Manufacturers and technology suppliers' vision

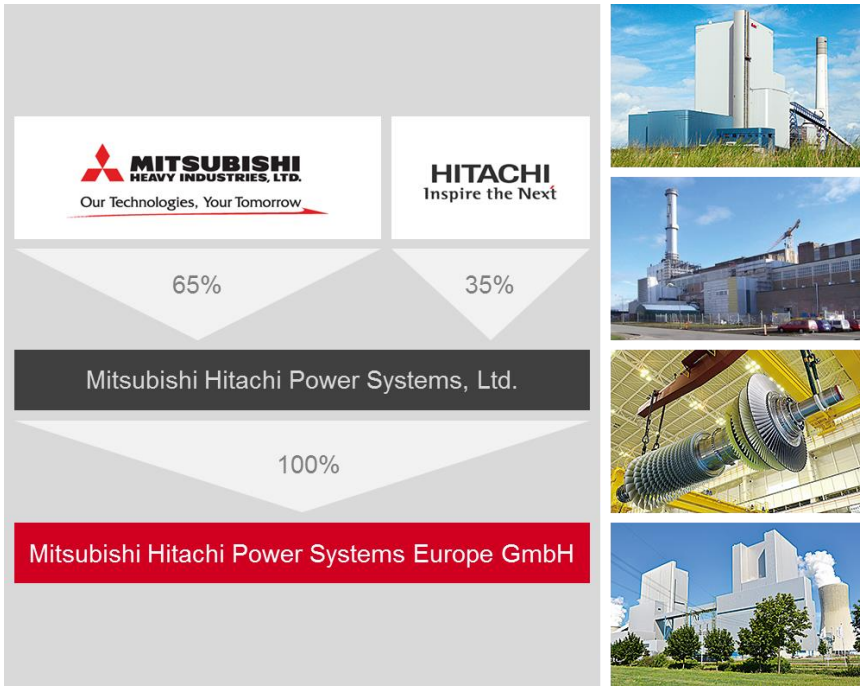
Workshop on experiences and conditions for successful implementation of storage, incl. cross-sectorial solutions

M.J. Duarte

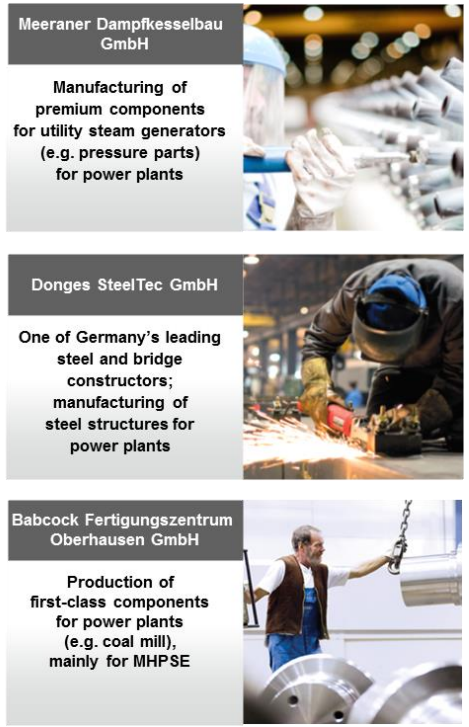
European Commission
Smart Grid Task Force
Brussels, Belgium - 1 July 2016

MITSUBISHI HITACHI POWER SYSTEMS EUROPE

Mitsubishi Hitachi Power Systems Europe
Group of companies



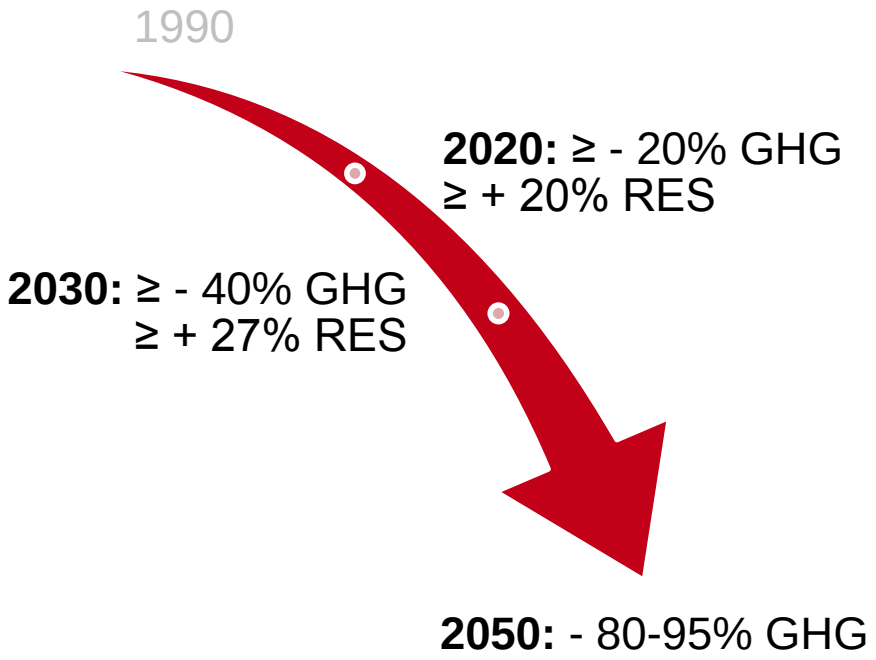
- **Mitsubishi Hitachi Power Systems Europe** (MHPSE) is a subsidiary of Mitsubishi Hitachi Power Systems, Ltd., and successor company of Hitachi Power Europe GmbH



- **Equity**: 154 Mio. EUR
- **Employees**: approx. 1,700 (Group)

Energy & Climate policy drivers

- **EU targets**



- **International dimension**

December 2015: global COP21 agreement adopted in Paris

Outcome: keep the increase in the global average temperature to well below 2 °C above pre-industrial levels

