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REPORT

# ENERGY

PROJECTION &  
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# ENERGY

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# 01. Introduction

The Chilean electricity sector is experiencing exciting transformations in almost all areas, as the country progresses in its transition toward a less centralized and more environmentally friendly network, driven in large part by the development of non-conventional renewable energy (NCRE) and the decarbonization of its energy matrix.

In the last ten years, the sector has undergone a remarkable and radical evolution. During the last decade, the installed capacity of renewable energy in the Chilean energy matrix increased from a negligible percentage in 2000 to more than 27% of total generation in 2022.

This trend is expected to accelerate significantly in the coming years. While five years ago, the most optimistic experts forecast that renewable energy would account for 90% of total generation by 2050, given the favorable conditions for its development, experts now commonly indicate that the country will achieve this goal by 2030.

Chile's leadership in the clean energy sector is recognized globally. Bloomberg's Climatescope 2022 report named the country as the most attractive emerging market to invest in renewable energy (ninth globally). Additionally, Chile is one of the most stable Latin American countries in terms of regulation and free-market principles, and its policy framework remains stable over time, making it a highly attractive destination for international investors.

In this eBook, we provide a general description of Chile's electricity system and its key regulatory aspects, as well as an overview of key industry players.

You will also find details on the main opportunities generated by the country's ambitious energy sector transformation, from traditional sources to cutting-edge developments, including the budding green hydrogen industry.

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## 02. Sector overview

Chilean regulation divides the electricity market into three specific segments: generation, transmission, and distribution. Each of these segments is operated exclusively by private-sector companies, which invest in the necessary infrastructure in accordance with the corresponding regulatory framework.

Chile's energy market was privatized in the 1980s, offering private investment opportunities for both Chilean and international companies.

More than 100 companies have owned electricity generation assets since that time, and the industry also includes multiple international independent power producers (IPPs), which participate either directly or through partnerships.

Electricity transmission and distribution are also operated by private-sector players, although these companies are subject to stricter regulations.

Chile's electricity supply system is composed primarily of a single interconnected network, referred to as the National Electricity System (Sistema Eléctrico Nacional - SEN). There are also two lower-capacity networks located in the south of the country, which cover specific isolated regions: the Aysén Electricity System (Sistema Eléctrico de Aysén - SEA) and the Magallanes Electricity System (Sistema Eléctrico de Magallanes - SEM).

Chile's northern regions have the strongest and most consistent solar radiation on the planet. As such, solar energy generation and Concentrated Solar Power (CSP) projects have increased dramatically in these regions during recent years (especially in the Atacama and Antofagasta regions), driven by an open and technology neutral tender system to supply electricity distributors, and the robust power purchase agreements (PPAs) market, together with other free customers. Similarly, the remarkable progress of wind energy projects in the north of the country highlights the opportunities derived from the region's unique geographical characteristics.



Meanwhile, the south of Chile offers excellent conditions for wind energy, including incipient opportunities for the development of offshore wind farms.

Another favorable factor for international investors that are interested in Chile's renewable energy sector is the country's history of coherent energy policies and regulatory stability. Chile's energy policies have remained largely stable regardless of changes in government, and the country has autonomous and capable regulatory authorities.

These extraordinary market conditions enabled the installed capacity of non-conventional renewable energy to grow from 2% of total electricity generation in 2005 (with just a handful of small biomass and mini-hydroelectric projects) to 36.8% in 2022, driven primarily by solar and wind energy projects.

## 03. Generation

### Overview

Chile has an open and competitive electricity generation market, in which the main generation assets are operated by private-sector players. The country offers extensive investment opportunities, especially in renewable energy generation.

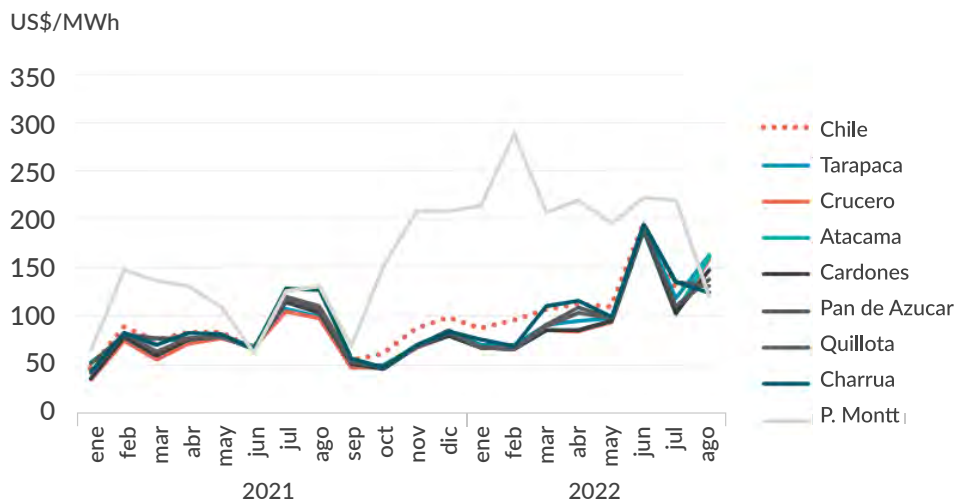
The generation segment is underpinned by free-market principles. When a generation company decides to connect to the national network, it is subject to dispatch regulations and wholesale market prices.

Chile's network operator, the National Electricity Coordinator (Coordinador Eléctrico Nacional – CEN), regulates dispatch priority and sets prices in accordance with its methodology, in order to ensure optimal system operation at the lowest possible cost.

Whenever a power plant connects to the national network, its owner or operator must adhere to the CEN’s instructions. When there is an increase in electricity demand, the CEN first instructs power plants with lower costs to inject energy into the system (such as solar, wind, and hydroelectric power plants), and only if necessary, higher-cost power plants (natural gas, coal and diesel).

Electricity generation companies can sell their surplus energy (the difference between energy injected into the system and energy used by contract clients) on the spot market at a price equivalent to the marginal cost of the electricity system. This spot price is defined as the variable cost of energy produced per hour by the least efficient generation company.

### Average marginal costs per node (2021-August 2022)



Source: Produced by InvestChile based on CEN data.

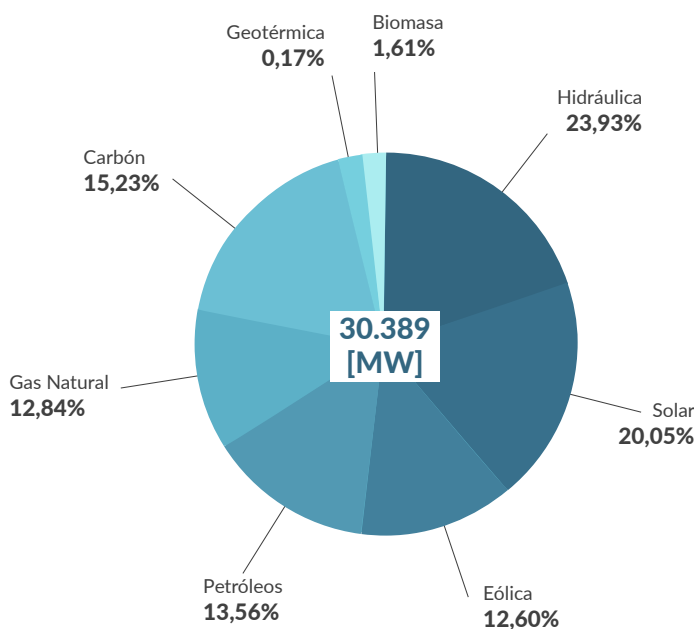
In addition to participating in the spot market, generation companies are free to enter into contracts with individual clients. This enables them to sell energy and/or power to private companies at a freely agreed price.

Finally, generation companies can sell energy and power to distribution companies through a public tender process supervised by Chile's National Energy Commission (Comisión Nacional de Energía - CNE), one of the main electricity sector regulators. Through this technology neutral process, any type of generation company can be awarded power purchase agreements (PPAs) for 15 years in a transparent competition on a level playing field.

Each year, the CNE assesses the need to hold short and long-term electricity supply tenders ([click here](#) for information on upcoming tenders).

According to the CNE, the installed capacity in Chile's national electricity system as of November 2022 was 30,190 MW, which accounts for 99.3% of the country's total installed capacity. Additionally, the Aysén electricity system has an installed capacity of 70 MW, and the Magallanes electricity system has an installed capacity of 129 MW.

