derived from the results and to develop the long-term capacity in this area.

PART 2: REVIEW TEAM REPORT

This part of the report was written by the review team and presents the team's conclusions and recommendations about energy efficiency policies and programs in Chile.

1. INSTITUTIONAL CONTEXT

1.1 Critique

Robust institutional structures are critical to the successful development and implementation of energy efficiency policies and programs.

Currently, Chile has a range of government institutions working to achieve increased energy efficiency. The body directly responsible for developing and implementing energy efficiency policy and programs is the National Energy Efficiency Program (Programa País de Eficiencia Energética, or PPEE), a program of the National Energy Commission (Comisión Nacional de Energía, or CNE).

In addition, significant policy and program development related to energy efficiency takes place within other government agencies responsible for transport, housing, economic development and technology transfer. These institutions, as well as local government and other bodies, need to work cooperatively to achieve a common energy efficiency vision and objectives.

It is important that the government's institutional arrangements relating to energy efficiency clearly:

- identify objectives;
- provide a mandate to act – linked to empowering legislation objectives;
- allocate areas of responsibility;
- set lines of accountability for performance;
- define the governance structure;
- facilitate access to expert advice from the market; and
- provide adequate funding for energy efficiency activities.

Chile's proposed future institutional arrangements focus on creating both a new Ministry of Energy as the body with primary energy policy setting responsibilities, and a new energy efficiency implementation agency (ACHEE) responsible for the administration of energy efficiency program delivery. In general terms, this proposed new structure appears consistent with institutional arrangements made in other parts of the world. The new arrangements are a very positive step that will see ACHEE and a proposed new Energy Efficiency Action Plan become the focus of much greater attention on energy efficiency in Chile.

However there are several critical decisions that must be made:

Governance Structure of ACHEE. Options under consideration for the governance of ACHEE include the possibility of direct involvement of representatives of the private sector in the governance of the agency. Direct involvement of the private sector via a public/private governance structure creates a high risk that program design and implementation could be biased or even undermined by the commercial vested interests of private sector organisations represented on the governance board. However, it is very important for ACHEE to have direct and ongoing access to advice from private sector businesses, alongside diverse expertise and experience from academics, NGOs, consultants

and other groups with a stake in accelerating the uptake of energy efficiency. Accordingly the review team considers that ACHEE should be established with the responsibility for governance of the agency located entirely within the public sector. A permanent advisory committee should also be established with wide representation from the private sector and civil society to provide ACHEE with expert advice on energy efficiency program development and implementation.

Relationship Between Policy Development and Program Implementation. It is important that the ongoing development of energy efficiency policy and regulations by the Ministry of Energy be informed and shaped by the ‘real world’ experiences and contacts with stakeholders made during the course of ACHEE’s development and implementation of energy efficiency programs. That way program implementation experience keeps broader energy policy (and related national policies) closely linked to developments in the marketplace. This feedback also allows policy and program design to be modified on an ongoing basis to maximize the rate of energy efficiency improvement.

Accountability. It would be useful to have ACHEE directly accountable to the Minister of Energy for its performance. That way the government retains strong direct control and awareness of practical barriers to the uptake of energy efficiency.

Funding. Obviously there is a need to provide ACHEE and other government bodies implementing energy efficiency measures, with stable and sufficient resources to implement effective long term energy efficiency policies and programs. The recent increase in funding for the National Energy Efficiency Program (PPEE) is positive. However the review team is concerned to see that this level of funding is maintained.

Legislative mandate. International experience suggests that effective energy efficiency agencies require a strong mandate established through legislation. Such a mandate is important for several reasons. First energy efficiency improvements require long term commitment. However, experience tells us that interest in energy efficiency waxes and wanes. A legislative mandate provides long term support despite shorter term changes in political, economic and market operating environment. Second, a legislative mandate also provides the agency with necessary authority to conduct its business (for example, to collect data). Third, such a statutory mechanism helps connect energy efficiency policy to broader policy frameworks. The Chilean government should consider establishing energy efficiency legislation (based on experience in New Zealand and Japan, for example) that provides ACHEE with a strong mandate.

Inter-agency Coordination. To achieve effective cross-sector improvement in energy efficiency requires very strong coordination among relevant government agencies, including those responsible for finance, transport, housing, environment, public works, etc. A high level inter-agency coordinating committee on energy issues would probably be useful. There are also strong synergies between the promotion of small scale renewable energy and energy efficiency. If an agency other than ACHEE were to take on this responsibility for promoting renewables then strong coordination with this agency would be crucial.

1.2 Recommendations

Recommendation 1. The Minister of Energy should establish the new Energy Efficiency Agency (ACHEE) with the responsibility for governance of the agency located entirely within the public sector. A permanent advisory committee should be established with wide representation from the private sector and civil society to provide the agency with expert advice on energy efficiency program development and implementation.

Recommendation 2. The Minister of Energy should ensure that the Energy Efficiency Agency (ACHEE) has a strong legislative mandate to encourage energy efficiency improvement in the Chilean economy. The agency should have as its main function the development, implementation and evaluation of programs that enable end users in all sectors to increase the efficiency with which they use energy. In addition, the agency should have a mandate to collect relevant energy end-use data and to provide advice to the Ministry of Energy on the development of energy efficiency policy and regulations.

2. ENERGY EFFICIENCY GOALS, TARGETS AND STRATEGIES

2.1 Critique

Energy efficiency goals, strategies and action plans are increasingly being used by governments around the world to help guide and encourage energy efficiency policy development and implementation. Measurable energy efficiency goals help governments focus effort and assess progress towards energy efficiency improvement. Energy efficiency strategies and action plans play a key role by:

- placing energy efficiency policy within the broader policy context;
- prioritising resource allocation across the energy efficiency portfolio;
- capturing synergies between policies and avoiding duplication; and
- allocating responsibility for program implementation, monitoring and evaluation.

The Chilean government has begun to take a strategic view of energy policy in general. The document *Energy Policy: New Guidelines* (National Energy Commission, 2008) plays a key role in starting the process of outlining strategic challenges, priorities and required institutional changes for energy policy development. However, the usefulness of this document is limited without specific, clear and measurable goals. Chile urgently needs to ensure that its overarching national energy strategy contains clearly articulated goals to provide a framework for energy efficiency policy.

The Chilean government should be commended for beginning the development of a National Energy Efficiency Action Plan. This Action Plan is one of the main products of the current energy efficiency policy being coordinated by the National Energy Efficiency Program (PPEE). The Action Plan will cover the period 2010-2020 and “will be developed with details regarding overall and sector objectives, fields of action, programs, goals, evaluation tools and the corresponding financing, all focused on energy efficiency in Chile over the coming decade” (Energy Efficiency in Chile, 2009). This Action Plan is due for completion in December 2009.

Given that the PPEE already has a full suite of energy efficiency programs to implement, developing the plan of action will face several challenges. First, it is essential that the energy efficiency action plan complements broader economic, environmental and energy policy goals. Second, it is important that the Action Plan development does not distract PPEE from continuing to implement those programs that are already underway. The injection of additional resources in this year's budget should help to avoid this problem. Third, international experience suggests that it is important for energy efficiency action plans to include several essential elements, including long-term, measurable overall and sectoral energy efficiency targets. Also, they need to clearly allocate responsibility for policy and program implementation.

Another challenge for PPEE will be establishing energy efficiency targets with a broad base of support. A key element in achieving this support will be engaging an appropriate level of stakeholder input into the Action Plan development process.

The action plan should also provide direction for energy efficiency policy in areas for which there is currently limited activity. These include the implementation of minimum energy performance standards (MEPS) to the range of appliances now typically covered in other OECD economies, mandatory energy efficiency performance standards for all buildings, and policies to promote public transport.

