Securing a lower grid temperature through increased digitalization

- Using heat load forecasting and feedback from the grid

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EUROPEAN UNION

Outline

- Background
  - Smart Cities Accelerator
  - Krafringens DH grid
  - Temperature control
- Securing a lower grid temperature
  - Digitalization
  - Pilot study
  - Evaluation of installation
- Conclusion of digitalization
  - Increased grid knowledge
  - Reduced grid temperature
  - Proactive instead of reactive measures
  - Economic and environmental benefits

Smart Cities Accelerator (SCA)

- Regional program Interreg-ÖKS
- Optimizing energy systems, reducing the dependency on fossil fuels
- Duration: Sept 2016-Feb 2020
- Budget: 6 468 035 Euro, 50% co-funded
- 6 technical themes
- Kraftringen: Integration of low-temperature district heating in urban districts

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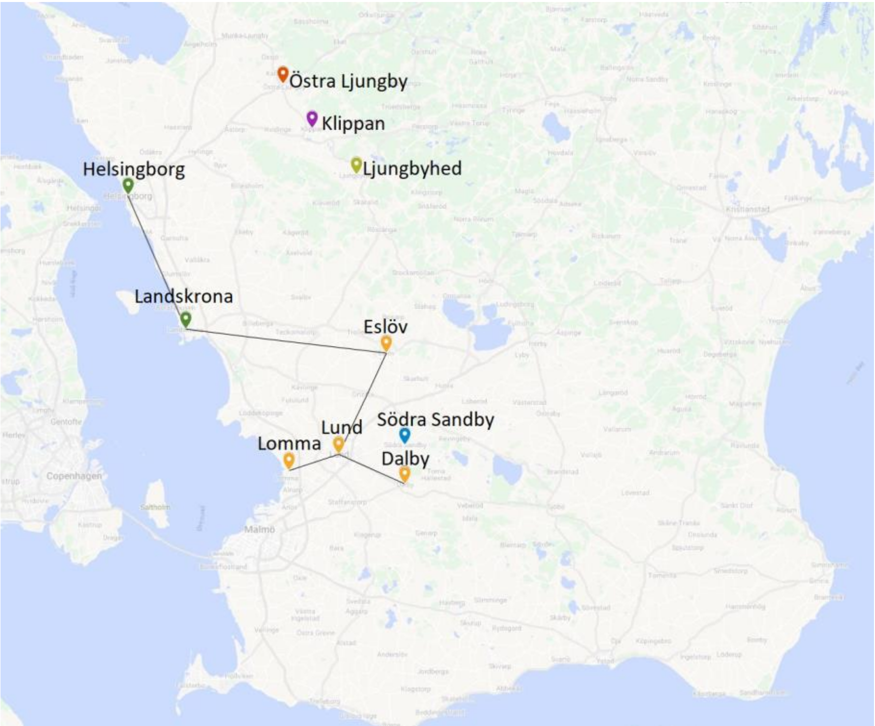
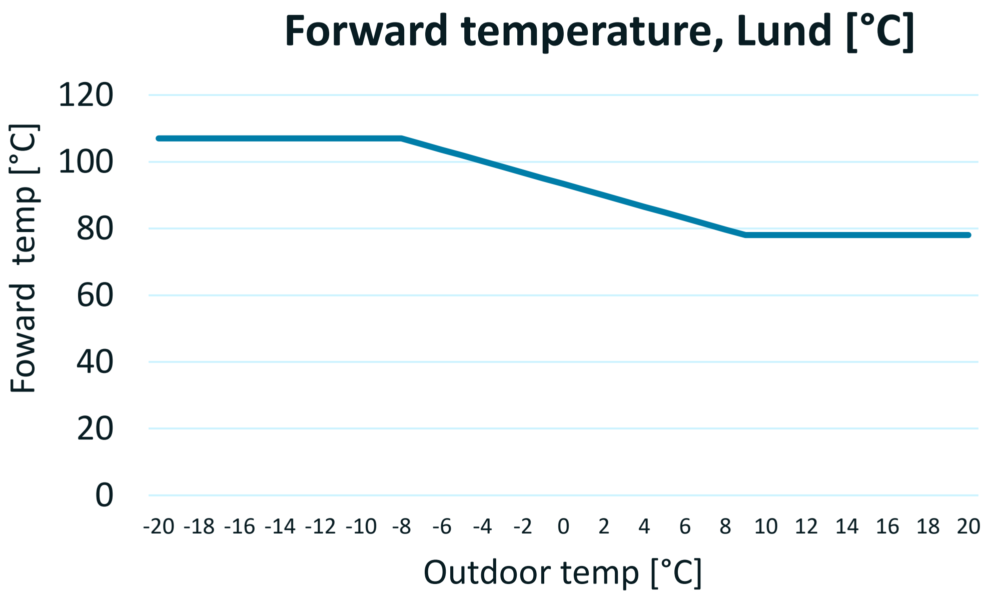
Kraftringens' DH-grid

