This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement 730224

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

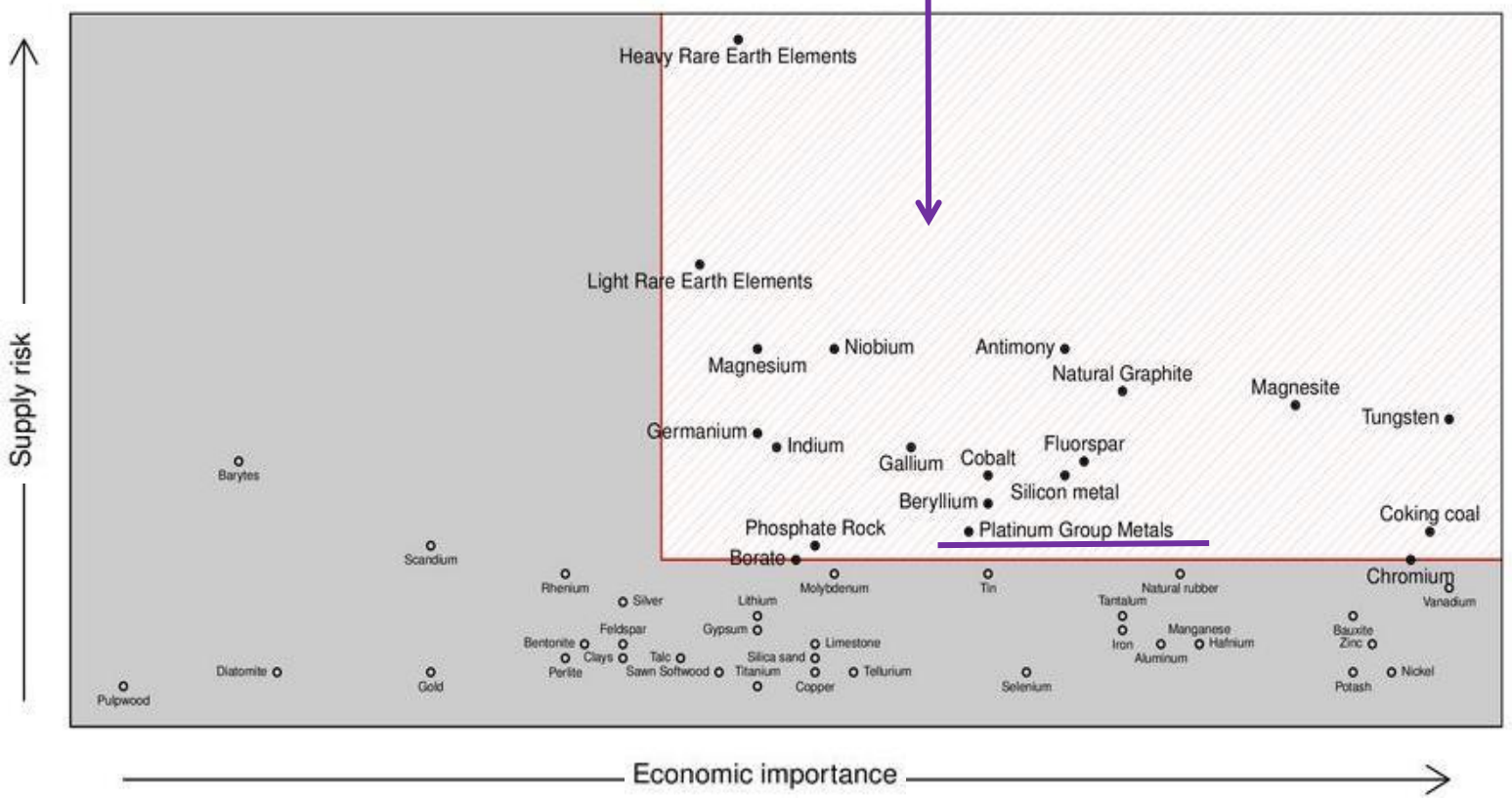
Dr Emma Goosey – Env-Aqua Solutions Ltd

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)

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



PGMs comprise 6 chemically very similar elements:

1. ruthenium (Ru),
2. iridium (Ir),
3. rhodium (Rh),
4. osmium (Os)
5. palladium (Pd),
6. platinum (Pt)

