Reducing the European deficit of Platinum Group Metals (PGMs), by upscaling to industrial relevant levels a novel cost-efficient and miniaturised PGMs recovery and raw material production process

Platirus Project - General presentation

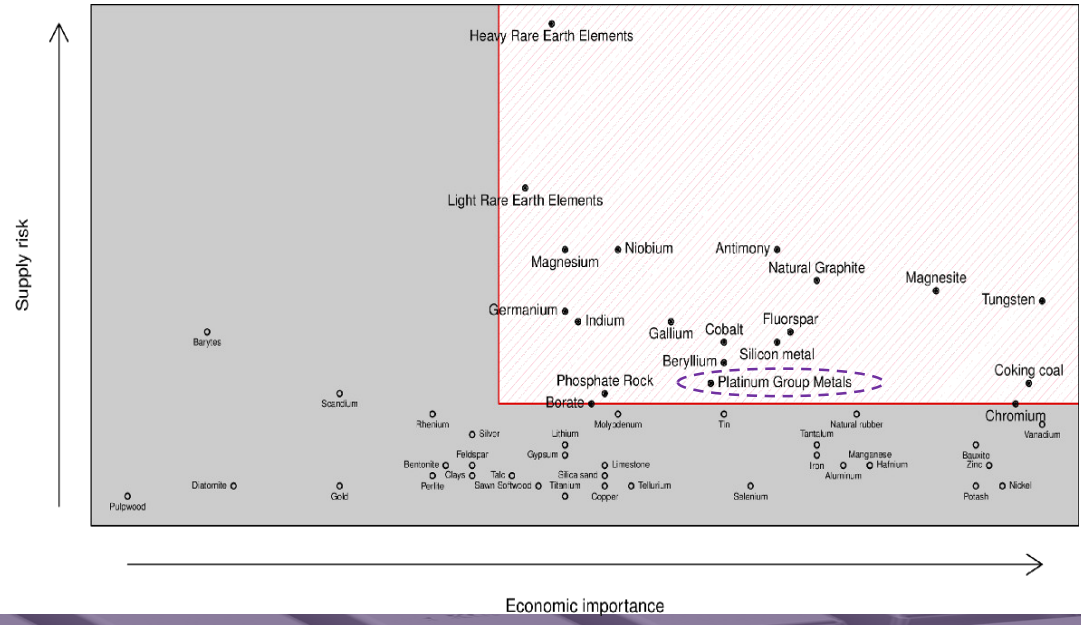
Outline

- The Platinum Group Metals (PGMs)
- Supply, demand and use of Platinum-Foresight for the coming years
- Importance of platinum for the EU economy
- The Platirus project: Its aim, activities and expected benefits

The Platinum Group Metals (PGMs)

- PGMs comprise 6 chemically very similar elements:
  1. ruthenium (Ru),
  2. rhodium (Rh),
  3. palladium (Pd),
  4. iridium (Ir),
  5. osmium (Os)
  6. platinum (Pt);

- Least abundant of the Earth's elements and classified by the EC as critical raw materials (CRMs);



- Platinum is the most commercially important, having the largest range of applications.

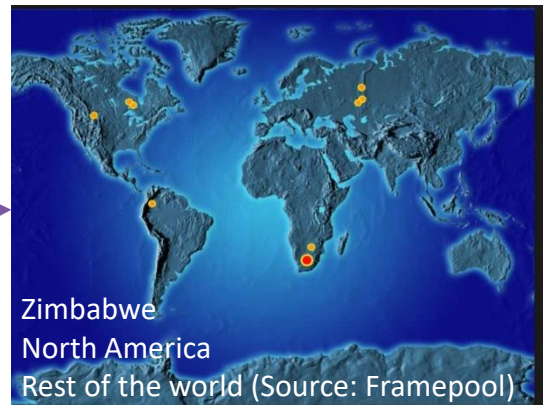
Supply, Demand and Use of PGM- e.g. Case of Platinum

