

EMBASSY OF INDIA

SANTIAGO

CHILE

RENEWABLE ENERGY MARKET SURVEY

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Commissioned from Ms. Carmen Gloria Fuentealba

on behalf of the



सत्यमेव जयते

Economic Diplomacy Division
Ministry of External Affairs

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This market survey aims to provide relevant information on the non-conventional renewable energy (NCRE) market in Chile so that Indian exporters of products and services related to this market or eventual investors may get a deep understanding of it and may also develop and execute a successful market entry into Chile.

The survey also provides information for Indian companies willing to participate as investors in the development of renewable energy projects in Chile.

1. Market Overview

1.1 Sources of renewable energy

This survey will cover the following sources of non-conventional renewable energy (NCRE):

- **Wind:** Type of energy obtained from the wind force and motion. Wind turbines convert the kinetic energy of the wind into electricity.
- **Solar:** Type of energy obtained from solar radiation. It corresponds to the one that came from the direct use of the radiation emitted by the sun, transforming it into heat through thermal collectors (CSP) or by photovoltaic cells (PV) into electrical energy.
- **Biological energy (biomass and biogas):** Type of energy obtained from organic and biodegradable material. It can be used directly as fuel or converted into other liquid, solid or gaseous biofuels.
- **Small hydraulic:** Small scale type energy obtained from water plants. It can be developed from natural channels, or associated with existing irrigation works (dams or irrigation channels). These plants convert the kinetic energy of the flow into electrical energy by a turbine and an electric generator.

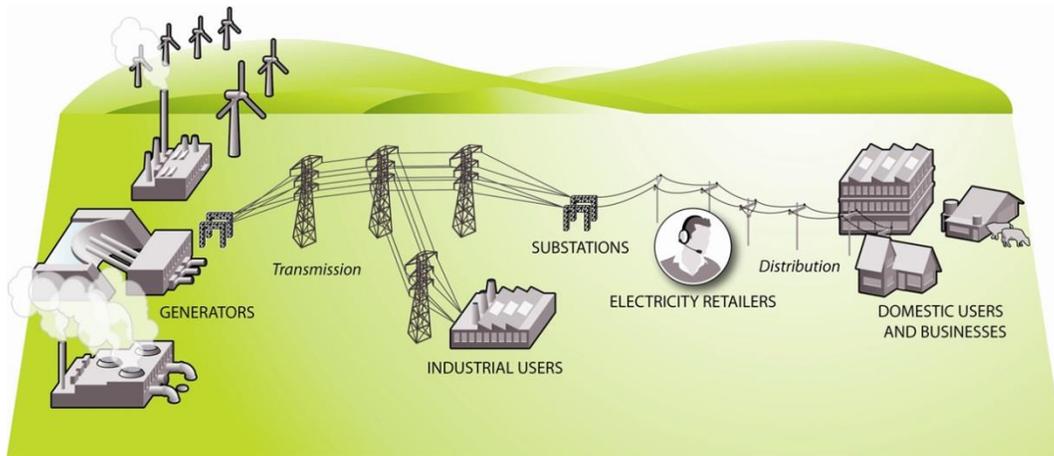
- **Geothermal energy:** Type of energy obtained from the natural heat of the earth. Geothermal reservoir is a low surface area where rocks are high temperature, high permeability and saturated with fluids.

1.2 Chilean electricity market structure

The electric market is divided in three different activities:

- **Generation:** Power generation requires an energy source—for example, sun, wind or water—and a power plant to convert the fuel source into electricity. Then, the generated electricity is supplied to the transmission lines after stepping up—or increasing—the voltage. Generating companies are remunerated for energy and capacity services. In Chile, there are about 70 companies in this segment, being the main ones Enel Generación, Colbún and AES Gener.
- **Transmission:** Transmission involves transmitting electricity over long distances. The energy is at very high voltages, permitting to transfer electricity more efficiently. Transmission facilities are remunerated through transmission tolls. In Chile, there are about 10 companies operating in the transmission segment; the main one is by far Transelec.
- **Distribution:** Distribution delivers electricity locally to commercial and residential customers, stepping down the voltage. For industrial users, electricity is supplied at high voltage power. There are about 30 companies, being Enel Distribución and CGE Distribution the main ones.

Electricity Market Scheme



All the companies operating in these three segments are private, belonging to local or multinational capitals.

The public agency in charge of the sector is the Energy Ministry. It is responsible for plans, policies and standards regarding the development of the sector. In addition, it grants concessions for power plants, transmission lines, substations and power distribution areas. The National Energy Commission (CNE), organizationally dependent on the Energy Ministry, is a technical agency responsible for studying prices, tariffs and technical standards, fixing tariffs and generating the electrical infrastructure works plan. The Electricity and Fuels Superintendence (SEC) sets technical standards and oversees its compliance.

Generation and transmission companies are grouped in 2 interconnected systems called SIC and SING, plus 2 minor systems (Aysén and Magallanes). Generation companies must submit the operation of their power plants to the respective Economic Load Dispatch Centers (CDEC-SIC and CDEC-SING).

In 2014, Chile created an energy-specific auction system, in which all clean energy technologies would compete. Under the system, generators commit to supply electricity during a certain time block.

Energy sale takes the form of financial contracts called Power Purchase Agreements (PPA). PPA's are signed by generators with distribution companies and unregulated clients¹.

¹ Unregulated clients correspond mainly to big electricity consumers (mostly mining and industrial companies).

Positions are adjusted in the spot market at the marginal cost determined hourly by the CNE for each node.

In 2014, a net metering programme was introduced. This enables retail electricity consumers who have renewable energy or co-generation installations smaller than 100kW to connect to the national grid, deliver surplus generation and obtain credit for excess electricity provided. The credit is equivalent to the price charged by the utilities to their consumers.

1.3 Renewable Energy Market Size

Chile has long been the leader of Latin America's renewable energy market. In 2015, the country ranked 10th worldwide in terms of renewables growth, according to the "Renewables 2016 Global Status Report"².

The development of NCRE plants (specially wind and solar) - which had no representation in the Chilean electricity markets one decade ago - results from many interacting conditions: an appropriate political and regulatory framework, an open access regime for new enterprises, outstanding natural resource conditions and access to financing.

Chile's growth ranks behind its neighbours Brazil (the world's third-largest renewables generator behind the U.S. and China) and Mexico. But Chile's investment in the sector outpaces all Latin American countries by far.

During 2017, power generation projects for 3.140 MW were in construction, representing about a half of those in 2016. From them, 51% corresponded to NCRE projects.

During 2017, the total gross power generation reached 74.647 GWh, representing +0.7% compared to previous year. From them, 17.8% corresponded to NCRE.

