

# American Transmission Company Smart Grid Investment Grant Update

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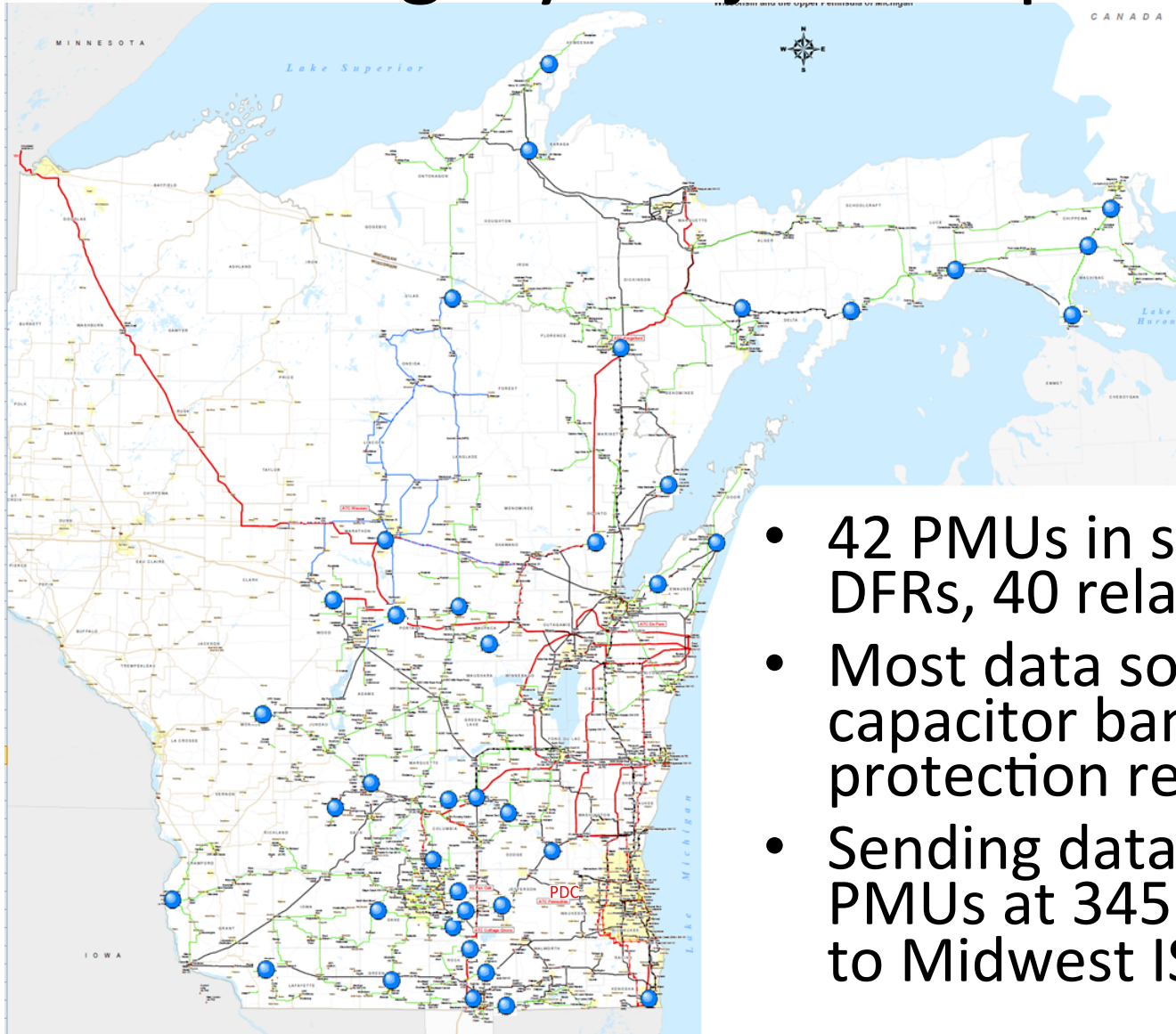
NASPI Work Group Meeting  
October 12-13, 2011



