68TH AMEU CONVENTION 2022

Durban International Convention Centre

2 – 5 October 2022

A JUST ENERGY TRANSITION ("JET") FOR SOUTH AFRICA

Advanced Grid Monitoring
An Essential Component of a Just Energy Transition

Presented by Willie van Wyk

CT LAB (Pty) Ltd

Hosted by

ETHEKWINI MUNICIPALITY

The Importance of Grid Performance Data

As an industry – we have not learned yet to appreciate the value of quality Grid Performance Data

- Treated as an optional extra
- Under-staffed (under capitalised)
- Not trained
- High personnel turnover
- Seldomly utilised as part of daily operations
- Data incomplete - not readily available throughout the organisation
- Seldomly analysed and converted to data driven decisions

A TRANSITION is urgently needed in this space!

The Importance of Grid Performance Data

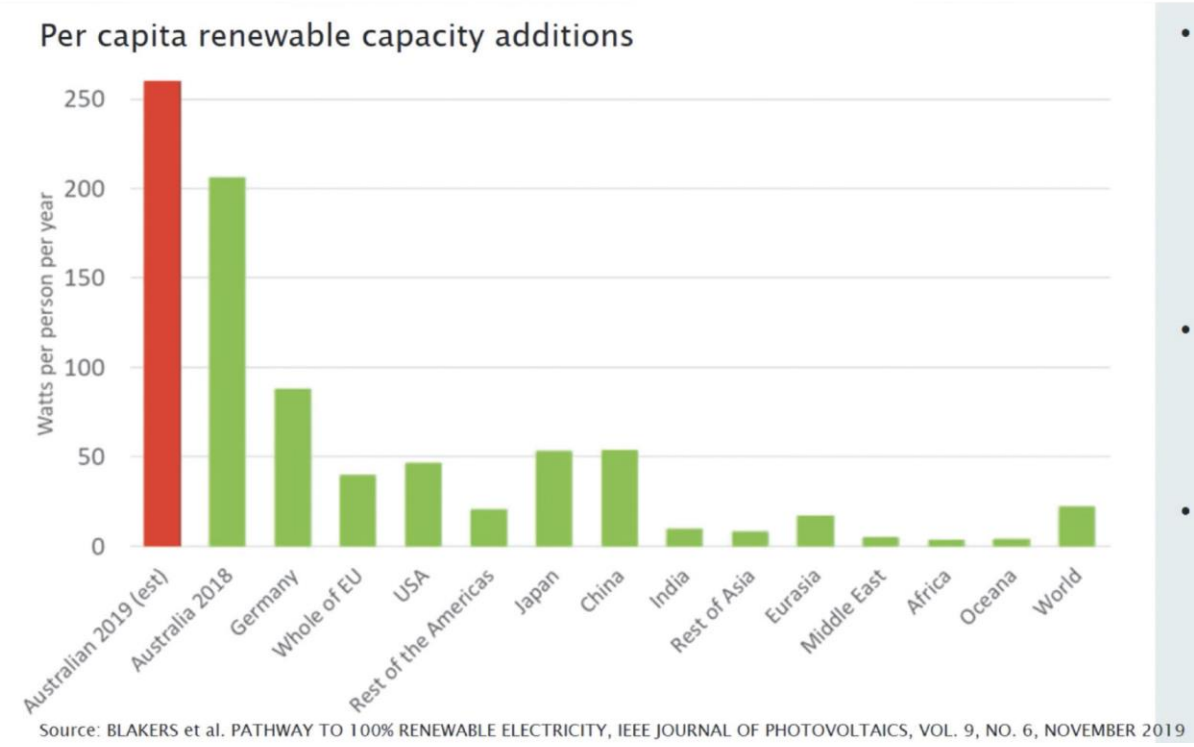
- Lots of new plant wil be built
- Operations, planning, maintenance paradigms will change
- New partnerships wil be built
- New technologies will be adopted
- …

Comprehensive datasets and the utilisation of analytical skills will be essential to drive the Energy Transition

It should be the foundation on which our new grids should be built.

