



# **FUTUREGAS**

# **Hydrogen**

**FUTUREGAS annual meeting – 26/11 - 2019**



# Agenda

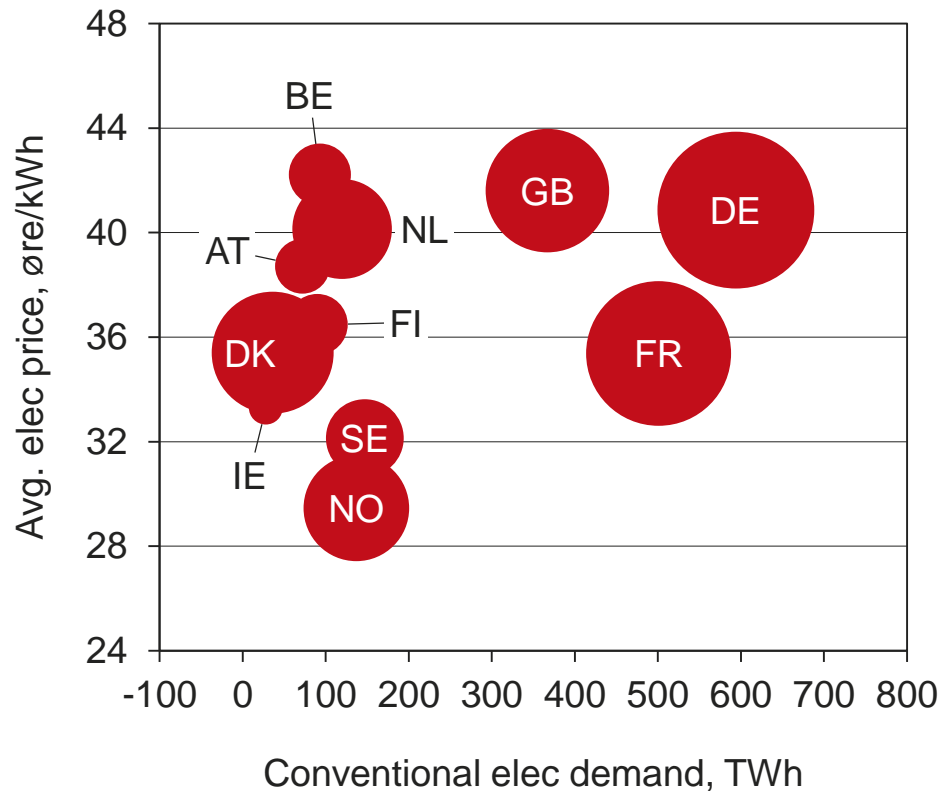
Demand for H2

H2 production, cost and system integration

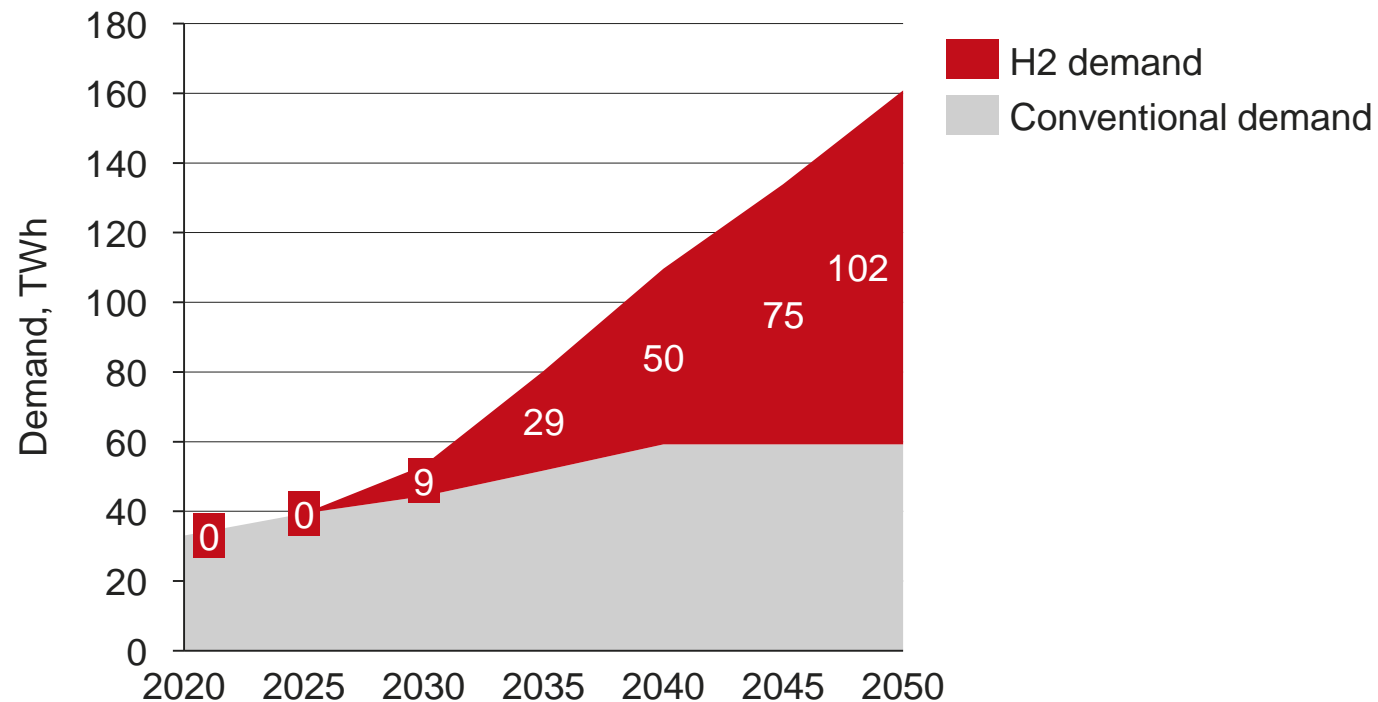
Value of hydrogen infrastructure

# Demand for hydrogen in Denmark

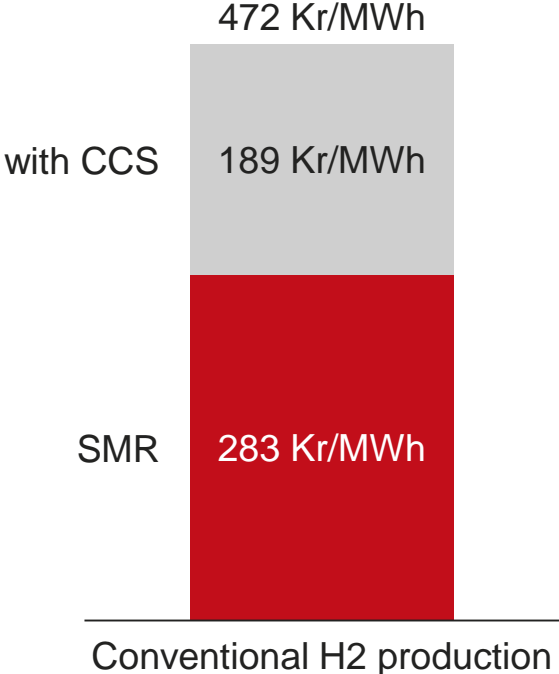
Potential for H2 production compared with countries electricity demand and avg. Electricity prices in 2030



