

# OFFGRID OUTBACK

DENHAM  
KING ISLAND  
DALY RIVER  
ROTTNEST ISLAND  
COOBER PEDY

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*and the rest ..*

**HOMER** International  
**MICROGRID** Conference | 8<sup>th</sup> Annual | #HIMC2020



UNIVERSITY of  
TASMANIA



# OFFGRID OUTBACK







# The Infamous Five

Denham

West Australia

Population 500

Annual Load GWh 5

RE%  
45%

Commissioned 1997

King Is.

Tasmania

Population 1700

Annual Load GWh 12

RE%  
65%

Commissioned 1998

Daly River

Northern Territory

Population 127

Annual Load GWh 3

RE%  
50%

Commissioned 2016

Rottnest Is.

West Australia

Population 300

Annual Load GWh 5

RE%  
45%

Commissioned 2017

Cobber Pedy

South Australia

Population 1700

Annual Load GWh 12

RE%  
70%

Commissioned 2018



# and the rest ...

Project	Annual Load MWh	Thermal MW	Wind MW	Solar MW	Storage MW/MWh	RE %	Year
Agnew	240,000	32	18	4	13, 4.0	60%	2020
Cooper Pedy	11,500	3.92	4	1	1.5, 0.49	70%	2018
Coral bay	3,000	2.24	0.675			45%	2007
Daly River	3,000	1.82	0	1	0.8, 2.0	50%	2016
Denham	5,500	2.62	1.02			35%	1997
Doomadgee	5,700	2.5	0	0.264		8%	2013
Flinders Island	6,700	3	1.2	0.7	0.75, 0.3	55%	2016
Granny Smith	180,000	24.2	0	8	2.0, 1.0	10%	2020
Hopetoun	5,800	5.18	1.2			40%	2005
Kalbarri	12,000	4	1.6	1.1	5.0, 4.5	40%	2020
King Island	12,000	6	2.25	0.9	3.0, 1.6 (+2 FW)	60%	1998-2014
Lord Howe Island	2,300	1.325	0	1.2	1.0, 3.2	60%	2020
Mackerel Island	1,000	0.44	0	0.32	0.6, 0.6	92%	2014
Marble Bar	2,365	1.28	0	0.3	(0.5 FW)	30%	2010
Nullagine	1,200	0.96	0	0.2		34%	2010
Onslow	8,200	8	0	1	3.0, 2.0	50%	2019
Port Gregory	26,000	9	2.5	1	2.0, 0.5	70%	2020
Rottnest Island	5,000	2.1	1.2	0.6		45%	1982/2006/2017
Thursday Island	18,500	9	0.45			5%	1997
Windorah	1,090	0.75	0	.13 (thermal)		16%	2009

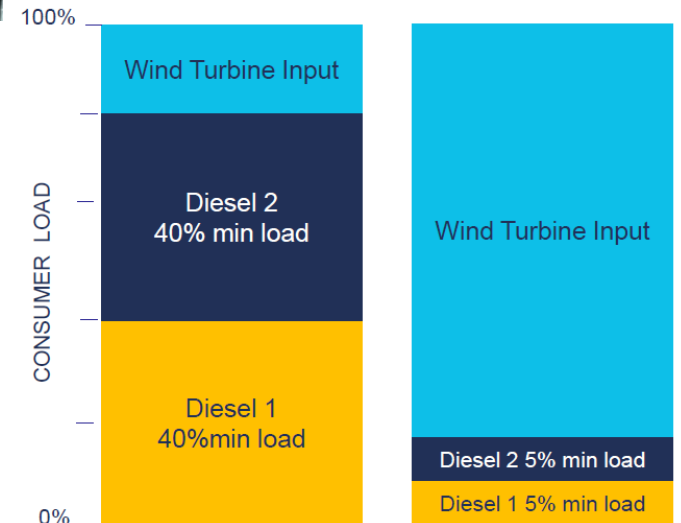
# Denham, Western Australia

- 1997**
  - First variable speed inverter wind turbine in Australia
  - Enercon E30 (Total 230kW) & Powercorp PSAC 20% wind penetration
- 1998**
  - Two additional E30 turbines (Total 690kW)
  - 30-35% wind penetration
- 2001**
  - Plans for 2 x 300kVA flywheels to run diesel off abandoned after not meeting technical specification.
- 2003**
  - Low load diesel developed for MTU Series 60 engines
  - 40-45% wind penetration
- 2007**
  - Enercon E 33 (Total 1020kW) added.
  - Comparatively, 2940kW of diesel generation onsite.
- 2021**
  - Renewable hydrogen production and generation pilot

Source: Chris Dowe, Synergy, 2018



Population: 500  
Load: 5050 MWh  
REP: 45%



Affect of 40% min diesel loading Severe constraint on wind energy  
Affect of low load diesel operation Allows very high wind penetration




# King Island, Tasmania

Population: 1600  
Load: 12,000 MWh  
REP: 60%

### King Island Power Station

Opened by the Hon Robin Gray MHA, Premier of Tasmania  
Friday 17 January 1986

A centralised power system for the whole of King Island.



