WHEN TRUST MATTERS

Impact of learning curves on future costs in new markets

Nordic Baltic Energy Conference

Magnus Killingland
magnus.killingland@dnv.com

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Impact of learning curves on future costs in new markets

1

Interconnected factors

2

Energy security a priority

3

Vulnerable new markets

DNV contribute to the journey down the learning curves

Certify, verify and test

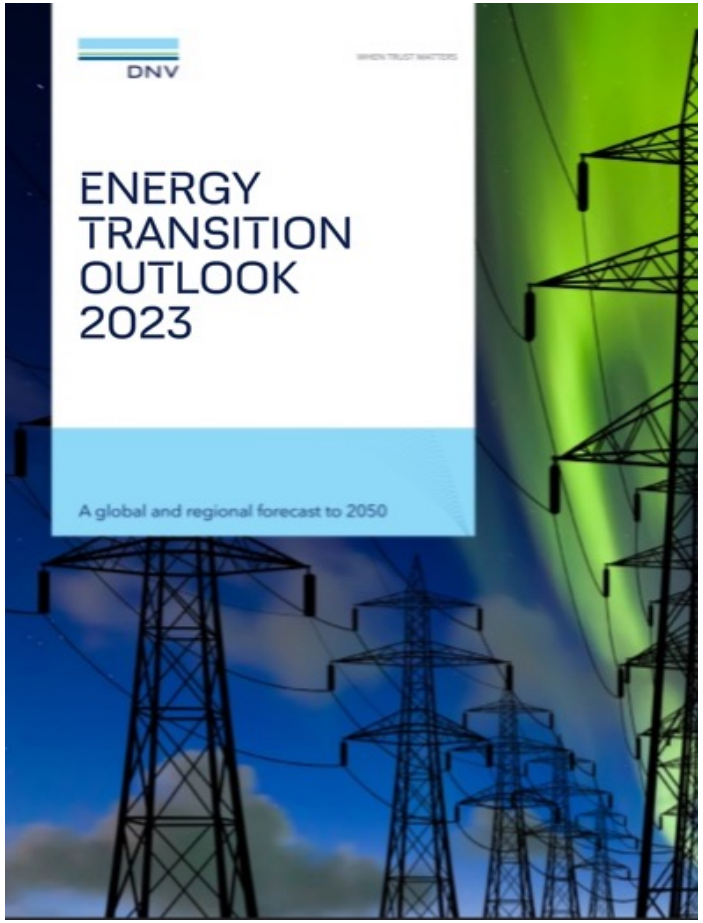
Qualify and assure

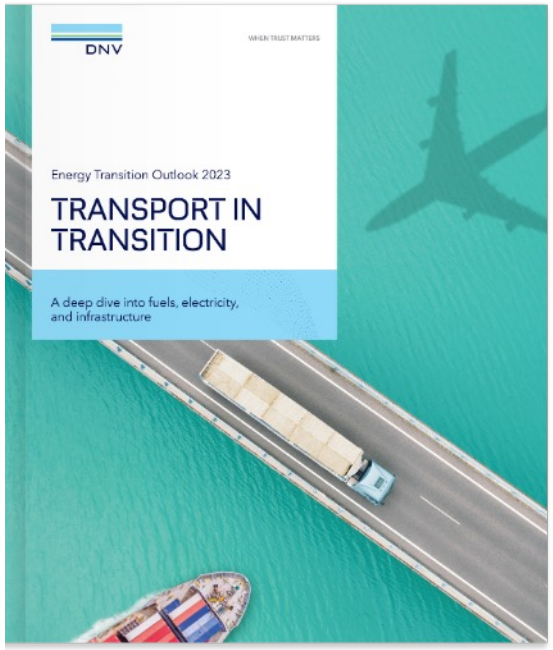
Give expert advice

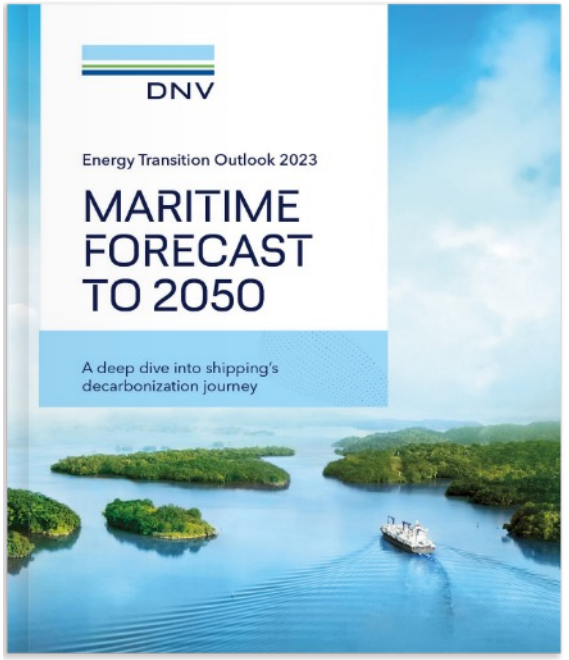
Co-create and share