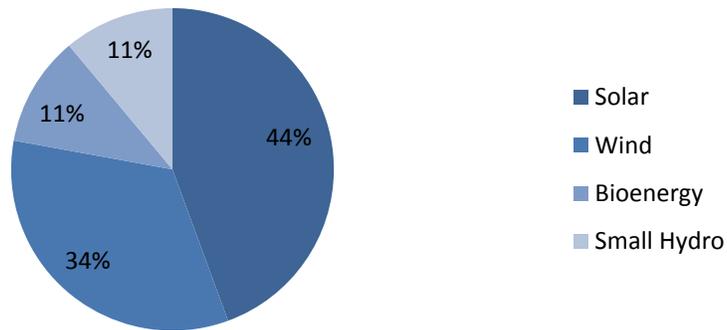
In December 2017, total installed electrical capacity reached 22.580 MW. From them, 4.064 MW (18% of total) corresponded to non-conventional renewable energy (NCRE).

Solar and wind energies represent almost 77% of total NCRE installed capacity, in line with its potential and importance among available natural sources of energy in Chile. See chart below.³ⁱ

² Report issued by REN21, the global renewable energy policy multi-stakeholder network, based at the United Nations Environment Programme (UNEP) in Paris, France.

³ Note that geothermal energy is not included, as the first geothermal plant installed in Chile started operating in 2017.

2017 NCRE installed capacity



Source: National Energy Commission (CNE)

The following chart shows the existing NCRE power plants to June 2018, classified under their current stage of development:

NCRE power plants per stage of development (in MW)

Source of energy	In operation	In construction	Environmentally approved	Under evaluation
Solar PV	2.341	310	14.225	5.140
Wind	1.537	625	6.678	2.338
Small hydro	628	64	342	96
Bioenergy	482	0	187	30
Geothermal	48	0	70	50
Solar CSP	39	0	0	1.200
Total	4.593	999	21.502	8.854

Source: ACERA A.G.

Most of the projects already environmentally approved correspond to Solar PV followed by wind energy. Similarly, in the case of projects in construction, Solar PV and wind also rank in the main positions. Even if solar PV shows the best figures in terms of projects in operations and in construction, it also shows the higher number of unrealized projects.

It is important to mention that the fact that a project is environmentally approved does not necessarily mean it will be constructed. In most cases, NCRE projects remain in stand-by for several years, waiting for financing or for more favourable conditions (i.e. higher energy price, low building cost, transmission line availability, etc.) that would make them economically viable or more profitable. Up to June 2018, almost 21.500 MW of NCRE projects have been environmentally approved but only around 5.600 MW from them have been constructed or are currently under construction.

1.4 Chile NCRE potential

Chile has plentiful natural resources that are ideal for the development of plants of different NCRE sources. According to the National Energy Commission (CNE), Chile has a huge potential of more than 1.835.000 MW of NCRE, representing slightly less than 100 times Chile's current total installed capacity. From them, the most relevant is, by far, photo voltaic solar energy (PV) with more than 1.230.000 MW, followed by thermal solar (CSP) with almost 550.000 MW.

Chile has the best conditions for solar energy production in the world; including 4 thousand hours of sunshine per year in the northern regions and the highest levels of solar radiation found anywhere on the planet. It should be noted that In the North of Chile are located most of the mining industry (the largest energy off-takers in the market) and the world's largest copper reserves.

In another field, a research conducted by the Ministry of Energy⁴ has identified several regions in Chile with a very high wind and hydroelectric potential.

Moreover, Chile has over 15% of the world's active and dormant volcanoes, being possible to identify more than 300 areas with good potential for geothermal energy, with a total estimate of 16.000 MW.

⁴ "Renewable energies in Chile: solar wind and hydro potential from Arica to Chiloé" – Ministry of Energy and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH - 2014

1.5 NCRE regulatory framework

One of the factors behind the fast development of NCRE in Chile is the existence of specific government policies, despite not offering subsidies or feed-in tariffs, and an adequate regulatory framework.

Some of the main laws affecting the NCRE market are the following:

- Law N° 20.257 better known as Non-Conventional Renewable Energy Law (NCRE Law), enacted on April 2008, aimed to fulfil future energy requirements by developing non-conventional renewable energy sources. The law required electricity providing companies, to demonstrate that a certain percentage of their total energy committed comes from NCRE sources. The energy can be produced by their own plants, or by contracting from third-parties. On October 2013, this law was reformed by Law 20.698 and mandated that electric utilities with more than 200MW operational capacity should generate 20% of electricity from renewable sources by 2025.
- Law 20.018 of 2005 mandated distribution companies to run tender processes for securing energy supply to their regulated customers (those with an energy demand of up to 2 MW). These tender processes are public, non-discriminatory, and transparent. In addition, they allow the participation of every investor interested in exploring the market even if they are not incorporated in Chile. In 2015 by Law 20.805 the tender process was amended by the introduction of different sized hourly blocks of energy supply (day, peak, night, 24 hrs), benefiting NCRE (i.e. solar and wind power) that cannot deliver energy during 24- hours of the day.
- Law 20.936 of 2016 (also known as “Transmission law”) allows grid expansion for specific regions and technologies, increases connection between the country's three grids, sets up an independent grid operator, guarantees open access to the grid and makes transmission pricing more transparent, favouring smaller generators, as well as those located in remote areas.
- Law 20.365 of 2009 grants a tax benefit until 2013 for construction companies including thermal solar systems in the new houses they build. A further amendment (law 20.897/2016) reinstated the application of this benefit until 2020

and incorporated a direct subsidy to the thermal solar provision in new social housing.

1.6 NCRE market prospects

According to the 2015–2030 demand forecast prepared by the CNE, the energy consumption in the SIC (the largest system) will increase from 49.9TWh to 88.2TWh, which means a 72.95 per cent increase in the said period, with an average annual growth of 3.72 per cent.

The same forecast estimates that energy consumption in SING (the second largest system) will increase from 16.8TWh to 32.5TWh, meaning a 93.76 per cent increase in the 2015–2030 period, with an annual average growth of 4.51 per cent.

According to AGG – the association gathering generation companies – solar PV and wind energy will represent around 20% of total in 2021, 30% in 2025 and more than 40% by 2030.

Chile has legally established the objective of generating 20% of its energy from NCRE by 2025. By 2035 this rate must reach 60% of the energy matrix, and by 2050, 70%.

Despite these promising prospects in terms of energy demand, Chile faced in 2016-2017 a slowdown trend in term of new project construction. According to industry experts, main reasons were the decrease in the energy demand (especially from the mining sector) and decay in the prices of electricity.

Nevertheless, in 2018 mining is showing a higher dynamism in terms of new mining projects. The Chilean Copper Commission (COCHILCO) forecasted a 31.8% increase in mining investment to be materialized within the 2017-2026 period, compared to 2016-2025.

