HYBRIDISATION

Integrating renewable energy into fossil fuel value chains in South Africa

BENEFITS

- Helps transition to a low carbon economy
- Increases uptake of renewables
- Technology integration rather than exclusion
- Reduces the risk of stranded assets

THERMAL

Solar thermal hybridisation

Virtually the whole of South Africa has suitable solar resources throughout the year.

- ✓ The use of direct solar heating is the most promising for hybridising low temperature fossil fuel applications.
- ✗ Concentrated solar thermal to augment steam in a coal boiler for high temperatures (>100°C) is currently not viable on an industrial facility scale. But is applicable for large scale systems, such as power stations.
- ⚠ Fossil fuel energy or storage system is required to compensate for variable thermal energy supply from solar.

Bioenergy thermal hybridisation

Limited resource availability across South Africa.

- ✓ Most promising and suitable where constant supply of thermal energy is required. Applicable for high and low temperature heating.
- ✗ The use of bioenergy is site specific and not applicable throughout South Africa.
- ⚠ It is only viable under certain conditions, including onsite bioenergy availability or within a 20 km radius, and at a low cost in order to compete with cheap fossil fuels.

MOBILITY

Bioenergy

Limited resource availability across South Africa.

- ✓ Blending of biofuels for vehicles, ships, aviation and rail pose good opportunities to reduce transport related emissions.
- ✗ Blended fuels are limited by factors such as vehicle engine specifications, commercial supply of biofuels, transportation challenges and mandatory blending limits.
- ⚠ A supporting policy and framework is required in South Africa in order for this type of hybridisation to develop.

Solar

Virtually the whole of South Africa has suitable solar resources throughout the year.

- ✓ Can support electrical auxiliary services such as air conditioner in trucks, support cooling in refrigerated transport or electricity driven services for ships.
- ✗ Solar electricity for hybridisation on mobility based application is limited by the area on the transport vehicle exposed to solar irradiation.
- ⚠ Adequate battery storage required

MECHANICAL

Small-scale wind and hydro for mechanical hybridisation

Limited resource availability across South Africa.

- ✓ Hybridised water pumping using wind to supplement electrical water pumping is found to be economically viable at commercially low discount rates
- ✗ These applications are site specific and not applicable throughout South Africa.
- ⚠ Suitable for facilities with existing limitations to grid electricity access.

ELECTRICAL

Solar electricity

South Africa has good solar resources and is applicable throughout the country.

- ✓ Solar PV is the most promising technology for hybridising electricity generation in any sector.
  Solar PV shows good technology learning.
  The levelised cost of electricity from solar PV is competitive with municipal tariffs.
- ✗ Concentrated solar for electricity generation is not viable on an industrial scale application.
- ⚠ Grid connection or energy storage is required to compensate for variable electricity supply from solar.

Bioenergy electricity

Limited resource availability across South Africa.

- ✓ More suitable to hybridise with applications that require high power output at a constant supply
- ✗ The use of bioenergy is site specific and not applicable throughout South Africa.
- ⚠ Specific conditions exist for this to be feasible, such as availability of onsite bioenergy which comes at low cost to compete with grid electricity.

Small-scale wind & hydro electricity

Limited resource availability across South Africa.

- ✓ Less promising technologies but viable in areas where resources are abundant, such as where there is a good wind source or a perennial stream for hydropower.
- ✗ These applications are site specific and not applicable throughout South Africa.
- ⚠ Applicable to remote locations, where there is no connection to the grid, or the extension and upgrading of the grid is costly.

CHALLENGES

- High upfront investment
- Lack of funding and incentives
- Low prices of fossil fuels
- Complexities of combining two technologies
- Lack of local technology support
- Regulatory barriers
- Resource availability and security

REASONS FOR IMPLEMENTATION

- Energy security
- Positive publicity
- Sourcing of lower carbon alternatives
- Costs savings
- Conversion of a waste stream into a resource

BARRIERS

- Limited capacity for small scale embedded generation (<1MW)
- Uncertainty surrounding waste legislation
- Limitations of Municipal Finance Management Act
- Uncertain timing of carbon tax and offsets regulations
- Regulated fuel specifications

ENABLERS

- Continued downward trend of capital costs of renewable technologies
- Incentives such as net metering or tax incentives similar to 12J and 12L
- Implementation of pending carbon tax and offset scheme