PLATINUM ESSENTIALS

How sanctions against Russia and Russian entities might affect the supply and demand of platinum group metals

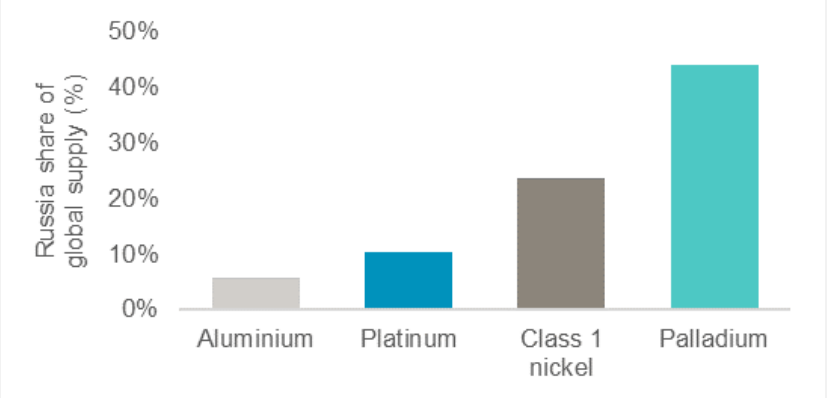
Russia is a major supplier of raw materials, including platinum group metals, to the automotive industry. An inability to pay for raw supplies from Russia could cause immediate shortages in platinum and palladium. Palladium security-of-supply considerations will be more severe and could accelerate medium-term substitution of platinum for palladium in catalytic converters. Another possible consequence is a potential boost to the generation and use of hydrogen as Europe looks to reduce its reliance on Russian natural gas.

In response to its invasion of Ukraine, Russia has been subjected to sanctions intended to inflict economic damage and bring it to the negotiating table. Sanctions have the potential to interrupt the global flow of commodities from Russia, at least temporarily. Commodities markets are inherently efficient, therefore we think that Russian-origin material will ultimately find a route to market in countries that have not applied sanctions, displacing some of those countries' demand previously satisfied from non-Russian countries. However, this effect will differ by commodity depending on Russia's global share of supply. In particular, Russia supplies over 40% of global mined palladium, around 20% of battery grade nickel, 10% of mined platinum and 6% of global aluminium.

Russian palladium production broadly matches demand from China, which has not applied any sanctions on Russia. However, it will take time for the flow of palladium to reorganise and for new manufacturing capacity to be added, such as for catalytic converter wash-coats in China for example. We therefore think a short-term disruption to the palladium market seems likely. Longer-term, ex-Russia palladium supply is not quite sufficient to meet ex-China demand, so it seems probable that this could support further platinum for palladium substitution in catalytic converters.

A further consideration is the security of energy supplies. Europe currently relies on Russia for some 40% of its natural gas needs, which been excluded from the sanctions. Hydrogen produced using renewable power could be blended into the existing gas system with no modifications to existing gas infrastructure at a level that would halve European reliance Russian natural gas. This makes strategic sense, and at current gas prices, admittedly inflated by current tensions, it would be economically competitive. An acceleration of the generation and use of hydrogen would be supportive of increased commercial adoption of fuel cell electric vehicles, a significant source of platinum demand in the future.

Figure 1. Russia is a material source of automotive raw materials



Source: WPIC Research, Metals Focus

Trevor Raymond
Director of Research
+44 203 696 8772
traymond@platinuminvestment.com

Edward Sterck
Analyst
+44 203 696 8786
esterck@platinuminvestment.com

Brendan Clifford
Head of Institutional Distribution
+44 203 696 8778
bclifford@platinuminvestment.com

World Platinum Investment Council
www.platinuminvestment.com
Foxglove House, 166 Piccadilly
London W1J 9EF

