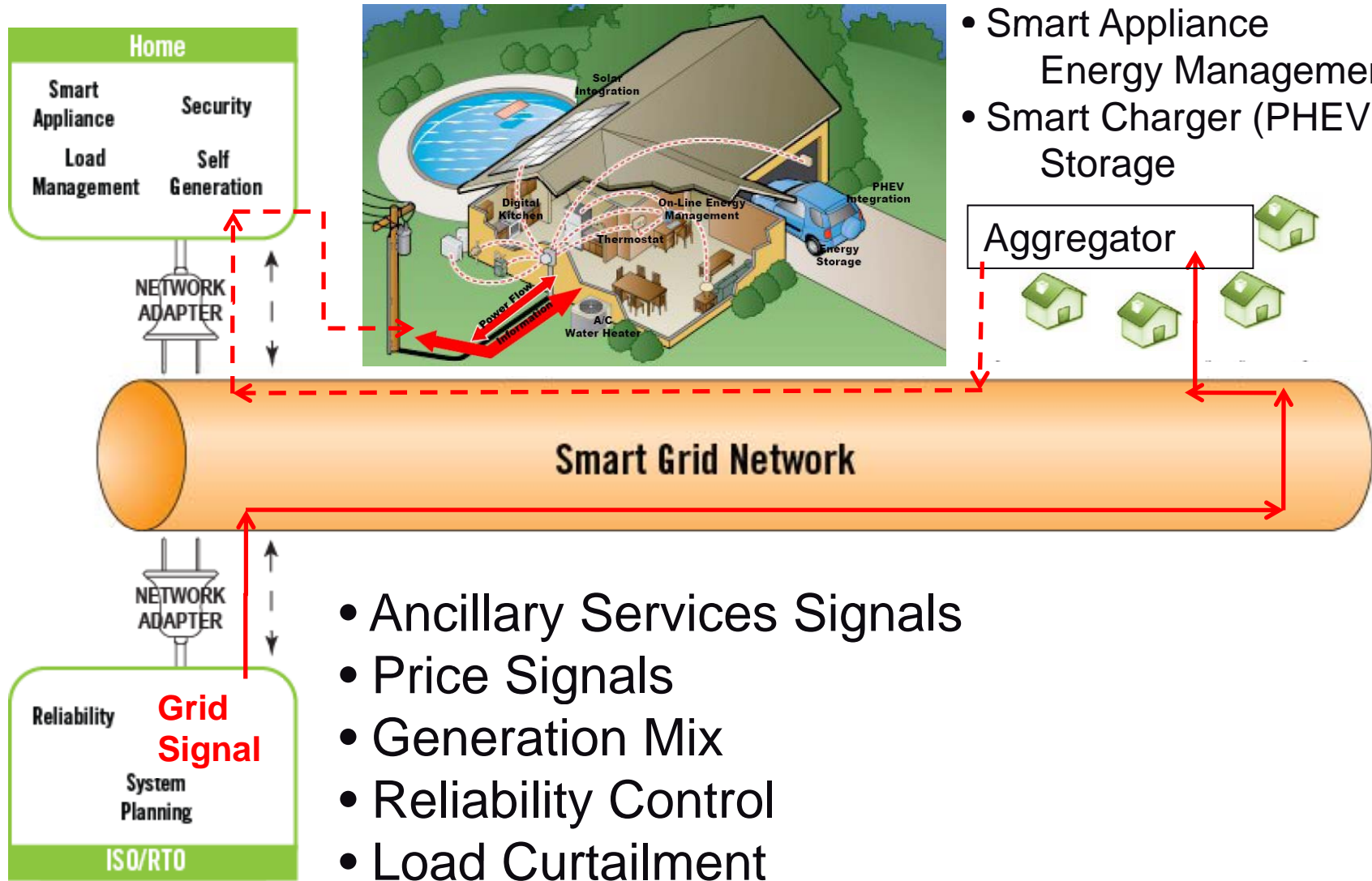




Energy and Transportation Convergence: Challenges and Opportunities for Electric Grid Modernization