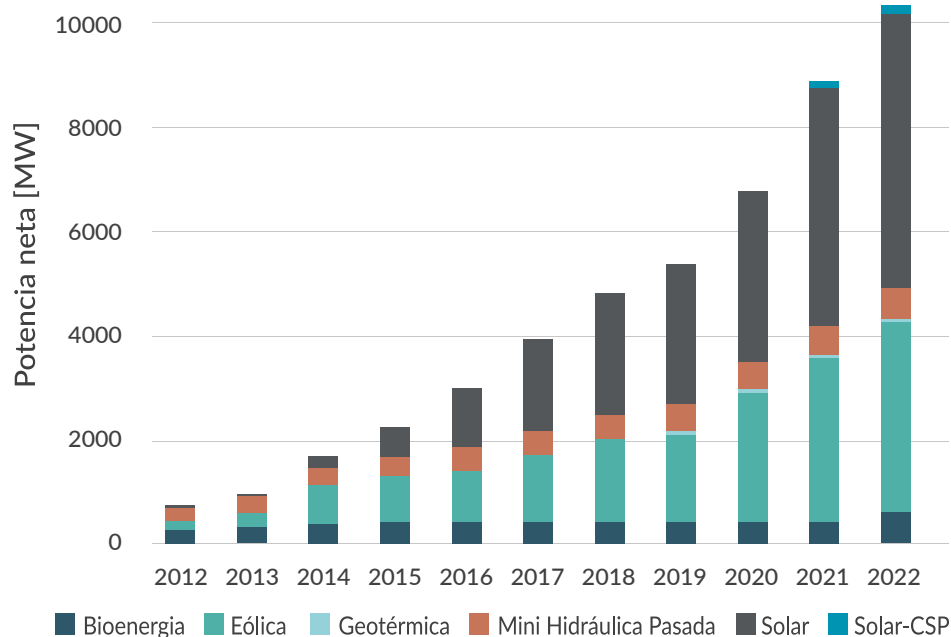
### National electricity system installed capacity by source



The recent structural changes in the national electricity system have been impressive. While in 2015, 12% of Chile's installed capacity was accounted for by non-conventional renewable energy, that figure increased to 36.8% in December 2022 ([click here](#) to see updated figures).



Graph: Evolution of net installed capacity [MW]  
 (September 2022).



Source: Produced by InvestChile based on CNE data.

This shift has been driven primarily by the solar power generation segment. In 2013, Chile's solar energy installed capacity was just 11 MW compared to 6 GW in 2021, with growth that continues to accelerate.

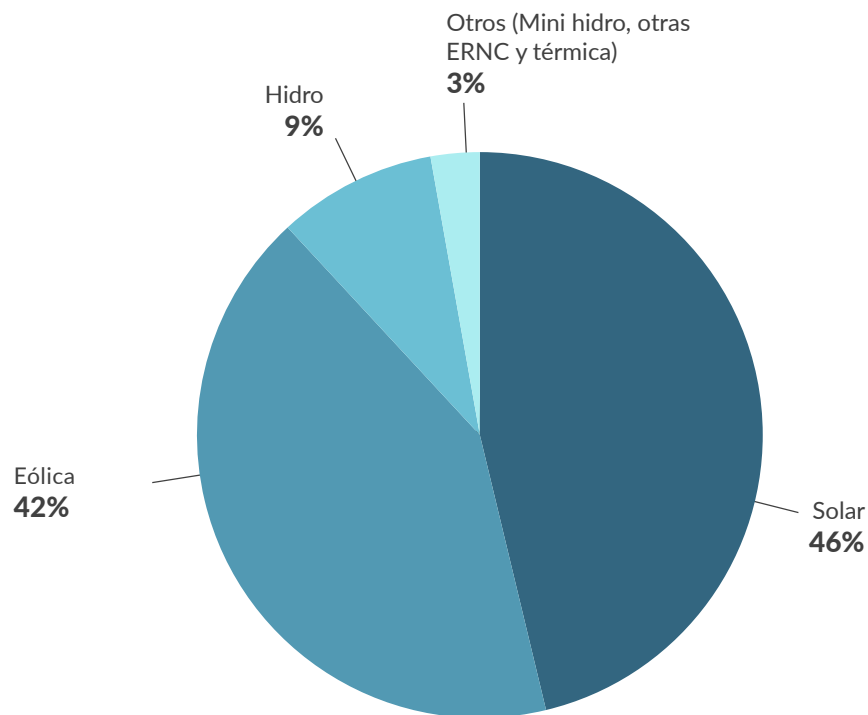
Since the beginning of 2013, renewable energy installed capacity in the country has increased each year, despite the challenges associated with the COVID-19 pandemic.

These developments have been made possible thanks to a combination of factors, primarily the quality of renewable energy resources in Chile; technology neutral tenders that enable renewable energy generators to compete freely with other companies; and the country's excellent reputation for regulatory stability and judicial independence in the region.

Chile's pioneering transformation toward renewable energy is expected to accelerate in the coming years. According to the Ministry of Energy's project status report, as of the end of July 2022, there were 86 power plants under construction in Chile representing an investment of US\$5.19 billion and a capacity of 3,683 [MW] (CEN 2022, CNE 2022b, CBC 2022, and Ministry of Energy 2022).

In total, 98% of power plants under construction will generate renewable energy, while 89% of the energy produced by these plants will originate from non-conventional renewable energy (NCRE) sources. The main contributions in terms of capacity (net MW) will originate from solar power (46%; 1,703 MW) and wind power (42%; 1,542 MW).

#### Distribution of projects under construction by energy type (July 2022).



Source: Produced by InvestChile based on project status report, July 2022 (Ministry of Energy).

As of the end of July 2022, 128 energy projects were being evaluated by Chile's Environmental Assessment System (Sistema de Evaluación Ambiental - SEA), representing total investment of US\$14.4 billion. Of these, 105 are electricity generation projects (US\$13.6 billion, 11.9 GW of installed capacity).

In the Aysén electricity system, 56% of the total installed capacity is generated by diesel power plants, 37% by run-of-the-river hydroelectric power plants, and 2.6% by wind power plants. In the Magallanes electricity system, 75% of the installed capacity is generated by natural gas power plants, 15% by diesel power plants, and 10% by wind power plants.

In terms of electricity generation, according to the National Electricity Coordinator (CEN), during 2022 the national electricity system generated 75,791.3 GWh, of which 24,778.0 GWh originated from NCRE.

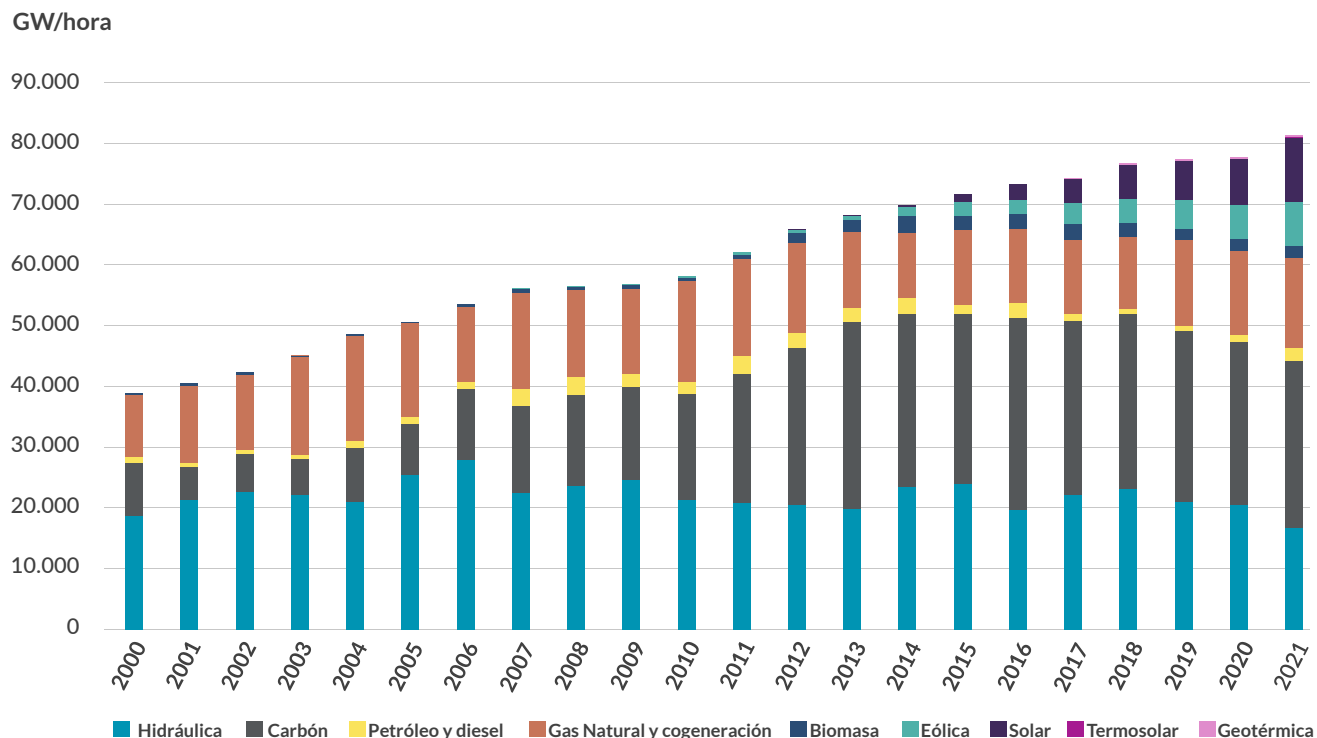
According to information from the CEN, coal was the largest source of energy generation in 2022, accounting for 28.2%; followed by natural gas, which accounted for 20.5%; hydroelectricity, which accounted for 19.1%; solar power, which accounted for 15.4%; and natural gas, which accounted for 4.1%. NCRE has gained a significant market share, accounting for 32.8% of total electricity generation in 2022.

