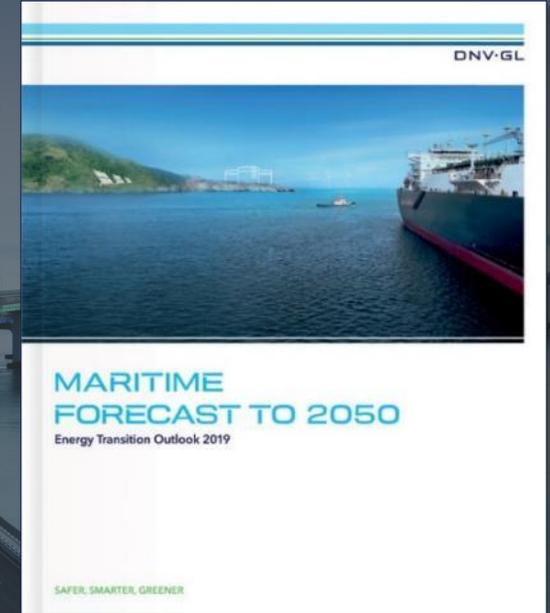
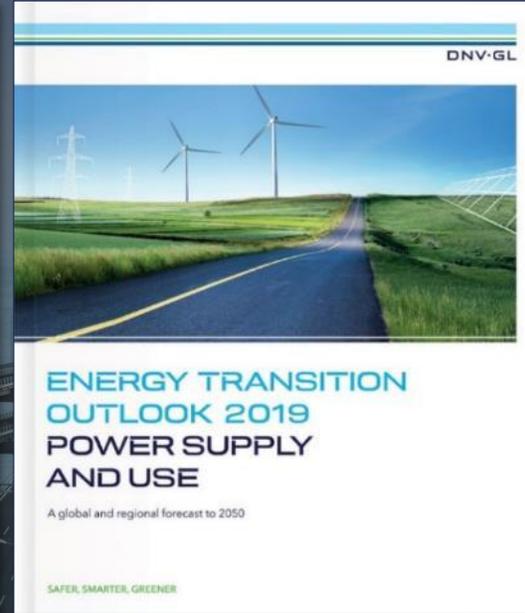
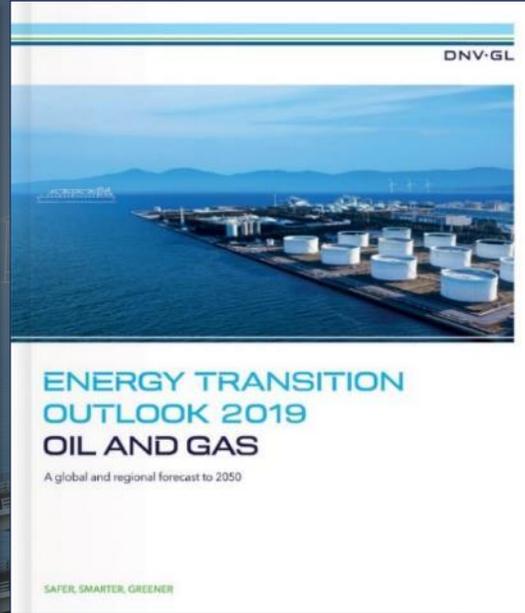
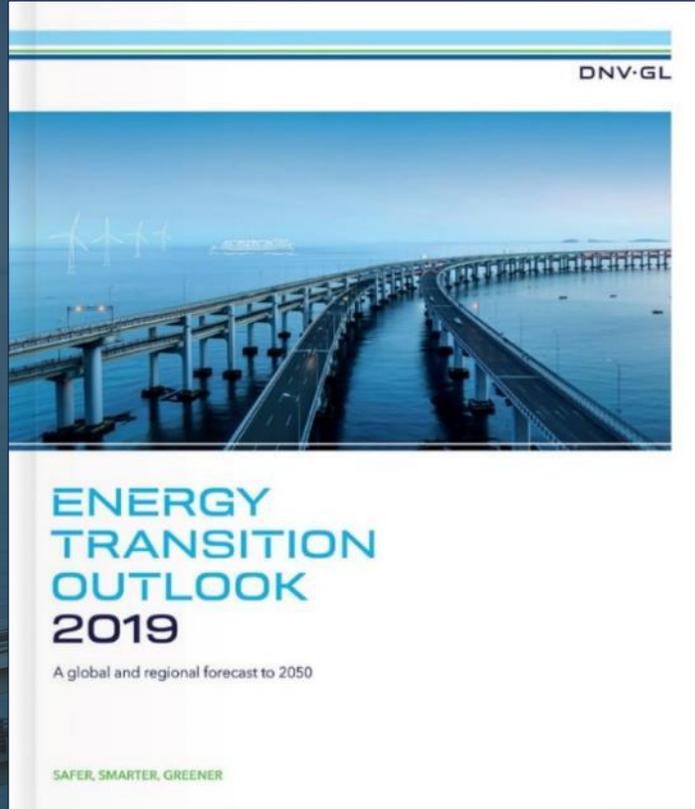


