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Robben Island Green Microgrid



Microgrids and Smart-grids Research Unit

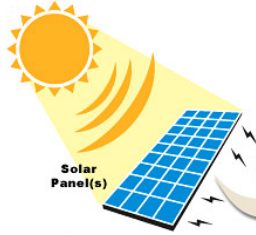
University of Cape Town

Dr. Sunetra Chowdhury

sunetra.chowdhury@uct.ac.za



1



Outline

Background on Robin Island

Current energy supply in the Island

challenges of RE technologies to the Island

Greening Robben Island Project

Proposed Technologies

Conclusions

Recommendations



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2

Background on Robin Island



- Discovered in the 1488s by Bartholomew Dias, Portuguese Explorer.
- Used primarily as prison and occasionally as hospital for chronic ailments such as leprosy and mental disorder from 1600s.
- Became a hub for political prisoners including South Africa's 1st black President, Nelson Mandela.



3

Background on Robin Island

- Declared as the World Heritage Site in 1999, by UNESCO.
- Very well known as the centre of South African heritage.
- Today, there's a mini residential area with houses of Tour Guides and their families. There is a school with about 20 pupils in total.



4

Background on Robin Island

- There's a school serving about 20 pupils.
- About 45 households live on the Island permanently.
- This is addition to tourist attraction places such as the museum.



<<Clearly, the island needs supply of sustainable energy>>



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5

Current energy supply in the Island

The Island is currently powered from two diesel generators

Four diesel generators available
for powering Robben Island



Two diesel generators run simultaneously and synchronously at any time to supply energy for daily running of the Island.

The Island spends about R450 000.00 per month (R5.4 million per year).

109 Tonnes of carbon are emitted per month.

“Greening of Robben Island project” has been proposed to reduce the Island’s CO₂ footprint.



6

Challenges of RE technologies in the Island

The Island is a marked UNESCO Heritage site,

Thus, no structure may exceed 30 m above sea level

Nature conservation is a priority,

Systems must NOT be disruptive to the surrounding
aesthetics of the surroundings

Hence a lot of consultations were necessary to involve all
stakeholders and get their buy-in.



7

Greening Robben Island Project

The project was initiated by SANERI and DoE with the aim of using the Island as a test-bed for RE pilot studies forming the Green Microgrid.

The project is targeted to produce 600kW from a hybrid of RE technologies.

The following technologies are targeted:

- Micro-hydroelectric
- Biomass
- Wind
- Solar and
- Wave energy



9

Technologies: Hydroelectric

Micro-hydroelectric turbines

These are seen as an option that could make use of the water flowing from springs on the Island to the sea.

Advantages:

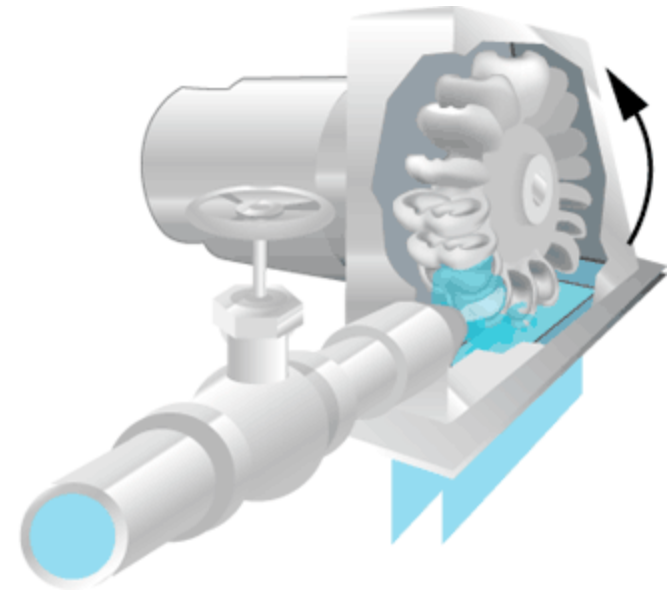
Less intrusive to the natural surroundings.

Less likely to disturb the Seal population in the Island.

Relatively cheaper than the other technologies.

Disadvantages:

Not so strong enough flowing water may limit energy production



Biomass and bio-fuels – Plant material and animal waste

Diesel generators will be converted to biodiesel.

