ENERGY 2050
CHILE'S ENERGY POLICY
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An active society doesn't just respond to reality; it activates it, setting it in motion in a way that would not otherwise have happened.
A society that renounces to the future of energy exposes itself to numerous ills. As starting point, it is ignorant of the future for the next generations to come and tacitly assumes that self-interested forces will move the pieces on the framework for their benefit and that there will be energy in our lives by inertia.

This is what was happening in Chile.

We are aware that the future of energy has been latent, hidden in the past and the present, so we made a commitment to the Energy Agenda in order to anticipate it and imagine its real possibilities. This document is the final testimony of the Energy 2050 process, an effort that encouraged unprecedented dialogue in Chile in order to raise collective awareness of the future of energy and dissipate the prejudices and fantasies that existed through carrying out serious and objective research into the past and gaining an understanding of the present.

Energy 2050 has been an enterprising way to respond to a vitally urgent need for Chile and to explore it and discover in it capacities that had not yet been developed in this field. “An active society doesn’t just respond to reality; it activates it, setting it in motion in a way that would not otherwise have happened.” It took us over 18 months to develop this long-term Energy Policy with social and technical validation. We held more than 130 regional workshops, which were attended by over 4,000
people. We formed an Advisory Committee composed of 27 people from diverse backgrounds, who generously worked to prepare a Road Map that informed the development of this Energy Policy. They brought wisdom and enthusiasm to the discussions. During the public consultation stage, we were shown once more how important democracy stoping the meaning that the history is a natural development.

Energy 2050 is opening up a space of possibilities through unrestricted dialogue. It is a beacon that shines a clear light so we can plan and take action. It also moves us towards broader horizons and nurtures healthy goals for our country, such as renewable energy sources coming to represent 70% of total electricity generation, the decoupling of energy consumption as a result of energy efficiency, the reduction of greenhouse gas emissions, and the decrease in energy prices to the level of developed countries. This process has erased isolated opinions, replacing them with well-founded and collective beliefs about energy with a decentralized approach and goals for the various regions of the country. And, for the first time, all of this has also been subjected to a strategic environmental assessment.

When it is oriented towards the common good, energy can be a fundamental driver for working together to build a better tomorrow for future generations.

Máximo Pacheco M.
MINISTER OF ENERGY
Executive Summary

The country that all Chileans dream of building by the year 2050, a country offering greater levels of personal and collective wellbeing, is now under construction. In order to move in the direction we want to go, we must plan our route and work together to develop a strategy that is a product of the contributions of the different sectors of society. We need adequate public policies so that we can systematically and deliberately model the country that we pass on to future generations of Chileans.

Energy is a key strategic factor for reaching the economic and social development goals that we have set ourselves. It is therefore vital to ensure that our future energy supply will respond to the needs of society. When the energy sector develops through market solutions, this does not always lead to decisions that maintain the common good or prioritize society’s preferences with regard to how best to use this essential resource. Chilean society expects the State to play a role in planning and management that includes all stakeholders in the definition of a solid and consistent market-oriented strategy.

On the other hand, in the development equation, energy is much more than a key input. Its generation and use represent additional opportunities to promote positive changes in people’s quality of life. When energy is obtained and used optimally, a virtuous circle is generated that directly impacts economic growth, offers opportunities to care for the environment, and favors people’s development, thus allowing society to move towards equitable and sustainable development.

Public policy decisions on energy are complex when it comes to achieving the nation’s objectives. It is everyone’s duty, and also a collective opportunity, for us to work together to build a path that will make the energy sector a safe, inclusive, competitive, and sustainable medium whose benefits extend to all areas of life for the Chilean people.
The Energy Agenda, presented in May 2014 by the President of Chile as a Road Map for the development of government actions in this area, established as one of its tasks “the design and execution of a long-term Energy Policy with social, political, and technical validation.” To that end, two horizons were identified: one short-term and one medium- and long-term. The first was to discuss the work areas in terms of the standards, policies, and regulations that will guarantee the technical feasibility and sustainability of the energy matrix. The second was to discuss strategic and technological aspects that will define the energy matrix that Chile will promote from now to 2050.

In the context of the Energy Agenda, a discussion process was developed that included key stakeholders from the public sector, industry, academia, civil society, the regions of the country, and the general public. The goal was to develop the country’s long-term Energy Policy. An Advisory Committee led by the Minister of Energy and composed of key participants from the sector was convened with regional and national representation. The members form part of various ministries and public institutions, trade associations, civil society, and Chilean universities. During September, the committee evaluated the proposed “Road Map for 2050: Towards Sustainable and Inclusive Energy for Chile.” The Road Map contains the key items to be considered by the Energy Policy in the long term. It has served as an essential input of the development that is presented here.

Between November 4 and December 4, a public consultation process was conducted in regard to the Energy Policy document. The process yielded over 400 comments that varied in scope and perspective. In addition, five regional workshops were conducted in Santiago, Calama, Puerto Montt, La Serena, and Concepción. They were attended by approximately 420 people from different areas of society who are interested in the energy sector. The comments collected during the public consultation process and at the regional workshops served as important inputs for the drafting of this document.

The Energy Policy proposes a vision of Chile’s energy sector by the year 2050 as being reliable, inclusive, competitive and sustainable. This vision is part of a systemic approach in which the main goal is to achieve and maintain the reliability of the entire energy system while meeting sustainability and inclusion criteria and contributing to the competitiveness of the nation’s economy. These attributes allowed us to establish the goal of moving towards sustainable energy in all of its dimensions.

In order to make this vision a reality by 2050, the Energy Policy is sustained by four pillars: Quality and Security of Supply, Energy as a Driver of Development, Environmentally-friendly Energy, and Energy Efficiency and Energy Education. The proposed measures and action plans shall be developed on the basis of these pillars between now and the year 2050.
QUALITY AND SECURITY OF SUPPLY

A reliable energy system is a key driver of the country’s development. It is fundamental that energy is available at a reasonable and predictable price that favors competition. The principle of reliability that is framed in the vision of this policy is understood in a way that goes beyond the classic concept of security in the energy sector. This definition also incorporates reliable access to energy, supply quality, and system flexibility criteria, among others.

To that end, it is necessary to move forward in the area of security and flexibility at the level of centralized production and to have decentralized production and active management of demand.

Long-term supply security in the energy system is closely tied to a robust and resilient energy system that can provide energy in accordance with the country’s needs. It is vitally important that it has the capacity to respond to and anticipate critical conditions. In view of this, the risks to which the country is exposed and the possible consequences of problematic situations must be analyzed. The country must have current risk and energy emergency management plans that ensure the resilience and reliability of the energy system.

In this sense, the role of international energy integrations is fundamental because it allows greater flexibility and security to be provided to energy systems. Chile’s long-term vision is to be connected in terms of energy with other countries of South America. In fact, our goal as a country is to be interconnected with other nations on the South American continent by the year 2035.

Along with rapid technological development, decentralized production has become increasingly important along with active management of demand in energy systems. According to this new paradigm, final energy consumers are taking on a more active role in the operation of the system. As a result, the demand management mechanisms and other smart network applications are allowing this new reality of the energy sector to be used adequately, contributing in a decided manner to the achievement of the Energy Policy objectives in the areas of security, efficiency, and flexibility. We thus aspire to create a completely bidirectional energy system in which energy can be produced and managed in a top-down manner and in a bottom-up manner, reaching distributed genera-
tion and demand management levels similar to those of other OECD member states.

Public access to energy is fundamental to move in the right direction. The public’s access to electricity is now almost complete. In fact, the network offers coverage to 99% of the population, though there are certain disparities at the urban and rural levels. However, the quality of the energy supply must improve. For example, sometimes users face service interruptions. In view of this, one of the goals for the year 2050 is for power outages in all regions to average less than one hour per year, excluding cases of force majeure.

**ENERGY AS A DRIVER OF DEVELOPMENT**

One of the pillars of our new energy policy is based on the vision of energy as a driver of the country’s development. Without energy, there is no growth. In order to promote growth, Chile must have inclusive energy development characterized by equitable access, territorial coordination, and prices that promote competition.

The advance of communications and a growing awareness of their rights are leading people to participate actively in the political and economic decisions that affect them. Today more than ever, our country needs an energy sector in which the vision and expectations of local communities with regard to the environment and development are considered alongside technological and technical-economic aspects. This new reality requires new forms of collaboration among communities, businesses, and the State in order to ensure that new projects go hand in hand with greater development that directly benefits local communities. In order to achieve this, the Policy has as a goal the development of an associativity strategy in the energy sector that will allow the quality of life in the places where projects are located to be changed for the better. In addition, it will be necessary to ensure the existence of formal, timely, informed, symmetrical and pertinent participatory processes for citizens in the development of policies, plans and projects, at the national, regional and local levels.

In the context of the United Nations’ SE4all initiative, access to energy is defined as “the physical availability of modern energy services to satisfy basic human needs, at affordable prices, inclu-
ding electricity and efficient appliances such as cooking stoves." Along these lines, access is understood in a broader context that involves satisfying the population’s basic needs through energy. This makes it even more urgent to think about an energy strategy from the perspective of equity in order to meet the population’s energy needs. For this very reason, it is important to define the concept of energy poverty, specify which variables determine it, and identify the country’s current situation. According to this Energy Policy, the next step is to ensure universal and equitable access to modern, reliable and affordable energy services for the entire population.

Another key factor to consider is the territorial management of energy throughout the country. Currently, territorial management is fragmented into multiple and varied instruments that lack coherence and connection. There is a need to integrate all the existing territorial management instruments into one tool that can coherently channel the interests of the various stakeholders, sectors, and institutions while keeping in mind the different territorial scales. One goal of the Energy Policy is for all regions to have Regional Energy Plans as well as regional territorial planning and management instruments that incorporate the guidelines of the Energy Policy. In addition, urban and rural territorial planning must include the requirements necessary to implement efficient and less polluting transport systems and buildings.

This involves building the Energy Policy from and in conjunction with the regions outside of Chile’s capital, Santiago. Energy facilitates decentralization, allowing people to stay in their home regions and municipalities through the creation of real opportunities for employment and personal development. **Energy is a driver of regional development.**

The challenges that must be addressed include the sector’s competitiveness and social protection for families’ access to energy. Chile currently has some of the highest electricity prices in Latin America, and they are in the intermediate range in comparison to other OECD member states. This not only affects final consumers and local communities, but also the economy as a whole. As such, it constitutes an obstacle to the nation’s development.

To address these challenges with a long-term vision, Chile must be capable of generating competitive prices for electricity. The Energy Policy states that one essential condition for achieving sustainable development is to position Chile among the three OECD member states with the lowest average residential and industrial electricity prices in the long term. In order to achieve this goal, an effort will be made to change regulatory, market, and social aspects so that they foster the growth of electricity generation technologies that are low in cost and offer good environmental performance, encouraging energy supply competition. One fundamental aspect of achieving the level of development that we want as a nation – so that our country is inclusive, equitable, and respectful of the environment and social coexistence – is the optimization of our technologies, incorporating innovation into all areas of energy production, generation, and distribution.
ENVIRONMENTALLY-FRIENDLY ENERGY

The development of the energy sector cannot be separated from environmental concerns. We must implement policies that address two major challenges simultaneously: the promotion of a renewable energy matrix and the development of guidelines for addressing local and global environmental impacts.

Historically, Chile has had a vocation for renewable electricity generation. In the 1980s, 80% of energy generation was hydroelectric. However, over the past five years, the average share of hydroelectric generation has been just 32% in spite of the significant potential that exists. One of the goals of the Energy Policy is to return to this vocation, implementing the necessary actions so that renewable energy sources constitute 60% of the electricity generation matrix by the year 2035 and at least 70% by the year 2050. We are a privileged nation in terms of solar radiation, particularly in northern Chile. This offers us an opportunity and the privilege to become a global leader in the area of solar generation.

The complement to this renewable energy matrix should be using the existing generation infrastructure to contribute as much as possible to the efficient performance of the system. We must focus on new developments with thermoelectric technologies that are low in emissions and cost-effective, such as natural gas and biomass. Chile has the opportunity to use biomass as an abundant source of energy, as it is local, renewable, clean and fairly accessible as long as the correct decisions are made in order to encourage adequate use of the resource. In particular, all communities should have regulations declaring forest biomass as solid fuel and changes must be made to heaters and collective heating in saturated or latent areas.

Today there is broad scientific consensus regarding the phenomenon of climate change. It is an unequivocal fact that this is caused mainly by human activities that generate greenhouse gas emissions. In Chile, we anticipate significant impacts on hydrological conditions, which will affect the generation of hydroelectric energy. This Policy reflects a commitment to address the challenge that climate change poses and decidedly supports a transition towards an economy—and an energy matrix—that is significantly lower in carbon, reaching at least a 30% reduction in Greenhouse Gas emissions (GHG) emissions by 2030 in accordance with the international commitments that have been made.

It will not be possible to achieve this electricity potential without incorporating elements of sustainability into project development, which should protect the environment and consider and incorporate communities’ social dynamics and cultural values so that the various groups are adequately integrated into local and national economic development. This Energy Policy recognizes the importance of reviewing, perfecting, and improving the environmental regulatory framework periodically and keeping up-to-date on the best international practices so as to reflect the interests of society and maximize social wellbeing.
ENERGY EFFICIENCY AND ENERGY EDUCATION

As is the case for any country in the midst of a transition to development, economic growth, the strengthening of the middle class, and urban development will all put pressure on energy demand in Chile. Even if energy efficiency measures are implemented to manage the decoupling of the indicators, it will be necessary to make an effort to ensure that greater energy demand is viable and sustainable.

Chile needs to make changes with regard to energy efficiency. The measures introduced thus far have not had the expected results. To achieve greater progress in the area of energy efficiency, an adequate legal framework is needed that can promote the efficient use of energy among the different types of consumers. This is the only way that Chile’s energy efficiency potential can be realized and it is the only way to decouple national growth from increased energy consumption.

Intensive energy consumption sectors such as industry and mining require systematized data and a robust institutional structure so that they can develop an advanced and innovative energy culture. The goal of the Policy through 2035 is for the large-scale consumers in the mining, industrial, and transportation sectors to make efficient use of energy with active energy management systems and the implementation of improvements in energy efficiency.

The construction and public and private building sectors can also contribute to this effort. One of the goals for 2050 is for all new buildings to meet OECD standards for efficient construction and to have smart energy control and management systems. In addition, the highest international standards on energy efficiency must be adopted for all modes of transportation, thus contributing to commitments to reduce greenhouse gas emissions.

It is clear that energy is an essential component for the development of our country. However, the relatively low visibility of its benefits compared to the costs associated with obtaining and distributing energy can lead to a rejection of the development of energy infrastructure and reduced awareness about the importance of conserving energy on the part of the people. As we move towards becoming a developed nation, it is urgent that we generate actions that allow the people to learn about and value energy through the promotion of an energy culture at all levels of society, including generators and users. It is not enough to correct asymmetries of information. We must also generate knowledge, build capacities, and align interests and objectives in a shared vision of Chile’s development in order to achieve the strategic objectives that form part of the vision of the energy sector through 2050. All formal education plans must incorporate cross-cutting contents on energy development for preschool, elementary school, and high school. If this is done in a planned and systematic manner, we will have a new generation of young Chileans who are aware of the importance of energy and interested in promoting and protecting it by the year 2035. This Energy Policy represents a new and challenging area of action for the country which should be implemented in clearly identified stages with the appropriate commitments and adequate supervision of the achievement of objectives. We are committed to ensuring that this Energy Policy will be reviewed every five years with the mechanisms, resources, and processes neces-
sary to ensure that it is legitimate in political, social, and technical terms. The Energy Policy will thus be ratified by Supreme Decree issued by the President of Chile and endorsed by all of the ministries involved in order to provide adequate inter-ministerial work. It will also be necessary to develop a short-term agenda that outlines the challenges to be addressed prior to 2020, when a new review will be conducted to update the priorities for this sector.
I. GENERAL CONTEXT
The challenge of designing an Energy Policy for Chile requires an understanding of this sector’s history, as well as the long-term national and international trends.

The international energy context has been influenced by various phenomena in recent years. In the first place, we have witnessed a technological revolution in renewable energies and in non-traditional fossil fuels such as “shale gas”, all of which are changing the historical composition of the energy matrix for many countries. On top of these technological changes, the exchange of energy on international markets and through regional energy integrations has been growing. The use of electricity to drive new activities poses challenges with regard to increases in the demand for electricity and the potential for energy efficiency.

A third phenomenon is international concern regarding reducing our reliance on fossil fuels in the worldwide energy matrix with the aim of sufficiently reducing Greenhouse Gas emissions (GHG).

Energy consumers were traditionally passive recipients of energy generated far from their homes, industries or businesses. However, they are now becoming active producers, managers and consumers, who are concerned about the source of the energy they use. They are altering the flow of energy from the “bottom up”. They are supported by intelligent networks that generate more and better information for the various stakeholders in the system, which makes the electrical systems more resilient, manageable and efficient.

Finally, public participation also poses challenges with regard to the installation of energy infrastructure, the use of specific energy sources and the policies that control them. Citizens are now engaged in the decision-making process.

These factors, together with changes in the patterns of non-energy consumption and production have changed not only the configuration of energy matrices but also the objectives and priorities of the Energy Policy, revealing the tre-
mendous energy transition that is taking place in the world and in Chile.

**ENERGY MATRIX**

Global consumption and production of energy has doubled over the past 40 years. The driving factors behind this growth are global economic growth, increased productive capacity in many countries, greater transport capacity and the larger world population.\(^1\)

An analysis of the primary energy supply during this period reveals that fossil fuels (coal, oil and natural gas) have been losing some of their share in the primary energy matrix, giving way to increasing levels of renewable and nuclear energy. In Chile, the sources of primary energy are oil with 32.9%, followed by coal with 24.4%, firewood and biomass with 23.7%, the latter being a particular feature of Chile, and hydroelectricity with 6.4%, which is more than in other countries. It is remarkable that 95% of oil is imported, while biomass is the principal local source of energy.

**FIGURE 1: PRIMARY ENERGY MATRIX**

![Primary Energy Matrix](chart)

**Source:** IEA, Ministry of Energy

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1 According to data from the United Nations, the world population is currently estimated at 7 billion, and will increase by a further billion over the next 12 years. By the year 2050, the world population is expected to total 9.6 billion.
The share of electricity in global final energy demand has significantly increased from 9.4% to 18.1% in the last four decades. This increase in the share of electricity in the secondary energy or final consumption matrix during this period has been complemented by a reduction in the share of fossil fuels in the matrix from 75.9% to 66%.

In Chile, the share of electricity in the final energy consumption matrix has also grown, but is still below the share of crude oil derivatives.

**ELECTRICITY MATRIX**

The increase in the share of electricity in total energy consumption has led to considerable growth in electrical energy generation. Over the past 40 years, coal-fired electricity generation has remained the most important worldwide source, reaching nearly 40% in recent years. However, the share of electricity generated from crude oil derivatives (i.e. diesel, fuel oil) reached an all-time low of about 5% in 2012. Meanwhile, the share of electricity generated from nuclear energy, natural gas and renewable energy (wind, geothermal, solar, etc.) has increased.

In 2014, electricity generation in Chile was predominantly thermal (coal 41% and natural gas 11%), with the principal renewable source being hydroelectricity at 34%.

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2 The share of electricity in final energy consumption in Chile rose from 19.2% in 2010 to 22.4% in 2014.
Historically, electricity generation in Chile based on renewable sources, mainly hydroelectric, had played an important role, with an average close to 65% in the 1960s, reaching 80% in the 1980s falling to a range of 30% to 40% over the last decade, depending on the hydrological year.

The electricity generation matrix in Chile consisted of a total installed capacity of 20,375 MW in 2015. This capacity was shared between the Central Interconnected System (SIC), which has 77.7% of total installed capacity, and the Norte Grande Interconnected System (SING), which has 21.54% of total installed capacity. Meanwhile, there are additional electricity grids in Aysén and Magallanes. The Aysén electricity grid has a capacity of 52 MW, while the Magallanes electricity grid has 102 MW. In addition to the grids in Aysén and Magallanes, there are medium-size grids at Los Lagos, Cochamó and Hornopirén and isolated grids on Easter Island and at San Pedro de Atacama, among others.

Average electricity generation between 2010 and 2014 for the SIC was 48,207 GWh, being mainly hydro-thermal, with a hydroelectric component comprising 43%, thermoelectric generation from coal, natural gas and diesel comprising 52%, and the remaining 5% comprising solar, biomass and wind power. The SING is basically thermal and average generation between 2010 and 2014 was 16,530 GWh with a minimal hydroelectric component of less than 1%, and thermoelectric generation of about 98%. Non-conventional Renewable Energy (NCRE) is only just taking off despite its high potential in the geographical area covered by the SING.

Source: Central Bank of Chile; Energía Abierta
FIGURE 4: HISTORICAL ELECTRICITY GENERATION

Source: Central Bank of Chile; Energía Abierta

FIGURE 5: INSTALLED CAPACITY SIC & SING 2015

Source: Energía Abierta
There has been a huge growth in solar, wind, biomass and mini hydraulic energy in recent years. Installed capacity from these sources in Chile was 286 MW in 2005, whereas it now totals 2,269 MW, which is 11.41% of the total electricity capacity across all the national electricity grids, equivalent to almost 10% of electricity generation for Chile in September 2015. Nevertheless, the diesel oil share of installed capacity has also increased significantly during the same period, as it has replaced natural gas that was imported from Argentina. This replacement, coupled with volatility in the international prices of imported fuels, the difficulty of executing specific generation projects and the extensive periods of drought that have affected hydroelectric generation, have steadily raised the cost of electricity supplies for several years, creating a fundamental challenge to energy policy. The evolution of electricity marginal costs are displayed in Figure 6, both for the SIC (Alto Jahuel 220 kV) and the SING (Crucero 220 kV).

**TRENDS IN ENERGY SOURCES**

The technological revolution has enabled further natural gas and crude oil reserves to be exploited, both from non-conventional deposits located mostly in the USA. This has changed the perspective of the energy sector over the last decade. Specifically, the USA replaced Saudi Arabia as the main producer of crude oil in 2015, and it is also ranked above Russia as the nation that extracts the most hydrocarbons. The USA has switched from being a net importer of crude oil to a net exporter, and this has caused a rupture in international fuel markets, with profound financial and political consequences.

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5 Center for Innovation and the Development of Sustainable Energy Report dated October 2015
The impact of this technological revolution has yet to be seen in Chile, considering that its neighboring countries have tremendous potential non-conventional reserves. If these are exploited, this would change the energy integration conditions for the continent.  

