



# Modelling of Power-2-X plants



**EMD International**

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# EMD International – who we are

- Founded in 1986
- EMD is a global company supplying software and consultancy services for design, planning, documentation and operation of wind energy projects as well as complex distributed energy projects.
- Regional sales offices in Germany, France, Spain, United Kingdom, Turkey, USA, Brazil and China
- Independent - owned by foundation Energi & Miljødata
- Large network of international cooperation partners
- Proven track record of world-wide project experience



USER

HEAT DEMAND

POWER DEMAND

SYNTHETIC FUELS



CITIES RESIDENTIAL  
INDUSTRY MOBILITY  
BUSINESS Public Facilities  
and Institution  
LIVING & WORKING

DISTRICT  
HEATING  
SYSTEM

SMARTGRID

Flexible  
& residual  
LOAD's

GAS NETWORK

HEAT  
PUMP

POWER  
to X

CO<sub>2</sub>

Environment

HEAT  
Storage

POWER  
Storage

GAS  
Storage  
Tank

Waste Heat

CHP

FUEL CELL

BOILER

SOLAR THERMAL

BIO MASS

Geo thermal

SOLAR PV

WIND

HYDRO

Green Electricity Market

BIO GAS

BIO METHANE

NATURAL GAS

Gas Market | eFuels



SECTOR COUPLING



# Our References (selection)

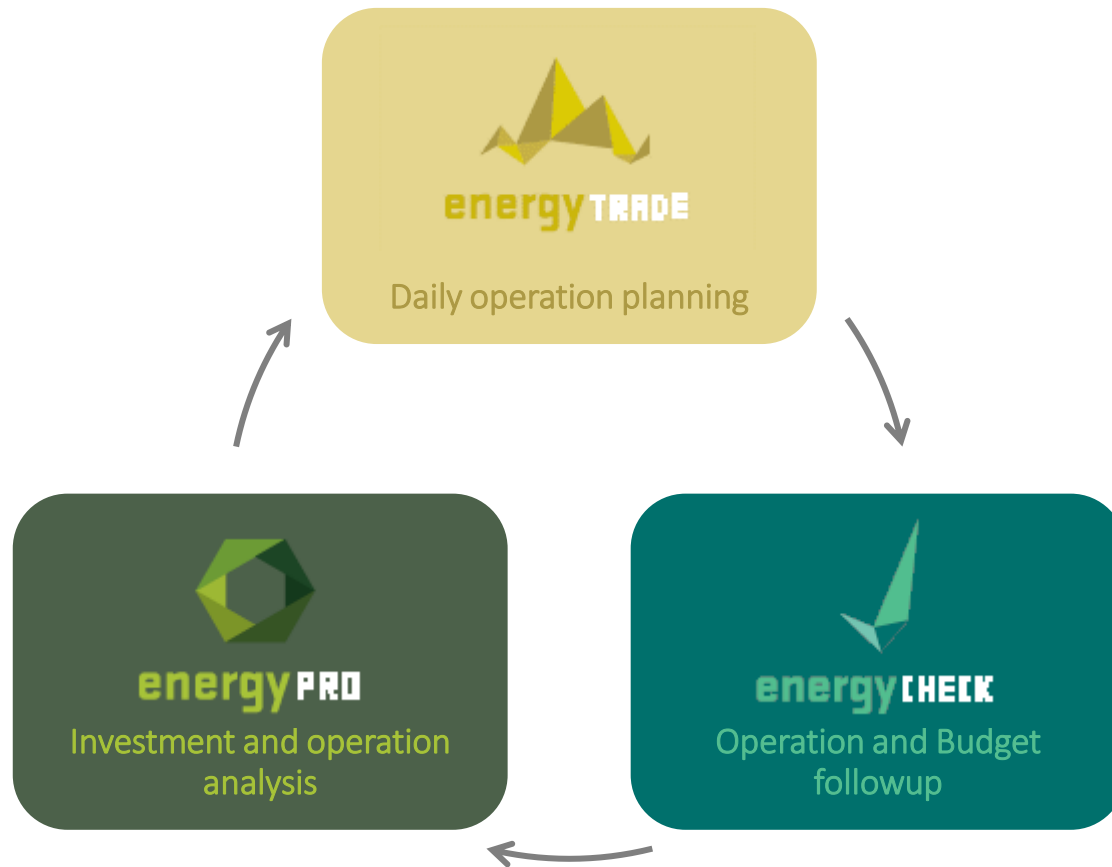


ENERGIE AUS DER MITTE





# Use cases for our suite



- CHP, Central Utility Plant or Power-2-X plant design, evaluation and operation
- Benchmarking
- Scenario-building and evaluation
- Complete Capex/Opex overview
- Most engineering consultancy companies uses energyPRO for case-studies on Heat pumps etc.
- Setting up CO<sub>2</sub> reduction solution space