Advantages:

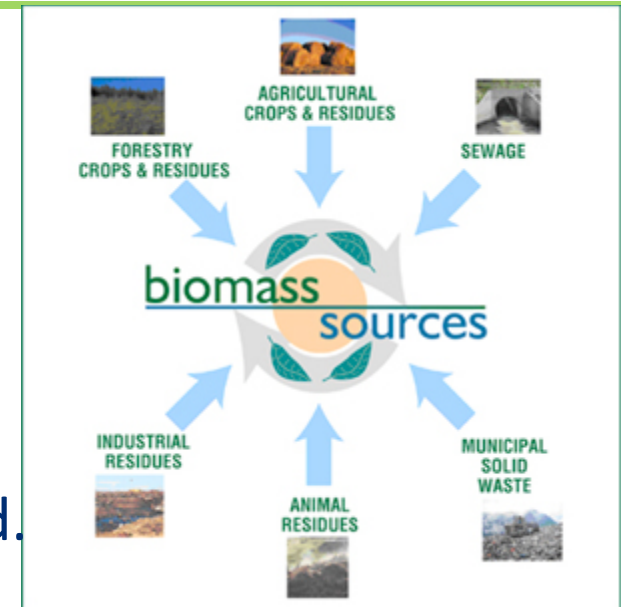
Biomass sources are readily available in the Island.

Relatively cheaper and predictable.

Challenges:

Growing bio-fuel crops in the Island may disturb conservation efforts.

UNESCO might not allow this approach without a plan of greening the Island.



11

Technologies: Wind – On-shore

On-shore wind – wind turbines erected on the Island.

Advantages:

Good wind resource around the Island.

Challenges:

Destructs aesthetic value of the Island.

Unpredictable wind resource.

No wind turbine masts longer than 30m will be allowed by UNESCO as the Island is a heritage site.



12

Technologies: Wind – Off-shore

Off-shore wind – having wind turbines erected in the sea surrounding the Island.

Advantages:

Good wind resource around the Island.

Less intrusive to the birds on the Island.

Challenges:

The marine life population around the area may be endangered.

Costly.

Unpredictable wind resource.



13

Technologies: Solar - PV

Solar PV – use of solar photovoltaic panels to capture energy from the sun and convert it to electricity.

1. Solar PV Farm



2. Solar PV Rooftop



Advantages:

Less Intrusive to the environment.

Disadvantages:

Cost .

Unpredictable.



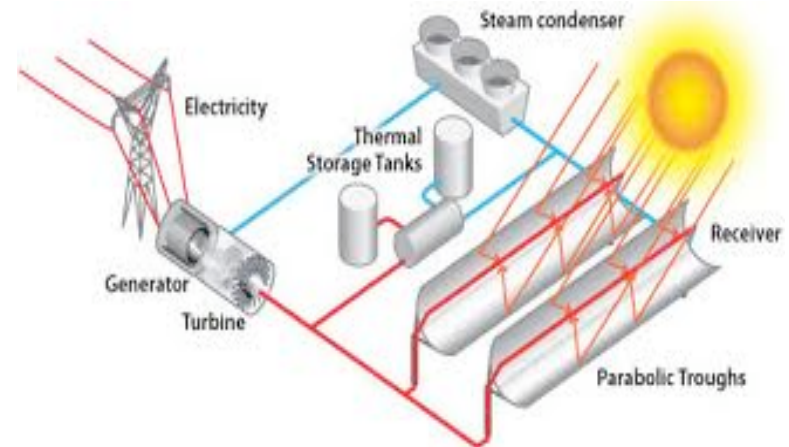
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CSP - Concentrating energy from the sun, heating water to steam which then turns turbines to generate electricity.

Solar Concentrators



CSP Plant



Advantages:

Less intrusion to the surrounding environment.