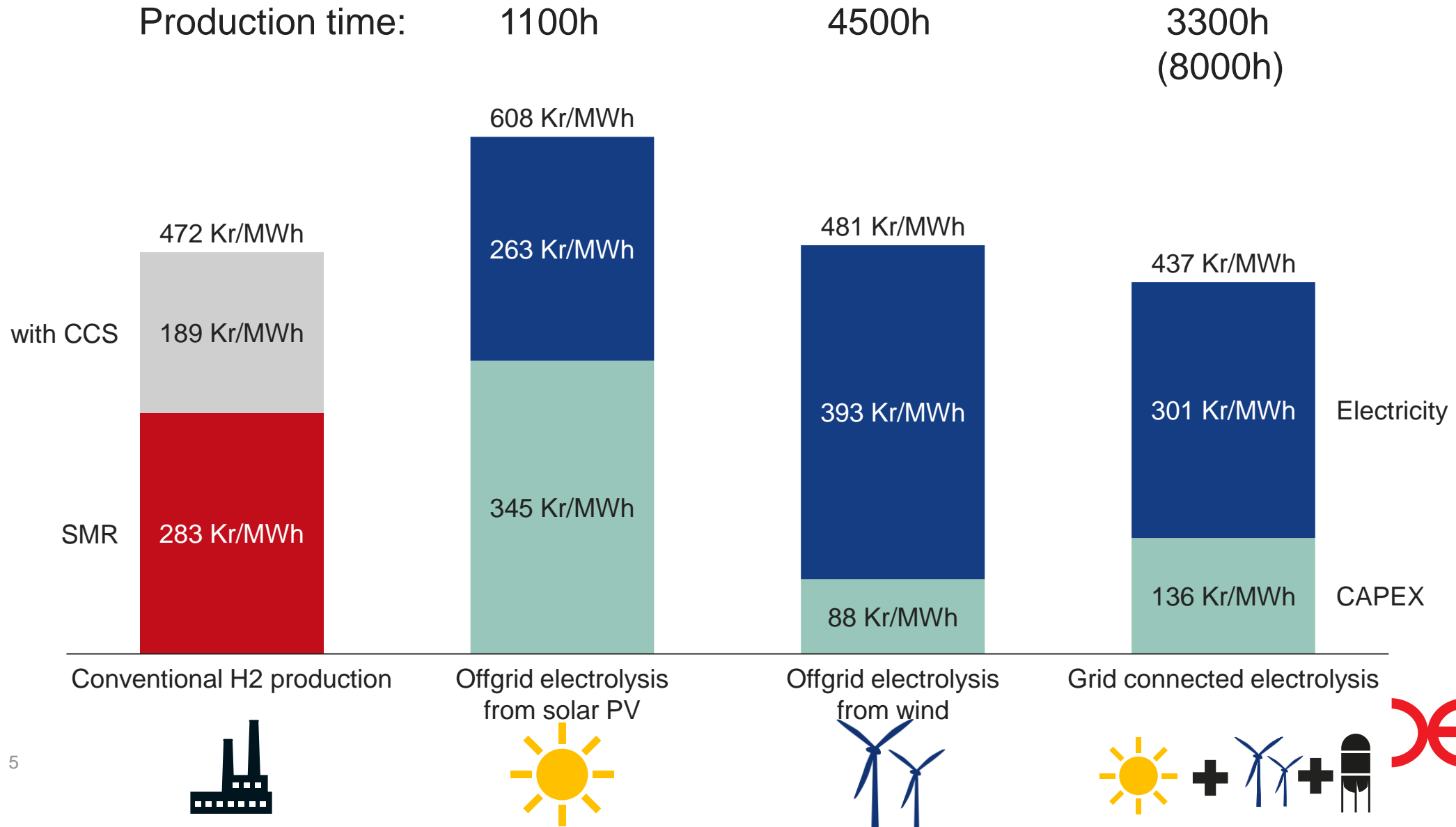
Electricity demand in Denmark