Supply, Demand and Use of Platinum

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

Multi-layer ceramic capacitors

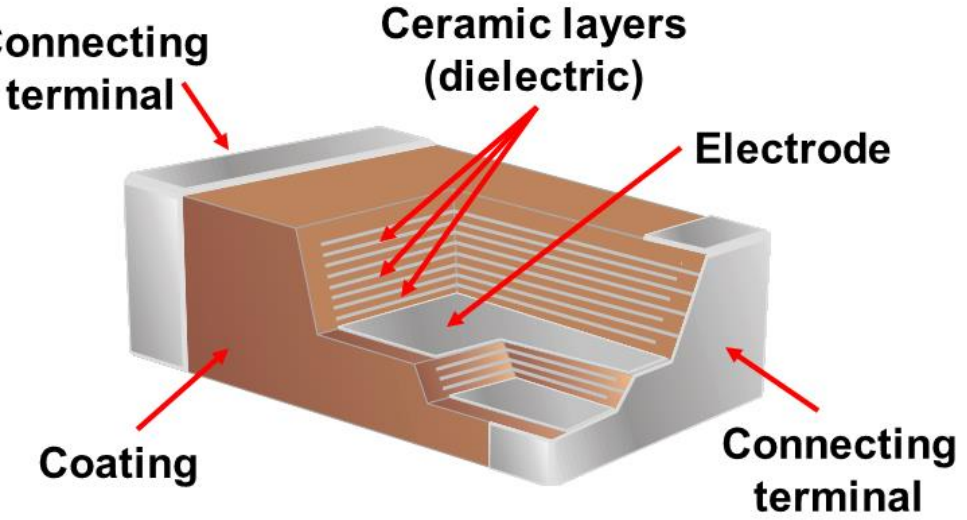
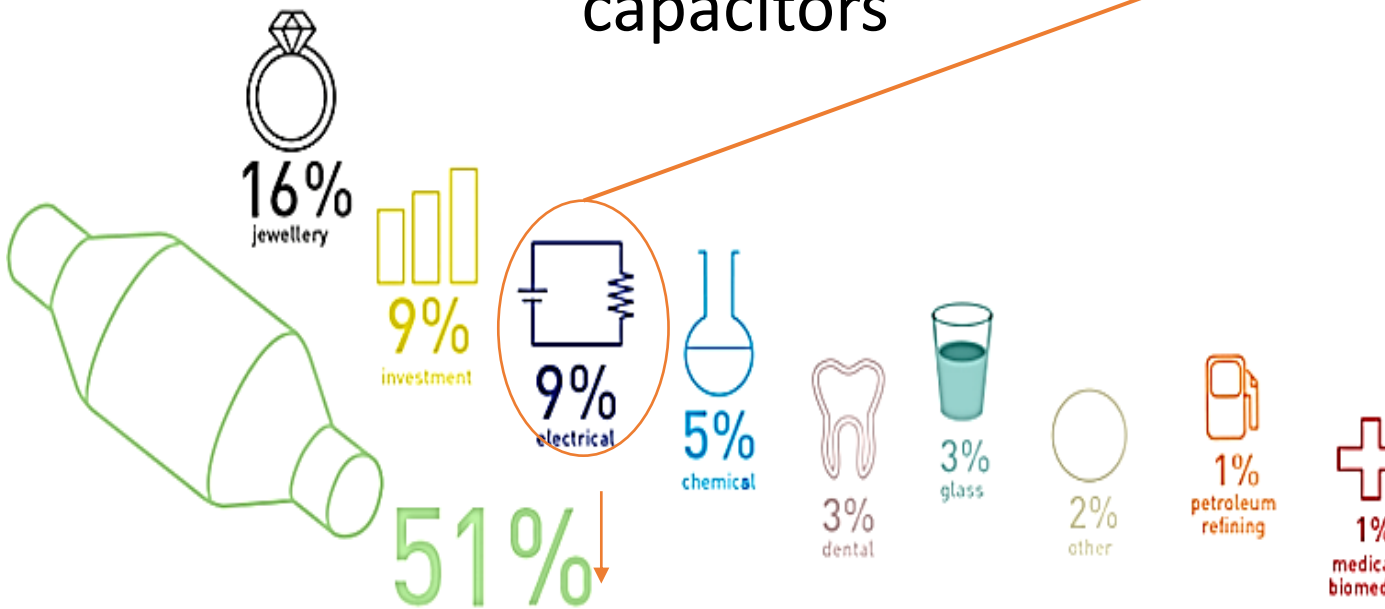


