



PGMs Use in Automotive Industry and Challenges and Untapped Potentials for Secondary PGM Resources in Turkey

Platirus Exploitation Workshop 21 April 2021, online

Aidin Sheikhi – Ford Otosan

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



Outline

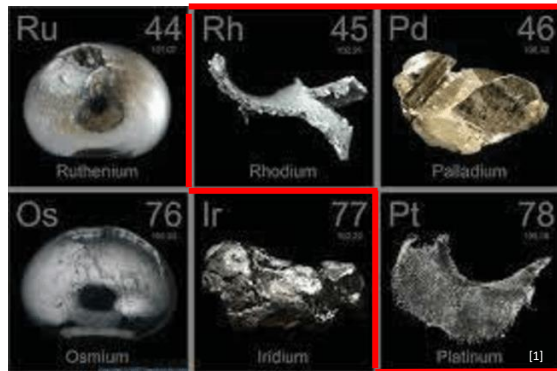
- PGMs use in Automotive Industry
- Secondary PGM resources in Turkey (Challenges and Untapped potentials)

PGMs use in Automotive Industry

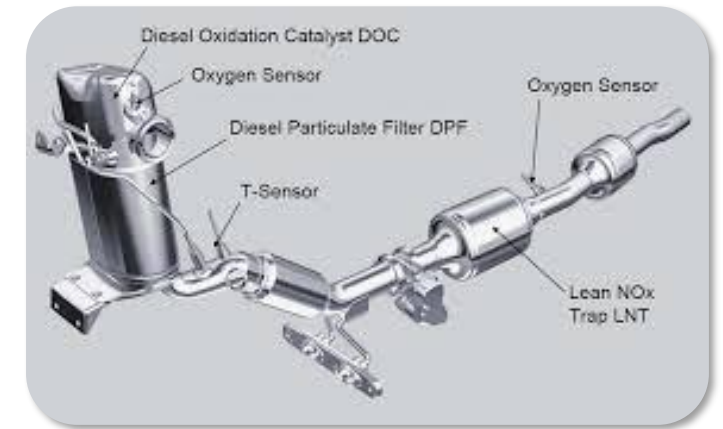
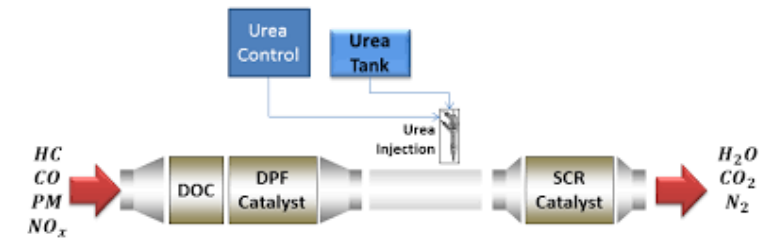
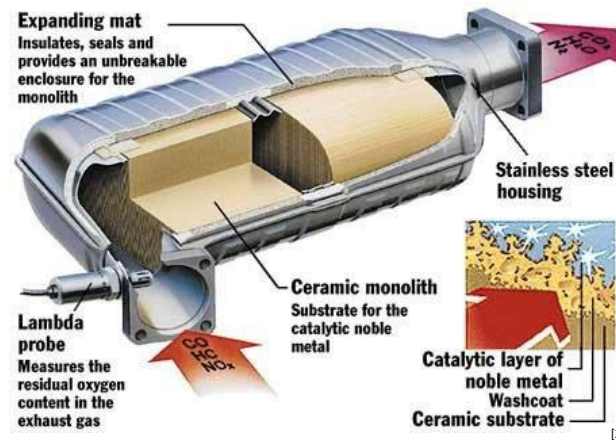
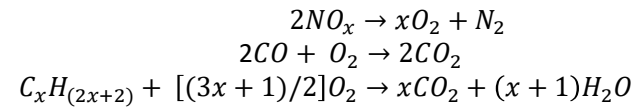
Gasoline Engine



