Operation at Low Temperature in the District Heating Network in Tartu

Virtual Study Tour on District Heating to Latvia and Baltic States

District Heating in Baltic States: Best Practices and Case Studies
on Wednesday, May 26, 2021

tecnalia MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

RELaTED

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RELaTED, REnewable Low TEmperature District

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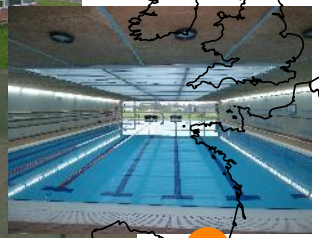
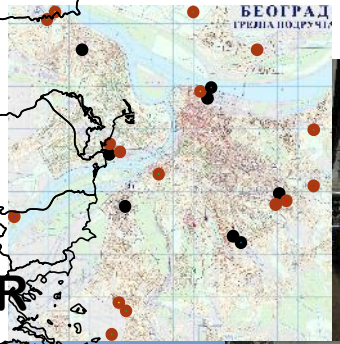
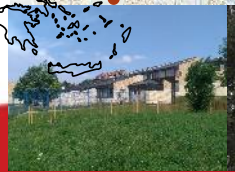
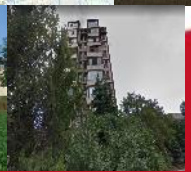
- Decentralized Ultra-Low Temperature (ULT) DH networks
- Incorporation of low-grade heat sources with minimal constraints
- Reduced operational costs due to fewer heat losses
- Better energy performance of heat generation plants
- Extensive use of de-carbonized energy sources at low marginal costs
- Technology developments in line with the overall concept:
  - Building Integrated Low Temperature Solar Thermal Systems (BILTST)
  - Triple Function Substations (3FS)
  - District Heating connected Reversible Heat Pump (DHRHP)
- Demonstration in four complementary environments in Denmark, Estonia, Serbia and Spain

Our Networks







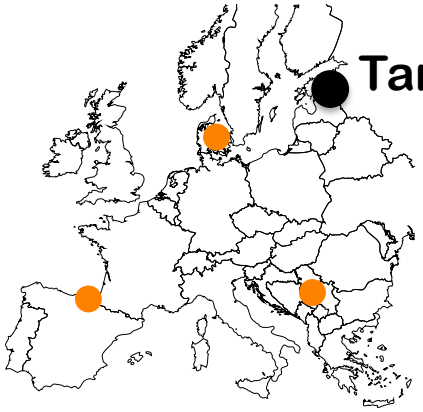


Vinge, DK

Tartu, EE

Iurreta, ES

Belgrade, SR



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Tartu in 80's

- Base load from heavy fuel oil fired heat only boiler.
- Coal based local heating in the city centre.

Tartu in 2016

- Base load from biofuel fired CHP plant.
- 95% heat from renewables.
- Usage of surplus heat from industry – voluntary agreements.
- Integrated heating and cooling.
- Chosen as a case study of an of well functioning and innovative District Heating and Cooling (DHC) systems in the EU.
- SmartEnCity project – Towards smart zero CO2 cities across Europe www.smartencity.eu.
- RELaTED project – Renewable Low Temperature District www.relatedproject.eu

Some figures (2017)

100 000	Inhabitants in Tartu
1687	Buildings connected to DH net
500 GWh	Heat sales annually
190 GWh	Electricity production annually
240 MW	Peak DH demand
176 km	Lenght of DH net
$24_{el}/62_{h}$MW	Bio CHP plant capacity
95%	Heat produced by bio/local fuels
14 MW	Installed cooling capacity
3	District cooling plant
3,85 km	Lenght of DC net

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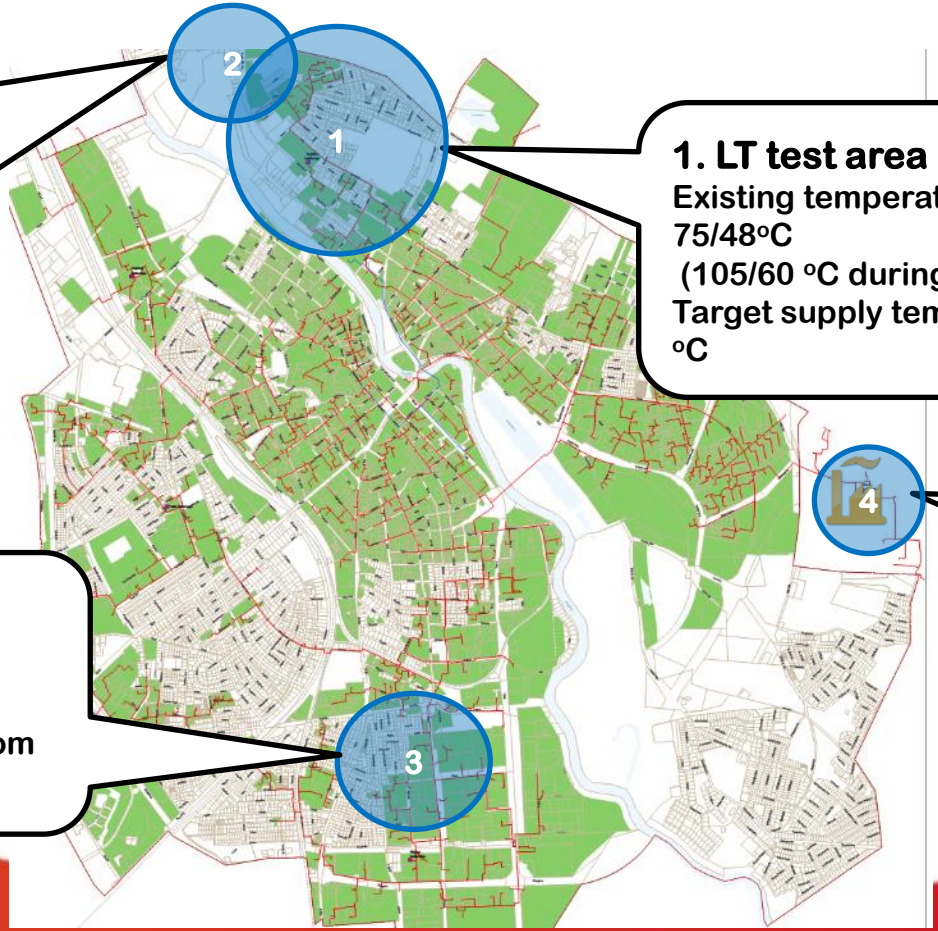
RELaTED Interventions