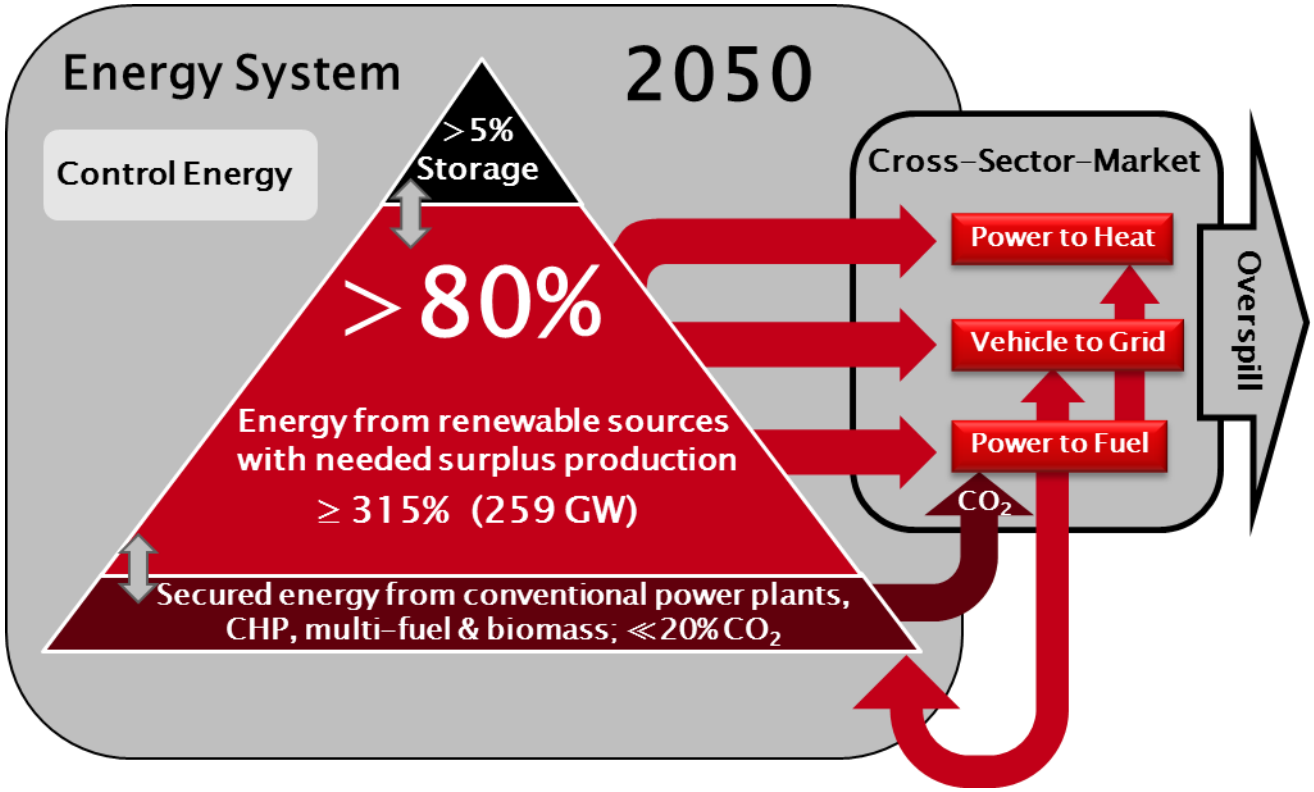
➡ Clear signals for investments in state-of-the-art low-carbon technologies

A changing Power Supply System

State 2050 (target)

- 100 GW max. load demand
- 383 GW available capacity
- 59 GW conventional
- 259 GW renewables
- 14 GW storage
- 39 GW cross sector
- 12 GW biomass

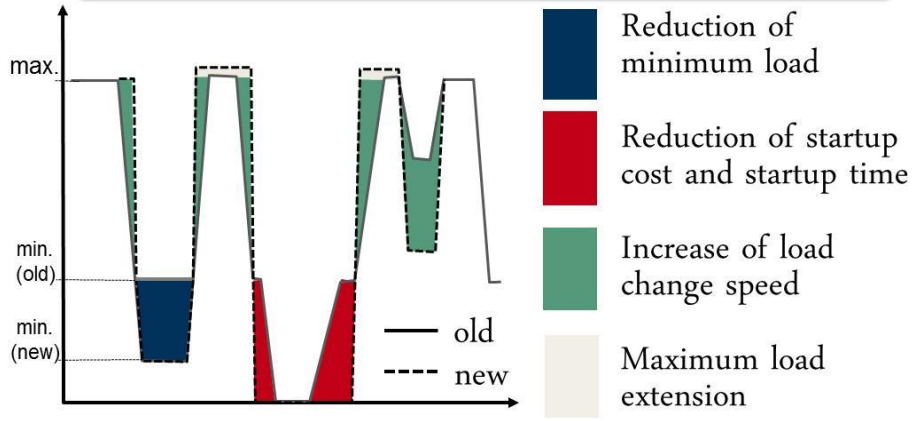
- Load demand is expected to slightly rise until 2050 (13 GW)
- Demand Side Management to be planned and operated by big consumers
- Conventional power plant fleet to decrease to 50%

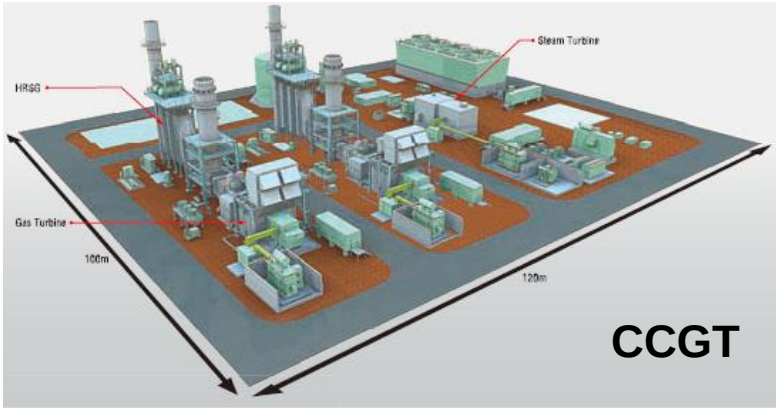


Electrification of Society

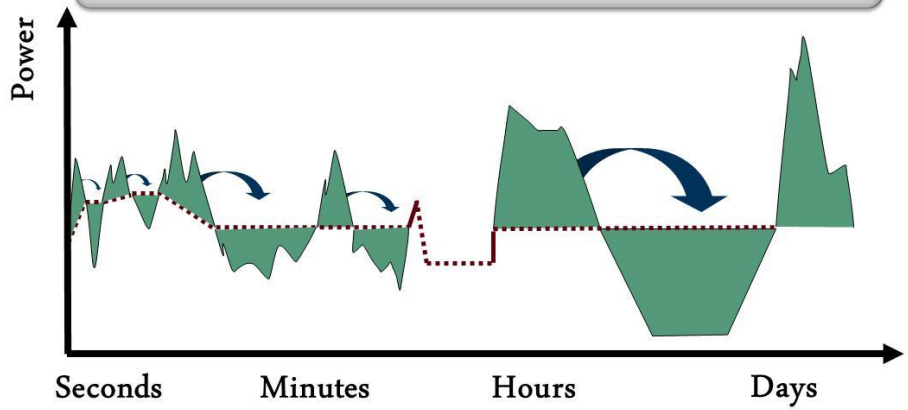
Technology portfolio for high RES systems

