

## ASX Announcement

March 23, 2016

### Energy Made Clean Presentation – 3<sup>rd</sup> Annual Remote Area Power Conference

Following the announcement of the Carnegie/EMC investment and strategic alliance, please find attached the *Energy Made Clean (EMC)* presentation delivered by EMC Business Unit Manager (Microgrids), Sid Masilamani, at the 3<sup>rd</sup> Annual Remote Area Power Conference in Melbourne on March 22.

This specialised industry forum brought together industry stakeholders to share knowledge and experiences on traditional, hybrid and innovative power solutions in remote areas and provided a platform to highlight current installations, systems, projects and share views and perspectives on project economics, finance and logistic capabilities.

Energy Made Clean representatives were joined in Melbourne by Carnegie Chief Operating Officer, Greg Allen and Carnegie Chairman, Jeff Harding.

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**LEFT:** EMC's Sid Masilamani (left), John Davidson (second from right) and Jamie Ally (right) with Carnegie's Chief Operating Officer, Greg Allen. **RIGHT:** EMC Managing Director John Davidson with Carnegie Chairman, Jeff Harding.



# **ENERGY MADE CLEAN**

**Technology driving Microgrids**

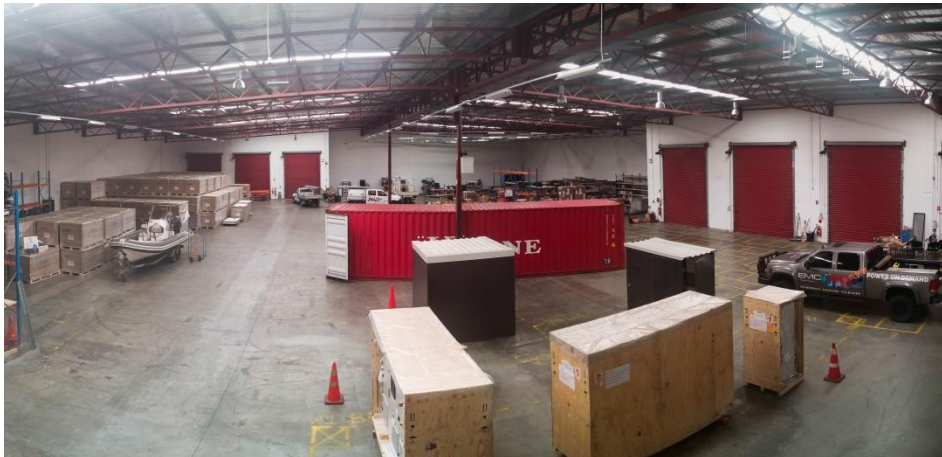
**Case Study – Meta Maya & Mackerel Island Projects**

**Remote Area Power System Conference  
March 22, 2016**



## EMC | BACKGROUND

- Unlisted public company (2002).
- Established engineering practice.
- Established construction business.
- Market leading projects.
- Fifty-five staff.
- Offices, workshop, warehouse, test facility and equipment fleet based in Perth.
- Offices in Brisbane and Melbourne.
- Licensed electrical contractor, licensed electricity retailer (SWIS), CEC accredited, chartered engineers & NPERs.
- Own and operate Carnarvon Solar Farm.



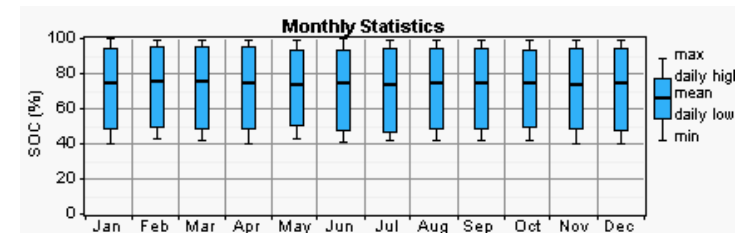
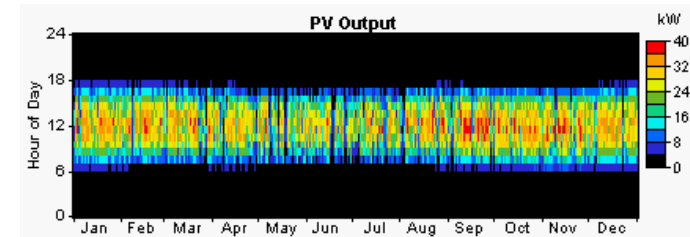
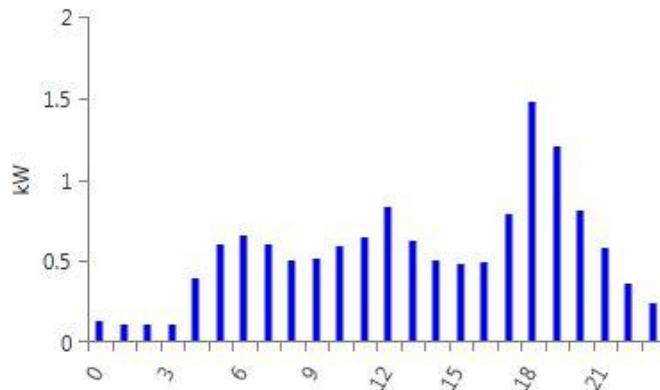
3,500 m<sup>2</sup> Construction facility, Belmont, WA



