Driving Industrial Decarbonization: Creating a Green Steel Market

Technology options and regulatory approaches

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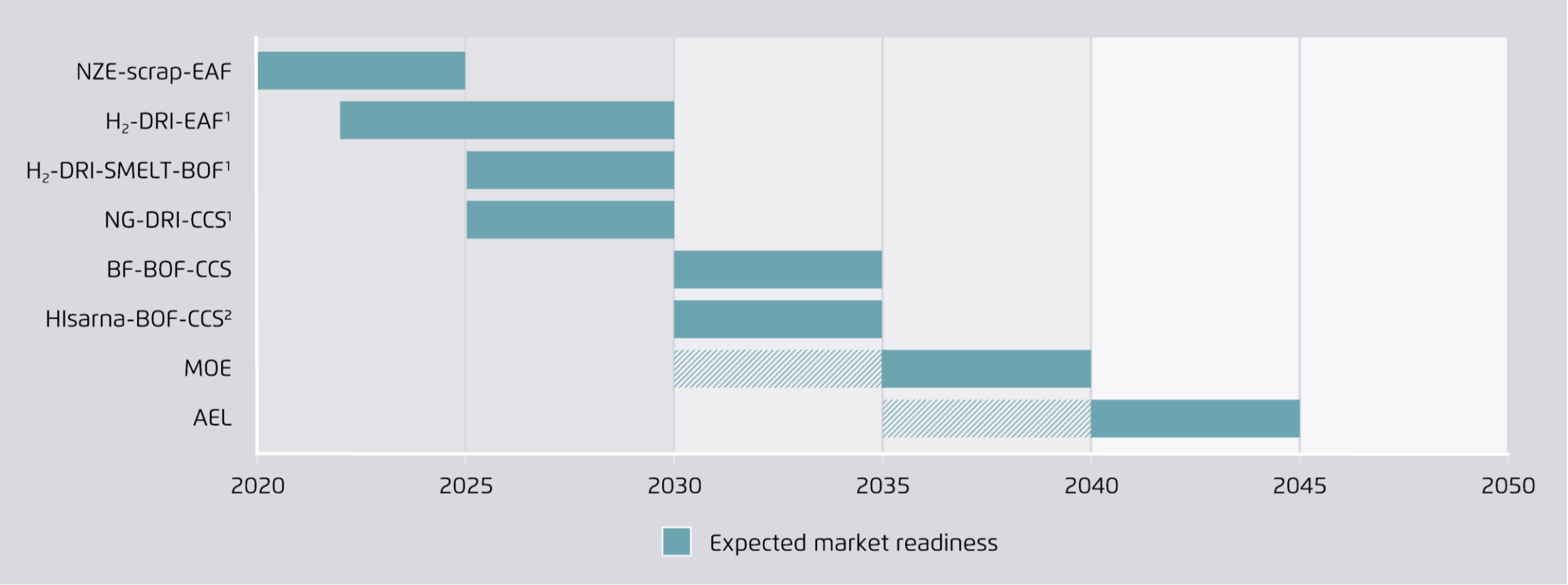
EAF- and DRI-based technologies for transforming the global steel industry will be commercially available this decade.

