Follow-Up Peer Review on Energy Efficiency in Chile

APEC Energy Working Group

January 2025

Asia-Pacific
Economic Cooperation

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ABBREVIATIONS AND TERMS

APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASE	Energy Sustainability Agency (Agencia de Sostenibilidad Energética)
BNE	Energy Balance Table (Balance Nacional de Energía)
CCHEN	Chilean Commission of Nuclear Energy (Comisión Chilena de Energía Nuclear)
CCGE	Consumers with energy management capacity (Consumidores con Capacidad de Gestión de Energía)
CES	Sustainable Building Certification (Certificación Edificio Sustentable)
CEV	Certification of Home Energy Rating (Calificación Energética de Viviendas)
CNE	National Energy Commission (Comisión Nacional de Energía)
CVS	Sustainable Housing Certification (Certificación Vivienda Sustentable)
DES	District Energy System
DFBOT	Design, Finance, Procure, Build, Operate, Transfer
DHAT	District Heating Assessment Tool
DHC	District Heating and Cooling
EENP	Energy Efficiency National Plan 2022-2026 (Plan Nacional de Eficiencia Energética)
EMS	Energy Management System
ESCO	Energy Service Companies
EV	Electric vehicle
EWG	Energy Working Group
GEF	Global Environment Facility
HVAC	Heating, Ventilation, and Air Conditioning
IEA	International Energy Agency
ISO	International Organization for Standardization
Law 20.402	Law that creates the Ministry of Energy
Law 21.305	Energy Efficiency Law 2021
MAPS	Mitigation Action Plan and Scenarios
MEFT	Ministry of Economy, Development and Tourism (Ministerio de Economía, Fomento y Turismo)
MEN	Ministry of Energy (Ministerio de Energía)
MEPS	Mínimum Energy Performance Standard
MTT	Ministry of Transportation and Communications (Ministerio de Transportes y Telecomunicaciones)
MINVU	Ministry of Housing and Urban Development (Ministerio de Vivienda y Urbanismo)
MMA	Ministry of the Environment (Ministerio del Medio Ambiente)
NABERS	National Australian Built Environment Rating Scheme

NZE	Net-Zero Emission
NEDO	National District Energy Office (NDEO)
OGUN	General Ordinance of Urban Planning and Construction (Ordenanza General de Urbanismo y Construcciones)
PAEE	Energy Efficiency Action Plan (Plan de Acción de Eficiencia Energética)
PEN	National Energy Policy (Política Energética Nacional)
PNEE	National Energy Efficiency Plan (Plan Nacional de Eficiencia Energética)
RNEE	National Register of Energy Evaluators (Registro Nacional de Evaluadores Energéticos)
REIT	Real Estate Investment Trust
SGE	Energy Management Systems (Sistemas de Gestión de Energía)
SME	Small and Medium-sized Enterprise

***Note**: Several abbreviations used in in this report were based on "Spanish", acronyms not "English."*

PREFACE

*A*ccording to the guidelines for the APEC Peer Review on Energy Efficiency (PREE), the objectives of PREE as endorsed by APEC Leaders at their 2007 meeting are to:

- Share information on energy efficiency performance as well as on policies and measures for improving energy efficiency.
- Provide opportunities for learning from the experiences of other economies and for broadening the network among energy efficiency policy experts.
- Explore how energy efficiency goals on an overall and/or sectoral basis and action plans could be effectively formulated in each economy under review, taking into account the range of possible strategies that could be used according to the circumstances of each economy.
- Monitor progress on energy efficiency goals on an overall and/or sectoral basis and progress on action plans if such goals and plans have been already formulated at the time of the review.
- Provide recommendations for voluntary implementation on how the action plans could be improved to achieve energy efficiency goals.

Two activities are undertaken as part of PREE:

- Peer Review of volunteer member economies.
- The Energy Efficiency Policy Workshop for capacity building of member economies.

The original peer review in Chile that was held in 2009 was led by APERC together with full support from five experts from Australia; New Zealand; Chinese Taipei; the United States and an expert from the International Energy Agency (IEA). The review covered all the energy sectors, Chile's energy efficiency goals and targets, data collection and monitoring, among others. With their able and careful review, the experts came up with 21 recommendations which became the economy's guide in improving policy and programs on energy efficiency.

This follow-up peer review in Chile took place from 6 to 10 May 2024 in Santiago. It focused on the **Energy Efficiency Policies Development and Deployment; Overview, Institutional and Legal Energy Efficiency Framework; Data Collection and Monitoring; Productive sector/Industry, Standards; Building, Labelling, Lighting and Energy Management Systems, HVAC; Transport, Energy Efficiency Mobility, Standards; Energy Efficiency in Cities, District Energy Systems; Energy Transition, Sustainable Energy and Energy Systems**

The review team (*ANNEX A*) that visited Santiago held a **5-day workshop** with a comprehensive discussion on energy efficiency with representatives and experts from the government ministry, regulator, and agency. As a result, **31 challenges** and **33 recommendations** have been identified, which may facilitate the development of an energy efficiency policy and program to effectively achieve the energy efficiency goal.

The Review Team wishes to thank all the presenters and key stakeholders who participated in the discussions. The Expert Team would like to especially thank the officials and staff (*ANNEX B*) from the Ministry of Energy, including the Sustainable Energy Division without whom this event and report would not have been possible.

Dr Kazutomo IRIE
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President, Asia Pacific Energy Research Centre (APERC)

EXECUTIVE SUMMARY

Improving energy efficiency is a critical strategy to bring multiple benefits such as enhancing the sustainability of the energy system, lowering fuel and electricity costs, increasing grid reliability, improving air quality and public health and more job opportunities. APEC Energy Working Group (EWG) also highlights energy efficiency as the key field and endorsed the Peer Review on Energy Efficiency (PREE) model as a core mission of the EWG's work to support the APEC economies to achieve energy intensity goal by 2035 since its inception in 2007.

To respond to the recommendations from PREE in 2009, Chile has undertaken significant efforts to improve energy efficiency and conservation across various aspects of its economy. These efforts include, among others, establishing the "Energy Sustainability Agency" with a permanent board of directors and passing the "Energy Efficiency Law" in 2021. Under this law, Chile created a "National Energy Efficiency Plan" that is updated every five years. Additionally, in the Energy Efficiency Law, Chile has mandated energy management systems for large consumers, introduced energy labelling for buildings, and set efficiency standards for vehicles. As a result, Chile's performance in transitioning its energy infrastructure and consumption is notable in a global context. Chile ranks 20th on the World Economic Forum's Energy Transition Index, outperforming 15 of the 31 'advanced economies.'

The Review Team have provided analysis and recommendations for the following topics in an energy efficiency context:

1) Energy Efficiency Policies Development and Deployment
2) Overview, Institutional and Legal Energy Efficiency Framework
3) Data Collection and Monitoring
4) Productive sector/Industry, Standards
5) Building, Labelling, Lighting and Energy Management Systems, HVAC
6) Transport, Energy Efficiency Mobility, Standards
7) Energy Efficiency in Cities, District Energy Systems
8) Energy Transition, Sustainable Energy and Energy Systems

In summary, **31 challenges** and **33 recommendations** were drafted by the experts for Chile's consideration. The PREE review team was already impressed with the energy efficiency initiatives currently occurring in Chile. They sincerely hope that each of the recommendations could support enhancing energy efficiency in Chile. The number of recommendations by scope reviewed is summarised in the table below:

Table 1: Summary of Recommendations in Follow-up PREE in Chile (2024)

Reviewed scope	Number of challenges	Number of recommendations
1) Energy Efficiency Policies Development	6	7
2) Institutional and Legal Framework	5	3
3) Data Collection and Monitoring	3	4
4) Productive and Industry Sector	5	5
5) Building and Appliance Sector	3	3
6) Transport Sector	3	4
7) Cities and District Energy Systems	4	4
8) Energy Transition and Systems	2	3

This report includes background information for Chile that provides a basis for the delivered review team recommendations and is followed by peer review results. The background section covers social and geographical information, energy supply and demand trends, key energy efficiency policies, and regulations.

SUMMARY OF RECOMMENDATIONS

1. ENERGY EFFICIENCY POLICIES DEVELOPMENT AND DEPLOYMENT

Recommendation 1: Incorporate the value of multiple benefits into cost-benefit assessments of energy efficiency and decarbonisation options and policies.
Recommendation 2: Use energy system modelling with more focus on end-use services as drivers of energy demand to explore the short- and long-term impacts of energy efficiency and other demand-side and distributed options on consumer and overall costs (energy bills), prices and carbon emissions and other multiple benefits.
Recommendation 3: Continually monitor these advancements and update the methodology to include a 'shadow' carbon price, incorporating the best available science and information based on independent analysis and acknowledging that this cost is increasing over time.
Recommendation 4: Extend the focus of energy efficiency policy and programs from individual business consumers to analysis and collaboration across value chains, using Scope 3 emission reporting, 'circular economy' partnerships, and 'value chain thinking' facilitated by digitalisation.
Recommendation 5: Review the scale and allocation of funds and resources and clarify the roles and responsibilities of government agencies to underpin rapid growth in activity.
Recommendation 6: Where existing energy market regulations limit necessary change to support demand-side measures, consider 'outside the box' options such as introducing 'distributor/retailer obligation schemes' that offer incentives for investment by consumers in targeted energy efficiency measures that cut carbon emissions while reducing peak electricity demand and consumer energy bills.
Recommendation 7: Continue to encourage the regional and local councils and their communities to actively participate in the implementation of energy-efficient initiatives across the different energy demand sectors.

2. OVERVIEW, INSTITUTIONAL AND LEGAL ENERGY EFFICIENCY FRAMEWORK

Recommendation 8: Evaluate the effectiveness of the policies developed by the Ministry of Energy and programs executed by the Energy Sustainability Agency to help identify adequate scope for the activities of the agency to help secure their effectiveness.

Recommendation 9: Strengthen regional energy ministry secretariats by improving the technical capabilities of their professionals so they can effectively oversee and facilitate the implementation of energy policy at the regional level.

Recommendation 10: Improve the retention of human resources working in the public sector on the development and implementation of energy efficiency policies.

3. DATA COLLECTION AND MONITORING

Recommendation 11: Consider the establishment of an energy efficiency testing laboratory for energy equipment designed for specific local applications.

Recommendation 12: Understand the variation and effect of the main economy, climate, and other characteristics on energy consumption (e.g., GDP per capita, average annual and seasonal outdoor temperature oscillations, urbanisation level, and rate of access to electricity) in the development and analysis of energy consumption and related energy efficiency indicators.

Recommendation 13: Consider assessing further to the lowest level of the pyramid (IEA Energy Efficiency Indicators pyramid) to better understand the energy consumption patterns by end-use, such as space heating energy demand by fuel in building, road passenger energy demand by fuel in transport, etc.

Recommendation 14: Consider establishing a mechanism to improve communication with end users (of information) and decision-makers to understand their data needs better. This will allow for more economical use of data analysts' time.

4. PRODUCTIVE SECTOR/INDUSTRY, STANDARDS

Recommendation 15: Vigorously promote the development of green finance, strengthen financial support for energy-efficient and low-carbon industry development, balance long-term and current needs, and balance incentives and funding constraints.

Recommendation 16: Promote the improvement of existing energy efficiency standards and performance indicators. Expand the product coverage of energy efficiency standards and cooperate with the responsible party supervising and managing the implementation, identifying areas where standards and indicators are most useful.

Recommendation 17: Strengthen energy auditing and combine it with green financial, subsidy, and regulation enforcement to strengthen the management of energy use in enterprises.

Recommendation 18: Establish a mechanism for updating energy-saving standards, explore a mechanism for transforming energy efficiency benchmarks, innovate energy-saving standardisation implementation by existing energy efficiency promotion platforms, and provide customised professional services such as standard development and standard system construction for enterprises and industry sectors.

Recommendation 19: Mobilise financial regulators to implement measures to require industries to adopt emission reduction strategies that reflect international best practices.

5. BUILDINGS, LABELLING, LIGHTING AND ENERGY MANAGEMENT SYSTEMS, HVAC

Recommendation 20: Define and benchmark baselines of energy consumption and performance of different building typologies based on data collection and statistics (as recommended in 'data collection') and validate these baselines on a regular basis (e.g., every 3-5 years).

Recommendation 21: Develop an economy-level or regional building energy efficiency roadmap with low-, high-, and net zero interventions, such as replacing outdated appliances with labelled ones, as coordinated actions, e.g., through massive buying or green procurement for a school retrofit project as a pilot.

Recommendation 22: Engage with private sectors (e.g., real estate developers) or financial institutions through REIT, ESCO, guarantee, or service models to improve building operation efficiency through energy audit and management as in ISO50001.

6. TRANSPORTATION, ENERGY-EFFICIENT MOBILITY, STANDARDS

Recommendation 23: Build strong links between the Ministry of Energy, the Ministry of Housing and Urban Planning, and related government entities participating in relevant policy decisions.

Recommendation 24: Modify the transport emission reduction target design so that it can be increased in line with likely high rates of global vehicle electrification and accelerate the stringency of vehicle fuel efficiency standards to maintain momentum for change.

Recommendation 25: Target electrification of freight vehicles that operate in congested traffic and heavy vehicles, including establishing an all-electric mine ore transport route for E-trucks from mines to ports to take advantage of the altitude change between mines and ports.

Recommendation 26: Utilise trailer-based batteries towed by semi-trailers or locomotives to provide flexible and widely accessible EV battery charging and other services (e.g. remote homes and post-disaster support) to minimise costs and pressures on electricity grids.

7. ENERGY EFFICIENCY IN CITIES, DISTRICT ENERGY SYSTEMS (DES)

Recommendation 27: Develop a regulatory framework, mechanism or guidelines on DES project development to clearly define the roles of different parties such as 'who should be responsible for what', standardised steps in project development, beneficial calculating and reporting methods or frameworks, engineering design rules and other relevant topics, in order to facilitate the development of DES market in Chile.

Recommendation 28: MEN should take the lead and coordinate with other relevant ministries for regional energy mapping and planning, with a view to sector coupling, and consider waste heat, building energy consumption, city/regional level urban planning and development planning etc.

Recommendation 29: Establish financing mechanisms for district energy to channel the potential investment from international financial institutions (e.g. sovereign funds, sustainable infrastructure funds, and responsible funds from insurance companies) through the design of business models (e.g.

DFBOT (Design, Finance, Procure, Build, Operate, Transfer), Cooling/Heating as a Service) under different types of public-private partnership.

Recommendation 30: Develop long-term knowledge sharing to build up economy/regional expertise on district energy implementation through a virtual knowledge sharing platform on tools e.g., DHAT (District Heating Assessment Tool) tool from the Danish Energy Agency), international or regional best practices, standards (e.g. ISO), and vocational training programs for professions and engineers.

8. ENERGY TRANSITION, SUSTAINABLE ENERGY, ENERGY SYSTEMS

Recommendation 31: Complement the National Lithium Strategy, published in 2023 that is focused on lithium extraction and the role of the state on this activity, with action roadmaps and detailed plans that will strengthen local lithium value chain.

Recommendation 32: Develop an improved strategic plan that better describes how its efforts meet its overall goals.

Recommendation 33: Consider establishing a high-level independent committee to evaluate activities carried out by the Ministry of Energy and the Energy Sustainability Agency for the implementation of energy efficiency initiatives.

PART 1: BACKGROUND INFORMATION

BACKGROUND

INTRODUCTION

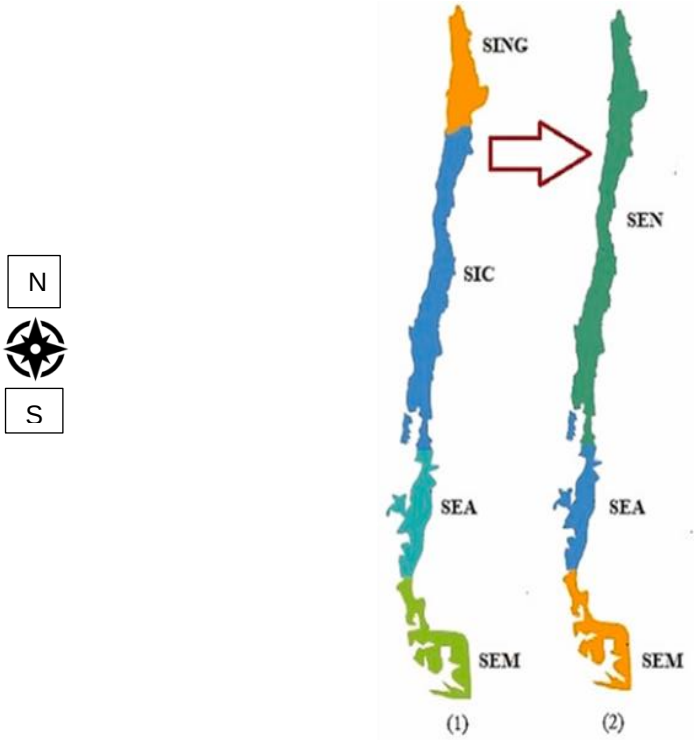
Chile is one of the two APEC economies located in South America; the other one is the neighbour Peru. With a population of 20 million people, Chile has the biggest GDP per capita in Latin America -GDP of around USD 25 000 (2017 USD/PPP)- making Chile a high-income economy according to the World Bank (World Bank, 2023). Access to electricity can be considered to have reached 100%, although reality indicates that there are around 24 000 houses without access to electricity, mainly in Southern Chile. The urban/rural ratio can be considered at 90/10, making Chile more urbanised than several APEC economies such as Peru; Thailand; and Viet Nam. Chile is the world's largest producer of copper (24%) and lithium (30% in 2022)[1], key materials for future global energy development.

The main part of the Chilean territory[2], is in the Southern region of South America, surrounded in the north by Peru, in the Northeast by Bolivia, and in the East by Argentina. Chile's geography is a long and narrow shape, stretching from about 17°S to 56°S latitude. This geography creates several areas with diverse climates: warmer in the North, and colder in the South. Chile is politically divided into sixteen regions that are further divided into provinces and communes, indicating that domestic policies need to be reinforced and supported at those levels.

For analysis and discussion purposes, Chile can be divided into four zones based on latitudes: Northern Chile, Central Chile, Southern Chile and Southernmost Chile.

The Chilean electricity grid was divided into four systems that resembled those zones but in 2018, the Northern Chile system and the Central Chile system were merged into what is known as the National Electric System or SEN.

Figure 1: Merging of Chilean Electric System



Source: National Energy Commission as reported in Review and Assessment of energy policy developments in Chile (Slimsek et. Al, 2018)

The Northern Chile region hosts mining activities, Chile's most important economic activity, and is rich in solar resources.

