International Energy Agency

Scaling up clean energy technologies

Dr Timur Gül, Chief Energy Technology Officer, International Energy Agency

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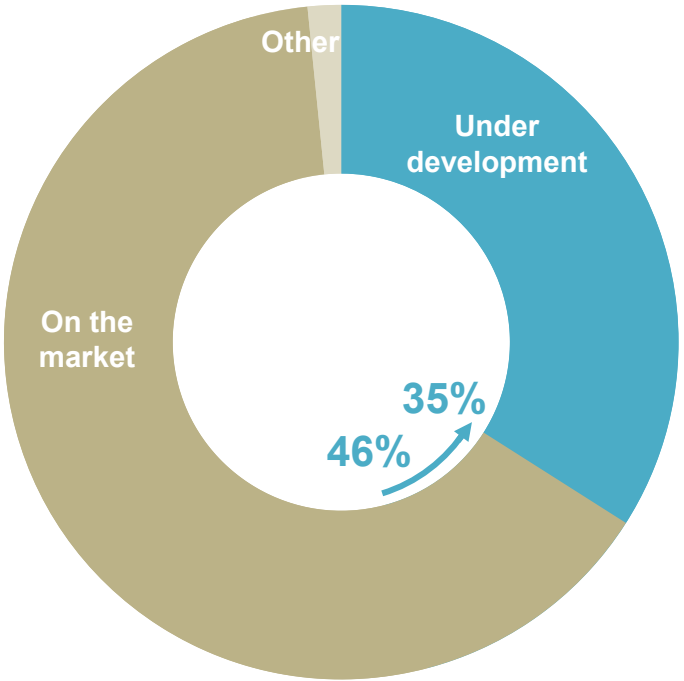
Innovation is already delivering new tools and lowering their costs

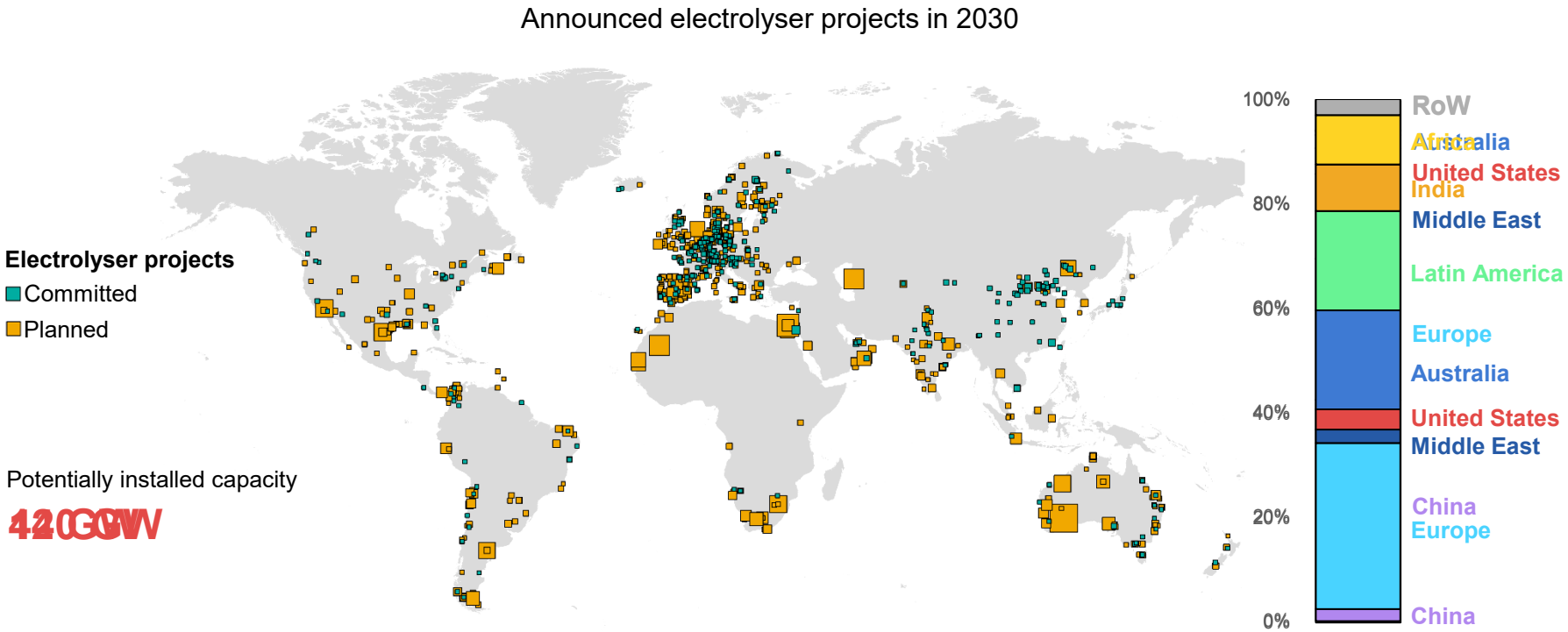
CO_2 emission reductions by technology maturity in 2050 in the NZE Scenario of **2023**



