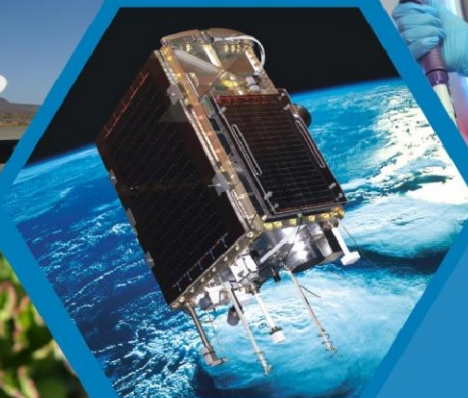


Fuel Cell Developments in South Africa: Towards building a local Hydrogen Fuel Cell Supply Chain



Presenter: Cosmas Chiteme

**Occasion: IPHE Workshop on Fuel Cell
Backup Power for Telecoms
Base Stations, Wuhan**

Date: 29 May 2015



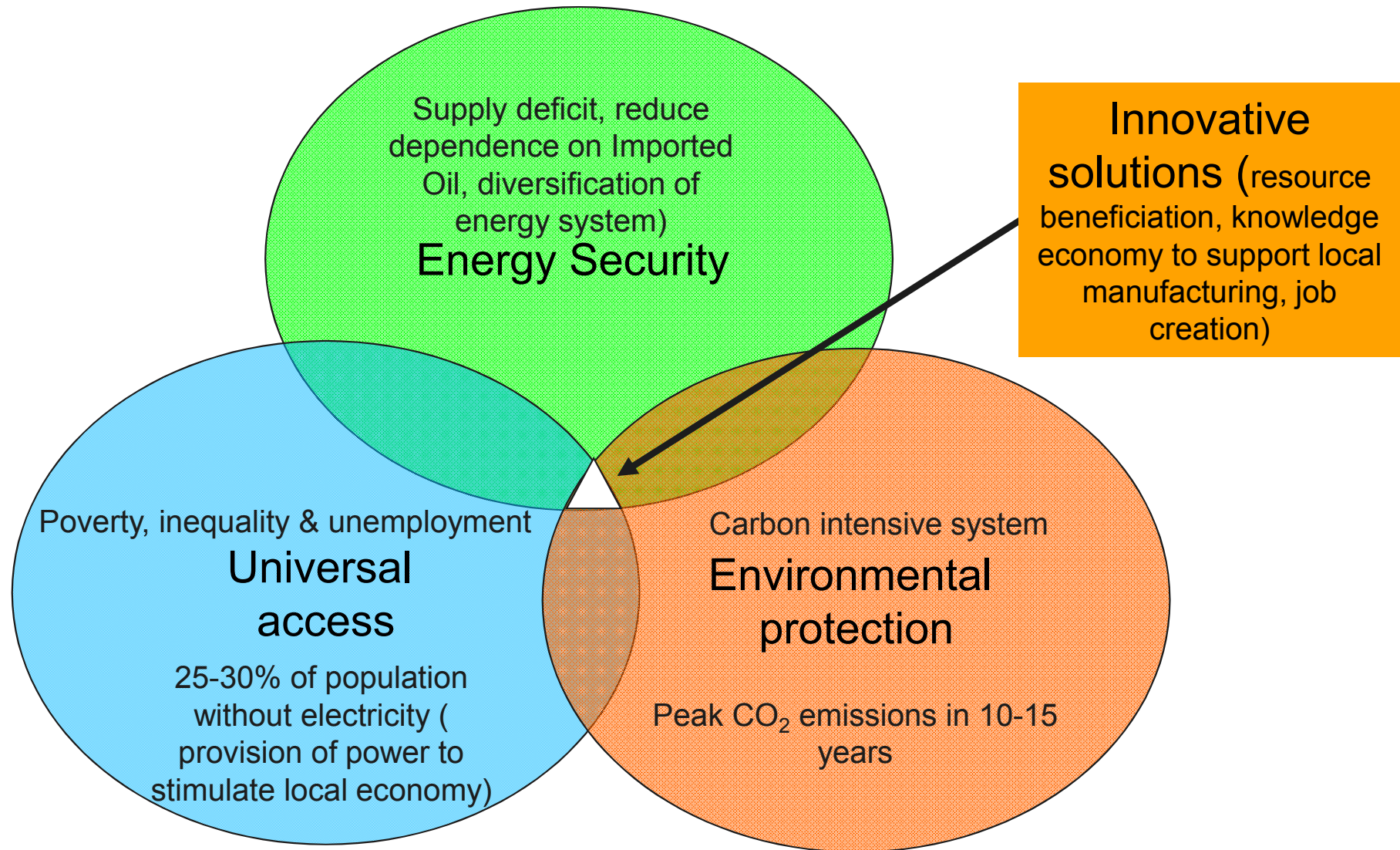
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- ▶ Background on Hydrogen South Africa (HySA)
- ▶ Application areas
- ▶ Challenges
- ▶ Industry Collaborations
- ▶ Concluding Remarks