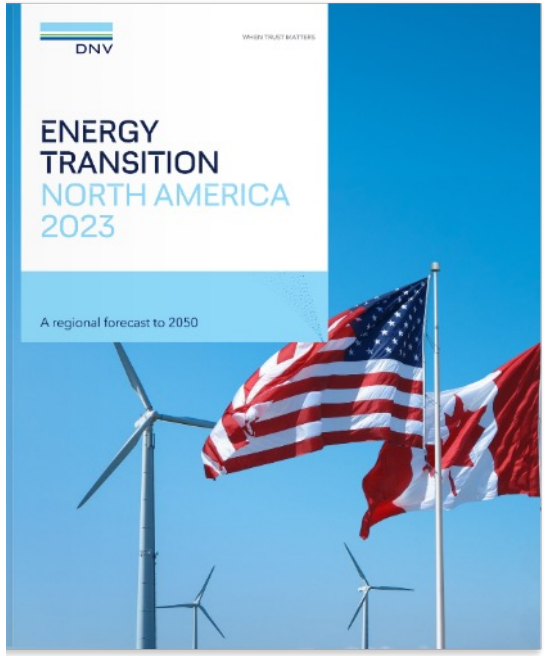
DNV

Future costs and learning rates









Publications available on [eto.dnv.com](eto.dnv.com)

Key assumptions in our forecasts for future costs

Population

9.6 bn

Projected global population in 2050 of 9.6 billion

- 1% lower than the UN median population forecast at 9.7 billion

Economy

2×

Global economy will almost double by 2050

- Reaching USD 320 trillion in 2050
- CAGR 2.5%/year from 2020-2050 (incl. 2020 COVID effects)

Technology

16-26%

Average % cost reduction per doubling of installed capacity

- Solar panels 26%, reducing to 17%
- Wind turbines 16%
- Batteries 16%
- Electrolysers 14%