Clean energy innovation has been accelerating in the last few years, yet more RD&D is needed to unlock the next generation of low-emissions technologies.

Source: IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach

Deployment of electrolysers is accelerating and expanding

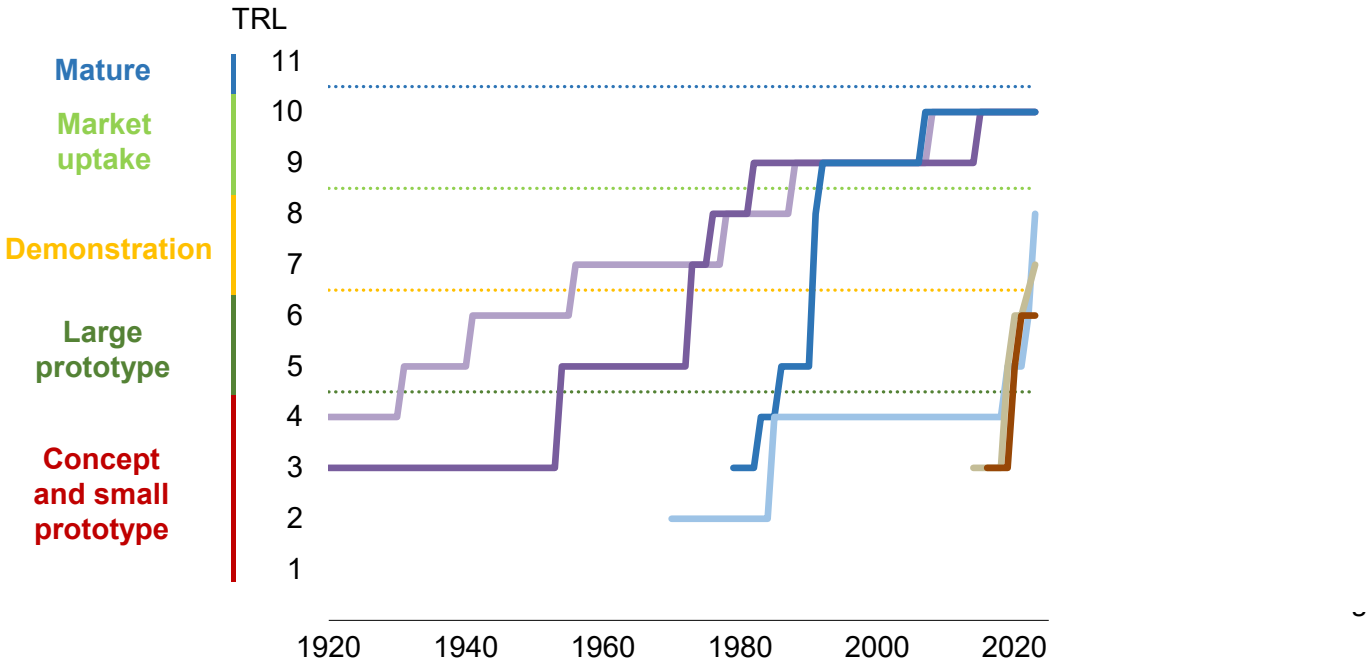


Projects under construction or having reached FID are concentrated in Europe and China, but a growing number of projects are being developed around the world.

