Challenges on Integrating Renewables into the Chilean grid

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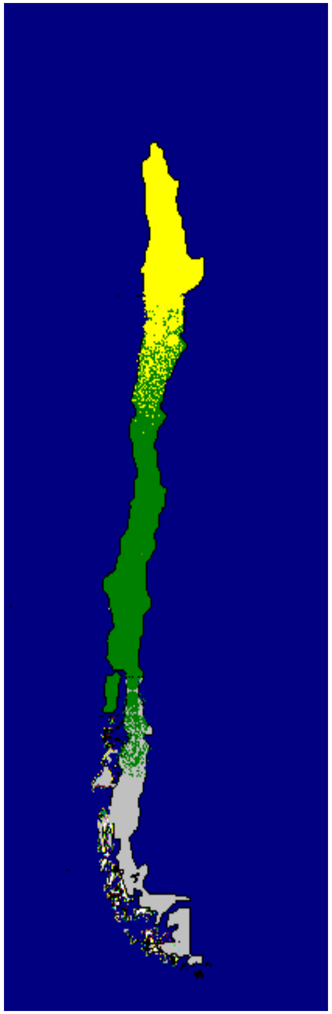
Overview

- Evolution of the Chilean electricity market
- Integration of Renewables into the Grid
- Impact derived from the Integration of Renewables
- Main challenges

Main Chilean Interconnected Systems



NORTHERN INTERCONNECTED SYSTEM (SING)

Average load growth 1999-2008	7.2 %
Expected annual load growth	5.3 %
Inst. capacity / Max. Dem. MW	3,610/ 1,816
Regulated/ Non Reg. Customers	10% / 90%
Hydro / Thermal	1% / 99%
Length	600 km
Population	6%

CENTRAL INTERCONNECTED SYSTEM (SIC)

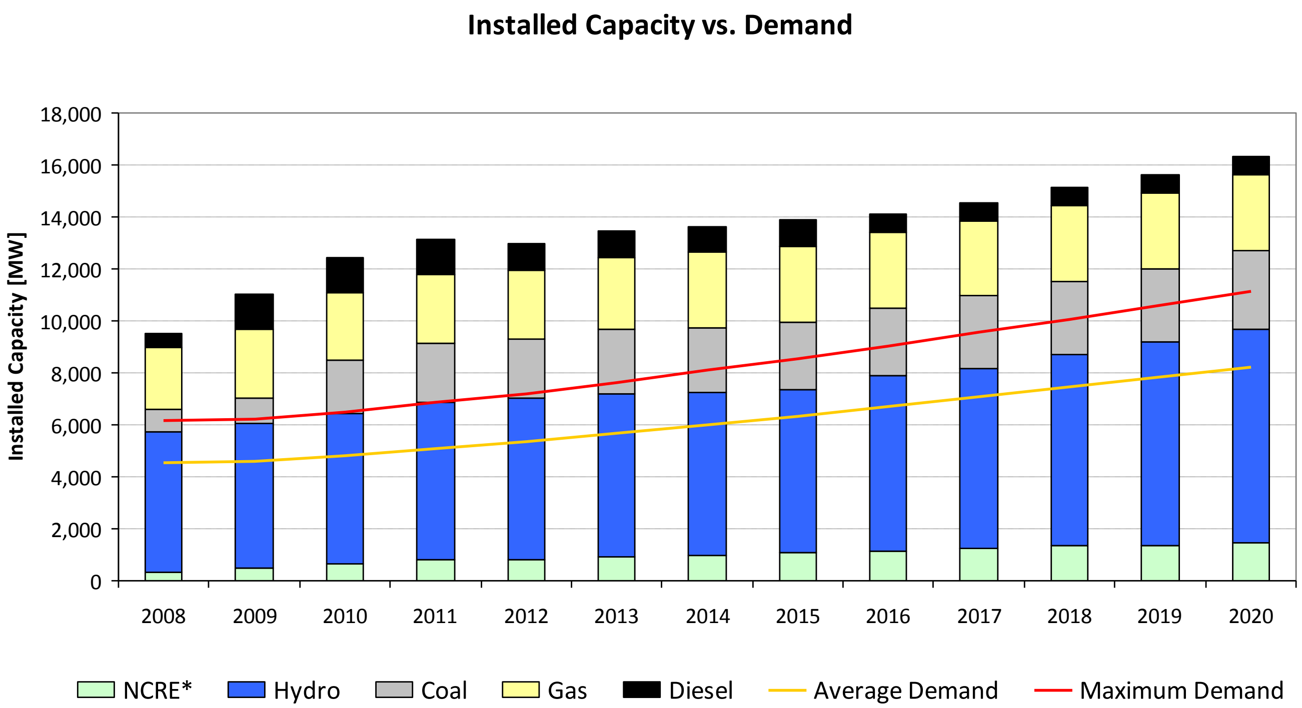
Average load growth 1999-2008	5.1 %
Expected annual load growth	5.3 %
Inst. capacity / Max. Dem. MW	11,290/ 6,240
Regulated/ Non Reg. Customers	65% / 35%
Hydro / Thermal	60% / 40%
Length	1,800 km
Population	93%