Australian Reflection

The NEM is undergoing the fastest transition of any energy system in the world

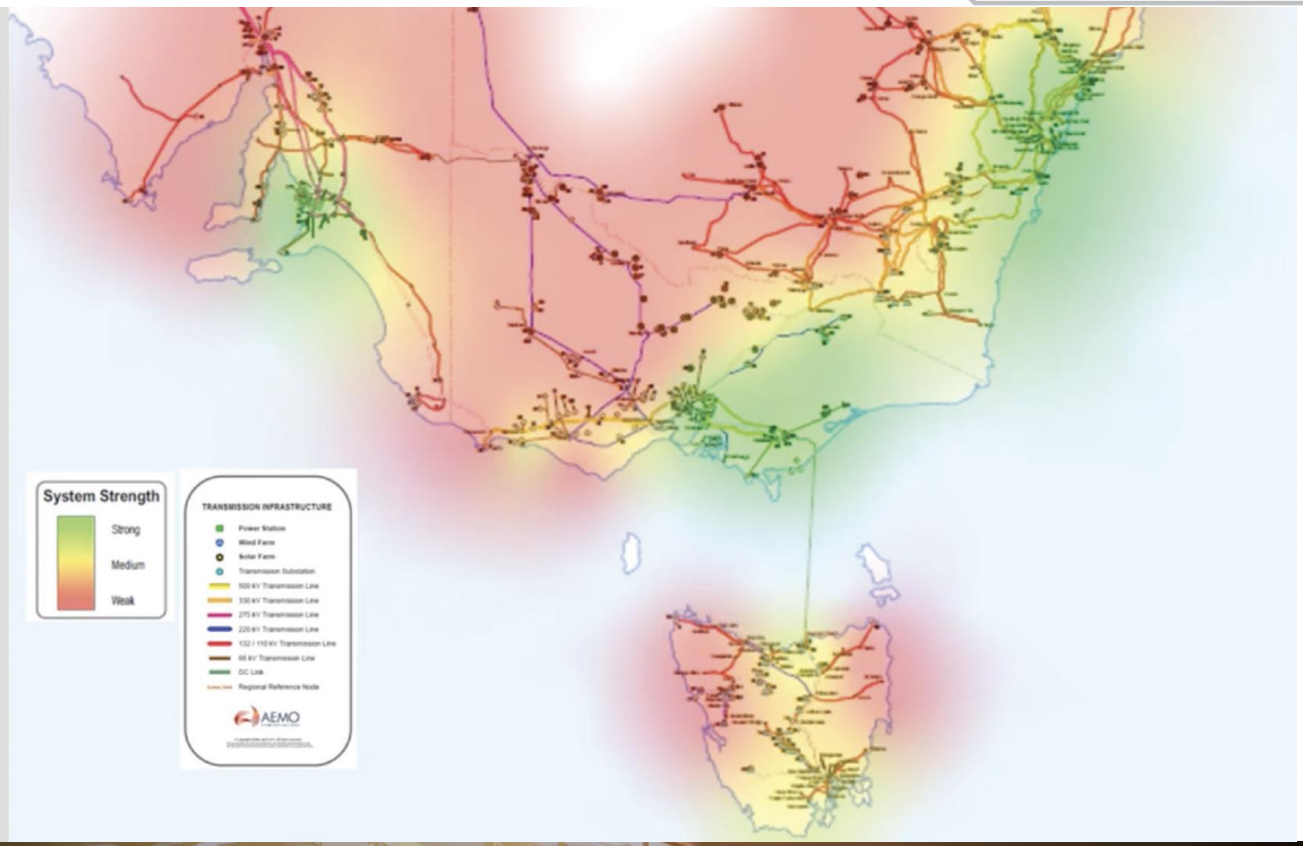


Source: BLAKERS et al. PATHWAY TO 100% RENEWABLE ELECTRICITY, IEEE JOURNAL OF PHOTOVOLTAICS, VOL. 9, NO. 6, NOVEMBER 2019

