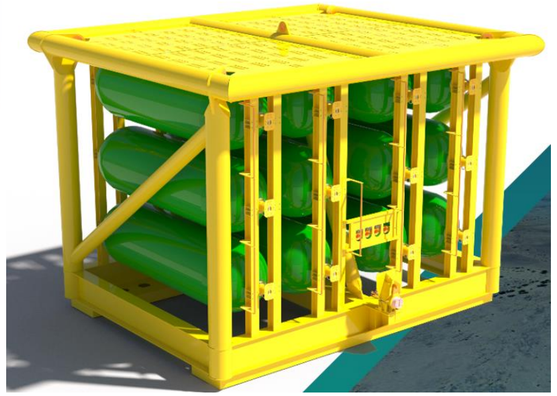
Case study: Decarbonizing an island with a large-scale subsea hydrogen storage

Andreas Løvli, System engineer

May 2025



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TechnipFMC – at a glance

We are a fully integrated technology and services provider in Subsea and Surface.

Key facts

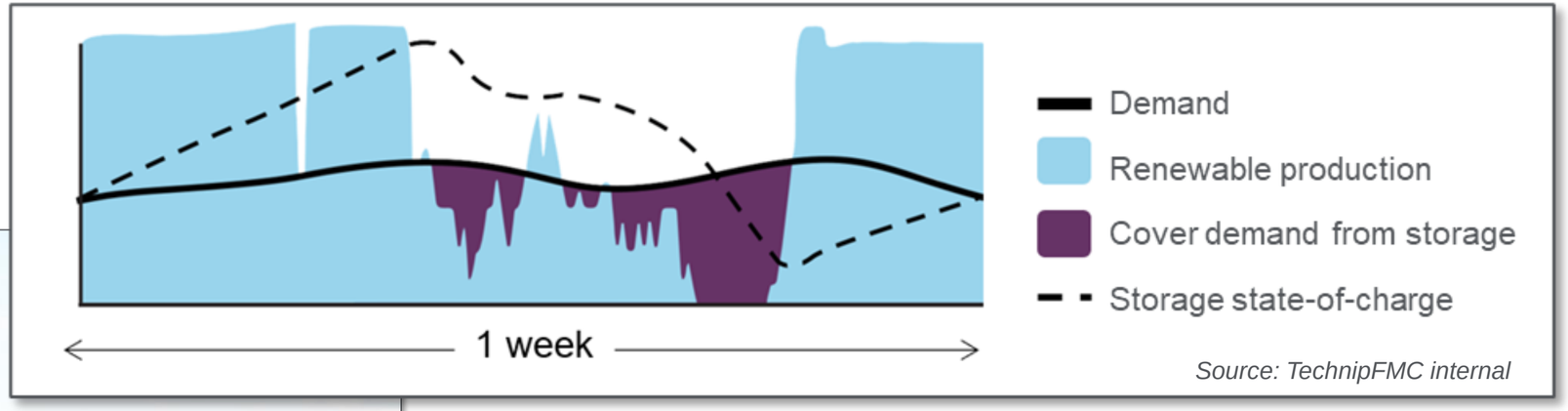
21,000
Employees

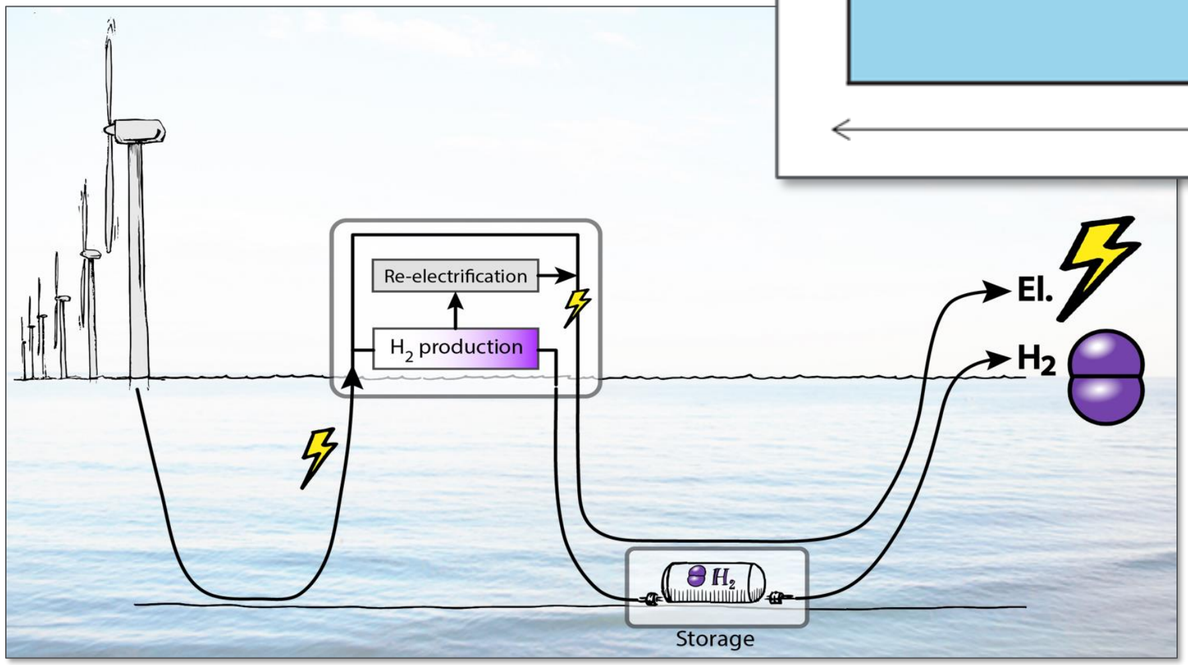
39
Countries

1
Stock exchange listing

$7.8B
Total company revenue (2023)