[1] Lithium production Global Share: 30 % in 2022 (Ref: Biblioteca Congreso Nacional - Asesoría técnica parlamentaria: Mercado del Litio, Marzo 2023). Copper Production Global Share: 24,5 in 2022 (Ref: Cochilco).
[2] Easter Island is a special territory of Chile located in Oceania of 163.6 km^2 and around 8 000 inhabitants.

Central Chile hosts several industrial activities and is home to more than half of the economy's population. This zone can be considered the main economic centre of Chile. This is the area where Santiago, the Capital of Chile, and Valparaiso, the major port of Chile, are located.

Oil products and natural gas are important sources of energy in both previous and existing zones however, these fuels are imported. Consumption of imported coal is declining, reflecting decarbonisation policy.

Countryside Chile is mostly located in the Southern region. The use of traditional biomass for heating and cooking is important in this zone of Chile, as access to other fuels can be challenging.[3]

The Southernmost part of Chile is the most isolated area of Continental Chile and is rich in wind energy potential. Some important green hydrogen projects are proposed for this area.

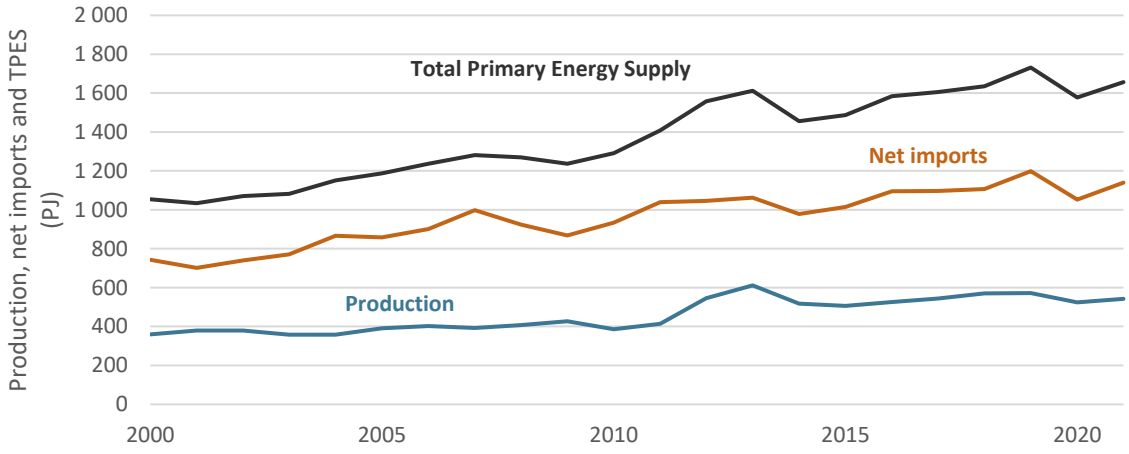
ENERGY SUPPLY AND CONSUMPTION

Total primary energy supply

Chile depends greatly on imports to support domestic energy supply, considering both primary and secondary energy sources, around 69%[4]. This dependency on imports has shown slight improvements since 2007, when the share of imports reached 78%. This dependency on foreign energy sources has influenced the design of energy policies in Chile due to concerns about reliability, cost of supply, and carbon emission reduction policies.

An important event occurred in 2007-2008 when Argentina curtailed natural gas exports to Chile. This increased the domestic consumption of oil products for power generation and consequently increased electricity prices.

Figure 2: Chile's energy supply, production, and net imports (PJ), 2000 to 2021



Source: EGEDA (2023)

Oil is the principal energy source, followed by biomass, coal, and natural gas. A large proportion of all fossil fuels is imported. Almost all the oil is imported and around 80% of gas and almost all coal. Biomass used in Chile, mainly traditional fuelwood that is consumed in the countryside, is important in Southern Chile regions in lower income families. Like in several emerging economies, Chile has specific policies focusing on regulating or decreasing the use of traditional biomass. The Law 21499, approved in 2022, regulates the market of solid biofuel. This law aims to promote the commercialisation of solid biofuel,

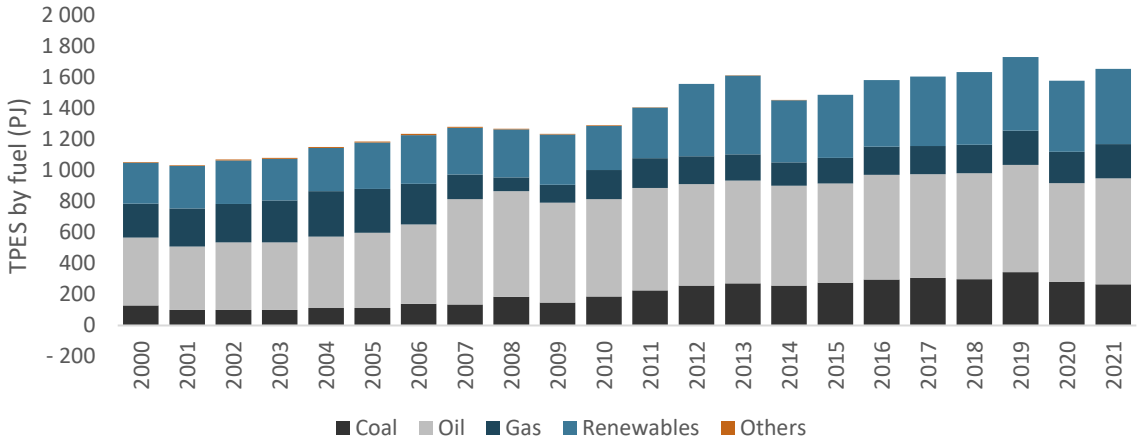
[3] Law 21.499 of Solid Biofuels (published by the end of 2022): The purpose of the Law is that solid biofuels (BCS), such as firewood, pellets, briquettes and charcoal, which are produced, transported and marketed in Chile, comply with mandatory minimum quality specifications, which allow efficient combustion, thus reducing the risk to the health and safety of people. These quality specifications will be defined in the regulation of the Law and are related both to the physical characteristics of the BCS (moisture content, dimensions, calorific value, etc.) and to the origin of the biomass, which must comply with current forestry legislation.

[4] According to the BNE (Energy Balance Table), if only imported primary energy supply is accounted:
in 2020 it was around 58,5%
in 2021 it was around 60,9%
in 2022 it was around 55,8%

e.g. biomass, with minimum standards, requires certification, and regulates the places where the biomass is commercialised[5].

In 2021, total primary energy production was 543 PJ, 3.5% higher than the 2020 level, mostly due to an increase in renewable energy production. Net imports saw an 8.3% increase from the previous year reaching 1140 PJ, mostly driven by an increase in oil and gas imports. The pandemic was the main factor that impacted the energy supply in 2020 due to the lockdown measures and lower economic activities.

Figure 3: Chile's primary energy supply by fuel (PJ), 2000 to 2021



Source: EGEDA (2023)

When 2021 energy demand is analysed by fuel type, oil supply was 685 PJ, a 7.7% increase from the 2020 level, and gas supply reached 221 PJ, a 9.4% increase. Given the limited production of oil and gas in Chile, it can be considered that these increases are met through imports. On the other hand, renewable energy supply from all sources increased by 5.8%, reaching 485 PJ in 2021. Relative to pre-pandemic consumption, coal consumption has fallen.

Total final consumption (including non-energy sector)

Due to diverse rates of growth in energy fuel consumption across different sectors, there has been a shift of shares of each sector, especially industry and commercial, in 2021 compared to 2020. Industry was the biggest fuel consumer at 36.1%, followed by transportation at 33.9%, and residential consumption at 17.5%. The share of the non-energy sector that includes the use of energy products as raw materials for the manufacture of products represented 3.3%.

Final energy demand (excluding non-energy sector)

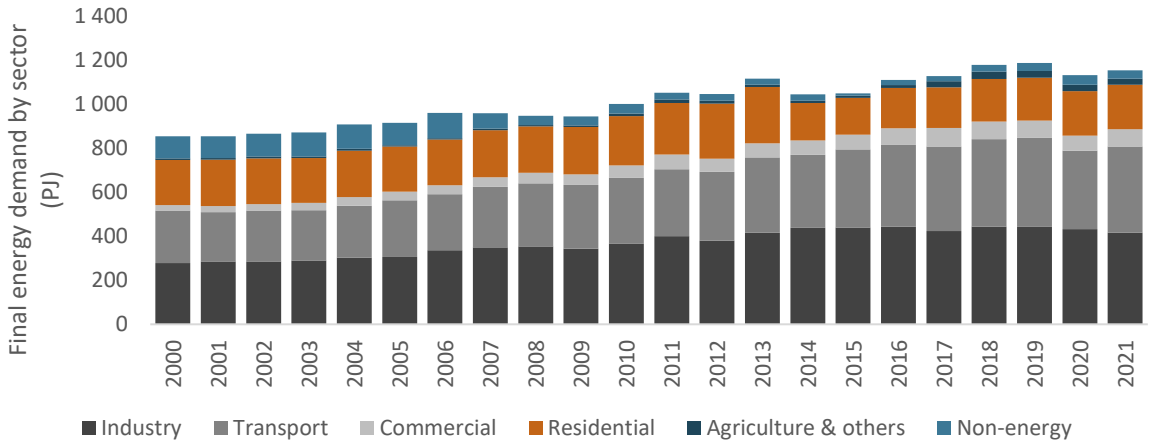
Due to the economy's recovery post-pandemic, an increase in total energy consumption was expected in 2021. Final energy demand grew 2.4%, reaching 1 114 PJ in 2021, although it did not reach the levels of demand observed in 2019 at 1 150 PJ. Transport experienced energy consumption growth of 9.3%, reaching 390 PJ in 2021 from 357 PJ in the previous year. The commercial and public sectors experienced growth of 15.7%, rising from 68 PJ in 2020 to 78 PJ in 2021.

In terms of fuel, the biggest demand growths were observed in coal at 15.6%, going from 6 PJ in 2020 to 7 PJ in 2021; gas at 7.2%, going from 64 PJ to 68 PJ and oil and oil products at 6.7% going from 589 PJ to 628 PJ. Renewable energy demand decreased 15.7% going from 160 PJ to 135 PJ.

It is noteworthy that the decreasing trend of coal supply, due to the decreasing use of coal in commercial power generation in energy transformation, is opposite to the increasing trend of final coal energy demand. On the other hand, the opposite is observed in the trends of renewable energy. In this case, the decrease in final renewable energy demand was due to a reduction of solid biomass in most of the sectors including industry.

[5] In southern Chile, the use of 'green' wood with high moisture content results in inefficient burning. Switching to pellets, which are dry and more controllable, improves efficiency and offers additional benefits.

Figure 4: Chile's final consumption by sector (PJ), 2000 to 2021



Source: EGEDA (2023)

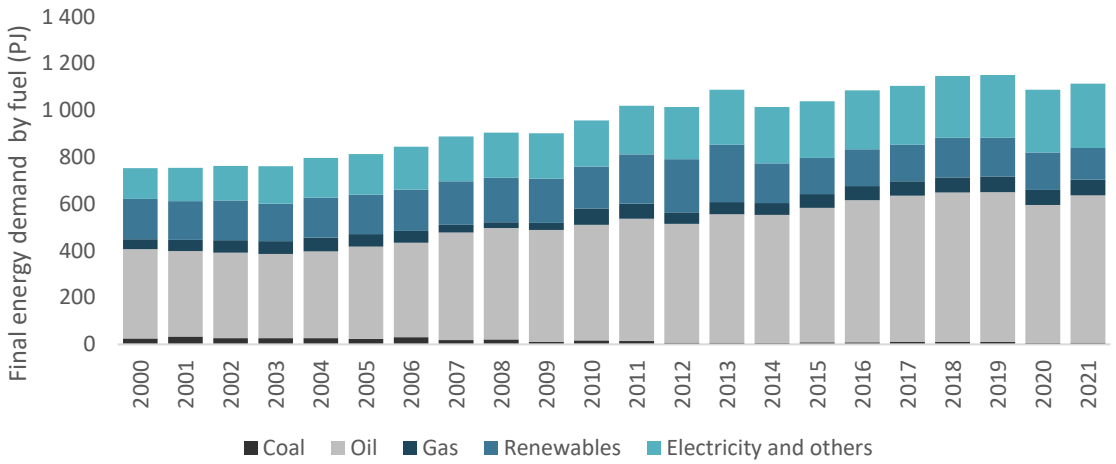
Chile's 2021 final energy demand fuel share did not change drastically if compared with 2020; more than half of the final energy demand, 56.5%, is satisfied by oil and oil products. Coal satisfied 0.6% of final energy demand; renewables 12.1%[6]; and natural gas 6.1%.

Around 25% of Chile's final energy demand is met by electricity and around 56% is met by oil products, mainly used in the transport sector. The main sources of energy in industry are oil products and electricity with more than 72% of the energy demand in this sector.

Biomass is the main fuel consumed in the residential sector with around 38%. The low efficiency of the technologies that use this energy source can be considered a major factor in this big share. Electricity represents around 27% of energy consumption in this sector. Oil products, mainly LPG account for 25% of the demand. Finally, around 11% of the demand in the residential sector is satisfied by natural gas.

Electricity is the main source of energy in the public and services sectors with, almost 58% followed by oil products at 33% and natural gas at 8%.

Figure 5: Chile's final energy demand by fuel (PJ), 2000 to 2021



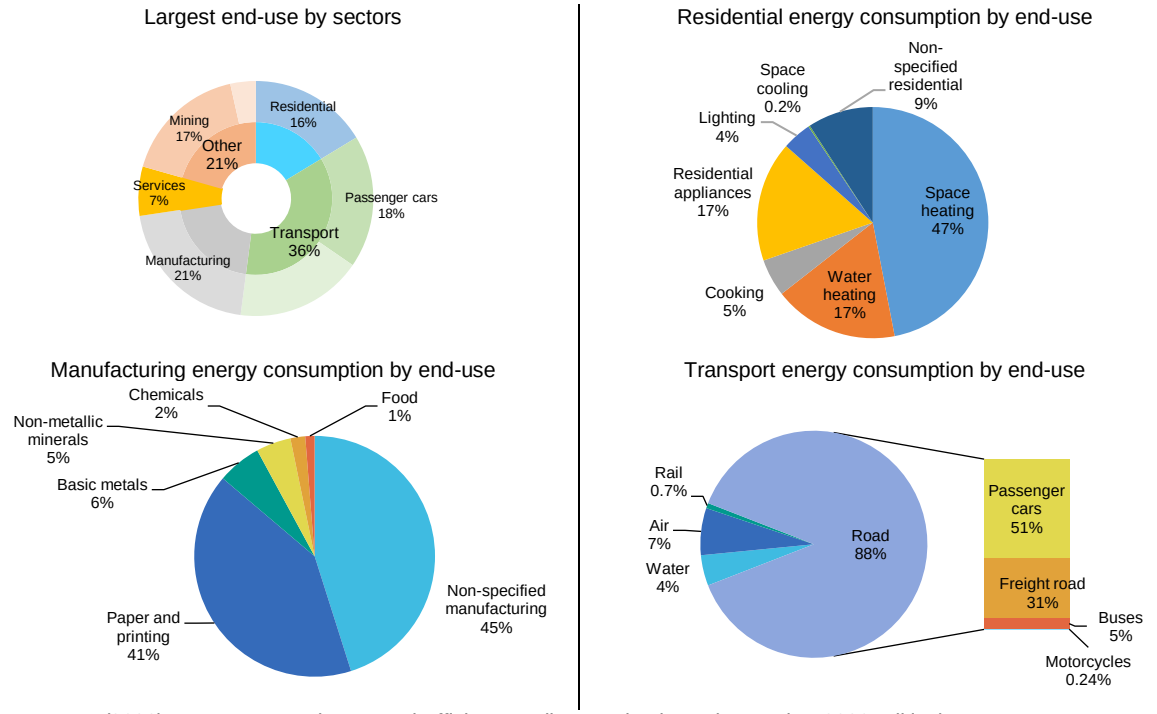
Source: EGEDA (2023)
***Note**: This does not include non-energy sector consumption of energy products.*

[6] Renewables refer to direct-use renewable energy, such as solar thermal energy for water heating, excluding renewable electricity, which is included in "**Electricity and other**".

Chile has launched a domestic Strategy for Electromobility. This strategy aims to zero-emission 100% of sales of light and medium vehicles, public transport vehicles, and major mining vehicles by 2035. Although ambitious, this vision may face challenges such as the need to build EV charging infrastructure throughout the economy, which, given the geographical conditions, makes this task particularly difficult. Nowadays, the transport sector is almost completely satisfied by oil products.

Furthermore, to break down the detailed end-use energy consumption profile based on Chile's end-use energy consumption data from the IEA (2023), the six largest end-use consumers are passenger cars, mining, road freight, non-specified manufacturing, paper and printing, and residential space heating.

Figure 6: Chile's final energy consumption by sub-sector and end-use, 2018



Source: IEA (2023) IEA Energy End-uses and Efficiency Indicators database (November 2023 edition)
Note: the latest breakdown of end-use data is only available in 2018.

TRANSFORMATION

Power sector

Chile has an ambitious goal of achieving 80% renewable energy in the electricity fuel mix by 2030 and 100% zero-emission energy by 2050 in electricity generation (between other actions, including energy efficiency goals) to achieve and maintain the neutrality of all greenhouse gas emissions by 2050. In 2021, the electricity generation fuel mix comprised coal at 29.6%, gas at 18.1%, oil at 3.5%, hydro at 22.0%, geothermal at 0.4%, and other renewables at 26.5%, mainly solar – including thermosolar (Concentrated Solar Power, CSP)- 13%, wind,8% and biomass, 2%.