CCUS 2019: Capturing the Clean Growth Opportunities

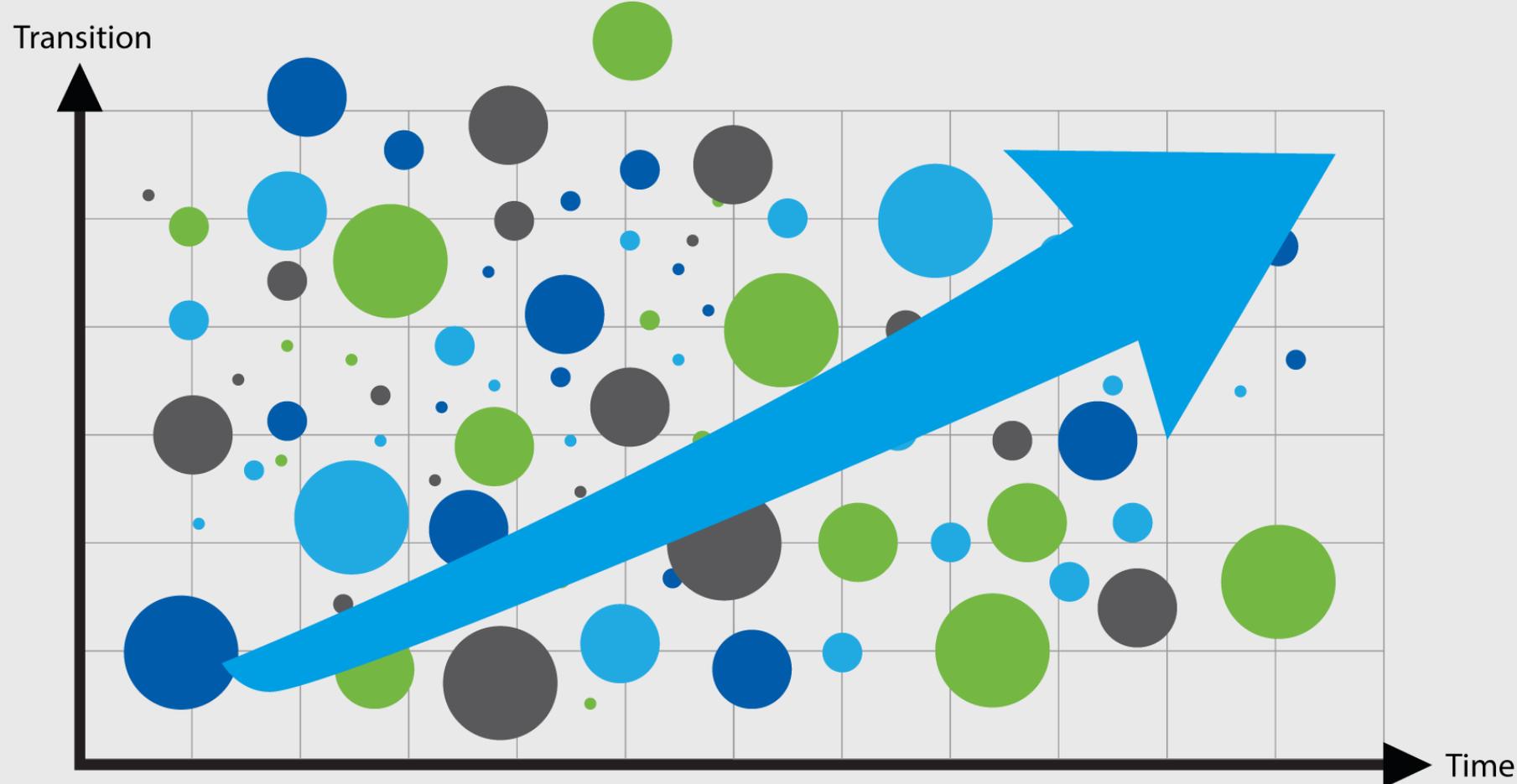
Liv Hovem

CEO, DNV GL – Oil & Gas