# Project Participant Information

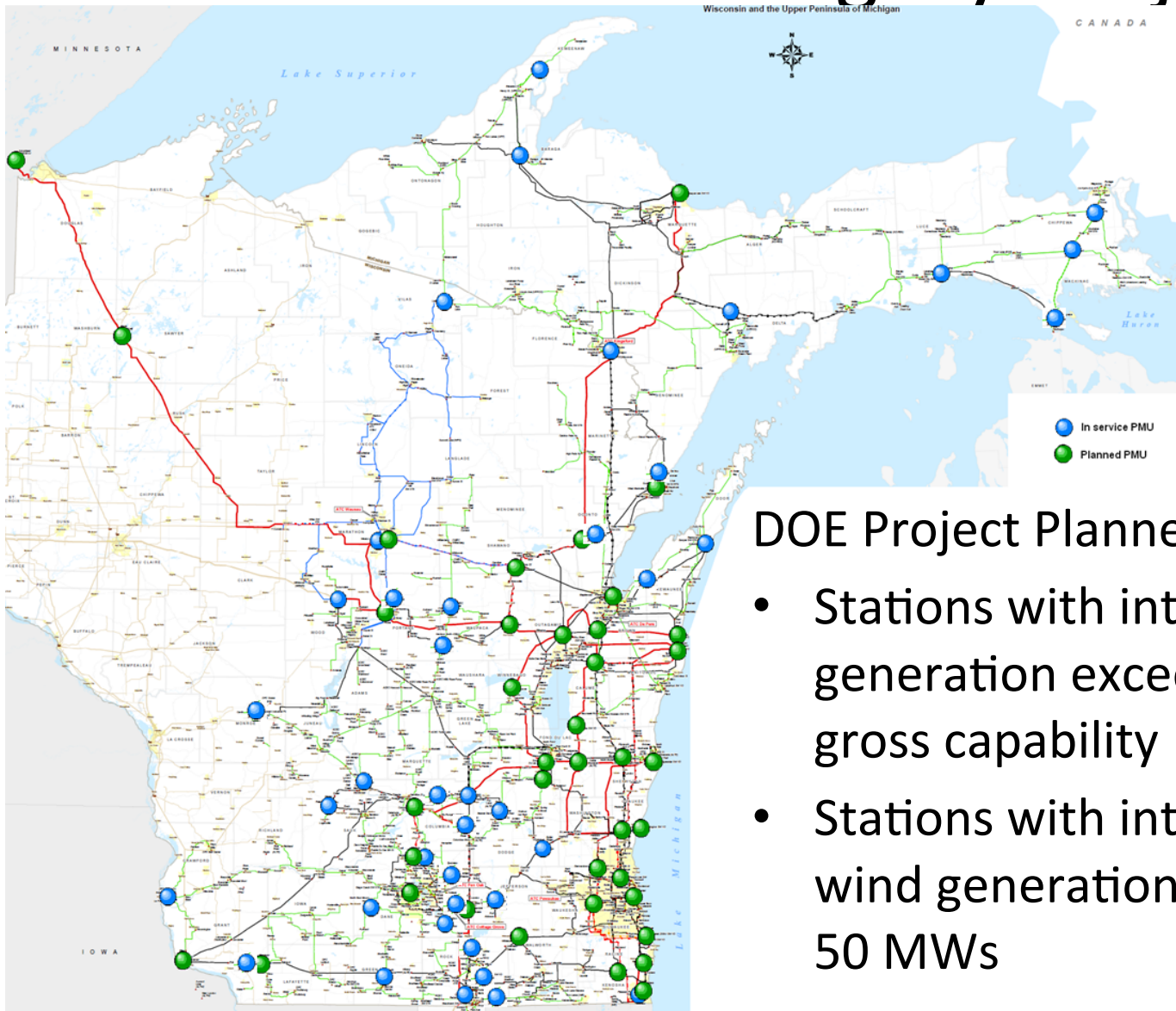
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# Legacy Project Map



- 42 PMUs in service (2 DFRs, 40 relays)
- Most data sourced from capacitor bank protection relays
- Sending data from 5 PMUs at 345 Kv stations to Midwest ISO.