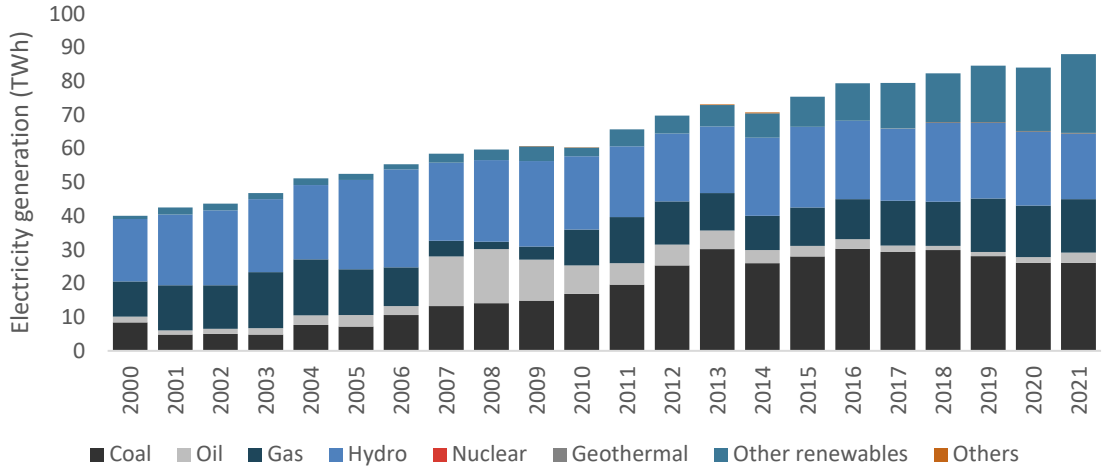
By 2023, Chile has experienced days where most of the electricity was generated by renewable energy.[7] Perhaps one of the most important challenges that Chile needs to face in the short term is strengthening transmission infrastructure and adapting to the market. Given Chile's length, transmitting high volumes of variable renewable electricity from Northern Chile to Central Chile can be challenging considering physical constraints, congestion of transmission lines, etc. Delay in building new power lines has severe impacts on the development plans of new renewable electricity projects.

In the previous charts, the effect of the natural gas import curtailment can be observed from 2007 to 2011. Following the calendar of the Coal Phase-Out Plan, nine coal-fired power units of electric generation were retired between 2019 and December 2023, and two more could be retired earlier than

[7] High level of renewable energy generation was observed during some hours. I.e. 6 January 2024, at 1 pm, 95% of electricity was generated with renewable energies.

originally scheduled in 2024. Additionally, four units are expected to close and another five are expected to switch fuels by 2025. To achieve the plan's objectives, the remaining eight units will be closed by 2040.

Figure 7: Chile's electricity generation by fuel, 2000 to 2021



Source: EGEDA (2023)

However, following these objectives will be challenging over the coming years because the retirement of coal-fired power units must not compromise grid stability and must adhere to operational grid requirements.

Chile has created several mechanisms to promote the inclusion of variable renewable energy, particularly solar energy, into its grids. For instance, Contracts between electricity distributors and power companies are structured on an energy basis and using time slices. These conditions allow solar energy, which is only produced during the day, to participate in energy auctions.

Additionally, Chile issued a Law to promote electrical energy storage in 2023. One of the goals of this Law is to support the inclusion of more variable renewable energy in the grid.

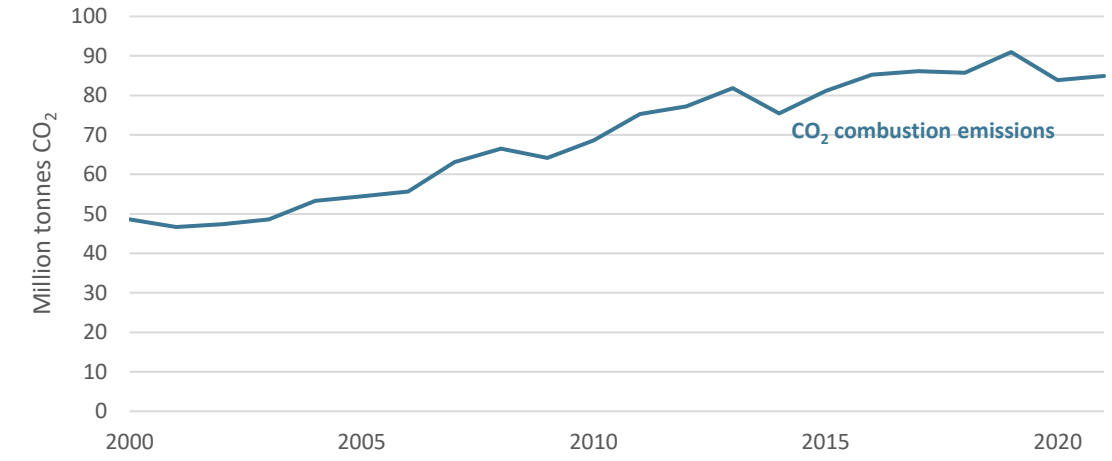
ENERGY TRANSITION

In addition to the policies mentioned above and the efforts to have the Energy Transition Bill approved, the Ministry of Energy and the Ministry of Environment have initiated the development of a Chilean decarbonisation roadmap with the objective of accelerating decarbonisation and making Chile carbon neutral by 2050 or earlier.

Emissions

Chile's CO_2 combustion emissions in 2021 increased by 1.3% relative to 2020, reaching 84 941 kt-CO_2 in 2021. This can be explained by the increase in energy consumption due to economic recovery after the pandemic. However, it is noteworthy that emissions have not exceeded levels observed between 2016 and 2019

.Figure 8: Chile's CO_2 combustion emissions (million tonnes), 2000 to 2021

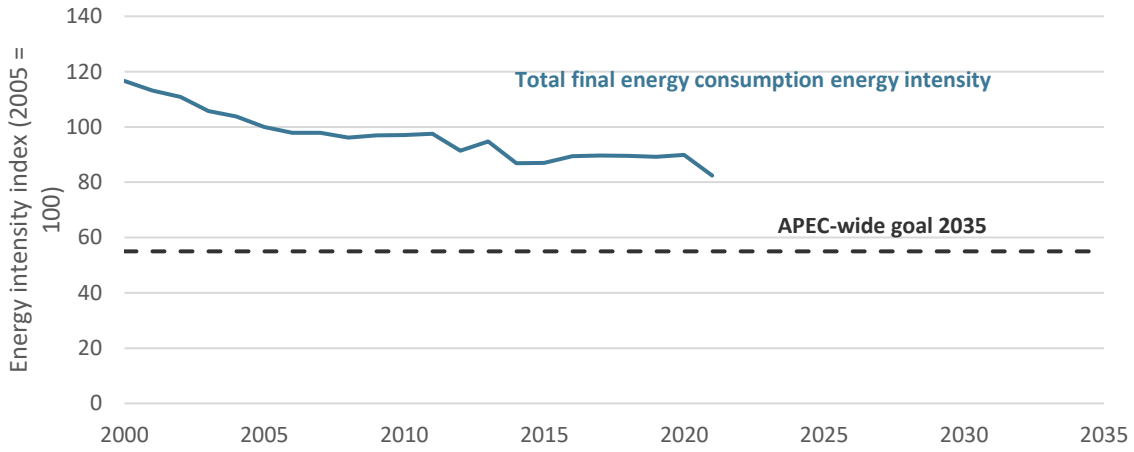


Source: EGEDA (2023)

Energy intensity

Chilean energy intensity decreased by around 8% in 2021, to the lowest recorded since this indicator has been monitored. Given that energy intensity is calculated as the ratio of total final energy consumption over GDP, this decline was mainly driven by the GDP growth observed in 2021, a growth that was the result of the economy's reactivation measures after the pandemic.

Figure 9: Chile's total final energy consumption intensity index, 2000 to 2021 (2005 = 100)



Source: EGEDA (2023)

If 2021 is not accounted for, the energy intensity has encountered difficulty in decreasing since 2015. In Chile, decoupling economy growth and energy consumption has been challenging despite the important efforts in incorporating more efficient technologies.

The following table can be used to summarise some macroeconomic and energy reserves data of Chile.

Table 2: Chile's macroeconomic data and energy reserves

Key data [a]		Energy reserves [b, c]	
Area (million km^2)	0.8	Oil (billion barrels)	000
Population (million)	20	Gas (trillion cubic feet)	000
GDP (2017 USD billion PPP)	495	Coal (million tonnes)	000
GDP per capita (2017 USD PPP)	25 174	Uranium (kilotonnes U < USD 260/kgU)	561
Household size (person/household)	3.0[d]		
Floor area per household (square meter)	44~169 [e]		

Source: [a] World Bank (2023; [b] Energy Institute (2023); [c] Nuclear Energy Agency (2023), [d] Ministry of Social Development and Family, Chile (2023) ; [e] LAERCERA (2019)

ENERGY POLICY

To achieve carbon neutrality. Chile has estimated that around 35% of the energy-related reductions in greenhouse gas emissions by 2050 must be obtained through the implementation of energy efficiency measures.

For that reason, the Chilean government has taken several actions to support the design and implementation of policies that can effectively impact on the Chilean energy mix.

For example, the Ministry of Energy was created in 2010, before that, regulation and energy issues were responsibility of the National Energy Commission (a decentralized public service lead by an Executive Committee, composed of a representative of the President of the Republic (President of the National Energy Commission) and the Ministers of Mining; Economy, Development and Reconstruction; Treasury; National Defense and the Secretary General of the Presidency).After its creation, long-term energy planning was focused and strengthened. Several studies have been carried out to support policies designed.

IMPORTANT STUDIES

The mitigation action plan and scenarios project, MAPS (Mitigation Action Plan and Scenarios), Chile, was developed between 2011 and 2016. The objective was to develop projections of several scenarios to 2030 to develop a mitigation action plan. The results of this study were input to the NDC presented by Chile in Paris in 2015 (Chile updated NDC in 2020). The projections suggest that emissions reduction in the power sector, industry, and transport have the biggest impact.

ENERGY AGENDA

In 2014, The Ministry of Energy launched the **Energy Agenda**. The vision of that agenda was to have reliable, sustainable, inclusive, and reasonable-priced energy. The agenda had 7 axes and include a list of measures for each axis. The axes are the following:

- The new role of the government for the development of the energy sector
- Reduction of the price of energy with more competition, efficiency and diversification of the energy market
- Development of domestic energy resources –this axis mentioned the development of hydroelectric and geothermal plants
- Connectivity for the development of the energy sector- the main action that was completely achieved was the interconnection between the Northern Chile electricity grid and Central Chile electricity grid
- An efficient energy sector that manages the consumption of energy – a key measure was the approval of the Law of Energy Efficiency
- Increased investment in the energy sector for the development of Chile
- Citizen participation and territorial Planning

The mention of solar or wind energy was not explicit in this agenda. Instead, hydropower plants seemed to have played a more relevant role in the elaboration of this document.

Following this version, Chile has updated the energy agenda. The last Energy Agenda is known as **Energy Agenda 2022-2026**. The axes of this new agenda are:

- Equitable access to quality energy
- Clean energy Mix
- Resilient and safe energy development
- Just energy transition and sustainable energy infrastructure
- Energy decentralisation
- Citizen empowerment and democratization of Energy
- Innovation and Inclusive economy growth
- Modernisation of public management

In this agenda, there is a special interest in the impact of the energy sector on the people's lives beyond energy services. Among important measures mentioned are the improvement of thermal insulation for houses, the regulation of firewood and the promotion of certified fuelwood, the access to quality energy, especially in rural areas, certification of zero-energy and zero-carbon constructions.

There is also the desire to accelerate the closing of coal power plants, increase of clean energy in natural gas pipelines, promotion of distributed energy generation.

At the beginning of 2023, an "Initial Agenda for a Second Energy Transition Time" was launched, which considers a series of actions to better enable an accelerated decarbonisation of the electricity sector.

This is in line with the long-term objectives outlined and agreed through the National Energy Policy and the Framework Law on Climate Change.

This agenda for the second half of the Energy Transition considers the deployment of the first 10 measures in four areas of action: Promotion of storage; Mitigation of risks to suppliers; Operational flexibility; and Policy, Regulatory Actions and Urgent Works.

Improvement in transport is mainly discussed as switching from internal combustion engines to electric vehicles.

NATIONAL ENERGY POLICY 2050

Chile published the **National Energy Policy 2050 (PEN 2050)** in 2015. This National Energy Policy was updated in 2022. In this document, Chile announced a vision that is the result of previous efforts to create a vision for the energy sector in 2050. The principles developed in this document were organised in four main pillars: quality and security of supply, energy as a driver of development, environmentally friendly energy, and energy efficiency and energy education.

In 2021, PEN 2050 underwent a two-year participatory updating process, calling on different sectors to participate: citizens, NGOs, civil society, the private sector, the public sector, academia, and members of indigenous peoples.

This document sets out the agreements for the future that accompany the energy transition, considering the changes in the domestic and global context of recent years and revalidating visions and consensus.

The updated PEN 2050 has a new shared vision of an energy sector that is sustainable, efficient, inclusive, resilient, accessible, and respectful of human rights and the diversity of cultures in our territory.

This vision seeks to achieve three great purposes, each embodied in 18 general objectives with 66 specific goals, defined as government commitments.

For each purpose, some of the specific goals are summarised below:

1) **To be protagonists of climate ambition, leading the energy transition to achieve sustainable development and overcome the climate crisis**
    - 100% of energies are zero emissions by 2050 in electricity generation (with 80% renewable energies by 2030)
    - By 2050 (compared to 2018) reduction of at least: 60% of emissions coming from the energy sector (25% by 2030); 40% of direct emissions from the transport sector (20% by 2040); 70% of direct emissions from the Industry and Mining sector

- 35% reduction in the economy's energy intensity by 2050, compared to 2019 (measured as total final energy consumption over total GDP)
- By 2030, the carbon price in Chile should be at least USD35 per ton of CO_2 equivalent, corresponding to the current social cost of carbon. This should be in a range between 50 and 80 dollars per ton of CO_2 equivalent by 2040

2) Improving the quality of life in people's daily lives through energy

- The energy performance of Chilean cities in 2050 should be equal to, or better, than that measured for 2030
- 100% of new public buildings should have "net zero energy consumption" in 2030, considering an optimal energy performance of heating, hot water, cooling, and lighting systems (including improvement in the passive design with optimal building envelope, the efficient use of buildings, the incorporation of distributed generation based on renewable energies and energy management)
- 100% of new residential and non-residential buildings are "net zero energy consumption" by 2050, considering optimal energy efficiency of heating, hot water, cooling, and lighting systems.
- By 2035 all new light and medium-sized vehicles on sale and new additions of urban public transport (buses and taxis) are zero-emission vehicles
- 100% of public and private urban transport buses and taxis are zero emission vehicles by 2040, ensuring that the necessary infrastructure is in place to achieve this
- At least 60% share of zero-emission vehicles in the private and commercial fleet in 2050, ensuring that the necessary infrastructure is in place
- By 2050 all children and young people in the economy receive an education that enables them to use energy responsibly and to take advantage of the benefits and opportunities it offers, and a large part of the Chilean population has an energy culture that allows them to use energy responsibly and sustainably, to understand the information necessary to exercise their rights and duties in energy

3) To have a new productive identity for Chile, transforming the productive sectors to forge a sustainable domestic industry based on energy

- Improve the energy intensity of major energy consumers by at least 25% compared to 2021, by 2050
- By 2050: At least 90% of the energy consumed in the economy to produce heat and cooling in industrial processes comes from sustainable sources
- 100% of medium and large companies in Chile, in 2050 have implemented effective and monitorable energy efficiency and/or renewable energy measures
- At least 6,000 MW of energy storage systems are implemented by 2050, in the National Electricity System (at least 2,000 MW by 2030)

Figure 10: The Eighteen General Objectives of the National Energy Policy 2050

Source: https://energia.gob.cl/energia2050

ENERGY EFFICIENCY LAW

The **Energy Efficiency Law** was enacted in February 2021, aiming to promote the rational and efficient use of energy resources at economy-level.

Its mandates the **Ministry of Energy** to develop a **National Energy Efficiency Plan** every five years, in collaboration with the respective sectoral ministries.

The plan should cover at least the following areas: residential energy efficiency; minimum standards and appliance labelling; energy efficiency in buildings and transport; energy efficiency and smart cities; energy efficiency in the productive sectors; and energy efficiency education and training.

Article 2 Law 21.305 mandates the Ministry of Energy to establish, by decree, the criteria for determining the large companies that must report both their energy consumption and intensity consumption for the previous calendar year. The MEN will update those criteria every four years. The same information must be reported by companies with annual energy consumption equal or bigger than 50 tera-calories (209 TJ). Based on the information reported by companies, MEN will establish the list of "**Consumers with energy management capacity (CCGE in Spanish)"** through a resolution published in the official Gazette, and CCGEs subsequently must implement and maintain an "**Energy Management System (SGE in Spanish)**" as long as they are considered a CCGE or for one year after they lose such status. The SGE could be certified or not, but CCGE must including, at a minimum, an internal energy policy, objectives and goals, action plans, Energy Performance Indicators (EnPI), operational control, measurement, and verification, identified opportunities and implemented or planned energy efficiency action to the MEN. CCGE must have an energy manager (not necessarily exclusive) and must submit an annual advance report.

Also, the law establishes that with the reported information, the Ministry of Energy must prepare an annual public report that describes, in general and by productive sector, the progress and projections of energy efficiency and consumption, good practices and cases of success, as well as the classification of companies, according to the established criteria, forms and deadlines.

Besides, **Article 3 Law 21.305** mandates that all new houses, public buildings, commercial buildings, and office buildings must have an energy rating using a suitable rating scheme to obtain the final approval or definitive acceptance act, issued by the local Municipal Office. For these purposes, an energy efficiency label shall be granted, which will have the purpose of informing about the energy efficiency of the buildings, which must be included in all sales advertising carried out by construction and real estate companies and also must be available for any potential buyer that request it. For

applying the energy rating, this labelling scheme assessment shall be executed by a “Energy Evaluator” figure, in **Article 4 Law 21.305**, a "**National Register of Energy Evaluators (RNEE)**" will also be created under the responsibility of the Ministry of Housing and Urban Development.

Additionally, in **Article 5 Law 21.305**, the law also mandates that municipalities, regional governments, public institutions, the different branches of government and the Armed Forces must ensure the proper use of energy in the buildings they occupy and/or administer and must report to the MEN the consumption of all energy sources used, as well as basic information on their characterisation (such as surface area, number of workers, year of construction, type of envelope, among others). For this purpose, the entity must have one or more managers duly trained in energy efficiency to fulfil the role of "energy manager". With the information reported, the MEN will in turn publish an annual report on energy management and greenhouse gas emission reductions in the public sector.

Regarding electromobility, in **Article 6 Law 21.305**, the law states that the Ministry of Energy shall regulate the interoperability of the electric vehicle charging systems. In the case of light, medium and heavy motorised vehicles, approved or certified, as necessary, the Ministry of Energy, together with the Ministry of Transport and Telecommunications, will set energy efficiency standards.

NATIONAL ENERGY EFFICIENCY PLAN.