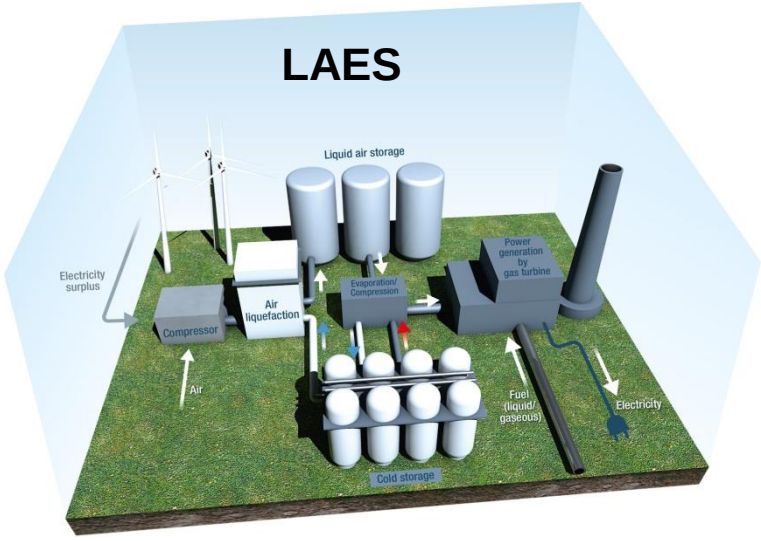
Flexibility



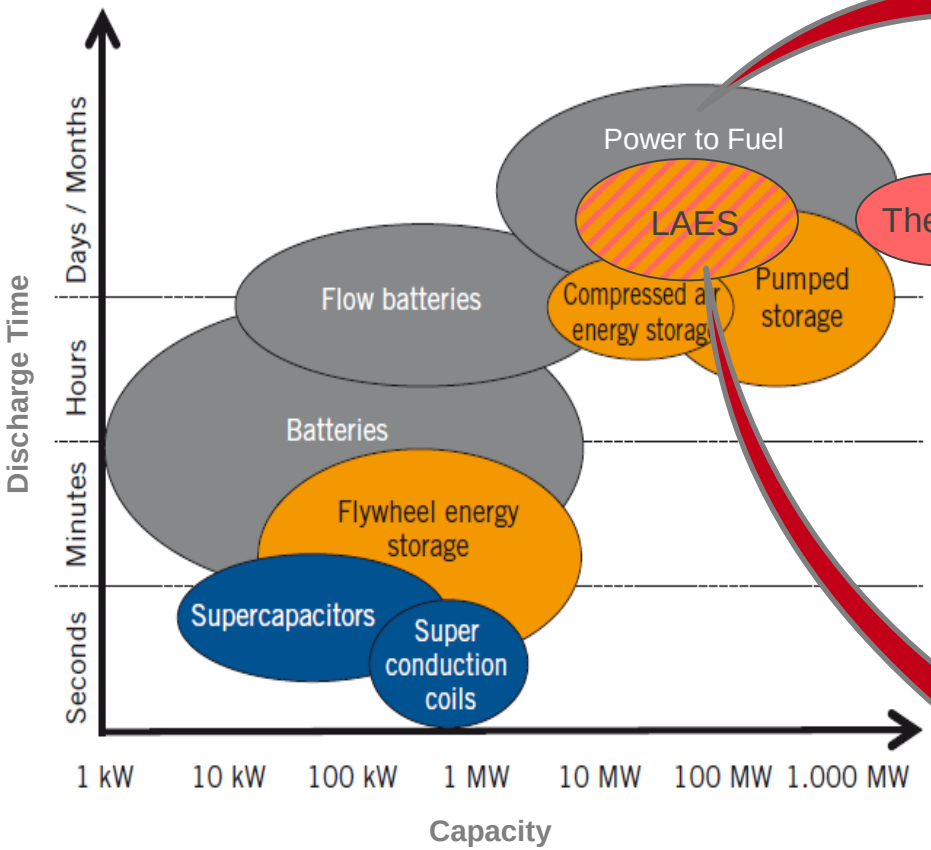


Energy Storage





Energy storage systems

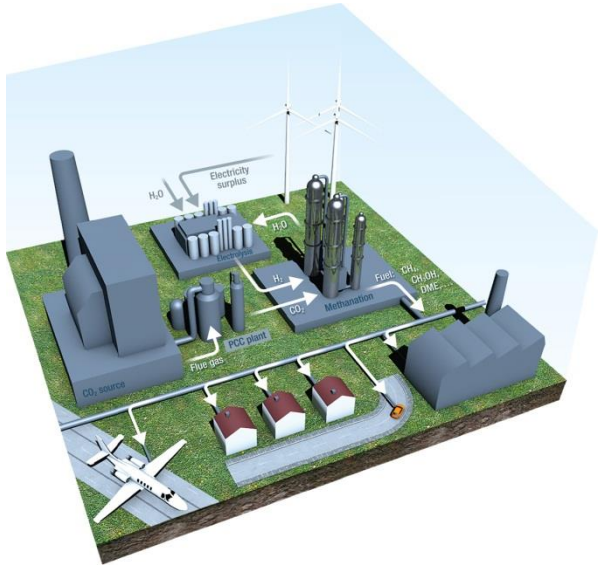


Mechanical storage systems

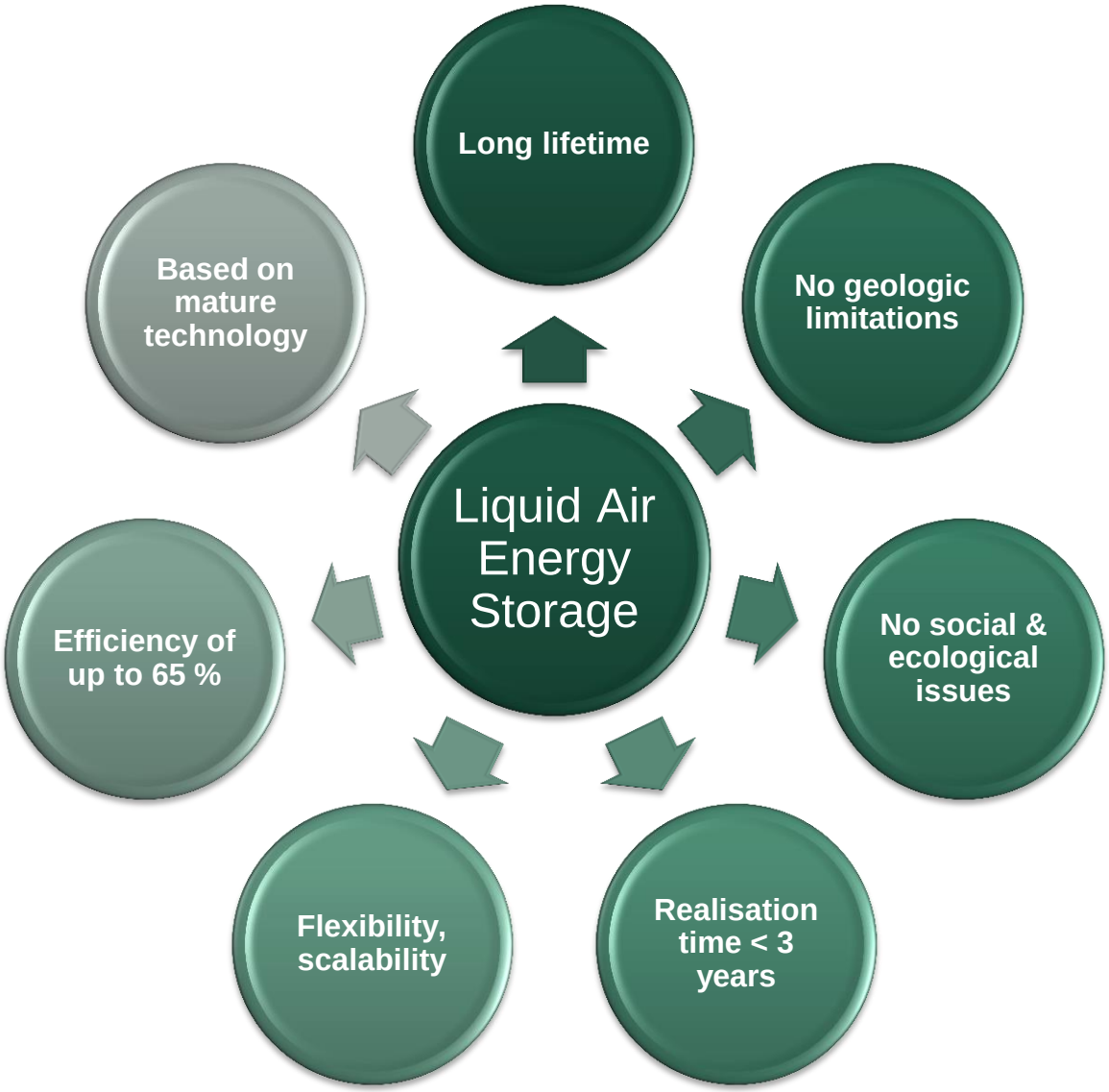
Electrochemical storage systems

Electrical storage systems

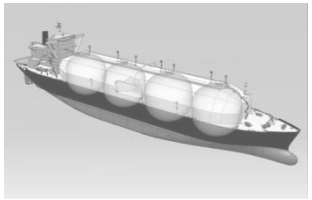
Thermal storage systems



Advantages of LAES



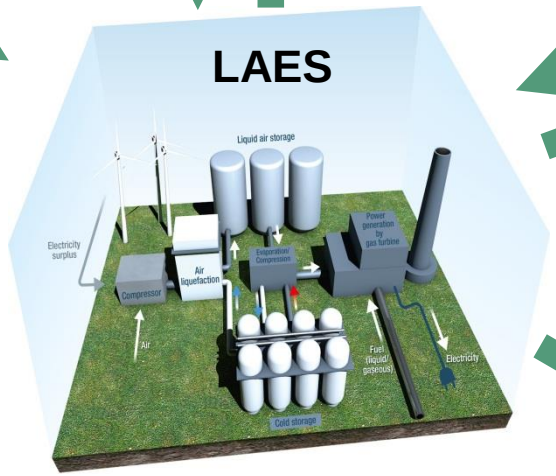
Integration Capabilities

