

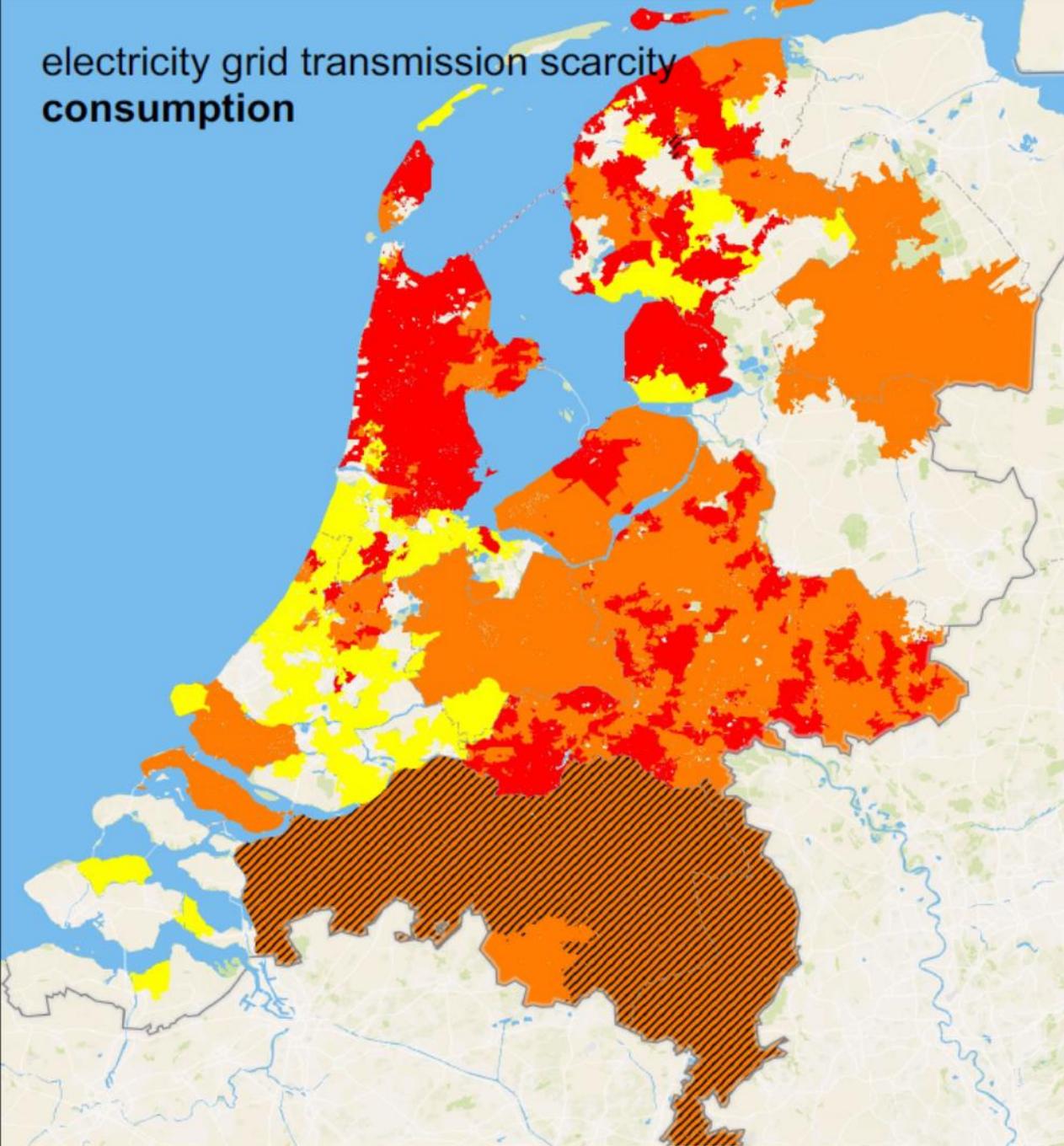
# Enabling Flexibility of Integrated Energy Systems

Milos Cvetkovic ([m.cvetkovic@tudelft.nl](mailto:m.cvetkovic@tudelft.nl))