Supported by the Energy Efficiency Law, the **National Energy Efficiency Plan** (PNEE) was published in 2023. The main goal is the reduction of 4.5% of energy intensity in 2026, 13% in 2030, and 30% in 2050 in comparison to 2019. There are 32 measures in that plan that are distributed in 4 sectors:

Table 3: Chile’s Energy Efficiency Plan Goals

Sectors	(base year 2019)	Goal 1	Goal 2
Overall	Energy Intensity reduction	4.5% @2026 13% @2030	30% @ 2050
Productive sector	Energy intensity reduction in large energy consumers	4% @ 2026	25% @ 2050
Transport	Performance improvement New Light vehicles	double @ 2035	quadruple @ 2050
Buildings	Thermal energy demand reduction in new buildings	30%@ 2026	50% @ 2050
People	Share of energy efficient appliances in the market for sale	70%@ 2035	100% @2050

The 33 actions described by sector are the following:

1) Productive Sectors (7 measures)

- Implementation of Energy Management Systems for large consumers
- Promote energy management for SMEs
- Update the minimum standards for energy efficiency for electric motors
- Promotion of efficient solutions for thermal and motive uses in the productive sectors
- Promote the training and certification of human capital in energy efficiency for the productive sectors
- Dissemination of the results and benefits of energy efficiency implementation in productive sectors
- Development of energy efficiency indicators for the different productive sectors

2) Transport Sector (8 measures):

- Establishment of energy efficiency standards for light, medium and heavy transport vehicles
- Financial incentives for electromobility
- Acceleration of deployment of sustainable and efficient transportation
- Development of enabling conditions for the electric vehicle charging infrastructure
- Promotion of the efficient use of transport (this measure includes walking and riding bicycles or personal micro-electric vehicles for trips shorter than 5 km)
- Promoting the training and certification of specialists on energy efficiency for efficient transportation

- Boosting Domestic Industry through the promotion of research and innovation in efficient and zero-emission transport
- Dissemination of the results and benefits of energy efficiency implementation in transport

3) Building Sector (5 measures)

- Update the Energy Efficiency Standards in buildings.
- Bolstering of the energy renovation (it means renovation and upgrades) of existing buildings.
- Promotion of thermal upgrades in existing households
- Energy rating of households and other buildings
- Implementation of energy efficiency in public buildings
- Efficient and sustainable residential cooling and heating systems
- Enabling District energy as an alternative to energy supply
- Promotion of economic instruments
- Strengthening the capacity of specialists in energy efficiency in buildings
- Dissemination of the results and benefits of energy efficiency implementation in buildings

4) Citizenship (8 measures)

- Dissemination of public information on the relevance of the efficient use of energy to the public
- Strengthening the educational program in energy and sustainability
- Updating and extending appliance's energy efficiency labels
- Updating and extending minimum energy efficiency standards for appliances.
- Dissemination of energy efficiency labelling for appliances
- Encourage the replacement of appliances with energy-efficient performance
- Analyse the impact of smart cities on energy efficiency
- Institutional coordination

Before the publication of the **National Energy Efficiency Plan**, Chile elaborated the **Energy Efficiency Action Plan** in 2013. The main goal of this action plan was to achieve 12% reduction of energy demand. The evaluation indicated that the energy savings reached 9% in 2019.

RELEVANT INSTITUTIONS IN CHILEAN ENERGY SECTOR

It is notable that Chilean policies undergo a process of public participation where different stakeholders of the energy sector participate during the elaboration of the draft of relevant documents and then drafts are published for public consultation. Although the benefits of this approach are evident, aligning different perspectives can be challenging e. g. regional vision of an issue vs economy-level vision.

The main institutions that play a role in defining the development of the energy sector are the following:

The Ministry of Energy (MEN), in general, is responsible for preparing and coordinating the plans, policies and regulations for the proper functioning and development of the energy sector, which includes all activities of study, exploration, exploitation, generation, transmission, transportation, storage, distribution, consumption, efficient use, import and export, and any other activity related to electricity, coal, gas, oil and oil derivatives, nuclear, geothermal and solar energy, hydrogen and hydrogen-based fuels, and other energy sources and energy vectors.

Some of the functions and attributions that correspond to the Ministry of Energy are:

- Prepare plans and policies for the energy sector
- Study and prepare projections of domestic energy demand and supply
- Study the operation and integral development of the energy sector and what is necessary for the formulation and execution of energy plans and policies
- Elaborate, coordinate, propose and dictate norms applicable to the energy sector, necessary for the fulfillment of plans and policies, as well as for **energy efficiency**, security and adequate functioning and development of the energy system
- Establish the **minimum energy efficiency standards** to be met by products, machines, instruments, equipment, devices, appliances, and materials that use any type of energy resource, for their commercialisation in the economy
- Regarding light, medium, and heavy vehicles, approved or certified, **set energy efficiency standards consisting of energy performance goals**

Through the Ministry of Energy, the following institutions are related to the Presidency of the Republic: the National Energy Commission, Energy Sustainability Agency, the Superintendence of Electricity and Fuels and the Chilean Nuclear Energy Commission.

The **National Energy Commission (CNE)** of Chile is a public decentralised technical body in charge of analysing prices, tariffs and technical standards to which energy production, generation, transportation and distribution companies must adhere, in order to provide a sufficient, safe and quality service, compatible with the most economical operation.

According to the law, the functions and attributions that correspond to the National Energy Commission include:

- To analyse technically the structure and level of prices and tariffs of energy goods and services
- Establish the technical and quality standards essential for the functioning and operation of energy facilities
- Monitoring and projecting the current and expected functioning of the energy sector and proposing to the Ministry of Energy the legal and regulatory norms required
- To advise the Government, through the Ministry of Energy, on all matters related to the energy sector for its better development

The **Superintendence of Electricity and Fuels (SEC)** is a decentralised public service responsible for overseeing and supervising compliance with legal and regulatory provisions and technical standards on the generation, production, storage, transportation and distribution of liquid fuels, gas and electricity, to verify that the quality of the services provided to users is as indicated in such dispositions and technical standards, and that the mentioned operations and use of energy resources do not constitute a danger to persons or things.

In general, the Superintendency of Electricity and Fuels has oversight faculties to supervise compliance with the obligations and duties imposed by the laws, regulations, and norms of the energy sector; sanctioning faculties to investigate and apply the corresponding fines or sanctions; and resolution faculties to resolve complaints from users and companies, ordering the adoption of certain corrective measures, if appropriate.

The responsibilities of the Superintendence of Electricity and Fuels can be summarised by:

- Monitoring and enforcing compliance with technical and safety standards of the electric sector (but is mainly focused on the distribution segment)
- Regulating the quality and safety of fuels, including gasoline, diesel, natural gas, and others
- Conducting inspections, investigations, and audits to ensure compliance with regulations
- Resolving disputes and conflicts between the electricity and fuel concession holders with consumers

The **Energy Sustainability Agency (ASE)** is a private law foundation without profit. Its mission is to promote, strengthen, and consolidate the efficient and sustainable use of energy by bringing together relevant actors at the domestic and international levels and implementing public-private initiatives in various energy consumption sectors, contributing to the competitive and sustainable development of the economy. Its Board of Directors includes representatives of the Ministry of Energy (the undersecretary acts as chairman), Ministry of Finance, Ministry of Public Works, academia and industry.

The agency implements specific programs and projects that promote energy consumption reduction, focusing on the main consumption sectors: industry and mining, transportation, construction, public sector, residential, and commercial. Furthermore, education and outreach play a prominent role, as they allow making Energy Sustainability a cultural value and thus achieving behaviour changes in citizenship.

The **Chilean Commission of Nuclear Energy (CCHEN)** is the government agency responsible for regulating and promoting nuclear energy activities in Chile. It operates under the Ministry of Energy and is tasked with overseeing all aspects of nuclear energy, including research, development, safety, and regulatory compliance.

The main responsibilities of the Chilean Commission of Nuclear Energy include:

- Regulating and licensing nuclear facilities and activities in Chile
- Promoting research and development in nuclear science and technology
- Ensuring the safe and secure use of nuclear materials and technologies
- Monitoring radiation levels and enforcing radiation protection standards

- Providing technical expertise and advice to the government on nuclear energy matters.
- Representing Chile in international forums and collaborations related to nuclear energy

Another institution related to the environmental regulation of energy projects and use is the **Ministry of Environment (MMA)**, which is responsible for overseeing environmental policies and regulations in Chile. The ministry's primary objective is to protect and preserve Chile's natural environment, promote sustainable development, and mitigate environmental impacts, looking for net zero at 2050 (according to the Climate Change Law N°24.455).

Responsibilities of the Ministry of Environment of Chile include:

- Developing and implementing environmental policies and regulations
- Monitoring and assessing environmental quality and biodiversity
- Promoting sustainable use of natural resources
- Fostering environmental education and awareness
- Collaborating with other government agencies, local authorities, and stakeholders to address environmental challenges
- Representing Chile in international environmental agreements and initiatives

PART 2: PEER REVIEW RESULT

REVIEW TEAM REPORT AND RECOMMENDATIONS

The Follow-up PREE in Chile review team has provided recommendations across:

1) Energy Efficiency Policies Development and Deployment.
2) Overview, Institutional and Legal Energy Efficiency Framework.
3) Data Collection and Monitoring.
4) Productive sector/Industry, Standards.
5) Building, Labelling, Lighting and Energy Management Systems, HVAC.
6) Transport, Energy Efficiency Mobility, Standards.
7) Energy Efficiency in Cities, District Energy Systems.
8) Energy Transition, Sustainable Energy and Energy Systems.

1. ENERGY EFFICIENCY POLICIES DEVELOPMENT AND DEPLOYMENT

CRITIQUES/ACHIEVEMENTS

Since the 2009 APEC Peer Review on Energy Efficiency (PREE) in Chile, significant progress has been made on development and implementation of energy efficiency policy though, as in all economies, there is room for improvement. As shown in Figure 9, trends in improvement in energy intensity have flattened out over the past decade and, as well, disruptions associated with the Covid pandemic and global economic factors have made it difficult to track recent trends. Policy has been supported by the creation of institutional structures, legislation, projects and programs.

The Ministry of Energy leads energy efficiency policy. It has a talented team, led by a head with extensive experience in an international context. Specific teams focus on key areas of energy efficiency activity. These groups provided extensive briefings on progress. Policy and program design seemed thorough, and implementation seemed effective within the limits of modest budgets.

There were some uncertainties and overlaps regarding the allocation of responsibilities across agencies, particularly related to the Energy Sustainability Agency, which seemed to have a very ambitious agenda given its structure and resources. However, members of the team seemed to liaise with each other, and showed respect for each other's efforts.

Chile's policy makers have made use of an effective mix of policy tools, including information, communication/education, incentives, regulation, targeting of measures and building supply chain capacity.

While some aspects of energy efficiency policy have progressed well, others have received limited attention. High level political priorities have limited progress in some areas, as discussed below.

The development of the 2026-2030 Energy Efficiency Plan offers an important opportunity to build on recent experience within Chile and internationally through engagement with APEC, the International Energy Agency, and other organisations.

Strong progress

Areas where strong progress seems to have been made include:

- Energy intensity targets with a clear baseline and target year are in place with tracking and reporting.
- Energy efficiency has been integrated into Chile's decarbonisation commitments and strategies.
- Development and implementation of vehicle efficiency standards are being phased in from later in 2024.
- One-third of the buses for public transportation in the Metropolitan region are electric and electric taxis are being piloted and incentivised, while roll-out of inter-operable chargers with associated consumer information is under way. Significant attention is being paid to the safety of Lithium-Ion batteries, the roll-out of inter-operable vehicle charging facilities, and the development of infrastructure for re-use and recycling of batteries.
- Appliance energy labelling, based on the European model, is comprehensive. Some performance standards are in place.

- A strong decarbonisation policy to reduce coal consumption, with an integrated approach to energy efficiency and renewable energy, is underway and is a priority in the decarbonisation strategy.
- Significant progress on industrial energy efficiency has been achieved, including training programs and requirements for implementing energy management systems in line with international standards (e.g. ISO 50001). Large energy consumers in the industry (known as CCGE) must regularly report on performance to the Ministry of Energy. In accordance with the Energy Efficiency Law, capacitation plans have been developed to prepare professionals in energy efficiency so they can become energy managers in the CCGE. Training energy managers who are familiar with each business and have existing internal relationships is potentially more effective than relying mainly on external consultants. This approach also empowers energy managers by giving them the competence to operate and maintain the implemented energy management systems. Additionally, they become counterparts to external consultants and act as technical contact points between the Ministry of Energy and the CCGE within the framework of the energy efficiency law. (See detailed in section 4)
- SMEs are supported by advisory services, finance schemes, and training. In some cases, the bank's confidence to provide loans is supported by a technical validation process and a "Seal of Energy Excellence" given to business, but this is not a requirement. There is increasing focus on the analysis and reporting of Scope 3 carbon emissions. This offers the potential to encourage collaboration between participants in supply chains to improve supply chain energy and carbon productivity.
- New, comprehensive electricity modelling capacity program is expected to be available soon. This will provide significant potential to explore a range of scenarios to compare short- and long-term electricity prices and overall costs of options, and to improve planning. Comparison of a diverse range of demand-side measures with supply-side alternative policies is increasingly important as they may have very different combinations of costs, benefits and implementation issues. When demand-side measures are thoroughly evaluated and their multiple benefits considered over appropriate timeframes, they can demonstrate significant value. Further, options with low short-term costs can have higher long-term costs and carbon emissions.

Limited progress

- Improvement in energy intensity has plateaued over the past decade, though the recent COVID-19 pandemic and global disruptions mean recent data are challenging to interpret. More resources and more robust policy measures are likely to be needed.
- There seems to have been limited focus on the importance of urban and territorial planning by the Ministry of Energy, which impacts transport energy use, and building energy regulation. These, in turn, impact on stationary energy use, health, and business productivity. These areas are managed by other agencies facing competing challenges, the **Ministry of Housing and Urban Development,** which oversees building energy regulation, has provided limited funding for building efficiency retrofitting, in contrast to more significant initiatives for new buildings.
- Constraints on funding, project duration, and scope of interaction with the private sector for the **Energy Sustainability Agency,** mean that some of its programs have a fairly short-term, narrow focus. For example, impressive school building energy upgrades have not documented critical performance outcomes or feedback on the value of multiple benefits for communities, such as increased attendance, lower illness, and improved learning outcomes. This limits the potential to make a strong case for broader implementation and to leverage the recognition of the lived experience of benefits to drive increased building and appliance upgrades in local communities.

CHALLENGES

Chile faces several challenges in planning for energy efficiency, including:

(1) The current design and regulatory structures of the electricity market present barriers to the development and implementation of cost-effective policies and programs on energy efficiency, demand-side management, and deployment of distributed energy resources, including rooftop solar, energy storage, and smart energy management systems. This reflects decisions made years ago, when the market model was developed and implemented to support traditional, centralised, fossil fuel-based technologies and business models. Change is needed to reduce transition costs, future costs, and carbon emissions. Chile is not alone in facing market design challenges, as most economies are confronting similar transitions.

(2) Many observers fail to recognise that the focus of energy policy should be on minimising consumer energy bills/costs, not just to reduce prices. A focus on short-term low prices is likely to lead to long-term increases in prices and overall energy costs, due to short-sighted investment decisions and poorly utilised energy generation and supply infrastructure. For example, reducing winter peak energy demand can reduce the need for additional energy supply infrastructure and increase its utilisation.

(3) Limited energy end-use data and insufficient reporting of efficiency indicators undermine effective policy design and consumer decision-making. For example, the identification of high energy-intensity consumers within each category would support targeted interventions. As renewable electrification expands and climate change impacts increase, the need to manage grid congestion, peak demand, and grid resilience will grow.

(4) Limited good quality monitoring and ex-post evaluation of implemented energy efficiency policies and individual programs make it harder to confirm or update ex-ante assumptions, identify challenging areas, and highlight areas for more efficiency resource allocation. Improved information from these evaluations could also help to adjust policies to achieve greater impact

(5) The **Ministry of Energy** has limited presence at the regional or local government levels. This makes it challenging to design and implement targeted programs that respond to regional and local circumstances. For example, challenges in southern regions include isolated homes and small communities, high and inefficient wood use, cold weather and poor building performance. In contrast, the northern region has the potential to utilise abundant solar energy in a very different climate.

(6) The **Energy Sustainability Agency** seems to have broad responsibilities related to development of design and implementation of projects while considering equity, poverty, gender, education, territorial relevance. But it faces structural and financial limitations and challenges engaging on energy efficiency with businesses.
Transitioning existing buildings to high-efficiency electric technologies away from heavy dependence on wood and fossil fuels for space heating within electricity supply capacity is challenging. Upgrading thermal performance is important to minimise peak demand and equipment cost while delivering improved comfort and health.

RECOMMENDATION

The Government should

1) Incorporate the value of multiple benefits into cost-benefit assessments of energy efficiency and decarbonisation options and policies.
   - Multiple benefits include improved business productivity, and health, lower carbon emission, reduced maintenance/improved reliability, reduced capacity and cost of high-efficiency HVAC and industrial process equipment, increased flexibility of operation, reduced energy infrastructure costs, creating job opportunities, resilience to extreme weather and other business, household and societal benefits.
2) Use energy system modelling with more focus on end-use services as drivers of energy demand to explore short-and long-term impacts of energy efficiency and other demand side and distributed options on consumer and overall costs (energy bills), prices and carbon emissions and other multiple benefits. Given that energy efficiency policies and measures have cross-sectoral impacts, a comprehensive analysis of the energy sector supported by modelling that expands the scope of existing electricity sector models to other energy sources and end-use service would allow for the study of interactions across various energy systems, including gas, oil, and transport, as well as different end-use sectors.
   - Apply these lessons to design consumer tariffs and other mechanisms to motivate change.
   - The review team noted that a study is under way to enhance modelling capability with potential to achieve this outcome.
3) Chile has recently updated its social prices of carbon to USD63.4 per tonne of CO_2 for use in the social evaluation of public investment projects. Estimating the optimal carbon social cost can be challenging because it is difficult to capture the full range of potential impacts due to data and modelling limitations. It is also important to acknowledge that emissions impact different sectors of the economy to varying degrees. While scientific and economic

advancements will help to improve these social price estimates in the future, it is necessary to continually monitor these advancements and update the methodology to include a 'shadow' carbon price, incorporating the best available science and information based on independent analysis (see, for example, https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf) and acknowledging that this cost is increasing over time. This will improve the business case for the implementation of energy efficiency measures.