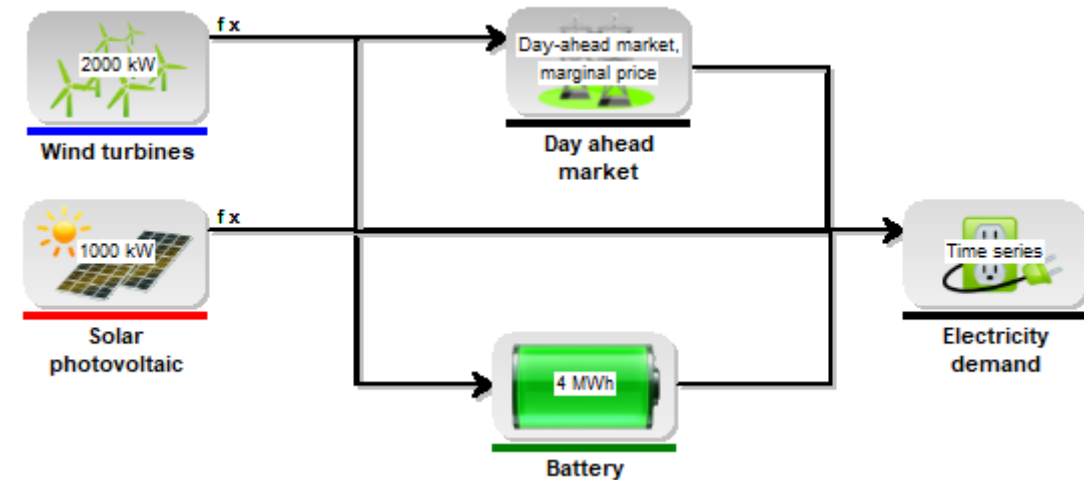
# What is energyPRO

**Technology, Capital, O&M Cost  
optimization**

# What is energyPRO

## Technology, Capital, O&M Cost optimization

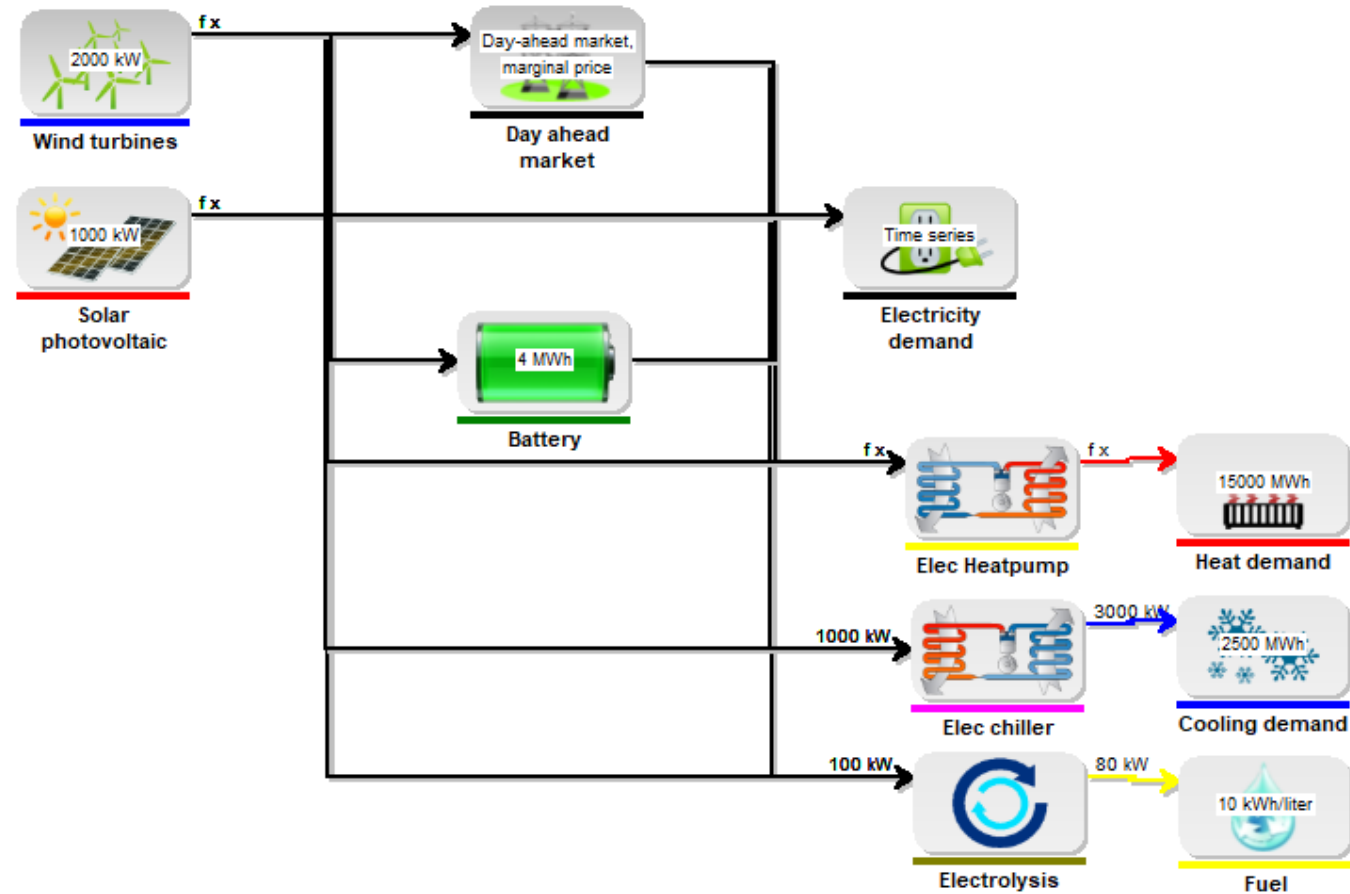
- Energy system modelling



# What is energyPRO

## Technology, Capital, O&M Cost optimization

- Energy system modelling
- Across energy sectors
  - Renewable energy
  - Electricity
  - Cooling
  - Heating
  - Fuel for transportation
- Hour by hour or less calculation
- 3 days or 40 years



