How integrated energy systems can form part of an industrial strategy?

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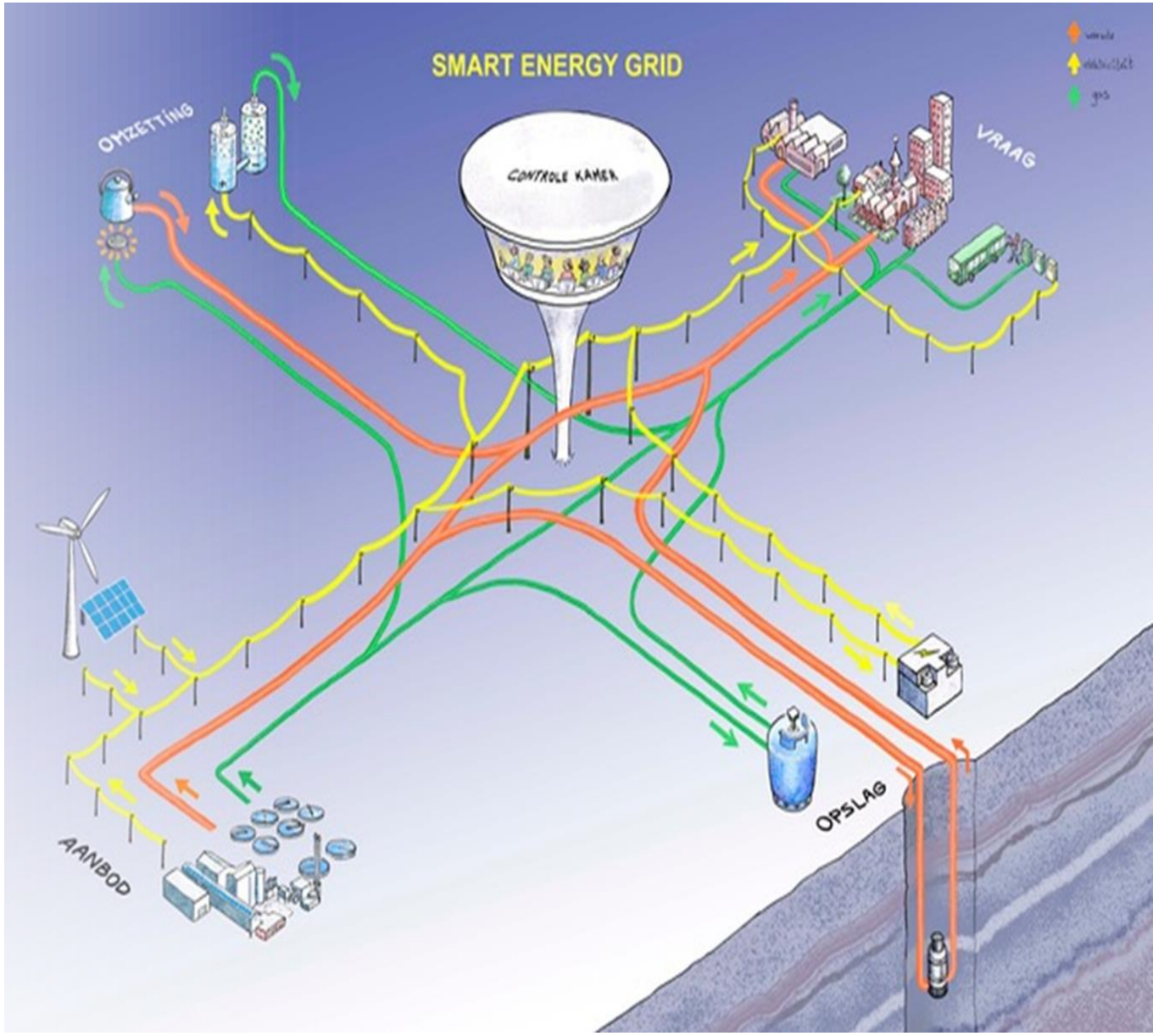
Energy Systems Integration,

University of Twente



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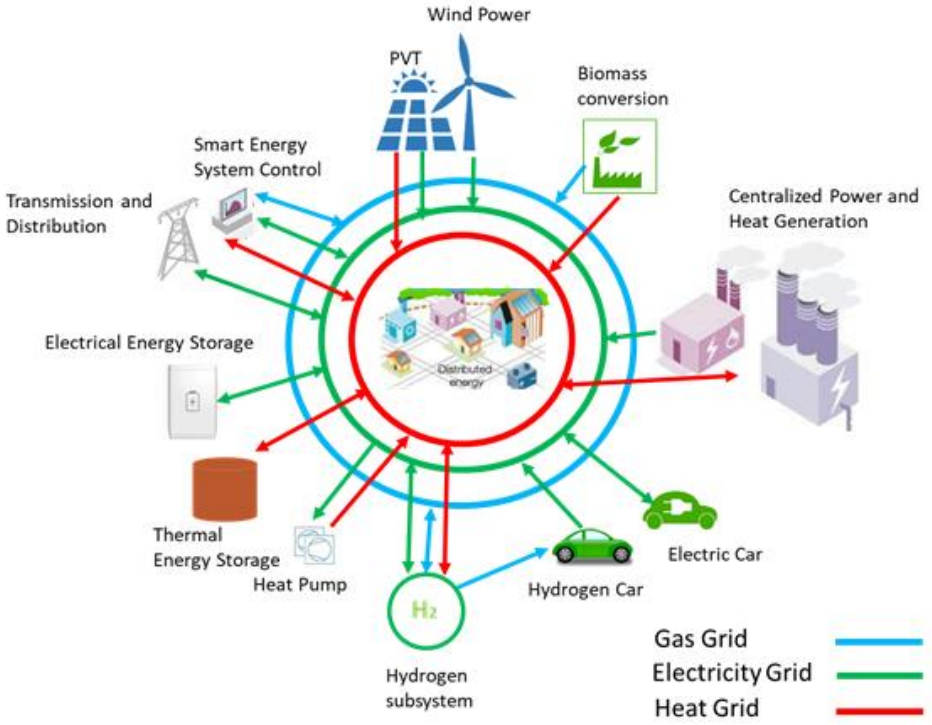
Energy Systems Integration



- What new and innovative energy technologies need to be encouraged?
- What is the optimized format of the future integrated energy systems?
- How integrated energy systems can form part of an industrial and transport strategy?