Diesel Engine



Three Way Catalytic Converters (TWC)



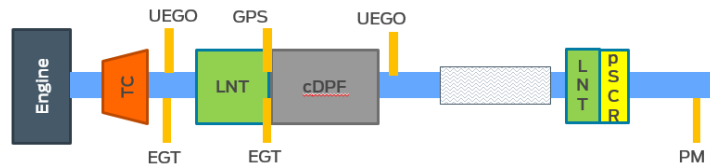
Autocatalyst demand percentage of total market demand:

- Pt: 32%
- Pd: 86%
- Rh: 92%

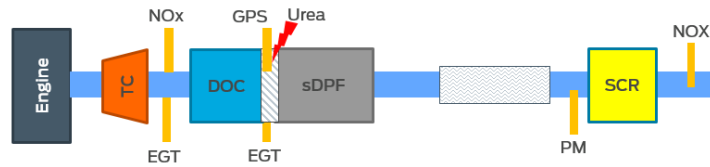
Source: Johnson Matthey – PGM market Feb 2021

[1] <https://www.researchgate.net/profile/Senem-Cabuk/publication/336305245/figure/fig1/AS:899439132676096@1591454408331/Platinum-Group-Metals-PGMs.png>
 [2] https://lh3.googleusercontent.com/proxy/J3e_9IGrCoRI_vk-LIKN548xxV267nd1jCniWMFFh22QpF3iyVF797IkqA9Eg92YwBnaaelN_2kerOKCY-9gRVV1qj-ZIHfTh_V_P6WuF5PBjMNoOu3TeE2cLUiOX56kQz1zeZH8uPBY_Oi68DrrAW6ggWGck4uPmVllaaPpSL2nKUG
 [3] https://www.fordotosan.com.tr/documents/Documents/yatirimci_iliskileri/Capture.JPG
 [4] https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRy_E96KH7Zyi2SSEdWEmGAOBK7gpg3wrSjog&usqp=CAU
 [5] <https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcT6iyC48w2r9NpjpS8SPu3Gj2L7fmN6v3xX1A&usqp=CAU>

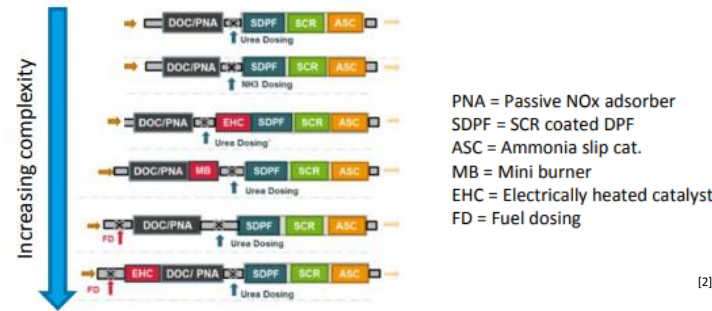
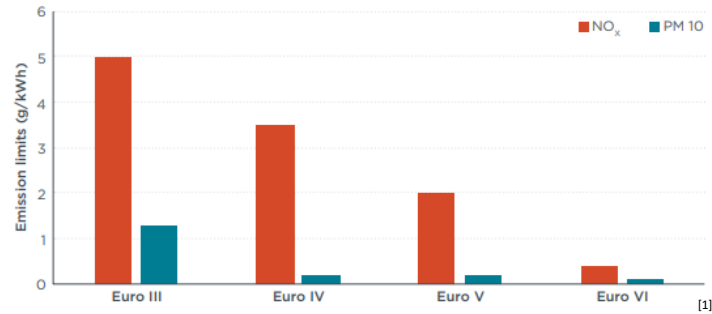
PGMs use in Automotive Industry



Component	PGM loading (g)	Ratio (Pt:Pd:Rh)
LNT	5.61	72:8:5
cDPF	0.43	1 : 0 : 0
LNT	2.87	70:7:5
SCR	N/A	N/A



