



## IPMI EC Chapter - Dublin

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**Closing the Recycling Gap within Open Loop Refining**



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# Agenda

- Introduction to the Hensel Recycling Group
- Recycling a circular economy
- Closed and open loop refining definition
- PGM demand analysis
- PGM open loop refining analysis
- Open loop refining market analysis
  - Autocatalyst
  - Electronics
  - Jewellery
- Conclusion



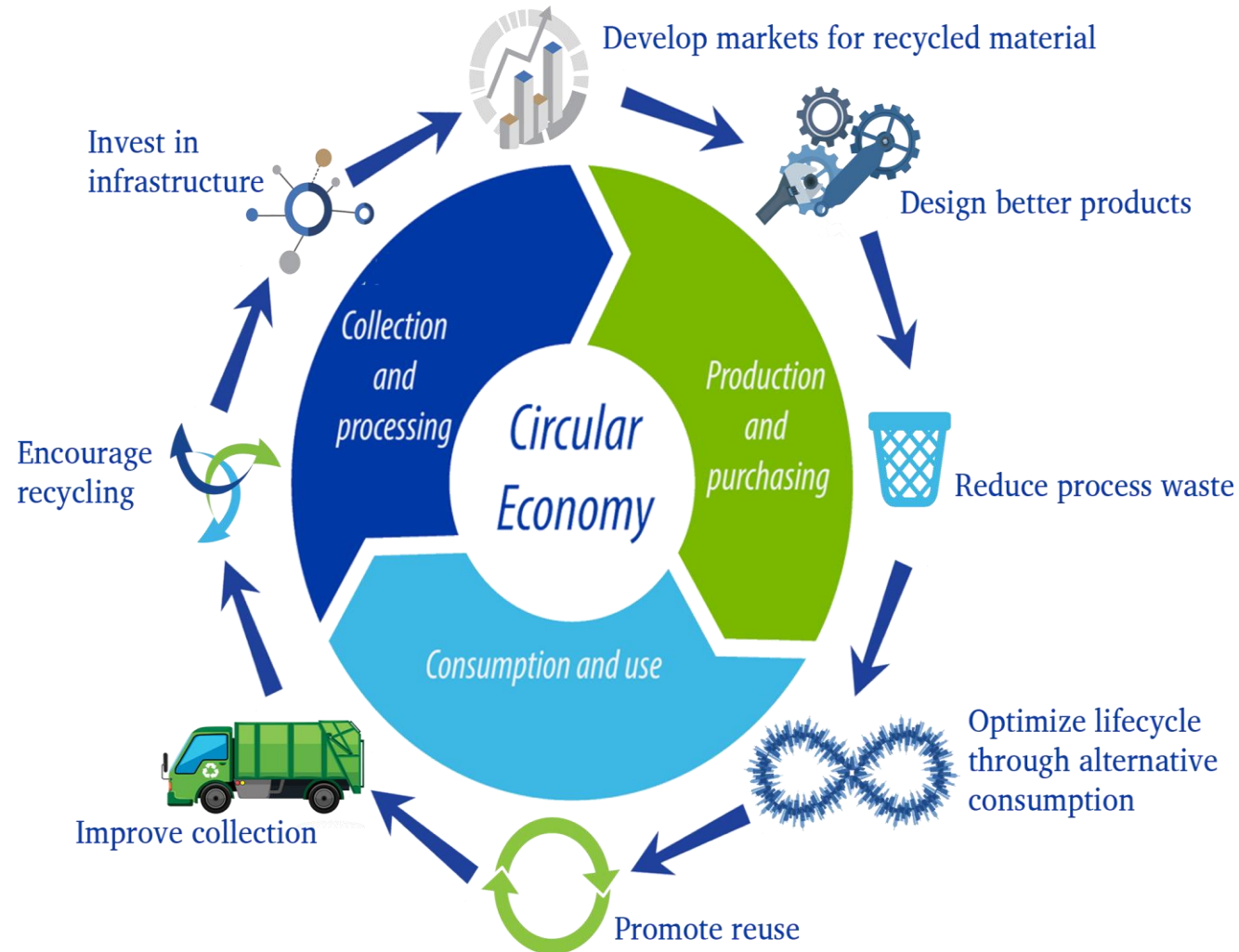
# Introduction to the Hensel Recycling Group

