Small Island Initiatives

Case Studies

- King, Flinders, Rottnest Islands (Hydro Tasmania)
- Tuvalu & Tokelau Islands (IT Power)

Comments on small island RE deployments

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ISES International Solar Energy Society

King Island case study : 1998-2014

Source: Google Earth

Population 1,600 2.5MW peak load 6MW diesel 12GWh pa 450km of 11kV

Hydro Tasmania

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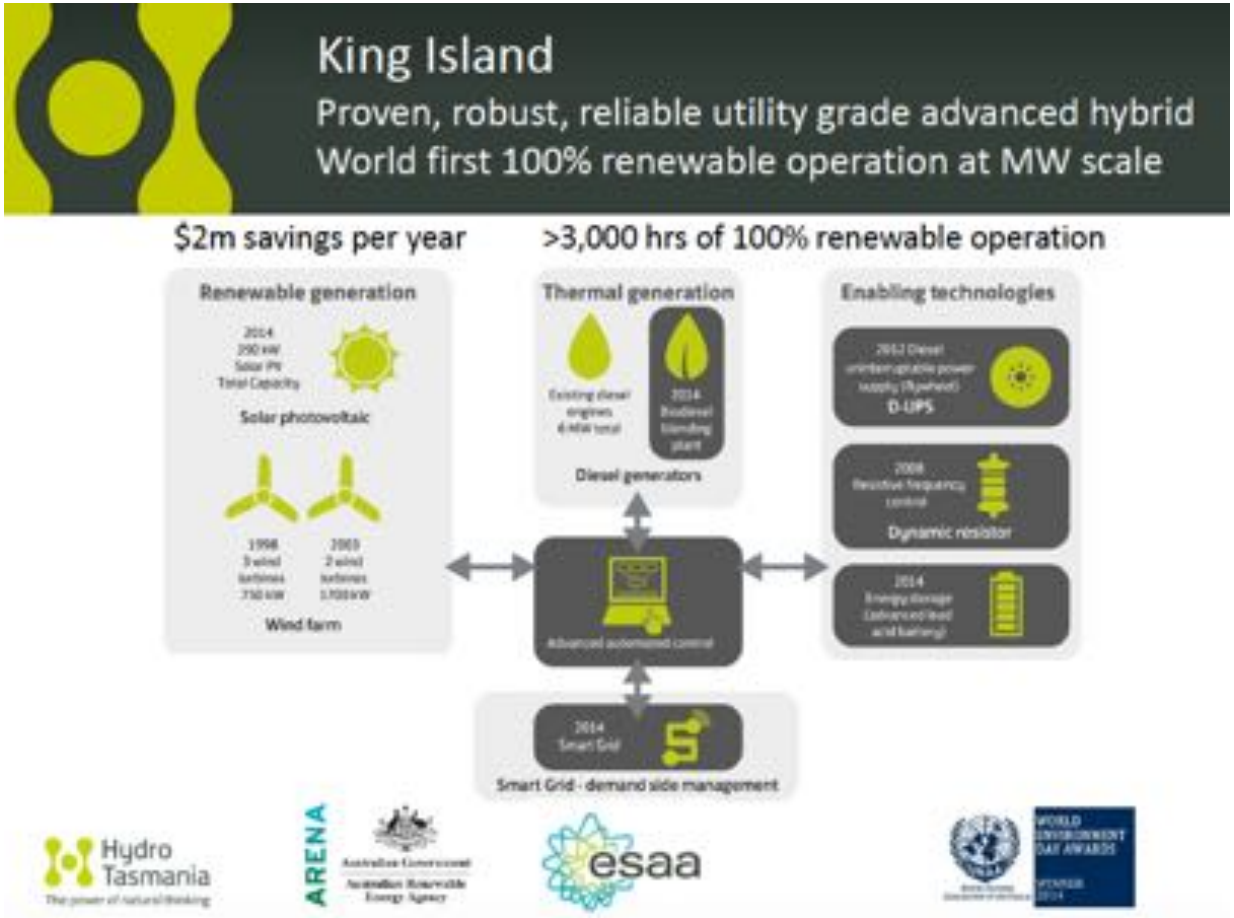