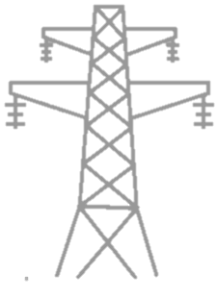


Peak shaving
Avoided curtailment

Utilisation of LNG regasification to avoid cold storage in LAES system

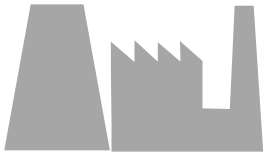
Utilisation of industrial waste heat, supply of cold, utilisation and supply of pressurised air





Ancillary services, Voltage support, energy trading, minimise grid expansion

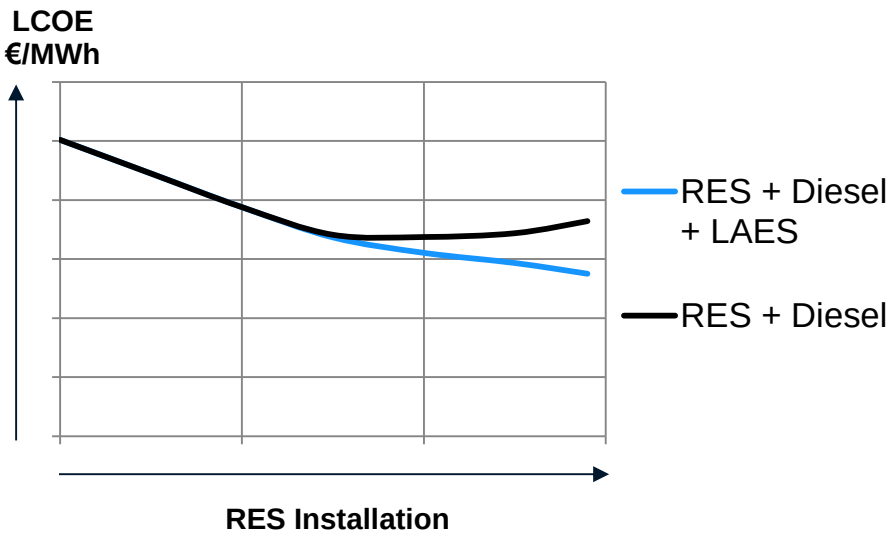
Flexibilisation of conventional power plants