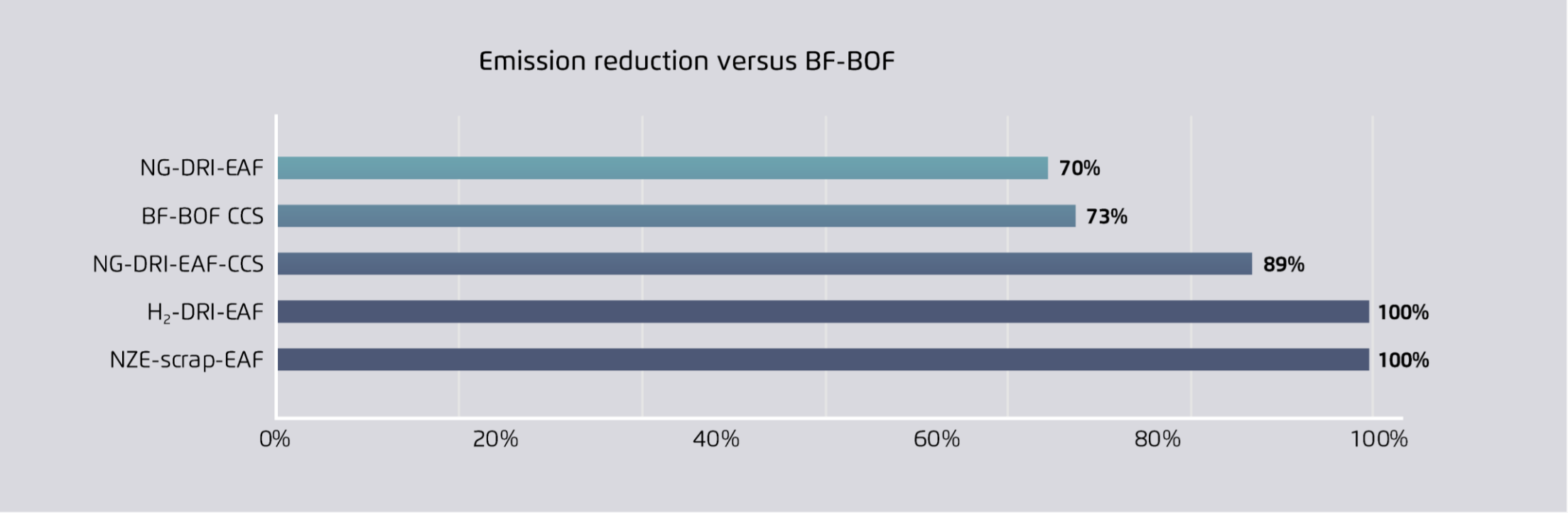
Expected market readiness of selected breakthrough technologies for steelmaking



Agora Industry and Wuppertal Institute (2024). Note: 1) DRI plants running on natural gas can already blend high shares of H2. Commerical DRI plants running on 100% H2 are expected by 2025. 2) It is currently not clear what the TRL of the technology is and whether it is actively being developed further.

