



# Chilean Energy Overview

## Chile: Leading the Path on Solar Energy

Sustainable Energy Division  
Ministry of Energy - Government of Chile



September 9, 2019



Ministerio de  
Energía

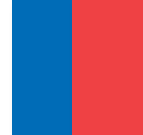
Gobierno de Chile



## Chilean Energy Context

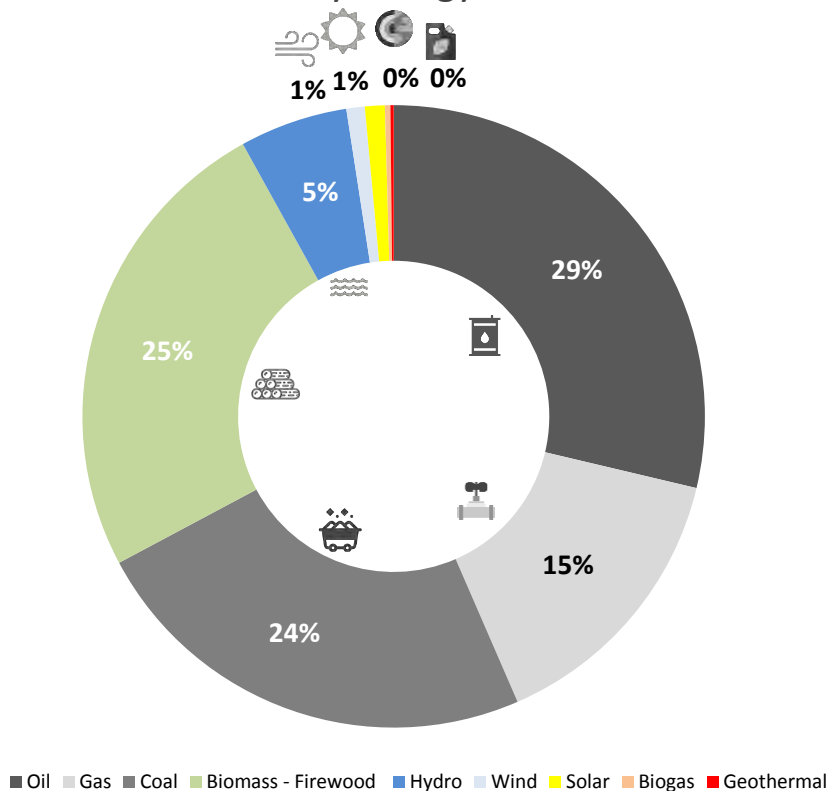
- 17.6 MM inhabitants
- GDP/capita of USD 22.7 M
- High dependency from imported fossil fuels
- Low level of electricity and gas interconnection with the region
- High renewable potential