Figures: December 2009

Evolution of Regulation and Markets

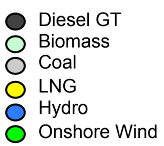
- 1982: The Electricity Law was enacted
  - Economic efficiency in operation and planning
  - Separation of generation and distribution activities
  - Competition in generation
- 1985: Creation of CDEC (System Operator)
- 1986-90: Privatization of gencos and discos
- 1993: Creation of Transelec – the main transco
- 2004: Law amendment I
  - Improved transmission business (pricing and investment)
- 2005: Law amendment II
  - Improved pricing between genco-disco (long term contracts)
- 2008: Law amendment III
  - Encourage the entry of Non Conventional Renewable Energy (e.g. wind, geothermal, biomass, small hydro < 20 MW)

Integration of Renewable Energy into the Grid -1



Non Conventional Renewable Energy (NCRE) targets:

- 2010-2014: 5%
- 2015-2024: 0.5% per year, up to 10%



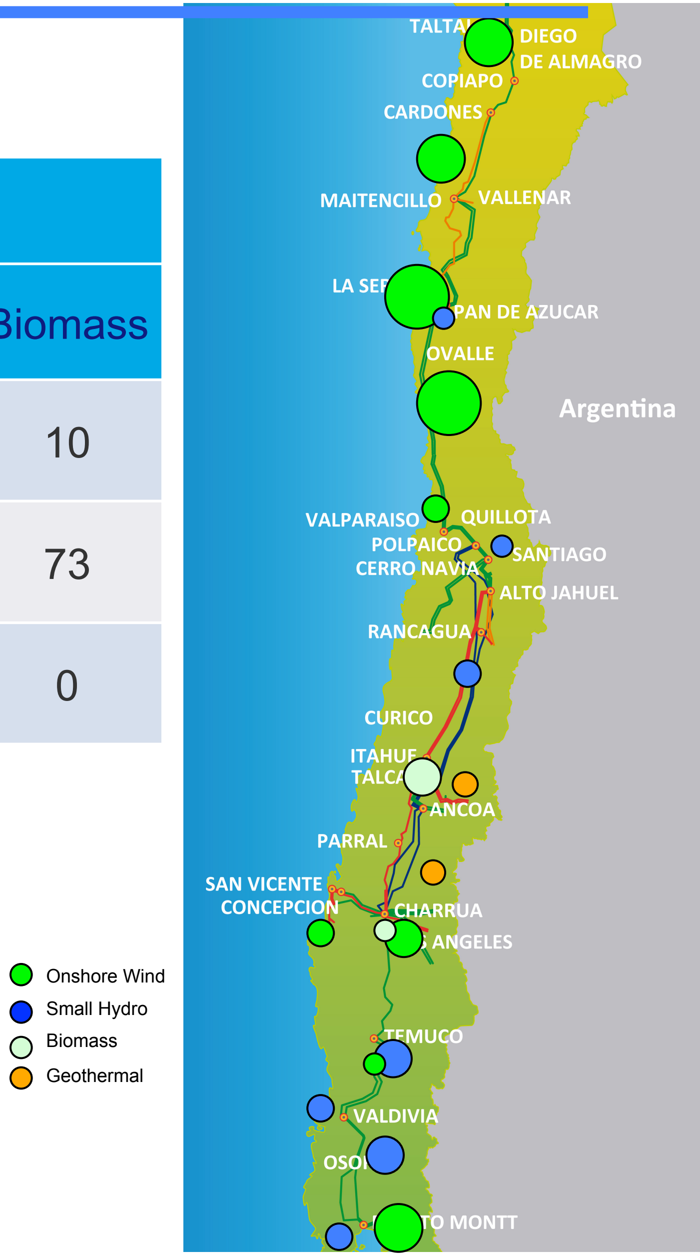
Integration of Renewable Energy into the Grid -2

