

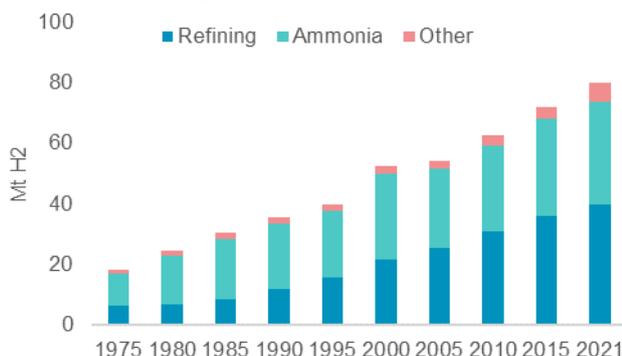
The significant existing market for grey hydrogen de-risks new green hydrogen projects supporting their growth and associated platinum demand

The installed production capacity for green hydrogen is doubling every two years, as are plans for new production capacity. Existing grey hydrogen demand exceeds 80 Mtpa, providing an existing mature end market for green hydrogen whilst fuel cell deployment grows. We estimate that by the latter half of the 2030's, hydrogen-related demand for platinum could equate to a third of all annual demand for platinum.

Hydrogen demand has grown at over 3% p.a. since 1975, underpinned by petroleum refining and ammonia applications for fertiliser production, with supply dominated by grey hydrogen. The Energy Transitions Commission estimates that the current market for hydrogen will now grow at over 9% p.a. through 2030. Currently, grey hydrogen is predominantly produced through steam methane reformation of natural gas. However, **the emission intensive reformation process releases 9-10 kg CO₂ per kg H₂, making emission free green hydrogen a viable decarbonisation solution for the existing hydrogen market.** In addition to decarbonising existing markets, growing uses for green hydrogen include **displacing natural gas in heating, and as an energy carrier to store or generate electricity in fuel cells, including fuel cell electric vehicles.**

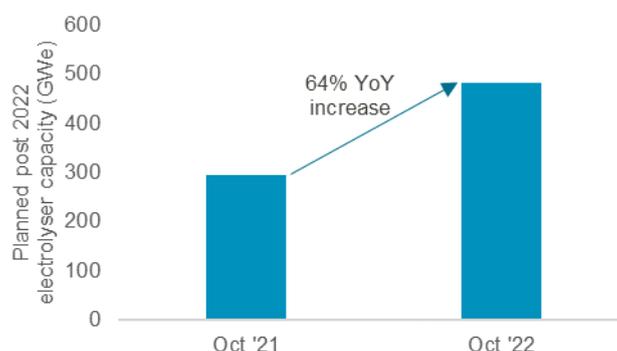
Demand growth gives developers of green hydrogen projects confidence to proceed with investments. While each project may target new applications of green hydrogen, output also has a fall back use in replacing grey hydrogen. Furthermore, a mature grey hydrogen market suggests experience and technology for handling hydrogen already exists, even if the infrastructure is not yet widespread.

The existing market for grey H₂ is already over 80 Mtpa and is expected to grow at 9% p.a. through 2030



Source: IEA, WPIC Research

The capacity of planned green H₂ projects increased by 64% between October '21 and October '22.



Source: IEA, WPIC Research

Green hydrogen is produced through the electrolysis of water using renewable electricity powering either a proton exchange membrane (PEM) or an alkaline electrolyser. PEM electrolysers use platinum as a catalyst, whereas alkaline electrolysers do not contain platinum (bar some minor R&D developing platinum use). PEM electrolysers are better at managing variable power loads (typical of renewable power supplies), which makes them well suited for green hydrogen production. Alkaline electrolysers operate better with a steady source of electricity, such as from hydropower. Reflecting the growing hydrogen industry, the capacity of green hydrogen projects in operation increased by 58% between October 2021 and October 2022, and the capacity of planned green H₂ projects increased by 64%. **If all planned green hydrogen projects are developed with PEM electrolysers, we estimate that the cumulative platinum requirements to 2030 would total over 2.7 Moz. Including platinum demand for fuel cells, we estimate that hydrogen-related demand for platinum could make up a third of total annual demand in the late 2030s.**

The developers of green hydrogen projects can have confidence that the existing market for hydrogen already stands at 80 Mtpa and is expected to grow at 9% p.a. through 2030.

We expect hydrogen demand for platinum to equal a third of the total annual platinum market in the late 2030's.

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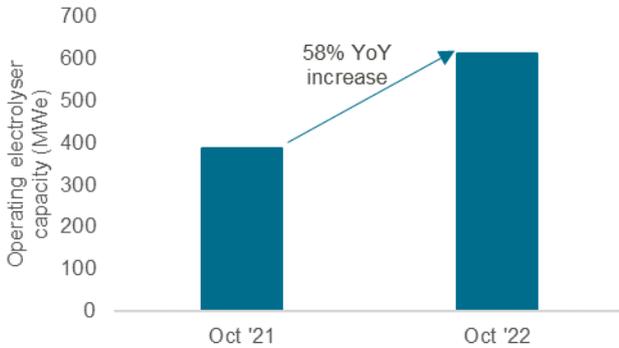
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Platinum's attraction as an investment asset arises from:

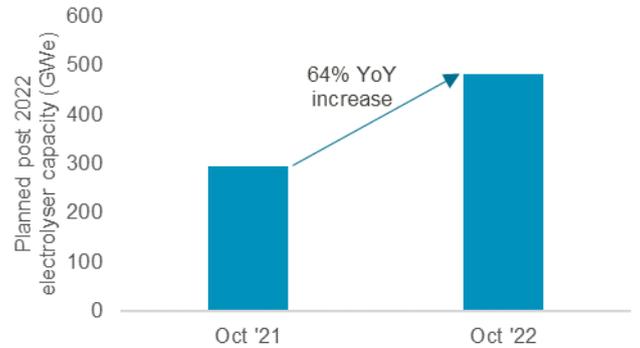
- Supply severely constrained by power shortages in South Africa and sanctions against Russia
- Platinum price remains historically undervalued and significantly below both gold and palladium
- Automotive PGM demand growth should continue due to ongoing substitution in gasoline vehicles
- Market balance and price mismatches between palladium and platinum drive substitution
- Investment demand is expected to move into positive territory after two years of negative demand

Figure 1: The capacity of operational green H₂ projects increased by 58% between October '21 and October '22.



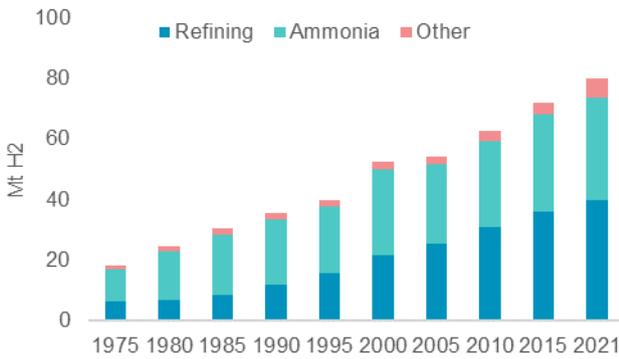
Source: IEA, WPIC Research

Figure 2: Over the same time period, the capacity of planned green H₂ projects increased by 64%.



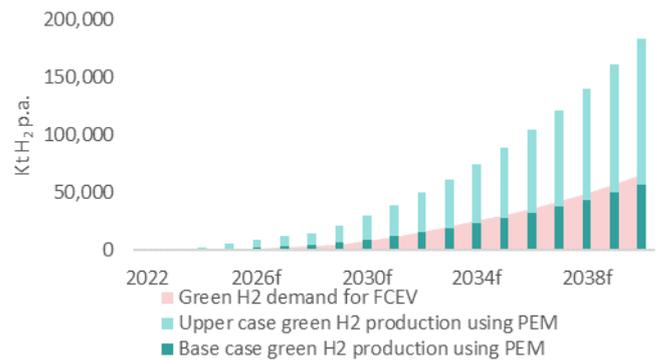
Source: IEA, WPIC Research

Figure 3: The existing end market for grey H₂ is over 80 Mtpa. It has grown by >3% p.a. since 1975 but is projected to grow by >9% p.a. through 2030.



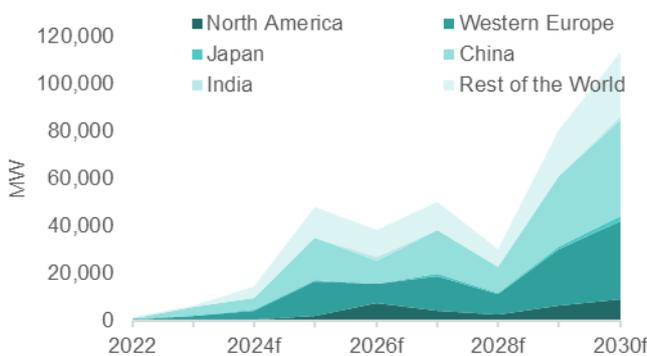
Source: IEA, WPIC Research

Figure 4: Green H₂ production rates are contingent on the pace of electrolyser project development. Our base case assumption is that 33% of projects will be platinum containing PEM electrolysers, with the rest alkaline.



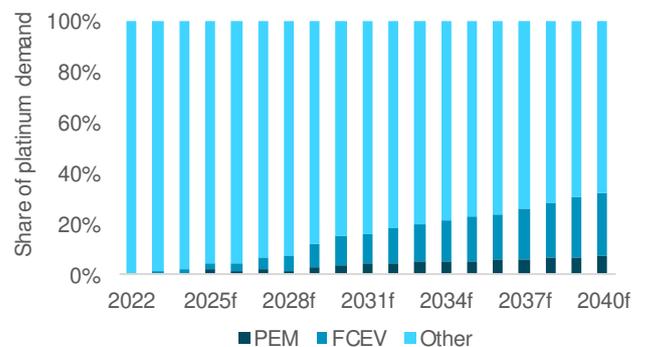
Source: WPIC Research

Figure 5: The planned green H₂ project pipeline is somewhat variable in terms of the timing of planned commission dates but is expected to accelerate through this decade.



Source: IEA, WPIC Research

Figure 6: On our projections, we estimate that hydrogen demand for platinum could be a third of the total platinum market by the late 2030's.



Source: Metals Focus (2022-2023), WPIC Research

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