Table: SEN electricity generation, 2021 and 2022 (July 2022, figures in GWh)

	Tecnología	2021	%	2022	%
Generación bruta anual Valores en GWh Valores al cierre de julio 2022 Para más información: <a href="http://www.coordinador.cl">www.coordinador.cl</a>	Hidráulica	16,477	20.2%	9,304	19.1%
	Carbón	27,666	33.9%	13,747	28.2%
	Diésel	1,830	2.2%	1,176	2.4%
	Gas Natural	14,487	17.8%	10,028	20.5%
	Fuel Oil	28	0.0%	26	0.1%
	Petcoke	354	0.4%	143	0.3%
	Cogeneración	310	0.4%	139	0.3%
	Biogás	143	0.2%	80	0.2%
	Biomasa	1,874	2.3%	1,094	2.2%
	Eólica	7,210	8.8%	5,160	10.6%
	Solar	10,633	13.0%	7,520	15.4%
	Termosolar	154	0.2%	144	0.3%
	Geotérmica	326	0.4%	255	0.5%
	<b>TOTAL</b>	<b>81,492</b>	<b>100%</b>	<b>48,815</b>	<b>100%</b>

Source: Produced by InvestChile with CEN data.

Graph: Evolution of historic energy generation by technology (in GWh)



Source: Produced by InvestChile based on CEN data (historic energy generation by technology).

In 2022, NCRE accounted for 37% of total electricity generation in Chile, reaching a 39% in december. Meanwhile, coal-based power generation accounted for 35% in december.

In 2008, Chile established annual renewable energy generation goals as a percentage of the total matrix through Law 20,257, starting at 5% and increasing to 10% in 2025. Law 20,698 set the more ambitious goal of renewable energy accounting for 20% of total generation by 2025, which has already been comfortably exceeded.

### Decarbonization plan

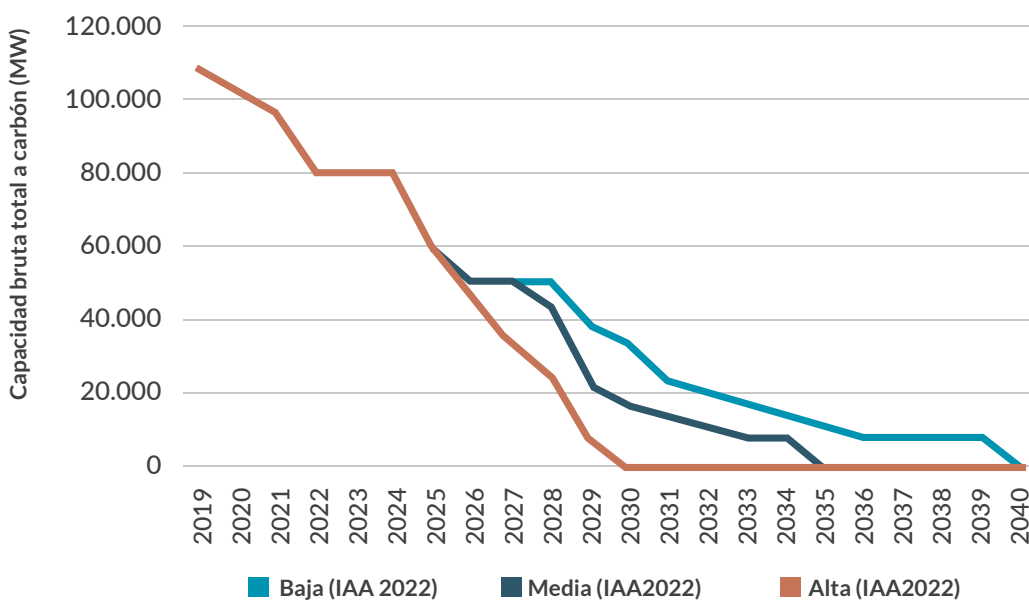
Chile’s long-term commitments to fight climate change include the transition toward an energy matrix made up of 70% renewable energy by 2030. This commitment had originally been established for 2040, but was brought forward as part of the UN Climate Change Conference COP 25 meeting in 2019.

The Government of Chile presented a carbon neutral plan in 2019 which aims to close all coal power plants with an installed capacity of 5.5 GW by 2040, and set the target of withdrawing 1.04 GW from the system by 2025.

This withdrawn capacity is expected to be offset primarily by the addition of renewable energy generation, storage technology, and low-emissions natural gas power plants, in order to maintain the system’s energy security.

This power plant withdrawal and reconversion process has been brought forward to 2025 thanks to the announcements of early closures by several companies. As such, the share of the energy matrix accounted for by coal generation is expected to decrease in the short term.

Graph: Coal power plant withdrawal forecast (in MW)



Source: Produced by InvestChile based on Ministry of Energy long-term energy planning data, 2022.

In any event, this withdrawal and reconversion plan is being implemented in a responsible and organized way, considering that coal power plants play a role in the security and stability of the energy system.

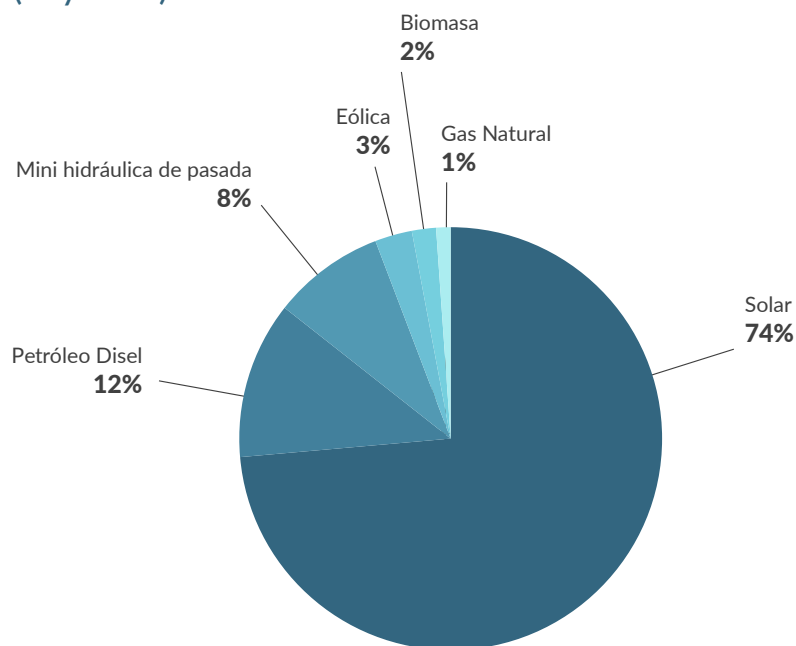
Additionally, coal power plant withdrawal or reconversion forms part of the Fair Transition (Transición Justa) program, which involves aspects of the energy sector (closure of coal power plants), mining sector, and efficient transport and residential energy initiatives.

### Small Means of Distributed Generation

Chile has also experienced strong growth of small and medium distributed generation assets of up to 9 MW, referred to by their Spanish acronym PMGD [*pequeños medios de generación distribuida*].

In July 2022, the installed capacity of PMGD reached 1,897 MW, of which 74% originated from solar power, 8% from run-of-the-river hydropower, 12% diesel, 3% wind, 2% biomass, and 1% natural gas.

Graph: Distribution of PMGD installed capacity by technology (July 2022)



Source: Produced by InvestChile based on CNE data.



PMGD can take advantage of several incentives, including more flexible network connection protocols and an independent price setting mechanism, known as the “stabilized price regime”.

The stabilized price is equivalent to the average value of a PPA in the market, adjusted based on spot market price forecasts for the next four years. This enables project developers to obtain greater certainty regarding their expected returns, which in turn facilitates access to financing for PMGD projects.