Original idea (2016)



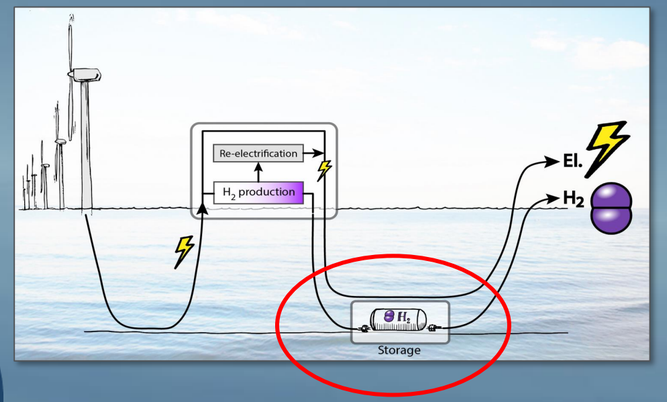


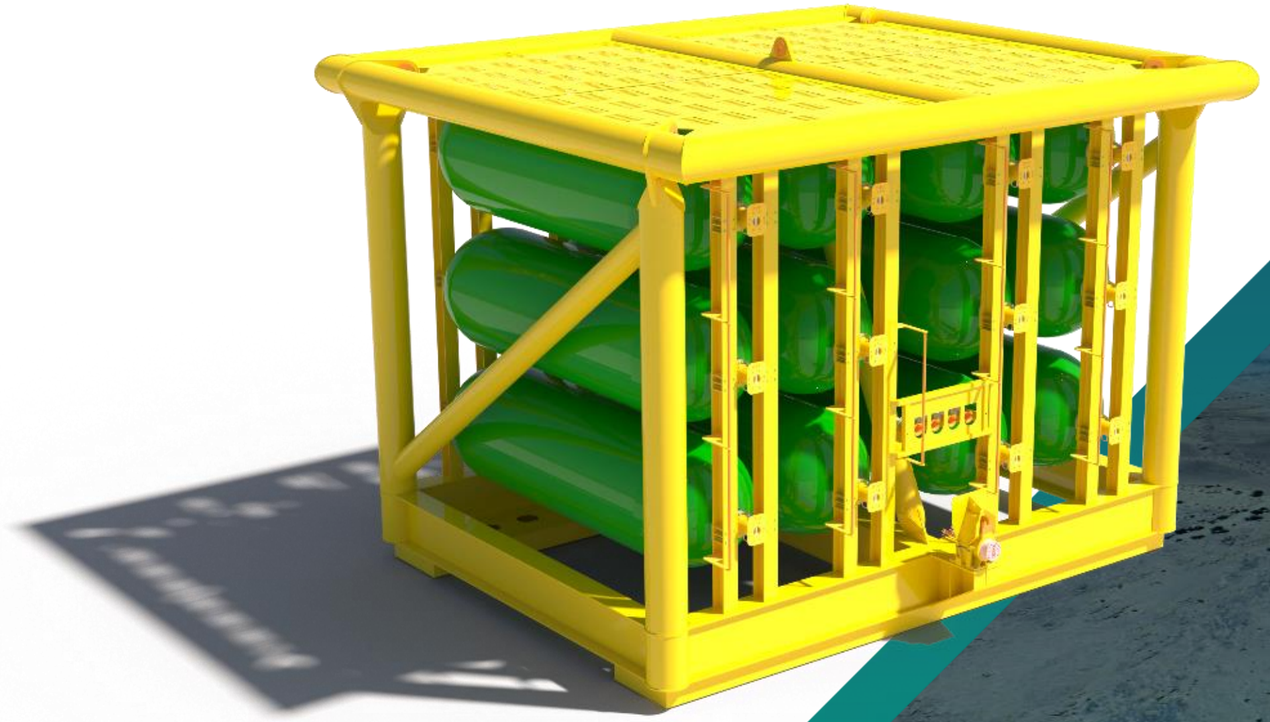
- an independent energy system capable of net zero

Technology Development

Subsea Hydrogen Storage Qualification

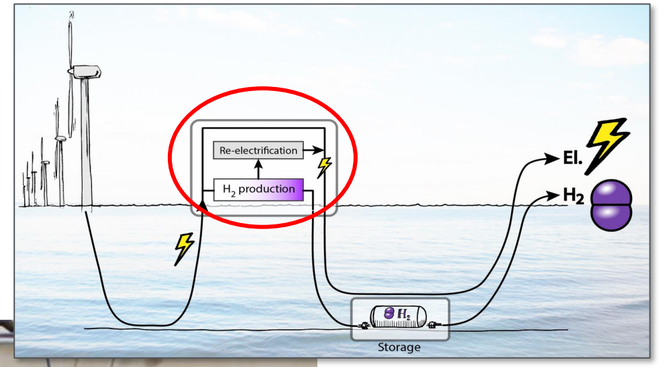
SAFE	FLEXIBLE	SCALABLE
Safe storage in stable environment out of harms way from people and assets	Minimize use of valueble onshore acreage for Footprint and safety areas	Modularized and easily scalable to meet increasing demand for storage