2. Open DH stategy
To take the industrial residue heat into DH net, promote open DH strategy.



1. LT test area (Tarkon)
Existing temperatures 75/48ºC
(105/60 ºC during peaks)
Target supply temp 60..65 ºC

4. Waste heat back to DH net
0,5..1,0 MW waste heat from sawage of CHP back to DH by heat pumps

3. Usage of residue heat from cooling.
To take the residue heat from cooling into DH net

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Heat Recovery, Various interventions, ~0,5-5 MW

Flue Gas

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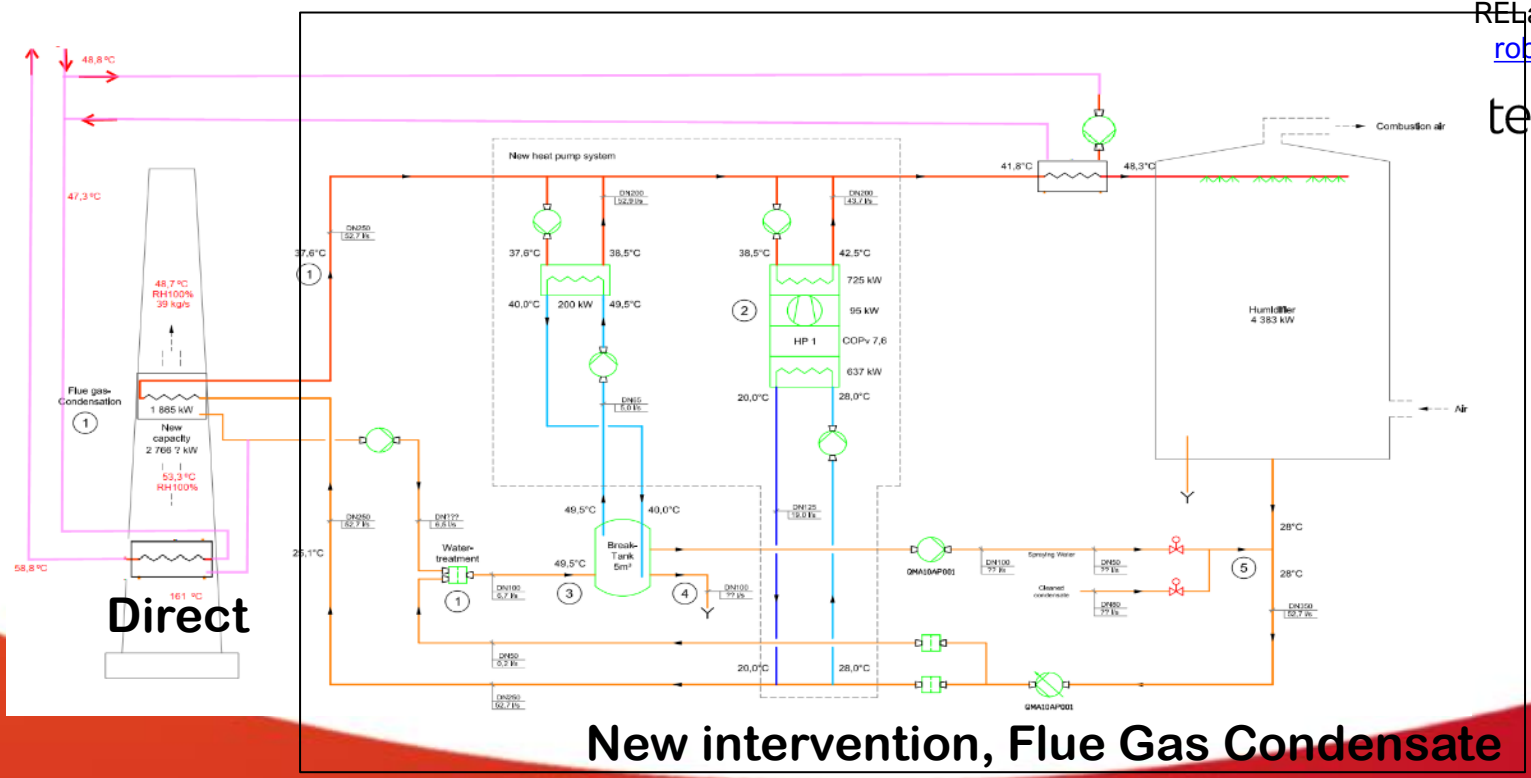
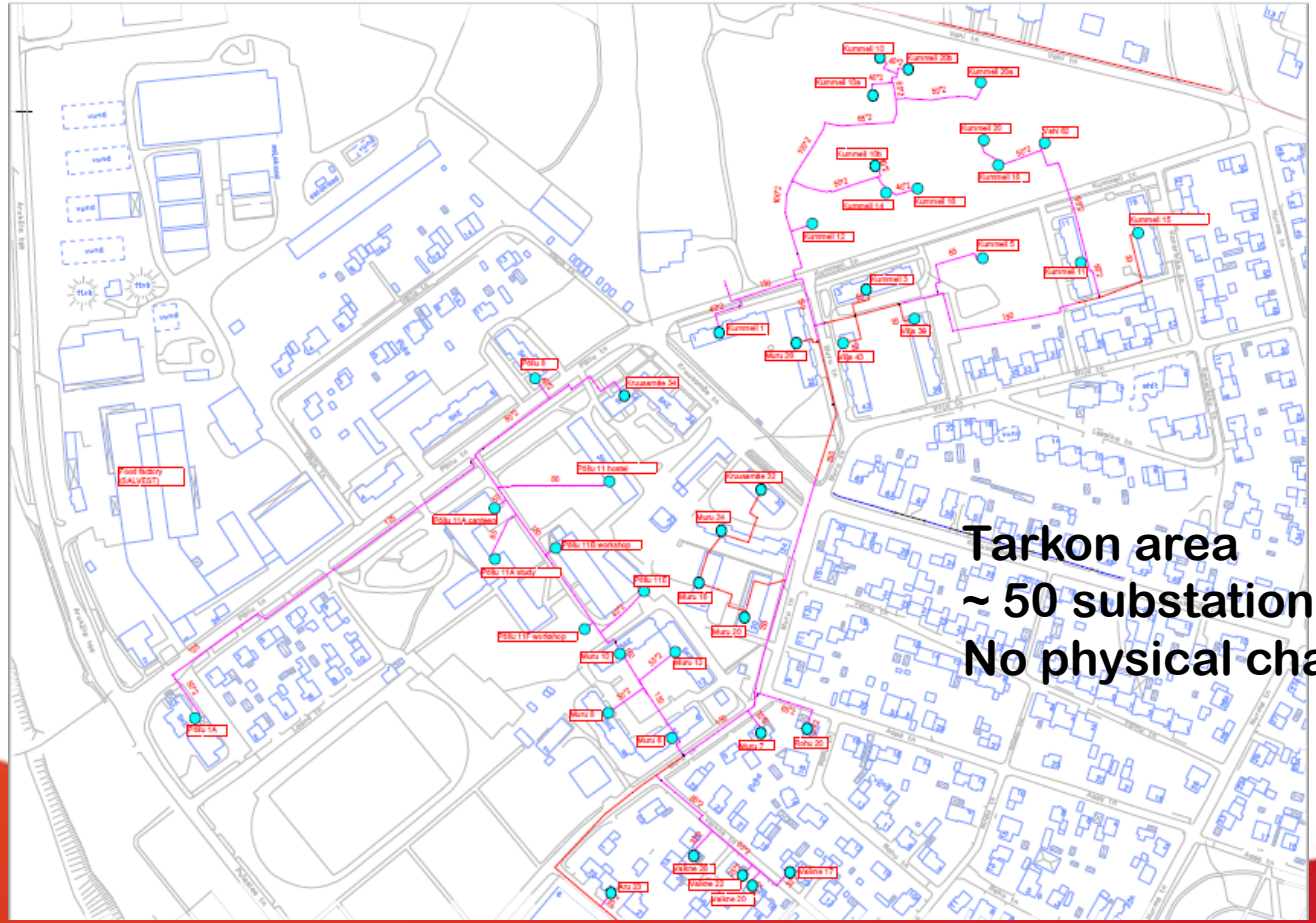