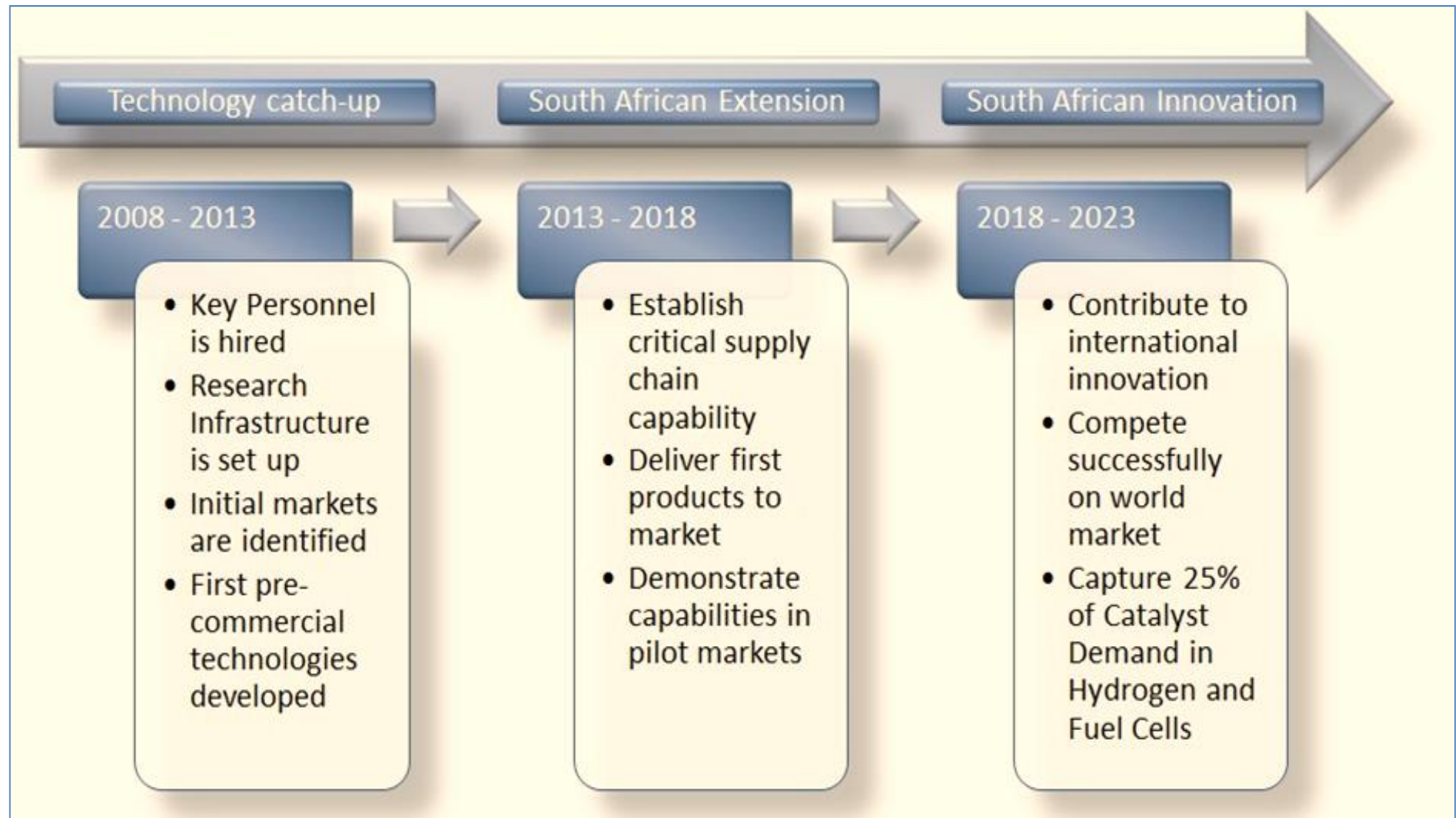


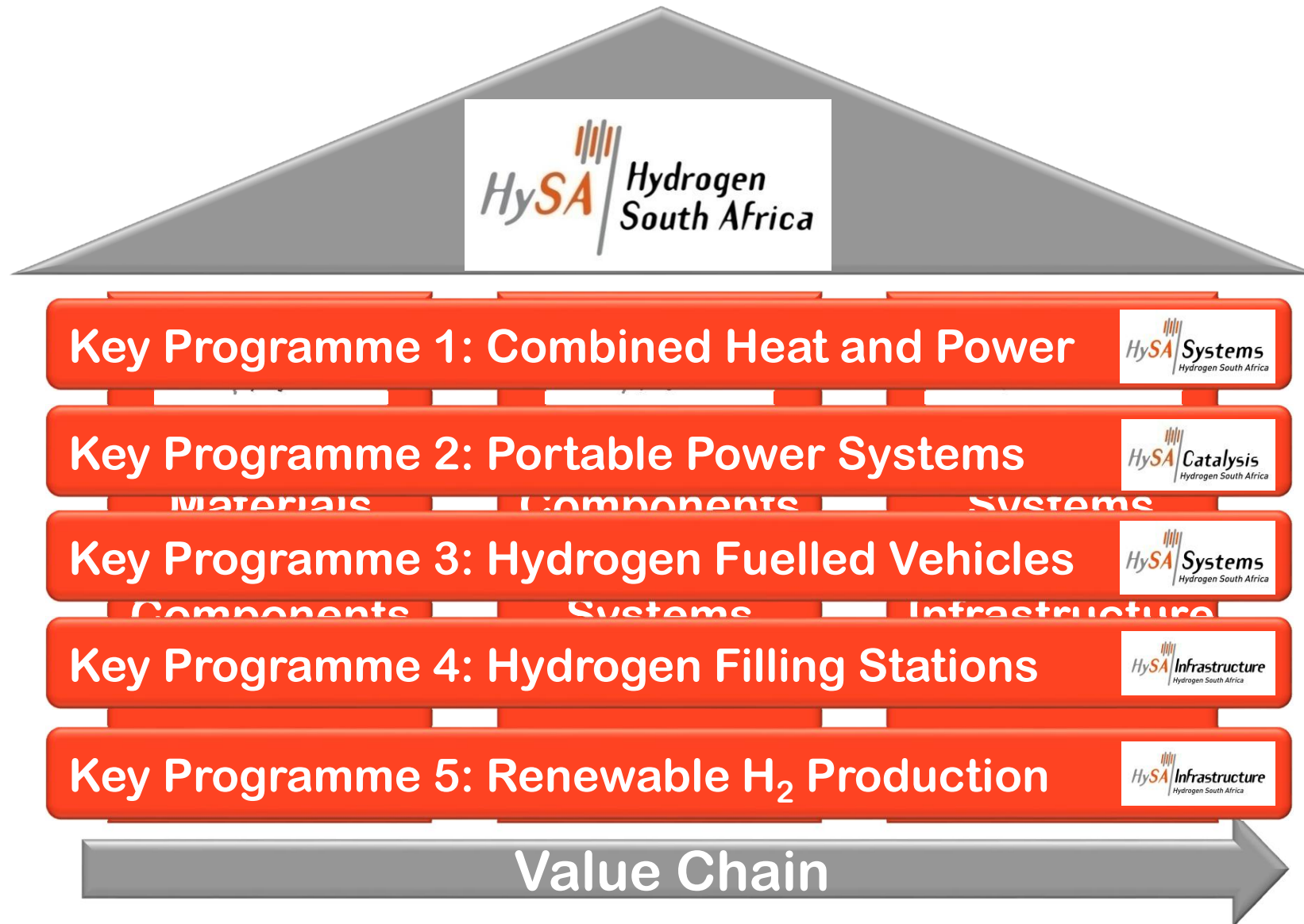
Key Drivers for investing in Alternative Energy



- ▶ Develop local cost competitive hydrogen generation solutions based on renewable resources
- ▶ Wealth Creation through value added manufacturing of PGM catalysis with a goal of supplying 25% of PGM catalysts demand by 2020
- ▶ Promote equity and inclusion in the economic benefits of South Africa's resources
- ▶ Strong focus on Human Capital Development







