



WHEN TRUST MATTERS

Pathway to bankability Hydrogen and Power-to-X

4th European Conference Hydrogen & PtX
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DNV's part of scaling hydrogen and PtX



Certify, verify and test



Qualify and assure



Give expert advice



Co-create and share

bankable

adjective /'bɑŋ-kə-bəl/

Sure to bring in a profit

bankability

noun /bɑŋ-kə-'bi-lə-.tē/

an ability to make money



Pathway to bankability

Using TRL and CRI as a guide

- **Technology Readiness Level**

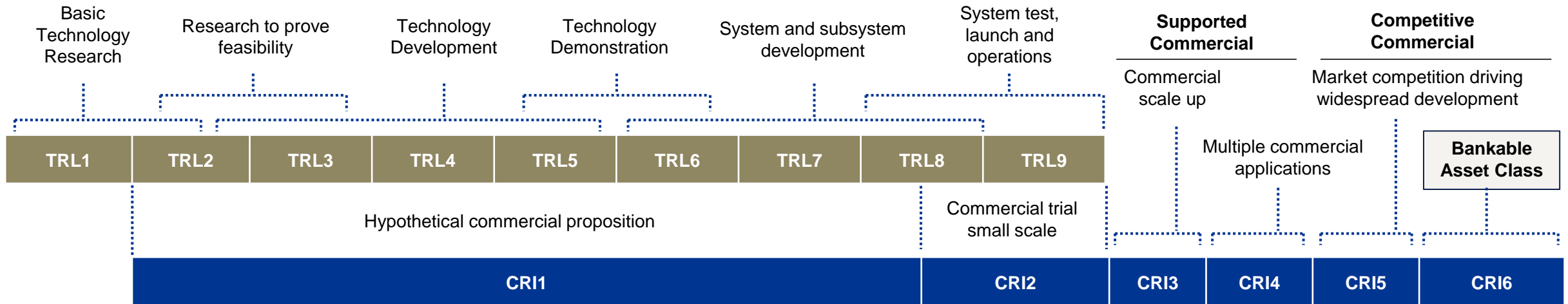
- From: Basic Technology Research (TRL1)
- To: System test, launch and operations (TRL9)
- Feedstock Readiness
- Fuel Readiness

- **Commercial Readiness Index**

- From: Hypothetical Commercial Proposition
- Via: Supported Commercial
- To: Competitive Commercial, and Bankable Asset Class



