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Hybrid Microgrid Systems

Providing energy security & improved affordability to the Pacific

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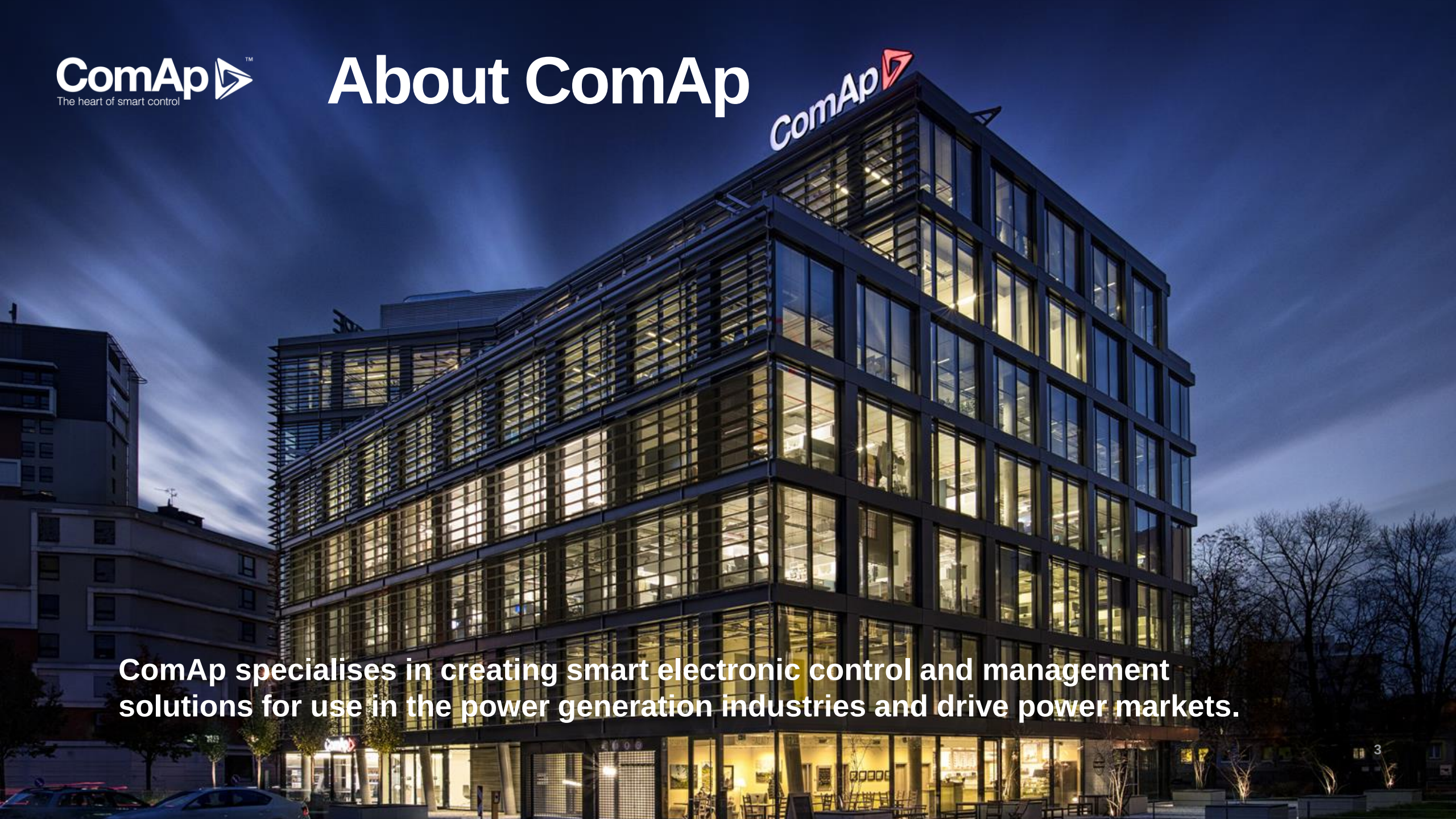
Agenda

- Company Profile
- ComAp RCE
- Hybrid System Definition
- Typical Applications
- Willinga Park - Project Example

About ComAp



ComAp specialises in creating smart electronic control and management solutions for use in the power generation industries and drive power markets.

