PLATINUM PERSPECTIVES

World Platinum Investment Council

European efforts to reduce reliance on Russian gas will accelerate hydrogen use and platinum demand

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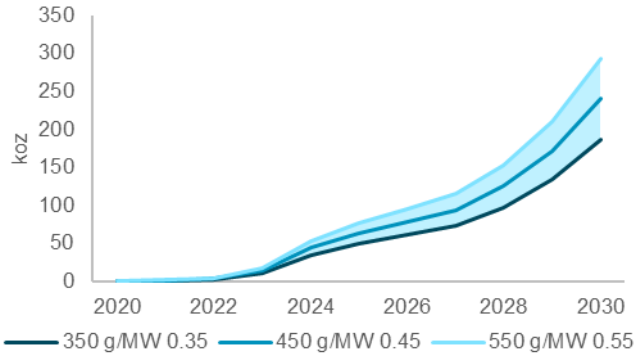
We estimate that the European Commission's plans to replace 25-50 billion m³ of Russian gas with green hydrogen could result in incremental platinum demand of ~240 koz p.a. by 2030. More importantly, this would boost the development of Europe's hydrogen production capacity and accelerate the commercial adoption of fuel cell electric vehicles (FCEV), bringing forward their associated significant platinum demand, similar in size to global demand from catalytic converters today.

The European Commission has announced multifaceted plans to reduce the continent's reliance on Russian energy supplies, including replacing 25-50 billion m³ of natural gas with hydrogen. We estimate that this equates to 7.3-14.6 Mt of hydrogen p.a. although the Commission has a target of 20 Mt including both domestic production and imports. The Commission estimates that 80 GW of electrolyser capacity will be needed within Europe by 2030, up from pre-crisis plans of 40 GW. Using a capacity factor of 49%, more typical of expected renewable power additions in Europe, we estimate that 80 GW will produce ~6.3 Mt of green hydrogen with the rest needing to be imported. From a global perspective, we estimate that displacing 50 billion m³ of Russian natural gas would require 186 GW of electrolyser capacity, while meeting the 20 Mt hydrogen target would need 255 GW. These are significant capacity targets, coming at a time when there is strong competition to install renewables to decarbonise electricity generation itself. As such, we believe 115 GW of electrolyser capacity powered by renewables may be more realistic for Europe and would replace >30 billion m³ of natural gas.

Realistically displacing 31 billion m³ of Russian natural gas supply to Europe requires 115 GW of electrolyser capacity

Bm³ NG	Energy (MW)	Mt H2	Required electrolyser capacity	
25	958	7	45	93
31	1,187	9	56	115
50	1,915	15	91	186
68	2,620	20	124	255
	Capacity factor >		100%	49%

Platinum demand for 115 GW of installed electrolyser capacity with 50:50 PEM/alkaline for varying platinum loadings



Source: WPIC Research, Bm³ = billion cubic metres, 49% capacity factor similar to 12 month UK offshore average and the same as captive renewable to hydrogen production reported in China

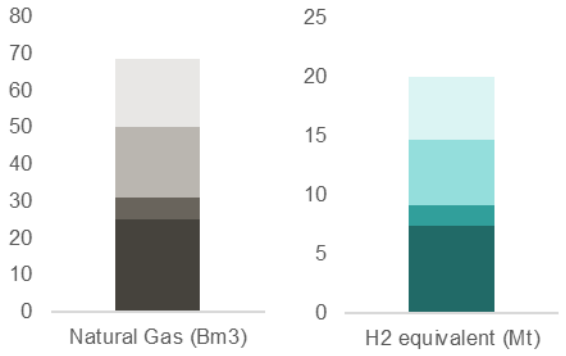
Adding 115 GW of electrolyser capacity using renewable energy in only 8 years presents a significant challenge, and is likely to require deployment of all available technologies. We anticipate that alkaline electrolysis will make up the majority of the earlier installations as it appears easier to scale existing production quickly. PEM electrolysers will likely make up the majority of the installations towards the end of the period due to the inherent flexibility advantages and improving economies of scale reducing costs. Assuming the alkaline/PEM ratio reaches 50:50 by 2030, we estimate incremental annual platinum demand of 234 koz to achieve 115 GW of installed electrolyser capacity. For illustrative purposes, 100% PEM would require annual platinum demand of 480 koz. Our base case calculations assume PEM electrolyser platinum loadings of 450 g/MW of capacity, but we recognise that loadingsvary significantly between different suppliers, conservatively by +/-22% from 350 to 550 g/MW.

We do not expect hydrogen electrolysers to drive significant near term platinum demand growth. However, the ancillary benefit of large scale hydrogen production and distribution is the potential acceleration of the commercial adoption of FCEVs, a significant source of future platinum demand growth.