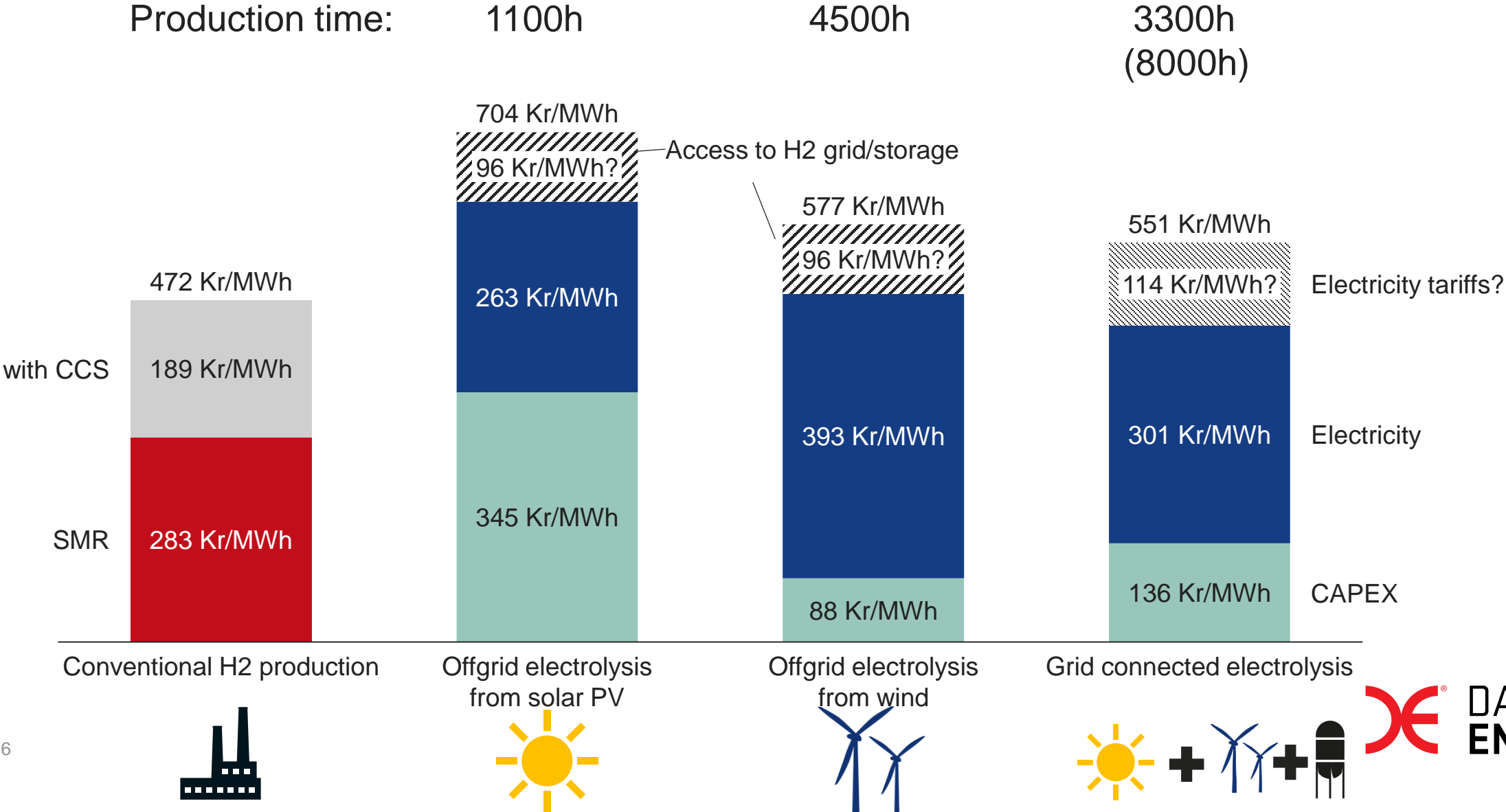
# Production costs for H2 in Denmark in 2030