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ARN (an incineration power plant)

Europese Unie

OPoost operationeel programma oost

Europees Fonds voor Regionale Ontwikkeling

Heat waste

Biogas available

Heat/ Electricity/ Hydrogen

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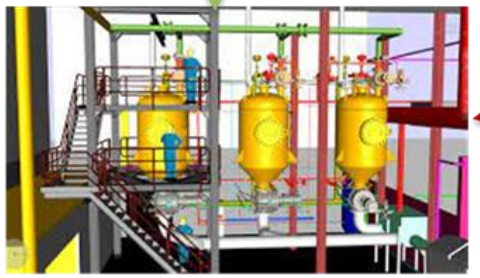
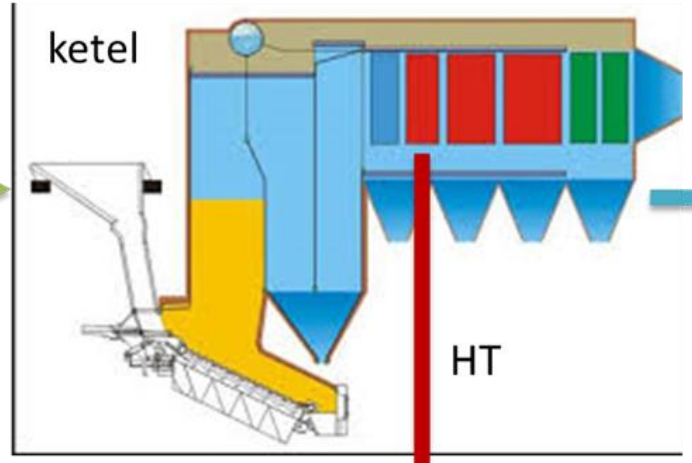
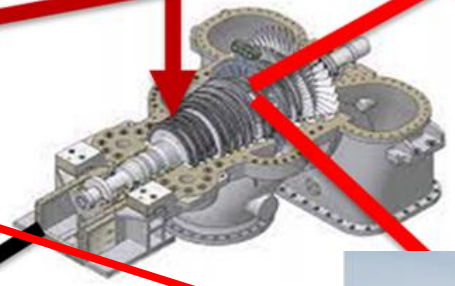
Electricity and Heat production

afval



conversie





turbine E/W

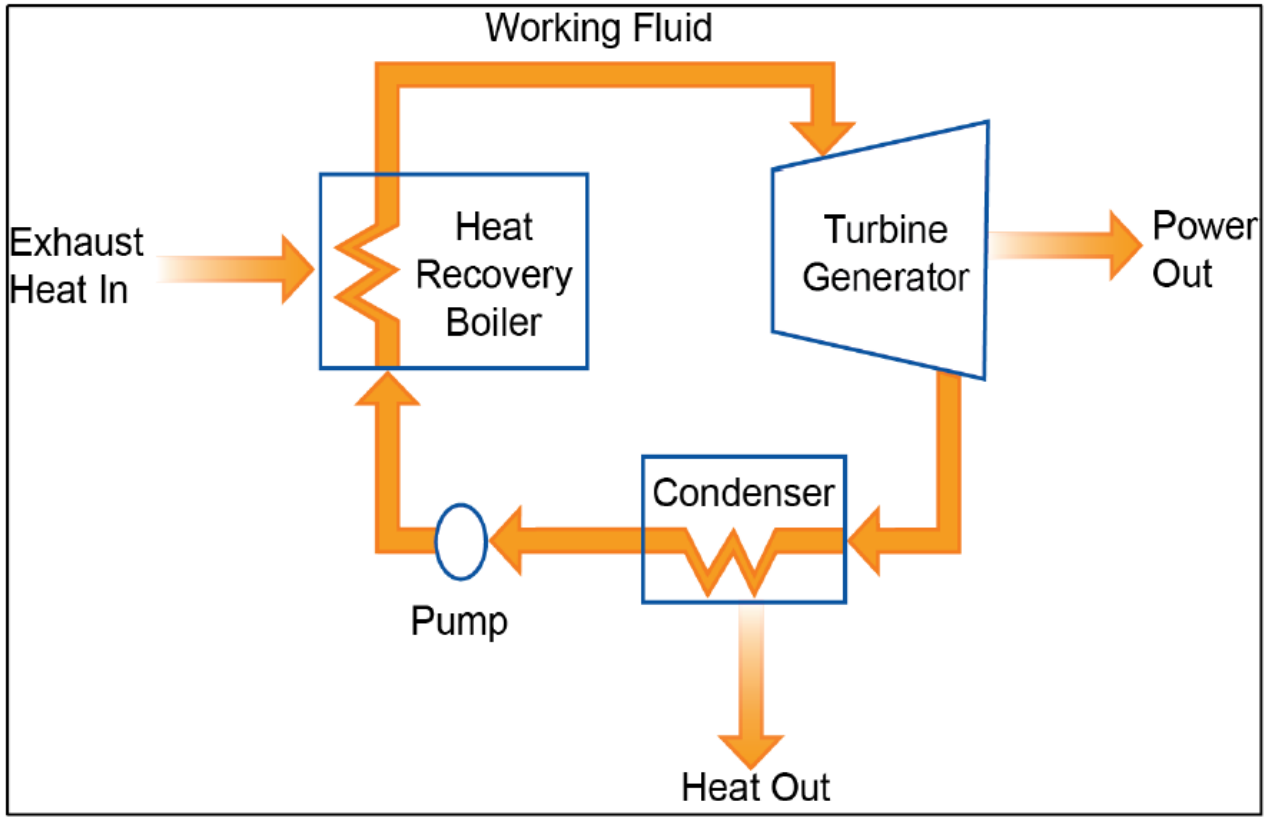
elektriciteit

MT

LT

warmtenet

Electricity and Heat production



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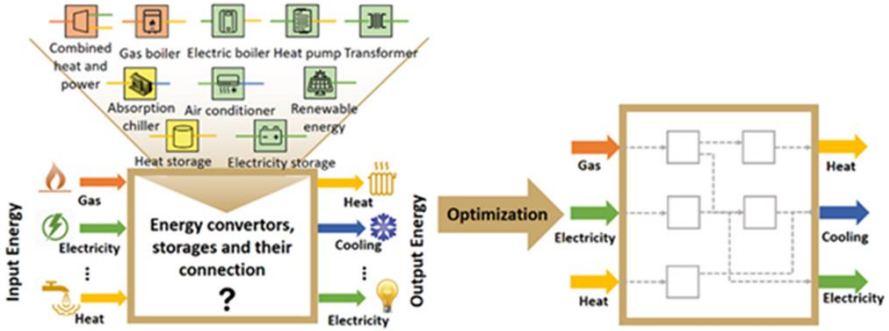
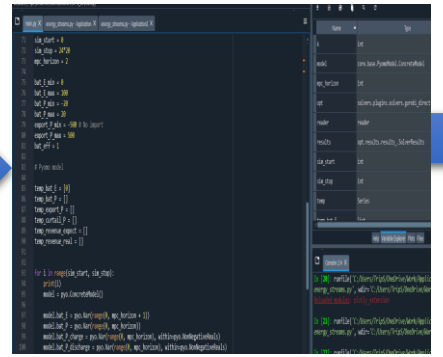
Approach