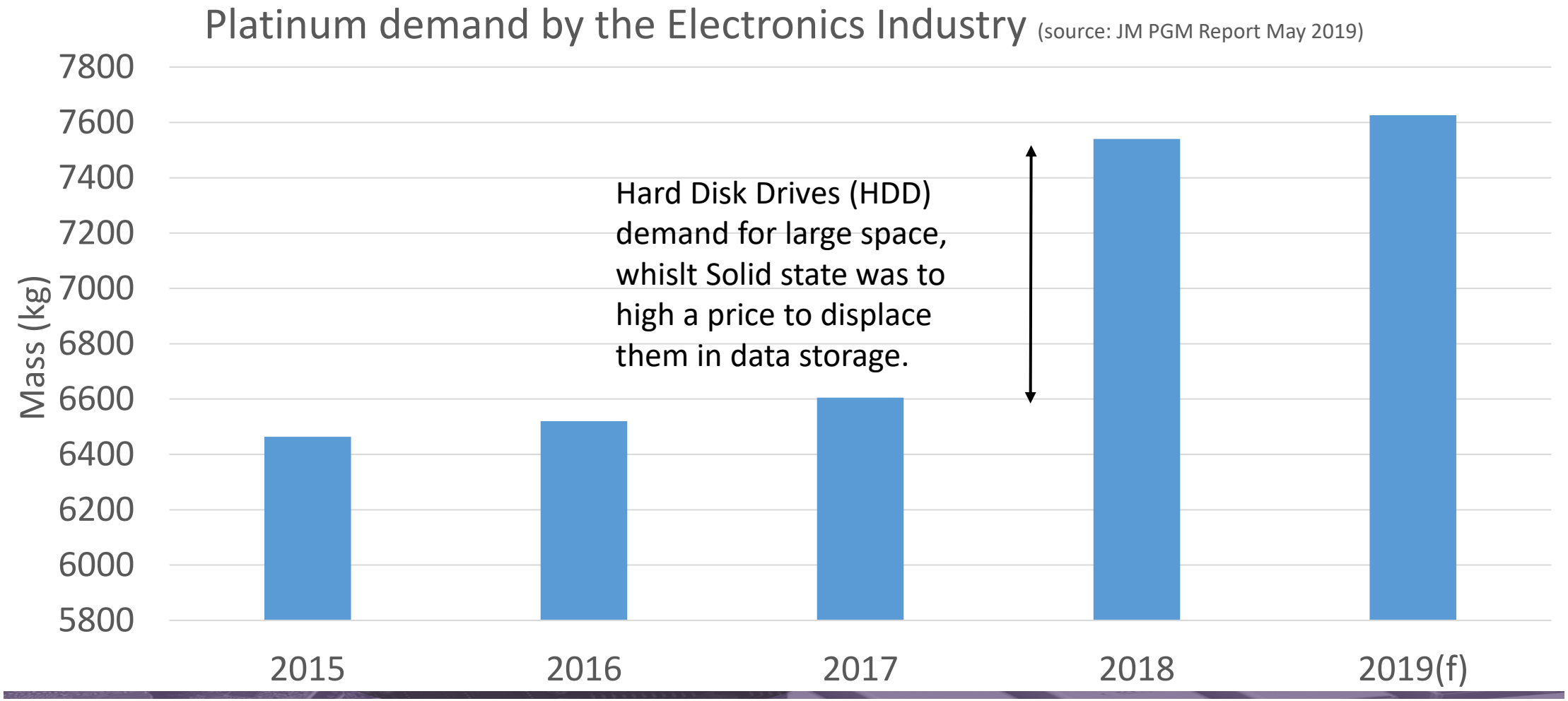
Image from Ulead Systems, Inc.



PGM usages per industry in 2010 *Source: IPA*

Image J.B. Electronics

Platinum Demand from Electronics Industry



Supply, Demand and Use of Platinum

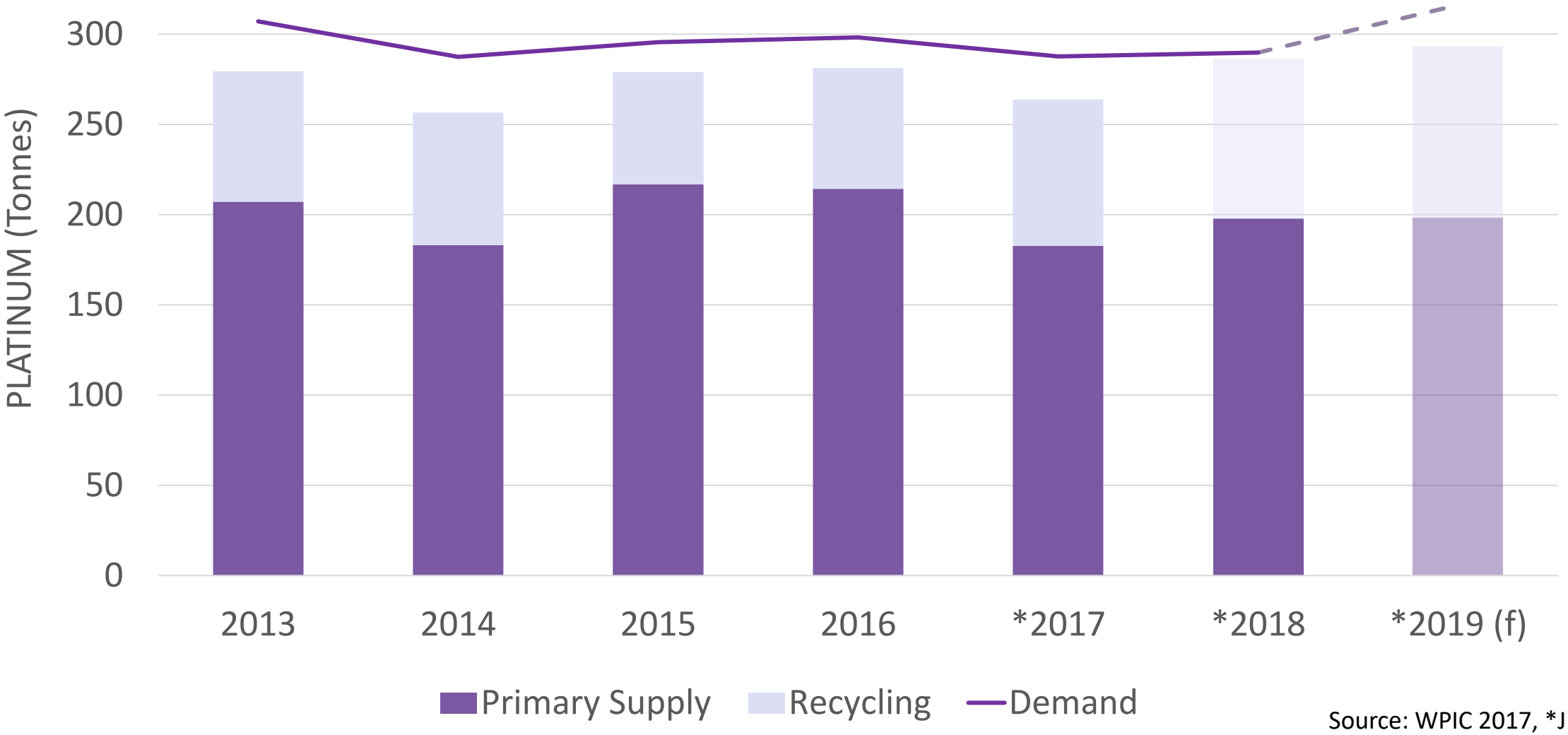
Platinum Supply & Demand (tonnes)		2014	2015	2016	*2017	*2018	*2019 (f)
SUPPLY	South Africa	99	128	122	126	127	129
	Russia	20	19	18	20	19	19
	Others	25	24	28	27	27	27
	Total Supply	**144**	**171**	**168**	**174**	**173**	**175**
DEMAND	Autocatalyst	87	91	93	92	86	89
	Jewellery	81	79	72	68	64	63
	Industrial	50	49	55	60	70	66
	Investment	8	13	14	10	2	24
	Total Gross Demand	**226**	**232**	**233**	**230**	**222**	**242**
Recycling		**-58**	**-48**	**-53**	**-68**	**-57**	**-63**
Total Net Demand		**168**	**184**	**180**	**172**	**163**	**179**
Movements in Stocks		-24	-13	-12	1	10	-4