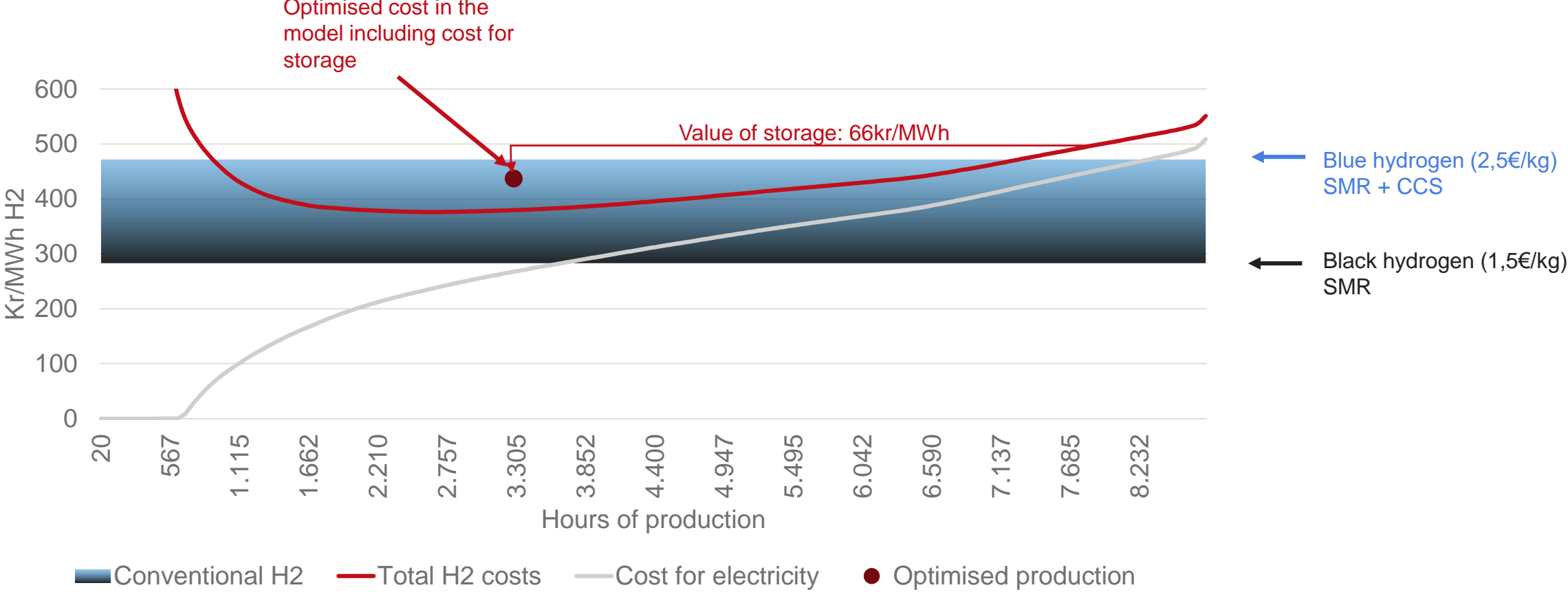
# Production costs for H2 in Denmark in 2030



