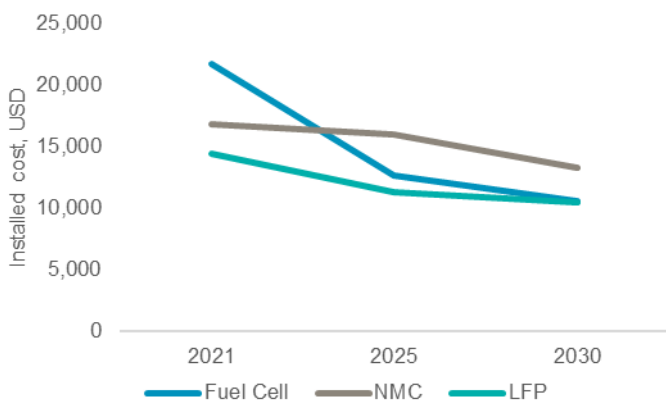


Hydrogen Tech Expo: Evidence of growing momentum, with platinum set for key role as a transition metal

WPIC attended the Hydrogen Technology Exhibition hosted in Bremen, Germany. The event had 500 exhibitors, 200 speakers and 8,000 delegates in attendance. The expo highlighted the hydrogen economy is building momentum. Participants highlighted key developments in decarbonisation policy over the past twelve months which are expected to accelerate investment decisions. Green H₂ electrolysis is expected to increase 30-fold to ~500 GW by 2035 while the levelised cost will reach parity with grey H₂ in the next decade. Accordingly, we expect hydrogen applications to account for ~20% of total platinum demand by 2030 with FCEV accounting for the majority of this consumption. This report offers a snapshot of developments in fuel cell use in automotive transport from the Expo.

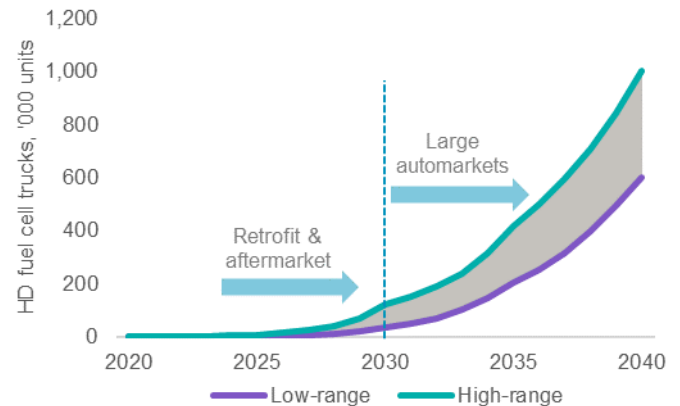
The UK's Advanced Propulsion Centre (APC) presented a cost study on battery (LFP and NMC) and fuel cell drivetrains for large SUVs and vans. APC expects a 300-mile fuel cell system to reduce installed costs by ~50% to 2030 (inset, left), while battery costs are expected to decrease between 21% and 27%. APC determined fuel cells' cost per mile economics are viable for "premium" SUVs and commercial vans. APC forecasts FCEV production (excl. HDV) to reach 1.4 million by 2035f, but concurrently noted rising BEV penetration will cause **lithium supply constraints** ([link](#)). In a lithium constrained market, APC suggests FCEV production could reach 5.9 million vehicles by 2035f. **The WPIC forecasts LV and LCV fuel cell penetration of 3.2% in 2035f** ([link](#)). WPIC's forecast aligns aggregated regional hydrogen roadmaps (Fig. 1, overleaf), and is between APC's FCEV market share forecasts of 1% to 6% (Fig. 4).

