NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Energy Research Institute @ NTU

REIDS

Renewable Energy Integration Demonstrator - Singapore

An ERI@N Flagship Project

Systems & technologies for a sustainable & affordable energy access-for-all in Southeast Asia

Prof. Fook Hoong Choo

29-30 November 2017

ERI@N structure

ERI@N

Energy Smart, Research Innovation

Flagship Projects : Eco-Campus & REIDS

Energy Systems

- Renewables & low-carbon generation
- Energy Storage & Fuel Cells

Grid Systems

- Renewables' integration
- Multi-Energy Systems & Grids

Urban Solutions

- Sustainable Buildings
- Future Mobility Solutions
- Maritime Clean Energy

Materials, Simulation & Modeling, Electrical Power / Control, Reliability

Colleges of Sciences, Engineering, Humanities, Arts and Business

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

REIDS

Renewable Energy Integration Demonstrator - Singapore

A Singapore-based RD&D platform
for the design, demonstration and testing of solutions
for sustainable off-grid and urban microgrid systems

Rationale for REIDS

- 1.2 billion people on this earth do not have access to electricity.
- An even higher number do not have access to proper sanitation, including drinking water.
- Most of this population live in Africa, in Southeast Asia and in Latin America.

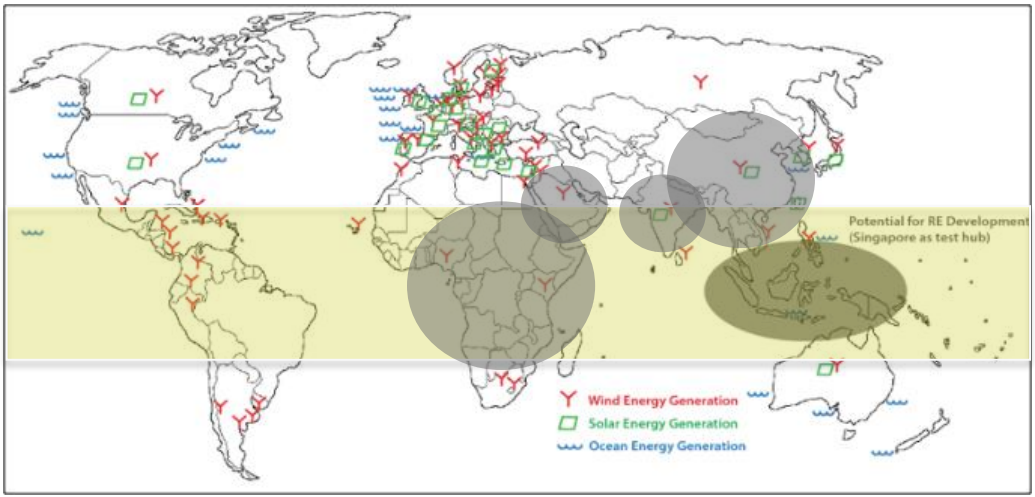
The solution must be localized networks - off-grid microgrids.

The deliberate focus of REIDS is on microgrid applications for:

- Islands
- Remote villages
- Emergency situations – earthquakes, tsunamis, refugee camps, etc..
- Remote mining operations
- "Fringe" networks
- Military bases