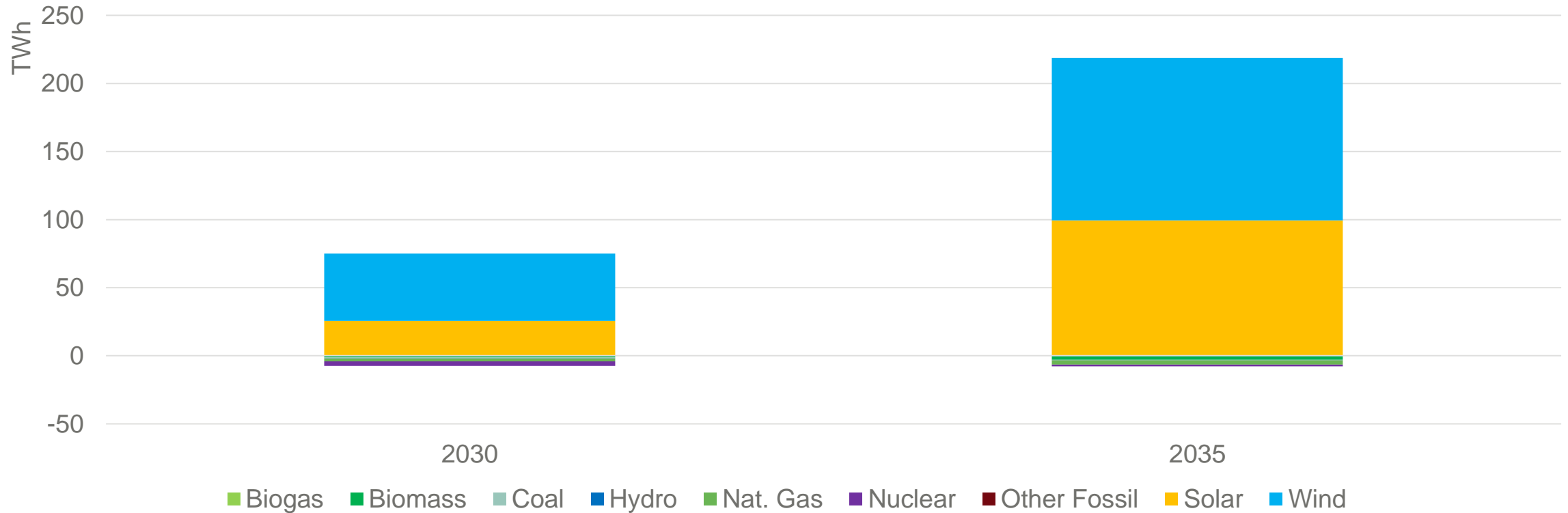
# Adding system integration costs



# Optimising H2 