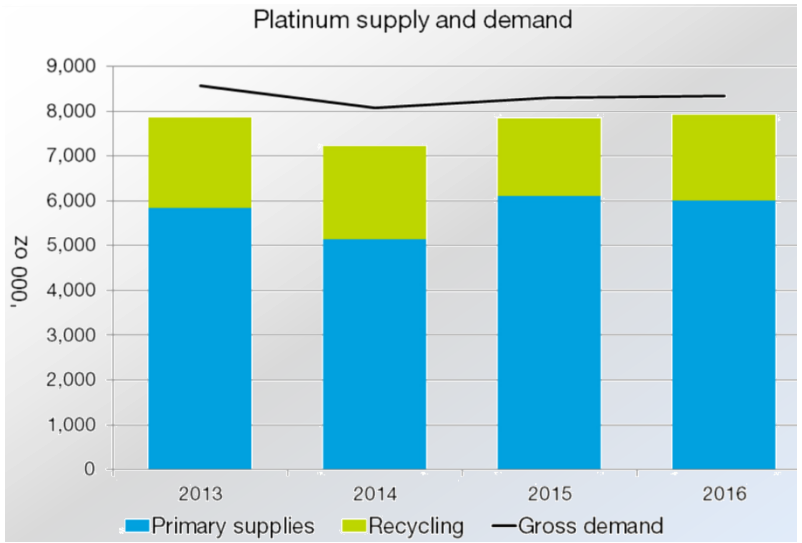
Platinum market remained in **deficit** in 2016 despite significant deterioration in platinum purchasing by Chinese jewellery fabricators

Platinum Supply and Demand '000 oz			
Supply	**2014**	**2015**	**2016**
South Africa	3,547	4,571	4,347
Russia	700	670	652
Others	896	868	1,008
Total Supply	**5,143**	**6,109**	**6,007**
Gross Demand			
Autocatalyst	3,120	3,267	3,318
Jewellery	2,897	2,829	2,572
Industrial	1,776	1,749	1,954
Investment	277	451	487
Total Gross Demand	**8,070**	**8,296**	**8,331**
Recycling	-2,071	-1,730	-1,902
Total Net Demand	**5,999**	**6,566**	**6,429**
Movements in Stocks	-856	-457	-422

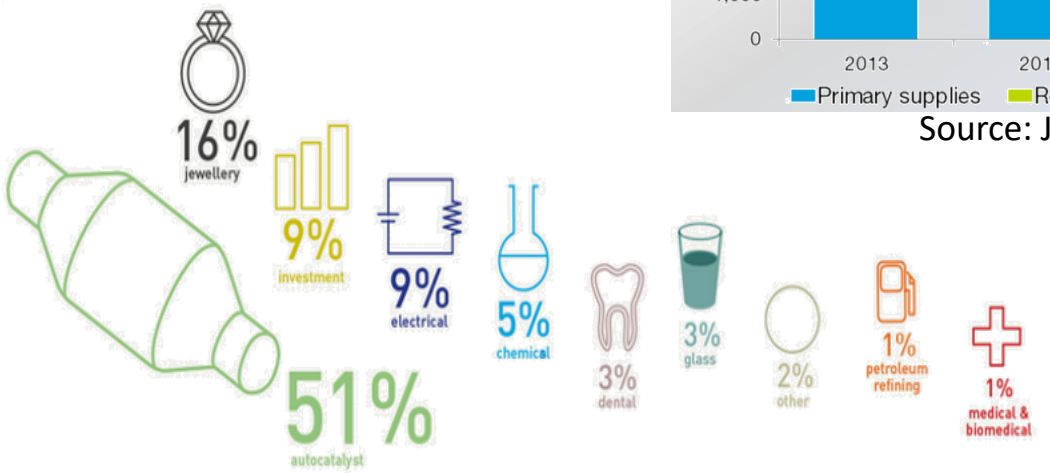
Source: JM's report November 2016

(1 Moz = 28 tonnes)