4) Extend the focus of energy efficiency policy and programs from individual business consumers to analysis and collaboration across value chains, using Scope 3 emission[8] reporting, 'circular economy' partnerships, and 'value chain thinking' facilitated by digitalisation.
    - Significant energy and resource waste can occur at interfaces between participants and as consequences of decisions made upstream play out in the rest of a value chain. Few businesses realise that a significant proportion of their input costs are actually energy costs paid by their supply chain. They should encourage or require their suppliers to improve energy efficiency to reduce their own input costs (see for example https://racefor2030.com.au/project/investigating-transformative-energy-productivity-improvement-in-the-food-systems-value-chain/
5) Review the scale and allocation of funds and resources and clarify the roles and responsibilities of government agencies to underpin rapid growth in activity.
    - The National Energy Efficiency Plan 2022-2026 includes many worthwhile measures. Improved tracking of progress, and ongoing research into reasons for slower or faster progress than expected should underpin ongoing review and improvement.
6) Where existing energy market regulations limit necessary change to support demand-side measures, consider 'outside the box' options such as the introduction of 'distributor/retailer obligation schemes' that offer incentives for investment by consumers in targeted energy efficiency measures that cut carbon emissions while reducing peak electricity demand and consumer energy bills.
    - These can be funded by a small levy on energy prices that can be shown to reduce consumer costs for individuals who take advantage of them as well as reducing electricity supply costs by increasing utilisation of existing electricity supply assets. The International Energy Agency and APEC have published guides for the design of such programs.
    - It is important that incentive and grant schemes can demonstrate real-world savings and benefits and ensure that public funds are spent wisely. But onerous requirements to install energy monitoring equipment, demonstrate precise 'baselines' and proof of performance can undermine participation. So, lessons from other economies, results of laboratory testing or field surveys, funding of monitoring equipment and a mix of up-front funding and rewards for ongoing performance should be used to minimise barriers to participation while ensuring program integrity.
7) Continue to encourage the regional and local councils and their communities to actively participate in the implementation of energy-efficient initiatives across the different energy demand sectors. These efforts can leverage decentralization initiatives, such as the 'Regional Energy Planning' and 'Comuna Energética' programs, where energy planning at the local level requires the involvement of local governments. Integrating energy efficiency concepts from the outset of these local energy plans will enhance alignment with the economy energy objectives and ensure more effective implementation.

[8] ***Note***: Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organisation but that the organisation influences in its value chain, (US EPA)

Box 1.1 Adopting Carbon Pricing Mechanism to facilitate energy efficiency

It is widely recognised that introduction of carbon pricing would send an important signal to markets to drive energy efficiency as well as other decarbonisation measures. However, it has also been found to be difficult to introduce such pricing in many economies for a variety of reasons. Nevertheless, a variety of mechanisms have been implemented in some jurisdictions, such as:

- **Safeguard Mechanism (Australia)** where a specified category of businesses must meet progressively stronger emission reduction targets (in Australia, scope 1 emissions only) and those that exceed their target can create credits tradable within the scheme with those that do not meet their target. This creates a simplified carbon trading scheme. https://cer.gov.au/schemes/safeguard-mechanism
- **Carbon Border adjustment mechanism (European Union)** where specified materials/items imported from economies that do not apply carbon prices have a levy applied. https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

Box 1.2 Energy Efficiency obligation schemes (EEOs): These require energy retailers to deliver energy or emission savings.

- **In New South Wales (Australia): NSW Energy Savings Scheme** focusing on reducing peak electricity demand has been implemented. https://www.ipart.nsw.gov.au/Home/About-IPART/Governing-Legislation/NSW-Energy-Savings-Scheme
- **In France:** the **White Certificate Scheme** has evolved to cover more sectors and also establish robust energy-saving targets for energy suppliers. https://www.ecologie.gouv.fr/politiques-publiques/dispositif-certificats-deconomies-denergie

CRITIQUES/ACHIEVEMENTS

Since the APEC Peer Review on Energy Efficiency (PREE) in Chile in 2009, significant changes have occurred in Chile's energy efficiency institutional framework. At that time, the Programa País de Eficiencia Energética (PPEE), a program under the National Energy Commission (CNE) and dependent on the Ministry of Economy, Development and Tourism (MEFT), was responsible for developing energy efficiency policies and programs.

Chile's efforts to incorporate energy efficiency into its strategic vision for the economy are commendable. Law 20.402 created the Ministry of Energy in 2010 and assigned the duties of developing and implementing energy efficiency policies and relevant regulations to this executive branch. The Law also mandated that energy efficiency be considered a functional area within the Ministry's internal structure. The same Law created the Chilean Energy Efficiency Agency which was established as a nonprofit organisation with public-private governance. Originally, the Chilean Energy Efficiency Agency focused on studying, evaluating, promoting, disseminating information, and developing initiatives related to energy diversification, savings, and efficient use, as per the 4th transitory disposition of Law 20.402. By 2018, its scope expanded to include renewable energy, electromobility, climate-resilient development, climatization(efficient heating and cooling and improved building energy efficiency), and efficient transport, leading to its renaming as the Energy Sustainability Agency. This broader focus, while more integrated, has somewhat diminished the original emphasis on energy efficiency.

This change in the Chilean energy efficiency institutional framework aimed to separate the tasks of developing energy efficiency policies and regulations from executing programs, delegating these responsibilities into two separate institutions.

Since its creation, the composition of the board of directors of the Energy Sustainability Agency has also changed which can influence the institution's priorities. The current board of directors consists of representatives from the Ministry of Energy, Ministry of Finance, Ministry of Public Works, government members, one from academia, one from industry, and one from the mining sector. All of them have legal responsibilities on the decisions made in every board meeting. It is recommended that future members could potentially include energy consumer representatives.

Since its change to the Energy Sustainability Agency, the number of projects has increased which led to an increase of workforce and its deployment throughout Chile. Given that the impact of energy projects is correlated to spatial conditions, deployment of personnel into different regions can facilitate information collection and increased participation. However, the real long-standing impact of these changes is yet to be seen as they are recent. As it was previously mentioned in this report, since the creation of the Energy Sustainability Agency, energy intensity decreased mainly between 2010 and 2015 but then plateaued. The effect of the COVID-19 pandemic may affect the correct understanding of the statistics of 2020 and 2021, however, the observed trend indicates difficulties in gaining energy efficiency, especially in productive sectors. This suggests that prioritization of programs with the highest impact on energy efficiency gains and improved health and business productivity may be required, especially if funds are not expected to grow.

The institutions' work is supported by a legal framework. Law 21.305, approved in 2021, tasked the Ministry of Energy with developing an Energy Efficiency Plan every five years. This plan must address energy efficiency in the residential sector, equipment labelling and minimum energy efficiency standards, energy efficiency in buildings and transport, smart cities, productive sectors, and education and training in energy efficiency.

Chile has demonstrated consistency and permanence in its energy efficiency policies and aspirations. Effective implementation of energy efficiency policies requires participation and coordination among various government institutions and stakeholders. The legal and planning frameworks provide a basis for this coordination and interaction.

There is an established process for developing and updating energy documents, incorporating feedback from multiple institutions. Furthermore, it is crucial to support and expand the critical human capacity for designing, proposing, and implementing energy efficiency policies, as higher ambitions and a more challenging reality will necessitate additional efforts.

CHALLENGES

(7) The rapidly evolving global energy landscape, characterised by emerging disruptive technologies such as smart grids, energy storage solutions, and renewable energy innovations, necessitates a responsive and adaptive institutional framework. Chile's energy efficiency institutions must develop mechanisms to quickly integrate new technologies and adapt to global energy market changes to maintain competitiveness and sustainability.

(8) Coordination challenges arise when institutional responsibilities are not clearly defined. This can lead to duplicated efforts, overly broad scopes, or neglected areas. A clearer delineation of roles and improved inter-agency communication are essential for maximising efficiency and effectiveness.

(9) Chile's ambitious energy efficiency goals require substantial resources, particularly in terms of skilled human resources and financial investment. However, spreading resources too thin can undermine institutional effectiveness. Strategic prioritisation and resource allocation are crucial to ensure that high-priority initiatives receive adequate support to succeed.

(10) High turnover rates among officers dedicated to energy efficiency policies, as seen in the Energy Sustainability Agency, disrupt policy continuity and institutional knowledge retention. Addressing this issue requires strategies to improve job stability, such as better career development opportunities, competitive compensation, and a supportive work environment.

(11) Insufficient funding is perhaps the most persistent barrier against the implementation of energy efficiency projects. Barriers to investment include high upfront costs and perceived risks.

RECOMMENDATION

The Government should

8) Evaluate the effectiveness of the policies developed by the Ministry of Energy and programs executed by the Energy Sustainability Agency to help to identify adequate scope for the activities of the agency to help to secure their effectiveness.
   - The priorities of the Energy Sustainability Agency may need to be evaluated to ensure that energy efficiency remains a priority and programs with the highest impact will be supported.
   - Energy efficiency is still the most cost-effective way to reduce greenhouse gas emissions.

9) Strengthen regional energy ministry secretariats by improving the technical capabilities of their professionals so they can effectively oversee and facilitate the implementation of energy policy at the regional level.
   - The technical capabilities will also allow the secretariat to access important resources from the regions for the Ministry of Energy that are useful for designing more effective energy efficiency policies.

10) Improve the retention of human resources working in the public sector on the development and implementation of energy efficiency policies.
   - Creating an engaging work environment and recognising their efforts can help to improve retention and outcomes. The outcomes could potentially include improved health, productivity, staff retention, reduced maintenance, etc.

Box 2.1 The use of energy intensity as a measure of energy efficiency gains

The main goals of the National Energy Efficiency Plan 2022-2026 are measured by the reduction of energy intensity. However, there is ongoing discussion (Lundgren et al., 2016) about whether energy intensity is an appropriate indicator. This discussion is particularly relevant in emerging economies where substantial structural changes in the productive sector are expected or when drastic economic disruptions, such as the effects of the COVID-19 pandemic, are experienced. Given that energy intensity will serve as a key indicator of the effectiveness of energy efficiency policies and programs, it is important to supplement it with additional data to adequately evaluate the effectiveness of these policies and programs.

Sources: *Ludgren, T., Marklund, P., & Zhang, S., (2016) Industrial energy demand and energy efficiency – Evidence from Sweden. Resources and Energy Economics 43 (2016) 130-152*

3. DATA COLLECTION AND MONITORING

CRITIQUES/ACHIEVEMENTS

Under Energy Efficiency Law 21.305 passed in 2021, the Energy Efficiency National Plan 2022-2026 has been institutionalised and developed clear short-term, medium-term, and long-term goals for energy intensity reduction. It also created the sector goals for achieving the overall energy efficiency goals, including productive, transport, building, and user behaviour and demand sectors.

In addition, the **Ministry of Energy** and **Energy Sustainability Agency** also adopted two different approaches to monitor energy savings, including economy-level savings (top-down estimation) and program savings (bottom-up estimation) aligned with international standards, e.g. Deemed savings (parameters from energy audits and energy labelling), IPMVP (International Performance Measurement and Verification Protocol) and also the LMDI (logarithmic mean Divisia index) decomposition analysis are recommended by **International Energy Agency**. The main achievements are shown below:

- The Ministry of Energy and Energy Sustainability Agency has a very good team that is involved in data collection and analysis and in conducting surveys when necessary.
- Like any other economy, Chile has set energy efficiency (or energy intensity) targets and a method to calculate the progress against their goals that address the different sectors of energy. The Ministry of Energy and Energy Sustainability Agency has established a working methodology to estimate and analyse data, e.g., baseline data for useful life, energy savings, and energy intensity. The conducted studies data can also be useful to amend survey data where possible.
- The Ministry of Energy has likewise established a good working relationship with other statistical agencies/offices to obtain and use other related data/information.

CHALLENGES

The Ministry, drawing on practices from the European Union and other international examples, has developed a systematic methodology for assessing energy-saving performance, incorporating both a top-down approach and a bottom-up approach.

However, there needs to be enhanced communication between this office and other departments within the Ministry of Energy. Specifically, it is essential to establish a clear understanding of why information is being collected, managed and analyzed, as the process of gathering, analysing, and managing energy and related data is costly. Decision-makers who will need these data and analyses for their activities should be clear on what information they need and how the information is best configured to meet their needs. Shortly, the Ministry could balance the accuracy of the energy performance evaluation methodology against the costs associated with data collection and management.

The presentation discussion pointed out that there appears to be some ongoing discussion about how to report trends best and evaluate these trends for best use by decision-makers in the Ministry of Energy. There should be a clear understanding as to the value of trend analysis. Simply because there may be a statistical aberration for a particular period doesn't mean the trend analysis is faulty. For any trend over time, there will be variances to the overall trajectory of a trend line. The important thing for analysts to do is to be able to explain these variations.

(12) Despite its efforts, the Ministry of Energy and Energy Sustainability Agency continuously struggles to obtain baseline data for labelling and other MEPS.
(13) While the team/staff have the necessary capacity to develop indicators to calculate energy intensity, a common understanding or definitions are needed. This will help to harmonise their knowledge, depending on the type of analysis or the target sector to analyse.
(14) In the absence of any other tools or actual data, the Ministry of Energy and Energy Sustainability Agency uses several assumptions and related studies for reference.

RECOMMENDATION

The Government should

11) Considering the establishment of an energy efficiency testing laboratory for energy equipment designed for specific local applications.

- A very critical component of the energy standards and labelling program is the testing of product samples to verify claims on energy ratings such as energy consumption and energy efficiency.
- Due to the current small market size in Chile, it is not feasible to establish testing laboratories for all energy-using products. However, it is possible to evaluate the establishment of an energy efficiency testing laboratory specifically for energy equipment used in unique local applications.
- Establish a baseline and benchmark (a manual) for labelling and standards, hence getting away from too many assumptions
- From the data point of view, the energy savings generated from the use of the more energy-efficient products translates to a potential savings equivalent as well as less importation of fuel products. Consider collaboration with a ministry that approves the standards ratings of appliances and lighting products that have undergone and obtained certification from the testing laboratory.
- For internationally common equipment, it can align with the energy efficiency standards and labelling of neighbouring economies or those with similar energy use profiles. Consider cooperating with other economies with demand for similar appliances and common interests and circumstances to improve cost-effectively, e.g. the "Equipment Energy Efficiency (E3)" Program, an initiative of the Australian Government, states and territories, and the New Zealand Government to improve the energy efficiency of appliances and equipment.

12) Understand the variation and effect of the main economy, climate, and other characteristics on energy consumption (e.g., GDP per capita, average annual and seasonal outdoor temperature oscillations, urbanisation level, and rate of access to electricity) in the development and analysis of energy consumption and related energy efficiency indicators.
    - These characteristics can have a large impact on the design of the domestic methodology for estimating energy efficiency indicators.
    - Improved approaches should be developed that clearly demonstrate trends. Where significant variance occurs over time, analysis should be performed to determine the reason for these variances.
    - Collecting, managing, and analyzing end-use energy data is a crucial process for assessing the effectiveness of energy efficiency. It is advisable to adopt advanced digital technologies (artificial intelligence and big data analytics) for the collection, analysis, and management of end-use energy data. For more detailed guidance, you may refer to the statistical report published by the IEA (2020): "Energy End-Use Data Collection Methodologies and the Emerging Role of Digital Technologies".
13) Consider assessing further to the lowest level of the pyramid (IEA Energy Efficiency Indicators pyramid) to understand better the energy consumption patterns by end-use, such as space heating energy demand by fuel in building, road passenger energy demand by fuel in transport, etc.
    - Depending on the objective of the analysis, calculation of the lower levels of indicators (IEA's energy efficiency indicators pyramid) approach requires additional data sets, which are most often collected in frame sample surveys. This additional data describes energy consumption characteristics and behaviours of consumers in more detail, they are very specific for different consumer groups.; e.g. length of use of appliances/lighting in the residential; distances of travel and for what purpose in transport, etc (APERC, 2012). Refer to successful surveys already conducted, e.g., Japan's "**Survey on the Actual Conditions of Carbon Dioxide Emissions from Residential Sector**" and U.S.-EIA "**Residential Energy Consumption Survey (RECS)**" and "**Commercial Buildings Energy Consumption Survey (CBECS)**."
    - Use consumer electricity data (and, where available, data on other energy source consumption) to identify high consumers (particularly in winter and summer) in each sector for targeted support. For businesses an indicator that reflects energy intensity based on business activity level (e.g. sales, Value Added, etc) should be used in each business category.
14) Consider establishing a mechanism to improve communication with the main end users (of information) and decision-makers to understand their data needs better. This will allow for more economical use of data analysts' time.

- IEA (2023) presents **a roadmap for the development of energy efficiency indicators** in its guideline, **"Demand-side Data and Energy Efficiency Indicators"**, based on an improvement cycle (Plan-Do-Check-Act) and implementation practices from other economies.

Box 3.1 Energy Research and Testing Laboratory in the Philippines

A very critical component of the energy standards and labelling program is the testing of product samples to verify claims on energy ratings such as energy consumption and energy efficiency.

Recognising this, the **Department of Energy (DOE) in the Philippines**, through the assistance of the **United Nations Development Programme (UNDP),** set up in the late 80's a Fuels and Appliance Testing Laboratory (FATL), which would serve as a neutral test house. FATL was later renamed to Lighting and Appliance Testing Laboratory or LATL. It is located at the University of the Philippines (Diliman) Commonwealth property, right beside the Philippine National Oil Company Energy Research and Development Center and within a few minutes of walking from the Philippine Nuclear Research Institute.

LATL is capable of conducting energy performance tests on electrical household appliances such as room air conditioners and refrigerators and lighting products such as fluorescent lamps and ballasts. It has an in-house calibration laboratory which also provides services to the appliance and lighting industry. It is also capable of conducting tests on energy-saving devices that apply to household electrical products. (DOE, 2024)

Source: *https://doe.gov.ph/ertls*

Box 3.2 A roadmap for the development of energy efficiency indicators (IEA)

For helping the economies to locate their start point and to identify suitable targets regarding their respective economy-level interests and priorities, IEA published a guideline for professionals and policymakers presenting a roadmap for the development of energy efficiency indicators in 2023. This roadmap is a strategic document that examines the entire value chain involved in developing energy efficiency indicators. It starts from the initial need for data and indicators and extends to the dissemination and usage stages. This document is designed to serve as a valuable resource for practitioners worldwide in the development of energy efficiency indicators.

Roadmap implementation steps for the development of energy efficiency indicators

Source: *IEA (2023) Demand-side Data and Energy Efficiency Indicators*

4. PRODUCTIVE SECTOR/INDUSTRY, STANDARDS

CRITIQUES/ACHIEVEMENTS

The Ministry of Energy's Productivity Sector Unit should be commended for the number of activities that it has led in energy efficiency. These will be enumerated below.