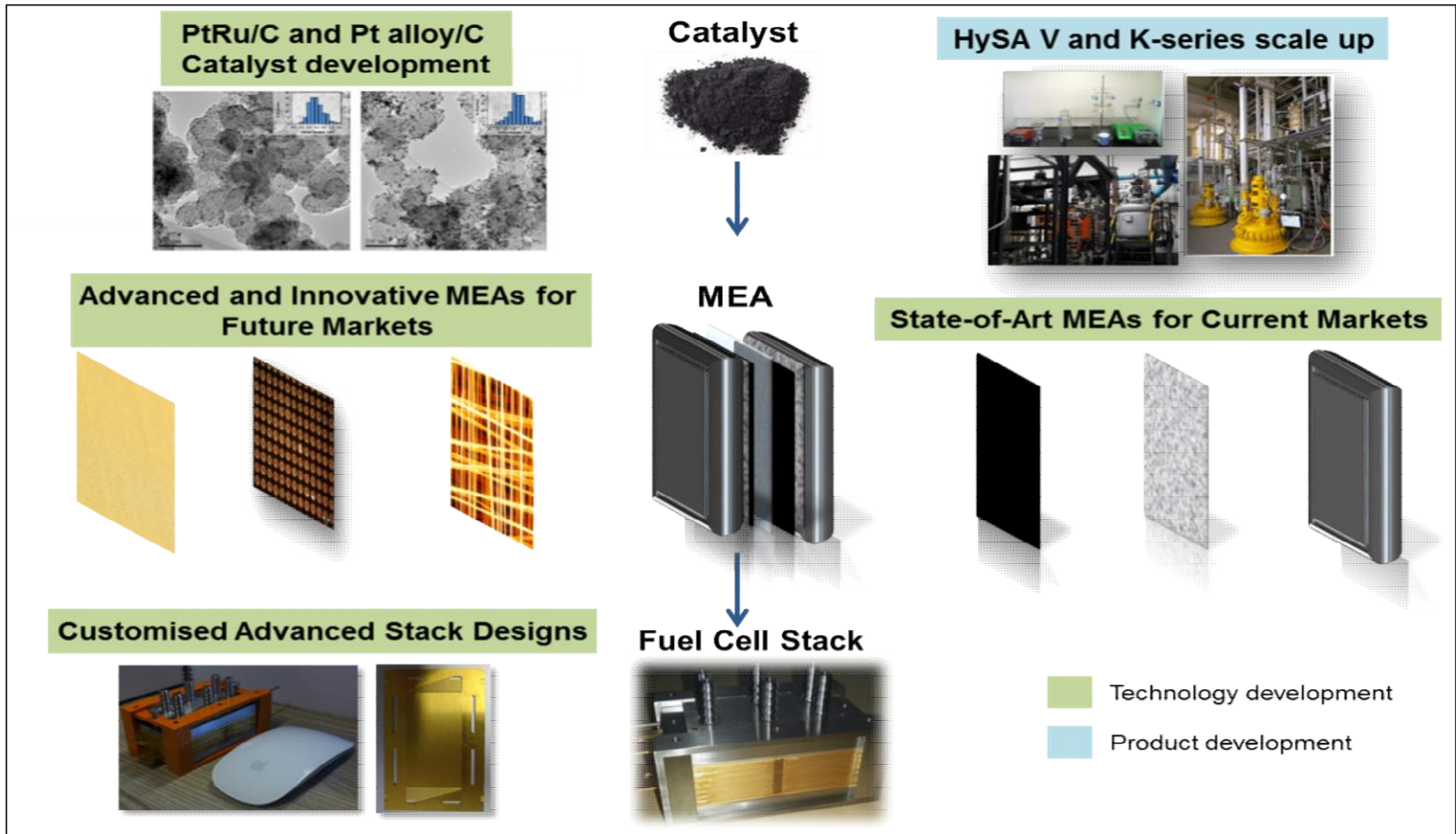
Gen 2 Solar-to-Hydrogen Plant. H₂ is available for local use.

