Hydrogen on the West Coast

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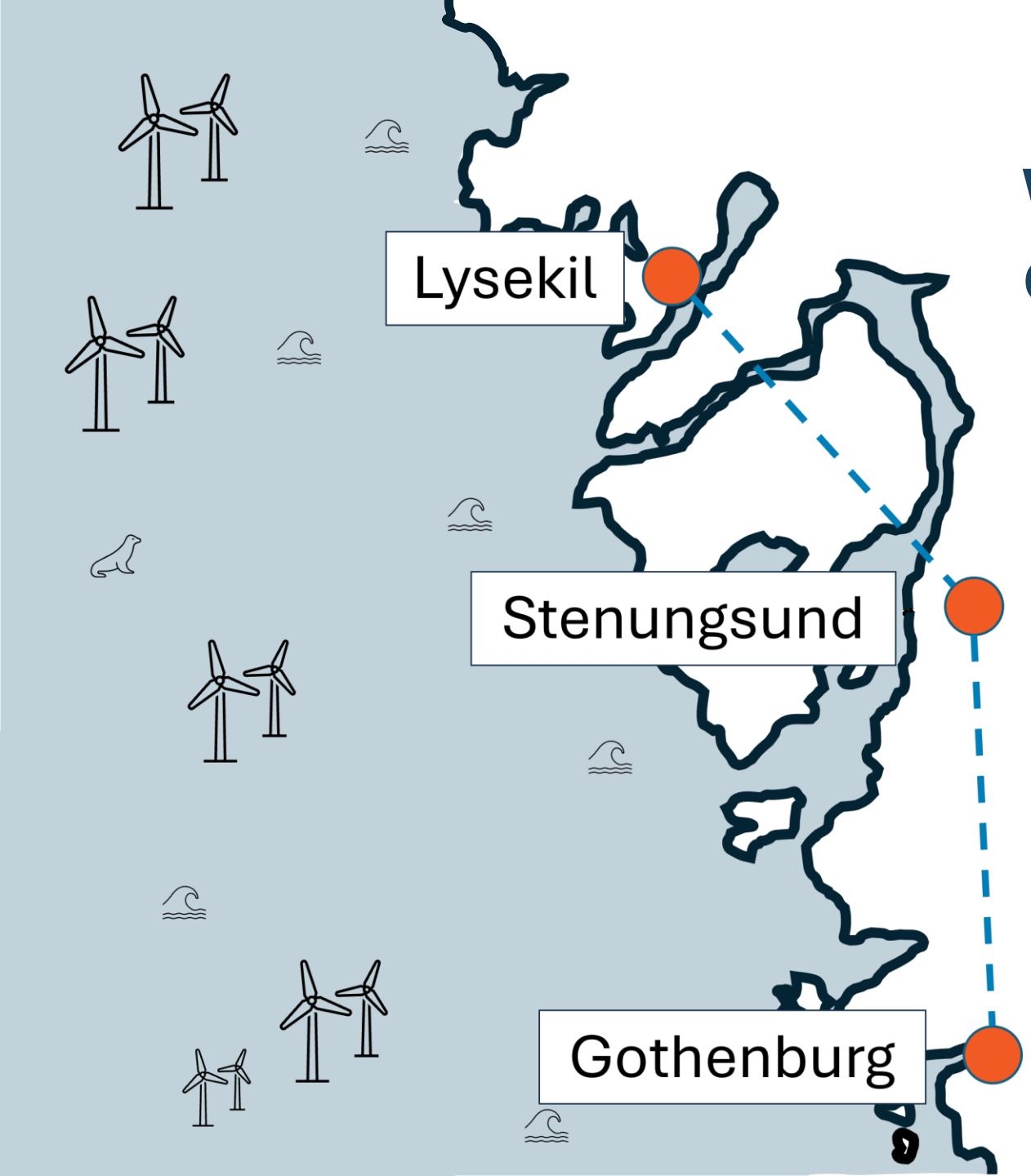


What is happening on the West Coast?

