14th Annual Southern African Coal Conference 2019

Low Grade Coal Commodity?

A Waste to Energy Perspective

- Vernon Harding from EPS –Environmental and Process Solutions

- EPS is:
  - Not a Coal company
  - Waste to Energy company
  - A green footprint promoter

EPS Track Record

- Investigations on the production of power from sewage/biomass
- Studies for Carbon houses on 10 smelter sites
- Completion of the IFM ICE project (17MWe)
- Completion of SACC Clean Energy project (8MWe)
- Basic Engineering design Hernic ICE (32MWe)
- Completion of Anglo Platinum Thermal Harvesting ™ Plant (5MWe)
- Cement Plant Thermal Harvesting ™ BFS (8MWe)
- Various Cogeneration & Heat Recovery Studies on Engine and Turbine plants
- Biofuel Production Testwork & Business Development
- Solid- and Liquid Waste Gasification to Power (30 – 50 MWe) BOO Development
- HTL Waste Water Sludge to Biofuels, City of Tshwane
- Flare gas to Power with Ripasso Engineering (Stirling Engines)

IFM ICE Cogeneration 17MWe

- 1st of its kind application in South Africa & the World
- "Non-intrusive"

SACC Cogeneration 8MWe

Award Winning Engineering

ACP ERP Cogeneration 5MWE

Award winning EPCM

ACP ERP Cogeneration 5MWE

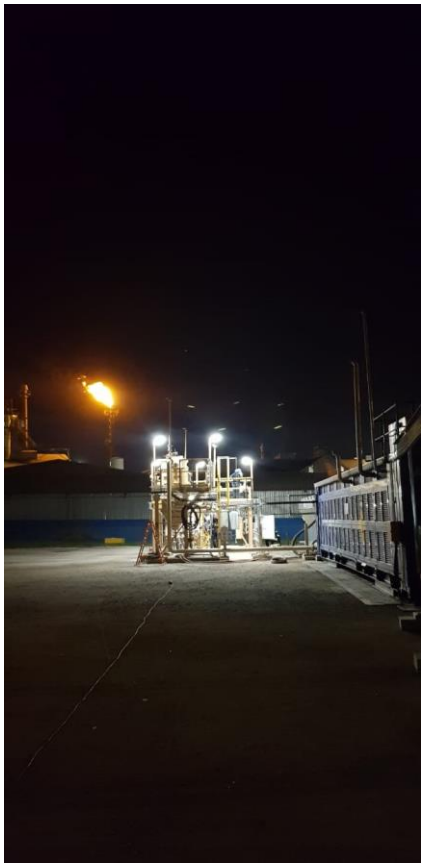
Award winning “Green Energy”

ACP ERP Cogeneration 5MWE

Award winning "Green Energy"

- **Hall of Fame Winner at the SA Innovation Awards 2015** and
- **Innovator of the year at the SA Innovation Awards 2015**
- **African Energy Innovation Winner at the African Energy Awards 2016** and
- **SANEDI RECORD/RERE COMMERCIAL APPLICATION AWARD 2016**
- **And a finalist for the IChemE Global Awards 2016**

RIPASSO ENERGY
Stirling Engine on Industrial Gas



- 1st of its kind application in the World
- Furnace Flare gas to Power generation
- Small Mobile operation

Low Grade Coal as an Energy Commodity

- What is Low grade Coal
  - Coal that is dumped or pumped to slimes dams
  - High content Ash, moisture and Sulfur
  - Calorific value below 16MJ/kg
  - Very fine coals / slimes
- Consequences of Low grade coal Dumping
  - EMP and ISO 14000
  - Acid Mine drainage / air pollution
  - Section 38 Minerals Act (Closure- and Life Cycle costs)

