



# Microgrids: Are we there yet? Australian Perspective

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# Australian Perspective



# Australian Perspective

- CSIRO APP + REIF
- Virtual Power Station
- Intelligent HVAC
- National Smart Metering Program
- Smart Grid Smart City

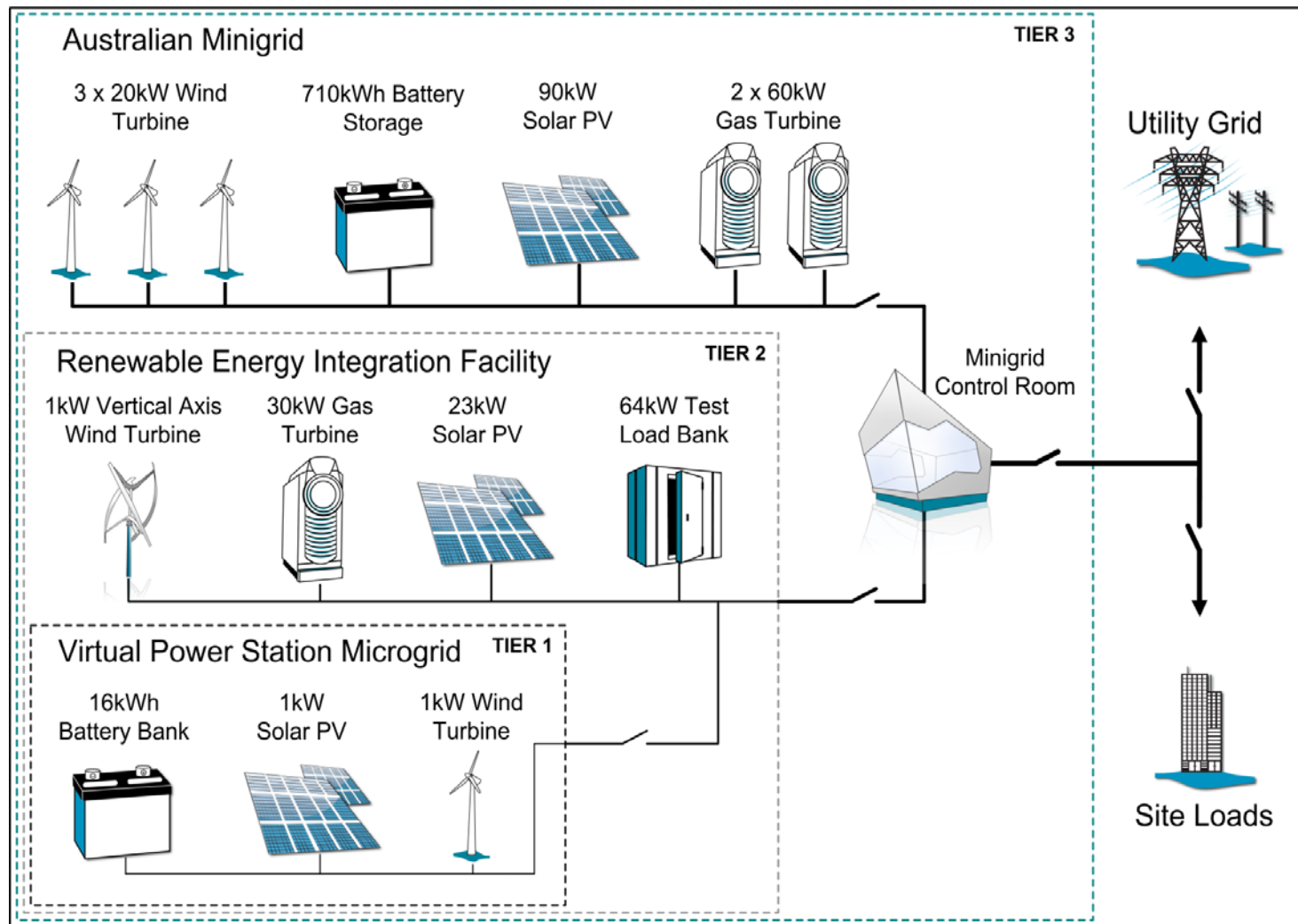
# CSIRO Energy Centre

- Provides a focal point in Australia for energy research
- The building showcases the work of Energy Technology and demonstrates:
  - sustainable energy generation initiatives
  - practical examples of building energy demand reduction
  - environmentally conscious, realistic energy supply options.
- Home to National Solar Energy Centre (NSEC) which houses a 500kW heliostat array
- Has substantial on-site generation
  - 3 x microturbines
  - 4 x wind turbines
  - 120kW photovoltaics
  - 710kWh battery storage
- Based in Newcastle, Australia