EMC Headquarters, Belmont, WA

# EMC | DESIGN METHODOLOGY

- System modelling with detailed load profile.
- Utilise HOMER/Helioscope/AISM/ETAP/DlgSILENT/MatLAB software for modelling of hybrid renewable energy systems and networks.
- Scenario development taking into account customer requirements for operational cost saving vs capital cost (custom excel files):
  - WACC, IRR, NPV analysis,
  - Customer specific fuel price and escalation,
  - Maintenance costs and replacements.
- System modelling defines system configuration and despatch strategy for a power system.



# EMC | POWER ON DEMAND

- Pre-constructed and pre-commissioned at EMC's Workshop in Perth.
- Plug and play installation.
- Systems from 10 kVA – 2000 kVA.
- Rapid deployment installation.
- Latest lithium battery integration.
- Diesel generators for backup.
- Fully remote, real-time monitoring systems.



# GRID MICROGRID | META MAYA

## FACTS AND FIGURES:

- Client: Pilbara Meta Maya Aboriginal Corporation.
- Project Location: Wedgefield, WA (near Port Hedland).
- Goal: Trial solar integration to the Regional Council building and ultimately achieve stand-alone capability.
- Intent: Train local Aboriginal communities to O&M the hybrid system and roll out to the remote towns currently running on diesel.

## EARLY STEPS by EMC:

- Installed a meter at the facility in 2014.
- Data modelling was performed using HP invoices.



Start date and time	End date and time	Number of days	Number of sample recorded	Recorded peak load over a 1 min period (kW)
12/03/14, 7:08:00	21/03/14, 14:15:00	9	13,388	71.57