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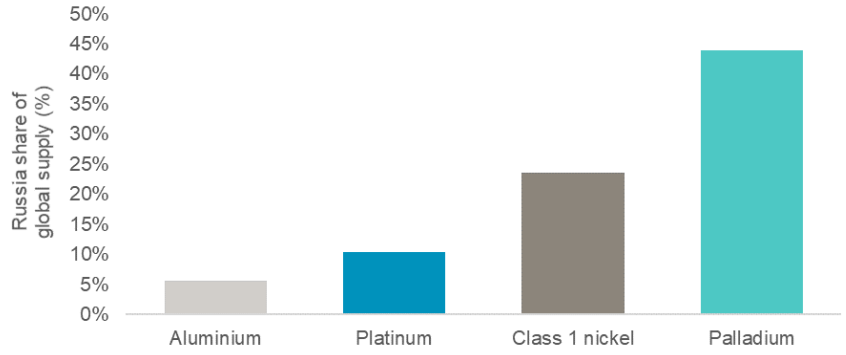
WPIC's ***Platinum Essentials*** is a publication which explores topics affecting platinum as an asset class. This is different to ***Platinum Perspectives***, which is a monthly publication which looks at a specific topic affecting supply demand dynamics for platinum and gives our view.

Russia is a major supplier of raw materials, including platinum group metals (PGMs), to the automotive industry. An inability to pay for raw supplies from Russia could cause immediate shortages in platinum and palladium. Palladium security-of-supply considerations will be more severe and could accelerate medium-term substitution of platinum for palladium in catalytic converters. Another possible consequence is a potential boost to the generation and use of hydrogen as Europe looks to reduce its reliance on Russian natural gas

In response to its invasion of Ukraine, Russia has been subjected to a raft of sanctions intended to inflict economic damage in an effort to bring it to terms. Arguably, one of the most significant is its exclusion from the SWIFT messaging system that underpins international commerce; without this, even entities not subject to direct sanctions are severely restricted from conducting international business. This means that companies in sanctioning countries are restricted from purchasing raw materials from Russia, which is likely to distort market dynamics for a short period of time, but with longer-term consequences. Added to which, the mutual banning of aircraft from Russia and sanctioning countries' airspaces complicates the transportation of precious metals, which are typically flown rather than transported by road or sea. However, commodities markets are inherently efficient; we think that all Russian origin material will ultimately find a route to market in countries that have not applied sanctions, displacing some or all of those countries' respective demand previously sourced from non-Russian countries. However, this flow can be distorted by the concentration of supply in certain commodities.

Taking four examples that impact the automotive industry: Russia supplies over 40% of global mined palladium, around 20% of battery grade nickel, 10% of mined platinum and 6% of global aluminium.

Figure 2. Russia is a material source of automotive raw materials



Source: WPIC Research, Metals Focus

Short term disruption for palladium benefits platinum longer-term

Let's start with platinum and palladium, which are key ingredients in catalytic converters for internal combustion engines. Given that the most rigorous emissions limits and therefore catalytic PGM loadings are typically in Western countries (and China), the concentration of palladium supply from Russia is significant. China's palladium needs broadly match Russian output, but given the complexity of global supply chains, current China demand will be met from multiple sources, albeit principally South Africa and Russia, and even Russian palladium destinated for China could be processed, currently, into catalytic wash-coats in Europe or elsewhere.

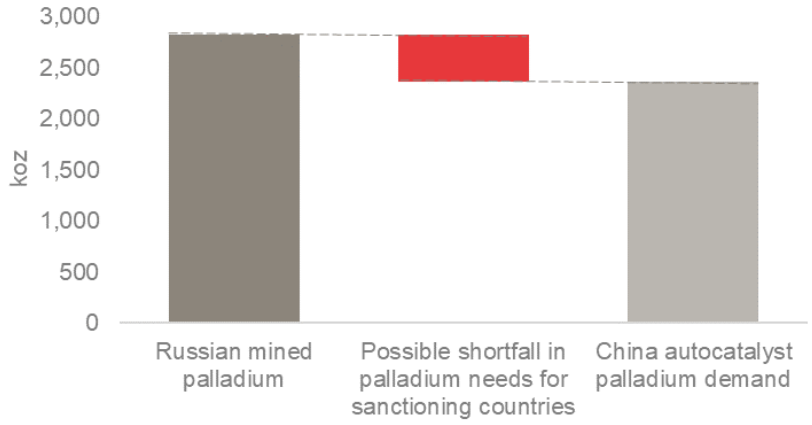
One issue is whether and how quickly China could terminate current, non-Russian palladium supply sources, to take all of Russian production. There is also the question of non-China supply commitments that Russian producers may be committed to, although it is probable that they will be able to call force majeure on those contracts and look for alternative customers, particularly if they are unable to pay. Reorganising the flow and processing of palladium sourced from Russia is therefore feasible, but would likely take time, particularly where new processing facilities need to be constructed. It is also worth noting that regulations in China currently

