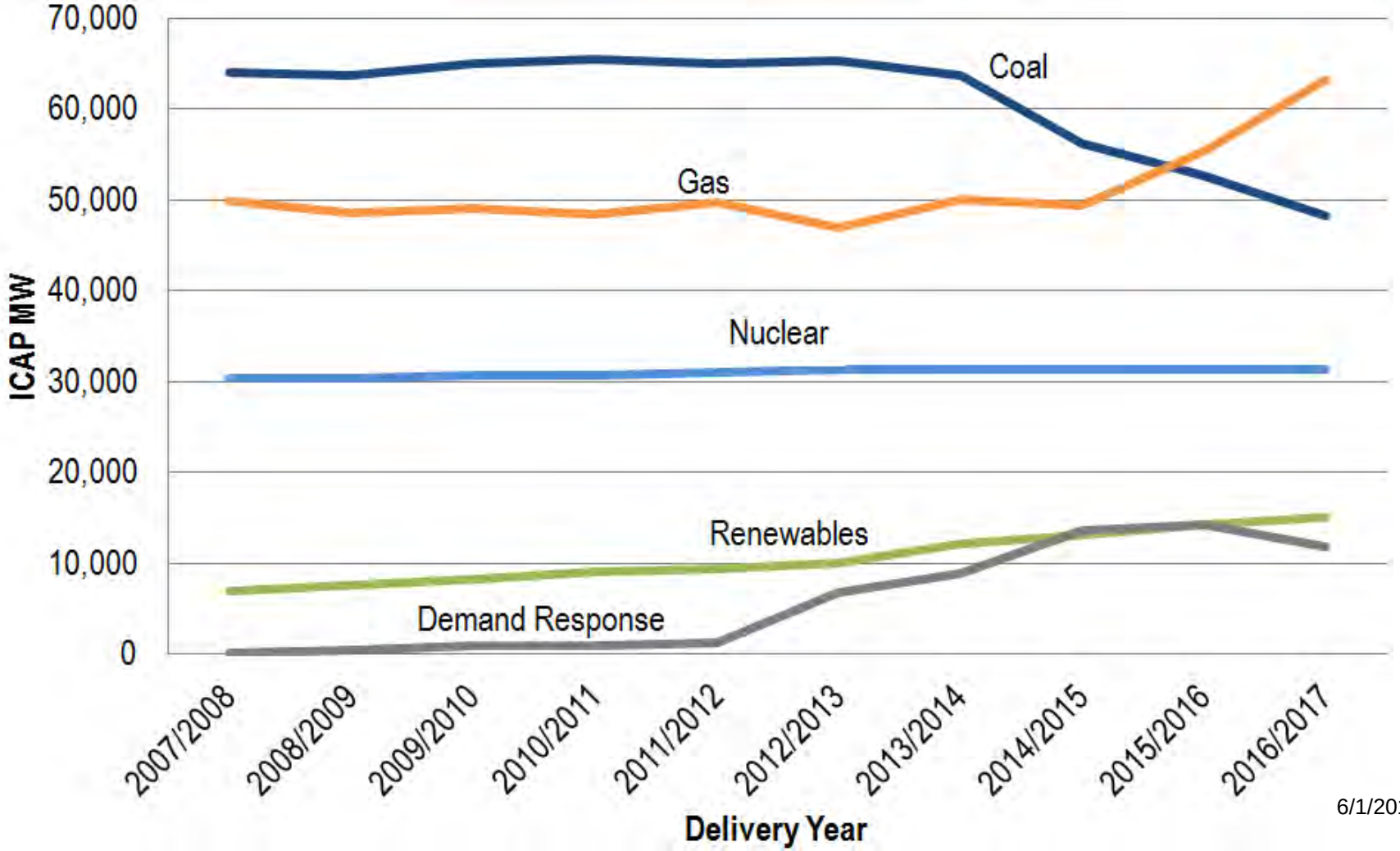
Enhanced Inverter Capabilities Problem Statement

