

## FCVs represent material long-term platinum demand

**Current Fuel Cell Vehicle plans, in aggregate, look material for platinum demand in the coming years.** Fuel cell electric vehicles' (FCV or FCEV) role in the world's transportation mix remains a topic of some debate. We analysed major FCV initiatives (listed in the table below and incorporated in the adjacent chart) and concluded that they could boost annual platinum demand by more than 40 koz by 2025. While not yet a game changer for platinum, our scenario provides a conservative base from which to monitor the impact on platinum of FCV adoption in the coming years. Not surprisingly, Japan and China dominate FCV growth. Should FCV cost of ownership match those of battery electric vehicles (BEVs or BEVs) and hydrogen (H<sub>2</sub>) filling points proliferate, we see significant upside to this scenario.

**400,000 FCVs by 2025.** The global FCV fleet today, remains modest at about 10k vehicles, over half of which are in California, arguably the region with the most ambitious decarbonization goals (zero carbon by 2045). The world's two largest programmes with specific FCV targets are China's technology roadmap, which envisions 50k FCVs by 2025 (1 mn by 2030), and Japan's plan to achieve 200k by 2025. Japan in the near term should drive an inflection point in the global FCV fleet as it ramps up production ahead of the country's 2020 goal of 40k. South Korea, Europe and California take a different approach, focusing on H<sub>2</sub> refuelling infrastructure buildout to foster FCV ownership rather than setting specific fleet targets. As H<sub>2</sub> infrastructure expands in these markets, we forecast steady FCV fleet growth with California, South Korea, and Europe reaching a combined 150k fleet by 2025.

*FCV programs for major regions are material in aggregate; Asian markets have taken the lead*

Country/Region	Programme
China	3k buses by 2020; 12%* 2020 vehicle sales as NEVs (incl FCVs); 300 H <sub>2</sub> stations and 50k FCVs by 2025; 1k H <sub>2</sub> stations and 1 mn FCVs by 2030
Japan	100 H <sub>2</sub> stations, 40k FCVs by 2020; 320 stations, 200k FCVs by 2025
South Korea	310 H <sub>2</sub> stations, 15k FCVs and 1k H <sub>2</sub> buses by 2022
Europe	100 H <sub>2</sub> stns by 2019; 600 H <sub>2</sub> buses by 2022**, 400 H <sub>2</sub> stns by 2023
California	100 H <sub>2</sub> stns by 2020; 200 H <sub>2</sub> stns by 2025; 1,000 H <sub>2</sub> stns by 2030

\* 12% NEV by the California regulatory (CARB) methodology, equating to <12% of vehicle sales;  
 \*\* Denmark is to receive 200 buses by 2020 - the balance to be sent to the UK and Latvia  
 Sources: China's "Energy Saving and New Energy Vehicle Technology Roadmap"; Korean Ministry of Trade, Industry and Energy; EU's Innovation and Networks Executive Agency; H<sub>2</sub> Mobility JV; Japan's JHyM, California Clean Air Board, WPIC Research.

**Platinum is no longer an important cost line for FCVs, in our view.** Platinum loadings for the latest generation of FCVs are estimated to be about 15g per vehicle, equating to less than 1% of the value of a typical FCV. Mercedes Benz reported a 90% reduction in platinum content from its B-Class F-Cell (available first in 2010), to the current GLC F-Cell SUV. GM stated that in its latest generation FCV, the ZH2 military pick-up truck, it achieved a platinum loading "in the 12-gram range". We currently model further reductions, reaching about 10g (the US DoE's target for 80kw fuel cell) before 2030.

**To achieve greater FCV penetration, lower FCV prices and more charging infrastructure are key.** Popular BEVs Tesla Model 3 (the base model with a 220-mile range), Chevrolet Bolt and Nissan Leaf all retail for below \$39,000, compared to the most popular FCV, the Toyota Mirai, retailing for \$57,500. Were price parity to be achieved, the upside could be dramatic. Scarce H<sub>2</sub> refuelling infrastructure is a second challenge that is being addressed gradually. Favouring FCVs are their significantly faster refuelling time and greater range. As scale and technology improve, FCV prices should close the gap with BEVs, especially on a range-adjusted basis.