Economic development opportunity

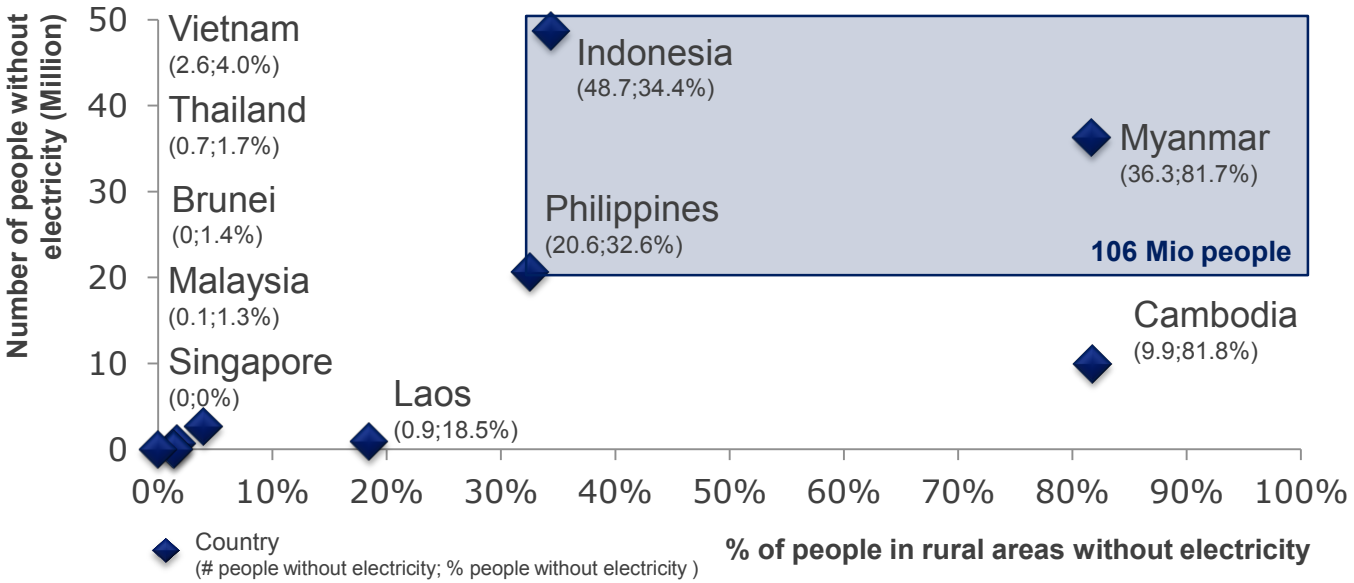
While challenging, energy transitions also represent formidable technology and economic development opportunities for energy infrastructure and systems solutions providers.



Indonesia : 17,508 islands - **Philippines** : 7,107 islands

World's top five fastest growing electricity production regions from 2010 to 2030

