Optimizing Asset Utilization and Operating Efficiency Efficiently

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Washington DC
Major Findings/Caveats

- Optimizing asset utilization and operating efficiently depends on proper integration of technologies with business processes and associated IT.
- Build metrics, by definition, need to be updated regularly to reflect new technology.
- Build metrics should not be technology prescriptive or result in narrowing technology options for Smart Grid (should be as “technology agnostic” as possible).
- Build metrics need to differentiate between statistics measuring number of deployed widgets/data versus having the widgets/data available for use.
- Focused value metrics are probably more critical, relevant, and meaningful than “build” metrics; however, build metrics could be considered as “leading indicators” of SG.
- Build metrics will be different for transmission, distribution and consumer parts of the “asset utilization and operating efficiently” smart grid characteristic.
- Advanced materials and equipment, local communications and local intelligence are also part of the solution for Smart Grid.
# Metrics for Measuring Progress

<table>
<thead>
<tr>
<th>Transmission</th>
<th>Distribution</th>
<th>Consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• # of assets deferred and period of deferral (better use of exstg)</td>
<td>• # MW of DG/storage connected to grid as dispatchable asset</td>
<td>• # of smart meters</td>
</tr>
<tr>
<td>• # of MW that are controlled by VOLT-VAR</td>
<td>• % of smart grid enabled switches/reclosers/capacitor banks</td>
<td>• # of customers utilizing real time pricing</td>
</tr>
<tr>
<td>• % of assets with real-time condition monitoring and diagnostics</td>
<td>• % of assets with real-time condition monitoring and diagnostics</td>
<td>• # of MW of dispatchable demand response</td>
</tr>
<tr>
<td>• # of lines with dynamic rating capability</td>
<td>• # of MW that are controlled by VOLT-VAR</td>
<td></td>
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<tr>
<td>• # miles of line with expanded transmission capacity through advanced</td>
<td>• % of customers connected per automated circuit segment</td>
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<tr>
<td>materials, e.g., superconductors, FCLs, and composite conductors, etc.</td>
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<td></td>
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<tr>
<td>• # of IEDs (smart sensors) deployed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• % of IEDs with communications that allows it to perform its function</td>
<td></td>
<td></td>
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<tr>
<td>• # of operational IT applications that are integrated</td>
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Metrics Issues (General)

- Need to determine who (organization) is responsible for “owning” the metric (collect, publish)
- How to get data (historical and future) from utility
- Need to identify critical data needed to calculate metric
- Need to define common method to “measure” the parameter
- Need to define division of responsibility for data collection policy → state (distribution) vs Federal (transmission)
- Before selecting communication infrastructure we need to know all smart grid functionalities and technologies that will be implemented

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Crosscutting Metrics (T, D, and C)

# of IEDs (smart sensors) deployed

- Issues
  - Easiest to measure
  - Should be used as the baseline
  - What should be the end point
  - Break into categories: 1) asset monitors, 2) power monitors, 3) meters, 4) controllers
  - There will be a different metric for each area of the power system (Transmission, Distribution, and Consumer)
Transmission Metrics (1)

- # of assets deferred and period of deferral
  - This is investment that is deferred while still maintaining the same result (e.g. reliability/performance) through better utilization of existing assets
  - Assets need to be tracked by category (large investment items)
    - Transmission lines
    - Substations
    - Substation transformers

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Transmission Metrics (2)

- % of assets with real time condition monitoring and diagnostics
  - Need to track according to each category of asset
    - Substation transformers
    - Circuit breakers
    - Static Var systems, FACTs devices
    - Capacitor banks, Shunt reactors, series capacitors
    - Transmission lines (e.g. dynamic line rating) - this was listed as a separate index but can be included in this set of indices
    - Surge Arresters
    - Insulators
    - Towers
  - Need to define the criteria that qualifies as real time condition monitoring and diagnostics
    - Communications
    - Diagnostics
    - Notification/alarming
    - Etc.

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Transmission Metrics (3)

- **Amount of active Voltage and Var control on transmission systems**
  - What technologies are included
    - FACTS
    - SVC
    - Series capacitors
    - HVDC
  - What is metric?
    - MVAR of compensation/active control (could include storage)
    - Increase in transmission capacity (MW)
    - % of MW or MVAR that are controlled with advanced equipment

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Transmission Metrics (4)

- # miles of line with technologies for expanded transmission capacity
  - Need to identify examples of technologies that are included in this metric
    - Superconducting cables
    - Composite conductors
    - Distributed transmission line var compensation
    - FCLs mentioned as technology to consider but may not be appropriate for this specific metric - this could be a separate metrics related to advanced fault management
  - Miles of line may not be the best metric for measuring the increased transmission capacity - if we used another metric like the increased capacity itself, we could include technologies like FACTS, FCLs, etc.
Transmission Metrics (5)

- # of IEDs (smart sensors) deployed
  - There are multiple categories of devices
    - Voltages, currents, powers, etc
    - Physical quantities (temperature, pressure, wind, etc.)
    - Analytical quantities (gas analysis, etc.)
  - We should track these by elements of the system that are being monitored/managed
    - Transformers
    - Lines
    - Breakers
- Criteria for including
  - Communications
  - Intelligence?
Transmission Metrics (6)

- Level of Implementation of Extensible Common Information Model and Integration Bus
  - This is an infrastructure metric
  - It needs to be measured with some kind of matrix of the applications that are integrated with interfaces that are standardized
    - EMS/SCADA (%)
    - GIS (%)
    - Asset Management Systems (%)
    - Etc. - need a full list for tracking

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Consumer Metrics (1)

- # of smart meters
  - Percentage of meters with
    - 2-way communications
    - Open protocol (plug and play)
    - Load management capability
    - Home area network enabled
- Sources
  - Utilities/meter companies
Consumer Metrics (2)

- # of customers with dynamic pricing
  - Percentage of meters with
    - Time of use
    - Real time\dynamic pricing (enabled and utilized for both)
  - Sources
    - SECF (??– handwriting unclear….)
    - Utilities

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Consumer Metrics (3)

- # of MW dispatchable
  - Percentage of meters participating
  - Available kW/meter
  - Realized kW/meter
  - Analysis needs:
    - Participation dynamics
    - Factors driving predictability *(or preplatability? Or predilatability? – handwriting unclear)*

- Sources
  - Utilities
## Value Metrics (Parking Lot)

<table>
<thead>
<tr>
<th>Deferred generation</th>
<th>System load utilization (peak load/average load)</th>
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<tbody>
<tr>
<td>Maintenance costs versus reliability</td>
<td>Unplanned outage rates</td>
</tr>
<tr>
<td>Time to convert data to action</td>
<td>Reduction in reliability violations</td>
</tr>
<tr>
<td>Hours of overtime</td>
<td>$ savings by optimizing and utilization of existing transmission assets</td>
</tr>
<tr>
<td>Transmission grid/line power losses (%) over time</td>
<td>Capital improvement costs versus demand and energy (load factor)</td>
</tr>
<tr>
<td>Joules of energy consumed/joules of energy sold</td>
<td>Increase in capacity/cost ($)</td>
</tr>
<tr>
<td>Improved circuit load factors</td>
<td>Transmission and distribution losses (total energy delivered/total energy generated)</td>
</tr>
<tr>
<td># or cost of assets where upgrades are deferred/eliminated that can be directly attributable to a technology/approach</td>
<td># years of equipment life increase</td>
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