International Energy Agency

# Research Gaps towards hydrogen commercialization

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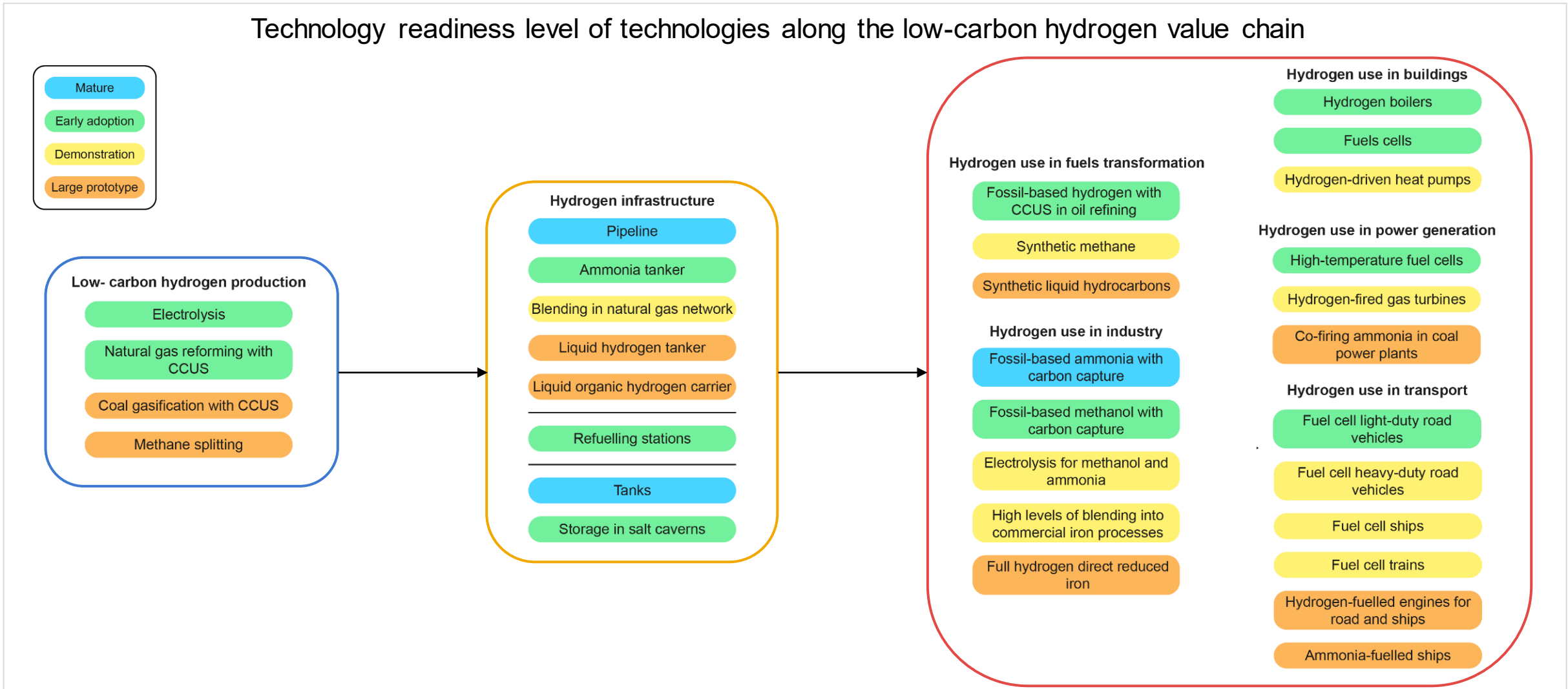
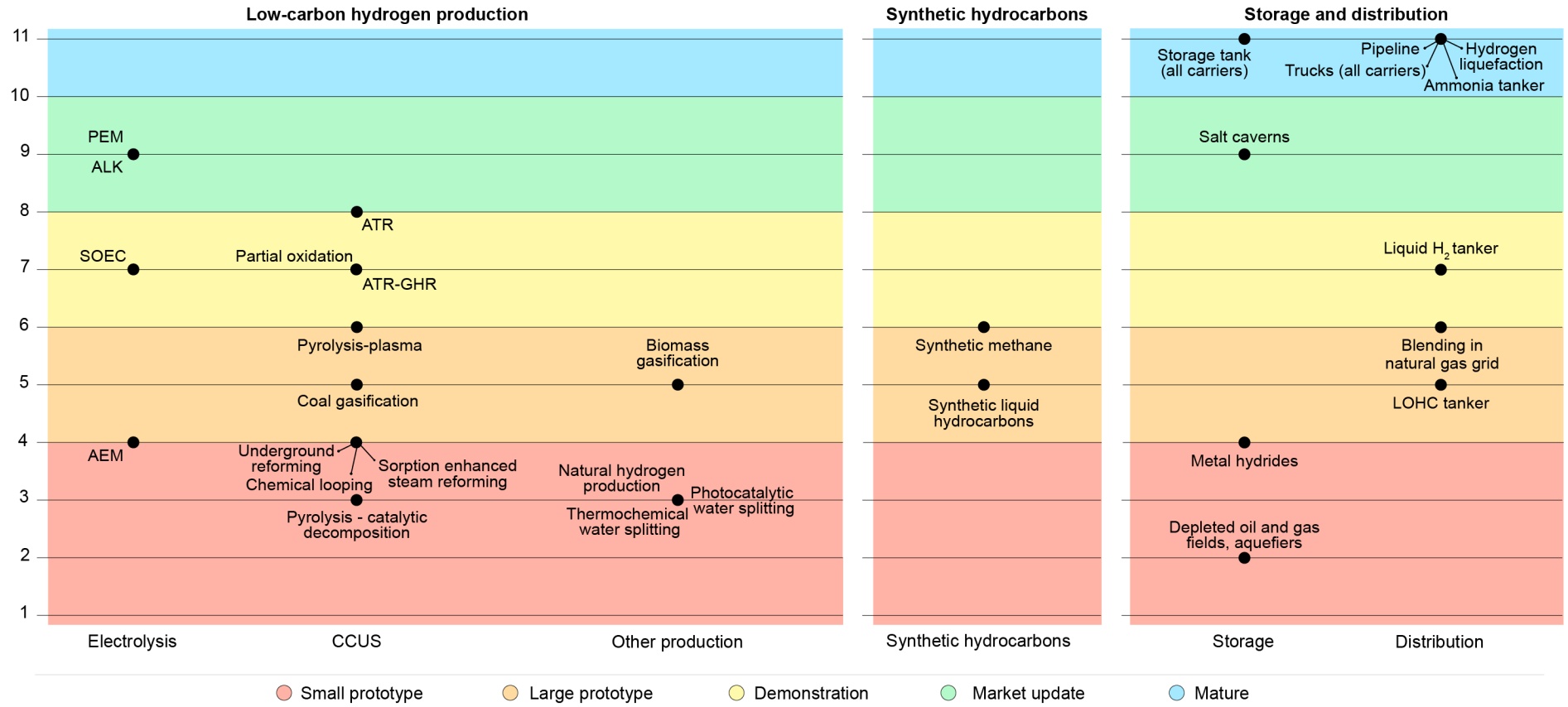
# Innovation needed across the whole value chain