- NEM: Over the last 3 years
  - 1,000% increase in large-scale solar farms from 6 to 52
  - Almost doubled the number of wind farms from 36 to 58
- Globally: >250 W per capita addition, which is more than twice the capacity additions of any other country
- Current rate of capacity addition (3 GW large-scale p.a.) is exceeding AEMO's step change scenario (2.5 GW)

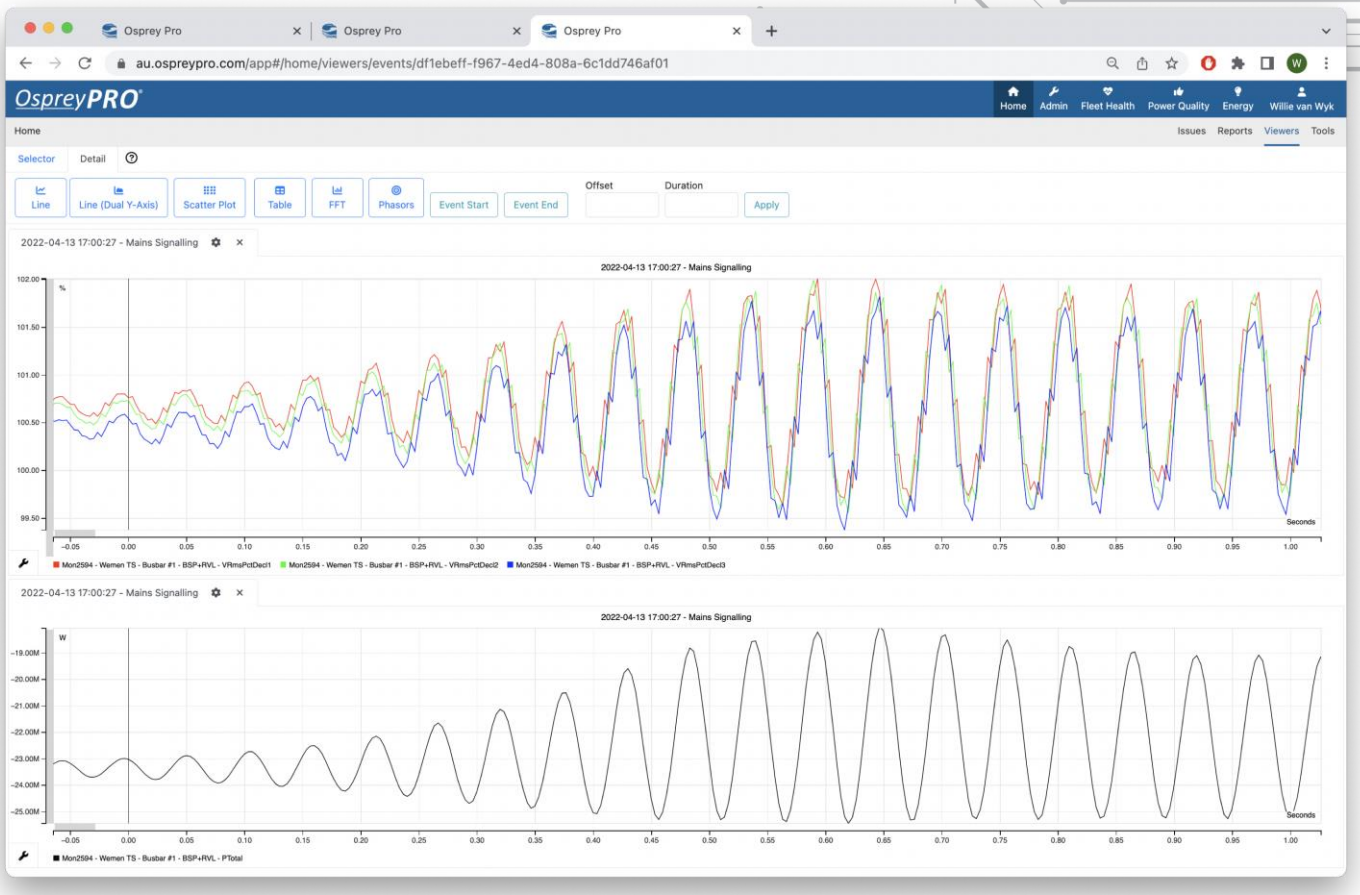
Australian Reflection

Weak system strength in almost all good solar locations



Australian Reflection

- 18-19 Hz Oscillations
- In excess of 5MW on a 20MW load
- Voltage oscillation only ±1%
- PMU recorders struggle to correctly quantify – too close to Nyquist frequency of 25Hz



Australian Reflection

- They experience uncontrolled growth in renewables
- Their biggest challenge today is voltage regulation
- They struggle with excessive amounts of VARS on their network
- It all leads to network stability
