



# Renewable Energy Options for SKA

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Wissenschaftsforum Berlin Mitte – April 7, 2011

# Horizons Service Area

- Supply Area 2.3M km<sup>2</sup>
- 42,000 customers
- 34 power systems
- 950 GWh sent in 2010
- **Regional Depots in:**
  - Kununurra
  - Broome
  - Karratha
  - Port Hedland
  - Carnarvon
  - Esperance
  - Bentley – Perth
- 18 milli customer per km<sup>2</sup>
- Southwest Interconnected System
- WEM- Wholesale Electricity Market
- Verve – Generation
- Western Power – Transmission
- Synergy – Retail



# MARS



- **Modular** – modular design, construction and deployment
- **Automated** – automation of network & generation
- **Renewable** – seamless integration of renewable energy
- **Scale-able** – ability to add or remove capacity to suit load change



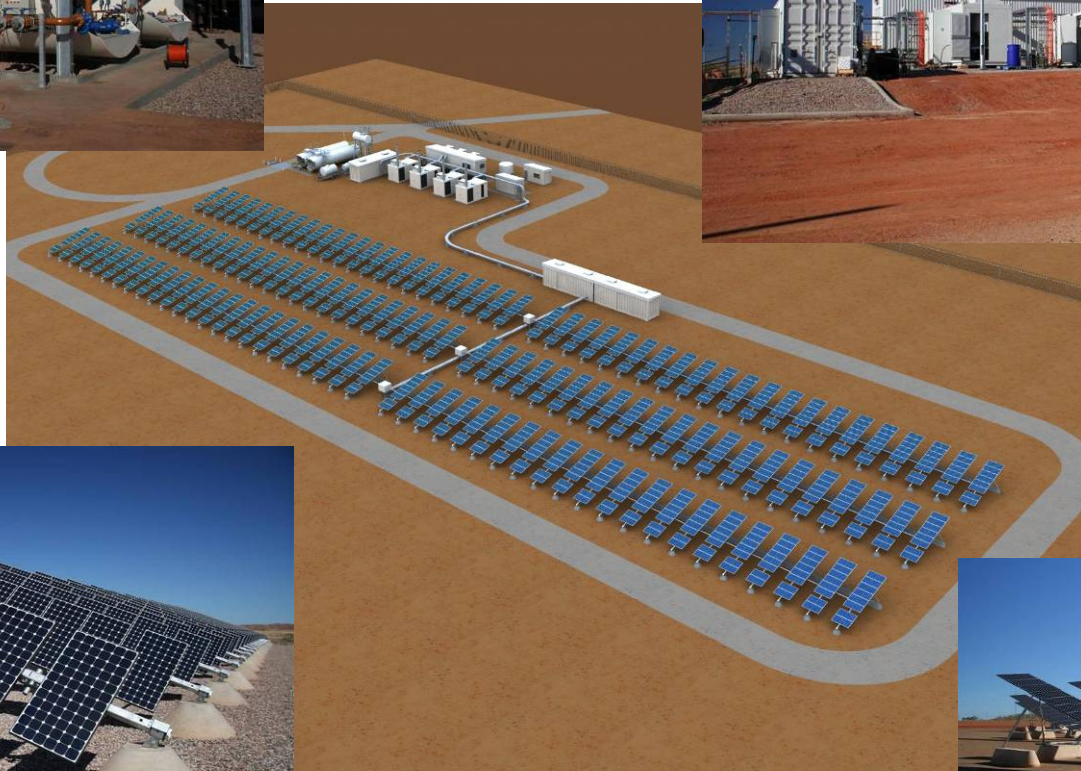
## Factors driving MARS development



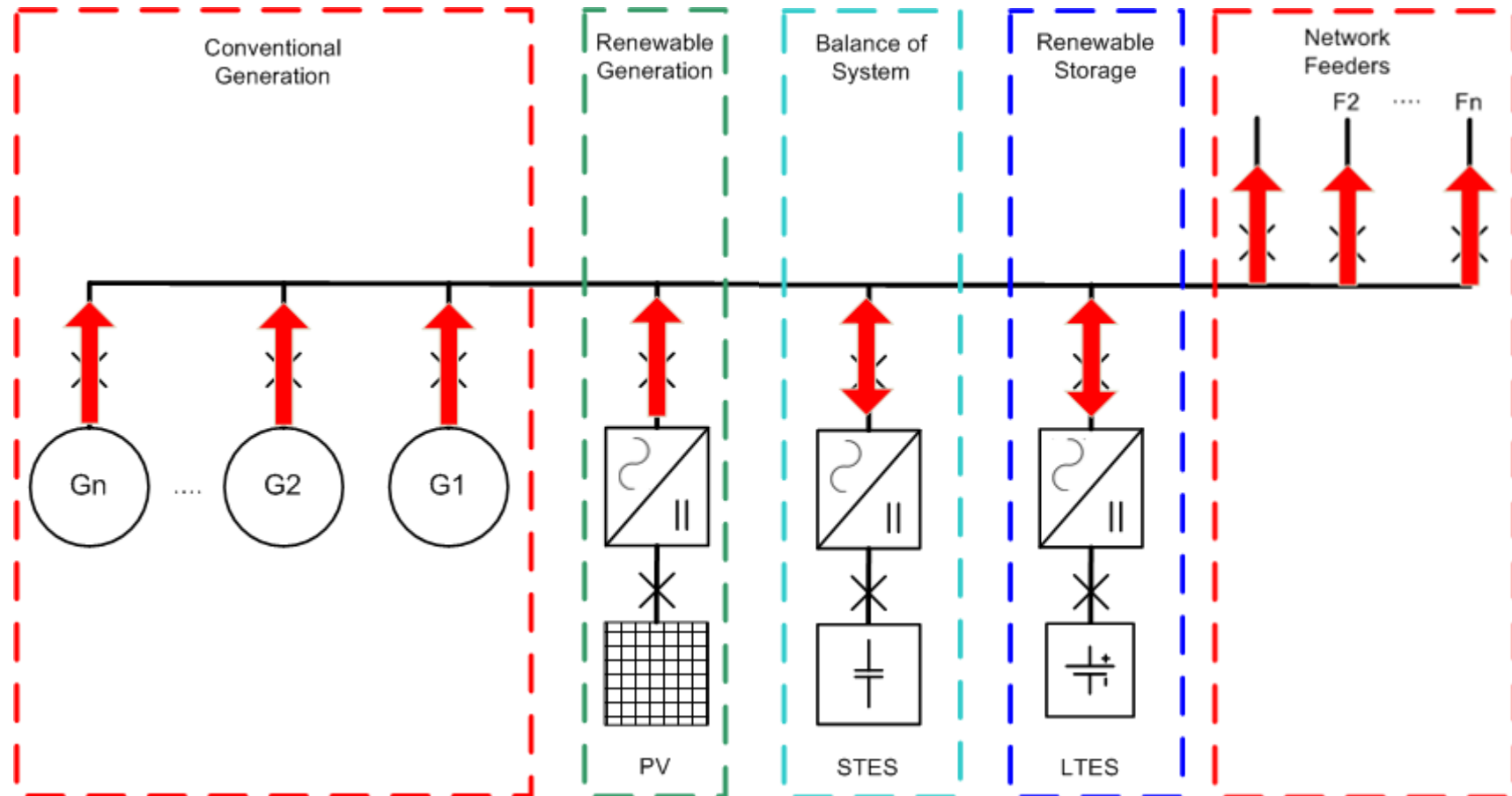
- Reduce the cost-to-deploy (CapEx)
- Reduce the cost-to-serve (OpEx)
- Reduce CO2 emissions ready for an Emissions Trading Scheme (ETS)
- Take advantage of falling cost of PV
- Need to develop pathways to suitable storage technologies