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1998 – First Wind Farm

Low renewable energy penetration

15% reduction in diesel

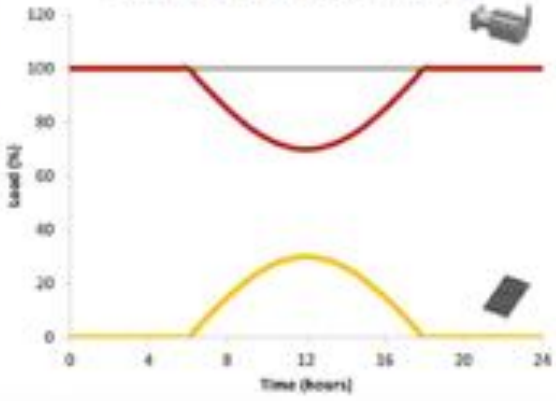
750kW wind

"Low hanging fruit"

Deliberately limited RE installed

No impact to operations

Simplified Solar PV example



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The power of natural thinking

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2004 – Wind Farm Expansion

Medium renewable energy penetration

2.45MW wind (1.2MW min load)

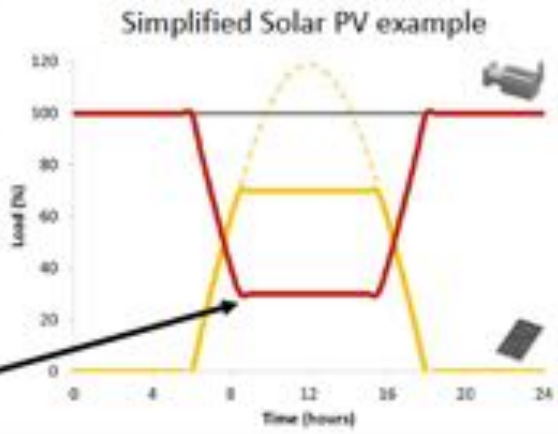
RE controlled (limited) protect diesels

Some RE is wasted (curtailed)

At this point you need enablers

30% annual reduction in diesel

Note minimum diesel operation



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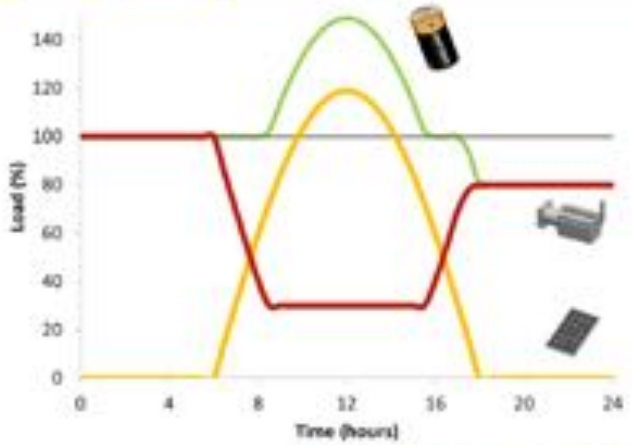
2014 - Energy Storage

An enabling technology option for high RE penetration



- Absorb excess RE (increase the load)
- Recover excess RE (power injected)
- Provide a range of services
  - Reserves – sustain 100% RE
  - Regulation – frequency control
  - Power – system security
  - Block shifting – energy recovery

Australia's largest battery – 3MW / 1.5MWh King Island

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2014 - Demand management

Real-time aggregated load control

- Aggregates controllable customer load to provide ancillary services
  - supports system during high renewable energy variation
- Fast discrete load shedding
  - Prevents feeder level load shedding – no customer impact
- Charging electric vehicles during periods of excess RE generation
  - Shift RE to transportation
- Real time data provided to customers via smart phone app