Grid Architecture and V2G

Ken Huber
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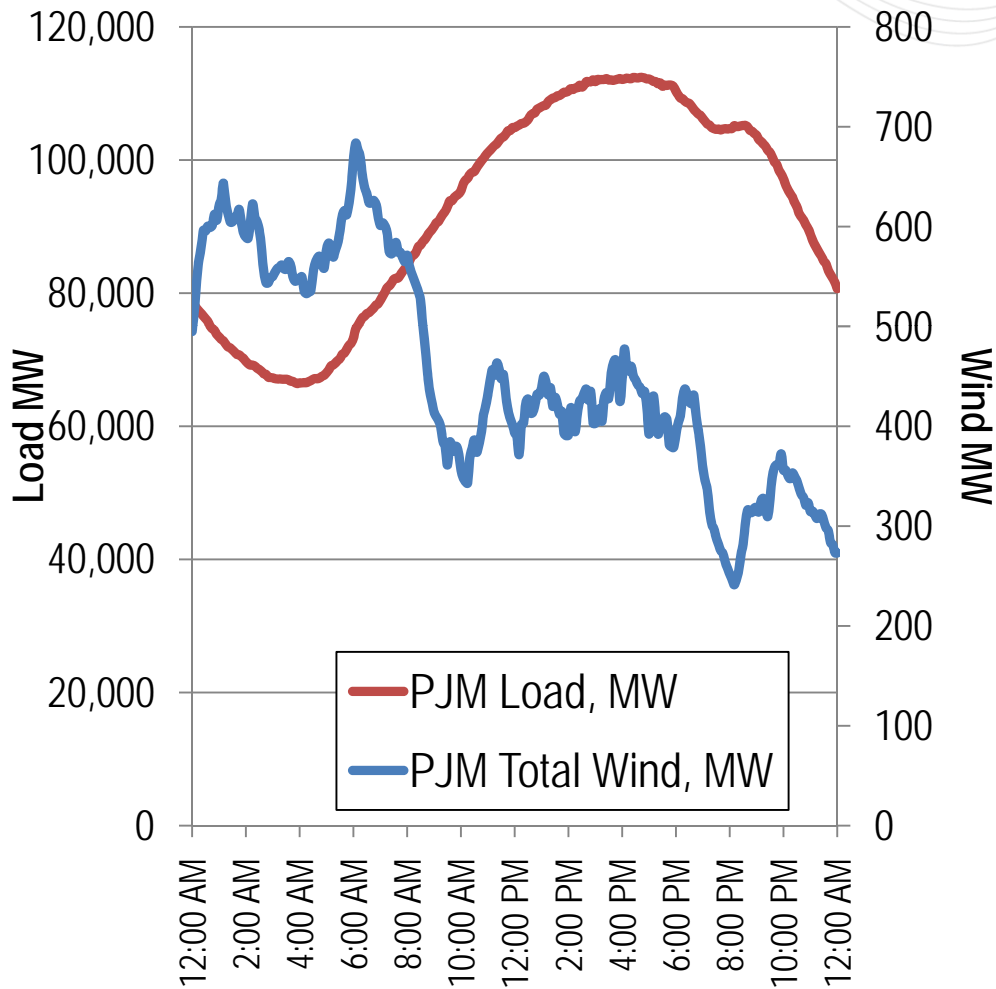
- Smart Appliance Energy Management
- Smart Charger (PHEV) Storage