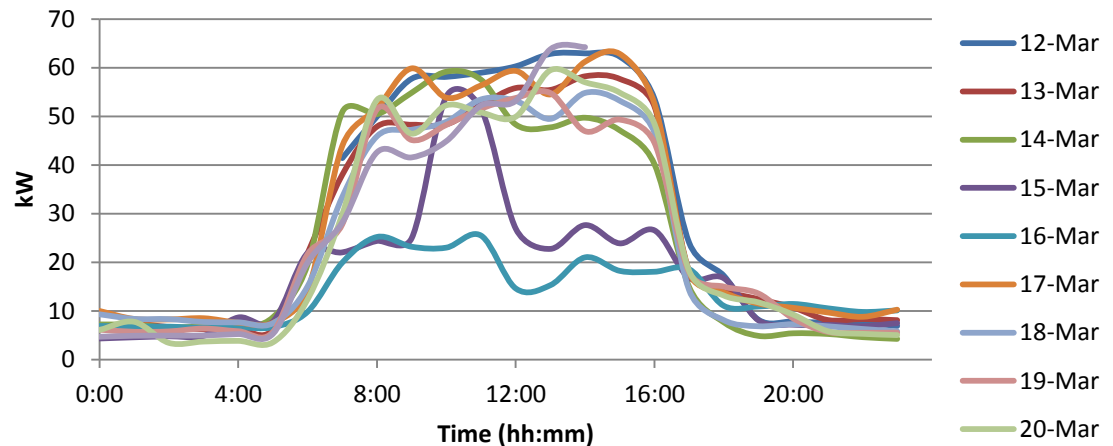


# GRID MICROGRID | META MAYA

## NOTES FROM MODELLING:

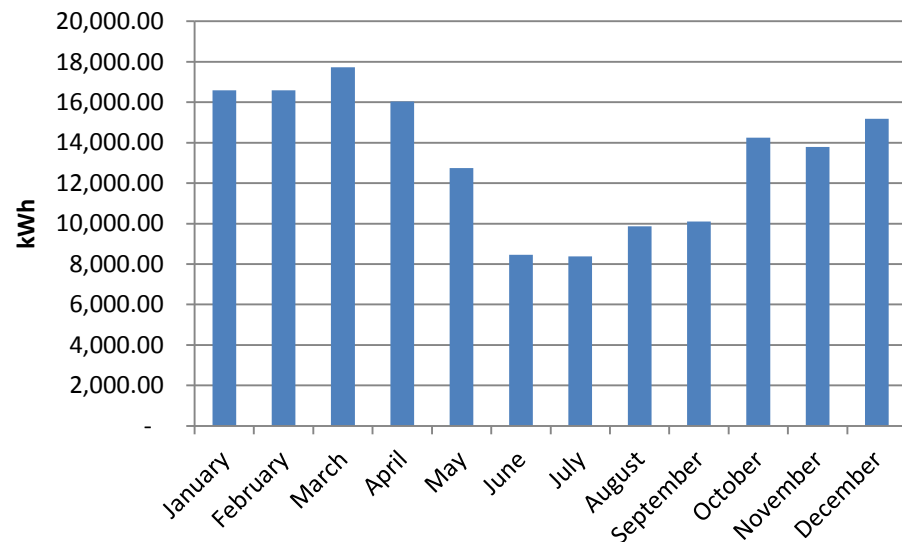
- Peak Load @ 70kW.
- Load was showing 7kW unbalance on one phase.
- Night time load approx. 7kW.
- Annual load data was built using Horizon Power invoices over 12 months.
- HP Smoothing system required in order to add solar to facility.

## Daily recorded power demand - 2014



## CONSIDERATIONS:

- Grid connected, no export.
- Grid connected, export.
- Distribution board location.
- Structural integrity for roof mounting.
- Oversizing of solar to load ratio.



# GRID MICROGRID | META MAYA

## EMC SOLUTION:

- 100 kW Solar PV (Carport Mounted partly CAT-D).
- 110 kVA Diesel Generator.
- Pre-assembled and pre-commissioned 20ft POD, 64 kWh Sony Lithium Iron Phosphate.
- Fully remote monitored and controlled.
- National Instruments control architecture.
- >35kAUD savings / year with a potential seven year payback.





# ISLAND MICROGRID | THEVENARD ISLAND

## FACTS AND FIGURES:

- Client: Mackerel Island Corp
- Project Location: 20mins offshore from Onslow, WA
- Conditions: Coastal location and CAT-D wind region.
- Revenue: Thevenard Island is a unique holiday location with spectacular fishing, diving and crystal clear waters.
- Goal: Fuel independence and savings.



## EARLY STEPS by EMC:

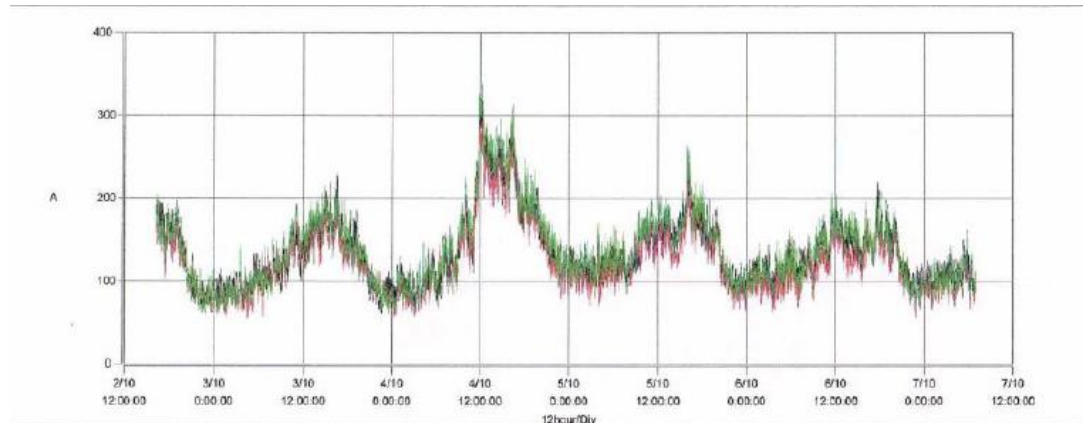
- Data modelling was performed using existing load data
- Evaluated using VRLA and Li-Ion technologies
- Evaluation of fixed to tracking PV systems
- Energy efficiency study to optimise the load use at the facility
- Delivery of diesel generators for early power use.