Moreover, the Corporation of Technological Development on Capital Goods (CBC) forecasts a 3.9% increase in energy investment in 2018 compared to previous year. This growth will be mainly in the development and construction of new wind farms (33.2%), solar thermal plants (15.3%) and solar PV plants (14.9%)

Energy prices have considerably diminished in recent years. PV solar capacity additions in the past two years have led to an oversupply of electricity that has pushed down prices,

impacting at the same time the viability of some projects in the pipeline, especially those belonging to small companies.

In 2013, the power tender process conducted by the Energy Ministry⁵ for regulated users resulted in an average electricity price of US\$ 128.9/GWh, while in 2016 the price decreased to US\$ 47.6/GWh and to US\$ 32.5/GWh in 2017.

According to market actors, these low energy prices are a consequence of the entry of more competitors into the market and of the decrease of capital costs of constructing new NCRE plants expected in the following years, as a result of new technologies and strongest competition among NCRE equipment and service suppliers.

It is worth mentioning that Chile's renewable energy developers also face transmission congestion, slow access to the market, low generation flexibility to complement the current intermittency of wind and solar and the opposition of communities to the construction of renewable energy projects in their vicinities.

Even though, Chile continues to be an attractive place to invest in NCRE, supported by adequate public policies and laws and a gifted geography and climate support.

It is expected that the NCRE market is recovering the dynamism shown in past years as long as the Chilean economy is growing again at higher rates.

⁵ The Energy Ministry is obliged to carry out every year a public bidding process for energy coming from NCRE sources, which objectives are to help to reach the quotes of NCRE required and to improve the financing conditions of NCRE

2. Imports and exports

The list of the equipment, services and supplies used in the construction and/or the operation of NCRE plants could be almost infinite.

For the purpose of this survey, we have identified equipment that could be associated directly and almost exclusively to NCRE plants.

Therefore, import and export statistics contained in this section correspond to these products, which are classified under the following Harmonized System (HS) codes:

Chapter/code	Description
84.10	84.10.11.10: Hydraulic Turbines < 1.000 KW 84.10.12.10: Hydraulic turbines > 1.000 KW and < 10.000 KW 84.10.13.10: Hydraulic turbines > 10.000 KW
84.19.19.00	Thermal solar collectors
85.02.31.00	Wind-powered generators
85.41.40.00	Photovoltaic solar panels

2.1 Imports

For the construction of NCRE plants, Chile depends mainly on foreign suppliers. Almost all main equipment is purchased abroad, while only some products (such as metal structures, minor parts and pieces, supplies, etc.) are manufactured by local companies.

2.1.1 Imports by type of product

Most imports correspond to wind power turbines and photovoltaic solar panels, which correspond to the most developed NCRE technologies in Chile. See chart below

Total Imports by type of product (in US\$ CIF)

HS Code	2013	2014	2015	2016	2017
Solar Power					
84.19.19.00	14.019.489	6.167.846	5.880.744	7.897.915	12.222.468
85.41.40.00	135.002.469	119.526.034	237.276.529	184.491.316	45.382.543
Hydro Power					
84.10.11.10	1.314.195	2.168.380	5.902.752	1.336.837	1.564.451
84.10.12.10	3.449.092	8.168.926	5.433.696	3.926.986	2.468.918
84.10.13.10	2.280.502	1.736.314	721.259	15.958.934	31.107.375
Wind Power					
85.02.31.00	336.602.675	243.782.244	104.613.924	407.053.777	276.339.590
Total	492.938.422	381.576.783	359.828.904	620.665.766	369.085.345

Source: Chilean Customs Statistics

Imports of equipment related to renewable energy grew significantly in 2016, mainly explained by the increase of the number and size of new wind projects.

It is worth mentioning that there are several variations from year to year in the imports in almost all categories. In these variations, it comes into play several factors.

For instance, in the case of thermal solar collectors (HS 84.19.19.00), from 2014 it can be observed a significant decrease in imports, coinciding with the end of tax benefit to solar thermal systems enabled by law 20.365 (see section 1.4). As the tax benefit has been reinstated from 2016 on, it could be seen an increase in 2017.

2.1.2 Imports by country

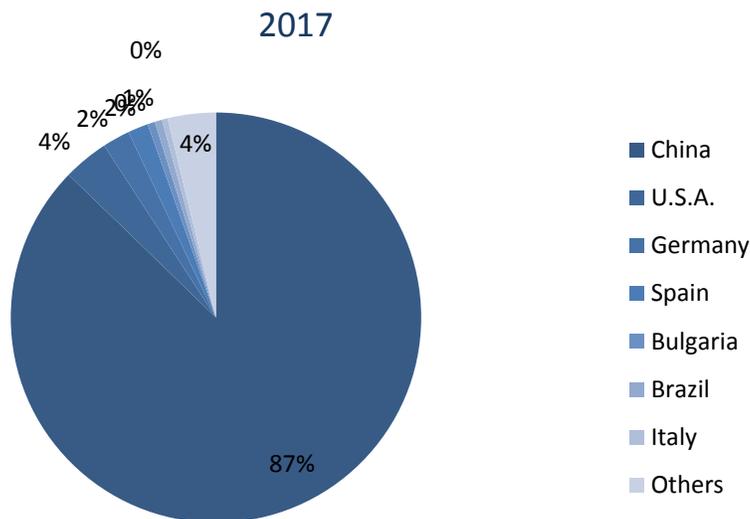
This section shows imports of NCRE equipment classified by country of origin.

It should be noted that most imports come from China. This country has developed a solid industry regarding NCRE technologies. China has also considerably improved the quality of the equipment they manufacture, while offering competitive prices, compared to European and North American producers.

2.1.2.1 Solar Power equipment

The following chart shows the imports of photovoltaic solar panels (HS 85.41.40.00) in 2017, by country of origin.

Photovoltaic solar panels imports – by country of origin (in US\$ CIF)



Source: Chilean Customs Statistics

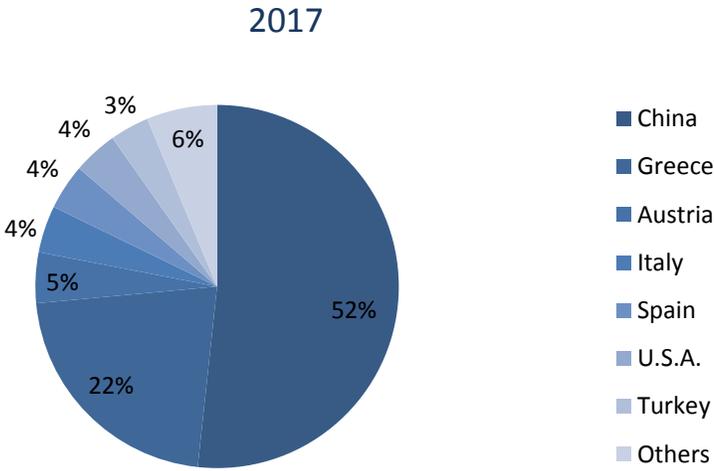
It can be observed that the main country of origin of photovoltaic solar panels imports is, by far, China (87%), followed by U.S.A. (4%) and Germany (2%). Imports from China have also significantly increased; in 2016 they were almost 20 times the value reached in 2012.