**A significant fraction of the full potential of hydrogen will remain untapped until key technologies across the whole supply chain are developed and demonstrated at commercial scale and then deployed**

# The success of hydrogen is a story about innovation (I)

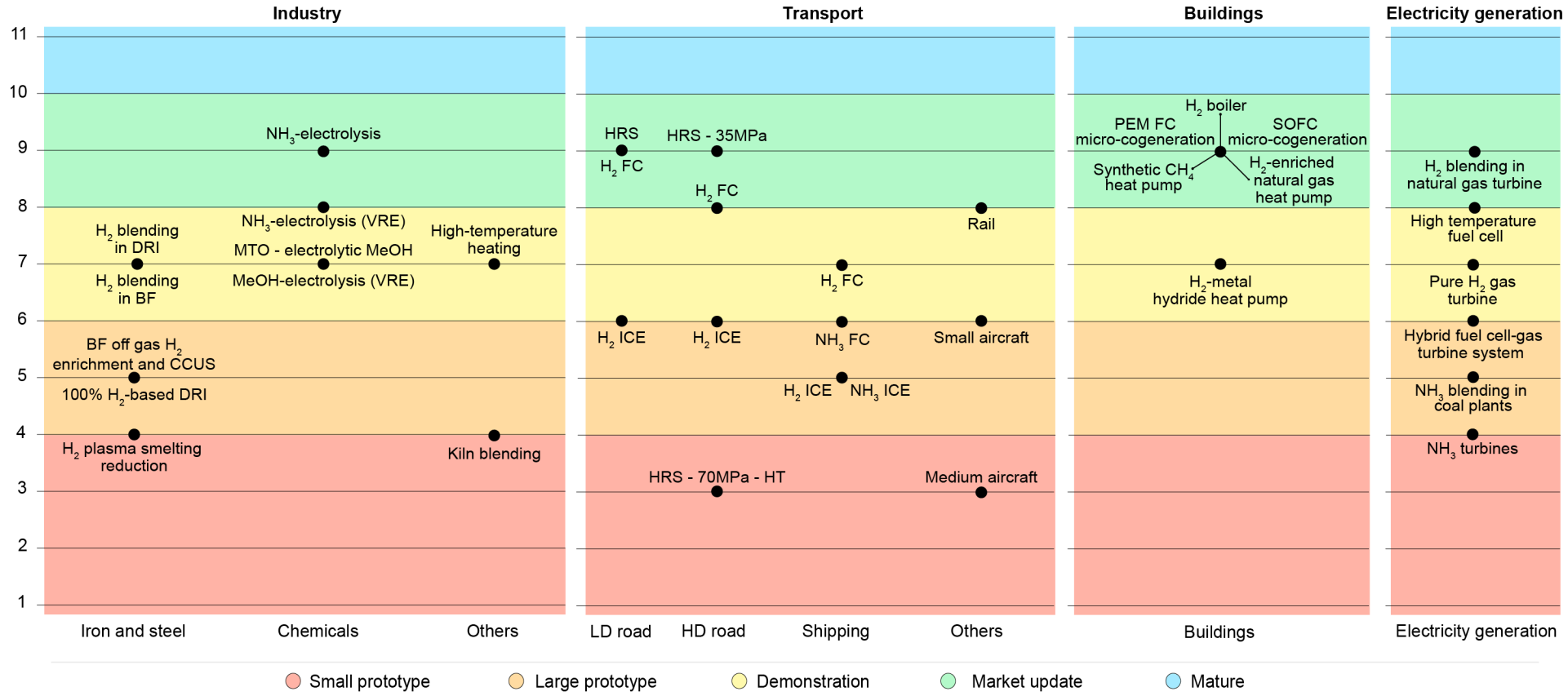
Technology readiness levels of key hydrogen production, storage and distribution technologies