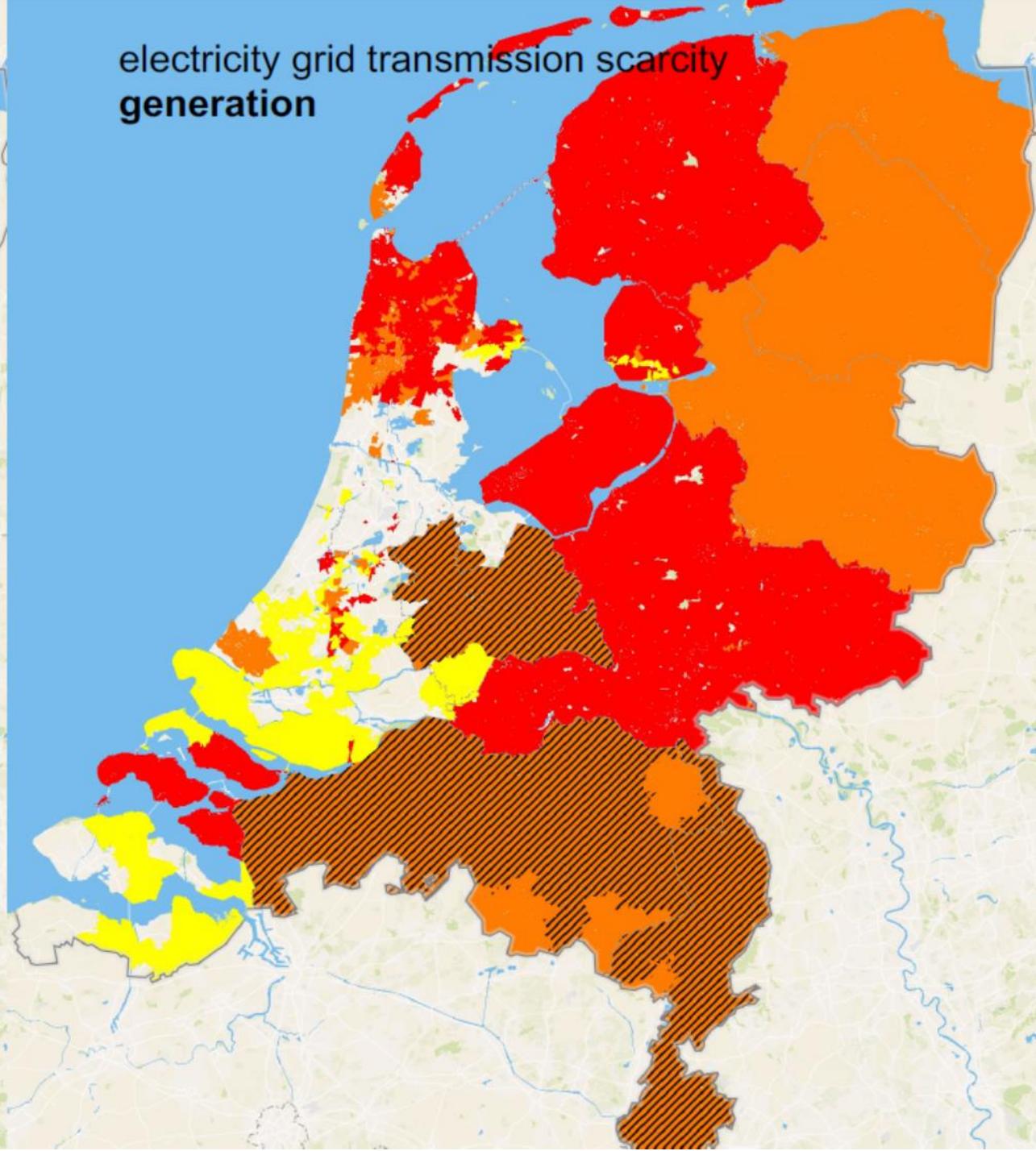


Intelligent Electrical Power Grids  
Electrical Sustainable Energy Department  
Delft University of Technology

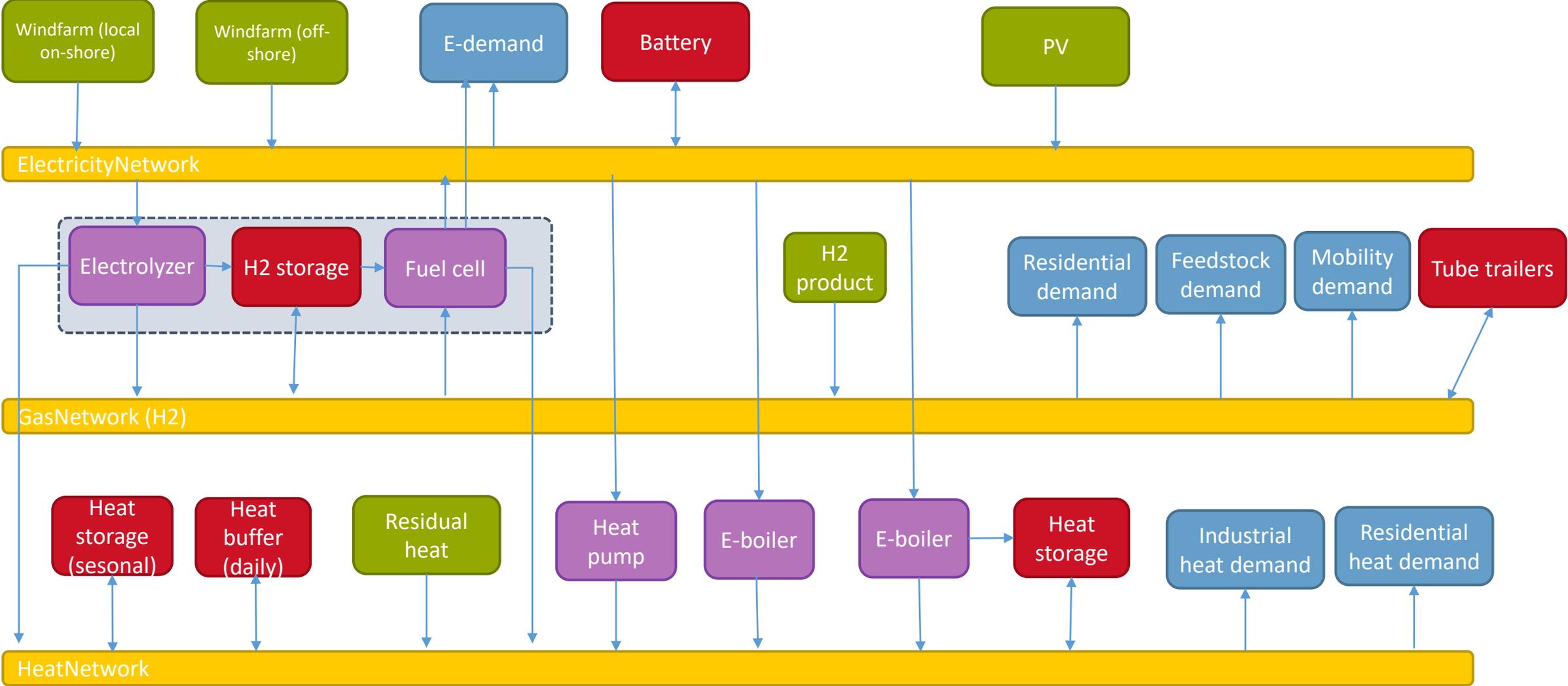
electricity grid transmission scarcity  
**consumption**