restrict the export of refined platinum and palladium, so it should not be considered a conduit for circumventing sanctions. All in all, the outcome is likely to be a relatively short-term disconnect in the supply and demand of palladium and to a lesser extent platinum, potentially compounded by an initial waiting period as market participants wait to take a view on the duration of the sanctions.

While Russian platinum supply is only 10% of global mine supply, the pressure on the platinum market from China imports has already created tightness in the platinum physical market with elevated lease rates and stock drawdowns from NYMEX necessary to ease shortages. Even a short disruption to Russian supply could exacerbate tightness and add to price volatility. It is possible the disruption will not be brief.

Longer-term, however, it seems likely that even with a relaxing of Russia's current pariah status, consumers of platinum and palladium will be reluctant to enter into long term off-take agreements due to security-of-supply concerns, as well as country of origin ethical considerations. A US automaker may well be unlikely to want Russian palladium in its catalytic converters. However, with only 60% of global mined palladium coming from outside of Russia, there is not enough palladium ex-Russia to satisfy global demand. To compensate for this, platinum would need to be substituted for palladium (on a one-for-one basis), which could be exacerbated by the current elevated price of rhodium, which is prompting efforts to substitute palladium for rhodium.

Figure 3. Non-China shortfall will drive increased platinum for palladium substitution



Source: WPIC Research, Metals Focus

While this picture might be positive for platinum and palladium in principle, it is also worth noting that Russia and Ukraine supply manufacturing services for the automotive industry, which could lead to a short- to medium-term reduction in vehicle production. Furthermore, it seems quite probable that the war in Ukraine and sanctions against Russia will have a negative bearing on global economic growth, which could inhibit demand for new vehicles. Our view is that pent up demand from the semiconductor crisis should be enough to offset this. There could also be a dip in industrial demand for platinum.

Battery Electric Vehicle Raw Materials

Turning to battery grade nickel and aluminium, these are respectively a key ingredient in lithium-ion batteries for electric vehicles and for the lightweighting of electric vehicles to compensate for the weight of the batteries. While Russia is a significant supplier of both of these materials, we think the dynamics are somewhat different from those impacting platinum and palladium. Firstly, nickel and aluminium are more widely available as commodities with significantly larger markets and a greater number of market participants. It is also easier for Russian suppliers to find customers in non-sanctioned countries, as seen when specific Russian aluminium suppliers were sanctioned in the past. China for example produces 77% of the world's lithium-ion batteries and with a large domestic

BEV market can easily absorb Russian supplies. However, while this is our view, any disruption to the battery grade nickel and aluminium markets could slow the pace of BEV production and adoption globally, which could be to the advantage of ICE and FCEV, both important consumers of PGMs.

Replacing natural gas with hydrogen improves energy security

One final area on which sanctions against Russia could have a lasting impact is the security of European energy supplies and an associated acceleration of the use of hydrogen. While most of the Russian economy is being financially isolated by being excluded from SWIFT, exceptions have been made for energy payments as Europe currently imports some 40% of its natural gas needs from Russia. This is a strategically vulnerable position to be in and one that is difficult to resolve with alternative supplies of natural gas, which would have to be seaborn due to the lack of associated shipping infrastructure capacity. One alternative is to blend hydrogen into domestic and industrial natural gas supplies; it is technically feasible to blend in up to 20% hydrogen without any material changes to gas infrastructure or domestic appliances. This would halve Europe's reliance on Russian gas supplies, significantly improve Europe's strategic position and reduce the flow of foreign currency to the Russian regime.