# CSIRO Multi-tier Test Site



# CSIRO - microgrid laboratory

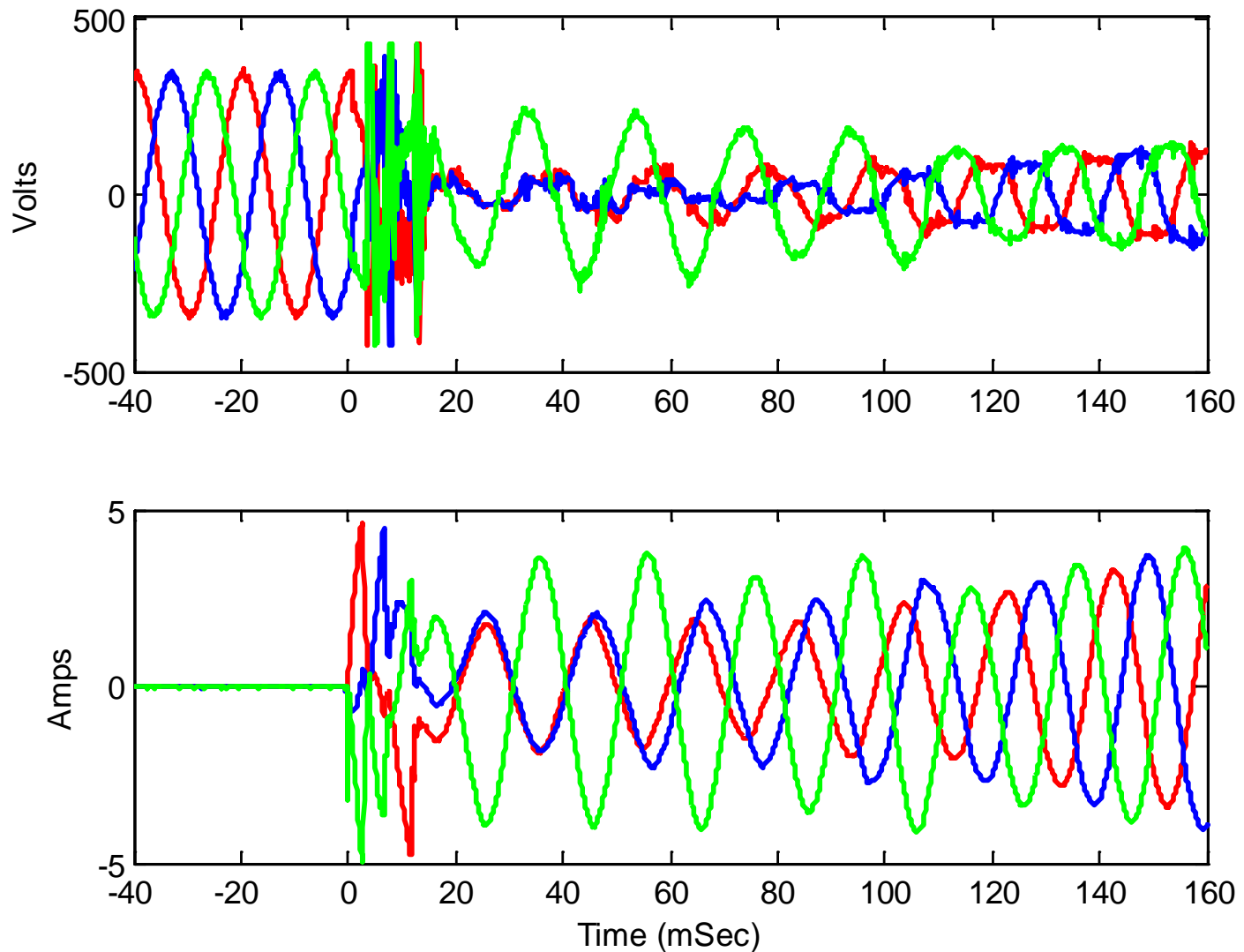




# ZBB Energy Storage (500kWh)



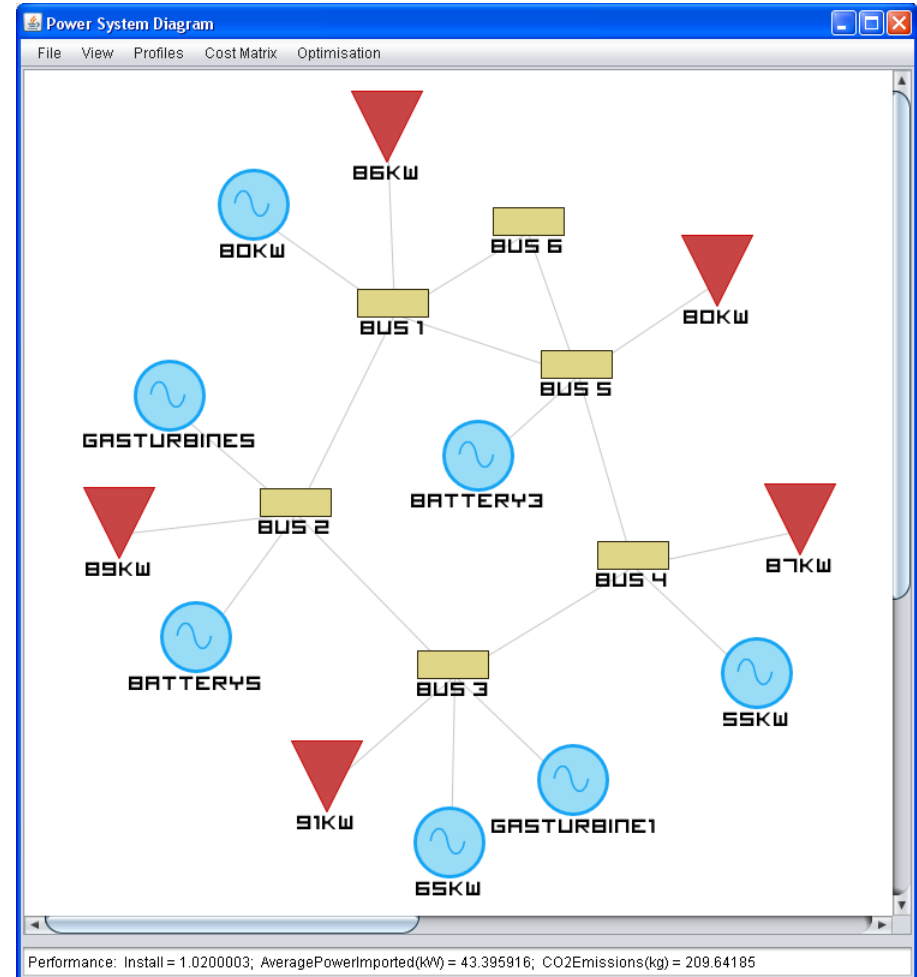
# Inverter Dynamics





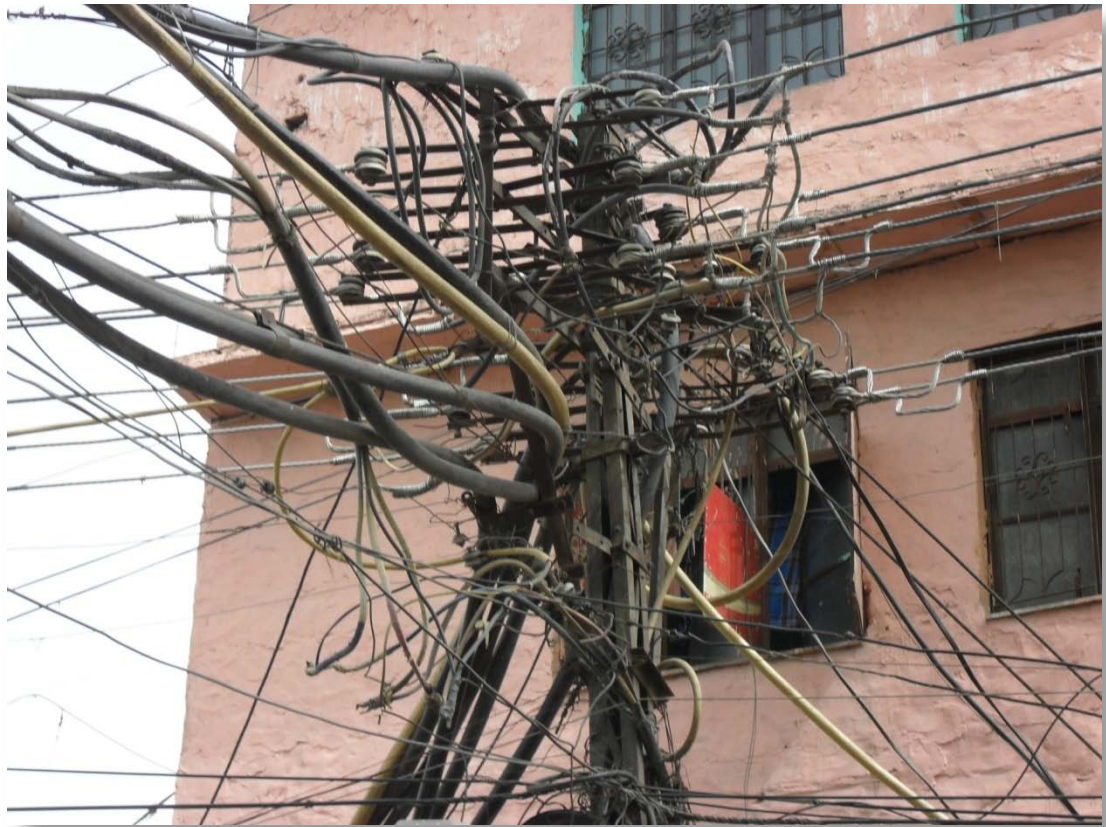
# CSIRO Minigrid Planning Tool

- Models for generators, renewables, power lines and batteries
- Uses load profiles to accommodate hourly changes in power flow
- Provides a trade-off between competing objectives
- Software at prototype demonstration stage



# APP – TERI Minigrids Project

- In India, poor power quality is a serious problem:
  - 10 power cuts a day
  - Voltage variation
  - No supply
- Skip centralised grid
- Same model as telecommunications:
  - No landlines
  - Mobiles