Component	PGM loading (g)	Ratio (Pt:Pd:Rh)
DOC	5.24	4:1:0
sDPF	N/A	N/A
SCR	N/A	N/A

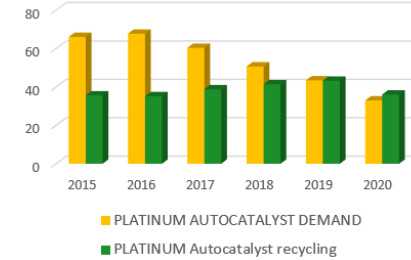


Pollutant category
G-Kat 87-90
Euro I
Euro II
Euro III
Euro IV

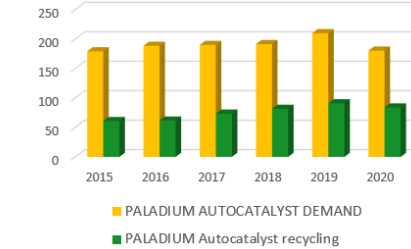
Displacement of engine (L)	Otto vehicle					Diesel vehicle	
	PGM, g/car					Displacement of engine (L)	PGM, g/car
	Pt	Pd	Rh	Total			
< 1.4	0.95	0.00	0.19	1.14	< 2		
1.4-2	1.43	0.00	0.29	1.71	> 2		
> 2	2.09	0.00	0.43	2.52	> 2		
< 1.4	0.95	0.00	0.19	1.14	< 2		
1.4-2	1.71	0.00	0.33	2.04	> 2		
> 2	2.76	0.00	0.57	3.33	> 2		
< 1.4	0.29	1.14	0.19	1.62	< 2		
1.4-2	0.38	2.00	0.29	2.66	< 2	1.43	
> 2	2.09	3.04	0.67	5.80	> 2	4.28	
< 1.4	0.10	2.47	0.29	2.85	< 2	4.09	
1.4-2	0.48	2.76	0.29	3.52	> 2	8.55	
> 2	0.57	3.71	0.67	4.94	> 2		
< 1.4	0.57	0.95	0.29	1.81	< 2	4.75	
1.4-2	0.67	2.85	0.48	3.99	> 2	8.55	
> 2	0.48	4.75	0.67	5.89	> 2		

[3]

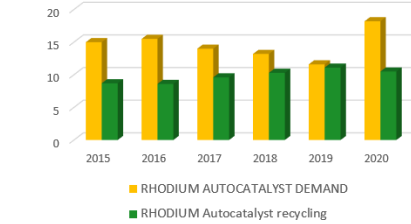
PLATINUM Demand & Recycling [Tonnes]



PALADIUM Demand & Recycling [Tonnes]



RHODIUM Demand & Recycling [Tonnes]



[1] https://www.ccacoalition.org/sites/default/files/resources/50-ppm-sulfur-impacts-04_2020.pdf

[2] <https://pdfs.semanticscholar.org/5c88/88a3b59606c854b111fcc67a2f3dd0a5811.pdf>

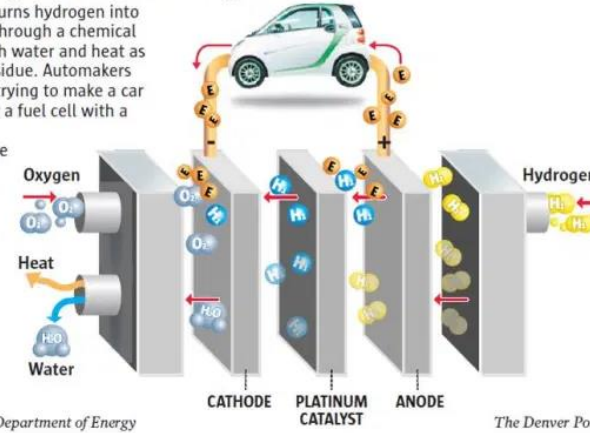
[3] https://www.researchgate.net/publication/270455068_Potential_of_a_Hydrometallurgical_Recycling_Process_for_Catalysts_to_Cover_the_Demand_for_Critical_Metals_Like_PGMs_and_Cerium/link/5a8d319ca6fdcc786eb06661/download

