Project participants

• Project Transmission Owners (# substations)
  – Bangor Hydro (2)
  – Central Maine Power (5)
  – National Grid (6)
  – Northeast Utilities (16)
  – NSTAR (4)
  – United Illuminating (4)
  – Vermont Electric (2)

• Project Manager
  – KEMA Consulting

• Other Partners
  – Mehta Tech Inc.
  – Alstom Grid
  – V&R Energy Systems Research
PDC Sites

TO PDC

ISO PDC
PMU Sites
Project Schedule

• Communications (PDCs)
  – Point to point circuits from ISO to each TO
  – Circuits procured through 3rd party (American Telesys)
  – Routers at both ends managed by ISO
  – Firewalls at each end (TOs manage their own Firewalls)
  – All circuits established by March 2011
  – One MPLS circuit from ISO to TVA planned
    – Replacing two existing MPLS circuits from two PMUs to TVA
Project Schedule (continued)

• PDC Installations:
  – openPDC developed by GPA, installed and supported by Alstom Grid
    o SEL PDC used by Central Maine Power – data filter to their openPDC then forwarded to ISO-NE openPDC
  – 8 openPDC sites: one at ISO, one each at 7 TOs
    o ISO installed Q1 2011
    o 2 TOs installed in Q1 2011
    o 1 TOs installed in Q2 2011
    o 1 TOs installed in Q3 2011
    o 2 TOs scheduled by Q4 2011
    o 1 TO scheduled by Q1 2012
  – TO openPDC installation coordinated with PMU
    ➢ TO must have at least one PMU providing at least one Voltage
    ➢ Data must have reasonable reliability & quality
Project Schedule (continued)

• PMU Installations (substations, not devices)
  – 345 kV substations – 44% (35 of 80)
  – 115 kV substations – less than 1% (4 of 688)
  – Substations providing synchrophasors according to ISO requirements (reliability and quality)
    • At least 50% of PMUs installed by end of 2011
    • Working with TOs to schedule all 40 PMUs in place by 6/30/12.
Project Schedule (continued)

- **Applications:**
  - **Alstom PhasorPoint (Trigger Event Application, Disturbance Event Management, Visualization, Historian)**
    - Q3 2011 delivery (Just installed)
    - Q2 2012 delivery meeting all ISO-NE project requirements
  - **V&R Region of Stability Existence (ROSE)**
    - Analytical analysis and benchmarking – Now till Q4 2012
    - Software enhancements based on analysis
    - Q4 2012 software delivery
  - **Mehta Tech**
    - Upgrades to existing DDRs(5) to support PMU functions (completed)
    - Performance enhancements to PMUs (Beta effort completed)
    - Master Station enhancements (ex. User Interface)
  - **Other applications being explored (internally developed)**
    - PMU data quality monitoring
    - PMU data reliability monitoring
PMUs – Data Quality

• C37.118-2005, 30 samples per second

• Data stream must be reasonably reliable
  o No systemic data delivery issues, wiring issues at substation, etc.

• Data must be of reasonably good quality
  o Proper time – start at top of second, progress in .033s increments, STAT codes not 2000, a000, etc.
  o Properly scaled ~ 200,000 Volts, ~ 60.000 Hz, etc.
  o Calculated flows close to SCADA & state estimator
PMUs – Type

• All PMUs will be new or upgraded multi function devices DFR/DDR/PMU

• TOs free to chose PMU manufactures

• Four PMU Vendors (# substations):
  – Mehta Tech (10) – DDR/PMU & dedicated PMU
  – ERL Phase (10) – DFR/PMU & dedicated PMU
  – Qualitrol (2) – DFR/PMU
  – SEL (18) – Relay/PMU & dedicated PMU
Challenges/Lessons Learned

• Communication
  – JMUX Serial card latency issue with SEL

• PMU Vendor issues
  – Not currently supporting 16 character channel names
  – Not currently supporting 5 digit IDCODE

• DOE Concerns
  – Timely turnaround on information requests and required approvals