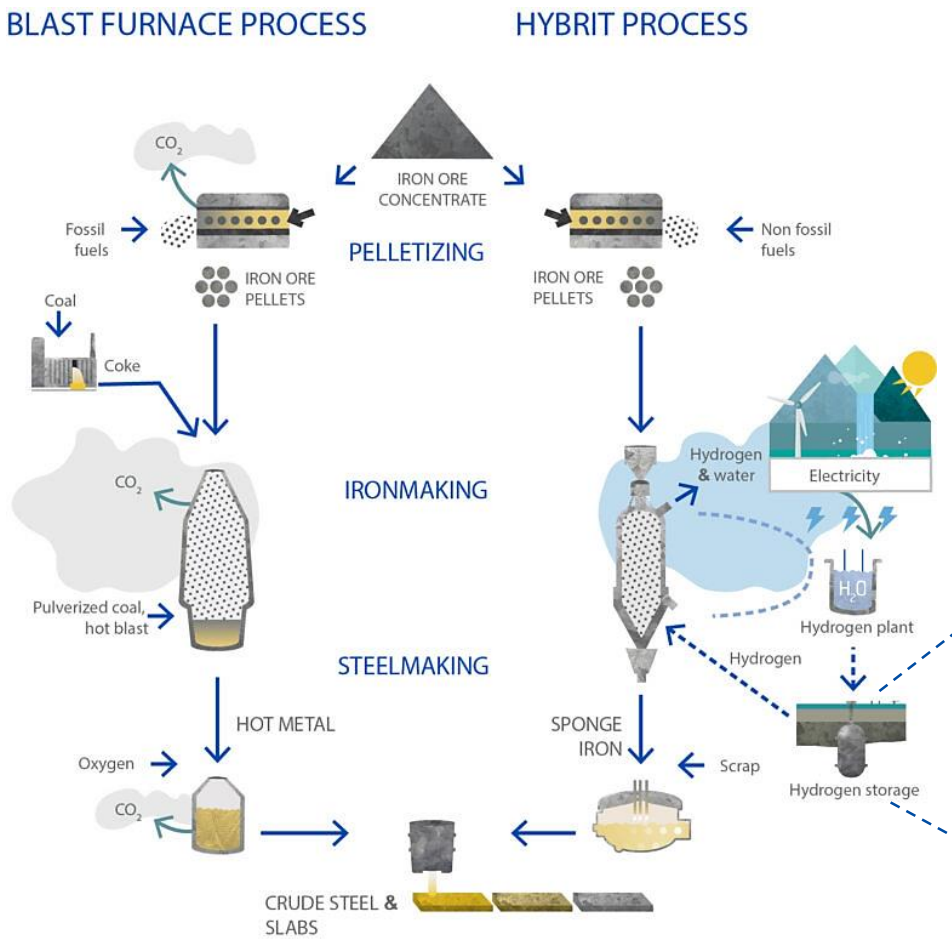
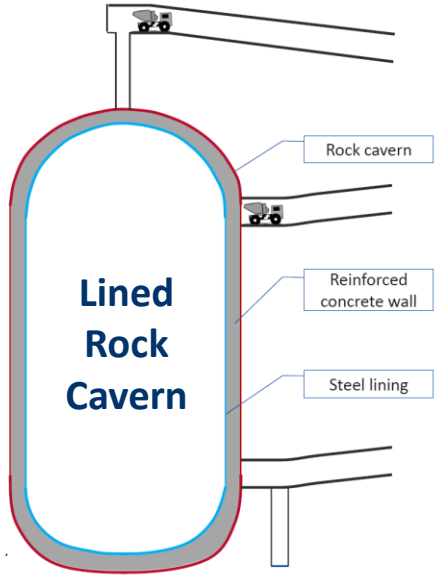
HYBRIT – System integration and flexibility