New intervention, Flue Gas Condensate

Temperature reductions



Tarkon area
~ 50 substations
No physical changes to substations

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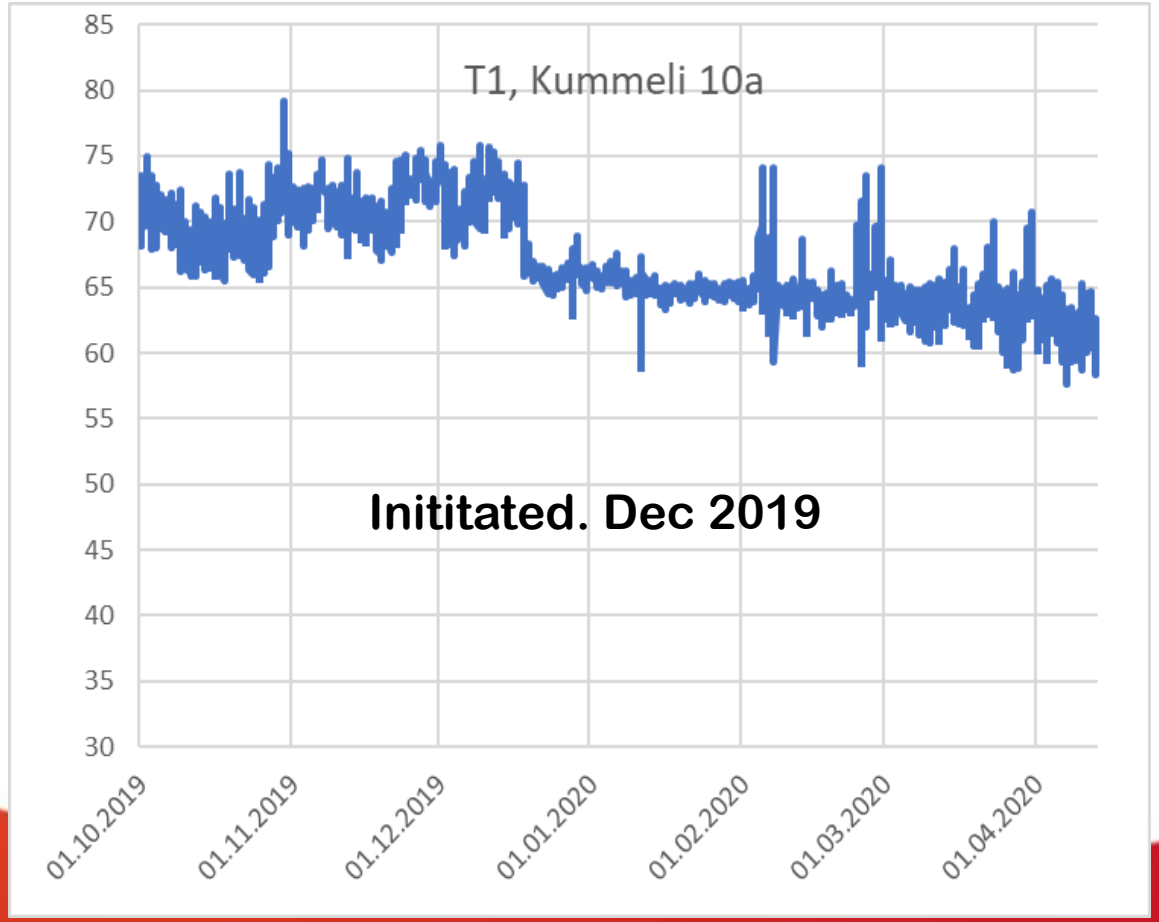
Temperature reductions



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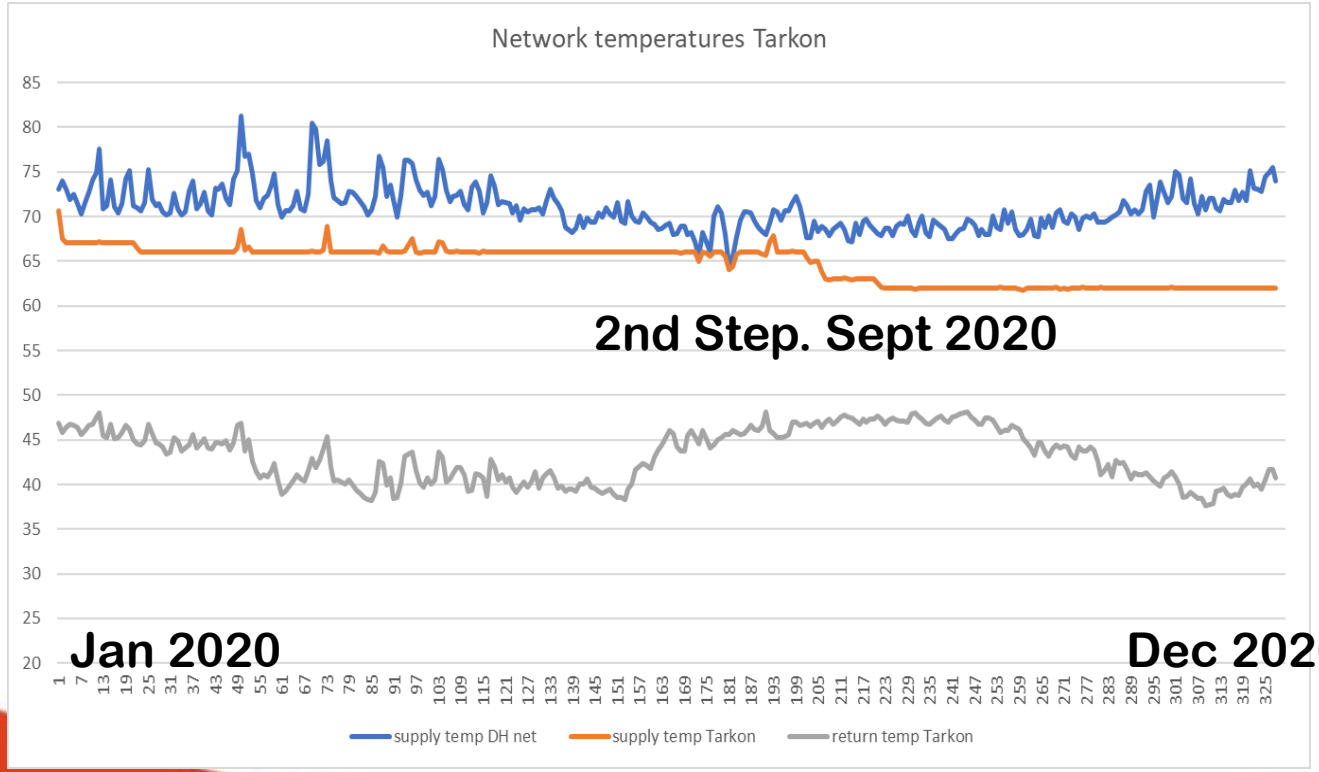
Temperature reductions



