Powerline Bushfire Steering Committee

5 December 2016

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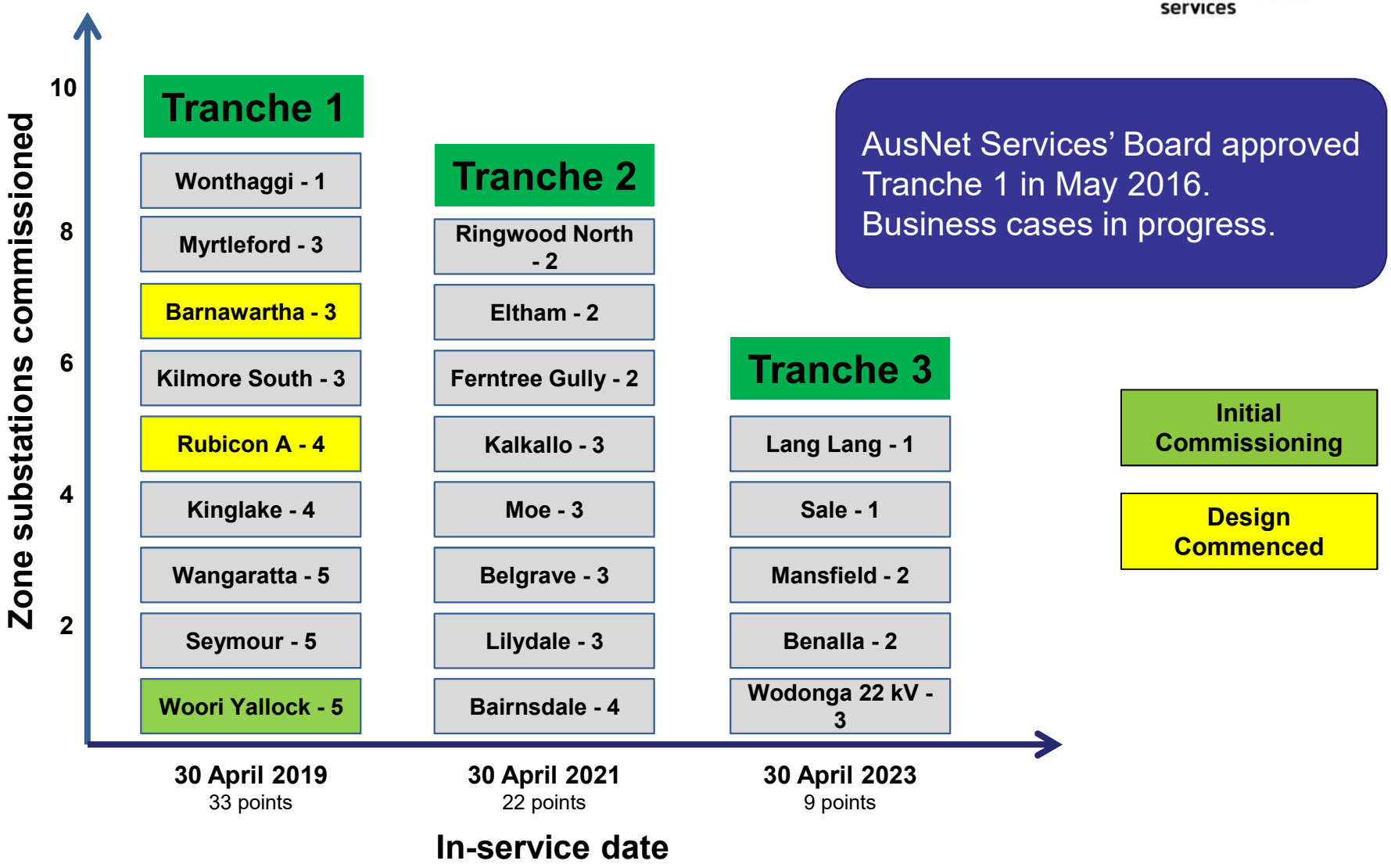
Focus and agenda