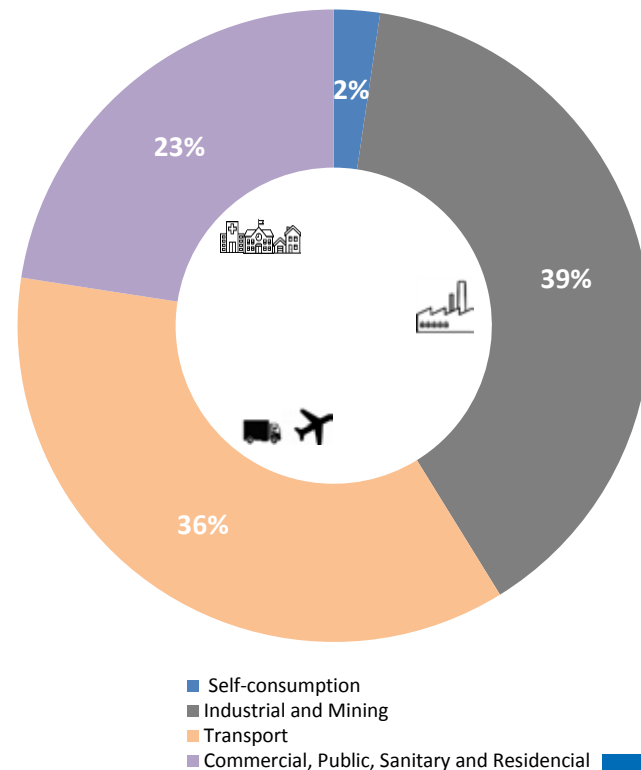


# Primary Energy Offer and Final Consumption

## Primary Energy Offer

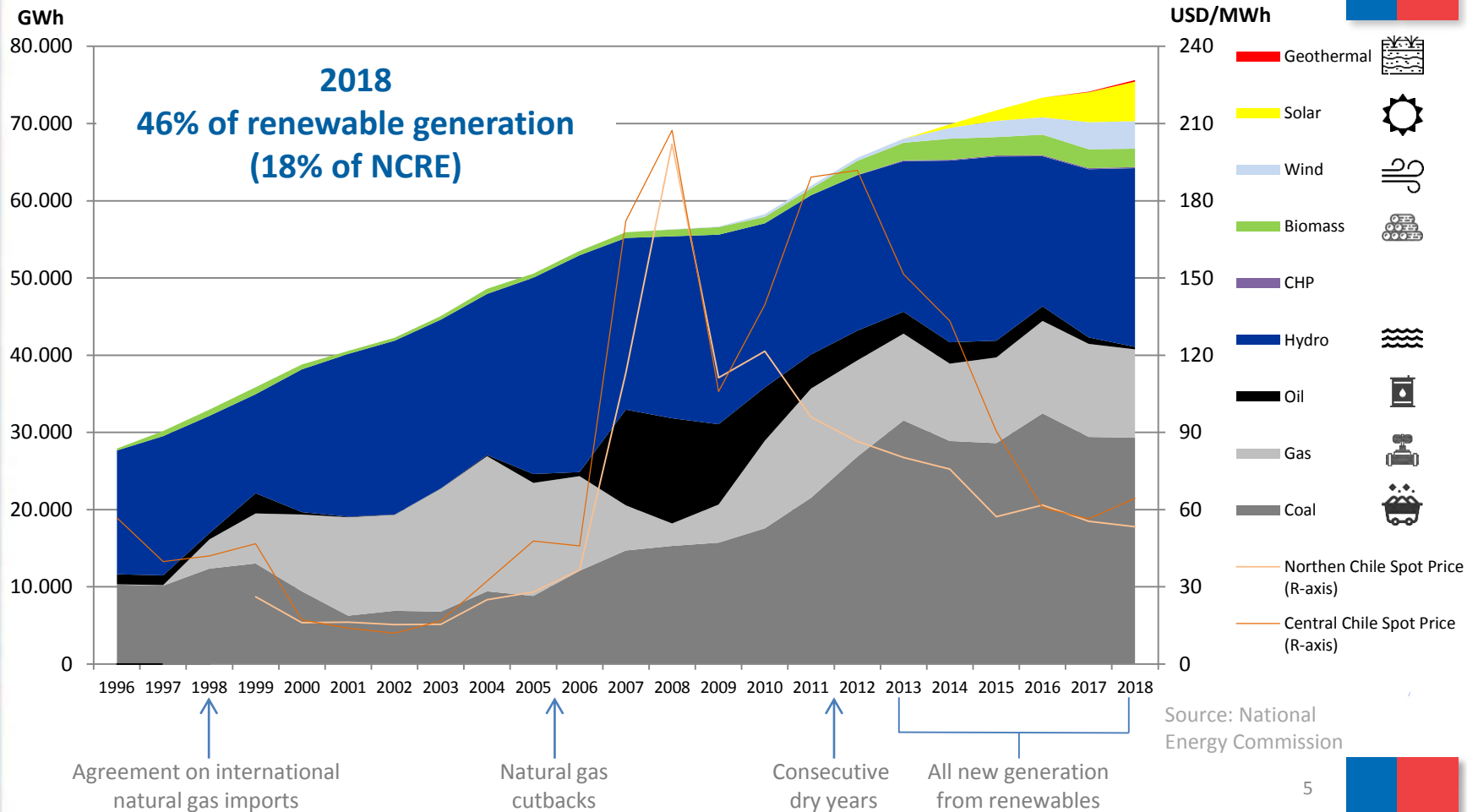


## Final Energy Consumption



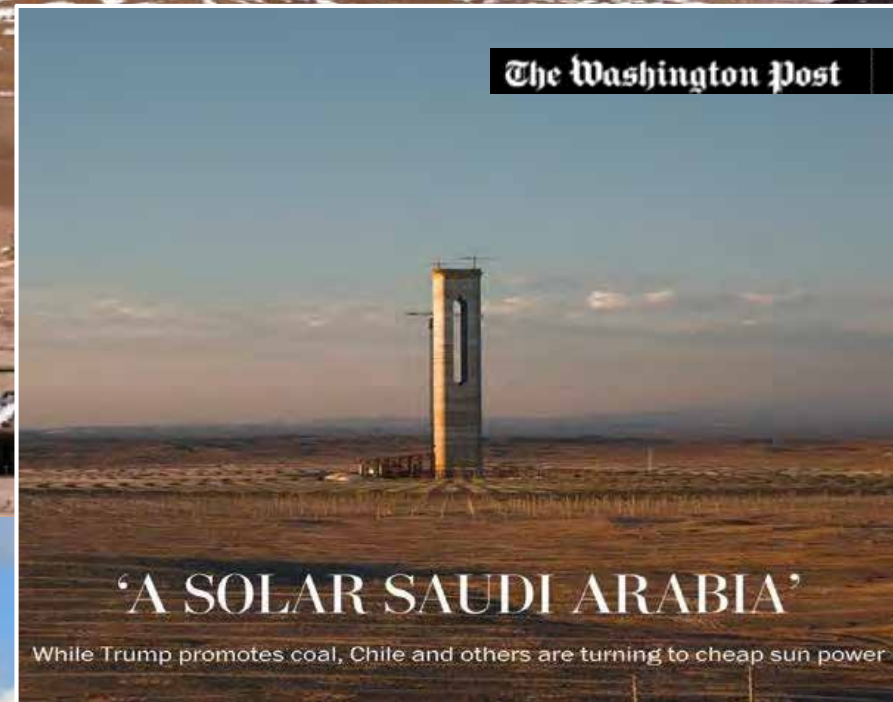