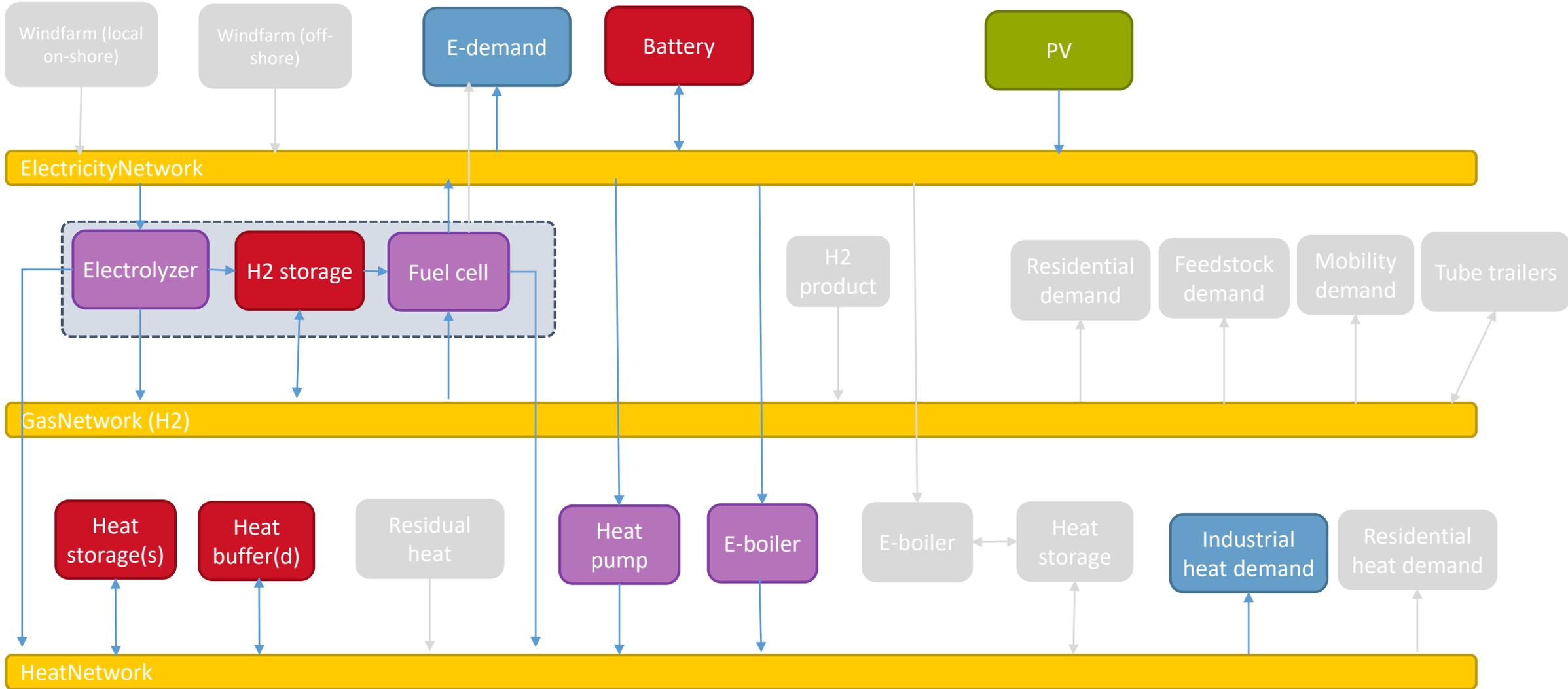
electricity grid transmission scarcity  
**generation**