PJM Load and Wind Resources – August 26, 2009

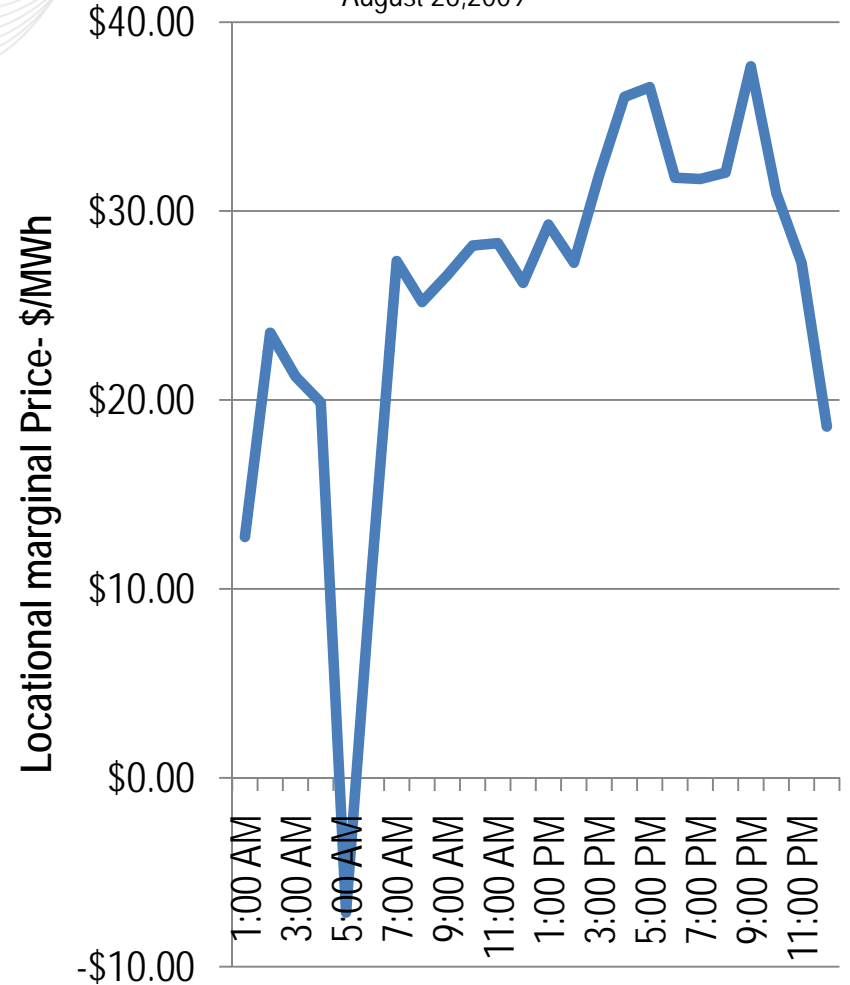
PJM Load and Wind Contribution