# Evolution of Electric Generation in Chile



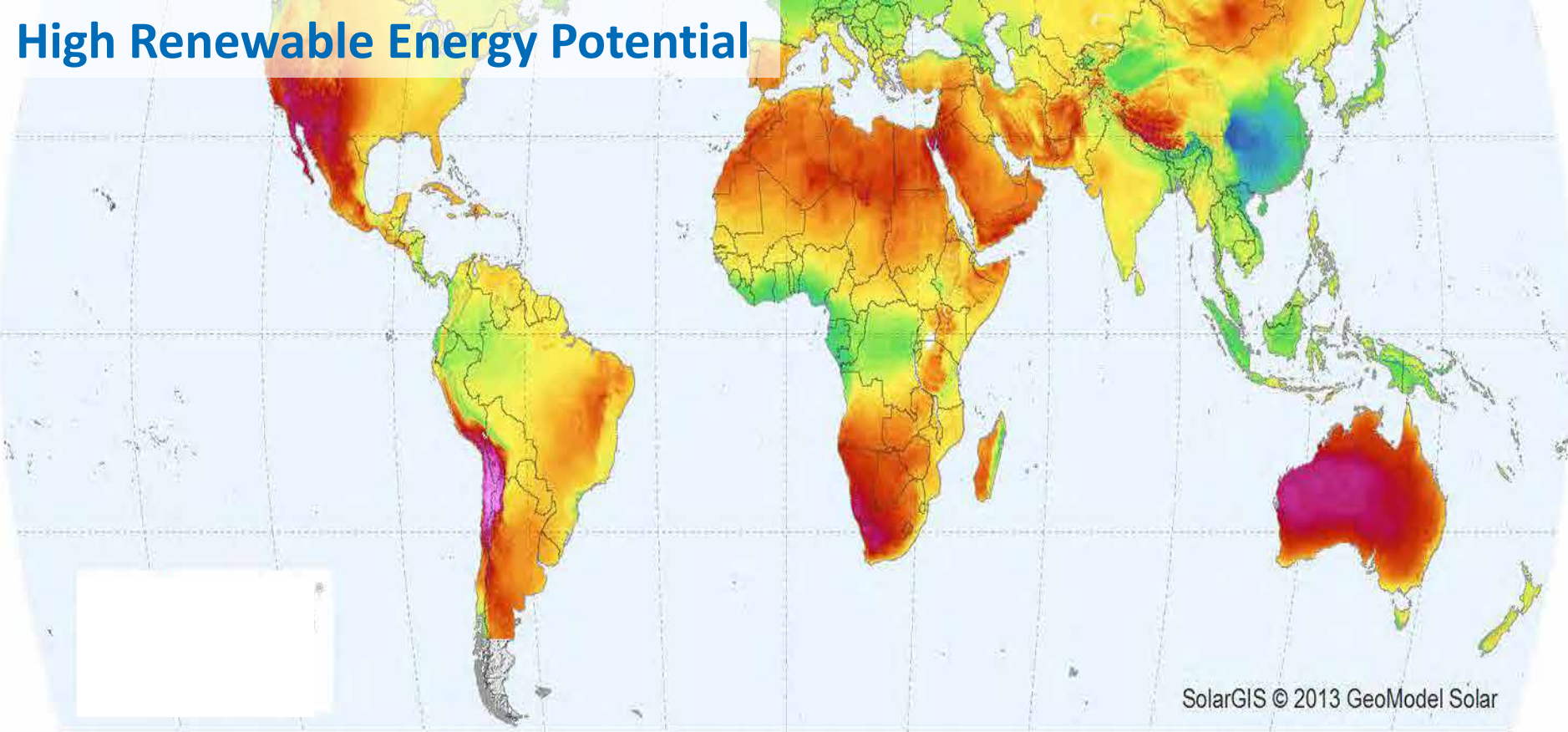
# Renewable Future

According to different studies, the future development of the energy matrix is forecasted to remain renewable.

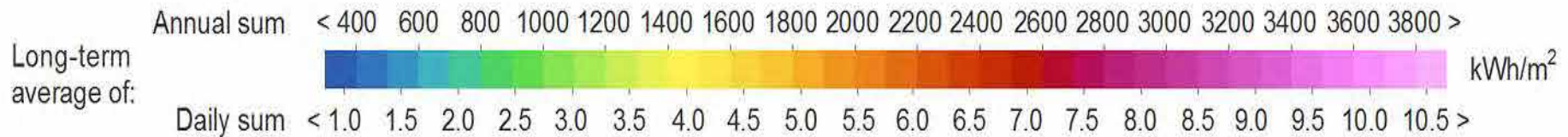


Chile ranked #1 on the 2018 Climatescope ranking of attractive emerging markets for clean energy investments.

# High Renewable Energy Potential



SolarGIS © 2013 GeoModel Solar





# Atacama Desert

Highest level of solar radiation in the world

>3.500 KWh/m<sup>2</sup>/Year (DIN)