Policy

≤250 USD/tCO_2

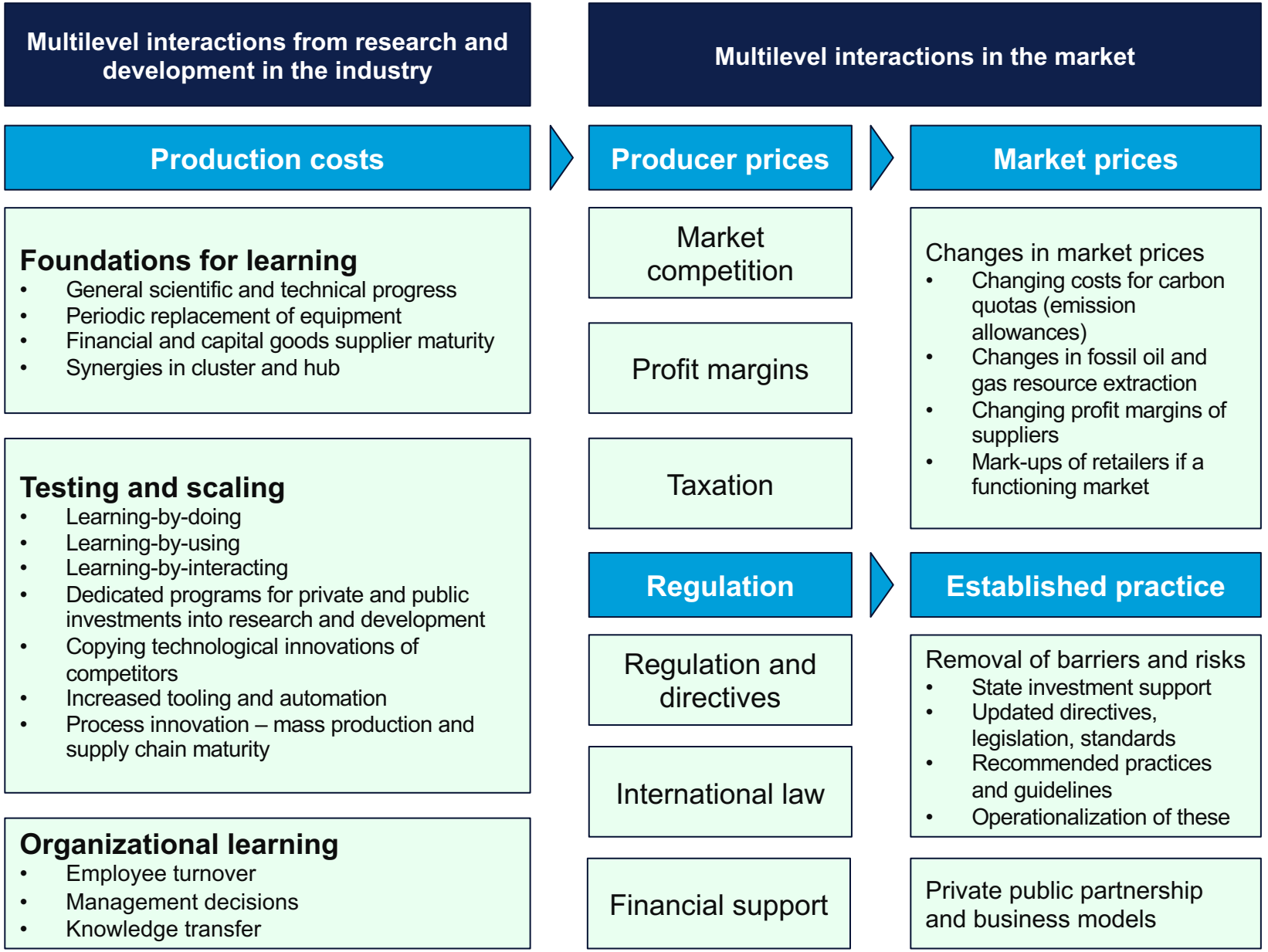
Carbon prices will be regional and in 2050 range between \$20-250/tCO_2 (USD 2023)

Other policy examples:

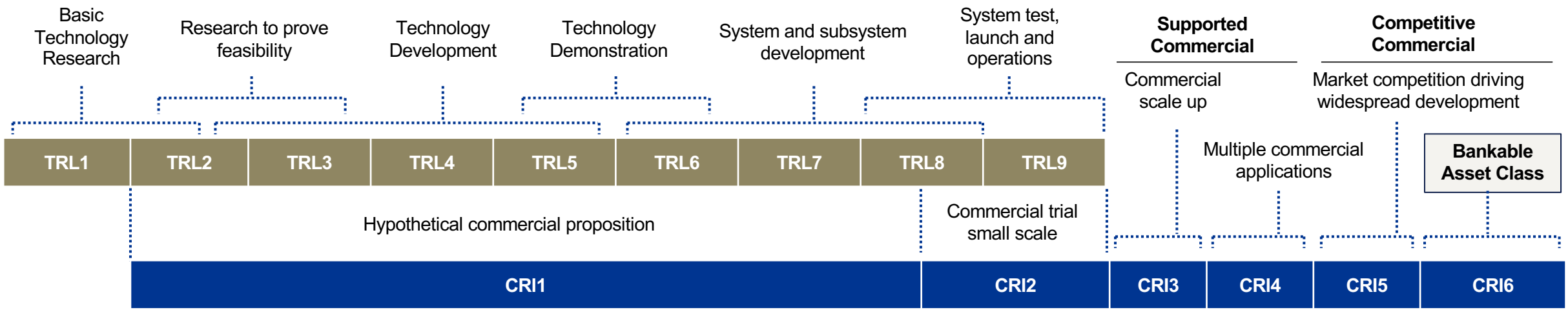
- Air pollution measures
- RE power support
- EV support
- Maritime environmental regulations