Fuel cell cost competitiveness improves to 2030



Source: Advanced Propulsion Centre of UK, WPIC Research

Aftermarket OEMs are facilitating early HD FCEV adoption



Source: AVL, WPIC research

AVL presented developments in heavy-duty transport where fleet owners want the benefits of a diesel truck without the emission penalties. Notably, the technology provider is witnessing rapid growth amongst the aftermarket and retrofit players. Aftermarket firms offer more flexibility to meet customer specific needs whilst heavy-duty fuel cell mobility remains nascent. As heavy-duty demand scales beyond 100,000 units annually from 2030, AVL expects to see larger automakers enter the market as they are better placed to drive efficiencies through standardisation (inset, right). With economies of scale and improved power densities, AVL expects fuel cell system costs to decrease ~EUR300 per kW to ~EUR80 per kW in the next decade (Fig. 6) reinforcing further demand growth and a high-single digit implied HD fuel cell penetration rate by 2035f (WPIC: 10%).

The ongoing development across the hydrogen value chain seen at the Hydrogen Tech Expo reinforced our forecasts that hydrogen could account for ~20% of total platinum demand by 2030.

Fuel cell system costs are forecast to decrease by ~50% by 2030 on growing economies of scale.

While forecast ranges are wide, FCEV vehicle market share (LD+HD) will reach mid-single digits by 2035.

PEM electrolyzers to produce green hydrogen will also be a big driver of platinum demand.

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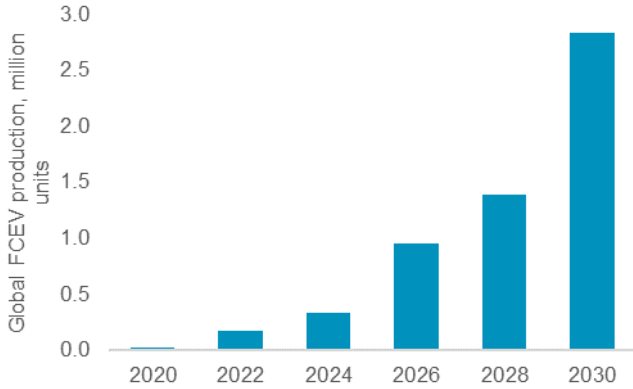
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26 October 2023

Platinum's attraction as an investment asset arises from:

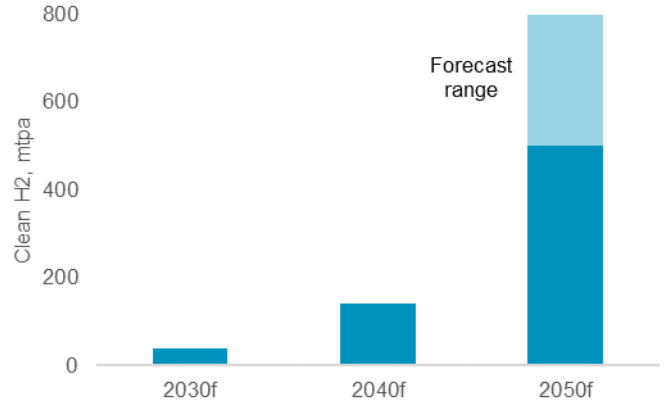
- WPIC research indicates the platinum market entering a period of consecutive deficits from 2023.
- Platinum supply remains challenged, hampered by electricity shortages in South Africa and suppressed recycling rates.
- Automotive platinum demand growth should continue due principally to substitution in gasoline vehicles.
- Platinum already reduces harmful exhaust emissions, lowers energy consumption and emissions in industrial applications, is critical to producing fibreglass for the wind turbine industry, and is a key enabler of the energy transition via green hydrogen.
- The platinum price remains historically undervalued and significantly below both gold and palladium.

Figure 1: The aggregation of regional hydrogen roadmaps suggests on-road FCEV production is expected to scale during the second half of the decade



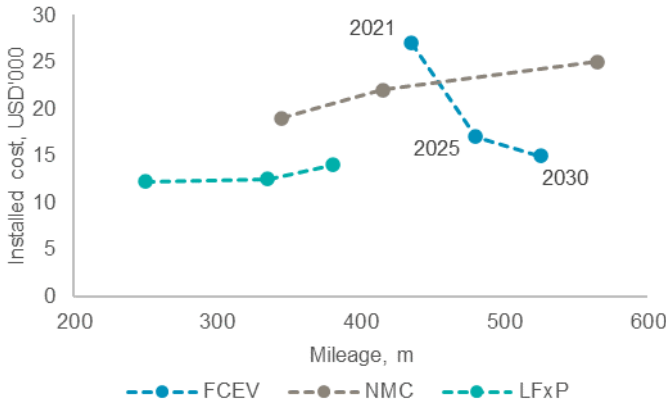
Source: S&P Global, Comau, WPIC Research