However, in 2017 they dramatically decreased from US\$ 177.7 to US\$ 39.6 million, highly impacted by the slowdown of new solar project construction

It is noteworthy that photovoltaic solar panels imports from India were US\$ 11.893 in 2017, ranking in the 29th position among import origin countries.

In the case of thermal solar collectors (HS 84.19.19.00), the following chart shows the imports in 2017.

Thermal solar collector imports – by country of origin 2017 (in US\$ CIF)



Source: Chilean Customs Statistics

As same as in the case of photovoltaic solar panels, imports of thermal solar collectors come mainly from China (52%). In the second position ranks Greece with 22%.

It is noteworthy that there are not thermal solar collector imports from India in 2017.

2.1.2.2 Hydro Power equipment

The following chart shows the imports of hydraulic turbines (classified under the HS 84.10.11.10, 84.10.12.10 and 84.10.13.10) in the last 5 years, by country of origin

Hydraulic turbine imports – by country of origin (in US\$ CIF)

Country	2013	2014	2015	2016	2017
Brasil	15.460	1.776	157.947	8.435.630	11.880.398
Italy	21.597	5.973.230	2.755.941	62.914	11.590.606
India	-	-	-	-	9.946.694
Germany	3.093.694	851.453	6.132.451	1.987.220	1.223.088
Poland	-	-	-	-	228.247
Rusia	-	-	-	4.625.967	92.825
Others	4.483.037	5.274.160	3.011.368	6.106.816	178.885
Total	7.613.788	12.100.619	12.057.707	21.218.547	35.140.744

Source: Chilean Customs Statistics

In 2017, main origin countries of hydraulic turbines imports were Brasil (34%), Italy (33%) and India (28%).

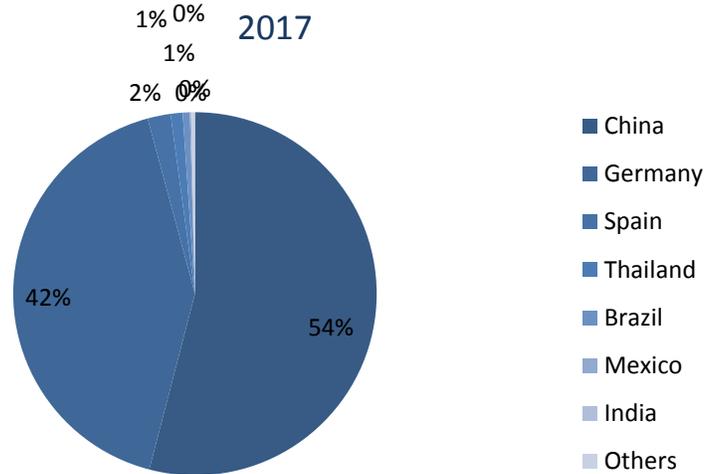
It should be noted that – given that hydraulic turbines have a high unitary cost and the number of project in construction is limited– imports by country of origin can vary widely from year to year, depending on the company the purchase was awarded to. For instance, imports from India in 2017 corresponded to equipment for a single project (Alto Maipo), but in previous years there were not imports from this country.

Same as for most imports from Brasil in 2016 and 2017, which corresponded to equipment imported for the same above project (Alto Maipo).

2.1.2.3 Wind Power equipment

The following chart shows the imports of wind-powered generators (HS 85.02.31.00) in 2017, by country of origin.

Wind-powered generator imports – by country of origin (in US\$ CIF)



Source: Chilean Customs Statistics

Imports in 2017 were highly concentrated, coming mainly from China (54.0%) and Germany (41.8%).

Imports from India ranked in 7th position with US\$ 170 M. However, in the previous 5 years, there were no imports from this country.

2.1.3 Imports by company

This section shows imports of NCRE equipment classified by importer.

It is worth mentioning that, in many cases and due to its high cost, equipment is imported directly by the companies that develop or construct the plants. This occurs even in cases in which foreign equipment manufacturing companies have local representatives or distributors or have a subsidiary in Chile.

In this context, equipment is imported specifically for each project or plant; therefore, the annual ranking of importing companies will directly depend on the number and size of the plants in construction during that specific year.

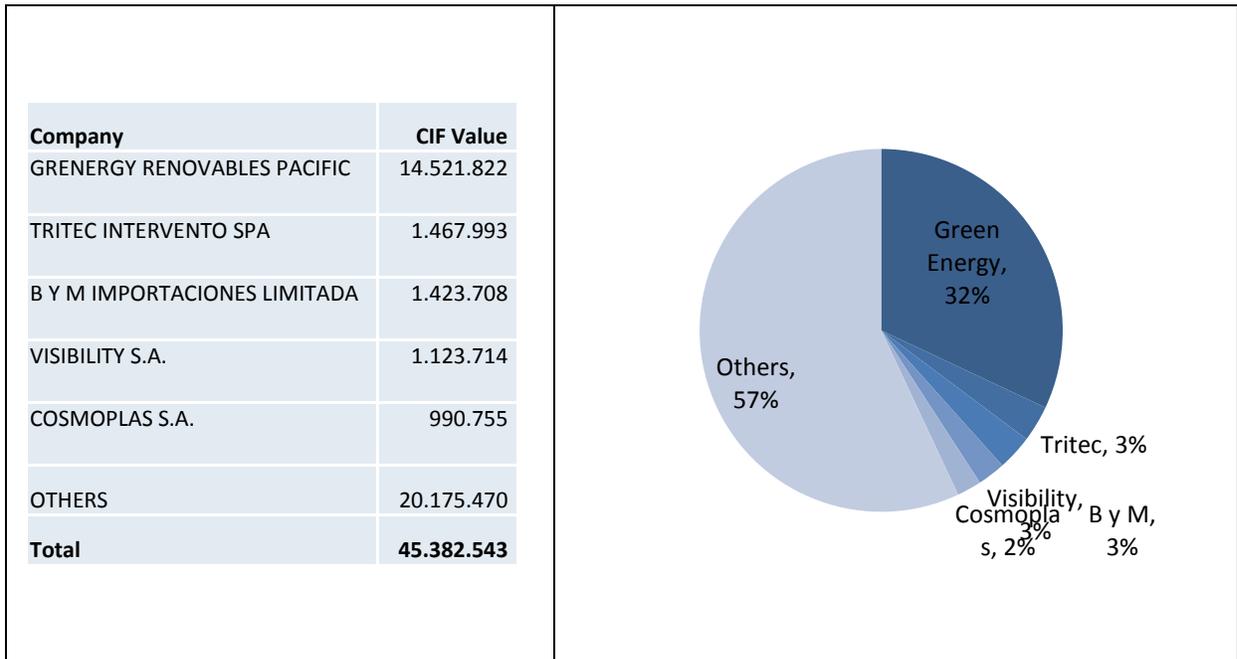
It should be also noted that – in the case of some projects – a new legal entity is created by the owners and imports are conducted under its business name.