# ISLAND MICROGRID | THEVENARD ISLAND

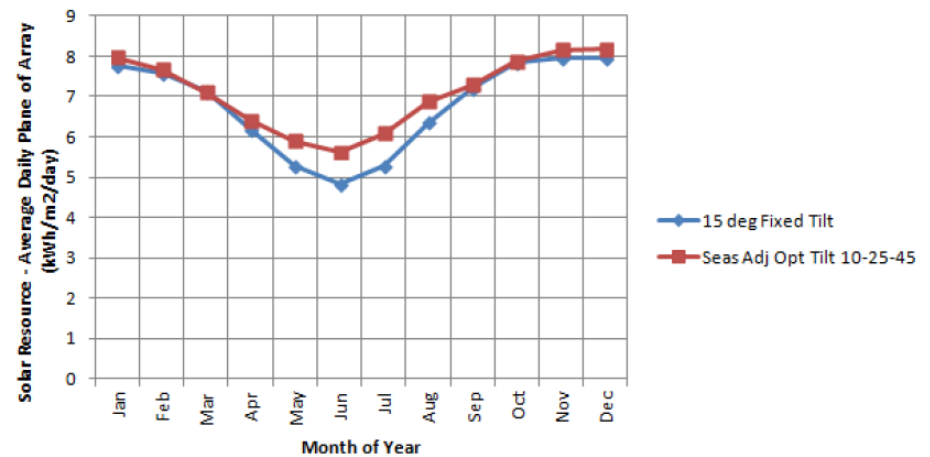
## NOTES FROM MODELLING:

- Peak Load @ 240kW.
- Annual load usage > 1GWh.
- Night time load approx. 20kW.
- Corrosive location and high wind region.



## CONSIDERATIONS:

- Maximum diesel savings.
- Reliability of batteries in remote areas.
- Ability to switch off diesel during full irradiance days.
- Allowance for low winter sun irradiance.



# ISLAND MICROGRID | THEVENARD ISLAND

## EMC SOLUTION:

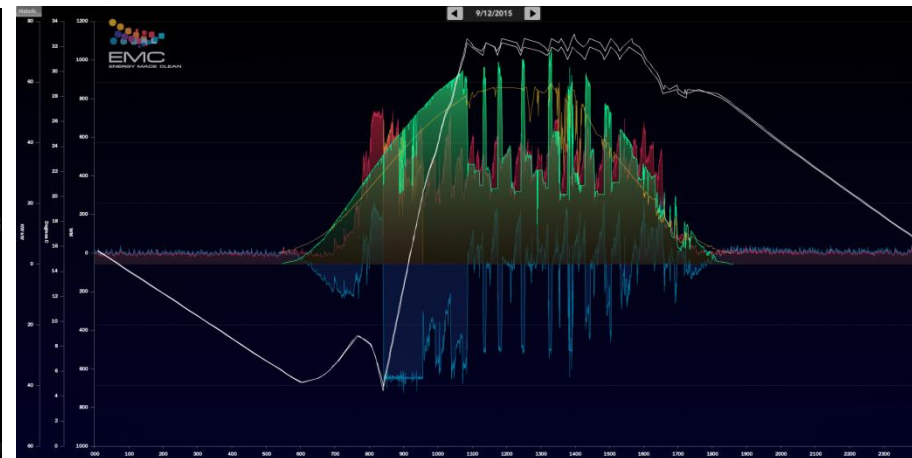
- 614 kWh Sony Lithium Iron Phosphate.
- 324 kW solar PV (east/west).
- 440 kVA diesel generation (4 x 110kVA).
- Containerised in 2 x 40ft containers.
- Ground mount screwpile solar PV (category D).
- Real time monitoring and control.