Source: JM's PGM Report Nov 2016 + *May 2019

Platinum market remained in **deficit** in 2017

- In 2018 demand from platinum purchase by Chinese jewellery fabricators to rise.

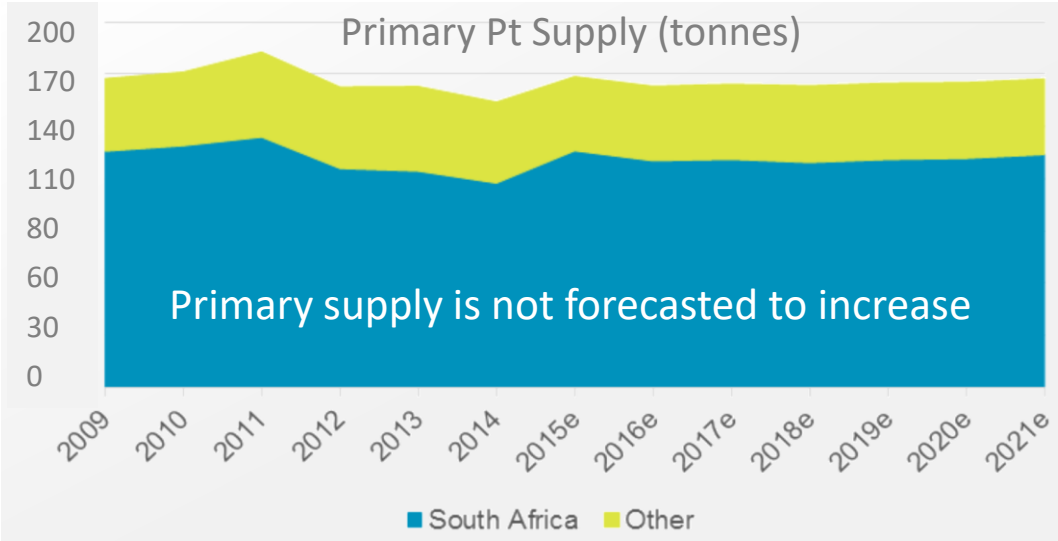
Global Supply, Demand and Use of Platinum