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## Tenders and contracts

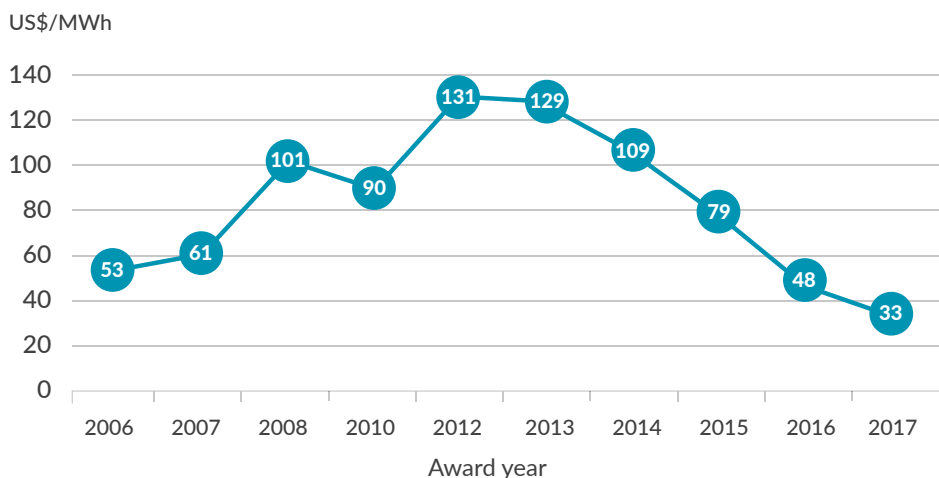
There are three ways for renewable energy project developers to obtain external financing for their projects in Chile: supply tenders, contracts with free customers, and the PMGD regime.

The main way to do this is through supply tenders offered by distribution companies. Electricity generators bid to offer the lowest prices, and are awarded long-term power purchase agreements (PPAs), which take effect five years after the award date.

Companies can use these PPAs to obtain financing for their projects, and have them ready by the time their contracts take effect.

With regard to the performance of NCRE in recent tenders, five tender processes have been held from 2015 to date, 100% of which were awarded to renewable energy generators, in addition to achieving lower prices. It should be noted that the average weighted price of energy awarded in the 2021/01 tender process in 2021 was US\$23.782/MWh.

### Average prices awarded in supply tenders



Source: CNE.

As shown in the graph above, tender award prices reached their highest levels between 2008 and 2014, following major droughts which obligated the system to rely on more expensive thermoelectric power plants. At that time, the majority of electricity generation projects were coal fired.

However, as renewable energy became a viable option, award prices fell dramatically to a record-low average of US\$23.782/MWh in 2021.

This price decrease was also made possible due to changes in the tender process implemented in 2015 in order to increase competitiveness. These modifications included the introduction of different time bands for electricity supply and a longer supply period, reaching up to 20 years.

## Direct and indirect incentives

Chile offers direct and indirect incentives for renewable energy development and for electricity sector investments in general.

The country's free-market principles in the generation segment, together with a robust regulatory framework and long electricity supply periods through competitive tender contracts, facilitate access to financing in order for participants to develop their projects with a clear long-term investment horizon.

In general terms, Chile has a proven track record of maintaining a coherent energy policy and regulatory framework through changes in government.

The current administration has expanded policies and increased already ambitious targets. Chile started to implement policies to expand renewable energy use in the middle of 2010, when it became clear that the costs involved in developing renewable energy had decreased significantly.

With regard to specific incentives to develop certain technologies, the country requires companies with an installed capacity of more than 200

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MW that withdraw energy from the electricity system to commercialize with distribution companies and consumers to certify that a percentage of their withdrawals originate from renewable sources.

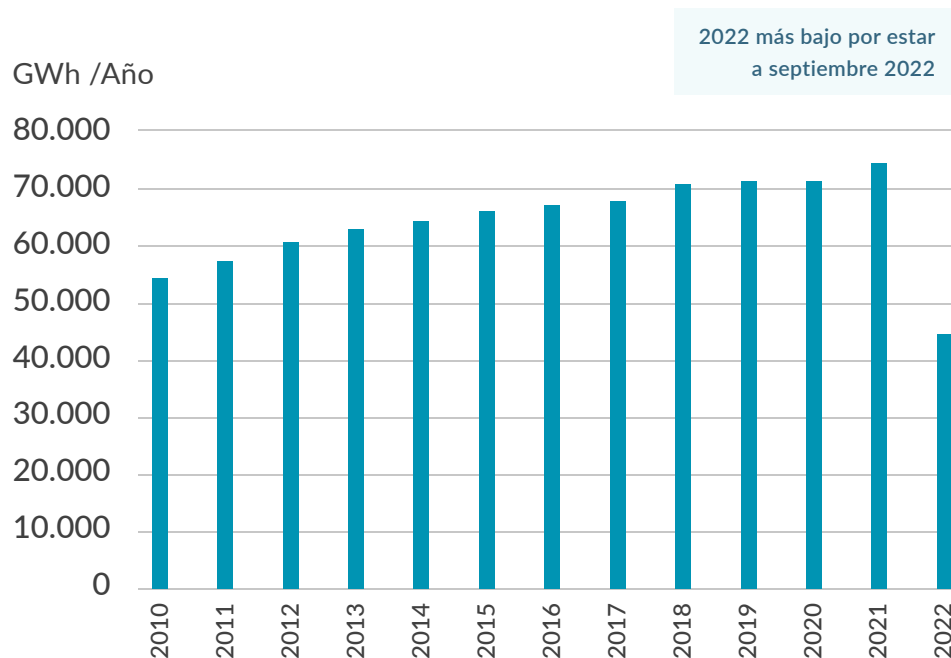
Since the implementation of Law 20,936, new plants are not required to pay transmission tolls, and old plants will be able to stop paying these tolls gradually.

Additionally, Chile has established a flexible tax for the polluting emissions including particulate matter, NO (nitrous oxide), and SO<sub>2</sub> (sulfur dioxide), and a fixed tax for total CO<sub>2</sub> emissions from power generation plants with a capacity of 50 MW and above, levying US\$5 per ton of CO<sub>2</sub> emissions.

The Government has also awarded concessions for the use of public land for the development of non-conventional renewable energy (NCRE) projects. In 2022, Chile's Ministry of National Assets tendered 28 lots to be used for NCRE as part of the Government's commitment to collaborating in the transition toward the country's decarbonization. Of these lots, 23 are located in the Antofagasta Region and 5 in the Arica y Parinacota Region. Additionally, as part of the country's National Green Hydrogen Strategy, in 2021 the Ministry of National Assets and Ministry of Energy launched the Window to the Future (Ventana al Futuro) initiative, which consisted of a single extraordinary period to allocate lots for green hydrogen production directly, without undergoing a public tender process.

## Electricity demand

Graph: Total electricity demand per year (GWh)



Source: BNamericas, (September 2022).

One of the key drivers of increasing electricity demand in Chile is industrial consumers, primarily the growing copper mining industry located in the north of the country.

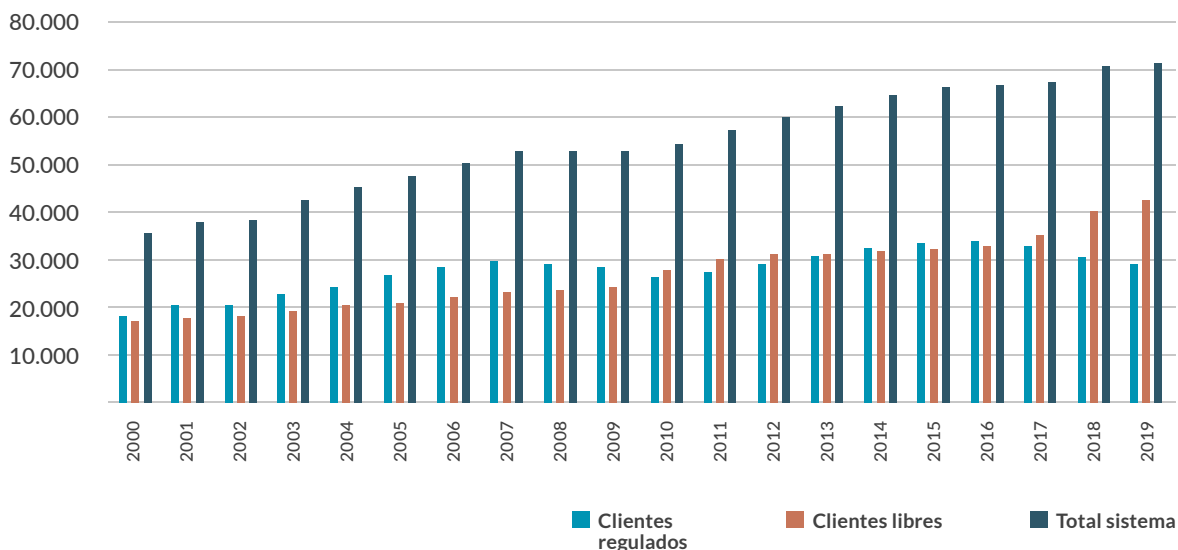
A key characteristic of this type of energy use is the demand for consistent and continuous supply.

In recent years, there has been a growing trend toward large industrial and commercial clients in the country, which have switched from being regulated customers to free customers, where they can seek solutions tailored to their needs.

Large mining companies, for example, have sought electricity supply with renewable energy certifications that they can purchase directly from generators to obtain environmental certifications for their final product.