Wednesday 6th November 2019



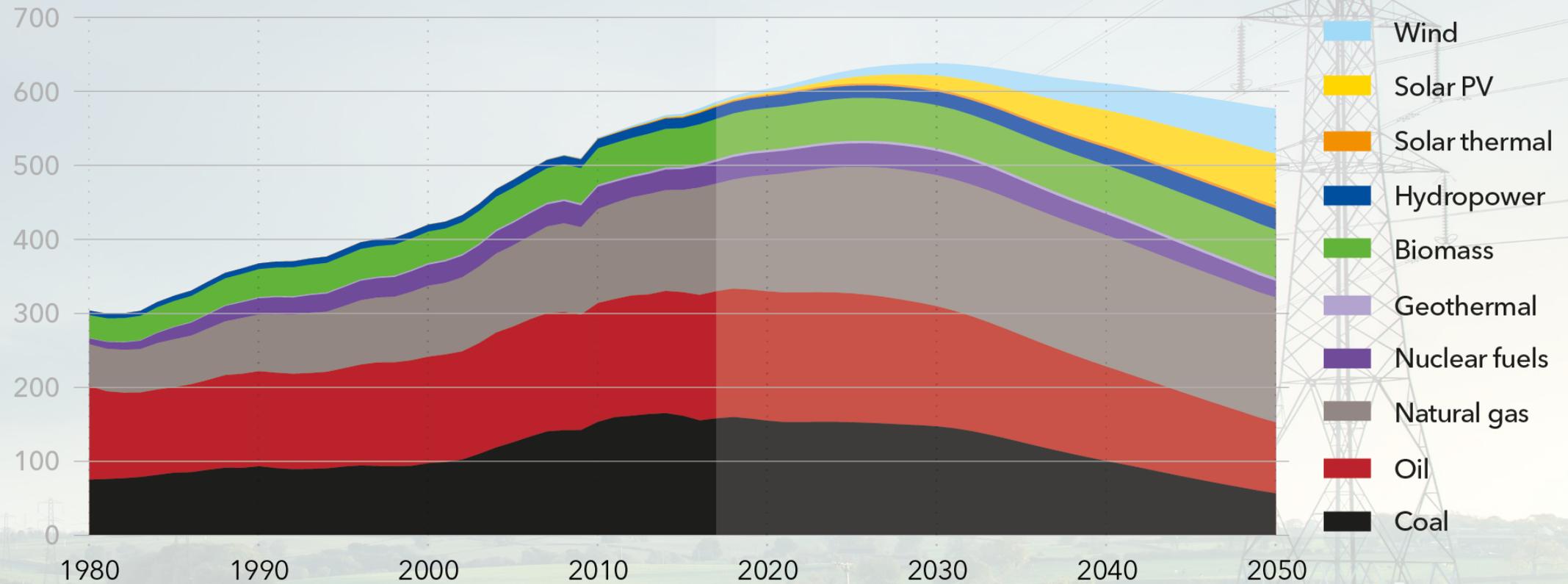
Energy Transition Outlook: a forecast, not a new scenario