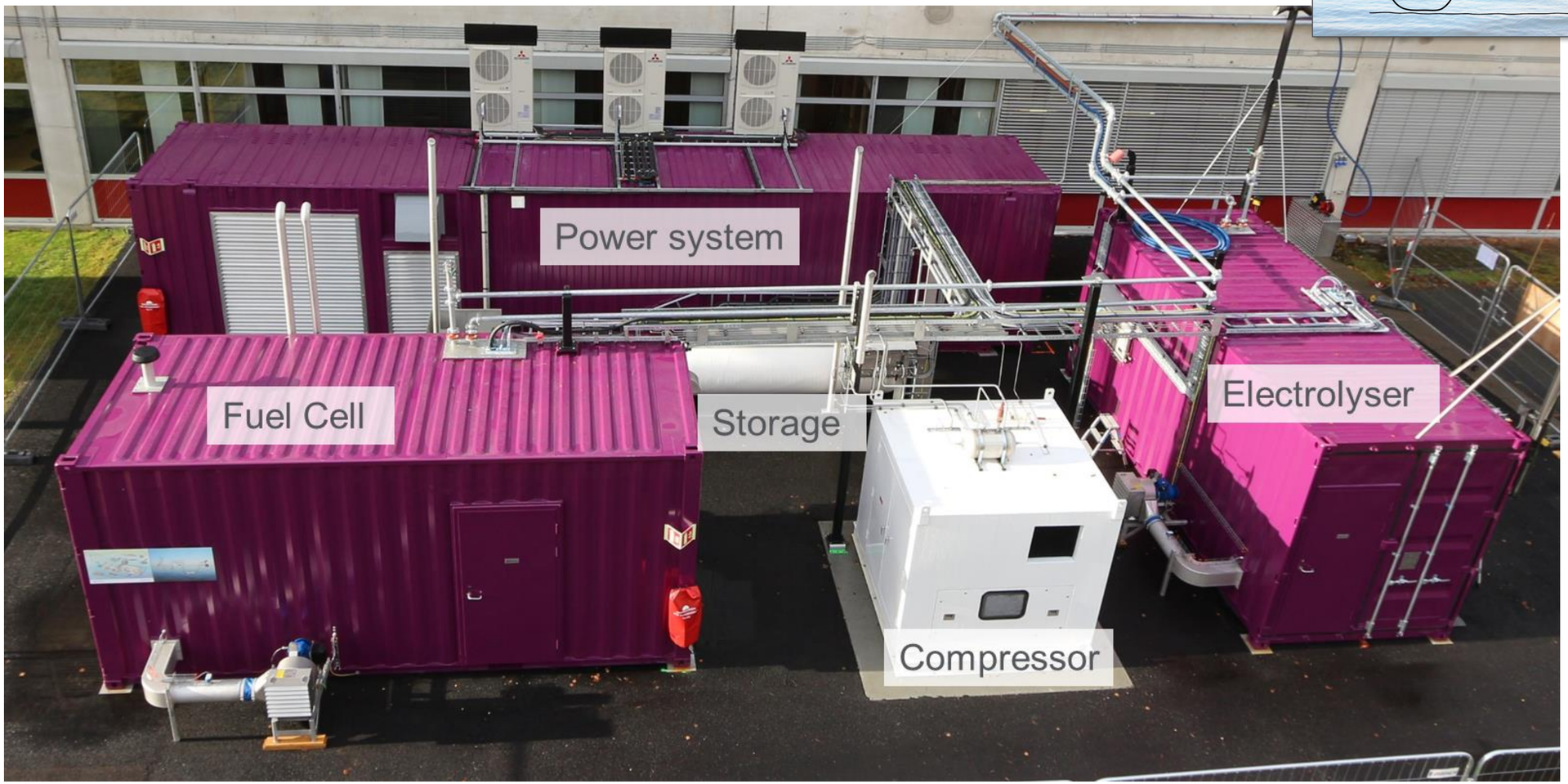




Pilot project 2021-2023

Demonstration of stable power supply from variable sources of energy





TechnipFMC VATTENFALL REPSOL nel SLÅTTLAND UMOE DNV ABB SINTEF Universitetet i Sørøst-Norge GCE Ocean Technology energy valley Arena Ocean Hyway Cluster Innovasjon Norge

