

# CHALLENGES OF DEVELOPMENT OF GREEN FIELD DISTRICT HEATING TECHNOLOGIES IN LATINO AMERICA TEMUCO CITY CASE IN CHILE

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## DISTRICT ENERGY IN CITIES

A GLOBAL INITIATIVE TO UNLOCK THE POTENTIAL OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

UN  
environment





## ANNEX



- Why District Heating in Chile?
- Methodology and principles for District Energy development in "Green Field" areas. Temuco city case;
- Technical - Economical results;





## DESCRIPTION OF THE TEMUCO CITY, CHILE, LA

- **Temuco** has **>300.000 residents**;
- Highly surrounded by the **mountains**, facilitating to stay air pollution longer.





# CHILE



## AIR POLLUTION

- **Temuco** has the **third-worst** air quality in Chile. It is estimated that **93%** of the particulate matter in the winter months is caused by **burning firewood** in **woodstoves in single homes**;
- In **2016**, Temuco experienced 26 days of emergency due to high air pollution levels;
- Inefficient burning of firewood produces contaminants such as **formaldehyde, methane, black carbon** which cause **effects on health**. In Temuco the current high levels of air pollution cause between **400-500 premature deaths** per year;







## ENERGY EFFICIENCY

- **Energy Efficiency** in the **Building Stock** is **low**, buildings have a low thermal insulation, one glazed windows can be found;
- The major share in the **fuel** consumption composition makes a **wood**, the **gas** is also used;
- The wood brought straight from the forests contains **high level of humidity**, leading to a **lower combustion efficiency**.





## ENERGY EFFICIENCY

- **Energy Efficiency** in the **Energy Production** chain is **low**, the boilers and individual wood stoves are of outdated technologies, so the burning process is incomplete, leading to **high** CO<sub>2</sub>, PM 2.5 and PM 10 **emissions**;





## NEXT STEPS: CAPACITY BUILDING

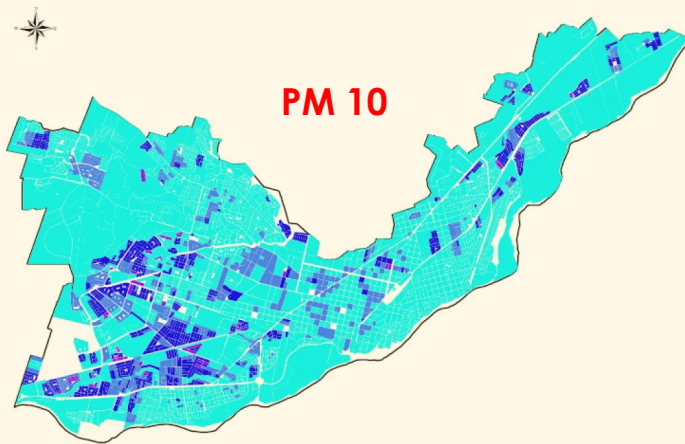
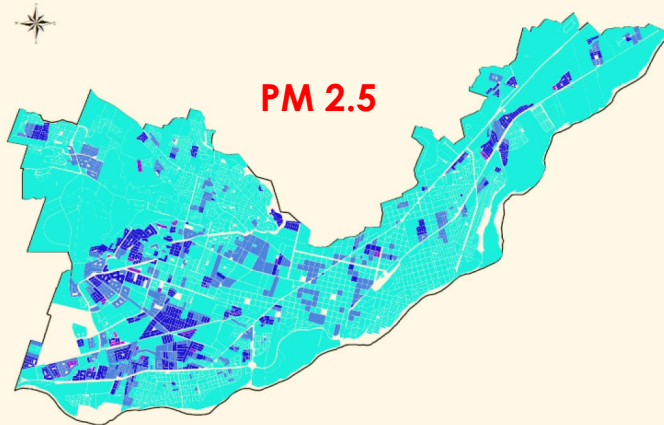


- A **few years ago** by the help of **District Energy in Cities Initiative** the development of **District Heating in Chile** has been **started**;
- It took some time to present a **District Heating** technology for the **national, local government** and **residents** and to explain advantages of DH for people utilising individual wood stoves, mostly not familiar with hydronic heating systems at all;
- After the **President of Chile** has supported the DH idea in Chile, the number of cities from 5 expanded to more than 10;



## NEXT STEPS: IDENTIFICATION OF EMISSIONS SOURCES

- The exact **Map** of **Emissions** was identified to show the location of most polluted areas in **Temuco** City, Chile;