As a result, the increased global availability of these fossil fuels has driven down international prices. This makes the use of such fuels more attractive, which form the primary source of GHG emissions. The effect on prices of fossil fuels in Chile can be seen in Figure 6.  

Renewable energy sources have become "conventional", with decreasing costs in recent years, enabling them to compete with fossil fuels.

The IEA report (2015) on "Projected Costs of Generating Electricity" indicates that the trend in development costs for renewable energies is falling, whilst such costs for conventional technologies are constant or increasing. Currently, the variable renewable energy share of electricity grids, such as solar and wind power, depends not only on their costs, but the flexibility of the grid they feed. Variable energy sources can be more easily incorporated when they are fed into more extensive and flexible transmission networks with regional and international interconnections, which facilitate the exchange of energy. Storage systems are also an option for the future, to the extent that technological progress facilitates their incorporation.

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6 For example, Argentina has reserves of 27 billion barrels of non-conventional oil, and almost 802 billion cubic feet of shale gas, according to the US Government Department of Energy.

7 The World Energy Outlook 2015 issued by the IEA indicates that the unit costs of technologies such as photovoltaics are expected to fall by 40% on average by 2040, and efficient lighting by 50% on average, whilst the cost of technologies based on fossil fuels would increase.
ENERGY CONSUMPTION

Final energy consumption in Chile can be broken down into five main areas: Commercial, Public, Residential (CPR), Transport, and Industrial and Mining.

The Industrial and Mining sector was the largest consumer of energy in 2014, with approximately 40% of final consumption, which can be split between 24% Industrial and 16% Mining. The energy consumed by this sector came mainly from three energy sources: electricity (33%), diesel (26%) and biomass (20%).

The Transport sector was the second largest consumer of energy, with 33% of final consumption in 2014. Almost 99% of the energy consumed by this sector came from crude oil derivatives (mainly diesel and petrol associated with road transport).

The Commercial, Public and Residential sector accounted for around 21% of final consumption. The largest source of energy in this sector was electricity, whose share in energy consumption was about 34%, followed very closely by biomass, mainly firewood, with a share of 32%. Other important energy sources in this sector were Liquefied Petroleum Gas with 18% and natural gas with 11%.

The three energy sources with the largest share in total final consumption were: crude oil derivatives with 56%, electricity with 22% and firewood and biomass with 15%.

Chile imported approximately 90% of its fossil fuel requirements in 2014.

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8 The LCOE (Levelized Cost of Energy) is the payment that the developer of an electricity project should receive to recover his costs and obtain a profit margin.
FIGURE 9: FINAL ENERGY CONSUMPTION IN TERACALORIES\textsuperscript{9}

Source: Ministry of Energy

FIGURE 10: HISTORICAL FINAL ENERGY CONSUMPTION BY SECTOR

Source: Balance Nacional de Energía

\textsuperscript{9}  The Total Supply is primary energy consumption and the Total Available is final energy consumption.
Final energy consumption grew gradually between 1997 and 2014, at an average rate of 2.5% per year. The Mining sector and the Commercial sector moderately increased their share of this consumption.

It is well known that countries cannot develop without energy. There is global evidence that an increase in national economic activity generates an increase in energy consumption. Historically, consumption growth in Chile has closely followed economic growth, as can be seen in Figure 11.

International trends have attempted to decouple the link between growth and energy consumption through greater energy efficiency. The decoupling in Chile has been greater in recent years as a result of efficiency measures introduced in the sector, as well as increases in energy prices that have encouraged more rational use.

Nevertheless, Chile is a country that has a lower primary energy consumption per capita than other countries or regions that have achieved higher levels of economic development. Our country consumes less than half the per capita consumption of other OECD countries on average. Therefore, it is expected that Chile will increase its per capita energy consumption to the extent that economic development continues. To which can be added the challenges presented by changes in trends in the energy sector, such as how energy infrastructure should be developed bearing in mind environmental and social considerations.
FIGURE 12: PRIMARY ENERGY CONSUMPTION PER CAPITA, 2012

Source: IEA

CLIMATE CHANGE SCENARIOS

There is great impetus within the international community to mitigate GHG emissions in a balanced manner, and thereby limit global warming. According to the IEA (2015), a "business as usual" scenario in the electricity sector continuing through to 2050 would increase the temperature of the planet by 6°C above temperatures in the pre-industrial era, causing unintended consequences for human development. To address this problem, the 21st Conference of Parties to review the United Nations Framework on Climate Change or COP 21 took place in December 2015, which sought to redouble commitments to reduce GHG emissions, and thereby limit global warming to 2°C.

The IEA estimates that to achieve an energy matrix that responds to the challenges of global warming by 2050, the share of certain energy sources should significantly increase and there should also be a significant increase in energy efficiency. It is renewable energy sources, such as hydropower, solar and wind, as well as nuclear energy that should increase.

In Chile, the energy sector has had the highest impact on GHG emissions, mainly due to its consumption of fossil fuels for electricity generation, land transportation and mining. Between 1990 and 2010, GHG emissions from this sector doubled, from 34 million tons of equivalent carbon dioxide, to 68 million tons. This means that in 2010, almost 75% of total emissions in Chile came from this sector. The share of total emissions from the electricity generation subsector increased from 17% to 36% over the same period. Emissions per capita in Chile are currently 4.4 tCO2/pp, which is very close to the worldwide
Average of 4.5 tCO2/pp, but below the average in OECD countries of 9.9 tCO2/pp.

Although Chile is only responsible for 0.25% of global emissions, it is highly exposed to its effects, due to low-lying areas along most of its coastline, its rivers being fed by melting snow and ice, its forests and its oceans, which are a key fishing resource.

Therefore, in September 2015 President Michelle Bachelet reported that Chile was committed to reducing its CO2 emissions per GDP unit in 2030 by 30% with respect to 2007 levels, assuming that future economic growth would enable the appropriate measures to be implemented to achieve this commitment. Furthermore, if the country can secure the requisite international funding, it would commit to improve its reduction in CO2 emissions per GDP unit by 2030 to between 35% and 45% with respect to 2007 levels, assuming that future economic growth would enable the appropriate measures to be implemented to achieve this commitment.

CHILE’S ENERGY POLICY

When the General Law regarding Electricity Services (DFL No. 1) was enacted in 1982 and the privatization process for state energy enterprises began, the foundation was laid for the current Energy Policy. This was embodied in a document entitled 'The Energy Sector in Chile', issued by the National Energy Commission (1989). It explained that 'The strategy that guides energy development is consistent with general policy on the economic and social development of Chile. It seeks to maximize living standards for the community by establishing the
required economic efficiencies in the energy sector, within the framework of a subsidiary role for the State. The document also explicitly defined the subsidiary role of the State indicating that "it does not need to intervene whilst there are people, organizations and intermediate institutions in different fields within society that are capable of managing their responsibilities at their own level."

The country’s strategy for sustained economic growth was based on safeguarding the predominant role of the private sector, leaving the State with a subsidiary role and that of a regulator where competition would not arise in a natural way. Therefore, the Energy Policy should primarily promote economic efficiency in the sector. Economic efficiency is understood to be the generation of the conditions for competition within the energy industry, or, if this is not possible, the emulation of these conditions in the respective markets, through appropriate regulation.

The regulatory and subsidiary role of the State was determined in a regulatory framework establishing limited powers with regard to tariffs in the case of natural monopolies and general oversight faculties, with the aim of laying the foundations to facilitate private investment. Thus, regulations were designed to avoid price distortions by completely liberalizing prices for all petroleum and coal derivatives, as well as the price of electricity supplied to unregulated large customers.

The State had an indicative role in planning investments in energy infrastructure, except for the regulated natural monopolies to distribute electricity. However, the State would be allowed to constantly evaluate energy resources that were not being considered by the private sector, due to market failures. For example, either directly or through State companies, the State could undertake pre-investment research into the development of energy resources whose prospects merited such research. Examples of this are assessing the potential for natural gas and crude oil in Magallanes and the tender to develop them.

The first change to this Energy Policy occurred at the beginning of the 1990s with the return to democracy, and around the same time the concepts of sustainability and equity began to be integrated into this policy. However, the predominant role of the private sector was strengthened, leaving public investment to cover social and infrastructure requirements that could not be met from private resources.

Accordingly, the National Program for Rural Electrification was created at the end of 1994, within a strategy to overcome poverty, improve the quality of life in rural sectors, and integrate them into the economic and social development processes in Chile. Its specific objectives were to eliminate the lack of electricity and/or improve the quality of energy supplied to homes and community centers in rural areas, thereby reducing the incentive for rural families to migrate to urban areas, promoting productive development and improving quality of life.

At the same time, environmental issues, optimizing the use of energy, renewable energy, and energy integration with neighboring countries, all became important issues. However, the crisis that affected the electricity sector due to a drought and consequent rationing in 1999, followed by the crisis in the supply of natural gas from Argentina in 2005, led the main objective of energy policy to become securing a stable supply of energy, under conditions of strict eco-
conomic efficiency, and aligned with the country’s sustainable development. These crises encouraged discussion about energy efficiency. Promoting conservation, the efficient use of energy at reasonable costs in line with the country’s level of development, all became important issues.

The National Energy Commission document (2008) "Energy Policy: New Guidelines Transforming the Energy Crisis into an Opportunity," was the first time the need was recognized for a long-term Energy Policy that would be a State policy integrating various sectors and using a systematic approach. The document suggested the following: "Given the uncertainty facing the energy sector and that the impacts of energy not only concern the sector itself, but are linked with—and a fundamental pillar of—the global competitiveness of the national economy and its social development, energy policies must not simply follow the principles of technical and economic efficiency, but must also actively integrate security, sustainability and equity."

Finally, in 2012 the Ministry of Energy designed and published a National Energy Strategy for 2012 to 2030, establishing that Energy Policy should be framed within a general policy whose objective is to enable Chile to become a developed country. This implied achieving specific macroeconomic and social goals, for example, in education, health, housing, and poverty reduction. The document indicated that this required sustained economic growth, which therefore required a greater supply of clean, safe and economic energy. It also suggested that the strategy should be implemented with various stakeholders at a national and regional level including various opportunities for public participation. The document also recognized the need for long-term institutions to regularly review and agree the objectives of the energy matrix, incorporating technical, economic and social criteria. It should include contributions from experts, related organizations and the public, in addition to guidance from the authorities.

**THE BEGINNING OF A NEW ENERGY POLICY**

The Energy Policy should not be considered in isolation, but contained within a strategy for Chile’s economic, social and institutional development.

The context and understanding from these decades convinces us that the Energy Policy cannot be limited to defining the market’s operating rules and responding to contingencies, but the coordinating role of the State is essential when proposing a vision for long-term energy development. All stakeholders are invited to participate in a process that defines and validates this vision, the participation of every individual, community and entity is fundamental if we wish to establish a long-term policy that represents all Chileans.
A fundamental pillar of this new policy is the private initiatives that will drive energy development. But the challenges in the coming decades require the State to coordinate stakeholders in the development of a shared long-term vision that has been constructed together, which directs energy development and secures the common good for all Chileans. The institutional framework that underpins this role of the State is focused on the Ministry of Energy, but involves a broad range of public services, which is crucial to give consistency and continuity to the policy.

The role of the State is complemented by markets being carefully monitored, reducing barriers to new business ventures and the arrival of new investors, environmental stewardship, user protection, energy availability, and encouraging the public to understand energy efficiency. The State is also required to channel the debate and participation by society regarding structural decision-making in the energy sector. Finally, the State has an irreplaceable role with regard to planning strategies to respond to energy emergencies and contingencies.

THE ENERGY POLICY PREPARATION PROCESS

The Government of President Michelle Bachelet presented its program in October 2013. This recognized that the country wants a secure and efficient supply of energy, at reasonable prices, which takes advantage of Chile's renewable resources in a sustainable and non-polluting manner. The Government promised to fulfill 50 measures during its first 100 days in office. One such measure was for the Ministry of Energy to prepare an "Energy Agenda" that would define the main guidelines for the Energy Policy to be developed during the Government's 4 year term. It would serve as a road map to design and implement a long-term Energy Policy with social, political and technical validation.

The Energy Agenda was presented to the President in May 2014. It proposed seven major objectives, within the action point "A New Role for the State". One such goal was the "Preparation of a State Energy Policy with social, political and technical validation", where the State committed itself to enter into dialogue on the key issues arising from the Agenda that define planning for the sector.

The method used to prepare this Energy Policy was not random: the Ministry of Energy decided to adopt international practice on this matter. Therefore, the Ministry of Energy launched the "Energy 2050" (E2050) initiative in July 2014, conceived as a participatory process to build the Energy Policy. Energy 2050 includes four development stages and three participation segments. These cover participation at a political-strategic level with an Advisory Committee; at a technical level with sector experts involved in energy and thematic panels; and at a public level encompassing the entire population with a public platform, discussion workshops and public consultations.

The document presented below is the result of a process that lasted a year and a half, which is described in detail in Appendix 2.

10 Therefore, the Chilean Ministry of Energy took into consideration the Energy Development Strategy for New Zealand, Energy Policy 2005 to 2030 for Uruguay, the German Energy Policy process, and the Australian Green and White Papers.
THE ENERGY 2050 PROCESS STAGES

**STAGE 1**
ENERGY AGENDA
August to December 2014

**STAGE 2**
VISION AND ROADMAP 2050
January to September 2015

**STAGE 3**
ENERGY POLICY
October to December 2015

**STAGE 4**
DISSEMINATION
2016

- Thematic Panels
- The Advisory Committee builds the vision and Road Map
- Delivery of the Road Map to the Ministry
- Preparation of the policy by the Ministry
- Public consultation regarding the Policy
- Delivery of the Policy to the President of Chile
- Dissemination
II. VISION AND PILLARS OF THE ENERGY POLICY
1. Vision

The vision of Chile’s energy sector by the year 2050 is that of a reliable, inclusive, competitive and sustainable energy sector. Energy will be a driving force for the country’s development, but not just any type of development: Chile’s development must be respectful of people, of the environment and of productivity, and must ensure continuous improvement of living conditions. Ultimately, the aim is to evolve towards sustainable energy in all its dimensions, on the basis of the four attributes of reliability, inclusiveness, competitiveness and environmental sustainability.

Chile’s Energy Policy —through the Energy 2050 participatory process— subscribes to the attributes defined in the Roadmap 2050, and also defines the need to adopt a vision that articulates and gives a hierarchy to these attributes as a function of the challenges faced by Chile on its path to development, while ensuring people’s well-being throughout the country’s territory.

The Energy 2050 Policy is inspired by a vision that prioritizes the different components and links the various objectives under a systemic approach. The primary objective is reliability of the energy system, but this cannot be achieved at any cost nor affect the inclusiveness and competitiveness of the economy. Furthermore, both objectives must be compatible with environmental sustainability, efficiency and energy culture. The system will be reliable and favor social inclusiveness and environmental protection, but it will also require energy efficiency and market competitiveness.
The Survey process in 2015 produced information about citizens' perceptions of different matters related to the Energy 2050 Policy. Figure 14 shows the main concerns voiced by the population about the present and the future of energy. These concerns are grouped under the various attributes set out in the Energy Policy to 2050.

As can be seen, at present the major concerns related to energy can be proportionally grouped under three important attributes. However, in the future, the inclusiveness and competitiveness of the energy sector become most important.

The vision that inspires this Policy is in line with the guidelines of the World Energy Council (WEC) on sustainable energy policies, which should take the following dimensions into account: Energy Security, Energy Equity and Environmental Sustainability. The WEC publishes the Energy Trilemma Index as a ranking of 129 countries on each of these dimensions, and.

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11 This Figure was put together on the basis of the following questions asked during the deliberative process, and by linking the answers with the objectives of the Energy Policy: What is your major concern in relation to energy?: (i) Price (Inclusiveness and competitiveness), (ii) Energy resources may become depleted (Reliability), (iii) Electricity will not be available (Reliability), (iv) Pollution (Sustainability), (v) The need for clean energy (Sustainability), (vi) Over-exploitation of natural resources (Sustainability), (vii) There is no renewable energy available (Sustainability). Which of the following is the major challenge faced by the country in relation to energy over the next few years?: (i) The need to generate environmentally-friendly energy (Sustainability), (ii) The state must plan and control the ways that energy is produced (Inclusiveness and competitiveness), (iii) The price of electricity and fuels (Inclusiveness and competitiveness), (iv) Ensure sufficient supply of energy throughout the country/power outages (Reliability), (v) Energy generation projects must be developed jointly with local communities (Inclusiveness and competitiveness), (vi) Achieve greater efficiency in energy consumption (Sustainability) and (vii) There should be more competition between the power companies (Inclusiveness and competitiveness).
on the success achieved by these countries in balancing the different dimensions.\textsuperscript{12} Chile is not well placed in this ranking: in 2014, it was ranked 89 in Energy Security, 55 in Energy Equity, 67 in Environmental Sustainability, and 53 in the overall ranking.

Given Chile’s current situation in energy matters, and considering the goals we have set for our country for 2050, this Energy Policy is a key factor for orienting the actions of everyone, and for moving towards the future we have envisioned.

\textsuperscript{12} Energy Trilemma Index Chile, 2014. Available at https://www.worldenergy.org/data/trilemma-index/country/chile/2014/.
2. Pillars of the Policy

In order to attain our vision of the energy sector on the basis of the above attributes, this Policy proposes the following pillars to uphold the long-term vision, so that goals and action plans can be defined for the state, the private sector and the people. To reach the objectives and goals of the Policy in the long term, it is imperative that a fair balance be struck between the four pillars, so that no pillar overrides the others.

A) QUALITY AND SECURITY OF SUPPLY

By 2050, our energy system should have the following attributes in terms of quality and security of supply:

- The country has a robust and resilient energy system capable of managing risks, and can face and even anticipate the effects of energy crises, natural disasters, climate events, geopolitical conflicts, etc.
- Chile takes advantage of opportunities for regional and global energy exchange, thereby minimizing the vulnerability of our energy system. To this end, Chile has achieved real flexibility to incorporate new technologies.
- Access to and availability of energy services have attained a standard of reliability, quality, and universality that makes it possible to satisfy the needs of the various end users of energy in Chile.
- The country has an intelligent electricity system that empowers citizens and organizations. Energy users are no longer passive consumers; they have now become “producers/managers/consumers” capable of making an intelligent use of energy. As a result, the system is more secure and can face unexpected circumstances successfully.
B) ENERGY AS A DRIVING FORCE FOR DEVELOPMENT

The attributes required by our energy system in order for it to function as a driving force for development are:

- Energy is "good news" for citizens and communities. It creates opportunities for local economic development, and it favors an equitable distribution of the costs and benefits associated with Chile's energy development.
- The energy sector helps improve the quality of life of citizens by means of equitable access to energy services.
- Energy infrastructure is respectful of regional and local visions and needs, and it promotes national development in line with participative territorial management. The role of the State is central in territorial planning.
- Achievement of competitive energy prices is a prerequisite for the country's sustainable development, and constitutes a source of competitiveness for the productive sector, while taking advantage of opportunities for regional and global energy exchange.
- The energy sector is open to the innovation, development, and application of new generation technologies and efficiencies in consumption, as well as development of human capital.

C) ENVIRONMENTALLY-FRIENDLY ENERGY

The attributes required by our energy system in environmental matters are as follows:

- Chile's energy infrastructure causes low environmental impact. Such impact should —in the first place— be avoided, then mitigated and compensated for, considering energy development and its effects on the ecosystems of the air, land, and marine and continental waters.
- The energy system stands out as an example of low GHG emissions and is an instrument to promote and comply with international climate-related agreements.

D) ENERGY EFFICIENCY AND ENERGY EDUCATION

The required attributes of our energy system in terms of energy efficiency and energy education are as follows:

- Chilean society and the industrial and service sectors —both public and private— adopt and promote responsible consumption habits and a responsible energy culture.
- Energy education has led to cultural change, by virtue of which users take responsibility for—and are aware of—the importance of efficiency in energy generation, transmission and consumption.
- Responsible use of energy along with progress in energy efficiency have improved the quality of life in our homes and lowered families' energy bills.
- Efficiency and energy management contribute to the sustainable development of our industry and of our cities and transportation systems.

It should be pointed out that, rather than defining specific actions, the aim of the Policy's strategic vision along with its pillars, goals and guidelines is to establish lines of action that will orient the decisions of the public sector (be they thematic, territorial, regulatory, etc.) from now till 2050. That is why, after the Pillars of the Policy have been developed, the Policy and the corresponding Short-Term Agenda will be updated regularly.
These various pillars should not be thought of as starting points of movement in different or opposite directions. On the contrary, joint development of the pillars is essential for realizing the long-term vision for the energy sector, considering interaction between the different pillars and their joint evolution over time.

The pillar of Quality and Security of Supply refers to the required reliability of the Chilean energy system. This pillar also contributes to Chile’s inclusive development by giving people quality access to energy. A secure energy system is a prerequisite for competitive prices, it promotes responsible use and the efficient production of energy, and it leads to a lower environmental impact.

The pillar of Energy as a Driving Force for Development basically pursues the objectives of inclusive development and economic competitiveness. Similarly, energy development is crucial for making progress in creating national, regional and local infrastructure. This is a basic requirement if the country and its regions are to have a reliable energy sector, and if the energy matrix is to reduce its environmental and social impacts. It will not be possible to have an environmentally sustainable energy sector without adequate territorial management, or efficient use of energy without a strategy for research and innovation in energy efficiency.

The pillar of Environmentally-Friendly Energy refers to major objectives relating to environmental sustainability. Obviously, if the energy matrix draws on renewable energy sources and if it is flexible and diversified, this will contribute to the overall security of the system. Energy efficiency and renewable energies can be developed in an integrated manner by taking advantage of the synergies between them, making it possible to make rapid progress towards a more sustainable energy matrix. Finally, if we are to achieve social inclusiveness that brings real improvements to people’s quality of life, environmental impacts must be reduced both at the local and the global level.

The pillar we have called Energy Efficiency and Energy Education will serve as a facilitator for creating the attributes of the long-term vision as a whole. On the one hand, system reliability depends on efficient use of energy and on users making good use of the same. Energy efficiency reduces families’ energy costs and makes the productive sector more competitive. Intelligent use of energy reduces environmental impacts, while energy education contributes transversally to all the above objectives.

