



FUEL CELL ROADMAP

Impala Fuel Cell Strategy

The Impala Fuel Cell Development Roadmap is a collaborative process supported by various departments of the South African Government with ties to strategic local and international partnerships. Its objective is to fast track local manufacturing of fuel cells (FC) and componentry within a proposed tributary Special Economic Zone (SEZ) in the Springs region. The localization strategy envisages partnerships with international manufacturers and in time, the backward integration of local South African sub-components.

The Impala Roadmap represents the critical steps in support of the nascent fuel cell industry, specifically for development of manufacturing capacity in South Africa, where the predominant supply of the critical platinum componentry is mined. The cross cutting opportunities identified through this local manufacturing are entrenched in the roadmap through extensive collaboration between industry, government and academia in South Africa.

Within this roadmap specific strategies and actions are detailed to overcome the current barriers to commercialization:

- 1** Stimulating early stage market demand through large scale demonstration projects that showcase fuel cell technologies, their economic viability as well as validating product reliability and output in both stationary and mobile applications (20 – 22MW of stationary power as well as fuel cell powered material handling, fuel cell buses and mobile mining equipment).
- 2** Improving product quality whilst reducing total cost of ownership through demonstration projects that support cost and performance value propositions within an operating environment.
- 3** Establishing a local supply chain (valid business case and financial model).
- 4** Innovative approaches to securing capital requirements for nascent fuel cell deployment through government incentives and developmental partners (through 20 year Power Purchase Agreements).
- 5** Leveraging current supporting infrastructure for both fuel cell manufacturing and deployment alongside Impala's current Refinery operations. This infrastructure includes: availability of sufficient skilled personnel; presence of codes and standards that allow for the safe integration and interconnectivity of fuel cell applications (IPR specifications); existence of a sophisticated security system; availability of pure hydrogen gas and natural gas onsite as well as an operational hydrogen refueling station.

IMPLATS

Support of FC applications

Stationary Application

Support of FC applications

Mobile Application

Research & Development

Support of R&D through metal donation/loan

REFINERIES POWER PROVISION

Potential 22MW
Phased approach

- 1.2 MW Hydrogen System
 - 8 MW Natural Gas System
 - 12 MW Natural Gas System
- CIP Grant**

FUEL CELL FORKLIFT

- 1 Operational Unit in Springs
- Potential roll out to 30 units
- H₂ refuelling infrastructure

UNDERGROUND LHD & FC BUSES

- Development of a demo LHD and bus with local OEMs
- SPII Funding**

HYSA SYSTEMS

- Development of a local power module for FC Forklifts

HYSA CATALYSIS

- Development of a local Pt catalyst

HYSA INFRASTRUCTURE

- Development of hydrogen generation technology

DEVELOPMENT BANKS



Pt supply to FC Industrial Hub

COMMERCIALIZATION AND INDUSTRIALISATION

- Fuel Cell Industrial Hub in Springs, Gauteng
- Establishing manufacturing of Phosphoric Acid FC by Doosan and others
- Establishing manufacturing of HT PEM FC by SerEnergy
- Establishing manufacturing of local FC sub-components by HyPlat, H₂ Systems and others
- Backward integration of HySA products as they become available
- Establishing a local supply chain
- Job Creation
- Skills development

Pt recycle to Impala

Impala Platinum



Cross cutting opportunities offered by a fuel cell manufacturing hub in Springs:

- 1 Guarantee of platinum metal supply to the fuel cell industrial hub and potential increase in global platinum demand
- 2 Closed looping of platinum within South Africa of worldwide recycled spent catalytic membranes
- 3 Provision of serviced land within an already industrialized region with minimal infrastructural requirements for an SEZ
- 4 Promotion of industrialization within South Africa
- 5 Potential to enhance overall competitiveness of the South African economy
- 6 Potential to significantly grow knowledge – based job opportunities
- 7 Provision of new opportunities for other key industry sectors
- 8 A platform to grow high value export products
- 9 An opportunity for South Africa to play a role in reducing global greenhouse emissions thereby contributing to diminishing urban pollutants with a subsequent reduction in health care costs and an improved quality of life.

Further collaboration is required in the following areas:

- 1 Fast tracking the fuel cell SEZ to allow for localization
- 2 Additional deployment of fuel cell applications by the private and public sectors
- 3 Establishing an early purchase program to encourage product procurement
- 4 Increasing collaborative R&D efforts between industry, government and academia on materials, component efficiencies and product standardization to ensure cost curve reduction
- 5 Identifying gaps in supply chain and develop strategies for enhanced domestic capabilities
- 6 Formalizing training utilizing fuel cell demonstration projects