THESE ALL SOUND LIKE WASTE

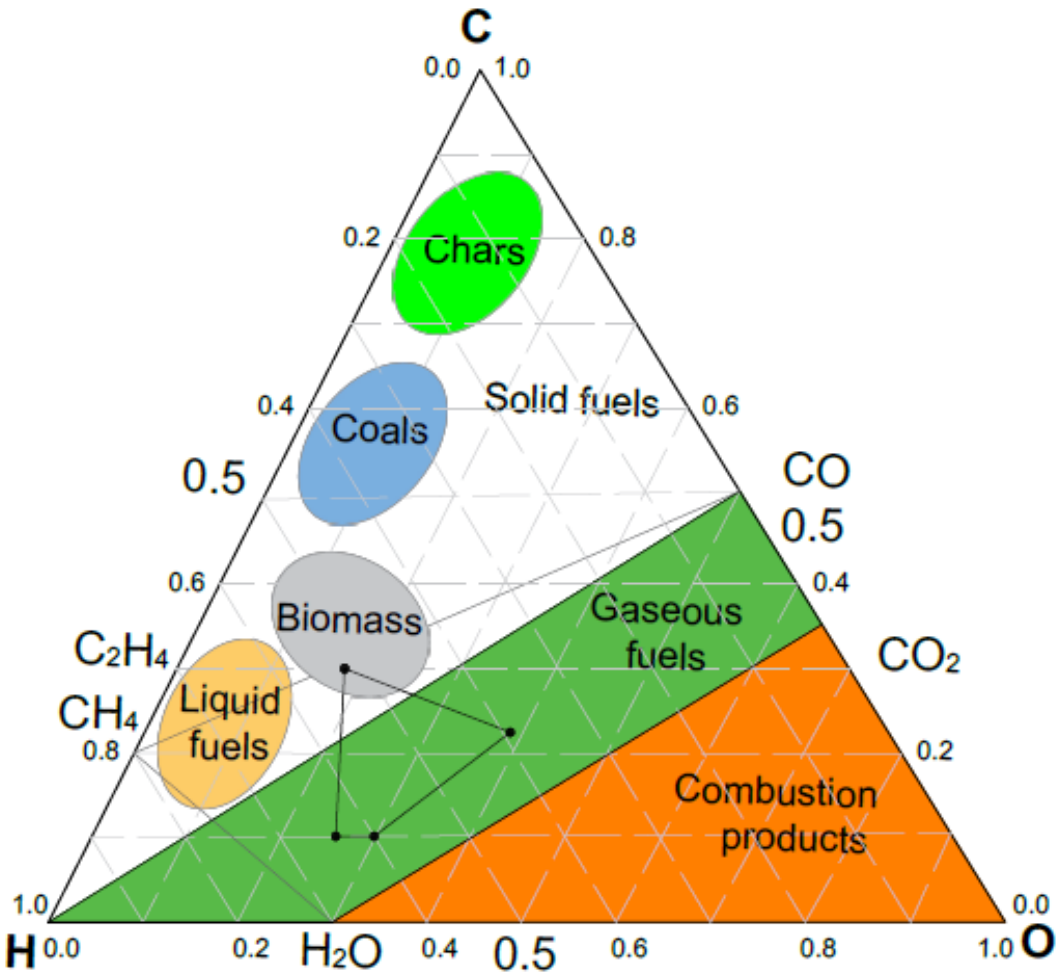
Solution Criteria

- Environmental Footprint reduction ISO14040
- Value Added product or basket of products
- Medium to small scale solutions
- Handling of re-mined sludges
- Medium moisture content (10%-15%)
- Usable ash and waste products (Zero Effluent)
- Small footprint
- Process and Site Operational & Environmental benefits

Technology Selection

Technology	Parameters	Advantages	Disadvantages
Pyrolysis (high temp)	• High Temp, 650°C • Reducing atm	• Low oils and tars • MSW & Biomass • Low Capex • High CV value gas ($9MJ/Nm^3$)	• Low carbon conversion • High Carbon in Ash
Combustion	• Stoichiometric combustion	• Lower Capex	• Higher NOx • Sulfur Oxides • Dioxins & Furans • Limited value added product (Steam)
Small Scale Gasification- Steam ($10,000Nm^3/h$)	• Above 1000°C • Reducing atm • Pyrolysis/gasification	• No oils and tars • MSW & Biomass • Medium Capex • High CV value gas ($18MJ/Nm^3$) • Hydrogen gas	• Reformer and /or Steam Generator • Complex process operations
Small Scale Gasification- Oxygen ($10,000Nm^3/h$)	• Above 1000°C • Pyrolysis/gasification • High grade O_2, PSA	• No oils and tars • MSW & Biomass • Medium Capex • Low CV value gas ($9MJ/Nm^3$)	• High cost of Oxygen (PSA) • Complex process Operations