Wireless private network

Round trip response : 500ms

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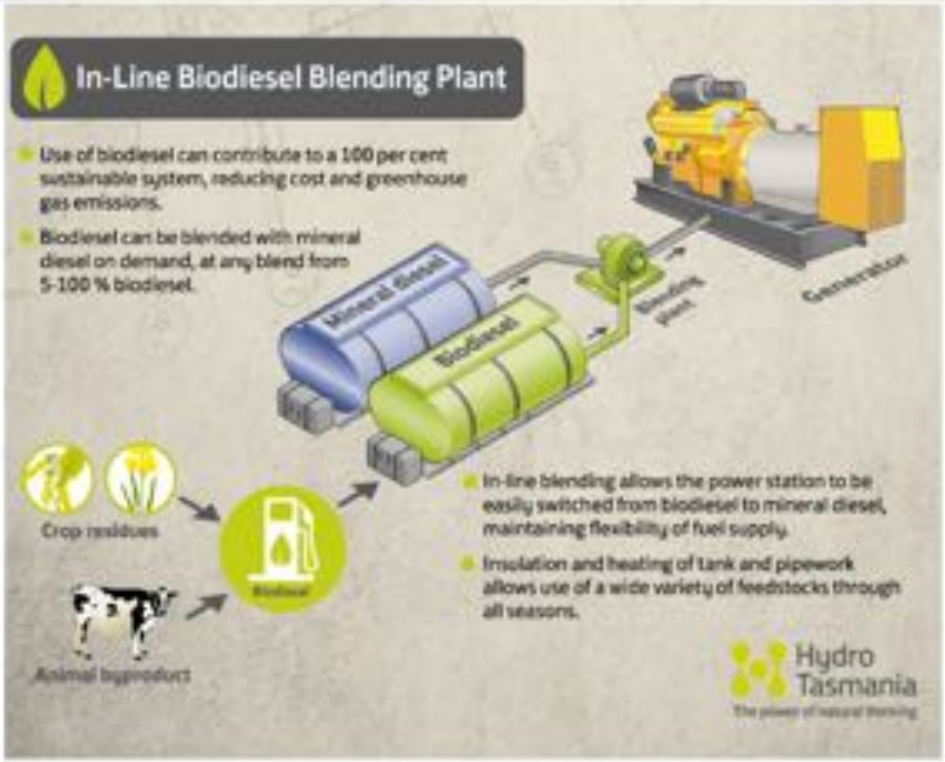
2014 - Biodiesel blending facility

Fuel flexibility, emissions reduction



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Want to see a 100% RE hybrid operating?