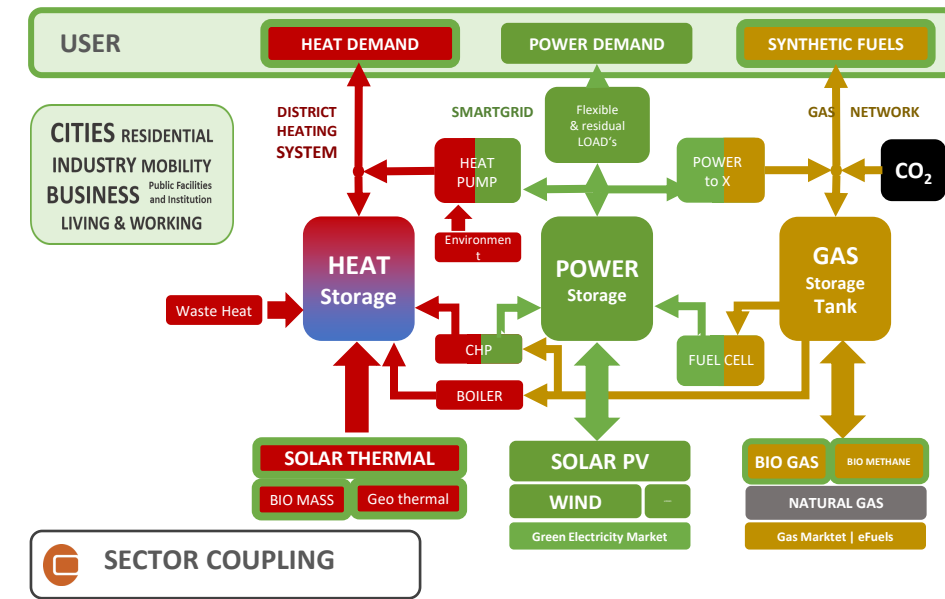
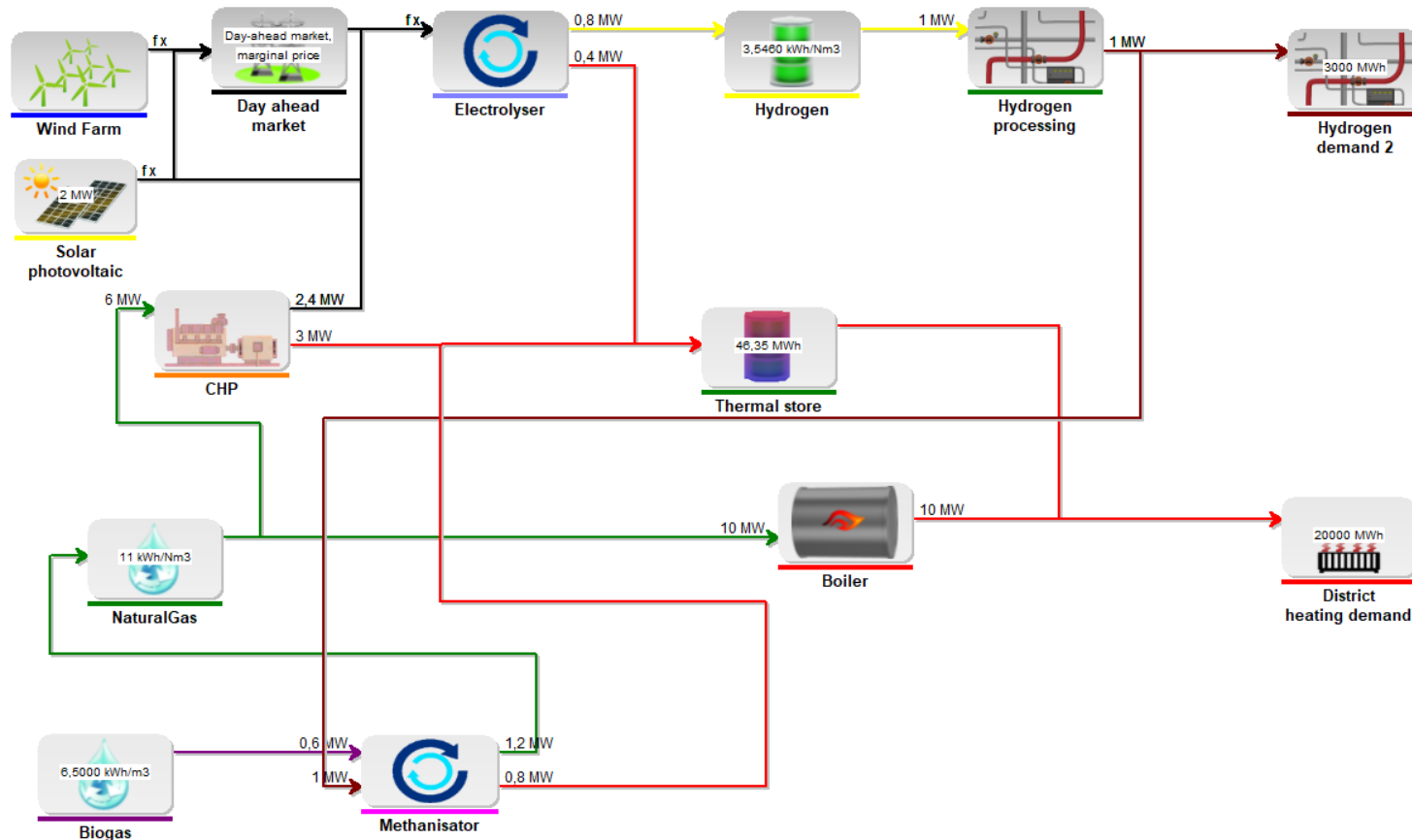


# Well suited for hybrid solutions

- Hybrid solutions – what we can model:
  - Wind
  - Solar
  - Battery
  - Pumped storage
  - Fuel cells
  - Power-2-X
  - ...
- Improved income from wind on electricity market
- Island operation
- Across energy sectors