Case study

Decarbonizing islands with variable renewables as wind and PV

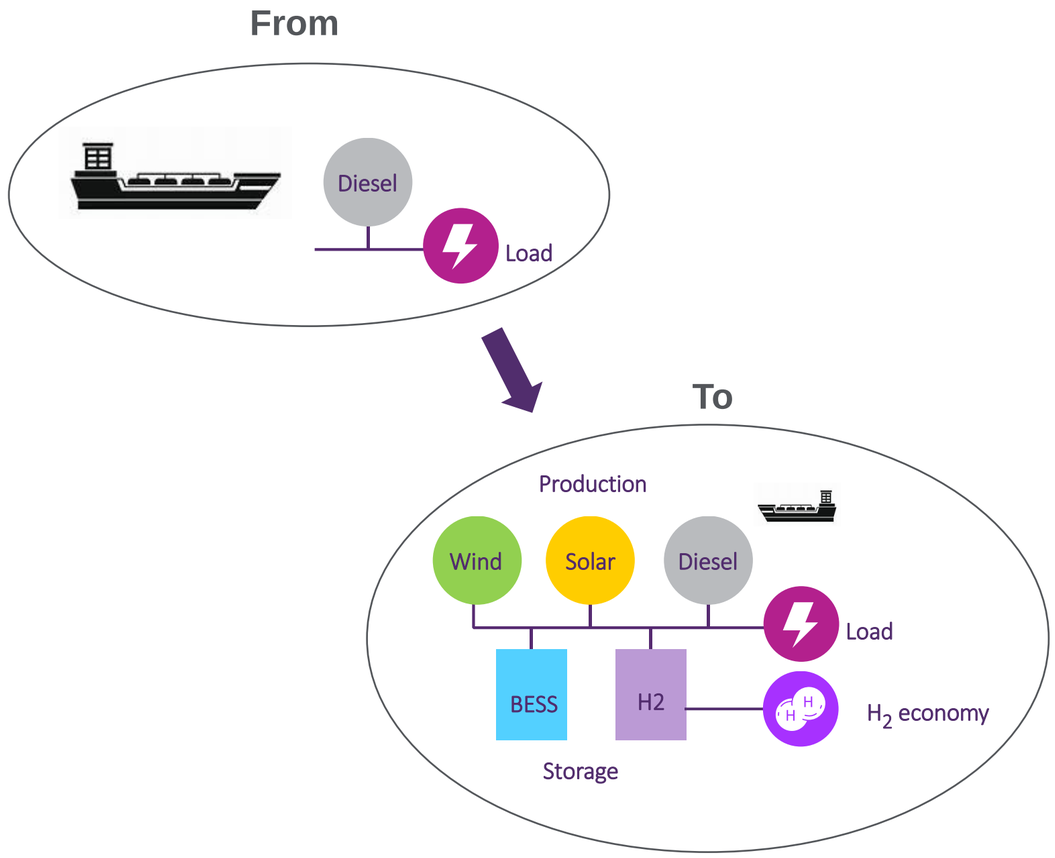
+ Reduced dependency of fuel import

- Energy storage and grid balancing capacity required

Objective:

Investigate drivers for using hydrogen as energy storage:

- Allow for integration of variable renewables
- Energy security
- Space constraints limiting PV capacity
- Opportunities for sector coupling / a local H2 economy



Case study – A real island scenario

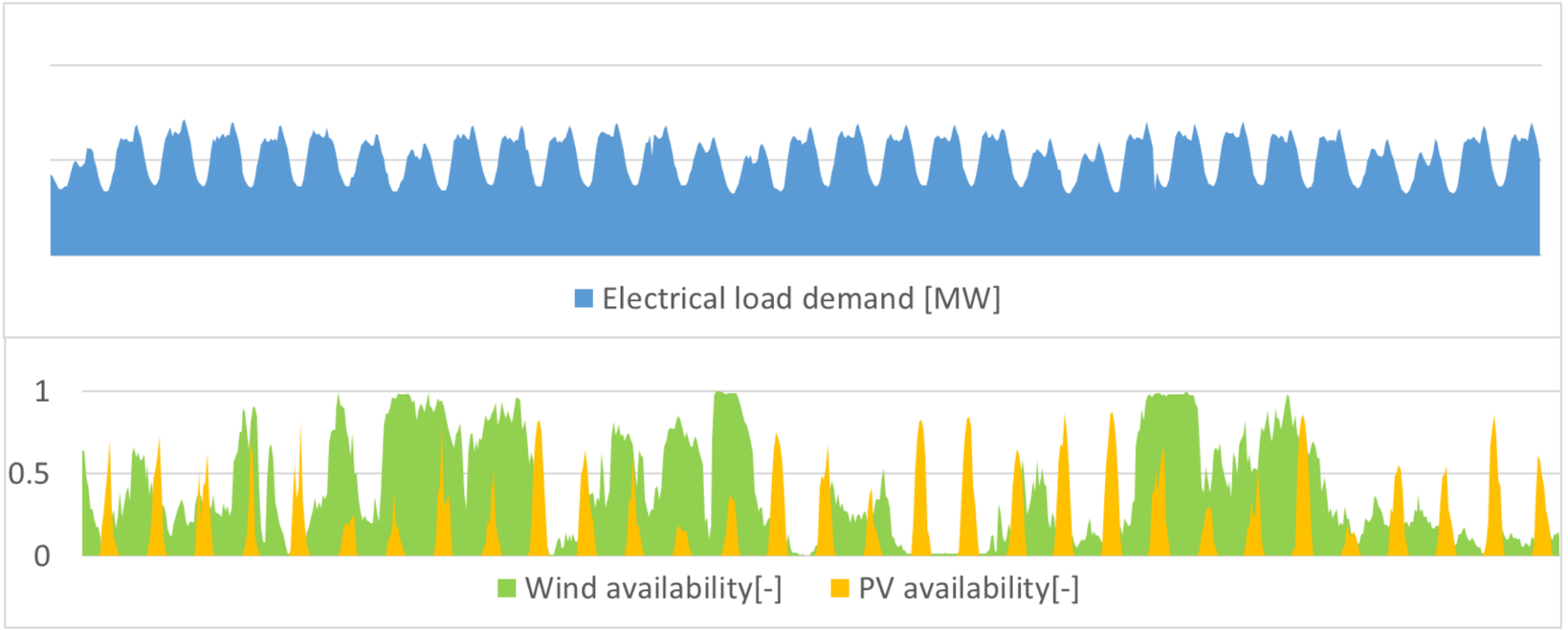
- Starting point 100% diesel case
- VRE capacity factors
  - Wind 36%
  - Solar 17%

Tool for techno-economical modelling for optimal sizing and operation

SINTEF 75 years

SOFTWARE
HyOpt model

Island profiles (hourly)



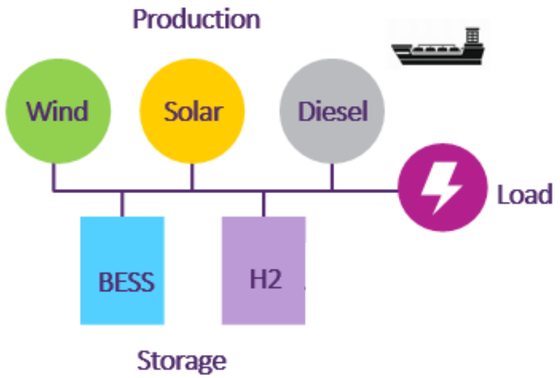
Base case parameters (2030)