# Marble Bar & Nullagine

**HORIZON**  
POWER



# Future Power Station Design

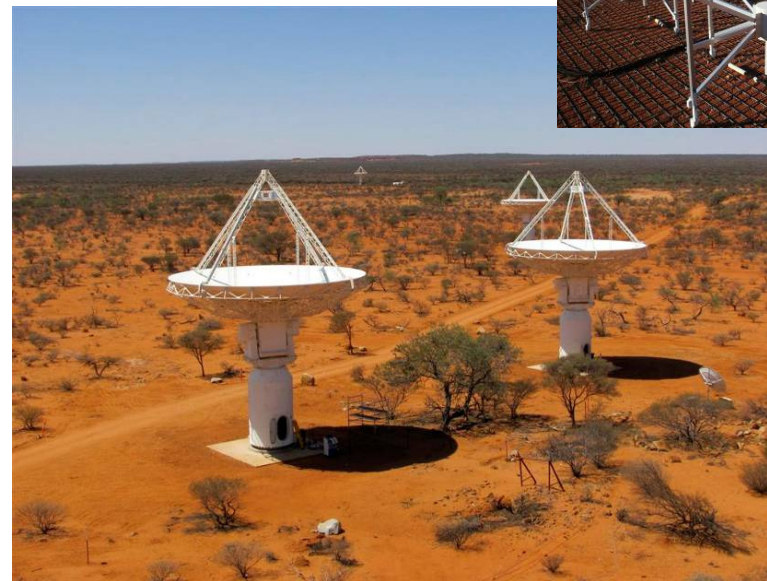
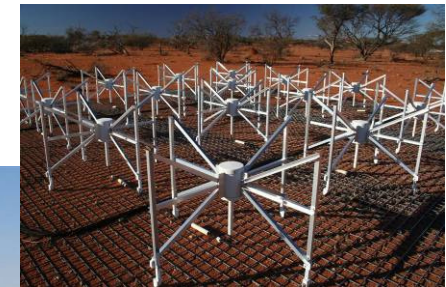


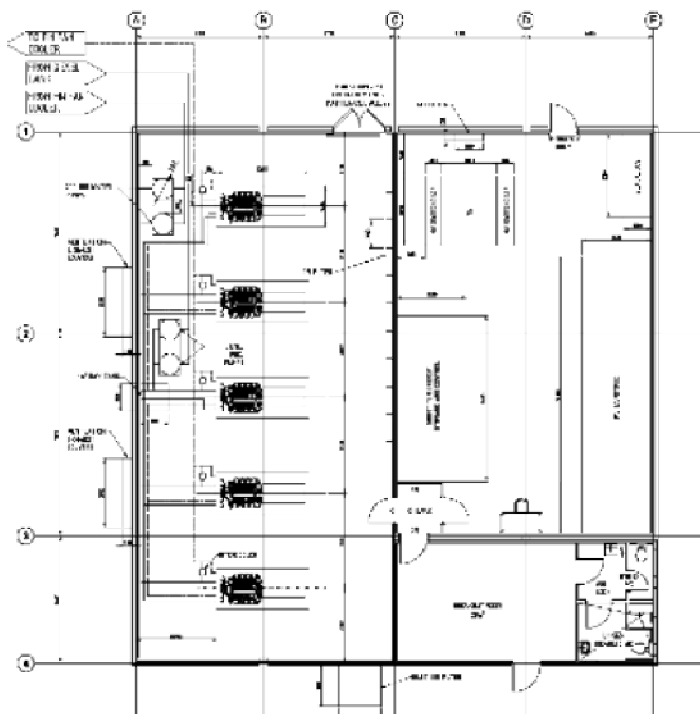
100% Renewable Controlled Renewable Power Station