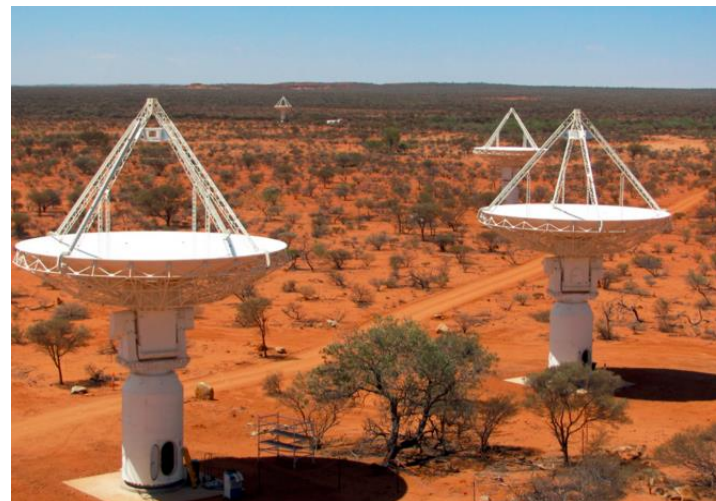
# MICROGRID | ADVANCED CONTROL

- Real time monitoring.
- Developed in-house.
- 3G, satellite and radio links.
- Immediate fault notification.
- Monthly reports.
- Customer portal.
- Tariff Quality Metering (BOOM).



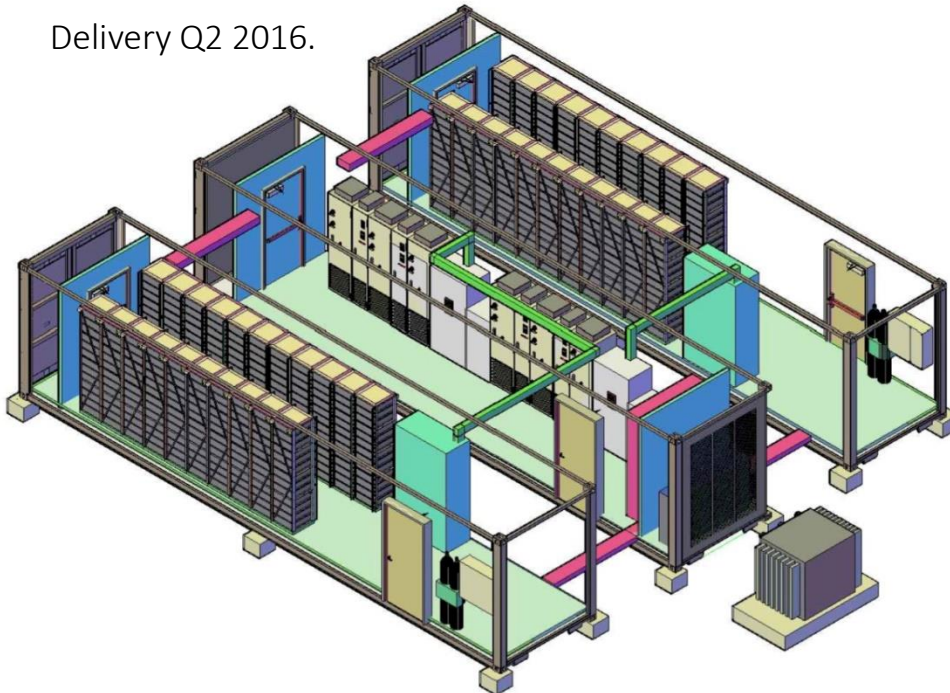
# UTILITY SOLAR | ASKAP

- Client: CSIRO.
- Location: 350km northeast of Geraldton, WA.
- Goal: Worlds most sophisticated antenna system to have the most sophisticated solar/storage/diesel power system in the world.
- EMC delivering 1.6MWp solar facility in combination with an N+1 IGBT based battery system being capable of diesel off functionality.
- PV central inverters delivered in EMI shielded containers manufactured by EMC in Perth.
- EMC tasked to perform structural design for solar installation and fully pre-commissioned containers from Perth.



