Enhanced Inverter Capabilities
Problem Statement

Planning Committee
January 9, 2014
Renewable Energy Continues to Increase in PJM

Graph showing the trend of installed capacity cleared in PJM from 2007/2008 to 2016/2017. The graph indicates a decrease in coal capacity, an increase in gas capacity, a decrease in nuclear capacity, and an increase in renewable energy capacity.
Reactive power (vars) is required to maintain the voltage to deliver active power (watts) through transmission lines.
• Reactive power produced by large generators or transmission system capacitors or SVCs
• Reactive power used to support voltage at the transmission level and the distribution system

BUT

• Renewables, particularly PV solar, are connected onto the distribution system and do not provide any reactive support, but are capable or can be made capable
• Variable generation increases demand for reactive power on the system
• Reduction in traditional resources that could provide reactive power widens the gap
• Gap widens with high penetration scenarios
• Need increased capabilities to control frequency as well as voltages
• Direct Current (DC) needs to be inverted into an AC waveform to be used on the power system

• Inverters are now capable of producing/absorbing reactive power – “smart inverters”
1. **Static VAR compensators at several stations**
   - Cost prohibitive
   - Does not address frequency issues

2. **Run additional conventional generators dedicated to reactive support**
   - Not cost effective
   - Does not address frequency issues
   - May cause negative Locational Marginal Prices
   - Limits the percentage of renewables (50% in Spain & Ireland)
3. Enabling smart inverters

- Proactive response
- Most cost effective for new resources
- Gain distributed control (not all eggs in one basket)
- Provide reactive power control (voltage control) and inertial & governing like responses (to some extent)
- Proven concept (being used in Germany, Great Britain)
Key Work Activities

• Review inverter-related standards
• Review potential solutions
• Determine rule changes to implement potential solutions

Deliverables

• Technical standards for inverters
• Tariff, OA, and Manual changes to implement standards