Source: IEA (2023), Global Hydrogen Review

Innovation today prepares the clean energy technologies of 2050

Evolution of technology readiness levels for selected clean energy technologies

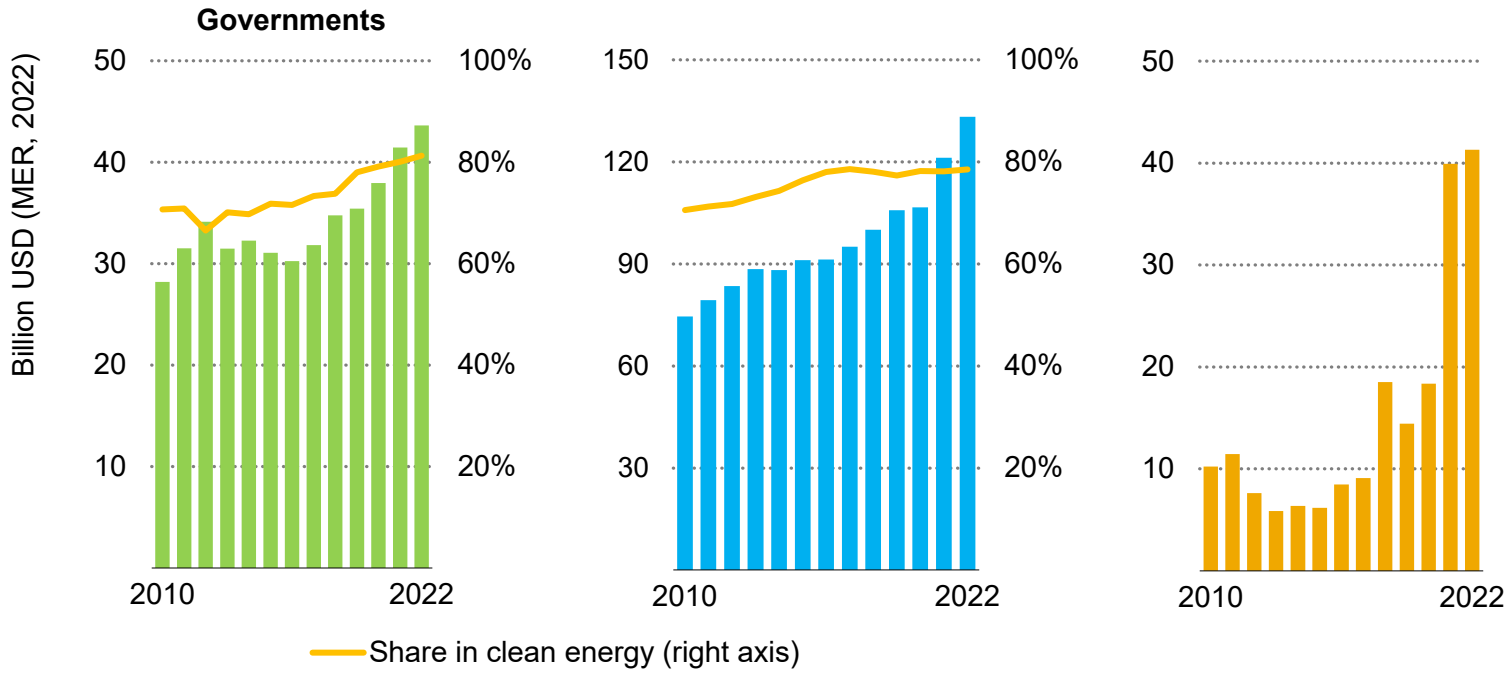


Innovation is moving quickly, opening significant market opportunities.
However, the innovation journey can be long, and must be accelerated significantly to get on track.

Source: IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach

A stronger role for government, industry and clean energy start-ups

Global spending on energy R&D and venture capital investment in clean energy start-ups, 2010-2022



Clean energy R&D spending by governments and corporations have increased substantially since 2010. The increasing role of clean energy start-ups indicates a new way of doing innovation in rapidly growing markets.

Source: IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach

Five priorities for decision makers to scale up clean energy techs

1. **Accelerate deployment of existing clean energy concepts**, such as renewables, energy efficiency technologies, and the electrification of end-uses

2. **Stimulate innovation by fostering demand for clean energy**, especially in sectors where innovation needs are greater (e.g. heavy industry and long-distance transport)

3. **Make pre-commercial technologies more bankable**, especially in sectors where there are few clean energy options today, and where risks are high (e.g. demonstration stage)

4. **Nurture a pool of innovators to generate diverse ideas** to embrace uncertainty and enable disruption, even if net zero emissions could be achieved without major discoveries

5. **Foster international collaboration on clean energy innovation** to share learnings and resources, such as through the IEA Committee on Energy Research and Technology (CERT) and the Technology Collaboration Programme (TCP)