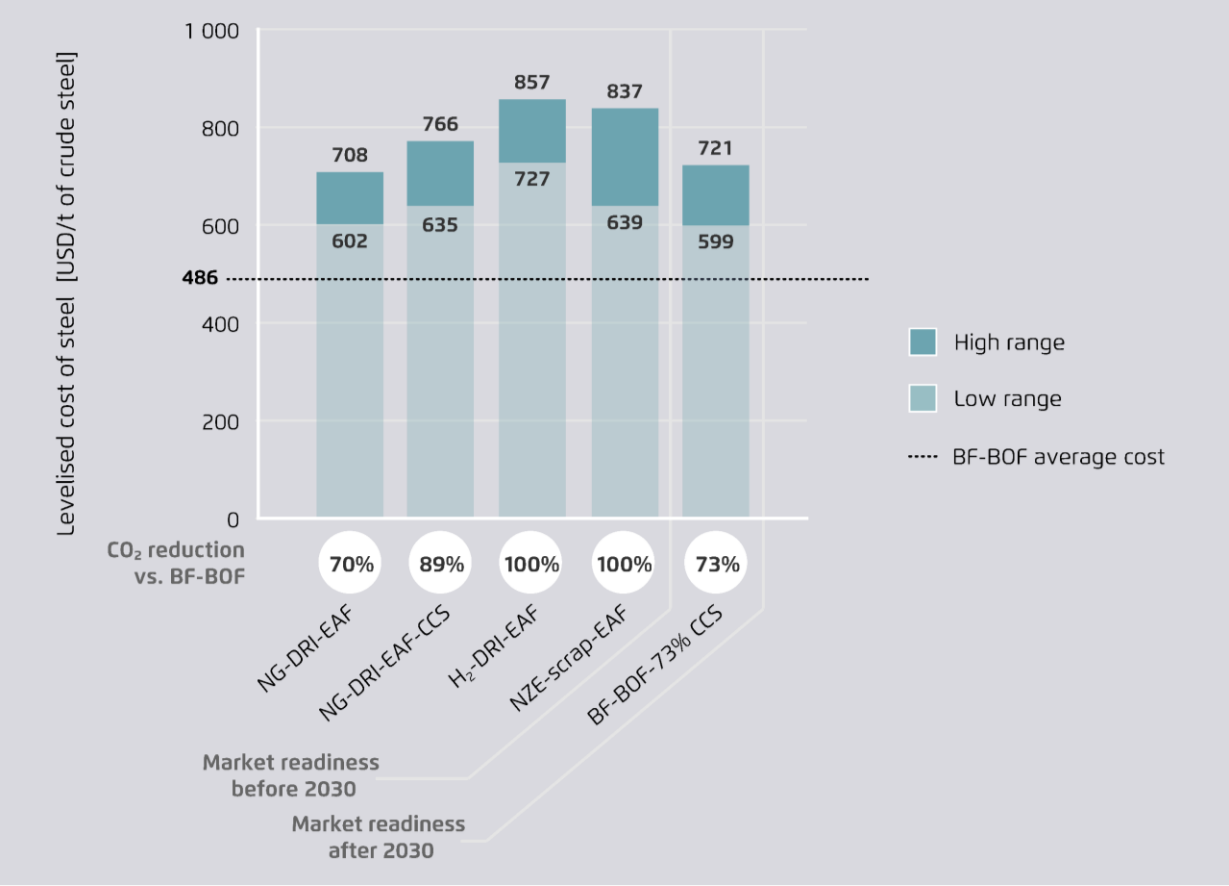
CCS-based technologies always lead to residual emissions.

CO_2 abatement potential of different breakthrough technologies compared to the blast furnace route (BF-BOF)



Near-zero technologies are more expensive than conventional steelmaking – policy measures are needed to create a business case.

Production costs of selected steel production routes in 2030



Agora Industry and Wuppertal Institute (2024). Note: Agora and Wuppertal Institute's cost assumptions are based on a literature review and a middle-of-the-road approach, in which the lowest and the highest costs are excluded from the cost range. Input assumptions for 2030 are: USD 50–80/MWh for delivered zero-carbon electricity; USD 2–3/kg of delivered low-carbon H2; USD 13–31/MWh natural gas; USD 30–60/tCO2 for CO2 transport and storage excluding CO2 capture for CCS-based technologies; no carbon pricing is included in the costs.

By 2030, CO2 abatement costs of most technologies will be above 100$/tCO2 – the cost of hydrogen is a crucial driver.