# Virtual Power Plants

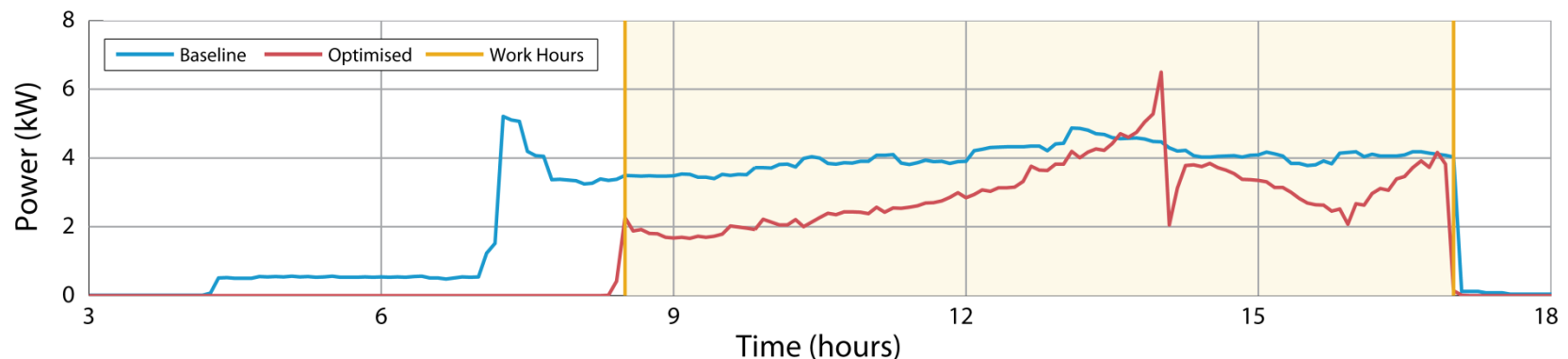
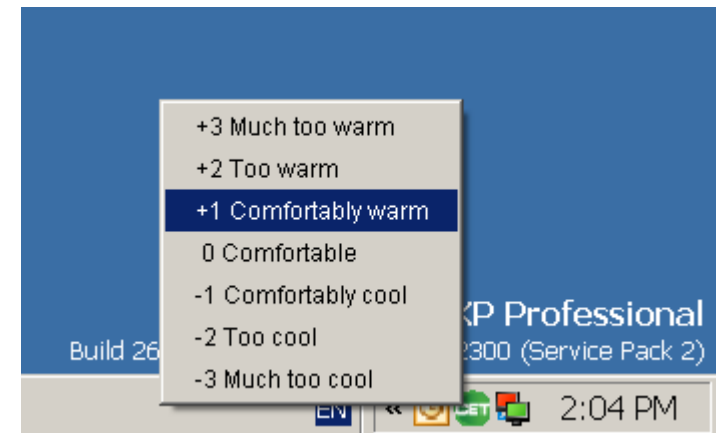
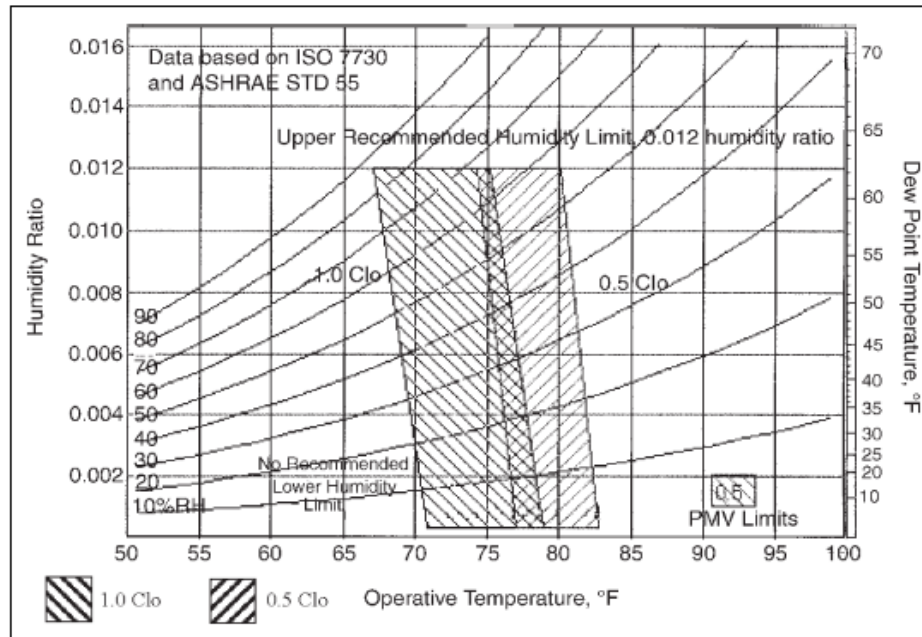
- Create 'Virtual' energy resources that aggregate load types.
- Requires:
  - High Speed Communications
  - Advanced Metering
  - Forecasting
  - Fault tolerance
  - Appropriate markets



# The Virtual Power Station



# HVAC Trichotomy – Cost, Comfort & CO<sub>2</sub>



# National Smart Metering Program

- Developing Australian AMI specifications
  - Consumer Information
  - Load Control
  - HAN
  - Network data





# Smart Grid Smart City

- Consumer engagement
- Active voltage support
- Fault detection & isolation
- Distributed generation
- Large scale trials:
  - Newcastle
  - Newington



# Are we there yet?

- A Rapidly Changing Demand Side
- Large amounts of local generation
- More intelligent end-use devices
- “Energy aware” consumers
- Mixtures of solutions
- Dynamic pricing
- Large scale trials underway

## CSIRO Energy Technology

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# Thank you

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