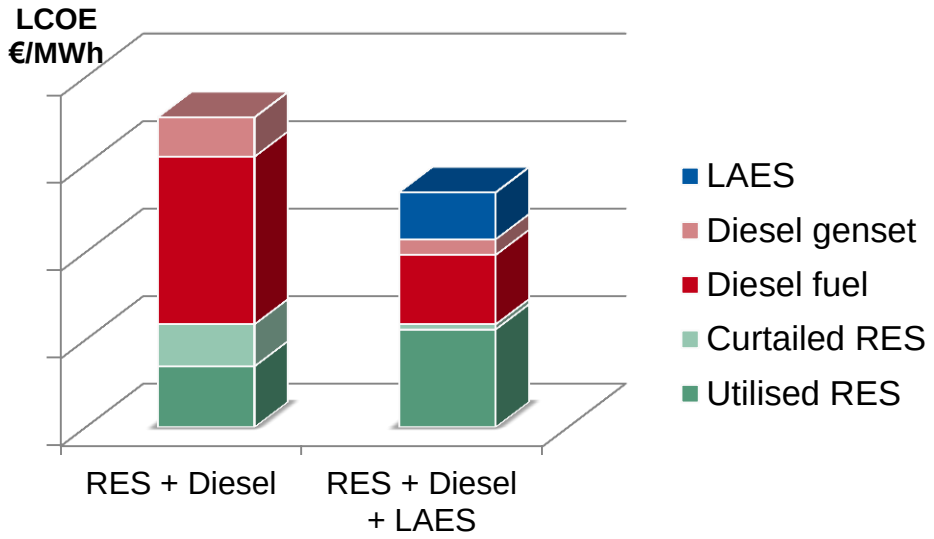


District heating and cooling

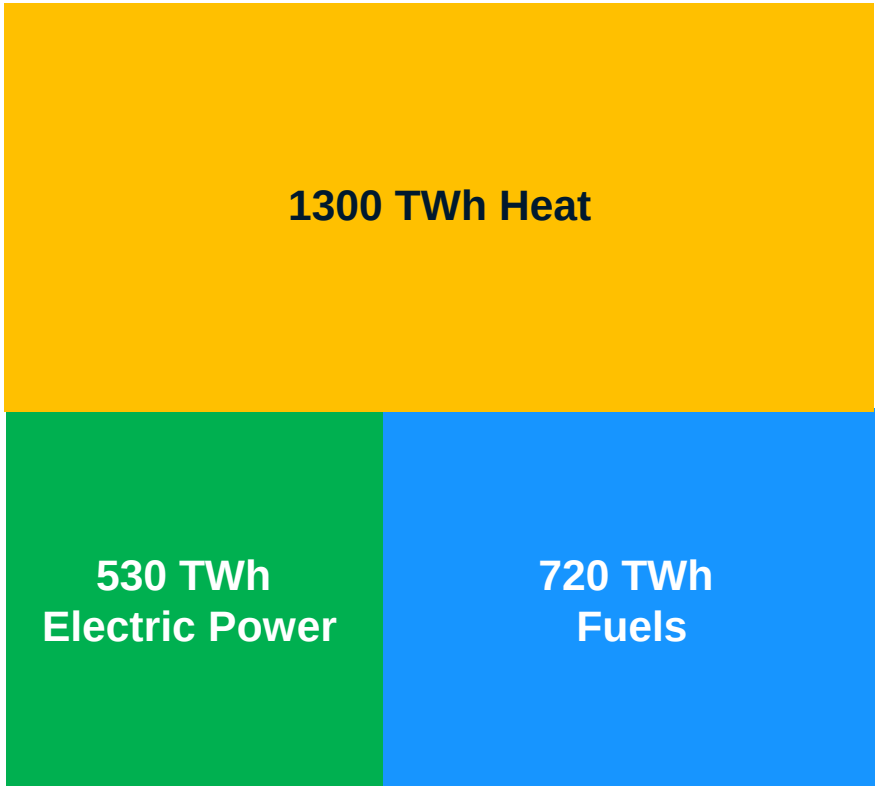
Island Case

- High electricity costs on islands w/o grid connection to the mainland (e.g. Greek Islands)
- Diesel generation power plants with high fuel costs
- RES can lower the overall levelised costs of electricity (LCOE) up to a point where RES have to be more and more curtailed due to overcapacity
- Energy storage like LAES can lower the LCOE and minimise curtailment of RES

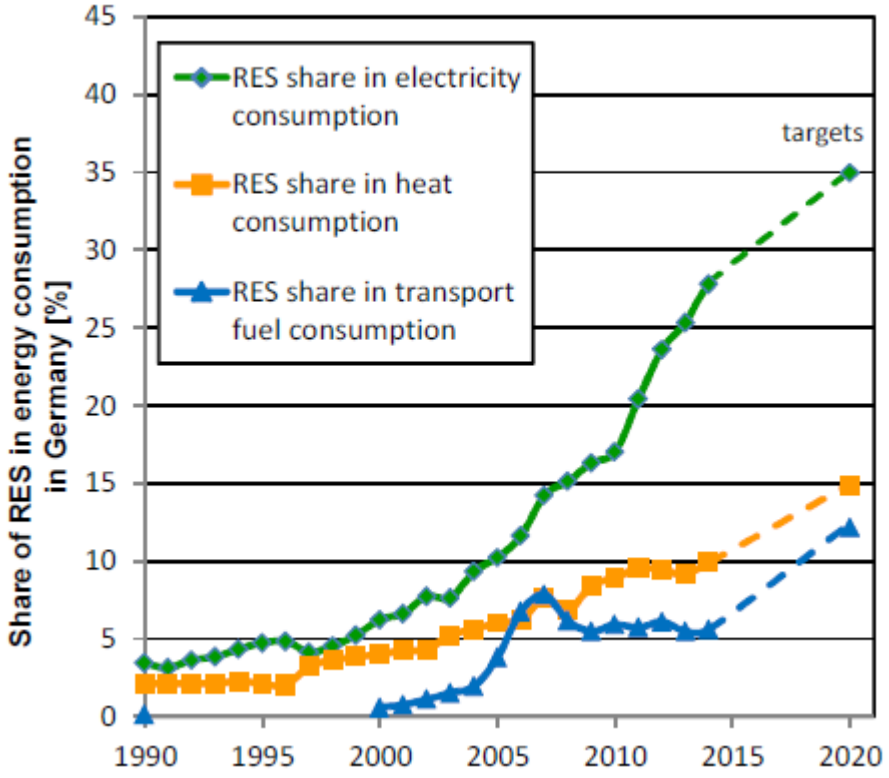




Energy Consumption in Germany 2014



Electricity, Heat, Fuel Consumption (DE 2014)

