**Abstract**

Traditional responses to enhance distribution network 'visibility' although very beneficial to an electricity distributor have one limitation in common and that is that they are generally very expensive to implement. There is therefore a need to develop a cost effective modular style solution that can provide an 'adequate' level of visibility to the distribution network, and by doing so may also complement the traditional responses to this need. This thesis project describes the development of a possible solution to enhance distribution network visibility in a cost effective manner in the form of a 'Distribution Substation Monitoring and Fault Location' (DSM&FL) System. Six prototype units have been installed. A preliminary cost/benefit assessment has also been undertaken of possible design options and investigates a number of other systems that may exist with the DSM&FL system in 7-10 years. A brief investigation into issues that may impact on the total system environment in the extended future (i.e. 15-25 years) is also included.

**1. Overview of the DSM&FL Design**

The DSM&FL System makes use of modified smart interval meters (modified Type 5 meters with communications support in the form of an externally connected modem). The meters can be installed inside an array of distribution centres in EnergyAustralia’s distribution network. Two Figures below show PoC installations and the third shows a photo of design development and testing.

**2. Standard Asset Monitoring (SAM)**

Through SAM the design is capable of providing the following 'standard capabilities'

- UPS.
- Process limited I/O triggers.
- EFI alarming/automation.
- Replace MDI functionality.
- Phase power outage alarming/automation.
- Restoration of supply alarming/automation.
- Profiling transformer secondary V, I, kVA, and max kVA demand.

**3. Advanced Asset Monitoring (AAM)**

Through AAM the design is capable of providing the following 'advanced capabilities' in addition to the SAM capabilities.

- LV fuse operation/automation.
- Distributor load Information.
- Other advanced digital I/O capabilities.

**4. Preliminary Cost Benefit Assessment**

A preliminary cost/benefit assessment and NPV analysis was undertaken to compare possible design options.

**5. Future Base Case Scenario – Total System Environment**

Potential systems in EnergyAustralia were investigated and an hypothetical system environment was outlined.

**6. Future Scenarios – Extended View**

A brief overview of the following issues were explored that may impact on the base case system in the extended future (i.e. 15-25 years).

- Distributed Resources:
  - Distributed Generation.
  - Energy Storage.
  - Smart Appliances.
- New Technologies & Standards:
  - Interoperability (IEC 61850).
  - Broadband over Power Line.