### Evolution of electricity demand in the national electricity system

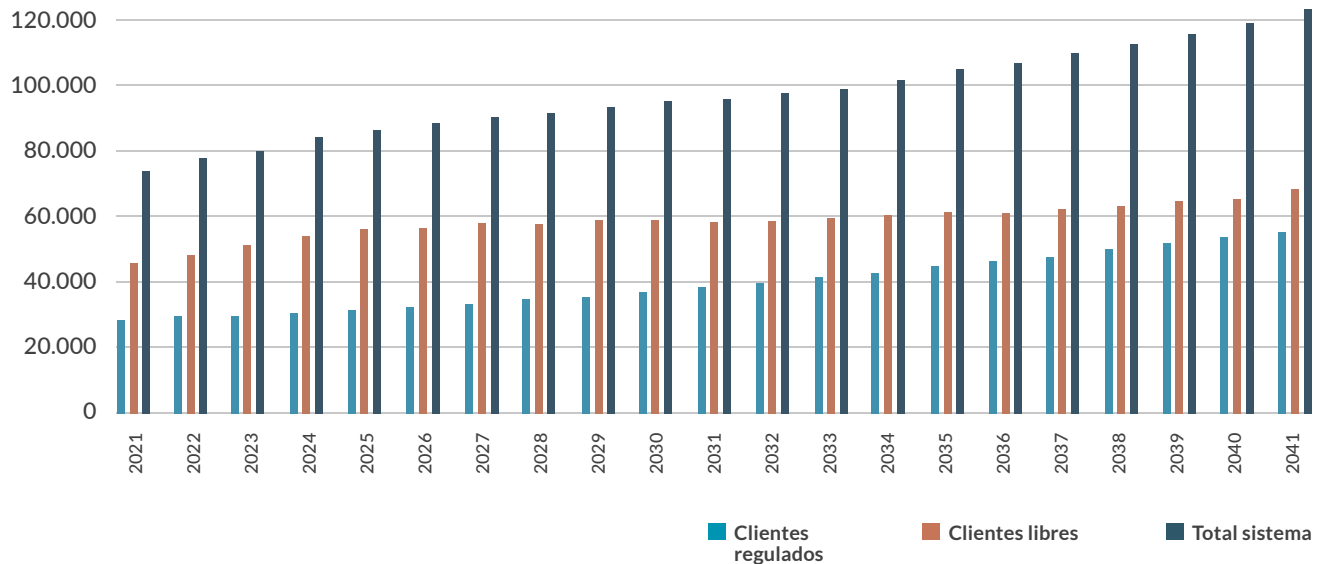


Source: BNamericas with data provided by the CNE

The CNE reviewed its demand forecasts for the 2021-2041 period in January 2022. Demand is expected to reach 122,860 GWh in 2041, a 66.4% increase compared to demand of 74,935 GWh in 2021. Demand is expected to grow by 2.58% per year on average, with the regulated customers segment growing by 3.43% on average and the free customers segment by 1.98%.

It is important to note that, despite the effects of the COVID-19 pandemic, the CNE's updated demand forecasts are greater than those made in 2019 (except for 2020, when demand was 0.5% lower than originally forecast), at which time demand was projected to increase by 2.10% per year until 2039. This is primarily due to an increase in average energy consumption forecast for the free customers segment.

Graph: National electricity system demand forecast [GWh]



Source: Produced by InvestChile based on the Final Demand Forecast Report 2021-2041 (national electricity system and mid-size systems), CNE (January 2022).

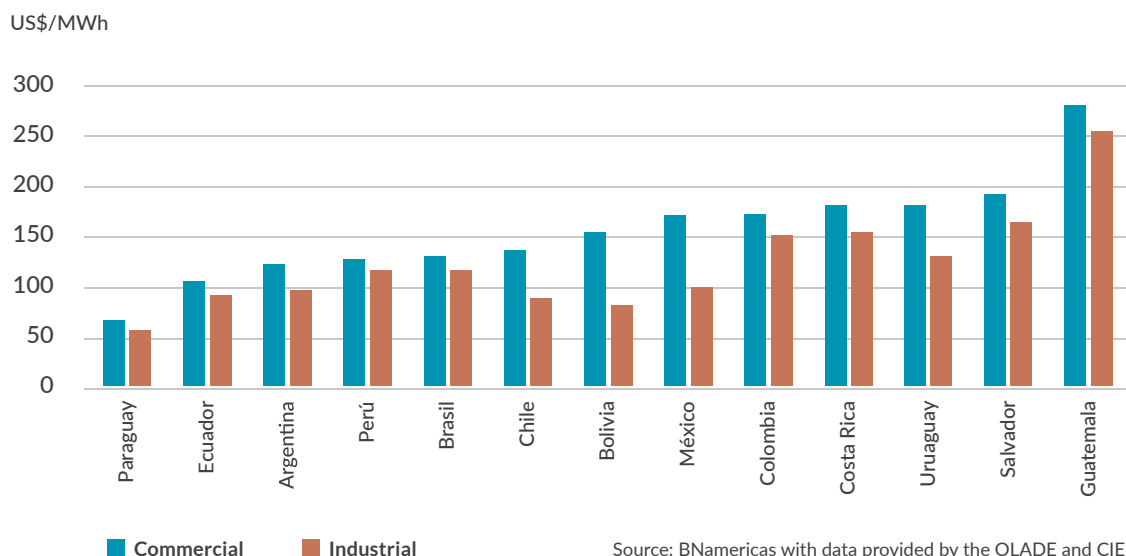
The CNE calculates demand for both the regulated customers and free customers segments. Its estimations for the former segment are a key factor in its decision to hold short or long term tenders to obtain additional supply.

The CNE updates its demand forecasts each year, and up-to-date figures can be found [here](#).

## Electricity prices

According to the Regional Energy Integration Committee (Comisión de Integración Energética Regional – CIER), which releases annual reports on energy distribution companies in Latin America, and the Latin American Energy Organization (Organización Latinoamericana de Energía – OLADE), energy prices for end users as of January 2022 were as follows:

### Electricity prices in Latin America



However, as indicated above, regulated prices are expected to continue to decrease during the coming decade due to the effect of supply tenders that have already been held. In any event, it is important to note that cost increases for projects under construction and those already in operation may have a negative impact on this trend. Projects related to supply contracts that have already been awarded began initiating operations in 2021.





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## Regulatory framework

With regard to the regulatory framework, the General Electricity Law imposes restrictions on vertical integration, which means that no Chilean electricity transmission company can participate in the generation or distribution business.

Similarly, electricity generation or distribution companies are not allowed to have a share of more than 8% of the value of Chile's transmission assets. If several companies jointly own transmission assets, their ownership may not exceed 40% of the value of Chile's transmission assets.

Companies are also subject to general anti-monopoly provisions in force in Chile, contained in Decree-Law 211/1973, which is also known as the Anti-Monopoly Law.

Additionally, Chilean legislation makes a distinction between conventional and non-conventional renewable energy. In accordance with Law 20,257, this latter category includes wind, biomass, biogas, geothermal, solar, and wave energy generation companies, together with small hydroelectric generation companies (below 20 MW). Large hydroelectric generation companies are thus excluded from this category, and are classified solely as renewable energy producers.

The main players in the electricity generation segment are represented by industry association Generadoras de Chile, and by Chilean renewable energy association ACERA.

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## 04. Transmission

The National Energy Commission plans transmission projects in Chile annually, based on its forecasts and the suggestions of private-sector operators. Each year, it selects a list of projects, whose construction is then awarded through an open tender.

Transmission is classified as a public service (national and regional transmission), and the remuneration, which lasts for a period of 20 years, is set by the bidder as part of the tender offer.

After this period, the assets remain privately owned, but the remuneration is determined by the CNE every four years through a study that assesses the existing assets based on their market value.

Both Chilean and international companies can participate in the tender process, provided that they operate existing electricity transmission assets either in Chile or overseas.

As of 2021, Chile's energy network was composed of 36,825 km of transmission lines, covering a distance of 3,100 km from the city of Arica in the north to the island of Chiloé in the south. Two small independent networks cover the needs of Chile's two southernmost regions, as explained above.

Between 2011 and 2019, Chile tendered transmission projects representing investments of US\$2.88 billion.

According to the National Electricity Coordinator (CEN), 210 projects will be tendered between 2020 and 2024, including both the construction of new facilities or expansion of existing facilities, representing investment opportunities valued at almost US\$2.70 billion.



## New transmission projects 2020-2024

	2020	2021	2022	2023	2024	Total 2020-2024
New projects	10	10	12	10	7	49
Expansions	21	34	33	33	40	161
<b>Total</b>	<b>31</b>	<b>44</b>	<b>45</b>	<b>43</b>	<b>47</b>	<b>210</b>
Investment value (US\$ millions)	246.8	234.5	632.9	1,398.20	185	2697.4

Source: Ministry of Energy.

