FLEXYNETS

LIFE 4 HEAT RECOVERY

Techno-economic scenarios for neutral-temperature DHC networks based on decentralized HPs

Smart Energy Systems Conference 2019

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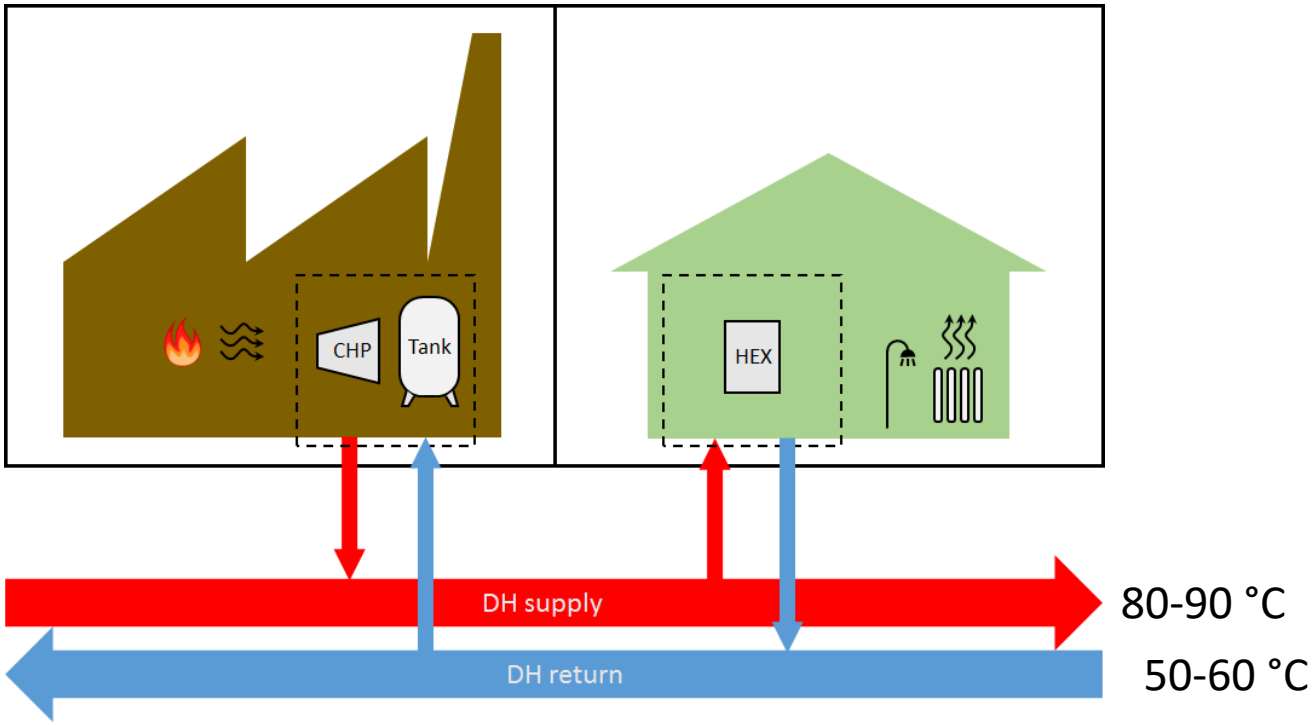
Traditional District Heating (DH)



DH concept: exploit “free” heat as much as possible

More sustainable then individual heating, but…

Traditional District Heating (DH)

3rd generation limits:

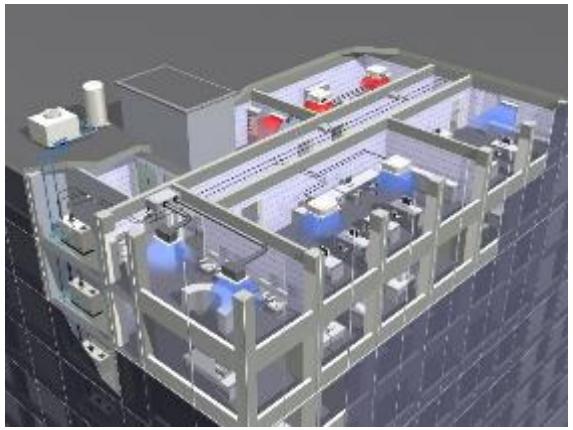
- Thermal losses
- Difficulties in integrating low T heat (high T HPs…)
- Not always feasible, not 100 % RES

Possible next steps?