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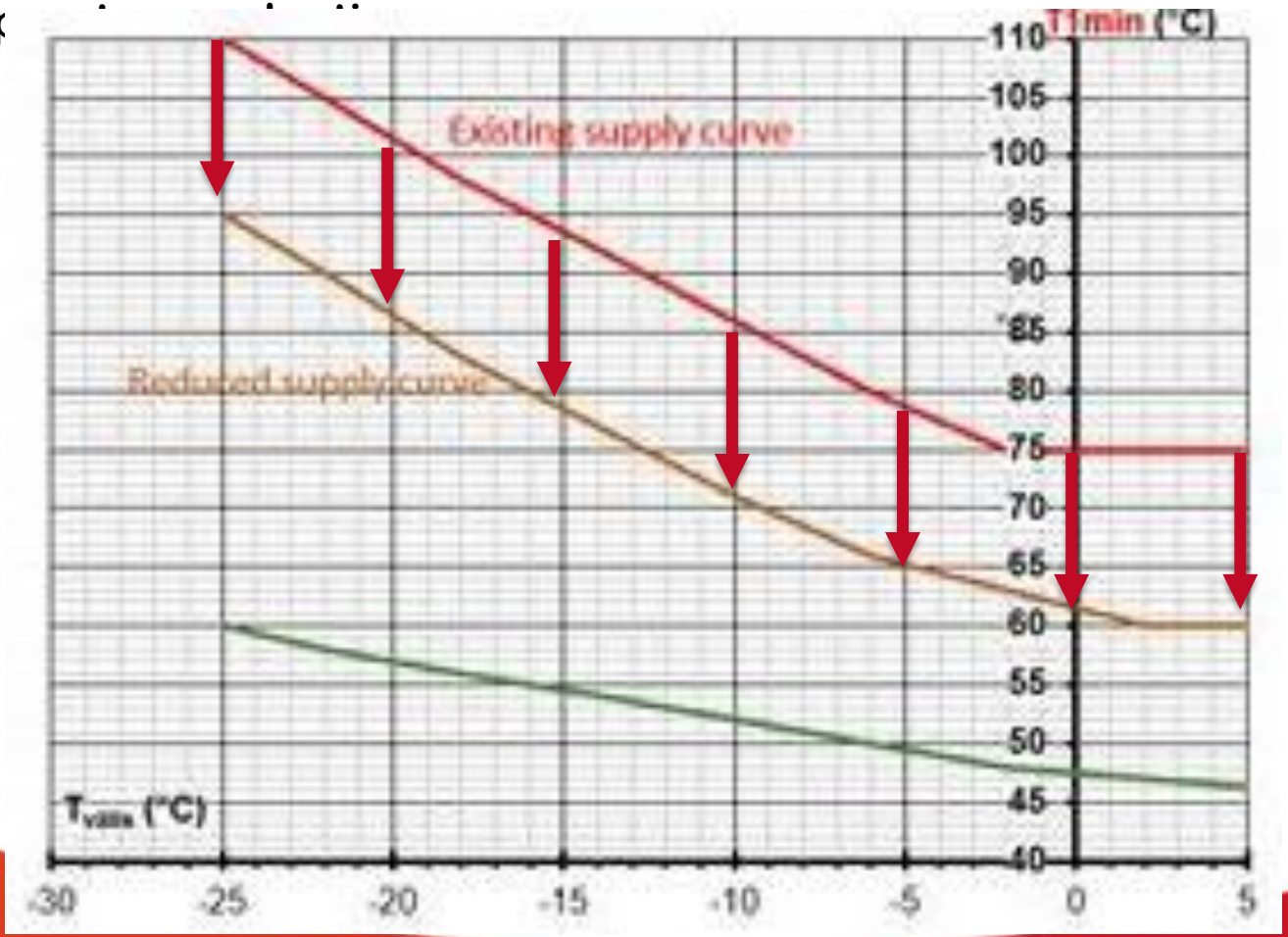
Temp



-15ºC

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Temperature reductions

Key Issues

- Increase flow in some areas
- Replace valves in small share of substations
- Supervision of substation parameters for faulty control