Finally, the timing of the Action Plan needs to be handled with care. It is important that the strategy does not fall into a 'political limbo' given that it will be completed between national elections and the March 2010 change of government in Chile.

2.2 Recommendations

Recommendation 3. The Minister of Energy should ensure that an overarching national energy strategy is developed for Chile, to provide a framework for energy efficiency policy. The strategy should include quantitative energy efficiency goals.

Recommendation 4. In developing the Energy Efficiency Action Plan, the National Energy Commission (CNE) should ensure that the Plan:

- ***supports broader economic, energy and environmental policies;***
- ***does not distract the National Energy Efficiency Program (PPEE) from continuing to implement its existing energy efficiency programs;***
- ***is consistent with international best practice, i.e., the strategy should address a range of issues including setting clear quantitative energy efficiency targets, allocating responsibility for program implementation, and establishing a robust program evaluation process;***
- ***achieves appropriate levels of stakeholder engagement in both program development and implementation;***
- ***provides direction for the development of energy efficiency programs in areas where there is currently limited activity; and***
- ***builds long term, broad-based political support for energy efficiency to ensure it remains relevant during the forthcoming change of government.***

3. ENERGY DATA COLLECTION AND MONITORING

3.1 Critique

Robust, accurate and timely energy statistics are essential for developing and monitoring high-quality energy efficiency policy. Chile has a useful set of energy statistics and is attempting to use them as extensively as possible. For example, Chile has good quality energy balances, as well as aggregate and sectoral energy intensity data. Also, through the work of Programa de Estudios e Investigaciones en Energia (PRIEN) of Universidad de Chile, Chile has also been able to conduct decomposition analysis to distinguish sectoral and activity changes in energy intensity. Regarding future energy use, Chile has sufficient data to apply the Model for Analysis of Energy Demand (MAED) developed by the International Atomic Energy Agency (IAEA).

Nevertheless, the review team has some concerns about the collection, use and monitoring of energy statistics in Chile. First, Chile does not always use terminology that is consistent with internationally accepted standards. For example, terms like “primary consumption,” “gross energy consumption” and “end-consumption” are used and not defined clearly in the reports the review team has received. The International Energy Agency Energy Statistics Division provides direction on terminology and definitions that are increasingly used by IEA member countries (see for example <http://iea.org/Textbase/stats/defs/defs.htm>).

Another important topic relates to the use of energy units. Information using inconsistent energy units was presented to the Review team, which makes comparisons difficult. Chile should define a common energy unit for its energy statistics – preferably those used in the International System of Units (Joules, in the case of energy).

A second major concern is that the availability of disaggregated energy end-use data is very patchy. In the transport sector, Chile has some information on the private vehicle fleet (age, size, and emission standards). However, there is little information on vehicle kilometers, passenger kilometers and tonne-kilometers travelled – necessary variables for helping to design energy efficiency policy and programs in the transport sector. Further, there is little information on how energy is used in residential and commercial buildings. There is also a particular gap in statistics on the use of firewood – the largest source of energy in households.

The National Energy Efficiency Program (PPEE) and the National Energy Commission (CNE) are working to fill these data gaps through sector studies (for example, in the metallurgical, agri-industry and wood products sectors (2006); tourism and fresh fruit export sectors (2007); chemical and graphics industries (2008); industrial and mining survey (2008-2009); and the end-use data collection surveys in the industrial, mining and residential sectors (2009)) and their attempts to improve the energy balances. However, it is clear that there is still significant potential to improve the quality and coverage of the energy end-use statistics. One common approach to addressing these issues adopted in many APEC economies is establishing a dedicated energy efficiency data and monitoring team within an appropriate agency.

3.2 Recommendation

Recommendation 5. Given that robust energy end-use statistics are a prerequisite for high-quality energy efficiency policy and program design and monitoring, the Minister of Energy should establish, within an appropriate agency, an energy efficiency data and monitoring team with relevant skills. The functions of this team should include:

- *establishing data collection systems that address urgent data gaps - particularly for collecting data on residential firewood collection, energy use in residential and commercial buildings and transport energy use;*
- *conducting regular energy efficiency benchmarking studies for key sectors that gather information on energy end use and factors affecting end use;*
- *providing relevant information to policymakers on past and current trends in energy efficiency and the potential for future energy efficiency improvements.*
- *working as a coordinating body between the different energy research centres in the economy in order to avoid duplicity of work and to help the foci of the research*

4. POLICY MEASURES – SECTORAL ANALYSIS

4.1 Commercial, Public and Residential Sector

4.1.1 Critique

The commercial-residential-public sector represents 25% of the national total final consumption of energy. CNE data show that the largest energy source in this sector is firewood for residential heating, water heating and cooking, while electricity and petroleum derivatives are also important in terms of final demand.

As noted in section 3 (page 22), there are weaknesses in the available data for final energy consumption for the buildings subsector. End-use data on the various fuel types consumed in this subsector have not been normalized and might distort perceptions about the relative importance of energy sourced from wood compared to other forms.

Based on the end-use data, Chile has focused the initial thrust of energy efficiency activities on the residential subsector. Impressive results have been achieved in the following areas:

- reduction in electrical demand through widespread adoption of compact fluorescent lamps (CFLs) for residential lighting;
- energy labelling for refrigerators and CFLs;
- development of minimum standards for envelope insulation in homes since 2007, and mandatory compliance to these standards in new houses, with planned revision of the standards by 2015;
- design tools for energy efficient new buildings, including energy consumption simulation;
- insulation retrofit programs for existing homes;
- energy certification program for residential buildings.

Although the present energy standards for the envelope of residential buildings represent a 20% improvement over the previous design for indoor temperatures, the next cycle of review should consider further improvements.

In the public buildings subsector, energy audits have been conducted on over twenty buildings, with measures taken to implement the recommendations from the audits in two facilities. Data collection is ongoing to gather energy consumption data for future use in the development of energy efficiency guidelines for government-owned buildings.

However to date there are no energy standards for commercial buildings, which form an important component of the building sector in urban areas.

4.1.2 Recommendations

Recommendation 6. *The Ministry of Public Works (MOP) and Ministry of Housing (MINVU) should:*

- *immediately embark on the development of mandatory energy efficiency standards for commercial and public buildings, and*
- *advance the review process for existing energy efficiency standards in residential buildings to a 5-year cycle, as practised in many economies.*

4.2 Industrial and Mining Sectors

4.2.1 Critique

The Chilean industrial sector represented 23% of the total national primary energy consumption, with the mining industry consuming another 13%. The industrial and mining sectors are addressed by various parts of the National Energy Efficiency Program (PPEE), which includes activities directed to introducing energy efficiency into industrial enterprises.

Energy efficiency programs in the industrial and mining sector have focused on carrying out energy audits of facilities and then implementing the recommendations from the audits. Audits and implementation projects are co-funded with public resources and are directed at all but the very largest companies (those with greater than USD30 million in revenues) in the economy.

Together with CORFO, PPEE created the Energy Efficiency Preinvestment Program (Programa de Preinversión en Eficiencia Energética, or PIEE), an instrument for energy efficiency development that enables companies with net annual sales of up to 1 million UF (USD35.650.000) to hire consultants or do audits to quantify potential energy savings and develop an improvement plan. CORFO covers up to 70% of the total cost of the audit, up to a maximum of CLP 6,000,000 (USD10,100). From 2007 through January 2009, 192 projects have been evaluated, with 67 of those already concluded.

To date one of the most successful energy efficiency project in the industrial and mining sectors is the pilot project for replacement of low efficiency motors (with capacities of 10 hp and below), initiated by the National Energy Efficiency Program (PPEE), with participation by the Sub-secretariat of Mining, Pro-Cobre and four mining companies.