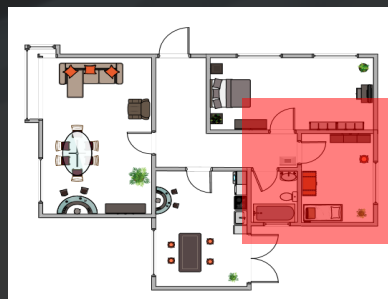




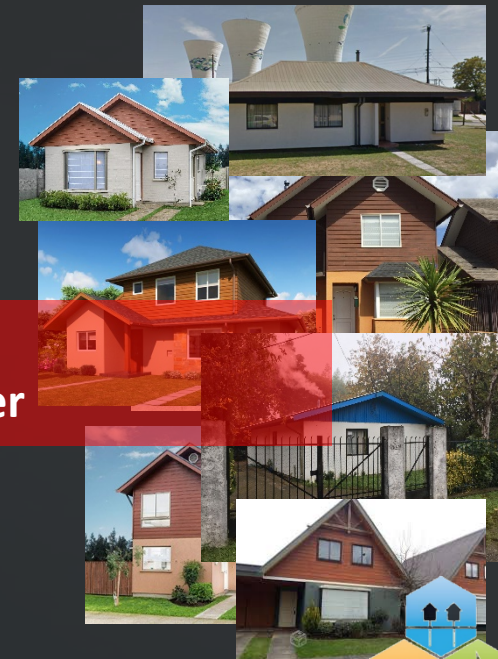


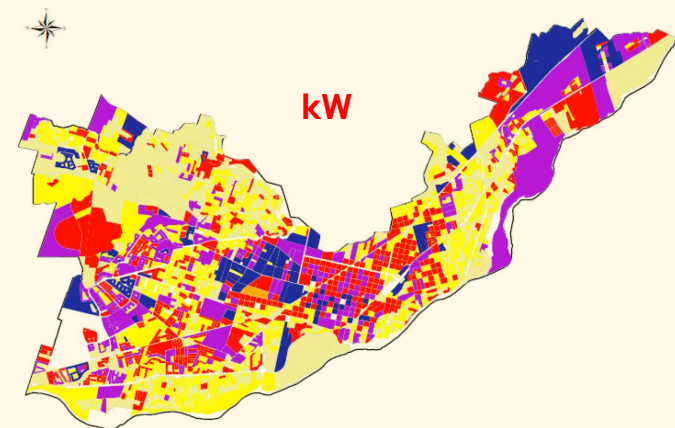
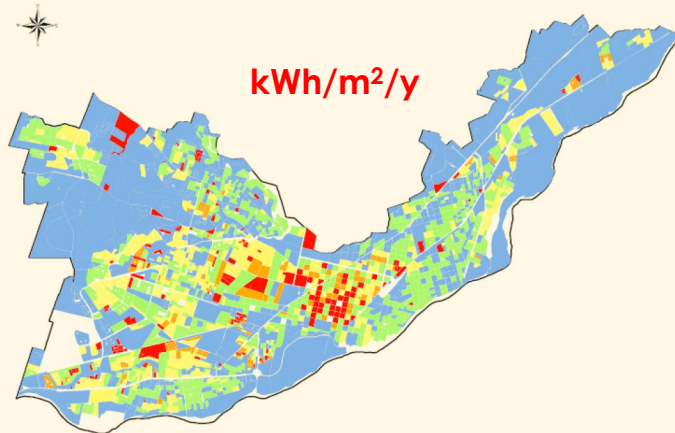
## NEXT STEPS: IDENTIFICATION OF ENERGY DEMAND

- The **Bottom-Up** approach has been used:
  - Identified the **typical housing** in Temuco and **fuel consumption** in it;
  - Calculated theoretical **energy demand** for heating and hot water;
  - Compared the actual and theoretical energy consumptions.



**E** Heating, Hot water





## NEXT STEPS: IDENTIFICATION OF ENERGY DEMAND

- The exact **Map of Energy Demand** was identified to show the location of most energy intensive areas in the **Temuco** City;
- Has been selected an area to start a **Pilot District Heating Project** in a city.