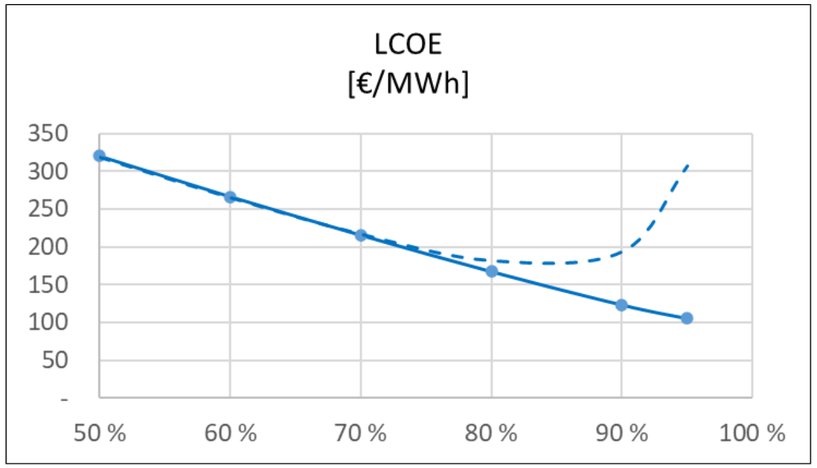
Electricity from diesel	Wind	Solar	BESS	Hydrogen storage system
600 €/MWh	950 €/kW (onshore)	570 €/kW	200 €/kWh RTE: 95% 4hr C-factor	ELY/FC: 450 €/kW (2030) Storage: TechnipFMC internal RTE: 60%

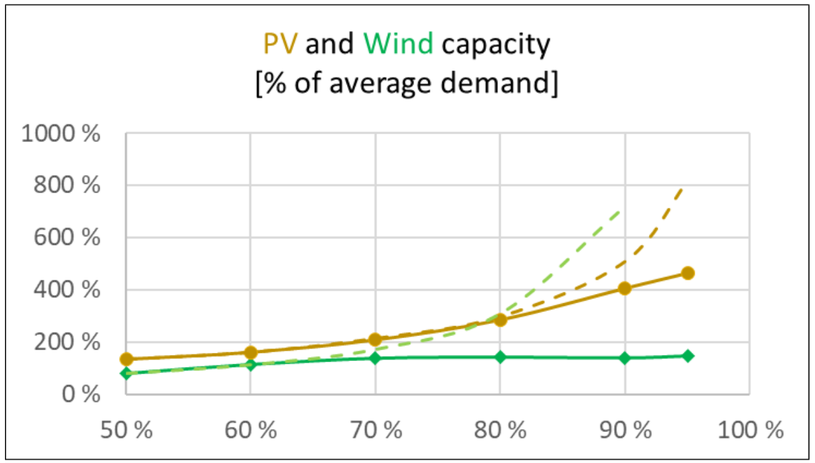
Source of graphs: Confidential

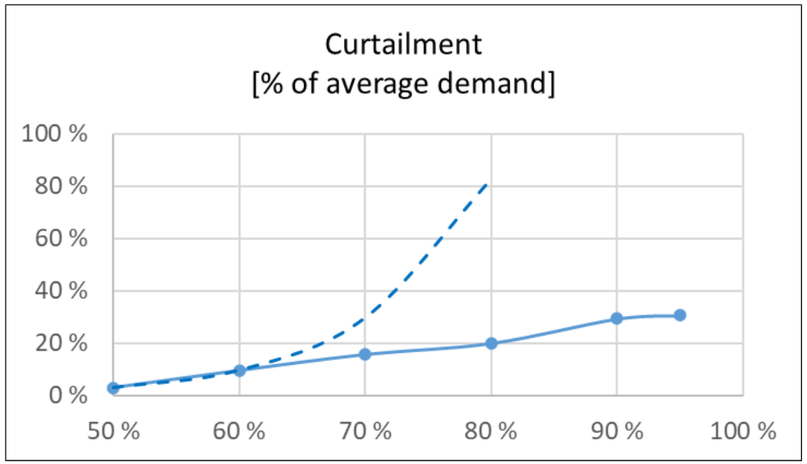
Case study

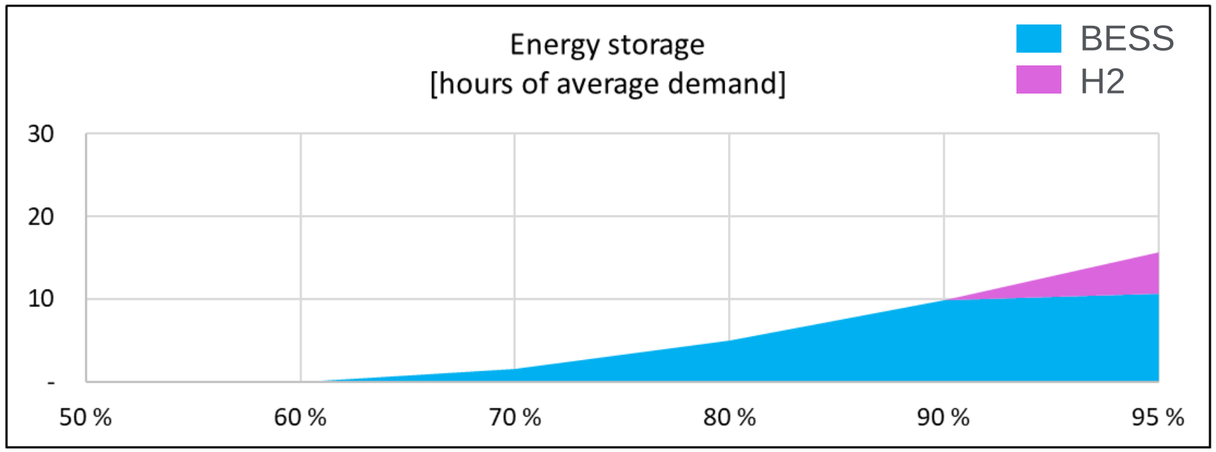
– Energy storage allow for integration of variable renewables and reduction of cost