Source: JM's report November 2016

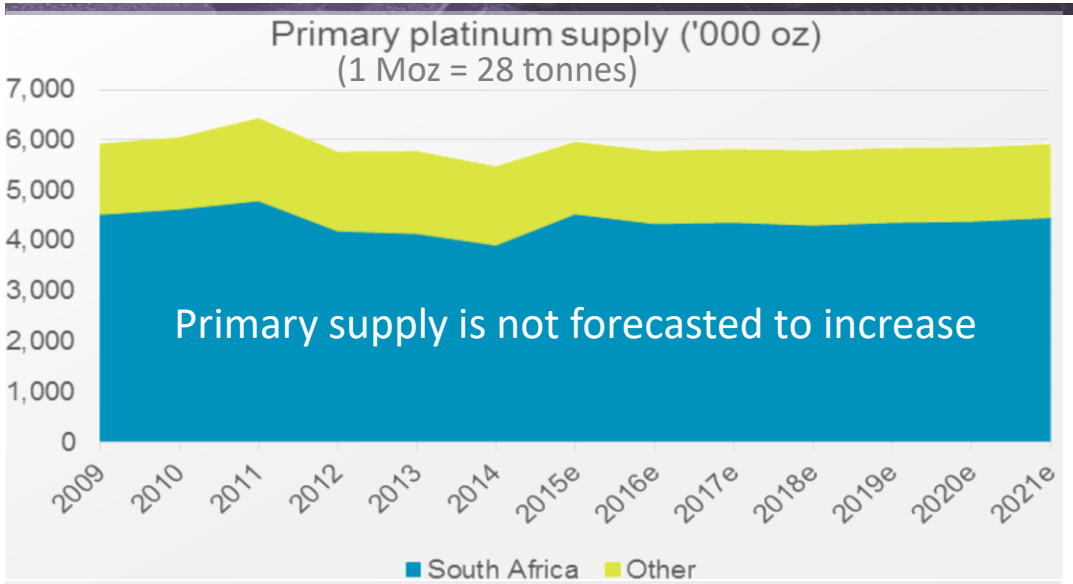


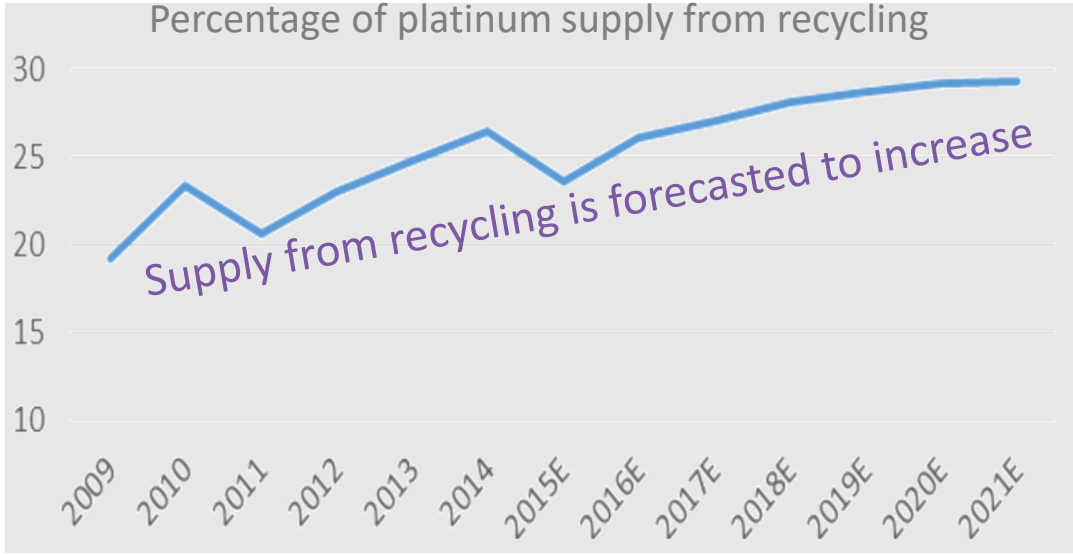
PGM usages per industry in 2010

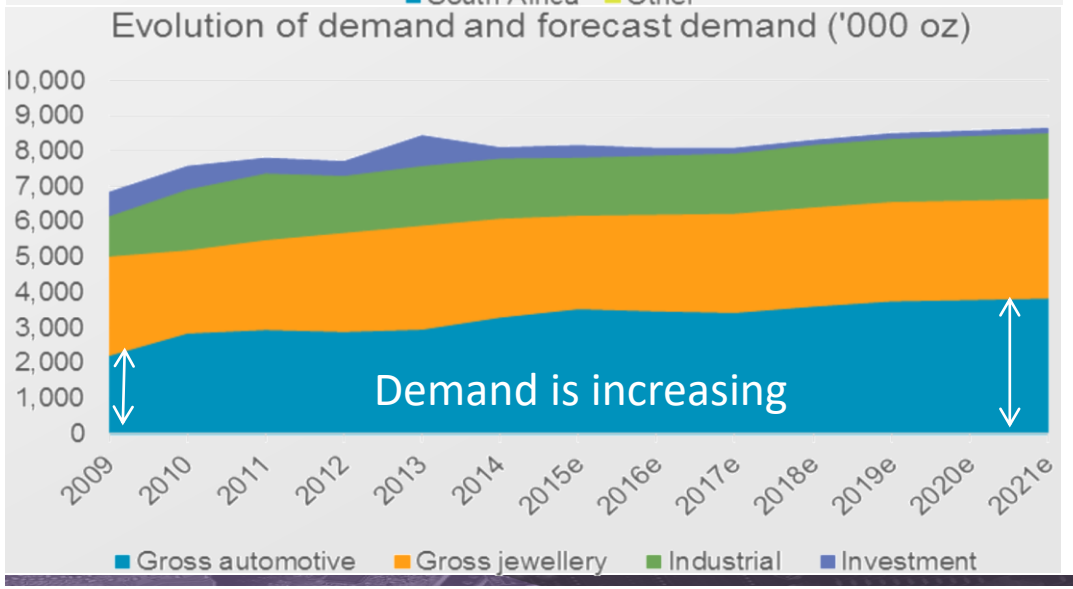
Source: IPA

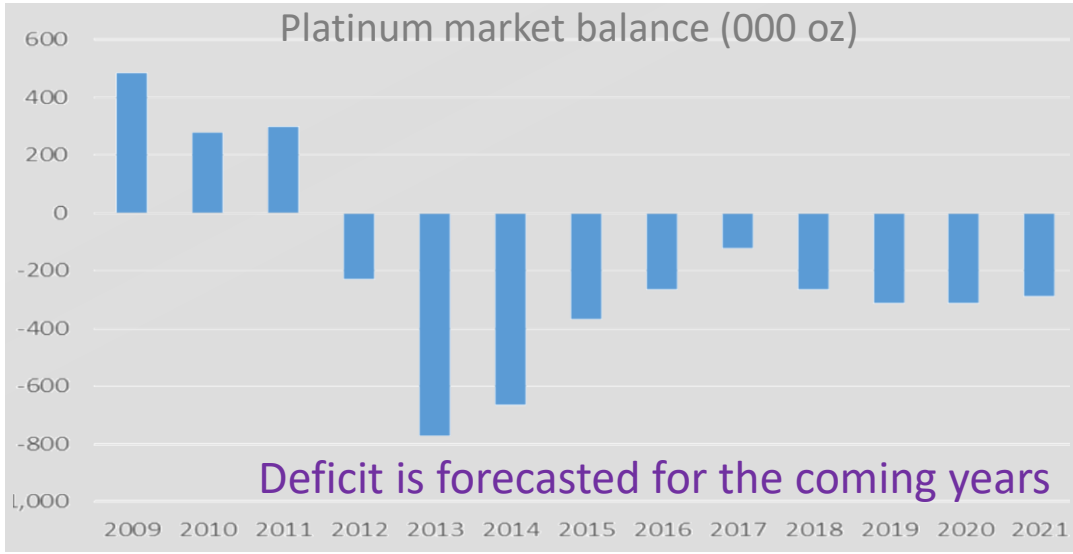
Forecast Platinum Supply and Demand

Source: Johnson Matthey, Glaux Metal , January 2016