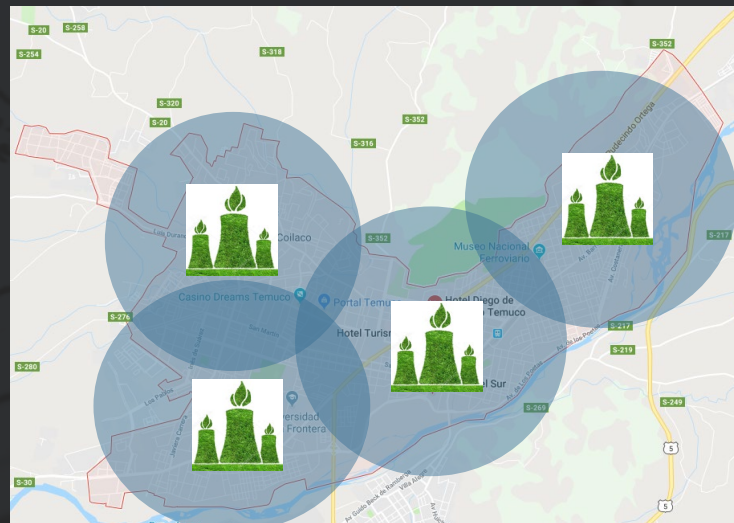




# CHILE



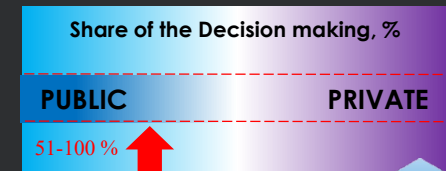
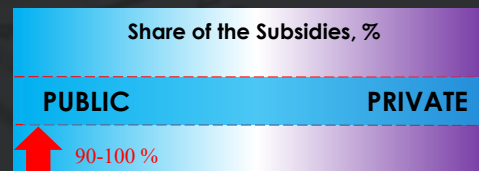
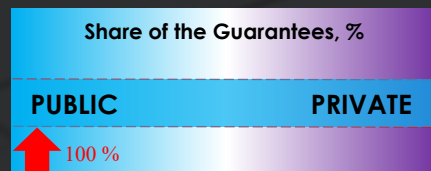
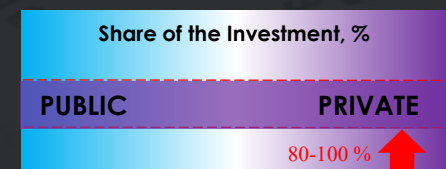
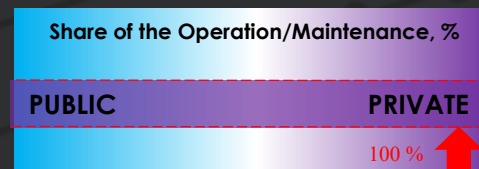
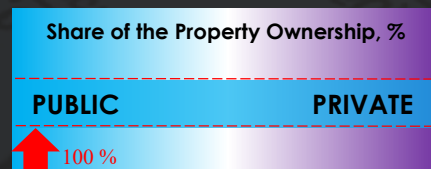
- Designed **Power Plants**: for the base load Biofuel and for the peak load Gas.
- Analysed optimal proportion between Biofuel-Gas power distribution;
- Identified principal areas for power generation in a Pilot area and in all city;





## NEXT STEPS: ASSESSMENT OF THE POTENTIAL BUSINESS MODELS

- 1. **The share of the property ownership: →100 % public.** The international practice shows that it is better to keep the property in the hands of the public sector in such monopoly sector areas as DH.
- 2. **Share of operation and maintenance: →100 % private.** The private sector usually is more experienced in operation and maintenance.
- 3. **Share of the investment: 80-100 % private.** The municipalities are responsible for very wide scope of services, city infrastructure development, and usually already having many public debts. Therefore, the private sector may step in and bring loans.
- 4. **Share of the guarantees: →100 % public.** The government may help to get cheap loans by the providing the guarantees for the financial institutions.
- 5. **Share of subsidies: 90-100 % public.**
- 6. **Share of decision-making: 51-100 % public.** As the energy supply services are considered as public services, having signs of monopoly, it should be regulated by the public sector.





## TECHNICAL - ECONOMICAL RESULTS

- Temuco city has about **130'000** buildings bringing **1.2 GWh** of annual heat energy consumption;
- For the Pilot area have been selected **13'000** mainly residential buildings with **140.000** MWh annual heat energy consumption; The selection was based on the **biggest "Key" Consumers - Public** and **Commercial** type buildings.
- For a newly designed **4<sup>th</sup> Generation Low temperature District Heating** system in the selected Pilot Area it may require about **70 MW** of installed power capacity and **190 mln. EUR CAPEX**.
- The emissions as PM 2.5, PM 10 has a potential to decrease by 97-99%.





## TECHNICAL - ECONOMICAL RESULTS

- The heat energy price for the final energy consumers **depends on the energy density** and is **higher in low energy dense** areas as one family residential buildings and **lower in a city Centre/Old Town**.
- **Financial-Economical Sensitivity analysis** shows that final energy price highly depends on a selected **Business Model** (Duration of the Contract, etc.), the **share of invested** owned/borrowed money, the length of loan, Profit level, Taxation, Internal Rate of Return, Discount and potential subsidies, so projected heat energy price vary within **0,06-0,11** EUR/kWh and will be selected on the mentioned factors.



# Thank You

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