Planning Committee

January 9, 2014

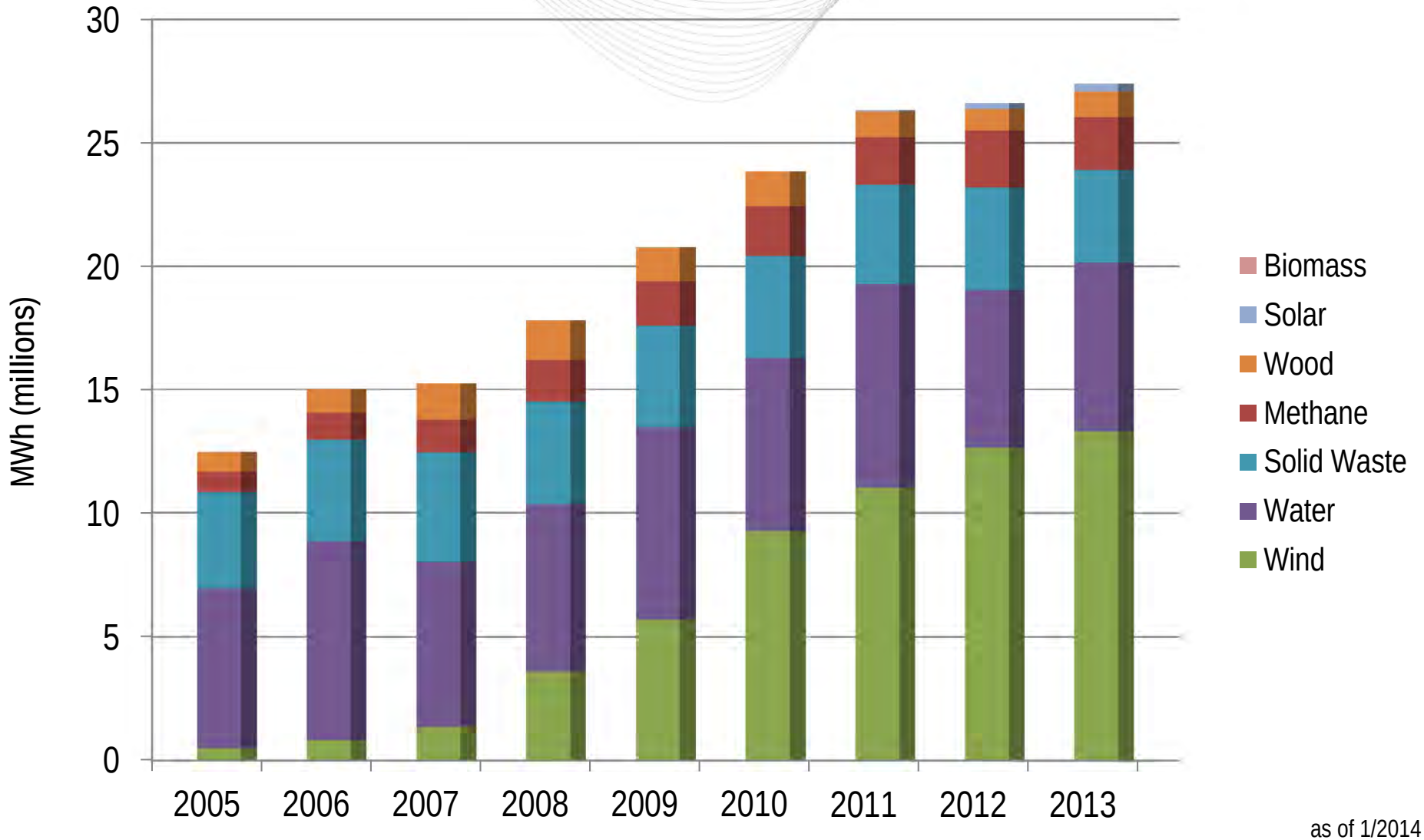
Renewable Energy Continues to Increase in PJM