ComAp's Industries

- Datacenters
- Power Plants
- Industrial
- Mining
- Commercial Buildings
- Agriculture
- Rental
- Renewables
- Hospitals
- Telecom
- Oil and Gas
- Events
- Marine
- Construction
- Banks

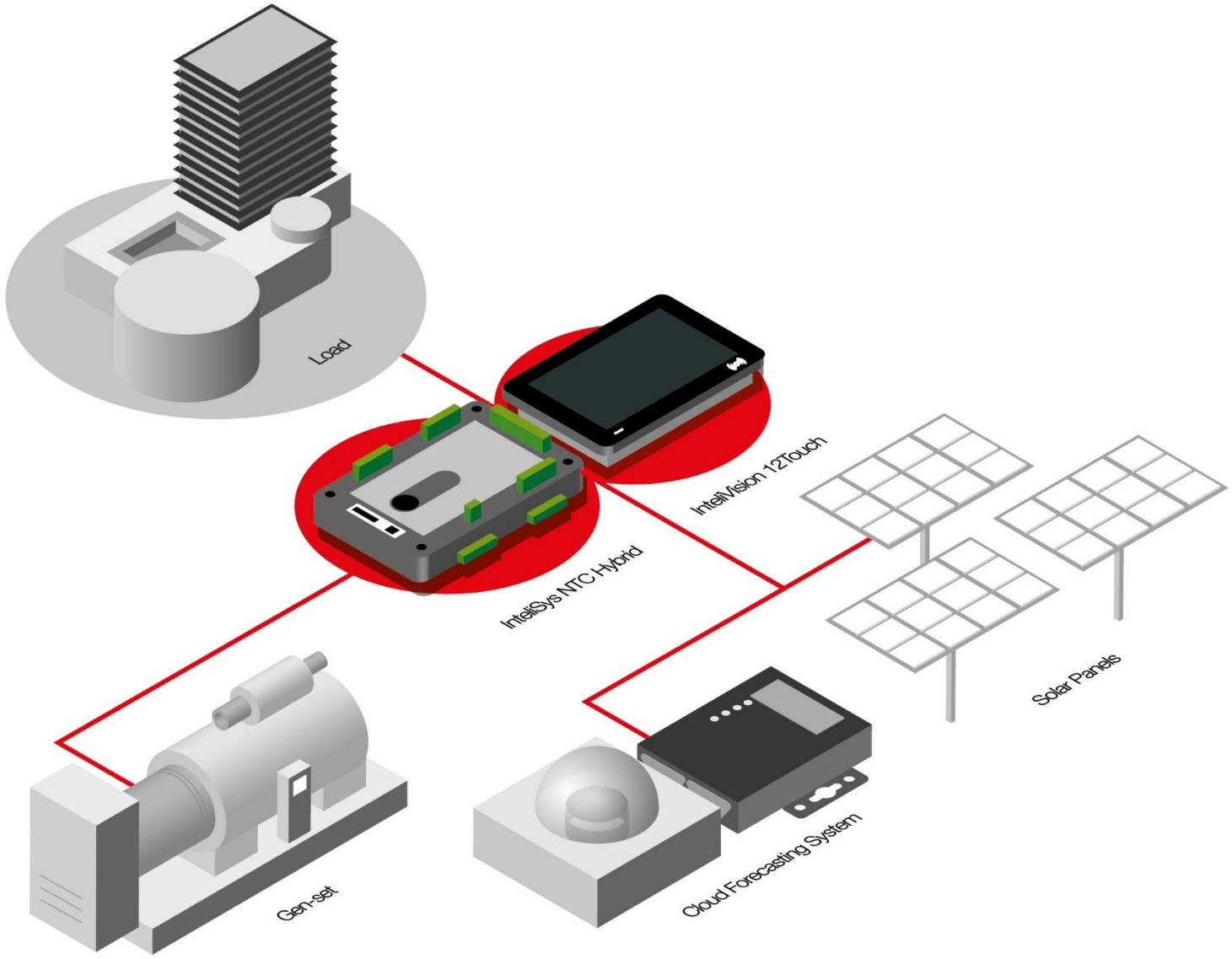
Renewable Centre of Excellence

ComAp’s Renewable Energy Centre of Excellence (RCE) is dedicated to developing products and solutions that meet the growing needs of the renewable energy market.

Hybrid Microgrid Systems (HMS)

- **What is a hybrid microgrid system?**
- *Renewable Generation component* – PV, Wind and/or geo thermal.
- *Thermal Generation component* – Diesel, Gas and/or Biofuel
- *Optional/Essential Storage Component* – BESS, Rotary UPS, Dispatchable Load
- **Existing Challenges?**
- *Competing Interests* – Performance Guarantees, Cycle rates, minimum loading
- *Commercial Viability & Funding* – Small Scale vs Large Scale, price sensitivity, upfront expenditure and med-long term payoffs vs IPP Model and long term commitments.
- *Technical Challenges for high RE penetration systems* – control complexity, response rates, frequency stability & control and visibility
- *Environment Conditions* – Battery Life, Generation efficiencies, additional maintenance requirements.
- **Typical Trade-offs in Today's Systems**
- Reliability
- Renewable Penetration
- Cost