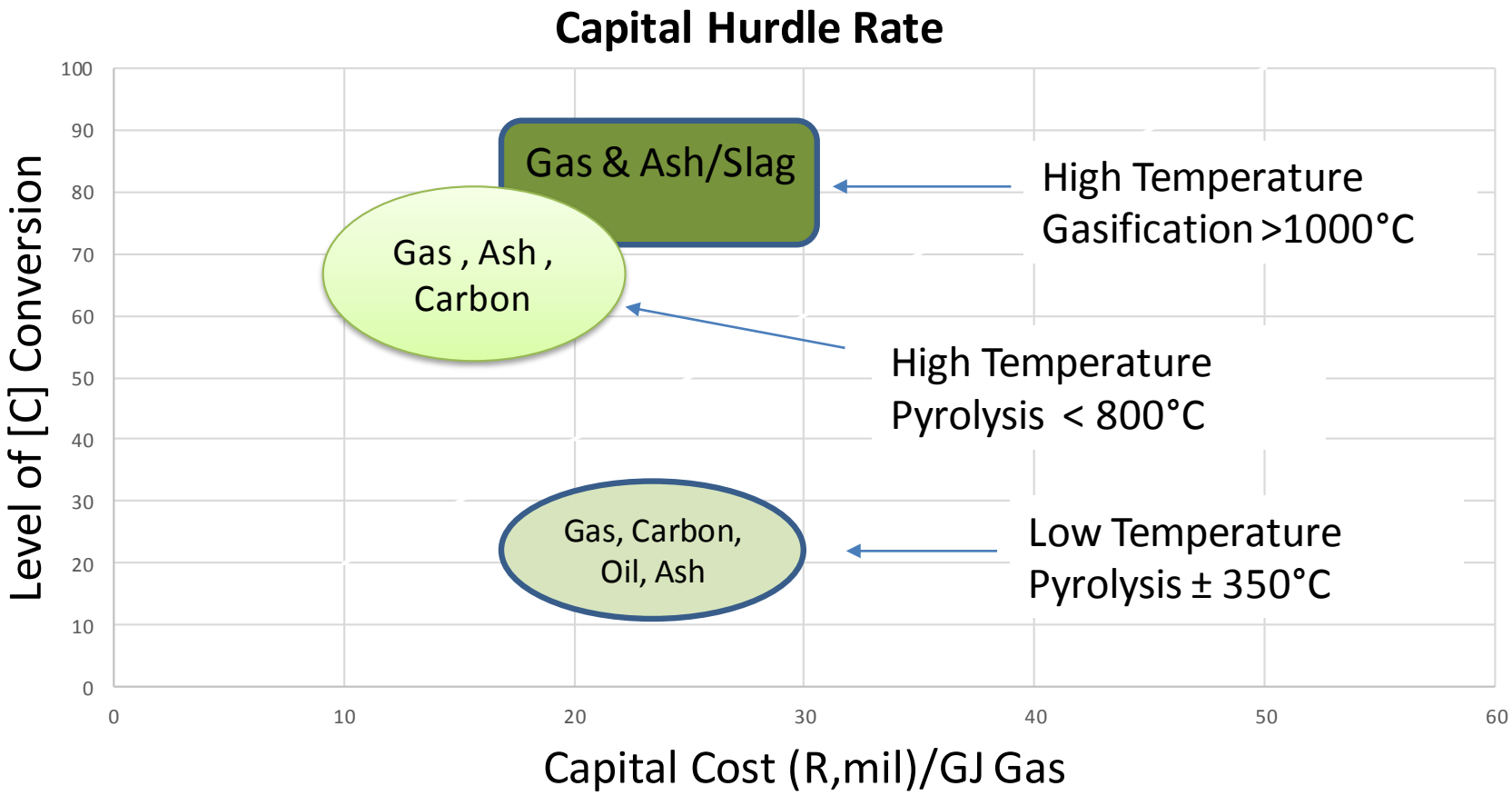
Waste Characterisation
(C-H-O Ternary diagram)



Technology Selection Criteria

- < 50MW Thermal - EIA advantages
- Not combustion (volumes, NOx, ..)
- Conversion efficiency
- Combined fuel / feedstock pool and energy balancer
- Capex hurdle rate and Opex lifecycle cost
- Downstream energy requirements