# Murchison Radio-astronomy Observatory

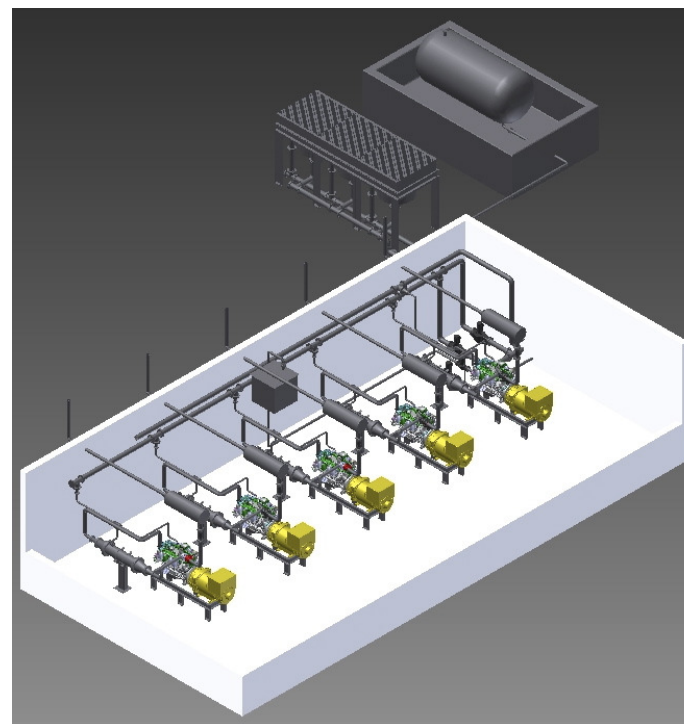


- Flexibility in fossil fuel generation loading – 20%
- Control of the renewable energy generation
- Energy storage – Short term & Long term
- Control system to facilitate energy balance
- Feeder management and dispatch-able loads
- Fuel flexibility – Biodiesel & Hydrogen co-firing
- >20dB below MIL Spec RF emissions