August 26, 2009



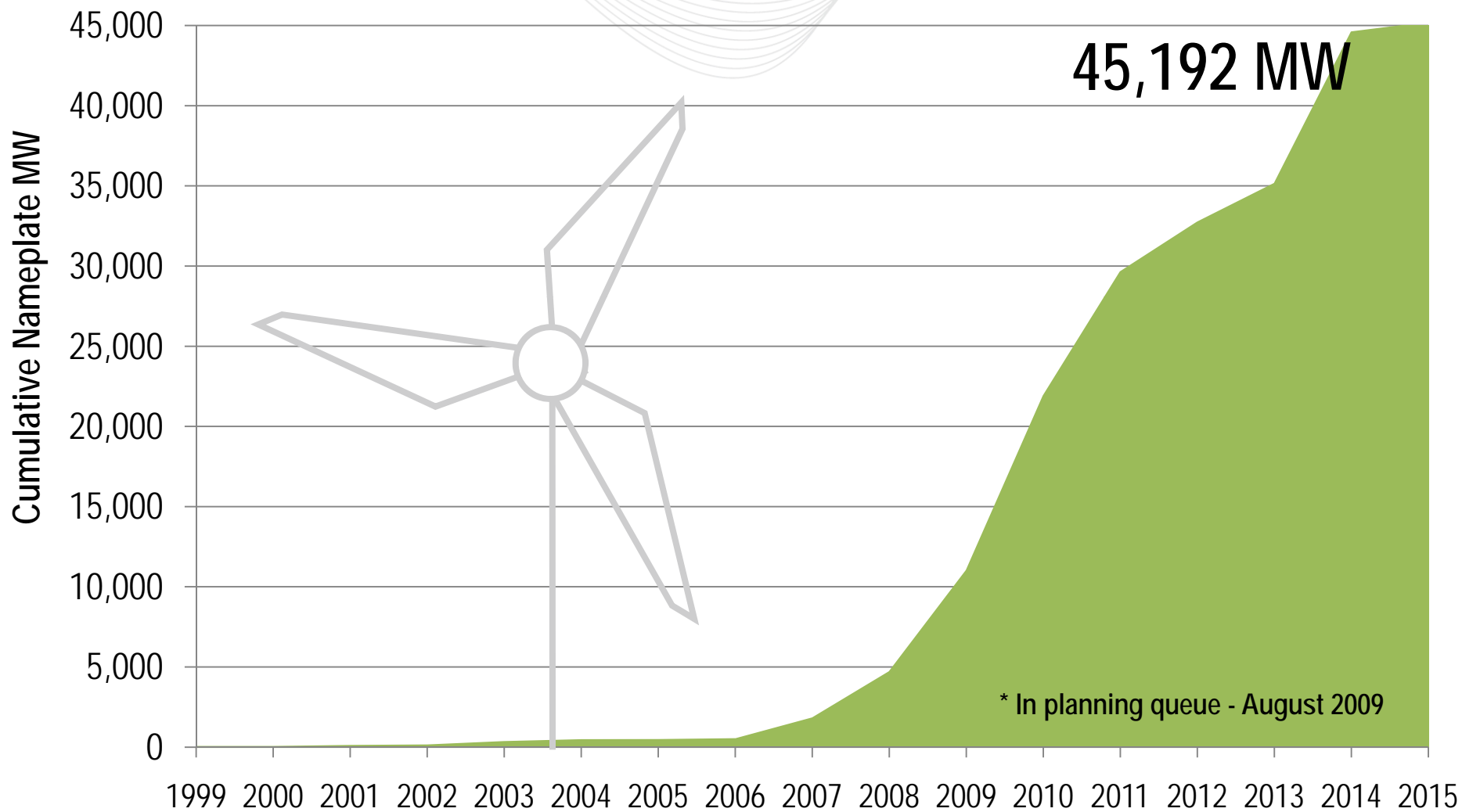
Chicago LMP

August 26, 2009

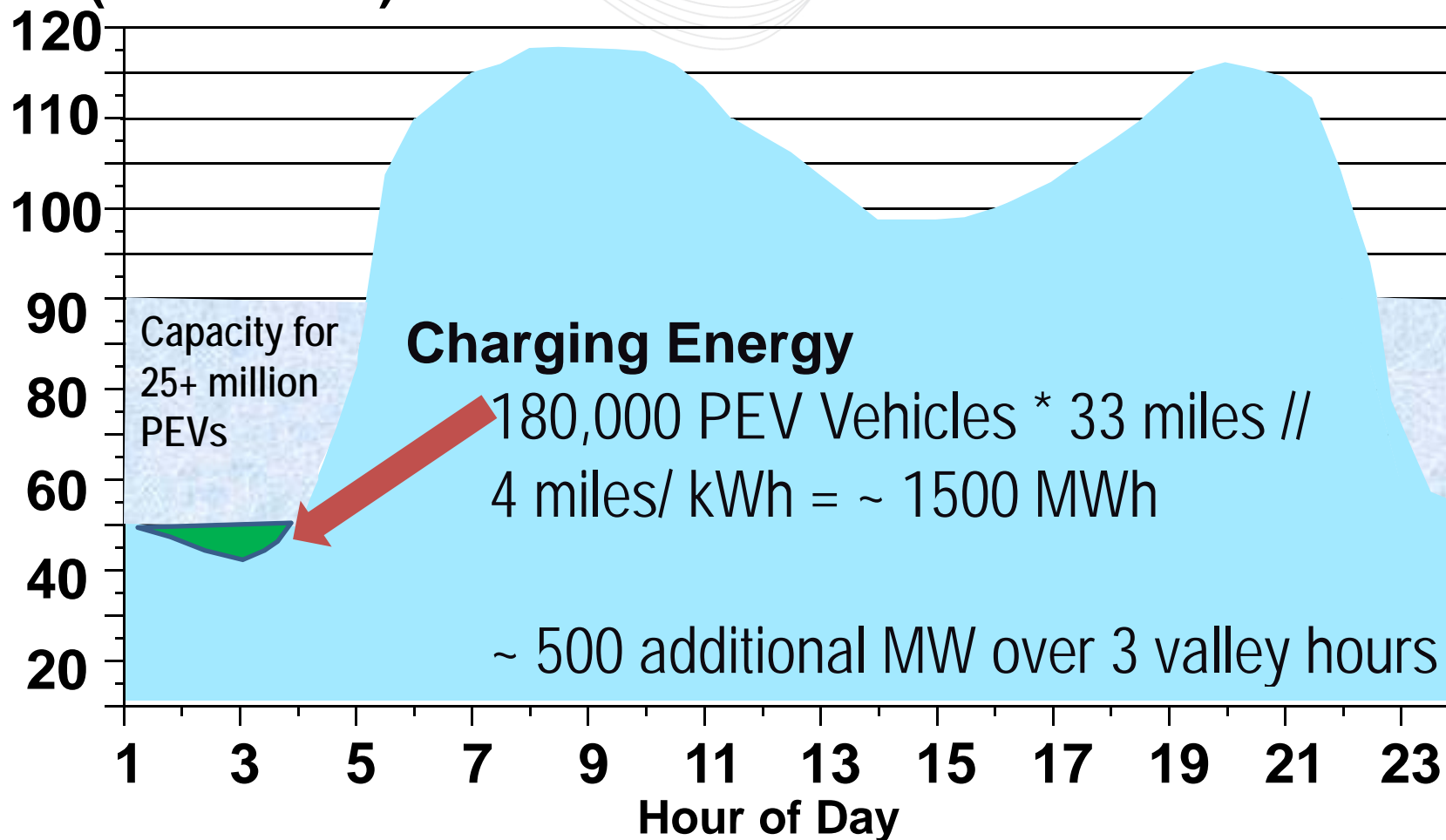