**Several low-carbon production technologies are ready of large scale deployment to deliver cost savings, but many others still require demonstration.**

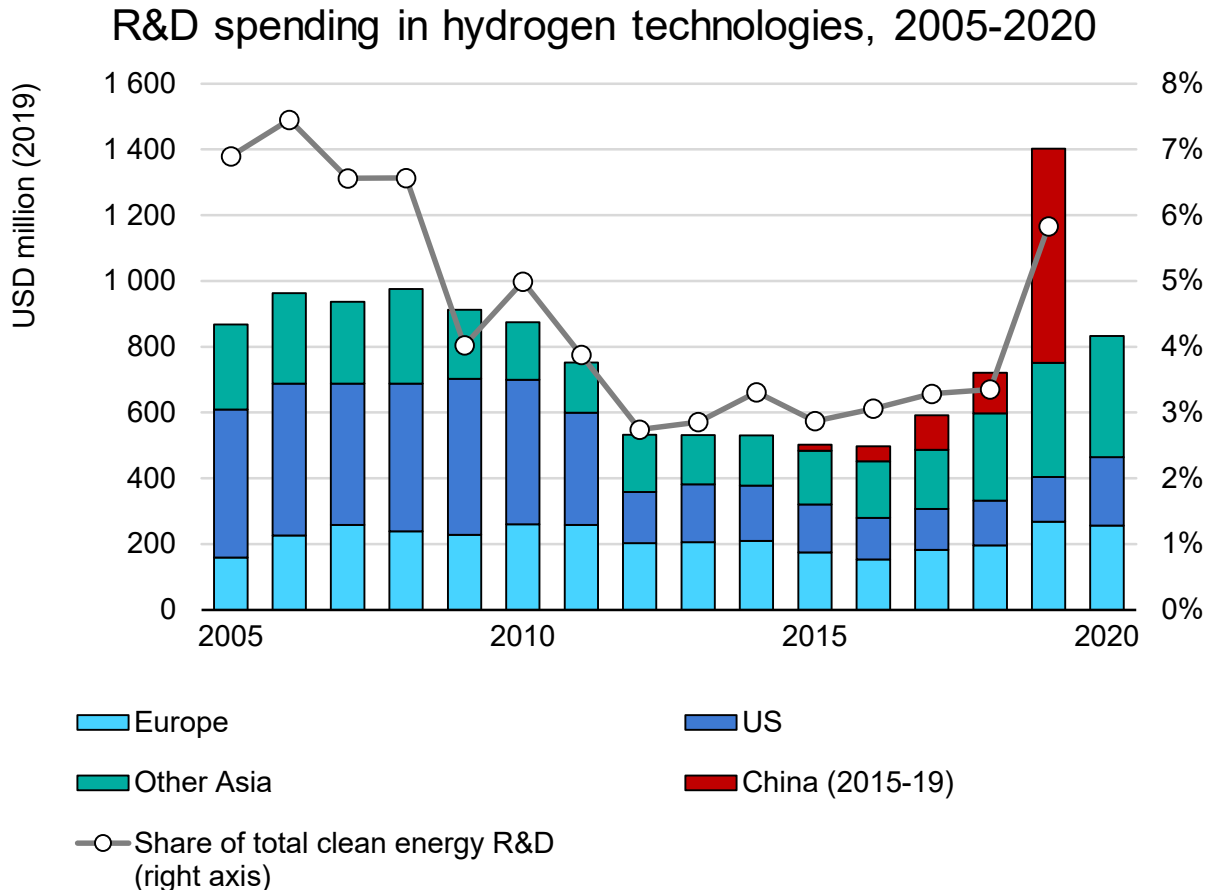
# The success of hydrogen is a story about innovation (II)