As for the goals of Chile’s Energy Policy, they will be pursued in a coordinated manner, without favoring one goal at the expense of the others.
**PRINCIPAL ENERGY GOALS – 2050**

1. **Electricity outages do not exceed 1 hour/year in any locality in Chile, except in cases of force majeure.**

2. **The GHG emissions of Chile’s energy sector are consistent with the thresholds defined by international guidelines and with the corresponding national emissions reduction goal, making an important contribution to achieving a low-carbon economy.**

3. **Ensure universal and equitable access to modern, reliable and affordable energy services for the entire population.**

4. **Regional and local territorial planning and land-use instruments are in line with the guidelines of the Energy Policy.**

5. **Chile is among the 3 OECD countries with the lowest average residential and industrial electricity prices.**

6. **At least 70% of the electricity generated in Chile comes from renewable energy sources.**

7. **Growth of energy consumption is decoupled from GDP growth.**

8. **100% of new buildings meet OECD standards for efficient construction, and are fitted with intelligent energy control and management systems.**

9. **100% of the major categories of appliances and equipment sold in Chile are energy-efficient.**

10. **Energy culture is installed at all levels of society, including energy producers, distributors, consumers and users.**
### Principal Energy Goals - 2035

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Chile’s interconnection with the other SINEA member countries, and other South American nations, especially the members of MERCOSUR, is a reality.</td>
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<tr>
<td>2</td>
<td>Electricity outages do not exceed 4 hours/year in any locality in Chile, except in cases of force majeure.</td>
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<td>3</td>
<td>100% of homes of vulnerable families have continuous quality access to energy services.</td>
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<td>4</td>
<td>All energy projects under way in Chile have adopted mechanisms for associativity between communities and the private sector, thereby promoting local development and improving implementation of the projects.</td>
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<tr>
<td>5</td>
<td>Chile is among the 5 OECD countries with the lowest average residential and industrial electricity prices.</td>
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<tr>
<td>6</td>
<td>At least 60% of the electricity generated in Chile comes from renewable energy sources.</td>
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<td>7</td>
<td>By 2030, Chile has reduced its GHG emissions by at least 30% compared to 2007.</td>
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<tr>
<td>8</td>
<td>100% of the large consumers of energy (industrial, mining and transportation sectors) make efficient use of energy, with proactive energy management systems and the implementation of energy efficiency measures.</td>
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<tr>
<td>9</td>
<td>By 2035, all local municipalities have adopted regulations classifying forest biomass as a solid fuel.</td>
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<tr>
<td>10</td>
<td>Energy efficiency is one of the aspects evaluated in tenders for all new vehicles used in public transportation systems.</td>
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III. ENERGY POLICY
This chapter refers to the main guidelines and goals of the long-term Energy Policy, which give form to the vision for the energy sector. Each pillar will include a brief diagnosis of the current situation, along with the corresponding goal. The goals have been set for horizons in the years 2035 and 2050. Please note that there are intermediate goals and action plans that contribute to achieving the main objectives of the Policy (the main objectives are presented in detail in Appendix 1).13

13 A large number of the action plans require inter-ministerial coordination in order to attain the proposed goals. For this reason, most Ministries were members of the Energy 2050 Consultative Committee.
1. Quality and Security of Supply

U
nderlying the long-term vision is the reliability of the energy system, in two different dimensions. On the one hand is system-wide security of supply, and on the other is reliable access at the local level. Centralized system-wide reliability, and decentralized local reliability are seen as complements rather than substitutes for achieving the goals for the energy sector. The objective is to make the energy system secure as a whole, at the local level, and for each individual user.

A. SECURITY AND FLEXIBILITY OF CENTRALIZED PRODUCTION

The concept of security of supply is based not only on uninterrupted availability of energy. Rather, energy must also be available at affordable, reasonable and predictable prices, thus making the country more competitive. Long-term security of supply requires a resilient energy system which can attract the necessary investments in infrastructure in a timely manner, so that it can deliver the energy needed by Chile's economic, environmental and social development. Also, in the short term, security of supply has to do with the capacity of the energy system to anticipate, react and adapt to unexpected changes in the balance between energy supply and demand.

The national energy system is constantly exposed to threats that affect both the people and economic activity. In particular, natural disasters such as earthquakes, tsunamis, landslides, and/or the unexpected failure of infrastructure can simultaneously affect the electric grid, the fuel pipelines and the transportation systems, thus impacting the reliability of the country’s energy supply. Although many of these events

14 This availability is related to the concept of sufficiency. This refers to the system's capacity to meet demand at all times.

15 As an example, the 1998 drought led to the rationing of electricity due to the impossibility of making sufficient supply available to meet demand. More recently, the unexpected cut-off of the flow of natural gas from Argentina starting in 2004, and which was almost total as of 2007 - in addition to the drought - put stress on the capacity of the energy system to respond and adapt to these unforeseen circumstances affecting the energy sector.
are relatively infrequent, it is of vital importance to analyze and estimate the risks and consequences to which the country is exposed, so that preventive action can be taken, mitigation measures can be designed, and policies can be developed that will favor a more resilient, reliable, and more secure energy system.

Operation of the energy sector involves complex interactions between multiple stakeholders, sectors, and distribution networks. In the case of Chile, the electricity sector is intimately linked with the liquid fuels and natural gas sectors. In turn, all these sectors are linked with transport and telecommunications. The transport sector makes intensive use of fuels derived from oil, and this sector is also used to deliver supplies of fuels to itself and to other sectors. Figure 15 shows the interdependence between various sectors, including the electricity, hydrocarbon, transport and telecommunications sectors.

In the context of this interdependence, the role of energy integration becomes crucial in terms of ensuring greater flexibility and security for the energy systems. In this sense, the countries of South America have started to move away from their traditional vision on these matters, which classified countries as either "exporters" or "importers" of energy. The vision that is taking hold in South America is one of complementarity and regional energy integration.

The current trend worldwide is towards the creation or implementation of interconnected meshed networks—for electricity, natural gas,
or liquid fossil fuels—in order to optimize countries’ energy resources, improve the security of supply, incorporate renewable energy sources, and reduce greenhouse gas emissions. From an economic point of view, electric interconnections have resulted in greater competition in the power generation market, and more competitive prices to the final users.

Figure 16 shows a map of Latin America and the existing electric interconnections. As can be seen, practically all the countries have some type of electric interconnection, apart from traditional exchanges in liquid or gas hydrocarbons. Nevertheless, these electricity exchanges are still limited, due to the absence of adequate market mechanisms and regulatory frameworks.
FIGURE 16: REGIONAL MAP OF PHYSICAL ENERGY INTERCONNECTIONS

Source: CIER (Regional Energy Integration Commission)
Taking a long-term view, it becomes clear that Latin America needs a more developed regional market for energy surpluses in order to increase the security of the energy supply. Regional exchange markets and mechanisms must become highly efficient and flexible to make our energy systems more secure. The following guidelines and goals take this into account:

### GOALS FOR 2050

The energy system is robust and highly resilient to external shocks

### GOALS FOR 2035:

- Chile has adopted national, regional and local plans to manage energy risks and contingencies. These plans are regularly updated through predefined procedures.
- Chile has an energy supply system and sufficient stocks to guarantee availability of supplies across the entire country.
- Chile’s interconnection with the other SINEA member countries\(^{16}\), and other South American nations, especially the members of MERCOSUR, is a reality.

The following is a list of intermediate guidelines for achieving the main goals:

- Develop national, regional and municipal plans for managing risks and emergencies affecting the energy sector that are aligned with other sectoral and national plans.
- Promote a cost-effective infrastructure for addressing critical situations arising as a result of force majeure.
- Increase the security of the supply, storage, transport and distribution of fuels.
- Promote research into and the exploration and exploitation of Chile’s hydrocarbon resources.\(^{17}\)
- Promote efficient regional exchange to increase the flexibility of the electricity system.

Further details on the Action Plans, Additional Goals, and Stakeholders Involved in attaining Security and Flexibility of Centralized Electricity Production may be found in Appendix 1, under Guidelines 1 - 4 and 6.

### B. DECENTRALIZED PRODUCTION AND ACTIVE MANAGEMENT OF DEMAND

The evolution of technology has made it possible to transform the daily life of the population, the way business is carried out, and the role of each actor in society. Energy is not an exception: information technology applied to intelligent grids, networks and energy meters, is helping create a new paradigm in the energy sector. In the future, energy users will no longer be mere consumers or receivers of energy

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\(^{16}\) Andean Region Electric Interconnection System, with Chile, Colombia, Ecuador and Peru as members, and Bolivia as an observer country.

\(^{17}\) This guideline is related to the possibility of maintaining an adequate level of security of the fuel supply throughout the country. The guidelines on research and development of other sources of energy have been incorporated into the pillar of Energy as a Driving Force for Development.
from producers, generators and traders (which now have rigid business processes and models in each segment). Rather, demand will be sufficiently flexible so as to be capable of influencing and taking an active role in the provision of energy. Progress in communications and management applications —within the paradigm of intelligent networks (smartgrids)— will result in energy use being manageable, even in the case of the most energy-intensive devices and appliances at the residential, commercial and industrial level.

The use of demand-side management mechanisms and smartgrid technologies will result in demand being more flexible and elastic. This flexibility will represent an important contribution to the security and reliability of supply because, as recent experience has shown, smartgrid technologies can dramatically reduce the total time of power outages at distributor level. During 2014, Chilean customers were without electricity —for reasons attributable to the distributors— for an average of 6.3 hours. Based on these data, one may predict that substantial benefits will be derived from adopting smartgrid technologies, as has happened in other countries.18

In spite of their many advantages, the development and implementation of smartgrids have been slow in many countries, including Chile, due to market barriers, regulatory constraints and technological/communications complexities.

As for the quality of access to the energy supply, the situation in Chile varies from place to place. On the one hand, the geographical coverage of the electricity system in Chile has reached high levels, similar to those of developed countries. Figure 17 shows that the electricity coverage in Chile is the highest in South America (more than 99% of the population).

However, there are disparities within the country in terms of access to electricity. Based on data from 2010, it may be seen that, in the Region of Magallanes and Chilean Antarctica, rural electricity coverage was less than 90% in 2010, while at the national level, rural electrification reached 96.1%. As for the supply of fuels, 11% of Chile’s 346 municipalities do not have service stations to serve the local population.

Although the country has good levels of access to electricity (as an absolute average), there is still much to be done in terms of providing similar quality of access to the entire population. There are also gaps related to continuity and security of the electricity supply. The SAIDI indicator (System Average Interruption Duration Index), which reflects the average number of hours during which a customer has been without electricity, shows that in some regions in Chile, service interruption in 2014 exceeded 25 hours (Figure 18). This was especially critical in Tarapacá Region, where users were left without electricity during almost 60 hours that year, due in large part to natural disasters and other causes not attributable to the distribution company (for example, breakdowns in transmission lines), all of which reflects the vulnerability of the power grid. Additionally, in 11 out of Chile’s 15 regions, users were without electricity during more than 15 hours in 2014, which is clear evidence that continuity is not the major asset of Chile’s

18 One of the benefits that can be derived from demand management, distributed generation and smartgrids, is a considerable improvement in energy efficiency based on taking advantage of opportunities in the Residential, Public and Commercial sectors. The corresponding goals and guidelines are part of the Energy Efficiency and Energy Education pillar.
electricity system. To put this into perspective, in European countries the SAIDI indicator does not exceed 8.5 hours per year, and is less than 1 hour in countries such as Denmark, Germany and Switzerland.\footnote{Council of European Energy Regulators (2014) "CEER Benchmarking Report 5.1 on the Continuity of Electricity Supply".}
In light of the above, improving the population’s access to energy means benefitting not only those families who currently have no access to electricity or fuel supply, but also those cases where the quality, continuity and security of the existing electrical service is inadequate. This Policy aims to ensure continuous, secure and sustainable access to energy, given that it is a key driving force for the development of individuals, families, communities, and the country as a whole.

20 SAIDI (System Average Interruption Duration Index) represents the average number of hours that a customer has been without electricity supply. It is the sum of external causes (not related to the distribution company), force majeure factors (which cannot be avoided by the concession company) and internal causes (attributable to the concession company that delivers the supply to the customer).
GOALS FOR 2050

- Electricity outages do not exceed 1 hour/year in any locality in Chile, except in cases of force majeure.
- 100% of the population has continuous quality access to energy services.
- The public, commercial and residential sectors make use of the potential for distributed generation and management of electricity demand.

GOALS FOR 2035:

- Electricity outages do not exceed 4 hours/year in any locality in Chile, except in cases of force majeure.
- The electricity system is completely bidirectional, with information technology systems making it possible to produce and manage energy at all levels of the system, in ways similar to other OECD countries.
- 100% of homes of vulnerable families have continuous quality access to energy services.

Early in the decade of the 2000s, in countries with levels of development similar to Chile—such as Portugal—power outages averaged around 9 hours. The latest figures available (for 2012) show that Portugal had reached an average level of power outages of 1.5 hours. Also, Poland today has more than 4 hours/year of power outages. Chile, as it advances towards full development, must set itself the goal of catching up to countries such as the above.

Given the geographical conditions, the difficulties in terms of access, the fact that Chile is a highly seismic country, and the high frequency of other force majeure events, the length of time of power outages must be minimized for both internal and external causes. Nevertheless, the promotion of infrastructure able to respond to force majeure situations, and the availability of national, regional and municipal plans for managing risks and emergencies affecting the energy sector, aim to minimize the likelihood of prolonged outages caused by force majeure.

The following is a list of intermediate guidelines for achieving the main goals:

- Promote an Intelligent System to Produce and Manage in a decentralized manner the Energy required for the residential, public and commercial sectors, to serve not just private users, but also cooperatives, municipal governments, and other organizations.
- Ensure continuous access to energy for vulnerable families, based on security and efficiency standards and criteria that are common to the entire population.

Chile's energy vulnerability is also related to our current dependence on imported energy sources. The goals of increasing the role of renewable energy in the energy matrix, and of taking advantage of the potential for distributed generation (use of local energy sources) will lessen our energy

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21 Council of European Energy Regulators (2014)

22 "Internal" refers to causes attributable to the distribution network, while "external" refers to causes attributable to the transmission network and the generation segment.
dependence levels. This is in line with the guideline on the promotion of research, exploration and exploitation of Chile’s own hydrocarbon resources, and with policies that promote energy research, innovation and technology development as a way to develop local energy solutions.

Detailed information on the Action plans, Additional Goals and Stakeholders involved in Decentralized Production and Active Management of Demand may be found in Appendix 1, in Guidelines 5 – 7.
2. Energy as a Driving Force for Development

On the basis of a reliable energy sector, we can now move on to the pillar of energy as a driving force for development. To achieve the latter, it is necessary to combine inclusive energy development and equitable access with adequate territorial administration practices capable of coordinating national, regional and local levels of decision-making, along with prices that drive competitiveness.

A. INCLUSIVE ENERGY DEVELOPMENT

The current social, economic and political context of our country is characterized by greater and more effective public participation. As a result of these changes in society, certain aspects of large investment projects—and particularly energy projects—which were formerly not called into question can now lead to social conflict and controversy. Such situations require different solutions and a redefinition of the concept of development, which must be inclusive at the national, regional and local levels.

This Policy recognizes the need to adopt better standards which must take into account—along with the technical and economic aspects—the vision and expectations of local communities regarding the environment and development. In this sense, one of the conclusions drawn from the deliberative process conducted under the framework of Energy 2050 was that 58%23 of people in Chile are not opposed to the construction of power plants in their region. Moreover, 83%24 said that they would support the construction of power generation projects in

23 This data was extracted from the following item in the deliberative survey process: “¿Which of the following options best describes your views about the construction of new power plants in your region?”

24 This data was extracted from the following item in the deliberative survey process: “¿To what extent would you be willing to support the construction of new power generation projects in your municipality or in nearby municipalities, in each of the following cases?”
their municipality provided the projects comply with the stricter environmental and social standards that are common in developed countries. The country is advancing towards new forms of cooperation between the various stakeholders living in a particular region (communities, organizations, authorities and firms), project developers, and the State.

To achieve this, the country needs more robust participatory processes. However, in order to ensure the harmonious integration of new energy projects it will not suffice simply to improve the participatory process. What is also required is to ensure that new projects go hand-in-hand with greater development—as seen from the local point of view—for the communities where the projects are to be sited. This is where the concept of associativity is crucial, meaning a mechanism for local stakeholders and project owners cooperating or working together with a view to achieving greater development in the territory in question.

The implementation of the Energy Agenda, and of the participatory process conducted in the context of this Energy Policy, has served to detect a number of gaps. This means that Chile has much work to do in achieving real associativity for local development.

In short, the key to achieving inclusive energy development is to ensure that Energy Development promotes local development—as defined by the communities—in line with national and regional strategies.

**GOALS FOR 2035**

- All energy projects under way in Chile have adopted mechanisms for associativity between communities and the private sector, thereby promoting local development and improving implementation of the projects.
- Local communities take advantage of energy projects, either through their own means and/or through associativity mechanisms, provided such projects are financially feasible, contribute to local development, and are of interest to the community.

Reaching these goals will require the structuring of information and participation on the part of the communities and other actors. To achieve these aims related to inclusive energy development, the following intermediate guidelines have been defined:

- **Empower stakeholders, organizations and communities in the area of Energy Development with regard to information about energy projects and their associated impacts, including participation in their development.** Also build capacities for generating opportunities for local development in accordance with the characteristics of the area and the cultural context.
- **The state must ensure the existence of formal, timely, informed, symmetrical and pertinent**

25 Pertinent participation refers to processes that involve citizens in such a way that their concerns and aspirations are adequately included and considered, and influence decisions on the matter at hand.
that impact national, regional and local policies, plans and projects.

- Ensure that energy development favors local development as defined by the community in a manner that is consistent with the national and regional strategy, and that facilitates the implementation of energy developments and projects promoted by small producers and communities interested in taking advantage of local energy resources. 26

Further details on the Action plans, Additional Goals and Stakeholders involved in inclusive energy development may be found in Appendix 1, Guidelines 8 - 10.

B. EQUITABLE ACCESS TO ENERGY SERVICES AND QUALITY OF LIFE

The United Nations’ Sustainable Development Goals were adopted in September 2015. Goal No. 7 refers to the need to “Ensure access to affordable, reliable, sustainable and modern energy for all”. To achieve this aim, the UN recommends that countries “ensure universal access to modern, reliable, affordable energy services by 2030”. In addition, the UN’s initiative SE4All (“Sustainable Energy for All”) states that “access to energy is the physical availability of modern energy services to satisfy basic human needs, at affordable prices, including electricity and efficient appliances such as cooking stoves.” 26

Access to energy is an essential part of the dimension of equity in satisfying the needs of the population. 27 In this sense, the definition of poverty, vulnerability, and satisfaction of energy needs becomes relevant. We must identify the specific components that make up energy poverty in Chile, and determine their current level. Additionally, it is necessary to define the basic energy needs that will have to be satisfied by 2050, considering Chile’s climatic diversity, and taking into account the different definitions of energy poverty that may be found in the specialized literature and in public policies on the matter. Some of the relevant aspects are: access to energy for home heating, thermal comfort, domestic hot water, cooking food, home refrigerators, lighting and other domestic needs, transport and productive activities and for the development of all citizens, etc. Similarly, Chile must define the manner in which access to energy can promote productive development of the citizens themselves.

In terms of thermal comfort, most homes in Chile do not have comfortable indoor temperatures, especially in mid-winter and mid-summer. According to Campos (2008), in winter the indoor temperature in 76% of Chilean homes is less than 17°C, and in 94% of homes the temperature is less than 20°C (Figure 19).

Our challenge for the year 2050 is to ensure that vulnerable families enjoy quality access to energy services characterized by security and

26 Along these lines, the Ministry of Energy promotes the development of Local Energy Strategies (EEL), a voluntary program that supports municipal governments wishing to undertake initiatives in the decentralization of energy generation and the use of local energy resources to improve the quality of life of the local people and involve them in a participatory process. It is expected that during the government of President Bachelet at least 10% of Chile’s municipalities will be actively enrolled in this program.

27 In this regard, equity requires not only access to, but also affordability of energy services. To improve quality of life, it is not enough to simply provide access to energy without taking into account its affordability.
efficiency conditions that are in line with Chile’s level of development, and that are common to the entire population. These quality services must be available both to users of interconnected grids and of isolated systems. To this end, the principal guideline for achieving equitable access is to reduce energy poverty and to ensure that homes have basic energy services to cover their needs.

GOALS FOR 2035:

- Ensure universal and equitable access to modern, reliable and affordable energy services for vulnerable families.

To reach these goals, intermediate guidelines need to be adopted. Defining and applying these guidelines will require inter-sectoral work given the multiple dimensions both of energy poverty and of equitable access. To achieve equitable access, it will be necessary to:

- Define the concept and measurement of energy poverty, in order to adopt specific policies to reduce it.
- Reduce the current ratio between the income level and energy expenditure of vulnerable families, without neglecting basic standards of thermal and lighting comfort.

GOALS FOR 2050

Ensure universal and equitable access to modern, reliable and affordable energy services for the entire population.

Source: Campos, 2008.
• Achieve acceptable standards of thermal and lighting comfort in the homes of vulnerable families in Chile.

The details of Action Plans, additional goals and the stakeholders involved to achieve Equitable Access to Energy Services are in Appendix 1, in the Guidelines 11 to 13.

C. TERRITORIAL INCLUSIVENESS

The current system of territorial planning and administration is highly fragmented and is composed of multiple instruments that cover different territorial and administrative jurisdictions. These instruments often lack mutual coherence, they are not interlinked, and they also are deficient in terms of assuring mutual compatibility of energy infrastructure.

Given that Chilean civil society is participating more and more in public affairs decision-making, that it is more environmentally-aware, and that it demands to be heard during the planning process, it has become unavoidable for the State to address the territorial complexities derived from the inadequacy of existing procedures. At the international level —especially in Europe— several innovative approaches to territorial planning and its corresponding regulatory mechanisms have been seen. One of the most relevant aspects of territorial and land-use planning in developed countries, comprises the framework laws on territorial planning and the integration of the various types of administrative processes at the regional level. In these countries, energy matters are addressed under the framework law, and decisions are materialized mainly through careful consideration of infrastructure siting.

Considering these international experiences, it is important to study all alternatives for our country, in order to select the best conditions for the development of energy projects, balancing the systemic vision of the energy sector with the participatory and inclusive decision-making processes conducted in the area where a project is to be sited.