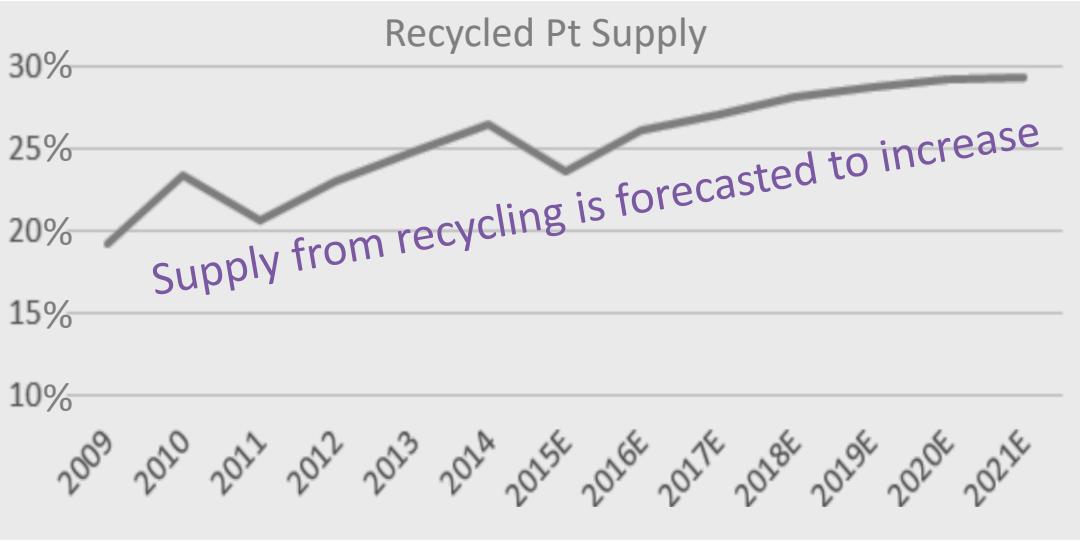


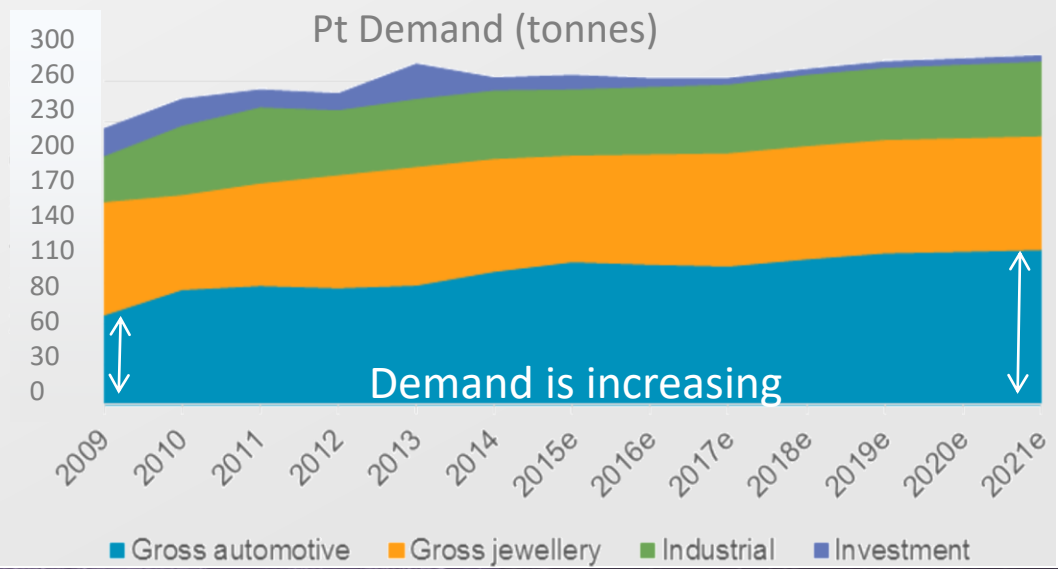
Source: WPIC 2017, *JM 2019

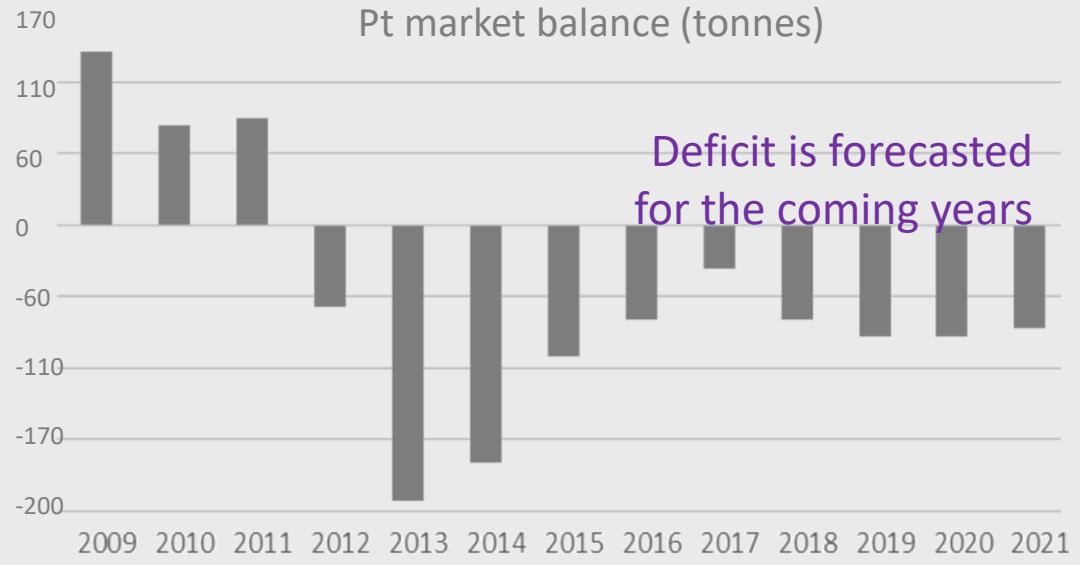
Forecast Platinum Supply and Demand

Source: Johnson Matthey, Glaux Metal , January 2016





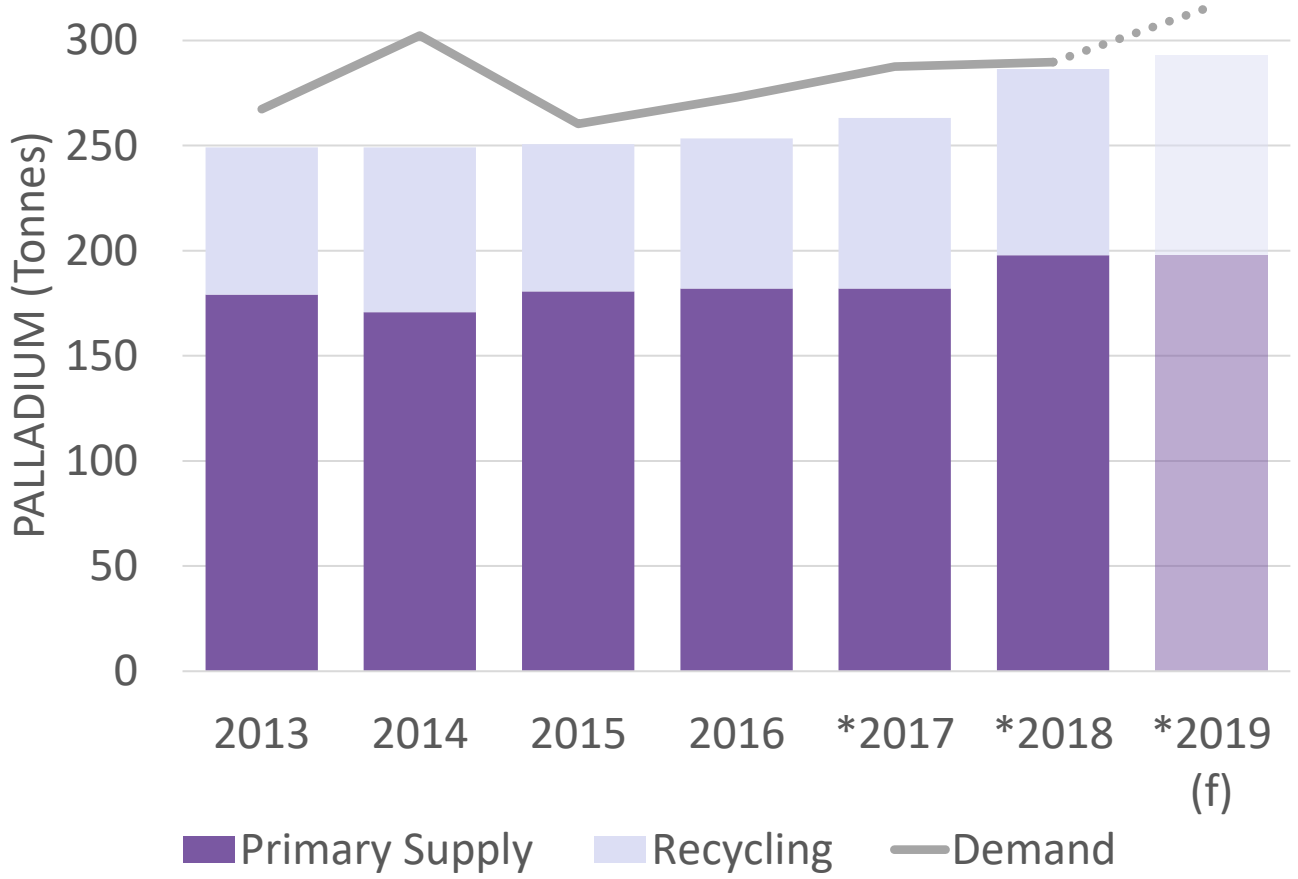




Supply, Demand and Use of Palladium

Platinum Supply & Demand (tonnes)		2014	2015	2016	*2017	*2018	*2019 (f)
SUPPLY	South Africa	60	75	72	72	72	78
	Russia	72	68	70	70	84	79
	Others	67	37	40	40	41	41
	Total Supply	**171**	**180**	**182**	**182**	**197**	**198**
DEMAND	Autocatalyst	210	214	220	242	247	269
	Jewellery	8	6	6	5	4	4
	Industrial	56	57	56	52	54	51
	Investment	26	-18	-10	-11	-16	-9
	Total Gross Demand	**300**	**259**	**271**	**288**	**290**	**316**
Recycling		**-77**	**-69**	**-71**	**-81**	**-89**	**-95**
Total Net Demand		**223**	**190**	**200**	**207**	**201**	**221**
Movements in Stocks		-52	-10	-18	-25	-3	-23