CO_2 abatement costs of selected technologies versus the BF-BOF route in 2030

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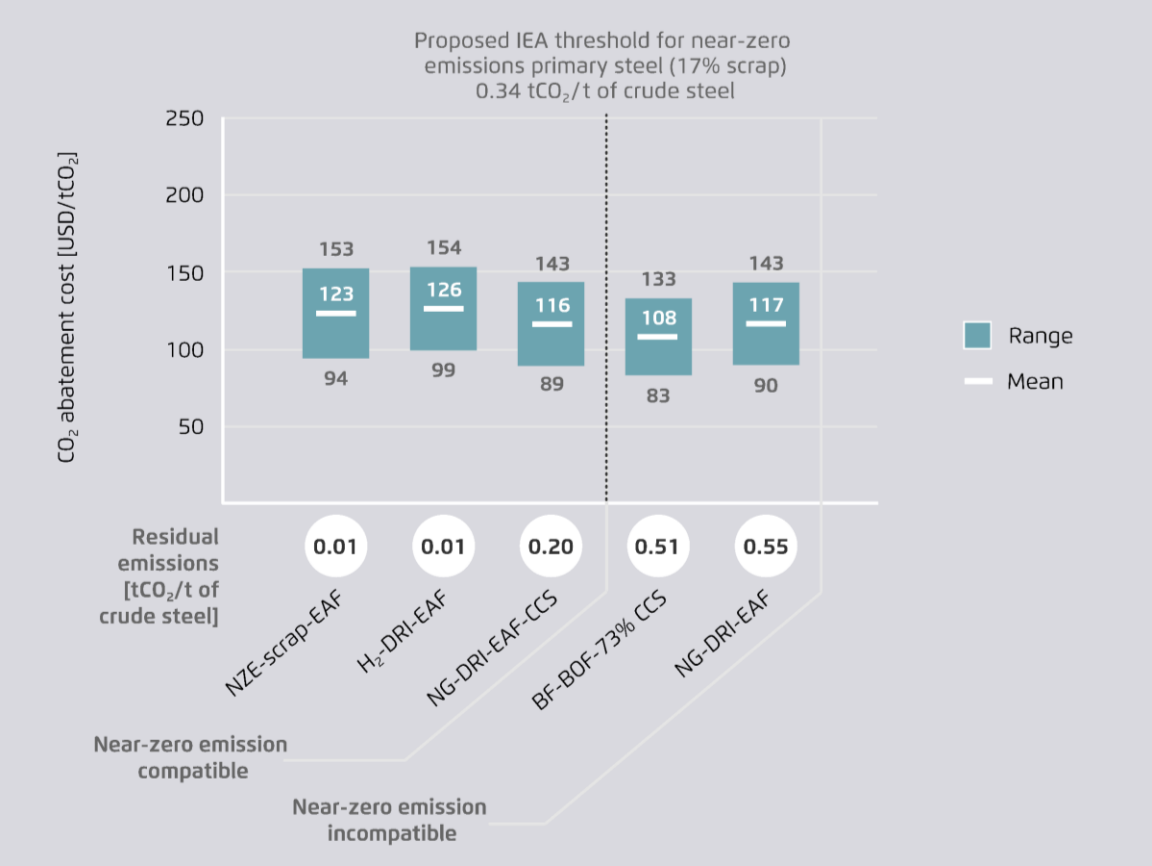
By 2050, hydrogen-based DRI routes will have similar CO2 abatement costs to NG-DRI-based routes.