It should be noted that the Ministry of Energy brought the tender for the largest project in Chile's electricity transmission investment portfolio forward. Instead of holding the tender in 2023 as planned, the network coordinator, CEN, brought it forward to the end of 2020, and the project was awarded in 2021.

This initiative involves an investment of US\$1.40 billion to build the HVDC Kimal-Lo Aguirre line, the first high-voltage direct current line that will connect Chile's capital city, Santiago, with Mejillones, located in the Antofagasta Region in the north of the country.

This transmission line is considered essential to enable the system to conduct the growing volume of renewable energy that is being generated in the north of Chile to areas with higher energy consumption, especially the capital, Santiago.

Additionally, it will use high voltage direct current (HVDC) technology, which reduces energy loss over long distances and offers a series of technological benefits, making it the first long transmission line in the country to use this technology.

Similarly, to ensure more efficient development, the Ministry of Energy decided to consolidate two new transmission line projects—Entre Ríos-Ciruelos and Ciruelos-Pichirropulli, in the Los Lagos Region in the south of Chile—in a single Strategic Environmental Assessment. The transmission line route is currently being studied.

In terms of private-sector players, Transelec, owned by China Southern Power Grid International and two Canadian funds (the Canada Pension Plan Investment Board and British Columbia Investment Management Corporation), is one of Chile's main transmission companies. The company is currently the largest high-voltage transmission line operator in Chile.

It owns 10,000 km of transmission lines and 60 substations, with a 28% share of all transmission lines in the country in terms of distance.

Meanwhile, Interchile, a subsidy of Colombian company ISA, owns the Cardones-Polpaico transmission line, with an investment of US\$1.0 billion, that strengthened the interconnection between networks in the north and central-south regions of Chile.

The rest of the country's transmission network is operated by Engie, Colbún, CGE, and another 33 transmission system operators, many of which also own generation assets or are large consumers.

## 05. Distribution

Distribution companies operate in a concession area granted by the state, which obligates them to deliver the service to each regulated customer who requests it. These companies are subject to service quality standards, and must ensure the availability of the energy they forecast to be needed during the next five years.

The CNE calculates distribution tariffs every four years, and revenue originating from regulated customers includes the value of the assets and expenses related to administration, operation and maintenance, customer service, and losses of energy and power. A new regulation, Law 21,194, published in December 2019, established a variable tariff of between 6%–8% after tax.

This tariff is adjusted every four years, taking into account three factors: the system risk, that is, an estimation of the variability in profits that an efficient company would have when subject to market fluctuations; a risk-free rate of return, which refers to the average internal rate of return

provided by the Central Bank; and the compensation for market risk, which is calculated as the difference between the return on a diversified portfolio and the risk-free rate of return.

Distribution companies purchase energy from generation companies in a competitive tender, which is usually referred to as a supply tender for distributors. Each block of energy is awarded to the company that offers the lowest price in power purchase agreements for 20 years.

In accordance with the law, prices for end users must reflect the real cost of electricity generation, transmission, and distribution under the assumption of efficient operation of the system. This regulation aims to establish indications of correct prices for private companies and consumers in order to ensure optimal development of the electricity network.

The regulation includes a free price setting system in those segments where adequate conditions for competition are observed. As such, for supply to end users whose maximum import capacity is less than 5,000 kW, the regulation considers market conditions to favor natural monopolies, and thus the law stipulates that such users are subject to price regulation. These clients are referred to as regulated customers.

For supply to end users whose maximum import capacity is greater than 5,000 kW, the law stipulates that they may freely agree prices, as it is assumed that these users have the negotiating capacity and the opportunity to obtain electricity supply by other means, such as self-generation or direct supply from generation companies. These clients are known as free or unregulated customers. Clients with maximum import capacity of between 500 kW and 5,000 kW may choose the regime (regulated or free) to which they adhere for four years.

In electricity systems with installed capacity for generation of above 1,500 kW, the law establishes two levels for price setting: the base generation-transmission price (linked to a specific substation from which the electricity is supplied), and the distribution or end user price.

The final price that may be charged by electricity distribution companies to their end clients is determined by a simple formula: the base price, plus Value-Added Distribution (VAD), plus a charge for backbone transmission system use.

The Chilean distribution market is dominated by four players which account for approximately 98% of energy distributed: Enel Distribución (owned by Italian company Enel); CGE (which was acquired by Chinese firm State Grid); Chilquinta (recently sold by Sempra to Chinese company State Grid International Development); and SAESA (owned by Canadian organization Ontario Teachers' Pension Plan/AIMCo).

An additional 19 regional distributors make up the remaining market share.

### Main distributors in Chile as of 2021

Group	Company	Distribution Region	Clients	Sales (GWh)	Investment Source Country
CGE	CGE	XV, I, II, III, IV, V, RM, VI, VII, VIII, IX	3,073,367	10,790	China
	Edelmag	XII	67,077	336	
Chilquinta	Chilquinta	V	640,088	2,304	China
	Litoral	V	65,964	117	
	EDECSA	V, Metropolitan	7,123	50	
	Luzlinares	VII	39,355	115	
	Luzparral	VII, VIII, XVI	28,579	97	
Enel	Enel Distribución	Metropolitan	2,038,172	13,676	Italia
Saesa	Frontel	VIII, IX	385,072	1,125	Canadá
	Saesa	IX, X, XIV	482,971	2,503	
	Edelaysen	X, XI	52,040	169	
	Luzosorno	X, XIV	26,447	189	
<b>Total</b>			<b>6,906,255</b>	<b>31,470</b>	

Source: Ministry of Energy.

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## 06. Green Hydrogen

“I believe that water will one day be used as a fuel, that hydrogen and oxygen, which constitute it, used alone or simultaneously, will provide an inexhaustible source of heat and light, of an intensity of which coal is not capable... when the deposits of coal are exhausted, we shall heat and warm ourselves with water. Water will be the coal of the future”. In this way, 150 years ago in his novel *The Mysterious Island*, Jules Verne foresaw the fuel that would enable us to decarbonize the global electricity matrix.

Currently, hydrogen is used primarily as a raw material in industrial processes such as petroleum refining and the production of chemical products, with the majority of H<sub>2</sub> production originating from non-renewable sources.

Renewable, low-carbon hydrogen is expected to replace fossil fuels and play a key role in the energy transition, thanks to its applications and technological improvements in heavy industry, maritime transport, aviation, storage, etc. Understanding this trend, a large number of countries have generated hydrogen roadmaps, strategies, and collaboration agreements, among other initiatives, to promote blue or green hydrogen, depending on the comparative advantages of each economy.

In Chile, the intention to make orderly progress and structure the work carried out for years by different public institutions was formalized through the publication of the National Green Hydrogen Strategy by the Ministry of Energy in November 2020, which laid the foundations for what could be Chile's largest industry, exceeding even mining.

Leveraging its huge potential to generate clean energy at a low cost, Chile could become one of the leading global producers of this element, making it a key player in supplying the world with clean energy. Additionally, its trade openness and good international relations position the country as a strong competitor in the global market.

With the ongoing announcement of new projects for the production of green hydrogen and its derivatives by key energy sector players in Chile, two potential hubs are starting to consolidate their position: the Antofagasta Region in the north, thanks to its high level of solar radiation,

and the Magallanes Region in the south, due to its potential for wind power generation.

The National Green Hydrogen Strategy forecasts strong local and international demand for this element and its derivatives. In Chile, studies are being carried out regarding the potential uses of hydrogen as an element that will aid energy decarbonization, including for existing industries that could transform their energy matrix and new industries that could be developed in the country thanks to this low-cost energy supply. On the other hand, large production volumes would be achieved thanks to demand from international markets, which are already making the necessary preparations to import this element and its derivatives (ammonia and synthetic fuels, among others) on a large scale. In that regard, Chile has made progress through major commercial and collaboration agreements.

Given the importance that this new industry could have for the country and the large scale of projects to produce green hydrogen and its derivatives, coordination between the public and private sectors is key for accessing new international markets, in compliance with the necessary certifications and substantiating CO2 emissions; ensuring the necessary infrastructure for the development of projects, including ports, desalination plants, highways and electricity systems; and implementing the required regulation to ensure that this industry complies with national standards.

There are still many challenges to scale up the hydrogen industry, both locally and international, in areas including costs, technological maturity, policy and legislation, the capacity to meet the requirements of green hydrogen using renewable energy, and the “chicken-and-egg” problem in the face of existing demand. However, progress is being made to structure a collaborative effort in order to resolve these issues.

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In May 2022, as part of its work to implement the National Green Hydrogen Strategy, the Chilean Economic Development Agency (CORFO) created the Green Hydrogen Industry Development Committee. The main objective of this committee is to support the implementation of the strategy and coordinate efforts between the various ministries that are involved through the Interministerial Committee, Technical Taskforce, Consultation Committee, Technical Team, and Technical Committees, with representatives from the following ministries and public services:

- a) Minister of Energy, who will chair the committee.
- b) Minister of Economy, Development, and Tourism.
- c) Minister of Finance.
- d) Minister of National Assets.
- e) Minister of Environment.
- f) Minister of Foreign Affairs.
- g) Minister of Science, Technology, Knowledge, and Innovation.
- h) Minister of Social Development and Family.
- i) Minister of Agriculture.
- j) Minister of Public Works.
- k) Minister of Transport and Telecommunications.
- l) Executive Vice-President of CORFO, who will be the vice-chair of the committee.