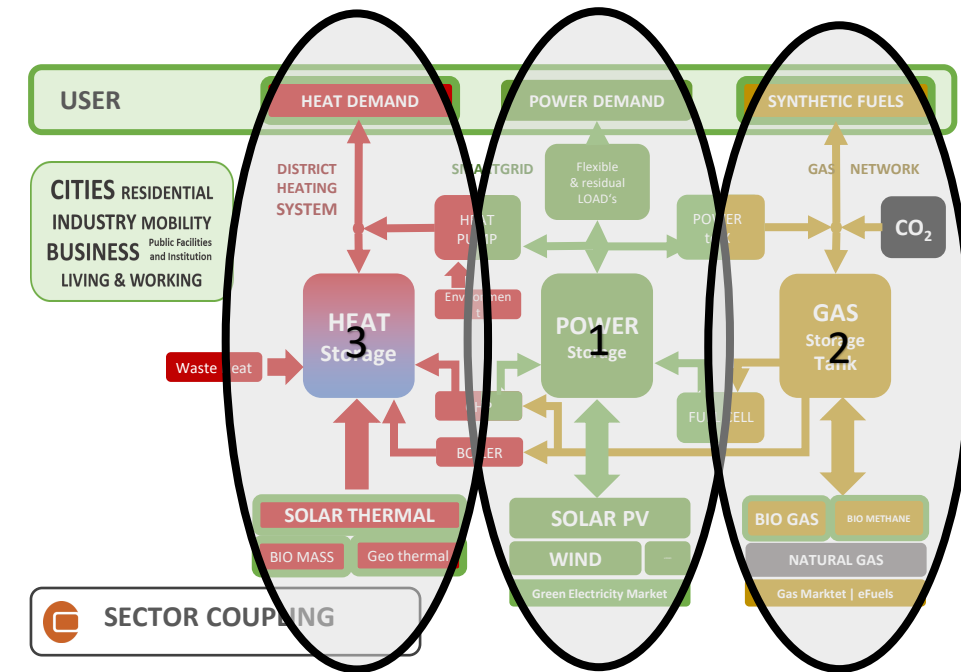
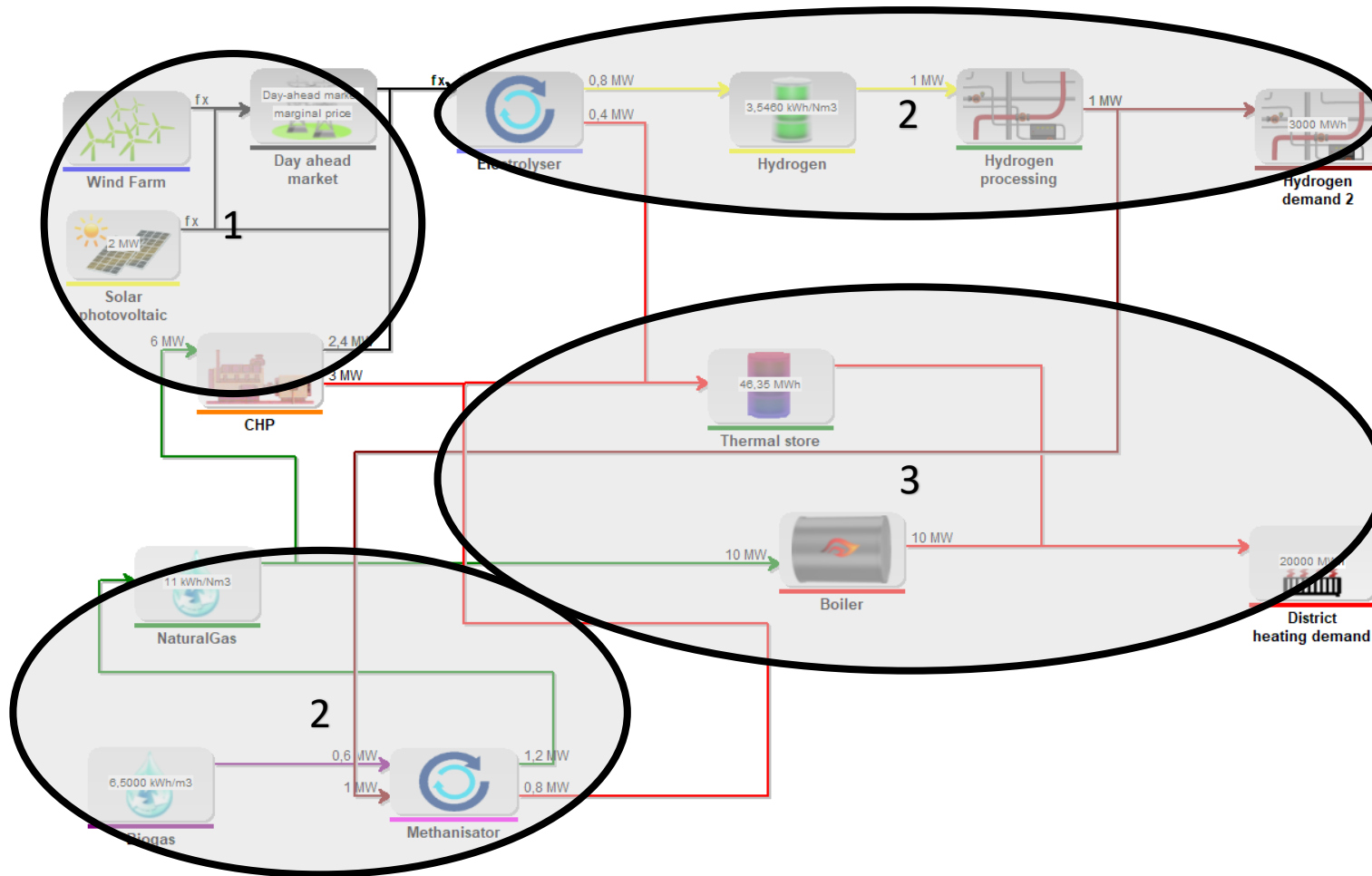
# Power-to-X