- 4GDH (supply T 55 °C, return T 35 °C)
- SDH (+ seasonal storage), other innovative solutions

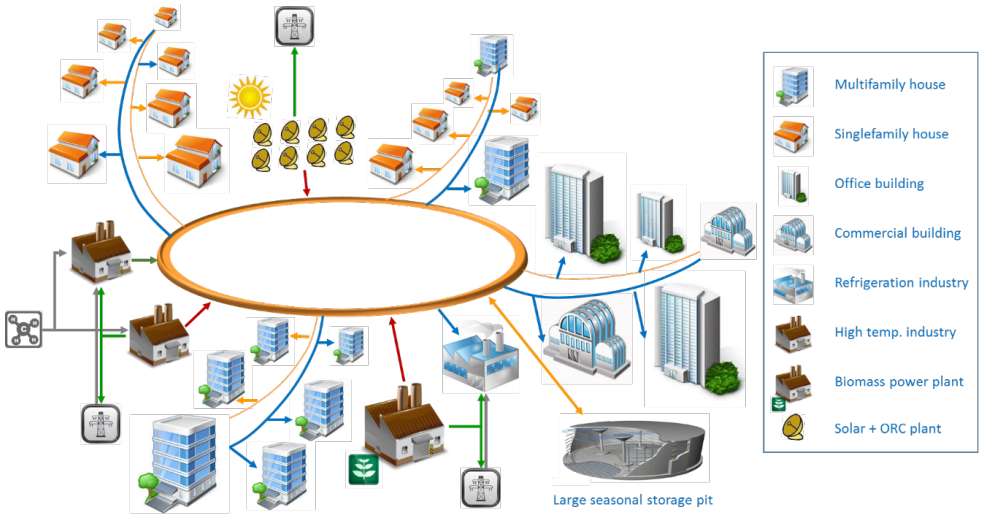
∞ FLEXYNETS: cold network + decentralized HP(+ seasonal storage) (5GDH(C)? see also Session 17)

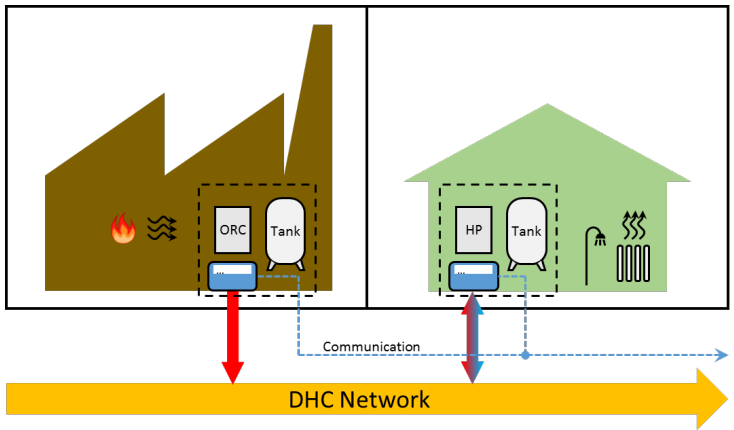
The FLEXYNETS approach



From the water-loop concept to a decentralised low-temperature DHC network (15-25°C)

Assessment of DHC network topologies





Elaboration of substations for connection to DHC network through reversible heat pumps

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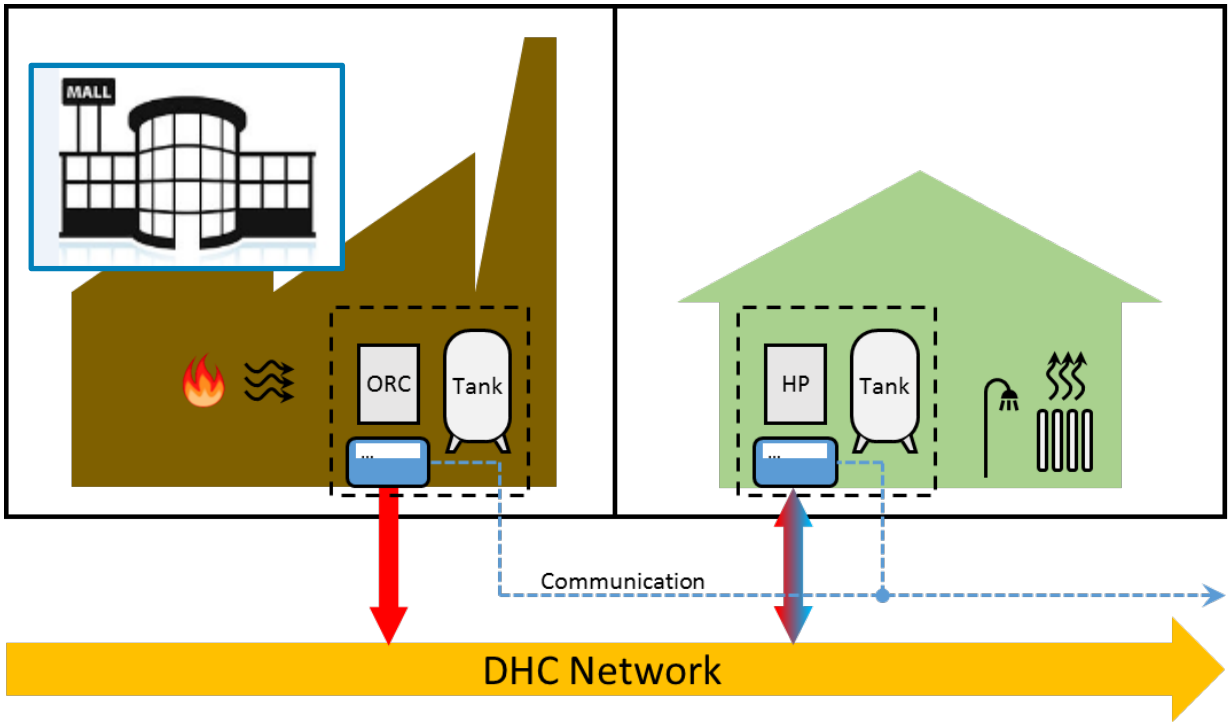
District Heating *and* Cooling



