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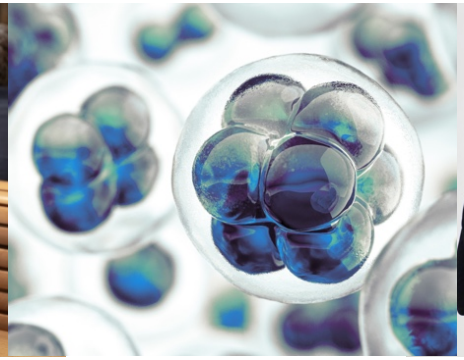
Hydrogen patents for a clean energy future

A global trend analysis of innovation along hydrogen value chains


Objectives of the study

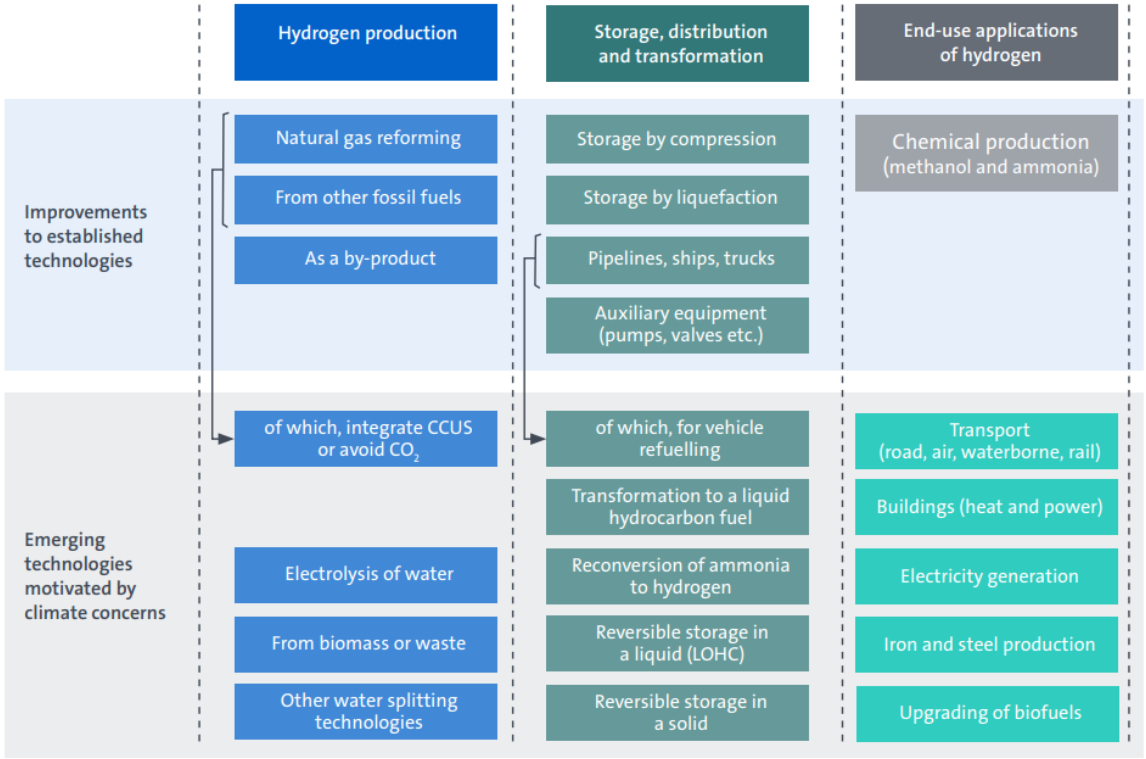
Use the combined expertise of EPO and IEA to map patent data to hydrogen technologies.

Use international patent families (IPFs) as a key metric to track innovation in those technologies

Key questions:

- How advanced are new hydrogen technologies in different parts of the value chain, and how fast are they advancing?
- Is innovation in low-emissions hydrogen outpacing that legacy hydrogen production methods?
- Which are the leading countries and key players in critical hydrogen technologies?
- Where should innovation efforts be directed?