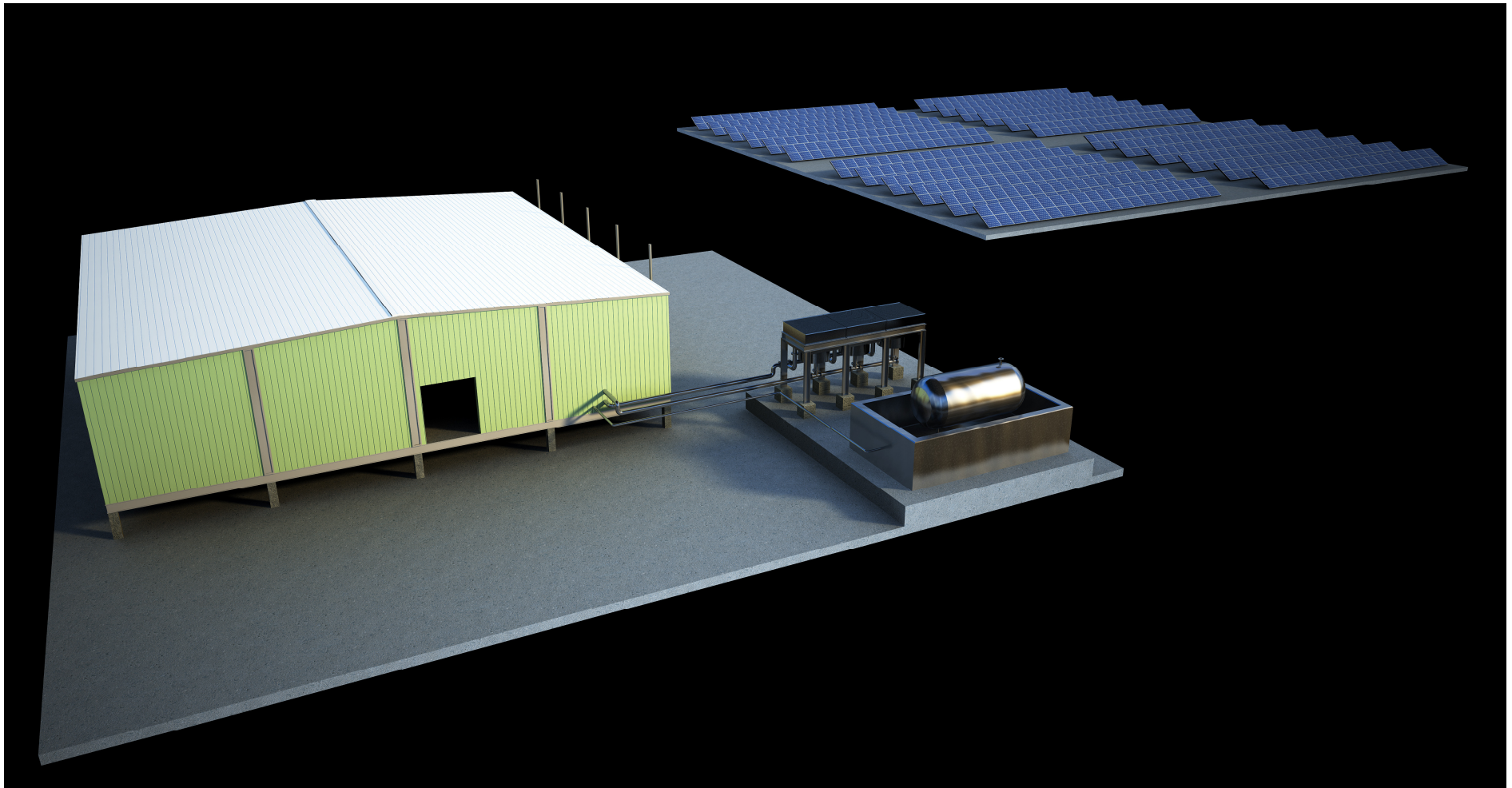




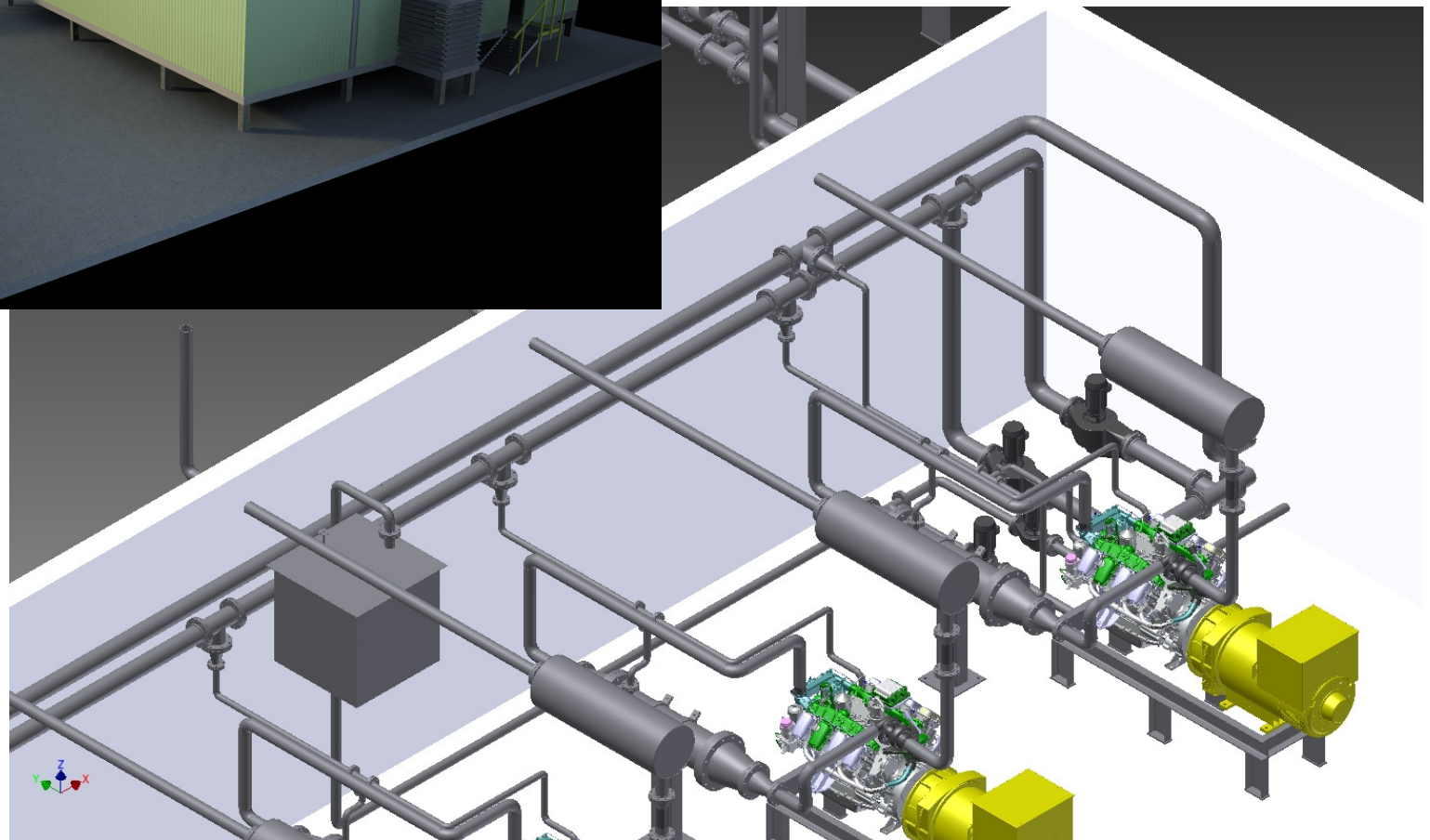
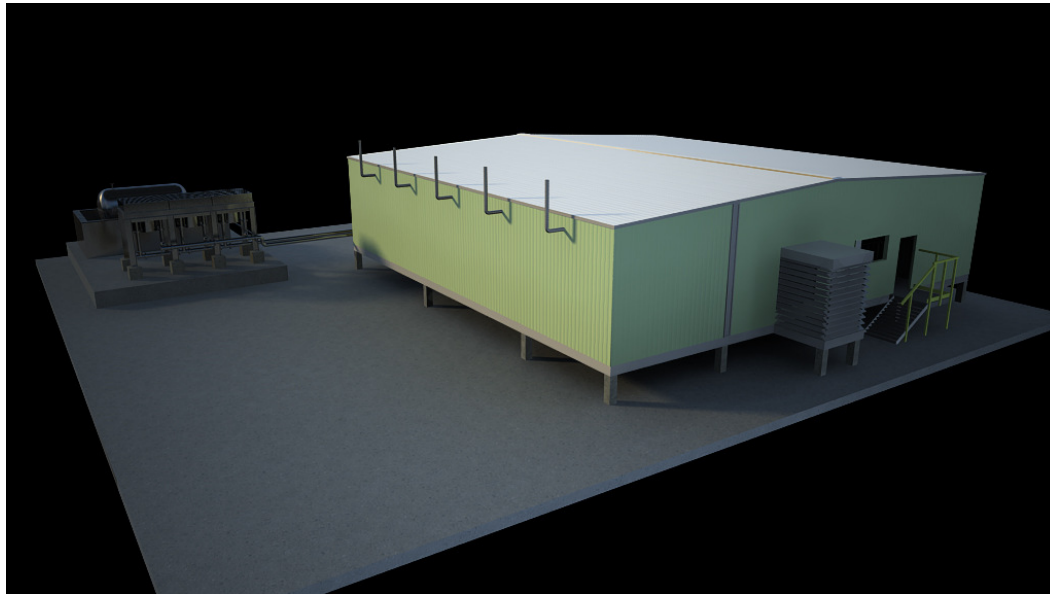
- Modular design using the same construction technique as the ASKAP correlator building
- Identical RFI mitigation techniques
- Two levels of attenuation in the room design
- Power station located > 1km from antennae
- All RFI emissions reduced to > 20dB below MIL spec 461F