Multiple factors for learning

Learning and experience effects contributing to cost reductions



Learning curve stages

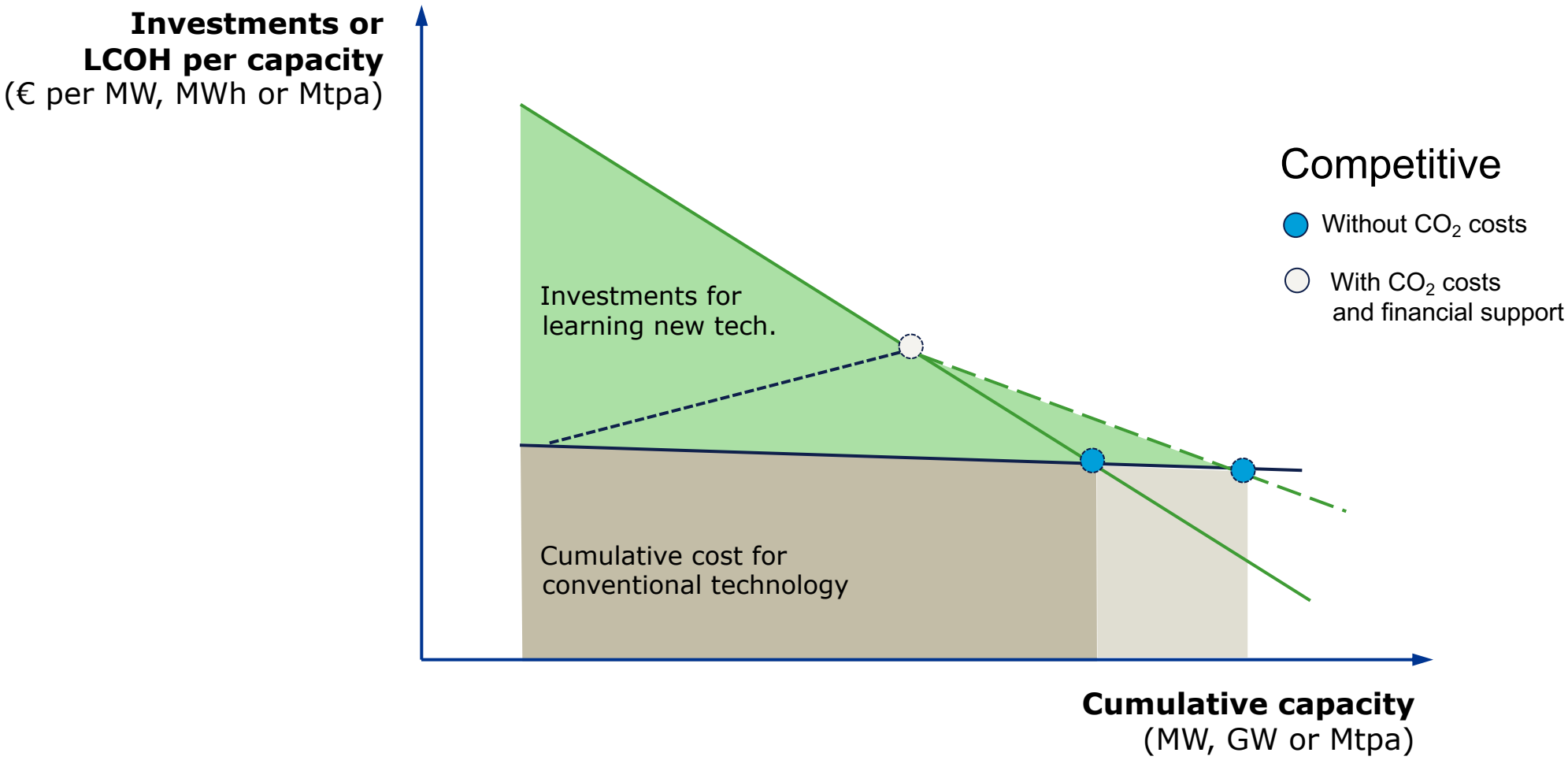


TRL levels can be increased by
R&D, Technology Qualification & Technical Assurance