- 3^{rd} generation DH
- Total length of grid: 1 050 Km
  - 50 000 households
- Annual heat delivery: 1 100 GWh/year
  - Örtofta 500 GWh/year
  - CHP: 150 GWh electricity
  - 100% renewable production
- Heat losses grid: 8-15%

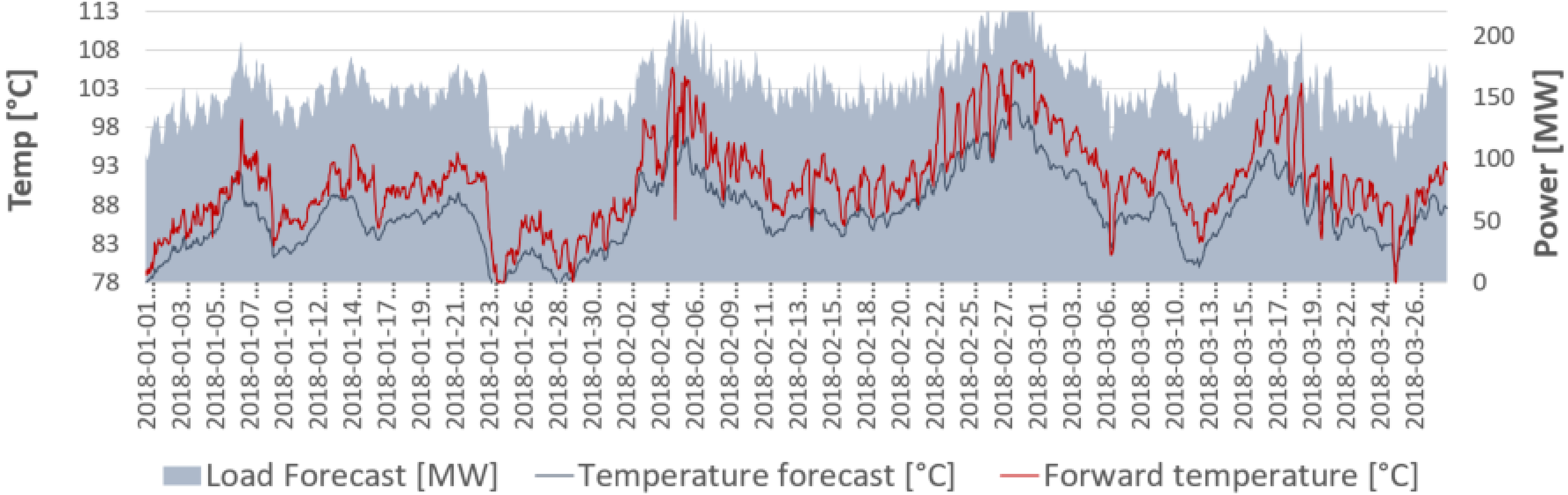


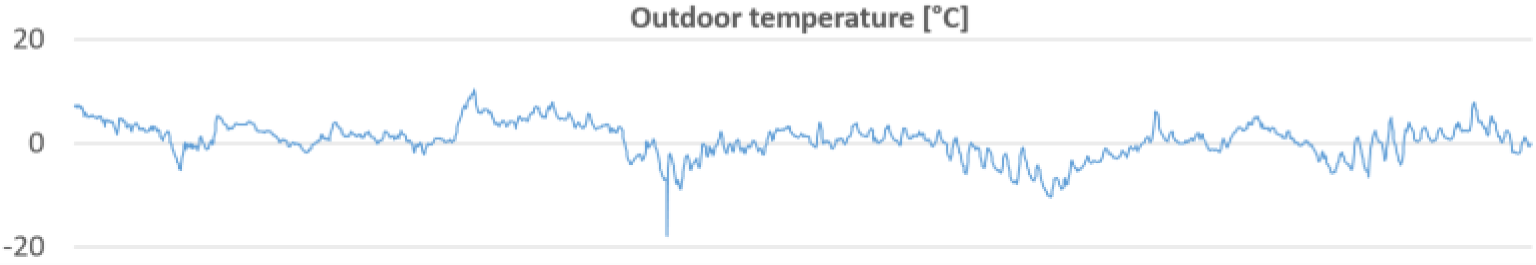
Existing grid temperature control

- Based on a static outdoor temperature curve
- No feedback from the grid
- Large safety margins



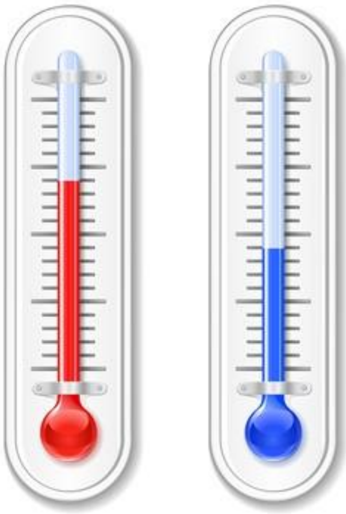
Existing grid temperature control





Why a lower grid temperature?

- Reduced heat losses
- Increased efficiency in steam and flue gas condenser
- Increased utilization of waste heat
- Economic and environmental savings
  - 100 000 Euro/year/1 °C reduction