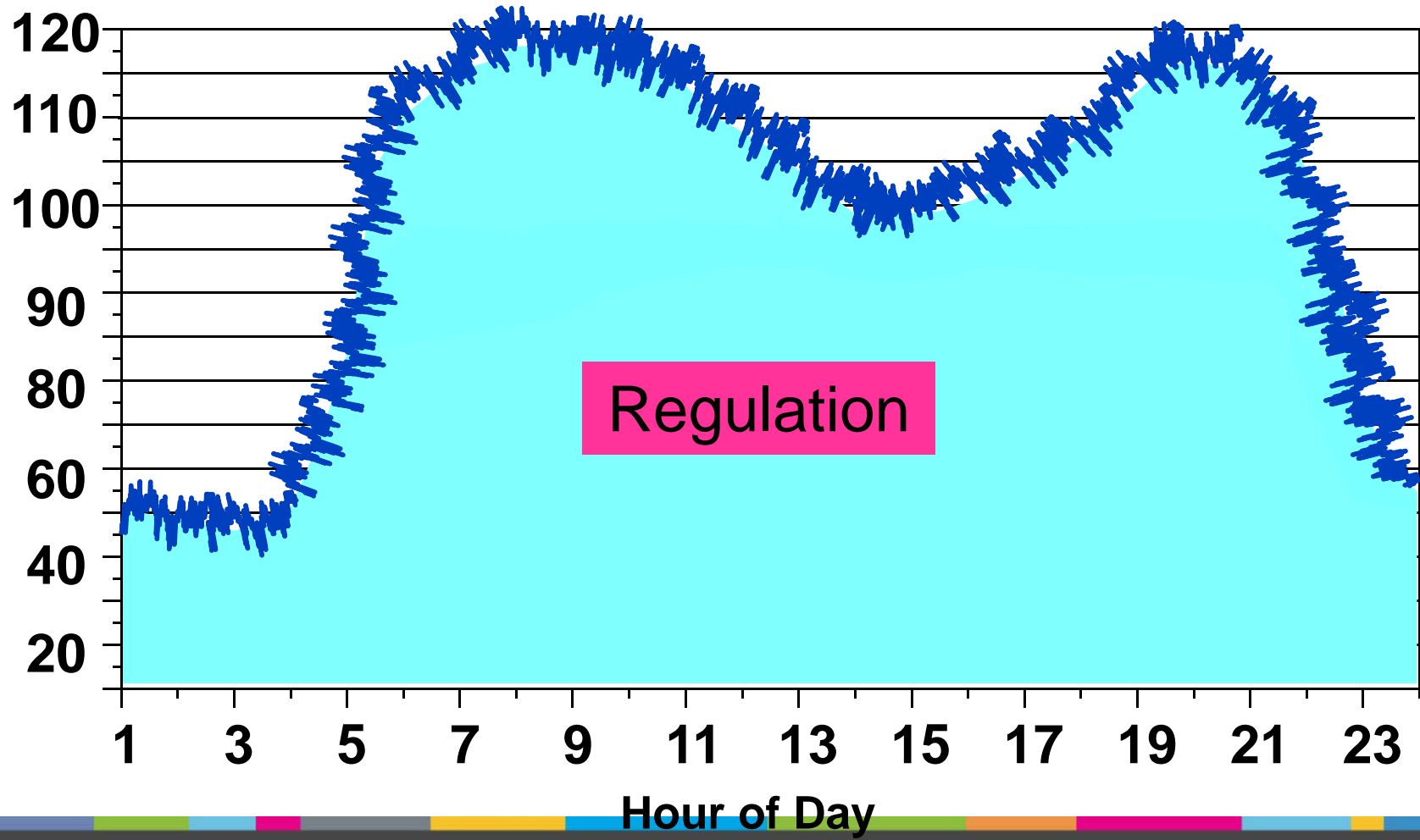
Wind Generation in PJM - Operational and Proposed