PJM Installed Capacity Cleared



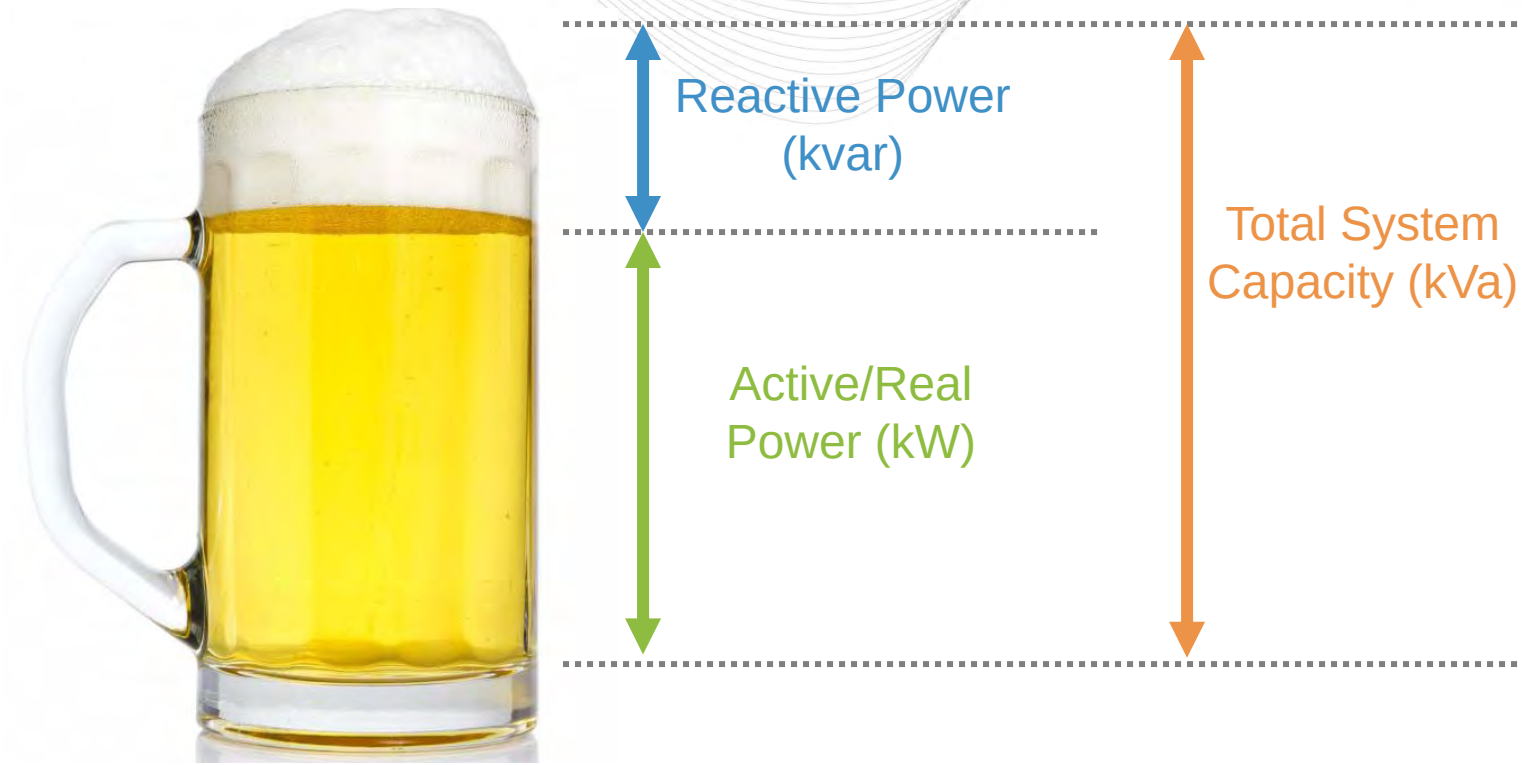
6/1/2013

Renewable Energy in PJM



as of 1/2014

Reactive Power Necessary to Control Voltage



Reactive power (vars) is required to maintain the voltage to deliver active power (watts) through transmission lines.

Traditional Voltage Control

- 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

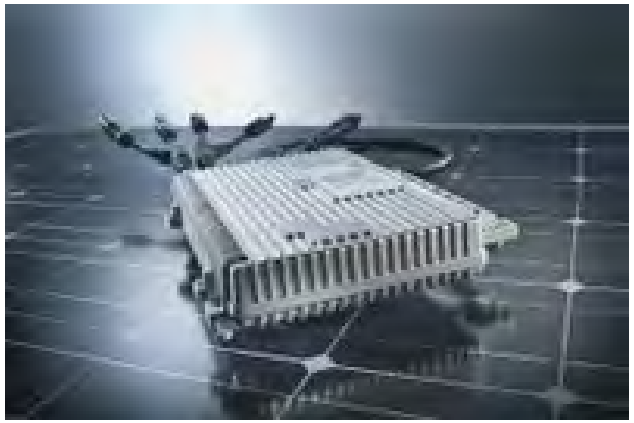
- Renewables, particularly PV solar, are connected onto the distribution system and do not provide any reactive support, but are capable or can be made capable

Problem- Mind the Gap

- 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

Renewable Resources (Wind, Solar) Produce DC Power

- 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