CRI levels can be increased by
Subsidies, Taxes and Financial Derisking Evaluations

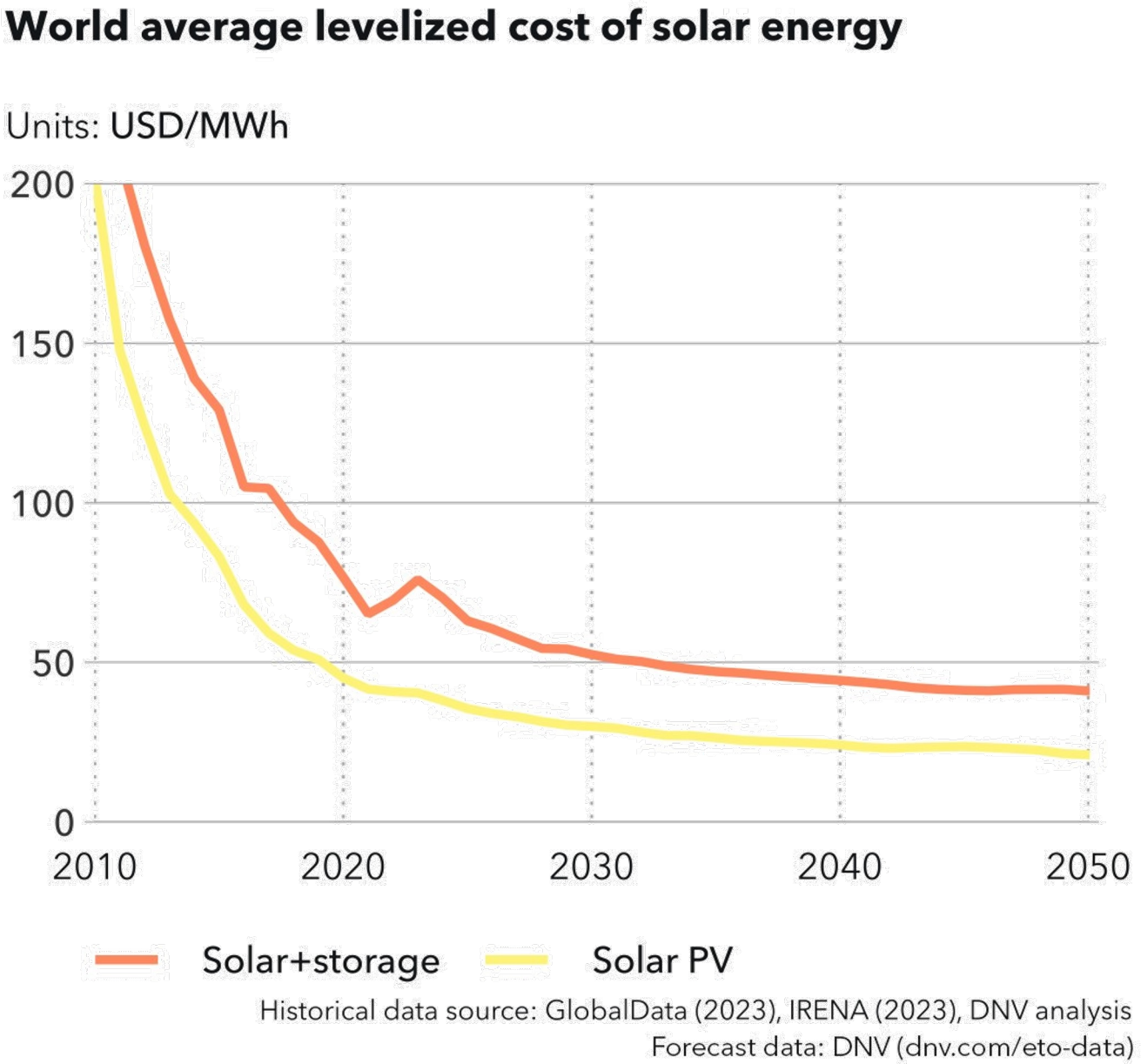
Reference: DNV team analysis, Commercial Readiness Index by ARENA (2014)

Learning rates reductions?