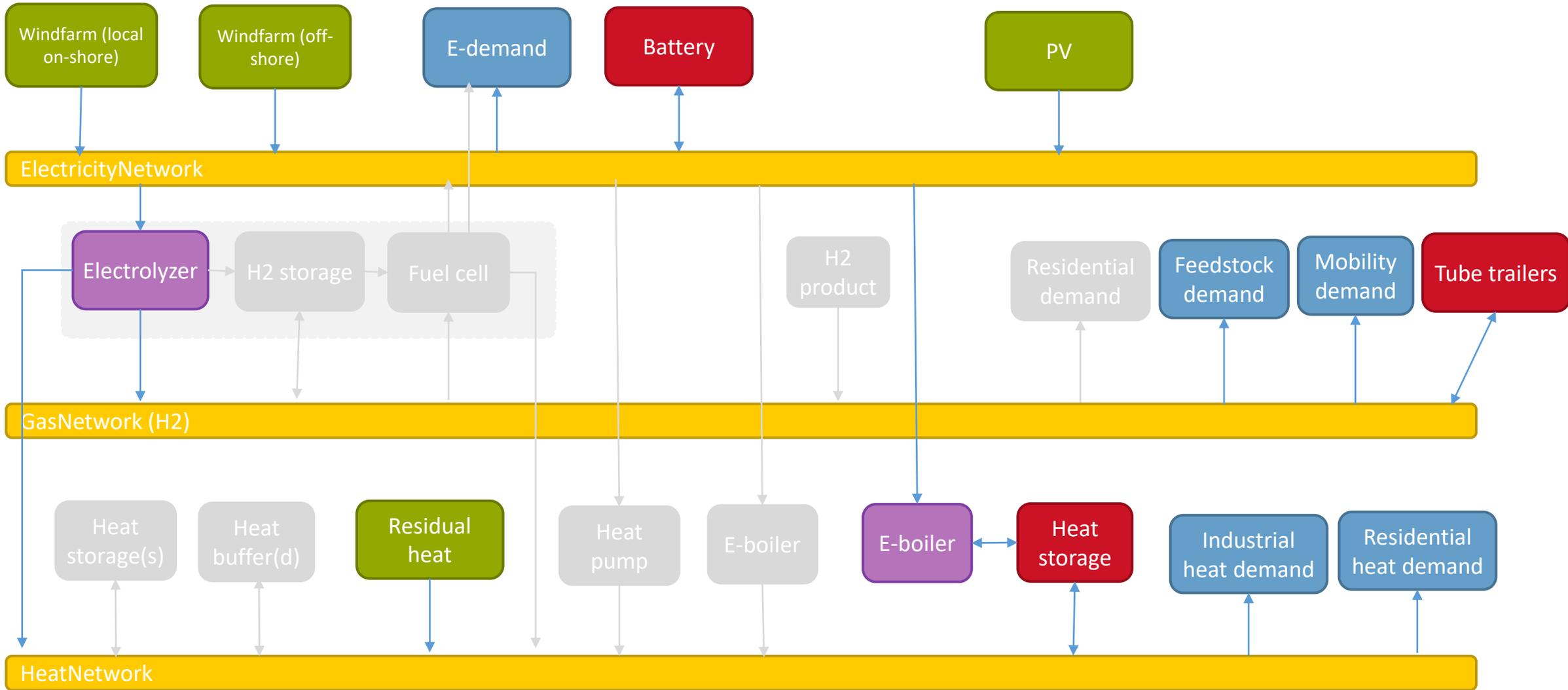
# An Integrated Energy System (IES)