## Hydrogen model example, incl. District heating and methanization



# Power-to-X

## Hydrogen model example, incl. District heating and methanization

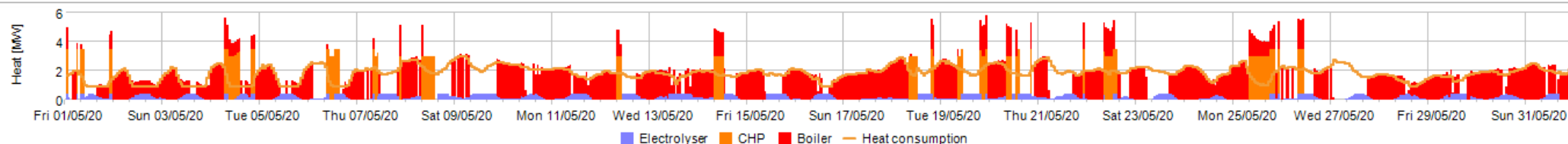


Operation income: -37.759 EUR

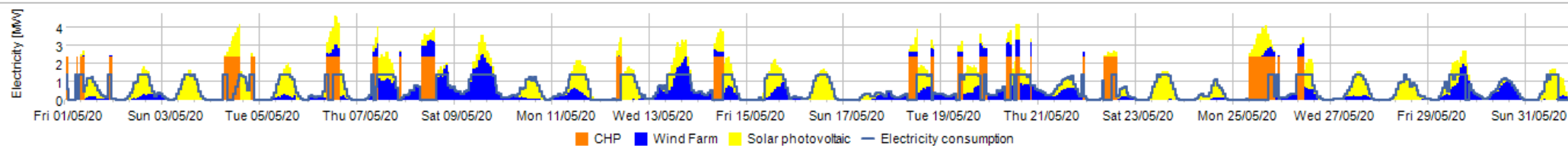
Spot price



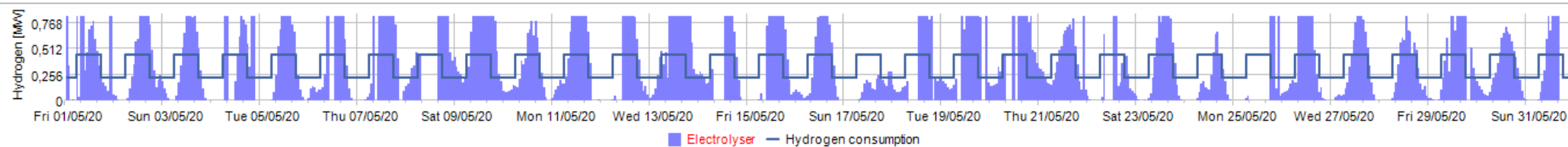
Heat