Capex Comparison



Advantages of Gasification

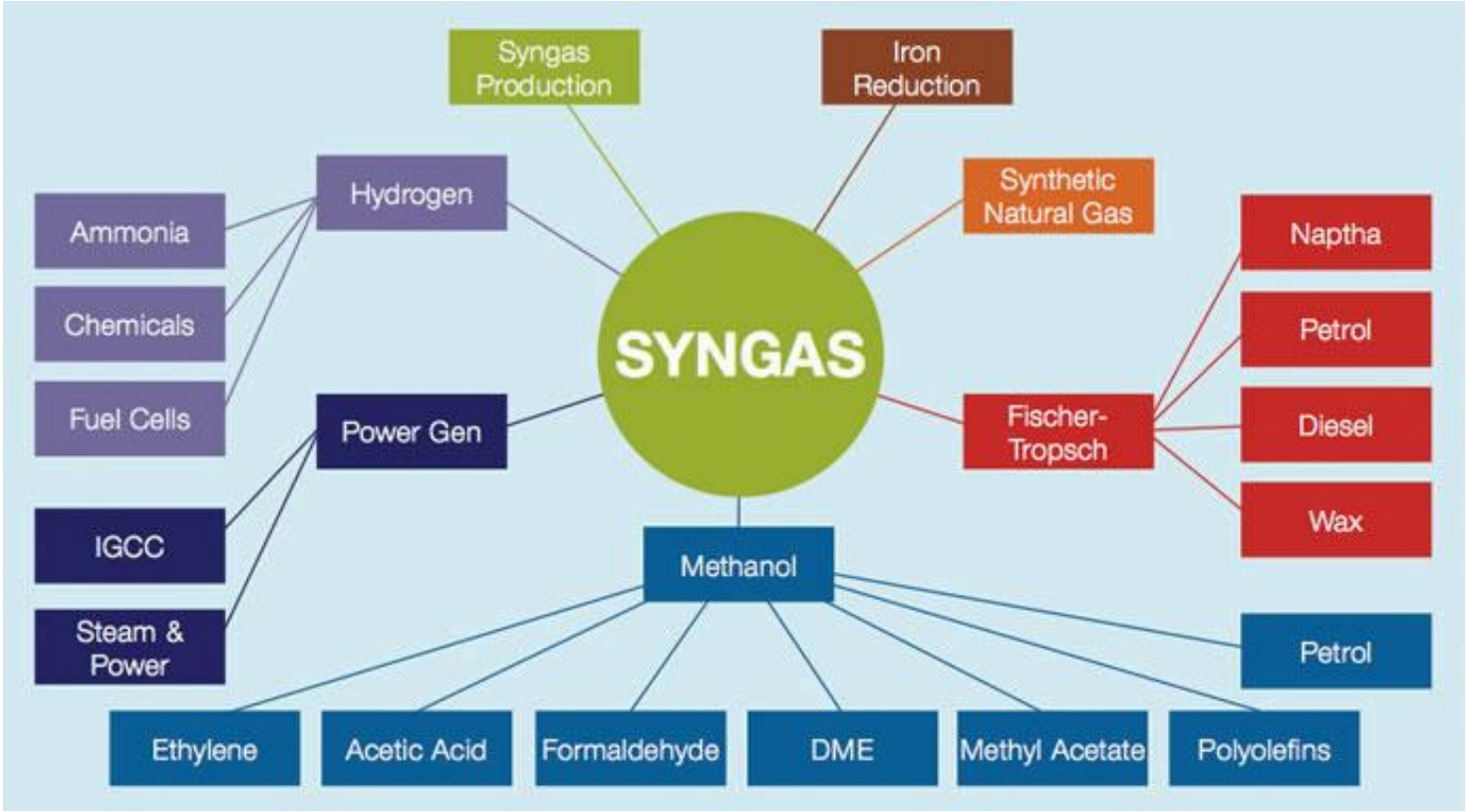
- Lower gas volumes
- Easier to remove H_2S than Sulfur Oxides from combustion product - lower Opex
- Low CV feed stocks possible
- Pending temperature; slag or ash
- Very low NOx
- Section 12 Minerals Act Certificate of Closure

Market trends and MSW synergies

- Thermal treatment of MSW caters for EIA requirements
- Coal feed-in if logistical constraints permit
- Several projects already backed by treasury in PPP format

Product Basket

- Gas Vs. Electrical only



Project and Product Costing

Stream	Type	Quantity
Plant feed (design)		**330 t/d**
Alternative feed streams available (more than required)	Fine Coal	200 t/d
	Industrial Waste (not included)	200 t/d
	Cut/Shredded Tyres	50 t/d
	Dried / Filtered WWTP Sludge	100 t/d
Solid Waste	Gasifier Ash	41 t/d
Syngas Production		26 500 Nm^3/h
Syngas CV		10.5 MJ/Nm^3
Overall Plant Electrical Output (30% efficiency)		**30 MWe**
Power Price	**Pending Gate fees**	**R0.85-R0.95/kWh**

Questions