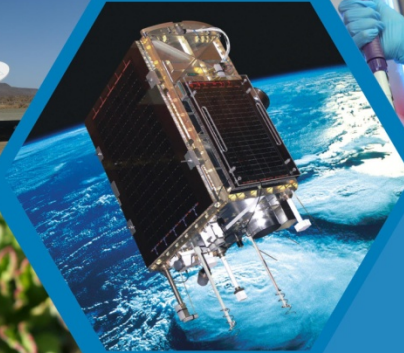


The Hydrogen Economy & Platinum: An SA Perspective



Presenter: C Chiteme
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Fukuoka
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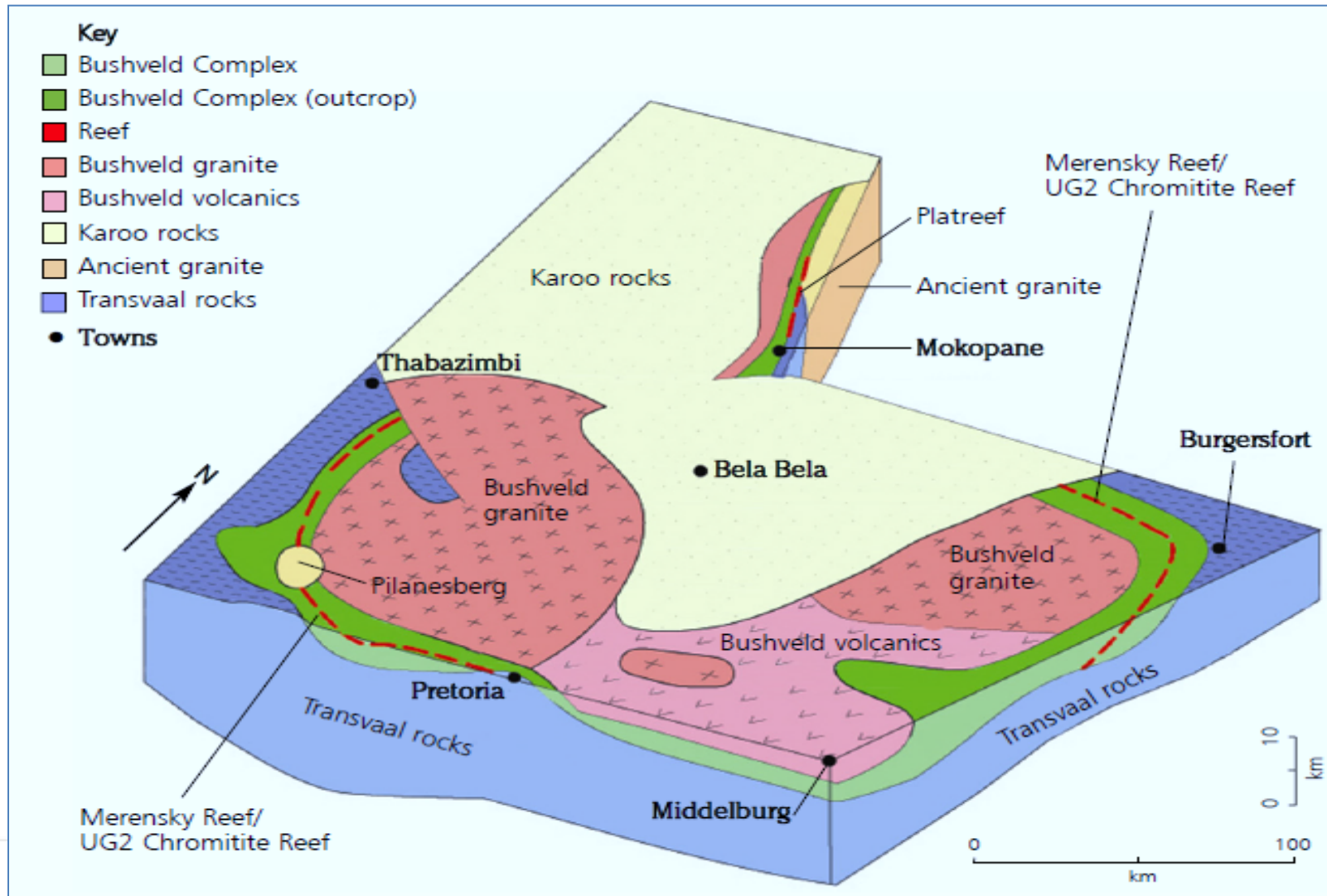
Hydrogen South Africa (HySA) Update