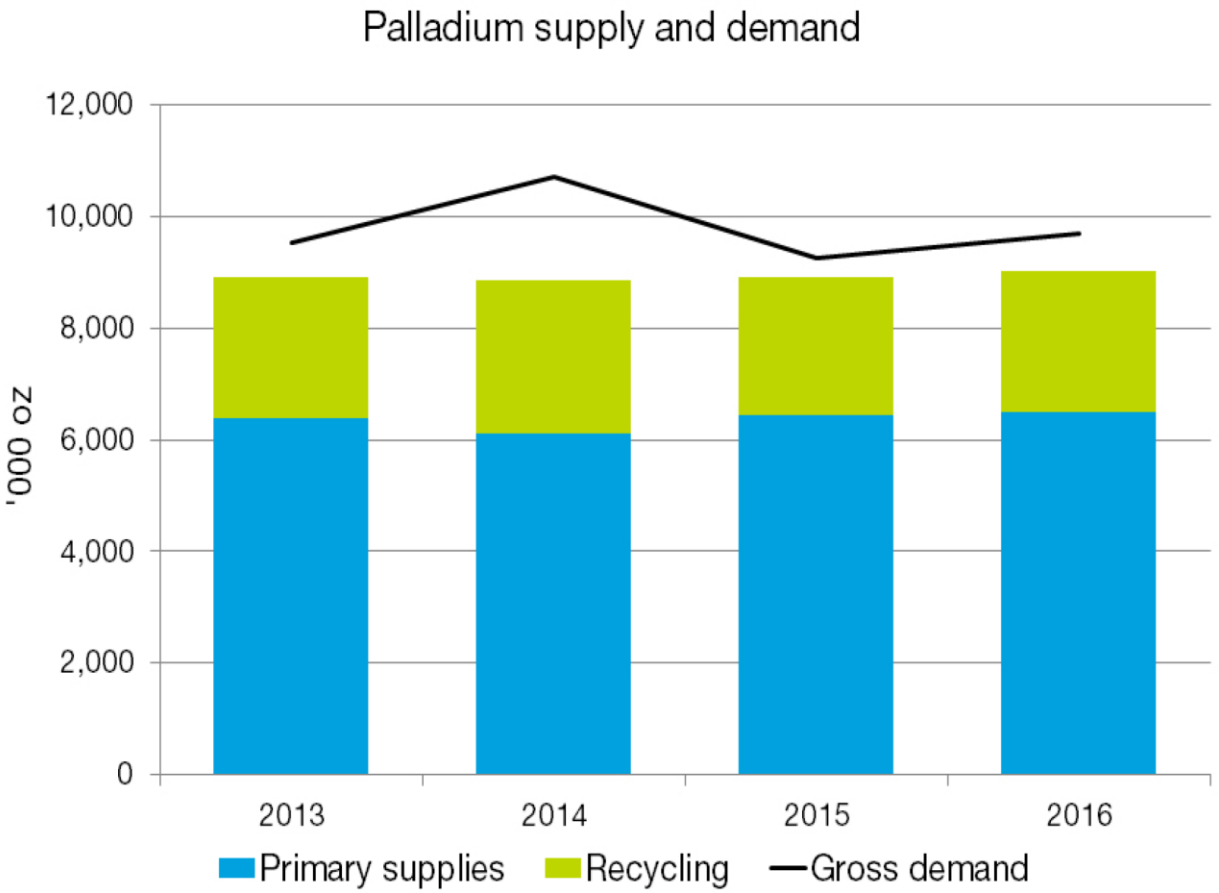




Supply, Demand and Use of PGMs- e.g. Case of Palladium

Similarly, palladium market remained in deficit in 2016

Palladium Supply and Demand '000 oz			
Supply	**2014**	**2015**	**2016**
South Africa	2,125	2,684	2,571
Russia	2,589	2,434	2,487
Others	1,389	1,326	1,427
Total Supply	**6,103**	**6,444**	**6,485**
Gross Demand			
Autocatalyst	7,500	7,655	7,840
Jewellery	272	225	215
Industrial	2,001	2,039	1,987
Investment	943	-659	-357
Total Gross Demand	**10,716**	**9,260**	**9,685**
Recycling	-2,752	-2,460	-2,549
Total Net Demand	**7,964**	**6,800**	**7,136**
Movements in Stocks	-1,861	-356	-651