PGMs use in Automotive Industry



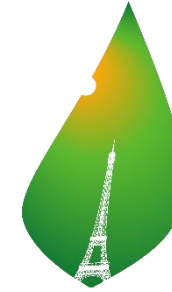
Powering a car with a real gas

A fuel cell turns hydrogen into electricity through a chemical process with water and heat as the only residue. Automakers have been trying to make a car powered by a fuel cell with a 300-mile range before needing a hydrogen fill-up.

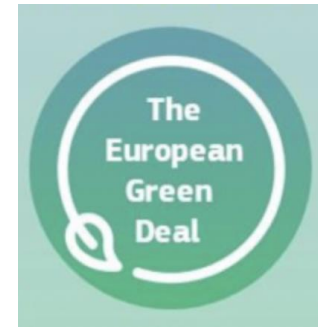


Source: U.S. Department of Energy

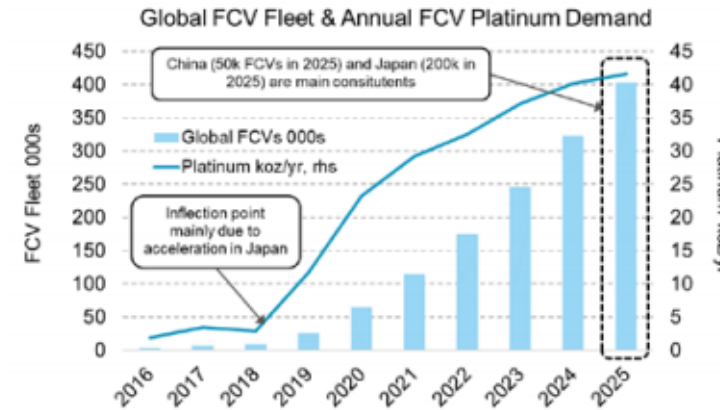
The Denver Post



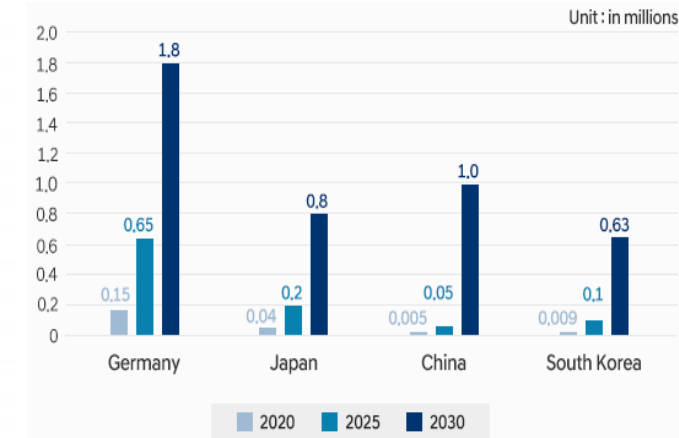
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11



Platinum impact of identifiable FCV programs should become significant in a few years