- **REFCL Program Update**
  - **Woori Yallock project**
  - **Barnawartha and Rubicon A project**
- **Key Implementation Risks**
  - **Sole Supplier**
    - New technology programs
    - Swedish Neutral
    - New Zealand visit overview
  - **Distribution Code**
  - **HV Customers**
- **Other Prescribed Programs**
  - **Electric line construction areas**
  - **SWER ACRs**

REFCL Program Update

Program – Timetable

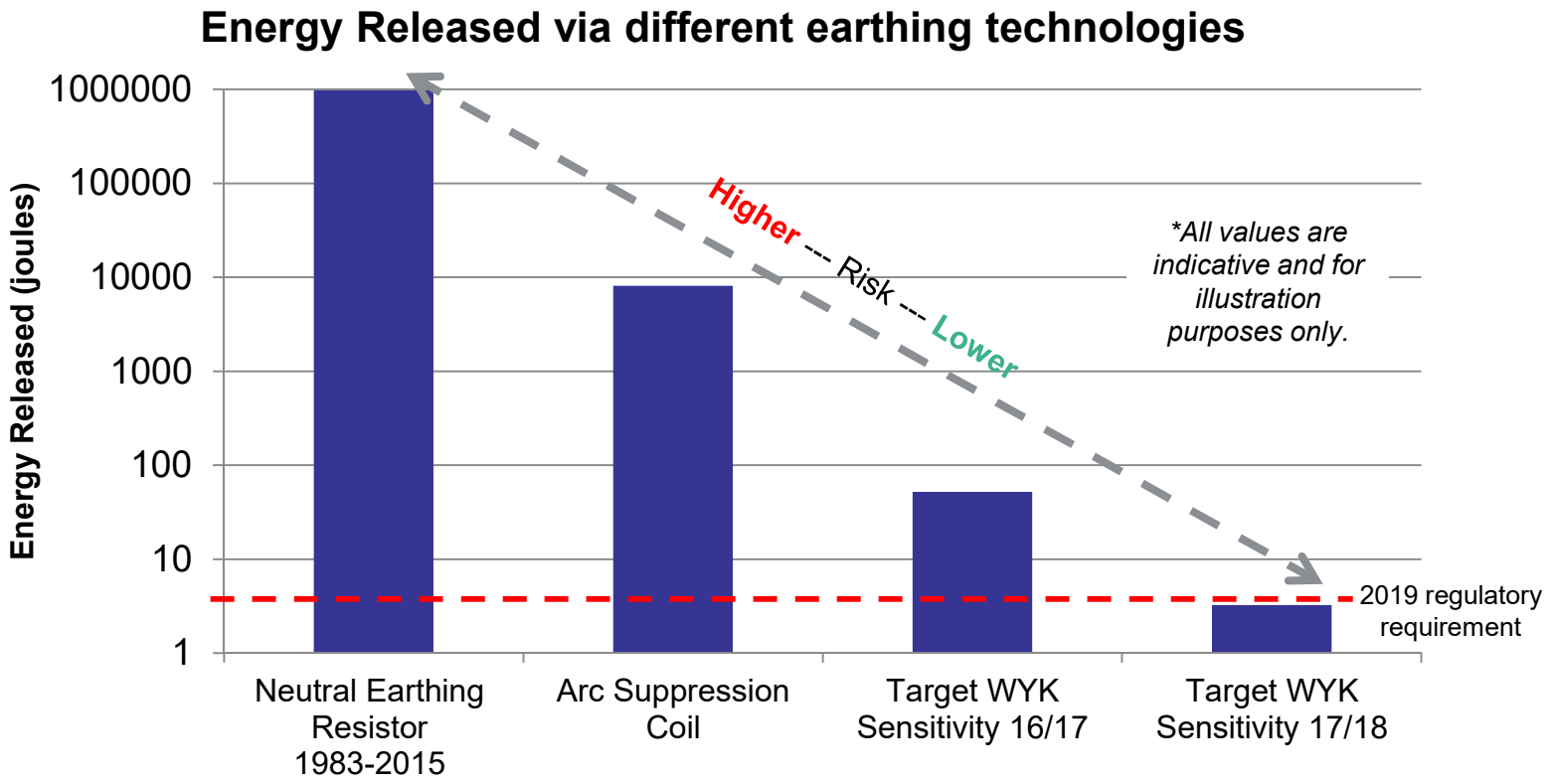


AusNet Services' Board approved Tranche 1 in May 2016.
Business cases in progress.