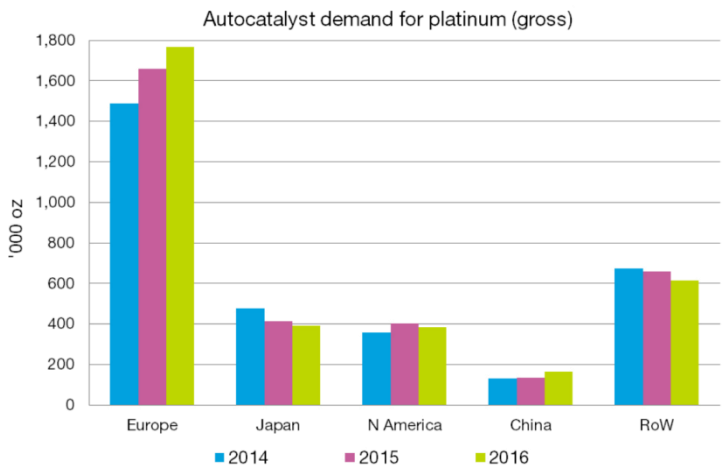
(1 Moz = 28 tonnes)

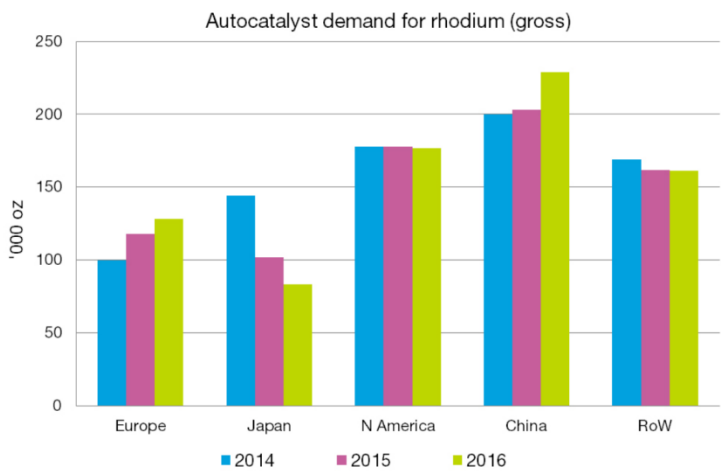
Source: JM's report November 2016

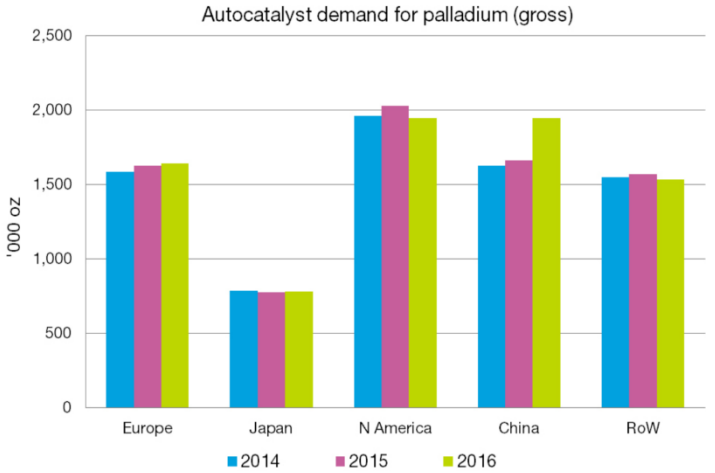
Importance of PGMs for the EU economy

- 2013: >21% of platinum global demand related to the European market (≈50 tonnes, worth >€1 Bn). **Europe is the first consumer of platinum in industrial products.**

- Autocatalyst application was estimated to use 41% of EU PGMs in 2014. **EU is the highest consumer of platinum and an important consumer of palladium and rhodium for autocatalysts.**