Source: DNV GL 2018 Energy Transition Outlook

No single pathway to a decarbonized energy mix

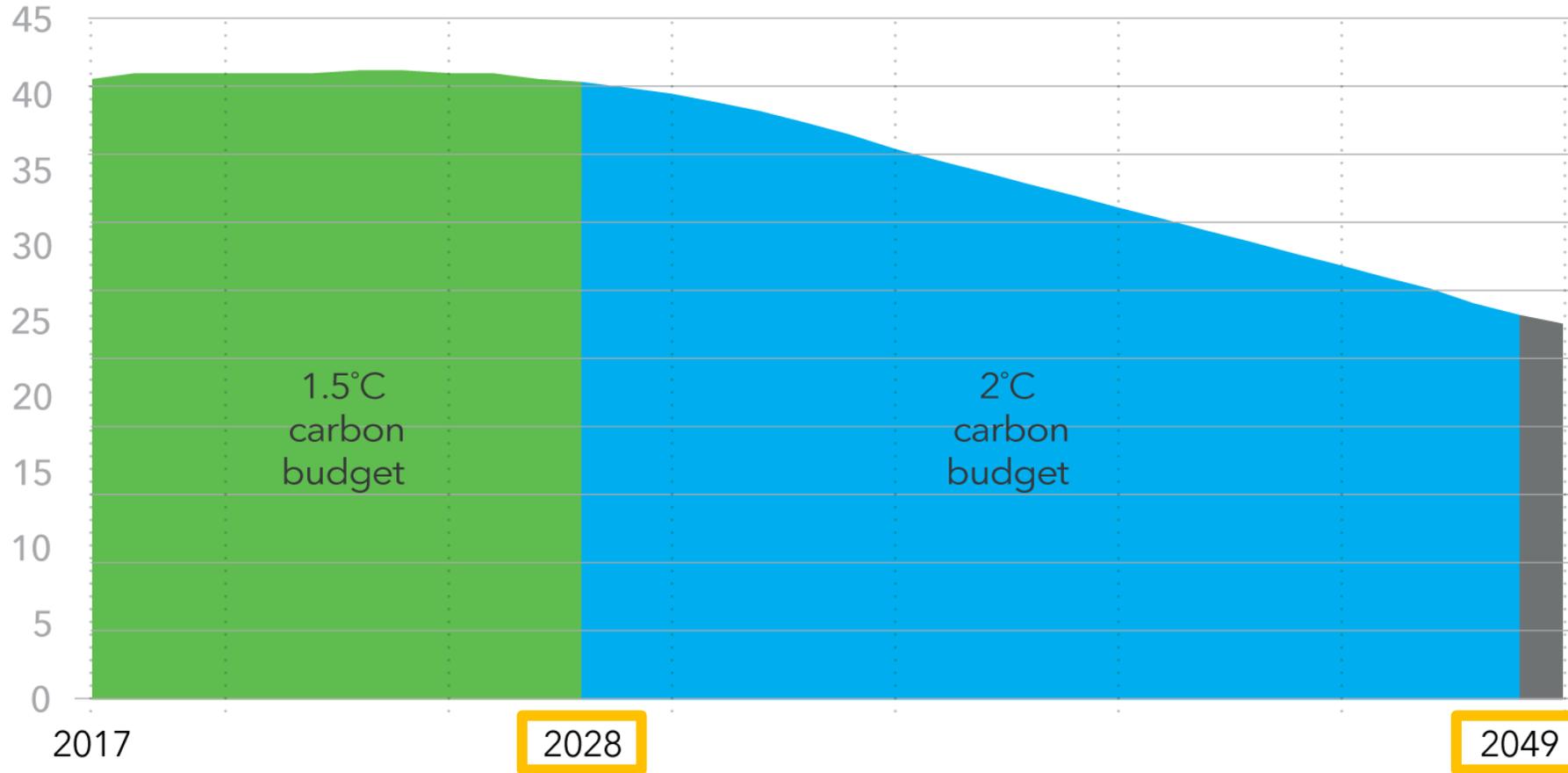
Units: EJ/yr



Historical data source: IEA WEB (2018)