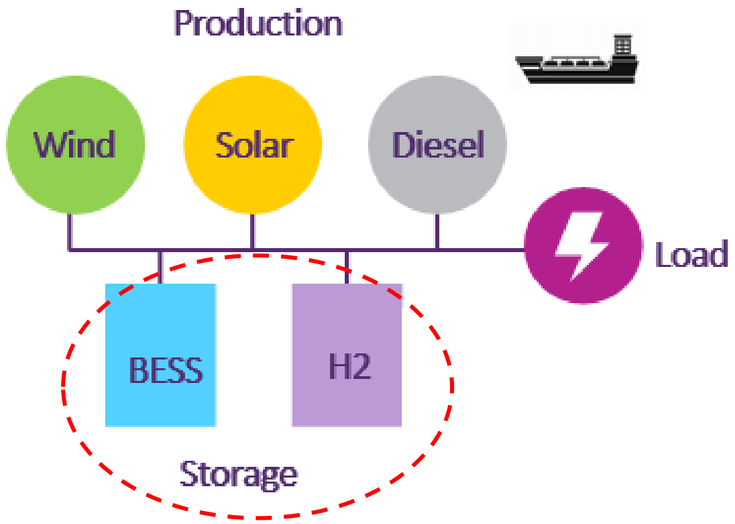






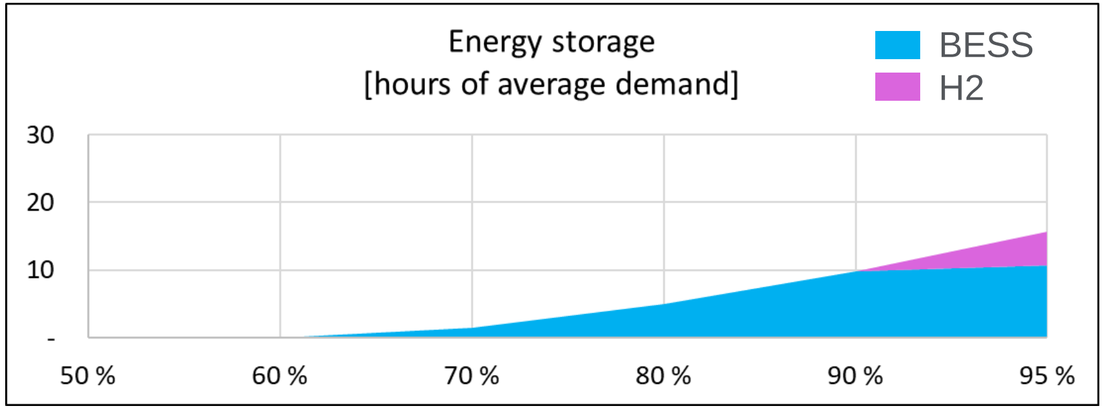
Source of graphs: TechnipFMC internal

Case study
– Sensitivity on Energy security

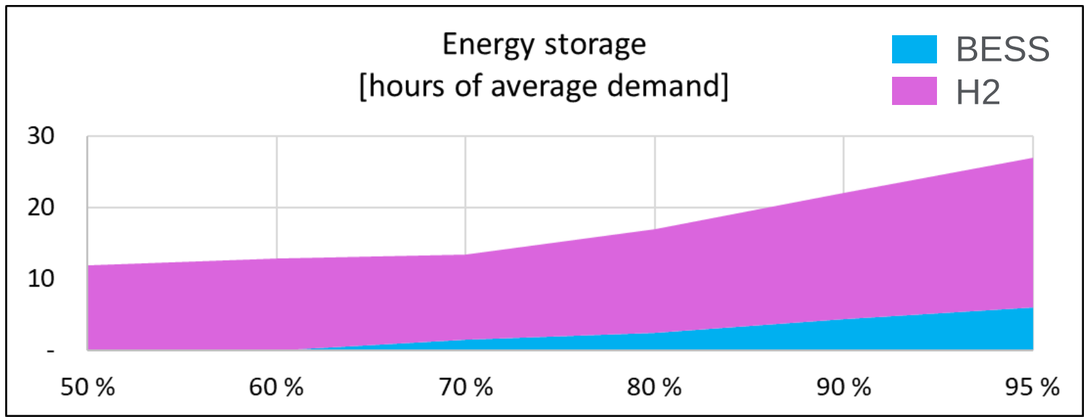


Always +12h of energy

Base case

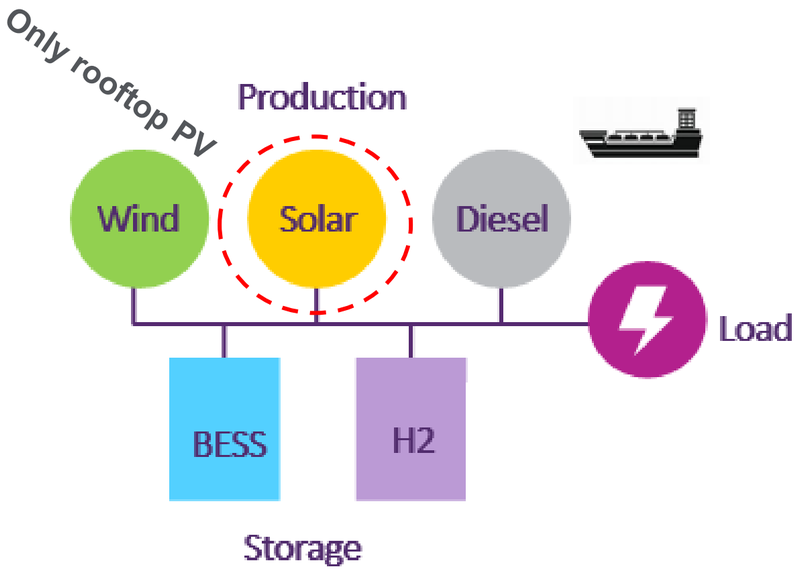


Energy security + 12h of storage

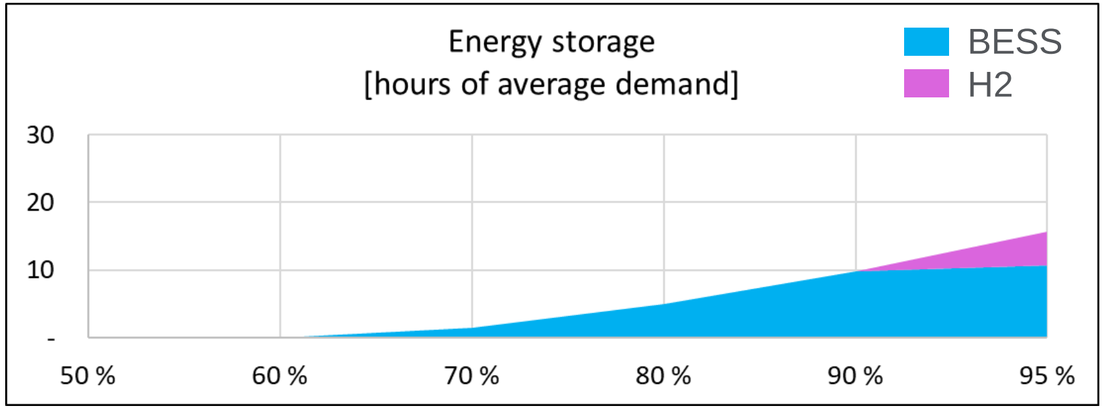