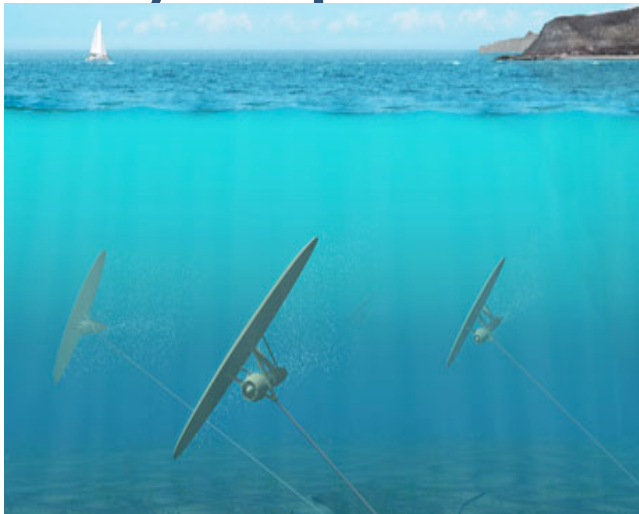
Challenges:

Consumes vast mounts of land.

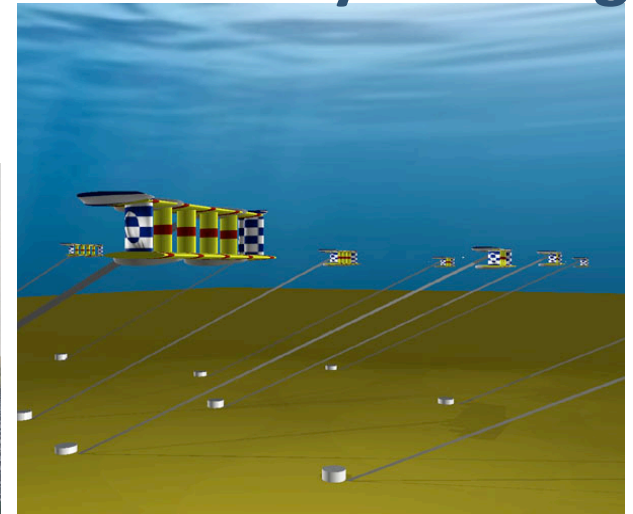


Extraction of energy from the tidal waves. Three extraction technologies available.

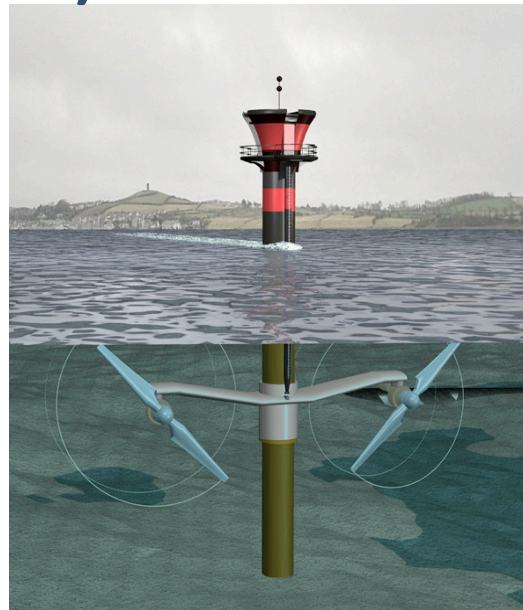
a) Deep Green



b) Moored HydroWing



c) SeaGen tidal



Extraction of energy from the tidal waves.

Advantages:

Does not disturb life at the Island itself.

Disadvantages:

Costly.

Difficulty of identifying appropriate technology that will suit the site on the Island.

Threatens marine life around the Island.



- *Clearly, the Green Mircogrid, bringing the RE technologies to Robben Island will save the Robben Island Council and the Museum money, (the R450 000 spend monthly).*
- *Feasibility studies need to be performed for the Green Microgrid to assess and measure impacts of each of this technologies.*
- *Some of the technologies identified may be more feasible than others, given the conservation requirement remains intact.*
- *Solar and Hydroelectric technologies are the less intrusive technologies.*
- *There are many stakeholders to the project, hence thorough consultations need to be done to get buy-in from everybody involved.*



Hydroelectric, Solar PV and wind should be considered because of their less intrusive characteristics.

Horizontal axis turbines and vortex generators may be considered to conform with UNESCO's 30 m structure restriction.

Rooftop solar PV should be used as it requires no need for extra land to be used.

A Solar PV – Wind hybrid should be used. The hydroelectric generator will provide additional energy. However, it may not be possible to completely do-away with the diesel generators as solar and wind are unpredictable.





THANK YOU