- The training activities have been impressive. Specifically, the training of energy auditors for the private sector is necessary and appreciated. Additionally, the training of private industrial energy managers is important for the overall domestic economy. Energy efficiency improvements provide financial benefits and energy security value to individual companies and the overall economy-level well-being.
- The **Ministry of Energy** should also be commended for working with the agricultural sector, such as the Clean Production Agreements led by the Sustainability and Climate Change Agency and other efforts on improving land use efficiency and energy efficiency led by National Commission for Irrigation, which deserve commendation. This approach highlights Chile's recognition of an area often overlooked in many economies—a significant oversight. By providing targeted analyses and support to the agricultural sector, Chile not only enhances energy efficiency but also addresses the critical challenge of water resource management. Some early work in the food industry in Chile was appreciated.
- The **Ministry of Energy** also addresses the need for load shifting and demand response. Evaluation of this activity appears to be lacking in other sectors.
- The energy efficiency promotion has been very successful. Based on the analysis of high energy-consuming sectors, good results have been achieved in the field through training, energy diagnosis, technical support, financial support, and other means. Targeted implementation of different policies for small and medium-sized enterprises and large enterprises can more effectively promote energy efficiency work.
- The Ministry of Energy has made remarkable regulation measures in the implementation of mandatory Energy Management Systems (SGE) aligned with international standards (ISO 500001) based on Law 21.305, particularly within its largest energy-consuming companies (CCGE). With 333 CCGE and 182 SGE successfully implemented to date, these efforts demonstrate Chile's commitment to enhancing energy efficiency at scale. This policy, spearheaded by the Productive Sectors Unit, represents a high-impact initiative that not only drives sustainable energy practices in key industries but also serves as a model for effective energy management in other economies.
- The Ministry of Energy and the Superintendence of Electricity and Fuels have established a well-defined division of roles in the implementation of mandatory Energy Management Systems (SGE). The Superintendence of Electricity and Fuels acts as the regulatory authority, ensuring compliance and enforcement, while the Ministry of Energy focuses on legislation and policy development. This collaborative framework has been instrumental in driving the successful adoption of Energy Management Systems, reflecting a strategic approach to achieving Chile's energy efficiency objectives.
- Some banks in Chile have provided green credit instruments to support energy efficiency activities, which are financed with loans from governments to the banks or backed by governments.

CHALLENGES

The Productivity Sector Unit is not without challenges. For example, as in other sectors, there is an overlap between what this Unit is doing versus what the **Energy Sustainability Agency** is doing.

(15) Improved messaging will be important for this productivity sector. There are several areas in which messaging can be improved. The sector should highlight the role that energy efficiency recommendations for energy managers and auditors can play in improving both operational savings, energy security, and multiple business benefits, such as reduced production failures and improved working environments. A greater focus should be on load-shifting technologies that take advantage of demand-side management and technology developments.

(16) There must be a greater focus on recycling and reuse of materials. This approach – now characterised as the "circular economy" – can lead to a reduction of energy use in the longer term. As operating efficiency improves, the significance of 'embodied' emissions in materials

and products is increasing. Chile has already implemented policies and initiatives to promote recycling and reuse of materials, aligning with the principles of the "circular economy." For instance, the Ministry of the Environment, through its Circular Economy Office, leads efforts under the framework of the Extended Producer Responsibility Law (REP Law), while the Ministry of Energy actively integrates circular economy practices into its Projects and Environment Unit. These efforts are further reinforced by the National Energy Policy 2050, which commits to applying circular economy principles throughout the life cycle of energy projects and infrastructure. While these measures demonstrate significant progress, Chile can continue to monitor international trends and best practices to further refine and enhance its strategies. Ongoing improvements in policy frameworks and implementation approaches will ensure that Chile remains at the forefront of sustainable development, balancing energy efficiency goals with broader environmental objectives.

(17) While this came up in discussions with other sectors, it is important to note that the goal of improving energy efficiency must be communicated better. As several presenters noted, there was much more enthusiasm for renewable energy as opposed to energy efficiency. This is not unusual, as many other economies struggle with the same set of perceptions.

(18) Typically, businesses do not focus much attention on energy unless it is unreliable, or prices increase suddenly. So, it is important to emphasise the business benefits of energy efficiency actions, provide relevant demonstrations, and minimise perceived risks, such as loss of production, the flexibility of financing to allow for unexpected changes in business conditions, etc. Internal advocates often need support to develop credible business cases for decision-makers.

(19) For larger businesses, pressure is emerging for reporting on Scope 3 carbon emissions, particularly from supply chains. This is beginning to impact on their supply chains, often SMEs, as they seek documentation of emissions and begin to collaborate or simply require them to meet new contract criteria. At the same time, industries exporting some materials and products face Border Adjustment Mechanisms if they do not pay a carbon price in their own economy. Internationally and within some economies (e.g., Australia), financial regulators are driving the agenda, not environmental agencies.

This commentary leads to one overarching recommendation as follows.

RECOMMENDATION

The Government should

15) Vigorously promote the development of green finance, strengthen financial support for energy-efficient and low-carbon industry development, balance long-term and current needs, and balance incentives and funding constraints.

16) Promote the improvement of existing energy efficiency standards and performance indicators. Expand the product coverage of energy efficiency standards and cooperate with the responsible party supervising and managing the implementation, identifying areas where standards and indicators are most useful.
    - Evaluate program status periodically to stay in front of new technologies and industrial processes.
    - Use financial means to encourage everyone to choose energy-saving products, like green credit from the bank, to promote the equipment's energy efficiency.

17) Strengthen energy auditing and combine it with green financial, subsidy, and regulation enforcement to strengthen the management of energy use in enterprises.

18) Establish a mechanism for updating energy-saving standards, explore a mechanism for transforming energy efficiency benchmarks, innovate energy-saving standardisation implementation by existing energy efficiency promotion platforms, and provide customised professional services such as standard development and standard system construction for enterprises and industry sectors.
    - Chile's implementation of Minimum Energy Performance Standards (MEPS) for appliances in the building sector has achieved notable results. However, many other economies, such as China, have expanded MEPS regulations to include equipment in the manufacturing sector. These economies integrate MEPS with their local energy management system

standards to guide companies toward adopting energy-efficient equipment, achieving more comprehensive energy efficiency improvements (see Box 4.1).

- Consider drawing from these international examples by expanding the scope of MEPS regulations to the manufacturing sector and aligning them with energy management system policies. This approach would promote energy efficiency in energy-intensive industries, further reduce energy consumption, and enhance overall energy efficiency.

19) Mobilise financial regulators to implement measures to require industries to adopt emission reduction strategies that reflect international best practices.

Box 4.1 Alignment of MEPS Application in China's Industrial Sector with International Standards

China has been studying Minimum Energy Performance Standard (MEPS) since the 1980s. So far, China has issued 66 compulsory energy efficiency standards which covered 19 industrial applications.

All 19 industrial applications are commonly utilized in the industry, including motors, pumps, fans, air compressors, and more. Following years of development, China has largely achieved alignment with ISO/IEC standards in terms of testing methodologies and indicator specifications. Specifically, for asynchronous induction motors, China's MEPS for motor, known as GB18613, is categorized into three tiers. Level 3 represents the MEPS criteria, which is equivalent to IEC60034-30-2's IE3, serving as the market entry threshold for motors. This level is a mandatory requirement for manufacturers. Additionally, Level 2, corresponding to IEC60034-30-2's IE2, represents the minimum government procurement standard for public sector use.

Overall, aligning with international standards has improved the energy efficiency of China's industrial applications, resulting in significant energy savings. Moreover, it facilitates improved cooperation in international trade and promotes the globalization of product commerce.

The issue that has arisen is that China, having invested heavily in supervision and regulation for implementation of MEPS, has long followed the ISO 50001 series of energy management standards. These have been equally converted into domestic standard by China, GB/T 23331, "Energy Management System Requirements," along with a suite of related energy management standards. This approach has yielded positive outcomes. Large enterprises are mandated to implement energy management systems and conduct energy management in accordance with these standards, and enterprises actively and consciously purchase high energy efficient applications which used in industry sector.

Source:

- ISO energy management：https://www.iso.org/iso-50001-energy-management.html
- GBT23331:https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=5C5DC8819C8F8D67ECF6EB7681C6907B
- GB18613: https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=42E6A7FD8C7E4BD896221D92ABA1709B
- IEC 60034-30-2: https://webstore.iec.ch/en/publication/30830

5. BUILDINGS, LABELLING, LIGHTING AND ENERGY MANAGEMENT SYSTEMS, HVAC

CRITIQUES/ACHIEVEMENTS

According to the **National Energy Commission** and the **Ministry of Energy**, buildings consume 23% of Chile's total final energy consumption, a large portion of which is used for heating, accounting for 7% of Chile's greenhouse gas emissions. For the building sector, one of the recommendations of the 2009 peer review was the development of mandatory energy efficiency standards for commercial and public buildings.

In this 2024 peer review, the review team has noted substantial progress has been made in promoting building energy efficiency policies and regulatory frameworks, including from voluntary building energy efficiency ratings and certifications to mandatory labelling of buildings energy, and the ongoing upgraded of minimum thermal standards for new houses, expansion of energy labels and MEPS for home appliances, tax exemptions for solar thermal used in new residential projects and technical support schemes for public building sector retrofits.

The achievements include in the following areas:

- Establishing energy efficiency standards for commercial, public, and residential buildings sectors and continually upgrading minimum thermal standards for new houses as part of the **General Ordinance of Urban Planning and Construction (OGUC)**.
- Promoting solar thermal for domestic hot water through tax exemption for new residential projects.
- Collaborating with Ministry of Housing and Urban Planning on voluntary rating and **Certification of Housing Energy Rating (CEV)** and **Sustainable Building Certification (CES**) between 2012 and 2014, and **Sustainable Housing Certification (CVS)** in 2019, and finally, the mandatory building energy labelling under the Energy efficiency Law 2021.
- Good progress has been made in promoting energy efficiency labelling. The implementation of energy efficiency labelling in 31 categories, especially high-energy-consuming products, has shown significant results, not only tapping into energy-saving potential but also considering cost-effectiveness. The overall product category selection is very reasonable, as over 80% of residential energy-consuming equipment is required to use energy efficiency labels. Introducing home appliance labelling in 2007 and MEPS in 2013-2015 to estimate the end-use energy consumption and corresponding savings of household appliances (e.g., lamps, refrigerators) through SEC sales statistics.
- The promotion of MEPS is very effective. The current standard can cover 46% of products, accounting for 10% of electricity consumption. This has improved the energy efficiency of products with high electricity consumption, such as lighting products, and has also brought significant energy-saving effects.
- Technical support scheme for the public buildings sector between 2017 and 2023, resulting in an average building energy intensity decrease of the sampled buildings by 12%.
- Demonstrating several pilot projects of retrofitting existing buildings, e.g. campus buildings.

On this basis, a key future focus is recommended on how to develop concrete and feasible projects under different climate conditions and to cover more building typologies. For example, given the regional differences in climate and building design across Chile, geographically oriented pathways to decarbonising buildings may need to be considered.

With the enactment of Chile's mandatory building energy labelling instrument, various measures to improve energy efficiency can be reviewed as part of a whole building assessment. As a fundamental requirement, continued enhancement of the building envelope’s thermal performance and efficiency of household appliances (e.g. HVAC, lighting, heating, etc.) is critical and requires a cross-ministerial effort. In addition, when adopting a building energy labelling system, some guidelines or standards should be considered that provide processes and procedures for energy management planning, energy efficiency target setting, energy auditing and decarbonisation assessment of buildings. Through these specific implementation methods, energy consumption and carbon emissions can be reduced more systematically within a longer-term schedule.

At the same time, under the NZE goals of decarbonisation and electrification in Chile, a clear energy transition and efficiency improvement timetable should be formulated to cope with short-term to long-term planning and arrangements of resources (such as financial funds and professional support) to meet the needs of new building construction and existing building renovation.

CHALLENGES

As mentioned above, implementation strategies to achieve the NZE goals of the building sector, including financial and professional workforce requirements, were not estimated in this review and are likely to be future challenges.

(20) Significant financial and technical support for retrofitting residential, commercial, and public buildings across the economy is considerable, according to information obtained from the mandatory building energy labelling introduced under the **Energy Efficiency Law 2021**. Estimating the identified requirements for improving the energy efficiency of buildings is critical, and it can be roughly estimated by studying the representative buildings of different types, climates, and energy labels.

(21) In addition to current efforts, these include improvements to the envelope of new and existing buildings, energy-efficient appliances and solar thermal, market-available building technologies such as direct integration of renewable energy, digitalisation, smart controls, heat pumps and district heating, and grid-interactions with the power system should also be considered in the NZE scenarios.

(22) Engagement with both the public and private sectors is critical to scaling up buildings with high energy efficiency. For the NZE, especially in most of Chile, private sectors are playing key roles in the procedures of design, construction, operation, and maintenance of buildings.

There are several comments to be made. While it is not the responsibility of this group (the Ministry of Energy and Energy Sustainability Agency), the analysis of building upgrades is based on improvements in the standards made in 2007 which were based on standards developed in 2001. A substantial amount of time has gone by since then. The technologies – in terms of appliance improvements, building materials, and building envelopes to improve efficiencies related to space conditioning have increased drastically. While standards have been developed for other systems, particularly household appliances and industrial machinery, such as electric motors, there needs to be a concerted effort to update overall building standards. The current ones, after all, are almost twenty years old.

RECOMMENDATION

The Government should

20) Define and benchmark baselines of energy consumption and performance of different building typologies based on data collection and statistics (as recommended in ‘data collection’) and validate these baselines on a regular basis (e.g., every 3-5 years).
    - Based on the baseline analysis, develop and catalog potential energy efficiency technologies (including technical details, cost, etc.) that are suitable for different climate zones and building types and factor in the implications of climate change over building life.

21) Develop an economy-level or regional building energy efficiency roadmap with low-, high-, and net zero interventions, such as replacing outdated appliances with labelled ones, as coordinated actions, e.g., through massive buying or green procurement for a school retrofit project as a pilot.

22) Engage with private sectors (e.g., real estate developers) or financial institutions through REIT, ESCO, guarantee, or service models to improve building operation efficiency through energy audit and management as in ISO50001.

Box 5.1 Australia's Commercial Building Rating Scheme

Australia's commercial building rating scheme, NABERS (National Australian Building Environment Rating Scheme) is one of few rating schemes that is based on actual performance. This has proved very effective, with savings of 30 to 40 percent. It is complemented by mandated performance disclosure at time of sale or lease. It is being expanded to a wider range of building sizes and types. New buildings are addressed by a 'commitment agreement' model, so that the owner of a building after it is occupied is required to demonstrate that it meets the performance claimed at time of design and construction. The scheme can also provide partial compliance with the mandatory building code.

Source: www.nabers.gov.au

Box 5.2 ASHRAE Standard 100 - 2018 Energy Efficiency in Existing Buildings Users' Guide

This users' guide is to provide additional explanation, examples, and reference material to supplement ASHRAE Standard 100. Standard 100 provides procedures and sets criteria to reduce energy consumption through improved energy efficiency and performance in existing buildings. It applies to existing buildings, portions of buildings, and building complexes, including the envelope and all systems.

The guide is generally applicable anywhere Standard 100 is implemented, although it provides some supplemental material specific to the regions of British Columbia and Washington State. However, it can be used as a valuable reference for all economies to develop accessible tools to support building owners, operators, and professionals to reduce the environmental impact of existing buildings.

Source: https://neea.org/resources/ashrae-100-users-guide

CRITIQUES/ACHIEVEMENTS

Chile's transport fuel is imported and comprises over a third of total final energy consumption and 60 percent of petroleum products, creating a significant Balance of Payments deficit and energy security risk (International Transport Forum, 2024)[9]. According to BNE's energy statistics (Ministry of Energy, 2023), Chilean transport energy consumption was 34 percent of the final energy consumption in 2022. It increased by approximately 35 percent to 403 PJ in the decade to 2019. Since then, COVID-19 pandemic and other factors have reduced consumption to some extent (see Figure 4). It produced a quarter of Chile's greenhouse gas emissions in 2022 (Ministry of Environment, 2022).

The main policy related to transport energy efficiency is the Electromobility Plan. This is very comprehensive and has been developed with extensive consultation. It provides a strong basis for future policy development and implementation. Reduction in transport emissions by electromobility is expected to play a significant role in Chile's decarbonisation strategy, reducing energy-related emissions by 18 percent, as noted in the **Carbon Neutrality Report** from the Ministry of Energy (2020).

Strong progress

- Electrification of vehicles is driven by a broad range of well-designed policies and significant institutional support, including training, safety, targeting of programs to high-kilometer vehicles, finance, etc. A third of the bus fleet for public transportation in the Metropolitan region is already electric. Electric taxis are being encouraged with incentives. Policy and practical support for roll-out of recharging infrastructure consider the provision of information on locations, capabilities, and inter-operability of chargers, renewable electricity supply and grid capability, safety, etc.
- Vehicle fuel efficiency is being driven by phase-in of scheduled fuel efficiency standards and driver education.

Potential for further progress

- While the **Electromobility Plan** includes some consideration of urban design to minimise the need for motorised transport and support micro-mobility, these deserve much greater emphasis, as they offer multiple benefits by addressing congestion, air pollution, road safety, independent travel by young, old, and infirm, and equity.
- The provision of safe and extensive micromobility infrastructure and EV charging services, as well as fire safety information and standards regarding batteries and recharging, should be high priorities in new and existing urban areas.
- The provision of services via 'virtual' systems such as telehealth, work-from-home (or local shared business office/workspaces) is evolving and could be encouraged.
- More focus on optimising the "**last kilometer (mile) problem"**[10]' and local small-item freight could also help reduce congestion. Targeting light freight vehicles used in urban areas can also be effective. Stop-start traffic and low speeds maximise EV energy recovery and reduce the significance of aerodynamic drag, while many vans can accommodate batteries and often travel moderate daily distances with access to battery charging.
- While electric bikes, 'micro-freight' vehicles, and bicycles are being supported, stronger measures could be implemented. Road safety is a key issue: in 2023, 13 percent of road fatalities were 'motorised two-wheelers,' 3 percent were cyclists, and 28 percent were pedestrians (International Transport Forum, 2024). All these groups could benefit from stronger policies and improved infrastructure.