Source of graphs: TechnipFMC internal

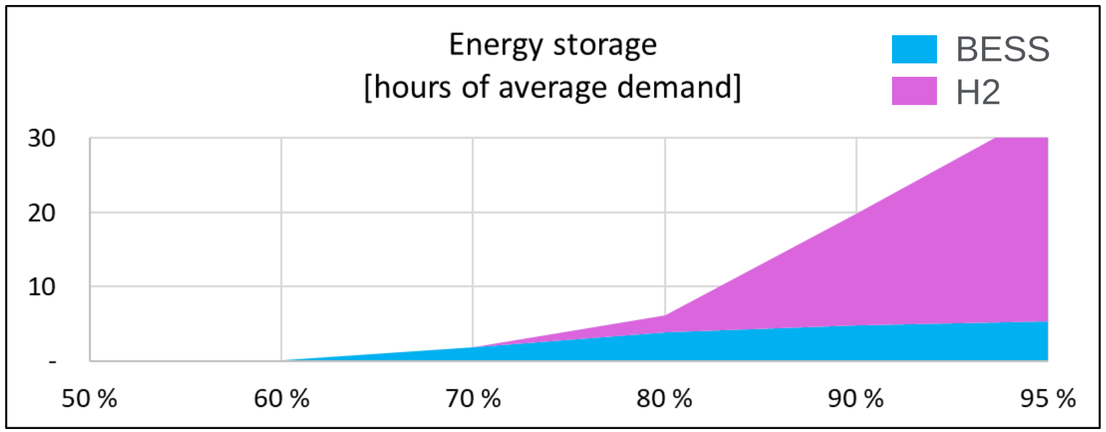
Case study
– Sensitivity on less PV – more Wind

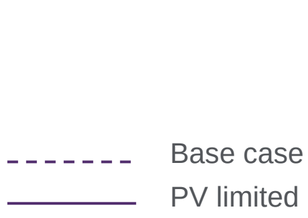


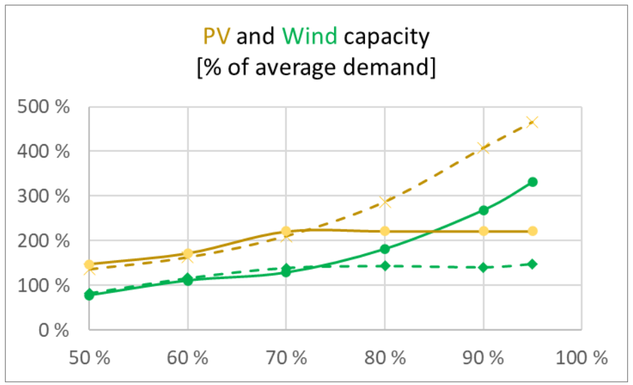
Base case



PV limited to rooftop only







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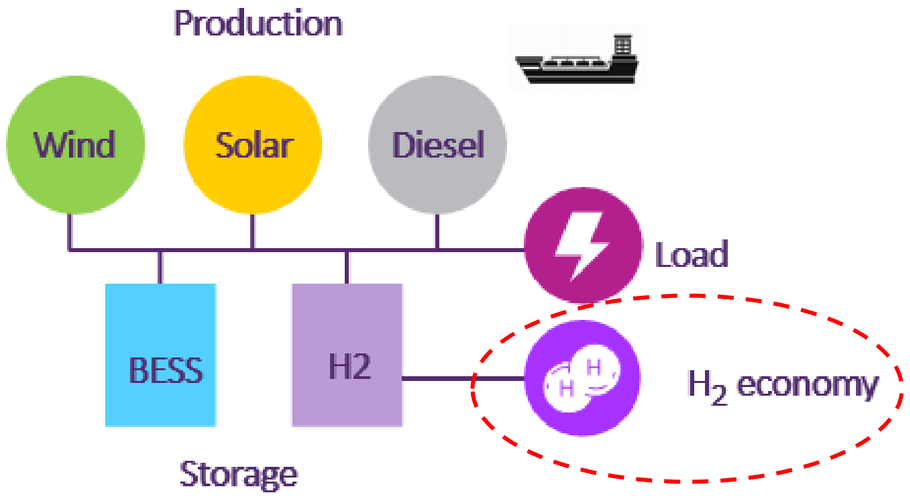
Source of graphs: TechnipFMC internal