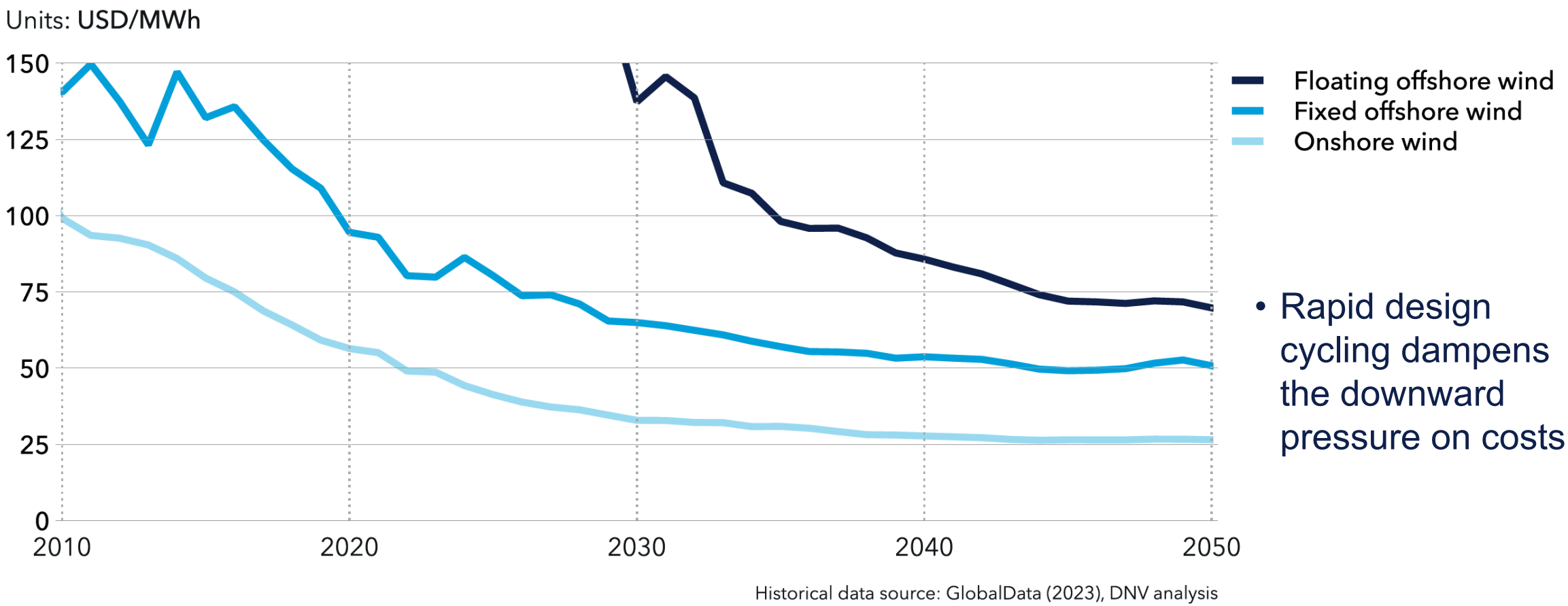
Cost reduction bumps on the road

- Short-term cost inflationary pressure may mask the cost reduction
- Regional protectionism and polarization may hinder effective transfer of technological learning
- Replacing technologies may not fully translate to learning rate impacts on costs