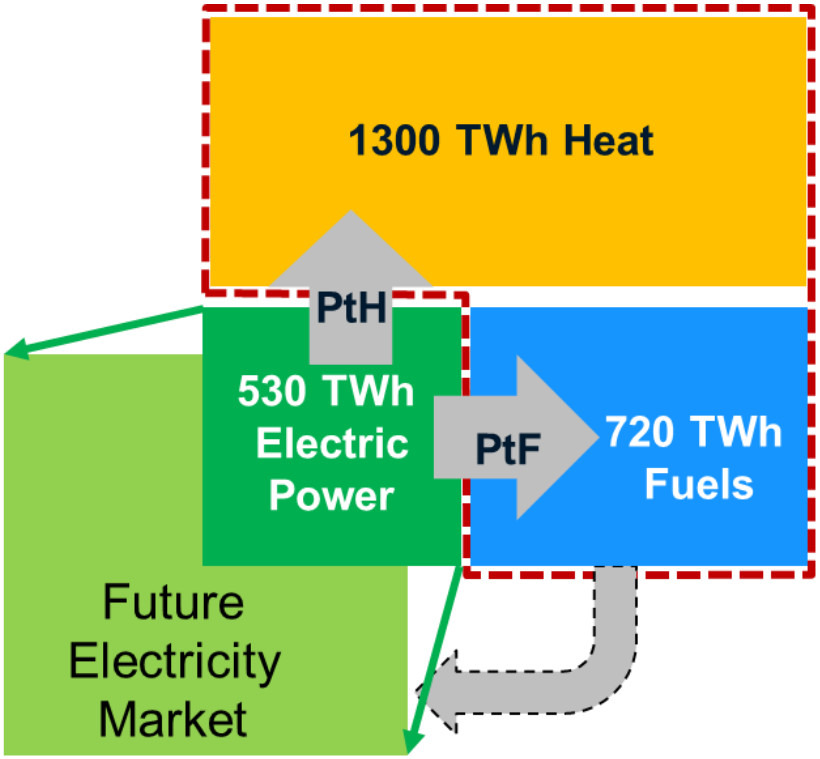


RES targets in the heat and fuel sectors will not be reached without a different approach

→ **"Power to X" is one solution**

Source: Arbeitskreis Energiebilanzen, BDEW, UBA

Energy production / consumption in Future



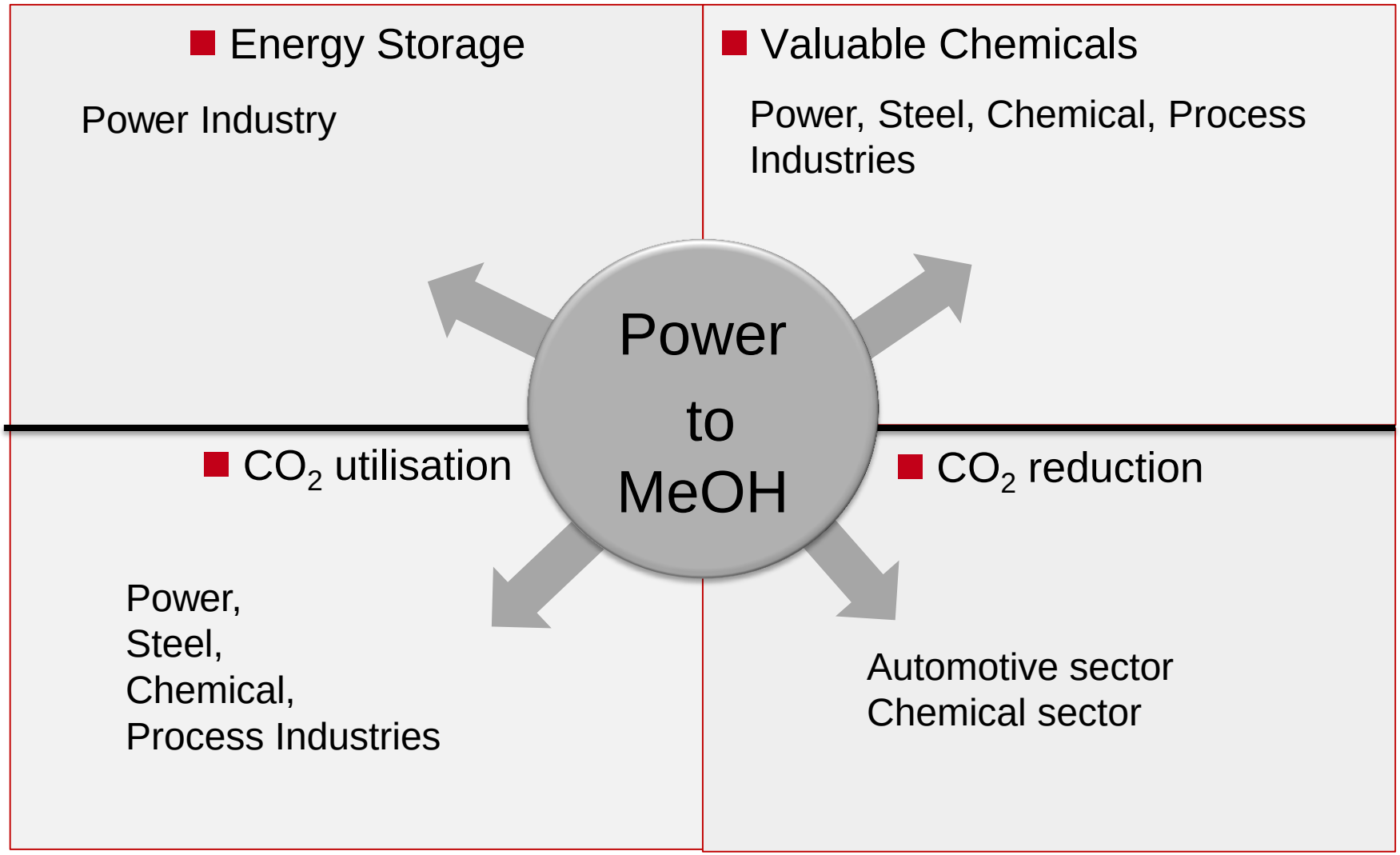
Power to X solutions:

Power to Heat (PtH) & Power to Fuel (PtF)

- allow sector coupling and GHG savings by use of low carbon electricity in other sectors
- allow storage of excess energy