# UTILITY STORAGE | CSIRO

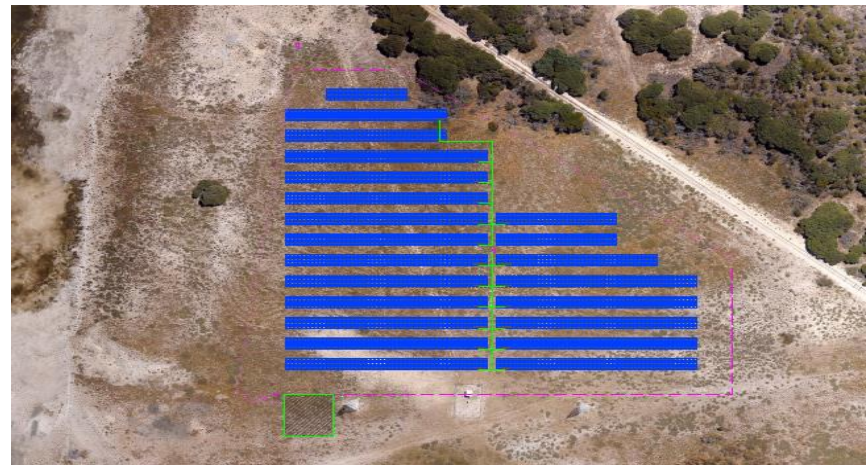
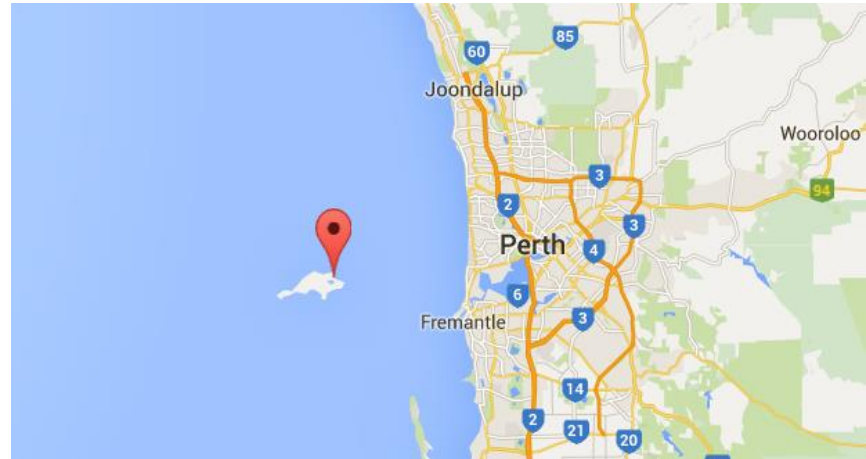
- 1.25 MVA microgrid-connected at 6.6 kV.
- ABB PCS100 Inverter 1.25 MVA.
- 2.6 MWh Samsung SDI Lithium batteries (68Ah).
- Containerised installation by EMC.
- Fire suppression/fire rated.
- EMC control system (National Instruments).
- Centralised HVAC.
- Delivery Q2 2016.





# ISLAND MICROGRID | ROTTNEST

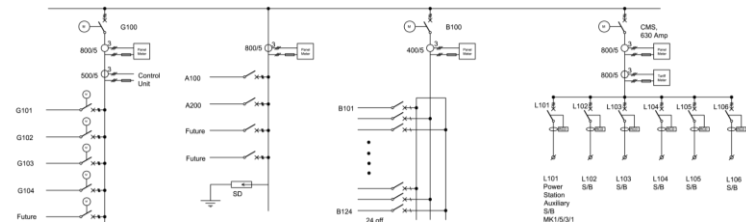
- Client: Hydro Tasmania, ARENA \$4.8M funding granted.
- Project: Rottnest Island Water and Renewable Energy Nexus (WREN) project.
- Location: 19km West of Fremantle, WA
- Goal: Increase renewable fraction to 45 per cent.
- Current Generation: 600kW wind, 7 x diesel generators including LLDs.
- EMC delivering new 630kWp solar facility including solar protection & control system.
- EMC providing POC at LV end of 11kV substation.
- Hydro Tasmania Control System and Load resistor used for dispatch of loads.



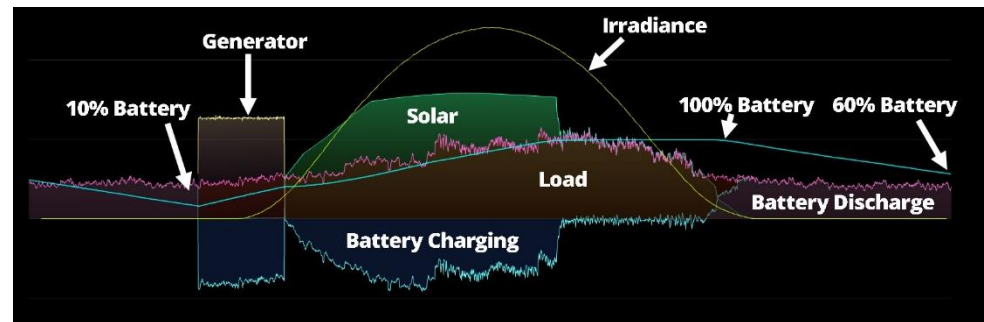
# MARKET NEWS | INFRATEC

**Infratec and EMC's new partnership model to expand state-of-the-art Solar/Battery/Diesel Solutions to NZ and the Pacific Islands**

EMC will expand it's focus and approach to service the NZ and Pacific Island markets.