NCRE Generation Projects (MW)					
	Project Status	Wind Power	Small Hydro	Geothermal	Biomass
Presented Projects	Approved	210	100	0	10
	Under qualifying	950	150	0	73
Announced Projects	Not yet submitted	850	200	100	0

North Zone: Wind Potential

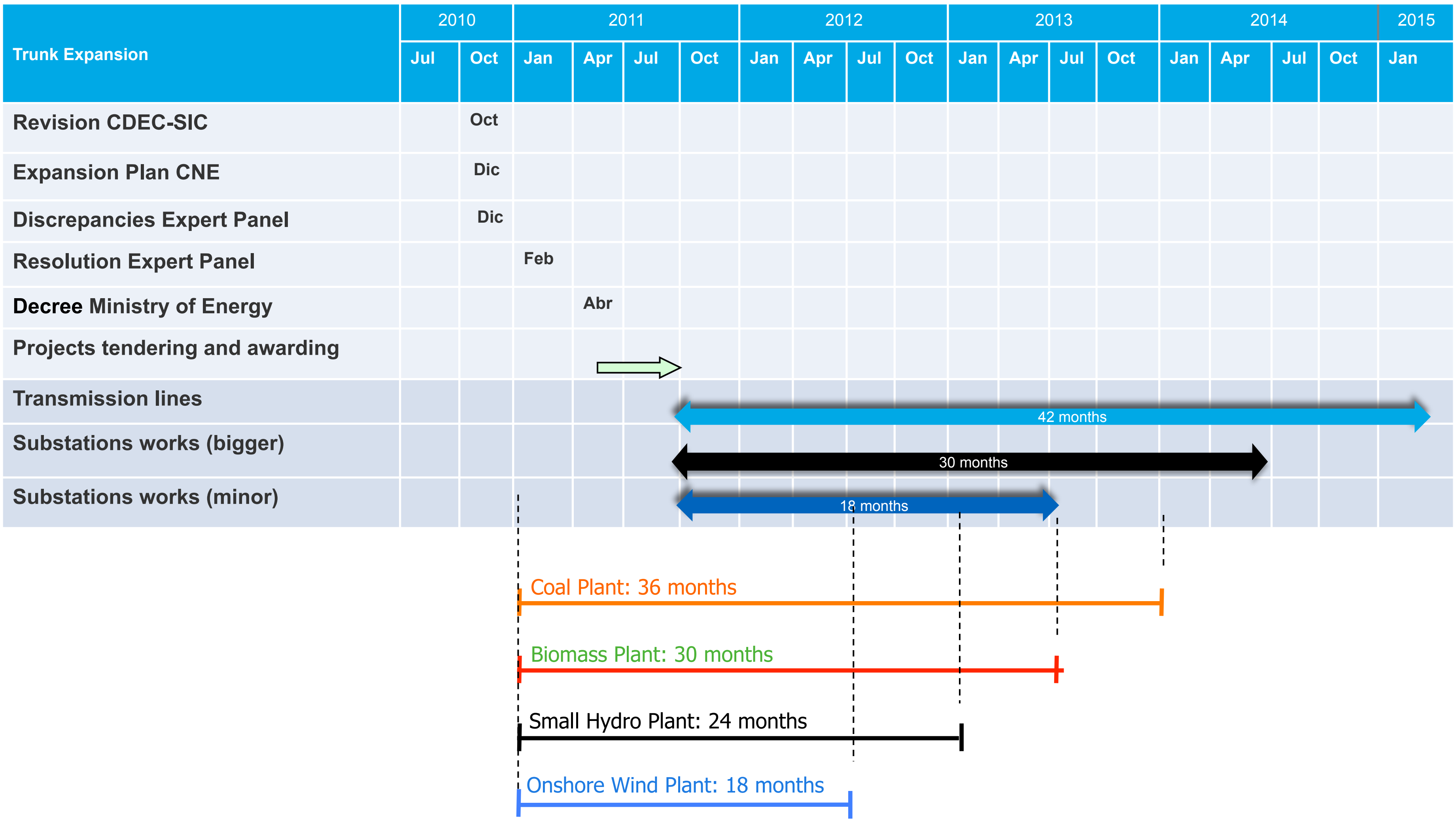
Central Zone: Small Hydro and Cogeneration Potential

