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Heat Roadmap Chile

District heating and cooling in the future Chilean energy system

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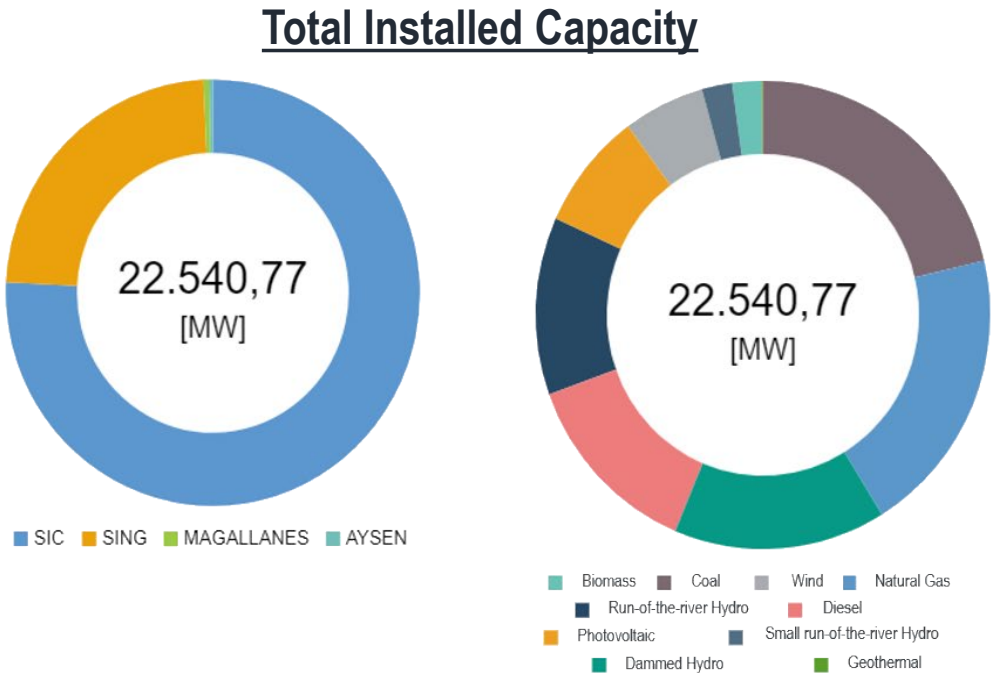

Background

- **Consists of non-connected systems**
  - Interconnection between North (SING) and Central (SIC) systems: >90% of demand
- **High fossil fuel consumption**
- **"2050 Energy Vision"**
  - 70% share of RES in electricity sector

** http://energiaabierta.cl/*

Background

- **Biomass based heating and individual solutions**
  - Harvesting resources sustainably
  - Air quality
- **Low energy efficiency in buildings**
- **High share of energy consumption for heating (residential sector):**
  - Heaters: 56,3 %
  - DHW: 17,6 %
  - Others: 26,1 %
- **District Energy seen as a potential solution for air quality concerns**

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Goals & Approach

MAP DISTRICT ENERGY POTENTIALS

- Heat & Cooling Demand
- Resources for DE
- Identify Potential
- Identify Costs of DE

ANALYZE ENERGY SYSTEM

- Reference model
- Integration of RES
- Integration and impact of DE
- Costs of new Energy System

SHOWCASE

- Communicate results
- Train local stakeholders
- Showcase replication potential

Data assumption

MAP DISTRICT ENERGY POTENTIALS
-> Regression analysis for heat demand model -> 1 km^2 grids

- Cadaster (not geocoded)
- ‘Population data
- Climate zones
- Land use and land cover
- Infrastructure