Bumps on the road for on- and offshore

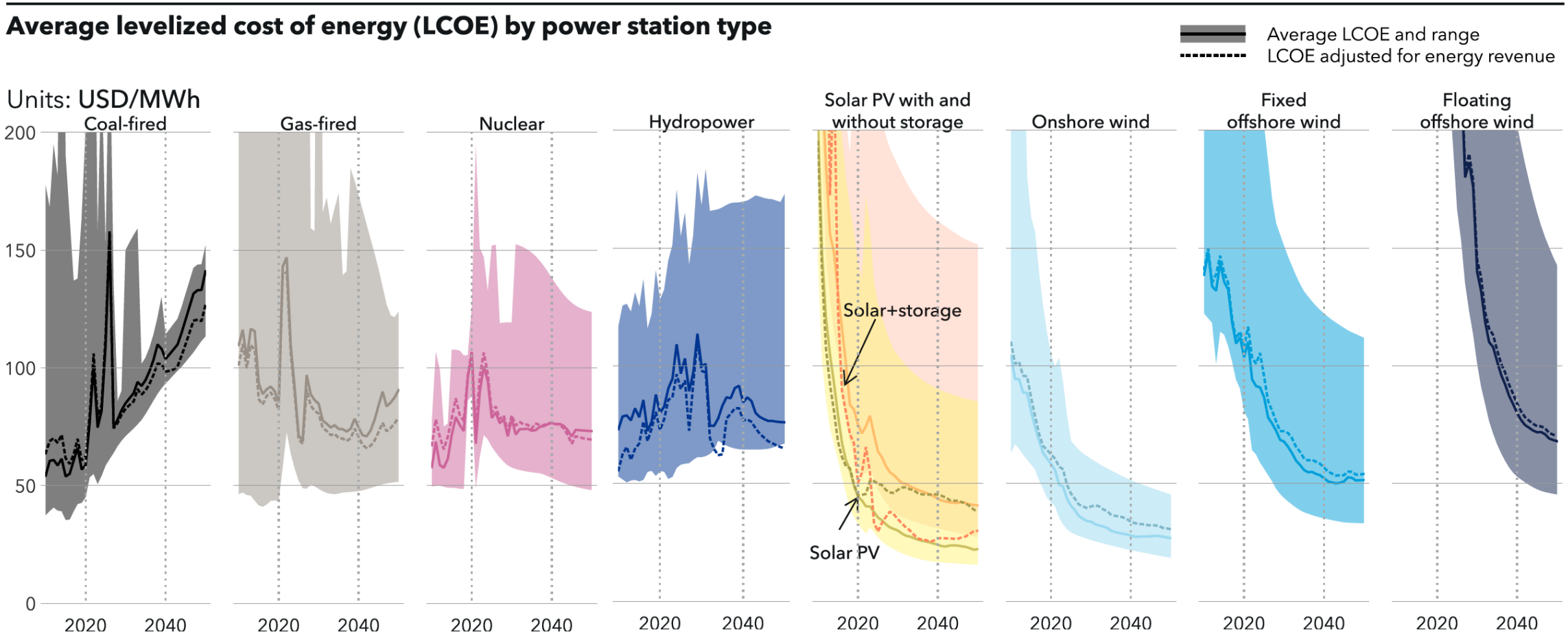
World average levelized cost of wind energy