Platinum's attraction as an investment asset arises from:

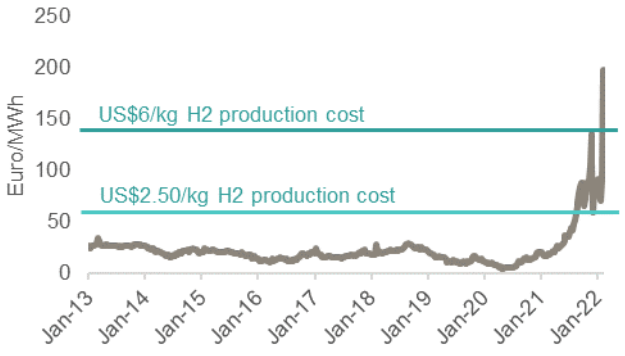
- Supply severely constrained for three more years despite some new investment in mining capacity
- Platinum price remains historically undervalued and significantly below both gold and palladium
- Automotive PGM demand growth should continue due to increasingly restrictive emissions rules
- Market balance and price mismatches between palladium and platinum drive substitution
- Investment demand is softer after two record years, but price and fundamentals remain attractive

Figure 1: 25-50 billion m^3 of natural gas contains the same energy as 7.3-14.6 Mt of hydrogen



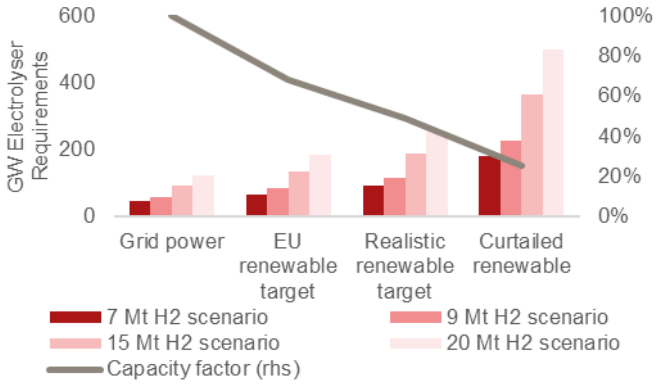
Source: WPIC Research

Figure 2: With green hydrogen typically costing between US$2.50 and US$6/kg, Europe's move to reduce reliance on Russia makes both strategic and economic sense at current, albeit inflated, natural gas prices



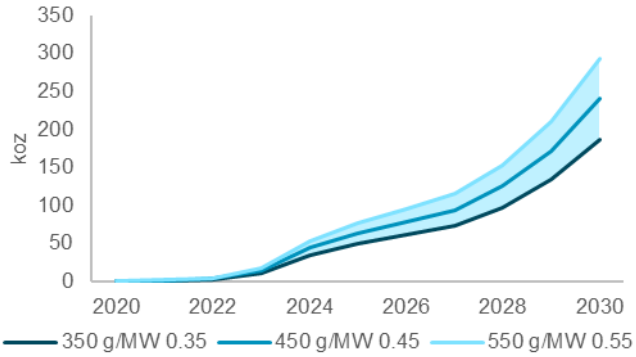
Source: Bloomberg, WPIC Research, N.B. Pegas day ahead natural gas prices

Figure 3: Producing enough green hydrogen to eliminate 30 billion m^3 of Russian gas on realistic renewable capacity factors requires 115 GW of electrolyser capacity



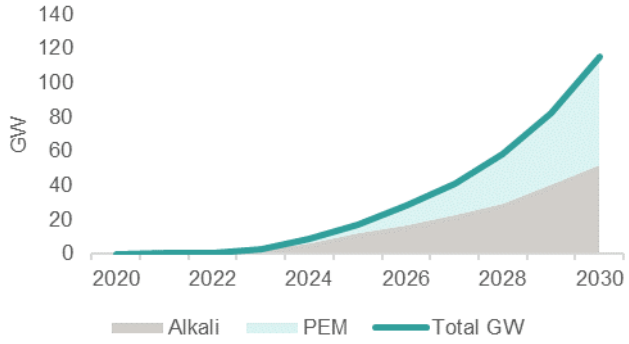
Source: WPIC Research

Figure 4: At a loading of 450 g/MW, 115 GW of electrolyser capacity would add 240 koz of incremental platinum demand on a 50:50 PEM/alkaline market share



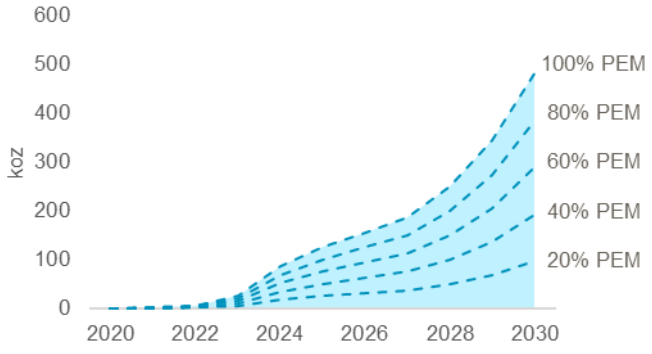
Source: WPIC Research

Figure 5: We assume that alkaline electrolysers make up most of the early capacity additions, but that PEM dominates later in the decade (115 GW scenario)



Source: WPIC Research

Figure 6: For illustrative purposes, 100% PEM hydrogen generation would create annual platinum demand of 325 koz by 2030 on the 80 GW scenario (shown here), or 480 koz under the 115 GW scenario



Source: WPIC Research

Note: *There were previously concerns that iridium supply limitations would limit the portion of PEM electrolyser capacity. The significant c. 90% reductions in iridium loadings announced by Heraeus in October 2020 suggest that the 115 GW, 50:50 PEM alkaline scenario would require a little over 3t p.a. of iridium by 2030, which is within annual production of 7t p.a. and associated recycling, but would have to displace demand from elsewhere.*

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