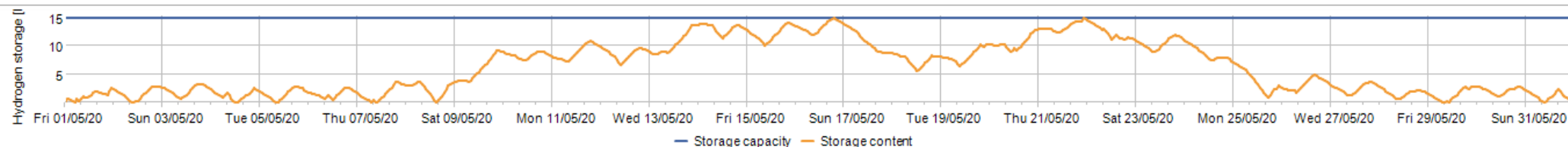
Electricity



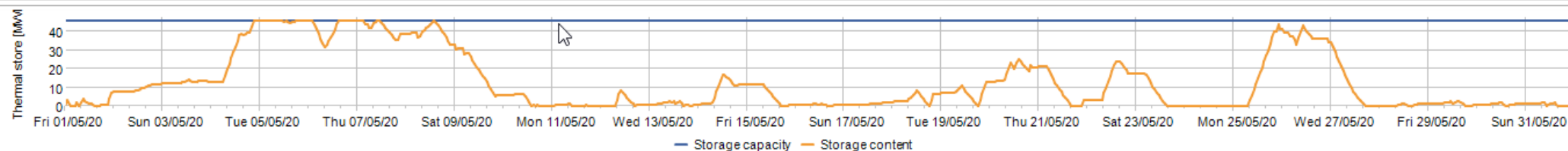
Hydrogen



Hydrogen Storage

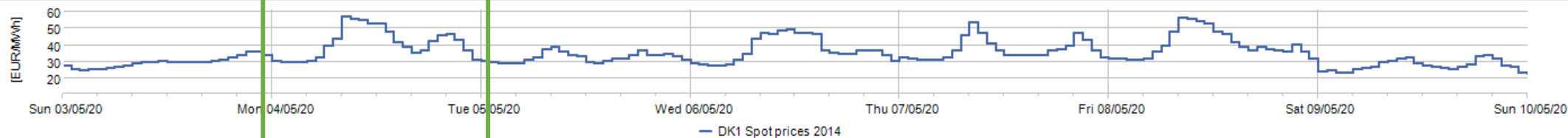


Thermal storage

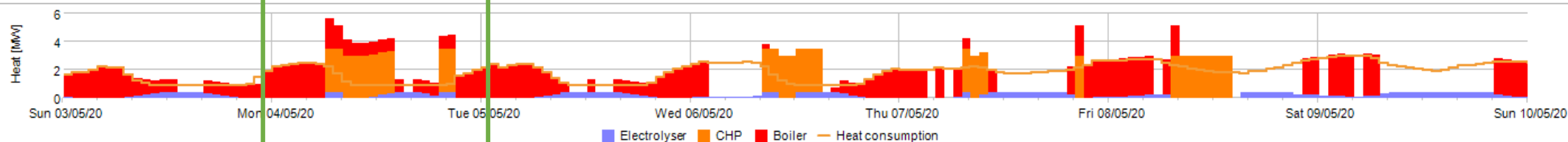


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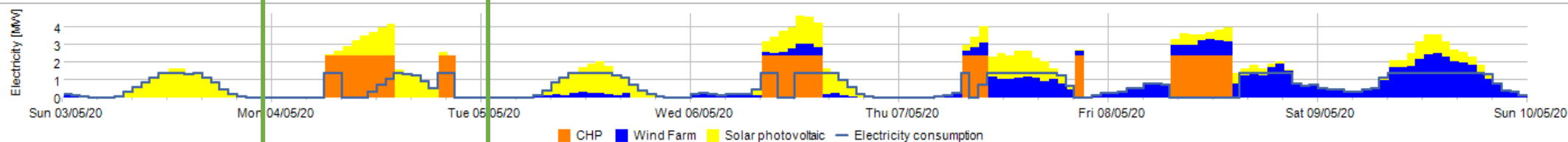
Spot price