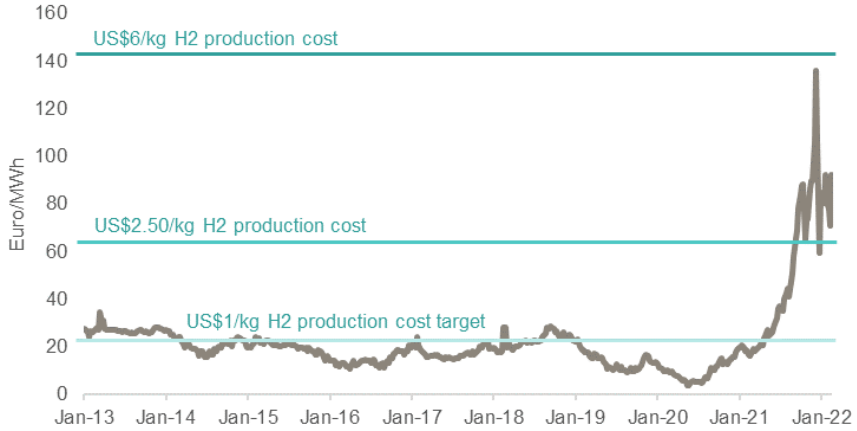
With gas availability the key consideration, blue hydrogen is not an option. Blue hydrogen is produced by steam reformation of natural gas and using carbon capture and sequestration to reduce its emissions profile. This leaves green and pink hydrogen as the only viable alternative sources, produced by the electrolysis of water using renewable or nuclear energy respectively. Strategically this makes sense, but more than that, at current gas prices in Europe, admittedly inflated by the current situation, it also makes economic sense, although it would be a herculean task to ramp up production.

To put hydrogen's competitiveness into perspective:

- Producing green hydrogen from renewable electricity currently costs between US$3/kg and US$6/kg
- The target for the hydrogen industry has been to bring this down to US$1/kg through technological improvements and economies of scale
- US$1/kg equates to a competitive cost level with historical gas prices
- World gas prices have rallied since mid-2021 and accelerated since Russia's invasion of Ukraine
- Current European gas prices equate to a hydrogen cost of ~US$6/kg

This cost analysis does not include the added strategic benefit of reducing reliance on Russian energy supplies. While gas prices are elevated for (hopefully) temporary reasons, it seems unlikely they will revert to historical levels. For European policy makers the path to improving energy security should be obvious and balance sheet light; they should offer a floor price of US$4-5/kg H2 and let private money fund the profitable build out of hydrogen infrastructure.

Figure 4. Chart of weekly average European day-ahead gas prices (Pegas); Note that spot prices of >€140/MWh equate to >US$6/kg H2



Source: Bloomberg

Advancing the use of hydrogen or indeed the hydrogen economy sounds interesting and strategic, but what does it have to do with platinum? Two things. Firstly, PEM electrolysers for the electrolysis of water contain platinum as a catalyst, and PEM electrolysers are the best suited of the electrolyser designs to cope with the variable power loads typical of renewable electricity generation. However, platinum demand from electrolysers is admittedly relatively limited, currently forecast to be 500 koz to 1 moz cumulatively over the next 10 years. More importantly, however, the natural corollary of developing extensive hydrogen production infrastructure is not just using hydrogen to blend with natural gas, but it provides an abundant direct fuel for fuel cells, which are potentially a significant source of platinum demand.

Conclusion

In conclusion, Russia's tragic war in Ukraine and the sanctions enforced on Russia have implications for the flow of commodities around the world. This could disrupt short-term platinum supply but could prove beneficial to platinum demand in the medium to longer term. Furthermore, the potential to accelerate the wider adoption of hydrogen as a fuel would be an important boost to global decarbonising and would raise further platinum's strategic role.

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