Source: JM report November 2016

Importance of Platinum recovery for the EU economy

Typical ores for PGMs contain 10 g PGM/ton ore

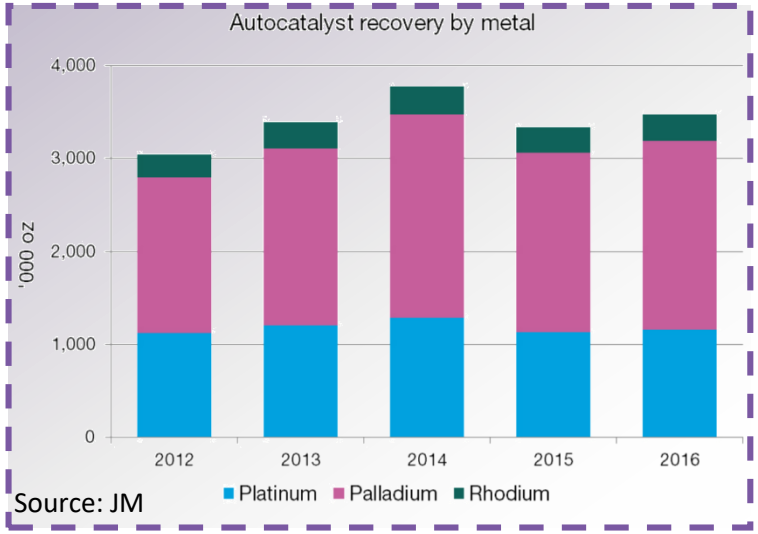
Source: Monolithos

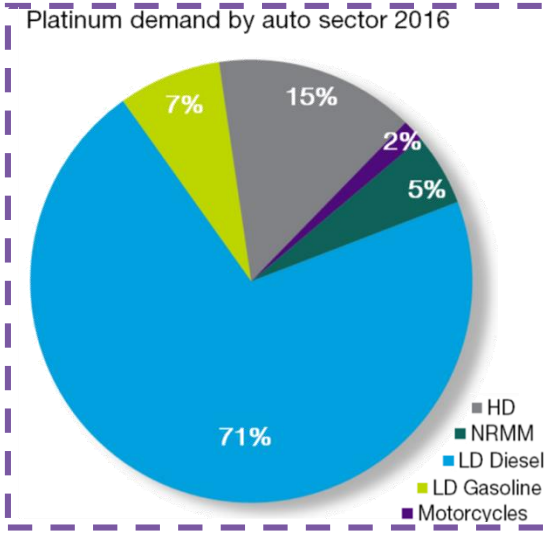
Typically, 2 g to 5 g of platinum per catalyst unit
➔ concentration is more than 1000 ppm
(~100 times higher than natural ores)

Importance of PGM recovery for the EU economy

- A gap remains between the amount of PGMs used for autocatalysts each year and the amount of PGMs recovered from autocatalysts.

- In the last few years (2012 - 2016) platinum recovered globally from autocatalysts is ca. 1 Moz (28 tonnes) per year, while the amount of platinum demand/use globally in autocatalysts per year is often >3 Moz





Platinum Demand: Autocatalyst '000 oz — Source: JM

	Gross			Recycling			Net		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
Europe	1,487	1,658	1,767	-530	-476	-501	957	1,182	1,266
Japan	475	413	391	-62	-62	-63	413	351	328
North America	356	402	382	-571	-460	-456	-215	-58	-74
China	130	135	165	-25	-29	-36	105	106	129
Rest of World	672	659	613	-94	-100	-105	578	559	508
Total	**3,120**	**3,267**	**3,318**	**-1,282**	**-1,127**	**-1,161**	**1,838**	**2,140**	**2,157**

- If 100% of the platinum from autocatalysts were recovered an additional 2 Moz (~50 tonnes) of platinum would be available in the global market each year, which is greater than the global supply-demand gap.

Importance of PGM recovery for the EU economy

- Europe already has a very strong position in recycling and refining of PGMs with major industrial players:

Johnson Matthey

umicore

BASF
The Chemical Company

- Important to keep a lead time in innovation compared to the rest of the world

- The Platirus project was designed to strengthen the European position in the production of PGMs

The Platirus project www.platirus.eu

PLATInum group metals Recovery Using Secondary raw materials

Aim: Reducing the European deficit of Platinum Group Metals (PGMs), by upscaling to industrial relevant levels a novel cost-efficient and miniaturised PGMs recovery and raw material production process

Targeted feedstocks: secondary raw materials including autocatalysts, electronic waste (WEEE), and nickel and copper smelter tailings and slags

Funding: The PLATIRUS project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n°730224