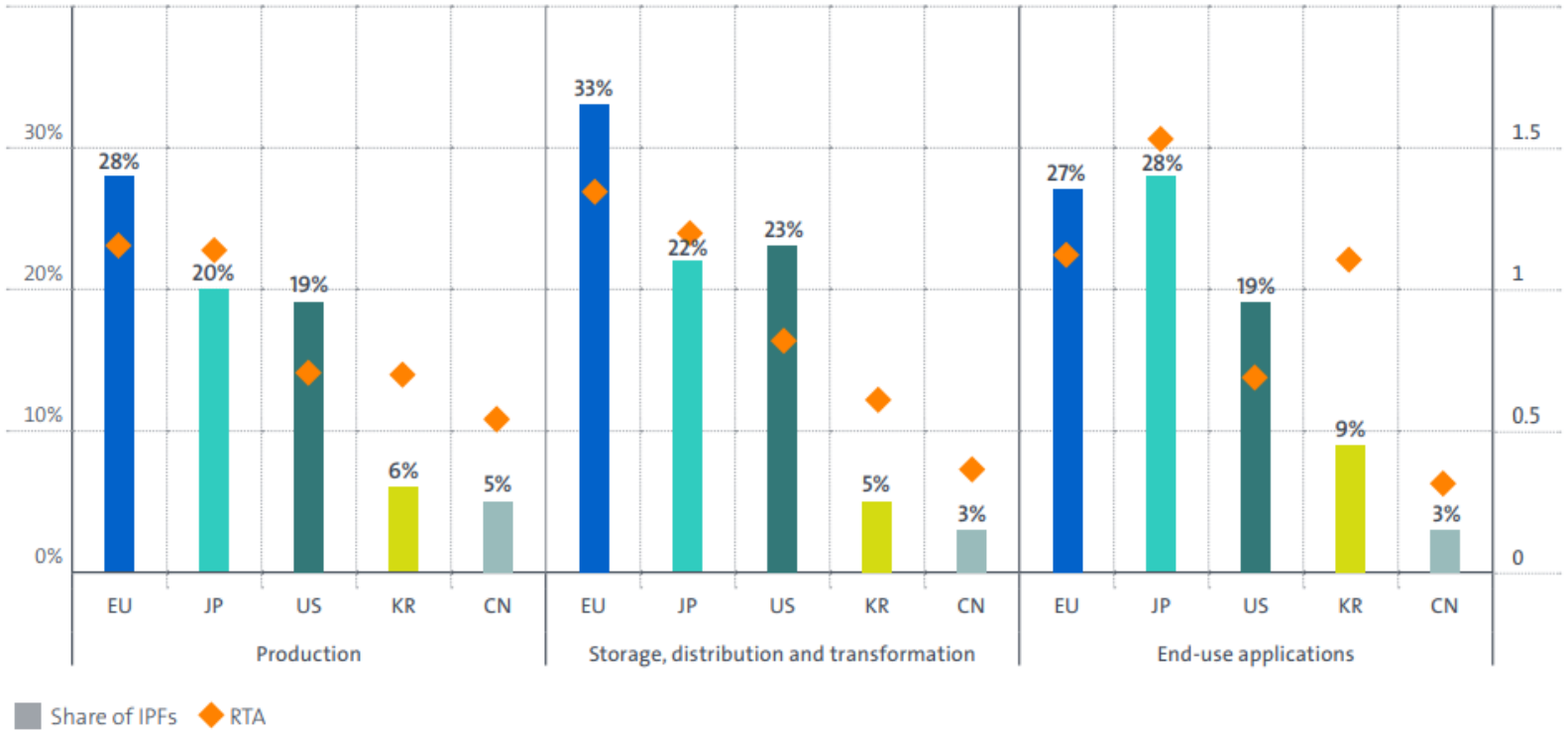
Cartography of hydrogen-related technologies



Notes: Refining is not analysed in the report due to the difficulty of reliably assessing the relevance of hydrogen in inventions for which a patent application has been filed in this field. Due to indistinguishability of technologies, methods for the production of ammonia from hydrogen are included only under chemical production applications and are omitted from hydrogen transformation, despite recent inventive effort to find new means of integrating ammonia and low-emission hydrogen production. Other end-use applications may be directly based on hydrogen, as well as on ammonia and methanol derived from hydrogen.

Global patenting in hydrogen is led by Europe and Japan, with the US losing ground in the period 2011–2020.