Historical data source: GlobalData (2023), DNV analysis

- Rapid design cycling dampens the downward pressure on costs

Cost trajectories

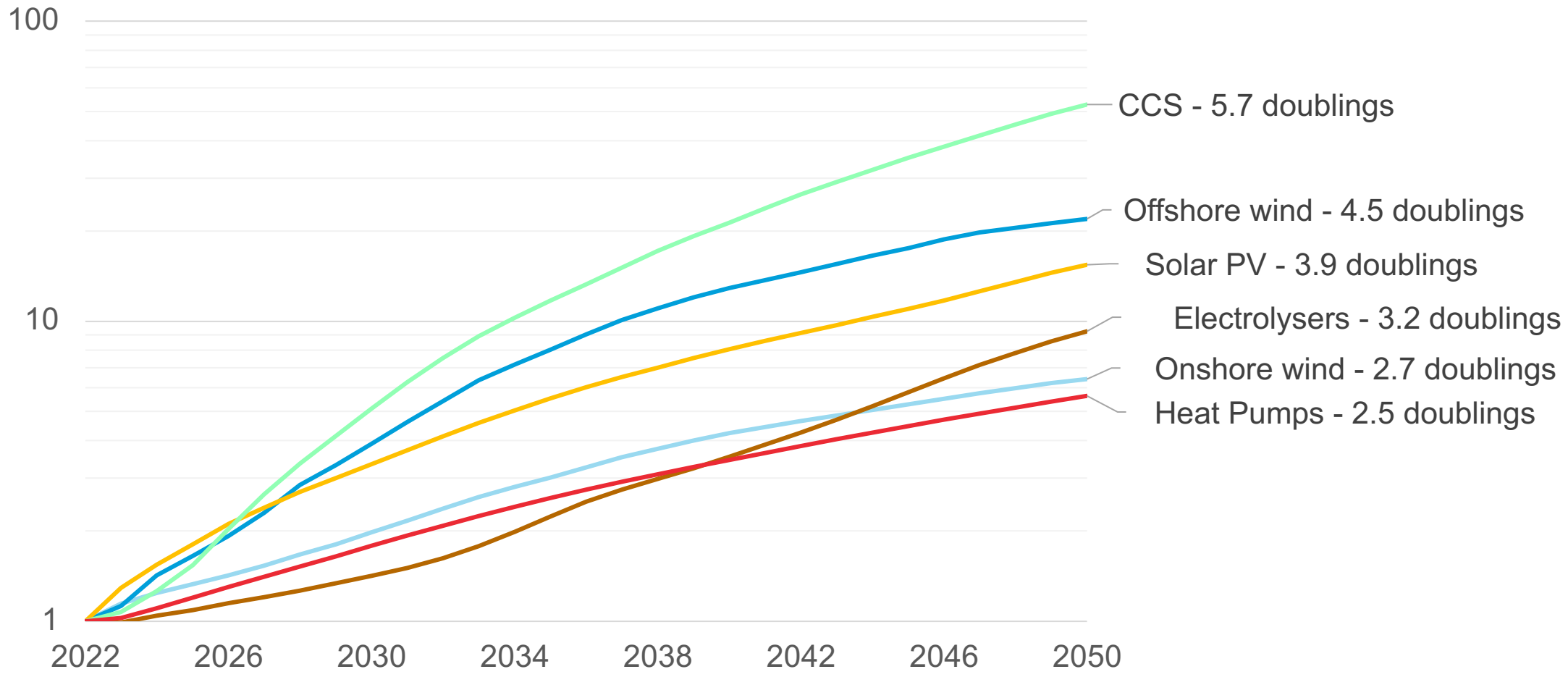


- New markets tend to be in the upper part of the ranges

Costs are for the year of financial close for new projects. Levelized cost includes CAPEX, OPEX, grid connection cost, carbon price, and CCS cost.
Lines show global weighted average. Shaded areas show spread over 10 regions. Historical data source: GlobalData (2023), Lazard (2023), WoodMac (2023), IRENA (2023).

Capacity trajectories

Global cumulative capacity additions of technologies relative to 2022 capacity



Energy security at the top of the agenda


SECURITY
AFFORDABILITY
SUSTAINABILITY

Energy security at the top of the agenda

- Worldwide, energy produced locally is being prioritized over energy imports.
- Governments are willing to pay a premium for locally-sourced energy.
- **In the long term, energy security and sustainability will pull in the same direction**

Vulnerable new markets

“Slowbalization”

- Less international trade
- More focus on
  - national energy security
  - supply chains
  - local manufacturing
- This often adds to the cost of energy CAPEX everywhere
  - And more for new markets?

Opposing forces shaping the transition

Pros	Cons
Record spending on renewables	Uneven geographical distribution
Strong pace for renewables in power	Critical solutions have unfair competition
Landmark global agreements	Let-down in implementation
Public support for climate action	Competing concerns on the public agenda
Front-runners advance solutions	System inertia

Impact of learning curves on future costs in new markets

1

Multiple factors

New supported technologies, with *both* market *and* regulatory readiness, gives high learning

2

Energy security a priority

Long term, energy security *and* sustainability will pull in the same direction

3

Vulnerable new markets

Opposing forces in the energy transition may affect new markets *more* then others

Thank you for your attention!

Reach out for further details and discussions

Magnus Killingland
Segment Lead Hydrogen, CCS and synfuels
Energy Systems North Europe

E-mail: magnus.killingland@dnv.com
Cel: +45 29 38 83 16

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