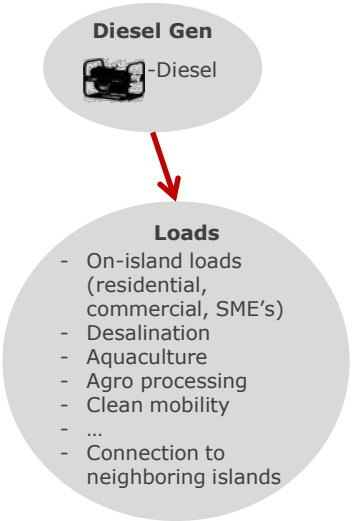
Rural electrification in Southeast Asia



Semakau Landfill – An emblematic site for REIDS

REIDS Technology Road Map – 1/4

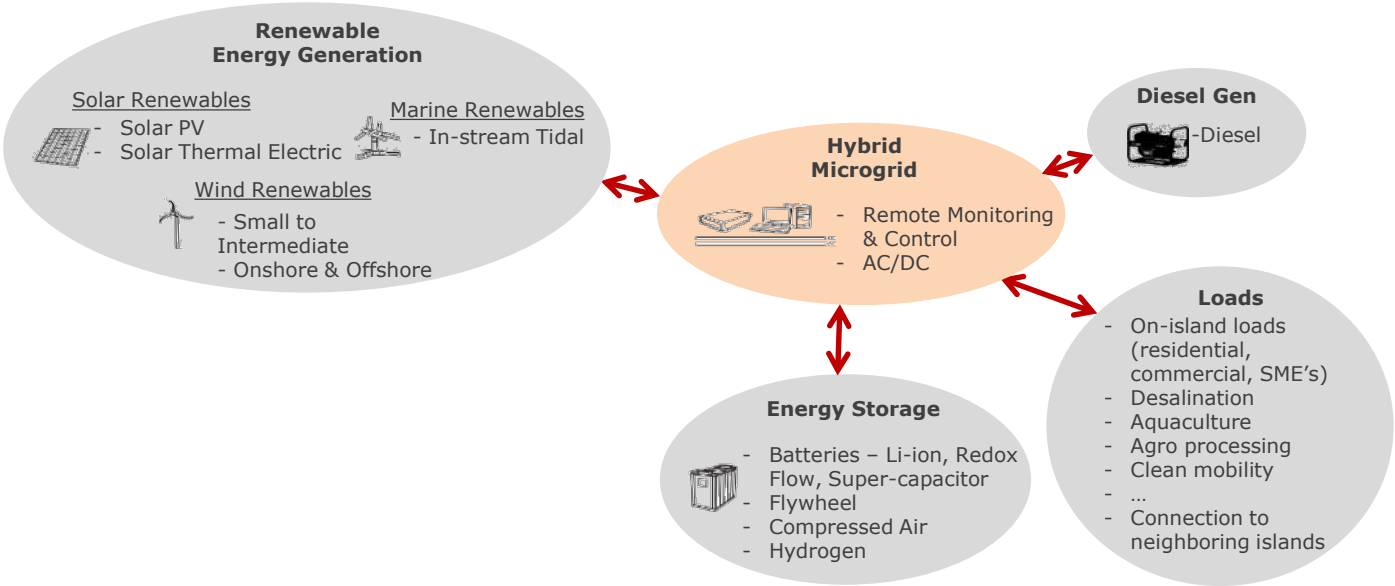
Legacy