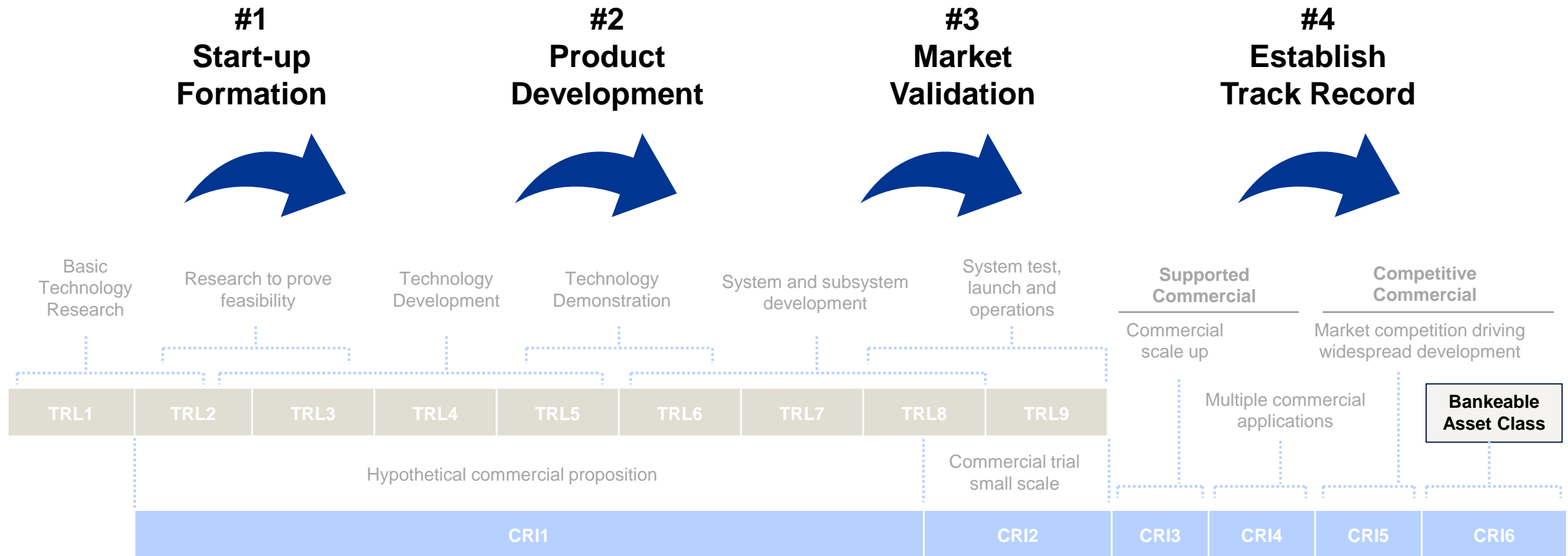
Technology and Commercial Readiness



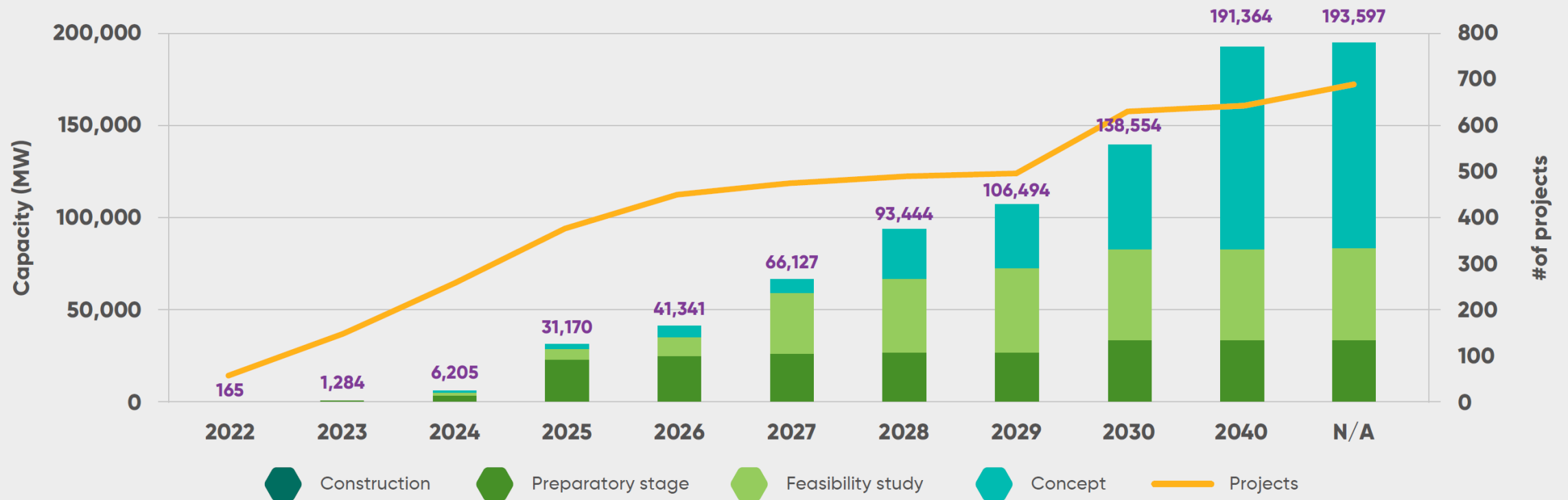
TRL levels can be increased by
Technology Qualification & Technical Assurance

CRI levels can be increased by
Financial Risk Evaluations

Several valleys of deaths on the pathway to bankability?