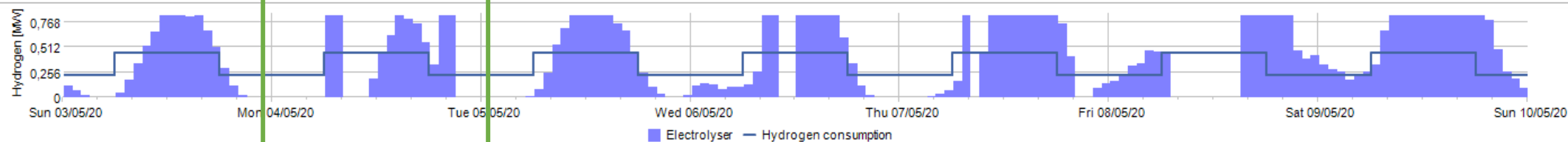
Heat



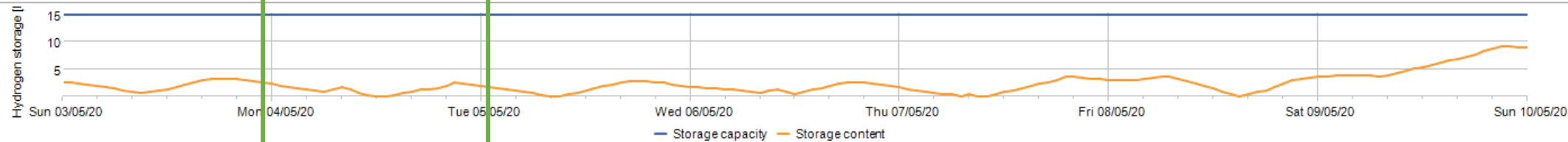
Electricity



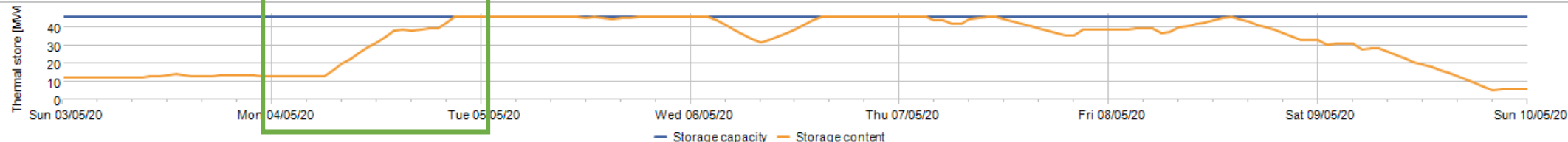
Hydrogen



Hydrogen Storage



Thermal storage



## Selected Energy Systems References: Power-2-X



### **Economic modelling of electrolysis plant in combination with Solar PV and BESS**



EMD has been appointed to develop a model, including Solar PV, battery and an electrolysis unit. The aim of this model is to evaluate the economic feasibility of adding a battery to the system or not. Also, the possibility of using the excess heat of the electrolysis unit in the local district heating system has been evaluated. And finally, the consumption of demineralised water and its costs has been added to the model.

Green Hydrogen uses this model during the sales process of their electrolysis units.





## Selected Energy Systems References: Power-2-X

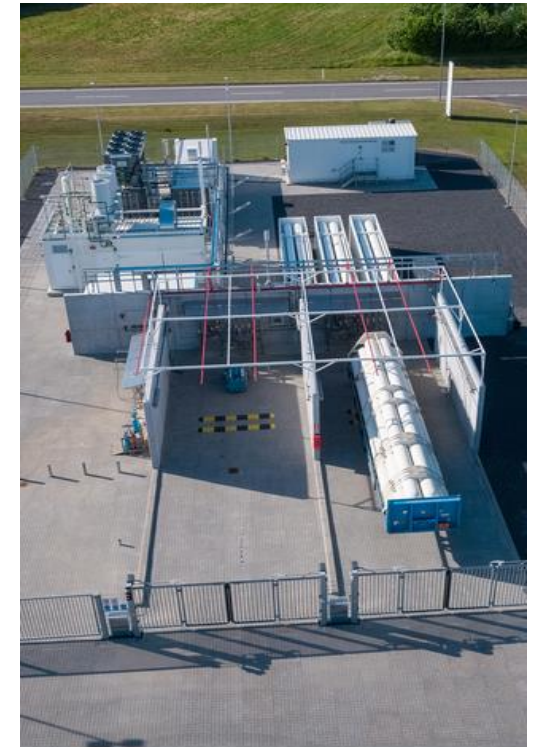


### **Simulation of the first Danish hydrogen production plant participating in both wholesale markets and in the balancing markets**



The aim of the project Power2Hydrogen was to demonstrate answers to two of