Arbeitskreis Energiebilanzen, BDEW, UBA

Power to Fuel capabilities



Technology status

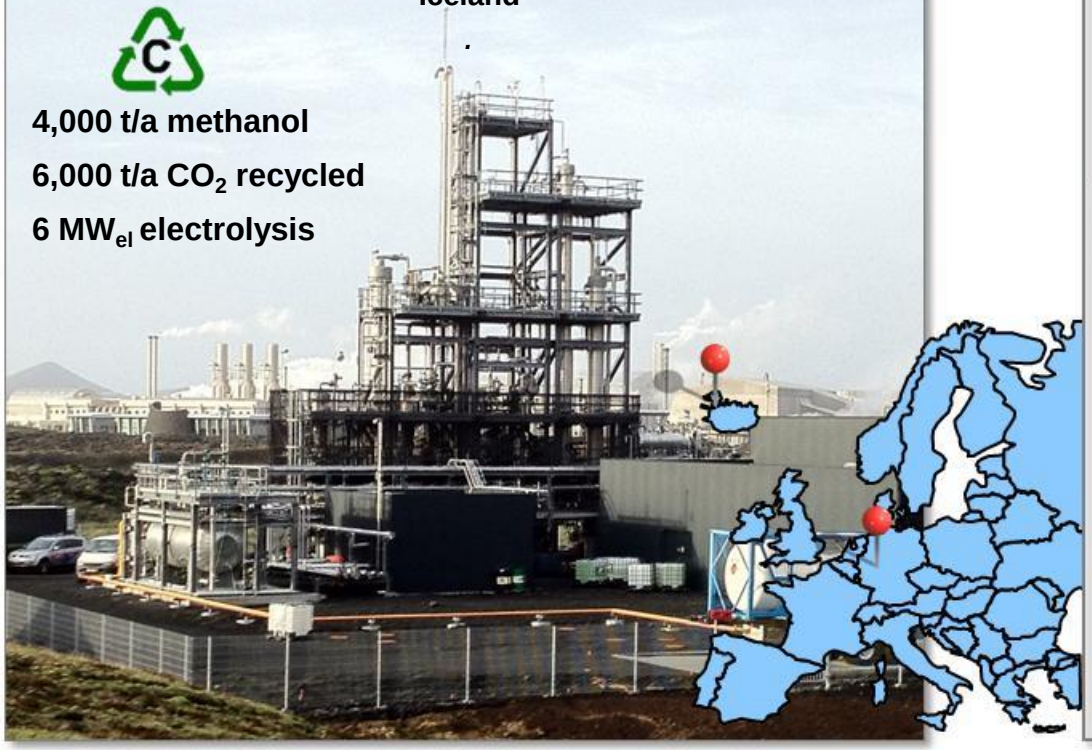
George Olah Plant at Carbon Recycling International

World's First Power to CO_2 Methanol Plant in Svartsengi, Iceland

4,000 t/a methanol

6,000 t/a CO_2 recycled

6 MW_{el} electrolysis

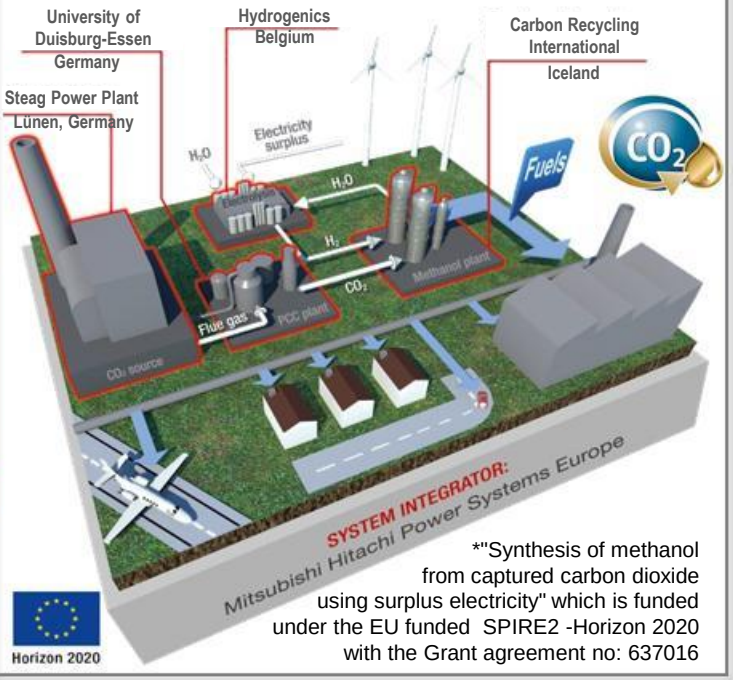


EU R&D Project to demonstrate Power Plant connected, flexible operation

1 MW_{el} (peak)
1 t/day Methanol

EUR 11million
80% EU funding *
Project start:
12.2014
Duration: 4 years

Other partners:
- Genoa University (Italy)
- Cardiff University (UK)
- Catalysis Institute (Slovenia)
- I-deals (Spain).



Horizon 2020

*"Synthesis of methanol from captured carbon dioxide using surplus electricity" which is funded under the EU funded SPIRE2 -Horizon 2020 with the Grant agreement no: 637016

- Power to Methanol (PtMeOH) is commercially available today in industrial scale
- Methanol and Methanol derived products can be supplied for the fuel sector immediately

Conclusions

- A wide range of innovative energy storage solutions are available today
  - Both LAES and PtF can be built today at industrial scale

- Decarbonisation efforts should be extended to other sectors via cross-sectoral solutions such as PtF
  - avoiding curtailment of RES & allowing an increased RES installation
  - avoiding curtailment costs and extensive grid refurbishment
  - reducing emissions in industry, energy and transport sectors

Conclusions

- **Political awareness for the benefits of storage is still lacking**

- **There is no business model**
  - Fair remuneration for energy storage services, including the positive cross sectoral spill over effects

- **Need for clear and stable framework for energy storage**
  - Level playing field and harmonised market rules
  - De-risk investments through adequate funding mechanisms
  - Define energy storage according to DG ENER proposal:

“Energy storage in the electricity system would be defined as the act of deferring an amount of the energy that was generated to the moment of use, either as final energy or converted into another energy carrier.”

European Commission, DG ENER, Proposed definition and principles for energy storage, June 2016

Thank you for your attention!