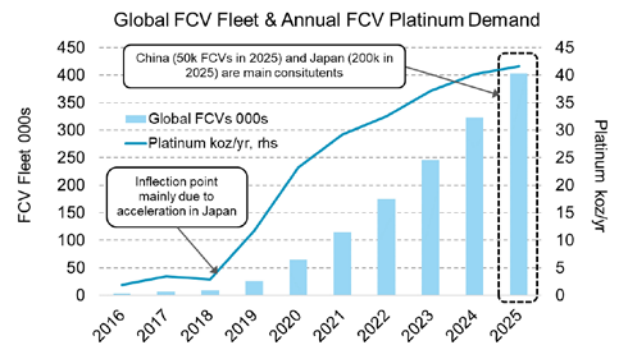
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*Platinum impact of identifiable FCV programs should become significant in a few years*



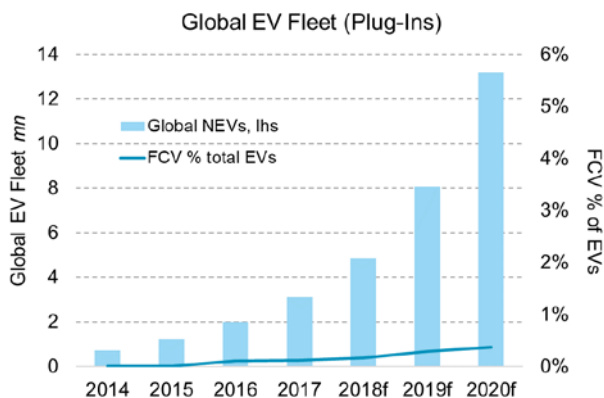
Note: Fuel cell electric vehicle numbers are for total on-road fleet (cumulative); Source: WPIC Research.

# Platinum Perspectives – December 2018

Platinum's attraction as an investment asset arises from:

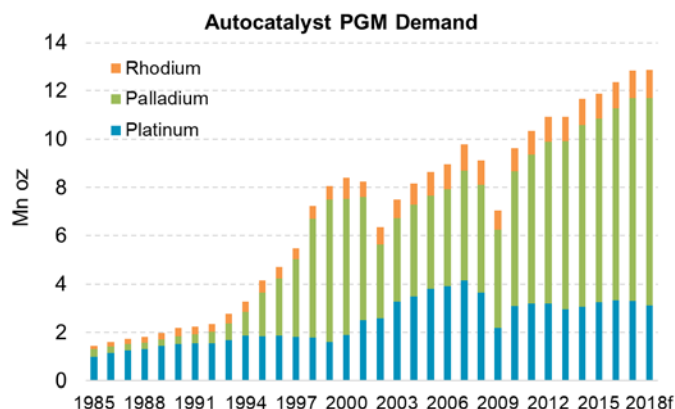
- Supply is relatively constrained with limited investment going into new PGM mines
- Platinum appears undervalued relative to gold and palladium
- Total platinum group metal (PGM) demand continues to grow
- Growing automotive PGM demand argues for potential substitution of palladium by platinum
- Managed money positioning looks to be improving

Figure 1: While FCVs are a small portion of total EVs, there is significant upside as infrastructure is built out



