Introductions

- Andy Swayne – Senior Municipal Liaison Manager
- Bill Foster – Distribution System Reliability Planner
- Tammie – Bechtel – Distribution System Operations Planner
- Rick Buell – Distribution System Regional Planning
- Sunitha Kothapalli – Transmission System Planner
- Kevin Gowan – Asset Management Supervisor
- Laura Feinstein – Smart Grid Planning Manager
- Dennis Martin – Electric System Senior Engineer
- Keri Pravitz – Community Projects Manager
- Sharmila Swenson – Manager Local Government Affairs
Workshop Purpose

• Provide an overview of PSE electrical system performance in 2016 as reported to the City

  • Overall performance
  • Reliability projects completed and proposed
  • Automation initiatives (Smart Grid)
  • Information technology initiatives
2016 Bellevue Reliability Overview

Bellevue is served by 96 distribution circuits from 23 substations

- 74 circuits (77%) had performance better than our system wide average
- 14 circuits (15%) experienced no unplanned outages
- 22 circuits (23%) had SAIDI or SAIFI exceeding system wide average figures
2016 Bellevue Reliability Overview

24 circuits from 4 substations serve customers downtown

- 7 reliability circuits provide redundancy for downtown customers
- There was two unplanned outage events which affected downtown customers in 2016:
  - A squirrel made electrical contact at Center Substation bank 2
  - A feeder cable fault along NE 8th ST caused a circuit outage on Lochleven 35
2016 Bellevue Reliability Overview

- Bellevue Performance & Comparison

**System Average Interruption Duration Index (SAIDI) & System Average Interruption Frequency Index (SAIFI)**

<table>
<thead>
<tr>
<th>Year</th>
<th>SAIDI Bellevue</th>
<th>PSE</th>
<th>SAIFI Bellevue</th>
<th>PSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>52.4</td>
<td>245.0</td>
<td>0.40</td>
<td>0.92</td>
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<tr>
<td>2013</td>
<td>100.7</td>
<td>247.0</td>
<td>0.41</td>
<td>0.86</td>
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<td>2014</td>
<td>160.2</td>
<td>312.0</td>
<td>0.60</td>
<td>1.04</td>
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<td>2015</td>
<td>186.9</td>
<td>361.0</td>
<td>0.71</td>
<td>1.11</td>
</tr>
<tr>
<td>2016</td>
<td>107.0</td>
<td>148.0</td>
<td>0.74</td>
<td>1.06</td>
</tr>
</tbody>
</table>

PSE SAIDI figures for 2012 - 2015 are five year rolling average figures. The 2012 Bellevue SAIDI figure was calculated as a single year figure. The 2013 Bellevue SAIDI figure was calculated as a four year rolling average for years 2010 - 2013. The 2014 - 2015 Bellevue SAIDI figures were calculated as a five year rolling average figures. 2016 SAIDI figures were calculated using the IEEE 1366 method for the single year 2016.

**System Average Interruption Duration Index [SAIDI]** SQI 155
Total customer outage minutes / average total customer count

**System Average Interruption Frequency Index [SAIFI]** SQI 1.3
Total customers affected / average total customer count
2016 Bellevue Reliability Overview

SAIDI IEEE 1366 calculation – why did we switch?

- PSE’s prior method of calculating SAIDI was based on estimated outage size reported in a legacy system (CLX).
- PSE’s 2013 implementation of GIS and OMS allows calculation of outage event duration with more precise customer counts capturing and reporting outage minutes more accurately.
- PSE’s outage reporting is now in line with industry standard IEEE 1366 used by most utilities.
- IEEE 1366 characteristics:
  - A sustained outage event is defined as 5 minutes or greater
  - Outage events occurring during Major Event Days are excluded
  - Calculation provides single calendar year figures
- The WUTC agreed that the IEEE 1366 methodology would provide improved understanding and reporting of outage events affecting PSE customers.
2016 Bellevue Reliability Overview

Bellevue circuits with SAIDI or SAIFI exceeding system wide figures

- 22 circuits had SAIDI or SAIFI in 2016 exceeding system wide figures. 17 of these circuits have been addressed or require no corrective action. The remaining 5 circuits have improvement actions identified or under review.
2016 Bellevue Reliability Overview