- They just recently embarked on a drive to create an ancillary market for Fast Frequency control (FCAS)
  - Clients that can dispatch energy within 200ms can participate and will be rewarded
  - Market was created mainly to accommodate large scale grid storage projects

Australian Reflection

- Monitoring of power levels & synchrophasors as part of an overall control scheme is essential for the development of the Australian grid.
- AEMO - the Australian grid operator has put out a directive to all TSO's to install devices that can stream data back to a central AEMO facility

The answer is called Datasets!

What is the difference between Data and a Dataset?

- Comprehensive
  - All required locations are monitored
  - Sub Harmonic Oscillations (DC-50Hz)
  - Synchrophasors (PMU Data)(50Hz)
  - Billing & Load Profiles (50Hz)
  - Power Quality (50-3kHz)
  - Higher Harmonics (3kHz – 150kHz)

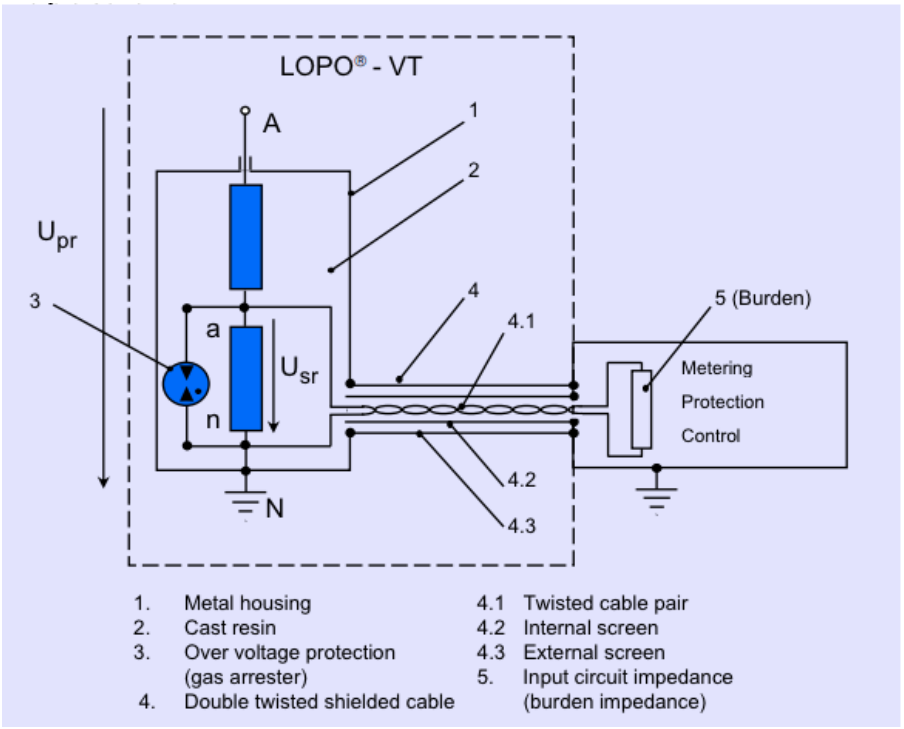
- Time Synchronised
  - Phase information is as important as amplitude information