Tobias Rehnholm

HYBRIT in short



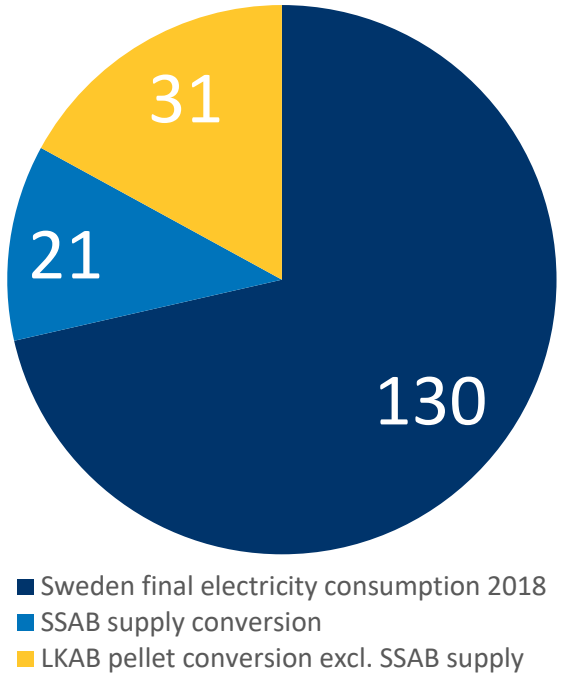


- ***HYBRIT = HYdrogen BReakthrough Ironmaking Technology***

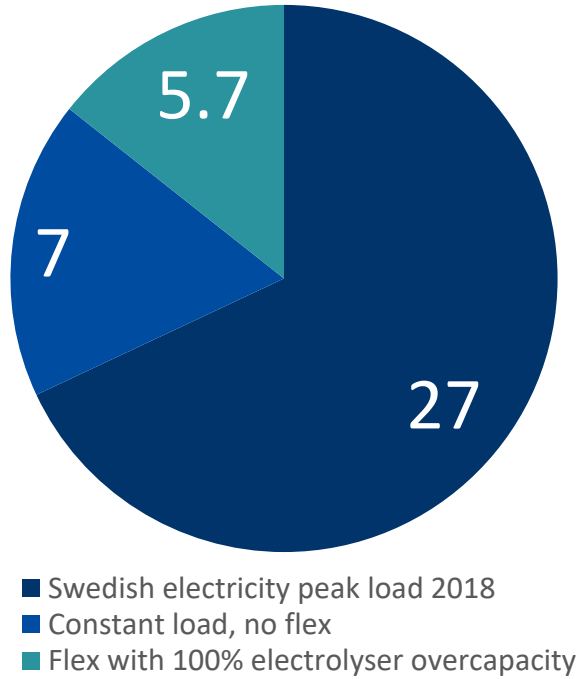
A joint venture between SSAB, LKAB and Vattenfall

Order of magnitude – transition of Swedish ore-based iron/steel

Electricity consumption [TWh]



Power demand 52TWh case [GW]



- *Reduce up to 35Mt of CO2*
- *+40% increase in Swedish electricity demand*
- *Minimum power demand can be reduced from 7GW to 1.3GW by storage flexibility*

Scenario analysis with market feedback

North European power market simulation

- 2035-2055
- 51 weather scenarios
- Energy demand is compensated with 100% wind

Flexible 21TWh (40% in SE1)

