

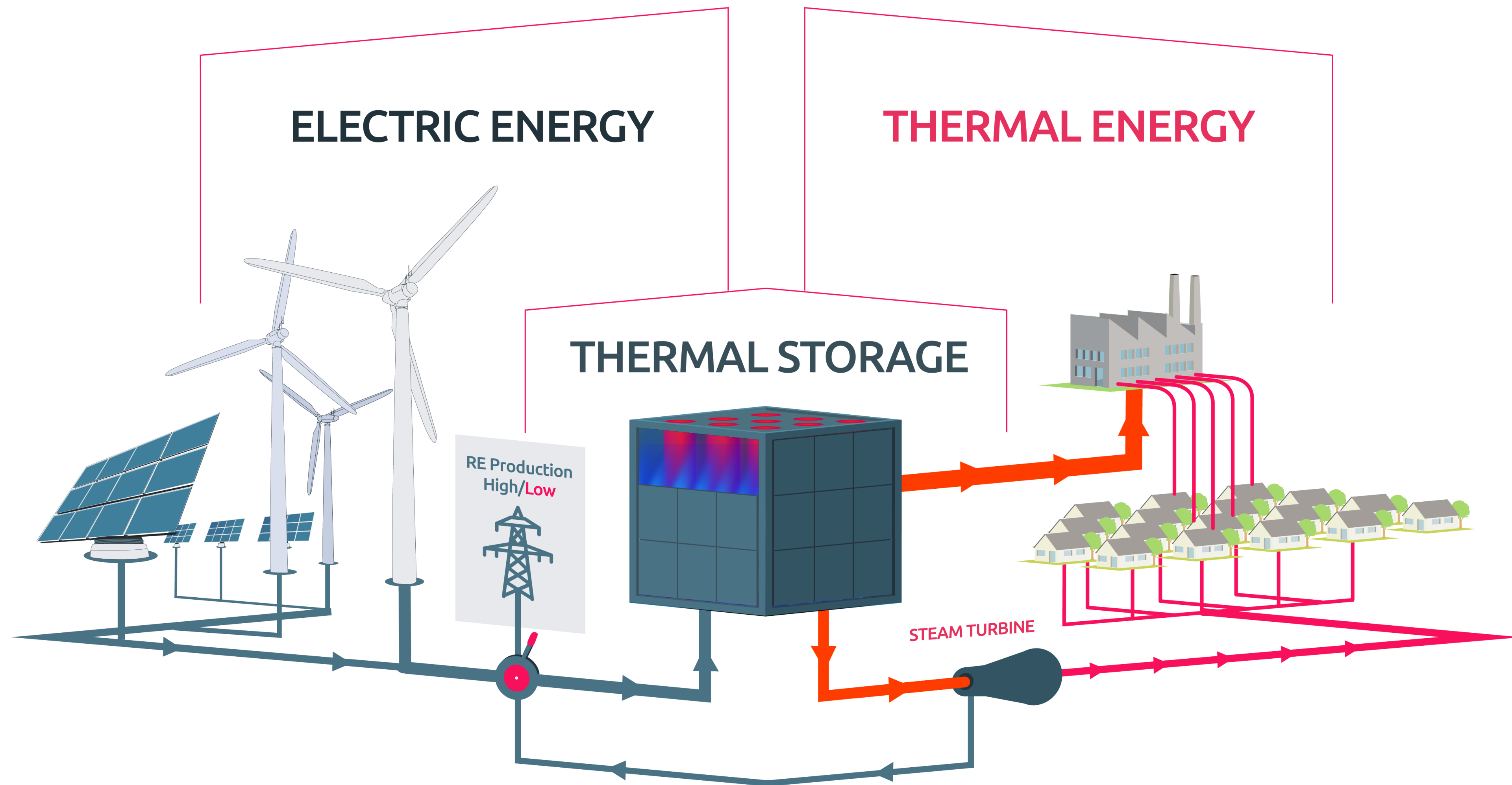


**CO₂-FREE
PROCESS HEAT
FOR OUR INDUSTRIES**

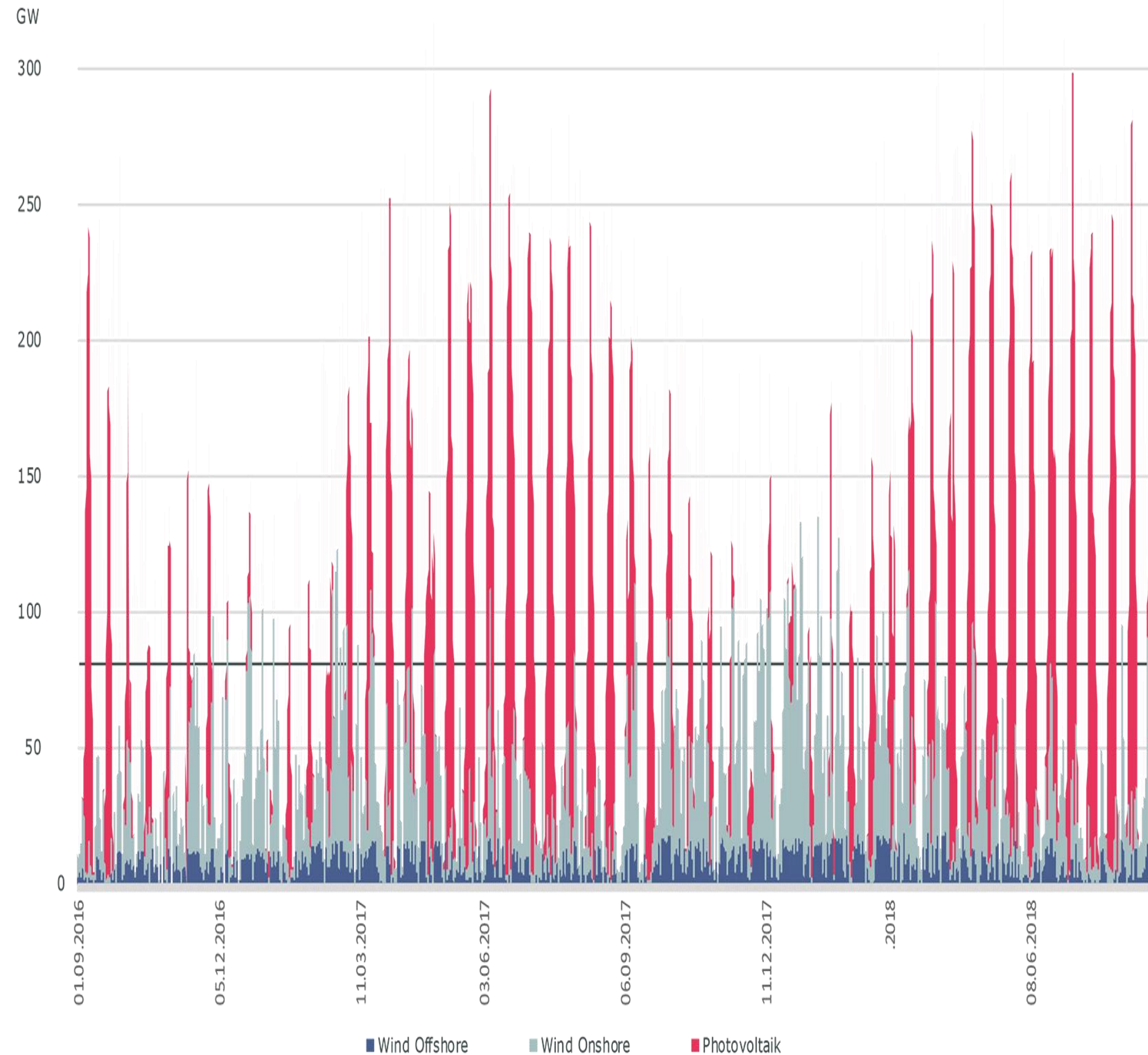


LUMEN N

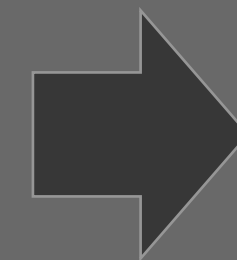
THE CLOSEST LINK BETWEEN RENEWABLES AND PROCESS HEAT