2.1.3.1 Solar power equipment

In 2017, there were 639 companies that imported photovoltaic solar panels (HS 85.41.40.00).

Imports were quite atomized (with the exception of Green Energy with 32% of total), showing the absence of big photovoltaic projects in construction during this year.

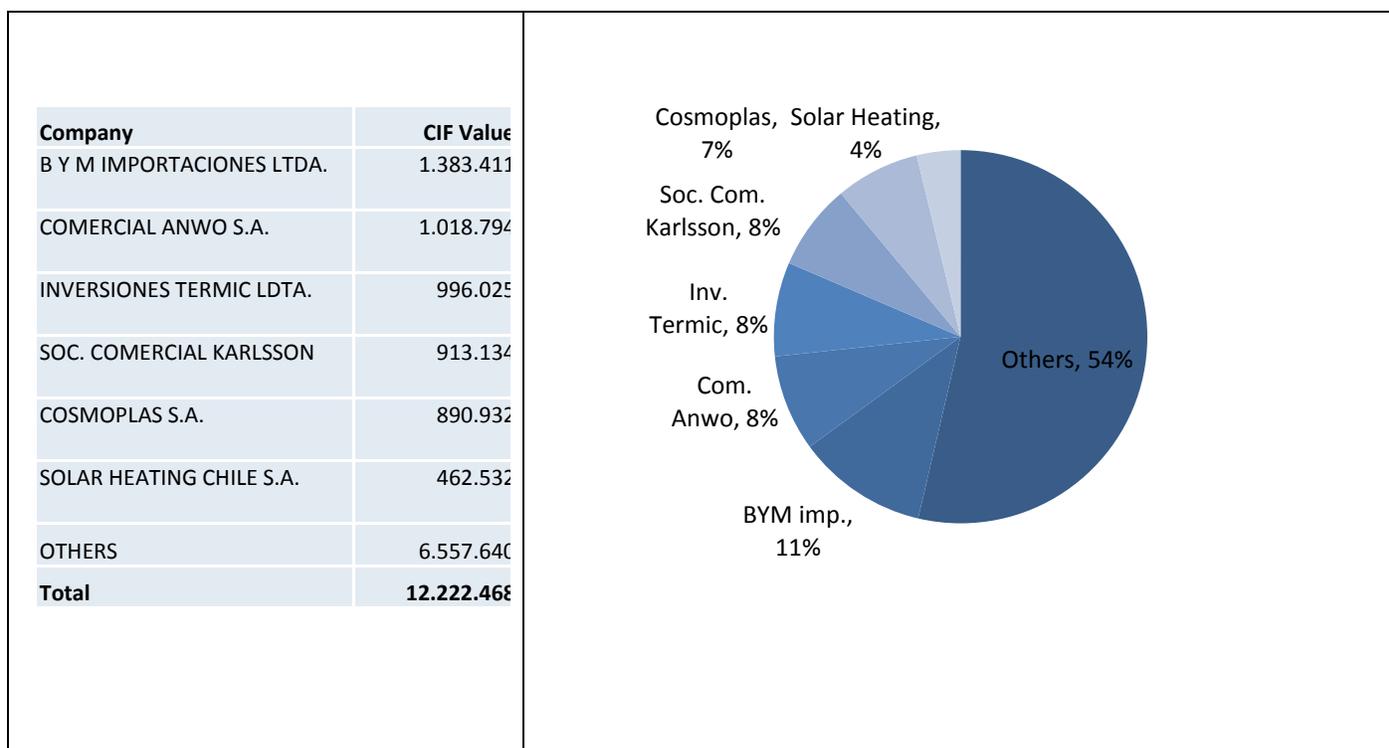
Photovoltaic solar panels imports – by company 2017 (in US\$ CIF)



Source: Chilean Customs Statistics

In the case of thermal solar collectors (HS 84.19.19.00), the following chart shows the imports by company in 2017.

Thermal solar collector imports – by company 2017 (in US\$ CIF)



Source: Chilean Customs Statistics

In 2017, thermal solar collector imports showed a high level of atomization among several companies. There were a total of 118 importing companies and natural persons, being the main one ByM Importaciones, representing 11% of total.

Unlike the rest NCRE equipment considered in this section, most thermal solar collector importers are local representatives and distributors of foreign companies. These companies usually import and keep equipment in stock locally, in order to supply the demand for small-scale thermal solar energy projects (i.e. for commercial and residential buildings).

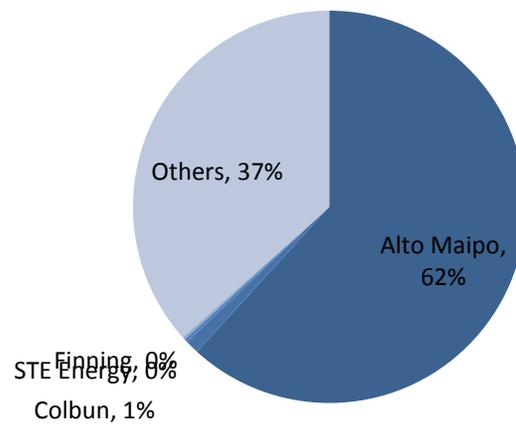
It is noteworthy that the number of local players in the thermal solar energy sector has increased significantly in the last years, given the fast-growing trend among residential and commercial customers to incorporate solar technology for heating purposes in new and existing buildings, given the high cost of other types of energy (i.e. electricity and gas).

2.1.3.2 Hydro power equipment

The following chart shows the imports of hydraulic turbines (classified under the HS 84.10.11.10, 84.10.12.10 and 84.10.13.10) in 2017, by company.