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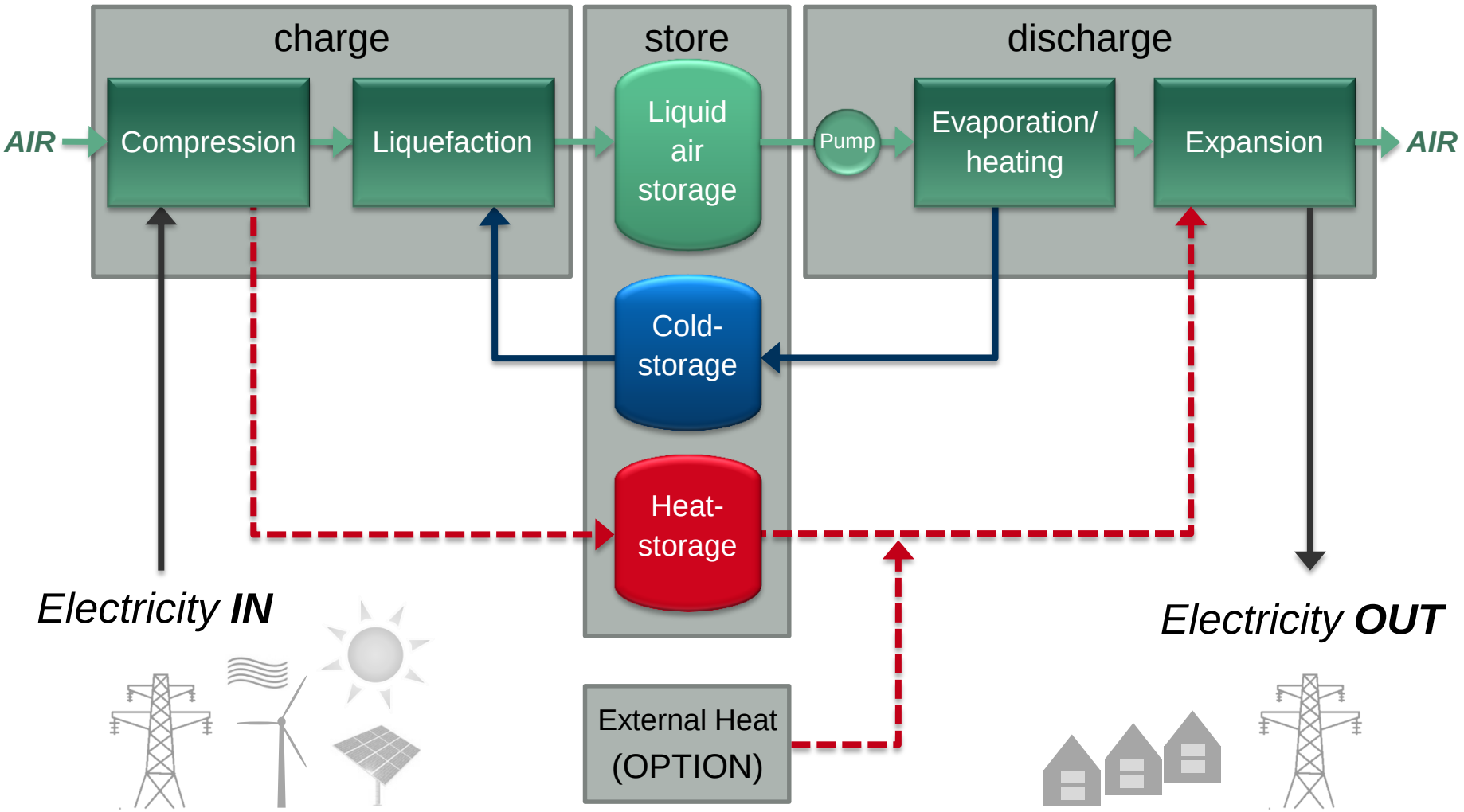
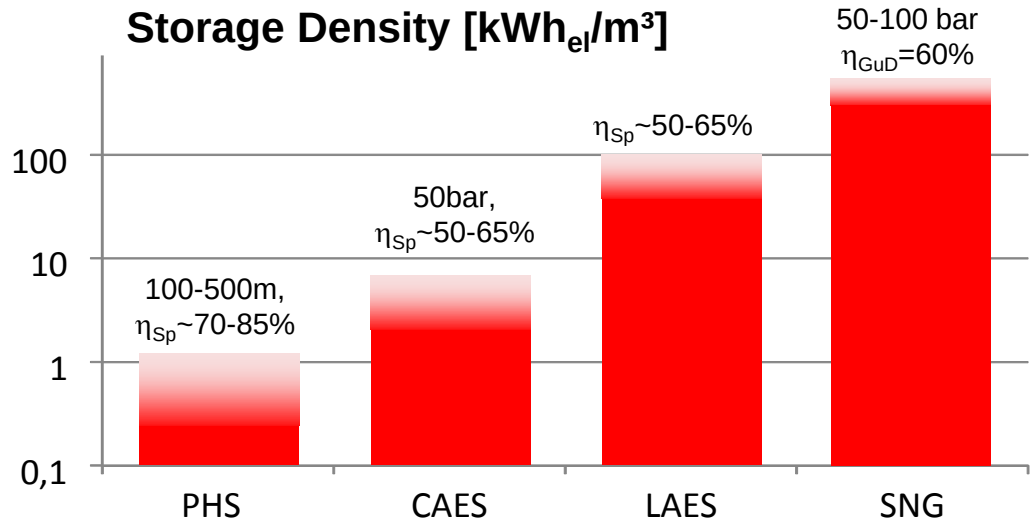
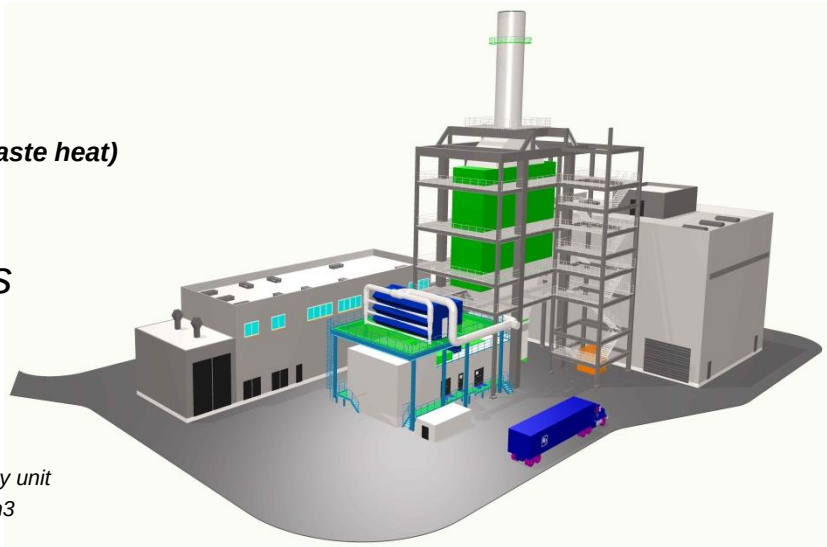
LAES – Principle



LAES – Fact Sheet

- Energy Density:
  70 – 100 kWh/m3
- Power output:
  10 – 600 MW
- Storage Capacity:
  > 1000 MWh
- Discharging duration:
  2 – 12 h
- Efficiency:
  50 – 65 %
  (>65 % by utilizing waste heat)
- Lifetime:
  20 – 30 years





Pictures:
1) 3D plot of LAES power recovery unit
2) Cryogenic storage tank 1600 m3

RES – connecting electric, gas and fuel grids