January 2011 Flood Impacts on ENERGEX

Chris Arnold, Executive General Manager Network Performance
January 2011

- The state average rainfall of 209mm exceeded 1975
- Three quarters of the state was disaster declared
- 300 roads were closed
- Significant lead-up rain in the Mary & upper Brisbane valleys

- January 10 – torrential rain led to flash floods in Toowoomba and a 7 metre ‘wall of water’ through the Lockyer Valley
- January 11 – water releases from Wivenhoe Dam expected to exceed 8000 cubic meters / sec in following days
- January 12 – 150,000 customers lose power supply as the network becomes affected by floodwaters
- January 13 – Brisbane River peaked at 4.46M, affecting 20,000 homes
Flood impacts on ENERGEX and the community

• Pre-emptive disruption to the power supply to about 120,000 customers, including parts of the Brisbane CBD

• Parts of the network along the Brisbane and Bremer Rivers, Lockyer and Brisbane Valleys were torn down or inundated with water.

• Assistance from Ergon Energy & NSW energy providers as well as local contractors to rebuild whole sections of network

• Supply to some customers could not be re-connected until equipment became accessible, then cleaned and tested.
Preparation for Flood Event

- Flood Risk Management Plan developed – first draft
- Assets affected by Q100 flood event captured (Brisbane and Ipswich areas)
- Operational Response for Network Assets (Substations, Overhead lines, Distribution Transformers, Pillars, Premises)
Preparation for Flood Event

- Electrical safety was the overriding consideration
- Flood Risk Management Plan developed
- Assets affected by Q100 flood event captured (Brisbane and Ipswich areas), plotted on maps and the response activated

Operational response included:
- Protection of network assets
- Informing customers to prepare for power outages
Flood Predictions Maps from BCC Flood Info Centre
Customers Impacted

SEQ Flood January 2011 - Customers off supply
Data from Power Outage Viewer (POV) system

- 7pm Wed - Loss of PLQ Rocklea Substation
- 4am Thursday Brisbane flood peak
- Mon 2pm - Toowoomba flash floods hit Wilcott
- Noon Friday 90% affected 11kV back in service, commence inspection and restoration of individual homes
- Mon 6pm - 80% customers back on. Access to worst affected areas including CBD now possible. 4 CBD off.
- Thunderstorm

Graph showing the number of customers off supply over time from Mon 10 Jan to Mon 24 Jan.
Organisational Response and Challenges

- Safety was the primary consideration in all actions
- Energex Business continuity plans proved invaluable – evacuated Newstead Control Centre and Call Centre
- Liaison with State and Local Counter Disaster meetings
- Logistics & HR management important, including for those ‘not involved’
- Customers must be informed, honestly – be part of the solution
- Fatigue Management - key roles required backup
- Restoration Management – central vs decentralised decision
- Use of portable generation fleet invaluable
- Information management critical
- Record keeping must not fall off the radar
Impact on Assets

### Impact on Power Supply

<table>
<thead>
<tr>
<th>Impact</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main zone substation outages</td>
<td>25</td>
</tr>
<tr>
<td>Main substations flooded</td>
<td>4</td>
</tr>
<tr>
<td>Distribution feeders tripped or isolated</td>
<td>157</td>
</tr>
<tr>
<td>Premises disconnected for repairs</td>
<td>~12,000</td>
</tr>
<tr>
<td>Total Customers off Supply</td>
<td>&gt;300,000</td>
</tr>
<tr>
<td>Peak Number of customers off supply</td>
<td>~150,000</td>
</tr>
<tr>
<td>Calls for assistance to contact centre</td>
<td>230,000</td>
</tr>
<tr>
<td>Premises still disconnected @25/5/11</td>
<td>~1,200</td>
</tr>
</tbody>
</table>