Analyze current system

Possible new components

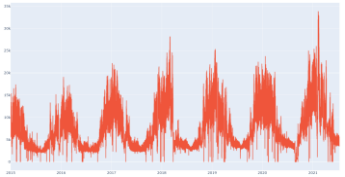


Python



- Optimal configuration
- Sensitivity analysis
- Usage of components
- Estimated profit
- Other KPIs

Future scenarios (e.g. ETM)



- Model (dynamics)
- Parameters of components
- Objective
- Constraints

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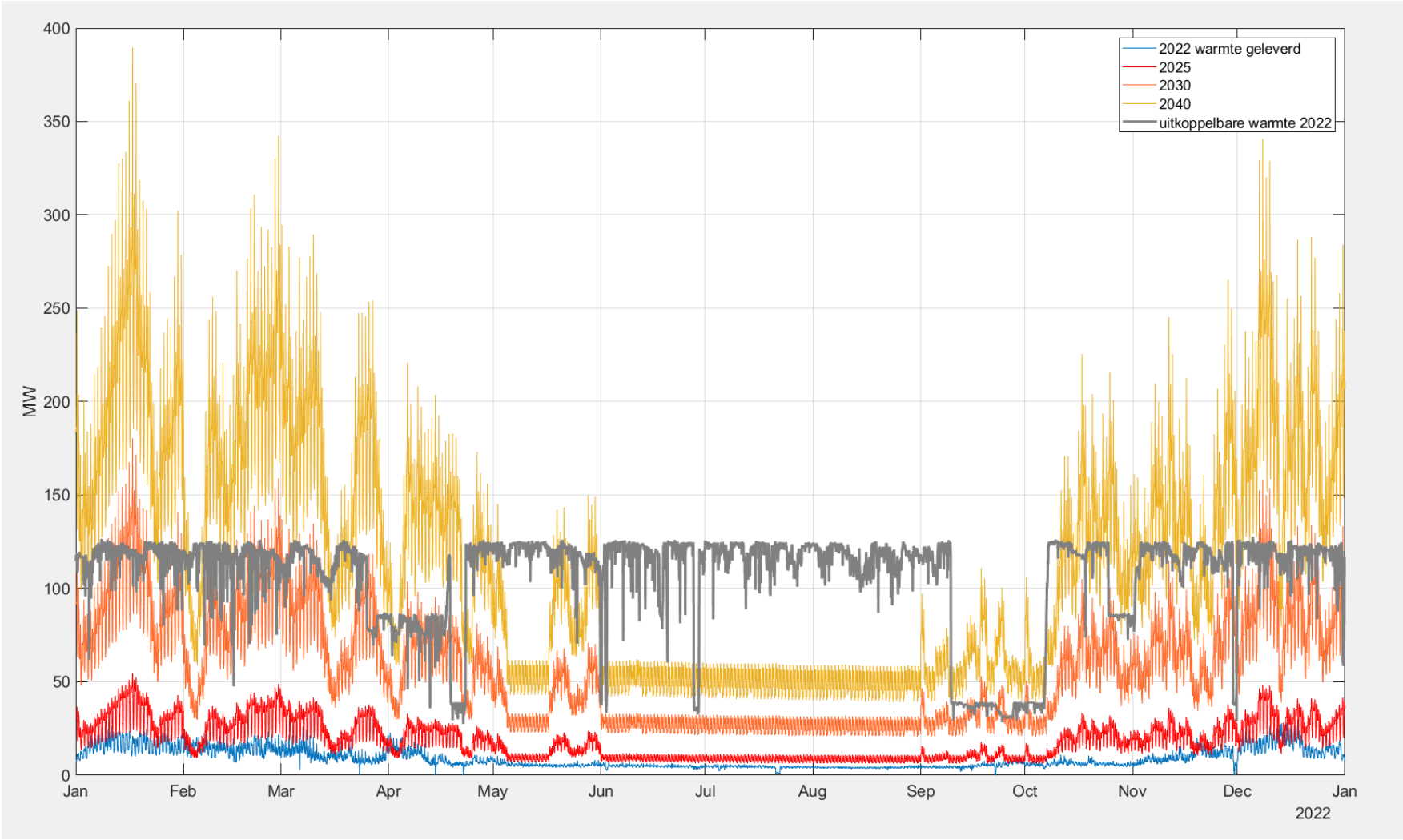
Short, Mid and Long-term scenarios

1. Given Priority to savings
2. Given Priority to district heating and cooling including the utilisation of waste heat from processes either internally or for district heating
3. Given Priority to heat pumps for remaining space heat demands



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if Technology Creating energy

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Technologies and criteria

- Heat Pump
- E-boiler
- ARN CHP
- Flue gas
- Heat storage
- Flow battery (Elestor)
- Electrolyzers (PEM & SOEC)

Criteria

- Efficiency
- Cost of the components
- Price of the electricity

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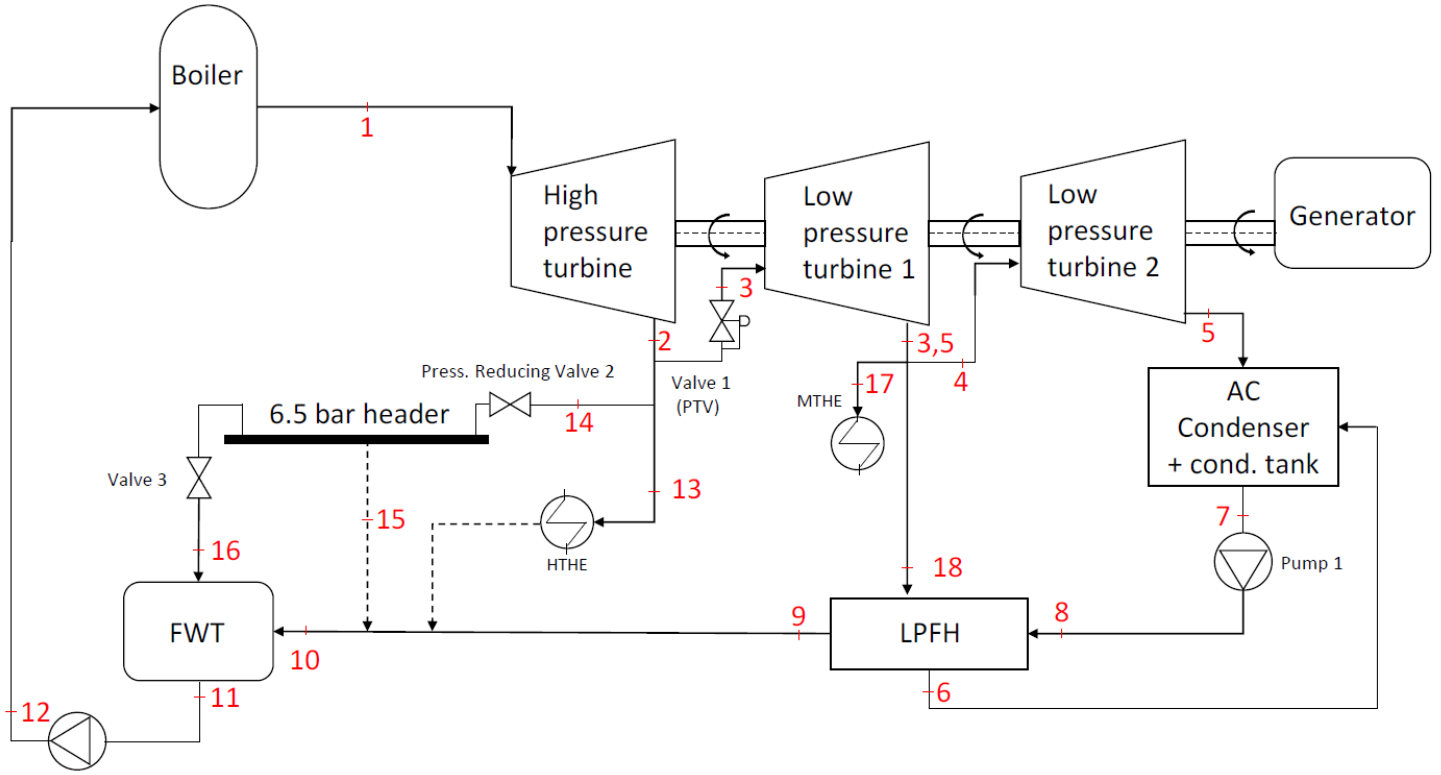
Component level: Incineration plant