See ioS smart phone app & web site

www.kireip.com.au

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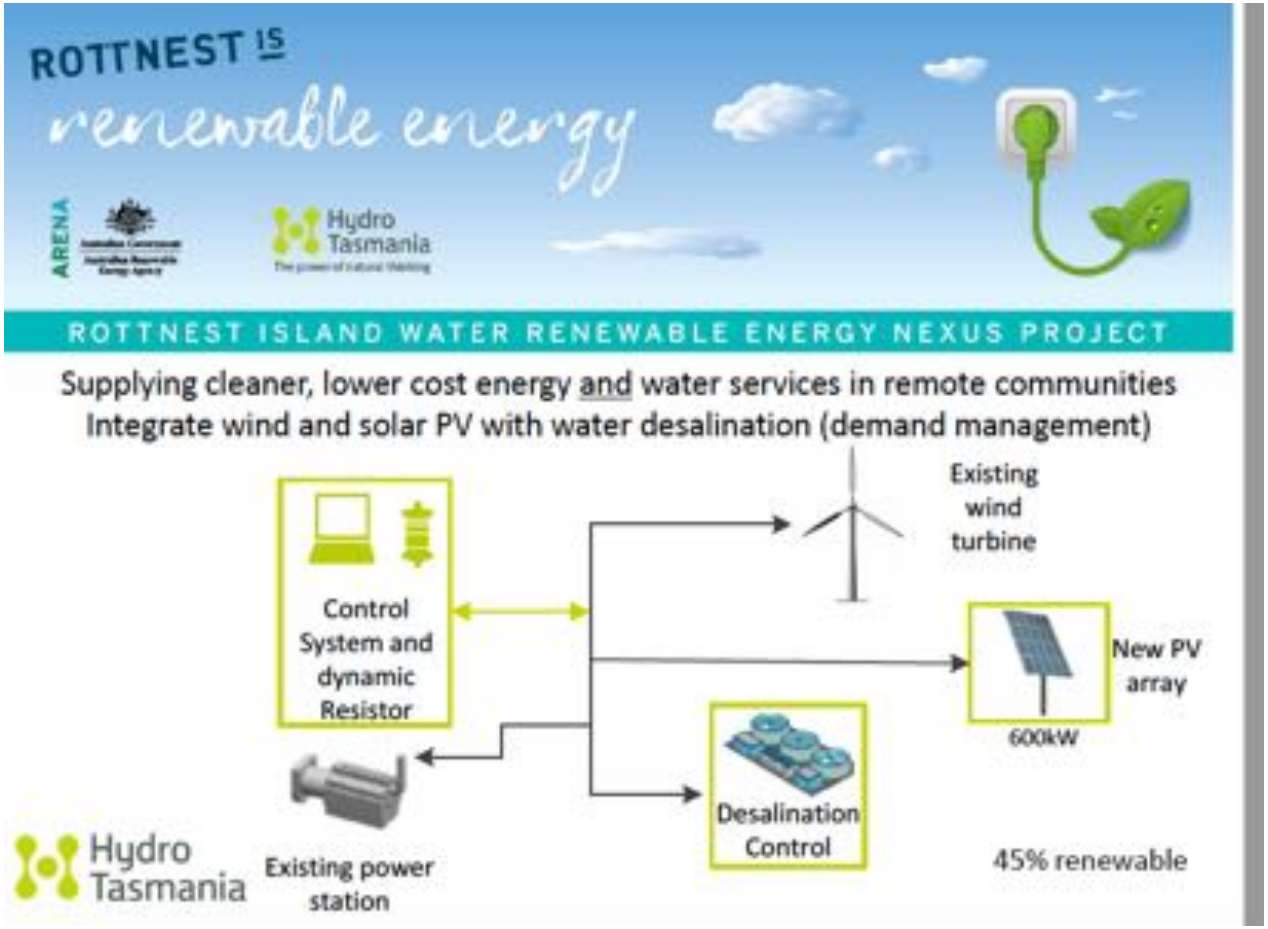
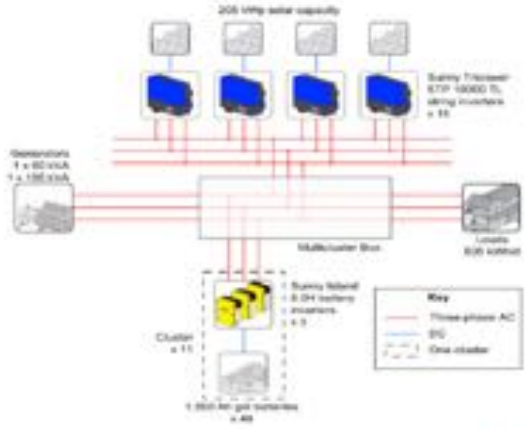
Flinders Island: 2015-2017


ROTTNEST IS
renewable energy
ARENA
Hydro Tasmania
ROTTNEST ISLAND WATER RENEWABLE ENERGY NEXUS PROJECT
Supplying cleaner, lower cost energy and water services in remote communities
Integrate wind and solar PV with water desalination (demand management)
Existing wind turbine
Control System and dynamic Resistor
New PV array
600kW
Desalination Control
Existing power station
45% renewable
Hydro Tasmania

Case Study: Tuvalu and Tokelau

System sizing overview

- 33,000 Ah battery bank (sealed lead acid batteries)
- 200 kW solar PV array
- SMA modular inverter/charger units
- Diesel generator to be switched off normally.



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Load estimate - Nanumea

- Average 550 kWh per day
- Little seasonal variation, but some "busy" times of year.
- Highest demand around Christmas and special events

- 40% of demand during "solar" hours
- 60% evening/night time

- Allowance for extra days with poor sun – 2 days

- Use this to size battery bank
- Then size solar PV array to meet day time load plus enough extra energy to fully charge the batteries.

IT Power Renewable Energy Consulting itp

Completed system

Closing Comments - Challenges

- Resource variability and integration of multiple technologies
- Adoption of microgrid technologies
- Installation logistics, system maintenance, spare parts, severe weather events
- Workforce Capacity
- Financing and payment schemes
- Supportive policies

…but the key outcome is the displacement and elimination of island's reliance on diesel fuel

Thank You

Dave Renné, President

International Solar Energy Society

Nanumea Power Station (Source: IT Power)