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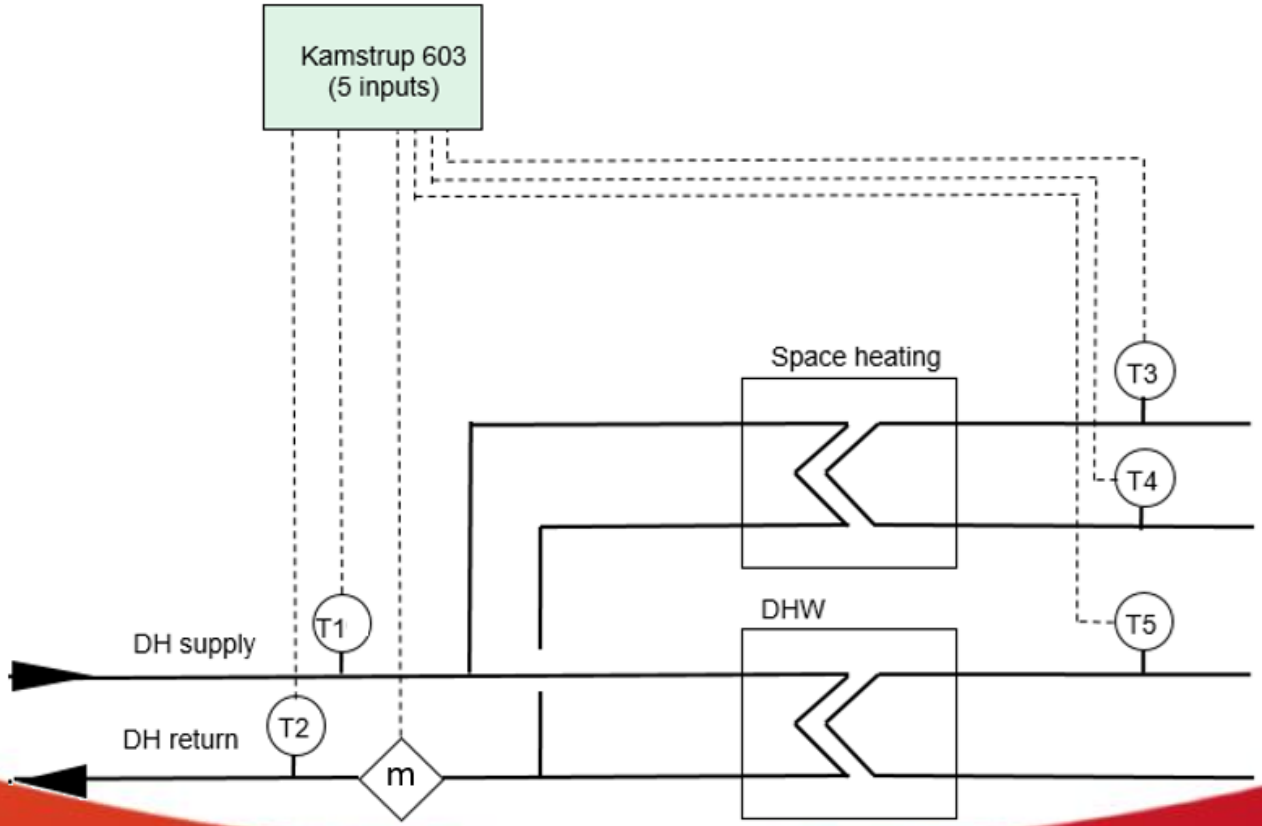
Substation Configuration & Meters



Substation regulations & performance. Compliance with Contracts

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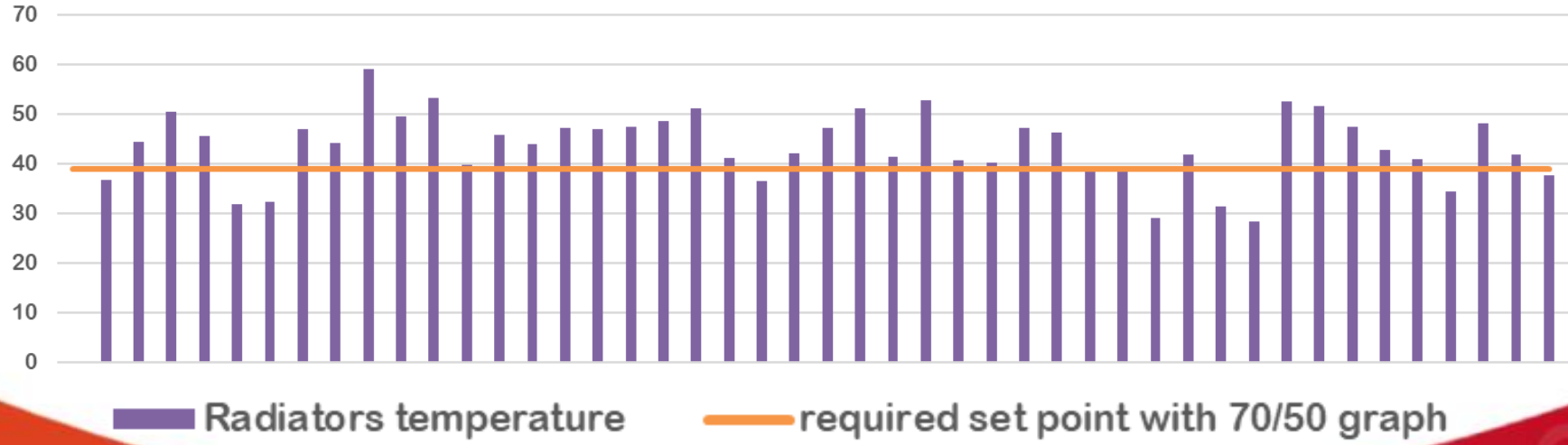