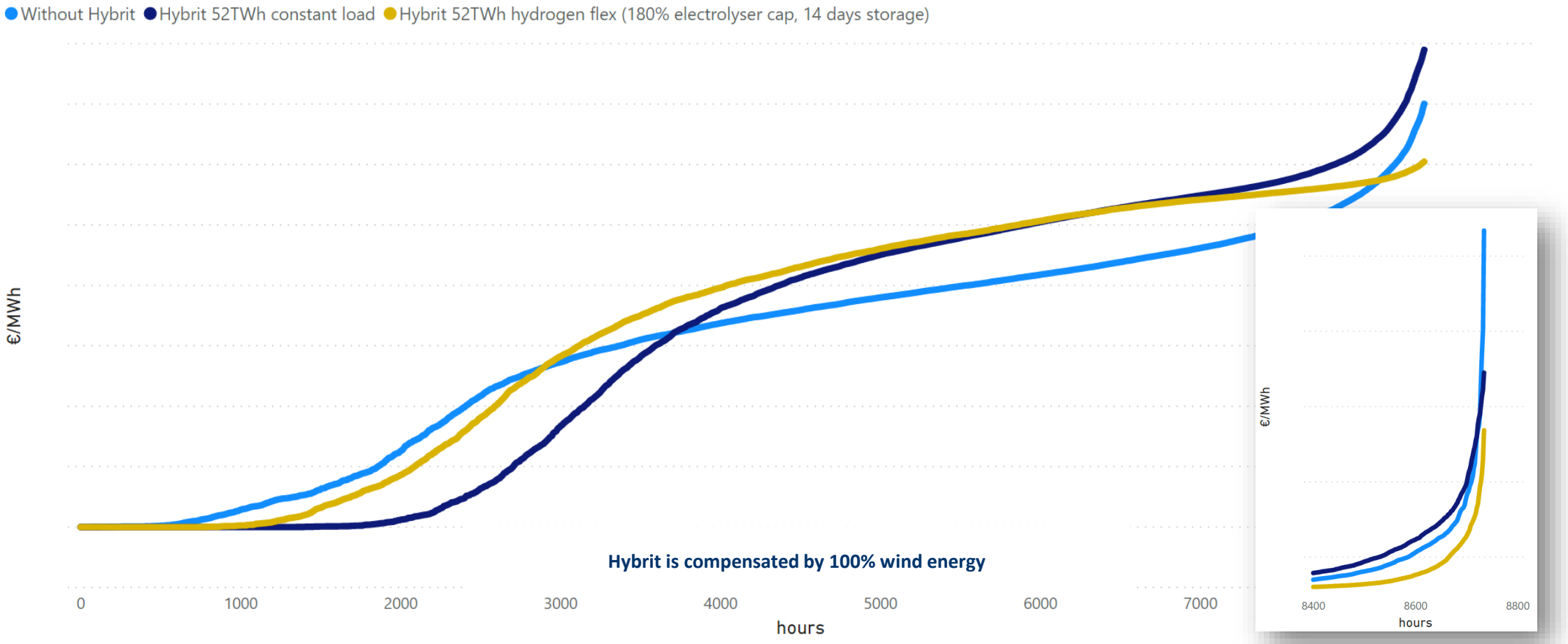
- 180% electrolysis capacity [3.7GW]
- 7 days hydrogen storage [0.3TWh]

Flexible 52TWh (95% in SE1)

- 180% electrolysis capacity [10.2GW]
- 14 days of hydrogen storage [1.6TWh]

- *Flexible consumption can **lower cost for Hybrit** and **increase the value of wind***