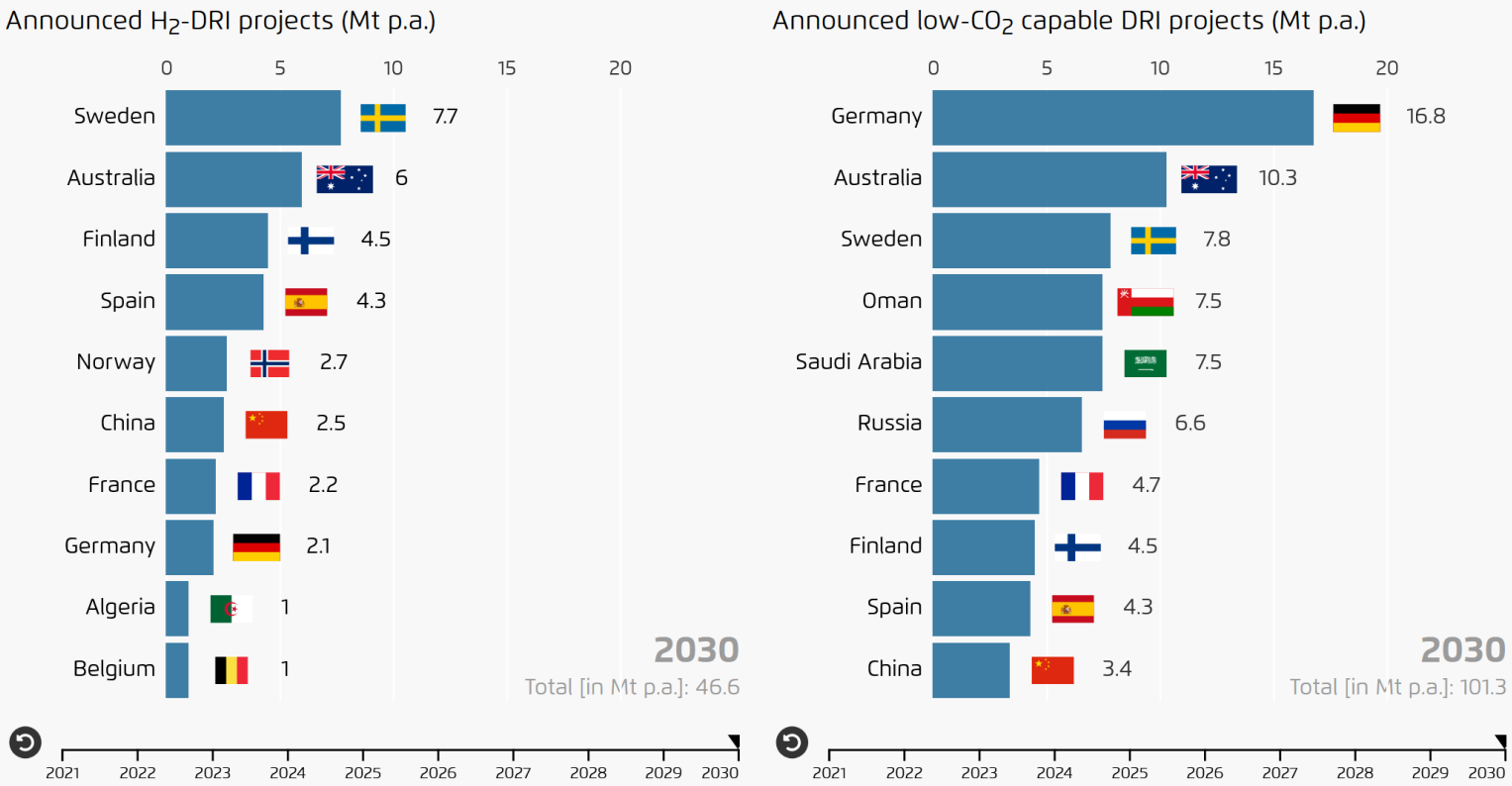
CO_2 abatement costs of key technologies versus the BF-BOF route in 2050



Agora Industry and Wuppertal Institute (2024). Note: Agora and Wuppertal Institute's cost assumptions are based on a literature review and a middle-of-the-road approach, in which the lowest and the highest costs are excluded from the cost range. Input assumptions for 2050 are: USD 50–80/MWh for delivered zero-carbon electricity; USD 1–2/kg of delivered low-carbon H2; 9–25/MWh natural gas; USD 20–30/tCO2 for CO2 transport and storage excluding CO2 capture for CCS-based technologies; no carbon pricing is included in the costs. All primary technologies use a share of 17% scrap. The IEA's proposed near-zero emission threshold of 0.34 tCO2/t of crude steel is adjusted to a 17% scrap input.