Hydraulic turbine imports – by company 2017 (in US\$ CIF)

Company	CIF Value
ALTO MAIPO S.P.A	21.709.347
COLBUN S A	395.987
STE ENERGY CHILE S.P.A.	102.796
FINNING CHILE S A	76.879
OTHERS	12.855.735
Total	35.140.744



Source: Chilean Customs Statistics

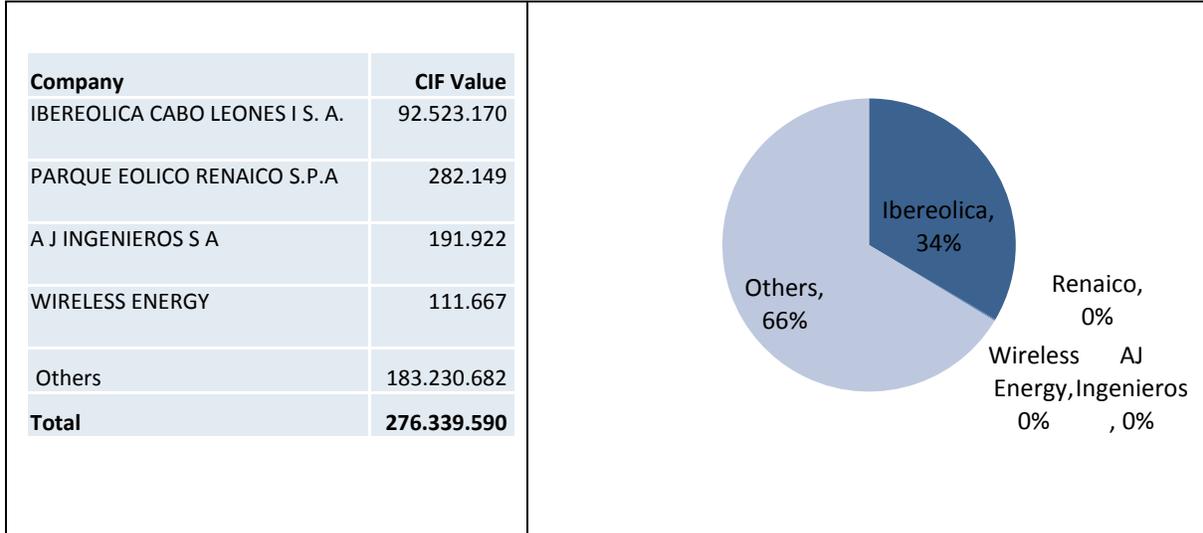
Main imports corresponded by far to Alto Maipo project (which main owner is AES Gener) representing 61.8% of total.

It is worth mentioning that - strictly speaking - Alto Maipo project should not be considered as an NCRE project, given that its installed capacity will be over 20MW once in operations. In the case of Colbún, the company is developing several projects hydro projects of different capacities, making impossible to determine for which projects equipment have been imported.

2.1.3.3 Wind Power equipment

In 2017, imports of wind-powered generators (HS 85.02.31.00) corresponded mainly to the project Cabo Los Leones, developed by the Spanish company Ibereolica. See chart below.

Wind-powered generator imports – by company 2017 (in US\$ CIF)



Source: Chilean Customs Statistics

2.2 Exports

Given that there are not local NCRE equipment manufacturers in Chile, there are not relevant exports of these products.

3. Main market players

This section analyses the main companies that participate in the Chilean NCRE market.

These companies can be divided in two groups:

- NCRE generation companies, that is to say, companies that own and/or operate one or more energy generation plants.
- Companies that provide services to NCRE generation companies, for building and/or operating NCRE plants.

ANNEX 1 shows some of the main companies participating in the Chilean NCRE market, with their contact data.

3.1 Main NCRE generation companies

In Chile, the development of all power plants goes through three well-established stages: prefeasibility and feasibility studies, environmental impact authorization and construction. This section shows the projects currently in operation or in construction for each type of NCRE.

3.1.1 PV Solar energy

According to Acera A.G. (Chilean Association of Renewable Energies) there are currently 61 PV solar energy plants in Chile in operation. The following chart shows the main ones, indicating their capacity and owner company.

Main PV solar plants in operation

PLANT NAME	OWNER	CAPACITY (in MW)
El Romero Solar	Acciona Energia	196.0
Finis Terrae (1 and 2)	Enel Green Power	160.6
Parque Bolero	EDF	146.0
Parque Luz del Norte	First Solar Energy	141.0
Parque Quilapilún	Sun Edison	106.2
Parque El Pelicano	Austrian Solar Chile	105.0
Parque Solar Conejo	Pattern Chile Development	104.0
Parque Llanos de Llampos	Sun Edison	100.6
Parque Cerro Dominador	Abengoa	100.0

Source: ACERA A.G.

In addition, at Jun 2018 there are currently 9 solar plants in construction. Main ones are Parque Huataconto (107.8 MW) belonging to Austrian Solar Chile and Parque Willka (107.5 MW) belonging to Desarrollos Fotovoltaicos de Chile S.A,

It should be noted that the majority of the solar projects operating and in construction are owned by foreign companies, mainly from Europe and the U.S.A.

3.1.2 Wind energy

According to Acera A.G., there are currently 31 wind-powered plants operating in Chile, most of them connected to the SIC system. The following chart shows the main ones.

Main wind-powered plants in operation

PLANT NAME	OWNER	CAPACITY (in MW)
San Juan de Chañaral	Latin America Power	193.2
Cabo Leones	Ibereolica	115.5
El Arrayan	Pattern Chile Development	115.0
Sierra Gorda	Enel Green Power	112.0
San Pedro	Transantartic	101.0
Tal Tal	Enel Green Power	99.0
Renaico	Enel Green Power	88.0

Source: ACERA A.G.

It is noteworthy that an half of major wind-powered plants belongs the Enel Green Power, the multinational company operating in Europe, Americas, Asia, Oceania and Africa and in the solar, wind, hydro and geothermal energy sectors.

Currently, there are 7 wind powered plants in construction. Main ones are Parque San Gabriel (belonging to Acciona), Parque Eolico Sarco (belonging to Mainstream) and Parque Aurora (belonging to Mainstream), with a capacity of 183.0, 168.8 and 126.4 MW, respectively.

3.1.3 Small Hydraulic power

Up to June 2018, 107 small hydroelectric plant projects are in operation. Main ones are:

Main small hydro plants in operation

PLANT NAME	OWNER	CAPACITY (in MW)
Central El Paso	Hydrochile S.A.	60.5
Central Pullinque	Enel Green Power	51.4
Central Pilmaiquen	Enel Green Power	40.8
Central San Andrés	Hydrochile S.A.	40.3

Source: ACERA A.G.

In addition, there are currently 4 small hydro projects under construction with a total of 51 MW.

3.1.4 Geothermal energy

Currently, geothermal exploration is very active, with over 86 exploration and exploitation concessions.

Up to date, there is only one plant in operation (Cerro Pabellón), belonging to Enel Green Power and the state-owned National Petroleum Company (ENAP). It is the first geothermal plant operating in South America. The plant has a capacity of 48 MW and started to operate in March 2017.

There is also a plant already approved (Curacautín), with a capacity of 70 MW and belonging to Mighty River Power Chile

The lack of projects in operation can be explained due to the high up-front cost originated by the remote location of resources, the lack of a consolidated geothermal industry and the difficulty to participate in the electricity market.

3.1.5 Biological energy

Currently, biomass is used in Chile to generate energy through cogeneration plants that use the waste from industrial processes, such as the production of pulp and paper and wood sawing. The biomass industry is closely linked to forestry companies, which are the owners of most plants.