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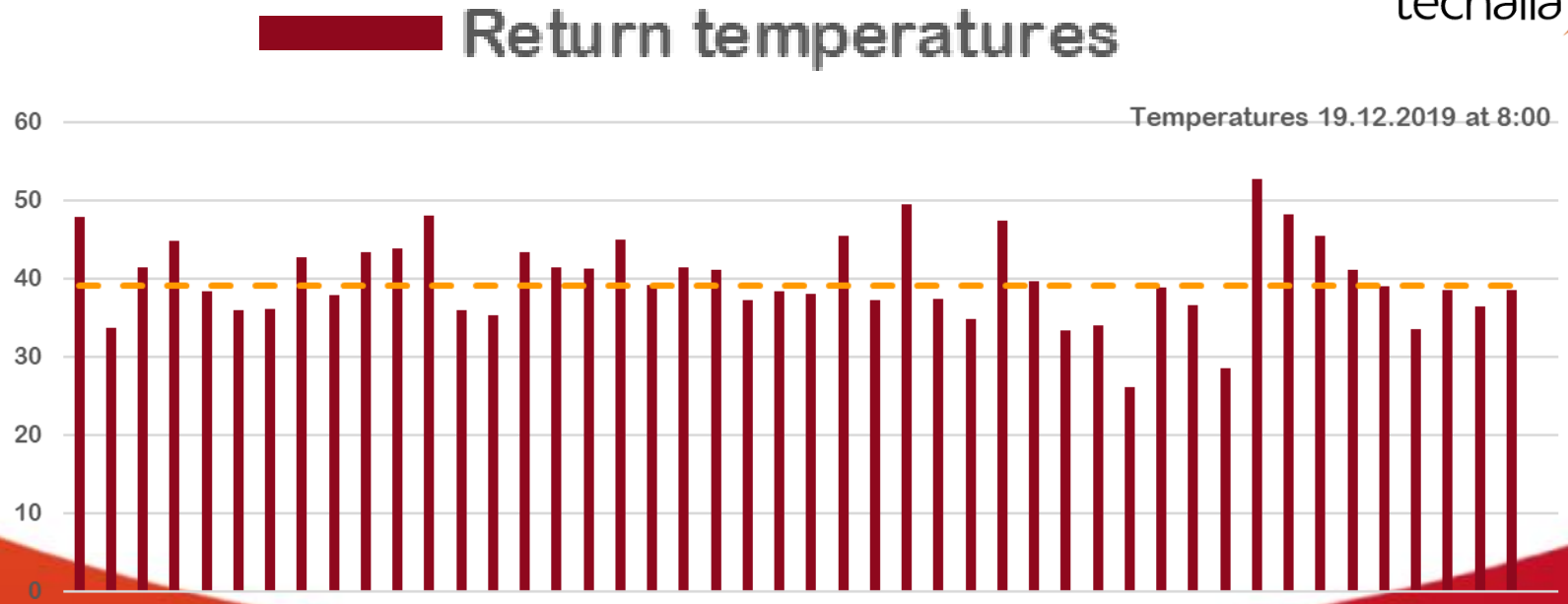
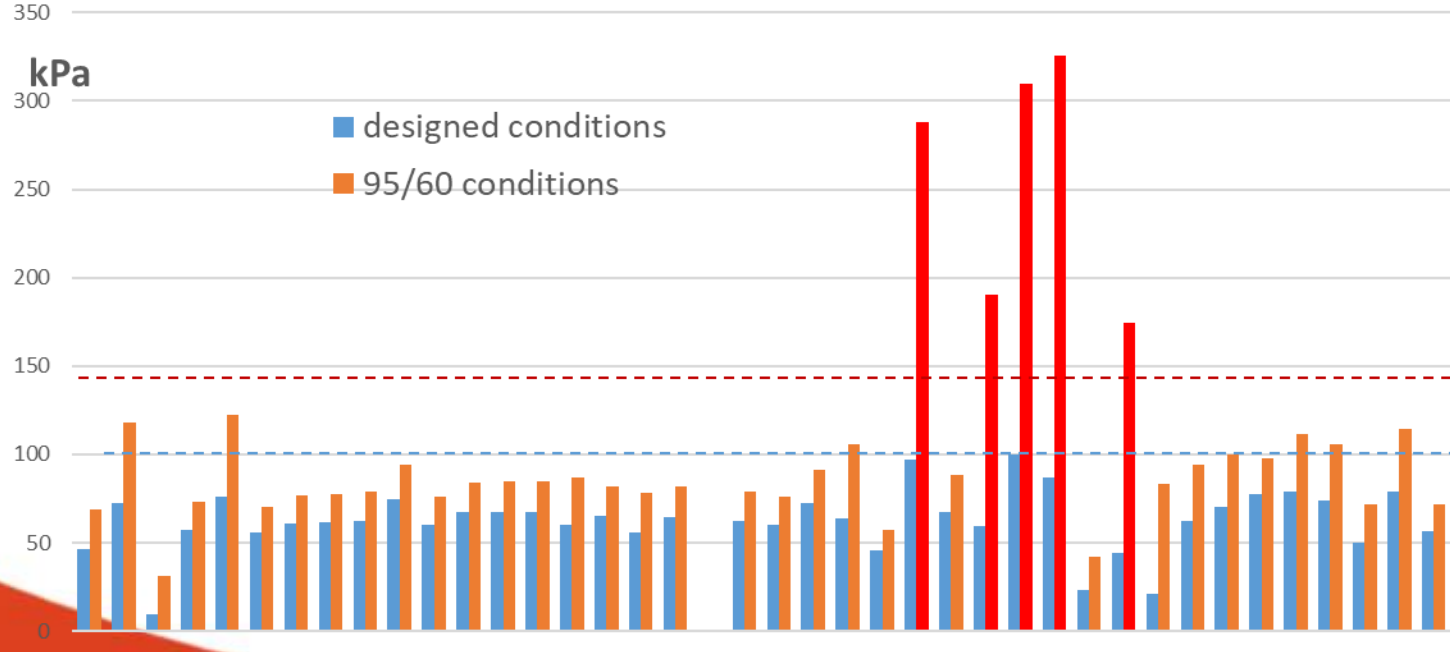