• Founded	1998
• Main Office	Aschaffenburg, Germany
• Employees	240
• Subsidiaries	Australia, Austria, France, Great Britain, Malaysia, South Korea, USA, China (Joint Venture)
• Sales Offices	South Africa, Czech Republic
• Services	Purchasing service, toll refining, fast Settlement, analysis & determination, logistics, precious metals management
• Materials	Catalytic converters from automobile / industrial applications, diesel particulate filters, oxygen sensors, e-scrap, cable harnesses, aluminium rims, etc.
• Certificates	Certified waste management company in accordance with § 56 of the German Closed Substance Cycle and Waste Management Act (KrWG), German law on emission protection (BImSchG), DIN EN ISO 9001, DIN EN ISO 14001, DIN EN ISO 45001
• Memberships	ARA, BIR, BVSE, FVEM, IPMI, VRA





# Recycling a Circular Economy





# Closed and Open Loop Refining - Definition

## *Closed Loop Refining*

“Used in industrial processes where the precious metals are used to **enable** the manufacture of the product such as chemicals, oil and glass. Products used are generally part of the manufacturing equipment **not** part of the products produced.

Metal is generally owned by the customer at all times and processes are operated on a **supply / refine bases** all time's, metal losses are minimal and fresh metal is only required as top up”

## *Open Loop Refining*

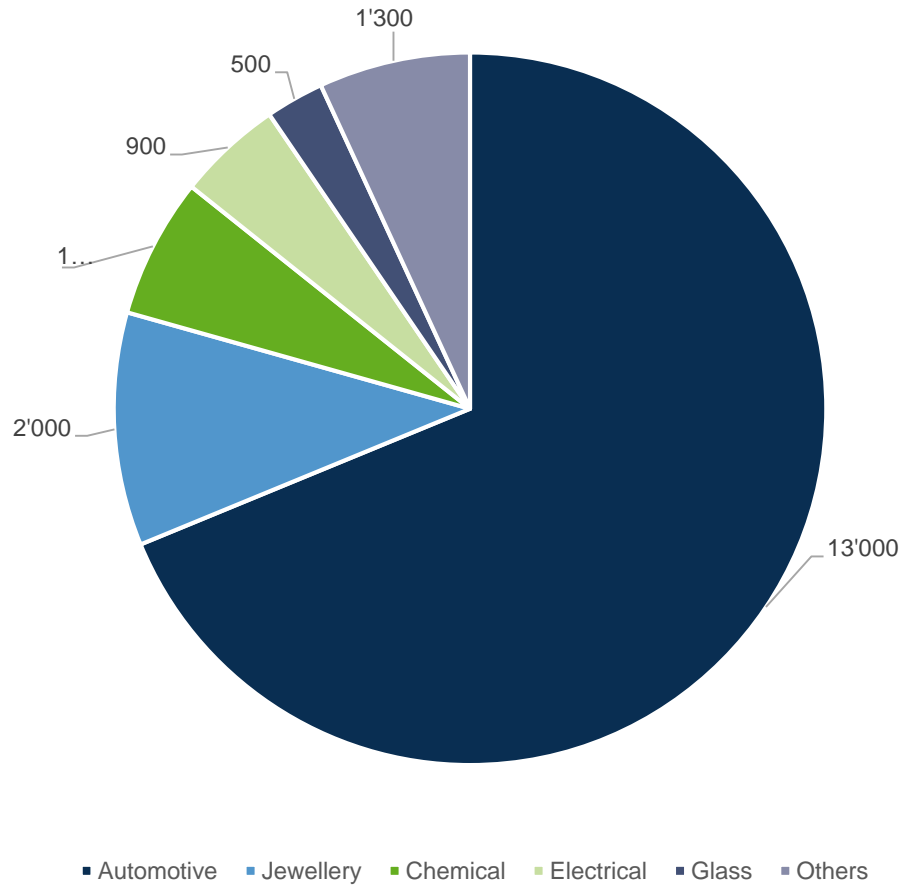
“Precious metals are generally found in the **products not the machines** that make them such as autocatalyst, electronics and jewellery. There is therefore a **disconnect** between those that own the material and the owners of the product at end of life

Recycling supply chains are therefore more complex and contain more opportunities for **system losses**, recovery rates can therefore be lower”