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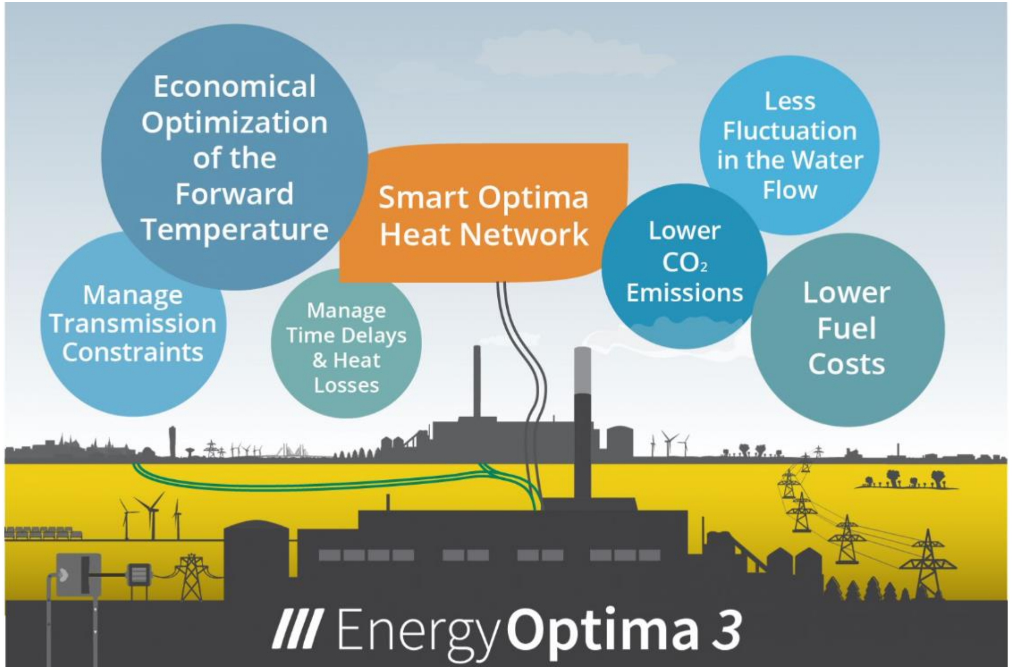
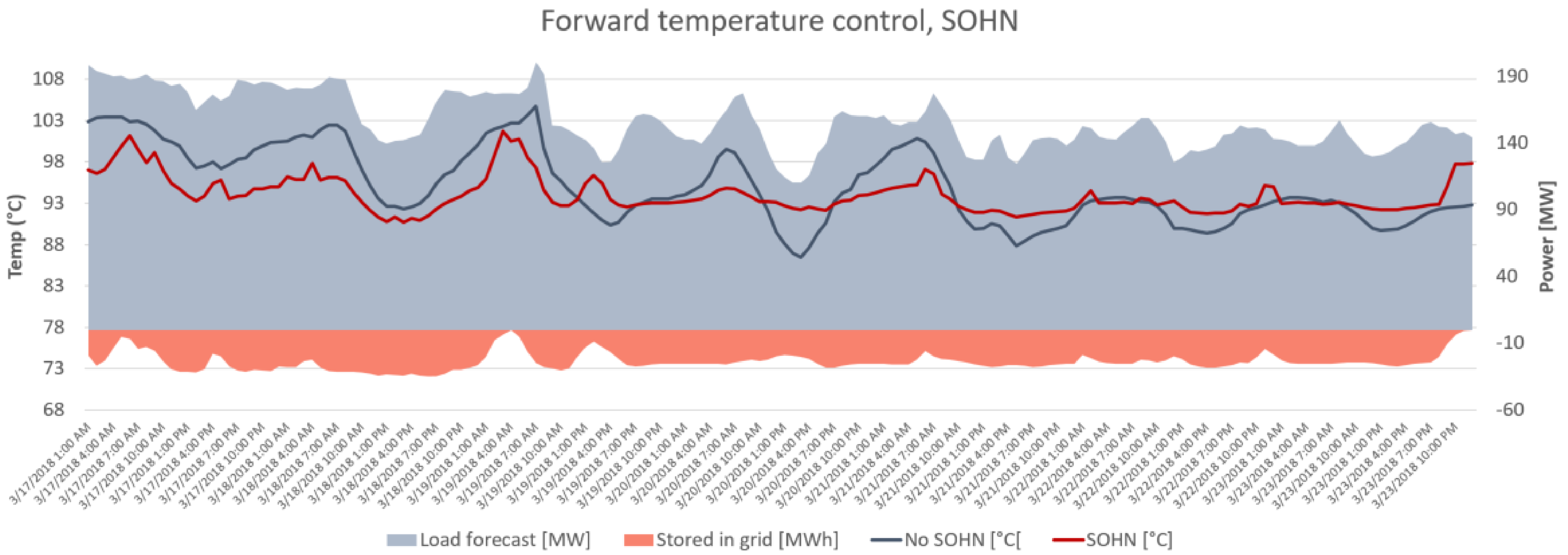
Securing a lower grid temperature

- Increased digitalisation
  - Feedback from grid
  - Weather forecasts
  - Time delay
  - Supply-thresholds
  - Improved production planning
  - Improved grid knowledge