production in 2030

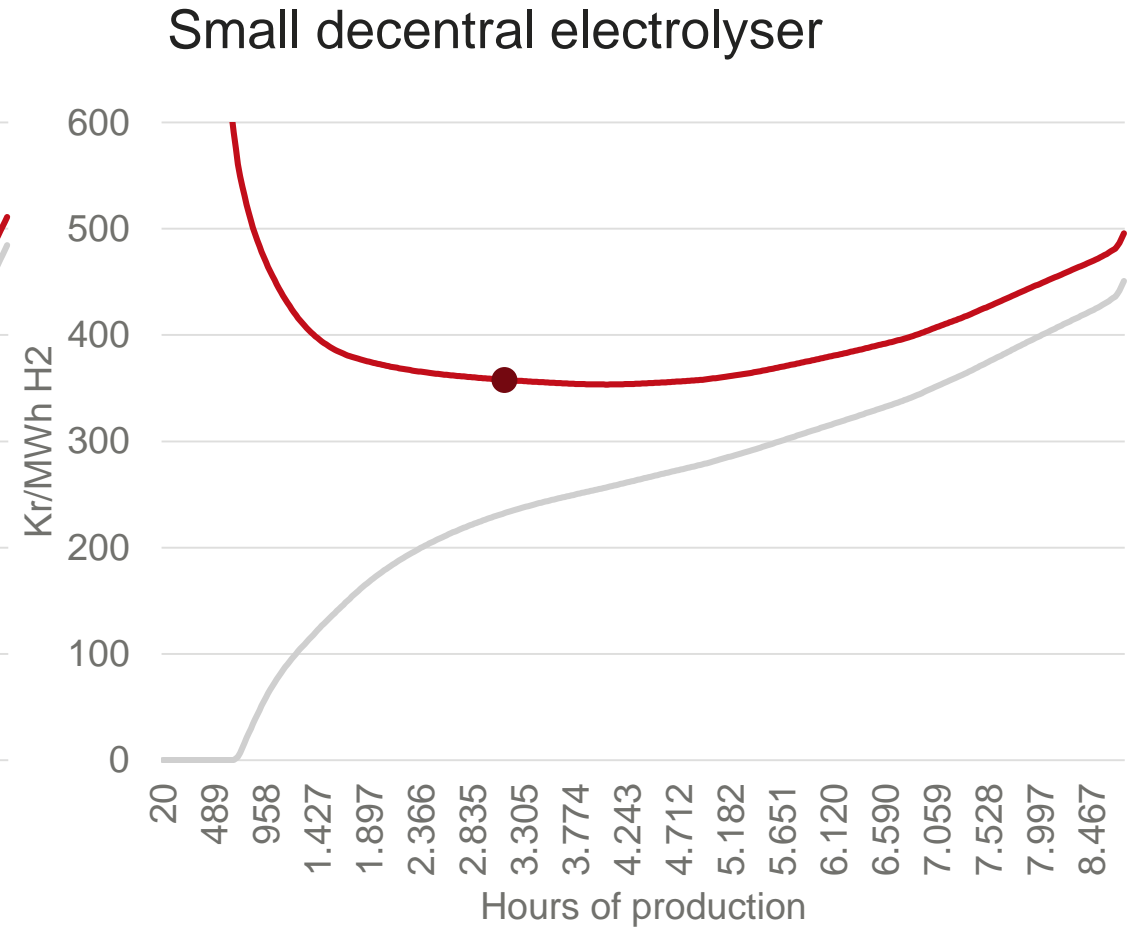
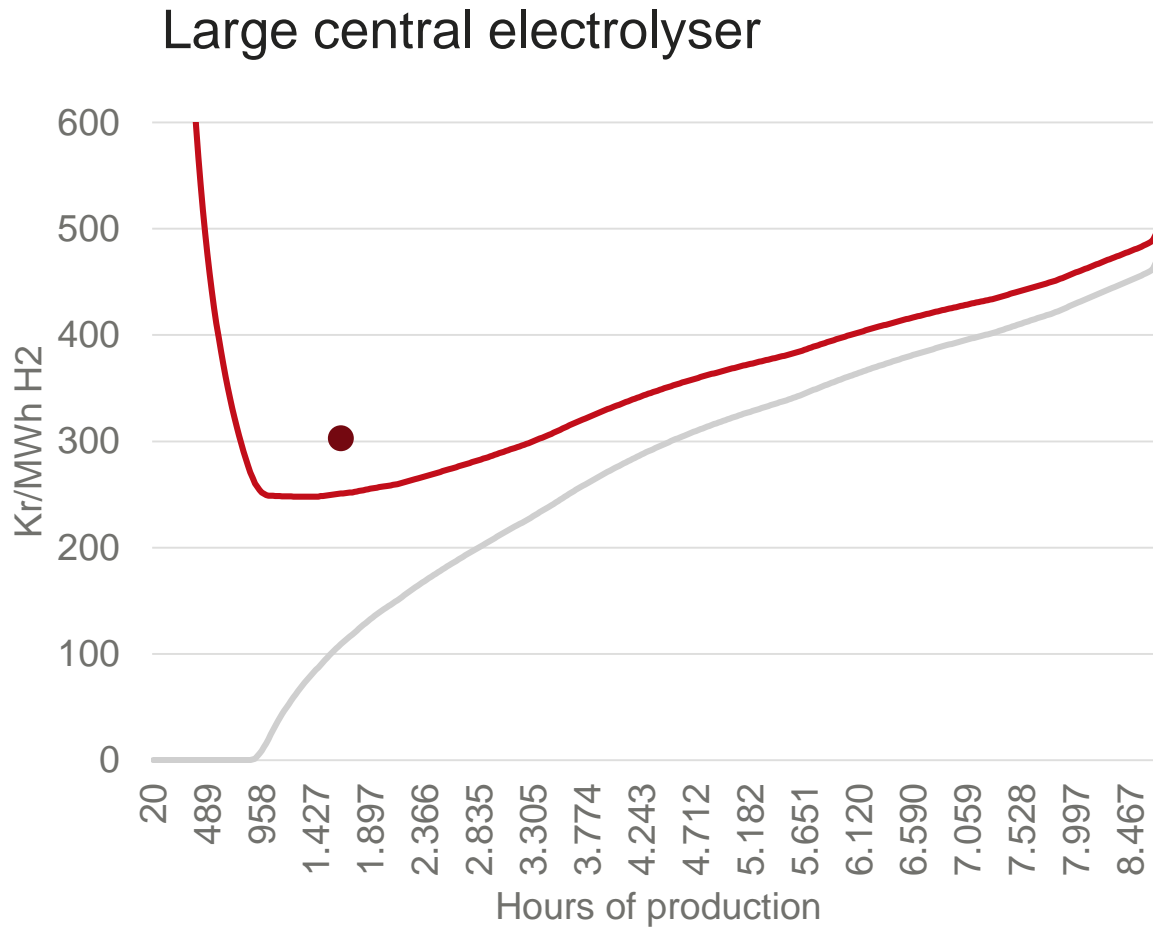