In general, Chile has accomplished successful energy efficiency programs in the industrial and mining sectors. However, there is still room for improvement. Based on international experience, one key factor is the appointment of an accredited energy manager and the

establishment of energy management systems by companies. One model that has shown to be extremely effective in promoting energy efficiency in industry is a continuous improvement process starting with detailed data collection and benchmarking, then moving on to reporting and analysis of energy usage, with designated energy managers responsible for project implementation. This approach has been applied to large industry for many years in numerous economies, such as Japan.

Because of the large number of small and medium size firms in the industrial and mining sectors, there seems to be a shortage of qualified personnel to provide technical service for energy efficiency. This situation could be improved if the Energy Efficiency Agency (ACHEE) established a technical service centre devoted to these enterprises.

4.2.2 Recommendations

Recommendation 7. The Minister of Energy should require each large industrial and commercial enterprise with energy demand above a set level (e.g., 1,000 kW) to appoint an accredited energy manager and establish an energy management system.

Recommendation 8. The Energy Efficiency Agency (ACHEE) should establish a technical service centre to assist small and medium size enterprises to implement energy efficiency measures in their facilities.

4.3 Transport Sector

4.3.1 Critique

Transport energy is critical to the functioning of Chilean society. Chile is extremely dependent on foreign oil and the transport sector is expected to experience one of the largest increases in energy consumption by 2030. As a result of Chile's energy inefficient transport system (with a reported 12% energy efficiency potential by 2021) the nation is:

- very exposed to volatility and likely increases in international fuel prices – including the effects of global depletion of fossil transport fuels and incorporation of carbon pricing;
- likely to become less economically competitive as a result of inefficient use of transport energy resource inputs;
- highly exposed to supply disruptions – which is a major energy security liability;
- incurring excessive overseas debt;
- producing excessive greenhouse gas emissions – a strategic liability on the international stage;
- subjecting its people to unnecessary air pollution – incurring additional health costs and imposing a consequent drag on the economy.

The systematic and urgent application of energy efficiency and diversification of the fuel mix is considered necessary to minimise these liabilities and costs.

Recent high transport fuel prices provided impetus for Chile's citizens to invest in more energy efficient vehicles, reduce their demand and switch to more energy efficient transport modes. High fuel prices also supported government transport policies and programs specifically targeting energy efficiency. These existing activities largely reflect commonly accepted practices adopted in many developed economies, but there is a need to do more and expand scope.

Looking to the future, it is important to develop a comprehensive and systematic approach to integrating transport energy efficiency policies into transport and environmental policy at a strategic level. Also critical is the development and implementation of a diverse range of practical and mutually supporting measures addressing:

- management of demand for personal travel and freight transport;
- support for more energy efficient transport modes, including public transport, rail, shipping, non-motorised energy modes, and integrated transport/land-use management;
- improvements in transport fleet energy efficiency – although we note that the existing truck scrappage scheme (despite its worthy practical focus) may not provide the best return on the government’s considerable investment (over USD7 million in 2009);
- the development and adoption of renewable and emerging transport fuels and technologies;
- changes to driver behaviour.

At a practical level it is considered important to build even stronger cooperative links across government transport, energy and environment agencies responsible for both policy development and delivery in the transport sector. Similarly, government should continue and extend its direction, engagement and support at the regional and municipal level to develop more sustainable transport systems.

While it is accepted that transport is a difficult sector in which to make substantial and enduring energy efficiency gains, many measures are currently acceptable and cost effective for both individuals and businesses. These include government-led actions to encourage the purchase of energy efficient vehicles, driver training, provision of light vehicle fuel efficiency labelling, and better traffic management. As a priority, these should continue to be pursued, and extended where appropriate.

The responsible government agencies should also pursue longer term strategically important policies and programs (some of which are already occurring) to address:

- the integration of transport and land use;
- urban intensification and infrastructure development to support non-motorised transport modes;
- support for the development of renewable transport fuels from sustainable sources;
- the need to keep fuel specifications up to date with international best practice, which will allow the latest fuel efficient technologies to be used in vehicles;
- the need to regain public confidence in public transport and make consequent investments further extending this infrastructure.

The application of fully cost-reflective pricing of transport fuels, roads and modes (including the progressive introduction of the cost of externalities such as environmental and health impacts) is also important to facilitate the transition to a more sustainable energy system. An oil price stabilisation fund and contingency management of oil stocks could help motorists see more clearly the longer term trend in oil prices and, in response, become more receptive to opportunities to improve their energy efficiency. A differential vehicle

taxation regime (favoring light vehicles) could usefully be extended to provide an even stronger support for transport energy efficiency.

While light vehicle fuel efficiency labelling is expected to deliver considerable benefits, government transport and energy agencies should introduce light vehicle fuel efficiency MEPS. Based on experience in Europe, Asia and North America, the energy cost savings and environmental benefits are likely to be substantial and cost effective. It would also complement the energy labelling scheme for light vehicles.

4.3.2 Recommendations

Recommendation 9. The National Energy Commission (CNE) should include in the Energy Efficiency Action Plan a comprehensive, integrated approach to improving transport energy efficiency that:

- *systematically prioritises and targets resources on opportunities to improve transport energy efficiency and related sustainable energy outcomes; and*
- *provides for strong government interagency coordination (around policy development, program design, implementation and resourcing) that recognises their shared interests in maximising benefits from improved energy efficiency.*

Recommendation 10. Responsible government agencies should give priority to implementing transport energy efficiency measures that are currently acceptable and cost effective to the individual and organisation, while progressively working to create a physical infrastructure and pricing regime that supports transport energy efficiency over the longer term.

Recommendation 11. Government transport and energy agencies should implement MEPS for light-duty vehicles.

4.4 Electricity Sector

4.4.1 Critique

Chile has four independent electricity systems that in 2008 generated over 56,000 GWh from roughly 13,200 MW of installed capacity. The principal generation technologies comprise hydroelectric plants, accounting for 60% of generation capacity, and thermal plants (including coal-fired and “dual-fuel” generation, the latter fired by natural gas and diesel), which account for 39% of generation capacity. The remaining 1% comes from other power sources, including non-conventional renewable generation (i.e., renewable power plants with a capacity of 20 MW or less).

Chile was the first economy in the world to reform its electricity industry by separating the functions of electricity generation, transmission and distribution (including retailing) into separate companies and introducing a competitive wholesale electricity market. These reforms commenced in 1982. As a result, all generation, transmission and distribution activities in Chile are in the hands of private companies. Currently there are 26 companies in the generation sector controlled by three main groups. The distribution sector comprises 36 companies controlled by four main groups. A single company owns and operates almost the entire transmission grid.

Currently, there are two markets for energy in the generation sector: a bilateral contract market and a short-term spot market. Prices for energy in the wholesale markets reflect equilibriums of supply and demand in an open market. Prices for energy, capacity and network services are regulated in those sectors with monopolistic characteristics (i.e., transmission and distribution, including retailing).

Energy efficiency activities in the electricity sector have been led by a joint effort between PPEE and the distribution companies, which have introduced a range of energy efficiency programs directed to their end-use customers, including free energy audits, bill-financed sales of efficient appliances (esp. CFLs), etc. Similar energy efficiency programs have not been implemented by the generation and transmission companies.

Systems for the collection of detailed data in each segment of the electricity sector, including data on end-use consumption of electricity, have not been established. This impedes the estimation of potential energy savings and effective targeting of energy efficiency measures.

The review team was impressed by a presentation in which representatives stated that electricity distributors in Chile are very supportive of energy efficiency and are willing to act as delivery agents for energy efficiency programs. Distributors could make effective delivery agents because they have established methods of contacting all electricity consumers in their franchise areas, as well as access to their consumption data. The review team believes that there is a significant opportunity to build on this support for energy efficiency with a series of measures to incentive electricity distributors to implement energy efficiency programs.