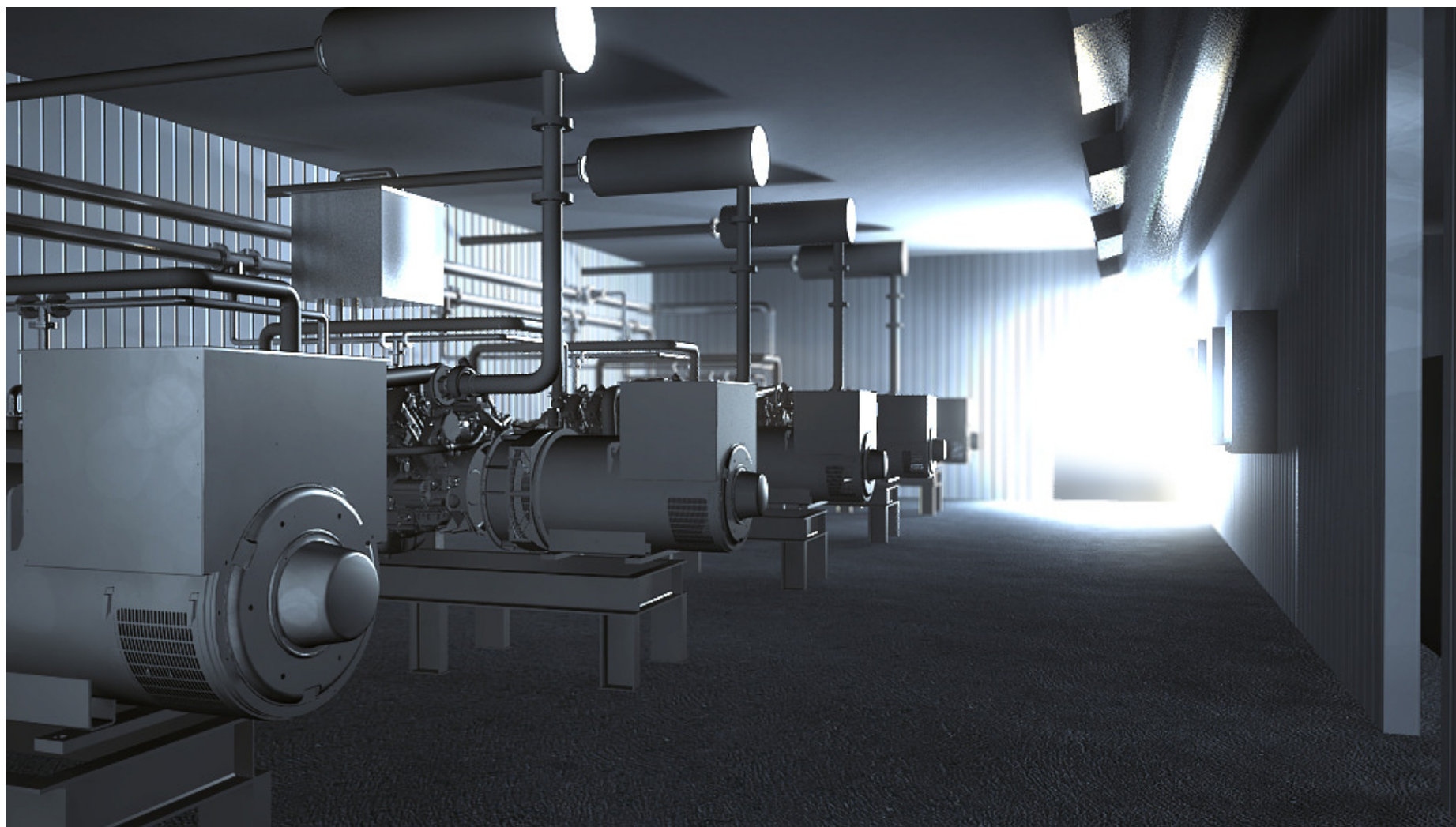
# MRO Power Station Site Layout



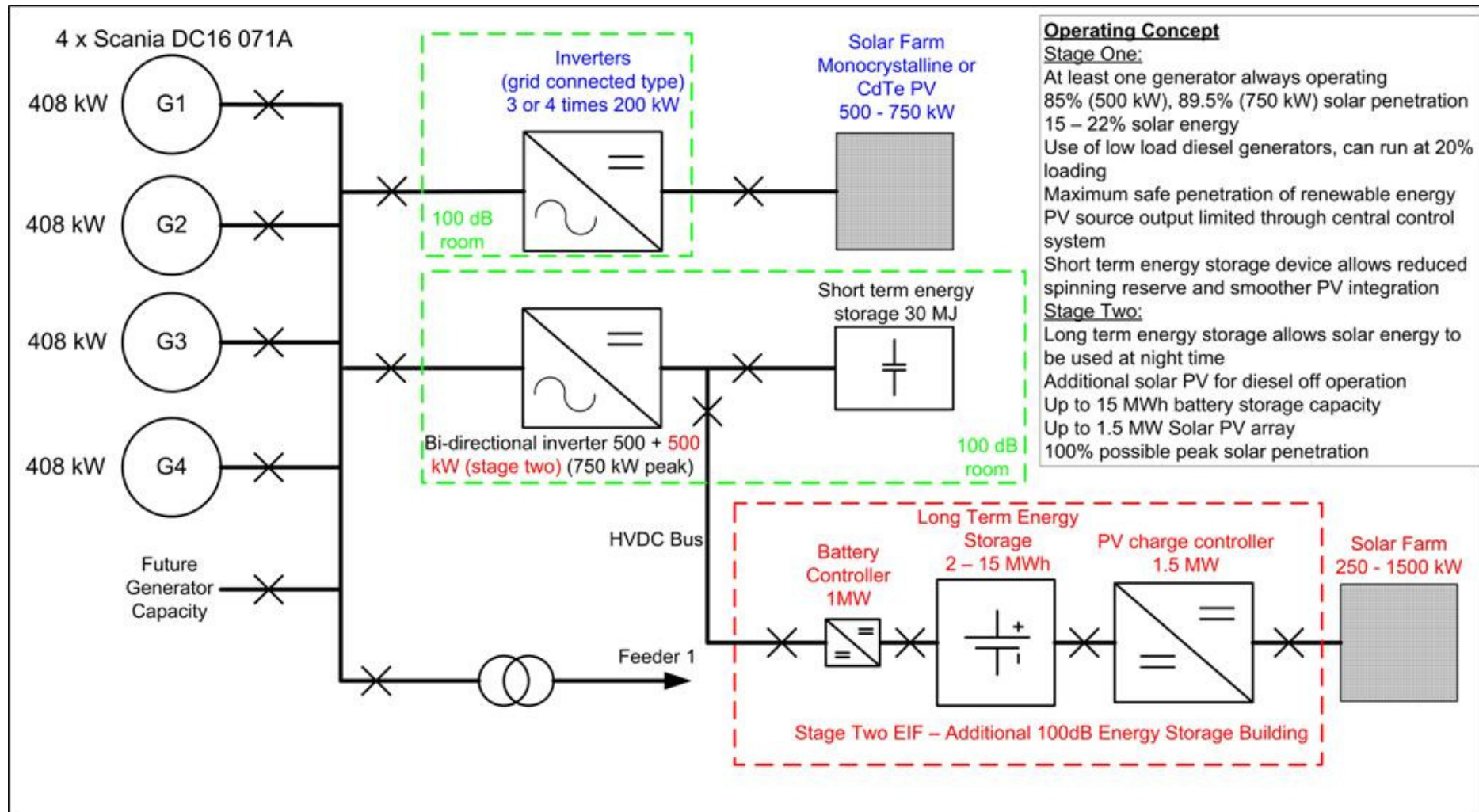
# MRO Power Station Fuel & Oil System Layout