Current electricity demand

• Västra Götalandsregionen	18 TWh/year
• Gothenburg	4,3 TWh/year
• Stenungsund	1.6 TWh/yer
• Lysekil	0.6 TWh/year

Potential and expected future electricity demand

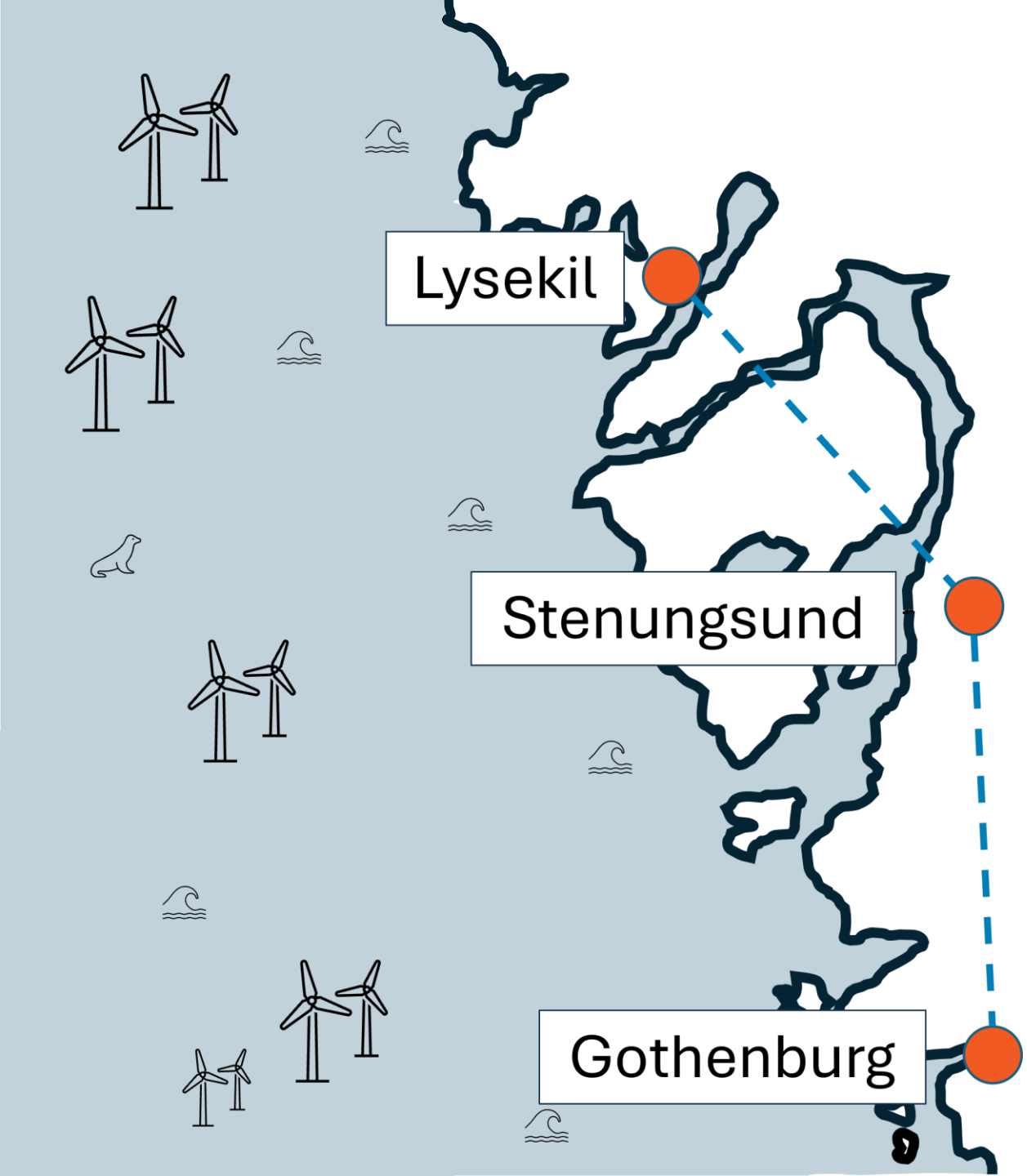
• Transportation sector	0,5-1 TWh/year
• The Port of Gothenburg	0,5 – a lot TWh/year
• Battery factory (NOVO)	2,2 TWh/year
• Heat pumps	
• Electricity to chemical industries • Electricity to refineries	7-20 TWh/year

Research questions

- How does hydrogen demand from industries impact municipal energy systems when produced through **electrolysis**?