# What powers the electrolysers?





# Central vs decentral H2 production

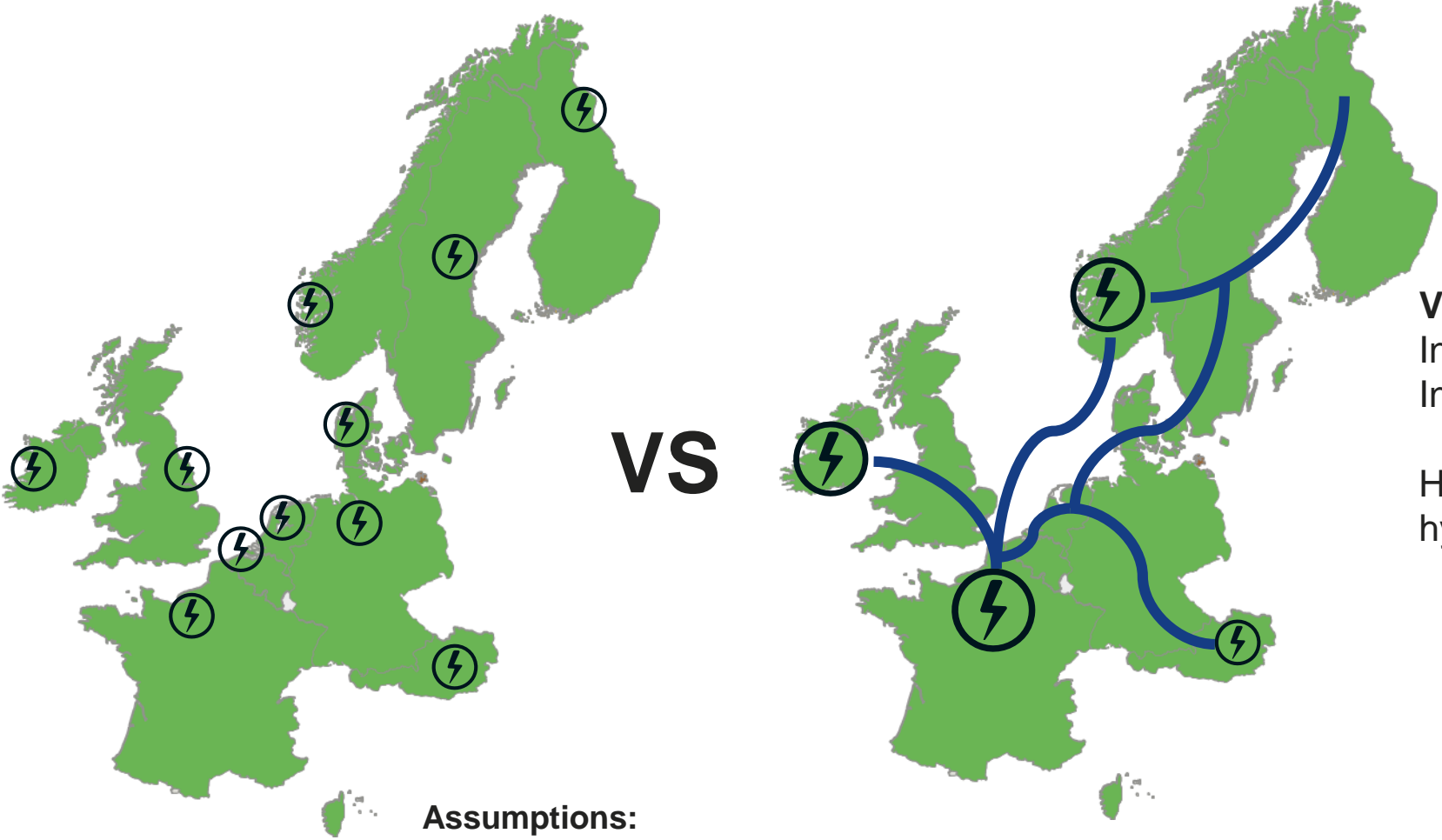


Value of central danish hydrogeninfrastruktur: 3B Kr/year = 55 kr/MWh H2



# Value of a pan-european hydrogen grid

Constant H2 demand in both scenarios



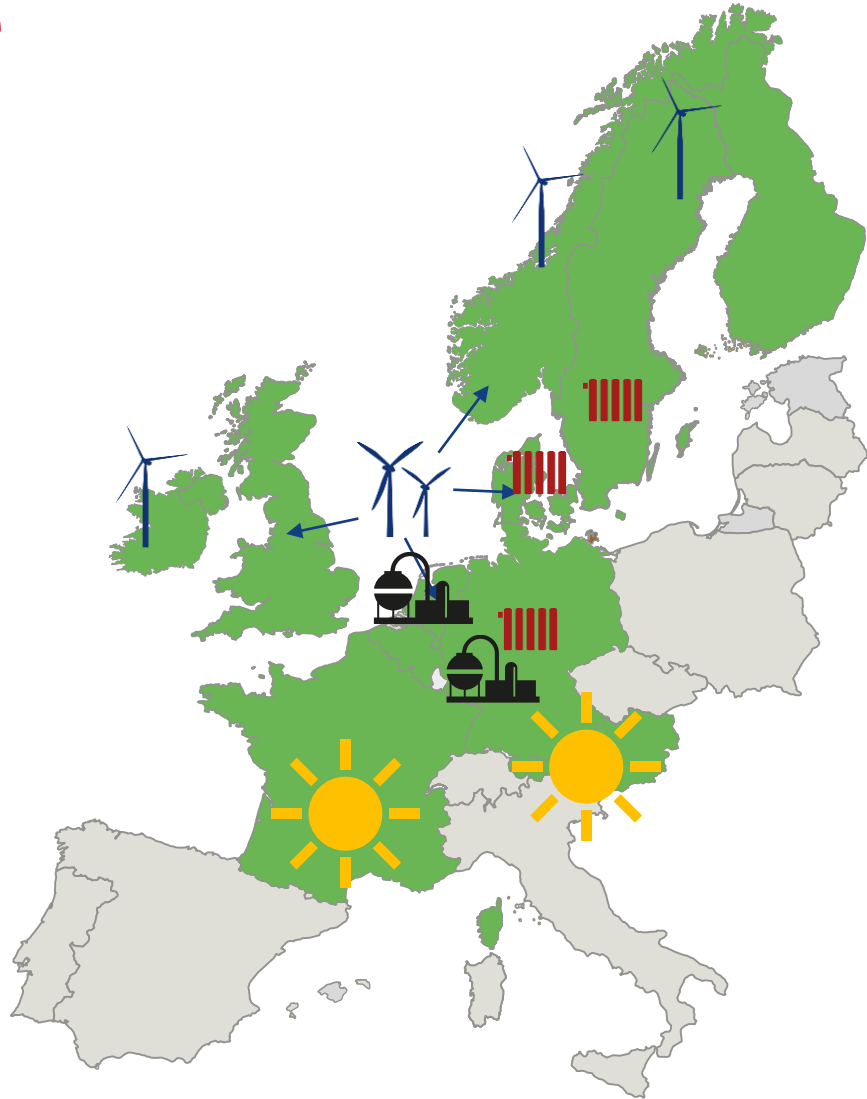
**Value with/without a hydrogen grid**  
In 2030: 5,1B Kr pr year (96 Kr/MWh H2)  
In 2035: 8,7B Kr pr year (51 Kr/MWh H2)

Has to pay for storage and back bone hydrogen grid across Europe

- Assumptions:**
- + Free placement of electrolysers
  - + More RES production on cheapest locations
  - + Investments in electricity interconnectors



# Competition for hydrogen production in the future



## Northsee region

Large offshore potential. Possible large scale offshore projects combining wind and P2X plants

## District heating

Possible sector coupling between P2X plants and DH sector

## Onshore wind

Cheap onshore wind in Ireland og North Scandinavia with less NIMBY concerns

## Solar PV

Cheap solar PV from southern parts of Europe. 2030 prices < 20 øre/kWh

## Hydrogen industry today

Europe has a hydrogen industry of 400 TWh today.

## Hydrogen infrastructure

Holland is building a national hydrogen grid. Leeds is converting city gas grid to hydrogen

# Questions?

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