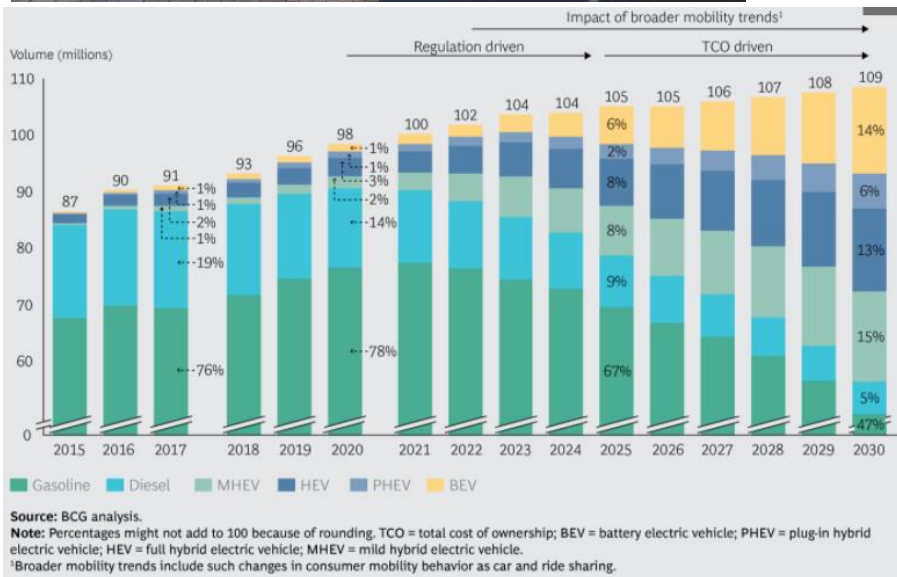


Note: Fuel cell electric vehicle numbers are for total on-road fleet (cumulative); Source: WPIC Research.



FCEV deployment plans by key countries

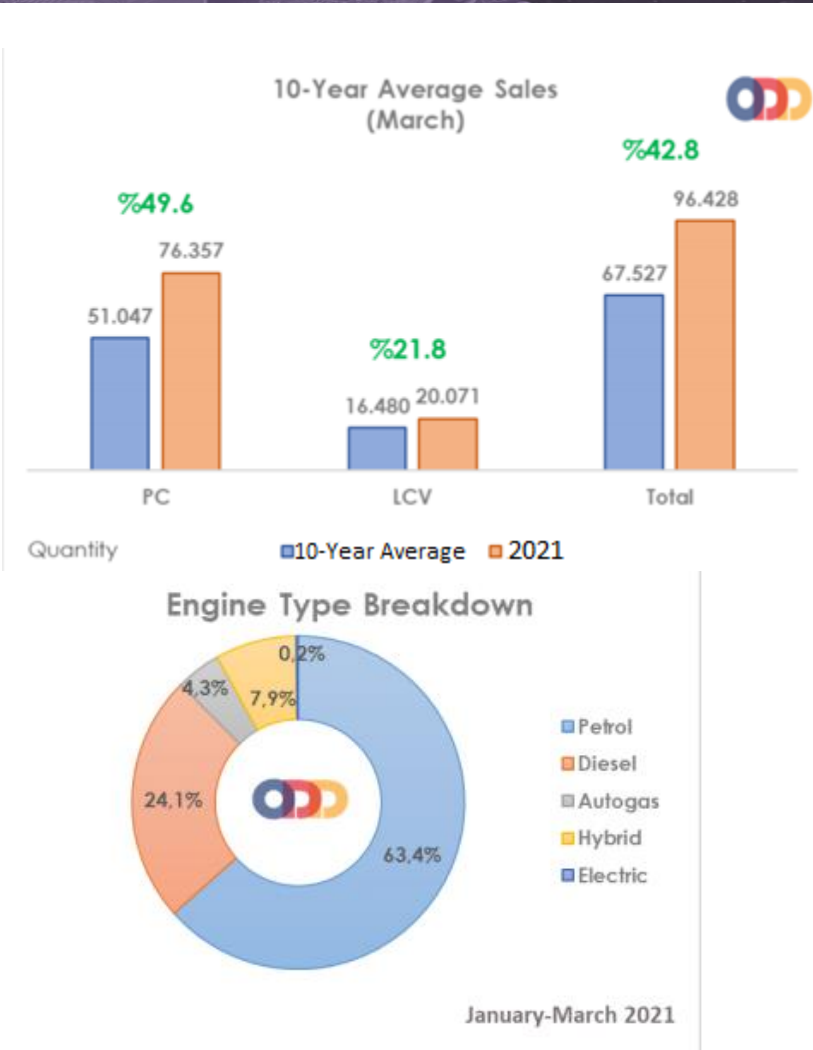
<https://news.hyundaimotorgroup.com/Article/FCEV-Green-and-Zero-Emissions>