>3.000 Sun hours/Year

<2mm rainfall/Year

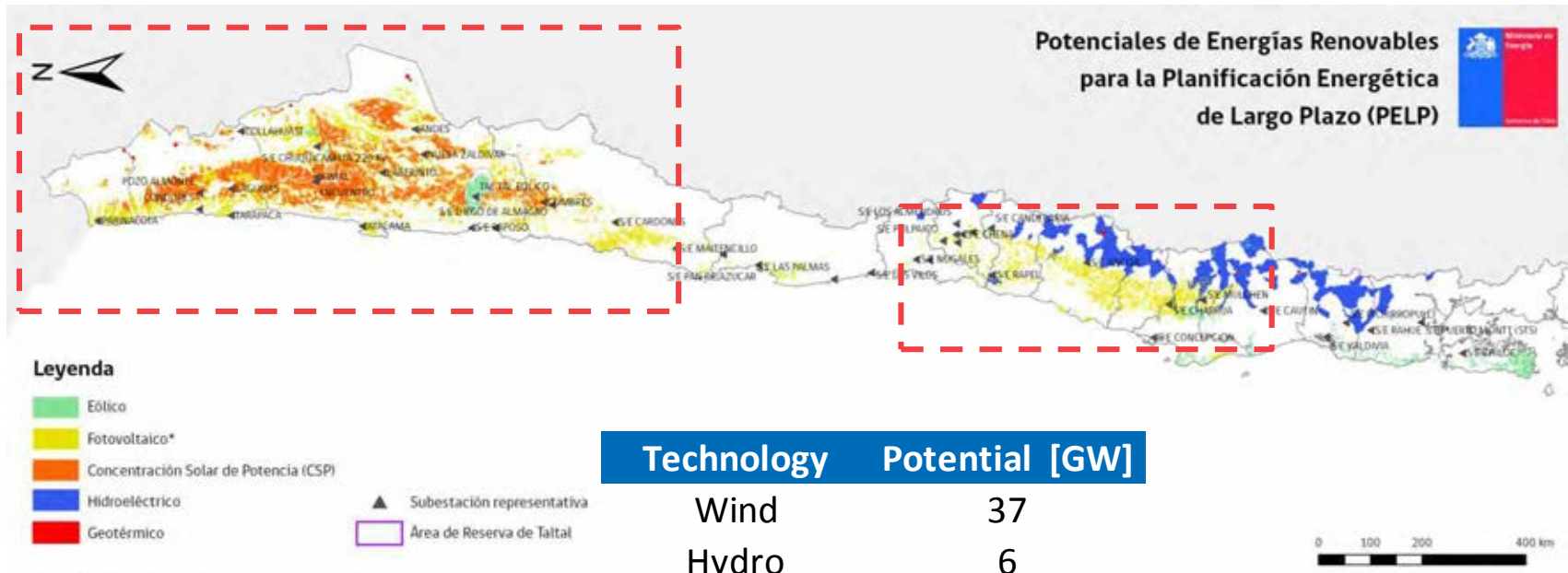






# High Renewable Energy Potential

Potential estimated by the Ministry of Energy for the last Long Term Energy Planning process.



Fuente: División de Energías Sostenibles (11 de marzo de 2019)  
\*Datos fotovoltaicos actualizados a marzo de 2019. El resto de potenciales corresponden a los modelados en 2017.

Over **30 GW** undeveloped capacity with environmental approval

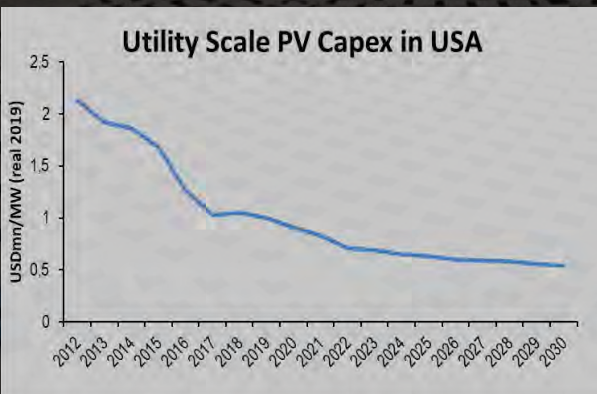
Technology	Potential [GW]
Wind	37
Hydro	6
Solar-PV	1,194
Solar-CSP	510
Geothermal	2
<b>Total</b>	<b>1,749</b>