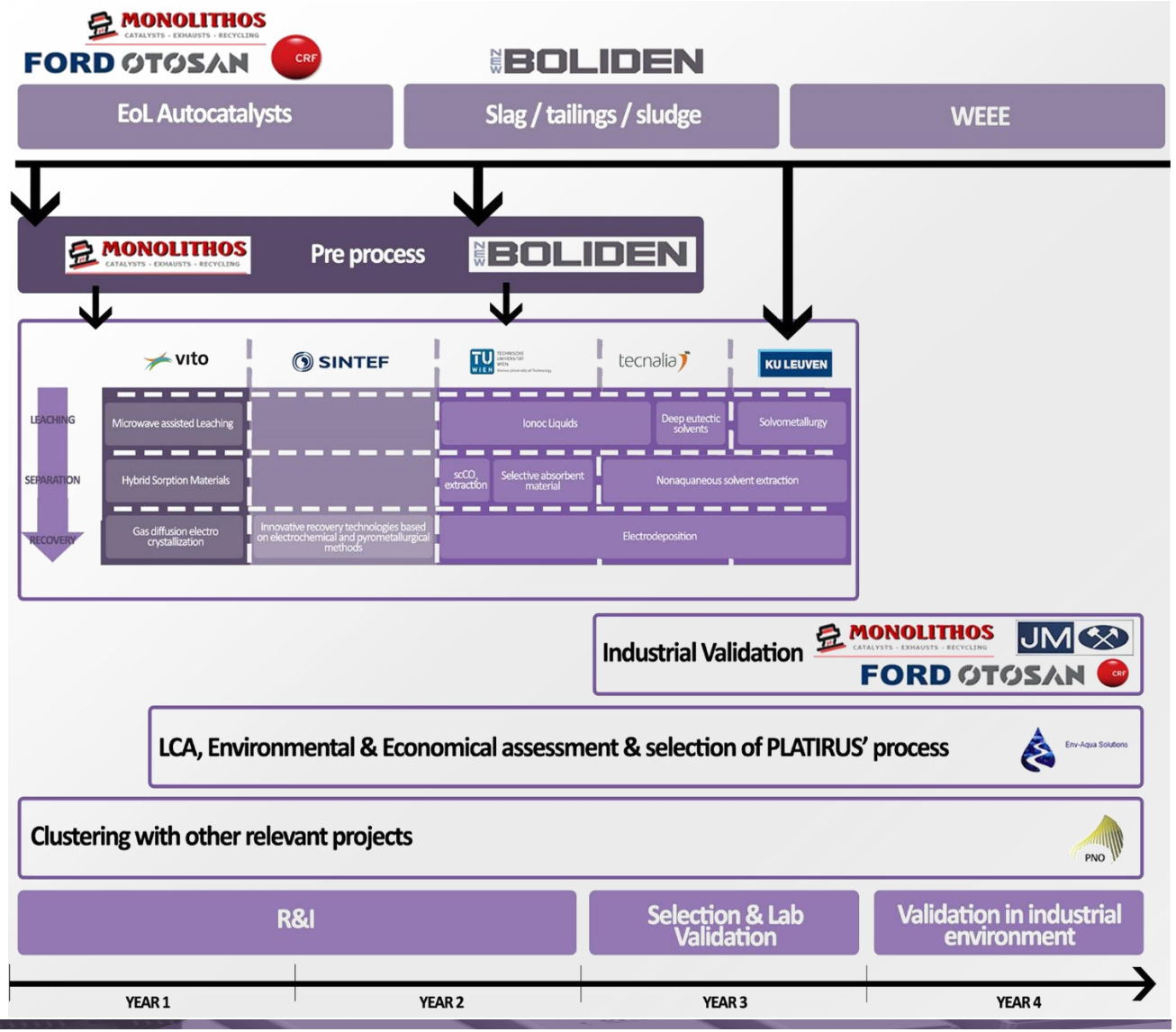
Duration: 2016-11-01 to 2020-10-31

Platirus Consortium

The Platirus project

Main Activities:

- Upscaling to industrially relevant levels, a novel cost-efficient and miniaturised PGMs recovery and raw material production process.
- Selecting best (combination of) recovery technologies and developing a Platirus recovery process and Blueprint Process Design for the final upscaling step, before market introduction.
- Preparing and stimulating market introduction.



The Platirus project benefits

Main benefits:

- Fill the supply-demand gap of PGMs
- Secure the supply of PGM materials and reduce dependency from global supply chains
- Lower energy costs and environmental impacts
- Providing solutions with low capital investment costs compared to centralized refineries to maximize the exploitation of the local wastes

Main contact

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