Initial Commissioning

Design Commenced

Woori Yallock summer 16/17



Energy released *= (Fault current)^2 x (protection response time) x fault resistance*

AusNet Services are targeting to have an enhanced level of fault protection available at Woori Yallock for high risk weather days in summer 16/17.

Woori Yallock Current Status

- **What is a primary fault test?**

  Simulating a phase to ground fault. Specifically a single conductor coming into contact with ground under normal network conditions.

- **How is it achieved?**

  Switching a resistive earth fault via an ACR onto the live high voltage network using a customised test rig.

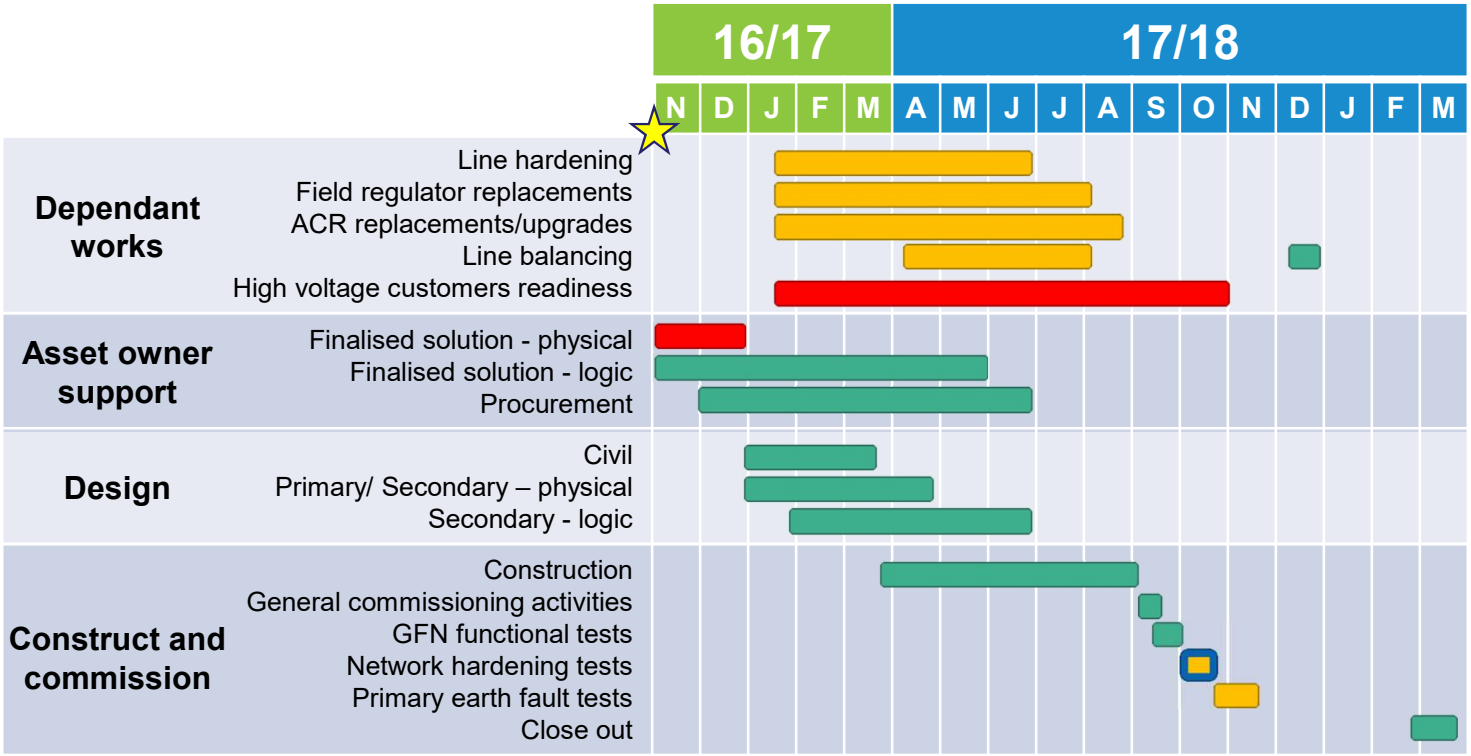
- **What has been the results?**
  - 28 tests completed over three days