In some economies, the number of fires caused by E-bike battery charging has increased. Chile seems to be focused on this issue through standards and education. An interesting development in India and Chinese Taipei (e.g. the business model of Gogoro) is the sale of electric 2 and 3-wheelers without batteries, linked to the provision of **"swap stations"**. This reduces the vehicle's capital cost, shifting

[9] International Transport Forum (2024) Road Safety Country Profile Chile 2023 report indicated over 2,000 deaths in 2022, almost half of them pedestrians, cyclists or e-2-wheelers, https://www.itf-oecd.org/sites/default/files/chile-road-safety.pdf

[10] Last kilometer (or called last mile) problem lies in the fact that while customers want deliveries to be free and fast, last mile also is the most expensive and time-consuming part of the supply chain process amounting up to 53% of total shipping costs.(FarEye, 2022)

battery cost to a running cost lower than petrol. It also reduces fire risk from home charging. These batteries could also be used for stationary energy activities by households who cannot afford to connect to the electricity grid, or for use at work sites or recreational events.

There are clear targets for rates of improvement in new vehicle fuel efficiency, adoption of electric vehicles and associated infrastructure, and data collection and engagement. However, global progress in this area is accelerating. The targets could be modified to strengthen them to match progress in economies that are major EV manufacturers and/or major markets. This would allow Chile to accelerate progress by taking advantage of global innovations and economies of scale.

CHALLENGES

Due to increased travel and freight activity, Chilean transport emissions and fuel use have been increasing. Measures that reduce travel and shift to alternatives to cars are important, as well as improving vehicle fuel efficiency and electrification.

(23) Present policy development has rightly focused on equitable, safe, and comprehensive provision of EV charging equipment as part of the EV 'ecosystem.' However, many economies are facing challenges such as the provision of charging for those without private garages and the high cost of provision of electricity supply infrastructure to fast chargers, especially in rural areas, where chargers have intermittent high use (e.g., rural areas at start and end of school holidays), and for heavy vehicles. The incorporation of battery storage and dedicated renewable generation in electricity grids can help. As the energy density of batteries improves and electric truck prime movers appear, the potential for trucks or trains to shift large batteries to where and when they are needed seems to be emerging. These could provide local stationary electricity sources as well.

(24) Road freight is a significant and growing share of transport fuel use. P.102 of the Electromobility Plan suggests freight used 27.3 percent (107 PJ) of transport energy in 2021, rising to 36.1 percent (183 PJ) in 2050, an increase of 71 percent. Presumably, this includes the transport of mined products.

(25) According to IEA (2023) data[11], almost half of the energy consumed by '**Other Industry** (Non-energy insensitive industries)[12]' in Chile, which includes mining, is oil. It is likely that much of this oil is used for the transport of mined products, as well as on-site. Gravity can also contribute to vehicle electrification, as outlined below.

A targeted program focusing on low-carbon transport of heavy freight/mining output could accelerate change in emissions and fuel use of both loaded trucks travelling downhill to ports and empty trucks returning to mines, using options such as solar battery chargers, battery trailers providing portable charging for trucks, and regenerative braking. For example, the Escondida mine is approximately 3,000 metres above sea level and 160 kilometres from its port. Electric or hybrid trucks could generate a substantial proportion of the electricity required[13].

Efforts have been made to improve aviation efficiency by coordinating landings. In 2021, air travel consumed 6.4 percent of transport fuel, approximately 25 PJ of the total of 390 PJ. However, P.102 of the Electromobility Plan suggests that air travel will increase to 17.1 percent of an increased amount of 507 PJ, 87PJ, more than triple present fuel use. Air travel energy use seems to deserve close attention. Ongoing improvements in operational efficiency could be combined with a shift to renewable fuels and electric aircraft for shorter flights or ground transport. [NOTE: the Electromobility report uses TCal not PJ – 1 PJ=239TCal]

RECOMMENDATION

The Government should

23) Build strong links between Ministry of Energy, Ministry of Housing and Urban Planning, and other ministries or related government entities participating in relevant policy decisions.

[11] IEA (2023) Latin America Energy Outlook, P214.
[12] Energy-intensive industries include chemicals, iron and steel, non-metallic minerals (cement and other), non-ferrous metals (aluminium and other), and pulp, paper, and printing. (IEA, 2023)
[13] BHP, Caterpillar, and Finning announce an agreement to replace entire haul truck fleet at Escondida Mine in Chile , https://www.bhp.com/news/articles/2022/08/bhp-caterpillar-and-finning-to-replace-entire-haul-truck-fleet-at-escondida-mine-in-chile.

- Urban and regional planning to minimise the need for motorised transport and provide safe, convenient infrastructure for low or zero-carbon movement, battery charging and 'virtual' service delivery is important – (e.g. case studies from APEC Low Carbon Model Towns project)

24) Support the Ministry of Environment on the modification of the transport emission reduction target design so that it can be increased in line with likely high rates of global vehicle electrification and accelerate the stringency of vehicle fuel efficiency standards to maintain momentum for change.
25) Target electrification of freight vehicles that operate in congested traffic and heavy vehicles, including establishing an all-electric mine ore transport route for E-trucks from mines to ports to take advantage of the altitude change between mines and ports.
26) Utilise trailer-based batteries towed by semi-trailers or locomotives to provide flexible and widely accessible EV battery charging and other services (e.g. remote homes and post-disaster support) to minimise costs and pressures on electricity grids.
    - A team at the LNBL in USA has studied the use of trains loaded with batteries as an alternative or complement to powerlines for electricity supply. See the following link as a reference https://www.nature.com/articles/s41560-023-01284-x

Box 6.1 Decarbonising Australia's transport sector: Diverse solutions for a credible emissions reduction plan

The Australia federal government's transport and infrastructure sector plan provides an ideal opportunity to incorporate this approach to develop a credible plan, as framed by Climateworks centre. These solutions include:

- Avoiding the need for some travel and making car and truck trips shorter and more efficient.
- Shifting to lower-emissions modes of transport, also referred to as 'mode shift', such as travelling by train instead of plane, using more active and public transport, and shifting freight by rail.
- Improving vehicle and fuel efficiency, for example, getting more zero-emissions vehicles – like battery electric vehicles or hydrogen fuel cell vehicles – on the road and using lower carbon liquid fuels.

Source: *https://www.climateworkscentre.org/resource/decarbonising-australias-transport-sector-diverse-solutions-for-a-credible-emissions-reduction-plan/*

7. ENERGY EFFICIENCY IN CITIES, DISTRICT ENERGY SYSTEMS (DES)

CRITIQUES/ACHIEVEMENTS

The Chilean government has made remarkable progress in developing the market for District Energy Systems (DES) to enable implementation since the last energy efficiency review in 2009. Modern DES with high percentage of renewable energy can deliver space heating (including domestic hot water) and cooling efficiently, especially in areas with high density of buildings and/or simultaneous needs for heating and cooling. Through the activities during that period, the DES market in Chile was well pre-heated and ready to be further developed to implement pilot projects and scale up to cover more cities as the next steps in the future.

The main achievements include:

- Establishment of the National District Energy Office (NDEO) as the main technical office to support, disseminate and facilitate DES in Chile. NDEO is the central think tank and technical center with expertise in DES in the Energy Sustainability Agency, and under the guidance of the Ministry of Energy.
- Political buy-in and recognition of DES as a key technology for energy efficiency and air quality. DES has been included in both short-term and long-term energy efficiency and climate change policies from the central government. The Ministry of Energy, together with other relevant ministries, e.g. the Ministry of Housing and Urban Development, has published regulations and policies to incentivise the development of DES, e.g. in urban planning stage, and some more policies, e.g. public financing evaluation method for DES, are under development.
- Assessed, evaluated, and identified potential DES projects across the economy through the leadership of NDEO and support by the GEF-7 and other international collaborations, e.g., with the Danish Energy Agency, Net Zero World Initiative, UNEP, etc.
- Conventional training programs, technical guidance and handbooks, evaluation tools and other capacity building materials and products were developed under the leadership of NDEO. These capacity building and training activities have largely supported build-up of the local expertise on DES thus in turn to enable the implementation and scale up of DES in Chile.

CHALLENGES

(26) The regulatory framework to define which ministry or units should take the lead on developing and implementing heating and cooling projects is lacking. The implementation of district energy systems requires great efforts to coordinate and engage among different sectors and across ministries, local governments and government agencies for decision-making, urban planning and connections with end-users etc.

(27) Lack of confidence from stakeholders in implementing/utilising district energy systems (DES). There is a need to set up pilot projects of district heating and cooling (DHC) to demonstrate the potential multiple benefits in social, environmental and economic aspects, among government agencies of different ministries, stakeholders and end-users.

(28) Lack of clear business models with long-term financial mechanisms in the context of Chile. There are some successful business models and financial mechanisms in different economies already, however, the conditions may vary considerably economy by economy.

(29) Lack of long-term awareness raising and capacity building plans in economy and sub- economy level, especially the implementation of DES, which normally links to sector coupling with a consideration of cooperation across traditionally separate sectors and needs to engage among stakeholders and policymakers from other sector outside of energy as well, requiring strong engineering background in local level, e.g. city engineers.

RECOMMENDATION

The Government should

27) Develop regulatory framework or mechanism or guidelines on DES project development to clearly define the roles of different parties as ‘who should be responsible for what’, standardised steps in project development, beneficial calculating and reporting methods or frameworks, engineering design rules and other relevant topics, in order to facilitate the development of DES market in Chile.

- It should also consider the various conditions of economic development and local context of available technologies (e.g. geothermal, waste heat from industry etc.) in different provinces and cities of the economy.

28) The MEN should take the lead and coordinate with other relevant ministries for regional energy mapping and planning, with a view of sector coupling, and consider waste heat, building energy consumption, city/regional level urban planning and development planning etc.
    - Thus, the future development of the district energy system should be aligned with the economy's commitment to energy efficiency targets.
    - Meanwhile, the leading role of the Ministry of Energy to coordinate, implement and evaluate DES projects is recommended to be defined by official documents from the central government.
29) Establish financing mechanisms for district energy to channel the potential investment from international financial institutions (e.g. sovereign funds, sustainable infrastructure funds, and responsible funds from insurance companies) through the design of business models (e.g. DFBOT (Design, Finance, Procure, Build, Operate, Transfer), Cooling/Heating as a Service) under different types of public-private partnership.
30) Develop long-term knowledge sharing to build up economy/regional expertise on district energy implementation through a virtual knowledge sharing platform on tools e.g., DHAT (District Heating Assessment Tool) tool from Danish Energy Agency), international or regional best practices, standards (e.g. ISO), and vocational training programs for professions and engineers.

Box 7.1 Best practices and virtual knowledge sharing for energy efficiency in cities:

- Global Platform for Urban Climate Neutrality (GPUC) by UNEP: https://c2e2.unepccc.org/gpuc/
- C40 climate action plan in cities knowledge sharing platform: https://www.c40knowledgehub.org/s/article/Mapped-Cities-with-a-climate-action-plan?language=en_US
- District energy academy by Danfoss: https://www.danfoss.com/en/about-danfoss/our-businesses/heating/knowledge-center/district-energy-academy-by-danfoss/
- Sino-Danish Clean and Renewable Heating Cooperation Centre: https://c2e2.unepccc.org/sdrhcc/sdrhcc-english/
- Amsterdam smart energy efficiency in cities: https://www.amsterdam.nl/en/

Box 7.2 Assessment tool for energy efficiency in cities:

- District energy rapid assessment tool for Chile: https://toolbox.unepccc.org/district-energy
- DHC planning tool THERMOS: https://www.thermos-project.eu/thermos-tool/what-is-thermos/
- City low-carbon development modelling tool RETScreen: https://natural-resources.canada.ca/maps-tools-and-publications/tools/modelling-tools/retscreen/7465

8. ENERGY TRANSITION, SUSTAINABLE ENERGY, ENERGY SYSTEMS

CRITIQUES/ACHIEVEMENTS

Chile has done a commendable job of linking energy policies and goals with the realities of climate change. This approach has required a systems approach with which the economy has done well. Specific to energy efficiency, Chile policies and the implementation of those policies has led to a 15% reduction in energy intensity, which, in turn, has led to a 20% reduction in greenhouse gas (GHG) emission from the level estimated in the PAEE 2020.

The **Energy Sustainability Agency** has been effective in several areas. Its cross-cutting approach to education, pilot projects, and data gathering demonstrates effective management systems, thinking and leadership. In particular, outreach for education will continue to be critical.

Energy Sustainability Agency should also be commended for effectively involving communities and women in human capital development programs and projects in collaboration with the Gender and Human Rights Office of the Ministry of Energy. **Energy Sustainability Agency** has also been effective in addressing equity concerns as well as reaching out to communities on a regional (territorial) basis.

CHALLENGES

However, there are a number of concerns related to how the **Energy Sustainability Agency** operates in conjunction with—sometimes in a duplicated form—the Ministry of Energy. Section 2 has covered this issue in part and it will be discussed as part of one of the recommendations.

(30) Funding for **Energy Sustainability Agency** activities, comes from the Ministry of Energy budget, allocated in the Public Sector Budget Law for this purpose. Additional funding for several initiatives and projects also comes directly from the Ministry of Energy. However, external funding for other initiatives approved by the Agency's Board of Directors, has been erratic, with no set budget other than that requested in projects from a variety of sources. This has led to the observation that – despite having a strategic plan – many activities seem ad hoc and opportunistic. The strategic plan simply serves as a rationale – after the fact – for the work that the ASE has been commanded to do. The need for clarity between agency responsibilities as to how Chile will meet its energy and GHG reduction goals in a cost-effective manner will need to be addressed.

(31) Through the Energy Storage Law published in 2022, the **Ministry of Energy** has considered how to make better use of demand-side management and demand response technologies at an economy level. As storage systems are rapidly increasing in importance around the world, Chile should take advantage of its lithium resources by having effective management plans for the use of energy storage systems on an economy-level scale. Despite these efforts, there is substantial untapped and emerging potential

RECOMMENDATION

The Government should

31) Complement the National Lithium Strategy, published in 2023, that is focused on lithium extraction and the role of the state on this activity, with action roadmaps and detailed plans that will strengthen local lithium value chain. These plans should prioritize the optimum local use of its lithium and other domestic resources that underpin a global transition to renewable electricity and zero carbon emissions. This approach would demonstrate their value to other economies and benefit Chile's economy.
    - These plans should be specific on how it will be implemented.
    - This in turn will allow for increase focus on expanded use of energy efficiency and renewable energy technologies as part of an overall demand-side management and demand response program.

32) Develop an improved strategic plan that better describes how its efforts meet its overall goals.
    - The second recommendation is based on the need for Energy Sustainability Agency to become more focused on the work they are already doing. This will also allow them to be more thoughtful about integrating the agency's various activities. The development of a

new strategic plan would also allow for funding entities to have a better idea of agency focus.

- The strategic plan should **NOT** be developed until there is clarification of roles and responsibilities between Energy Sustainability Agency and the Ministry of Energy. Thus, the Recommendation from Section 2 will be repeated here with an analogy to the United States Department of Energy (DOE) and its laboratory system.
- Based on the brief history (See the box 8.1) provides a basis for a comparison between the United States Department of Energy Laboratory complex and the situation between the Ministry of Energy and the Energy Sustainability Agency. The recommendation is to strengthen ASE's technical focus and protect it from temporary government shifts and changing policy priorities. One example of these changes is the broadening of the ASE's scope from energy efficiency to sustainable energy. These efforts could enhance the effectiveness of ASE's activities.
- A possible strategy could help to strengthen ASE's technical character may involve structural changes, which would require further discussion in Chile. Summarizing the analogy of the examples in the box 8.1, a possible future scenario envisions the Ministry of Energy overseeing ASE. ASE would be an independent part of the Ministry. The Ministry would be required to develop funding requests that would include funding for Energy Sustainability Agency. Energy Sustainability Agency would still be allowed to work for other agencies and the private sector as long as these activities were consistent with Ministry objectives and Energy Sustainability Agency's strategic plan.

Based on this historical review, Chile might use the United States Department of Energy laboratory analogy (see Box 8.1) in order to carry out the following recommendation:

33) Consider establishing a high-level independent committee to evaluate activities carried out by the Ministry of Energy and the Energy Sustainability Agency for the implementation of energy efficiency initiatives. The purpose of this committee would be to identify strategies to enhance synergies between their actions and allocate efforts and resources more efficiently and effectively for implementing energy efficiency strategies, considering the roles and functions that are determined by the relevant Laws. These committee's findings and recommendations could be then implemented to improve outcomes. In considering this analogy:
    - Given **Energy Sustainability Agency**'s position as compared to the **Ministry of Energy**, the government could consider using the US Department of Energy model with its laboratories as discussed in Box 8.1. In that way there would be clarity for avoiding duplication of work between MEN and ASE.
    - Following this model would also provide for consistent funding to **Energy Sustainability Agency** for activities which complement other parts of the Ministry.
    - This model would also provide clarity in terms of how different decision-making roles and responsibilities would be distributed.

Box 8.1 Evolution and Expansion of the U.S. Department of Energy Laboratory System:

The Department of Energy laboratory system is based in part by a document developed by Vannevar Bush shortly after World War II, entitled, "Science, the Endless Frontier; A Report to the President on a Program for Postwar Scientific Research." The thesis of the report was that the United States should continue to fund research and development in a variety of areas.

Initially, the Department of Energy laboratory system focused on weapons research and testing and basic sciences, such as chemistry and physics. However, the laboratory system evolved over time to include substantive amounts of engineering development that were not associated with weapons. The laboratories were originally part of the Atomic Energy Commission. However, over time – and in large part due to oil embargoes – two new agencies were created in 1978. The Nuclear Regulatory Commission focused on licensing of commercial nuclear reactors. The Department of Energy focused on weapons research and testing and on science and technology development, broadly writ. Thus, during the Carter Administration, the laboratories' roles were significantly expanded to include analysis and assessment of programs, policies, and technologies.

The laboratories were initially prohibited from receiving funds from government or non-government organisations as a means of preventing them from competing with the private sector. This prohibition was partially eroded in the early 1980s with the allowance to do work for others as long as it was considered "unique" as compared to private sector capabilities.

Finally, in 2016, a report entitled, "Review of National Laboratory Capabilities to Support DOE's Grid Modernization Initiative" – with requested addendum in June 2016." This report, sent to Congress, was catalogued DOE Laboratory Capabilities. The report contributed to the current situation where the Department of Energy laboratories are allowed to compete on certain governmental solicitations.