The measure that should be introduced immediately is regulation to decouple the revenue of electricity distribution companies from their sales volumes, thereby removing disincentives for the companies to promote energy efficiency by their end-use customers. This form of regulation has now been introduced in many jurisdictions, most notably in California and several other states in the US, the State of New South Wales in Australia, and in many other regions and economies around the world.

In addition to decoupling, there are several other measures that could be implemented in Chile to encourage electricity distributors to implement energy efficiency programs. Many jurisdictions around the world, including in Australia, Italy, the United Kingdom and the United States, have placed obligations on electricity distributors to achieve quantitative energy efficiency targets through programs directed at their end-use customers. A range of different mechanisms have been used to implement, monitor and verify the obligation, including requiring distributors to spend a set amount of money per customer on energy efficiency programs, as in the United Kingdom, and establishing energy efficiency certificate (“white certificate”) trading schemes, which were first implemented in Australia and then in Italy.

Many jurisdictions have placed a levy on the revenue of electricity distributors to be used to fund energy efficiency programs, with or without also requiring distributors to meet quantitative energy efficiency targets. Levies were first introduced in Norway, the United Kingdom and the United States. In the United States, the energy efficiency programs funded by the levy may be delivered by electricity distributors, or by other parties. In the State of Vermont, a separate “energy efficiency utility” has been established to deliver energy efficiency programs funded by financial contribution from electricity distributors.

Finally, several jurisdictions have introduced a requirement that electricity distributors undertake integrated resource planning (IRP) so that demand-side options are considered on the same basis as supply-side options in meeting consumers' energy needs.

If the Government of Chile decides to introduce measures that establish electricity distributors as delivery agents for energy efficiency programs, care will be needed to determine how to handle potential overlaps between these programs and energy efficiency programs implemented by the new energy efficiency agency (ACHEE). Any problems should be relatively easy to resolve by discussion and formal agreements between ACHEE and the distributors. Similarly, any difficulties experienced in verifying compliance by distributors with mandates in relation to energy efficiency programs should be relatively easy to resolve through careful design of the regulatory instruments.

4.4.2 Recommendations

Recommendation 12. The National Energy Commission (CNE) should establish a regulatory regime that decouples the revenue of electricity distribution companies from their sales volume, thereby removing disincentives for the companies to promote energy efficiency by their end-use customers.

Recommendation 13. The National Energy Commission (CNE) should investigate the feasibility of:

- *placing obligations on electricity distribution companies to achieve quantitative energy efficiency targets through programs directed at their end-use customers;*
- *placing a levy on the revenue of electricity distribution companies to be used to fund energy efficiency programs.*

Recommendation 14. The National Energy Commission (CNE) should investigate the feasibility of requiring electricity distribution companies to undertake integrated resource planning so that demand-side options are considered on the same basis as supply-side options in meeting consumers' energy needs.

5. APPLIANCES AND EQUIPMENT

5.1 Critique

In the past two decades, developed economies around the world have adopted policies to improve the efficiencies of energy-using products in their economies. The two most prominent among these policies are:

- energy information labelling – product labels that identify the efficiency and/or usage of products for sale, sometimes in relation to similar models;
- minimum energy performance standards (MEPS) – regulatory restrictions that require that models for sale are no less efficient than a designated level.

Chile has begun a product labelling program in a thoughtful and impressive manner. The program leverages the European comparative labelling scheme, which breaks all similar models of a product into one of seven efficiency categories, A (most efficient) through G (least efficient). This has been applied to five product types in Chile, with another five to six planned in 2009-2010. Products covered are for strictly residential applications so far, with future coverage aimed at residential to small commercial applications.

Chile has not yet implemented the second strategy, the establishment of MEPS (though the review team understands that efforts in this area are underway). MEPS are perhaps the most successful energy-saving strategy in the developed world, both in terms of total savings and also cost-effectiveness. In fact, there are numerous evaluations worldwide that conclude that MEPS have delivered substantial benefits at low, and even negative, cost.

The institution of MEPS to cover both residential products, such as the ones already labelled and planned for labelling, as well as a suite of commercial and industrial products (such as motors, packaged rooftop air conditioners, air- and water-cooled chillers, and dry-type distribution transformers), would be enormously effective at reducing energy use and electric demand in Chile. The review team witnessed the use of some product types, especially in the commercial equipment realm (such as air-cooled chillers using reciprocating compressors), that are grossly inefficient relative to viable alternatives.

Other product efficiency programs also have promise for Chile, such as an existing program promoting energy-efficient purchasing among government purchasers, and a demonstration program to promote the use of emerging and under-utilized technologies (such as evaporative cooling, which could be used very cost-effectively in much of Chile's climate).

5.2 Recommendations:

Recommendation 15. The National Energy Commission (CNE) should aggressively pursue the implementation of minimum energy performance standards (MEPS) covering electric, gas and wood-burning appliances and equipment. Coverage should span the range of residential and commercial/industrial products and should also include light-duty (and possibly other) vehicles. Prioritisation of products and vehicles to be covered by MEPS should be based on total energy savings potential as well as cost-effectiveness.

Recommendation 16. The National Energy Commission (CNE) should continue its appliance energy labelling program, maintaining or accelerating its current schedule. Beyond the 2009-2010 roster of products, consideration should be given to including commercial and industrial products in the labelling program. Close attention should be paid to the issue of "grade inflation," where the range of available models clusters disproportionately in the highest categories.

6. RETROFIT PROJECTS AND PROJECT FINANCING

6.1 Critique

Retrofitting of existing buildings and facilities, especially when coupled with strong project financing schemes, has proven to be an effective energy-savings approach in most developed economies and has stimulated a thriving new industry in many. The greatest challenge has been in making the leap from energy audits to implemented projects. A second problem has been the tendency to "skim the cream" and implement only those measures with the shortest payback periods, leaving many reasonably attractive measures unaddressed.

The National Energy Efficiency Program (PPEE) has made an admirable attempt at promoting retrofit projects in public sector facilities, as well as small and medium-sized enterprises. The crux of the strategy has been the subsidy of energy audits, which has generated 70 completed audit reports (including proposals for bankable projects) and the creation of a low-interest loan program from the Chilean Agency for Development

(CORFO) to Chilean banks for the projects. Currently, with the help of a thorough process evaluation effort, the PPEE and CORFO program managers have recognized the slow uptake of the loans (only two contracts have been signed in the eight months since the loan program's inception) and begun the development of a loan guarantee program that will hopefully lower the interest rates further.

A field trip taken by the review team to two wineries was elucidating. An energy consulting firm working with several dozen wineries in the economy showed us their audit report as we toured one of the wineries. They had identified about ten projects for the winery with various payback periods. When we asked about the winery's threshold for conducting the projects, we were told that only the projects with simple payback periods of 3.5 years and less would be considered because of the high cost of capital. The quite large winery, with annual revenues in the tens of millions of dollars, is apparently unable to get bank loans for energy efficiency projects at less than about 18% interest. When the team communicated this to PPEE staff working on the retrofit financing program, they told us that small and medium-sized enterprises can only borrow for energy efficiency projects (unsubsidized) at considerably higher rates, approaching 30%.

Fundación Chile is spearheading a project to promote performance contracting with ESCOs, along with third-party financing. Loans for this performance contracting initiative are also available through the CORFO-backed lending program identified above. As with the PPEE retrofit initiative, this effort is generating strong interest from energy consultants, with 30 audits completed. However, it has also encountered similar barriers with prospective lenders.