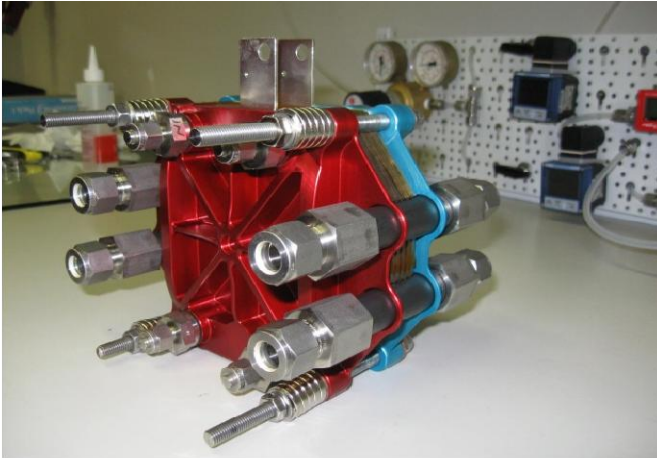
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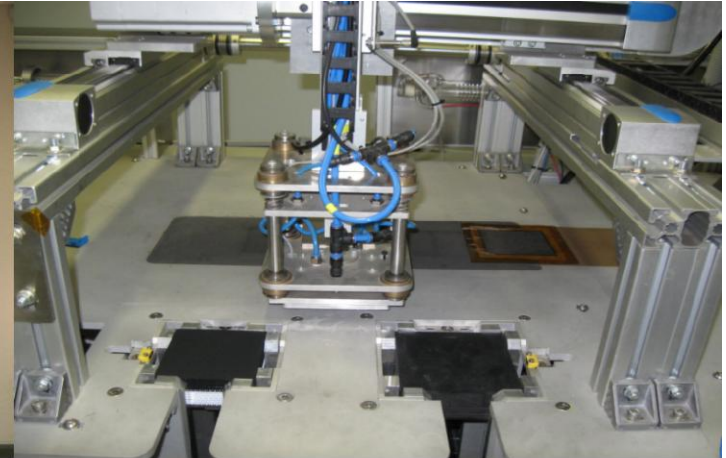




PEM fuel stack (HT)