Carbon emissions and carbon budget

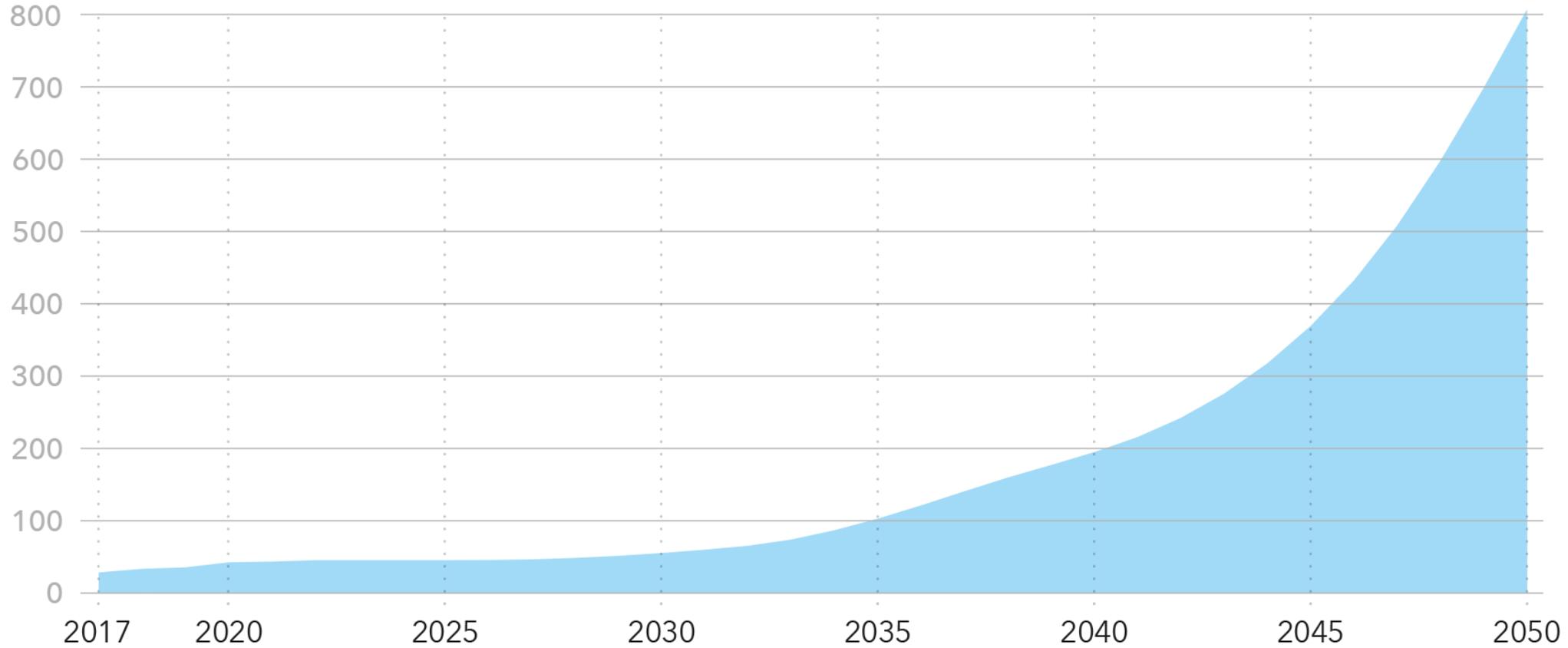
Units: GtCO₂/yr



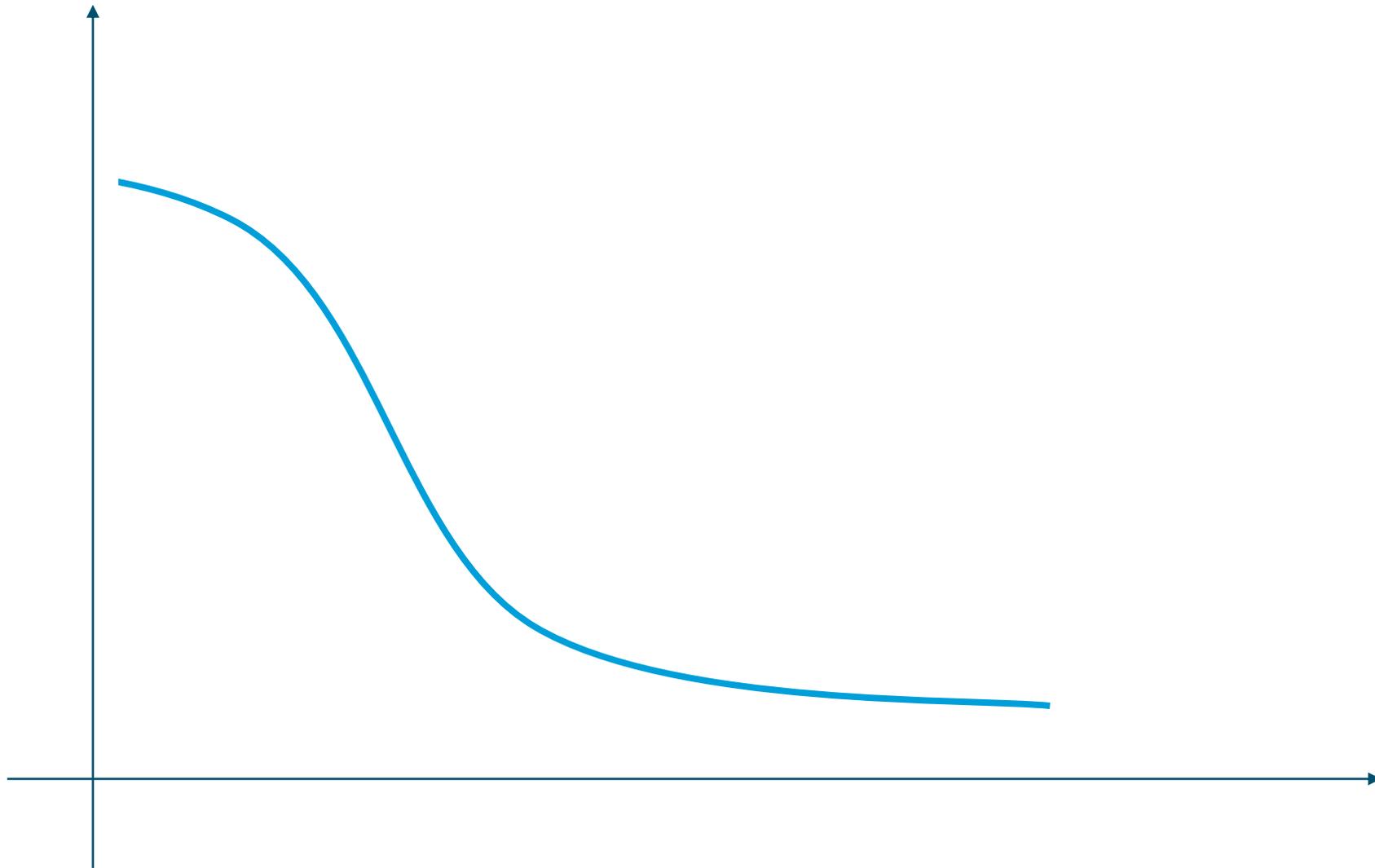
CCS: policy needed for rapid uptake

Carbon emissions captured globally

Units: MtCO₂/yr



Cost of CCS will come down



The technology already exists, but needs more help from Governments and policy

Solar

- Requirements, targets
- Advantages, Access
- Price guarantees
- Carbon price
-



Wind

- Onshore wind
 - like solar
- Offshore wind
 - R&D
 - Investments



Batteries

- R&D
- Grants
- Investment support



Carbon capture

- Funding/Support
- Mandatory
- Pilot facilities
- Carbon price
- R&D



The importance of learning from technology



Offshore wind

- Existing facilities: 1 + 5 floating wind turbines in operation
- Installation of 8 new turbines at Tampen decided
- Learning Rate (wind): 16%
- Can provide 20% reduction globally in the cost of floating offshore wind – on a single field