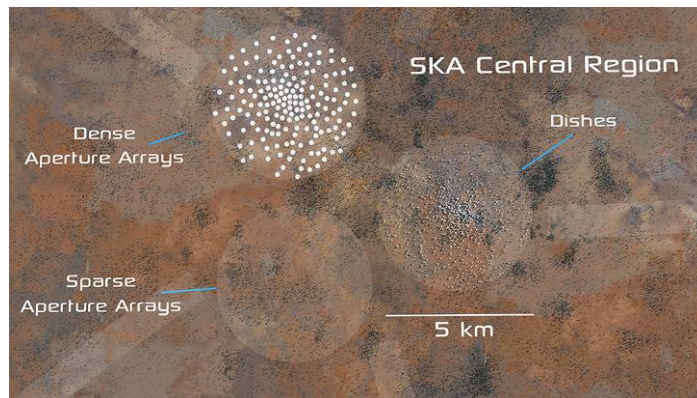
# MRO Power Station Engine Room



# MRO Power Station Design



# Square Kilometer Array

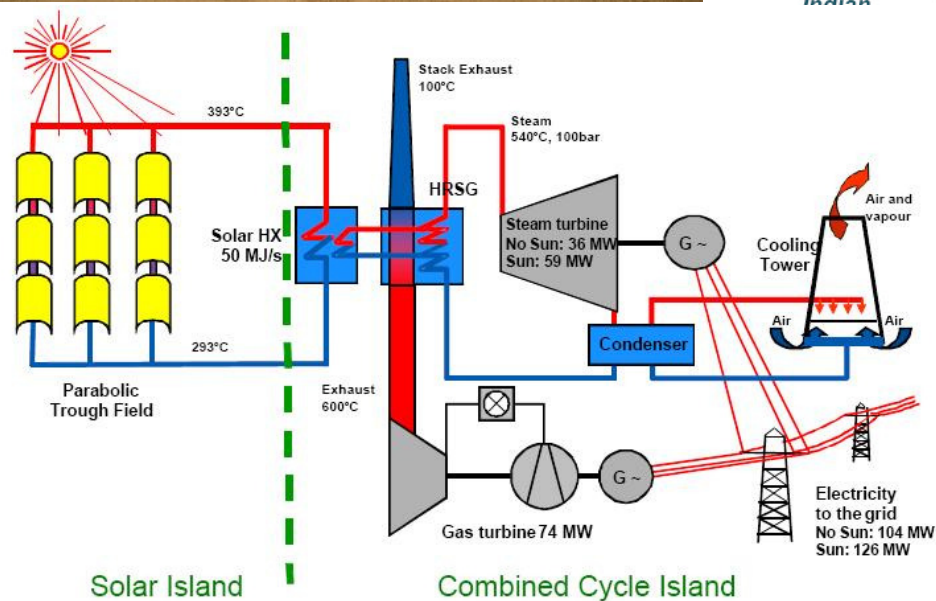
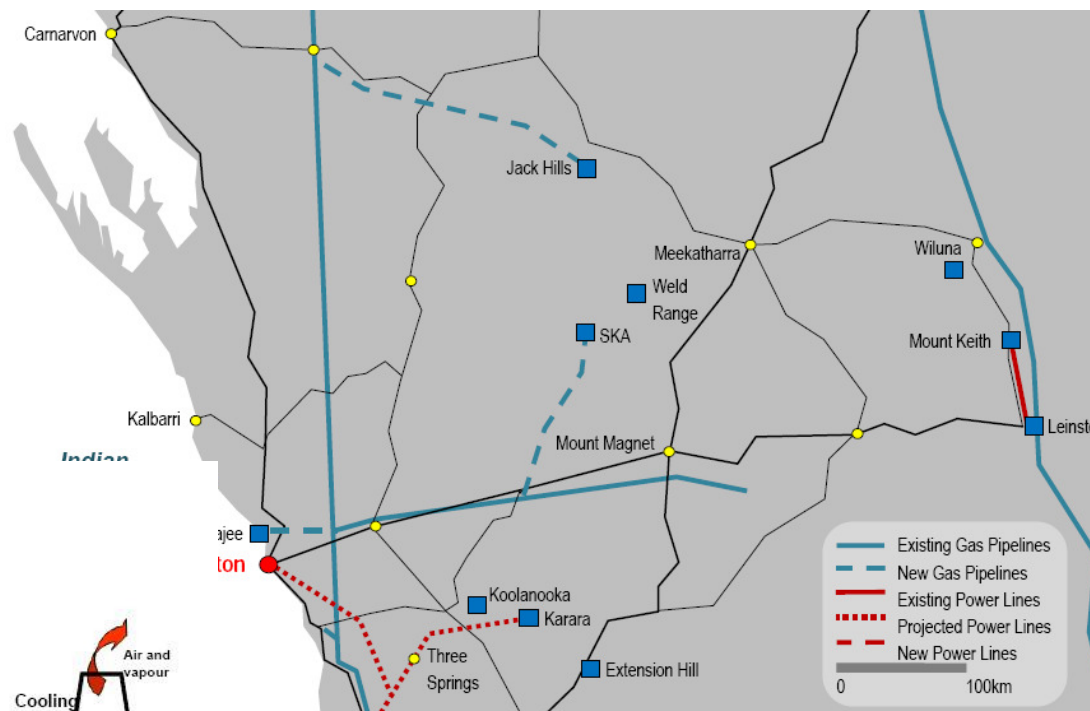


Horizon Power has a strong working relationship with the regional power utilities in each state and territory through the:

**Isolated Power Developers Forum**

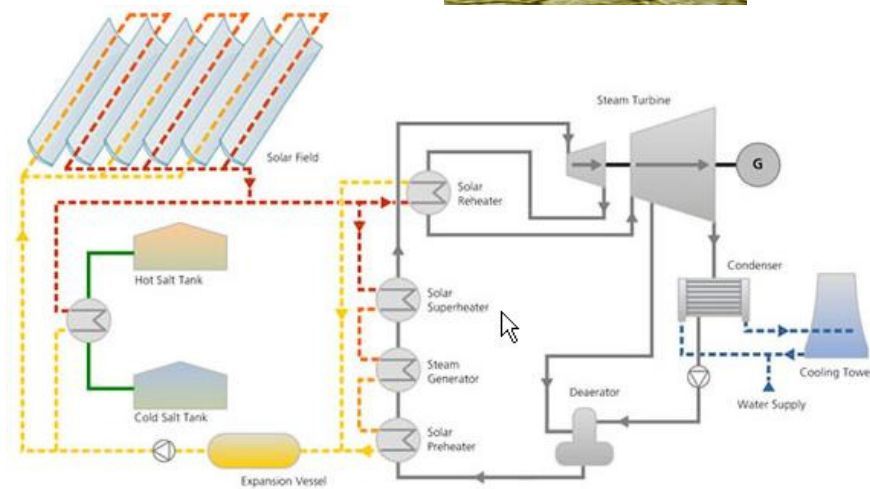
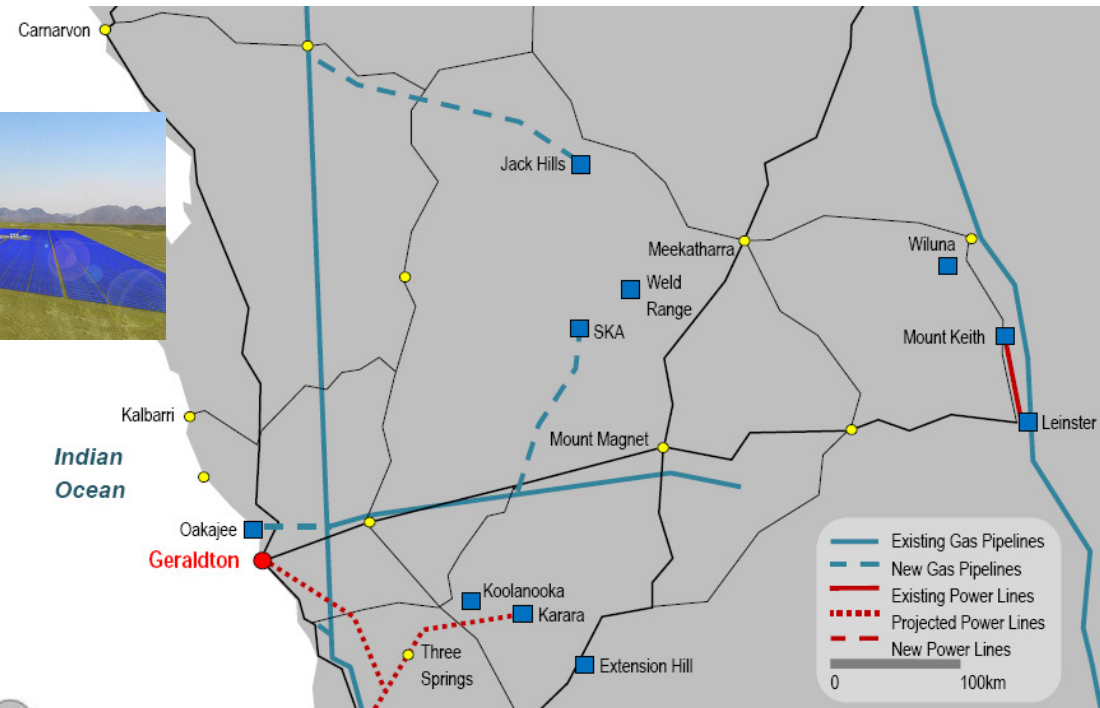
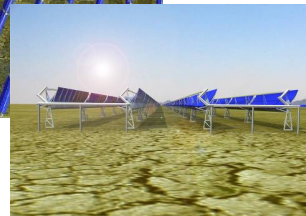
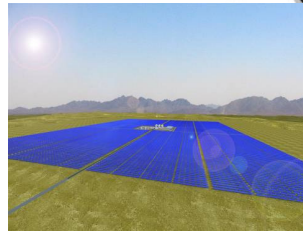
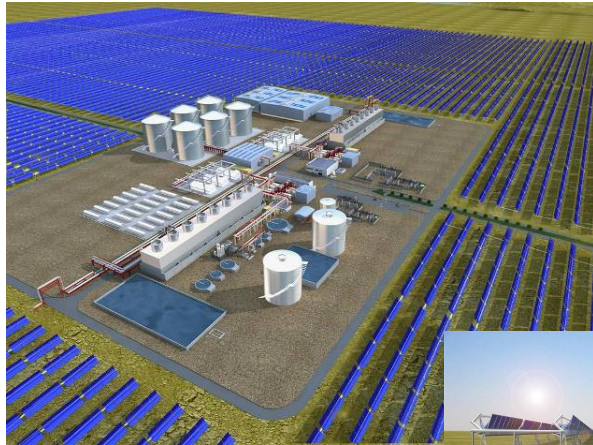
chaired by Horizon Power

