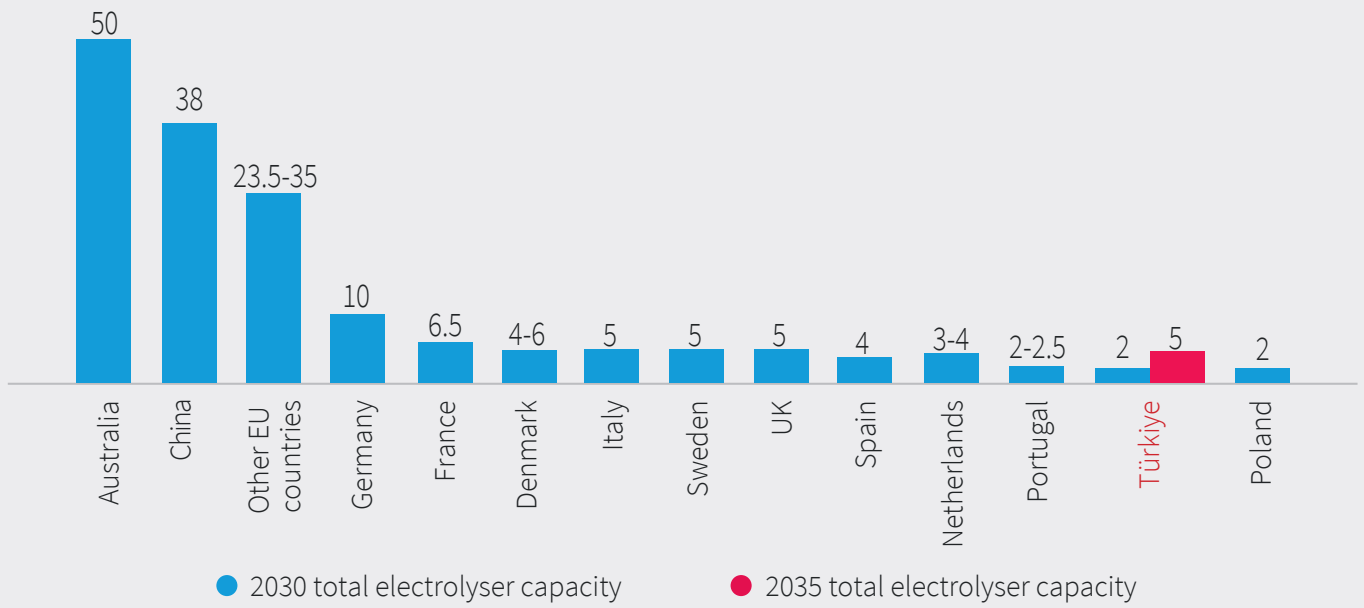


While energy efficiency, electrification and direct use of renewable energy will be essential for reaching net zero emissions targets by mid-century, they will not be sufficient. It is expected that **green hydrogen and its derivatives** will also be needed especially for decarbonizing hard to abate sectors, such as heavy industry and long-distance transportation with heavy duty vehicles. **With the hydrogen strategy published in January 2023, Türkiye has joined the countries announcing midterm targets for hydrogen.**

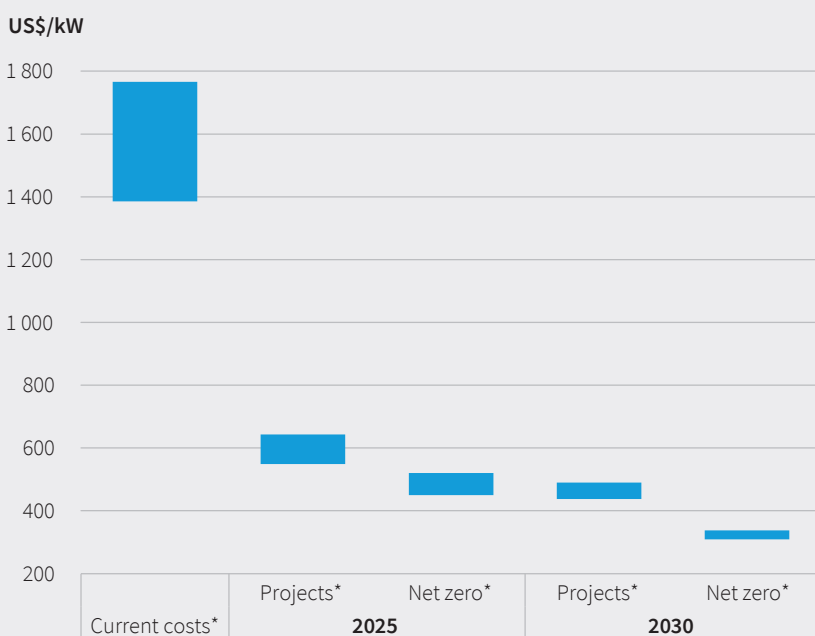
Global electrolyzer capacity targets (GW)