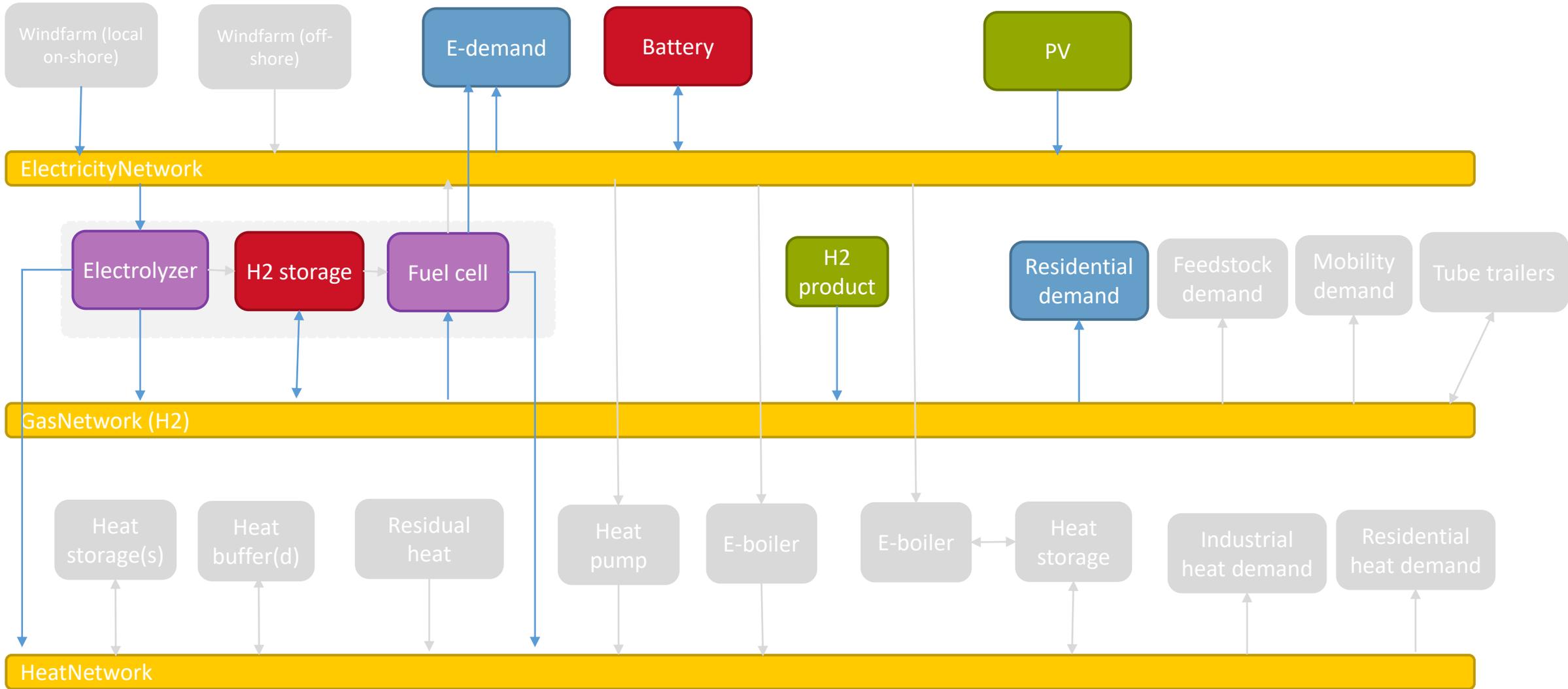
# IES 1



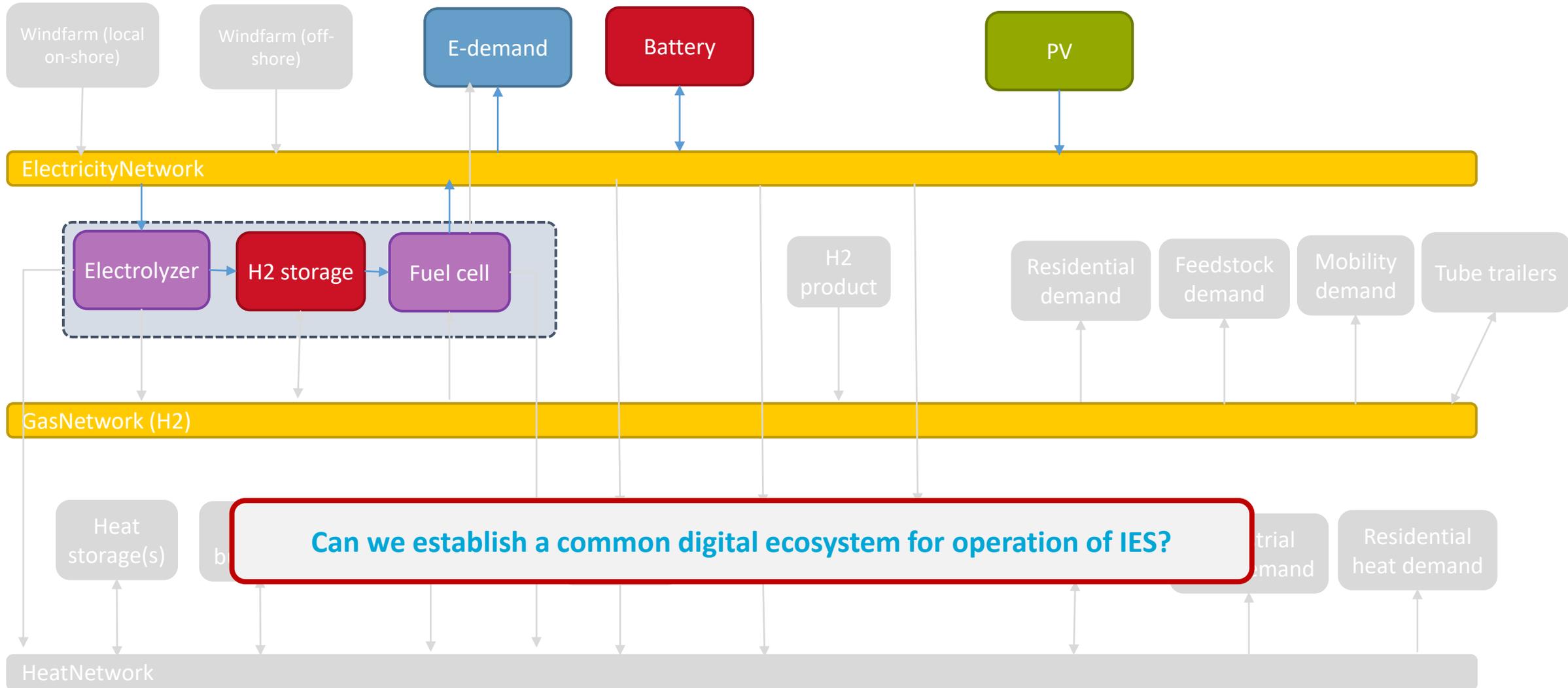
# IES 2



# IES 3



# IES 4



# Organization models

Microgrid

**Single stakeholder**  
**Energy is utility**

Energy valley/hub

**More stakeholders**  
**Energy is utility**

Virtual power plant

**Single stakeholder**  
**Energy in focus**

# Technologies needed

Control/coordination

Digital twin

Services

# Design requirements

Control/coordination

Interoperability  
Scalability  
Modularity

Digital twin

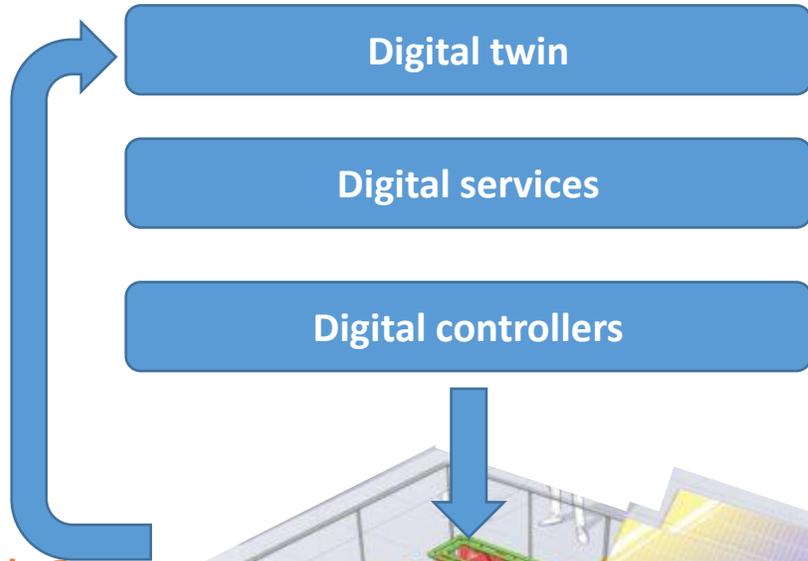
Past/present/future  
Flexibility & multiplicity  
Modularity