# SKA Core - Power Options - Gas



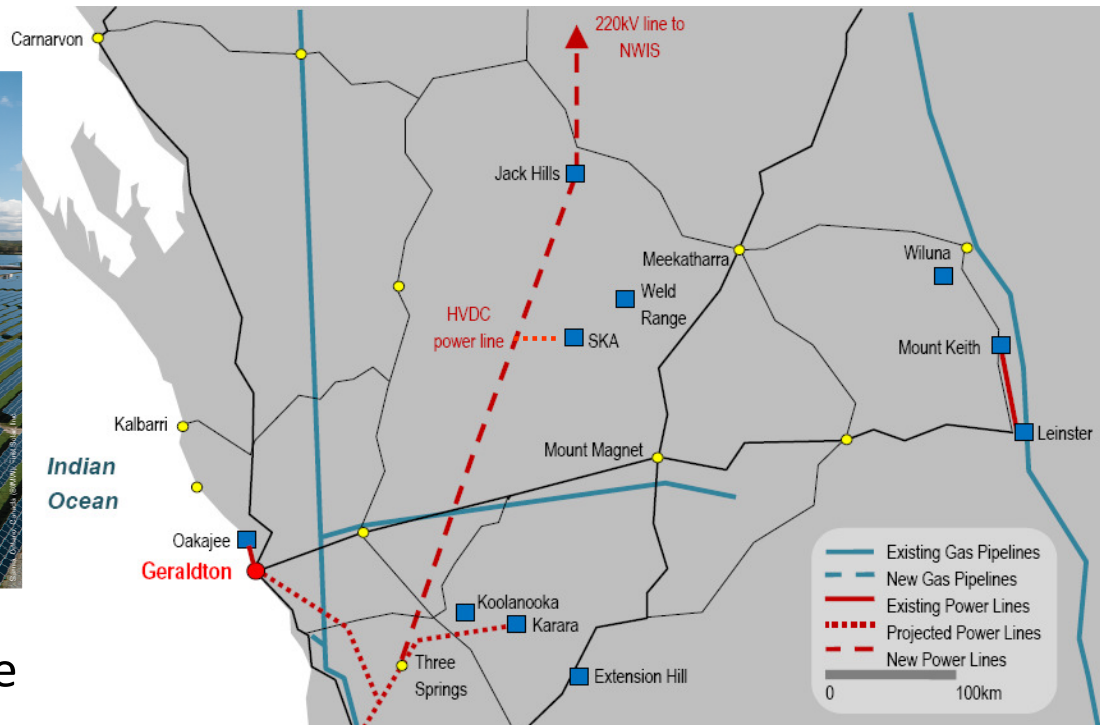
- ISCC (Integrated Solar Combined Cycle)
- No Thermal Storage
- Day time only offset of gas consumption
- Water considerations

# SKA Core - Power Options - Gas



- Large scale solar thermal
- Molten salt thermal storage
- Could be combined in an ISCC
- Higher level of solar energy penetration
- Water considerations

# SKA Core - Power Options - HVDC



- HVDC avoiding radio quiet zone
- Large scale photovoltaic
- Large scale solar thermal or Organic Rankin Cycle systems
- + DC to DC conversion
- Large Scale electrical storage or use the SWIS / grid as 'virtual' storage
- Supply Contracting Strategy to achieve 100% renewable energy from SWS

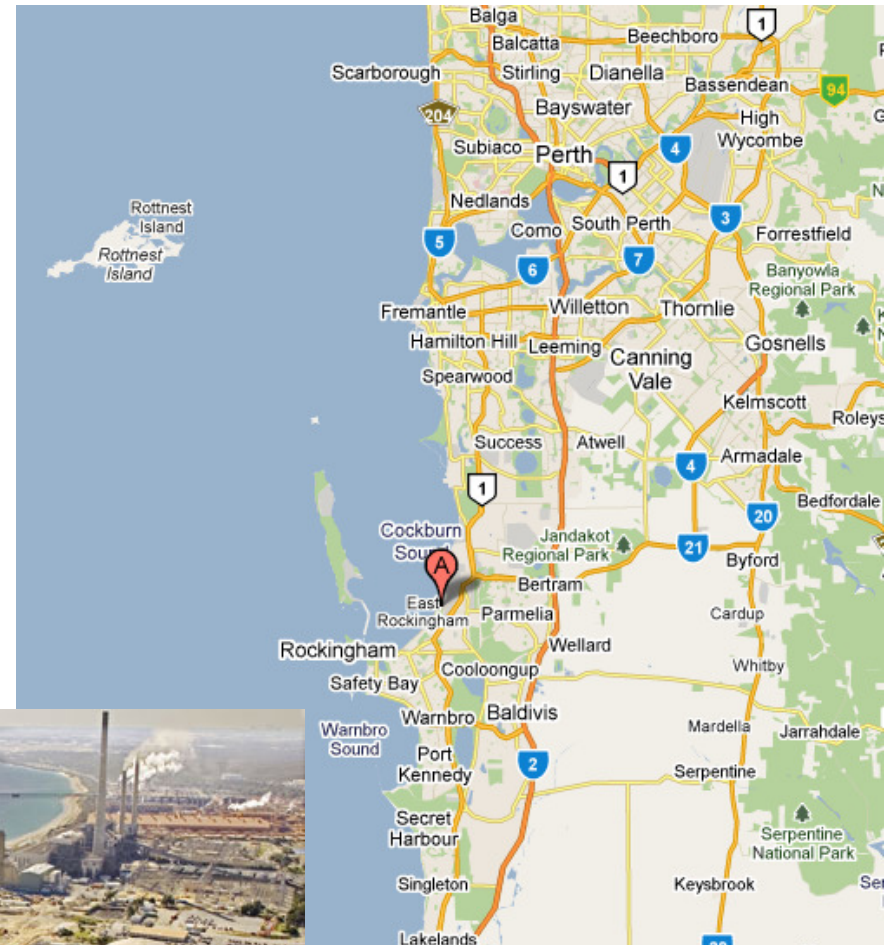
# SKA Super Computer - Power Options



- Super Computer based in Perth
- Load in excess of 150 MW ?
- Supply infrastructure by Western Power
- SKA will be a contestable customer with freedom to purchase energy
- Energy purchased through the Wholesale Electricity Market (WEM)
- Generation by Verve or multiple Independent Power Producers ?

# Supercomputer location

- Water requirements for cooling- considerable
- Location in Kwinana adjacent to desalination plant- advisable
- Existing energy delivery infrastructure
- Desalination plant already runs on 100% renewable energy (180 GWh/yr)
- Desalination plant offers existing water inlet and outlet to Indian ocean



- Power Supply options for the SKA core could include:
  - Gas as firm capacity with renewable energy offset
  - High Voltage Direct Current as firm capacity with renewable energy offset
  - Contracted renewable energy from the Southwest Interconnected system
- Western Australia offers a significant solar energy resource
- ASKAP power station is replicable for SKA isolated dish clusters
- Super Computer Location in Kwinana offers strategic advantages
- The Wholesale Electricity Market offers 100% renewable energy options for the supercomputing component of SKA



Thank You



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