- Accessible in near real-time

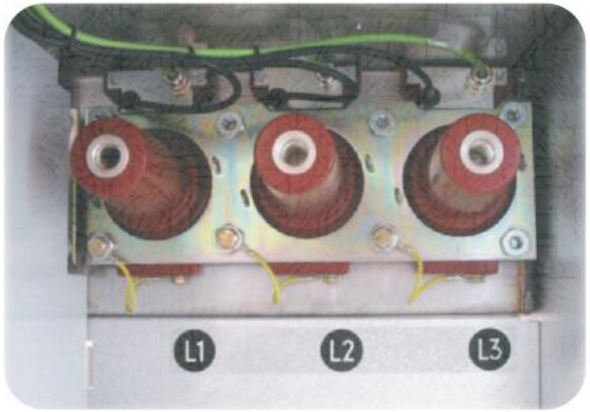
- Broadband
  - Most IBR sources switch at frequencies higher than 3kHz

What is a Low Power VT (LPVT) or Voltage Sensor

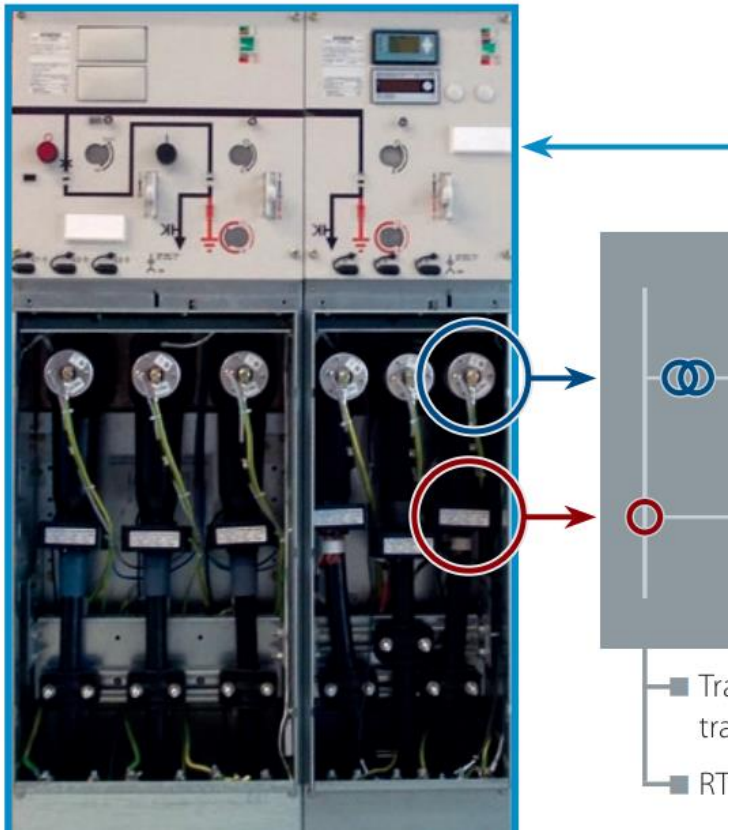
- It is a passive resistive voltage divider circuit
- Protected by a low voltage spark gap
- Output voltage range from 500mV up to 10V
- There is no power available
- Most modern substation equipment can directly interface to LPVT's
- An external substation DC supplied amplifier can be used to boost the voltage back to conventional 110V signals.



Various Voltage & Current Sensors



What is a Low Power VT (LPVT) or Voltage Sensor



Conclusion

- Datasets are an essential part of the energy transition
- Invest in a strong analytical office – Serve the entire organisation
  - Build a strong analytical culture
- Make the transition from conventional VT's & CTs' to Low Power Voltage & Current sensors.

68TH AMEUCONVENTION 2022

A JUST ENERGY TRANSITION (“JET”) FOR SOUTH AFRICA

Thank you

ETHEKWINI MUNICIPALITY

A

68TH AMEUCONVENTION 2022

A JUST ENERGY TRANSITION (“JET”) FOR SOUTH AFRICA