# Combined DOE and Legacy Project Map



## DOE Project Planned Installations

- Stations with interconnected generation exceeding 200 MW gross capability
- Stations with interconnected wind generation greater than 50 MWs
- 345 Kv stations



# Project Timeline – Other

- We have two legacy PDCs in service and operational. We will transition to newer PDCs when technical issues have been addressed. (Planning for Q2 2012)
- Existing communications allow us to implement now. Our SCADA enhancement project will extend our fiber optic network to improve reliability and performance of the communications network.
- Some applications already developed in house using our OSI Soft – PI tools. Looking at other applications when more data is available 4Q 2012.

# PMU Installation Statistics

- We are the sole transmission owner involved in this project and will be installing a total of 45 PMUs
- Elements monitored by PMUs Today (legacy plus DOE)
  - 5 stations operated at 345 Kv (0 from DOE project)
  - 37 stations operated between 69 Kv and 230 Kv (0 from DOE project)
  - 36 capacitor banks / 1 transformer tertiary / 5 - 345 Kv lines / 0 generators monitored
- 8% of our system substations (those operated at or above 69 Kv) are now monitored by PMUs (42 substations with PMUs). We expect to see that increase to close to 25% at project completion.

# PMU Installation Statistics (cont'd)

- Minimum PMU sampling rate will be 30 samples/second
- PMU installation rate
  - 42 units have been installed as of 9/30/2011 over a 3 year period. 2 of these were DFR upgrades. The remainder were new installations where the PMU data was made available from a dual function relay/PMU.
  - We expect to have 4 DOE installs completed between now and year end. This will be a mix of stand alone PMUs and DFR upgrades
  - We expect to have all 45 DOE projects completed by year end 2012. Approximately half of these projects involve new installations of stand alone PMUs. The remaining units involve upgrades of existing Digital Fault Recorders
  - Any installations in 2013 will be done as part of our legacy project. We do not have any specific plans at this time.



# PDCs and Communications

When our project is complete we will have the following in service equipment:

- PDCs
  - One redundant PDC pair at our offices in southeastern Wisconsin
  - One cold standby PDC at our offices in south central Wisconsin
    - The above reflects MISO PDC expectations and is beyond what we anticipated when we originally scoped our project
  - Archive/database status
    - Currently Storing ~4 GBytes per day to our PI Historian database
    - All data is available since we began scanning (no compression)
    - We will store all data until such time that we determine what data we do not need
- Communications system
  - Communication link to MISO – highly available and redundant
  - Retired our link to TVA – MISO now providing that data
  - No direct links to other TOs anticipated at this time. We envision MISO as our “PMU data hub” if we need data from others in our region