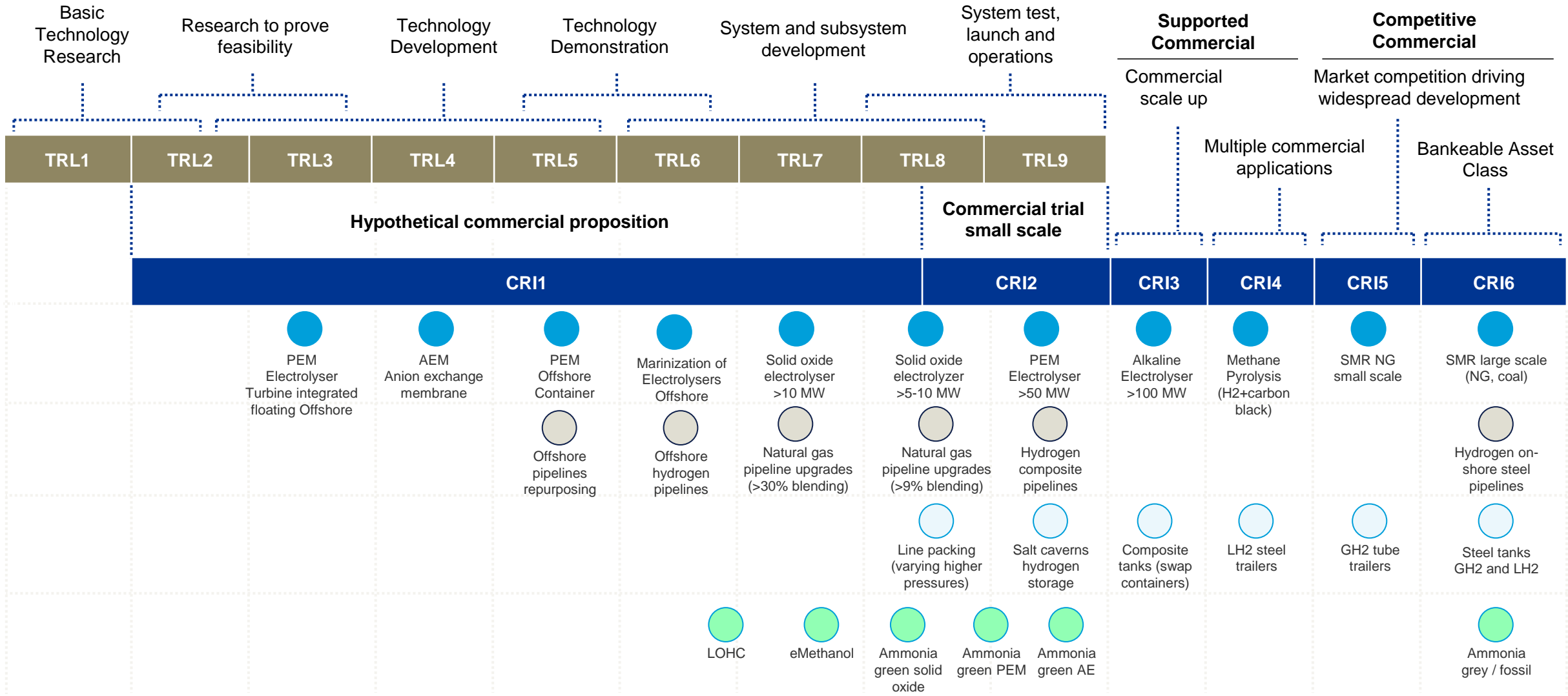


Cumulative planned PtX projects in Europe 2022 – 2040, in MW and # of projects with extensions