    (13 momentary and 15 sustained)
  - High risk weather day and normal day REFCL modes tested
  - GFN response to earth faults optimised
  - No wide spread customer outages
- **What needs further investigation?**
  - Inverter malfunction in the Swedish Neutral GFN product.
    - Occurring 25% of the time, parts to be replaced and software to be updated within the GFN product.
    - Unclear whether part replacement will solve the issue.

Primary fault testing has nearly concluded. Testing confirmed functionality of the GFN under real fault conditions. GFN is currently out of service, awaiting replacement parts and software upgrade from Swedish Neutral following malfunction during primary fault testing.

Above: Members of the ESV party inspect the customised test rig.

Barnawartha / Rubicon A delivery schedule



Legend

- Activity requiring customer engagement.
- **Proposed night time testing.**
- Business cases approved.
- **Greatest risks to the delivery schedule at present.**

Barnawartha and Rubicon A REFCL installations are targeting November 2017 operation. Greatest risks to the delivery schedule at present are:

- Outcome of HV customer issue (Government process). Work will be required at customer installations. Initial discussions held with all HV customers; and
- Physical engineering solution being finalised for all components prior to Christmas 2016, enabling design to commence in the new year.

Implementation Risks

Identified Implementation Risks

- **Sole supplier**
- **Electricity Distribution Code**
- **High voltage customer installations**
- **Operational / change management**
- **Regulatory (technical performance)**
- **Regulatory (cost recovery)**
- **Design risk**
- **Program schedule / strategy**
- **Construction**
- **Adverse reputation (pre, during and post project) including customer impact**
- **Reputation of Government**

Implementation risks are shared by the Distribution Businesses, Regulators and the State Government.

Sole Supplier Risk
New Technology Programs

- **The intended use and performance requirements of the GFN is unique**

- **Long record of poor outcomes when the complexities of new technology meet the real world**

- **Learnings from our own experiences with Smart Meter roll out**
  - › Implement robust, independent governance.
  - › Be clear on what success looks like and measure it – from day one.
  - › End to end accountability for the program and the outcomes.
  - › "Whole of business" approach – not run in a silo.
  - › Where possible, avoid sole suppliers.
  - › Ensure vendors have successfully delivered comparable solutions previously.
  - › Develop and implement a clear stakeholder engagement strategy.

New large scale technology projects need a staggered, considered implementation where lessons learned can be incorporated before the large scale roll-out.

Sole Supplier Risk

Swedish Neutral

- Turnover $5m per annum
- 10 Employees
- Less than 200 Ground Fault Neutralizers (GFNs) installed worldwide
- Across Europe, Israel, Brazil, Malaysia, Russia, New Zealand, Australia
- 80% Utilities, 20% Industry
- Installed primarily for Network Safety and Reliability purposes, rather than the bushfire mitigation.

Issues

- Australian REFCL software requires:
  - Much more sensitive performance settings
  - More balanced networks
  - Soft fault confirmation to ensure a fire does not start when the device is confirming the fault on the network is still present.
- Software still being modified and developed.

Swedish Neutral are a small family run business with limited expertise. Further product development and quality control work is needed **before** it can be installed and operated successfully across Victoria.

Sole Supplier Risk
Learn Lessons from New Zealand Visit

- **Swedish Neutral**
  - Recurring theme of abandonment.
- **Operating mode**
  - Continuous compensation mode adopted from day 1.
- **Fault management**
  - Faults were much harder to find.
- **Network hardening**
  - Grossly underestimated the impact of sustained over-voltages.
- **Reliability impact**
  - Got worse before it got better.
- **Organisational change**
  - Big challenge to ensure whole business was aware of paradigm shift
- **Key risk messages**
  - Develop in-house commissioning and post commissioning support. Pursue technology solutions to improve fault identification and isolation

Lack of operational support capability and "believers" within businesses have resulted in the one third of New Zealand REFCLs being out of service.