VECTOR COUPLING AT SOURCE



- Electricity network „relief value“
- Reduced connection costs



LUMENION STORE / HEAT NETWORK

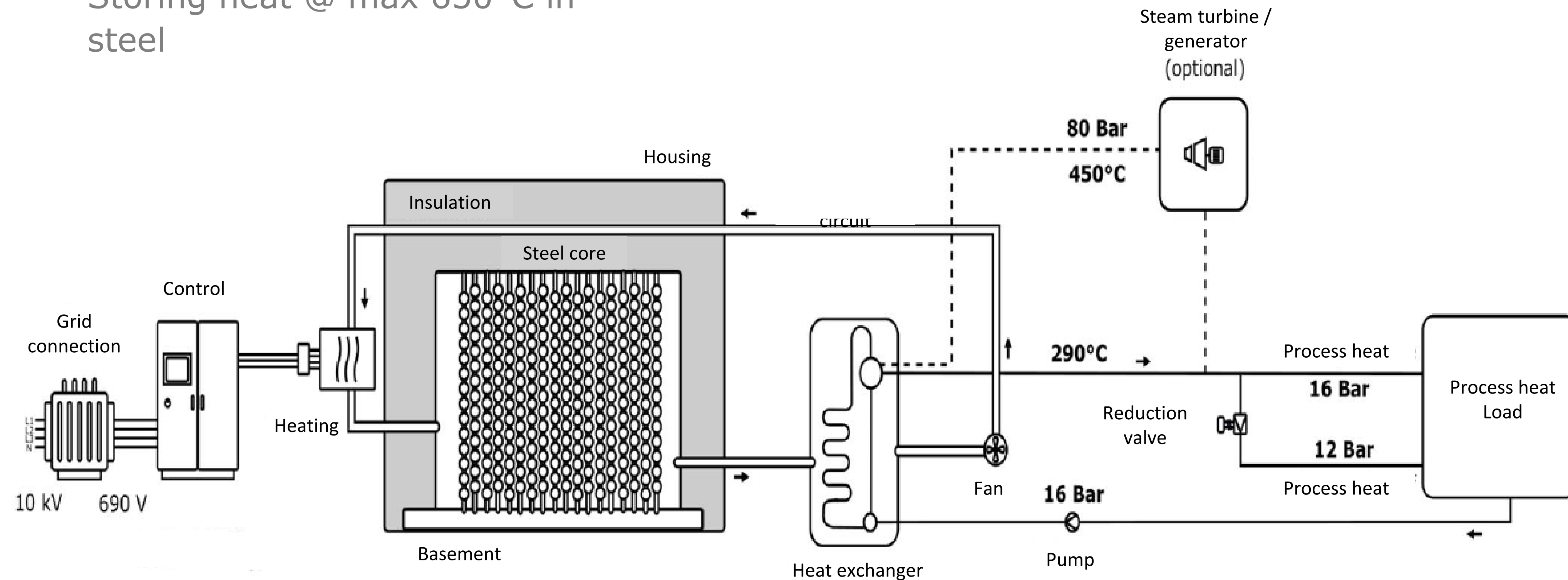


ELECTRICITY NETWORK

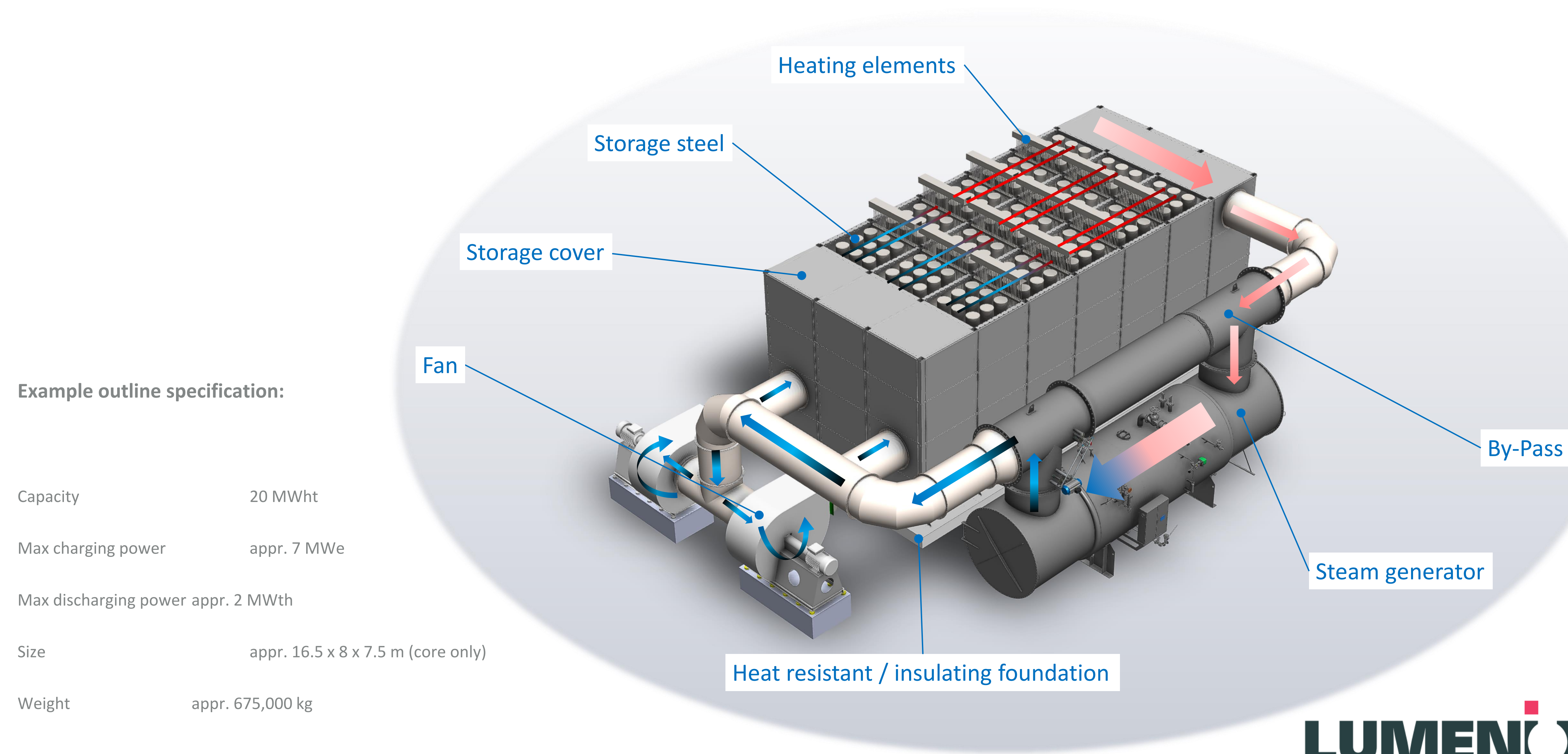
- More connections per network capacity

FUNCTIONAL SCHEME

- Charged flexibly with electricity
- Charging power 3 – 5x discharging power
- Storing heat @ max 650°C in steel
- Continuous provision of thermal energy @ 80-500°C
- Potential to generate electricity via steam turbine gen-set



WORKING PRINCIPLE AND MAJOR PARTS



Example outline specification:

Capacity	20 MWht
Max charging power	appr. 7 MWe
Max discharging power	appr. 2 MWth
Size	appr. 16.5 x 8 x 7.5 m (core only)
Weight	appr. 675,000 kg