### Equipment Replaced as at 1/2/2011

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Transformers</td>
<td>101</td>
</tr>
<tr>
<td>Distribution Transformers Impacted</td>
<td>~400</td>
</tr>
<tr>
<td>Switch Fuse gear</td>
<td>55</td>
</tr>
<tr>
<td>Substation relays</td>
<td>55</td>
</tr>
<tr>
<td>Watt hour meters</td>
<td>3645</td>
</tr>
<tr>
<td>Poles</td>
<td>95</td>
</tr>
<tr>
<td>Overhead Cable</td>
<td>98 km</td>
</tr>
</tbody>
</table>
Time to restore power

Legend
Distribution Transformers
Time without Power
- Green: Minimal or no impact
- Yellow: Within 2 days
- Orange: 2-5 days
- Red: 5-10 days
- Black: 10-14 days
ENERGEX invoked Business Continuity Plans (BCPs)

Shift to backup site for Control Centre, Contact Centre, dispatch & Comms

Field ops caravan dispatched as a ‘local focus’ and coordination centre for all services

Network Data kept updated during emergency conditions
Energy Market (metering & billing) emergency plans
Payroll, Logistics, Treasury must continue to function
Moggill Ferry (with 33 kV river crossing pole)
RMU Flashover at Suncorp Stadium
The Defined Flood Level Has Now Changed

<table>
<thead>
<tr>
<th>River Height Station</th>
<th>Feb 1893 (m)</th>
<th>Feb 1931 (m)</th>
<th>Jan 1974 (m)</th>
<th>Jan 2011 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatton (Lockyer Ck)</td>
<td>16.33</td>
<td>9.14</td>
<td>14.63</td>
<td>&gt;16</td>
</tr>
<tr>
<td>Ipswich (Bremer R.)</td>
<td>24.50</td>
<td>15.50</td>
<td>20.70</td>
<td>19.25</td>
</tr>
<tr>
<td>Mt Crosby (Brisbane R.)</td>
<td>32.00</td>
<td>21.78</td>
<td>26.74</td>
<td>n/a</td>
</tr>
<tr>
<td>Moggill (Brisbane R.)</td>
<td>24.50</td>
<td>15.40</td>
<td>19.93</td>
<td>17.86</td>
</tr>
<tr>
<td>Jindalee (Brisbane R.)</td>
<td>17.90</td>
<td>9.60</td>
<td>14.10</td>
<td>12.89</td>
</tr>
<tr>
<td>Brisbane City Gauge (Brisbane R.)</td>
<td>8.35</td>
<td>3.32</td>
<td>5.45</td>
<td>4.46</td>
</tr>
</tbody>
</table>

Reproduced from *Independent Review of Brisbane City Council’s Response to the January 2011 Flood*

- Old DFLs were based on 1974 less an allowance for Wivenhoe
- Old DFLs (2011 Flood)
  - Moggill 16.2m (17.86m)
  - Jindalee 11.4m (12.89m)
  - Brisbane City 3.7m (4.46m)
Key Learning from Flood Event

• Previous Defined Flood Levels are not suitable for the future
• It is not possible to locate all distribution assets in “flood-proof” locations – infrastructure follows demand / customer locations
• Pre-emptive disconnection can be optimised if the “perfect” flood occurs with well known height prediction and plenty of notice (not likely)
• Flood “resilience” does not just occur through electricity assets – it is an overall combination of supply and customer response
• BCPs are critical for any business – many businesses don’t have them!
• A Flood Risk Management Plan is critical
• Substations that are inundated can be optimised for the future (eg. Removable equipment)
• Water Courses change significantly during a major flood
• Customers want “end to end” service, not just our asset perspective
Actions following Flood Event

Reviews underway to seek opportunities, including:

• CBD communications and engage customers regarding BCPs
• Regularly update the Flood Risk Management Plan
• Identification of ‘Dry’ Flood Disconnection Points
• Minimise the flood exposure of major substations, based on new DLFs
• Improve the resilience of CBD Customer substations
• Review standards for ground mounted 11 kV assets
• Review of river crossings of overhead constructions
• Auditing of flood affected assets to assess long-term implications
• Examine powers regarding planning of new installations
• Lock in Electricians’ arrangements