>72x Chile's installed capacity  
~1.7 times the installed capacity of USA

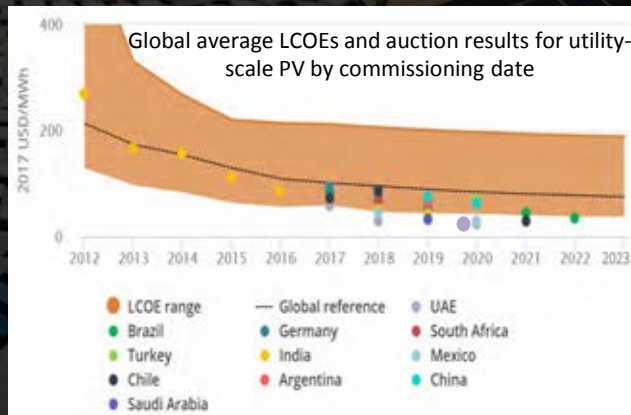


# Cost Driven Change

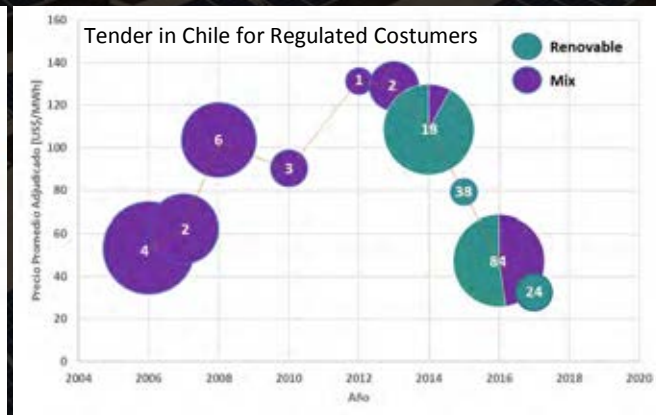
- The price of **PV systems** continues to decrease as results of technology innovations, economies of scale and manufacturing experience.
- Competitive offers in tender



Source: Bloomberg New Energy Finance



Source: IEA - Analysis from Renewables 2018

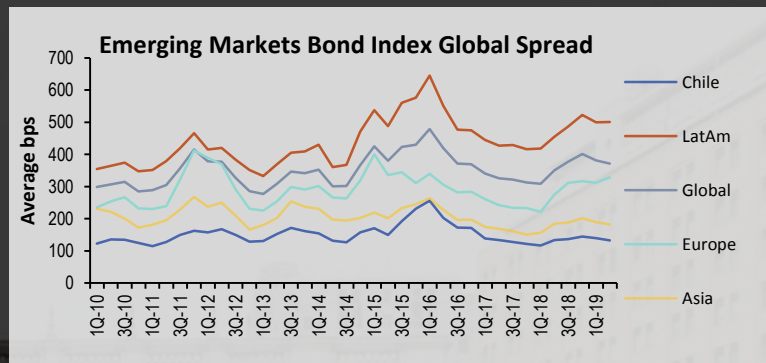


Source: National Energy Comision; Chile

# Solid Institucional Framework

Chile leads to an attractive country for clean energy investments.

- Controlled inflation.
- Responsible fiscal policy.
- Controlled fiscal deficit.
- Good risk rating (Moody's A1, S&P A+, Fitch A).



Source: Central Bank of Chile

## Power Sector

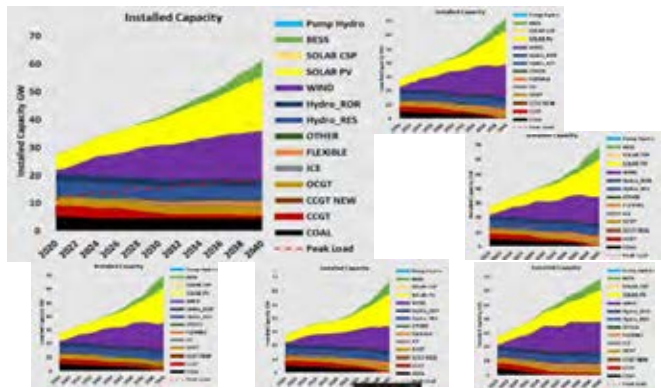
- Liberalized, competitive and unsubsidized market.
- Generation: Spot market based on audited costs.
- Transmission: Centrally planned for national grid.
- Distribution: Regulated monopoly.