Services

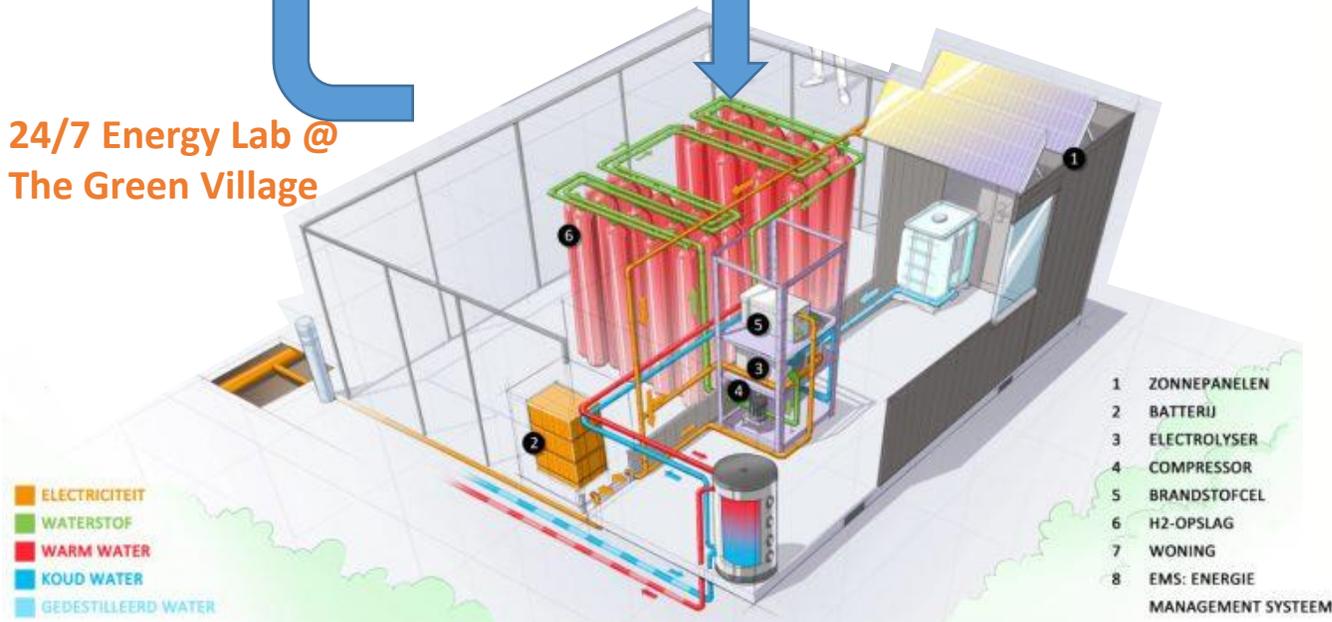
Flexibility provision  
Evaluate design options  
Evaluate controller actions

The goal: the software architecture blueprint including: interface ontologies,  
software modules and template models