DHC with even more “free” heat…

…and more “communication” as well

FLEXYNETS ingredients

- Neutral temperature network, **15-25 °C**
- **Reversible heat pumps** at substations → prosumers

∞ Advantages

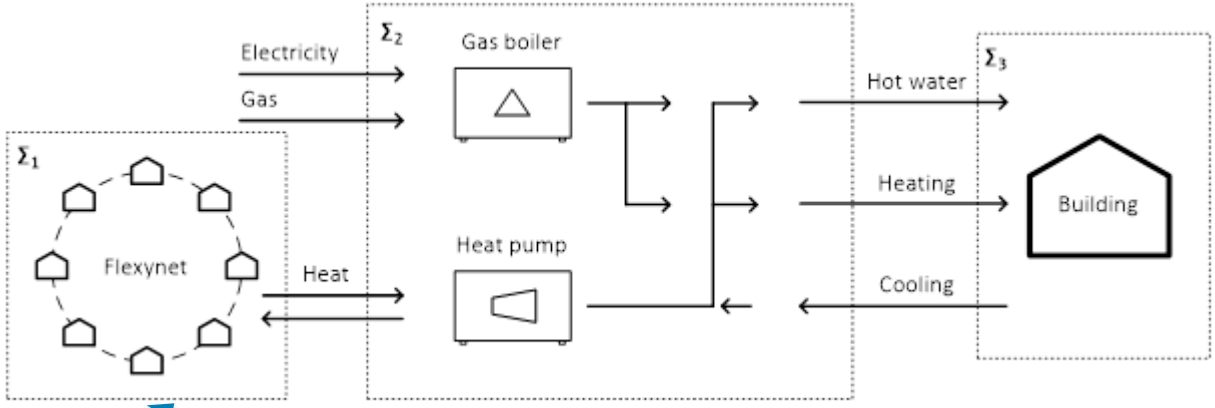
- Strong reduction of thermal losses
- Direct integration of low-temperature waste heat
- Reversible network

∞ Disadvantages

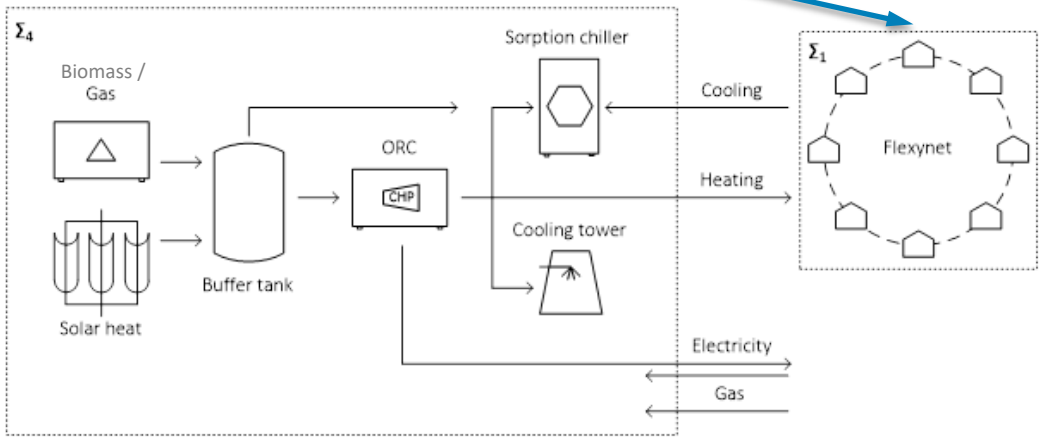
- Electricity costs and primary energy
- Higher substation costs