6.2 Recommendations

Recommendation 17. The National Energy Commission (CNE) and the Chilean Agency for Development (CORFO) should continue their efforts to address bank financing as the weak link in energy efficiency retrofit programs. The nascent loan guarantee initiative appears promising, but other initiatives to address the financing barrier, such as accelerated depreciation for project measures and further education of the financing sector, should also be explored.

Recommendation 18. The National Energy Commission (CNE) should assist program managers in energy efficiency retrofit programs to learn from their international predecessors and avoid the common failures in retrofit programs:

- *low implementation rates of audits, which can be addressed with means such as pre-screening for commitment, higher recipient co-funding, and active follow-up;*
- *“cream skimming” (i.e., implementing only the fast-payback measure(s) identified in an audit), which can be addressed by requiring comprehensive multi-measure projects (bundling) and minimum payback thresholds.*

7. EDUCATION, CAPACITY BUILDING AND R&D

7.1 Critique

Education and capacity building are important foundations for capturing energy efficiency potential. To date, Chile has made significant progress in educating its citizens about the importance of energy efficiency – particularly during the energy supply shortage in 2008.

In addition, there are numerous opportunities for training energy efficiency and related professionals, including courses offered in 19 universities, and two engineering associations with sub-groups focused on energy. However, achievement of Chile's ambitious energy efficiency goals will require substantial expansion of human capacity in this area.

Research and development in the area of energy efficiency are essential for the success of energy efficiency and conservation potential. Most economies have set up frameworks to direct national energy efficiency R&D programs, with designated funding resources. In addition, assessment and evaluation structures should be established to monitor the performance of the R&D programs. There appears to be no structured energy efficiency R&D framework in Chile.

Several energy research analyses have been conducted by academics on energy intensity and energy use by sectors. Unfortunately, information on funding sources and budget size was not available to the review team. Furthermore, the process or criteria for selecting energy research topics is not clear.

7.2 Recommendations

Recommendation 19. The Minister of Energy should establish clear priorities to substantially expand the resources (including human capacity) devoted to energy efficiency research and development.

Recommendation 20. The Minister of Energy should ensure that sufficient and stable funding for energy efficiency research and development is available. A defined evaluation procedure should be established for R&D projects that have been funded.

Recommendation 21. The Minister of Energy should establish a clear plan (securing sufficient and stable funding) to improve the quantity, quality and capacity of specialists at all levels carrying out the design and implementation of energy efficiency projects.

8. STRENGTHS, WEAKNESSES AND OPPORTUNITIES

8.1 Strengths

8.1.1 Broadly-based Support for Energy Efficiency

The review team was impressed with the broadly-based support for energy efficiency that currently exists in Chile. This support extends from the Minister for Energy who has a strong personal interest in promoting energy efficiency, to the general public who responded positively to an energy efficiency information and education campaign during an energy supply shortage in 2008, resulting in energy savings of 8.4%. Strong government support for energy efficiency was shown by a 1,335% increase between 2007 and 2009 in the budget for the National Energy Efficiency Program (PPEE) (from USD 2.4 million to USD 32.3 million). The review team particularly noted that the electricity distribution

companies in Chile already promote some energy efficiency programs to their customers and are willing to participate in delivering an expanded suite.

8.1.2 Supportive Institutional Structure

PPEE was established in 2005 with strong support from the Government of Chile. As noted above, the PPEE budget has been significantly increased and this led in early 2009 to a doubling of PPEE staff from 20 to 40. PPEE has established strong cooperation with other relevant government agencies, including the Ministry of Housing, the Ministry of Transport, the Ministry of Public Works and the Chilean Agency for Development (CORFO), as well as with a range of companies and organisations in the private sector. The Government has foreshadowed the creation of a Chilean Energy Efficiency Agency (ACHEE), which will take over the program design and implementation functions of PPEE, while the policy development and regulatory functions will be undertaken by a newly established Ministry of Energy.

8.1.3 Strong Planning and Policy Development

Energy efficiency features strongly in the document *Energy Policy: New Guidelines* released in January 2009 by the Minister for Energy. While this document has no official government status, it sets guidelines for substantive energy efficiency policy development to be undertaken by the proposed new Ministry of Energy. PPEE has also been active in undertaking planning in relation to energy efficiency: it has set process targets for current energy efficiency programs and is developing a 10-year Energy Efficiency Action Plan to be released towards the end of 2009.

8.1.4 High Momentum in Establishing Programs

PPEE has been very active in developing a broad range of energy efficiency programs most of which are in the early stages of implementation. While there are as yet few substantive results from these programs in term of energy savings, PPEE has been very active in developing and implementing these programs and results should follow shortly.

8.2 Weaknesses

8.2.1 Organisation of PPEE Activities

PPEE activities are organised along functional lines, e.g., public policy and education and training, rather than being related to economic sectors, such as industry and transport. The review team found this difficult to understand – for instance, programs directed to the industrial sector were scattered across several functional areas – and are concerned that this method of organisation may not be optimal. In the review team's experience, most organisation involved in the development of energy efficiency programs organise their activities along sectoral lines. This enables staff members to build up experience within sectors and provides clear communication channels for customers seeking to access programs.

8.2.2 Stakeholder Involvement

In Chile, no formal mechanisms appear to exist to involve stakeholders in commenting on policy and programs during their development. The review team believes that establishing such mechanisms would improve the effectiveness of policies and programs and also increase participation rates in energy efficiency programs.

8.2.3 Lack of Information to Support Program Development

The review team was concerned about a general lack of information to support the development of energy efficiency programs in Chile. In particular, disaggregated energy end-use statistics are not available for most sectors. This makes it very difficult to target energy efficiency programs. While the lack of energy end-use statistics is a problem in most APEC economies, this seems to be particularly acute in Chile.

8.2.4 Gaps in Sectoral Coverage

The review team identified several gaps in the sectoral coverage of energy efficiency programs in Chile. In particular, coverage of the transport sector is patchy, and programs to encourage use of public transport should continue, in spite of the problems encountered with Transantiago. The lack of energy efficiency standards for commercial buildings is also a major omission.

8.3 Opportunities

8.3.1 Achieving Bipartisan Political Support

A national election will be held in Chile in December 2009. Because the Chilean Constitution prohibits the President from serving consecutive terms in office, a new President will be elected and is likely to replace most, if not all, the current Government Ministers. Given the broad-based support for energy efficiency in Chile, there is a unique opportunity to develop a long-term energy efficiency action plan with broad political support. This will be necessary if the current high momentum in developing and implementing energy efficiency programs is to be continued following the change of government in Chile.

8.3.2 Establishing Quantitative Targets

Currently, only process targets have been set for energy efficiency programs in Chile, e.g., a specified number of old inefficient trucks will be retired by a set date. This is appropriate for the current stage of development and implementation of the programs. However, as more experience is gained in implementing programs, and more detailed energy end-use statistics become available, there is an opportunity to set quantitative targets in terms of the energy saved by each program.

8.3.3 Creating an Effective Institutional Structure

Given the current high level of support for energy efficiency in the Government of Chile, and the government's intention to reform the institutional structure related to energy, there is a unique opportunity to establish a world-class energy efficiency agency. There is now a lengthy experience in establishing and operating energy efficiency agencies in many economies around the world and Chile can draw on a range of best practices in establishing its own agency.

8.3.4 Establishing Effective Program Delivery and Funding

Given that the electricity distribution companies in Chile appear to support energy efficiency, there is an opportunity to involve these companies in the delivery of energy efficiency programs. Electricity distributors are uniquely placed to achieve effective program delivery since they have established methods of contacting all electricity consumers in their franchise areas. There is also an opportunity to use a levy on electricity

bills to establish stable funding for energy efficiency programs. However, care will be needed to determine how to handle potential overlaps between energy efficiency programs delivered by electricity distributors and programs implemented by the new energy efficiency agency (ACHEE).