# The Green Village fieldlab

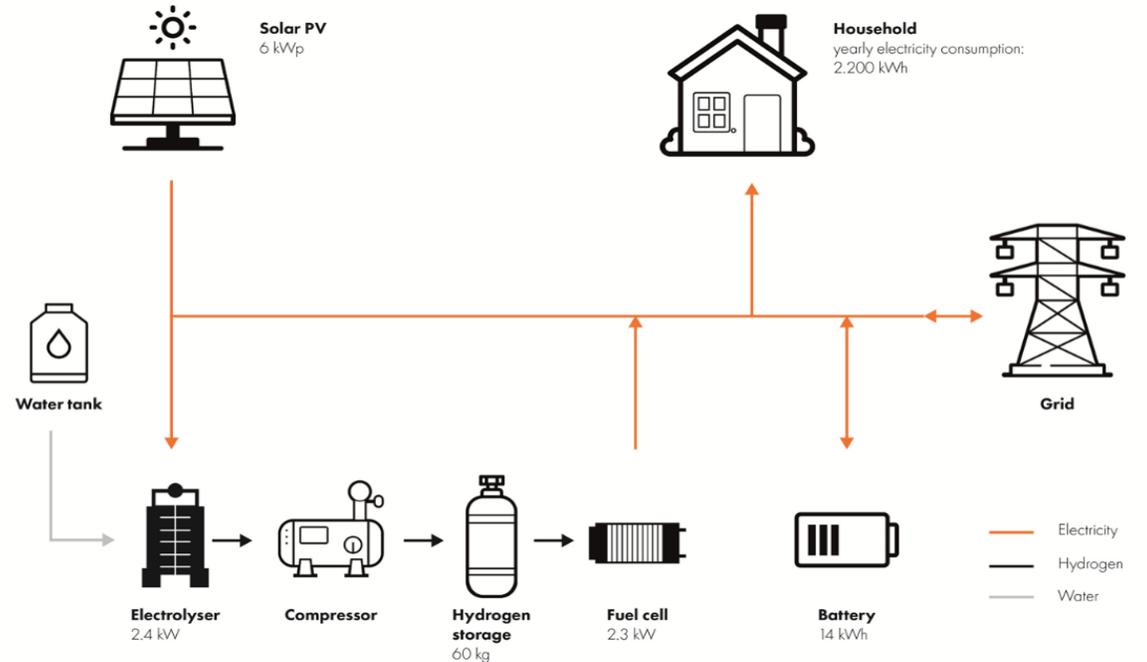


24/7 Energy Lab @  
The Green Village

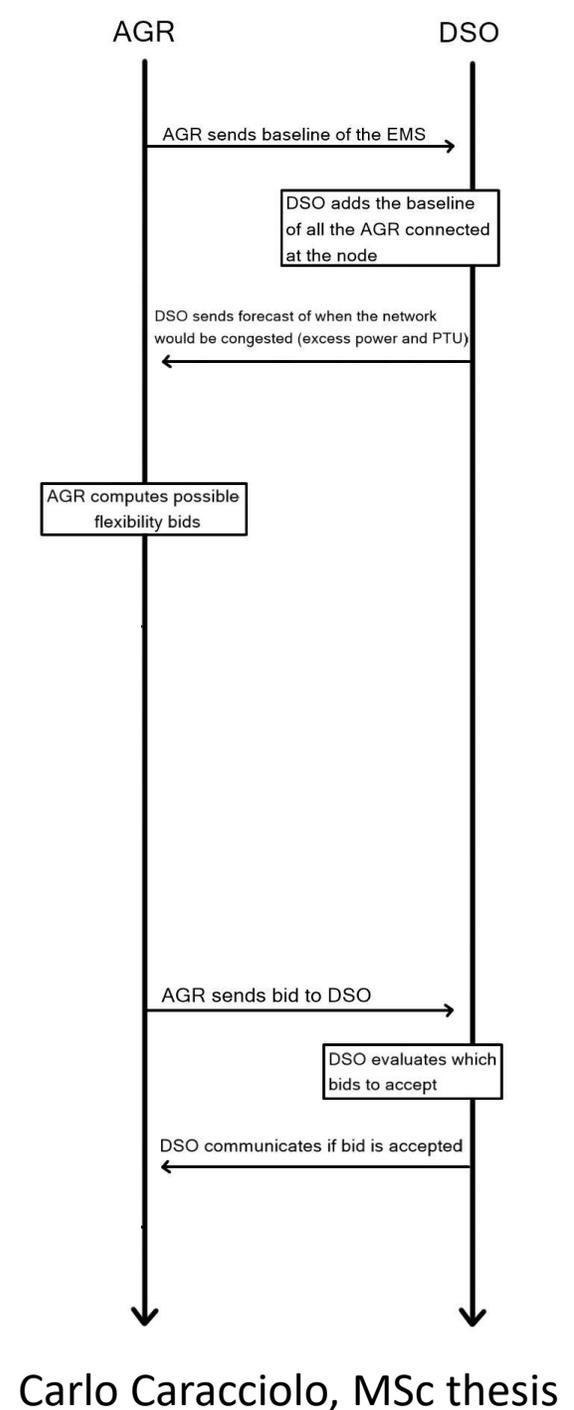
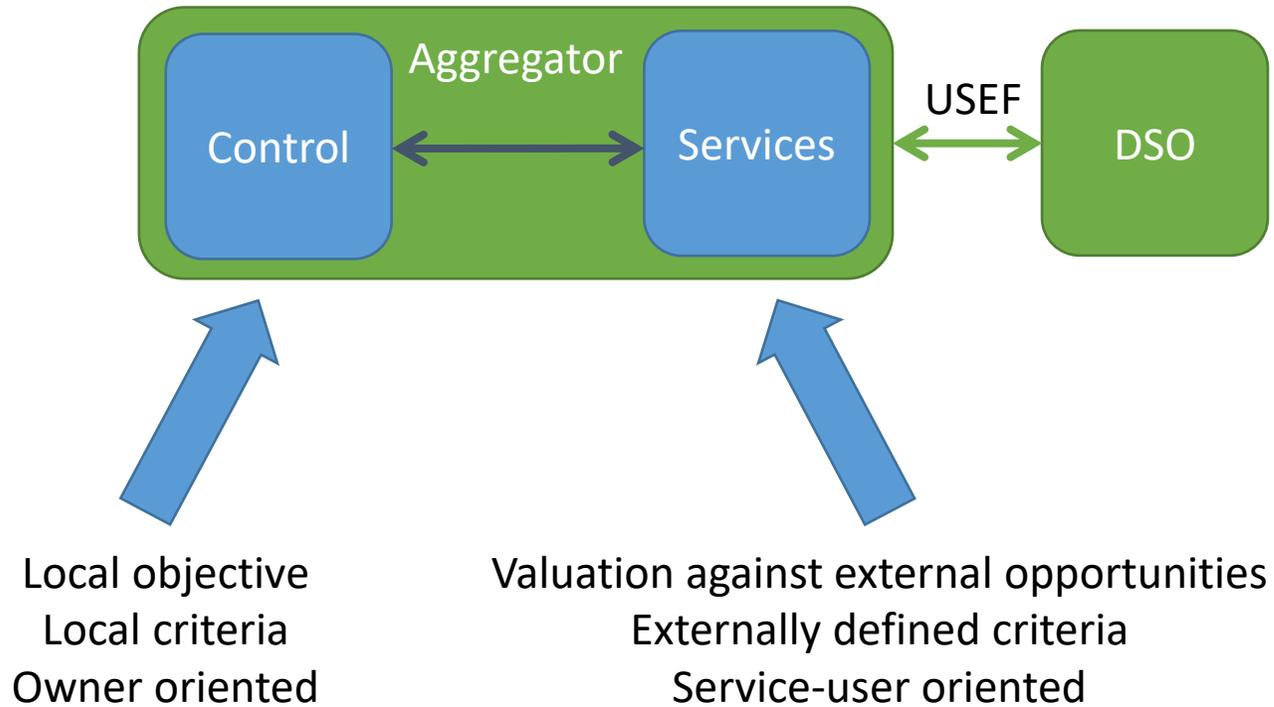