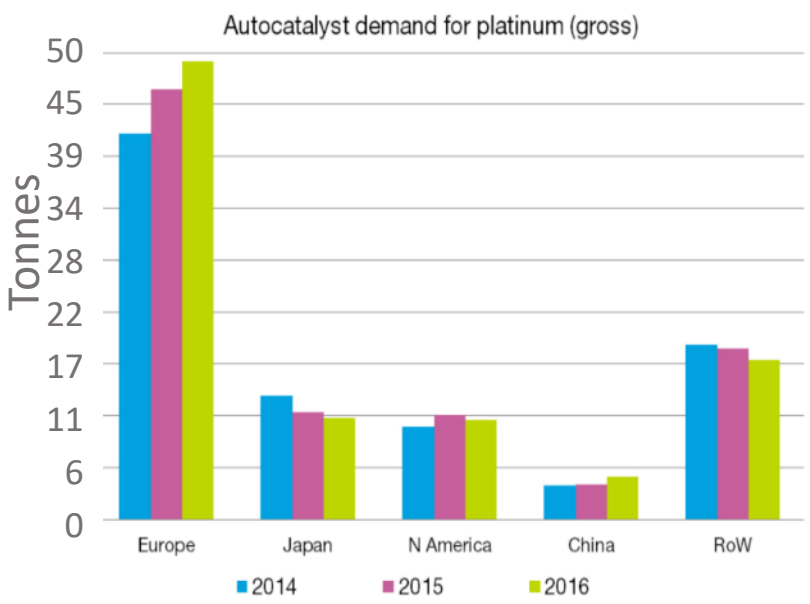
Pd electronics applications continue to be impacted by thrifting and substitution, demand falling by 6%*

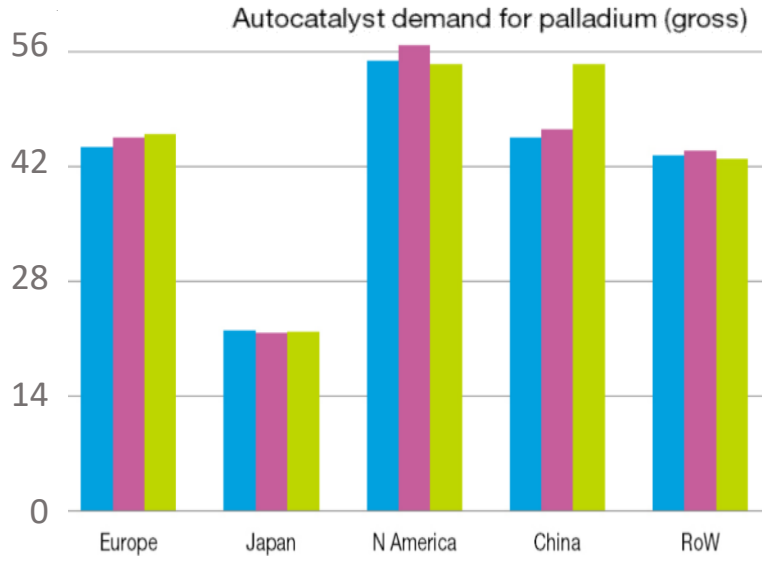


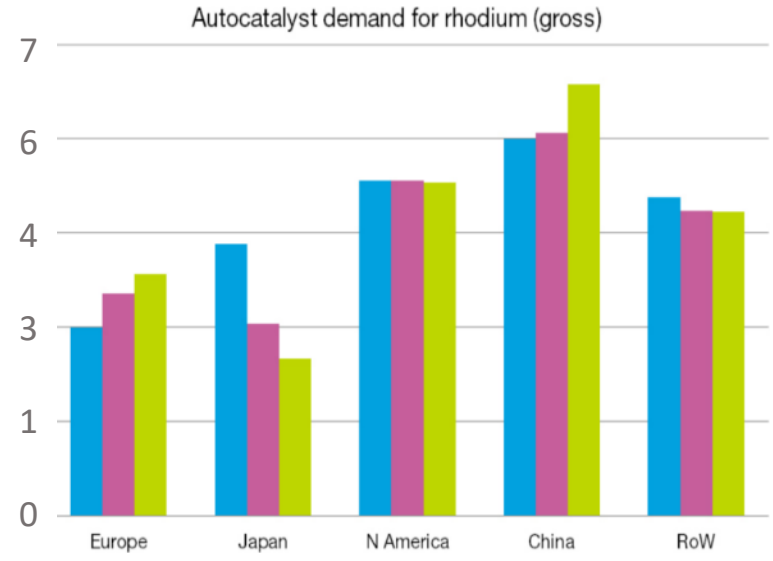
*Source: JM's report Nov 16 and *May 2019*

Importance of PGMs for the EU economy

Source: JM report November 2016







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

- Autocatalyst used ca. 41% of EU PGMs in 2014.
  EU is highest consumer of platinum and an important consumer of Pd & Rh for autocatalysts.

