Smart Pullman & WSU Microgrid as part of the PNW Smart Grid Demonstration

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Smart Grid Demonstration Project

- Distributed to centralized control
- 3 substations
  - Regulator controls
  - Reclosers/relays
- 13 feeders
  - 45 automated line switches & reclosers
  - 20 switched and fixed capacitor
  - Fault Indicators
  - Low loss transformers w/ telemetry
- Wireless & fiber communications

NW Smart Grid Demonstration Project

Battelle NW
Bonneville Power Administration

Utility Partners
Avista
Benton PUD
City of Ellensburg
Flathead Electric
Idaho Falls Power
Inland Power & Light
Lower Valley Energy
Milton-Freewater
Northeastern Energy
Peninsula Light & PEC
Seattle City Light

DMS – Distribution Management System

- 3 substations
  - Regulator controls
  - Reclosers/relays
- 13 feeders
  - 45 automated line switches & reclosers
  - 20 switched and fixed capacitor
  - Fault Indicators
  - Low loss transformers w/ telemetry
- Wireless & fiber communications
- Grimes Way Generator 1,2 & 3 Dispatch
- Loop Chillers Load Shed
- HVAC Load Shed/EMS/CVR (McKinstry)
- Biotechnology Life-Science Generator Dispatch
- Global Animal Health Backup Power
- College Avenue Steam Plant Automation

Feeder F3 with 38.3R, 39.8C, 21.9I

Average Percentage Demand Savings (EOL=120V)
Feeder F3 with 38.3R, 39.8C, 21.9I

Average Percentage Demand Savings (EOL=119V)

Feeder F3 with 38.3R, 39.8C, 21.9I

Average Percentage Demand Savings (EOL=118V)
Feeder F3 with 38.3R, 39.8C, 21.9I

Average Percentage Demand Savings (EOL=114V)

Average Percentage Demand Savings for July 16, 17, 18, 19

<table>
<thead>
<tr>
<th></th>
<th>EOL = 120 V</th>
<th>EOL = 119 V</th>
<th>EOL = 118 V</th>
<th>EOL=114V</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3 (38.3R, 39.8C, 21.9I)</td>
<td>1.86%</td>
<td>2.64%</td>
<td>3.53%</td>
<td>6.61%</td>
</tr>
<tr>
<td>F6 (56.9R, 43.1C, 0I)</td>
<td>1.60%</td>
<td>2.39%</td>
<td>3.14%</td>
<td>5.85%</td>
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</table>
### 18th July 15:15 (peak savings with load = 1650kW)

<table>
<thead>
<tr>
<th>EOL (V)</th>
<th>Tap Setting (for all phases)</th>
<th>Demand (kW) (manual) – with both caps ON</th>
<th>Our results (kW) (simulation) - no caps ON</th>
<th>Diff (kW) (manual – simulation)</th>
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</thead>
<tbody>
<tr>
<td>120</td>
<td>-3</td>
<td>4834</td>
<td>4843</td>
<td>9</td>
</tr>
<tr>
<td>119</td>
<td>-4</td>
<td>4805</td>
<td>4814</td>
<td>9</td>
</tr>
<tr>
<td>118</td>
<td>-5</td>
<td>4776</td>
<td>4785</td>
<td>9</td>
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</table>

### 18th July, 00:30 (lowest savings with load = 973 kW)

<table>
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<th>EOL (V)</th>
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<th>Demand (kW) (manual) – with both caps ON</th>
<th>Our results (kW) (simulation) - no caps ON</th>
<th>Diff (kW) (manual – simulation)</th>
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</thead>
<tbody>
<tr>
<td>120</td>
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<td>2895</td>
<td>2884</td>
<td>-11</td>
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<tr>
<td>119</td>
<td>-5</td>
<td>2877</td>
<td>2861</td>
<td>-16</td>
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<tr>
<td>118</td>
<td>-6</td>
<td>2860</td>
<td>2837</td>
<td>-23</td>
</tr>
</tbody>
</table>
### Preliminary Conclusions

- CVR may save about 3% of energy
- IVVC may not save significant energy
- Automatic and remote switching sectionalizers will improve reliability
- Load control by WSU can provide efficiency on campus (other customers)
- Load control by Avista can provide emergency assist
- Generation control by Avista can provide emergency assist