RENEWABLE ENERGY

0%


Diesel

# 1986

### Huxley Hill Wind Farm

Opened by the Hon Tony Rundle MHA, Premier of Tasmania  
Tuesday 17 March 1998

First wind farm in Australia to receive Renewable Energy Certificates, providing renewable energy for King Island.



RENEWABLE ENERGY

15%


Diesel Wind

# 1998

### King Island Renewable Energy Expansion

Opened by the Hon Dr David Kemp, Federal Minister for Environment and Heritage, with the Hon Bryan Green, Tasmanian Minister for Infrastructure, Energy and Resources  
Thursday 26 February 2004

More renewable energy for King Island with control system and energy storage to maximise its use.



RENEWABLE ENERGY

30%

Diesel Wind Liquid Battery Control System

# 2004

### King Island Renewable Energy Integration Project Stage One

Opened by the Hon Martin Ferguson AM MP, Federal Minister for Resources and Energy, with the Hon Lara Giddings MHA, Premier of Tasmania.  
Friday 26 October 2012

World-leading demonstration project: a power system able to operate solely on renewable energy.



RENEWABLE ENERGY

>45%


Diesel Wind Solar Control Upgrade Resistor Diesel UPS

# 2012

### King Island Renewable Energy Integration Project Stage Two

Opened by the Hon Ian McFarlane, Minister for Industry,  
Tuesday 9 May 2014

The world's most advanced off-grid power system.



RENEWABLE ENERGY

>65%

Diesel Wind Solar Biodiesel Control system Resistor Diesel UPS Battery Smart Grid