- Relation between electricity and heat production?
- Influence of steam extraction?



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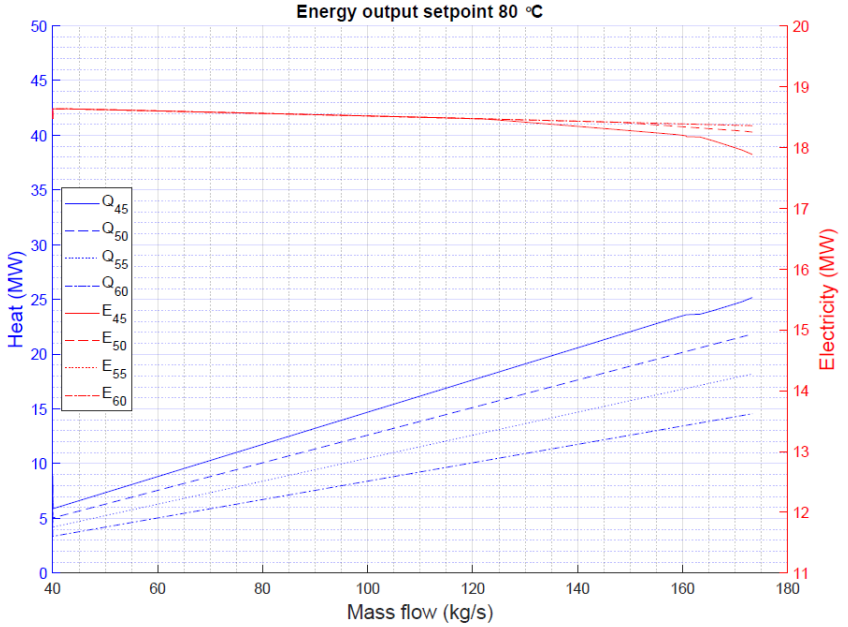
Incineration plant (work Remco Tak)

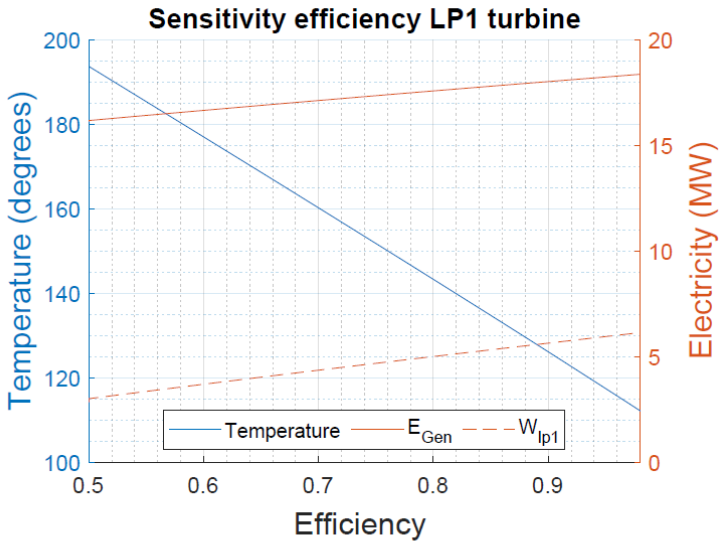
First turbine

- High impact on electricity production
- Controlled extraction
- More exergy available
- Pressure drop 2nd extraction significant

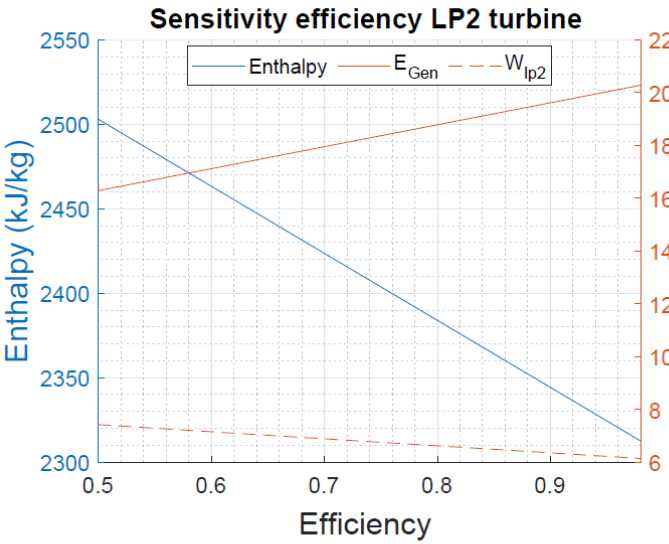


Second turbine

- Low impact on electricity production
- Pressure drop less significant
- Less exergy available