the energy sector's major challenges in the transition to 100% renewable energy: The need to balance the electrical grid due to an increasing integration of electricity from fluctuating energy sources such as wind and solar, and the challenge of producing transportation fuels that can satisfy both the need for mobility and sustainability as well as being competitive from an economic point of view.

EMD's economic model set-up described both the balancing and mobility aspect.



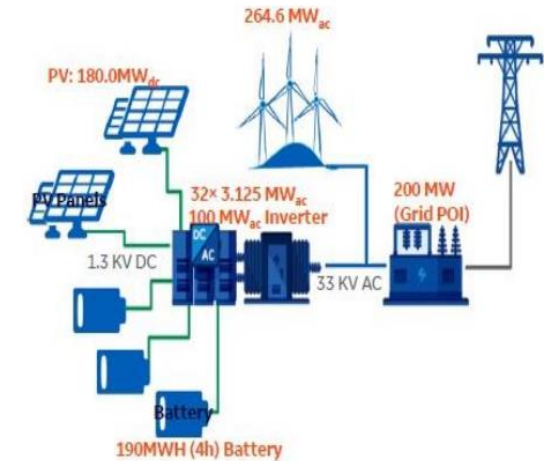
# Selected Energy Systems References: Hybrid



## Modelling and feasibility of Hybrid System in India, Capacity building



EMD has been appointed to model a 50 MW hybrid system in India consisting of solar PV, wind energy and batteries. The modelling enabled Ayana to optimize the dimensioning of the hybrid solution.



## Thank you for the attention

Download energyPRO as a free trail at  
<https://www.emd.dk/energypro/download/>

Real-time view on 5 different district energy plants can be see at  
<https://www.emd.dk/energy-system-consultancy/online-presentations/energyweb/>

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