Feed with bioethanol management responsibility and renewable energy contributor

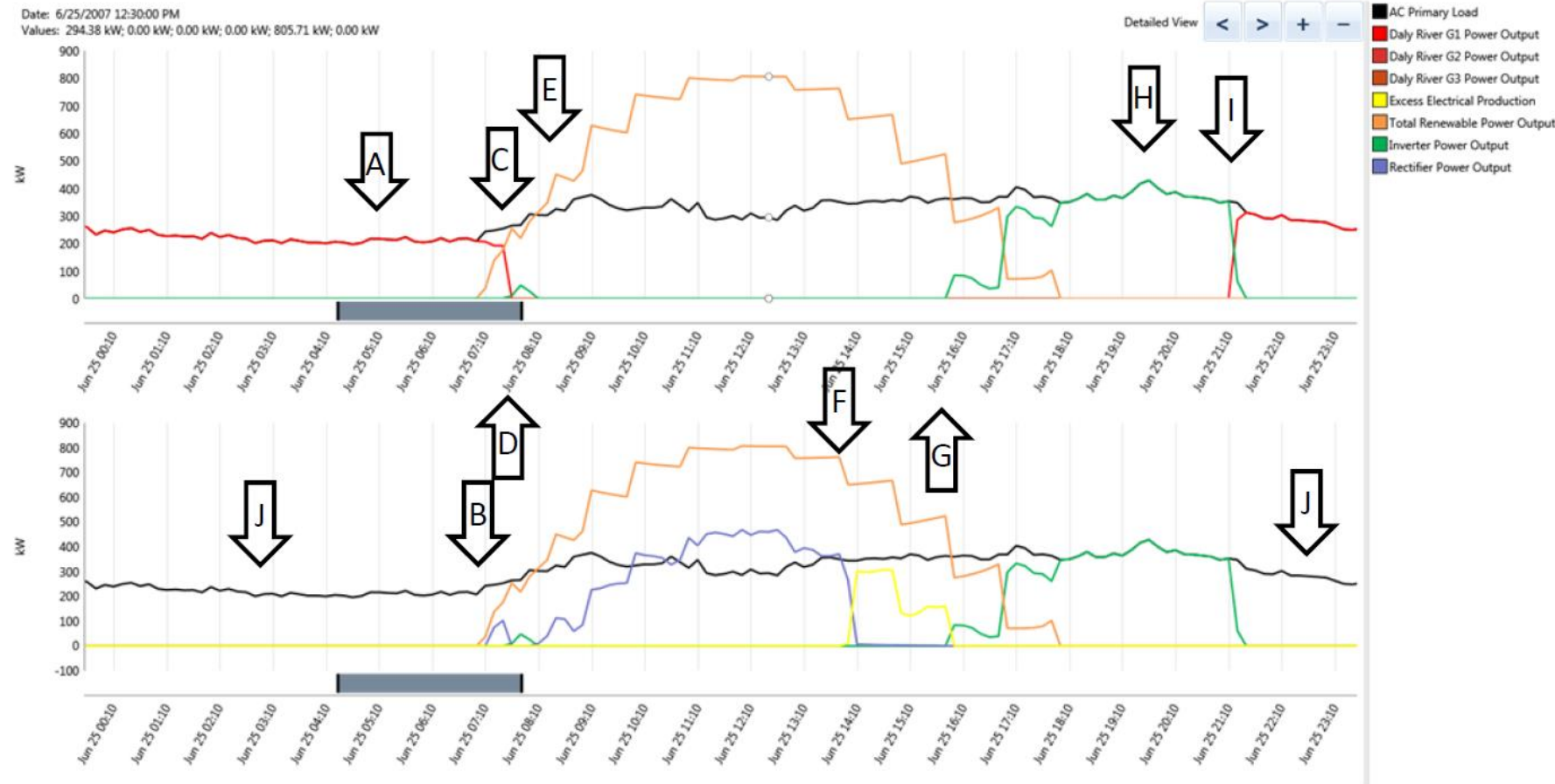
# 2014



# Daly River, Northern Territory

Population: 127  
Load: 3,000 MWh  
REP: 50%

- A. Morning load, diesel on, BESS empty.
- B. PV coming online
- C. Diesel at low load with BESS charging
- D. Bess charging & performing isochrono control
- E. Excess solar charges BESS
- F. Solar PV spill as BESS full
- G. BESS discharge into evening.
- H. Diesel off until BESS empty
- I. Diesel on
- J. Diesel supply night time load