Bipolar Plates



MEA pilot manufacturing line



Hydrogen storage material



Fuel cell powered forklift



Hydrogen Fuel cell Generator

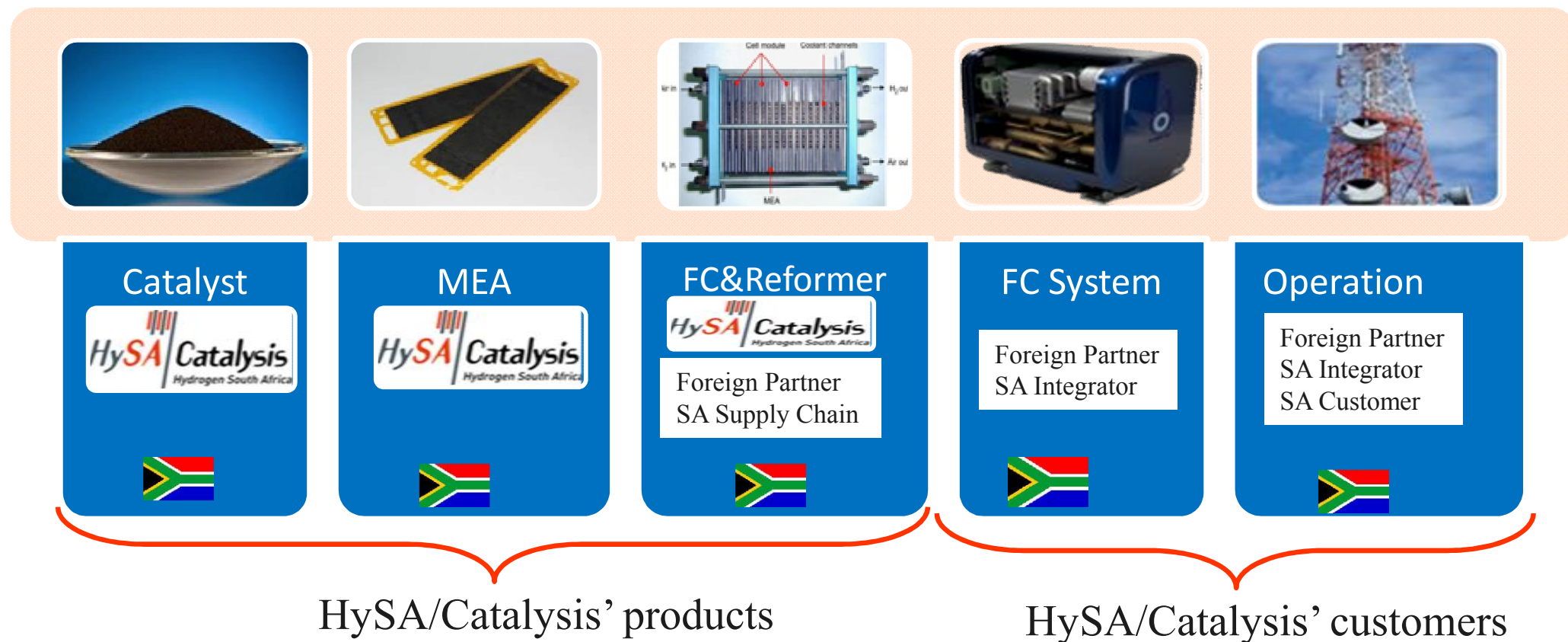


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- ▶ Distributed power generation
- ▶ Backup or primary power for rural schools and clinics
- ▶ Mining Applications
- ▶ Telecoms back up power (Estimated 2MW methanol based fuel cell installations so far in the telcos)





- HySA/Catalysis
 - Develops products in early part of value chain
 - Works with partners higher up the value chain to understand requirements
 - Delivers catalysts and/or MEA and/or fuel cell stack to customer

Advantages	Disadvantages
Fuel Cell System	
No emissions	Cost of bottled H ₂ very expensive ¹
High efficiency	Transportation logistics of H ₂ to and from site a limiting factor
Low noise operation	High cost per kWh for operation ¹
Low maintenance	
Not dependant on sunlight or grid power	
Diesel Generator System	
Low capital cost	Higher carbon emissions (5676 kg CO ₂ pa for a 2.5kW system)
Compact in size	Noisy >75dB during operation and poses a health risk to people
Liquid fuel with high energy Density	Efficiency dependent on load
	Voltage regulation not as good as inverter solutions
	Requires regular service intervention every 250 to 300hrs of operation or monthly if not operated
	Service life of 500 to 2000hrs
	Risk of theft of generator and fuel

¹Challenges still exist around the hydrogen distribution logistics in South Africa



- ▶ Challenges around fuel quality especially during refuelling on site – effective sealing needs to be developed to avoid fuel exposure to contaminants
- ▶ Diesel reforming-high temperature required during reforming needs the reformer to be kept warm and therefore leads to high parasitic power
- ▶ Presenting a good business case where fuel cell back up power is competitive against diesel generator with the current hydrogen distribution model
- ▶ A cost effective high pressure on site hydrogen refuelling system could change the economics but requires high initial capital investment.



Project Description	Fuel Cell type and Size (kW)	Project Partners
Fuel Cell Mini grid providing primary power to 34 homes in Kroonstad in Free State	3 x 5 kW (15 kW) methanol based fuel cells	Anglo Platinum and Ballard Power Systems, Other local companies involved in assembly and system integration and maintenance
Hydrogen fuel cells deployed to provide back up power to ICT equipment in three rural schools in Cofimvaba in Eastern Cape	3 x 5 kW hydrogen fuel cell	Department of Science and Technology (DST), Anglo Platinum, Clean Energy, Air Products
Hydrogen fuel cell deployed to provide back up power to vaccine fridges at a clinic in Johannesburg	5kW hydrogen fuel cell	DST, Anglo Platinum, Clean Energy, Powertech System Integrators, Air Products, Gridline Construction
Phosphoric Acid fuel cell deployed to provide base-load power to the Chamber of Mines building in Johannesburg	100 kW Phosphoric Acid fuel cell powered by NG	Department of Trade and Industry, Chamber of Mines, Egoli Gas, Mitochondria Energy Company
Hydrogen fuel cell prototype providing power to the University of Western Cape Nature Reserve building	2.5 kW hydrogen fuel cell	DST, HySA Systems, Hot Platinum, Clean Energy



- ▶ Facilitate government investment in infrastructure that will enable the uptake of hydrogen fuel cells in telco sites and unlock other sectors e.g. automotive
- ▶ On going research to resolve the methanol and diesel reforming issues
- ▶ Engage with provincial and local government to extend fuel cell trials in off-grid schools and rural clinics
- ▶ Focus on increasing the incorporation of locally developed components in fuel cell demonstration units
- ▶ Engage with potential customers to validate performance of fuel cell components developed through HySA e.g. Catalyst and metal hydride material for hydrogen storage
- ▶ Address funding issues through collaboration with other government departments as global initiatives in HFCT e.g. Horizon 2020
- ▶ Increase public awareness and acceptance of HFCT through strategic demonstration projects
- ▶ Explore options to attract more corporate investors to support national roll out.



Thank you

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