Green hydrogen is produced by splitting water into hydrogen and oxygen with electrolyzers which utilize renewable energy sources. Global targets indicate rapid growth in electrolyser capacity over the next 10 years. **By 2035, Türkiye aims to install 7% of the 70 GW national electrolyser capacity foreseen for 2053. Türkiye's 2035 electrolyser capacity target is equal to the total current existing capacity in the world.**

Source: MENR, 2023; IEA, 2022

Projected electrolyser investment costs



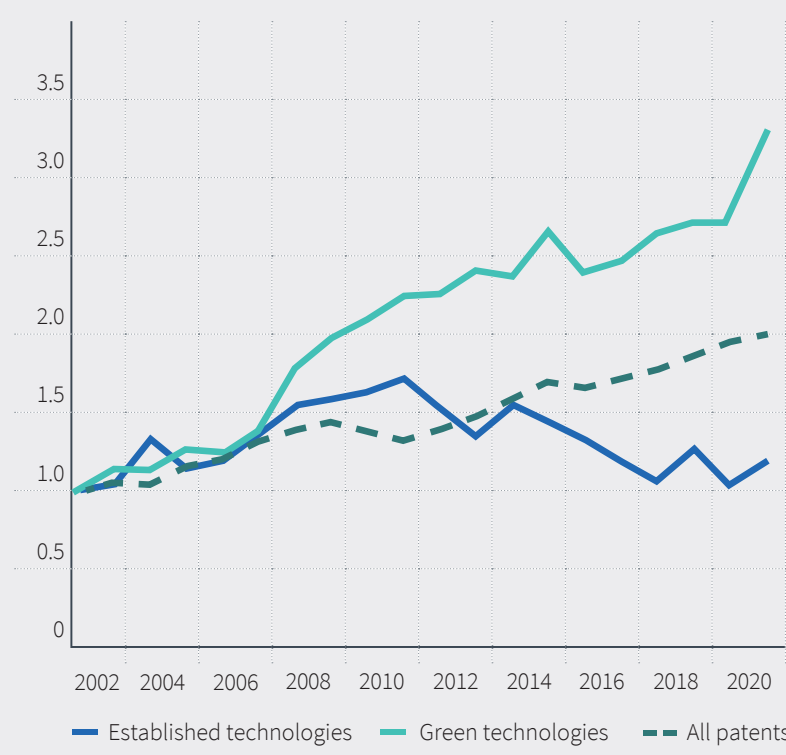
Current costs*: The figures in the graph refer to prices of European and US producers. The low end price refers to alkaline and the high end to PEM type electrolyzers. Prices of producers in China and other countries can be significantly lower.
Projects*: Estimates based on projects currently under construction or planned.
Net zero*: Estimates foreseen in the IEA net zero emissions scenario.

In order to reach the announced targets for green hydrogen, it is of critical importance to reduce the production costs which are currently very high. Studies by the International Energy Agency (IEA) show that **the unit investment costs for electrolyzers can decline by 78%-82% by 2030** as indicated by current trends. Türkiye's hydrogen technologies strategy document aims for a

hydrogen production cost of 2.5 US\$ per kg by 2035, which corresponds to a decline of 70%-75% compared to the level in 2020.