Electricity Distribution Code

- Cannot be compliant with both new Regulations and Code
- Issue raised over 3 months ago
- Awaiting action from ESC
- REFCL operation and Code changes will create HV customer issues

Table 1

STANDARD NOMINAL VOLTAGE VARIATIONS				
Voltage Level in kV	Voltage Range for Time Periods			Impulse Voltage
	Steady State	Less than 1 minute	Less than 10 seconds	
< 1.0	+10% - 6%	+14% - 10%	Phase to Earth +50%-100% Phase to Phase +20%-100%	6 kV peak
1-6.6	± 6 %	± 10%	Phase to Earth +80%-100%	60 kV peak
11	(± 10 %		Phase to Phase +20%-100%	95 kV peak
22	Rural Areas)			150 kV peak
66	± 10%	± 15%	Phase to Earth +50%-100% Phase to Phase +20%-100%	325 kV peak

Desktop Analysis of HV Customers associated with REFCL sites and transfers

More than 70 customer sites with approximately 422 HV transformers:

- **Infrastructure Owners** (5 Custs with 244 Tx across 38 sites)
  - Jemena (Kalkallo, 3 entire feeders, 76 Tx)
  - Australian Defence Force (6 sites, 87 Tx)
  - Metro Rail (17 sites, 56 Tx)
  - Melbourne Water (8 sites, 15 Tx)
  - United Energy (off 2 Feeders, 10 Tx)
- **Large Customers (4 or more Tx)** (16 Customers with 129 Tx)
  - Murray Goulburn, Leongatha (17 Tx), Mars (Uncle Ben's), Wodonga (15 Tx)
  - Nestle (Uncle Tobys), Barnawartha (13 Tx), Thales Australia, (12 Tx)
  - Melbourne Market, Epping (10 Tx)
  - Murray Goulburn (Maffra), Australian Textile Mills,
  - Wonthaggi Windfarm, D&R Henderson Carter Holt Harvey,
  - LMS Wollert, Olex, AGL, Central Gipps Water, Wodonga Rendering, Simplot
- **Other Customers** (26 Customers with 49 Tx)

Process for testing and upgrading High Voltage customers installations remains unclear.

Other Programs

Electric Line Construction Areas

- **Approximately 1,600km of high voltage bare wire**
- **Government $200M Powerline Replacement Fund**
  - › Current driver of replacement (approx. 50km replaced LTD)
    - Difficult terrain, high cost solutions to date (i.e. Dandenong Ranges/Warburton Valley)
  - › Government propose bringing completion of program forward to FY19
- **Conductor replacement proposals rejected by AER in EDPR 2016-20 Final Decision**
  - › Require detailed scoping and design. Application through contingent project framework (same as REFCL funding process)
- **No customer or network augmentation projects pending in ELC areas**
- **Current design solutions**
  - › Hybrid Underground (installed by combination of direction bore and open trenching)
    - High cost structures (substations & switches) remain on poles
  - › HV ABC
  - › Spacer cable (PLP)
    - Current issue of ‘galloping’ under investigation
  - › Awaiting Powercor completion of LoSag trial

SWER ACRs

- **Program completed December 2015**
  - 528 remote controlled SWER ACRs installed
- **Total Fire Ban & Code Red Days**
  - Group control of >1,000 devices on polyphase & SWER networks
- **Determination of highest risk & remaining areas**
  - ESV no longer undertake Fire Loss Consequence Modelling (Operational Model)
  - AusNet Services have established fixed areas based upon AN140 model (Investment Model)
  - Greater number of devices in 'highest' consequence areas (>165 *vs* >105 under AH70)
    - Next step to update BFM Plan & provide supporting paper to ESV
    - Maintain previous year application until implemented