Securing a lower grid temperature



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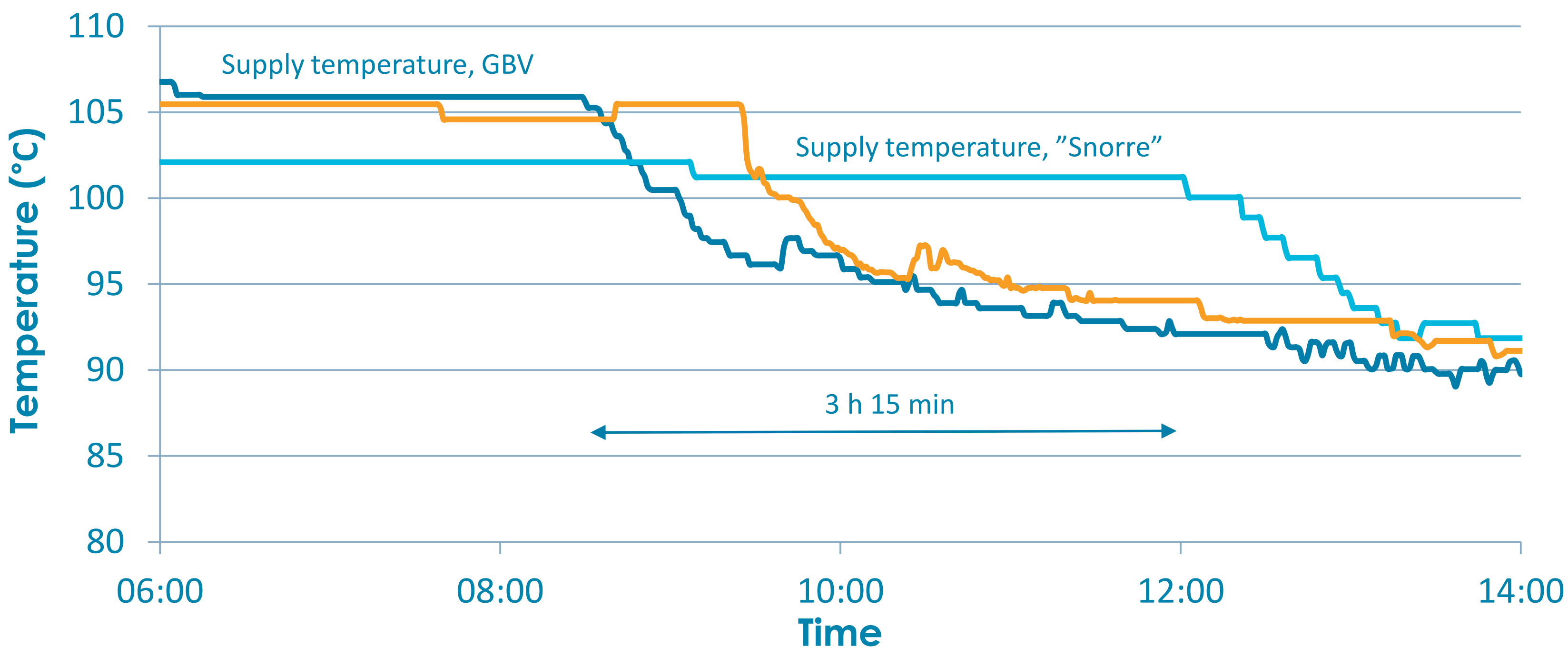
Time delay in the grid



Pilot study

- Based on historical data (7 weeks)
- Hydraulic simulations to identify:
  - Critical points
  - Critical flow
- Limits in transmission pipes
- Three scenarios were evaluated:
  - Restrictive, *±5 °C, 80°C, -20%,*
  - Restrictive but reasonable, *±8 °C, 78°C, -10%,*
  - Theoretical optimal, *±10, 78°C, 0%*