Source: IEA, 2022; MENR, 2023; SHURA, 2021

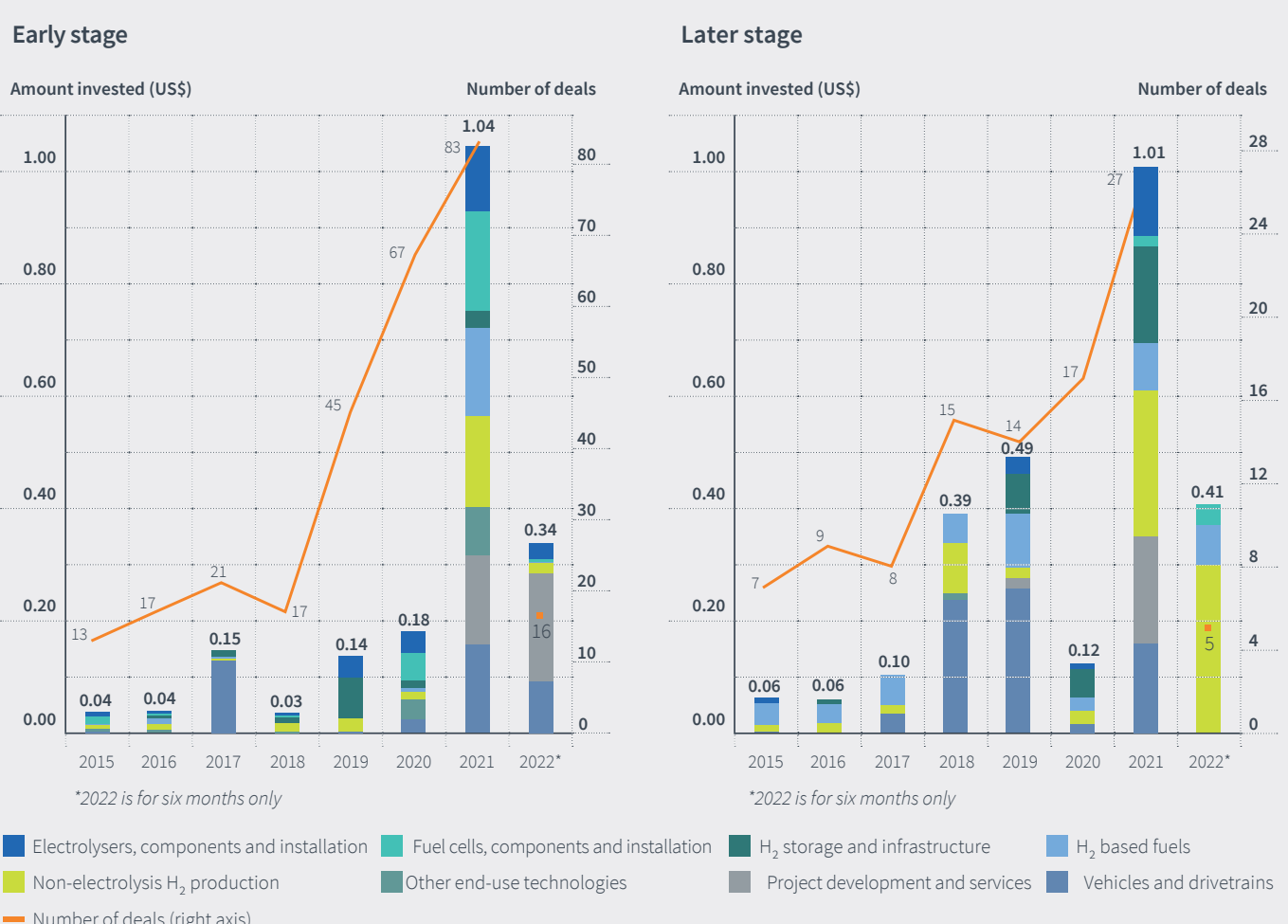
Development Trend of Patents Related to Hydrogen Production (2001=1)



According to the IEA, the annual rate of decline in hydrogen production costs (learning rate) with technological development is around 18%. It is important to support innovation in order to speed up the rate of cost decline. **The 3.5-fold increase in the number of patents related to green hydrogen technologies during 2001-2020 raises hopes for further technological development and cost decline.**

Annual investments in start-ups related to hydrogen technologies increased by more than 20 times since and 2015 and surpassed 2 billion US\$.

Venture capital investments in start-ups related to hydrogen technologies



*2022 is for six months only

Source: IEA, 2023

- To increase the effectiveness of its hydrogen strategy, Türkiye should prioritize actions in line with its net-zero emissions target and put special emphasis on actions related to developing green hydrogen technologies.
- In order to achieve the targets defined in the roadmap, it will be important to detail the actions and define support mechanisms for domestic production, innovation and product development for green hydrogen.