Carbon capture

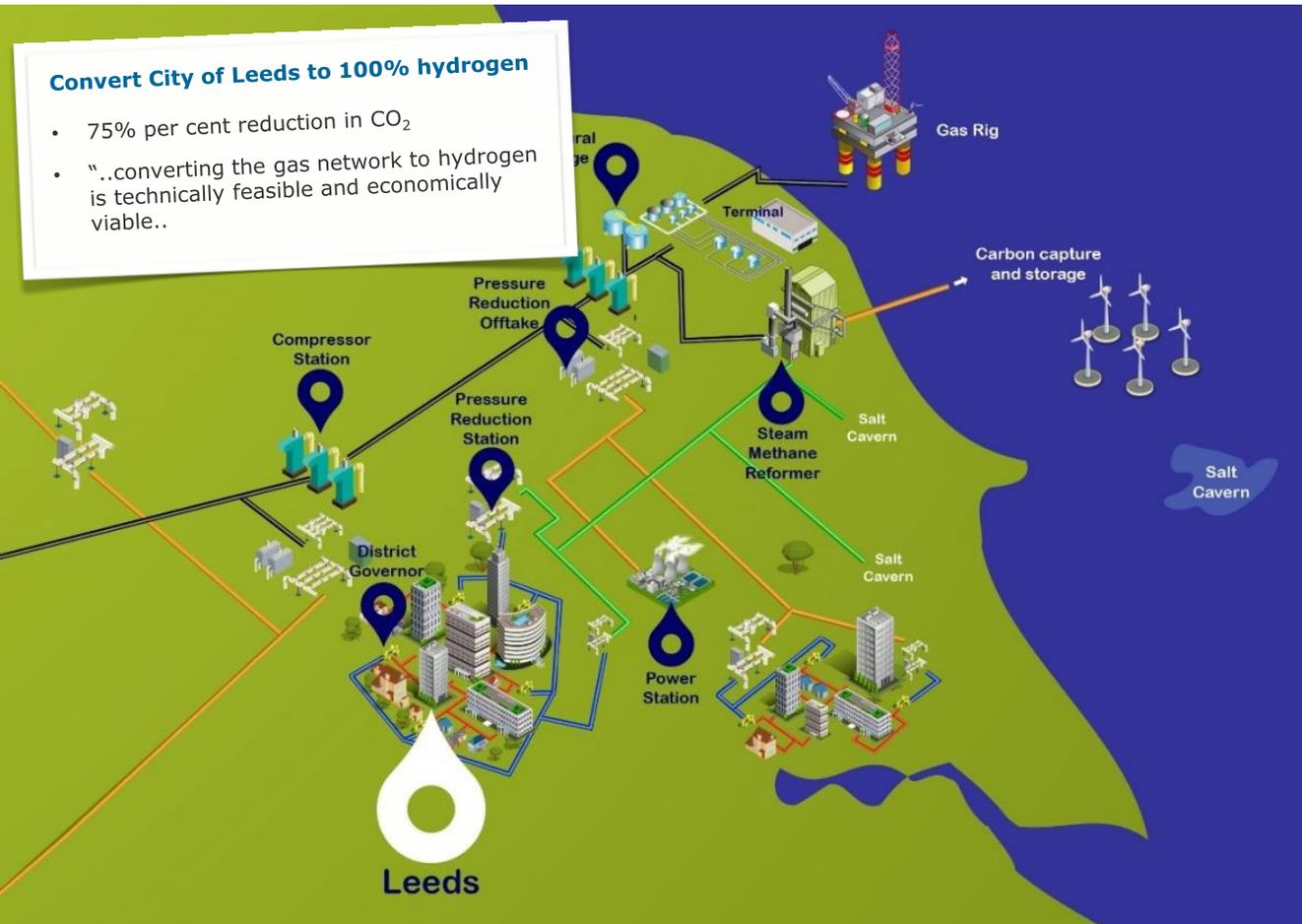
- 19 facilities in operation globally and about 5 under construction.
- 2 new plants in the Norway can help with 0.8 Mt capacity
- Learning Rate (CCS): 13/15%
- Can provide 1-2% cost reduction for CCS technology globally – on these two plants

Governmental initiatives to reduce political and market risks

- The H21 project may transform Leeds into a hydrogen city

Convert City of Leeds to 100% hydrogen

- 75% per cent reduction in CO₂
- "...converting the gas network to hydrogen is technically feasible and economically viable.."



It is **currently unclear** if H₂ will become a major zero-carbon energy carrier



Uncertainties include:

- What role will the governments take?
- Will CCS be in place in time?
- What value chain will eventually succeed?
- Will society accept the perceived HSE risk?

CCS can unlock new options



Hydrocarbon and renewables
energy technologies together

Power-to-gas

Decarbonizing gas networks

Thank you.

www.dnvgl.com

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