9. CONCLUSION

The review team was impressed with the broadly-based support for energy efficiency that appears to exist in Chile. This support extends from the Minister for Energy who has a strong personal interest in promoting energy efficiency, to the general public who responded positively to an energy efficiency information and education campaign during an energy supply shortage in 2008.

A national election will be held in Chile in December 2009. Because the Chilean Constitution prohibits the President from serving consecutive terms in office, a new President will be elected and is likely to replace most, if not all, the current Government Ministers. Given the broad-based support for energy efficiency in Chile, there is a unique opportunity to develop a long-term energy efficiency action plan with broad political support. This will be necessary if the current high momentum in developing and implementing energy efficiency programs is to be continued following the change of government in Chile.

APPENDIX A: MEMBERS OF THE REVIEW TEAM

Faust Bovelander, Senior Policy Analyst at the Energy Efficiency and Conservation Authority in New Zealand

Philip E. Coleman, Senior Research Associate at the Lawrence Berkeley National Laboratory in the United States

David Crossley (Review Team Chair), Managing Director at the consultancy firm Energy Futures Australia Pty Ltd in Australia.

Yie-Zu Robert Hu, Senior Researcher & Deputy General Director at the Industrial Technology Research Institute in Chinese Taipei

Nigel Jollands, Head, Energy Efficiency Unit, Energy Efficiency and Environment Division of the International Energy Agency based in France

Kenji Kobayashi, President of the Asia Pacific Energy Research Centre in Japan

Tran Thanh Lien, Research Team Leader at the Asia Pacific Energy Research Centre in Japan

Wong Yew Wah, Associate Professor at the Nanyang Technological University in Singapore

APPENDIX B: ORGANISATIONS AND OFFICIALS CONSULTED

Government Officials

Marcelo Tokman, Minister President of the National Energy Commission

Rodrigo Iglesias, Executive Secretary of the National Energy Commission

National Energy Commission directors:

- Claudio Huepe, Head, Studies Area
- Jaime Bravo, Head, Renewable Energy and Environment Area
- Juan Antonio Ruiz, Head, Hydrocarbons Area
- Daniel Salazar, Head, Electricity Area
- Rosa Maria Argomedo, Head, Rural Electrification Program Area
- Jose Luis Lima, Head, Regulation Area

Andrés Romero, Executive Director of the National Energy Efficiency Program (PPEE)

Iván Jaques, Deputy Director of the National Energy Efficiency Program

The directors of all the areas of the National Energy Efficiency Program

Jaime Roman, Engineer, Studies and Development Division at the Ministry of Transportation

Ruben Triviño, Engineer, Studies and Methodological Development Area at the Transportation Planning Secretariat (SECTRA)

Jaime Gonzalez, Head of the Standards and Studies Department at the Electricity and Fuels Superintendence (SEC)

Alicia Olivares, Program Officer, Promotion Division at Chile's Economic Development Agency (Corfo)

Leonardo Dujovne, Professional, Ministry of Housing and Urbanism (Minvu)

Margarita Cordaro, Architect, Head of the Design Department, Public Construction Division of the Ministry of Public Works (MOP)

Private Sector and Industry Associations

Rodrigo Castillo, Executive Director of Empresas Electricas AG

Javier Hurtado, President of the Environment and Energy Commission at the Confederation of Production and Commerce (CPC)

Rafael Caballero, Head of the Energy Management Area at Chilectra, Chile's largest distribution utility

Guillermo Pérez del Río, General Manager, Regulation Area at Chilectra

Academics and Non-Profit Organizations

Manlio Coviello, Regional Expert in Energy at the Natural Resources and Infrastructure Division of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC)

Pedro Maldonado, Deputy Director, Energy Studies and Research Program (PRIEN) at the University of Chile

Carlos Silva, Professor, Faculty of Engineering and Sciences at the Adolfo Ibañez University

Miguel Marquez, Professor, at Diego Portales University

Ana María Ruz, Director of Energy Program at Fundacion Chile

Stephen Hall, Consultant for the U.S. based Natural Resources Defense Council (NRDC)

APPENDIX C: ACTION LINES PER AREA

1. Education Sector

The education sector is cross-cutting and includes support initiatives for the various areas of the National Energy Efficiency Program (PPEE). The goal of this area is to contribute to the development of an energy efficiency market, generating labor competencies in energy efficiency; support the proper execution of PPEE projects through training of the stakeholders involved, whether they are direct beneficiaries or professionals linked to the development of the plan; generate and distribute information for the different segments, such as educational guides and citizen guides; to educate the school community about energy efficiency criteria; and create awareness about energy efficiency among children and/or students ages 8 to 14 through directed campaigns.

Since 2006, the National Environmental Commission (Comisión Nacional del Medio Ambiente, or CONAMA) and the PPEE have developed an annual work plan that includes teacher training, development of teaching guides for including energy efficiency in elementary, middle and high school curricula, the creation of a pilot project at a school, the Liceo Confederación Suiza, the launch of an Energy Efficiency Area within the Environmental Protection Fund (Fondo de Protección Ambiental) and finally, environmental certification of educational establishments through energy efficiency.

Another initiative being developed for the education area is a campaign directed toward students 8 to 13 years old. The project consists of the development of an animated, 15-minute film which will be shown inside a bus which is specially outfitted for this purpose (a mobile theater for 3D films). Energy efficiency will be the central message of the film, which will be shown at 1,000 public schools in Chile located from La Serena to Puerto Montt.

In the field of higher education, a study is being done on "Energy efficiency requirements of professionals and technicians in the areas of construction, industry and transportation" in order to support universities, professional institutes and technical training centers in developing energy efficiency training models. A seminar will be held to publicize the results of the study.

In addition, various awareness and training projects are being carried out and are planned, as indicated in each of the sector tables (see below) under the field of action titled Education and Information.

The following sections contain a description of the fields of action, programs and goals for each of the principal final consumption sectors in the economy. It is important to note that, because the energy efficiency policy and the action plan are currently in development, the goals are not related to impact but to process.

2. Industrial and Mining Sector

The industrial and mining sector is addressed by various parts of the National Energy Efficiency Program, which, depending on the topic, develop activities that enable fulfillment with the objective of introducing energy efficiency into the industry.

At the development level, the actions have focused on the promotion of consulting projects targeting the industrial sector. These consulting projects are co-financed with public resources and are directed at more than 90% of the companies in the economy. At the level of voluntary agreements, there are clean production accords coordinated by the National Clean Production Council (Consejo Nacional de Producción Limpia), which starting in 2006 have included an energy efficiency component and the work carried out through the sector work group, the oldest of which is that of the mining sector.

Thus, in 2006, together with CORFO, the PPEE created the Energy Efficiency Pre-investment Program (Programa de Preinversión en Eficiencia Energética, or PIEE), an instrument for energy efficiency development that enables companies with net annual sales of up to 1 million UF⁹ (US\$35.650.000)¹⁰ to hire consultants or do assessments to quantify potential energy savings and develop an improvement plan.¹¹ CORFO covers up to 70% of the total cost of the consultancy, up to a maximum of \$6.000.000 CLP¹² (US\$10.100).¹³ From 2007 through January 2009, 192 projects have been evaluated, with 67 of those already concluded.

In July 2008, the CORFO energy efficiency credit was launched. This credit finances investments with a value up to 25 thousand UF¹⁴ (US\$890.000). This credit enables companies to finance needed investments in projects for optimizing energy use. Among those eligible to apply are companies, cooperatives or production associations with annual sales of up to 1 million UF¹⁵ (US\$35.650.000) excluding value-added tax. The credit is available for companies from a variety of sectors, such as industry, agriculture, mining, fishing, tourism and healthcare, among others.