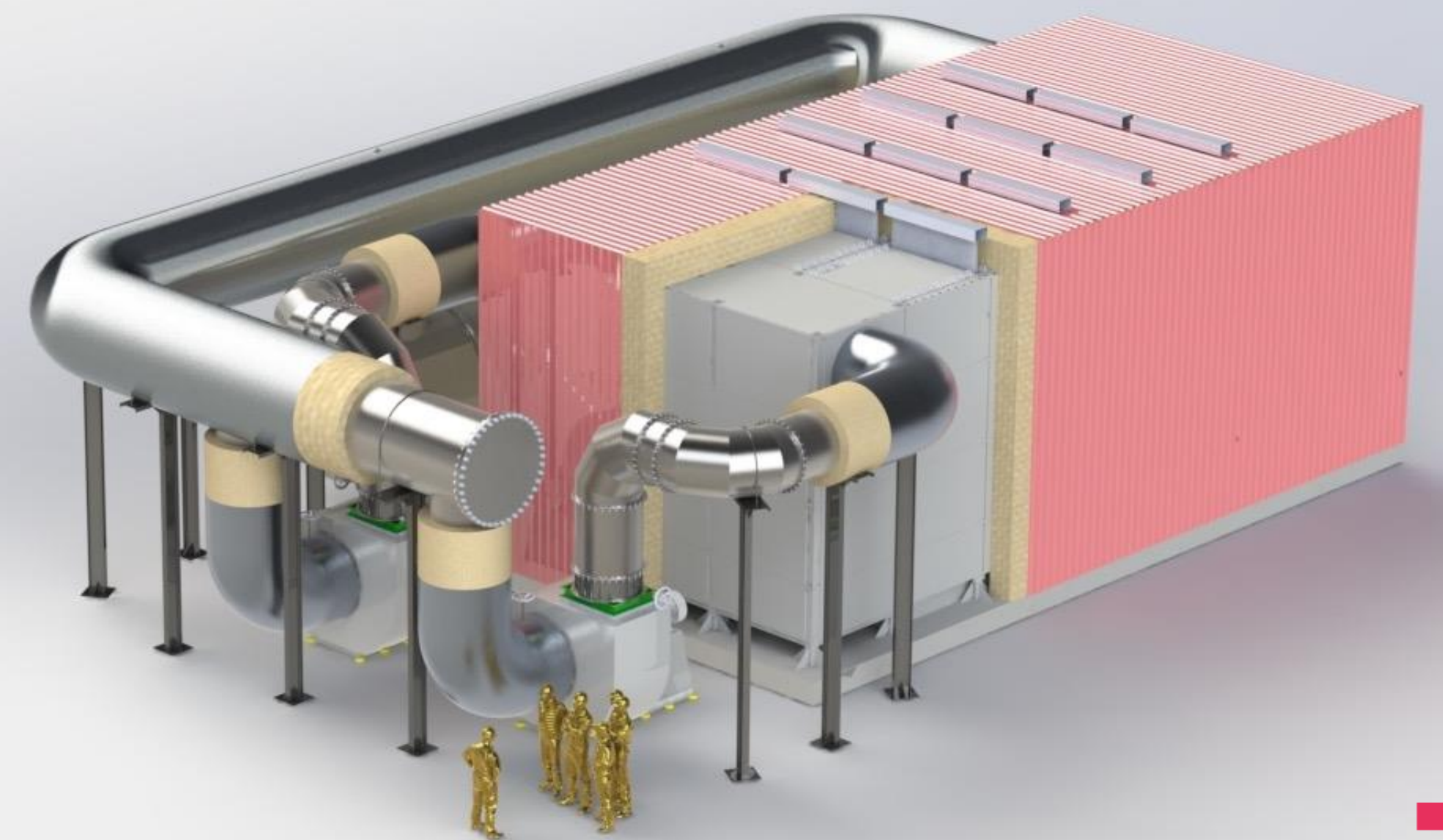


PROCESSING PLANT FOR ORGANIC FROZEN VEGETABLES IN SCHLESWIG HOLSTEIN GERMANY



20 MWh Capacity

→ 4 t/h steam @ 204 C / 16 bar



LUMENION

Orkney Islands



GREENING DISTILLERIES

- Turn otherwise curtailed wind energy (27 GWh p.a. on Orkney Islands) into CO₂-free steam (Replace diesel)
- Grant support for feasibility study at Highland Park Distillery from BEIS Greening Distilleries Competition





DE-CARBONISE & FLEX FOSSIL FUELLED POWER PLANT

**Paralleling of a CHP-plant and
LUMENION heat store**

- ❑ **Increase efficiency through peak shaving**
- ❑ **Fuel flexibility**
- ❑ **Extended balancing services**



KEY BENEFITS

- ✓ 90% energy efficiency → "The closest link...."
- ✓ High temperature heat up to 500°C
- ✓ High energy density / small footprint
- ✓ Rapid charging switch on and off times
- ✓ Purely resistive load
- ✓ Simultaneous charging and discharging
- ✓ Low technology risk
- ✓ No hazardous materials
- ✓ Superior system durability unaffected by cycling
- ✓ High residual value of steel modules
- ✓ Low CAPEX and OPEX
- ✓ Low life cycle costs
- ✓ Local value added, can be manufactured locally

MARKET SECTORS

POWER GENERATION

Wind and PV

- Reduce connection costs
- Avoid curtailment
- Higher infeed tariffs
- Support new installation now

Fossil fueled power plants

- Peak shaving
- Fuel flexibility
- Two way balancing services

Coal power plants

- The above
- Pre-heating after interruption of ops
- “Transitioning”

Offshore wind

- Onlanding substation

INDUSTRIES

Chemical

- Bio - Ethanol to Ethylene

Refineries

Food processing

Distilleries and breweries

Vegetable farming

Pulp & paper

Rubber & plastics

Print media

Hospitals

GREEN FUELS

Hydrogen

- Solid oxide electrolyzers
- UK Industrial Hydrogen Accelerator?

Black pellets, green coal

DISTRICT HEATING

AGGREGATORS

„Physical option“

NEXT STEPS

- Market assessment
- Identify early projects
- Identify project development partners
- Identify manufacturing partners
- Identify sourcing partners

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