SE1 price duration curves 2040: 52TWh

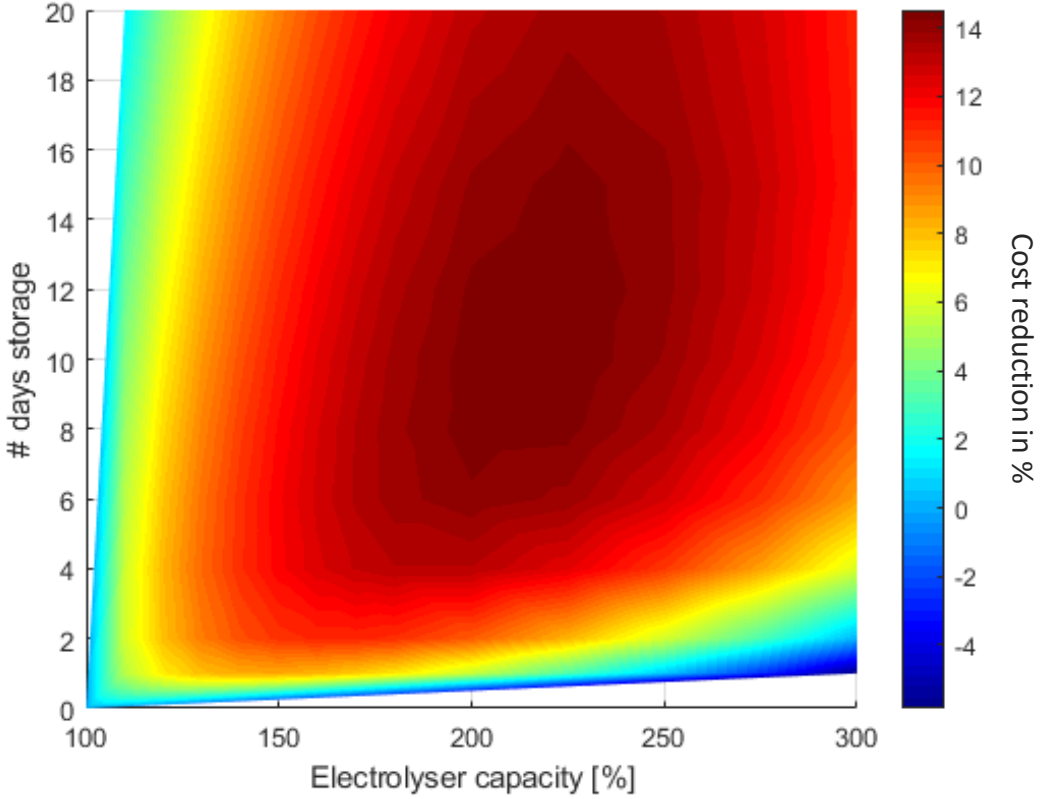


- *Hybrit flexibility raises low prices and lowers high prices*
- *More wind increases the number of low-price hours*

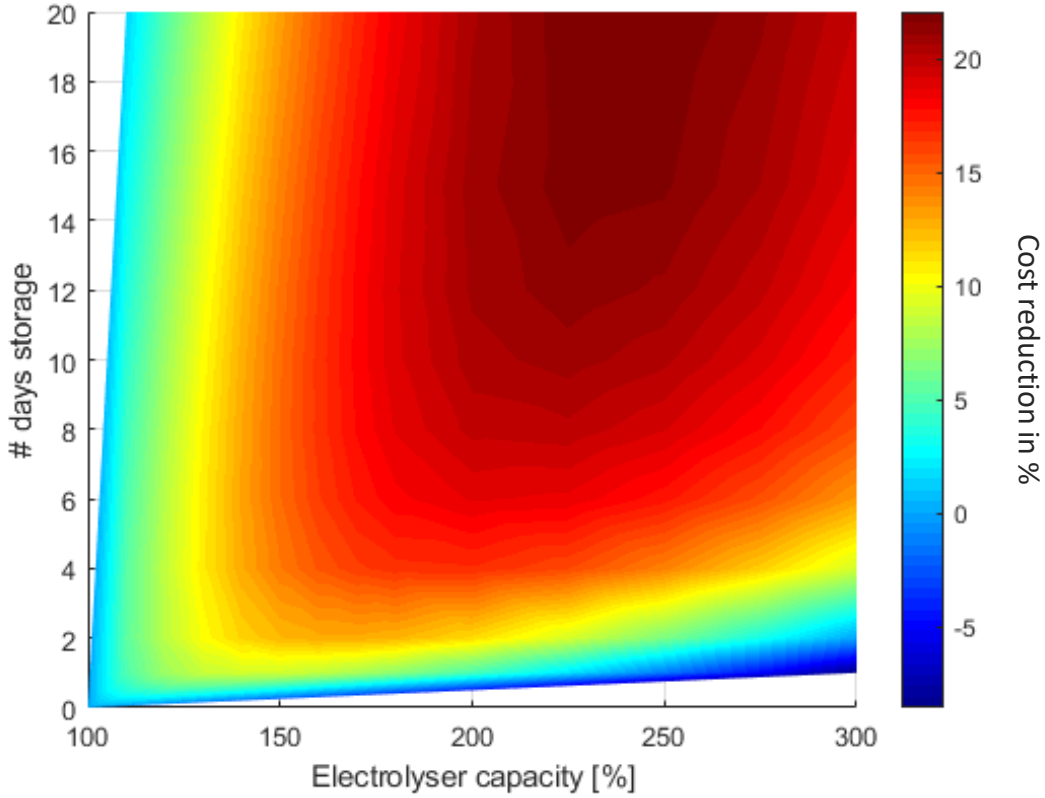
Hybrit cost reduction with demand flexibility