(a) LP turbine part 1



(b) LP turbine part 2

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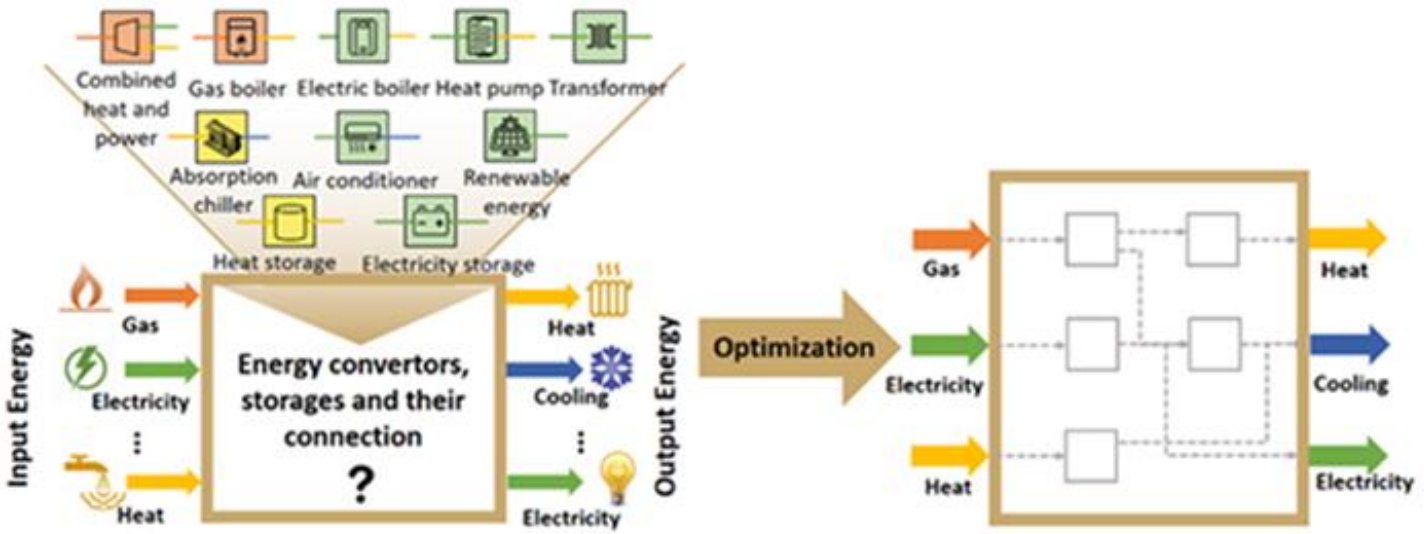
Energy level



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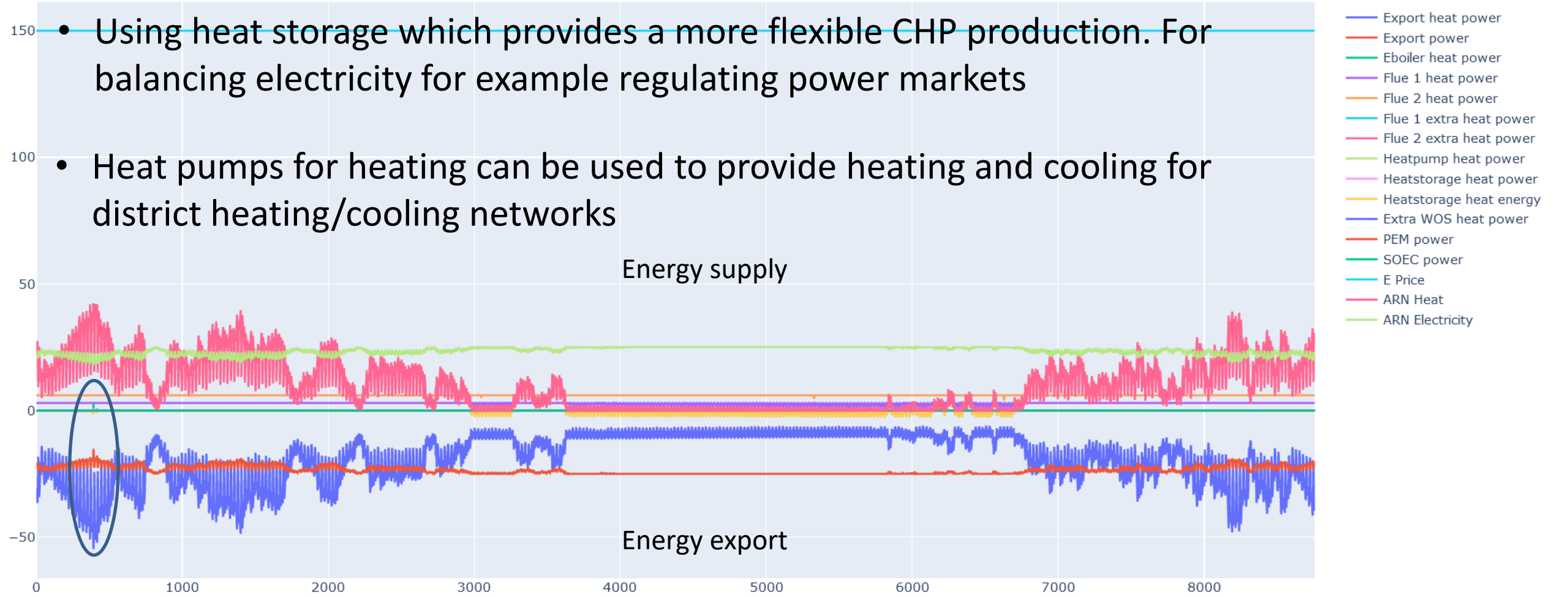
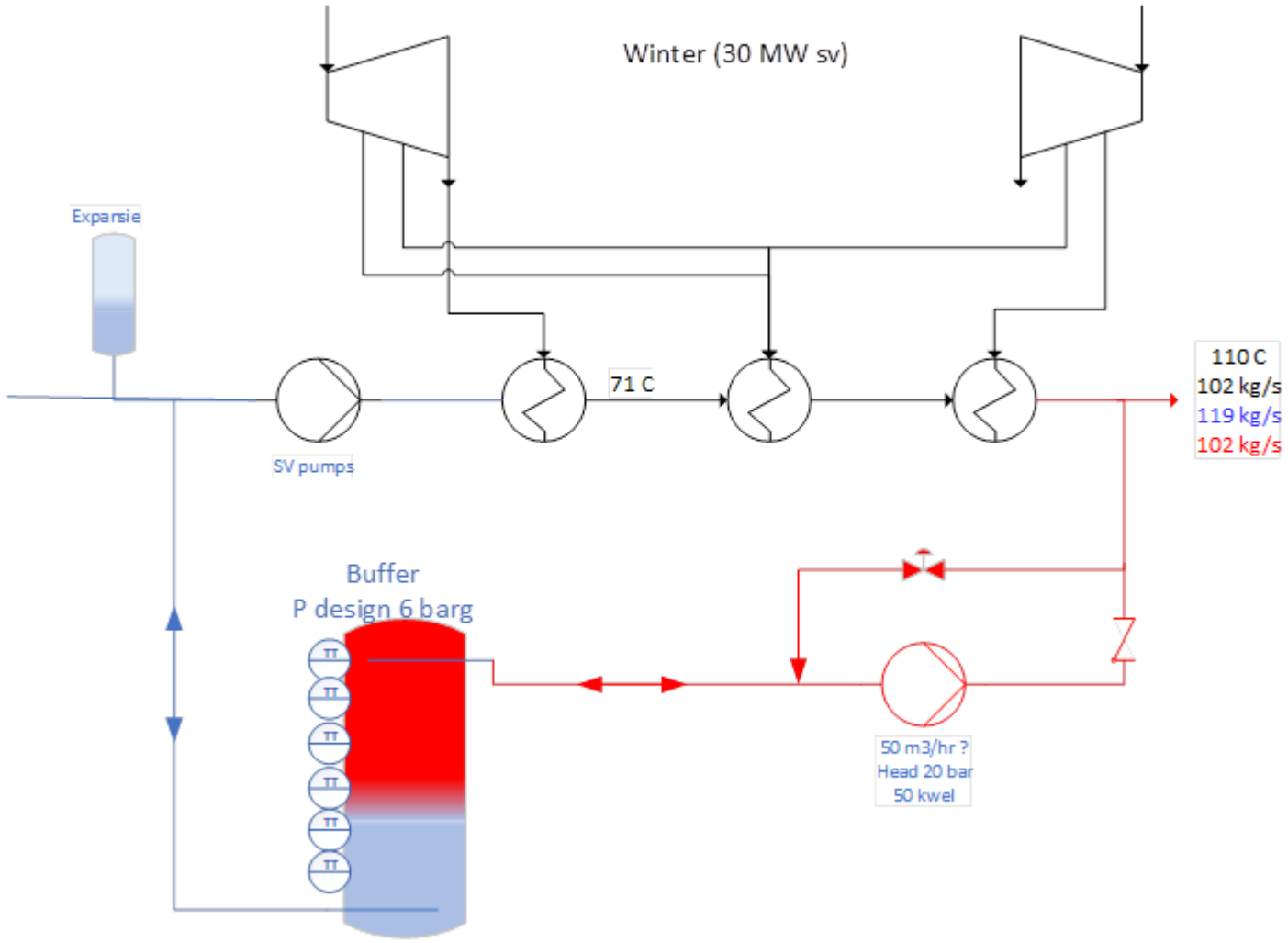
2025