FLEXYNETS substations

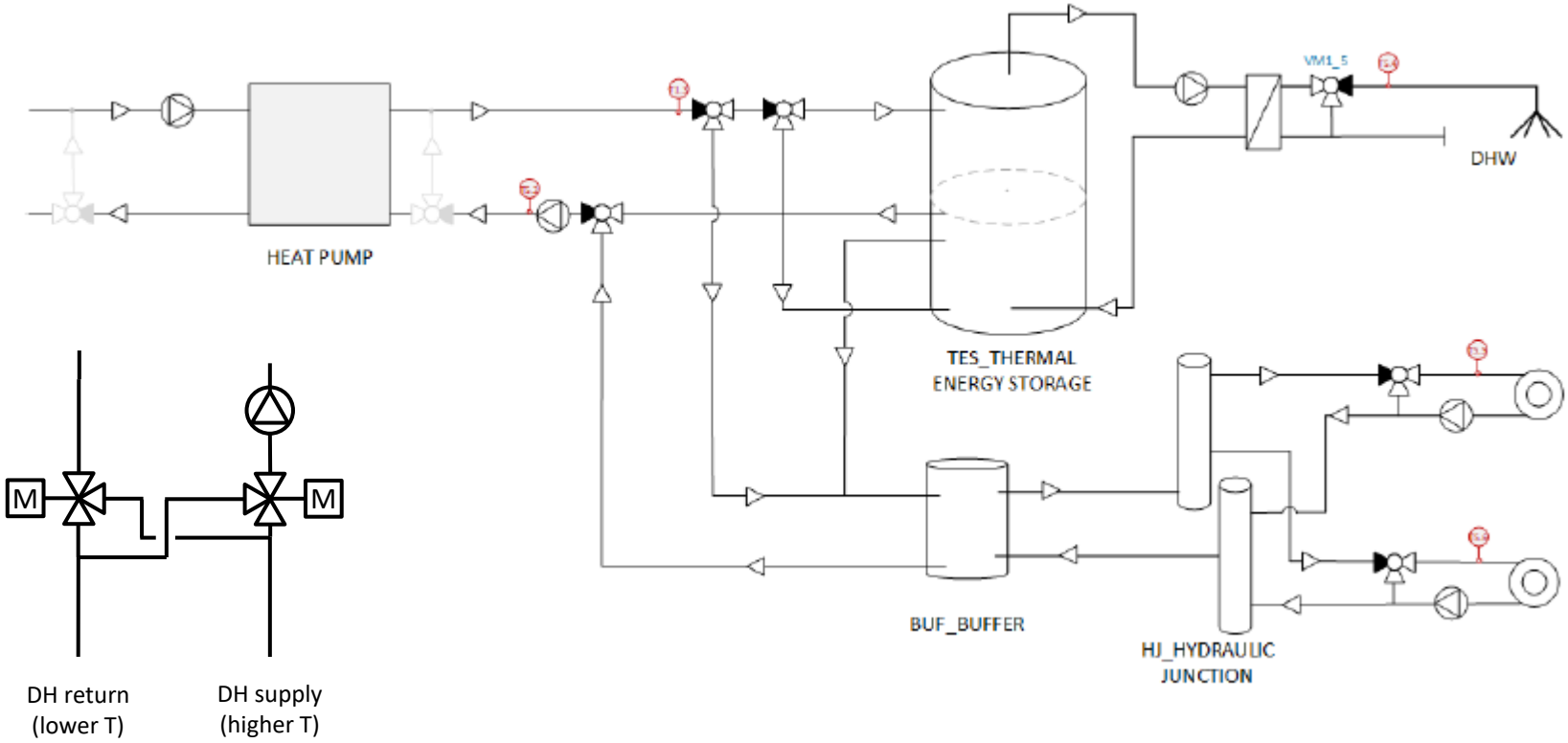
Prosumers substations



Producers substations



Prosumer substations



Key ingredient: HP

Also needed: DHW storage

Possibly needed: HP recirculation and flow reversal

Energy sources

Traditional DH:

- High-temperature waste heat
- CHP, boilers (biomass, gas)
- High-temperature HPs
- Solar collectors 90°C

FLEXYNETS DHC:

- Low-temperature waste heat (e.g., chillers)
- Solar-CHP
- Solar collectors 45 °C
- Geothermal

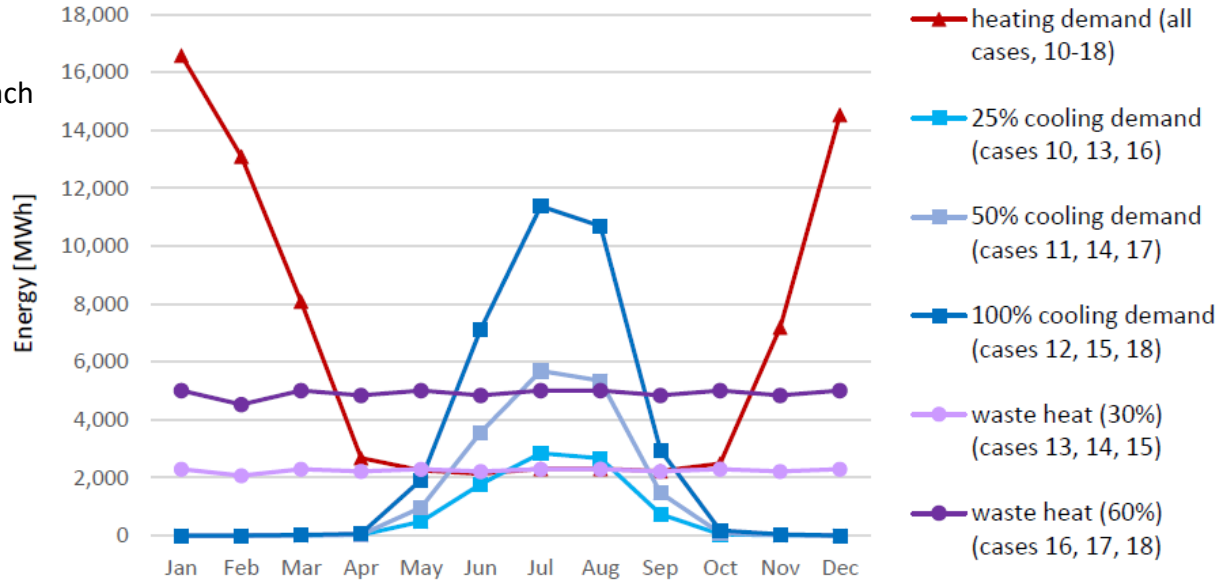
Simplified techno-economic estimates

Excel model / pre-design tool

- Test general scenarios
- Simplified analysis based on time slices
- Economic and environmental database

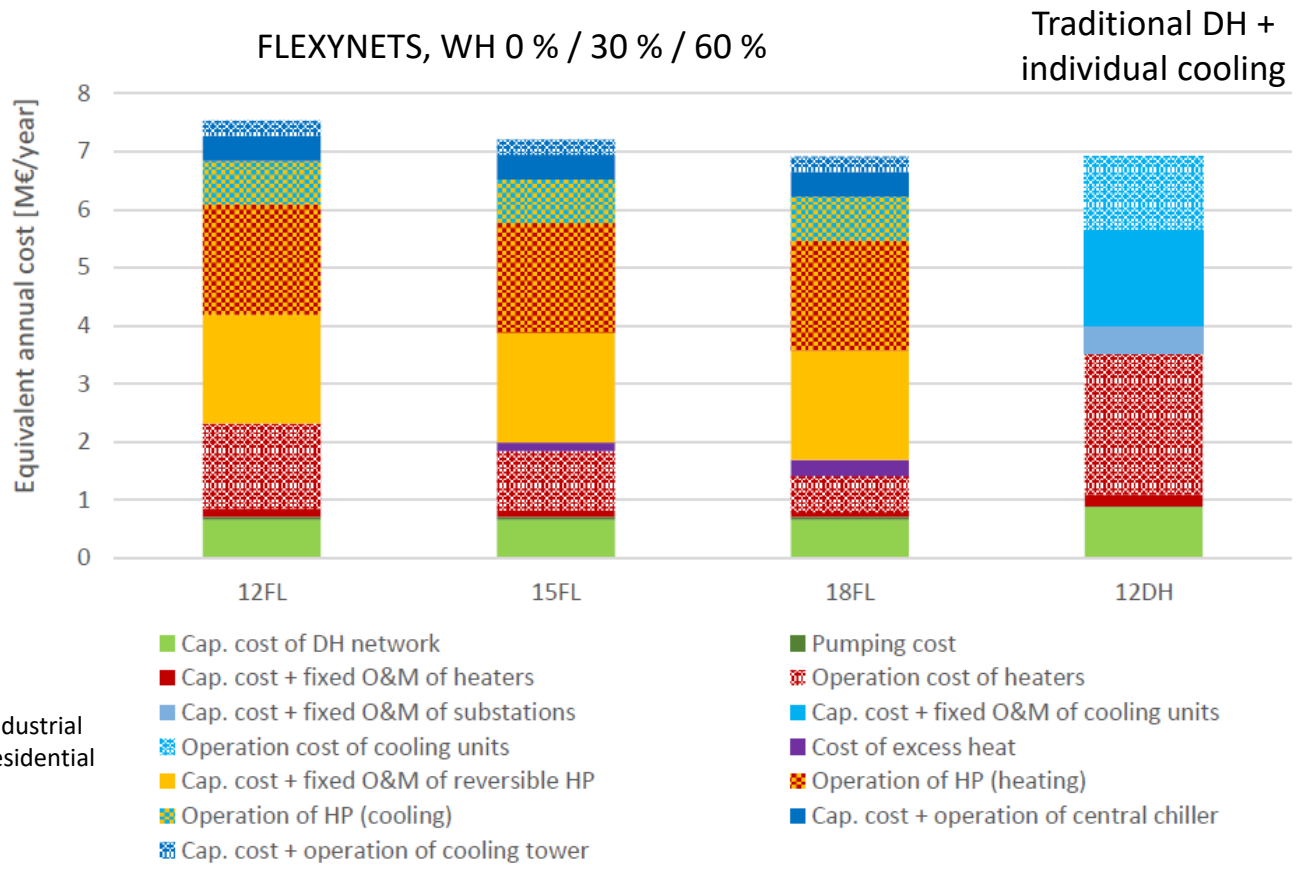
Example:
- 1600 insulated buildings, 500 m^2 each
- Rome climate, H&C