ANALYZE ENERGY SYSTEM
-> Future Scenarios

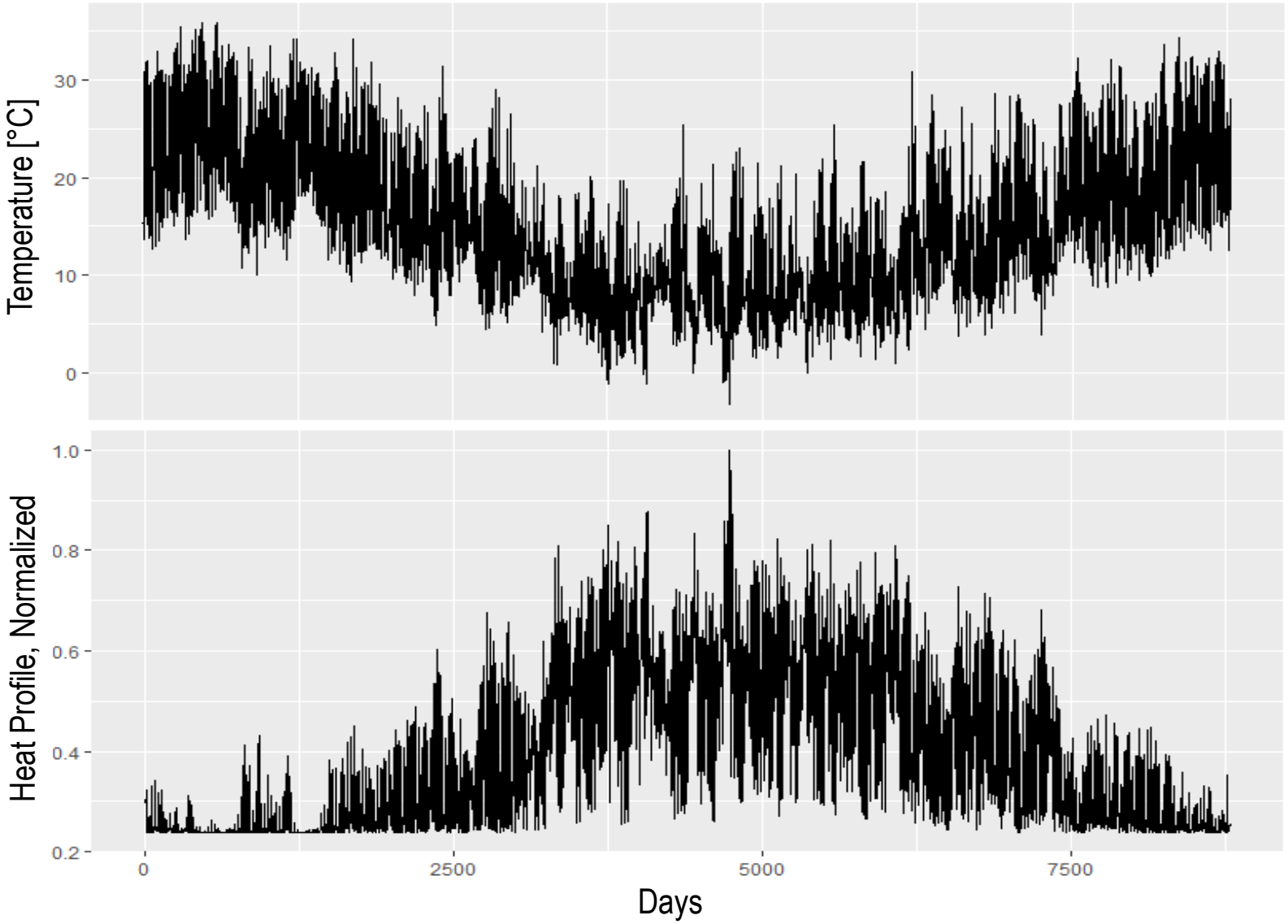
- Aggregated temperature data
- National statistics (Energiaabierta)
- Costs of new Energy System (?)

Reference Energy System

	2016	2050
Wind Capacity [MW]	1,042	3,875
Solar PV Capacity [MW]	1,129	12,022
CSP Capacity [MW]	0	4,835
NGas Capacity [MW]	4,973	5,488
Transmission line capacity [MW]	0	4,800
Electricity Demand [TWh]	73.1	180.9
Heat Demand (Res.) [TWh]	39.8	-
Cooling Demand (Res.) [TWh]	0.02	-

- Medium changes in energy demand
- Medium developments in technologies
- Electricity demand: 2.7% per year increase
- Power plant generation capacity maintained overall
- Renewable electricity generation capacity increases:
  - Onshore Wind, PV, CSP, River hydro

Heat demand profile



CHILE 2016: Reference Model Validation

Chile 2016	Reported	EP	Dif.
PRIMARY ENERGY CONSUMPTION			
Fuels:	410.1	408.9	-0.3%
Coal	87.7	87.1	-0.7%
Oil	177.0	176.9	0.0%
Gas	50.3	50.1	-0.4%
Biomass	95.1	94.8	-0.4%
Nuclear	0.0	0.0	0.0%
Waste (for incineration)	0.0	0.0	0.0%
Renewable Electricity:	28.2	28.2	0.0%
Wind, onshore	2.5	2.5	-0.1%
Wind, offshore	0.0	0.0	0.0%
Solar PV	2.6	2.6	0.0%
Geothermal power	0.0	0.0	0.0%
Tidal power	0.0	0.0	0.0%
River hydro	13.1	13.1	0.0%
Other hydro	10.0	10.0	0.1%

Chile 2016	Reported	EP	Dif.
ELECTRICITY			
Production	73.1	72.7	-0.5%
Power plants (condensing)	44.9	44.6	-0.7%
Renewable electricity	28.2	28.2	0.0%
Demand	73.1	72.7	-0.5%
Electricity demand	71.7	71.3	-0.5%
Flexible and transport	1.0	1.0	0.4%
Electricity for cooling	0.0	0.0	8.7%
Electric heating Individual	0.4	0.4	-0.4%
CO2 EMMISSIONS	0.0	87.6	