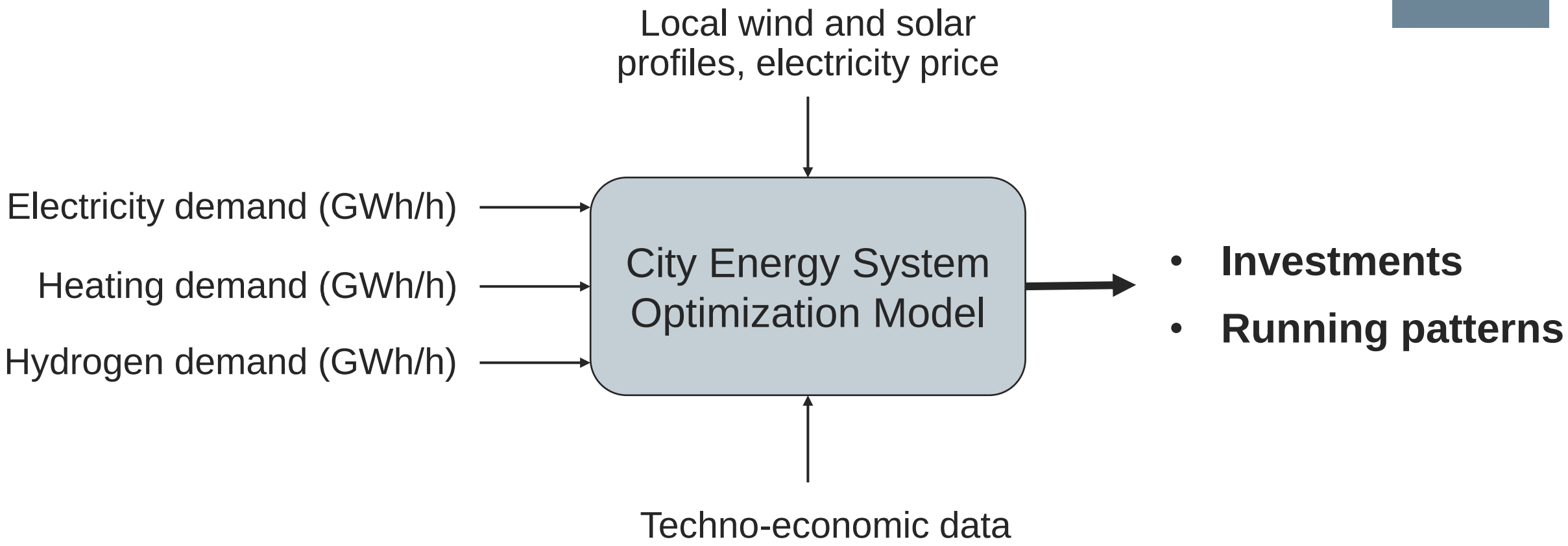
- How could **regional collaboration** in trading hydrogen through **a pipeline** between three industry intense nodes impact the energy system configurations?

- Does the role of **sector coupling** depend on whether the demand for hydrogen is met locally or through regional collaboration?