# Major operational applications using phasor data

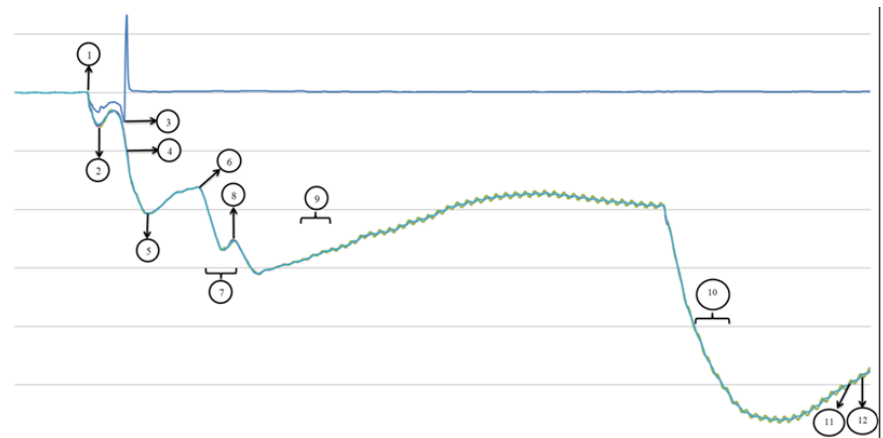
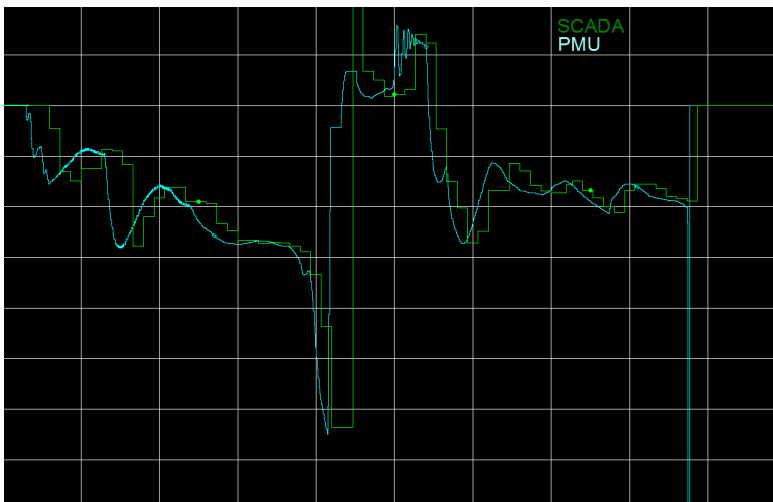
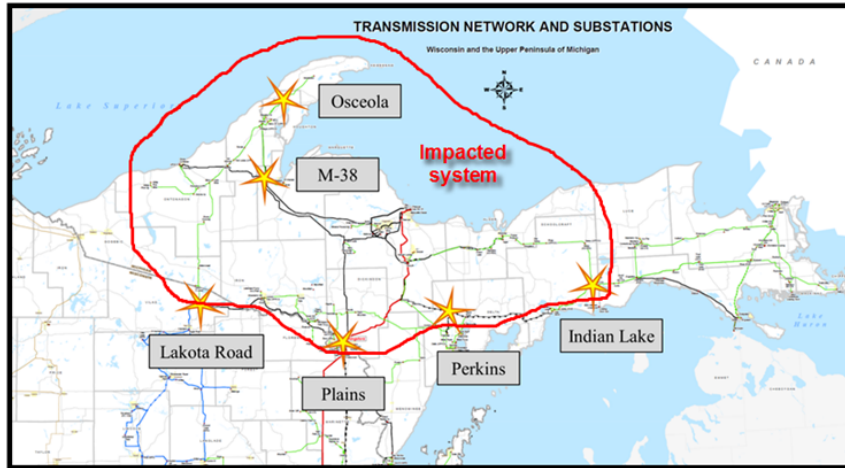
- We will be making all our PMU data available to MISO. We do not envision any direct connects to other TOs to share data at this time.
- Wide-area situational awareness
  - ALSTOM eterraVision in development for overall wide area view. Looking at ways to leverage those capabilities with our non-standard PMU data configuration to enable use of PMU data.
  - Also looking at RTDMS and PGDA applications from Electric Power Group. Need to figure out how our project fits with the MISO project
  - PI ProcessBook prototype displays already created. Need to get Operations buy in and further direction.
- State estimation
  - ALSTOM EMS already has capability to use phase angle data as an input.
  - We are already feeding angle data to our EMS at 1 sample/second rate from our legacy sites but it is not used as an input to SE.
  - Plan to test SE once we have the majority of our 345 Kv sites in service. Currently that puts us out to 4Q 2012 / 1Q 2013

# Challenges and lessons learned

- Execution challenges
  - We are still struggling with buy in from Operations to make this a real time decision making tool. Some forward movement but we haven't been able to get what we've developed to be considered "screen worthy" by Operations
  - We have completed all site visits and have specified installation work to be done but have yet to install one PMU under the project
  - Longer lead times from some of our vendors than expected causing installation delays
  - Review cycle for drawing updates taking longer than planned
  - Problems getting the work scheduled on this non-standard project. We don't normally have projects that span many stations scattered across our footprint like this project
- Other challenges
  - PMU performance has been good but we have yet to determine acceptable downtime
  - Managing our data archives as we grow our PMU network will require that we get smarter about what data we need to keep and for how long

# Other things we should know about your project?

- Already using the PMU data we have to help with post event analysis - 5/10/2011 event example



# Other things we should know about your project? (cont'd)

- System protection requesting data to assist in post event fault analysis especially in areas where older electromechanical relays are used
- Operations requesting data periodically to address operational questions (Did you see any voltage spikes on the transmission system at this time, etc...)
- Using the data to validate generator models in isolated areas where events have occurred.

Questions?