According to Acera A.G., there are currently 22 biomass plants operating in Chile which generate around 480 MW. The following chart shows the main plants.

Main biomass plants in operation

PLANT NAME	OWNER	CAPACITY (in MW)
Santa Fe	Bioenergias Forestales (CMPC)	67.2
Valdivia	Arauco Bioenergia	61.0
Nueva Aldea (1 and 3)	Arauco Paneles	51.0
Lautaro	Comasa S.A.	48.0
Pacífico	CMPC	25.0
Laja	CMPC	101.0

Source: ACERA A.G.

Currently, there are not biomass plants under construction.

3.1 Main NCRE service providers

A high percentage of the Chilean NCRE projects are constructed under the EPC modality, (Engineering + Procurement + Construction). Under this modality, the engineering and construction contractor carry out the detailed engineering design of the project, procure all the equipment and materials necessary, and construct to deliver a functioning facility or asset to their clients.

EPC contractors participate actively in the identification of the type of equipment, services and materials to be used for each project, as same as in the selection of the suppliers to be invited to submit technical and price proposals. The decision on which supplier the purchase will be allocated is generally taken together with the project owner. In this sense, EPC contractors are key contacts for NCRE equipment and material suppliers.

Most EPC contractors are building and engineering companies. Some of the main Chilean companies participating in NCRE projects are the following.

- Conpax
- Besalco
- Brotec
- Obechile
- Claro, Valenzuela, Vicuña
- Ebco
- Abengoa

- Emin
- Salfa Montajes
- Balzola

It is notable that some of the above companies are vertically integrated, that is to say, they have created subsidiaries with the purpose of directly developing NCRE projects as owners. This is the case of Besalco, Brotec, Conpax, Abengoa, among others.

4. Business opportunities and market barriers

4.1 Business opportunities

The Chilean NCRE market offers multiple opportunities to Indian companies. Abundant natural resources (solar radiation, wind, rivers, etc.), together with an appropriate political and regulatory framework and some subsidy programs, give enormous potential of business

Several opportunities could be identified:

- **Development of new plants.** Foreign investors can develop new projects, by their own or in association with local or multinational companies. In this framework, there are also opportunities in acquiring already operating plants to small owners who cannot or are not interested in operating them. In this framework, it should be noted that, from time to time, Chilean government conducts state-owned land tenders for NCRE project construction. The last one is currently in process (lands located in Tal Tal for wind projects).
- **Transmission line construction.** According to the CNE, Currently, more than 2,130 km. (with a total investment of US\$ 2.4 billions) are under construction. It is estimated that, at least, Chile will require a similar investment in new projects during the next 4 years.
- **Equipment and material supply.** Given that local equipment manufacturing industry is almost inexistent, there are good opportunities for companies capable to supply advanced technology equipment and materials at competitive prices. There are also opportunities in giving technical and design assistance to NCRE

plant developers, in order to identify and select the most adequate technology, as well as the appropriate equipment and material suppliers for each project.

- **Engineering and construction services.** There are good opportunities for highly specialized and long-standing experienced NCRE engineering and construction services. Foreign companies providing these types of services are advised to establish joint-ventures or consortiums with local companies having a good knowledge and vast experience in the local market, in order to participate together in tender processes.
- **Technical services.** According to experts, there are not sufficient well- trained and experienced professionals in some specialised NCRE areas, such as geothermal and marine energy. In addition, there are also opportunities for foreign companies able to conduct studies (geological, geodesic, topographic, meteorological, etc.,) to identify the best locations to construct NCRE plants.
- **Environment and community dealing services.** There are good opportunities for companies specialized in designing and conducting plans to mitigate the potential environment impact the construction of a NCRE plant could cause to its vicinity. Also, there are opportunities for advisory companies specialised in dealing with aboriginal or conflictive communities and in proposing and conducting compensation plans, in order to avoid conflicts that could delay the development of projects.
- **Financing advisory services.** Given that financing is one of the main key factors for NCRE projects, there are opportunities for capital advising companies, been able to provide advisory in finding investors for projects, in accessing to available financing sources or in creating and managing investment funds for financing NCRE projects.

4.2 Market barriers

Following are the main obstacles foreign companies could face when entering into the Chilean NCRE market:

- **High concentration in the energy generation market.** Three companies (AES Gener, Enel and Colbún) represent around 75% of total electricity generation

market and 90% of total energy contracts. This leaves less room for new companies willing to invest in new plants and to compete in energy call for bid processes. In addition, these 3 companies are also the more active in the construction of new plants; therefore, they concentrate much of the demand for equipment and materials.

- **Difficulties for accessing to financing.** Currently, one of the biggest obstacles in obtaining debt financing for renewable power projects in Chile is the highly competitive environment to secure a long-term PPA with a creditworthy counterpart. Financing alternatives are governed by the idea that payments associated with the loan are substantiated exclusively on the project flow generation capacity and therefore flow predictability is a key element in the granting of the credit.
-
- **Insufficient transmission lines.** Currently, there is a limited technical capacity available of the existing transmission facilities for transporting the energy. In addition, procedures to get the concession of land and rights of way are long and complicated. Moreover, some NCRE projects in remote areas are located far from existing transmission lines, making necessary to construct connexion lines and, therefore, increasing project costs. The recently enacted Law 20.936 of 2016 (see section 1.4) is addressing some of these issues.
- **Delays in project approvals.** To secure all the necessary surface land rights and mining rights over the project development area may be substantially complicated in certain areas of the country, causing important delays. These delays are even more crucial when the land where the plant would be constructed has been granted for consideration by the Chilean State, as inasmuch as this latest imposes strict terms for plant construction.
- **Community opposition.** In Chile, several projects are currently in stand-by or were definitely cancelled due to the opposition of communities, because of their social and environmental impacts or the effect they would have on the tourism industry. Communities are more conscious of the projects' impact on their environment, of the usually big money that is at stake and of their rights. Negotiations with communities to mitigate social and environmental risks could take years, delaying and increasing the cost of projects.

5. Market access formalities

This section includes the general formalities companies should fulfil in order to enter into the Chilean NCRE market, from two perspectives: foreign direct investment (FDI) and equipment and material export to Chile.

5.1 Foreign direct investment in Chile

5.1.1 Entering capitals into Chile

Direct foreign investment (FDI) between US\$ 10.000 and US\$ 5 million is regulated by the Foreign Exchange Regulations of the Central Bank of Chile (Chapter XIV). FDI must be in a foreign currency and does not convey any special rights to the investor regarding tax rates

FDI of more than US\$ 5 million is regulated by Law No. 20,848/2015. Under this regime, investors receive a Foreign Investment Certificate (FIC), which recognizes the rights to non-discrimination, access to foreign exchange and free remittances mentioned above, as well as the exemption from value-added tax on imports of capital goods for up to USD 5 million, for seven types of investment projects: mining, industrial, forestry, energy, infrastructure, telecommunications; and R&D.