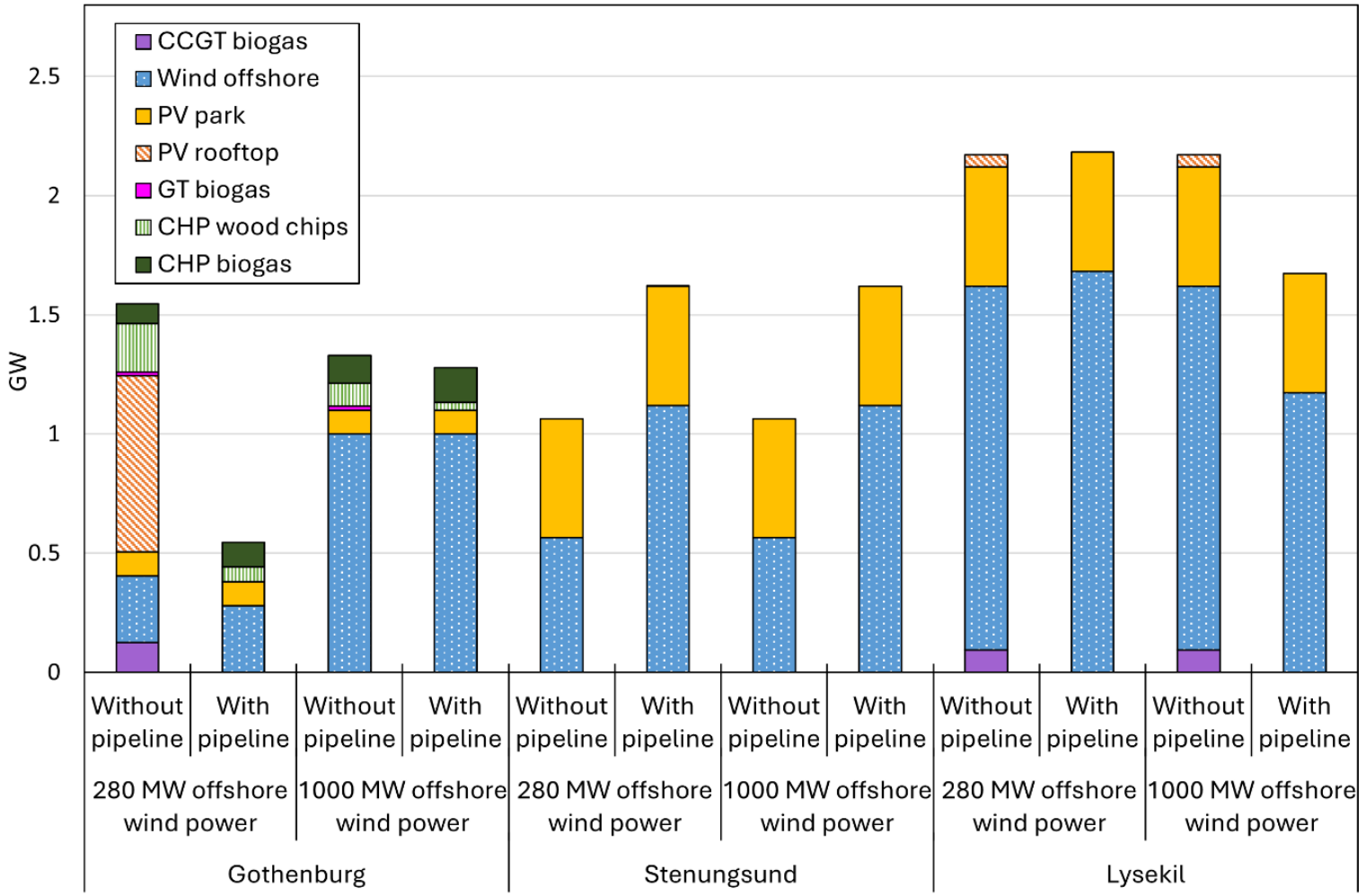
	Gothenburg	Stenungsund	Lysekil
Electricity import capacity [MW]	1545	1000	50
Offshore wind farm availability [MW]	280/1000	1120	5000
Solar PV park availability [MW]	100	500	500
Rooftop solar PV availability [MW]	1900	100	50
Hydrogen demand [TWh/yr]	5	5	4
Possibility to invest in LRC	No	Yes	Yes

Cases	Wind availability	Pipeline possibility
1	280 MW	No
2		Yes
3	1000 MW	No
4		Yes