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Pilot study – results

- Three different scenarios
- Five parameters

	El-buy [EUR]	El-sell [EUR]	Other exp. [EUR]	Fuel-cost. [EUR]	Fuel-tax [EUR]	Saving/ 7W* [EUR]	**Saving/year* [EUR]**
Restrictive *±5 °C, 80°C, -20%,*	-1 100	42 400	- 8 800	6 300	- 13 000	25 800	**103 100**
Restrictive but reasonable *±8 °C, 78°C, -10%,*	5 300	14 300	- 4 000	29 100	1 300	45 900	**183 500**
Theoretical optimal *±10, 78°C, 0%*	8 100	24 400	- 1 900	26 200	2 700	59 500	**238 000**

**Increased turbine efficiency not included*

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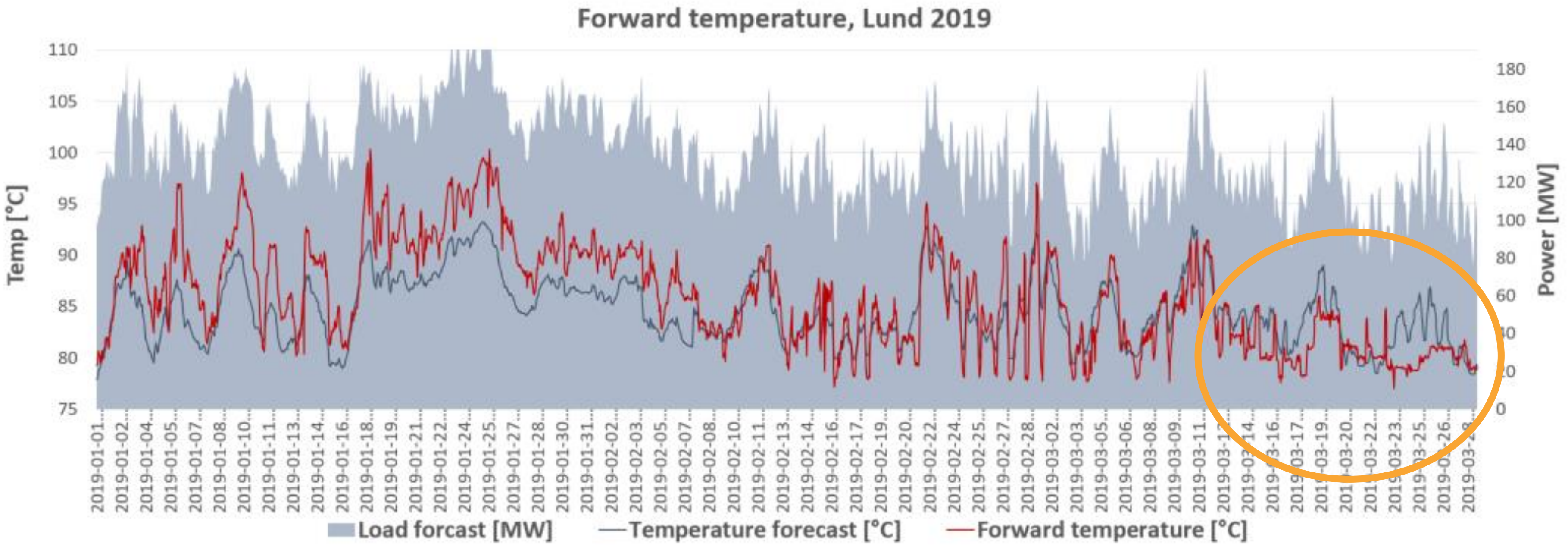