Substation regulations & performance. Increased Pressure Loss



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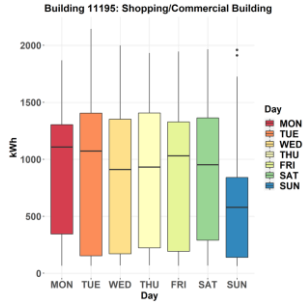
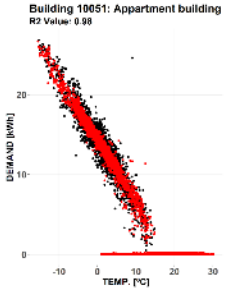
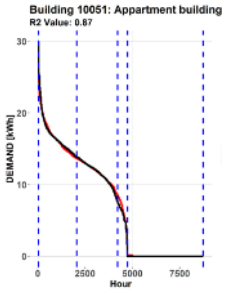
Substation regulations & performance. Detailed Assessment







ExPOST Identification of capacity to keep service at lower temperature:

- **Exploratory data Analysis & Pattern Recognition**
- **Heat Load Modelling**

"If the building & user remain constant, substation load should be equal before and after the temperatura reduction"

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Substation regulations & performance.
Detailed Assessment

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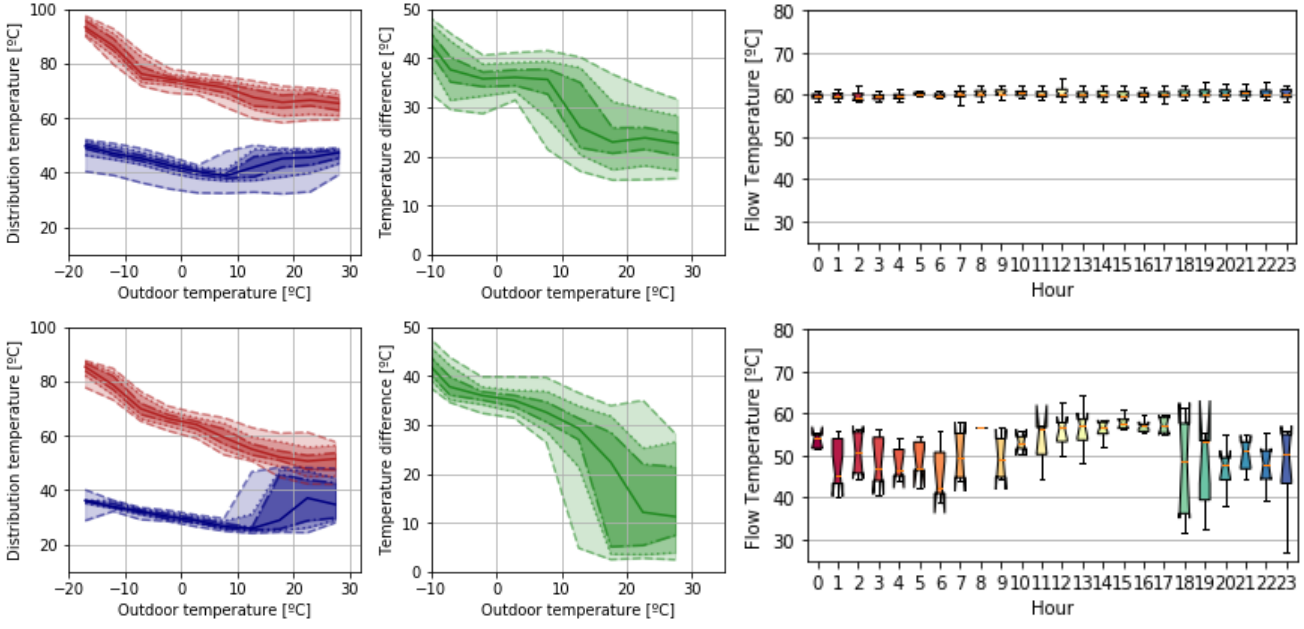

OK

Improvement needed

Further assessment by O&M team

Next Steps

- Summer 2021. Further Temperature Reduction
- Extension to full network
- Additional heat recovery projects

Role of Tecnalia

- Project management
- Technical Assessment
- Engineering design & Assessment (partial)
- Data Driven Analysis

Public documents

- www.relatedproject.eu
- Energy meters in District-Heating Substations for Heat Consumption Characterization and Prediction Using Machine-Learning Techniques, http://doi.org/10.1088/1755-1315/588/3/032007
- RELaTED Project: New Developments on Ultra-Low Temperature District Heating Networks, https://doi.org/10.3390/proceedings2020065008
- District Heating De-Carbonisation in Belgrade. Multi-Year transition plan http://doi.org/10.1088/1755-1315/588/5/052034
- RELaTED, Decentralized & Renewable Ultra Low Temperature District Heating, Concept Conversion from traditional District Heating, https://doi.org/10.1088/1757-899X/609/5/052004
- New substation and booster systems for Ultra Low Temperature District Heating, https://doi.org/10.1088/1757-899X/609/5/052008
- Mikel Lumbreras, Roberto Garay, Energy & economic assessment of façade-integrated solar thermal systems combined with ultra-low temperature district-heating, https://doi.org/10.1016/j.renene.2020.06.019

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Danish Technical Institute
Fortum Tartu
Beogradske Elektrane
Basque Government
Metro Therm
Nibe
Inaventa
Innometal
Basque Energy Agency
Mazovia Energy Agency
Institute of Baltic Studies
FEDARENE
El Taller De Comunicación y CIA.

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