In the first place, with regard to electricity infrastructure, it will be necessary to develop long-term Energy Plans which can orient, on a regular basis, the adequate and timely development of power transmission infrastructure and poles of development. In the second place, the realization of Regional Energy Plans (Planes Energéticos Regionales, PER) —which the Ministry of Energy has already begun to draw up— along with the respective Regional Commissions on Energy Development, include the first energy planning initiatives with a territorial focus, in a framework of coordination and integration with other regional planning instruments. One of the specific objectives of these plans is to have a direct bearing on the formulation of Regional Land Use Plans (Planes Regionales de Ordenamiento Territorial, PROT). To do this, it becomes necessary to implement the PERs with indicative character, in an articulated manner with the PROTs and the Regional Development Strategies (Estrategias Regionales de Desarrollo, ERD), and coherent with the long-term Energy Plans and the Energy Policy. Finally, it is necessary to give thorough consideration to energy matters in the Regional Development Strategies.
The interests of stakeholders, sectors, and national, regional and local institutions and levels associated with managing land for energy development are integrated and aligned through the goals that are presented below. In any event, an inter-sectoral approach involving all the stakeholders will be required in order to progress.

**GOALS FOR 2035:**

- All regions have Regional Energy Plans, which are updated regularly and impact Regional Land–use Plans.\(^\text{28}\)
- Regional Development Strategies and other regional and municipal territorial plans adequately address Energy Policy guidelines.

As guidelines for territorial inclusiveness, they should:

- Integrate and align the interests of stakeholders, sectors, and national, regional and local institutions and levels associated with managing land for energy development.

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\(^{28}\) Therefore, the Ministry of Energy has developed a Guide to prepare Regional Energy Plans, which was published in December 2015.
• Integrate into urban and rural planning the requirements for efficient and less polluting transport systems and buildings.
• Reduce distances and the number of trips to improve transport efficiency.

Further details on the Action Plans, additional goals and the stakeholders involved in Territorial Inclusiveness may be found in Appendix 1, Guidelines 14 to 16.

INDIGENOUS PEOPLES

Indigenous peoples have been specifically invited to participate in the initiative to develop an Energy Policy for 2050, in order to incorporate their point of view. Initially, the strategy prepared by the Ministry contained a general diagnostic process that arose from meetings with representatives of various indigenous peoples according to their territorial and cultural contexts. During 2014 there were 18 local meetings and in 2015 there were 13 local meetings and 5 broader meetings with communities.

In 2016 the action points raised to date are expected to be validated, and in conjunction with indigenous peoples, strategic guidelines and Energy Policy goals will be designed from the indigenous perspective. The participation process for 2016 will be designed with indigenous peoples, which is expected to be a broad, participative process that complies with the guidelines established by ILO Convention 169, and meets the deadlines and modalities that have yet to be defined in conjunction with them.

D. COMPETIVENESS IN THE ENERGY SECTOR

Chile has experienced various cycles in electricity prices, but never before has it seen prices sustained so high for several years. The main causes for this rise in electricity prices include the unplanned replacement of Argentine natural gas by diesel, followed by the interruption of gas flow from Argentina; volatility in international prices for fossil fuels with Chile being a price follower; the difficulty in implementing a number of generation projects; and prolonged periods of drought that have affected hydro-electric generation; among others.

Although the current price of electricity is in the middle of the range compared with OECD countries, Chile has among the highest electricity prices in Latin America.

The high price of electricity in Chile affects the country's capacity to develop. Electricity costs are a significant component of total costs for industry and this affects competitiveness, especially in the mining industry. The Mining Council indicates that approximately 20% of the operational costs at mining companies is electricity, and when added to the cost of fuels, these become a third of operating costs. This situation is very important as the mining sector has historically represented about 20% of national GDP and over 50% of the nation's exports. The high cost of electricity affects residential users and communities, as it negatively impacts the most vulnerable segments of the population.

29 http://www.consejominero.cl/ambitos-estrategicos/energia-y-cambio-climatico/
Therefore, starting right now but addressing these challenges with a long-term strategic approach, Chile needs to make changes to the regulatory, structural and operational framework of its markets and social environments, so they become conducive to electricity technology expansion and development. Encouraging competitive prices is an essential condition for sustainable development, which can be driven using strategic guidelines, so energy becomes a competitive factor in productive sectors.

**GOALS FOR 2050**

Chile is among the 3 OECD countries with the lowest average residential and industrial electricity prices

**GOALS FOR 2035:**

- Chile is among the 5 OECD countries with the lowest average residential and industrial electricity prices.

Current forecasts indicate that if Chile continues along a path of falling prices for electricity supply contracts, both for regulated and non-regulated customers, it will be possible to reach the proposed goal. This is exemplified by the results obtained in the regulated supply tenders dated September 2015, with average prices of US$79/MWh. Achieving this goal will require progress towards a more competitive market for electricity generation. Figure 21 shows how electricity prices in Chile compare to those in the principal OECD economies, and where prices in Chile should be in 2035 and 2050, assuming that prices in developed countries remain the same.

The dream that Chile will make the leap from being a developing country to a developed country, is coming closer every day. However, we do not want just any kind of development, but one that is inclusive, equitable, and respects the environment and social harmony. Therefore doing more of the same, albeit in a better way, is no longer enough. This is where innovation emerges as a great opportunity for the energy sector, which is a key sector for the competitiveness of the nation. The following guidelines are proposed to promote energy as the driver of innovative development:

- Define a policy for science, technology and innovation in energy.
- Reduce barriers to innovation and entrepreneurship in energy.
- Strengthen and coordinate Chile’s technological capacities for carrying out research, development and innovation in energy.

The goal is that Chile becomes an exporter of technology and services for the solar industry by 2035 and that by 2050 it does this in the different energy innovation focus points identified. Furthermore, innovation policies for the industry contribute to achieving a reduction in energy consumption.

It will be necessary to implement activities to follow up on the latest technological developments in the energy sector in order to anticipate and take advantage of technological changes in the sector, which would then serve as a tool for developing public policies. The Ministry of Energy will therefore include in its annual policy progress report an analysis of trends in technological developments that are relevant to the energy sector. Some specific technological developments are currently considered important that could change the configuration of the
sector. However, as technological surveillance is strengthened, its focus may vary over time. An opportunity that has arisen from this initial monitoring policy is storage systems that introduce greater flexibility to the electricity grid and facilitate the role of ‘prosumer’ in homes. Chile has great potential to develop lithium for storage systems. A second opportunity refers to the electrification and widespread use of hydrogen as a source of energy for public and private transport, which would support compliance with the established goals for local and global emissions. A third opportunity relates to the potential development of smart or intelligent cities, where a city is designed by and for the public, making use of processes to innovate, apply and develop
technologies that enable integrated and sustainable solutions to be incorporated into urban design. Smart cities can become platforms to facilitate the introduction of transportation with low emissions, with energy resources distributed cleanly and efficiently, in a manner that improves local sustainable development.

The details of Action Plans, additional goals and the stakeholders involved to achieve energy sector competitiveness are in Appendix 1, in the Guidelines 17 to 20.
3. Environmentally-friendly Energy

Compatibility between energy development and the environment must be at two levels: energy sources and environmental effects. A renewable energy goal is proposed with regard to energy sources. Guidelines are proposed for addressing local and global environmental effects.

A. RENEWABLE ENERGY MATRIX

New sources of renewable energy are increasing their share of the electricity generation matrix in Chile. This is not by chance. Historically, renewable sources of electricity generation, mainly hydroelectric, played an important role in Chile, accounting for around 65% of the total share in the 1960s and peaking at 80% in the 1980s. In the decades that followed, this percentage fell until it reached 40% in 2014, despite the fact that renewable energy has great potential for electricity generation in Chile.

Deliberative Surveys have revealed that people would not reject the construction of an electricity generation project in their community based on renewable energy technology, provided it complies with international environmental standards.31

In recent years there has been huge growth in Non-Conventional Renewable Energy (NCRE) sources. In 2005 there were 286 MW of installed NCRE capacity, whilst by September 2015 this

31 This data was extracted from the following question in the deliberative survey process: “To what extent would you support the construction of the following electricity generation projects in your community or in nearby communities, if they complied with the strict environmental and social requirements applied in developed countries, and provided concrete benefits for your community?” The responses were that 97% would not reject the construction of wind power plants, 97% for solar power plants, 90% for tidal power plants, 71% for geothermal power plants, 57% for hydroelectric power plants using reservoirs and 56% for run-of-river hydroelectric power plants.
had reached 2,135 MW, which represented 11.43% of the electricity generated in the country in October 2015.

The Energy 2050 NCRE Panel developed an assessment of the manageable technical and financial impacts arising from a significant increase in renewable sources (wind and solar). Initially they forecasted long-term scenarios to determine a plausible increase in NCRE within the expansion of the main interconnected systems, the SIC and the SING, using the criterion of minimum overall direct cost. In this phase, the results by 2035 indicate that on average NCRE might account for 40% of the electricity generated under various scenarios, and if we include all renewable energies, their share could be at around 60%.

This analysis revealed signs of a growing share of renewable energy sources, in particular hydroelectric, wind and solar power, without prejudice to the contribution from other renewable energy sources.

In order to complement and analyze the robustness of the NCRE Panel results, the Energy Center at the Universidad de Chile analyzed

Source: NCRE Panel – Ministry of Energy

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32 Considering the SIC, SING, Aysen and Magallanes.

33 The NCRE Panel brought together specialists from the public, private and academic sectors within the framework of Energy 2050, with support from the German Government through GIZ, who contributed their experience so that researchers from the Universidad de Chile could perform an analysis of a type never done before in Chile. Available at: http://www.energia2050.cl/material/633
plausible scenarios for the expansion of the electricity grid from 2015 to 2050, within the framework of the Energy 2050 process. The results for virtually all the scenarios analyzed, which included important energy efficiency measures, showed a large increase in renewable energy, with renewable energy comprising at least 70% of electricity generation by 2050.

This analysis shows a growing trend towards greater use of renewable energies and the models indicate these to be cost-effective sources, mainly solar and wind energy by 2050 (over 20 GW, respectively). Geothermal energy could also contribute, although with a lower potential than other renewable sources.

Hydroelectricity emerges as an important source in all the scenarios analyzed. It is important to increase the level of hydroelectricity to enable a greater penetration from variable sources, adding flexibility to the grid and minimizing emissions and costs. Although there will be increasing technological alternatives for energy storage, the advantage of hydroelectricity in terms of costs and availability as a domestic resource is significant. In a country with a good potential for storing energy in reservoirs, the possibilities of their use should be explored to the maximum extent possible, whilst safeguarding environmental sustainability as mentioned above, and also assessing the impact of climate change on future water availability. Therefore, the potential for electricity generation from renewable energies must be adjusted to match their vulnerability to changes in the climate.

As indicated in the 2050 Roadmap, Chile has 16 GW of gross potential for hydroelectricity. It will not be possible to develop this electricity potential without incorporating sustainability into these projects, although this also applies to all sources of electricity, both renewable and non-renewable. They all need to safeguard the environment, social dynamics and cultural values, appropriately integrating them into local and national economic progress. The Energy Policy for 2050 offers the opportunity to address the development of hydroelectricity in Chile by incorporating the concepts of sustainability and social and environmental stewardship, and promoting the advantages that this energy source represents for the country. Among the key advantages are hydroelectricity’s contribution to energy independence, flexibility, regulatory capacity and the additional services provided to the electricity grid, which encourage the incorporation of other renewable energy sources. Furthermore, hydroelectricity can contribute to reducing greenhouse gases.

The complement to this renewable energy matrix should be using the existing generation infrastructure to contribute as much as possible to the efficient performance of the system. We must focus on new developments with technologies that are low in emissions and cost-effective, such as natural gas and biomass. In the future it may be possible to include new technologies in

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34 This analysis used MAPS Chile information to predict demand, and used the information gathered by the NCRE Panel to predict electricity generation.

35 Details of these scenarios and the supporting assumptions can be found at: http://www.energia2050.cl/uploads/libros/hojaderuta.pdf.

36 Sources such as energy from the oceans, biomass/biogas, hydrogen and nuclear were not analyzed in detail, but will be evaluated when a Science, Technology and Innovation in Energy Policy is prepared, as indicated in the previous section on competitive prices.
storage systems and fuels, such as hydrogen, if they become economically viable. Therefore, the energy sector will be able to flexibly adapt to technological change, incorporating new energy sources that would move the grid toward more renewable and cleaner sources.

The analyses show that it is possible to achieve the goal of competitive prices without sacrificing environmental, social or supply quality goals. The simulations performed by the NCRE Panel found that incorporating variable renewable energy to achieve the goals set does not increase the costs of supplying electricity, even without considering future improvements in the flexibility of the system. The increase in competition, the expected cost reductions, and an adequate Energy Innovation and Efficiency Policy should compensate for cost increases associated with improved infrastructure, higher service quality and the internalization of external factors.

**GOALS FOR 2035:**

- At least 60% of the electricity generated in Chile comes from renewable energy sources.\textsuperscript{37}
- The complement to this renewable energy matrix should be using the existing generation infrastructure to contribute as much as possible to the efficient performance of the system. We must focus on new developments with technologies that are low in emissions and cost-effective, such as natural gas at present and other sources that will be developed in the future.

The following are fundamental guidelines for achieving the goal of a more renewable energy matrix:

- Promote a greater contribution from renewable energy sources to the electricity matrix.
- Promote sustainable hydroelectricity development, to increase renewable energy’s share of the electricity matrix.
- Promote the share in energy matrix of fuels with low GHG emissions and atmospheric pollutants.

The International Energy Agency believes that nuclear energy can play a key role in the reduction of CO2 emissions.\textsuperscript{38} Despite the fact that Chile’s Energy Policy does not exclude a priori any generation technology, nuclear energy has not been included as a short-term option, because it requires research on key issues, such as its long-term economic viability in the face of various legal and market conditions, and the legal and institutional amendments required.

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\textsuperscript{37} This goal is aligned with the United Nations Sustainable Development Objectives, which include substantially increasing the proportion of renewable energies in the global energy matrix by 2030.

among others. This research should be directed by the Chilean Nuclear Energy Commission (Comisión Chilena de Energía Nuclear, CCHEN) by drawing on competent national agencies. The next evaluation process of Chile’s long-term Energy Policy will review the appropriateness of incorporating this technology into the electricity generation matrix.

The details of Action Plans, additional goals and the stakeholders involved in achieving a Renewable Energy Matrix are in Appendix 1, in Guidelines 21 to 23.

**B. LOCAL EXTERNALITIES**

Rigorous environmental stewardship is an essential part of an Energy Policy focused on a sustainable energy system. The environmental effects of electricity generation, transmission and distribution, and the exploitation and consumption of liquid and solid fuels, involve risks and environmental impacts that must be anticipated, managed, incorporated and mitigated or compensated for when appropriate, considering the other Energy Policy objectives associated with the security, inclusion and competitiveness that energy offers the country.

The reasons why people currently reject new investment projects are largely based on environmental issues, in a manner consistent with complaints regarding the environmental impact of installing energy infrastructure. The deliberative discussions revealed that 70% of the people who reject energy construction projects in their regions argue that it is due to their environmental impact.

This Energy Policy recognizes that for the country to progress, the regulatory framework will need to be refined and improved on a regular basis, through reviewing and drafting new environmental management regulations and instruments and environmental sustainability standards relating to the energy sector, with inter-ministerial coordination. These programs must reflect the interests of society, ensuring that social welfare is maximized, and progressively reducing the gaps between current environmental regulations in Chile and those applied to other OECD countries. This will also involve reviewing these regulations and standards to keep our regulatory framework up to date and aligned with best international practice.

Reconciling energy development in Chile with the conservation of ecosystems and biodiversity presents a major challenge to the State, since 80% of the country is not covered by Protected Wildlife Areas. As biodiversity is essential to the maintenance of ecosystem services, it is important to progress towards Zero Net Loss of Biodiversity. First we should seek to avoid negative impacts; those impacts that cannot be avoided should be mitigated and the final option is to compensate for any impact that has occurred. There is no case in which there is zero impact. In the short term, the concept of Zero Net Loss of Biodiversity as it applies to energy development needs to be defined. We also need to improve the available base information so it can be correctly adopted, and implement the *The SEIA Guide*

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39 These and other aspects are mentioned in the conclusions of the report by the Nuclear Energy Committee in 2015, *Nuclear Electricity Generation in Chile, towards a rational decision*.

40 This data was extracted from the following question in the deliberative survey process: *Why do you take this position against the construction of new power stations in your region?*
to Compensate for Biodiversity⁴ issued by the Ministry of the Environment.

The situation described demonstrates the need to work with the Ministry of the Environment to review and draft new environmental management regulations and instruments for the energy sector. The Ministry of Energy will coordinate this process with the Ministry of the Environment and will address the environmental management topics that are considered necessary for inclusion in the review of regulations and instruments, following the existing process for the General Analysis of Economic and Social Impacts.

GOALS FOR 2050

Regulatory changes to new and existing regulations and environmental standards for energy projects are consistent with international guidelines and with the interests of society in these areas.

GOALS FOR 2035:

• Energy projects that come into operation adopt the Zero Net Loss Of Biodiversity approach.

Intermediate guidelines to achieve the proposed goals promote the internalization of environmental externalities relating to energy infrastructure, and the sustainable use and production of forest biomass for energy purposes, to protect natural heritage and human health.

Chile has significant areas that are relatively cold and so heating is necessary across a substantial part of the country. Historically firewood and its derivatives (pellets, briquettes, charcoal, among others) have been used, due to Chile's widespread forested areas, making firewood an economical solution to meet this need.⁴¹ The use of this energy source has become a cultural expression for the population that uses it, and an important part of their idiosyncrasy. However, it has also brought problems to human health, atmospheric pollution and the barely sustainable exploitation of forests.

Chile has the opportunity to use biomass as an abundant source of energy, as it is local, renewable, clean and fairly accessible, provided that it is correctly used. For example, using low humidity biomass. The Energy Policy recognizes the Use of Firewood and Derivatives for Heating Policy issued by the Ministry of Energy, which aims to improve the way in which we heat rooms in Chile, by progressing from firewood towards products with greater added value and efficiency and lower emissions. Therefore, more efficient buildings and sustainable firewood are needed, together with the development of markets for other sources of energy for heating, such as gas or electricity, improving heating technology, changing institutions and improving energy education. In particular, all communities should have regulations declaring forest biomass to be solid fuel, and a process to replace heaters or heating systems in saturated or dormant areas.

⁴¹ From the Sixth Region southwards, 81% of the energy used for heating comes from firewood. Other energy sources are natural gas at 9%, paraffin at 5%, liquefied gas at 4% and other sources of minor importance, such as coal, electricity and pellets (Source BNE, 2013).
The details of Action Plans, additional goals and the stakeholders involved Internalizing Local Externalities are in Appendix 1, in the Guidelines 24 to 25.

C. ENERGY AND CLIMATE CHANGE

There is now broad scientific consensus that the phenomenon of climate change is an unequivocal fact, mainly caused by human activities\(^\text{42}\) that emit greenhouse gases. In many regions of the world, changes in rainfall or melting snow and ice are altering hydrological systems, affecting the quantity and quality of water resources, and productive and service infrastructure, particularly those located near water courses and coasts. Furthermore, the IPCC predicts that during the twenty-first century, climate change will significantly reduce renewable surface water and groundwater resources in most dry subtropical regions, intensifying the competition for water between various sectors.

In Chile the prognosis is not much different. According to local weather projections,\(^\text{43}\) significant changes are expected in the hydrological conditions of various river basins, particularly between the Coquimbo and Los Lagos Regions, where a large proportion of hydroelectricity generation is concentrated. According to The Economics of Climate Change in Chile—Synthesis (CEPAL 2009) study, the reduction in the potential for hydroelectricity generation across the entire SIC would range from 11% in the immediate period analyzed (2011-2040), to 22% in the distant future (2079-2100) for IPCC scenario A2. Also, this same research suggests that the vast majority of river basins where mining activity is concentrated will continue to have a water deficit.

This will have an even greater effect on hydroelectricity generation, and will impact other activities where water is a key factor, such as mining and agriculture. Hydroelectric plants are sensitive to the flow of water, as a reduction in water flow can have a significant effect on electricity production. When the weather conditions reduce the availability of hydroelectricity, fossil fuel generation increases. This situation can be seen in Figure 23, which shows the pattern of GHG emissions in Chile and how it has historically fluctuated with hydroelectricity generation.

It has therefore become imperative to carefully assess the impact of climate change on electricity generation, and design a Climate Change Adaptation Plan for this sector that can be implemented over the coming decades.

In addition, the anthropic cause of climate change needs to be addressed in parallel. According to the IPCC, if we want to stabilize climate change at around 2°C above pre-industrial temperatures, we will need to reach 'zero net emissions' by the year 2100. The 2°C goal has been agreed by scientists as the maximum acceptable degree of global warming. The international community is aware that this is required in order to effectively address the problem of climate change, and is therefore committed to securing a new legally binding agreement that involves all the stakeholders in the struggle to contain climate change, with a central focus on reducing greenhouse gas emissions. This global

\(^{42}\) Mainly due to burning fossil fuels to generate energy, transport and energy intensive industrial processes, such as mining, changes in land use and forestry, and agriculture and livestock activities.

\(^{43}\) The Economics of Climate Change in Chile—Synthesis, CEPAL 2009; Second National Communication from Chile to the UN Framework Convention on Climate Change, 2011
collective action will minimize the impact of this phenomenon and will reduce the cost of measures to address the consequences.

The milestone for reaching this agreement was the twenty-first Conference of Parties of the Climate Change Convention (COP21), which took place in Paris in December 2015. When this agreement is reached, it is expected that there will be a "before and after Paris" for the world, and in particular for developing countries, which will have to actively participate in the reduction of emissions to the levels advised by scientists. Chile has already begun this journey by announcing its national contribution to the new Climate Change Treaty. Chile undertook to reduce its GHG emissions by 30% compared to 2007 levels by 2030, as a mitigating measure. If international financing is secured, this goal could increase to a 45% reduction in CO2 emissions per GDP unit.45

The energy sector contributed 75% of Chile’s total emissions in 2010, and approximately 28% of that total comes from the electricity generation sector, 22.5% from transport and 13.5% from mining and industry. Therefore, emission mitigation measures have to focus on these sectors. The implementation of an Emissions Mitigation Plan that is focused on these sectors will significantly reduce greenhouse gas emissions and complement other measures defined

44 Measured in terms of Emissions per Gross Domestic Product Unit.

45 The commitment also includes sustainable management and the recovery of 100,000 hectares of mainly native forest, to capture nearly 600,000 tons of equivalent CO2 per annum.
for the sector aimed at sustainable, competitive and safe energy development.

This Policy reflects that commitment by strongly supporting a gradual transition toward an economy, and an energy matrix, significantly lower in carbon by 2050. Making the best use of renewable energy resources, using low emission fuels, and exploring more extensive energy efficiency measures, are crucial elements in this transition.