Comparison between:
- Gas DH
- FLEXYNETS 0/30/60% WH



Simplified techno-economic estimates

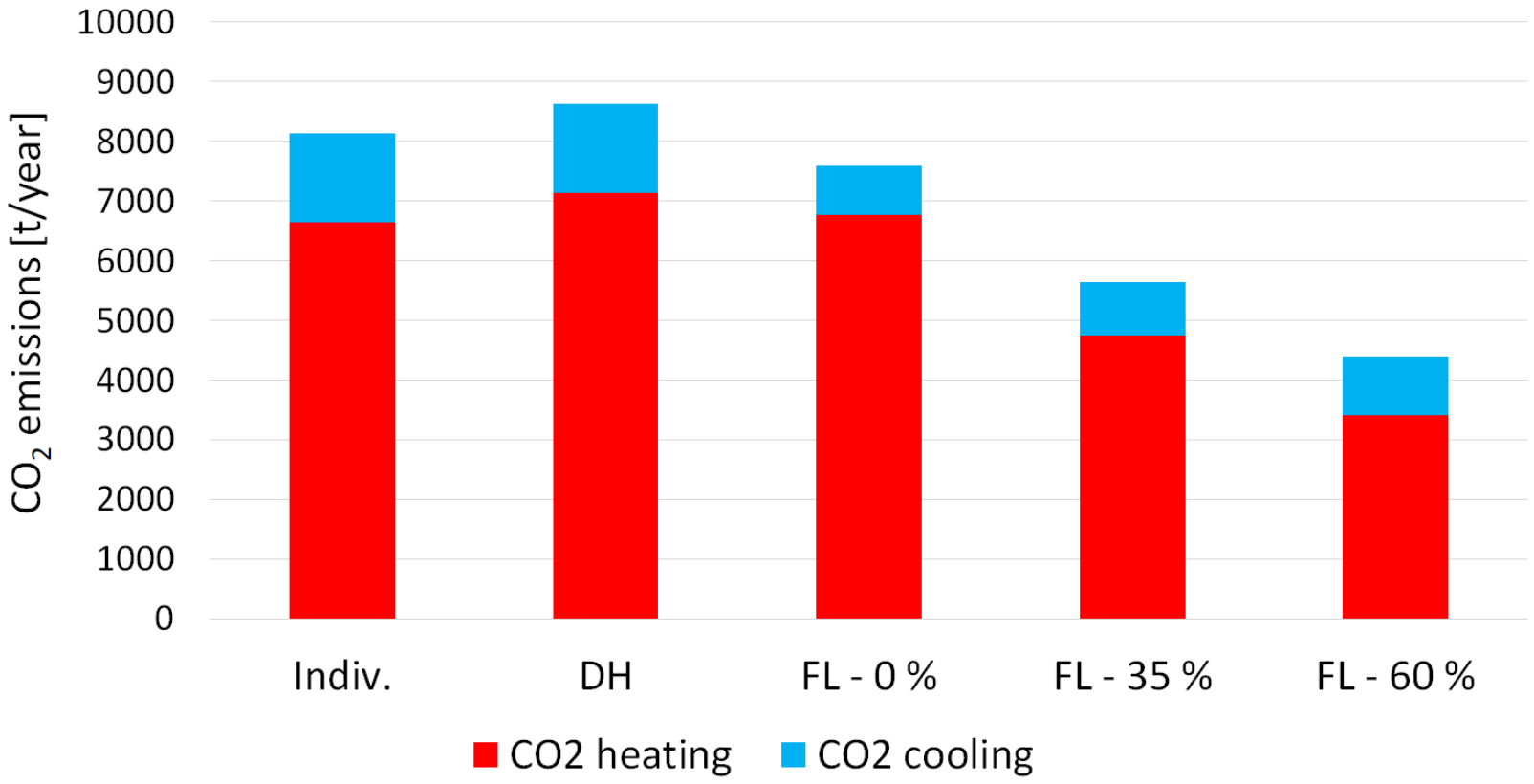
Annualized costs



10 €/MWh waste heat
35 €/MWh gas
100 €/MWh electricity, industrial
200 €/MWh electricity, residential