- Heat supply is increased by 90% with efficient heat recovery (steam, flue gas, e-boiler and heat storage)
- H2 production will be feasible if the price of electricity is 80 EUR /MW.
- Using heat storage which provides a more flexible CHP production. For balancing electricity for example regulating power markets
- Heat pumps for heating can be used to provide heating and cooling for district heating/cooling networks



Heat buffer



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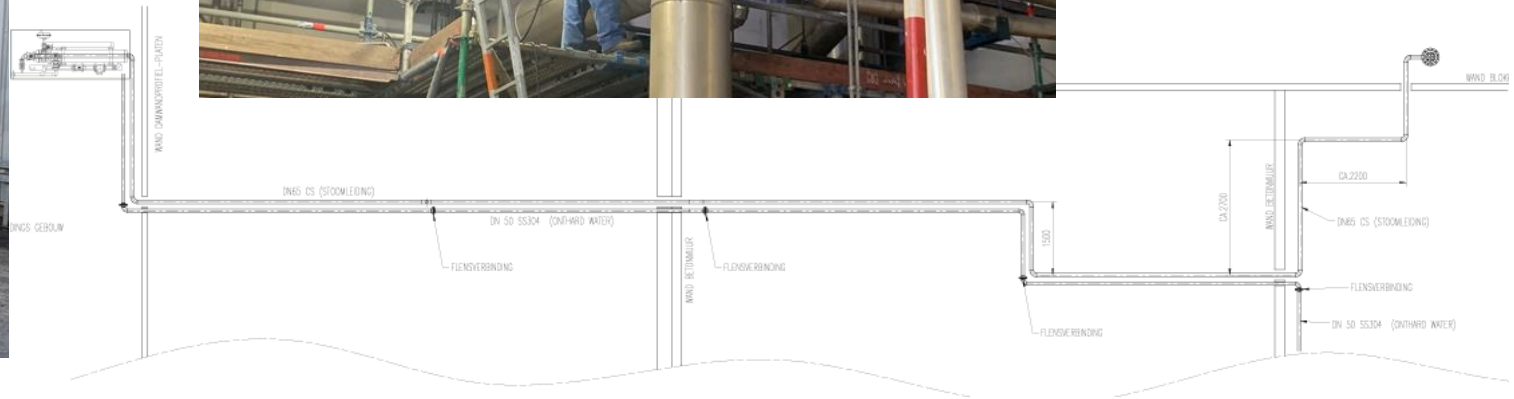
Pilot project hot water buffer



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Hydrogen production in ARN plant

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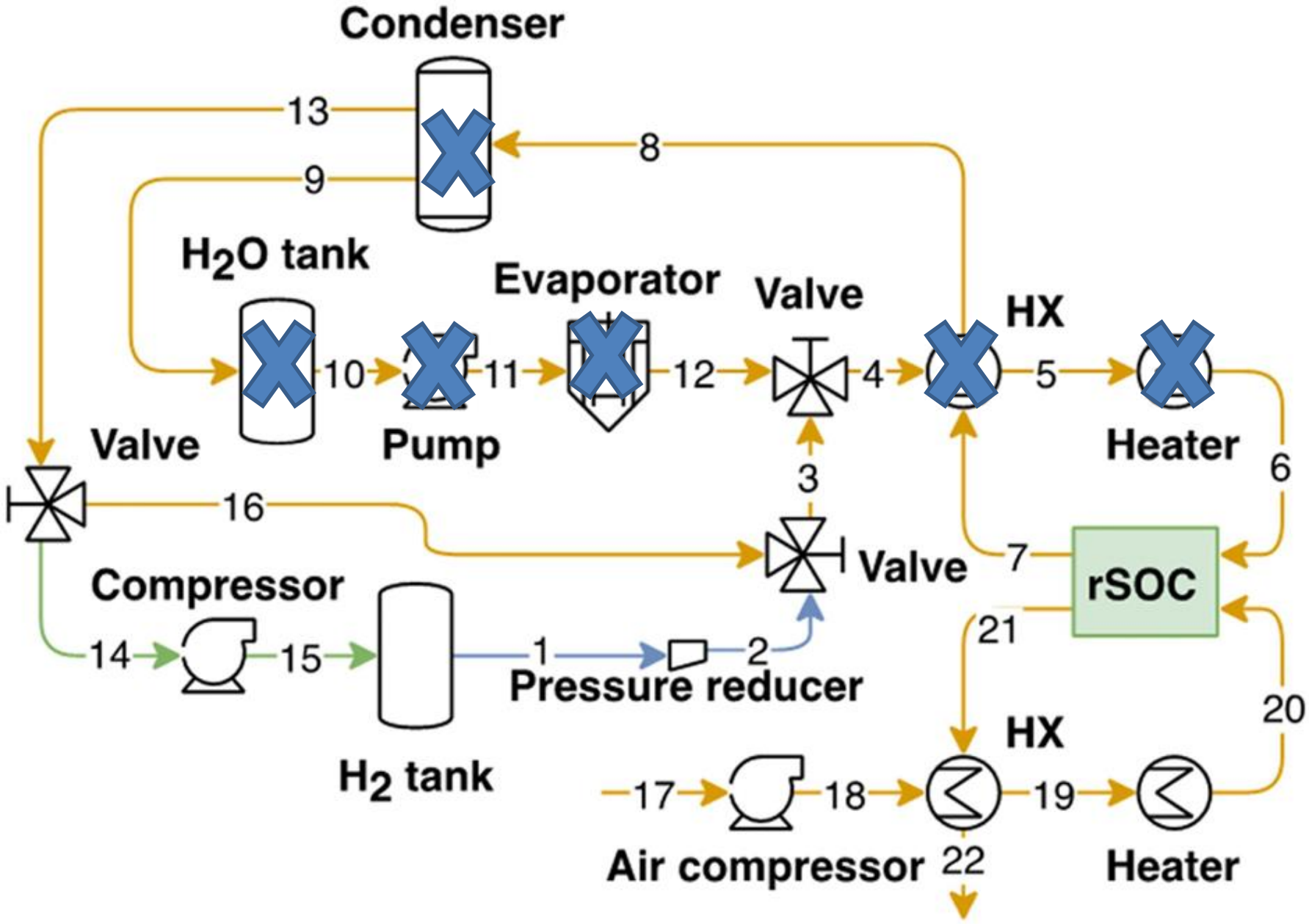
rSOC and BoP connected to ARN plant