The price of carbon combined with an intelligent energy reform could be crucial in unleashing clean technologies and building a low-carbon economy. Chile has established a tax on the overall pollution caused by electricity generation, which increases the cost of polluting energy sources. The analysis of other carbon price instruments will be important to internalize the environmental externalities of energy development. The World Bank initiative “Partnership for Market Readiness” will assess these economic and market instruments, such as Emissions Trading Schemes (ETS, or Cap & Trade), which may reduce carbon dioxide emissions and other greenhouse gases in the energy sector. This initiative focuses on the analysis of carbon pricing instruments to generate market mechanisms or through direct regulation, that will internalize part of the local and global social and environmental costs of these emissions.

The design of the Energy Policy for 2050 is a unique and strategic opportunity to integrate the issue of climate change into future energy development. Incorporating an analysis of mitigation and adaptation objectives will generate new perspectives on these impacts and the social, environmental and economic benefits. This entails designing each initiative to strengthen national, regional and local energy development.

GOALS FOR 2050

Greenhouse gas emissions by the Chilean energy sector are consistent with the global limits defined by science and with the corresponding national reduction goals, whilst promoting cost-effective mitigation measures.

GOALS FOR 2035:

- Contribute to the COP 21 commitment of reducing the intensity of GHG emissions in Chile by 30% compared to 2007 levels.
- Implementation of a GHG Emissions Mitigation Plan for the energy sector that is consistent with the goals committed to by Chile within the framework of international negotiations.
- The public policy instruments used to achieve the GHG mitigation goals are regularly reviewed.
- Implementation of a plan to adapt the energy sector to climate change, within the national climate change plan. This plan promotes measures to deal with climate variability and any potential damage to energy infrastructure. All the larger companies report and manage their GHG emissions, in a manner consistent with the country’s commitments.

A greater proportion of low GHG emission fuels is required, such as natural gas, hydrogen, biofuels, high quality firewood, pellets, solar thermal energy, among others, in order to achieve consistency with international emission standards and environmental regulations. These goals are for at least 65% of electricity genera-
tion to come from low GHG emission fuels and low atmospheric pollutants by 2050, and 50% by 2035. To achieving this goal it is important to consider its relationship with renewable electricity generation, because a greater proportion of electricity generated from renewable energy sources implies a smaller proportion of electricity generated from fuels.

The details of Action Plans, additional goals and the stakeholders involved in Energy and Climate Change are in Appendix 1, in the Guidelines 26 to 27.
4. Energy Efficiency and Energy Education

Despite all its benefits, energy efficiency will not happen automatically. It needs to be addressed by an integrated State policy that encompasses all segments of society. The Pillar of Energy Efficiency and Energy Education proposes guidelines, goals and plans to address this challenge.

A. ENERGY EFFICIENCY

As Chile advances toward development, the country’s economic growth will continue to require an increasing supply of energy. Even if these indices can be decoupled by implementing energy efficiency measures, the commitment made by developed countries will have to be replicated in Chile to ensure that the greater demand for energy is viable and sustainable.

One way of visualizing Chile’s challenges with regard to improving the use of energy is to observe the energy intensity index, which is the energy required to produce one unit of product. The index for Chile is above those for OECD countries, i.e. they are more energy efficient than Chile.

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46 Great commitments to energy efficiency are vital to achieving the long-term vision. The demand scenarios used to establish the goals incorporate important energy efficiency measures and competitive cost assumptions. The energy demand growth scenarios have been analyzed in http://www.energia2050.cl/uploads/libros/hojaderuta.pdf.

47 Decoupling is understood to mean that the growth rate of energy consumption is significantly lower than the growth rate of the economy.
However, Chile is more efficient than other developing and underdeveloped countries (non-OECD), which demonstrates Chile's competitive advantage in comparison to them (Figure 23). Nevertheless, the energy consumption growth rate per capita for Chile is above the average for OECD, South American and Caribbean countries, which is to be expected given the rate of development that Chile has achieved. But this certainly results in risks to providing the energy that will be required in the future (Figure 24).

Energy efficiency or the good use of energy is the foundation that enables the Energy Policy pillars to be achieved, provided that Chile's energy security is increased and its dependence on imported fossil fuels is reduced. The effect will be to decrease the cost of generating energy as demand reduces, and increase sustainability in the sector by reducing local pollution and GHG emissions as consumption falls.

In addition, energy efficiency produces benefits in various areas outside the energy sector. Within the industry it generates improvements in productivity and competitiveness; it creates employment and business in the energy services field; and it stimulates improvements in human capital by making productive processes more sophisticated. Within households, it improves the

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48 When using energy intensity to compare energy consumption between countries, it should be taken into consideration that they may have different productive structures. Therefore, a difference in this indicator can be due to both the energy efficiency policies adopted by a country and the development of energy intensive industrial production, such as those found in mining processes versus the service industry.
quality of life for people by increasing comfort levels, reducing their energy bills and reducing local and internal environmental pollution.

Over the last decade there has been progress in this area. However, there is still plenty of room for improvement, and the public policies currently being developed will be critical to encourage energy efficiency, as international experience has demonstrated.

For decades, a significant part of the developed world has had policies and regulations that promote energy efficiency and focus on different types of energy consumers. If we want to decisively progress in the same direction, we must propose measures to be implemented by the big consumers of energy: households, businesses, small industry, transport, buildings and the public sector. In addition, we must promote the development of the energy services industry, which will provide efficient and innovative solutions.

We need a modern regulatory framework that encourages energy efficiency to be adopted by industry, mining companies, businesses and households, that encourages vehicles to be replaced and secures a more efficient vehicular fleet, that secures higher efficiency standards in new and existing buildings, that encourages the public sector to reduce its energy costs and assign these resources to other purposes, and finally, that launches the energy services market and encourages this industry to develop.

Additionally, we must continue to provide information to consumers on labels, to set

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**FIGURE 25: ENERGY CONSUMPTION GROWTH RATE PER CAPITA FOR VARIOUS COUNTRIES**

![Energy Consumption Growth Rate Per Capita for Various Countries](image)

*Source: World Bank*
minimum consumption standards for various appliances, and to educate people on how to correctly use energy.

Progress in this direction will result in industries, mining companies and businesses that use energy highly efficiently, making them more productive and competitive, while reducing their carbon footprint and their impact on the environment, as a result of reducing the energy required to cover their needs. It will also increase Chile's energy security by reducing fossil fuel imports.

Within the transport sector, we will have a light, medium and heavy vehicle fleet that is more efficient, which will reduce fuel costs and polluting gas emissions, and contribute to greater energy security for the country. Additionally, we will incorporate efficiency into new bus procurement for public transport, to reduce total costs over the life cycle of these vehicles.

Our households will adopt best practice in their daily use of energy. More sustainable housing and more efficient equipment will become available. These measures will enable them to significantly reduce their expenditure on energy and to improve their comfort levels, whilst contributing to cleaner cities. The goals are associated with three large energy consumers: the industry and mining sector at 40% of final energy consumption for Chile, the transport sector at 33% of final consumption, and the residential, public and commercial sector at 21% of final consumption.

**GOALS FOR 2050**

- Growth in energy consumption is decoupled from GDP growth.
- Residential, Public and Commercial Sector:
  - 100% of the main categories of appliances and equipment sold in the market are energy efficient.
  - 100% of new buildings meet OECD standards for efficient construction, and are fitted with intelligent energy control and management systems.

- Transport Sector
  - Chile has adopted the highest international standards of energy efficiency for road, air, rail and maritime transport.

**GOALS FOR 2035:**

- Mining and Industrial Sector
  - 100% of the large consumers of energy (industrial, mining and transportation sectors) make efficient use of energy, with proactive energy management systems and the implementation of energy efficiency measures.

- Residential, Public and Commercial Sector
  - 100% of new public and residential buildings meet OECD standards for efficient construction.
• 70% of the main categories of appliances and equipment sold in the market are energy efficient.
• The Public Sector has high standards of energy efficiency at its facilities and projects, fulfilling its exemplary role.
• All residential buildings being sold in Chile report their energy consumption.

Transport Sector
• Chile has energy efficiency standards for the largest consumers of energy for road transport.
• All new tenders for public passenger transport include energy efficiency criteria in their evaluation.
• Energy efficiency standards are introduced for new lightweight vehicles.

These goals are aligned with UN Sustainable Development Objectives that aim to double the rate of improvement in overall energy efficiency by 2030.

Intermediate guidelines for energy efficiency are as follows:

• Build a robust regulatory framework for energy efficiency. Progressively implement energy management tools that have been validated by competent bodies.
• Use locally available resources and explore potential energy savings in production processes.
• Build efficiently by incorporating energy efficiency standards into the design, construction and refurbishment of buildings, in order to minimize energy requirements and environmental externalities, whilst attaining adequate comfort levels.
• Promote control, intelligent energy management and self-generation systems to enable progress to be made towards buildings with efficient solutions to meet their energy needs.
• Strengthen the market for efficient buildings, and progress toward more productive and efficient local markets. Improve the energy efficiency of vehicles.
• Promote a fundamental shift toward more efficient modes of transport.

The details of Action Plans, additional goals and the stakeholders involved in Energy Efficiency are in Appendix 1, in the Guidelines 28 to 35.

B. EDUCATION AND ENERGY CULTURE

Energy is an important factor in the development of our country. We need it in every moment of our lives since it is a basic element that enables us to have education, healthcare, security, transport, communication, food, etc. However, we do not often reflect on its role in supporting our daily lives. Above all, we are not aware of its benefits and the potential for development that it offers. Instead, we visualize the problems associated with installing and operating energy projects. This results in the public rejecting energy infrastructure projects, and communities failing to value or carefully use energy.

The current diagnosis is that asymmetric information and knowledge can be found amongst members of the public regarding energy issues. This highlights the need to inform and education different sectors about this topic, and we need to promote public debate on the present and future challenges facing Energy Policy in our country. We must distinguish between "information" and "education", since the first concept refers to a
particular situation or providing basic data on a specific subject, while the concept of "education" is broader and involves a long-term vision that enables knowledge to be built.\textsuperscript{49}

However, it is not enough to correct the information asymmetries between members of the public regarding energy issues. We also need to generate knowledge, build capacities, and align interests and objectives, in order to develop a shared vision of the country's development, to fill the gaps that prevent the achievement of strategic objectives for the energy sector by 2050.

On our path to becoming a developed country, we urgently need to make concrete and extensive progress that enables the public to understand the role of energy in our lives, appreciate its contribution, develop it, transform it into an opportunity, improve it and care for it.

The solution to most of these challenges can be found in various forms of education, understood to be:

- **Informal education**: A process linked to developing people within society, facilitated by their interaction, without requiring an educational establishment. It happens in a non-structured and systematic way within the nuclear family, in the media, at work and in a person's general surroundings.

- **Formal education**: A structured process that is systematically and sequentially delivered. It comprises levels and methods that secure a uniform educational process and ensures that it can continue throughout people's lives.

- **Non-formal education**: An educative process that uses a systematic though not necessarily evaluated program, which can be verified as valuable learning, and may eventually result in a certificate.

Therefore, nursery, junior and senior school education provides us with an opportunity to convey to new generations sufficient knowledge to change current habits, favoring the installation of an energy culture in Chile.

In higher education, it is important to introduce energy into training plans for technical and vocational education, to capture value and potential positive externalities where energy development is taking place, while at the same time promoting innovation in Chile. This can be achieved by providing competitive funds to promote research into new energy technologies, by providing national and international fellowships and internships to promote technical, vocational and post-graduate education, and by providing specialization grants to professionals in the energy sector.

Additionally, civic education is required in order to promote an energy culture within nursery, junior, senior and higher education, and to the general public. The aim being to encourage people to learn in informal and non-formal environments, through systematic campaigns that promote the principles of valuing and caring for energy. We have a valuable opportunity to design communication initiatives that raise public awareness and achieve the cultural change necessary to advance towards the goals Chile has set itself.

\textsuperscript{49} The importance of education was already highlighted at the Johannesburg Summit (2002): "The objective of sustainable development and eradicating poverty cannot be achieved, without investment in primary education and public outreach".
We need to educate the general public, social organizations, the authorities and those public bodies who make energy decisions. It is also vital to foster coordination with environmental certification initiatives at municipal level and the extension of energy-related competencies among technicians and professionals at different public and private organizations that currently participate in formal and informal environmental assessment processes.

In formal education, energy should be incorporated in preschool education and continued in elementary and high school education. This education should focus on an integrated understanding of energy, rather than teaching specific knowledge that quickly becomes technically obsolete. Initiatives can be developed that promote changes and improvements in curricular and extracurricular programs, so they can provide broad general knowledge to new generations, and optional advanced courses to those who show a special interest. It is therefore fundamental that the national curriculum at all educational levels is updated and that teachers and students are provided with educational resources to give them a theoretical and experimental experience in the classroom. Specific interventions need to be incorporated to enable the educational community to address issues, train teachers, provide competitive funds to equip science laboratories in educational establishments, develop educational programs using public-private partnerships, etc.

It is essential to promote training and certification of technical and professional skills so there are people with the skills and abilities necessary to develop energy in Chile. We must therefore progress with developing job profiles and vocational training to contribute technical support to the energy matrix, and develop professional and technical human capital that supports the production, innovation and use of sustainable management of energy.

We currently have higher education establishments that provide such courses. However, there are still gaps in the training of those workers and professionals that are needed in a mature market in order to internally satisfy the expansion and innovation needs of our energy matrix, to drive the productive and social development of our country.

Design informative and/or educational programs, especially for priority stakeholders, in formal, non-formal and informal education, in order to contribute to collective knowledge amongst the general public, which enables changes to occur in consumption habits, and contributes to discussions on energy development and its sustainable growth. We therefore need to take advantage of the potential offered by digital media and e-learning platforms, which represents an opportunity to broaden the coverage of our target audience.

State organizations must coordinate to secure the availability of relevant and timely courses that are differentiated by target audience, whilst encouraging public-private partnerships to implement priority initiatives that build a culture of energy education in our country.

If this can be achieved in a planned and systematic manner, by 2035 we shall have a new generation of young people who are aware of the fundamental role of energy in all aspects of human life, who are committed to its promotion and care, willing to lay the foundations for a new civic culture to develop energy in Chile, and integrating their energy vocation across all of Chile’s regions.
The purpose of the goals and plans detailed below is to strengthen energy education so as to promote behavioral changes in society with regard to sustainable energy production and consumption, either through existing programs or mechanisms in other public services or through the generation of targeted courses that value the energy sector and focus on its requirements, both because of its strategic importance to the productive sector, and to promote a culture of energy responsibility amongst the population as a whole.

GOALS FOR 2050

- An energy culture exists at all levels of society, including among producers, suppliers, consumers and users.
- A new energy culture exists at public and private institutions.

GOALS FOR 2035:

- Everyone who is interested in energy is well informed.
- 100% of formal education plans incorporate cross-curricular contents relating to energy development.
- National awareness programs on carefully using energy and sustainable energy, with a macro-zonal approach that reflects the situation in each area and community, are developed and implemented.
- National energy education programs, with a macro-zonal approach that reflects the situation in each area and community, are developed and implemented.

Additionally, competency profiles will need to be prepared, implemented and monitored for the energy sector, to diagnose market requirements when implementing the long-term Energy Policy.

The details of Action Plans, additional goals and the stakeholders involved in Education and Energy Culture are in Appendix 1, in the Guidelines 36 to 38.
5. The Monitoring and Review Process for Energy Policy

This Energy Policy grew from a process that enabled the construction of political, technical and social validation. The objective of this process has been to create a State Energy Policy, to guide the preparation of public policies relating to the energy sector over the coming years. Therefore, the Energy Policy will be approved by Supreme Decree signed by the President of Chile, and endorsed by all the ministries involved, to secure full inter-ministerial cooperation.

When this policy has been published, institutional mechanisms will need to be agreed and validated that enable the monitoring and evaluation of its implementation status.

While this Policy is being implemented, technological changes, external shocks, or new priorities for society may arise that change the projected scenario. Therefore, these institutional mechanisms must allow the Policy to be reviewed in the light of new conditions in the regional, national and international context, and its course corrected, if necessary.

The key institutional elements associated with implementing and monitoring the long-term Energy Policy therefore include the following criteria:

- Long-term commitment and review: a long-term Energy Policy with commitment from the State, and subject to a regular, participatory review every 5 years.
- For each review, an Advisory Committee will be established, comprising people from various areas related to the energy sector. This committee will propose changes to the long-term Energy Policy.
- Follow-up and monitoring: there will be mechanisms to follow up, monitor and evaluate on an ongoing basis.
- Annual Monitoring Report on the policies and goals established by the Ministry of Energy, submitted to the Civil Society Council at the Ministry and to the citizens through the Ministry’s Participatory Public Accountability Report, as defined by Law 20,500 on Associations and Civil Participation on Public Administration.
• Adequate coordination between the Ministry of Energy and other public services.

In order to fulfill commitments relating to the implementation, review and monitoring, mechanisms, resources and processes will be needed to ensure that the reviews are politically, socially and technically valid. The Ministry of Energy will ensure that there is sufficient knowledge and information to monitor and review the long-term Energy Policy.

The first step in implementing the long-term Energy Policy will be to prepare a short-term Agenda to address the challenges for the period leading up to 2020, when a review of the Energy Policy will update the priorities for this sector. This Agenda will contain the legal and regulatory changes that are required to continue moving in the same direction between 2035 and 2050. This Agenda will be prepared during 2016.
APPENDIX 1: Details of Guidelines, Action Plans, Goals and Stakeholders
Quality and Security of Supply

GUIDELINE 1: DEVELOP NATIONAL, REGIONAL AND MUNICIPAL PLANS FOR MANAGING RISks AND EMERGENCIES AFFECTING THE ENERGY SECTOR THAT ARE ALIGNED WITH OTHER SECTORAL AND NATIONAL PLANS

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
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<tbody>
<tr>
<td>Develop national, regional and municipal plans for managing risks and emergencies affecting the energy sector. Such plans must be regularly updated.</td>
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<tr>
<td>Develop an institutional framework for managing risks and emergencies affecting the energy sector.</td>
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<th>GOALS FOR 2035</th>
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<tbody>
<tr>
<td>• The country has the institutional framework for managing risks and emergencies affecting the energy sector.</td>
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<tr>
<td>• Chile has adopted national, regional and local plans to manage energy risks and contingencies. These plans are regularly updated through predefined procedures.</td>
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<tr>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>The energy system is robust and highly resilient to external shocks.</td>
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</table>

STAKEHOLDERS: Ministry of Energy, SEC, ONEMI, market agents, electricity system operators, Interior Ministry.
The energy system is robust and highly resilient to external shocks. The infrastructure for managing critical situations and the associated management models are developed. The energy system is robust and highly resilient to external shocks.

**GUIDELINE 2: PROMOTE A COST-EFFECTIVE INFRASTRUCTURE FOR ADDRESSING CRITICAL SITUATIONS ARISING AS A RESULT OF FORCE MAJEURE.**

**GOALS FOR 2035**
- The infrastructure for managing critical situations and the associated management models are developed.

**GOALS FOR 2050**
- The energy system is robust and highly resilient to external shocks.

**STAKEHOLDERS:** Ministry of Energy, Interior Ministry, ONEMI, electricity system operators, CNE, universities, market agents.

**GUIDELINE 3: INCREASE THE SECURITY OF THE SUPPLY, STORAGE, TRANSPORT AND DISTRIBUTION OF FUELS.**

**GOALS FOR 2035**
- Chile has an energy supply system and sufficient stocks to guarantee availability of supplies across the entire country.

**GOALS FOR 2050**
- New access routes by area to ensure that secure fuel supplies are a reality.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Foreign Affairs, ENAP, distribution companies, trucking companies, new private stakeholders.

- Prepare a register of energy and non-energy infrastructure, and critical public buildings and natural disaster zones.
- Define critical infrastructure.
- Identify the events and contingencies that should be included within critical infrastructure requirements.
- Systematically implement the critical infrastructure and management models required.
- Develop financing mechanisms and incentives for developing and implementing critical infrastructure.

- Increase investments in infrastructure to support the fuel chain.
- Reduce the vulnerability of fuel supplies, through bilateral actions in special interest markets.
### GUIDELINE 4: PROMOTE RESEARCH INTO AND THE EXPLORATION AND EXPLOITATION OF CHILE’S HYDROCARBON RESOURCES.

**STAKEHOLDERS:** Ministry of Energy, ENAP, oil refining companies, petrochemical and LNG companies.

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<tr>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>The hydrocarbon resources in the Magallanes basin have been identified.</td>
<td>The hydrocarbon resources in Chile have been identified.</td>
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<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
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<tbody>
<tr>
<td>Promote research into and exploration of hydrocarbon deposits in Magallanes basin and design plans to expedite their extraction under environmentally appropriate conditions.</td>
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<tr>
<td>Promote research into and exploration of hydrocarbon deposits across Chile in environmentally appropriate conditions.</td>
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### GUIDELINE 5: PROMOTE AN INTELLIGENT SYSTEM TO PRODUCE AND MANAGE IN A DECENTRALIZED MANNER THE ENERGY REQUIRED FOR THE RESIDENTIAL, PUBLIC AND COMMERCIAL SECTORS, TO SERVE NOT JUST PRIVATE USERS, BUT ALSO COOPERATIVES, MUNICIPAL GOVERNMENTS AND OTHER ORGANIZATIONS.

**STAKEHOLDERS:** Ministry of Energy, electricity system operators, CNE, universities.

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<tr>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tr>
<td>The electricity system is completely bidirectional, with information technology systems making it possible to produce and manage energy at all levels of the system, in ways similar to other OECD countries.</td>
<td>The public, commercial and residential sectors make use of the potential for distributed generation and management of electricity demand.</td>
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<th>ACTIONS</th>
<th>2016</th>
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<tbody>
<tr>
<td>Conduct demand characterization studies for each type of customer, by geographic zones, at an intra-day level.</td>
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<td>Evaluate introducing telecommunications technology into energy consumption devices.</td>
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<tr>
<td>Evaluate, design and implement mechanisms and incentives to adopt smart technology that contributes to system flexibility.</td>
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<tr>
<td>Cost-benefit analysis studies of Demand Response (DR) programs.</td>
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<tr>
<td>Technical training for end users with respect to smart technologies for communication and management.</td>
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<tr>
<td>Evaluate the potential costs and benefits of regulatory changes to promote an intelligent system to produce and manage energy in a decentralized manner.</td>
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<td>Regularly review the design of the transmission network to respond to the new configuration of the electricity system and to demand.</td>
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**GUIDELINE 6: PROMOTE EFFICIENT REGIONAL ENERGY EXCHANGE TO INCREASE THE FLEXIBILITY OF THE ELECTRICITY SYSTEM.**

**ACTIONS**

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<th>Year</th>
<th>2016</th>
<th>2020</th>
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<tr>
<td>• Analyze and develop opportunities for exchange that benefit the matrix and its security.</td>
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<tr>
<td>• Establish an international relations strategy in order to achieve a robust legal and regulatory framework providing security for investors and guaranteeing supply.</td>
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<tr>
<td>• Progress regulatory harmonization and information systematization for regional energy infrastructure.</td>
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**GOALS FOR 2035**

- Chile's interconnection with the other SINEA member countries, and other South American nations, especially the members of MERCOSUR, is a reality.