APPENDIX A: REVIEW TEAM MEMBERS

Name	Position	Organisation	Economy	Primary role
Dr Kazutomo IRIE	President	APERC	Japan	Team Leader
Mr Alan PEARS	Senior Industry Fellow	RMIT University	Australia	Expert
Dr Ren LIU	Associate researcher	China Institute of Standardization	China	Expert
Dr Hsu-Cheng CHIANG	Technical Director	Industrial Technology Research Institute	Chinese Taipei	Expert
Dr Terry SURLES	Consultant	The University of Hawaii	USA	Expert
Dr Zhuolun CHEN	Senior Advisor	UNEP Copenhagen Centre on Energy Efficiency	China	Expert
Ms Elvira Torres GELINDON	Research Fellow	APERC	The Philippines	Facilitator
Dr Manuel Antonio HEREDIA MUNOZ	Senior Researcher	APERC	Peru	Facilitator
Mr Ting-Jui SUN	Senior Researcher	APERC	Chinese Taipei	Facilitator

APPENDIX B: ORGANIZATION AND OFFICIALS CONSULTED

Name	Organisation
Claudia Sanhueza *Undersecretary of International Economic Relations*	Undersecretariat for International Economic Relations
Gonzalo Yevenez	Undersecretariat for International Economic Relations
Héctor García	Ministry of Foreign Affairs
Luis Felipe Ramos *Undersecretary of Energy*	Ministry of Energy
Doris Mora	Ministry of Energy
Michel Núñez	Ministry of Energy
Jonathan Sepúlveda	Ministry of Energy
Javiera Rossel	Ministry of Energy
José Ignacio Medina	Ministry of Energy
Maria Helena Lee *Head of International Relations Office*	Ministry of Energy
Adelaida Baeriswyl	Ministry of Energy
Laura Arce	Ministry of Energy
Mauricio Riveros *Head of the Sustainable Energy Division*	Ministry of Energy
Ximena Ubilla *Chief of Internal Management Unit*	Ministry of Energy
Rubén Muñoz *Chief of Geothermal and District Heating Unit*	Ministry of Energy
Felipe Mellado	Ministry of Energy
Carolina Riobó	Ministry of Energy
Hernán Sepúlveda *Chief of Sustainable Energy Resource Unit*	Ministry of Energy
Carolina Monserrat García	Ministry of Energy
Fabián Bustos	Ministry of Energy
Danilo Jara *Chief of Regulatory Support Unit*	Ministry of Energy
Danae Cancino	Ministry of Energy
Daniel Gonzalez	Ministry of Energy
Alexander Cerda	Ministry of Energy
Juan Pablo Donoso	Ministry of Energy
Marcelo Padilla *Chief of the Efficient Transport Unit*	Ministry of Energy
Pamela Castillo	Ministry of Energy
Armando Pérez	Ministry of Energy
Marcel Silva *Chief of Productive Sectors Unit*	Ministry of Energy
Priscilla Leufuman	Ministry of Energy
Katherine Navarrete	Ministry of Energy

Name	Organisation
Matías Cárcamo	Ministry of Energy
María Soledad Barrios	Ministry of Energy
Alberto Ortega	Ministry of Energy
Vittorio Tronci *Chief of Buildings & Cities Unit*	Ministry of Energy
Ignacio Sánchez	Ministry of Energy
David Cabieles	Ministry of Energy
Yanara Tranamil	Ministry of Energy
Andrés Veliz	Ministry of Energy
Luis Ternicien	Ministry of Energy
Julio Clavijo Cabello *Chief of Sustainable Energy Unit*	Superintendencia de Electricidad y Combustibles (SEC)
María José Fuenzalida González	Superintendencia de Electricidad y Combustibles (SEC)
Nicolas Mena Reyes	Superintendencia de Electricidad y Combustibles (SEC)
Rosa Riquelme *Executive Director*	Energy Sustainability Agency
Cristina Victoriano Bugueño	Energy Sustainability Agency
Juan Pablo Payero Díaz	Energy Sustainability Agency
Rodrigo Barrera Rojas	Energy Sustainability Agency
Ignacio Rivas Zeballos	Energy Sustainability Agency
Claudio Pérez Barra	Energy Sustainability Agency
Jessica Miranda Gálvez	Energy Sustainability Agency
Clément Demons	Energy Sustainability Agency

APPENDIX C: AGENDA

APEC Follow-up Peer review on energy efficiency (PREE) in Chile

6 - 10 May 2024 | Santiago, Chile

Venue: Under-Secretariat for International Economic Relations Hall, Santiago City

SUNDAY, 5 MAY 2024 – DAY 0	
18:00	**Meeting at the Hotel lobby** **Hotel Gran Palace** Address: Huérfanos 1178, floor number 10
18:00 – 20:00	Pre-meeting with PREE experts

MONDAY, 6 MAY 2024 – DAY 1	
08:30 – 09:00	**Registration**
09:00 – 9:30	• **Welcoming.** Undersecretary of International Economic Relations ○ Claudia Sanhueza Undersecretary of Energy ○ Luis Felipe Ramos • **Opening Remarks.** ○ Dr Kazutomo IRIE, APERC President • **Introduction of delegation and participants.** ○ Ms Elvira Tores Gelindon, APERC • **Group Photo**
	Day 1 - Section I
9:30 – 10:15	**I. ENERGY EFICIENCY CONTEXT IN CHILE** **Topics**: - Overview of Chilean Energy Sector. - Follow Up on APEC PREE 2009 Recommendations. - Institutional & Legal Energy Efficiency Framework. Speaker: Mauricio Riveros – Head of Sustainable Energy Division
10:15 – 11:00	**Q&A - Panel Discussion** (APERC Expert Review)
11:00 – 11:15	Coffee Break
11:15 – 12:00	**II. ENERGY EFICIENCY CONTEXT IN CHILE** **Topics**: - Strategic Overview of Energy Efficiency Policy, Strategies and Plans. Speaker: Alex Santander – Head of Strategic Planning and Sustainable Development Division
12:00 – 12:45	**Q&A - Panel Discussion** (APERC Expert Review)
12:45 – 14:15	**Lunch Break**

MONDAY, 6 MAY 2024 – DAY 1	
Day 1 - Section II	
14:15 – 15:00	**Energy Sustainability Agency (former Energy Efficiency Agency)** **Topics: Energy Sustainability Agency Initiatives and Programs** Speaker**:** Rosa Riquelme – Head of Energy Sustainability Agency
15:00 – 15:45	**Q&A - Panel Discussion** (APERC Expert Review)
15:45 – 16:00	Coffee Break
16:00 – 16:45	**CONTEXT - OTHER ENERGY EFFICIENCY TOPICS** **Topics: TBA** Speaker: TBA
16:45: – 17:30	**DAY 1 FINAL Q&A – PANEL DISCUSSION** (APERC Expert Review)
17:30 – 18:00	**Closing Remarks & Day 2 Agenda Review**

TUESDAY, 7 MAY 2024 – DAY 2	
Day 2 – Section I	
09:00 – 09:30	**Registration**
09:30 – 10:15	**ENERGY EFFICIENCY IN INDUSTRY** **Topics:** - Energy efficiency law 21.305 (art. 2). - Energy management systems. - Development of energy efficiency indicators for Productive Sectors. - Efficient Solutions for thermal and motor uses. - Training of specialists in energy efficiency for productive sectors. Speaker: Marcel Silva – Chief of Productive Sectors Unit
10:15 – 11:00	**Q&A - Panel Discussion** (APERC Expert Review)
11:00 – 11:15	Coffee Break
11:15 – 12:00	**ENERGY EFFICIENCY IN TRANSPORT** **Topics:** - Energy efficiency standards for vehicles. - Sustainable and efficient transportation deployment. - Promotion of efficient use of transportation. - Research and innovation in efficient and zero-emission transportation. - Energy efficiency specialists training. Speaker: Marcelo Padilla – Chief of Efficient Transport Unit
12:00 – 12:45	**Q&A - Panel Discussion** (APERC Expert Review)
12:45 – 14:15	Lunch Break
Day 2 - Section II	
14:15 – 15:00	**ENERGY EFFICIENCY IN BUILDINGS** **Topics:** - Energy efficiency standards for buildings: commercial, public, and residential sectors. - Energy renovation & thermal retrofitting of existing buildings - Renewable energies as complement of energy efficiency in the residential sector. - Decarbonisation of the building sector. Speaker**:** Vittorio Tronci – Chief of Building and Cities Unit
15:00 – 15:45	**Q&A - Panel Discussion** (APERC Expert Review)
15:45 – 16:00	Coffee Break

TUESDAY, 7 MAY 2024 – DAY 2	
16:15 – 17:00	**ENERGY EFFICIENCY IN CITIES** **Topics:** - District Energy Institutional framework - District energy as an efficient energy supply alternative - Programs, studies, and projects Speaker**:** Rubén Muñoz – Chief of Geothermal and District Energy Unit
17:00 – 17:45	**Q&A - Panel Discussion** (APERC Expert Review)
17:45 – 18:00	**Closing Remarks & Day 3 Agenda review**

WEDNESDAY, 8 MAY 2024 – DAY 3	
Day 3 - Section I	
09:00 – 09:30	**Registration**
09:30 – 10:15	**ENERGY EFFICIENCY - DEMAND MANAGEMENT** **Topics:** - Regulatory framework: flexibility, distributed energy resources, and the distribution network. - Regulatory modifications for distributed generation (focused on Net Billing), storage, additional works, and the use of networks. - Flexible tariffs for encouraging energy efficiency and demand response. - Demand-side management as a resource to provide flexibility within the system. - The need for Distribution System Operators for managing demand and other distributed resources. Speaker: Danilo Jara – Chief of Sustainable Energy Regulatory Unit
10:15 – 11:00	**Q&A - Panel Discussion** (APERC Expert Review)
11:00 – 11:15	Coffee Break
11:15 – 12:00	**LABELLING & STANDARDS** **Topics:** - Energy efficiency labelling of appliances. - Minimum Energy Performance Standards: Equipment and electric motors. Speaker: Marcelo Padilla – Chief of Sustainable Transport Unit
12:00 – 12:45	**Q&A - Panel Discussion** (APERC Expert Review)
12:45 – 14:15	Lunch Break
Day 3 - Section II	
14:15 – 15:00	**ENERGY EFFICIENCY DATA ANALYSIS AND PUBLIC SECTOR** **Topics:** - Methodology for the determination of energy savings. - Energy Management Program for Public Institutions. - Statistics and results. Speaker**:** Hernán Sepúlveda – Chief of Sustainable Energy Resource Unit
15:00 – 15:45	**Q&A - Panel Discussion** (APERC Expert Review)
15:45 – 16:00	Coffee Break
16:15 – 17:00	**GUEST INSTITUTION (TBA)** **Topics:** TBA Speaker**:** TBA
17:00 – 17:45	**Q&A - Panel Discussion** (APERC Expert Review)
17:45 – 18:00	**Closing Remarks & Day 3 Agenda review**

THURSDAY, 9 MAY 2024 – DAY 4	
Day 4 – SITE VISIT TO MUT – TERRITORIA PROJECT	
09:00 – 09:30	**Gathering at the meeting point**
09:30 – 10:00	**Transport to Site - Urban Market Tobalaba (MUT) - Territoria Project**
10:00 – 13:00	**Site Visit: MUT – Territoria Project**
13:00 – 14:30	**Lunch Break / Travel to Venue**
Day 4 – PREE EXPERT TEAM CLOSED WORKING SESSION	
14:30 – 17:00	**PREE expert team discussion of draft recommendations**
17:00 – 17:30	**Session Closing**

FRIDAY, 9 MAY 2024 – DAY 5	
Day 5 - Section I	
08:30 – 09:00	**Registration**
09:00 – 10:30	**Presentation of the preliminary recommendations to Chile officials**
10:30 – 10:40	Coffee Break
10:40 – 12:00	**Presentation of the preliminary recommendations to Chile officials**
12:00 – 13:20	**Lunch Break**
Day 5 - Section II	
13:20 – 15:20	**Discussion and evaluation**
15:20 – 15:30	Coffee Break
15:30 – 16:00	**Closing Remarks** -APERC Dr. Kazutomo IRIE -MEN Representative
16:00 – 17:00	**Back to the hotel / check-out**
17:00 – 18:00	**Travel to the airport**

APPENDIX D: RECOMMENDATIONS

APERC is responsible for consolidating all recommendations here.

Energy Efficiency Policies Development and Deployment

The Government should

1) Incorporate the value of multiple benefits into cost-benefit assessments of energy efficiency and decarbonisation options and policies.
2) Use energy system modelling with more focus on end-use services as drivers of energy demand to explore short-and long-term impacts of energy efficiency and other demand side and distributed options on consumer and overall costs (energy bills), prices and carbon emissions and other multiple benefits.
3) Continually monitor these advancements and update the methodology to include a 'shadow' carbon price incorporating the best available science and information based on independent analysis and acknowledging that this cost is increasing over time.
4) Extend the focus of energy efficiency policy and programs from individual business consumers to analysis and collaboration across value chains, using Scope 3 emission reporting, 'circular economy' partnerships, and 'value chain thinking' facilitated by digitalization.
5) Review the scale and allocation of funds and resources and clarify the roles and responsibilities of government agencies to underpin rapid growth in activity.
6) Where existing energy market regulations limit necessary change to support demand-side measures, consider 'outside the box' options such as the introduction of 'distributor/retailer obligation schemes' that offer incentives for investment by consumers in targeted energy efficiency measures that cut carbon emissions while reducing peak electricity demand and consumer energy bills.
7) Continue to encourage the regional and local councils and their communities to actively participate in implementing of energy-efficient initiatives across the different energy-demanding sectors.

Overview, Institutional and Legal Energy Efficiency Framework

The Government should

8) Evaluate the effectiveness of the policies developed by the Ministry of Energy and programs executed by the Energy Sustainability Agency to help to identify adequate scope for the activities of the agency to help to secure their effectiveness.
9) Strengthen regional energy ministry secretariats by improving the technical capabilities of their professionals so they can effectively oversee and facilitate the implementation of energy policy at the regional level.
10) Improve the retention of human resources working in the public sector on the development and implementation of energy efficiency policies.

Data Collection and Monitoring

The Government should

11) Consider the establishment of an energy efficiency testing laboratory for energy equipment designed for specific local applications.
12) Understand the variation and effect of the main economy, climate, and other characteristics on energy consumption (e.g., GDP per capita, average annual and seasonal outdoor temperature oscillations, urbanisation level, and rate of access to electricity) in the development and analysis of energy consumption and related energy efficiency indicators.
13) Consider assessing further to the lowest level of the pyramid (IEA Energy Efficiency Indicators pyramid) to understand better the energy consumption patterns by end-use, such as space heating energy demand by fuel in building, road passenger energy demand by fuel in transport, etc.
14) Consider establishing a mechanism to improve communication with end users (of information) and decision-makers to understand their data needs better. This will allow for more economical use of data analysts' time.

Productive sector/Industry, Standards

The Government should

15) Vigorously promote the development of green finance, strengthen financial support for energy-efficient and low-carbon industry development, balance long-term and current needs, and balance incentives and funding constraints.
16) Promote the improvement of existing energy efficiency standards and performance indicators. Expand the product coverage of energy efficiency standards and cooperate with the responsible party supervising and managing the implementation, identifying areas where standards and indicators are most useful.
17) Strengthen energy auditing and combine it with green financial, subsidy, and regulation enforcement to strengthen the management of energy use in enterprises.
18) Establish a mechanism for updating energy-saving standards, explore a mechanism for transforming energy efficiency benchmarks, innovate energy-saving standardisation implementation by existing energy efficiency promotion platforms, and provide customised professional services such as standard development and standard system construction for enterprises and industry sectors.
19) Mobilise financial regulators to implement measures to require industries to adopt emission reduction strategies that reflect international best practices.

Building, Labelling, Lighting and Energy Management System, HVAC

The Government should

20) Define and benchmark baselines of energy consumption and performance of different building typologies based on data collection and statistics (as recommended in 'data collection') and validate these baselines on a regular basis (e.g., every 3-5 years).
21) Develop an economy-level or regional building energy efficiency roadmap with low-, high-, and net zero interventions, such as replacing outdated appliances with labelled ones, as coordinated actions, e.g., through massive buying or green procurement for a school retrofit project as a pilot.
22) Engage with private sectors (e.g., real estate developers) or financial institutions through REIT, ESCO, guarantee, or service models to improve building operation efficiency through energy audit and management as in ISO50001.

Transport, Energy Efficiency Mobility, Standards

The Government should

23) Build strong links between Ministry of Energy, Ministry of Housing and Urban Planning, and related government entities participating in relevant policy decisions.
24) Modify the transport emission reduction target design so that it can be increased in line with likely high rates of global vehicle electrification and accelerate the stringency of vehicle fuel efficiency standards to maintain momentum for change.
25) Target electrification of freight vehicles that operate in congested traffic and heavy vehicles, including establishing all-electric mine ore transport route for E-trucks from mines to port to take advantage of the altitude change between mines and ports.
26) Utilise trailer-based batteries towed by semi-trailers or locomotives to provide flexible and widely accessible EV battery charging and other services (e.g. remote homes and post-disaster support) to minimise costs and pressures on electricity grids.

Energy Efficiency in Cities, District Energy Systems

The Government should

27) Develop a regulatory framework, mechanism or guidelines on DES project development to clearly define the roles of different parties as 'who should be responsible for what', standardised steps in project development, beneficial calculating and reporting methods or frameworks, engineering design rules and other relevant topics, in order to facilitate the development of DES market in Chile.
28) MEN should take the lead and coordinate with other relevant ministries for regional energy mapping and planning, with a view to sector coupling, and consider waste heat, building energy consumption, city/regional level urban planning and development planning etc.
29) Establish financing mechanisms for district energy to channel the potential investment from international financial institutions (e.g. sovereign funds, sustainable infrastructure funds, and responsible funds from insurance companies) through the design of business models (e.g.

DFBOT (Design, Finance, Procure, Build, Operate, Transfer), Cooling/Heating as a Service) under different types of public-private partnership.

30) Develop long-term knowledge sharing to build up economy/regional expertise on district energy implementation through a virtual knowledge sharing platform on tools e.g., DHAT (District Heating Assessment Tool) tool from the Danish Energy Agency), international or regional best practices, standards (e.g. ISO), and vocational training programs for professions and engineers.

Energy Transition, Sustainable Energy and Energy Systems (DES)

The Government should

31) Complement the National Lithium Strategy, published in 2023 that is focused on lithium extraction and the role of the state on this activity, with action roadmaps and detailed plans that will strengthen local lithium value chain.
32) Develop an improved strategic plan that better describes how its efforts meet its overall goals.
33) Consider establishing a high-level independent committee to evaluate activities carried out by the Ministry of Energy and the Energy Sustainability Agency for the implementation of energy efficiency initiatives.

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Ministry of Energy (Ministerio de Energía, MEN) - https://energia.gob.cl/

Ministry of Housing and Urban Development (Ministerio de Vivienda y Urbanismo, MINVU) - https://www.minvu.gob.cl/

Ministry of the Environment (Ministerio del Medio Ambiente, MMA)-https://mma.gob.cl/

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