Share of international patenting and revealed technology advantage by main world regions and value chain segments (IPFs, 2011–2020)



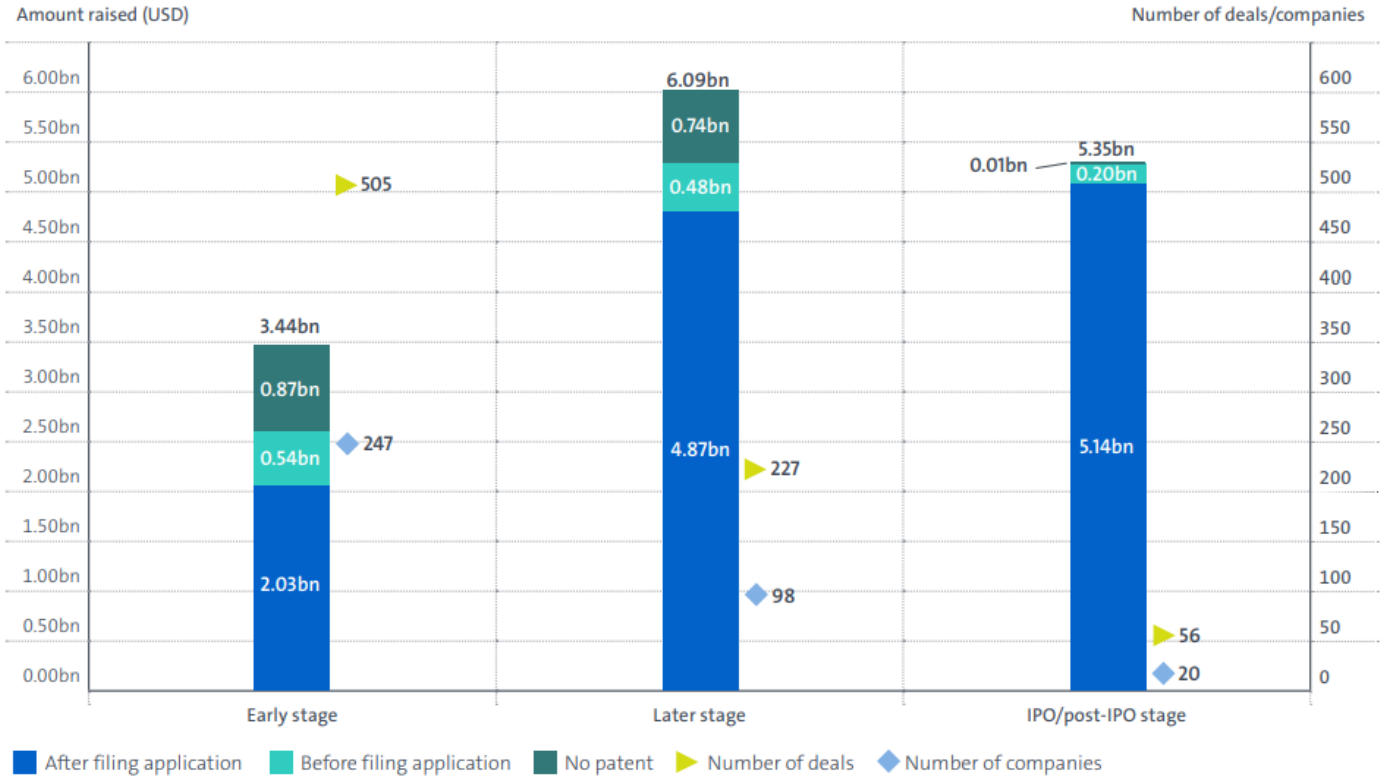
Innovation in established technologies is dominated by the chemical industry, but new heavyweights are from the automotive sector

Top international applicants in established technologies and technologies motivated by climate (IPFs, 2011–2020)

More than 80% of later-stage investment in hydrogen start-ups going to companies which had already filed a patent application.