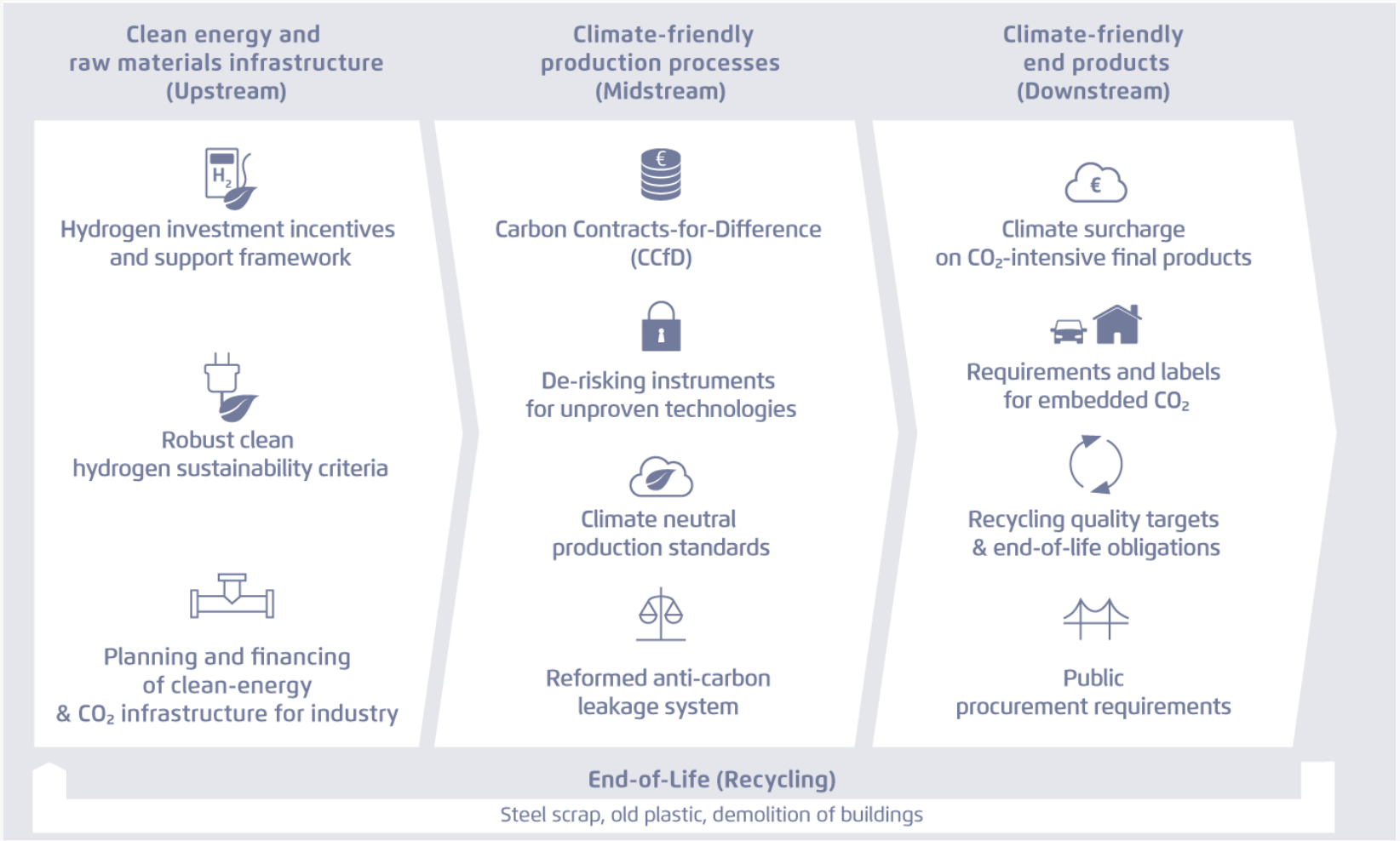
Several DRI-investments by 2030 have been announced.

Announced new DRI capacity by 2030



Agora Industry (2024). Note: The category **Announced low-CO_2 capable DRI projects** includes the announcements of new NG-DRI plants, which are assumed to be H_2-ready if using the latest DRI technology.

For a successful transition of the steel sector, consistent policies are needed along the value chain.



- **Upstream:**
  - Continued RES expansion – and H2!
  - Pan-European infrastructure & **access to competitive power prices and incentives for flexibility**.
- **Midstream:**
  - Strong EU-ETS, successful **CBAM** implementation.
  - **De-risking financial instruments** e.g. CCfD (but: lack public funding).
- **Downstream:**
  - **Instruments for lead markets** to be developed (Clean Industrial Deal: steel label, green public procurement).

https://www.agora-industry.org/publications/breakthrough-strategies-for-climate-neutral-industry-in-europe-study#charts

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Thank you for your attention!

Do you have any questions or comments?

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