## SHPLES and SynergyS projects

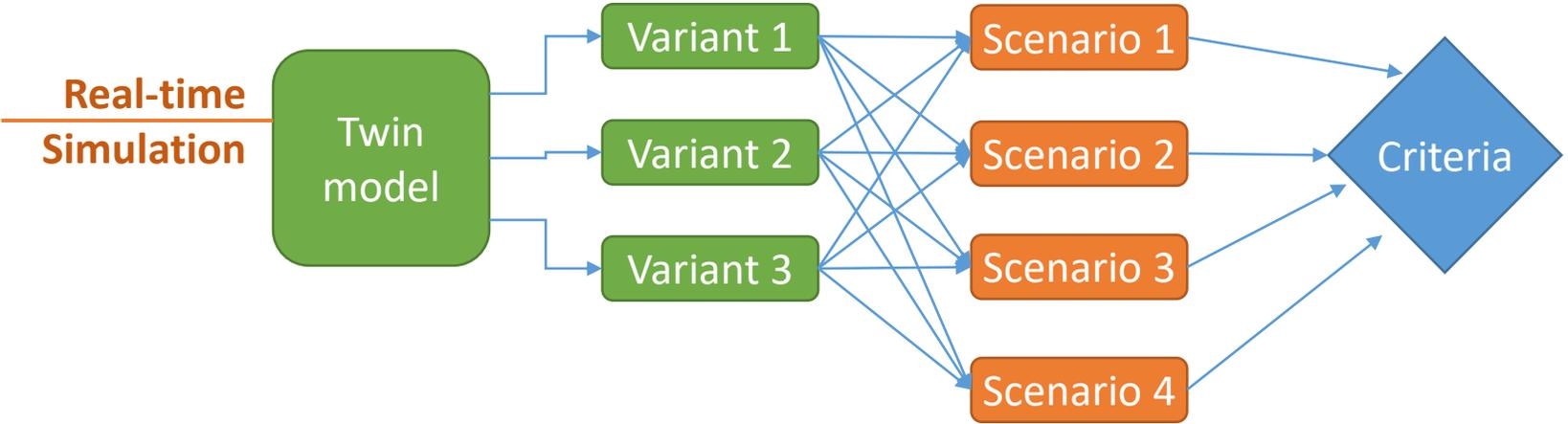
Single stakeholder  
Entire blueprint



# Flex provision (USEF example)



# Evaluation using digital twin

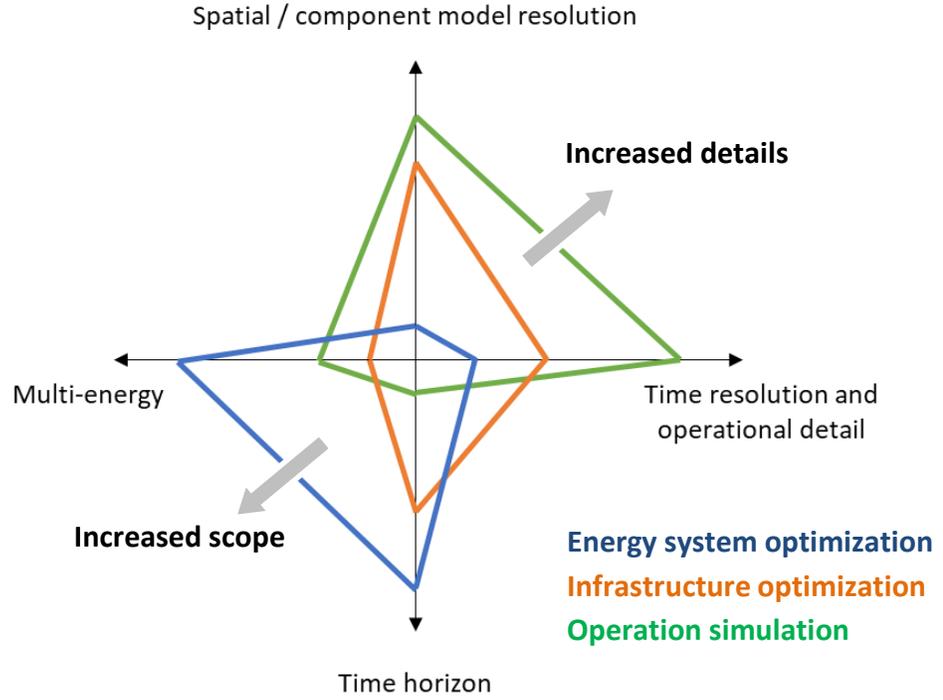


Point-by-point or all at once?

Time horizon?

Min & max time resolution?

Single model or a family of models?



# Next steps

- How would you use such a blueprint?
- Get in touch:
  - [M.Cvetkovic@tudelft.nl](mailto:M.Cvetkovic@tudelft.nl)