**GOALS FOR 2050**

- Regional energy integration has become a reality, favoring supply security and economic efficiency.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Foreign Affairs, CNE, multilateral agencies, electricity system operators.

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**GUIDELINE 7: ENSURE CONTINUOUS ACCESS TO ENERGY FOR VULNERABLE FAMILIES, BASED ON SECURITY AND EFFICIENCY STANDARDS AND CRITERIA THAT ARE COMMON TO THE ENTIRE POPULATION.**

**ACTIONS**

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<tr>
<th>Year</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
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<tbody>
<tr>
<td>Promote instruments and incentives that ensure a high quality and continuous supply of energy.</td>
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<td>Strengthen the oversight mechanisms for energy generation, transmission and distribution companies to minimize the risk of outages through noncompliance.</td>
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<tr>
<td>Provide clear, timely and simple information on sources of financing to implement energy solutions that promote a high quality and continuous supply of energy.</td>
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<tr>
<td>• Develop a regulatory framework that secures sustainable energy services, to guarantee access to energy in isolated areas.</td>
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<tr>
<td>• Generate programs to develop energy solutions for the public that ensure a high quality and continuous supply of energy.</td>
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**GOALS FOR 2035**

- 100% of homes of vulnerable families have continuous quality access to energy services.
- Electricity outages do not exceed 4 hours/year in any locality in Chile, except in cases of force majeure.

**GOALS FOR 2050**

- 100% of the population has continuous quality access to energy services.
- Electricity outages do not exceed 1 hour/year in any locality in Chile, except in cases of force majeure.

### Energy as a Driving Force for Development

**Guideline 8:** Empower stakeholders, organizations and communities in the area of energy development with regard to information about energy projects and their associated impacts, including participation in their development. Also build capacities for generating opportunities for local development in accordance with the characteristics of the area and the cultural context.

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<tr>
<th>ACTIONS</th>
<th>GOALS FOR 2035</th>
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<tbody>
<tr>
<td>2016</td>
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<td>2030</td>
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</table>

- **Actions:**
  - Implement an information, training and empowerment plan for organizations regarding energy issues related to projects developed in their communities, which enables information from those organizations to be generated and fed back into existing information systems.
  - Generate organizational strengthening programs for communities where energy projects are taking place.
  - Allocate public and private resources for capacity building among stakeholders, communities and organizations to generate opportunities for local development in matters such as energy efficiency, solar thermal systems, and socio-environmental technologies for using energy on a small scale.

- **Goals for 2035:**
  - An institutionalized and regulated process exists to ensure that all relevant stakeholders, organizations and communities are informed, trained and empowered with regard to the energy issues that interest them, and to build their capacities for generating local energy development opportunities.

- **Goals for 2050:**
  - An institutionalized and regulated process exists to ensure that all relevant stakeholders, organizations and communities are informed, trained and empowered with regard to the energy issues that interest them, and to build their capacities for generating local energy development opportunities.

**Stakeholders:** Ministry of Energy, Social Organizations Division (MSGG), Ministry of Social Development, Ministry of Finance, SUB-DERE, civil society, private enterprises.
GUIDELINE 9: ENSURE THAT ENERGY DEVELOPMENT FAVORS LOCAL DEVELOPMENT AS DEFINED BY THE COMMUNITY IN A MANNER THAT IS CONSISTENT WITH THE NATIONAL AND REGIONAL STRATEGY, AND THAT FACILITATES THE IMPLEMENTATION OF ENERGY DEVELOPMENTS AND PROJECTS PROMOTED BY SMALL PRODUCERS AND COMMUNITIES INTERESTED IN TAKING ADVANTAGE OF LOCAL ENERGY RESOURCES.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Social Development, Ministry of Finance, Ministry of Agriculture, Regional Governments, SUB-DERE, CONADI, municipalities, civil society, the public, NGOs, universities, trade associations and companies.

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Address the definition of community at different territorial levels for inclusion by planning authorities in energy-related instruments.</td>
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<tr>
<td>• Generate shared diagnostics to implement local development opportunities that are enhanced by energy development on any scale.</td>
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<tr>
<td>• Generate project portfolios that provide collective benefits and develop local markets and production chains.</td>
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<tr>
<td>• Evaluate and develop associativity tools to enable companies to contribute to local development, such as creating private development corporations with extensive local representation that coordinate public and private resources, etc.</td>
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<tr>
<td>• Implement a technical assistance program for communities, so they can take advantage of local energy opportunities.</td>
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<tr>
<td>Generate energy development planning mechanisms focused on local development that ensure public participation.</td>
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<table>
<thead>
<tr>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>• All energy projects under way in Chile have adopted mechanisms for associativity between communities and the private sector, thereby promoting local development and improving implementation of the projects.</td>
<td>• All energy projects under way in Chile have adopted mechanisms for associativity between communities and the private sector, thereby promoting local development and improving implementation of the projects.</td>
</tr>
<tr>
<td>• Local communities take advantage of energy projects, either through their own means and/or through associativity mechanisms, provided such projects are financially feasible, contribute to local development, and are of interest to the community.</td>
<td>• Local communities take advantage of energy projects, either through their own means and/or through associativity mechanisms, provided such projects are financially feasible, contribute to local development, and are of interest to the community.</td>
</tr>
</tbody>
</table>
GUIDELINE 10: THE STATE MUST ENSURE THE EXISTENCE OF FORMAL, TIMELY, INFORMED, SYMMETRICAL AND PERTINENT PUBLIC PARTICIPATION PROCESSES THAT IMPACT NATIONAL, REGIONAL AND LOCAL POLICIES, PLANS AND PROJECTS.

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<thead>
<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
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<tbody>
<tr>
<td>• Implement educational processes regarding public participation in energy issues.</td>
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<tr>
<td>• Implement, monitor and evaluate participation criteria and standards for policies, plans and projects throughout their life cycle, helping to reduce their asymmetries.</td>
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<tr>
<td>• Develop mechanisms for channeling and resolving disputes in policies, plans and projects, where all stakeholders are represented.</td>
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<tr>
<td>• Promote coordination within communities to apply best international practices with regard to participatory processes, as adapted to national circumstances.</td>
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<tr>
<td>• Design public empowerment indicators for energy issues that measure the impact of public participation processes.</td>
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<tr>
<td>Create predictability and community conflict resolution mechanisms that are appropriate, efficient and effective, and that reconcile local interests with those of the country.</td>
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GOALS FOR 2035

Public participation processes have an impact and follow best international practice, adjusted to the circumstances in Chile.

GOALS FOR 2050

Public participation processes have an impact and follow best international practice, adjusted to the circumstances in Chile.
GUIDELINE 11: DEFINE THE CONCEPT AND MEASUREMENT OF ENERGY POVERTY, IN ORDER TO ADOPT SPECIFIC POLICIES TO REDUCE IT.

**ACTIONS**

- Define basic energy requirements and regularly review them.
- Define energy consumption and quality standards that meet basic energy needs, taking into account local circumstances and climatic areas.
- Generate information about the availability of energy services to meet basic needs.
- Develop the concept of energy poverty, which includes access to sufficient energy to meet basic energy needs. Regularly review these items.
- Generate baseline data associated with consumption and quality standards for energy services and access to energy to meet basic energy needs.
- Identify the target population as those people living below the energy poverty line and vulnerable families.
- Generate programs to develop energy solutions for the target population, and review them every five years.
- Provide clear, timely and simple information on sources of financing to achieve equitable access to energy for the target population.
- Analyze instruments, incentives, and regulatory changes that increase equitable access to energy.
- Implement financing mechanisms for infrastructure investments to achieve equitable access to energy for the target population.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Social Development, Ministry of Housing and Urban Development, Regional Governments, Regional Energy Authorities, municipalities, SEC, CNE, INE, civil society, citizens, universities.

**GOALS FOR 2035**

- Ensure universal and equitable access to modern, reliable and affordable energy services for vulnerable families.

**GOALS FOR 2050**

- Ensure universal and equitable access to modern, reliable and affordable energy services for the entire population.
Vulnerable families reduce the percentage of their income spent on basic energy needs to levels defined as suitable for Chile.

Obtain regular statistics and indicators regarding basic energy needs and average energy expenditure, according to the income level of vulnerable families.

Define as a percentage of income the level of expenditure needed to cover basic energy needs, in accordance with the geographical, socio-economic and cultural circumstances in Chile, in order to focus planning authorities on reducing this proportion.

Identify mechanisms for reducing the proportion of family expenditure that is spent on basic energy needs.

Introduce building regulations for housing for vulnerable families that enables energy consumption to be reduced.

GUIDELINE 12: REDUCE THE CURRENT RATIO BETWEEN THE INCOME LEVEL AND ENERGY EXPENDITURE OF VULNERABLE FAMILIES, WITHOUT NEGLECTING BASIC STANDARDS OF THERMAL AND LIGHTING COMFORT.


GUIDELINE 13: ACHIEVE ACCEPTABLE STANDARDS OF THERMAL AND LIGHTING COMFORT IN THE HOMES OF VULNERABLE FAMILIES IN CHILE.

GUIDELINE 14: INTEGRATE AND ALIGN THE INTERESTS OF STAKEHOLDERS, SECTORS, AND NATIONAL, REGIONAL AND LOCAL INSTITUTIONS AND LEVELS ASSOCIATED WITH MANAGING LAND FOR ENERGY DEVELOPMENT.

GUIDELINE 15: INTEGRATE INTO URBAN AND RURAL PLANNING THE REQUIREMENTS FOR EFFICIENT AND LESS POLLUTING TRANSPORT SYSTEMS AND BUILDINGS

**STAKEHOLDERS:** Ministry of Energy, Ministry of the Environment, Ministry of Transport and Telecommunications, Ministry of Housing and Urban Development, SUB-DERE, CONAF, Regional Governments, municipalities, Regional Energy Authorities, CNE, universities and companies.
### GUIDELINE 16: REDUCE DISTANCES AND THE NUMBER OF TRIPS TO IMPROVE TRANSPORT EFFICIENCY.

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<thead>
<tr>
<th>ACTIONS</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>Incorporate transport efficiency criteria into urban planning and policy instruments, to shorten journeys and reduce traveling time when commuting between home and work.</td>
<td>100% of the urban development plans and instruments for the main cities in Chile are developed and evaluated using transport efficiency criteria, such as the length and time of journeys to carry out activities.</td>
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<tr>
<td>Promote teleworking, to reducing the number of trips.</td>
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### GUIDELINE 17: PROMOTE COMPETITIVE PRICES AS AN ESSENTIAL CONDITION FOR CHILE’S SUSTAINABLE DEVELOPMENT, BRINGING COMPETITIVENESS TO PRODUCTIVE SECTORS.

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<tr>
<th>ACTIONS</th>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>• Eliminate barriers to competition in the electricity sector, including amendments the transmission regulations.</td>
<td>Chile is among the 5 OECD countries with the lowest average residential and industrial electricity prices.</td>
<td>Chile is among the 3 OECD countries with the lowest average residential and industrial electricity prices.</td>
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<tr>
<td>• Monitor market functioning and defend competition.</td>
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<tr>
<td>Continuously improve bidding process for distributors.</td>
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<td>Establish economically efficient and sustainable exchanges with neighboring countries.</td>
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<td>Bring information transparency to the contract market and evaluate tender mechanisms for groups of unregulated customers.</td>
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<tr>
<td>STAKEHOLDERS: Ministry of Energy, Ministry of Foreign Affairs, CNE, National Economic Inspection, Tribunal for the Defense of Free Competition, free consumers, universities, distributors, electricity system operators, private sector.</td>
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</tbody>
</table>
CHILE has become an exporter of technology and services for specific energy innovations. Innovation policies in the energy industry contribute to achieving a reduction in energy consumption.


GUIDELINE 19: REDUCE BARRIERS TO INNOVATION AND ENTREPRENEURSHIP IN ENERGY.

ACTIONS
2016 2020 2025 2030

• Identify and remove regulatory barriers to energy innovation.
• Install a process to monitor the latest national and international technological advances applicable to the Chilean energy sector.
• Promote innovation management programs in energy companies.
• Promote mechanisms to incorporate highly skilled human capital into the energy sector.
• Promote the adoption and transfer of new technology, and coordinate pilot initiatives.

GOALS FOR 2035
Chile has become an exporter of technology and services for the solar industry.

GOALS FOR 2050
• Chile has become an exporter of technology and services for specific energy innovations.
• Innovation policies in the energy industry contribute to achieving a reduction in energy consumption.

Chile has become an exporter of technology and services for specific energy innovations.

Innovation policies in the energy industry contribute to achieving a reduction in energy consumption.

STAKEHOLDERS: Ministry of Energy, Ministry of Education, CORFO, CONICYT, AGCID, universities, research centers, trade associations.
Environmentally-friendly Energy

**GUIDELINE 21: PROMOTE A GREATER CONTRIBUTION FROM RENEWABLE ENERGY SOURCES TO THE ELECTRICITY MATRIX.**

**ACTIONS**

- Reduce barriers to improve the competitiveness of prioritized sources, without resorting to subsidies that distort the electricity market.
- Study and apply mechanisms to efficiently remunerate the complementary services aimed at increasing the flexibility of the electricity grid.
- Study mechanisms to increase the flexibility of the electricity grid to international standards.

**GOALS FOR 2035**

- At least 60% of the electricity generated in Chile comes from renewable energy sources.
- The complement to this renewable energy matrix should be using the existing generation infrastructure to contribute as much as possible to the efficient performance of the system. We must focus on new developments with technologies that are low in emissions and cost-effective, such as natural gas at present and other sources that will be developed in the future.

**GOALS FOR 2050**

- At least 70% of national electricity generation should come from renewable energy sources.
- The complement to this renewable energy matrix should be using the existing generation infrastructure to contribute as much as possible to the efficient performance of the system. We must focus on new developments with technologies that are low in emissions and cost-effective.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Environment, CONAF, General Water Directorate, CNE, electricity system operators, universities, trade associations.
**GUIDELINE 22: PROMOTE SUSTAINABLE HYDROELECTRICITY DEVELOPMENT TO INCREASE RENEWABLE ENERGY’S SHARE OF THE ELECTRICITY MATRIX.**

**ACTIONS**

- Provide economic, social, cultural, environmental and productive information for the territorial management instruments of at least eight basins in Chile.
- Develop a coordination mechanism between the public, private, civil society and academic sectors to implement hydroelectricity sustainability standards.
- The energy sector participates in the inter-sectoral panel on water resources, with special emphasis on legislative proposals relating to the regulatory framework for water rights and the economic mechanisms that support and sustain the generation of hydroelectricity.
- Develop proposals to regulate intra-day flow variations caused by peak generation, in the context of operating the electricity grid.
- Support the development of standards to protect biodiversity and ecosystems associated with the specific impacts of hydroelectricity.

**STAKEHOLDERS:** Ministry of Energy, Ministry of Environment, General Water Directorate, Public Services, universities, civil society, electricity system operators, trade associations.

**GOALS FOR 2035**

- Provide flexibility and security to the electricity grid through its regulatory capacity.

**GOALS FOR 2050**

- Contribute significantly to the goal of renewable energy having a 70% share of the electricity grid.

---

**GUIDELINE 23: PROMOTE THE SHARE IN ENERGY MATRIX OF FUELS WITH LOW GHG EMISSIONS AND ATMOSPHERIC POLLUTANTS.**

**ACTIONS**

- Develop standards for the hazardous substances contained in fuels.

**STAKEHOLDERS:** Ministry of Energy, Ministry of the Environment, Ministry of Transport and Telecommunications, Ministry of Economy, Ministry of Finance, CORFO, Forestry Institute, General Water Direction, universities.

**GOALS FOR 2035**

- At least 50% of the fuels in the energy matrix should be low in GHG emissions and atmospheric pollutants.

**GOALS FOR 2050**

- At least 65% of the fuels in the energy matrix should be low in GHG emissions and atmospheric pollutants.
• Bring greater professionalism to the market, strengthen technical skills throughout the production and marketing chain for firewood and its derivatives.
• Secure technological improvements for individual equipment in urban areas, and promote minimum standards and technology labeling through replacing heaters in rural areas.
• Increase productivity in the market for firewood and its derivatives, by investing in infrastructure, technology and training.

• Strengthen management plans for exploiting firewood in native productive forests.
• Strengthen regulations and oversight to ensure the sustainable production of this resource.

Implement the regulation that declares forest biomass to be a solid fuel.

Start collective heating pilots in areas that have Decontamination Plans, and define financially viable business models for them, in order to switch from individual to collective heating in urban areas, where it is cost-effective.

• Forest biomass as a solid fuel is completely regulated.
• 40% of native forests that produce firewood and forest biomass have regulations that control the sustainable management and production of this resource, in accordance with national and/or international standards.


GOALS FOR 2035
• All native forests that produce firewood and biomass are regulated and managed in accordance with national and/or international standards.
• The use of collective heating using biomass with emissions exceeding 0.5 g/h under any operating arrangement is predominant in saturated or dormant areas.

GOALS FOR 2050
• 30% of heaters have been replaced with equipment that meets a minimum standard, in saturated or dormant areas.
Regulatory changes to new and existing regulations and environmental standards for energy projects are consistent with international guidelines and with the interests of society in these areas.

Energy projects that come into operation adopt the Zero Net Loss of Biodiversity approach.

Regulatory changes to new and existing regulations and environmental standards for energy projects are consistent with international guidelines and with the interests of society in these areas.

**STAKEHOLDERS:** Ministry of Energy, Ministry of the Environment, CONAF, universities, energy companies, trade associations.
### GUIDELINE 26: PROMOTE THE REDUCTION OF GHG EMISSIONS IN THE ENERGY SECTOR.

**Actions**

- Analyze GHG mitigation tools within the framework of the "Market Preparation Alliance" initiative.
- Assign resources to design and implement a GHG Emissions Mitigation Plan for the energy sector.
- Update the emission factors for the SIC-SING.
- Develop a plan to adapt the energy sector to climate change.

**Goals for 2035**

- Contribute to COP 21 commitments.
- Implement a GHG Emissions Mitigation Plan for the energy sector.
- The public policy instruments used to achieve the GHG mitigation goals are regularly reviewed.
- Implement a plan to adapt the energy sector to climate change, within the national climate change plan.

**Goals for 2050**

- Greenhouse gas emissions by the Chilean energy sector are consistent with the global limits defined by science and with the corresponding national reduction goals, whilst promoting cost-effective mitigation measures.

**Stakeholders:** Ministry of Energy, Ministry of Finance, Ministry of the Environment, CONAF, universities, industry, trade associations, businesses.

### GUIDELINE 27: REPORT AND MANAGE DIRECT AND INDIRECT EMISSIONS AND THEIR ENVIRONMENTAL IMPACT.

**Actions**

- Develop an institutional structure to ensure compliance with regulations and promote the adoption of standards, in order for the sector to contribute to fulfilling the State's environmental commitments.
- Plan educational and awareness campaigns, and technical assistance programs for SMEs.
- Analyze and implement regulatory changes that allow businesses to accredit their reduction in GHG emissions.

**Goals for 2035**

- 100% of large companies report and manage their GHG emissions, in a manner consistent with the country’s commitments.

**Goals for 2050**

- Companies that represent 95% of energy consumption in the productive sector report and manage their GHG emissions, in a manner consistent with the country’s commitments.

**Stakeholders:** Ministry of Energy, Ministry of the Environment, Ministry of Finance, Ministry of Economy, CORFO, CONAF, trade associations.
Energy Efficiency and Energy Education

GUIDELINE 28: FORM A ROBUST MARKET FOR ENERGY CONSULTANTS AND ENERGY SERVICE COMPANIES.

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
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<tbody>
<tr>
<td>Implement development instruments to enable the incorporation of energy services companies into the public and private sectors.</td>
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<tr>
<td>Strengthen the role of the public sector in the field of energy efficiency through energy performance contracts.</td>
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<tr>
<td>Develop a critical mass of companies that are committed to energy innovation and good energy use in industry and trade.</td>
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<tr>
<td>Maintain a register of consultants trained in energy efficiency issues.</td>
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<thead>
<tr>
<th>GOALS FOR 2035</th>
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<tbody>
<tr>
<td>A consolidated market has been achieved for energy services in the public and private sectors and there is a culture rooted in the efficient use of energy in these sectors.</td>
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<tr>
<td>Chile is an exporter of energy efficiency services.</td>
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**GUIDELINE 29: PROGRESSIVELY IMPLEMENT ENERGY MANAGEMENT TOOLS VALIDATED BY COMPETENT ENTITIES.**

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<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
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<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>• Create a regulatory framework to ensure that companies manage energy, and generate the appropriate incentives to ensure continuous improvements in energy efficiency.</td>
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<td></td>
<td>• 100% of the large consumers of energy (industrial, mining and transportation sectors) make efficient use of energy, with proactive energy management systems and the implementation of energy efficiency measures.</td>
<td>• Growth in energy consumption is decoupled from GDP growth.</td>
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<tr>
<td>• Create new institutions and/or assign roles to existing institutions, making them responsible for the objectives of a national policy on energy efficiency.</td>
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<td>• 70% of the main categories of appliances and equipment sold in the market are energy efficient.</td>
<td>• The transport, mining and industrial sectors have become regional models for energy efficiency.</td>
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<tr>
<td>• Constantly monitor the progress of energy management within companies.</td>
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<td></td>
<td></td>
<td>• 100% of the main categories of appliances and equipment sold in the market are energy efficient.</td>
<td>• 100% of the main categories of appliances and equipment sold in the market are energy efficient.</td>
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<tr>
<td>• Create coordinated initiatives to share experiences in reducing energy consumption and to incorporate the best global technologies and innovations in energy use.</td>
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**STAKEHOLDERS:** Ministry of Energy, Ministry of the Environment, Ministry of Finance, Ministry of Economy, CORFO, CONAF, trade associations.
### GUIDELINE 30: USE LOCALLY AVAILABLE RESOURCES AND EXPLORE POTENTIAL ENERGY SAVINGS IN PRODUCTION PROCESSES.