- A six member Advisory Board (AB) consisting of three international experts and three locals was inaugurated
- The AB will give strategic advice to the DST on the HySA RDI programme
- An inter departmental task team is overseeing a rural electrification project in partnership with Anglo American Platinum, Ballard and Air Products in demonstrating the use of fuel cells for mini grid applications
- An independent review panel consisting of local and international experts is being constituted to conduct a five year review of the HySA programme
- Collaboration with local organisations (think-tanks) in organising conferences on mineral beneficiation has led to the development of valuable resource material and increasing awareness of HFCT
- HySA centres of competence continue to develop some key components within the fuel cell value chain in collaboration with local and international partners.



South African Platinum Reserves

South African Bushveld Complex



Oblique view from the southeast of the BC: Cawthorn 2010



SA Platinum Reserves

- *“There are enough platinum group element deposits in the Bushveld Complex in South Africa to supply world demands for many decades or even a century using current mining techniques”.*
- *“For each 1 km of depth into the Earth in the Bushveld Complex, there is in the order of 350 million oz (10,885 tons) of platinum. For comparison, annual production of platinum from the Bushveld Complex currently is only around 5 million oz (155.5 tons)” -Cawthorn 2010.*

South African Mineral Codes (SAMCODES)¹ I

- Mining companies may only publish ‘reserves’ and ‘resources’ of Platinum that has been rigorously quantified in the short to medium term mining plans.
- A mineral reserve is an ore body for which adequate information exists to permit confident extraction. Information pertains to:
 - *Drilling*
 - *Assaying*
 - *Mineralogical & metallurgical studies*
 - *Mine planning*
 - *Beneficiation*
 - *Environmental*
 - *Social and legislative issues*
 - *Financial viability*
- Mining companies typically plan their exploration and evaluation strategies such that they have a minimum of ten years of ore as reserves.
- A mineral ‘resource’ is an ore body for which there are reasonable and realistic prospects for eventual extraction
- No mining company is likely to incur major expense in exploration beyond the combined time period of their reserves and resources of about twenty years. ¹ www.samcode.co.za



Cawthorn 2010 report

- Cawthorn (2010) reported that confirmed PGM reserves from the SA mining companies under CRIRSCO codes (SAMREC, Jorc, et al) stood at 250 million ounces (7,776 tons) in 2009 and resources at 1072 million ounces (33,342 tons)
- Estimates of PGM reserves in the BC are critically dependent on views on the maximum depth for economic mining
- A depth-dependent estimation for the Merensky and UG2 reefs of 350 million ounces (10,886 tons) for each kilometre of depth excludes the Platreef and other PGM containing chromitite layers
- Assuming a 3km depth cut-off and that about half the reserves in the first kilometre have already been mined, the Merensky and UG2 reserves would be in the order of 875Moz (27,212 tons).
- The Platreef resources (northern Limb) are more difficult to determine due to greater variation in reef thickness (50-100m) and PGM grades. These PGM resources have been estimated at around 300Moz for opencast mining (500-800m), but reserves are known to continue to over 2km in depth
- Total PGM resources that could eventually be mined from the Merensky, the UG2 (to 3km), the Platreef (OC) and the higher PGM chromitite seams (to 3km) are in the order of 2,000Moz or about 62,000t (125 years of current global demand of ~16Moz).

South Africa & the Global Hydrogen Economy

- South Africa regards the PGM industry as an asset of National Strategic importance
- South Africa is committed to being a global player in HFCT
- It is in South Africa's interest to ensure adequate supply of PGMs to the global community
- Advances in recycling will ensure that a significant amount of the original platinum metal is kept in circulation
- There are adequate reserves of PGMs for mining to continue and make an impact on the South African Economy
- South African government and the Mining companies are committed to addressing social issues associated with the sector.