# Solar Future

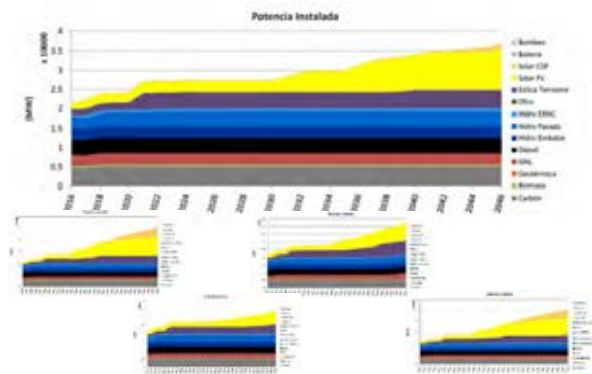
There is wide agreement that Solar is important in Chile's energy future



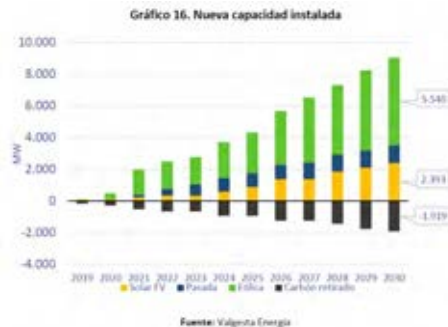
Path to 100% Renewables, Wärtsilä 2019



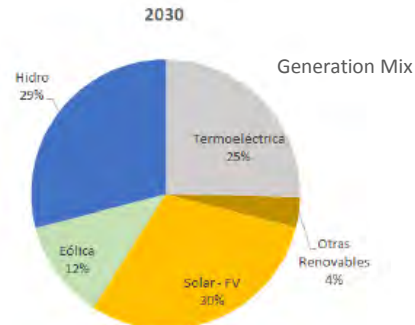
Decarbonization development and operation study,  
Coordinador Electrico Nacional (ISO), 2018



PELP, Ministry of Energy 2018



Propuesta regulatoria sobre flexibilidad, Valgesta, 2019



Long term analysis for SEN,  
Moray and PSR, 2018





# Towards a sustainable energy transition

- Allow **development of flexibles systems** that allow integration massive amount of renewables.



- High quality projects not only from technical point of view, but also **solid involvements with communities**.
- Allow development of new solutions** (Storage, Electromobility, Demand Side Management, Energy Efficiency, Internet of Things, Smart Grids, etc.)





# Not only Utility scale...

Solar development is growing in all segments



## Utility Scale

**AI size** of projects. Generators connect to the grid, accessing to the liberalized market (PPAs or Merchant). Dispatched under command of the ISO.

# Projects: **33**

Solar Installed Capacity: **2,108 MW**



## PMGD/PMG

Projects **up to 9 MW**, connected to distributions or transmission grid under some special conditions. Can access spot market or an stabilized price scheme.

# Projects: **131**

Solar Installed Capacity: **517 MW**



## Net-billing

Regulated clients can connect projects **up to 300kW** for self-consumption, but surpluses feed to grid and are valued in your electricity bill.

# Projects: **5,874**

Solar Installed Capacity: **38.5 MW**



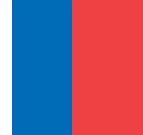
# Why are solar and other renewables important for Chile?

Solar and renewables have proven to be the **most competitive option**,

lower dependence on imported fuels,

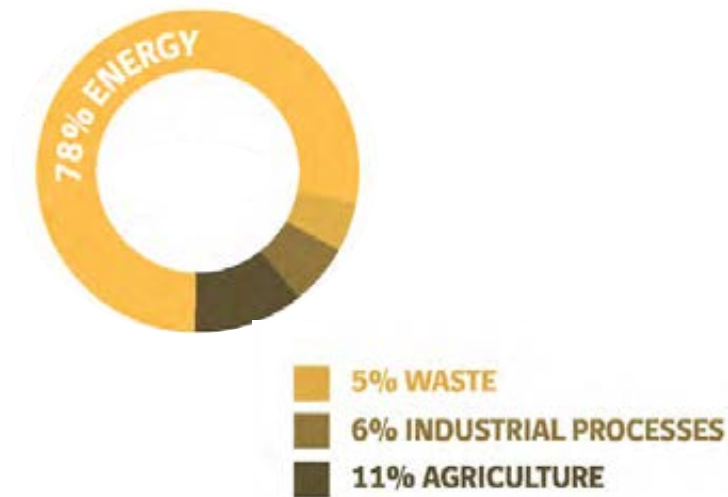
opportunity to become *energy* exporter,

and also....