Circuits Exceeding System SAIDI and/or SAIFI 2012 – 2016

- 64 circuits have exceeded system wide average performance during this period …
  - 35 (55%) once in five years
  - 15 (23%) twice in five years
  - 12 (19%) three times in five years
  - 2 (3%) four times in five years
2016 Bellevue Reliability Overview

2016 IEEE SAIDI/SAIFI Scatterplot
(Excludes Major Event Day Events)

Distribution circuits serving Bellevue relative to all PSE circuits
2016 Bellevue Reliability Overview

Enlargement focusing on distribution of circuits serving Bellevue
Distribution Reliability Projects Completed in 2016

- Installation of a new Reclosers on Northrup 23
- Distribution System reconfiguration on South Bellevue 25 in the Surrey Downs Neighborhood
- Distribution cable replacement projects in the Crossroads area (programmatic replacements planned to continue into 2018 and beyond)
- 25 cable replacement projects (various circuits – 49,000 circuit feet) including proactive replacements
- Vegetation management trimming of 12 distribution circuits and 1 transmission line
Proposed Distribution Reliability Projects

- Mark 1 switch replacement in the Cherry Crest Neighborhood
- Installation of Reclosers on Eastgate 28 and South Bellevue 22 feeder circuits
- Tree wire retrofit projects on Eastgate 12, Kenilworth 23 and Overlake 15
- Bridle Trails 22 feeder undergrounding west of 140th AVE NE
- CBD SCADA switch installation (continuing). 7 installed in 2016. 7 & 10 switches are planned for 2017 & 2018 respectively
- Distribution cable replacements in Crossroads area (continuing) via the CRP in locations where new conduit is needed
- 13 cable replacement projects engineered for future construction (30,000 circuit feet)
- 22 cable replacement projects scoped for future engineering (41,000 circuit feet)
Smart Grid Initiatives Including Automation

- AMI (Advanced Meter Infrastructure) -- Network installation is complete in Bellevue and is in verification testing. Meter installations are planned to begin in 2018.

- Distribution Automation (formerly referred to as Fault Location, Isolation, Service Restoration) – Initial projects commissioning is complete; expansion to Bellevue CBD planned in the future.

- Distribution SCADA Switchgear – 66 switches in the CBD area get SCADA and EMS integration to allow system operators to see the distribution system configuration and respond to events in real time. 31 switches completed. 7 switches expected to be retrofit in 2017. 10 switches proposed for retrofit in 2018. Precursor to CBD DA.

- Bellevue Urban Smart – PSE is supporting downtown businesses in managing building energy use including combinations of behavioral and technology solutions to achieve energy savings.

- Scoping and planning for Spring District & Bel-Red corridor Smart Grid development environment is underway
Distribution Automation

- Distribution Automation (DA) can provide a level of self-healing response to distribution system outage events using SCADA equipped devices and automated control software.
- DA isolates faults through switching, then attempts to restore power outside of the faulted (isolated) area. Fewer customers experience a sustained outage while more customers can see their power restored in under five minutes.
- Pilot projects are underway in PSE service territory areas of lowest reliability and locations with customer funded projects. Intent is to validate efficacy of various approaches and implementations.
- To be effective DA requires a robust and redundant transmission system to keep power flowing to distribution substations.
CIS, GIS & OMS

- PSE implemented three integrated systems in April 2013
  - Customer Information System
  - Geospatial Information System
  - Outage Management System
- These systems work together to improve company response to outage events
- In 2017 AMR meter status data has been integrated into OMS to provide system operator real time status display and support customer notification functions
Transmission System Improvements

- **In Progress …**
  - Lake Hills – Phantom Lake 115kV – New transmission line between existing substations to provide redundant (looped) transmission connection for three substations – project expected to begin construction in 2018.
  - Lakeside 115 kV Switching Station Rebuild – Multi-year phased replacement and upgrade of control and operating equipment in the substation for enhanced automation and reliability – planned completion in 2017.
  - Energize Eastside 230kV – Upgrading existing transmission lines and build a new transmission substation in Bellevue to provide increased system capacity and reliability for Bellevue and the greater Eastside – currently in permitting with planned construction in 2018-2019.

- **On the Near Horizon …**
  - Vernell Substation – New 115kV transmission switching station with local distribution substation for improved transmission system flexibility/reliability and new distribution system capacity to support Sound Transit and Spring District development in 2022, in coordination with the City and Spring District Developers.
Wrapping Up

Questions & Discussion