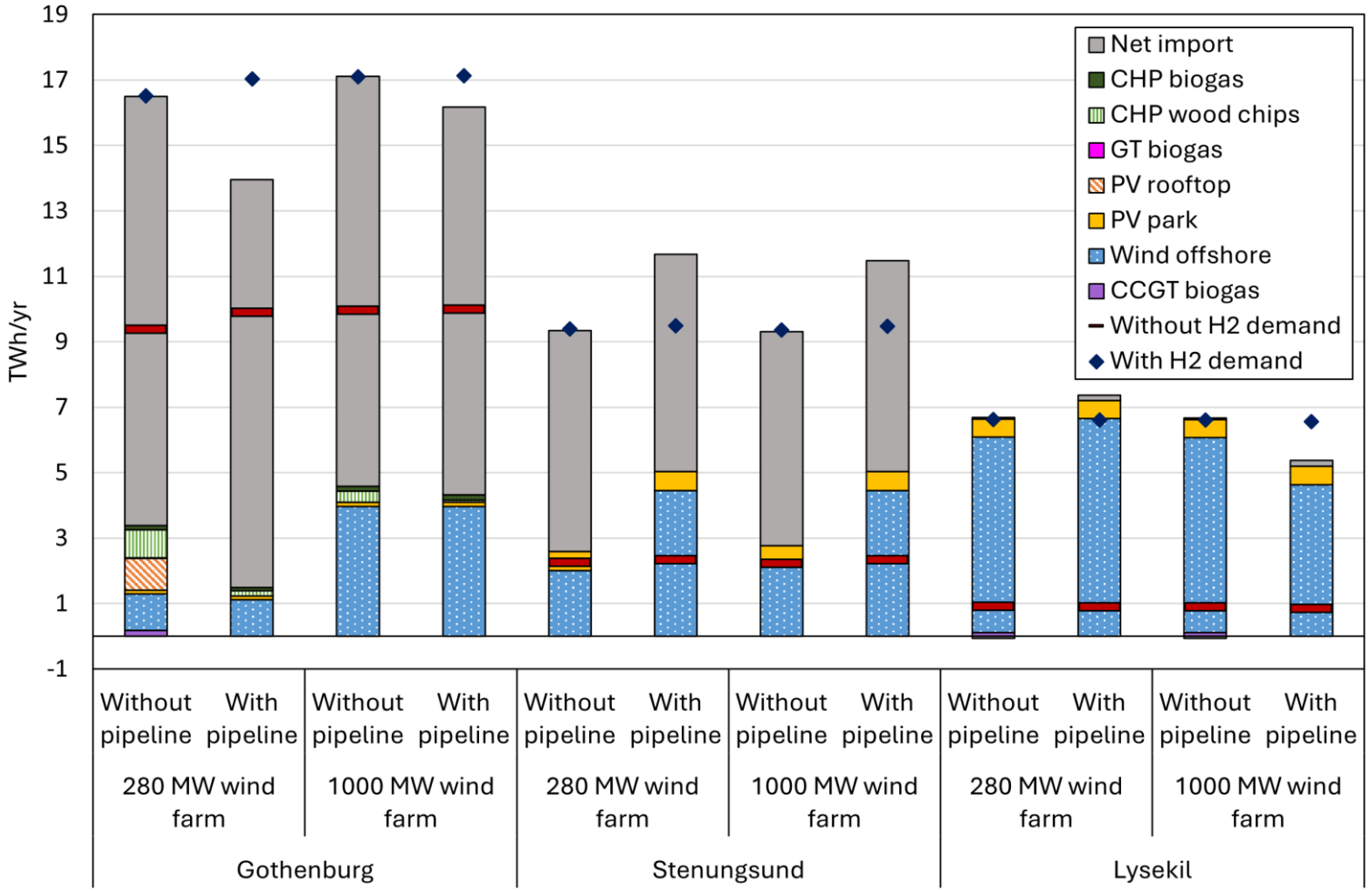


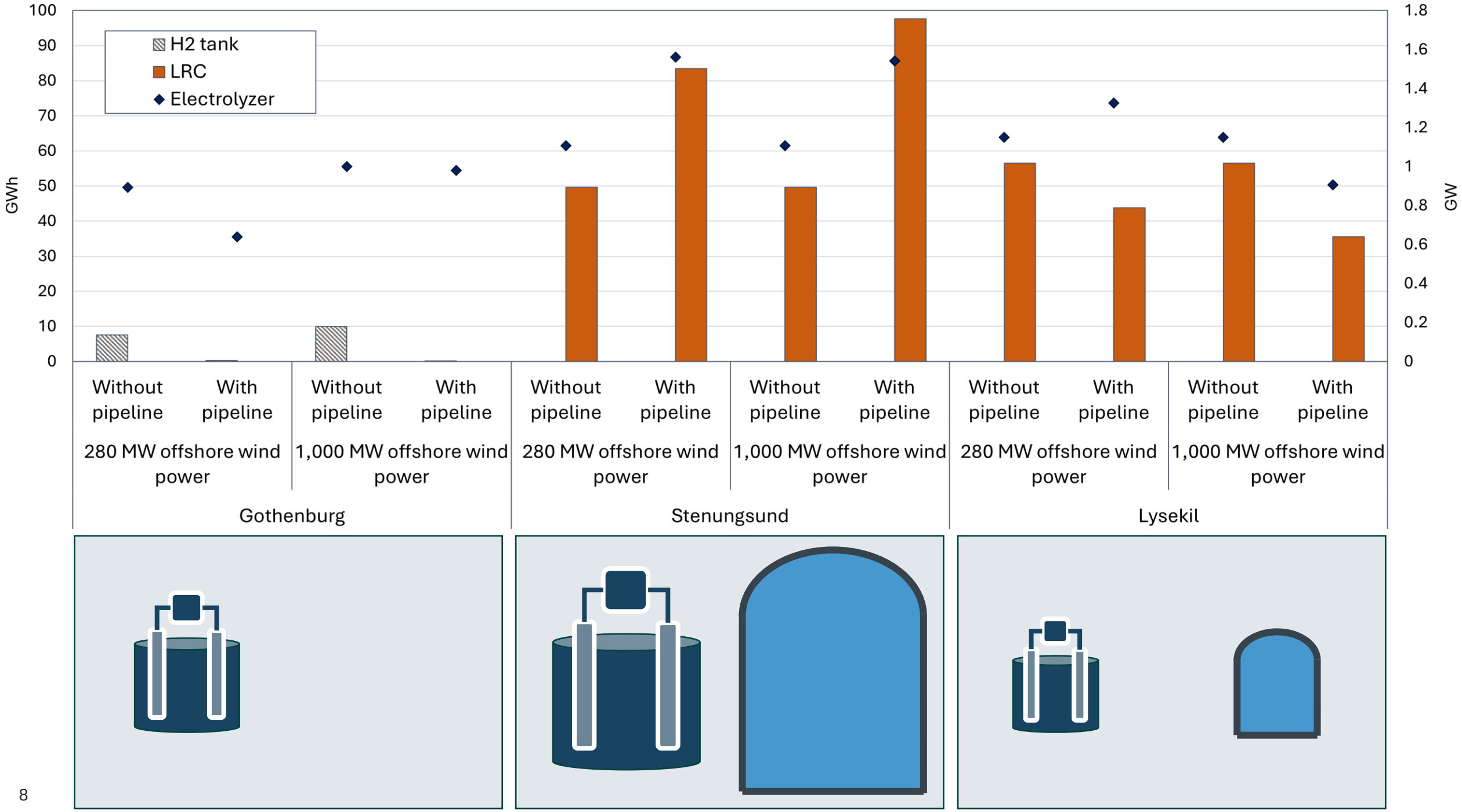
- **Investments**
- **Running patterns**