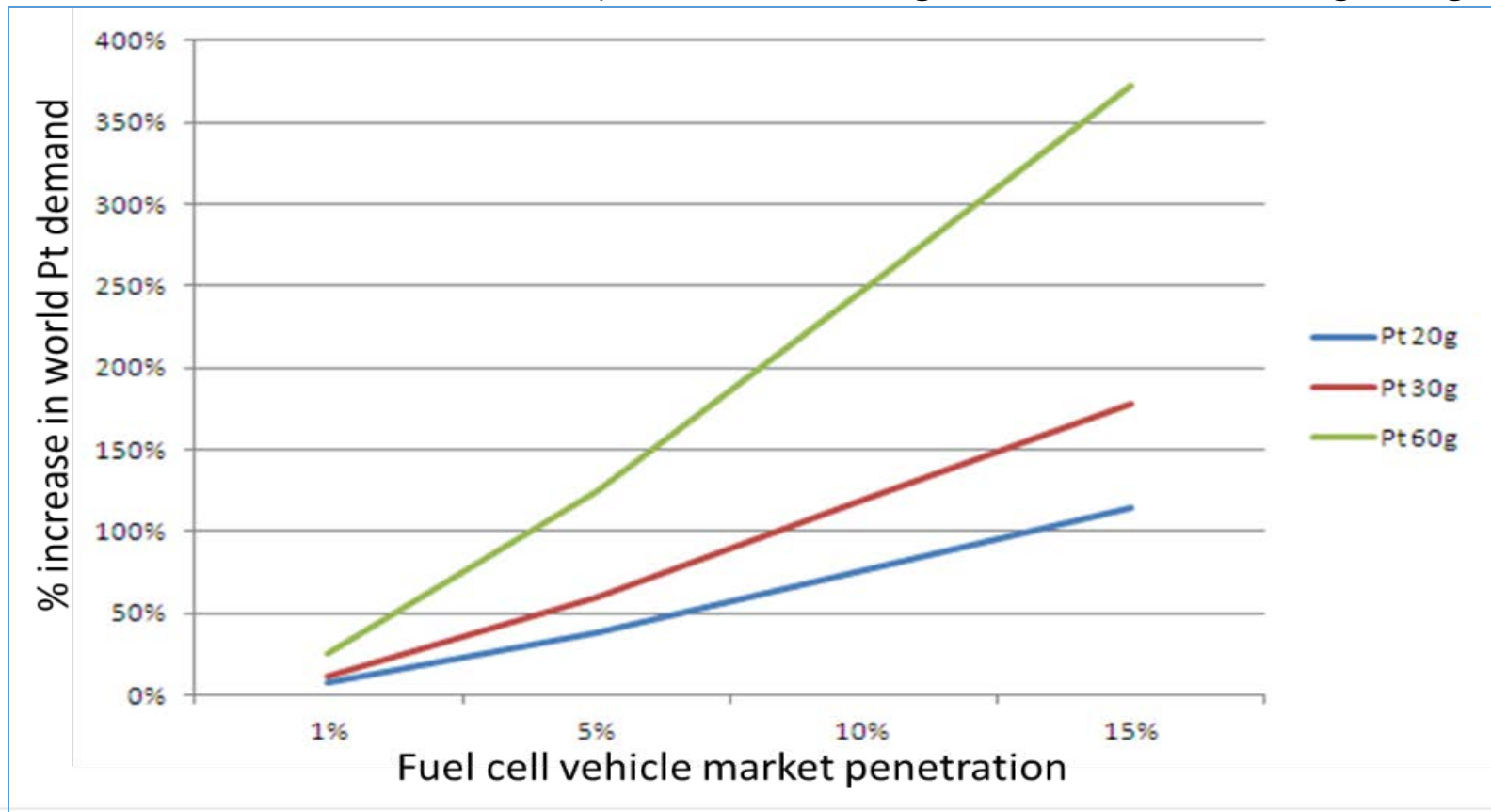
South Africa & the Global Hydrogen Economy

Estimation of Pt availability to meet demand from large scale deployment of FCV is dependent on:

- Time horizon of the projection
- Assumptions made in the projections
- Advances in technology both in FCV, EV & ICE
- Viability of mining of the ore. At high input costs, mining of the ore is going to be increasingly difficult
- Advances in recycling-It is estimated that there is 3 000t of Pt in autocatalysts. With lower input costs in recycling, the output is estimated at 2kg Pt/tonne of autocats.