Simplified techno-economic estimates

CO_2 emissions



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CO_2 emission trend for electricity

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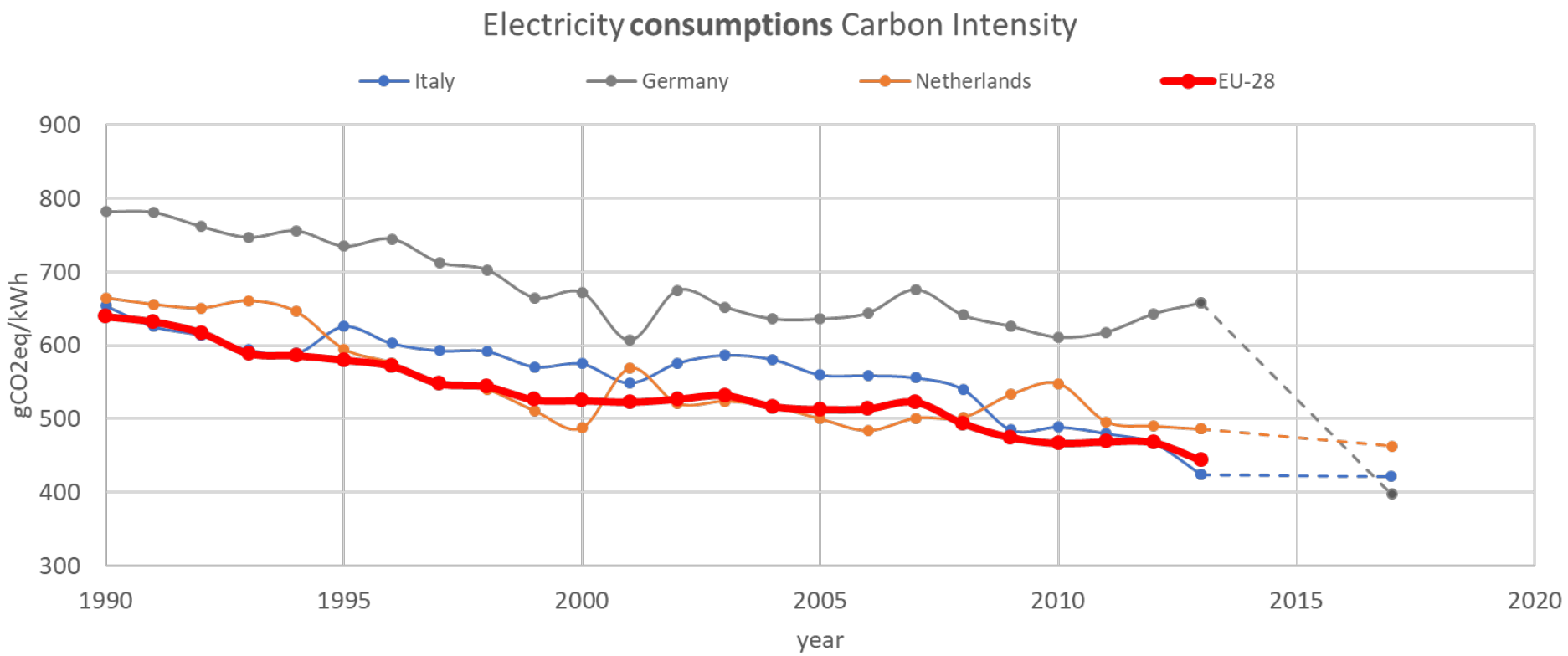