Infratec bring a known presence in the NZ/Pacific region, now combine with EMCs technology to offer the worlds best high penetration solar systems.



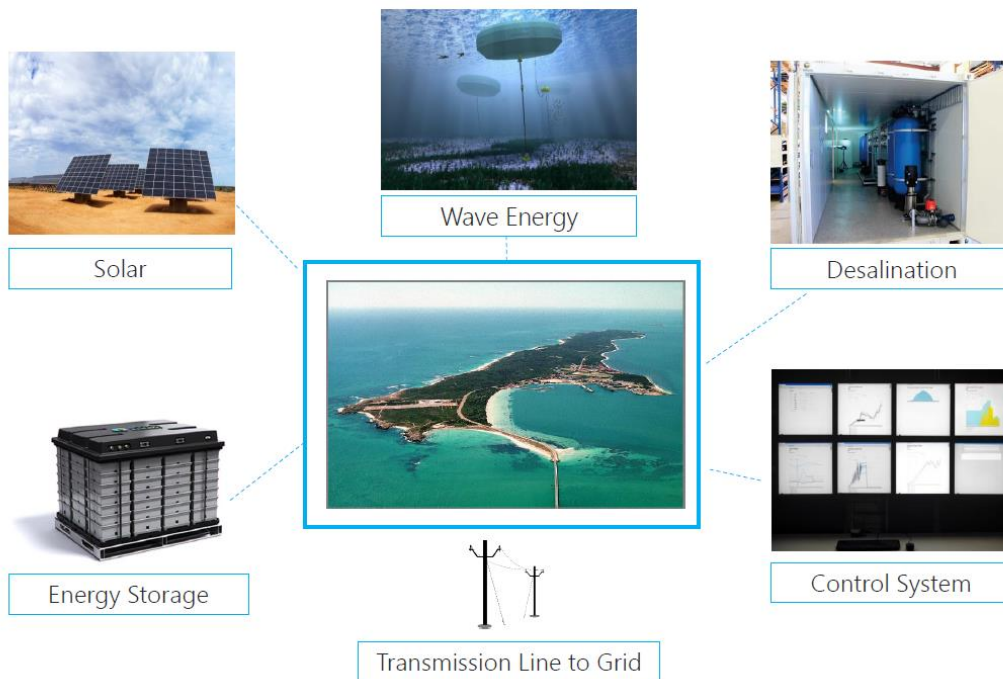
\* Infratec Renewables is part of NetCon Ltd, electricity distribution specialists based in Timaru, New Zealand.

# A STRATEGIC ALLIANCE | EMC & CARNEGIE

- Leading wave energy developer, Carnegie Wave Energy (ASX: CWE) today announced an investment and alliance agreement with Energy Made Clean (EMC) worth \$4.5 million.
- Deal composed of \$1.5 million in Carnegie shares and \$3 million in cash for a 35 per cent stake with the two companies forming an alliance to share resources, skills and expertise.
- Companies to share a joint focus on the delivery of a combination of renewable technologies such as solar, wave, wind and energy storage in the form of microgrids to islands, off-grid and grid-connected communities.
- Partnership combines Carnegie's transformational work in wave energy with EMC's microgrid expertise.



# WAVE-INTEGRATED MIROGRIDS | Mauritius



- Carnegie to deliver study and design initiatives on Mauritius and the neighboring island of Rodrigues, including:
  - A renewable energy roadmap.
  - Assessment of the Mauritian wave energy resource and the identification of a preferred site.
  - The design of a microgrid powered desalination plant on Rodrigues.
- The integration of a mix of renewable technologies is set to provide cheaper, cleaner and secure solutions for island nations.
- Mauritius first combined CWE/EMC project with others to follow.

# THANK YOU FOR YOUR ATTENTION

[www.energymadeclean.com](http://www.energymadeclean.com)