REIDS Technology Road Map – 2/4

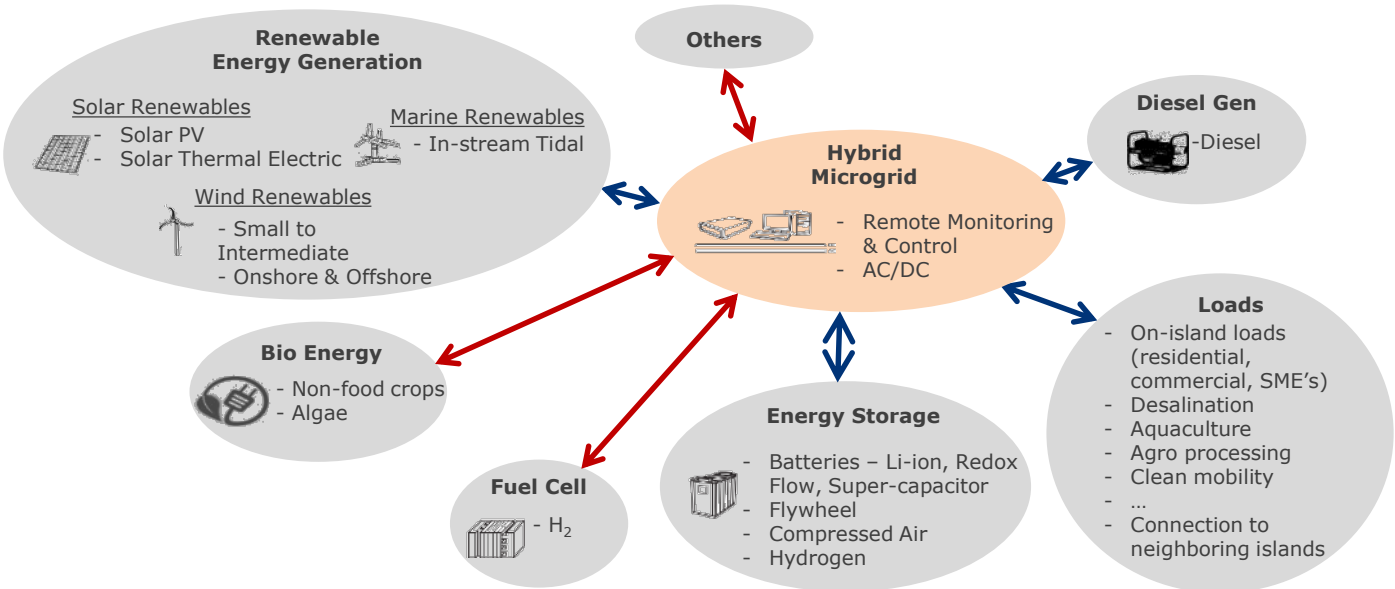
Microgrid Infrastructure

Renewable & storage enabled
Phase-out of diesel as primary provider

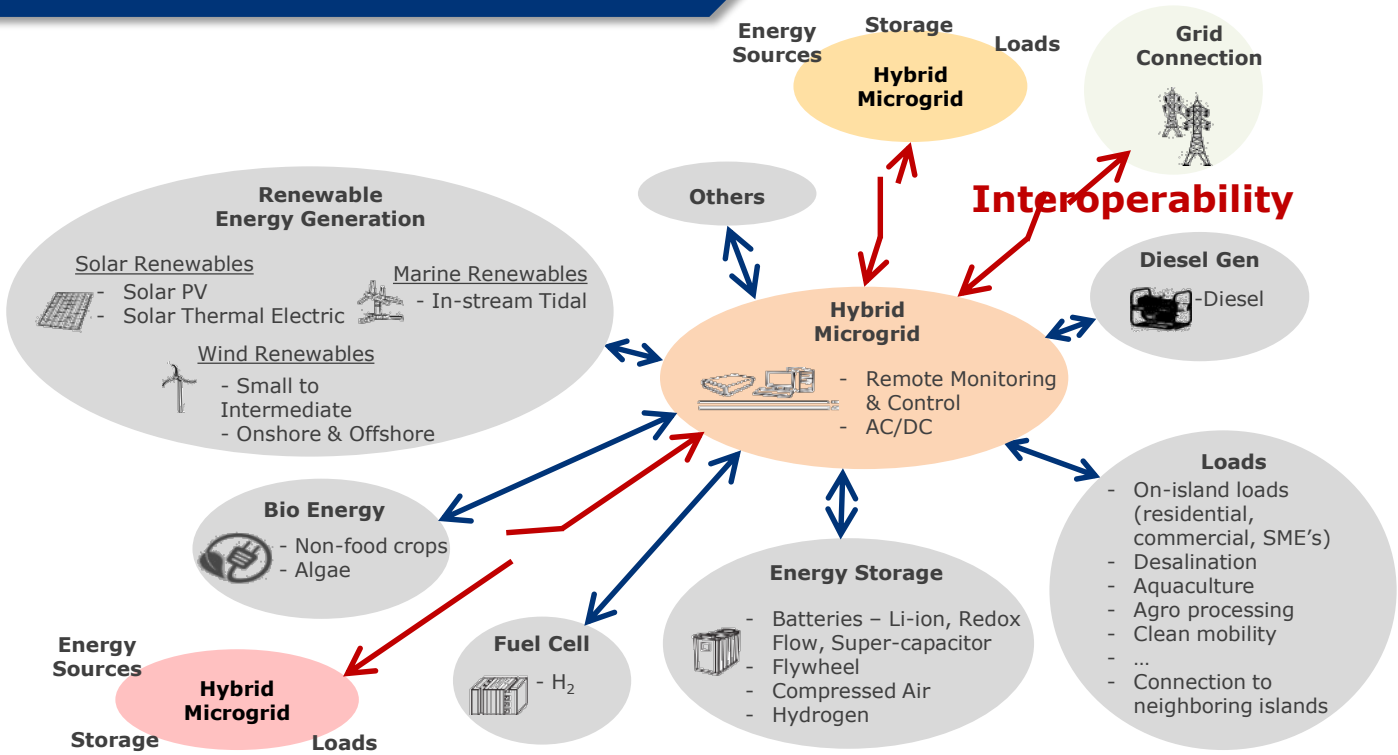


REIDS Technology Road Map – 3/4