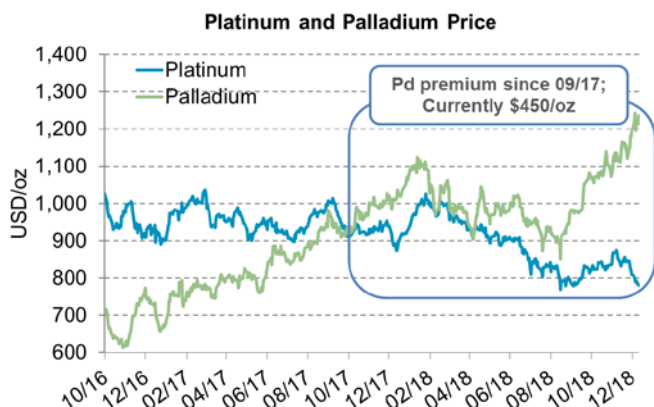
Source: IEA, InsideEVs, WPIC Research

Figure 2: Rising PGM autocat demand is carried mainly by palladium, presenting a potential availability challenge



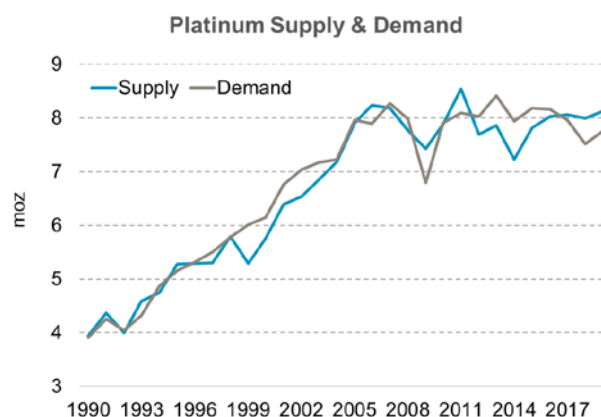
Source: Johnson Matthey, WPIC Research

Figure 3: Palladium's price premium to platinum reflects a tight market and is unlikely to be long-term sustainable



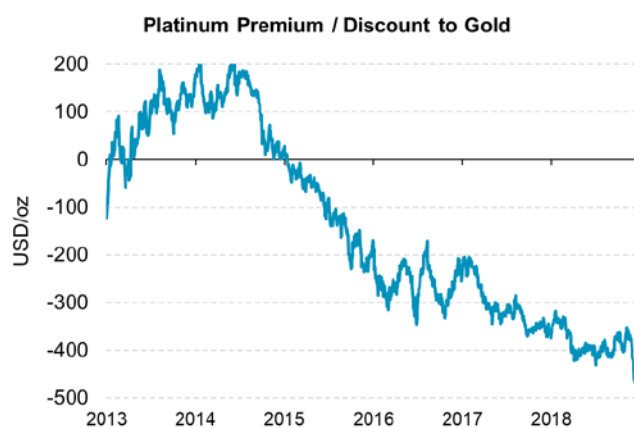
Source: Bloomberg, WPIC Research

Figure 4: Platinum is expected to see a supply surplus on the order of 500 koz this year and next



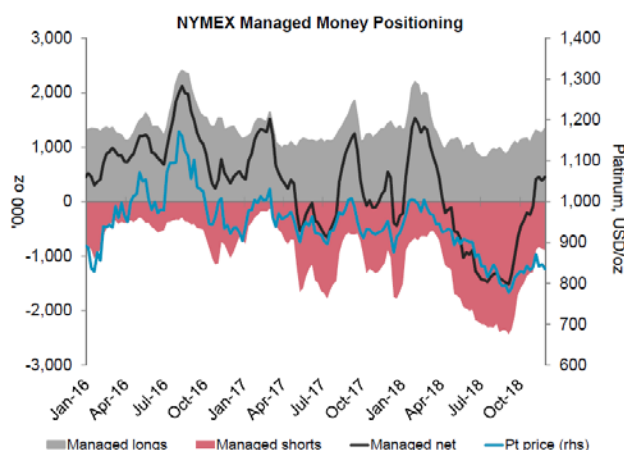
Source: Johnson Matthey, WPIC Research

Figure 3: Similar to platinum's discount to palladium, the discount to gold is at an all-time high



Source: Bloomberg, WPIC Research

Figure 6: NYMEX net positioning has improved



Source: Bloomberg, WPIC Research

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