South Zone: Small Hydro and Wind Potential



Integration of Renewable Energy into the Grid -3

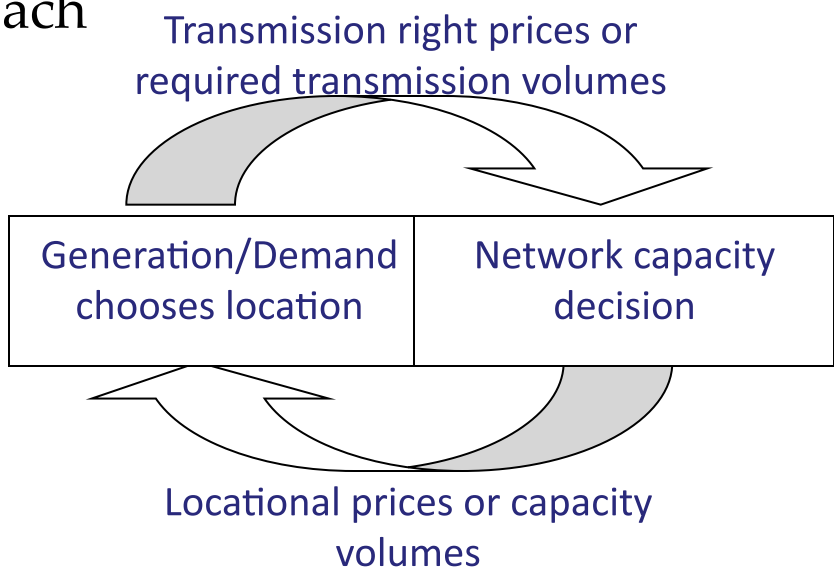
Annual Revision of the Trunk Transmission System' Expansion Plan



Integration of Renewable – the GB Experience

The integration of 30 GW of wind power in Great Britain by 2020 has triggered:

- Transmission Access Review (TAR):
  - Change from "invest then connect" to "connect and manage"
  - Critical balance between short and long term costs
- GB SQSS Review:
  - Best use of N-k criteria
  - Deterministic vs. probabilistic approach
- RPI-X @ 20 Review
- Anticipatory investment proposals
- Transmission network charging scheme