# Rottnest Island, West Aus.

Population: 300  
Load: 5,000 MWh  
REP: 45%

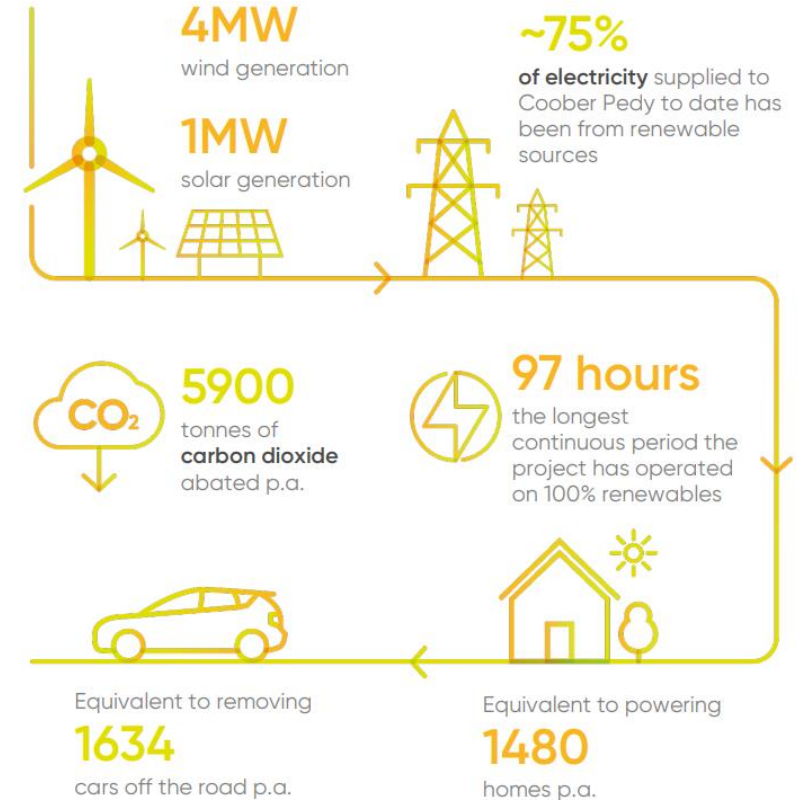
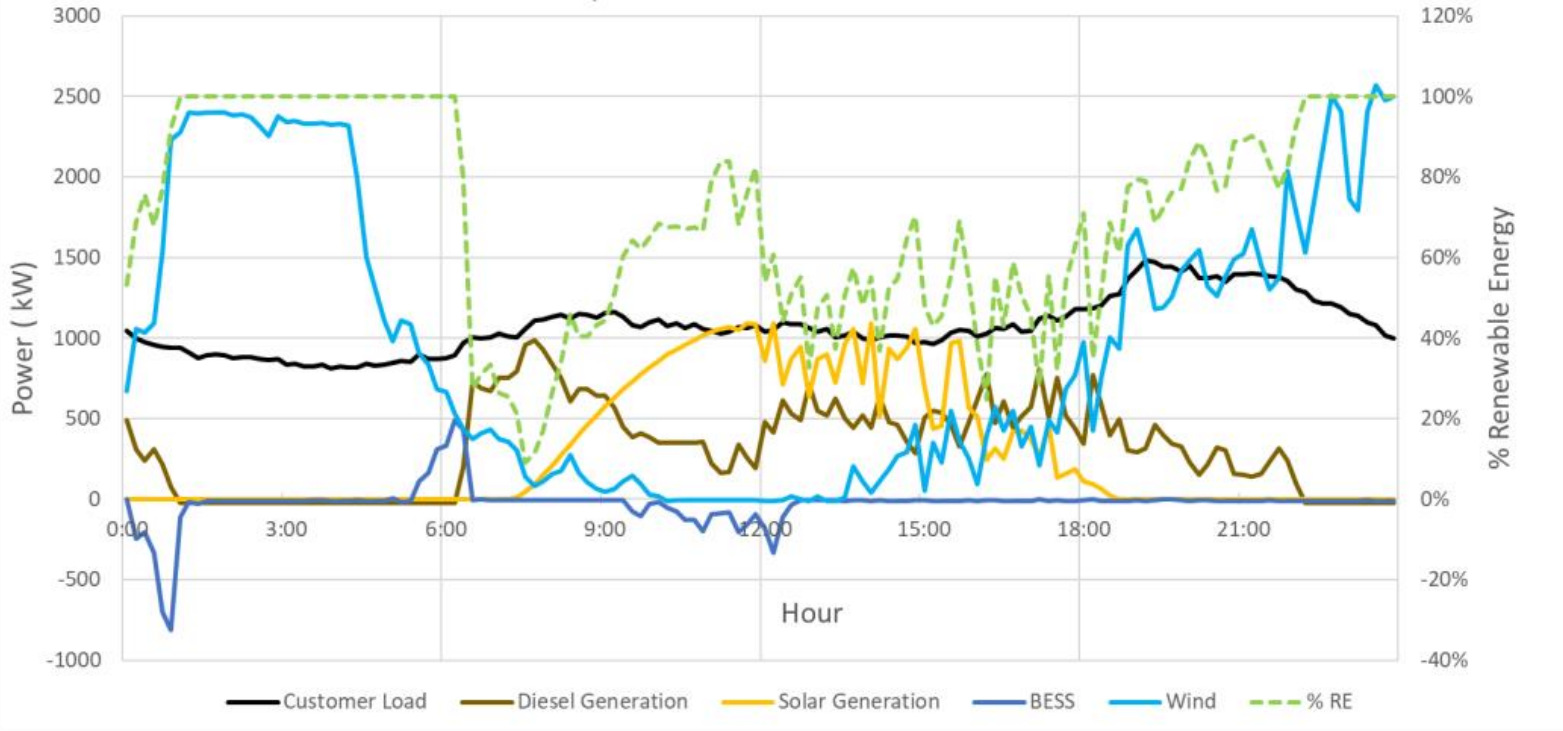
<http://www.rottnestisland.com/the-island/travel-tools-and-tips/apps>



# Cooper Pedy, South Australia

Population: 1790  
 Load: 11,500 MWh  
 REP: 70%

Cooper Pedy Renewable Hybrid Daily Generation Profile  
 2nd September 2018





# Knowledge Bank

- <https://www.hydro.com.au/clean-energy/hybrid-energy-solutions/success-stories>
- <https://www.powerwater.com.au/about/projects/current-projects/solar-energy-transformation-program>
- <https://edlenergy.com/project/coober-pedy/>

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June 2022  
Jabiru, Aus.

[www.ipconnect.org](http://www.ipconnect.org)