Another initiative under development that is aimed at industry and mining –which together represent close to 38% of energy end-consumption- is the Efficient Electric Motor Introduction Incentive Program (Programa de Incentivo a la Introducción de Motores Eléctricos Eficientes), which consists of a subsidy to make the prices of efficient motors competitive with those of standard motors. The goal of this subsidy is to reduce demand for electric energy by approximately 13.5 GWh per year.

In 2008, the Global Environmental Facility (GEF) project titled “Promoting and strengthening an energy efficiency market in the industrial sector in Chile” was approved, with external cofinancing of US\$ 2,637,000. This project will be carried out in three fields of action designed to strengthen the energy efficiency market in the industrial sector. The

⁹ The Unidad de Fomento (UF) is a unit of account that is used in Chile. The exchange rate between the UF and the Chilean peso is constantly adjusted to inflation so that the value of the Unidad de Fomento remains constant.

¹⁰ At the dollar exchange rate on February 2009

¹¹ This includes 90% of Chilean companies in this sector

¹² Chilean Peso (CLP) is the national currency

¹³ See footnote 10

¹⁴ See footnote 9

¹⁵ See footnote 9.

component with the most external financing is technical assistance, which will consist of the creation of a technical assistance center.

In addition, the specific actions listed in Table 1 are being or will be carried out.

Table 1. Specific Programs and Activities by Fields of Action for the Industrial and Mining Sector

Fields of action:	Activities
Research	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Energy description survey for the metallurgical, agro-industry (wine production) and wood products sectors (2006). - National energy description survey for the tourism and fresh fruit export sectors (2007). - Assessment of the current state of motors used in Chile (2006). An energy efficiency potential of 7% was associated with the replacement of motors in the productive sector. <p><u>In development:</u></p> <ul style="list-style-type: none"> - Description of the industrial sector (through a 2008-2009 survey) <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Description of energy consumption in the chemical industry (2009) - Description of energy consumption in the graphics industry (2009) - Study of final uses of energy in the industrial and mining sector and an Energy Conservation Curve (2009) - Potential for co-generation in Chile (2009) - Market study of energy efficiency in Chile (2009)
Economic and financing incentives	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Energy efficiency pre-investment instrument for companies (2006) - Preferential credit for energy efficiency investments (CORFO) (2008) - Agreement with motor distribution companies to apply a 20% discount to the price of efficient motors (2008) <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Energy efficiency credit guarantee fund, together with CORFO (under development) - Technical assistance center with GEF financing, starting in 2009 - Incentive program for purchasing 9 thousand high-efficiency electric motors of up to 10 HP, to finance the price difference between efficient and standard motors

<p>Regulation and certification</p>	<p><u>In development:</u></p> <p>Certification, labeling and minimum energy efficiency standards for high-consumption equipment in the industrial sector (motor labeling is already done; protocols and implementation are now being developed)</p>
<p>Voluntary agreements with the private sector</p>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Creation of a Mining Working Group for Energy Efficiency (Mesa Minera de Eficiencia Energética) with voluntary participation of 11 of the largest mining companies in Chile. This constitutes the only forum for sharing experiences in energy efficiency matters (beginning in 2006) - Signing of a Protocol Agreement for Energy Efficiency in Large-scale Mining (Protocolo de Acuerdo para la Eficiencia Energética en la Gran Minería, 2008) - Energy management development program for small and medium-size mining companies (2007-2008) - Incorporation of energy efficiency in Clean Production Agreements signed with the industrial sector (2006) - First public-private pilot project for replacement of motors. Participants include PPEE, the Sub-secretariat of Mining, Pro Cobre and four mining companies (2007-2008) - Signing of a Cooperation Agreement for Energy Efficiency with the chemical industry and graphics printers (2008) - Signing of a Cooperation Agreement for Energy Efficiency with the metallurgical industry (2007) <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Energy efficiency working groups in the supermarket and shopping mall and food sectors.
<p>Education and information</p>	<ul style="list-style-type: none"> - Training program for energy managers - Information system for energy users - Development program for specialized consultants - Training for CORFO executives and employees on the CORFO instruments. - Incentive activities program on CORFO instruments, directed at private companies. - Informational workshop for bank executives regarding the energy efficiency line of credit.
<p>Linking stakeholders</p>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Inter-company working group - Business roundtables in five regions of the economy to inform about and promote the use of CORFO instruments (2008) - National and international seminars - Development of an assessment of the energy situation faced by small and medium-size mining companies

3. Transportation Sector

The actions in the transportation sector are primarily directed at three segments: freight transport, light vehicles (private cars and collective taxis) and non-motorized transport.

Regarding the first area, incentives will be provided for the renewal of freight transport fleets. This will not only mean a significant reduction in fuel consumption, estimated at 23.6 million liters of diesel per year, but will also help to improve environmental and safety conditions. The program includes the removal of the oldest trucks through economic subsidies and soft credits for acquisition of new trucks. In this same sector, the PPEE is developing a training program in efficient driving and an energy efficiency technical assistance program for urban and inter-urban freight transport. Both initiatives aim to promote good driving practices, mechanical maintenance of vehicles and efficient management of truck fleets, in order to promote efficient use of fuels in this sector. In both programs, work is being done in association with associations of truck drivers, given the large number of freight companies in the national market.

In the second area, an incentive was created for the purchase of hybrid vehicles, and work is being done now on the implementation of energy efficiency labeling for automobiles.

For its part, to promote non-motorized transport, work has been done with members of the transportation working group to identify places where bicycle parking can be located, along with appropriate business models to ensure their operations, as well as promotional campaigns directed at students. To do that, work is coordinated with the regional government, the Sub-secretariat of Transportation, Transantiago and various cycling organizations.

Other specific actions included in this area are listed in Table 2.

Table 2. Specific Programs and Activities by Fields of Action for the Transportation Sector

Fields of action:	Activities
Research	<ul style="list-style-type: none"> - Studies on "Efficient locations for bicycle parking" (the construction of bicycle parking will be financed with resources from the National Fund for Regional Development (Fondo Nacional de Desarrollo Regional) and "Business models associated with bicycle parking". - Study titled "Analysis of Energy Efficiency in Urban and Inter-urban Public Passenger Transport" - Study of energy efficiency in freight transport
Economic and financing incentives	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Incentive for the purchase of hybrid vehicles through a discount on the registration fee <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Fleet renewal development program (replacing old, inefficient trucks with new, more efficient and environmentally friendly models) (2009)

<p><i>Regulation and certification</i></p>	<ul style="list-style-type: none"> - Energy efficiency certification or seal for light vehicles. In 2007 a study was done to assess and define a light vehicle energy efficiency seal that would provide information to buyers. Subsequently, a study was done to develop an implementation strategy for the seal. The standard related to the use of this seal is currently being developed by the Standards Division of the Sub-secretariat of Transport.
<p><i>Education and information</i></p>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Competition to motivate the use of bicycles by high school students. - Information to energy users through publications - Promotion of the use of bicycles <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Efficient driving pilot project and large-scale program for freight vehicles (2009)
<p><i>Technical assistance</i></p>	<p>Development of a technical assistance center for energy efficiency development in freight transport</p>
<p><i>Linking of stakeholders</i></p>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Transport working group, comprised of representatives from the Ministry of Transport, the Inter-ministerial Secretariat for Transportation Planning Mesa de transportes, en que participa el Ministerio de Transportes (Secretaría Interministerial de Planificación de Transporte, or SECTRA), the National Environmental Commission (CONAMA) and Transantiago <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - International seminar (March 2009, in the framework of Energy Efficiency Week), to promote energy efficiency as a competitive tool for transport companies

4. Residential, Commercial and Public Sector

In the residential sector, the main fields of action are directed towards improving the thermal quality of both existing housing as well as new housing, in addition to increasing the efficiency of household appliances. Among the areas that will be developed are periodic review of thermal standards for housing and the extension of such standards to other kinds of construction.