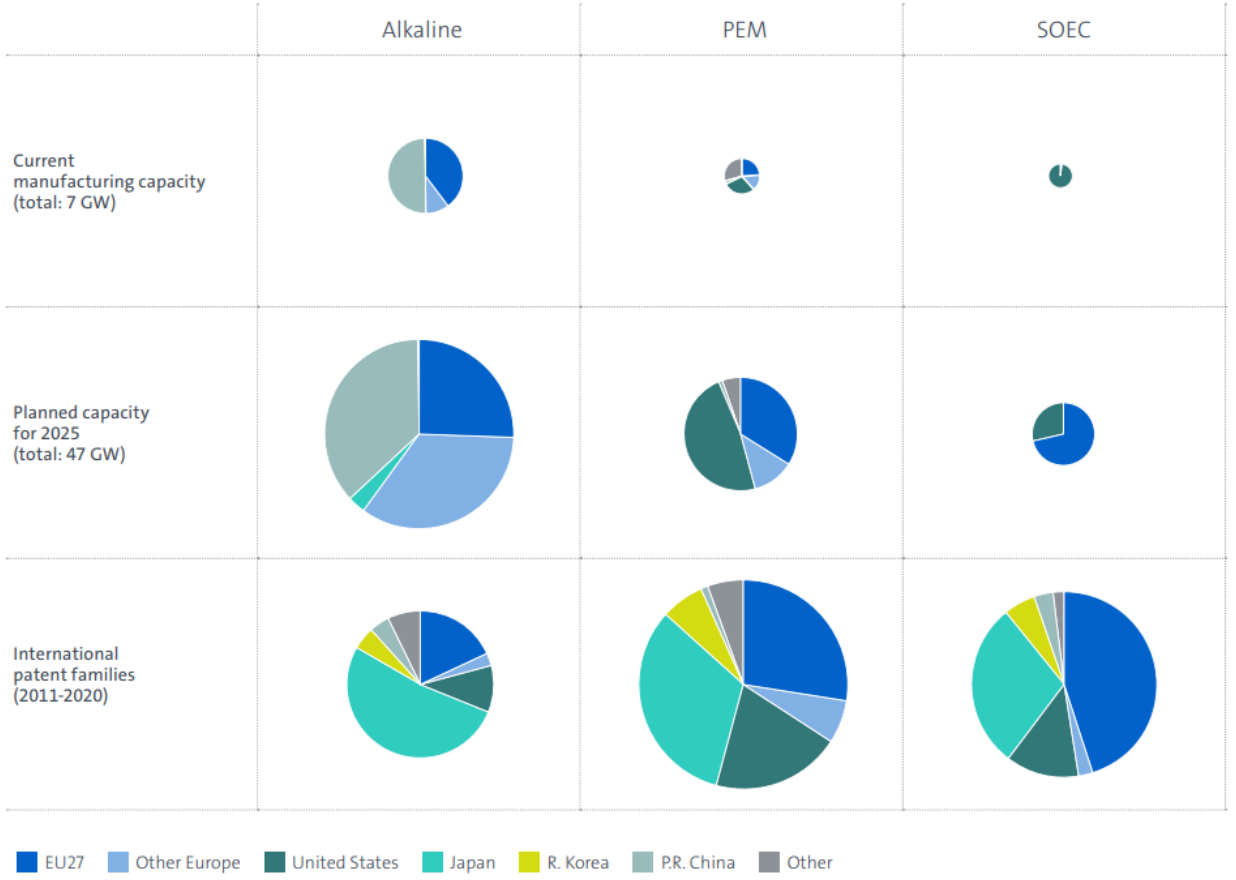
Share of funding accruing to start-ups, by funding stage, 2000-2020

Note: Funding deals are only included for companies that were founded between 2000 and 2020. The reference date with respect to the patent filing is the earliest priority date calculated for the set of patent families assigned to the specific company. Cleantech Group, Crunchbase and Dealroom have been used as data sources for funding rounds. Early-stage funding contains the following investment types: Seed, Series A, Series B. Later-stage funding contains the following investment types: Series C-F. IPO/post-IPO stage: non-equity type transactions are not included in this stage. Reported funding at the post-IPO stage is limited to private investments in public equity types of investments, thus excluding additional public shares issues.



Patenting has already seen a major shift towards alternative, low-emission methods, anticipating a boom for electrolysers.

Origins of inventions related to electrolysers and manufacturing capacity



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Thank you for your attention!

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