## Technology readiness levels of key hydrogen end-use technologies




**The majority of demand technologies are only at the demonstration or prototype stage, particularly in sectors where hydrogen can play a more important role for decarbonisations (industry, long-distance transport, shipping, aviation)**

# Innovation in hydrogen requires a boost

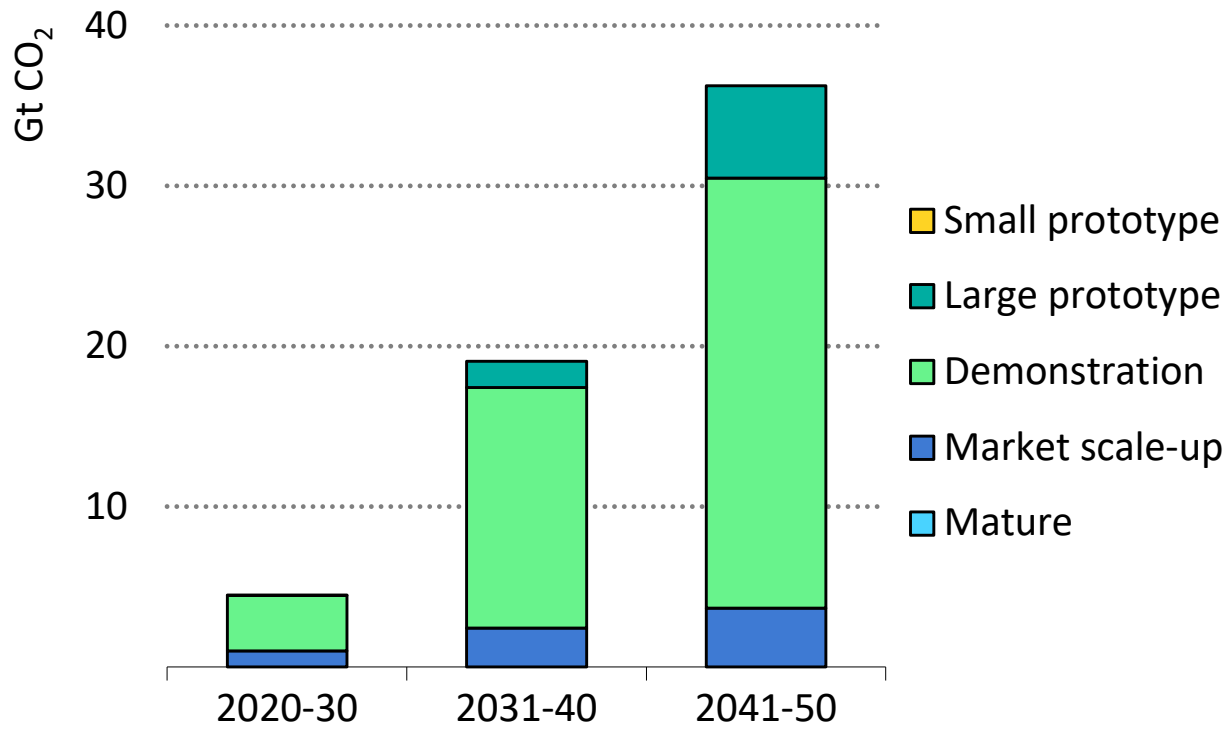



Source: Based on IEA and Mission Innovation data. 2020 data for China not available

**Despite recent surge, R&D spending on hydrogen technologies is not aligned with net-zero needs and requires a significant increase as soon as possible**

# Innovation and demonstration is urgently needed

Global CO2 emissions reductions from hydrogen-based fuels by technology maturity in the Net zero Emissions Scenario, 2020-2050




**Almost 90% of the 60 Gt of $CO_2$ emissions that hydrogen-based fuels can avoid in the Net zero Emissions Scenario come from technologies that are not yet commercially available**