Analysis exclude grid costs

Hybrit 21TWh (8.3TWh in SE1): ~15% cheaper

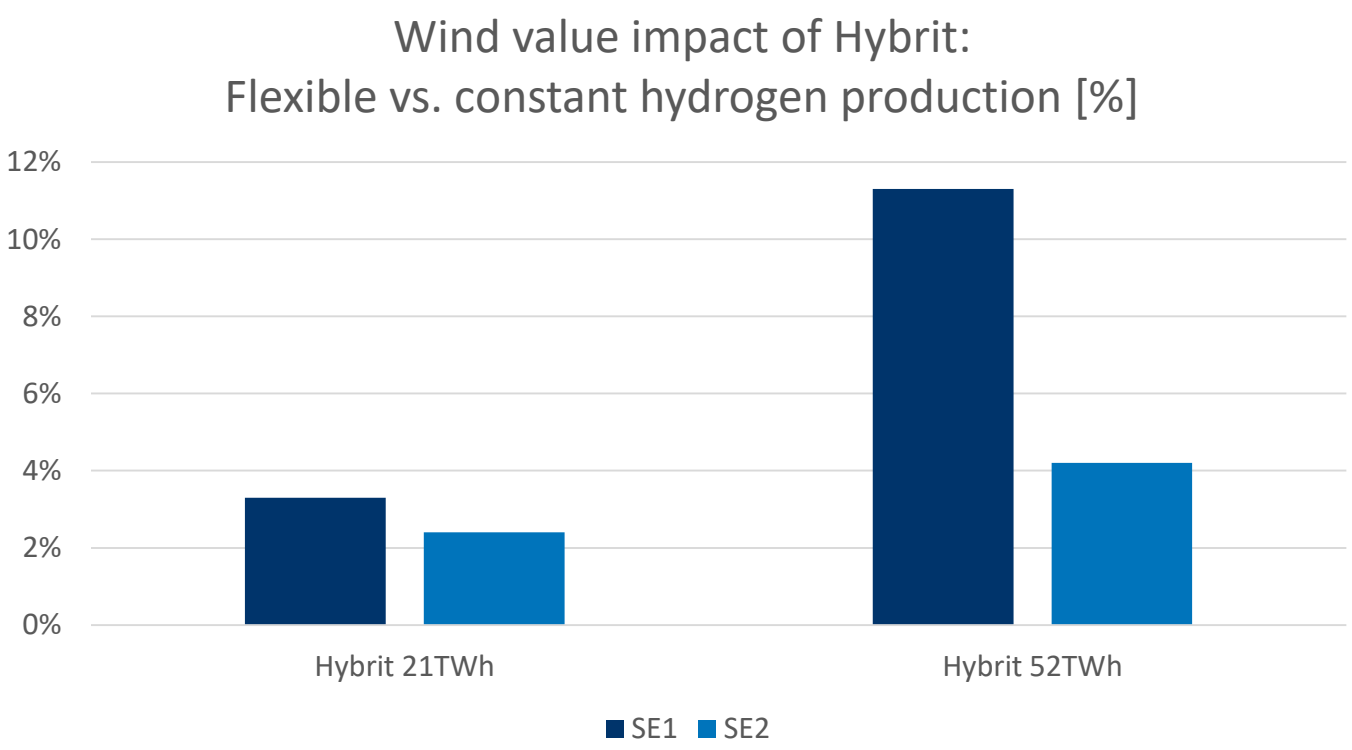


Hybrit 52TWh (49.3TWh in SE1): ~20% cheaper



- *Flexibility reduces the cost of hydrogen production for Hybrit*
- *Increased wind penetration increases the value of flexibility*

Wind value impact of Hybrit flexibility



- *Demand flexibility increases the value factor of wind*
- *Challenging grid situation between SE1 and SE2 in the 52TWh case*

Integrative approach

- Partnerships enable a more attractive approach to value chain transitions.
- Industry flex can increase build-out of variable renewables, which in turn benefits the industry.
- Solutions are built for fitting into the next generation electricity system.

HYBRIT

FOSSIL-FREE STEEL

Tobias Rehnholm
tobias.rehnholm@vattenfall.com