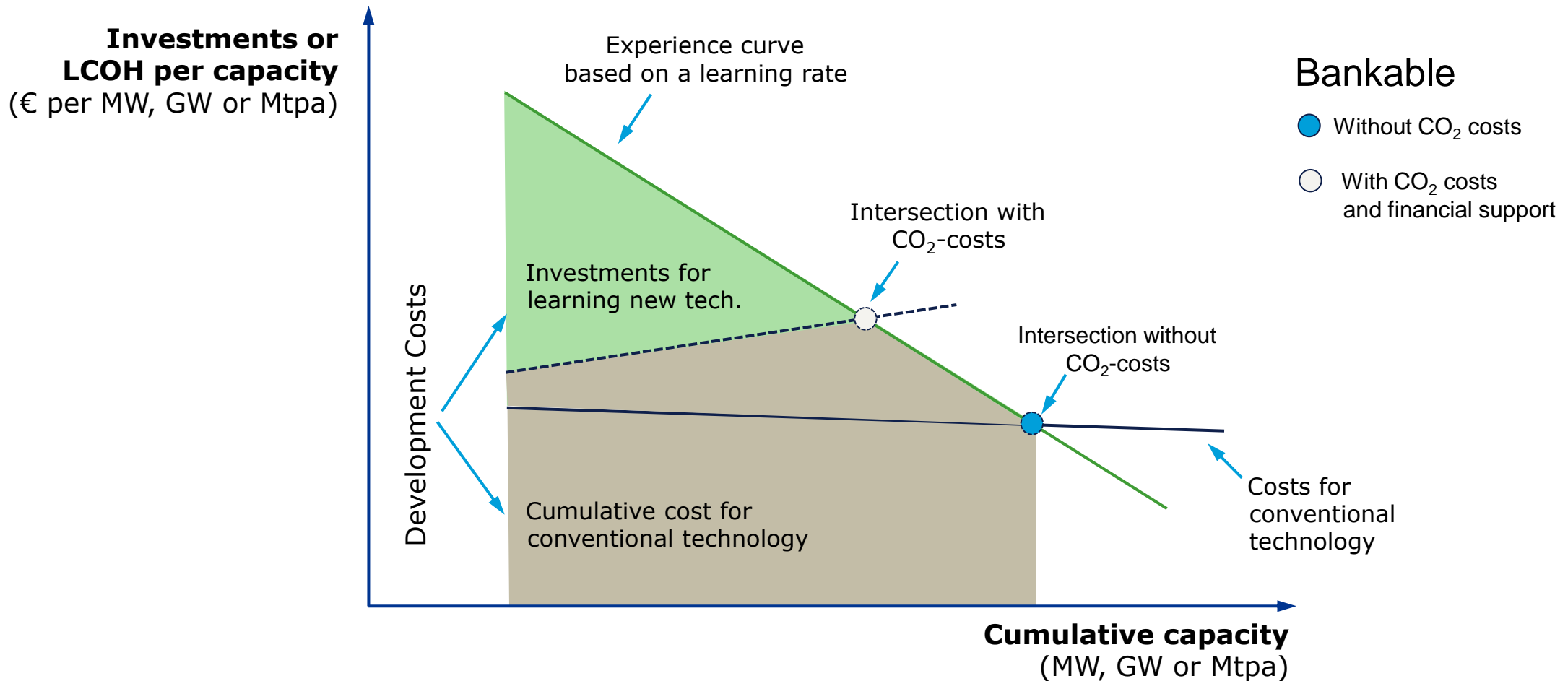


Maturity of H2-production, use, storage and transport

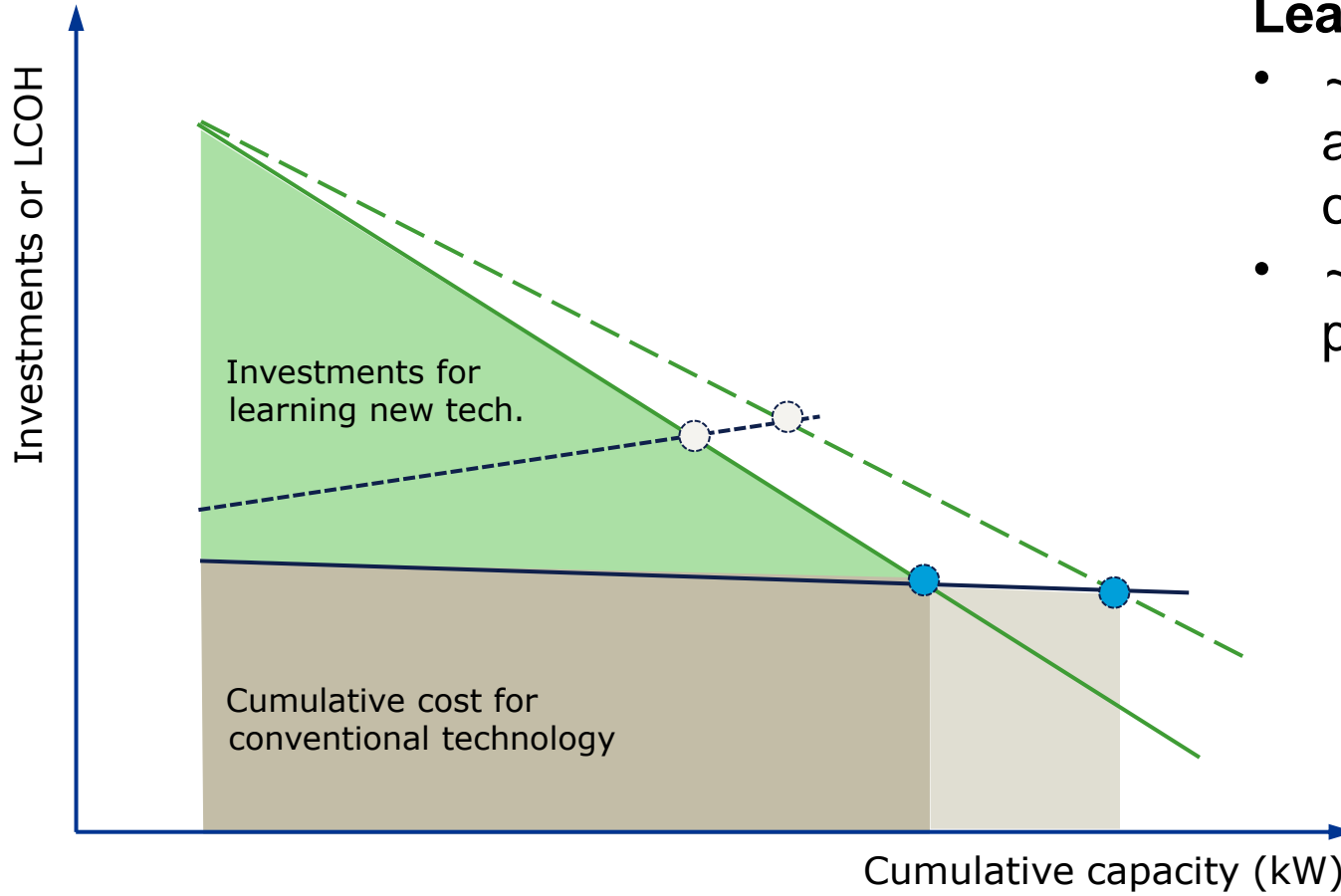
A high-level overview for discussion – illustrative and supplier dependent