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<thead>
<tr>
<th>ACTIONS</th>
<th>2018</th>
<th>2020</th>
<th>2025</th>
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<tr>
<td>• Remove regulatory barriers that prevent the exploitation of local energy opportunities and processes.</td>
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<td>• Implement instruments that promote the exploitation of opportunities within companies and between neighboring consumers (e.g. co-generation).</td>
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<td>Create a portfolio of energy opportunities to be shared between local consumers, so they can be taken advantage of in a coordinated manner.</td>
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<td>Strengthen the role of those institutions that promote, encourage and finance the use of energy opportunities, with emphasis on the small and medium-sized productive sectors.</td>
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<td>• Develop infrastructure that encourages the use and exchange of energy, using opportunities arising from productive processes within a company.</td>
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<tr>
<td>• Develop regulations that will encourage the use and exchange of energy, using opportunities arising from productive processes within a company.</td>
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<tr>
<td>• Develop a market for neighboring entities to take advantage of energy opportunities arising from companies’ productive processes.</td>
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**GOALS FOR 2050**

100% implementation of the technically, economically and financially viable opportunities to use local resources and take advantage of potential energy projects that have been identified in audits.

**STAKEHOLDERS:** Ministry of Energy, the Ministry of Finance, CNE, CORFO, Regional Governments, universities.
GUIDELINE 31: BUILD EFFICIENTLY BY INCORPORATING ENERGY EFFICIENCY STANDARDS INTO THE DESIGN, CONSTRUCTION AND REFURBISHMENT OF BUILDINGS, IN ORDER TO MINIMIZE ENERGY REQUIREMENTS AND ENVIRONMENTAL EXTERNALITIES, WHILST ATTAINING ADEQUATE COMFORT LEVELS.

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
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</thead>
<tbody>
<tr>
<td>• Develop an energy refurbishment plan for all existing public and private buildings.</td>
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<tr>
<td>• Implement private and public mechanisms for financing the energy refurbishment of existing buildings.</td>
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<td>• Review current certifications, labeling and seals and add to them so that there is energy labeling for all buildings.</td>
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<tr>
<td>• Continuously improve energy efficiency and sustainability standards, certification and seals.</td>
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<tr>
<td>2017: Generate baseline information on the energy consumption of all buildings.</td>
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<tr>
<td>• Update technical construction standards to reduce energy consumption in new residential, education and healthcare buildings by at least 30%.</td>
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<tr>
<td>• Implement energy labeling for buildings, as a compulsory requirement for real estate sale transactions.</td>
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<tr>
<td>2018: Introduce energy ratings for residential buildings, which shall be mandatory for new public and private buildings.</td>
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<tr>
<th>GOALS FOR 2035</th>
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<tbody>
<tr>
<td>• 100% of new public and residential buildings meet OECD standards for efficient construction.</td>
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<tr>
<td>• All residential buildings being sold in Chile report their energy consumption.</td>
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<tr>
<td>• All public buildings in Chile report their energy consumption.</td>
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<tr>
<td>• The Public Sector has high standards of energy efficiency at its facilities and projects, fulfilling its exemplary role.</td>
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<tr>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>• 100% of new buildings meet OECD standards for efficient construction, and are fitted with intelligent energy control and management systems.</td>
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<tr>
<td>• 100% of the buildings in Chile report their energy consumption at the time they are sold.</td>
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**GUIDELINE 32: PROMOTE CONTROL, INTELLIGENT ENERGY MANAGEMENT AND SELF-GENERATION SYSTEMS TO ENABLE PROGRESS TO BE MADE TOWARDS BUILDINGS WITH EFFICIENT SOLUTIONS TO MEET THEIR ENERGY NEEDS.**

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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</thead>
<tbody>
<tr>
<td>2016: Technical training for end users with respect to smart technologies for communication and management.</td>
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<tr>
<td>2018: Design and implement market tools to minimize energy consumption and encourage users to adopt control and intelligent energy management systems.</td>
<td>30% of buildings have control and intelligent energy management systems.</td>
<td>100% of new buildings have control systems and intelligent energy management systems.</td>
</tr>
<tr>
<td>• Develop and implement measurement and verification programs for the energy consumption of buildings.</td>
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<tr>
<td>• Strengthen the regulations that promote the adoption of more efficient technologies and innovations to produce and use energy in buildings.</td>
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<tr>
<td>• Develop the institutional and technical capacity and the legal framework to enable appropriate information to measure and monitor the impact of programs that introduce energy efficiency measures and take advantage of local energy resources within homes.</td>
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The market for energy efficiency in construction in Chile meets the needs of every locality in the country. All the regions within Chile have local suppliers of materials and services that satisfy the market for energy efficiency in the construction sector.


GUIDELINE 33: STRENGTHEN THE MARKET FOR EFFICIENT BUILDINGS, AND PROGRESS TOWARD MORE PRODUCTIVE AND EFFICIENT LOCAL MARKETS.

<table>
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<tr>
<th>ACTIONS</th>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>2016</td>
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<td>2020</td>
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<td>2030</td>
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- Incentivize the development of efficient suppliers of materials and services to the construction industry.
- Promote the good use of efficient constructions and include efficient design in training for everyone involved in construction.

2017: Develop informative tools that provide the energy properties for each territory, to enable the selection of the most appropriate technologies, materials and self-provisioning options for it.

The market for energy efficiency in construction in Chile meets the needs of every locality in the country.
Chile has adopted the highest international standards of energy efficiency for road, air, rail and maritime transport.

- 100% of new models of road transport vehicles carry an energy efficiency label.
- 100% of new tenders for public passenger transport include energy efficiency criteria in their evaluation.
- All road transport vehicles acquired by the State incorporate energy efficiency criteria in their procurement evaluation.
- Any gaps with regard to international standards on energy efficiency and local pollutant and greenhouse gas emissions for air and road vehicles are reduced to a minimum.
- Energy efficiency standards exist for new lightweight vehicles.

**GUIDELINE 35: PROMOTE A FUNDAMENTAL SHIFT TOWARD MORE EFFICIENT MODES OF TRANSPORT.**

**ACTIONS**

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<tr>
<th>2016</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td>• Invest in specialized infrastructure for public and non-motorized transport.</td>
<td>• Bicycles account for at least 6% of journeys in large cities.</td>
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<tr>
<td>• Develop and implement a strategy to encourage the use of public transport, which includes improving its service quality and image.</td>
<td>• The share of public transport in large and intermediate cities remains constant, despite a net increase in the number of private vehicles.</td>
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<tr>
<td>• Foster the complementarity and physical, operational and tariff integration of intermodal transport.</td>
<td>• Railways account for at least 15% in the modal split for cargo transport.</td>
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<tr>
<td>• Develop and implement policies for public bicycles.</td>
<td>• Bicycles account for at least 10% of journeys in small and medium-sized cities.</td>
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<tr>
<td>• Implement measures that encourage intermodal freight transport, integrate the transport system, and replace road transport with rail.</td>
<td>• The share of public transport in the modal split for large and intermediate cities remains constant, despite a net increase in the number of private vehicles.</td>
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<tr>
<td>• Remove restrictions on national coastal traffic and improve access to port services.</td>
<td>• Railways account for at least 15% in the modal split for cargo transport.</td>
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</table>

- Implement campaigns to encourage the rational and efficient use of private automobiles, including promoting public transport and the use of bicycles.
- Incorporate mechanisms to control congestion and discourage private transport, such as road congestion tolls, limits to parking, reallocating road space to more efficient modes, etc.


**GUIDELINE 36: ENSURE THAT CITIZEN HAVE SUFFICIENT, TIMELY, CLEAR AND TRANSPARENT INFORMATION REGARDING CONSUMER’S DUTIES AND RIGHTS, IN RESPECT OF ENERGY IN ALL ITS SPHERES, INCLUDING ENERGY DEVELOPMENT AND ITS IMPACT ON COMMUNITIES AND THE ENVIRONMENT, ALTERNATIVE ENERGIES AND ALTERNATIVE METHODS.**

**ACTIONS**

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<tr>
<th>2016</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td>• Develop mechanisms to collect key energy information requirements and ensure that this is socio-culturally relevant.</td>
<td>• Everyone who is interested in energy is well informed.</td>
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<tr>
<td>• Publish relevant information regarding energy in all its spheres, energy development and its impact on communities and the environment, through widespread campaigns that involve different audiences and use diverse mechanisms, (media, places that experience a high flow of people, etc.).</td>
<td>• Everyone who is interested in energy is well informed.</td>
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<tr>
<td>• Implement mechanisms to ensure the timely delivery and internalization of information.</td>
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</table>

- Develop a one-stop-shop that provides rigorous and relevant energy information in an accessible, educational and validated manner from various sources.
- Integrate this one-stop-shop into the official information system, to constantly register the availability and quality of information on energy development.

**STAKEHOLDERS:** Ministry of Energy, CONADI, ACHEE, SERNAC, municipalities, civil society, universities, electricity distributors, other stakeholders for information and dissemination.
An energy culture exists at all levels of society, including among producers, suppliers, consumers and users.

- 100% of formal education plans incorporate cross-curricular contents relating to energy development.
- National awareness programs on carefully using energy and sustainable energy, with a macro-zonal approach that reflects the situation in each area and community, are developed and implemented.
- National energy education programs, with a macro-zonal approach that reflects the situation in each area and community, have been developed and implemented.
- An energy culture exists at all levels of society, including among producers, suppliers, consumers and users.

GUILDLINE 38: DEVELOP PROFESSIONAL AND TECHNICAL HUMAN CAPITAL FOR THE SUSTAINABLE PRODUCTION, USE AND MANAGEMENT OF ENERGY.

<table>
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<tr>
<th>ACTIONS</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td>Develop technical assistance and energy training programs for SMEs.</td>
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<tr>
<td>- Promote standards on hiring or prioritizing the inclusion of local labor in the construction of energy projects.</td>
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<tr>
<td>- Develop prospective studies of professional and technical needs.</td>
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<tr>
<td>Develop technical assistance programs on energy for municipal governments.</td>
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<tr>
<td>- Implement mechanisms that promote technical education programs, related to all energy areas.</td>
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<tr>
<td>- Develop professional training and certification programs, regarding energy issues in the main consumption sectors, such as the industrial, transport, commercial, public and residential sectors.</td>
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<tr>
<td>2018:</td>
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<tr>
<td>- Implement mechanisms that promote the development of professional training and certification programs.</td>
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<tr>
<td>- Incorporate the concepts of sustainability, the efficient production and use of energy, and taking advantage of local resources, in all technical and professional courses connected to the use and production of energy.</td>
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<tr>
<th>GOALS FOR 2035</th>
<th>GOALS FOR 2050</th>
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<tbody>
<tr>
<td>National training programs in development skills, with a macro-zonal approach that reflects the situation in each area and community, have been developed and implemented.</td>
<td>A new energy culture exists in public and private institutions.</td>
</tr>
</tbody>
</table>

APPENDIX 2: Detail of the Energy 2050 Process
GOVERNMENT PROGRAM

The Government of President Michelle Bachelet presented its program in October 2013. This recognized that the country wants a secure and efficient supply of energy, at reasonable prices, which takes advantage of Chile’s renewable resources in a sustainable and non-polluting manner. The Program called for a diagnosis of the energy sector and the potential scenarios that could impact Chile in the short and medium term. It also stated the need for a "National Energy Policy" and a long-term energy strategy.

The Government promised to fulfill 50 measures during its first 100 days in office. One such measure was for the Ministry of Energy to prepare an "Energy Agenda" that would define the main guidelines for the Energy Policy to be prepared during the Government’s four-year term. This would serve as a road map for designing and implementing a long-term Energy Policy with social, political and technical validation.

ENERGY AGENDA

The Ministry proposed from the beginning that the preparation of the Energy Agenda should be the result of an open and participatory process, including meetings and ideas exchanged between a wide range of stakeholders, politicians, congressmen, municipal governments, entrepreneurs, academics and NGOs that had reflected on and/or assessed the energy situation in Chile. This debate included an energy workshop organized in conjunction with the Senate Future Commission, in the former National Congress, with more than a hundred stakeholders from the sector. An important part of this process was to listen to the concerns and needs expressed by people from all of Chile’s regions and to find out, first-hand, the energy-related problems and challenges faced by the inhabitants of different parts of the country.

The Energy Agenda was presented to the President in May 2014. It proposed the need for pro-
found transformations, which were structured around seven fundamental pillars:

- A new role for the State
- A reduction in energy prices through greater competition, efficiency and diversification in the energy market.
- Development of self-owned energy resources.
- Greater connectivity for energy development.
- An efficient energy sector that manages consumption.
- Stimulation for investment in energy infrastructure.
- Citizen participation and territorial organization.

One of the Energy Agenda’s seven objectives and a key action point within “A New Role for the State”, is the ‘Preparation of a State Energy Policy with social, political and technical validation’, whereby the State has made a commitment to enter into broad dialogue on the key issues arising from the Agenda and that define the planning for the sector. To that end, two horizons were identified, one short-term and one medium- and long-term. The first was to discuss the work areas in terms of the standards, policies, and regulations that will guarantee the technical feasibility and sustainability of the energy matrix by 2025. The second was to discuss strategic and technological aspects that will define the energy matrix that Chile will promote from now to 2050. The decades up to 2050 were defined as medium-term.

Consistent with this, a discussion process was developed that included key stakeholders from the public sector, industry, academia, civil society, the different regions of the country, and the general public. The goal was to develop the country’s long-term Energy Policy. This policy was to identify the long-term vision, and the guidelines and goals to ensure its sustainability and feasibility over the timeframes specified. It was also to define action plans and emphasize the strategic aspects of this Policy up to the year 2050. Finally, a dialogue process was defined, aimed at legitimizing the adopted policies, in order to progress the concrete policies that the country requires.

**JUSTIFICATION FOR A LONG-TERM ENERGY POLICY**

Public policies are tools that governments use not only to satisfy public needs, but also to change course with regard to issues as diverse as the labor market, the country’s competitiveness, the financial system’s sustainability, or the quality of the country’s environment. Public policies are tools to achieve the future of our dreams, whilst focusing on people’s wellbeing.

State energy policy is justifiable both technically and strategically. With regard to the technical aspects, several segments of the energy sector show a high potential for introducing market imperfections that make appropriate State regulation necessary, to ensure that the market functions correctly in the future. Many of the investments required to develop the sector intensively use fixed capital and are very specific and long-lasting, which exacerbates the natural monopoly in the market where these investments are made. Therefore, the market has to be well regulated, to provide security and certainty for investors. Information gaps represent another failure of the market that invites greater regulation and a more active role by the State. This is especially true now, as it is clear that citizens are no longer content to merely receive information about what is going on, but is
becoming increasingly involved in constructing a common future, and therefore needs clear and timely information.

Energy is also a strategic factor for achieving our goals in other areas, such as security, competitiveness, environmental and social constraints, where technical and market solutions do not necessarily maintain the common good. Energy is a key driver of economic and social development, so securing its future supply is very important. However, while energy is a means to other ends, its generation also provides an opportunity to promote positive changes in people's quality of life. How we obtain and use energy has a direct impact not only on economic growth, but also on many other relevant areas, such as caring for the environment and opportunities for people to develop. This is why we require a defined policy and an active role by the State.

Defining public policy on energy is therefore no trivial task. It is our duty and also a collective opportunity, to work together to build a path that will make the energy sector a safe, inclusive, competitive, and sustainable medium whose benefits extend to all areas of life for the Chilean people.

INTERNATIONAL PRACTICE IN PREPARING AN ENERGY POLICY

The method used to prepare this Energy Policy was not random: the Ministry of Energy decided to adopt international practice on this matter. International practice involves a decision by the national government, which depending on the country may be represented by a department or ministry of energy, to develop a high level long-term State policy, which channels the plans of both the government and the private sector for the issues that are most important to the energy sector.

According to international experience, a long-term State policy that represents the aspirations of present and future generations, should include active public participation. Therefore, the Chilean Ministry of Energy took into consideration the Energy Development Strategy for New Zealand, Energy Policy 2005 to 2030 for Uruguay, the German Energy Policy process, and the Australian Green and White Papers.

In addition to broad public participation in the preparation of a policy with a vision for the future, international energy policy processes also rely on support from external agents. The agency that designs the policy, which in Chile's case is the Ministry of Energy, uses them to provide political, strategic and technical advice that contributes to the discussion. Other countries, such as Germany and Australia, have also relied on private and public expert advice from academics and civil society, to prepare their energy strategies. For example, the Energy Strategy to 2050 in Denmark references the conclusions of the Danish Policy Commission on Climate Change, which was created by a Government mandate and composed of ten scientific experts from various fields related to climate change.

International practice shows that for a strategic policy to be correctly implemented it has to be monitored. For instance in Ontario, Canada, the authorities set up this type of oversight and each year a report is provided on the progress of the long-term energy plan and any changes to supply and demand. Every three years, the authority updates the plan, taking account of progress and providing room for public participation. Similarly, a process for monitoring the
policy has been established in Germany. The Ministry of Economy and Energy publishes an annual report that monitors policy progress, with data from various sectors, and produces a more detailed report on policy progress every three years, which includes an analysis of barriers to implementation, impacts, and potential amendments. The reports are prepared following the advice of a committee of four independent experts, assigned by the government, who also separately publish their views. The regulator has an administrative unit that provides organizational support to this process.

International experience shows that a strategic policy that defines the direction of a sector must be focused on the long term, clearly identifying the goals to be achieved in the future and in the intervening period. For example, Brazil defined policies with 10- and 35-year timeframes, while Uruguay set 25-year goals. Germany, Denmark and Switzerland prepared their respective policies for the timeframe to 2050.

ENERGY 2050

The Ministry of Energy launched the "Energy 2050" (E2050) initiative in July 2014, conceived as a participatory process to build the Energy Policy. This fulfills action point number 3 of the first pillar of the "Energy Agenda". Energy 2050 includes four development stages and three participation segments. These cover participation at a political-strategic level with an Advisory Committee; at a technical level with experts and people from the energy sector involved in thematic panels; and at a public level encompassing the entire population with a public platform. A technical and academic team was formed dedicated exclusively to addressing Energy 2050. Its role is to coordinate and facilitate the Policy and it led by the Executive Secretary for Energy 2050, based at the Ministry of Energy.
Stage 1 of Energy 2050 was developed during the second half of 2014 with the overall objective of addressing the short- and medium-term challenges defined by the Energy Agenda. Ten thematic panels were formed, led by Divisions at the Ministry of Energy, and supported by academic groups from various Chilean universities. The idea was to gather visions and guidelines from various points of view, to help steer the policies for the sector. Most of the panels included workshops in different regions of Chile. There were nearly 130 meetings throughout the country, involving more than 3,500 people.

The following is a summary of the thematic panels for Phase 1 of E2050:

I. Energy Efficiency Law

The Energy Efficiency Law panel was led by the Energy Efficiency Division at the Ministry of Energy and was supported by a technical team from the Universidad de Chile. Its objective was to discuss and propose guidelines that should be incorporated into a future Energy Efficiency Law. Therefore, important stakeholders from all sectors of society were invited, which included the public, private, civil society and academic sectors. In total, 15 discussion meetings were held between September and December 2014, divided into 5 sub-sectoral panels: Residential, industry and mining, public sector and armed forces, transport and technology. All the meetings were held in Santiago. The average attendance at each meeting was 27 people.

The result was the preparation of a draft law on energy efficiency to be submitted to Congress in 2016.
II. Hydroelectricity

The hydroelectric panel meetings were held in Santiago and Concepción. Their objective was to propose guidelines for developing sustainable hydroelectricity. The panel was led by the Sustainable Development Division at the Ministry of Energy and was supported by technical teams from the Universidad de Chile and the Universidad de Concepción. The Santiago meetings were subdivided into three sub-panels to address the main theme: The role of hydroelectricity in the energy matrix, legislation and regulations, and the policy on where to locate hydroelectric development. Twelve working meetings were held in total, comprising two participatory workshops and two expert meetings for each sub-panel. The average attendance at each participatory workshop in Santiago was 34 people. Of these, 21% represented the public sector, 21% were from civil society, 49% from private institutions and 9% were academics.

The meetings in Concepción took place between November and December 2014, and there were also three sub-panels: The role of hydroelectricity in the energy matrix, sustainable design and operation, and the factors relating to the location of hydroelectric projects. Six working meetings were held in total, two for each sub-panel. The average attendance was 22 people, with the largest group representing the public sector with 30%, followed by business representatives from the hydroelectric sector with 26%, and academics and experts with 26%. NGO representatives accounted for 10% and other groups 8%.

III. Thermoelectricity

The thermoelectric panel was led by the Sustainable Development Division. Its objective was to develop guidelines for a thermoelectric development proposal to be incorporated into a sustainable energy policy. Within this framework, discussions covered the role of thermoelectric energy in the energy matrix, its environmental impacts, the available technology and territory management. The panel discussions were grouped into three scenarios based on the role of thermoelectricity: thermoelectricity as basic energy, thermoelectricity to support NCRE, and the transition towards a matrix without thermoelectricity based on fossil fuels.

Two workshops were carried out in Santiago in October 2014. The attendance at the workshops was 41 and 42 people, together with 14 members of the academic team from the Universidad Católica de Chile who supported this panel. 36% of attendees came from the private sector, 28% from the public sector, 23% were academics and consultants, and 13% represented civil society and NGOs.

Subsequently, a further working day took place in Valparaiso and another in Concepción, with the aim of gathering regional views on the future of thermoelectricity in the energy matrix within the context of a sustainable Energy Policy. The working day in Concepción took place in March 2015, and 27 people participated, of whom 37% represented the private sector, 33% were from civil society, 19% were academics and 11% were from the public sector. The working day in Valparaiso took place in April 2015, and the 34 people who participated consisted of: 59% from the private sector, 21% from civil society and NGOs, 12% were academics and consultants, and 9% from the public sector.
IV. NCRE in the Interconnected Systems

The NCRE in the Interconnected Systems panel was led by the Renewable Energy Division at the Ministry of Energy, and supported by a team of academics from the Universidad de Chile and the German Agency for International Cooperation (GIZ). The panel discussion meetings were inclusive and participatory, and included all the stakeholders involved in NCRE, such as NGOs, the public and private sectors, civil society organizations and universities. In addition, a more limited group of stakeholders with technical expertise was invited to these workshops. This particular group addressed the issues that arose in the discussion meetings using model analysis. The NCRE panel identified electricity generation expansion scenarios that incorporated different levels of NCRE, and at the same time assessed the capacity of the interconnected systems to efficiently and safely absorb high levels of variable renewable energy.

