Phasors in New Zealand

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New Zealand Grid

Two 50Hz asynchronous systems - North and South Island

Joined by HVDC (1200MW).

Long and skinny, high impedance, 220kV, 110kV, 66kV

South: Hydro, Wind
North: Hydro, Thermal, Wind
Why Phasors?

• Situational awareness
• Early warning on emerging stability issues
• Monitor equipment performance
• Validate power system models
PMU Locations (14)

**North Island**
1. Otahuhu (Gen & Load)
2. Huntly (Gen)
3. Whakamaru (Gen)
4. Stratford (Gen)
5. Bunnythorpe
6. Haywards (HVDC terminal)
7. Westwind (Windfarm)

**South Island**
1. Kikiwa (STATCOM)
2. Islington (SVC & Load)
3. Twizel (Gen)
4. Benmore (HVDC terminal)
5. Roxburgh (Gen)
6. Tiwai (Smelter)
7. North Makarewa

Main generation sources
Main load centres
Grid backbone
HVDC link
Phasor measurements

- Synchronised recording of phasor data – time stamped by GPS clock
- Real Time measurement of 3 phase Voltage & Current – both magnitude and phase angle
- Sampled 50 times per second (50 Hz is nominal system frequency)
- Phasors are extracted from our protection relays
Data access

1. PI (OSIsoft) – Main data source
   SCADA, PMUs, protection logs, system logs, etc.

2. Psymetrix – Phasor-only data source
   Real-time monitoring and alarms
   Oscillation frequency, damping (stability)
   Locus plots
   Monthly system stability reports
1. PI (OSIsoft) data access

- Main data source with SCADA, PMU, logs, etc.
- Screens
- EXCEL link
- MATLAB link
1. PI (OSIsoft) data access
Custom screens are relatively easy to make
2. Psymetrix data access

- More specialized phasor applications.
- Real time monitoring, e.g., alarms
- Oscillations (freq and decay), locus plots
PMU Usage

- An investigation tool (not used in real time operations)
- Event analysis
- Power system model validation
- Monitoring oscillations (Psymetrix)
System Under-frequency event

6.5Hz oscillation
“Generator Pole slipping”
Monitoring SVC performance during grid faults

Islington 220 kV bus voltage (kV)
Undamped Oscillation in South Island (with mainly Hydro)

15 MW

1.5 Hz
Phasors, to finish…

• 14 PMU sites give good grid coverage
• Plans to add 2 new sites at top of North Island
• Used for investigations:
  • Fault analysis, oscillation monitoring
  • Model validation
  • Equipment monitoring
• Storage / Data processing with PI & Psymetrix
• Developing more uses as time goes on, e.g. Anti-islanding detection