Training Survey

Summary of Results
Primary Users of Phasor Technology

- Real-time Operations: 51%
- Operations Engineering: 42%
- Planning: 28%
- Protection Engineering: 25%
- Other (please specify): 16%
- Research/R&D/Development: 12%
Operation Applications

- Real-time visualization: 77%
- Voltage monitoring: 64%
- Oscillation monitoring: 62%
- Line monitoring: 47%
- Automatic equipment controls: 34%
- State estimation: 6%
- Other: 6%
- Model analysis/validation: 4%
- Fault location: 4%

>60%
# Training Gaps per Function

<table>
<thead>
<tr>
<th>1: What is your company's primary function? (Select all that apply.)</th>
<th>Reliability Coordinator</th>
<th>Transmission Owner/Coordinator</th>
<th>Generation Owner/Operator</th>
<th>Balancing Authority</th>
<th>Consultant</th>
<th>Vendor</th>
<th>Other (please specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMU data quality</td>
<td>Count</td>
<td>4</td>
<td>12</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>% by Col</td>
<td>66.7%</td>
<td>70.6%</td>
<td>71.4%</td>
<td>87.5%</td>
<td>71.4%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Calibration</td>
<td>Count</td>
<td>1</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% by Col</td>
<td>16.7%</td>
<td>52.9%</td>
<td>57.1%</td>
<td>50.0%</td>
<td>14.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Installation</td>
<td>Count</td>
<td>1</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% by Col</td>
<td>16.7%</td>
<td>47.1%</td>
<td>42.9%</td>
<td>37.5%</td>
<td>14.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Standards</td>
<td>Count</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% by Col</td>
<td>33.3%</td>
<td>52.9%</td>
<td>42.9%</td>
<td>62.5%</td>
<td>42.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>Count</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% by Col</td>
<td>0.0%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>28.6%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Who Responded

<table>
<thead>
<tr>
<th>Company Function</th>
<th>Frequency</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Owner/Coordinator</td>
<td>31%</td>
<td>26</td>
</tr>
<tr>
<td>Vendor</td>
<td>22%</td>
<td>18</td>
</tr>
<tr>
<td>Consultant</td>
<td>13%</td>
<td>11</td>
</tr>
<tr>
<td>Balancing Authority</td>
<td>12%</td>
<td>10</td>
</tr>
<tr>
<td>Generation Owner/Operator</td>
<td>12%</td>
<td>10</td>
</tr>
<tr>
<td>Reliability Coordinator</td>
<td>10%</td>
<td>8</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td>6</td>
</tr>
<tr>
<td>Research/R&amp;D</td>
<td>5%</td>
<td>4</td>
</tr>
<tr>
<td>University</td>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td>PMU Calibration</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Regulator</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Training</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>
Plans to use Phasors

Use or Plan to Use Phasor Technology

- Yes: 72%
- No: 28%
Primary Users

<table>
<thead>
<tr>
<th>Primary Users</th>
<th>Percent</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time Operations</td>
<td>51%</td>
<td>29</td>
</tr>
<tr>
<td>Operations Engineering</td>
<td>42%</td>
<td>24</td>
</tr>
<tr>
<td>Planning</td>
<td>28%</td>
<td>16</td>
</tr>
<tr>
<td>Protection Engineering</td>
<td>25%</td>
<td>14</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>16%</td>
<td>8</td>
</tr>
<tr>
<td>Research/R&amp;D/Development</td>
<td>12%</td>
<td>7</td>
</tr>
</tbody>
</table>
Integrated to Other Systems

Phasor Data Integration

- Yes, it is integrated: 40%
- No, not yet: 42%
- No, stand-alone: 18%
Who will use Phasor Data

Phasor Technology Applications

- Operations: 25%
- Planning: 8%
- Both: 67%
Operation Applications

- Real-time visualization: 77%
- Voltage monitoring: 64%
- Oscillation monitoring: 62%
- Line monitoring: 47%
- Automatic equipment controls: 34%
- State estimation: 6%
- Other: 6%
- Model analysis/validation: 4%
- Fault location: 4%
Planning Applications

- System load modeling: 61%
- Generator modeling: 58%
- Contingency analysis: 53%
- SPS or RAS design: 34%
- All of these: 3%

>50%
Data Sharing

Do you share phasor data?

- Yes: 50%
- No, no plans to share phasor data: 21%
- No, but plan to share phasor data: 29%
Who Need Training

Training Groups

- Real-time Operations: 63%
- Operations Engineering: 56%
- Planning: 42%
- Protection Engineering: 40%
- Research/R&D/Development: 10%

≥40%
Equipment Training

Phasor Technology Equipment Training

- Yes: 45%
- No: 55%
Equipment Training Methods

**Equipment Training Styles**

- In-house developed classroom training, taught by...: 60%
- NASPI conference attendance: 44%
- In-house developed simulator training, taught by...: 32%
- Phasor equipment vendor-supplied training material: 28%
- Give staff a set of material for self-directed...: 28%
- Commercial conference attendance: 28%
- Training vendor-supplied training material: 16%
- In-house or company-hired consultant-developed...: 16%
Synchrophasor Data Applications Training

- Yes: 44%
- No: 56%
Application Training Methods

Phasor Application Training

- In-house developed classroom training, taught by internal staff or a consultant: 60%
- Application vendor supplied training and materials: 28%
- Simulator training: 20%
- Training vendor supplied training materials: 16%
- In-house or company-hired consultant-developed on-line training: 12%
- Other (All of the above): 4%
Training Hours per Person

Synchrophasor Training Per Individual

- Training program not started: 47%
- 1-5 hours: 28%
- 6-10 hours: 14%
- More than 10 hours: 11%
Training gaps

- PMU data quality: 59%
- Standards: 39%
- Calibration: 27%
- Installation: 23%
- Applications: 7%
Summary of Training Potentials

Training courses that could be offered that may appeal to a wide audience:

- Writing a phasor technology business case for operations
- PMU data quality
- Operations applications course to include:
  - Real-time visualization
  - Voltage monitoring
  - Oscillation monitoring
- Planning applications course to include:
  - System load modeling
  - Generator modeling
  - Contingency analysis
- Sharing phasor data