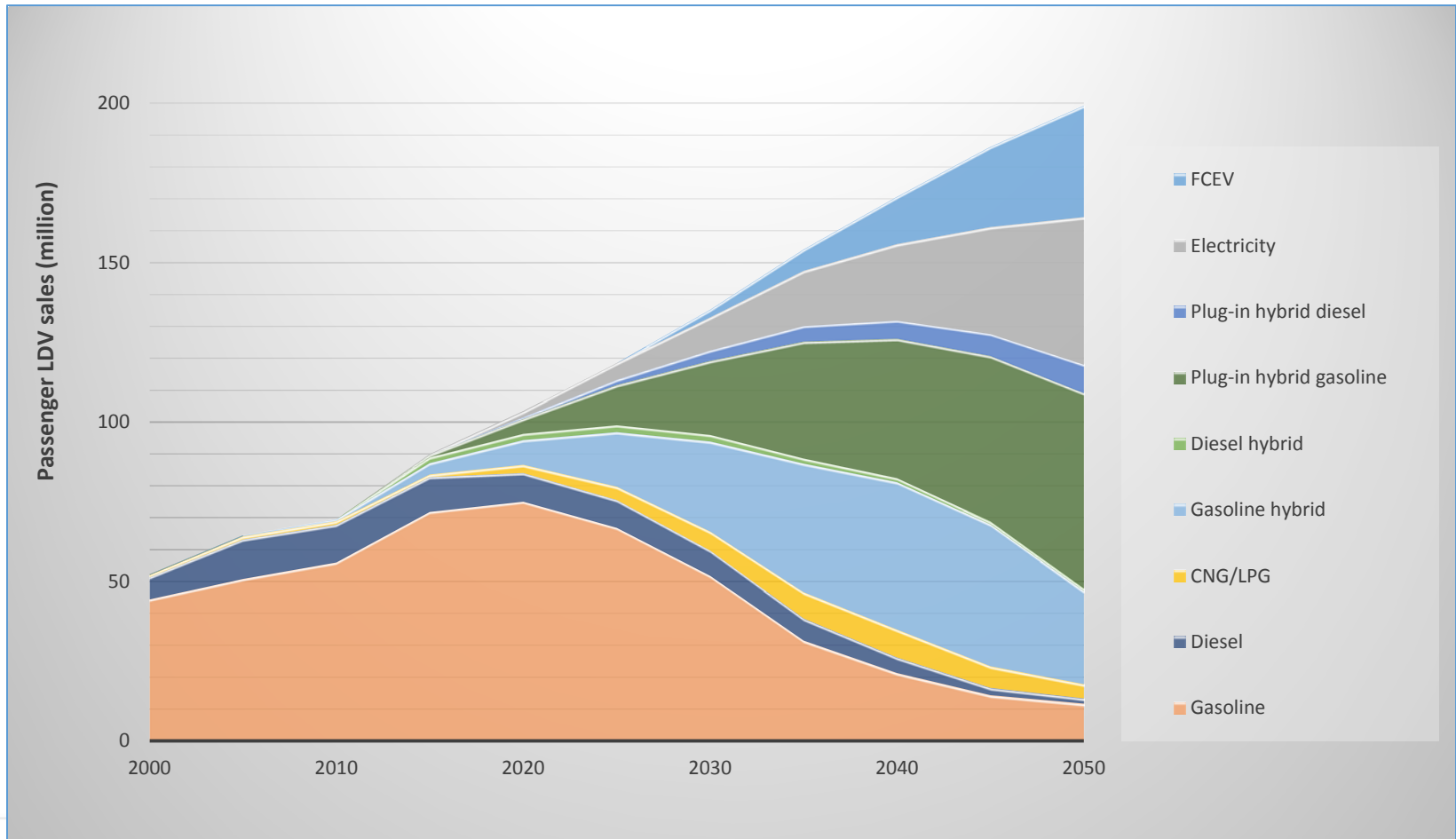
FCV Market Penetration

- A 1% penetration of fuel cells into the new vehicle market \cong a 10% increase in Pt demand at ~25g/vehicle (50kW vehicle), which is considered to be economic (current loadings are in the 50-60g range).



FCEV Projected Market Share

- IEA projection of 25% FCEVs by 2050 would equate to a 250% increase in Pt demand.





Concluding Remarks

- Transition to FCEV will not happen overnight but will be gradual:
 - Typical of disruptive technologies
 - Efforts will continue to improve the efficiency of ICE
 - Penetration of FCV will be lower at high platinum loading
 - Lower platinum loadings will lead to higher penetration but has not been realised yet
 - Competition from electric vehicles
- Absence of international regulations and standards to support large scale deployment leads to lower penetration rates
- Increased demand for platinum at the perceived penetration rates can be met through a combination of mining and recycling of the metal.



Thank you

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