An Example Hybrid Microgrid

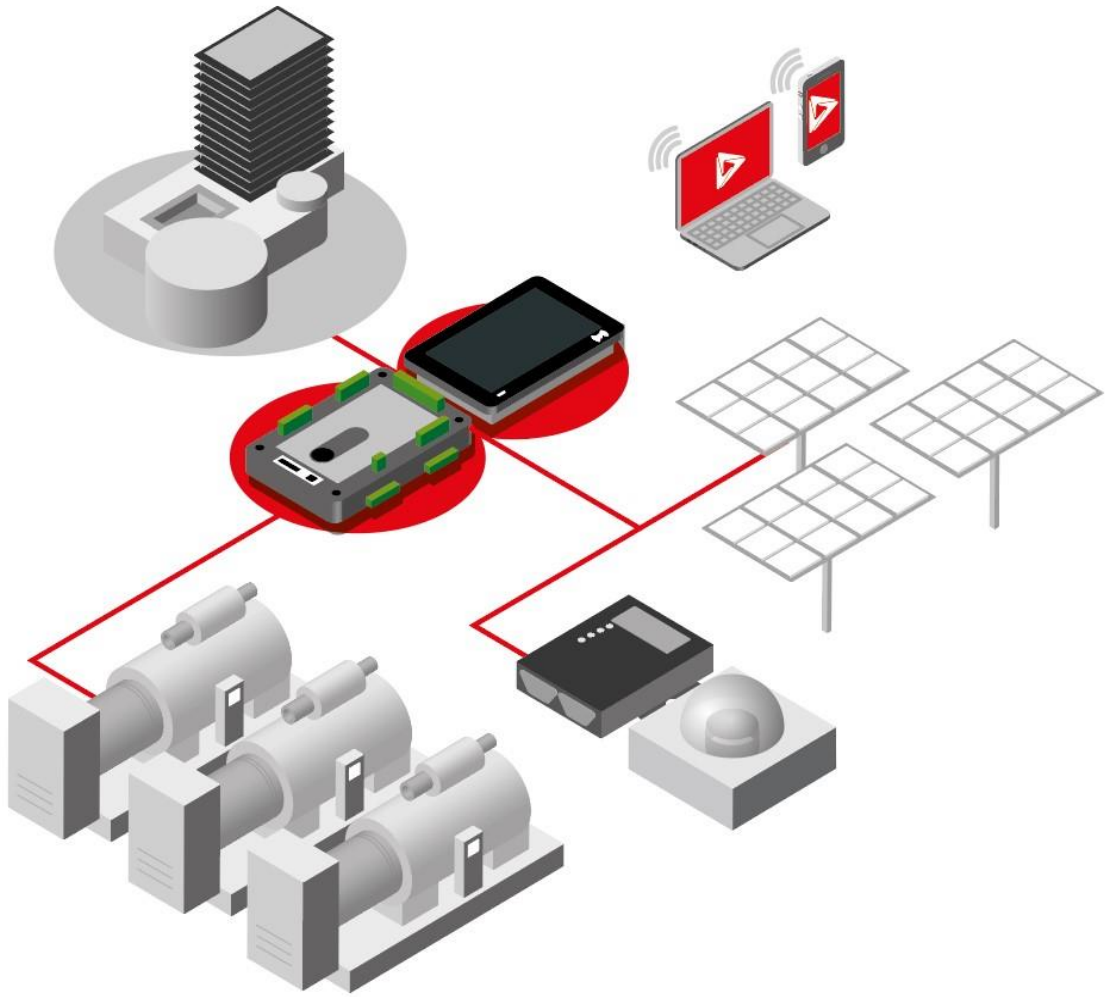


Single Diesel PV Hybrid

- **Simple cost effective solution (Fuel Offset)**
- **Typical Application –** Anywhere a generator is running continuously to provide power
- **Technology Constraints –** Minimal. Most generators & PV inverters are suitable.
- **Renewable Penetration constrained by Genset**
  - 50% Mechanically governed generators
  - 60-70% Electronic governed generators
  - Up to 90% on low load generators
- **Direct & Passive control methodologies available**
  - Direct P/Q Control – PV constrained to maintain minimum loading (Additional complexity)
  - Passive Droop Control – PV automatically regulated via frequency & voltage droop regulation of the Genset.

Multiple Diesel PV Hybrid

- **Simple cost effective solution (Fuel Offset)**
- **Typical Application –** Existing diesel powerhouse operating 24/7.
- **Technology Constraints –** Minimal. Most generators & PV inverters are suitable.
- **Renewable Penetration constrained by Genset**
- **Wholistic Energy Management –** Direct power management of PV contribution and number of gensets required to support load.
- **Improved Fuel Offset Technology –** Cloud forecasting systems can reduce over capacity and PV spill (Increasing system efficiencies without Battery Storage)
- **Does not support Diesel Off as an option.**



Diesel, PV & Battery Hybrid

