INTERNATIONAL PLATINUM GROUP METALS ASSOCIATION

Platinum Group Metals Life Cycle Assessment

(covering Platinum, Palladium, and Rhodium)

FAQs

1. What is a life cycle?

A life cycle describes the consecutive and interlinked stages of a product or service system, from the extraction of natural resources to the final disposal.

2. What is a life-cycle assessment (LCA)?

As defined by ISO in their Principles and Guidelines for Life Cycle Assessment (ISO 14040.2), an LCA is a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life cycle. It shows where the greatest environmental impacts occur and where improvements would deliver the most benefits.

3. What are life cycle data used for and who is the target group?

Life cycle data are used by e.g., end users to assess the environmental performance of a product. Existing tools are, e.g., ISO standardized life cycle assessments. The inputs and outputs of two products fulfilling the same function can be compared.

The IPA LCA data are intended for use by the IPA and its members, for communications to LCA practitioners, LCA database providers, end-user of PGMs (customers), and legislators. Against the background of the growing public debate about energy and climate change, it has also become of increasing interest to financial stakeholders such as investors, the broad media landscape, and the public.

4. What does the IPA LCA 2017 cover?

The IPA LCA 2017 is a cradle-to-gate study that quantifies the environmental impacts of primary and secondary production of platinum group metals (PGMs) and their use in catalytic converters (autocatalysts). It represents an update to the first industry wide LCA that was based on fiscal year 2010 production data and finalized in 2013.

The IPA LCA 2017 is highly representative of the industry, covering more than 95% of primary PGM production, more than 70% of secondary PGM production, and over 90% of autocatalyst fabrication.

On the input side, the LCA includes, inter alia, the volume of ore mined and processed, electric energy, fuel, water, explosives, and process chemicals. On the output side, it covers e.g., the emissions to air and water, as well as waste. These data are shown in the relation to the production of 1 kg of platinum, 1 kg of palladium, and 1 kg of rhodium; and the production and use phase of one Euro 6d-TEMP modelled 1.4 Litre gasoline engine vehicle and one Euro 6d-TEMP modelled 2.0 Litre diesel engine vehicle.

The cradle-to-gate life cycle inventory (LCI) also includes the production of fuel and ancillary materials and represents all resource use and emissions caused by PGM production as well as the use of PGMs in a catalytic converter application.

5. What are the main improvements of the second LCA (2017) compared to the first (2010)?

The 2017 LCA improves on the 2010 study in several aspects:

- *Representativeness and geographical coverage*

  Compared to the 2010 study, the industry coverage of primary production increased by 40% and for secondary production by more than 130%. The geographical coverage of PGM operations (production and autocatalyst fabrication) was broadened by including sites in Russia, France, Poland, Macedonia, and China.

- *Data Quality*

  The quality of the data was enhanced by including assay data; measuring a greater range of scrap materials in secondary production; collecting data on the production of chrome concentrates, which is a by-product at some PGM mines in South Africa; and by using the GaBi 2017 database for data on fuel and electricity inputs and upstream and downstream raw materials and unit processes.
  In addition to being assessed by a third-party independent technical expert, the 2017 data also received a formal ISO certification.

- *Reporting elements*

  Enhanced reporting elements include: Presenting results for the Global Warming Potential (GWP) or impact from GHG emissions of primary and secondary production split into Scopes 1, 2 and 3, as defined in the GHG Protocol for corporate reporting; the addition of results for the impact of production on Blue Water Consumption; and separate impact assessments (segregated data) for primary and secondary production, which were aggregated in the 2010 study.

6. Who performed the IPA LCA, and what are their qualifications?

The IPA LCA was carried out by Sphera, a recognized leader in providing life cycle assessment and developing sustainable solutions for corporate operations and products.

7. Why has IPA conducted this update?

As processes and technologies used in production change and improve over time, it is recommended to update LCA data every 5-7 years. The IPA LCA 2017 update also reflects changes in data category requirements, i.e., data required by regulators and other stakeholders to assess environmental impacts. New data categories are covered in the 2017 study. These include, e.g., land use transformation data due to its relevance for assessment of the Product Environmental Footprint (PEF) method which is currently being developed by the European Commission, and blue water consumption, defined as freshwater leaving the watershed, due to the increasing environmental threat associated with freshwater scarcity.