Source: BCG analysis.
Note: Percentages might not add to 100 because of rounding. TCO = total cost of ownership; BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle; HEV = full hybrid electric vehicle; MHEV = mild hybrid electric vehicle.
1 Broader mobility trends include such changes in consumer mobility behavior as car and ride sharing.

[1] <https://electriccarsreport.com/wp-content/uploads/2019/09/Ford-Transit-Custom-Plug-in-Hybrid.jpg?559188&559188>
 [2] <https://hips.hearstapps.com/hmg-prod.s3.amazonaws.com/images/2021-mustang-mach-e-01-1598915272.jpg>
 [3] [https://cdn.vox-cdn.com/thumbor/ZpM89niqV9dw8LNP2Ql4q7XZ4MY=/0x0:6440x4197/1200x0/filters:focal\(0x0:6440x4197\):no_upscale\(\)/cdn.vox-cdn.com/uploads/chorus_asset/file/22030273/All_New_Ford_E_Transit_06.jpg](https://cdn.vox-cdn.com/thumbor/ZpM89niqV9dw8LNP2Ql4q7XZ4MY=/0x0:6440x4197/1200x0/filters:focal(0x0:6440x4197):no_upscale()/cdn.vox-cdn.com/uploads/chorus_asset/file/22030273/All_New_Ford_E_Transit_06.jpg)
 [4] <https://thedriven.io/wp-content/uploads/2018/09/ford-f-vision-semi-2.jpg>

Secondary PGM resources in Turkey (Challenges and Untapped potentials)



sahibinden.com Kellime, ilan no veya mağaza adı ile ara Detaylı Arama

Yedek Parça, Akses... Otomotiv Ekipmanları Yedek Parça Otomobil & Arazi Ar... Egzoz

W204 C Kasa Komple Egzoz

550 TL

İstanbul / Maltepe / Bağlarbaşı Mh.

İlan No	916921499
İlan Tarihi	07 Nisan 2021
Kategori	Yedek Parça
Tipi	Otomobil & Arazi Aracı
Ürün	Egzoz Komple
Araç Markası	Mercedes
Araç Serisi	C
Ürün Markası	Fabrikasyon
Kimden	Mağazadan
Çıkma Yedek Parça	Evet
Takas	Hayır
Durumu	İkinci El

İlan ile ilgili Şikayetim Var

- Social awareness about the value of PGMs in autocatalysts is increased
- There are lots of small businesses dealing with collecting autocatalysts.
- There are many companies dealing with recycling PGMs.
- The existing refinery systems are expensive and require large space.
- There is no transparency with regards to EoL autocatalysts prices.

[1] <https://lh3.googleusercontent.com/proxy/k9-fx4eedQx9TjvMPfUPROHx2TWPQvFNPau6iMBI8Gg7x3f8C2WmrBWTaunGsmttcbwB54X6ns1cV9Uu5CoEhMxfrOUGjBenXDvEiYHsgvXEncnJlkQ1AfkoouDedX43IMoLcl50Qzw>

Conclusions

- Catalytic converters are the most important secondary PGM resources
- FCEVs will be the future alternative for secondary PGM resources
- There is a great potential for secondary PGM resources in Turkey since it has a large automotive market
- PGM refining systems should be improved in order to be more obtainable by small businesses
- EoL autocatalyst market monitoring should be more organized

Main Contact

FORD OTOSAN

Aidin Sheikhi

Email: asheikhi@ford.com.tr

Project website: www.platirus.eu



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