# Most CO<sub>2</sub> emissions are from Energy Sector

GHG emissions in Chile:





# Energy: highest opportunities to lower emissions of GHG in Chile



- Chile has committed (in June 2019) to reach **carbon neutrality by 2050**
- Phase out plan of coal power plants by 2040 (!)  
(8 will be closed by 2023)
- Other actions in transport, heat, cooling, efficiency, etc.



## Coal-dependent Chile vows to eradicate fuel by 2040

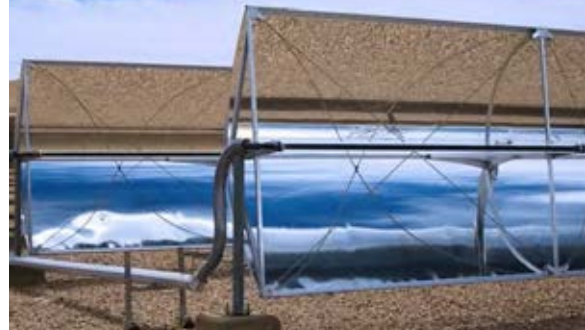
Published on 04/06/2019, 7:00pm

The host of the next UN climate talks announced its ambition to reach carbon neutrality by 2050, which will require one of the fastest coal shut downs anywhere

# Thermal Use (Heating and Cooling)

Renewables allow decarbonization in other uses further than electricity.

- Represents 36% of total energy consumption in 2017.
- **Opportunities** for solar energy (and other renewables) in **industrial and residential sector**.
- Renewable Thermal National Strategy under development during 2019.



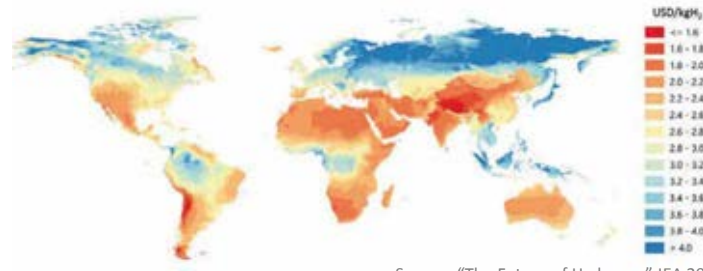


# Green Hydrogen & Power-to-X

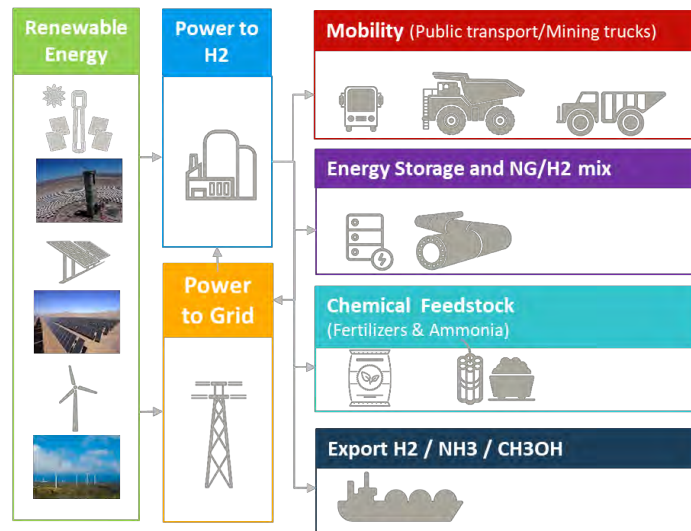
A need for reaching worldwide carbon-neutrality

- Competitiveness of green hydrogen depends on **energy cost** (+CAPEX and running hours)
- Chile's potential has been highlighted by several international publications.  
(IEA, IRENA, WEC, BNEF, Asia Pacific Energy Research Center, Jülich Research Institute, among others)
- Potential uses go **beyond energy sector** and is expected to be a 9 trillion USD industry by 2030.

Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



Source: "The Future of Hydrogen" IEA 2019



# Our vision for the future

Lead the **energy transition**, not only to adapt to the technological changes, but to **accelerate its development and become a leader** of this process in the region.

**Social and citizen** stamp has to be part throughout the process







# Thank you

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**Chile**  
en marcha