Chile's green hydrogen industry will generate supply chains, new companies, and local players, both in the production of green hydrogen and its derivatives, and in its use as a chemical element or for energy. As such, this new sector is expected to have multiple positive impacts with wide-ranging benefits for the country, in accordance with the required standards.

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## 07. Conclusion

The Chilean electricity sector is experiencing a series of exciting changes, especially in the generation segment, where the energy matrix is undergoing a rapid transformation driven by private investment.

Although Chile has historically imported the majority of hydrocarbons required by its energy sector, the development of renewable energy has enabled the country to leverage world-class local resources. This availability, together with Chile's attractiveness as an investment destination and open economy, have driven accelerated growth of the country's renewable energy sector.

However, there is still much work to do, and the country has established major commitments to decarbonize its energy matrix, which is forecast to be composed of 70% renewable energy by 2030. To achieve this goal, Chile will need private-sector players to develop new projects to replace outgoing coal-based power, creating opportunities for foreign investors in the coming years.

The country must also develop technologies and best practices to ensure the reliability of the energy network at an efficient cost, with a highly varied generation capacity and robust transmission system, as well as making investments in electric energy storage banks, and implementing laws to achieve greater flexibility and more competitive tenders for complementary services.

Currently, long-term investment opportunities can also be found in new areas such as green hydrogen and its derivatives, particularly ammonia, as well as the widespread adoption of electromobility in Chile during the coming decades. Efforts are increasing to establish appropriate regulatory frameworks for these sectors, which will make a major contribution to the country's energy transition.

The Chilean energy sector enjoys regulatory and institutional stability focused on improving the existing framework, with a view to promoting investment and increasing the system's efficiency and technological structure. Chile's growth strategy for renewable energy is also supported across the political spectrum, ensuring its long-term development.



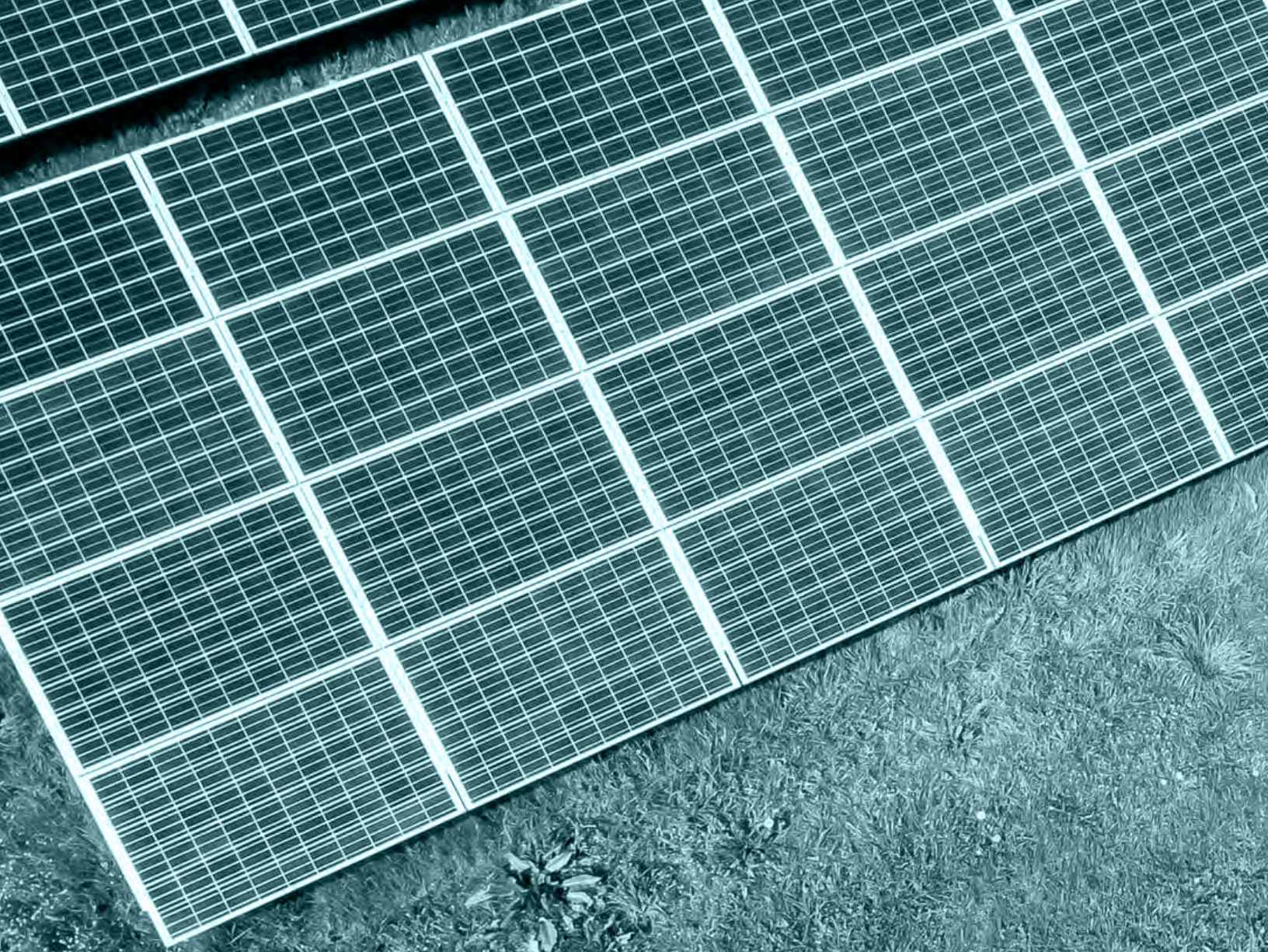
Both private companies and local authorities are constantly seeking ways to innovate and develop future-oriented solutions, including the study and adoption of new renewable energy technologies. The country's regulatory bodies are also closely following new trends, such as the implementation of storage banks for energy generation and transmission, and the use of renewable energy assets to deliver complementary services to the network.

Chile is expecting to receive a wave of private investment in renewable energy to achieve its ambitious climate change goals, with a strategy that involves setting clear rules and enabling private-sector players to compete freely.

These factors make Chile one of the most attractive countries in Latin America for investing in renewable energy, according to various studies such as EY's Renewable Energy Country Attractiveness Index, which placed Chile 14th in the list of the world's most attractive markets for investing in renewable energy, similar to countries such as Spain, the Netherlands, Japan, and France. Meanwhile, Bloomberg's Climatescope ranking named Chile as the world's most attractive developing market for investing in renewable energy.

The industry's outlook in Chile is undoubtedly highly attractive for development by international companies.





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# 07. Annex

## Competent authorities

### Ministry of Energy

Chile's Ministry of Energy is the main government authority responsible for establishing the country's energy policy and overseeing the energy sector's operation.

The ministry's general objective is to create and coordinate plans, policies, and standards for the appropriate operation and development of the energy sector, ensuring compliance and advising the government on all energy-related matters.

The ministry's area of competence includes all matters related to the study, exploration, generation, transmission, transport, storage, distribution, consumption, efficient use, import and export, and any other activity related to electricity, coal, gas, oil and its derivatives, nuclear, geothermal, solar, and other sources of energy.

Its head office is located in Santiago.

<https://www.energia.gob.cl/>

### National Energy Commission (CNE)

Chile's National Energy Commission (Comisión Nacional de Energía - CNE) is a technical public body responsible for overseeing prices and drafting technical standards that govern the conduct of generation, transmission, and distribution companies. Its objective is to ensure a reliable and high-quality service that is compatible with a cost-effective operation.

The CNE also monitors the energy sector and makes forecasts, in addition to recommending potential regulations to the Ministry of Energy, which it also advises on matters related to the energy sector.

Its head office is located in Santiago.

<https://www.cne.cl/>

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### **Superintendency of Electricity and Fuel (SEC)**

Chile's Superintendency of Electricity and Fuel (Superintendencia de Electricidad y Combustibles – SEC) is an institution that is responsible for establishing standards and overseeing their fulfillment through inspections and fines.

The SEC brings charges and penalizes electricity companies or individual users for violating reliability or service quality standards.

Its head office is located in Santiago. <https://www.sec.cl/>

### **National Electricity Coordinator (CEN)**

The National Electricity Coordinator (Coordinador Eléctrico Nacional – CEN) is an independent body that is responsible for coordinating the operation of the Chilean electricity network, in order to ensure a constant, reliable supply with the most cost-effective operation possible, as well as open access to the country's transmission infrastructure.