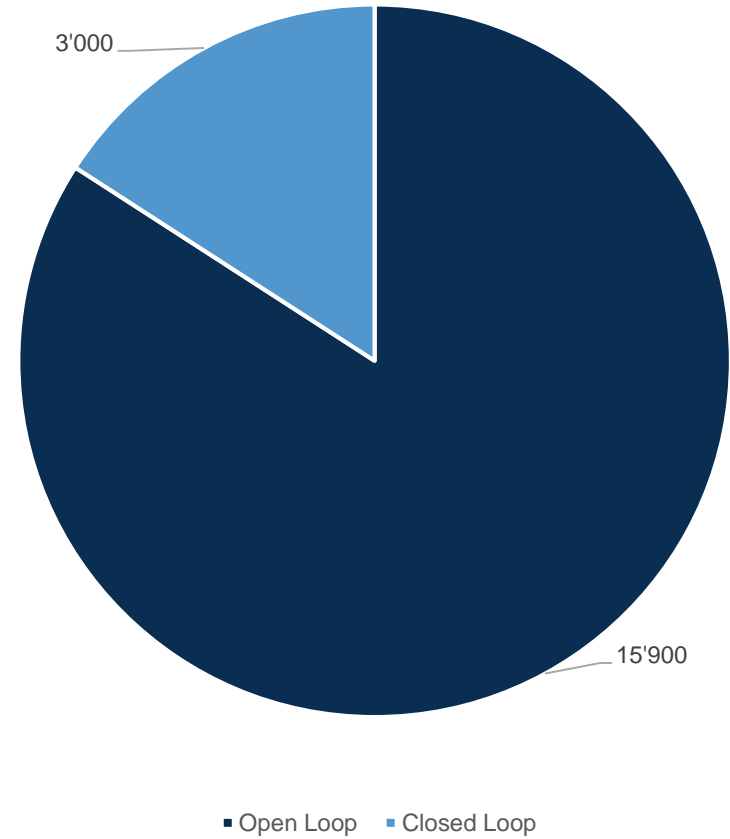


# PGM Demand Analysis

Pt, Pd, Rh Demand (kozs)