In general terms, there are no currency controls restricting the repatriation of capital, the repayment of debt, or the making of profit distributions or other payments to a non-Chilean shareholder, member or partner of a local joint venture.

5.1.2 Create a company in Chile

Electricity concessions may only be granted to nationals or companies incorporated in Chile, therefore if a foreign developer wishes to obtain an electricity concession it must do so via a subsidiary incorporated in Chile.

A company must typically register through a notary certification, give notice of initiation of activities to the Internal Tax Service (SII), obtain a working license from the competent municipality, and finally register with the labour-related accident insurance company.

Despite the above, for some type of societies, Chile implemented an easier business start-up through an online system for registration and for filing the request for publication. An immediate temporary operating license is provided to new companies.

The business registration process includes currently seven different procedures and takes 5 to 6 days.

Corporate income tax is currently 25% under fully integrated regime and 25.5% under partially integrated regime. From tax year 2018 on, tax rate for this latest regime will be 28%. Additional 35% withholding tax applies to accrued or remitted profits, with credit available for first category income tax paid.

5.1.3 Power project approvals

In general terms, to construct and operate a power project in Chile no specific governmental authorisations are required (i.e., concessions to operate, except for the concession system for public distribution services).

Nevertheless, other sector specific regulations may oblige the developer to request and obtain the following authorisations: the awarding of an environmental approval resolution (RCA), to obtain a favourable report for construction from the regional office of the Agricultural and Livestock Service and to obtain a construction permit from the relevant municipal works department.

5.2 Equipment and material export to Chile

Although most of import formalities are conducted by local importers, it is advisable that the exporter be aware of the documentation and product requirements necessary to fulfil the Chilean regulation.

5.2.1 Import procedures

In the case of any import, Chilean Customs requires that each customs entry be supported by the following documents:

- Commercial Invoice
- Certificate of Origin

- International Transport Document (Bill of Lading or Air Way Bill)
- Packing List, when necessary
- Value declaration
- Other Documents (i.e. safety certificates)

All imports of a total value exceeding USD 1,000 (FOB) require the participation of a Customs Broker. Minor imports (less than USD 1,000 FOB) can be cleared directly by importers, following a simplified procedure.

Prior import licenses are not requested by authorities. This is valid for any type of goods.

5.2.2 Duty fees and taxes

The tax treatment applicable to imports into Chile includes the payment of customs duties, 19% Value Added Tax (VAT) and other taxes (if applicable), all calculated on CIF value and determined under GATT valuation standards.

The ad-valorem customs duty rate is 6%. However, goods originating in any of the countries or regions having signed a Commercial Agreement with Chile and evidencing such condition by means of a Certificate of Origin can be benefited with a reduction or exemption of import duties.

Chile has signed 25 Commercial Agreements with 66 countries, which have granted tariff preferences which each country applies to imports.⁶

India and Chile have signed a Partial Scope Trade Agreement (PSA) giving to some products a tariff preference of 20%.

5.2.3 Product Certification

To be installed, photovoltaic panels and inverters, as well as thermal collectors should meet with the IEC⁷ standards and must be previously certified by the Electricity and Fuels

⁶ Find the list of countries and the complete texts of Commercial Agreements signed by Chile, by clicking on this link: www.direcon.gob.cl/acuerdos-comerciales/

Superintendence (SEC). Certificates issued by organizations adhered to the International Accreditation Forum (IAF) are accepted, but should be submitted firstly to the SEC.

Moreover, the installation of any energy generation equipment should be conducted by a previously SEC approved electric contractor, while the connexion to the electricity distribution system should be supervised by the distribution company.

6. Market opportunities and conclusions

6.1 SWOT analysis

The following SWOT Analysis is intended to be a useful technique for understanding the Strengths and Weaknesses of India NCRE equipment producers and service providers, and for identifying both the Opportunities open to them and the Threats they face in the Chilean market.

SWOT ANALYSIS

Strengths	Opportunities
<ul style="list-style-type: none">• Good quality of Indian products.• Very competitive prices.• Emerging NCRE product and service industry.• General good image of Indian products.• Duty tax preference (India-Chile Partial Scope Agreement).	<ul style="list-style-type: none">• Outstanding Chilean potential of natural resources for NCRE.• Adequate NCRE policies and regulation framework.• Opportunities for investment in new plants• Opportunities for NCRE related service providers.• Opportunities for NCRE high technology equipment at competitive prices.

⁷ The International Electrotechnical Commission (IEC) is the world’s leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

Weaknesses	Threats
<ul style="list-style-type: none"> • Small Indian industry of NCRE equipment, still in a growing step. • Relatively low experience of Indian service suppliers (i.e. engineering and construction companies) in NCRE projects. 	<ul style="list-style-type: none"> • Economy slowdown • Decrease in energy prices and demand. • High concentration in the energy generation market. • High competition in equipment supply, especially from China • Insufficient transmission lines. • Delays in project approval. • Difficulties for obtaining financing. • Community opposition to projects.

6.2 Main conclusions

Chile has an outstanding potential of NCRE natural resources, estimated in more than 1.835.000 MW, which represents about 100 times Chile's current total installed capacity.

The rapid growth of the Chilean NCRE industry is the result of many interacting conditions: an adequate political and regulatory framework, an open access regime for new enterprises and the access to financing, among others.

Nevertheless, in recent years the NCRE industry growth has been threatened by a number of challenges, mainly explained by the general Chilean economy slowdown and, more specifically by the decrease in the internal energy demand and the decay in the prices of electricity.

Hopefully, the above situation seems to be improving in 2018, according to last NCRE investment figures. It is expected that – inasmuch as the Chilean economy start growing again at higher rates with the subsequent increase in energy demand – the NCRE market will rapidly recover the dynamism shown in past years.

In this context, the revitalization of the mining sector (which in 2015 represented almost 33% of the total power generated in the country) will importantly contribute to re-boost the construction of new NCRE projects. It is worth mentioning that some mining

companies (i.e. Codelco, Antofagasta Minerals) have developed their own NCRE generation projects, by themselves or in association with other companies, to partially cover part their energy consumption.

Importantly, it is expected that Chile could become an exporter of electricity in the near future. Indeed, in February 2016, the country materialised its first transmission of electricity to Argentina. Additionally, by 2021 Chile expects to interconnect its National Transmission System with the Peruvian, Ecuadorian and Colombian ones. International interconnections will further promote competition by enabling transmission capacity for the participation of new actors in the energy sector.

The main challenge for the NCRE industry will be to make their technology more competitive while keeping a good product quality, producing kilowatt-hours in a stable and reliable way. Indian exporters can take advantage of this opportunity, offering technologically advanced equipment and engineering and construction services at competitive prices.

There are also opportunities for Indian investors in developing new NCRE projects or in acquiring already operating plants, by their own or in association with other companies.