The CEN adheres to the guidelines issued by the CNE and Chile's general electricity legislation. It is also responsible for coordinating the operation of mid-size networks, defined as those that operate with more than one generation company.

Its head office is located in Santiago. <https://www.coordinador.cl/>

### **Environmental Assessment Service (SEA)**

The Environmental Assessment Service (Servicio de Evaluación Ambiental – SEA) supervises the assessment of all private projects, including for the energy sector, based on their compliance with current environmental legislation.

Companies must obtain approval from the SEA in order to continue implementing their projects, and as such the organization plays a crucial role in the development of electricity generation, transmission, and distribution projects.

<https://www.sea.gob.cl/>

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## Differences between regulated and free customers

In Chile, the regulation establishes a free price setting system in those segments where adequate conditions for competition are observed. As such, for supply to end users whose maximum import capacity is less than 5,000 kW, the regulation considers market conditions to favor natural monopolies, and thus the law stipulates that such users are subject to price regulation. These clients are referred to as regulated customers.

For supply to end users whose maximum import capacity is greater than 5,000 kW, the law stipulates that they may freely agree prices, as it is assumed that these users have the negotiating capacity and the opportunity to obtain electricity supply by other means, such as self-generation or direct supply from generation companies.

These clients are known as free or unregulated customers. Clients with maximum import capacity of above 500 kW may choose the regime (regulated or free) to which they adhere for four years.

## Value-Added Distribution (VAD)

The Ministry of Energy sets an indicator known as value-added distribution (VAD) every four years. In this way, it establishes an average distribution cost that incorporates investment and operation costs of an efficient model company in the investments policy.

VAD is a key component of the final price that a distributor will charge to its regulated end clients. This price is determined by the CNE, based on the sum of the base price, value-added distribution, and a toll for using the backbone transmission system.

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## Small Means of Distributed Generation (PMGD)

In Chile, means of generation up to 9 MW connected to low and medium-voltage networks are classified as small means of distributed generation, or PMGD [*pequeños medios de generación distribuida*] according to its Spanish acronym.

PMGD can take advantage of several incentives, including more flexible network connection protocols and an independent price setting mechanism, known as the “stabilized price regime”.

The stabilized price is equivalent to the average value of a PPA in the market, adjusted based on spot market price forecasts for the next four years. This enables project developers to obtain greater certainty regarding their expected returns, which in turn facilitates access to financing for PMGD projects.

## Tendering of lots for the construction of renewable energy projects

The Ministry of National Assets tenders public lots for the construction of renewable energy projects. Click [here](#) for more information about these tenders.

## Electricity supply tender for regulated customers

According to Chilean law, distribution companies must ensure sufficient electricity supply to meet the demand of all clients located within their concession area. This is achieved through supply contracts awarded in open, transparent, and non-discriminatory public tenders designed, coordinated, and implemented by the National Energy Commission (CNE).

A tender starts with a preliminary report issued by the CNE that assesses the need for additional short or long-term supply.

Table. National electricity system demand forecast [GWh]

Year	Regulated Customer	Free Customer	Total
2021	28,161	45,655	73,816
2022	28,973	47,919	76,891
2023	29,252	50,868	80,121
2024	30,083	53,505	83,588
2025	31,010	55,446	86,456
2026	32,033	56,299	88,332
2027	33,021	57,126	90,147
2028	34,115	57,120	91,235
2029	35,276	58,039	93,315
2030	36,446	58,658	95,105
2031	37,806	57,640	95,446
2032	39,242	58,299	97,541
2033	40,772	59,024	99,796
2034	42,371	59,975	102,345
2035	44,032	60,727	104,759
2036	45,738	60,728	106,467
2037	47,537	61,863	109,400
2038	49,387	62,919	112,306
2039	51,264	64,064	115,327
2040	53,223	65,196	118,420
2041	55,245	67,615	122,860

Source: Final demand forecast report 2021-2041 (National electricity system and mid-size systems), CNE, January 2022 (<https://www.cne.cl/tarificacion/electrica/>).



## Comparison of average capex per MW between different technologies

The most recent figures by the CNE, in March 2020, provide an estimation of average investment in different generation technologies for Chile's national electricity system.

Diesel power plants are the most cost effective to build in the country, with an average investment of US\$448,000 per MW of installed capacity, followed by natural gas power plants with an average investment of US\$675,000/MW for combined cycle plants and US\$898,000/ MW for open cycle plants. Meanwhile, solar power plants require an average investment of US\$871,000/MW.

Table. Benchmark investment costs per unit (US\$/KW)

Tecnología	US\$/KW
Termoeléctrica - diésel	448
Termoeléctrica - gas natural (ciclo combinado)	965
Solar fotovoltaica	818
Termoeléctrica - gas natural (ciclo abierto)	725
Biogás	1.229
Eólica terrestre	1248
Solar FV con almacenamiento	1.518
Eólica con almacenamiento	1.935
Biomasa	3.697
Mini-hidro	2.471
Hidroeléctrica de pasada	4.216
Geotérmica	4.664
Hidroeléctrica de embalse	5.126
Solar/ Concentración Solar de Potencia	5.673

Source. Electricity generation technology cost report, CNE, April 2022 (<https://www.cne.cl/wp-content/uploads/2022/04/RE-CNE-279-2022.pdf>).

As storage capacity improves, the cost of developing solar and wind power plants is decreasing, in line with the trend for renewable energy generation in general.

# 09. Investor support: Services, stages, and tools

## InvestChile

### Foreign Investment Promotion Agency

InvestChile, the Foreign Investment Promotion Agency, promotes Chile as an investment destination and Latin American hub for global business. It serves as a bridge between your interests and existing business opportunities, offering free personalized assistance in order to facilitate investment installation and expansion.

Check out our services!  
**Let's make your next  
project a reality!**



2021 HubSpot Success Story



Best Investment Promotion Agency in South America (Best to Invest 2022, 2021, 2020, 2019 reports, Site Selection)



Best Investment Promotion Agency 2019 (International Business Magazine)

Government Standard of Excellence

WEBAWARDS 2017

2017 Standard of Excellence - Government Category

## We connect / We advise / We support

### IN EACH STAGE:



#### PROSPECTION



#### PRE-INVESTMENT



#### LANDING



#### COMPANY INSTALLED

### FREE SPECIALIZED SERVICES

#### Knowledge and Information

- Business environment and FDI statistics, data and information on opportunities
- Key aspects of the market and sectors
- Legal and tax information
- Detailed information on installation and sectoral costs
- Portfolios of public projects and tenders

#### Promotion and Advising

- Schedule of e-meetings with public and private entities
- Delegations of investors and bilateral meetings
- Investment tours, lectures and workshops
- Portfolios of public projects and tenders
- Investment incentives and special programs (i.e., R+D+i, tax deductions and credits)

#### Guide and Access

- Experts from the sector available to advise you in various languages
- Sectoral and legal advising on the implementation stage
- Contact with key stakeholders from the business ecosystem and site visits
- Assistance applying for public incentives and programs
- Public-private portfolios and tenders
- Inclusion in the Support Network developed to install projects in various regions

#### Ongoing Support

- Assistance for the installation of projects and expansion/re-investment of established companies
- Investment environment and climate management (policy advocacy)
- #InvestChileOnline offers immediate free answers to your questions
- Monitoring of contingencies and assistance with public agencies to facilitate your investment (i.e., permits, R+D+i, human capital)
- Online Investor's Toolkit with everything necessary to facilitate your landing and the expansion of your investment
- Press management to make your company's contribution to the country visible
- Advising on added value and sustainable development initiatives
- Connections with public and private entities in order to promote synergies and cooperation

**Over 700 companies advised each year!**  
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# #InvestChileTools for promoting your business

We are an environmentally friendly company and are strengthening our commitment to promoting sustainable development in Chile. Our promotional materials are mainly digital, which helps us to disseminate “Why Chile” is the ideal investment destination for making your project prosper. In these challenging times, we strongly support the operation of companies so that you can run your business remotely.



## Guide: How to Invest in Chile \*中文

A complete guide to establishing business operations. Steps for establishing a presence/ Foreign investment incentives/ Intellectual property/ Chile’s tax structure/ Environmental legislation/ Visas and foreign visitors/ Personal information legislation/ Labor laws and social security



## Sectoral e-books

Projections and opportunities in mining and other sectors in Chile (infrastructure, food, energy, venture capital, pharmaceuticals, sustainable packaging, global services and the digital economy).



## InvestChile Talks *The Power of Dialogue*

In-person and virtual talks and events with public and private officials about economic contingencies and opportunities for investment in Chile.



## InvestChile Insights

Reports, studies and guides that address key investment topics (FDI) and the business environment.



## ChinaDesk

Assistance, tools and content in Mandarin Chinese to facilitate your arrival and expansion in Chile.



## Investment Opportunity Portfolios

This public-private portfolio includes over 30 projects from the mining sector and other sectors such as infrastructure, tourism and energy.

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