Three participatory discussion meetings were held between October 2014 and August 2015 with an average attendance of 67 people. In addition, six technical workshops were held with an average attendance of 28 people, plus the team from Universidad de Chile. In total, 59 technicians participated in the workshops, of whom 61% came from the private sector, 36% from the public sector and 3% were academics. The final results of the NCRE panel were presented in September 2015.

V. Territorial and Land Use Planning and Associativity

The Territorial and Land Use Planning and Associativity panel held two rounds of workshops in seven Chilean cities (Santiago, Punta Arenas, Coyhaique, Concepcion, Valparaiso, La Serena and Antofagasta) between August and November 2014, with a total of 14 meetings. This panel was led by the Sustainable Development Division at the Ministry of Energy, and its objective was to record local expectations and opinions on the Ministry of Energy’s guidelines regarding Territorial and Land Use Planning and Associativity.

The first round of workshops attracted 323 participants from the seven cities, whereas the second round attracted 227. The total attending both rounds was therefore 550 participants, and Santiago had the largest number with 128, while Punta Arenas had the smallest number with 54. The largest sectoral participation in the 14 workshops was the private sector with 37%, followed by the public sector with 28%, civil society with 23%, academics with 11%, and other groups that included representatives from indigenous communities with 1%.

VI. Efficient Heating and Wood Energy

The Efficient Heating and Wood Energy panel was led by the Energy Efficiency Division at the Ministry of Energy, and supported by academic teams from various universities in Chile in accordance with the location of the regional panels (U. de Chile, U. de Talca, U. de Concepción, U. de la Frontera, U. Austral, U. de Los Lagos and U. Austral, U. Católica, both in Temuco). The objective of the panel was to provide guidelines for a policy on heating and using firewood and other wood energy sources, whilst considering regional aspects and criteria.

Between July 2014 and May 2015, the panel met at 43 meetings in the regions of O’Higgins, Maule, Bio-Bio, Araucanía, Los Ríos, Los Lagos and Aysén, with an average of 5 meetings per region.
It invited important stakeholders in the public and private sectors, neighborhood associations, NGOs, other civil society groups and academics. Over 1,000 people participated, with an average of 29 attending each meeting. 50% of participants were representatives from the public sector. Furthermore, interviews were carried out to gather relevant information for this diagnosis, and participatory workshops were carried out in various places to collect views from a wider audience.

VII. The Future of the Transmission Network

This panel was led by the National Energy Commission, and supported by Universidad Católica de Chile. It aimed to generate proposals to reform the transmission system, which would then be used to develop a new Transmission Law. This panel was divided into four sub-panels, in order to facilitate discussions: Network expansion, free access and remuneration; security, technology, continuity, and quality of service; Interconnected System operation; and the location of networks and territories. Four meetings were held for each sub-panel, making a total of 16 meetings. These were held in Santiago during July and August 2014. This panel was composed of technical experts from the private, public and academic sectors, and a total of 273 people participated. Furthermore, two public-private workshops were held between March and July 2015, to discuss the proposed regulatory changes, one focused on the New Independent Coordinator of the Electrical System and the other on the new planning and pricing process for the transmission systems. Over 40 experts participated in these fortnightly workshops, totaling 16 meetings. The panel concluded by preparing a draft Transmission Law, which was submitted to Congress in August 2015.

VIII. Gas Network

This panel was led by the National Energy Commission. It aimed to produce guidelines to refine the Gas Service Law. The panel worked on two main themes: priority refinements to the Gas Service Law, and reforms to the gas market. This panel comprised highly technical people from ministries, the SEC, the CNE, and external technical experts. It received technical support from the Universidad de Chile and the World Bank. The panel concluded by preparing a draft law, which was submitted to Congress in January 2015.

IX. Innovation in Energy

The participatory workshops of the Innovation in Energy panel aimed to gather information and define and recommend policies to promote innovation and industrial development in the energy sector over the short, medium and long term. This panel was led by the Energy Forecast and Policy Division at the Ministry of Energy, with technical support from the Universidad de Chile. The panel was divided into two sub-panels of participatory workshops to address two broad themes: Supply and energy storage; and Demand, energy networks and energy efficiency. An executive committee was convened, to complement the work of the two sub-panels. The committee was composed of representatives from the Ministry of Energy, CORFO, CONICYT, Ministry of Economy, National Innovation for Competitiveness Council (CNIC), the National Center for Innovation and Promotion of Sustainable Energy (CIFES) and the Chilean Agency for Energy Efficiency (AChEE). Moreover, close to 30 experts were interviewed, to improve the background information required for the diagnosis and to introduce more references into the discussion.
The sub-panel for Demand met between October and November 2014, and aimed to identify opportunities and challenges for innovation in five sectors: Commercial, residential, urban development and construction, industry and mining, transport, and energy networks. Four workshops were held in Santiago, Concepción, Puerto Montt and Antofagasta. 131 stakeholders participated, who were drawn from various areas of national energy consumption, 65% represented the private sector, 19% the public sector, and 16% were academics.

The Supply sub-panel aimed to provide guidelines for a road map for local industrial innovation, taking into account technology evolution and energy supply solutions. Four meetings were held in Antofagasta, La Serena, Santiago and Concepción between September and October 2014, and they were supported by Universidad de Antofagasta, Universidad Católica del Norte, Universidad de la Serena, Universidad de Concepción and Universidad Técnica Federico Santa María. 135 important stakeholders from the sector participated, including representatives from the energy industry, support services and infrastructure sectors, entrepreneurs, academics and research representatives, the public sector, and national and regional civil society organizations.

X. Indigenous Affairs

The Indigenous Affairs panel was led by the Participation and Social Dialogue Division at the Ministry of Energy.

18 participatory workshops in 9 Chilean regions, including the I, III, VIII, IX, X, XI, XIV, XV and RM regions, were held between October 2014 and January 2015. They were attended by representatives of indigenous councils at CONADI, the Regional Authorities attached to the Ministry of Social Development, provincial governors, ADI leaders, and leaders of regional and provincial indigenous panels. The average attendance at these workshops was 26 people.

STAGE 2 OF E2050 - ADVISORY COMMITTEE AND THE ROAD MAP

Reports from the ten thematic panels were discussed by an Advisory Committee, and used to prepare the Road Map, which was part of Stage 2 of E2050.

Stage 2 of Energy 2050 was marked by the work of the Energy 2050 "Advisory Committee", a cross-sectional group, chaired by the Minister of Energy and composed of 27 key national and regional stakeholders from the sector, including representatives from ministries and public institutions, trade associations, NGOs, civil society and university academics. The role of the Advisory Committee included building a shared vision for the energy sector by 2050, and a Road Map that proposed major guidelines and plans to enable that vision to be achieved. The Committee met 30 times between September 9, 2014 and September 7, 2015. The construction of the Road Map itself, began with two days of work at Termas de Jahuel on January 13 and 14, 2015. During those two days, the overall vision for 2050 was defined, which was to guide the Committee’s deliberations. The Committee held prior meetings on September 9 and November 20, 2014, to define its role as a strategic guide for Energy 2050, and agree on a governance mechanism for the Committee. It also confirmed that the Committee's key output would be the Road Map to 2050, and defined how this would be prepared.
The Advisory Committee meetings discussed the proposals that emerged from over 150 Thematic Expert Group meetings, in addition to specialized seminars and workshops. These were comprised of thematic expert panels with the participation of Committee members and other stakeholders invited from various sectors, to address various issues where energy has an important role. These groups produced proposals that were discussed at Committee meetings, to channel the final proposals of the expert groups.

Each thematic expert group had its own scope, which depended on the preparation phase of the Road Map. In the first phase, the thematic expert groups met around five sub-sectors relating to energy supply and demand. These were generation, storage, transport and use of electricity; production, storage and distribution of fuels and energy integration; commercial, public and residential sector; transport; and industry and mining. They also discussed five universal themes, which were environmental sustainability and ecosystem services; poverty, equity, participation, associativity and indigenous peoples; territorial, land use and urban planning, and decentralization; innovation and productive development; and institutionalism. The work by these expert groups was to lead to the vision to 2050 for each sub-sector and criteria for the universal themes, which would be brought together to identify the main gaps in the sector.

In the second phase, an analysis of the visions and main gaps led to the definition of six strategic pillars to achieve the vision for 2050. These were structured using 34 strategic guidelines with concrete goals to be achieved by 2035 and 2050 and a short-term action plan to set Chile on the right track. The six strategic pillars were: Sustainable energy, territorial and land use management, community relationships and energy poverty, efficient energy use and energy culture, innovation and productive development, and the universal pillar of institutions.

**STAGE 3 OF E2050 – ENERGY POLICY**

The work to build the "Energy Policy" took place in Stage 3 of Energy 2050 and began with presenting the document "Road Map 2050: Towards Sustainable and Inclusive Energy for Chile" on September 29, 2015.

The building of the Energy Policy was also supported by direct inputs from citizens. A virtual participation platform was used to publish the material generated during the whole E2050 process, to receive opinions from citizens, to conduct deliberative surveys, and to perform a public consultation on the Policy document.

The deliberative surveys were an important component of public participation, and the methodology adopted went beyond traditional surveys. Information was gathered through a deliberative process which was a pilot experience in Chile. There have been about 36 deliberative surveys in the world between 1998 and 2015, of which only 7 covered energy and environmental issues. The aim of these surveys was to collect informed public opinion on their visions for the future of energy in Chile, as defined in the Road Map prepared by the Advisory Committee.

The deliberative surveys sought the opinions of a representative sample of the population from three provinces: Concepción, Valparaíso and Greater Urban Santiago. They were invited to participate in a deliberative forum in their respective regional capital. This event included the following
activities: (i) Presentation 1 “How will we produce energy in the future?”, (ii) Presentation 2 “How can citizens influence energy development in the future?”, (iii) the meeting was divided into conversation groups, (iv) Presentation 3: “How will we save energy in the future?”, (v) the meeting was divided into the same conversation groups, and (vi) a follow-up survey was conducted after the deliberative event. Information was provided to the participants about topics relating to energy, to encourage the debate. Furthermore, the follow-up survey after the deliberative event was the same as the survey conducted before it. This indicated how people had changed their opinion on the topics surveyed in the light of greater understanding and an opportunity to reflect on these issues. 1,362 people participated in the initial survey, and 212 of them attended the deliberative events, of whom 209 responded to the follow-up survey.

An important part of preparing the Policy was a public consultation process regarding this document held between November 4 and December 4, 2015. This public consultation took place over the internet at the www.energia2050.cl portal. People were able to make comments or observations about every section of the document. During this process over 400 comments were received with different scopes and indicating different points of view. Furthermore, five workshops were carried out in Santiago, Calama, Puerto Montt, La Serena and Concepción, where discussions were held regarding the Energy Policy document submitted to public consultation. Approximately 420 people attended these regional workshops from various sectors of society interested in the energy sector. The participants were divided into groups, to discuss the issues associated with each of the four pillars of Energy Policy. The meeting then received a summary of the topics covered in each group. The participants were also able to make further comments, in addition to those made in their respective groups, using a mailbox that was available throughout the event. Close to 316 further comments were received through the mailbox. The comments gathered in the public consultation process and at the regional workshops were important inputs to this document.

**DISTRIBUTION OF COMMENTS RECEIVED DURING THE PUBLIC CONSULTATION USING THE INTERNET PLATFORM**

<table>
<thead>
<tr>
<th>Región</th>
<th>Number of Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan Region</td>
<td>286</td>
</tr>
<tr>
<td>Los Lagos Region</td>
<td>29</td>
</tr>
<tr>
<td>Valparaíso Region</td>
<td>25</td>
</tr>
<tr>
<td>Aysén Region</td>
<td>19</td>
</tr>
<tr>
<td>Araucanía Region</td>
<td>13</td>
</tr>
<tr>
<td>Biobío Region</td>
<td>7</td>
</tr>
<tr>
<td>Liberator General Bernardo O’Higgins Region</td>
<td>5</td>
</tr>
<tr>
<td>Coquimbo Region</td>
<td>4</td>
</tr>
<tr>
<td>Maule Region</td>
<td>4</td>
</tr>
<tr>
<td>Antofagasta Region</td>
<td>2</td>
</tr>
<tr>
<td>Tarapacá Region</td>
<td>2</td>
</tr>
<tr>
<td>Region of Atacama</td>
<td>1</td>
</tr>
<tr>
<td>Magallanes Region and the Chilean Antarctic</td>
<td>1</td>
</tr>
<tr>
<td>Not specified</td>
<td>3</td>
</tr>
</tbody>
</table>

Furthermore, the preparation process for this Policy document included specific meetings to refine and validate the proposals presented in it. Various personalized meetings were held with Divisions at the Ministry of Energy; the National Energy Commission, the Superintendent of Electricity and Fuels, the Chilean Nuclear Energy Commission and with the Ministerial Regional Secretaries for Energy.
STRATEGIC ENVIRONMENTAL ASSESSMENT

The whole Energy 2050 process, including the work of the Advisory Committee, the participatory meetings, and the preparation of the Energy Policy during stages 1 to 3, was accompanied by a Strategic Environmental Assessment (Evaluación Ambiental Estratégica, EAE). The EAE is a relatively new methodology in Chile, and this is the first time that it has been applied to such an important policy. The role of the EAE is to accompany the policy preparation process, providing timely information on the implications of policy decisions on sustainability for the energy sector and the country. Therefore, it is a strategic decision-making tool, which explicitly and actively incorporates economic, environmental and social considerations.

STAGE 4 OF E2050 – DISSEMINATION AND IMPLEMENTATION

Finally, planning the public dissemination of the Energy Policy took place during Stage 4 of Energy 2050. The Ministry of Energy will manage this process during 2016, in parallel with its implementation.
**Biomass**
This is renewable organic matter of vegetable or animal origin, or coming from a natural or artificial transformation of such matter; and is a varied source of energy.

**Cost effectiveness**
This refers to an approach that prefers the lowest cost alternative to achieve a desired goal, once all costs have been included in the financial evaluation, including the direct and indirect value of externalities defined by the regulatory framework.

**Decoupling**
This takes place when countries adopt policies that allow their economic growth and energy consumption to follow independent trends.

**Electrical system**
Electricity generating systems and consumers connected by transmission and distribution lines, operated by one or more control centers, that can incorporate storage systems.

**Electricity generation**
This is the conversion of a primary energy source, such as coal, natural gas or the wind, into electricity.

**Electricity matrix**
This corresponds to all the sources of energy used to generate electricity over a given period of time.

**Energy consumption**
This is the use of energy as a source of energy or heat, or as a raw material for a particular process. Energy consumption in homes includes the consumption of electricity, gas, heating oil and biomass, in addition to the energy used in private transport, such as automobiles, motorcycles etc., where petroleum derivatives are used.

**Energy efficiency**
This optimizes the relationship between the amount of energy consumed and the final products and services obtained. Therefore, being more efficient at using energy means "doing more with less".

**Energy services**
This is where usable energy is used to carry out the tasks required by consumers.

**Fossil fuels**
These are non-renewable fuels produced from material extracted from specific geologic deposits. These deposits were originally organic, such as buried and decomposed plants and animals, which have been subject to special conditions for millions of years, and converted into crude oil, coal or natural gas.
Fuel matrix
This is the final energy consumption across all the fuels used in the country over a given period of time.

Geothermal energy
Geothermal energy is a renewable energy source that uses the underground heat of our planet. This is a renewable energy resource that can be found in areas of volcanic activity and along geological faults.

Glacial regime
River flows that are strongest in spring and/or summer, due to glacier melt that basically depends on solar radiation.

Greenhouse gases (GHG)
These are gases with the potential to cause global warming. When the atmosphere contains these gases, its ability to absorb and retain heat radiation increases, causing temperatures to rise. Examples of these gases are carbon dioxide (CO2) and methane. Some greenhouse gases occur naturally in the atmosphere, such as carbon dioxide (CO2), methane, ozone and water vapor, while others are the result of human activities, such as burning fossil fuels, which increase their quantities and contribute to global warming.

Isolated electricity systems
Electricity self-generation systems that operate in isolation from the Interconnected Systems (SING or SIC) and medium-sized systems.

Inclusive development
This is development that widens people's opportunities to achieve their maximum potential and promotes a better quality of life, whilst respecting territorial vocations, in accordance with the larger territorial context for that locality, such as municipal, regional and national.

It depends on each territory and must be performed on the basis of relevant information, integrating local stakeholder's views and based on their abilities and their subjectivity. It seeks a balanced relationship between people, the environment and technology.

Lighting comfort
This is when direct, indirect and environmental lighting is in harmony with the activity taking place in that area and fulfills its lighting requirements.

Nival regime
River flows that are usually strongest in summer due to melting snow.
**Nuclear energy**  This is energy released by splitting heavy atoms (fission) or combining light atoms (fusion). A nuclear power plant uses a controlled atomic chain reaction to produce heat. The heat is used to generate steam, which passes through conventional turbines.

**Pertinent participation**  This is participation in matters of public interest delivered in the most appropriate manner and time to be able to influence the results. This means that the participants are included among those who can participate, and are sufficiently well-informed to be able to participate. This means that they have systematically received timely information. Those people responsible for inviting people to take part must ensure that the above conditions are met, and adequately weigh the opinions provided by the participants. They should try as hard as possible to include them in decision-making, and provide appropriate justification when it is not possible. They should report back to the participants regarding how their opinions were treated. Both parties should seek to reach an agreement and behave responsibly during the participation process and at its outcome.

**Photovoltaic energy**  This is the direct conversion of solar radiation into electricity. This transformation occurs in devices called photovoltaic panels.

**Primary energy**  This is the energy found in nature prior to being subjected to processes to transform it. It is found in coal, crude oil, natural gas, solar radiation, water in reservoirs or in motion, the tides, the wind, uranium, heat stored in the earth or geothermal energy, etc.

**Regulation capacity**  The regulation capacity of a reservoir is the percentage of its average contribution that it can guarantee for a certain period of time, which can be intra-daily, intra-monthly, intra-annually or inter-annually.

**Renewable energy sources**  Energy from natural resources that cannot be exhausted and so can be used on a permanent basis. Renewable energy sources include solar, wind, geothermal, hydro, biomass and tidal energy, among others.

**River basins**  These are the continental flows of continuous water flowing into the sea, a lake or into another principal river, i.e. into rivers.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary energy</td>
<td>This is the result of transforming or developing natural or primary energy resources, or in certain cases using an energy source that has already been processed, such as tar. The only possible source for all secondary energy is a transformation center and the only possible destination is a consumption center.</td>
</tr>
<tr>
<td>Solar energy</td>
<td>This is a renewable energy source obtained from the sun, which can be used to generate heat and electricity. There are several ways to collect sunshine and generate solar energy. These are: photovoltaic, where sunshine is transformed into electricity using solar panels, photothermal, where heat is collected using solar collectors, and thermoelectric, which indirectly transforms the heat into electrical energy.</td>
</tr>
<tr>
<td>Thermal comfort</td>
<td>This is when people do not experience a sensation of being hot or cold, i.e. when the air temperature, humidity and movement conditions are in harmony with the activities taking place in that area.</td>
</tr>
<tr>
<td>Variable energy sources</td>
<td>Energy sources that are not continuously available, due to factors that cannot be directly controlled, such as the wind blowing or the sun shining.</td>
</tr>
<tr>
<td>Vulnerable families</td>
<td>These are groups of people who are related to one another, living in conditions subject to physical, social and environmental processes, who have diminished capacities for coping with, resisting and recovering from these conditions. They are more susceptible and exposed to the effects of a hazard caused by nature or human activity.</td>
</tr>
<tr>
<td>Wind energy</td>
<td>Wind energy is a renewable energy source, where the kinetic energy of the wind is transformed into usable energy. It is usually obtained from wind turbines or 'windmills' of variable size that use vanes to capture the kinetic energy of the wind and transform it into mechanical energy.</td>
</tr>
<tr>
<td>Zero Net Loss of Biodiversity</td>
<td>Through this approach, we should first seek to avoid negative impacts on biodiversity; those impacts that cannot be avoided should be mitigated and the final option is to compensate for any impact that has occurred.</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>ACHEE</td>
<td>Chilean Agency for Energy Efficiency (Agencia Chilena de Eficiencia Energética)</td>
</tr>
<tr>
<td>AGCID</td>
<td>Chilean Agency for International Cooperation for Development (Agencia Chilena de Cooperación Internacional para el Desarrollo)</td>
</tr>
<tr>
<td>CCHEN</td>
<td>Chilean Nuclear Energy Commission (Comisión Chilena de Energía Nuclear)</td>
</tr>
<tr>
<td>CIFES</td>
<td>National Center for Innovation and Promotion of Sustainable Energy (Centro Nacional para la Innovación y Fomento de las Energías Sustentables)</td>
</tr>
<tr>
<td>CNE</td>
<td>National Energy Commission (Comisión Nacional de Energía)</td>
</tr>
<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CONADI</td>
<td>National Corporation for Indigenous Development (Corporación Nacional de Desarrollo Indígena)</td>
</tr>
<tr>
<td>CONAF</td>
<td>National Forestry Corporation (Corporación Nacional Forestal)</td>
</tr>
<tr>
<td>CONICYT</td>
<td>National Commission for Scientific and Technological Research (Comisión Nacional de Investigación Científica y Tecnológica)</td>
</tr>
<tr>
<td>COP 21</td>
<td>Twenty-first Conference of the Parties for the United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>CORFO</td>
<td>Chilean Economic Development Agency (Corporación de Fomento de la Producción)</td>
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<tr>
<td>E2050</td>
<td>Energy 2050</td>
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<tr>
<td>EAE</td>
<td>Strategic Environmental Assessment (Evaluación Ambiental Estratégica)</td>
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<tr>
<td>ENAP</td>
<td>National Oil Company (Empresa Nacional del Petróleo)</td>
</tr>
<tr>
<td>ERD</td>
<td>Regional Development Strategy (Estrategia Regional de Desarrollo)</td>
</tr>
<tr>
<td>NCRE</td>
<td>Non-conventional renewable energy</td>
</tr>
<tr>
<td>ESCOs</td>
<td>Energy Services Companies</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gases</td>
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<tr>
<td>GW</td>
<td>Giga-Watt</td>
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<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>INE</td>
<td>National Statistics Institute (Instituto Nacional de Estadísticas)</td>
</tr>
<tr>
<td>MERCOSUR</td>
<td>Southern Common Market</td>
</tr>
<tr>
<td>MINVU</td>
<td>Ministry of Housing and Urban Development</td>
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REGIONAL WORKSHOPS
PUBLIC CONSULTATION LAUNCH

ADVISORY COMMITTEE