- **Complexity dependent on functionality**
  - Grid connected vs Islanded Systems
  - Prioritisation of Energy sources – Minimisation of LCoE
  - Scale & Renewable Penetration Targets
- **Typical Application –** Existing diesel power house with increased reliance on renewables for primary supply
- **Cost –** C&I Scale cost effective. Utility Scale reliant on either Complex control solutions and/or increased reliance on BESS technology.
- **Flexibility & Reliability –** The “right” combination of control & BESS technologies ensure generation assets can be utilised to ensure the best overall outcome.

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Case Study – Willinga Park

Case Study – Willinga Park

- **World Class Equestrian Centre**
- Located 4hrs South of Sydney, NSW
- Stud Farm, Agistment, Show Jumping, Dressage, Camp Drafting etc.
- Hybrid Microgrid System Installed behind the meter
- On & Off Grid Capable
- PV, Diesel Gen & BESS (LI based)
- **Main Parties Involved**
- EPC – Shepherd Electrical
- Owner's Engineer – Rudds Consulting
- System Integrators – ComAp

- **Key Equipment Suppliers**
- ComAp Control Systems
- SMA Inverters
- Tesla Battery System
- MTU Diesel Gens
- **Other Features**
- Full balance of plant control & monitoring with 13 distinct hubs being monitored in addition to the power station.
- WebSupervior Pro - Remote Monitoring, Reporting and Paging System