Investments in electricity production

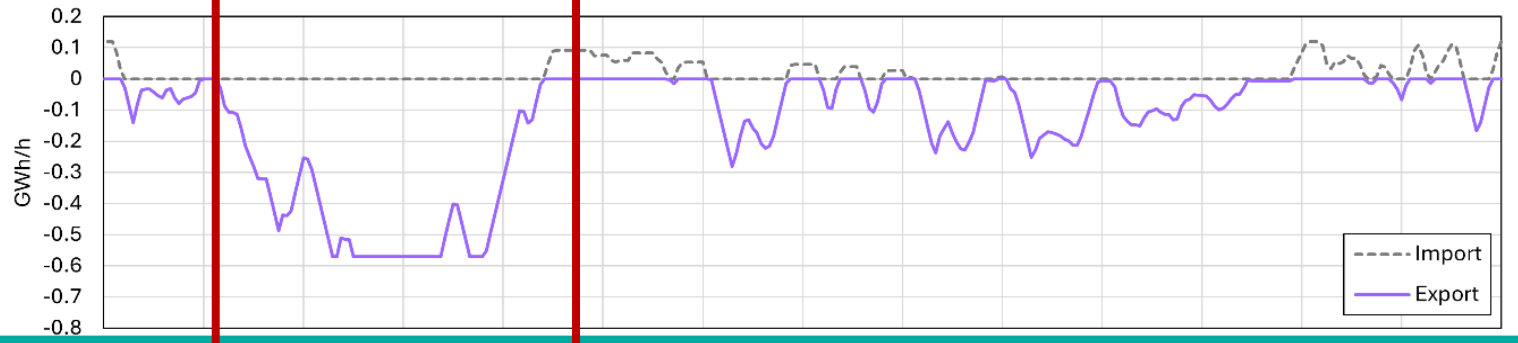


Electricity generation

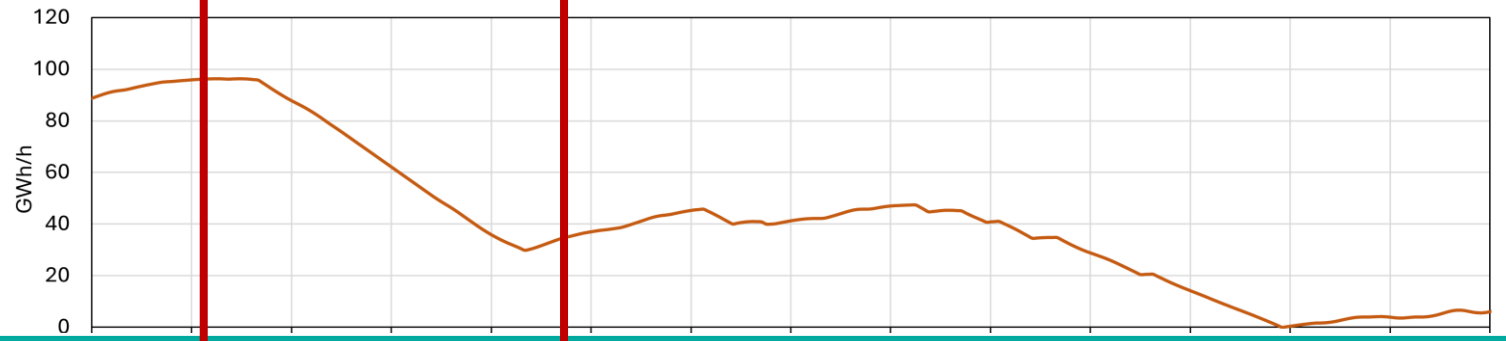



H2 tank
LRC
Electrolyzer
GWh
GW
100
90
80
70
60
50
40
30
20
10
0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Without pipeline
With pipeline
280 MW offshore wind power
1,000 MW offshore wind power
Gothenburg
Stenungsund
Lysekil