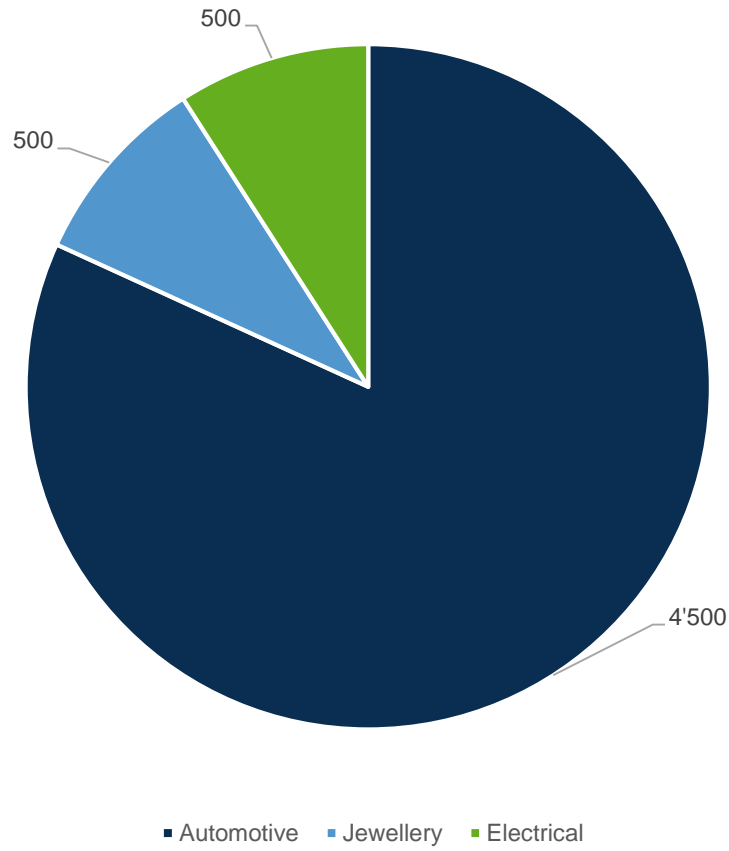
PGM Demand (kozs) Closed vs Open Loop



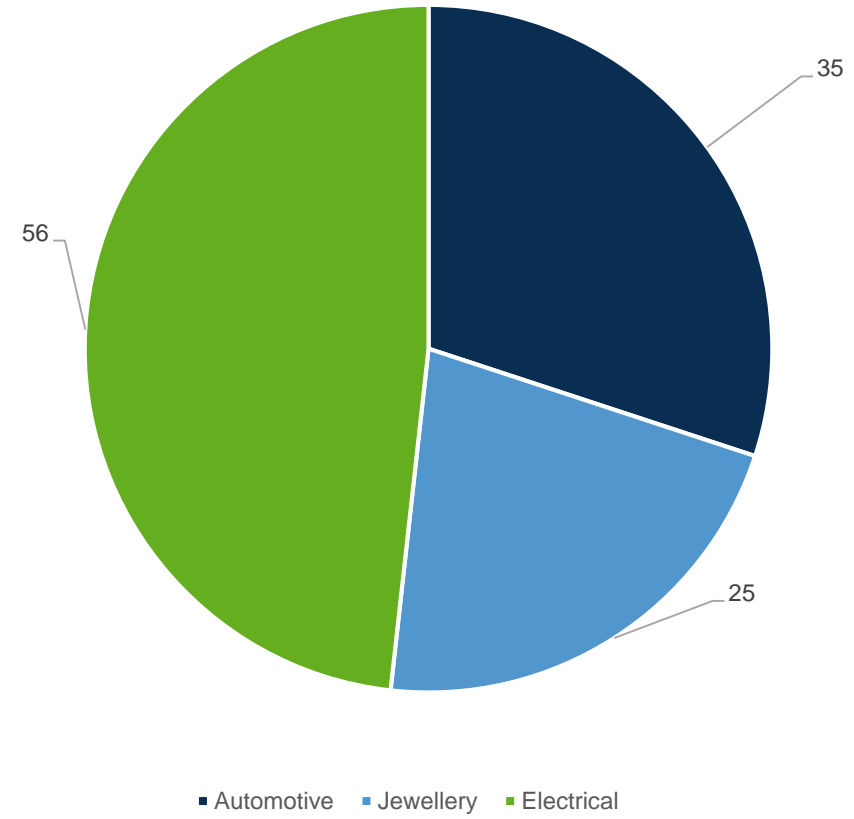


# PGM Open Loop Refining Analysis

Open Loop Recycling (Pt, Pd, Rh kozs)



Pt, Pd, Rh (Kozs) Recycled oz's as a percentage of total demand





# Open Loop Refining Market Analysis – Autocatalyst

## Market analysis

4,500 K total PGM ozs recycled which is 35 % of annual PGM fresh automotive demand

Recycling spent automotive catalyst has grown year on year and will continue to do so going forward

Average car lifecycles are ~ 12-15 years

Perceived 65 % recovery of PGM's loaded onto catalysts ie 35 % metal loss

## Source of metal losses said to be

Technical in use losses - Incorrect fuel used, on road sintering, catalyst poisoning, driving conditions

Collection losses – Car exports, cars not scrapped, whole cars shredded, theft, other part losses

Process losses – Smelters, refiners, inefficient recycling processes

## Opportunities to reduce 35 % metals losses could include

Improved car catalyst formulations and car running conditions

Car scrappage / de registration programmes, including tracking of exports

# Open Loop Refining Market Analysis – Electronics

## PGM market analysis

500 K total PGM ozs recycled which is 56 % of annual PGM demand

Most oz's recovered are ex high grade items such as MLCC's, resistors and targets

Low recycling rates (35 %) mainly driven by large volumes of material to process

## Electronic waste recycling

Material type, volume, value and location is vast, also difference between recycling and disposal

Majority of higher grade e scrap is recycled for Au, Ag, Pd and Cu via up to 10-20 smelters

Insufficient capacity to handle this material

## E waste **main** issue

E waste recycling is more of an environmental, sustainability issue not metal recovery

Re use of components such as plastics, chips, rams can help the circular cycle

Still a lot of low grade / no value material disposed of / incinerated in China, India etc



# Open Loop Refining Market Analysis – Jewellery

## Market analysis

- 500 K total PGM ozs recycled which is 25 % of annual PGM fresh Jewellery demand
- Demand is dominated by China and Japan and often linked to metal prices

## Jewellery Recycling

- Major recycling is production scrap and people exchanging Jewellery for new models, ie scrap used to make new Jewellery so more like a closed loop refining cycle
- If not sent for recycling material is stored for value, investments or gifts
- Recycling dominated again by China and Japan
- Not an environmental issue as a solid metal as can be reused easily



# Summary & Conclusion

- As industrial demand for precious metals continues to rise, the **efficient recovery** of high value critical materials remains economically and environmental essential
- Secondary refining will become more important in future as sustainable source of key metals from ‘mine above ground’ as demand increases and mine supplies become depleted
- Increasing the recovery rates across “Open Loop” networks will be critical to overall supply / demand equation, overall business economics and environmental / sustainability targets , Closed Loop refining will still form a large part of the overall PGM refining markets and is set to continue to grow
- Recycling from “open loop” markets often have different drivers
  - Autocatalyst – Value return
  - Electronics – Environmental and sustainability
  - Jewellery – Reuse and storage
- Moving forward more focus needs to be taken to reduce metal losses, looking specifically
  - Design to recycle on new products
  - Strong recycling legislations and goals
  - Robust supply chains
  - Efficient and extra capacity processing routes



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**Thankyou**