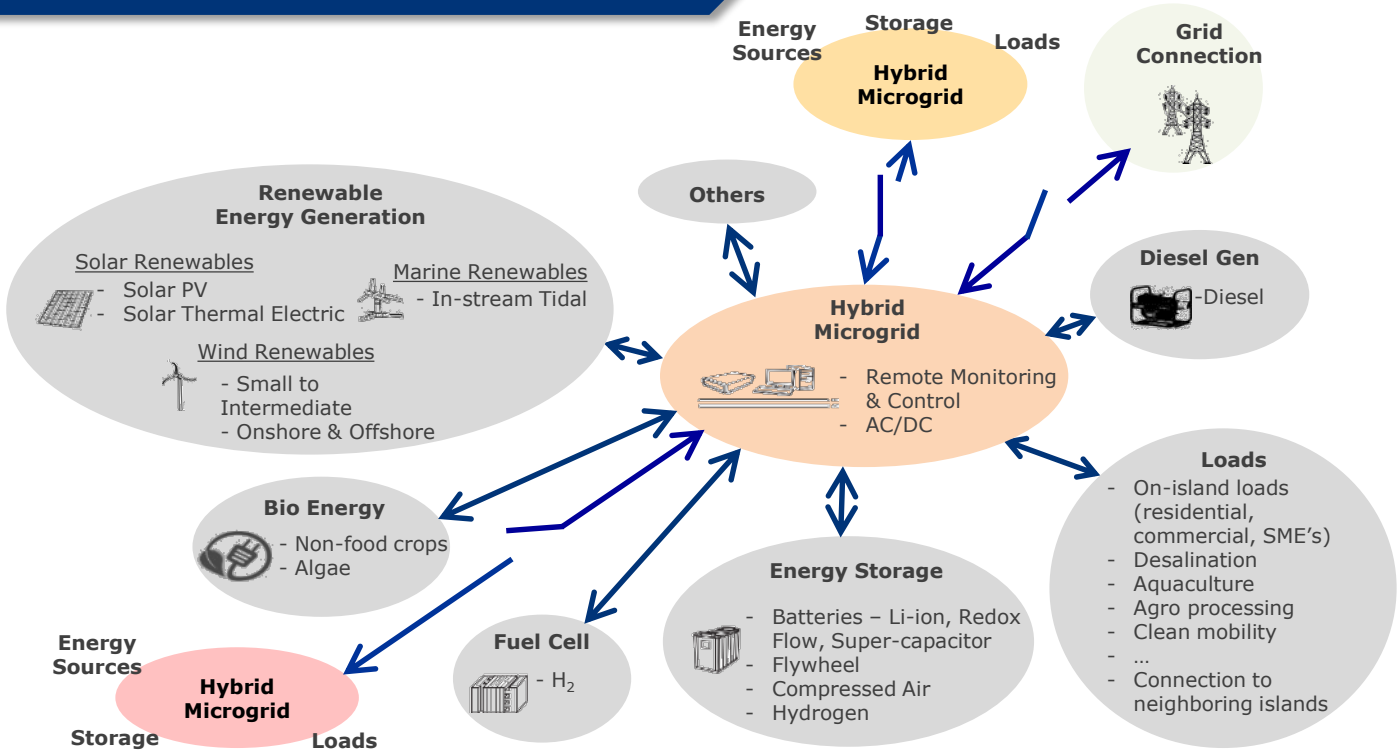
Plug & Play expansion



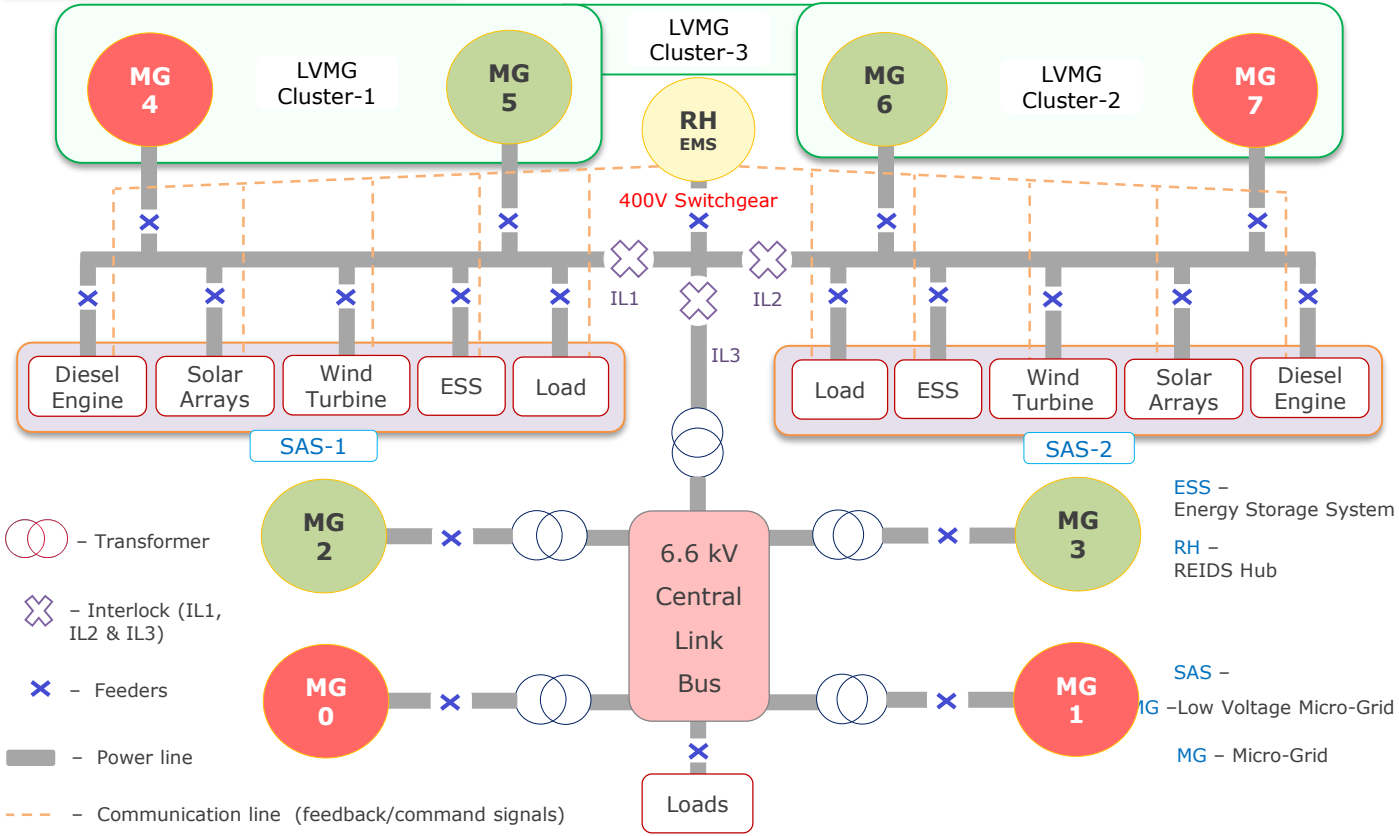
REIDS Technology Road Map – 4/4



REIDS Technology Road Map



REIDS Microgrids



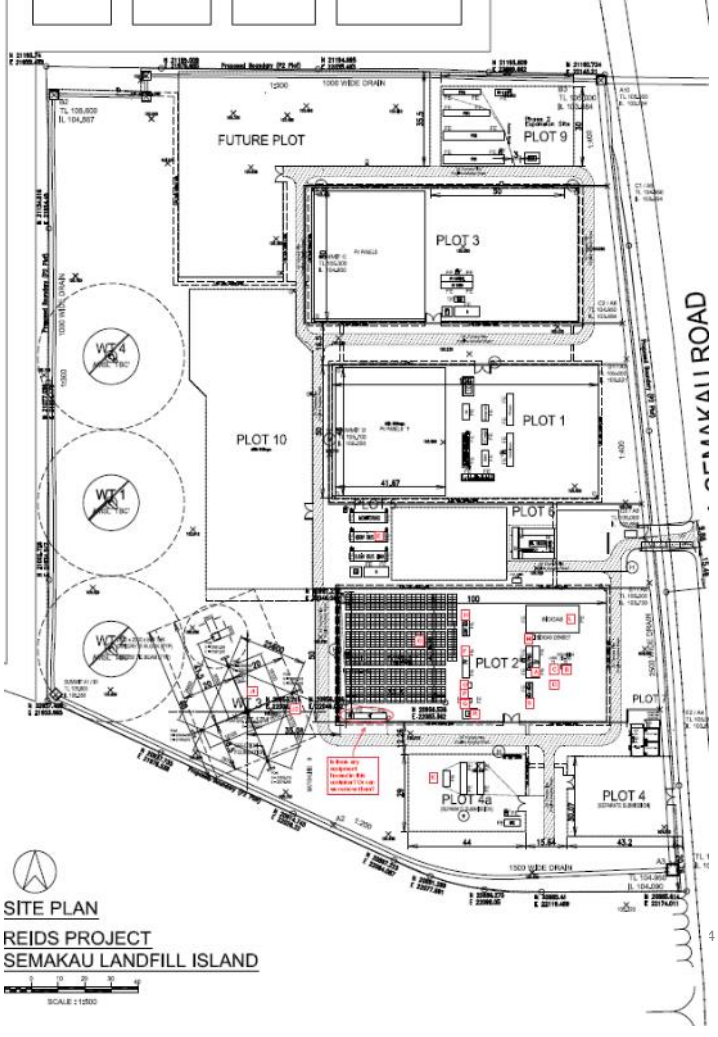
LVMG Cluster-1	Operating MG4 and /or MG5 with RH & shared assets set -1
LVMG Cluster-2	Operating MG6 and /or MG7 with RH & shared assets set -2
LVMG Cluster-3	Operating Clusters 1 & 2 with RH & shared assets set 1 & 2