Values up to 2013 are from JRC database (LCA approach).
The values of 2017 are the yearly average of hourly data from electricityMap

FLEXYNETS experiments

Energy Exchange Laboratory
EURAC

LIFE4HeatRecovery project → Demonstration

PROJECT LOCATION: Italy, Germany, Netherlands

BUDGET INFO:

- Total amount: € 5.612.877
- % EC Co-funding: 60 %

DURATION: Start: 15/06/18 - End: 14/06/22

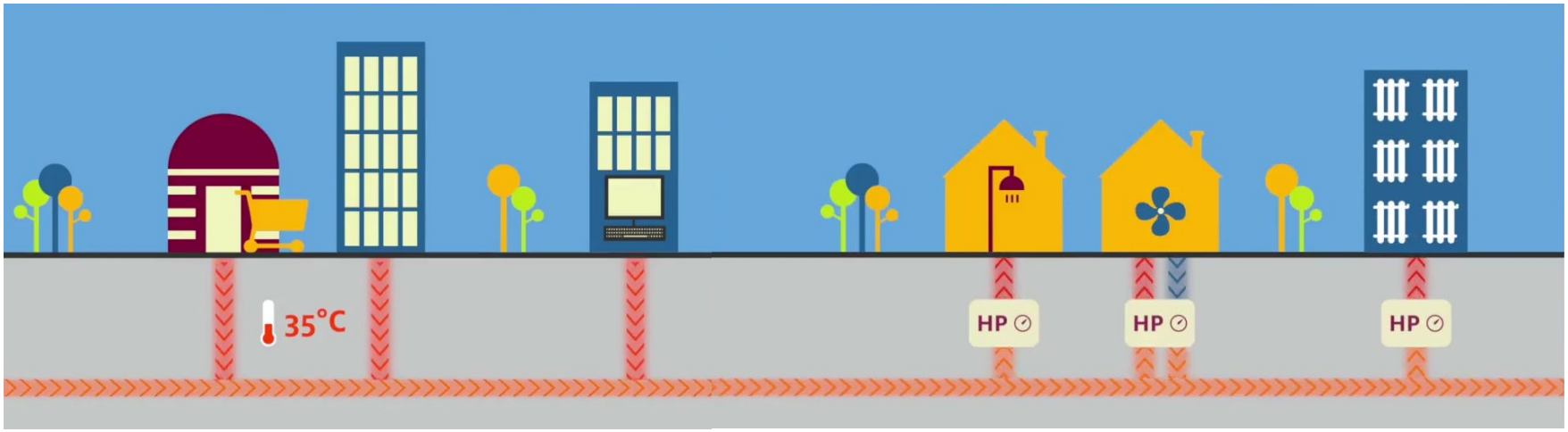
PROJECT'S IMPLEMENTERS:

- Coordinating Beneficiary: Eurac Research (coordinator: Roberto Fedrizzi)
- Associated Beneficiaries: Alperia, Cogeme, Enisyst, KWA, LGH, Mijnwater, UHRIG, WBR, Wüstenrot

LIFE4HeatRecovery

Demonstration of **recovery of low temperature urban waste heat** (< 40 °C) in **DH networks** operated at conventional temperatures or low temperature.

Done **by means of reversible HPs** used either at heat recovery and or heat utilization sides, with a focus on **prefabricated** solutions.



LIFE4HeatRecovery

Waste heat recovered and used:

- **Ospitaletto**, 232 MWh/y
- **Wüstenrot**, 200 MWh/y
- **Rotterdam**, 480 MWh/y
- **Heerlen**, 1140 MWh/y

Corresponding to about 195 typical EU houses

→ Innovative prefabricated skids including HPs
→ Financing schemes
→ Business models

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LIFE 4 HEAT RECOVERY

Summary

DHC based on decentralized HPs

- Requires a major share of low-T “free” heat
- More convenient with a significant cooling demand
- Economically challenging due to HP costs (investment and electricity), but environmentally promising
- Key advantages: access to otherwise unexploited sources, lower losses, reversibility, coupling with the electric sector

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VISIT FLEXYNETS AND LIFE4HEATRECOVERY WEBSITES

WWW.FLEXYNETS.EU

WWW.LIFE4HEATRECOVERY.EU

This FLEXYNETS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 649820

The LIFE4HeatRecovery project has received funding from the LIFE programme of the European Union under contract number LIFE17 CCM/IT/000085