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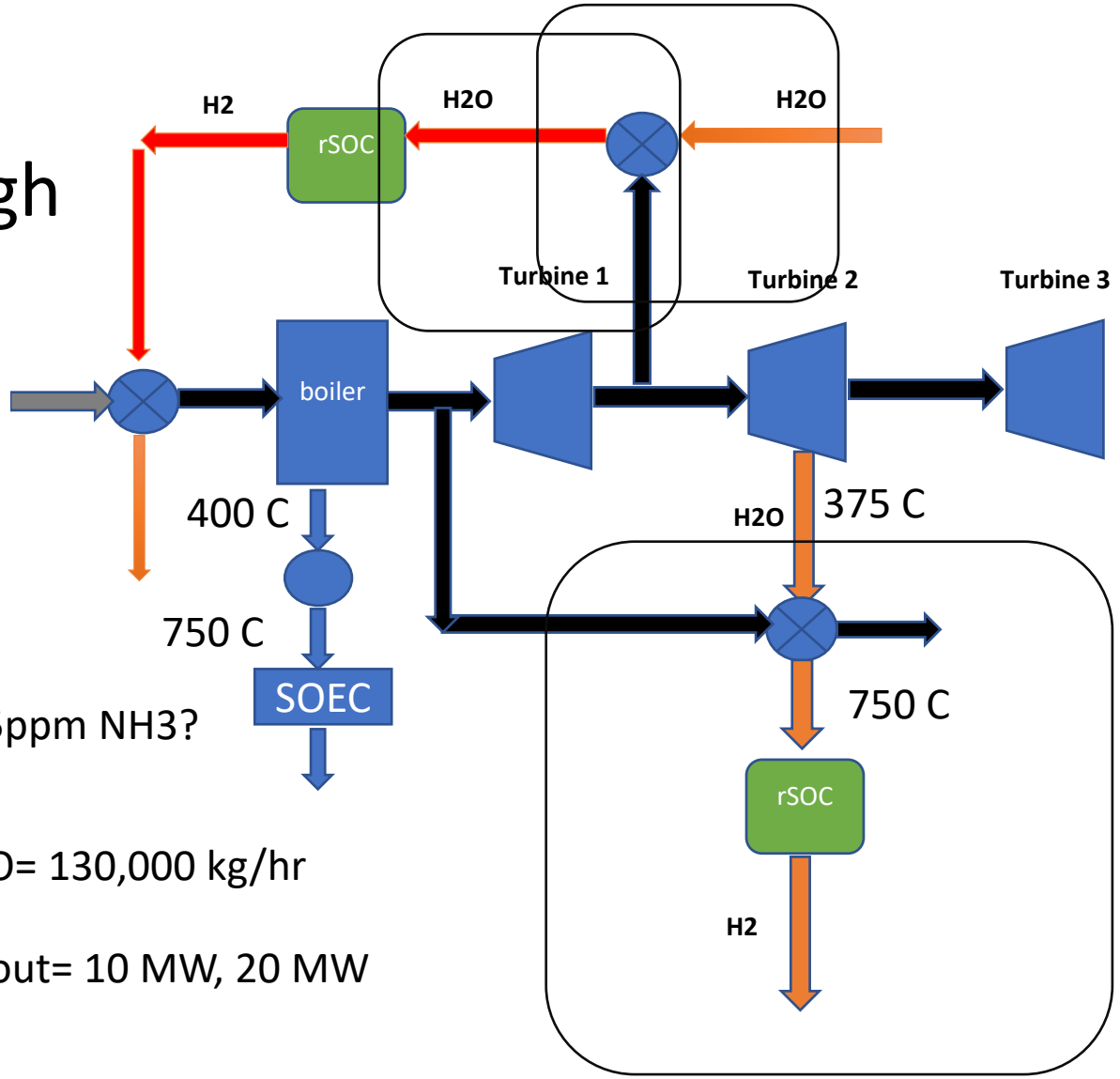
rSOC integrated with ARN plant