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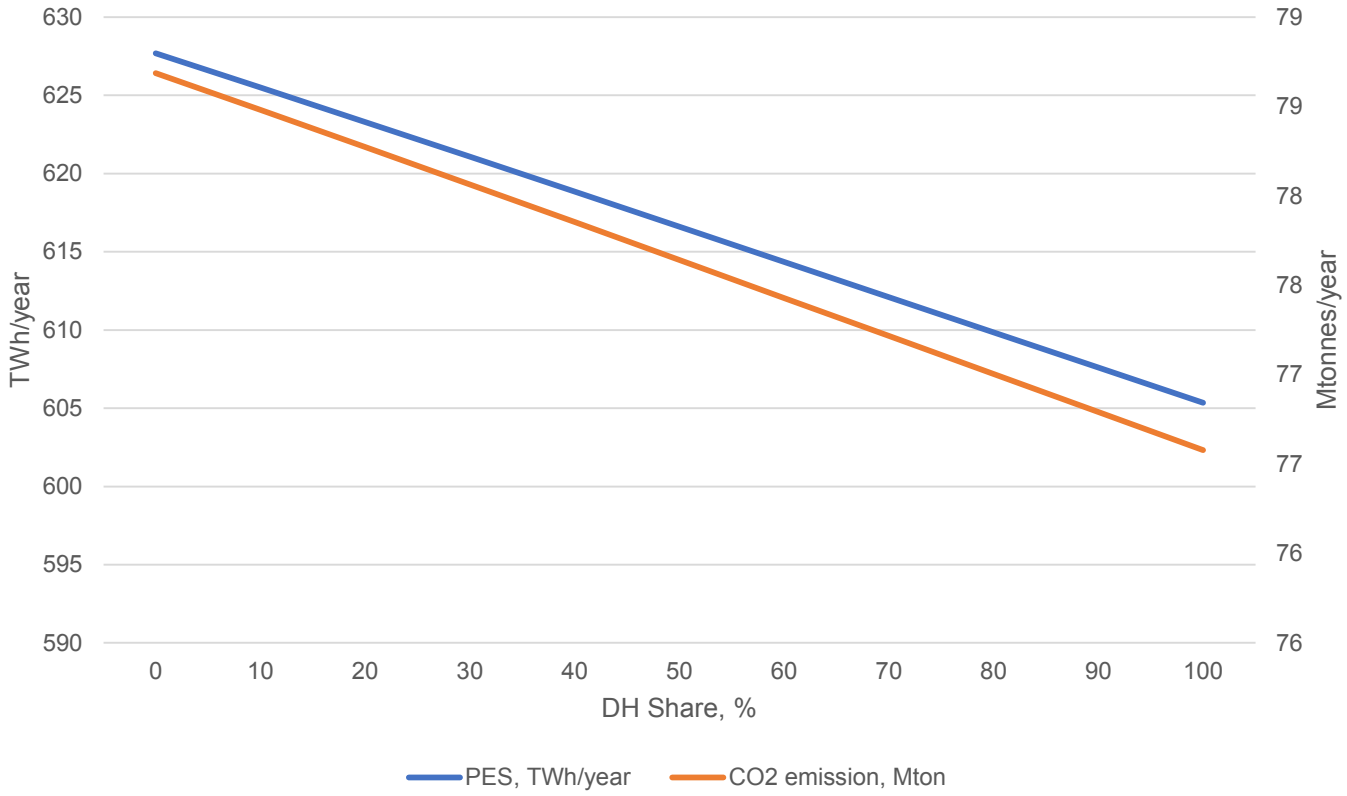
4DH
4th Generation District Heating Technologies and Systems

Does the reference meet 2050 ambitions?

- 70% renewable electricity: 74%
  - Only 17% of PES is intermittent renewable
- 65% of fuels are low in environmental pollutants
- Conforms to international climate change ambitions*

Overarching question – how can we make that happen?



Preliminary Scenarios

Description of Ref.:

- Medium changes in energy demand
- Medium developments in technologies
- Electricity demand: 2.7% per year increase
- Power plant generation capacity maintained overall
- Renewable electricity generation capacity increases:
  - Onshore Wind, PV, CSP, River hydro

Next steps and challenges

- Include mapping inputs
- Update heating and cooling demand
- Costs: especially for fuels, district energy
- Correlate PM to energy consumption (mostly biomass)
- Decarbonize:
  - Electrify heating, adjust capacities
  - Implement DE, adjust all capacities
  - Vary levels of changing demands
    - Lower: higher levels of insulation, building standards
    - Higher: increased access to energy and rise in comfort demands

Thank you!

Any questions/feedback?