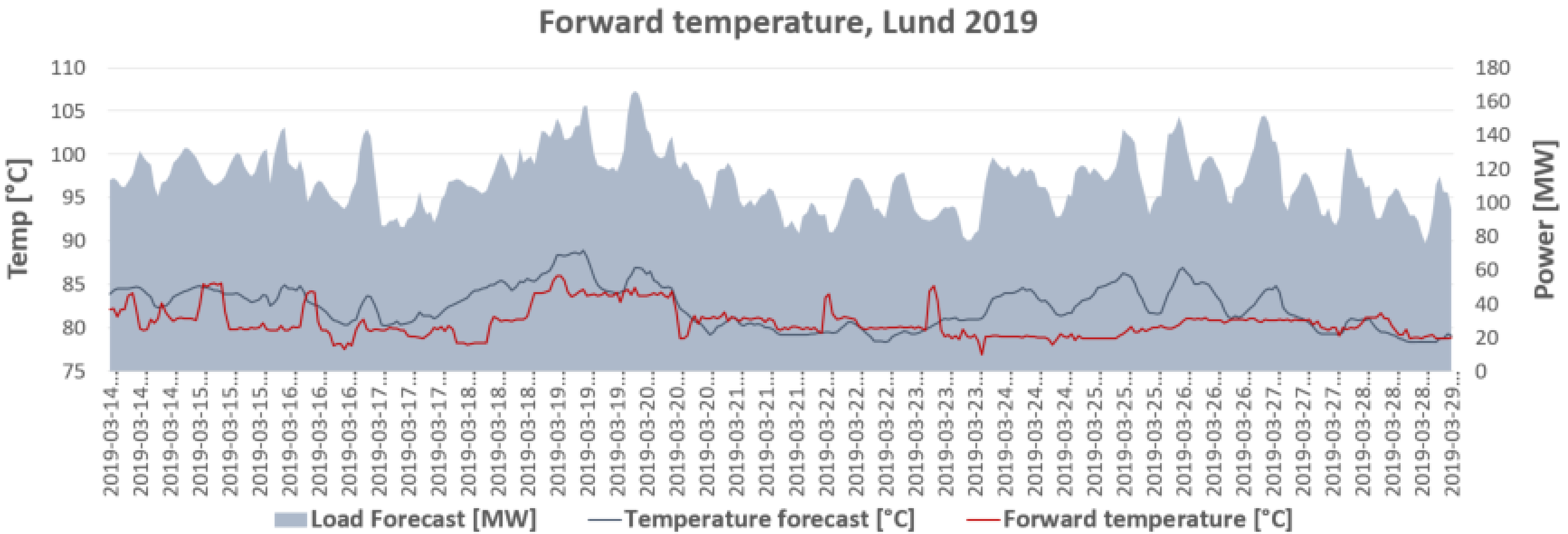
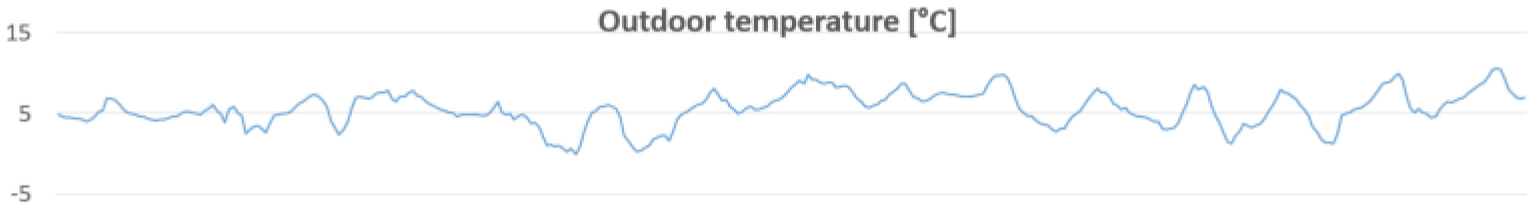
Evaluation of installation



Evaluation of installation





Conclusion and future possibilities

- Conclusion of digitalization:
  - Increased grid knowledge
  - Reduced grid temperature
  - Proactive instead of reactive measures
  - Economic and environmental benefits
- Future scenario
  - Feedback from costumers
  - Improved load forecasting
  - Complex, big data filtration
  - Peak shaving in the grid

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Thank you for your attention!

Any questions or remarks?

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