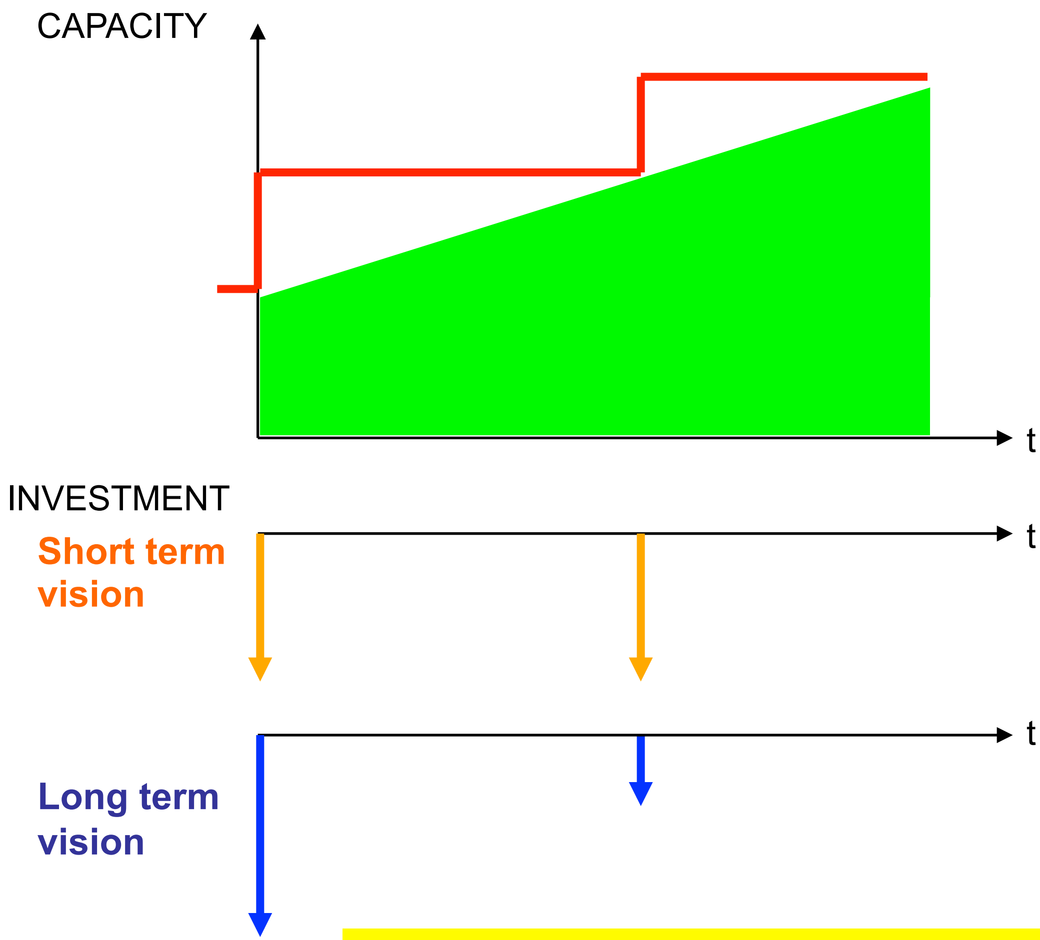


Impact derived from the Integration of Renewables

- Wind in large scale has a big impact on long radial transmission grids.
  - Generation intermittency and unpredictability mean new voltage and frequency control criteria
  - Allocation of transmission charges (tolls) based on use
- Generation market uncertainties:
  - What kind of technology will be used in the new generation plants?
  - When will the new plants being connected?
  - Where are the new plants going to connect to the grid?
  - How much capacity is being connected?
- Transmission expansion strategy based on generation scenarios and aiming on anticipatory investment

Transmission Investment and Tolls

The current transmission tariff model aims on a short-term vision from users perspective



Investment (LT) < Investment (ST), but Toll (ST) < Toll (LT)

Main Challenges

- Growth is a must in developing countries like Chile, then more participation of renewables means higher electricity costs compared to conventional sources.
- Anticipation in transmission investment decisions is essential to facilitate access to renewable plants, with construction duration faster than transmission.
- Competition in generation market requires a flexible approach for transmission expansion planning and using smarter technologies for operation.
- Sustainable development means a long term vision when designing new transmission corridors.

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Thank you
Xie xie
Muchas gracias