There has been important work coordinated with the Ministry of Housing and Urbanism (MINVU), with which various initiatives have been developed, including housing certification and subsidy programs for thermal refurbishing of 10,000 existing low-income housing units (for 2009-2010) and the construction of 400 new low-income housing units to a level that exceeds the current thermal standard.

In this same area, work is being done in close cooperation with the German Technical Cooperation Agency (GTZ), with whom the PPEE has a collaboration agreement that includes actions in the industrial sector. The work of GTZ has included, among other things, studies, housing rehabilitation and projects in hospitals.

Regarding improvement of the efficiency of household appliances, an important component is the National Light Bulb Exchange Program, in which energy efficient light bulbs are provided to the poorest 40% of households in Chile. The goal is to cover 90% of that population by delivering approximately 3 million efficient light bulbs, which would lead to savings on the order of 225 GWh/year, which is equivalent in power to a 205-MW plant. The estimated savings for these families would more than US\$ 50 million annually. It is important to note that this is the first public project involving sales of greenhouse gas reductions. Since the program began in March 2008, approximately 1,270,000 efficient light bulbs have been delivered. This program will continue during 2009, improving and expanding the distribution channels in comparison to those used in 2008. Among the alternatives being considered is that every low-income housing unit built come equipped with efficient light bulbs.

In addition, the PPEE coordinates the initiatives of the National Energy Efficiency Labeling System (Sistema Nacional de Etiquetado de Eficiencia Energética) for household appliances. This action is carried out jointly with the Superintendency of Electricity and Fuels (Superintendencia de Electricidad y Combustibles, or SEC), the National Consumer Service (Servicio Nacional del Consumidor, or SERNAC), the National Standards Institute (Instituto Nacional de Normalización, or INN), Fundación Chile and other organisms.

One of the most important initiatives is the start-up of the National Energy Efficiency Certification and Labeling Program (Programa Nacional de Certificación y Etiquetado de Eficiencia Energética, or P3E) which began in 2005 with light bulbs and refrigerators. These two items were selected based on the 2002 census and a study carried out in 2005 by the CNE, which indicated that they are responsible for approximately 60% of electricity consumption in the residential sector. Currently, labeling programs for a series of other appliances is being developed, as well as the definition of the next products to be incorporated into the program.

The objective of the P3E program is to create a market for energy efficient household appliances, stimulating manufacturers to increase the energy performance of their models and providing clear goals in terms of improving the performance of their products. It also seeks to provide tools to users so that they can recognize products that are economically advantageous, by providing information for informed purchasing.

Regarding the public sector, the actions have been oriented basically in three areas: improving the efficiency of public lighting, public purchasing using energy efficiency criteria and improvement of energy management in public buildings.

In public lighting, work is being done with the SEC on a new regulation that incorporates energy efficiency criteria, as well as on public lighting replacement projects in poor municipalities. This last project is being done jointly with the United Nations Development Program (UNDP). To support these actions, a public lighting technical assistance hotline will be set up for municipalities.

With respect to public purchasing, a manual was developed with the energy efficiency criteria that must be considered when making government purchases.

With respect to public buildings, energy audits have been done on emblematic buildings and the recommended measures will be implemented for demonstration purposes. One notable project is the one being done at La Moneda Palace (the seat of government) which will incorporate the most efficient technologies together with the use of renewable energies.

Likewise, within the framework of measures adopted to address the energy crisis in 2008, there is constant collection of information regarding energy consumption by government units located throughout the economy. The analysis of this information will provide guidelines for more efficient energy management.

The following table summarizes the actions carried out and some which have yet to be executed.

Table 3. Specific Programs and Activities by Fields of Action for the Residential, Commercial and Public Sector

Fields of action:	Activities
<i>Research</i>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Studies on thermal performance of housing - Studies on residential consumer behavior and willingness to incorporate energy efficiency into consumer decisions and habits - Energy consumption surveys and audits in public institutions <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Study of final uses of energy in the residential sector, schools, medical clinics and hospitals and an Energy Conservation Curve
<i>Economic and financing incentives</i>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Low-income housing pilot project in the Santiago Metropolitan Region. Construction of 125 low-income housing units using energy efficiency criteria, in the municipality of Lo Espejo. An agreement between GTZ, the PPEE and Fundación Un Techo para Chile (the project was developed in 2008 but construction of the housing will occur in 2009) - Thermal refurbishment project for 1,000 houses in Temuco and Padre Las Casas - Sale of efficient equipment through energy distribution companies - Delivery of 1.5 million CFLs to the poorest 40% of households in the economy <p><u>To be developed:</u></p> <ul style="list-style-type: none"> - Thermal refurbishing program for 10,000 low-income housing units (2,300 in 2009 and the remainder in 2010). Subsidy provided through MINVU's Family Asset Protection Program (Programa de Protección al Patrimonio Familiar). - Improvement of thermal standards in 400 low-income housing units. Subsidy through MINVU's Housing Solidarity Fund (Fondo Solidario de Vivienda). - Delivery of 1.5 million CFLs to the poorest 40% of households in the economy

<p><i>Regulation and certification</i></p>	<p><u>Completed:</u></p> <ul style="list-style-type: none"> - Labeling of household appliances in the retail market. Labeled appliances on the market: incandescent light bulbs and compact fluorescent light bulbs; single-door and double-door refrigerators and freezers. The labeling requirement for import and manufacturing businesses has been in force since 2007. All of the appliances mentioned must have an energy efficiency label, which are now on those appliances that consume almost 60% of household electricity. - Regulations to incorporate new appliances. In 2007, labeling regulations were introduced for the following appliances: air-conditioning equipment, fluorescent tubes, ballasts and stand-by energy for microwave ovens and other appliances. - Regulation of housing construction: required standards for thermal insulation were incorporated for new housing starting in 2007. - Updating of the Building Energy Performance Certification Tool (Herramienta de Certificación de Comportamiento Energético de Edificios, or CTE V2.0). A new version of the energy simulation software for housing was developed, with updated climate data and new construction solutions which are recognized by MINVU, to facilitate and expand its use among architects as they review their projects to determine if they comply with Stage II of the thermal regulation that went into force in January 2007. <p><u>To be developed and already in development:</u></p> <ul style="list-style-type: none"> - Appliance emission standards (e.g., wood-fueled appliances) - Certification of housing units. Work is currently underway on the design of an energy certification system for housing, equivalent to the labeling of household appliances. The aim is to provide information to consumers regarding how much their home consumes in heating, lighting and potable hot water. - Incorporation of energy efficiency criteria in the design of public hospitals - Pilot experience for introduction of the supply contracting model in the Padre Alberto Hurtado and Luis Calvo Mackenna hospitals
<p><i>Education and information</i></p>	<ul style="list-style-type: none"> - Information and dissemination campaigns, energy efficiency awareness campaign directed at students using well-known cartoon characters (Diego & Glot) - Housing and construction seminars and training at various levels - Publications on energy efficiency in buildings - Awareness program directed toward beneficiaries of the Thermal Refurbishing Incentive and the National Light Bulb Replacement Program. - Training program for public employees on public purchasing using energy efficiency criteria. - Energy efficiency pilot training program for community leaders
<p><i>Linking stakeholders</i></p>	<ul style="list-style-type: none"> - Coordinated work with MINVU, GTZ, the Construction Institute (Instituto de la Construcción), the Chilean Chamber of Construction (Cámara Chilena de la Construcción) and other private stakeholders - Standardization of the energy certification systems developed by different entities in Chile

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