Learning rates and experience curves



Learning rate: high or low going forward?



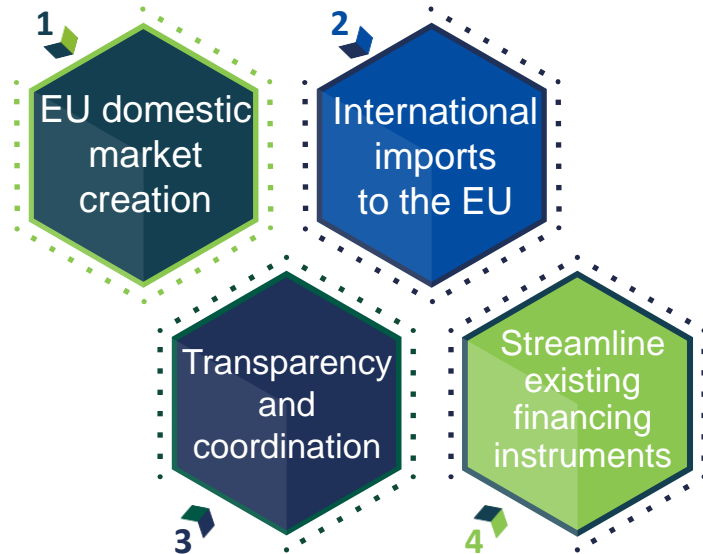
Learning rates

- ~10-20% as for batteries, solar and onshore wind power?
or
- ~5-10% as for gas and chemical processes?