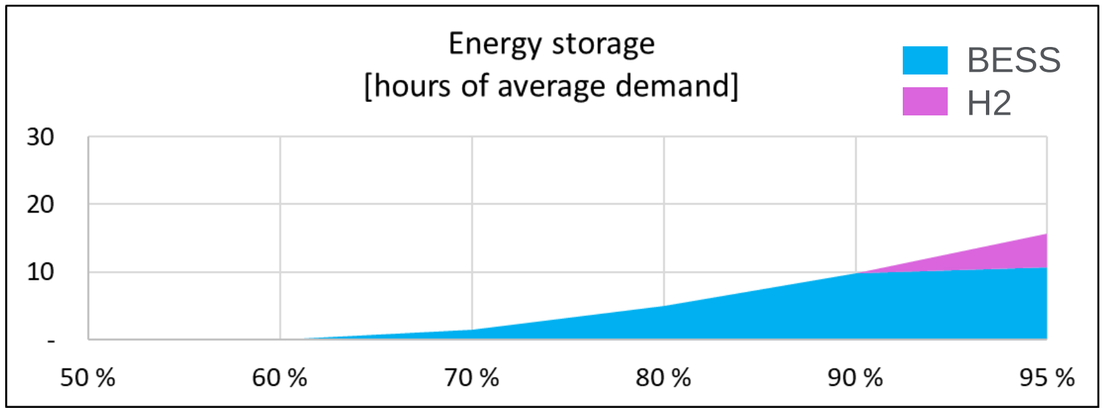
Case study

– Sensitivity on H2 offtake / sector coupling

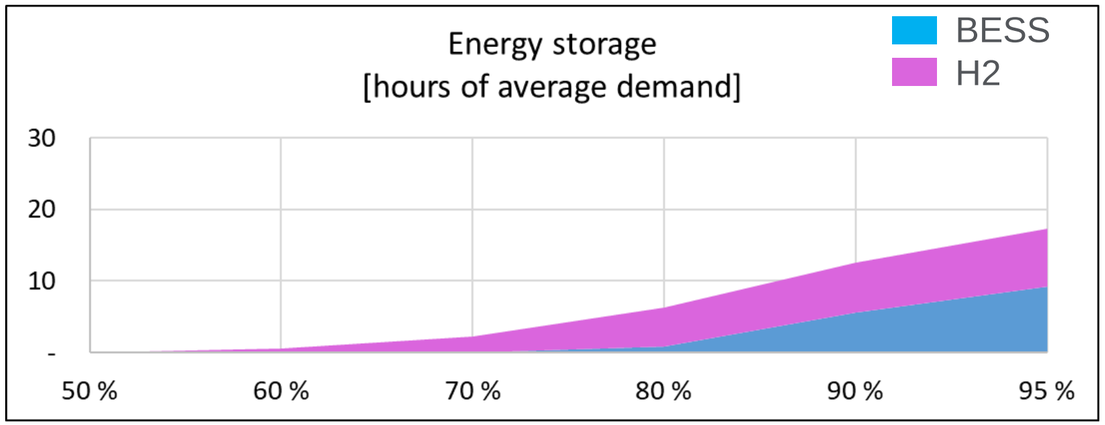


H2 offtake @ 20% of average demand

Base case



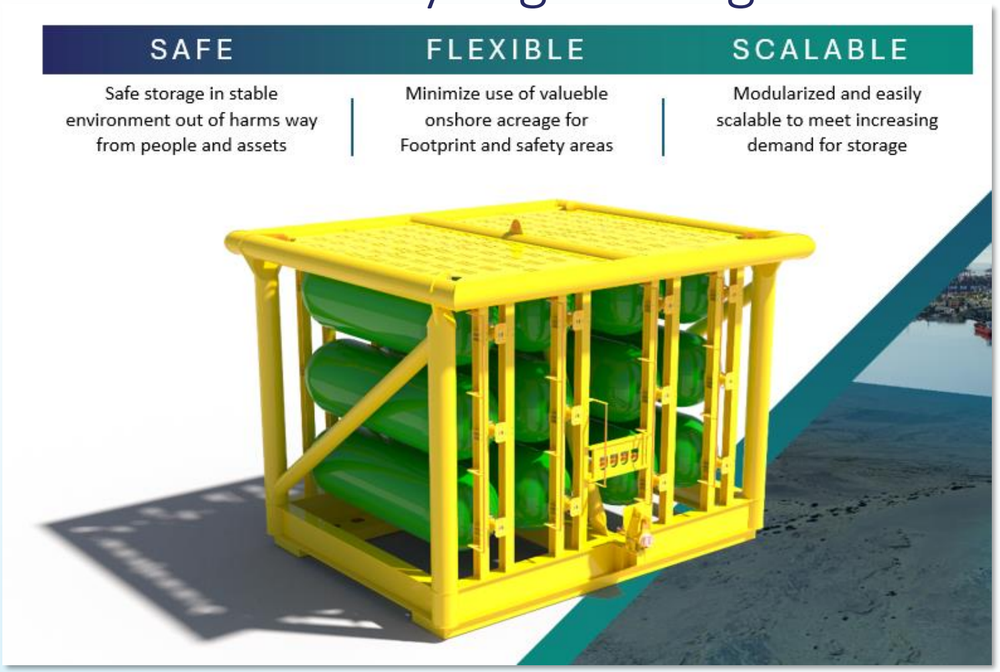
H2 offtake



Source of graphs: TechnipFMC internal

Flexible operation

Subsea Hydrogen Storage



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Drivers for hydrogen storage:

+ Cost efficient integration of variable renewables
+ Energy security
+ Less PV - More wind
+ Opportunities for sector coupling / a local H2 economy

Thanks for your attention

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