- High temperature high pressure Steam
- syngas



H2O= 130,000 kg/hr

P_out= 10 MW, 20 MW

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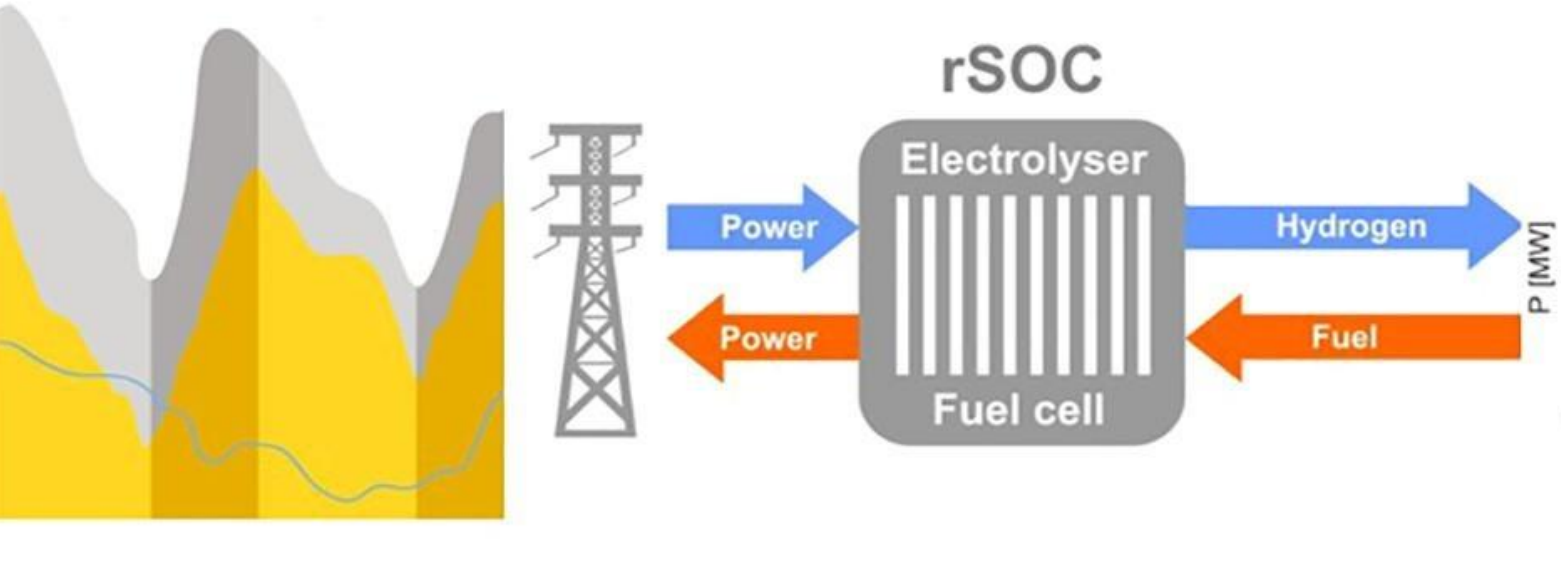
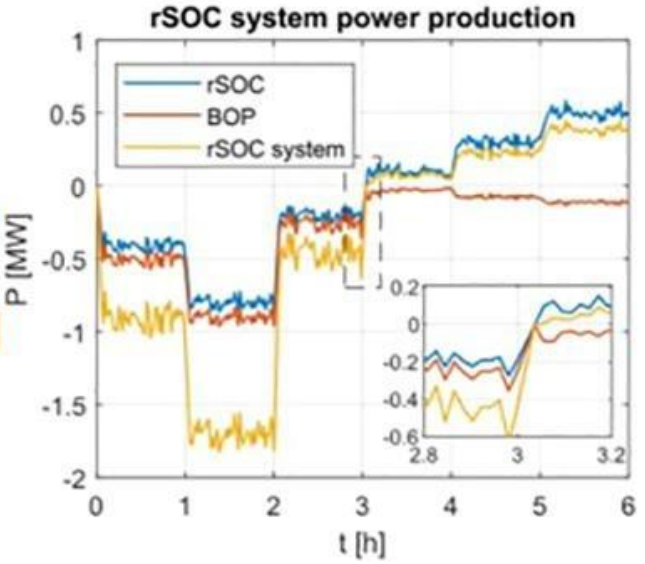
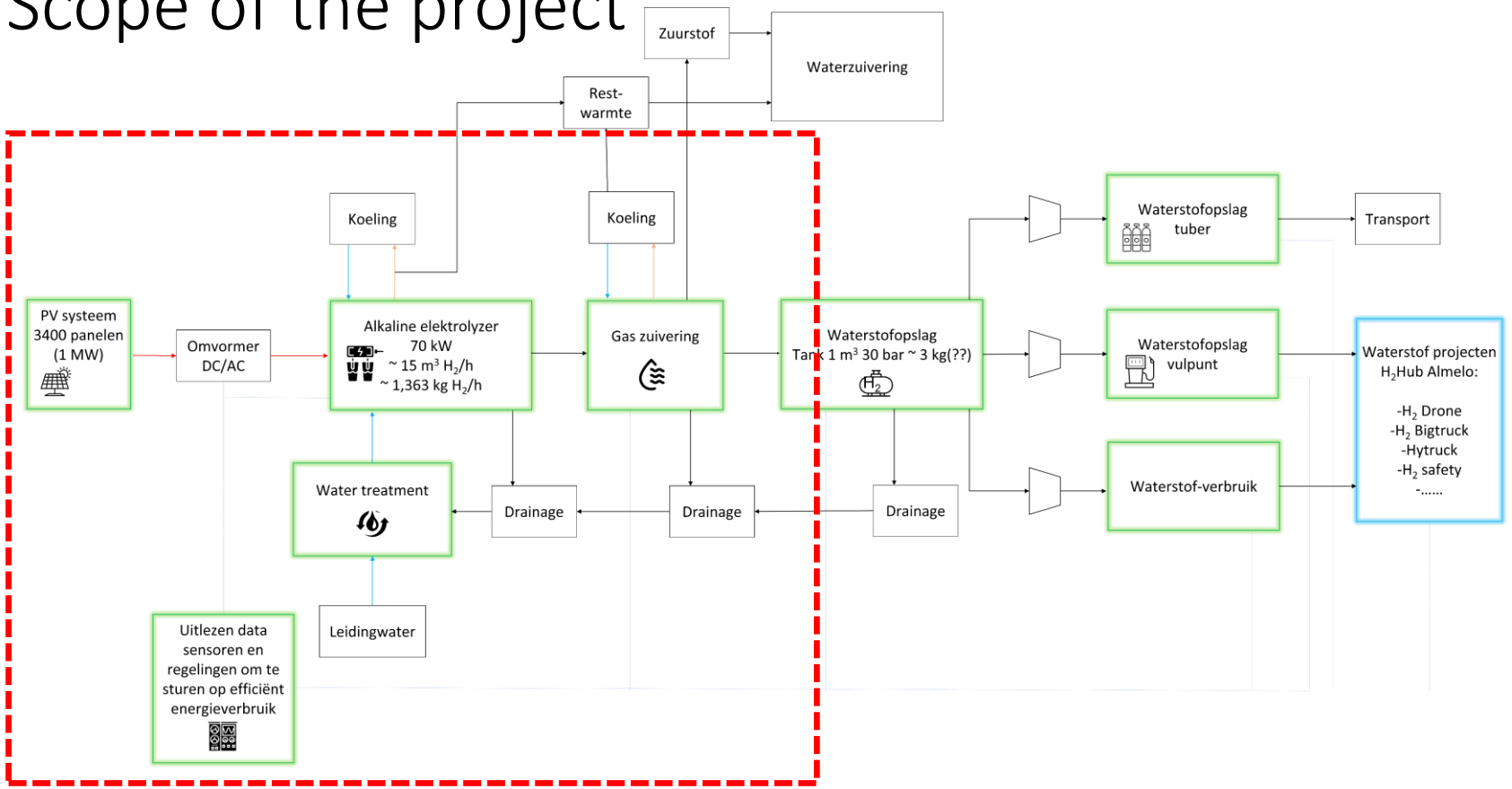
rSOC for grid balancing at System level





Hygenesys- Learning Community

Scope of the project



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Thank you

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