Figure 2: From current production levels of ~1mtpa, the clean hydrogen* market is expected to grow exponentially in the coming decades



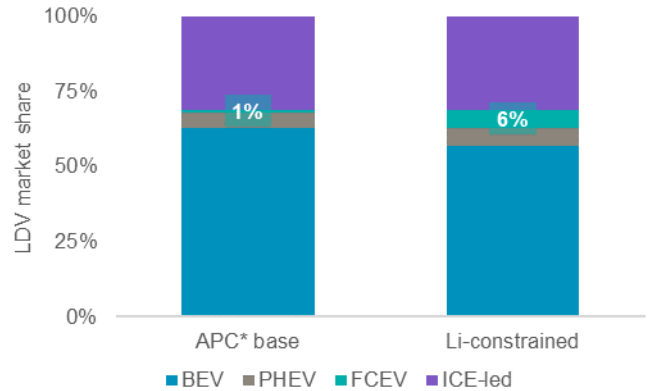
Source: Aramco, W.L Gore & Associates, WPIC research, *Green hydrogen market share to increase from ~50% in 2030 to ~80% by 2050

Figure 3: FCEV's cost per mile economics benefits from increasing milage requirements suggesting a use case in premium SUV and LCV markets



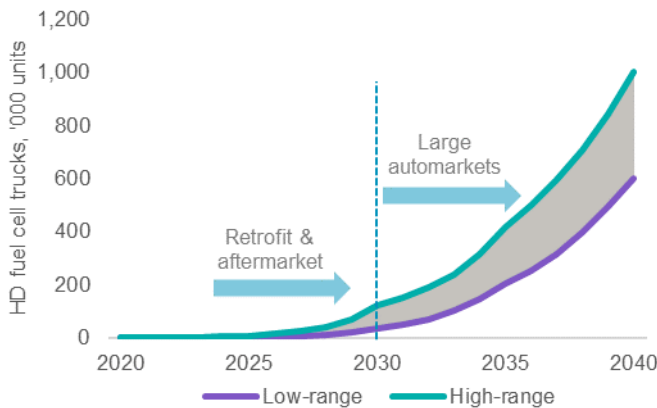
Source: Advanced Propulsion Centre of UK, WPIC Research

Figure 4: The UK's Advance Propulsion Centre expects single digit LDV and LCV fuel cell penetration rates by 2035



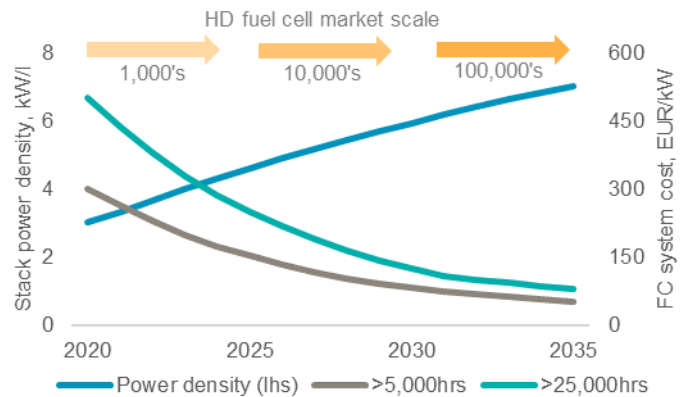
Source: *Advanced Propulsion Centre of UK, WPIC Research

Figure 5: The retrofitting market is servicing first movers adopting fuel cell drivetrains in heavy duty transport



Source: AVL, WPIC research

Figure 6: Improving power densities are expected to lower fuel cell system costs, driving increased market adoption



Source: AVL, WPIC research

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