Willinga Park - Functionality

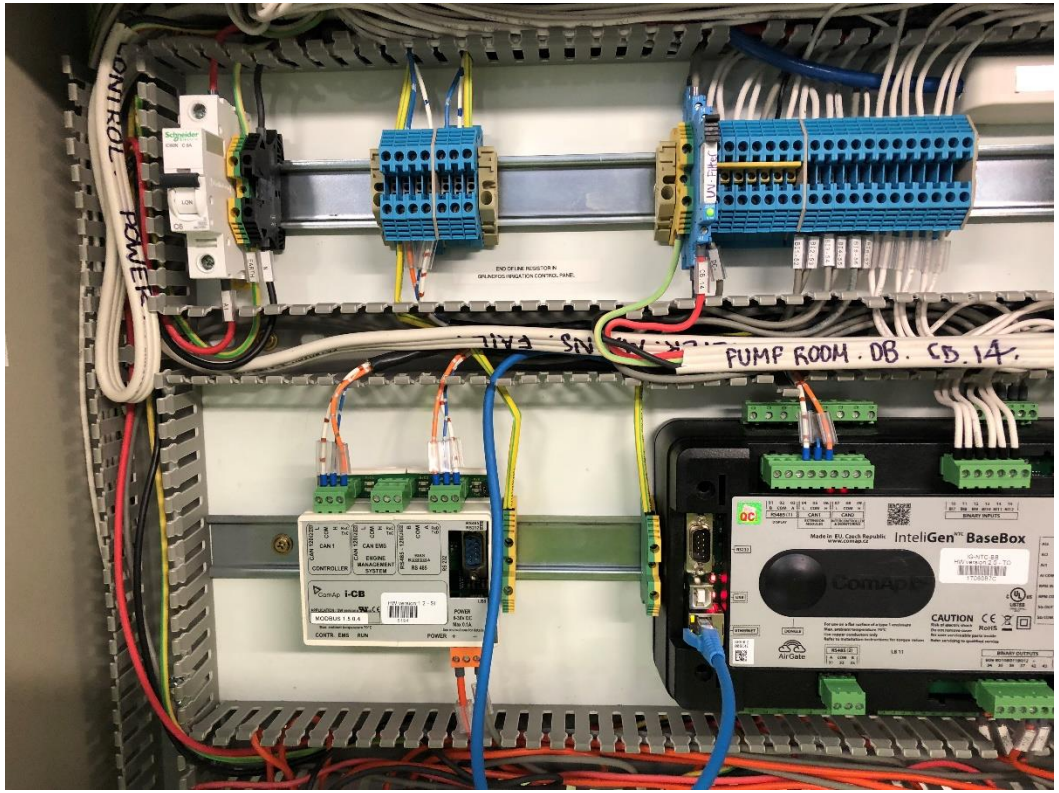
- **Key Features of the System**
- On Grid
- Network Support using BESS & Export of additional PV
- Peak Lopping – Managing on-site demand with 900kVA network constraint
- Seamless transfer to off-grid when network is volatile
- Off Grid
- PV plus Battery System only during non-event days (Gens utilised for battery charging during sustained poor weather events)
- Diesel, PV & Battery during event days. (Load up to 10 times nominal usage)
- Diesel plus PV feature for battery servicing or under fault conditions.

Willinga Park - Outcomes

- **Key Outcomes of Willinga Park HMS**
- Reduced Costs
- Usage
- Demand Charges
- Network Upgrades
- Export Revenue
- Local DNSP Support
- Energy Security
- Lower Operational Risk
- Improved Environmental Footprint


DIESEL FUEL


TESLA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i-CB


InteliVision 5
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InteliVision 12Touch
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Home [1/21]
-10 kW
29 kW
39 kW
TESLA
LOAD
GENSETS
LOAD/PF CTRL

Willinga Park - Video


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