In the application study on catalytic converters, the study reflects changes in catalyst technologies as well as tightened emissions standards (Euro 6d-TEMP) which include on-road measurements of Real Driving Emissions (RDE) to validate emissions under real driving conditions, as opposed to previous laboratory-only measurements. RDE legislation specifically targets nitrogen oxides (NOx) and particulate emissions (PM).

8. Which PGM products were covered by the IPA LCA 2017?

The IPA LCA 2017 covers the production of platinum, palladium, and rhodium as they are the most widely used metals out of the PGM family, and the production and use of an autocatalyst in one 1.4 litre gasoline vehicle and one 2.0 litre diesel vehicle over a lifetime of 160,000 km. The use phase was modelled on the European region using a Euro 6d-TEMP model vehicle (gasoline and diesel) from the internationally approved and widely used GaBi 2017 database. For the catalyst, a typical mix of PGMs of 72% primary PGMs and 28% secondary (recycled) PGMs was assumed.

9. What processes were included in the study?

The LCA covers all main production processes to produce PGMs from “cradle to gate”, which means from ore extraction, the production of other raw materials, energy supply and the production of the PGMs themselves. The cradle-to-gate life cycle inventory also includes the production of fuel and ancillary materials and represents all resource use and emissions caused by PGM production as well as the use of PGMs in a catalytic converter application.

10. Which companies participated in this exercise?

In total eleven out of twelve IPA members participated in the study: Anglo American, Implats, Sibanye-Stillwater, Royal Bafokeng Platinum, Northam, Nornickel, BASF, Johnson Matthey, Heraeus, Umicore, and Tanaka.

11. How does the 2017 data set compare to the previous (2010) data? Could the PGM industry improve its environmental performance?

Due to significant changes between the database versions (background data) and the contributing data (participants to the study), no direct conclusions can be drawn in terms of the environmental performance of the industry.

For example, for the *primary production route*, the Primary Energy Demand (PED) related to the production of platinum has increased by 8%, while the PED to produce palladium has decreased by 21%, and by 3% for rhodium. This can be explained by the inclusion of new participants with different power sources, such as hydro power and natural gas in Russia where a great amount of palladium is mined, and at the same time with the inclusion of deeper mines in South Africa with higher electricity demand.
When comparing the average results of those participants who also contributed data in 2010 with the 2017 figures, a generally lower energy consumption is evident for 2017.

Similarly, no comparisons can be drawn regarding the environmental performance for the *secondary production route* as the mix of companies represented has changed. Data collected for 2017 is more representative and comprehensive than data collected for 2010, and the volume of secondary production covered is considerably higher (increase by 130%) and more representative of the market situation.

12. How can I get access to the results of the LCA?

The full IPA LCA 2017 report is an internal document and not intended for publication. However, the main results for the most requested impact categories and conclusions are summarized in the Environmental Profile of Platinum Group Metals document and the LCA Fact Sheet. The LCA data set can be requested by filling out the LCA data questionnaire on the IPA Website. If access is granted, a Data Usage Agreement between the interested party and IPA is to be signed, and data will be released in the ILCD format. The IPA is also considering the release of its LCA data into the GaBi and Ecoinvent databases.

13. How does the industry intend to further reduce the carbon footprint of PGM production and its impact on climate change?

IPA Members are operating in very diverse environments, with access to different power sources. In South Africa, electricity generation is still highly dependent on mainly hard coal fired electricity supply by Eskom, which has the strongest impact on CO_2 emissions during primary production. However, the implementation of South Africa's postulated Integrated Resource Plan is anticipated to reduce the carbon intensity of national electricity supply. Mining companies have therefore started to invest into alternative energies.

Each mining company has adopted its very own strategic initiatives towards climate change – e.g., reducing Scope 1 and Scope 2 (purchased electricity) Greenhouse Gas emissions by 27% by 2025 from a 2010 base; appointing energy service companies to assist with energy optimisation initiatives (optimisation of compressed air and water refrigeration circuits).

Further to reducing carbon emissions, water preservation is becoming an increasingly important issue. To prepare operations for the impact of climate change, several members have implemented programmes to actively reduce water consumption, especially in water scarce environments.