P2 plot layout

- 3 plus 4 microgrids on a 6.4 ha land
- Capable of operating in islanded mode at 400 V, 3Ø, 50 Hz

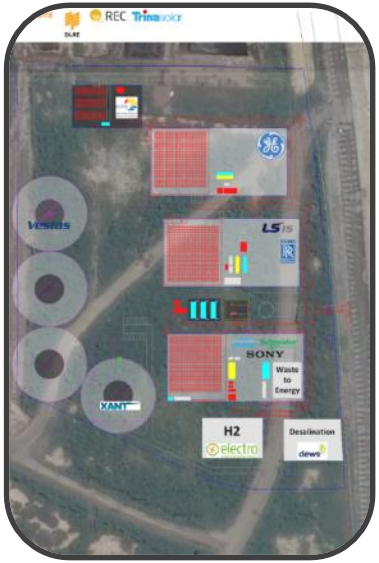
Resources:
- PV & wind
- RLC & other loads
- DGs
- Battery Storage
- ICT infrastructure

- Microgrid inter-operability demonstration and connection to remote assets (production & loads) by way of 6.6 kV Link Buses.
- Flexible allocation of local loads & assets by way of Asset Allocation Module.
- Microgrid cluster



Microgrids 1, 2 and 3 on a 64’400 m² greenfield – Plot 2 (P2)

P2 plot conceptual diagram:



Three separate microgrids

400 VAC – DC distribution possible

Within each microgrid:

- PV – several 100 kWp
- Wind – 50 to 200 kW
- Energy storage – Li-Ion, Redox flow, supercapacitors, etc.
- 400 kW 3Ø passive load
- Microgrid-specific loads
- Possibility to connect to shared loads and sources

Each microgrid should be capable of operating in a fully islanded / isolated mode.

Inter-microgrid operation “interoperability demonstration” by way of 6.6 kVAC network.

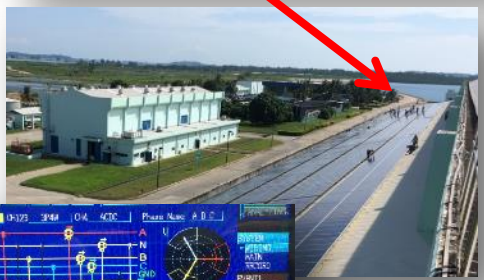
Connection to off-P2 assets: 6.6 kVAC

- Fish nursery
- Desalination plants
- In-stream tidal machines
- ….

REIDS 3D rendering

REIDS Development status – "Microgrid 0"

MG0 Test & Commissioning - March 2017



REIDS Development status – “P2 plot”

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REIDS HUB

REIDS Partners 2017

Summary - Three pillars of long-term strategy for excellence

1 Microgrid R&D

- Solve engineering, economic, environmental and societal energy transition challenges for off-grid communities and urban microgrid systems.
- Partner with Southeast Asia private, public and civil society organizations.

2 Microgrid systems demonstration and equipment testing

- Implement large-scale microgrid system demonstrations under tropical climatic conditions.
- Design and execute equipment performance assessment tests in a neutral environment under in-the-field operating conditions.

3 Outreach: engineering support, seminars, presentation & publications

- Broadly disseminate the REIDS message in Southeast Asia: conference participations, seminars, executive education – Singapore and off-site.
- Road-map energy transition strategies in Southeast Asia.
- Enroll REIDS public and private sector members in Southeast Asia.

Thank you

REIDS

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http://erian.ntu.edu.sg/REIDS

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