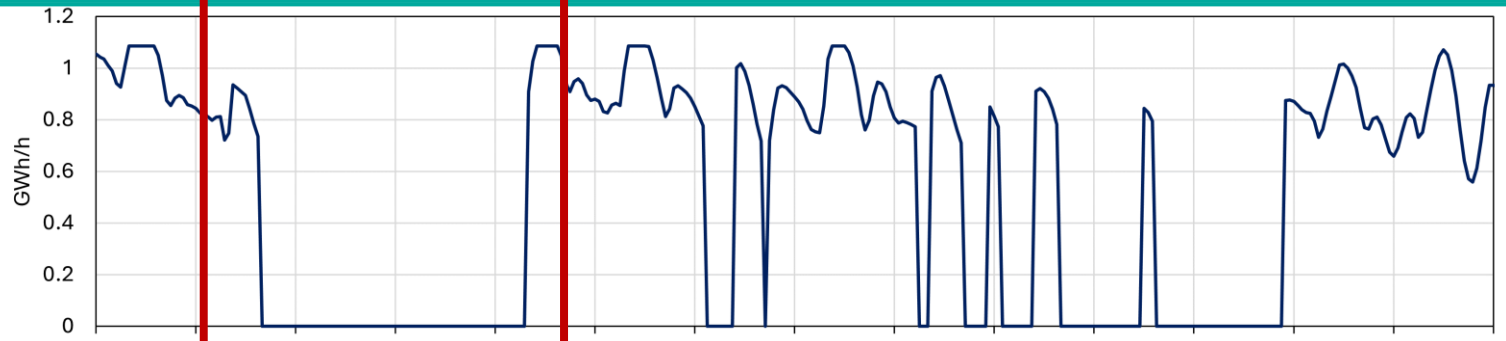
Pipeline (Gothenburg-Stenungsund)



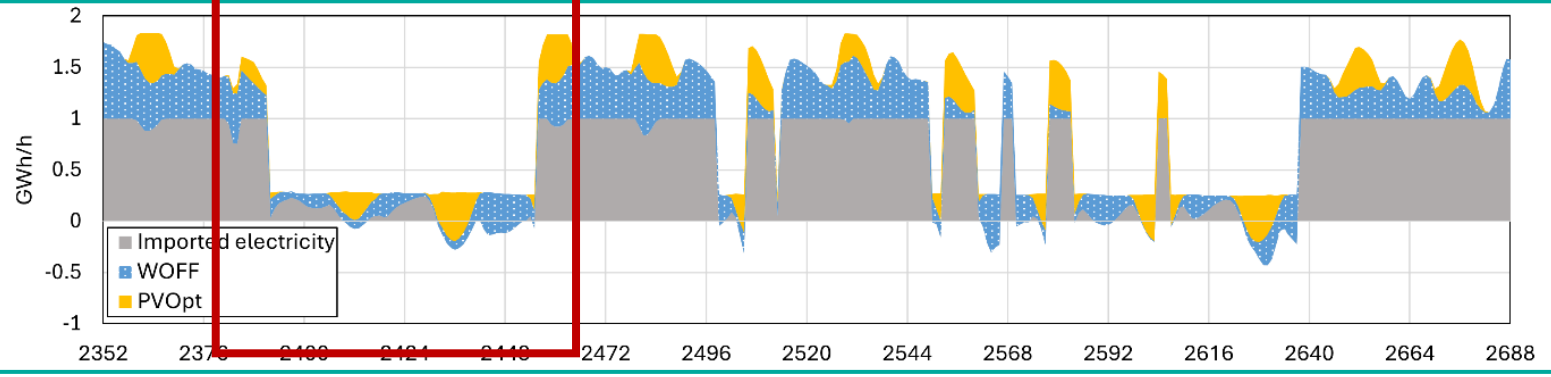
Lined Rock Cavern



Electrolyser



Electricity supply



System cost

	≤ 0.28 GW offshore wind power outside GBG		≤ 1 GW offshore wind power outside GBG	
	Without pipeline	With pipeline	Without pipeline	With pipeline
Total system cost (M€/year)	1580	1470	1510	1450
Change (%)		- 7%		- 4%