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:

- 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

Printed Circuit Board Metal Content	
Copper	11 - 40%
Lead	0.3 – 3%
Tin	0.3 – 2.7%
Zinc	0.3 - 3.2%
Nickel	0.05 – 0.9%
Silver	50 – 5700 ppm
Gold	10 - 1200 ppm
PGMs	3 – 50 ppm

Smelting of concentrates from Ni-Cu mining can also be a moderate source of pgms

The main primary raw material for copper smelting is $CuFeS_2$-FeS_2 concentrate that usually includes:
Ag, Au, **PGMs,** As, Sb, Bi, Mo, Ni, Pb, Se, and Te.

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

*As of April 2020 Env-Aqua Solutions Ltd is not involved in the project activities.

The PLATIRUS project

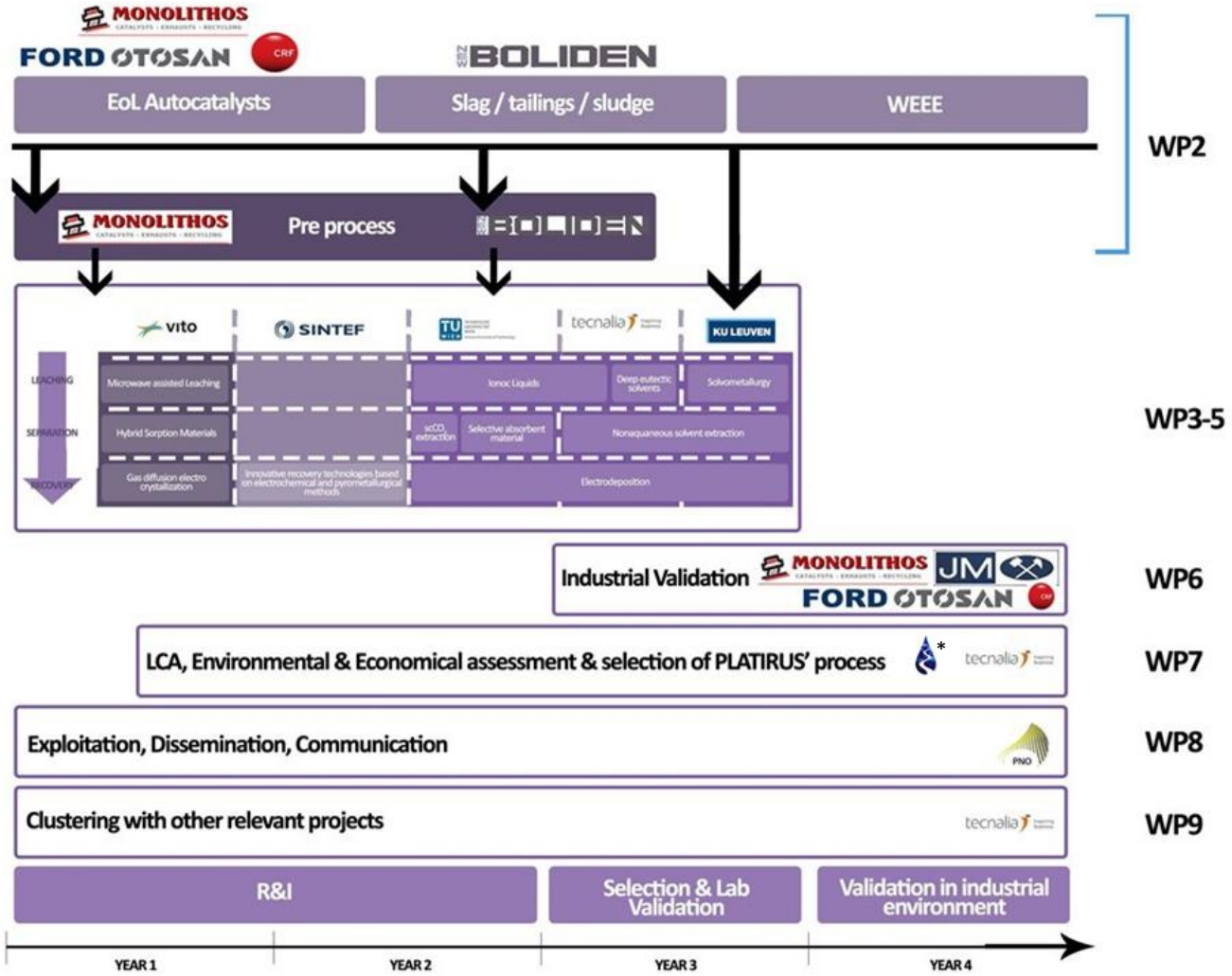
Main Activities:

- Upscaling to industrially relevant levels, novel cost-efficient and miniaturised PGMs recovery and raw material production process.
  - Decentralised for localised use
  - Minimise impact of transport (triple bottom line)

- 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



*As of April 2020 Env-Aqua Solutions Ltd is not involved in the project activities.

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 Project Contact

TECNALIA
Dr. Amal Siriwardana (Project Coordinator)
Amal.Siriwardana@tecnalia.com

Main Project Contact

TECNALIA
Dr. Amal Siriwardana (Project Coordinator)
Amal.Siriwardana@tecnalia.com

PLATIRUS is a project funded by the European Commission. This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n° 730224

Project website: www.platirus.eu