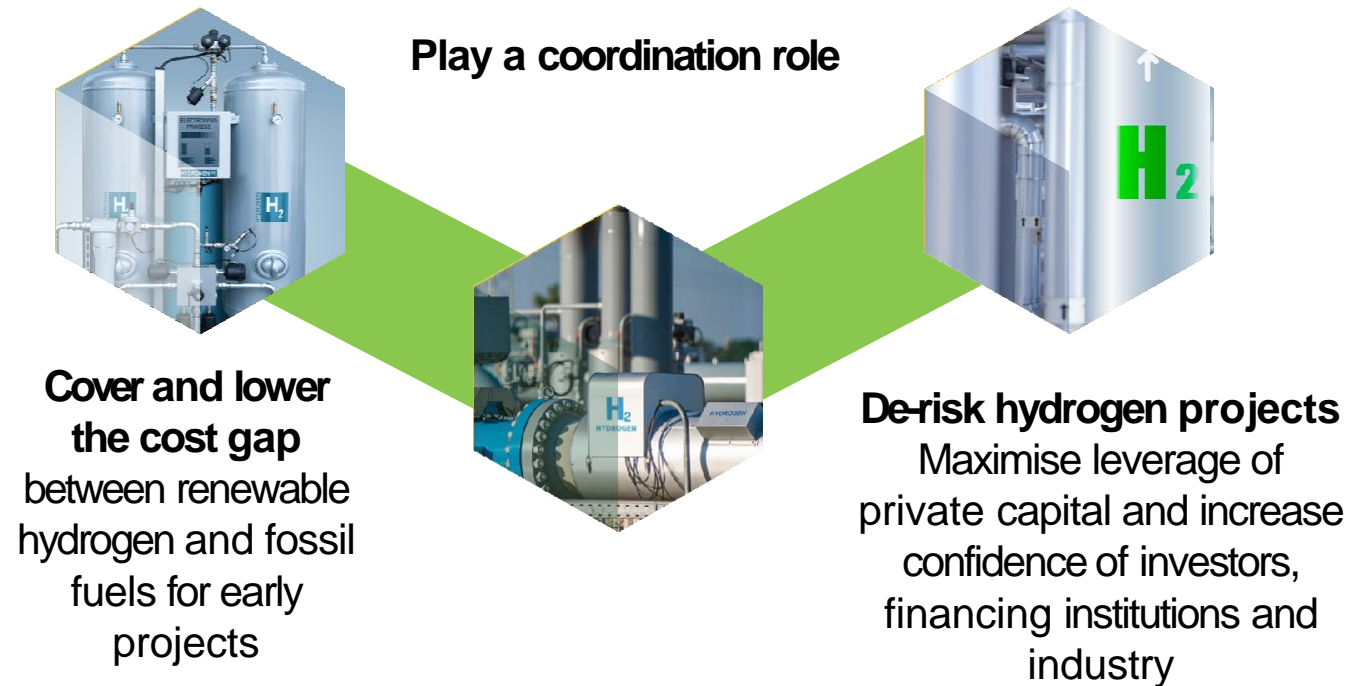
Bankable

- Without CO₂ costs
- With CO₂ costs and financial support

The Four Pillars and goals of the EU Hydrogen Bank



Aim:
Make all pillars
operational by end of 2023



European Hydrogen Bank Timeline



First auction for renewable hydrogen



Dec 2023

First auction



Spring 2024

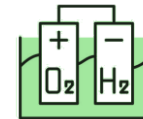
Publication
of results



2024

Signature of grant
agreements

3,5 years project
delivery time¹⁾



Autumn 2027

Commercial
operations
of projects



Spring 2028

Support
cancelled if
online later



Up to 10 years

Annual
payments²⁾

Points raised in consultation:

- 1) Possibly longer project delivery time
- 2) Possibly bi-annual payments

Support can have a shorter duration if

- a) Late COD – commercial operations date
By up to 6 months of the project comes online later
(subsidy is e.g. paid for 9,5 instead of 10 years)
- b) Overproduction
Project uses allocated budget earlier, e.g. a bid for 1 ktpa
produces +20% and 1,2 ktpa, will receive subsidies for 8 years

European Hydrogen Bank Timeline



First auction for renewable hydrogen



Dec 2023

First auction



Spring 2024

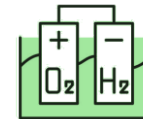
Publication of results



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3,5 years project delivery time¹⁾



Autumn 2027

Commercial operations of projects



Spring 2028

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Up to 10 years

Annual payments²⁾

General functioning:

Supplier of green hydrogen (REDII DA compliant), bid for a premium for each kg of hydrogen produced

- Pay-as-bid pricing
- Euro per kilo premium
- Mature projects with PPA and HPA



Implications for the project pipeline:

Project volume 1st auction:

Maximum bid:

Minimum hydrogen produced:

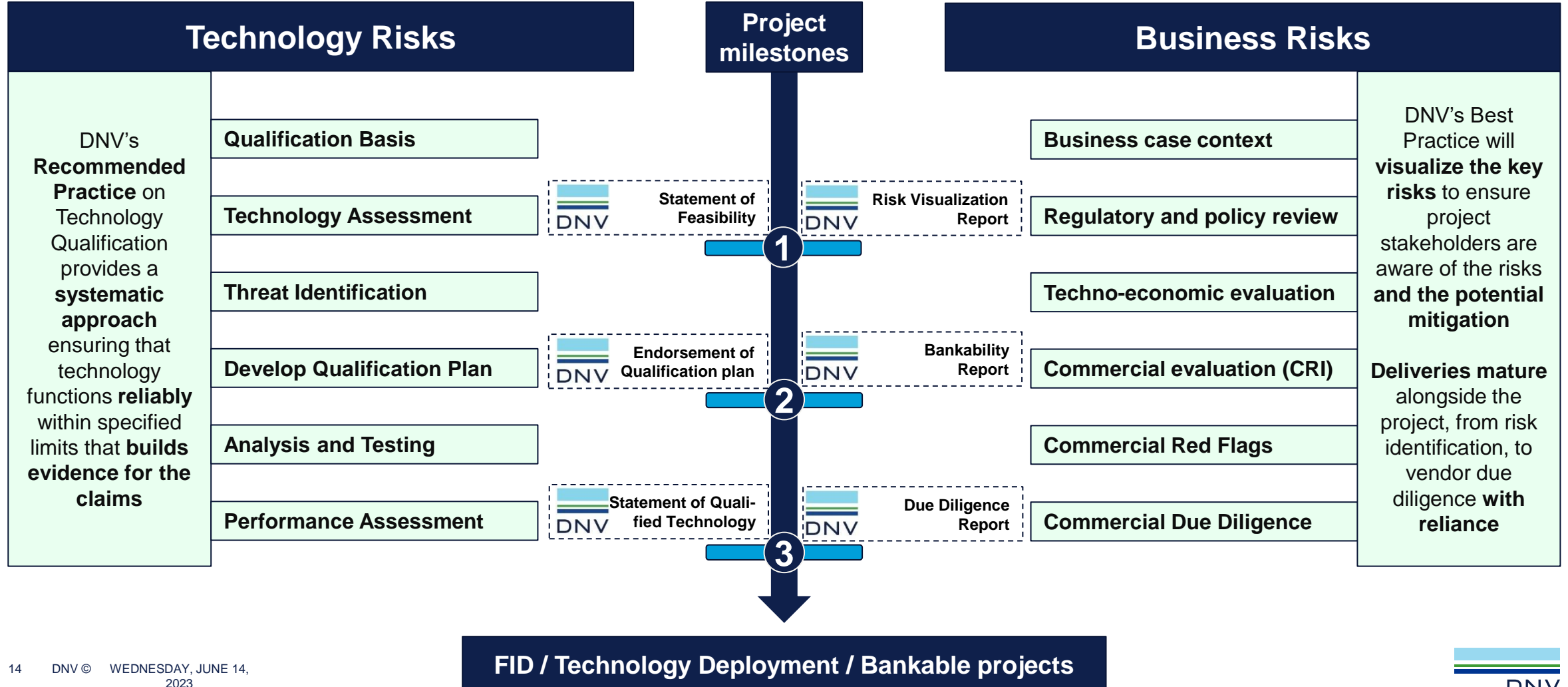
800 mill. EUR

4 EUR/kg

0.2 Mt for 10 yrs

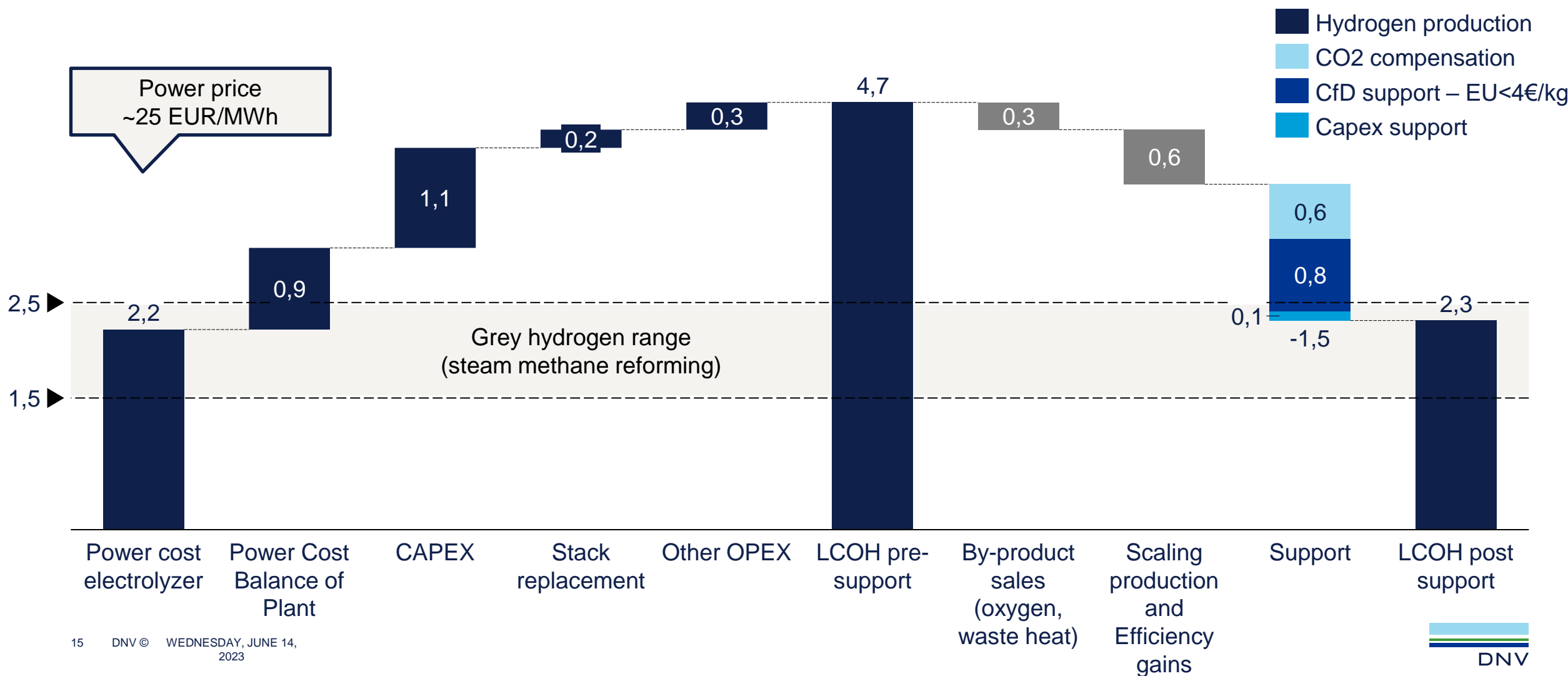
Maturing technology and the business case

– *by reducing risks*



Estimating bankability, with CfDs

LCOH is the sum of all costs and assumptions for the project



VERIFICATION OF HYDROGEN AND AMMONIA CARBON FOOTPRINT

- For organizations involved in production and delivery of hydrogen or ammonia, seeking third party services.
- Made to validate that a system or product has certain attributes, such as greenhouse gas emissions below a certain threshold.



SERVICE SPECIFICATION: SE-0654

“VALIDATION OF ATTRIBUTE CLAIMS FOR LOW CARBON AND RENEWABLE HYDROGEN AND AMMONIA”

VERIFICATION OF POWER-TO-X FACILITIES

- A structured framework and methodology for planning, preparation and execution of independent risk-based verification or certification for PtX facilities.
- Intended to minimize risks for all stakeholders, by defining assurance activities for the safe design, development, construction and operation of PtX facilities



SERVICE SPECIFICATION

DNV-SE-0656

Edition June 2023

Verification of power-to-X facilities



The PDF electronic version of this document available at the DNV website [dnv.com](https://www.dnv.com) is the official version. If there are any inconsistencies between the PDF version and any other available version, the PDF version shall prevail.

DNV AS



DNV's part of scaling hydrogen and PtX



Certify, verify and test

against standards,
specifications and
regulatory requirements



Qualify and assure

new technologies,
systems, data, platforms,
supply- and value chains



Give expert advice

on safety, technology and
commercial risk, and
operational performance



Co-create and share

new rules, standards,
software and
recommended practices

Safety

Thank you for your attention!

Reach out for further
details and discussions

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