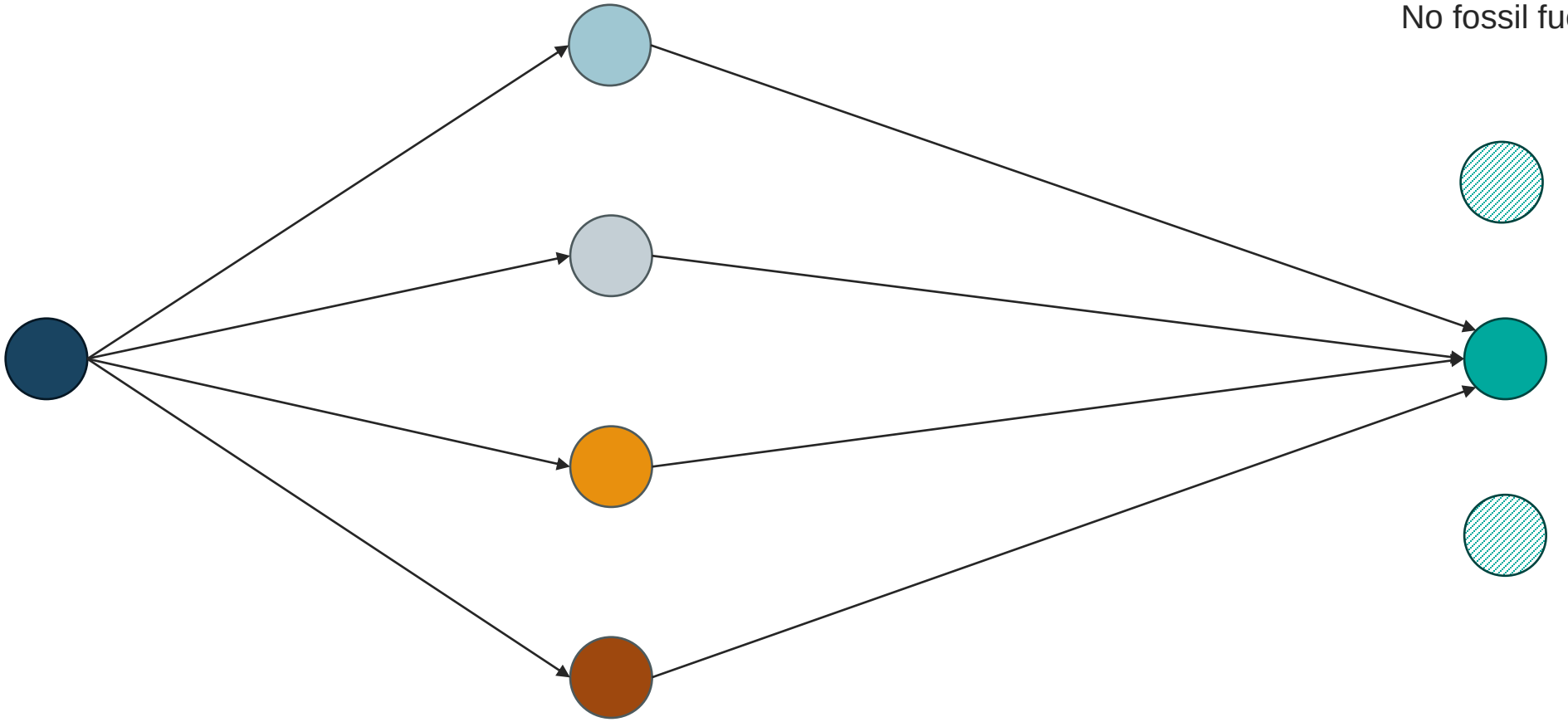
Conclusions

- Meeting hydrogen from electrolysers significantly increases the demand for electricity in the studied region (~155%)

- Regional collaboration through a pipeline lowers total system cost (4-7%)

- Driving force for collaboration are the different characteristics of the cities investigated:
  - Gothenburg – high demand, limited VRE and grid connection
  - Stenungsund – comparatively large availability of VRE and grid connection
  - Lysekil – large availability of VRE but restricted grid connection

Future work - How do we get there?



Today **~2035** **2050**

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Important assumptions

- Access to offhsore wind farms
- Available grid connection
- Not possible to build electricity grid between the nodes