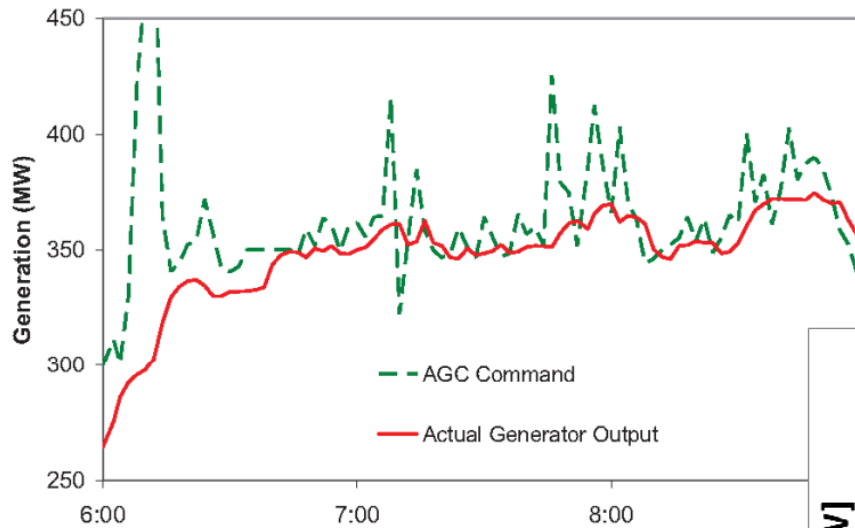


Load (MW x 1000)



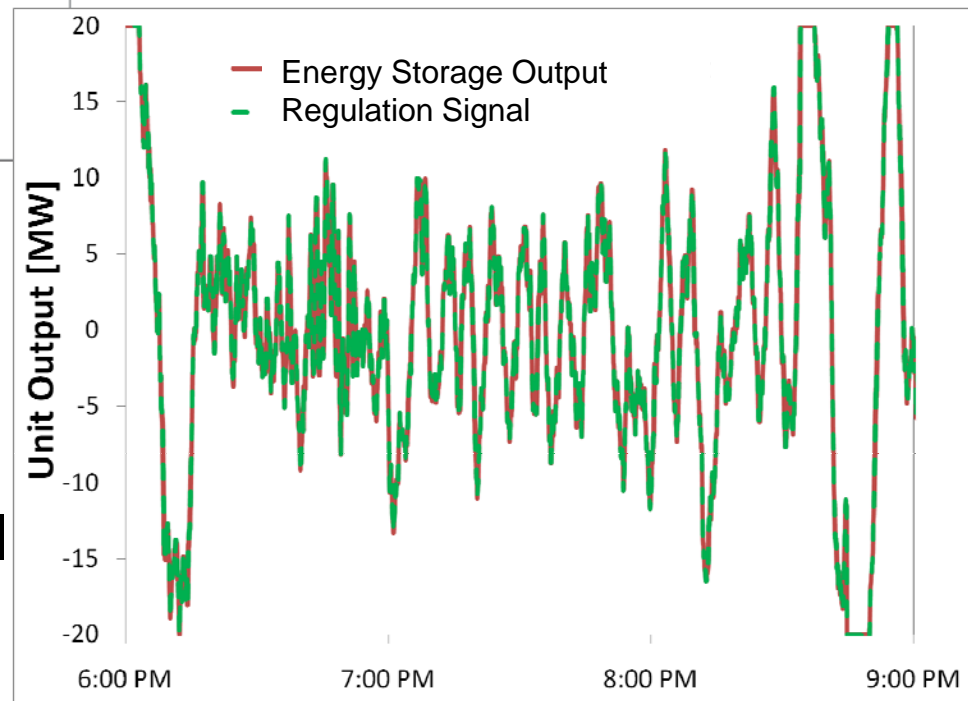
Load in GW





A fossil power plant following a regulation command signal

Energy Storage (batteries / flywheels) accurately following a regulation command signal





Mid-Atlantic Grid Interactive Car Consortium V2G Demonstration Project



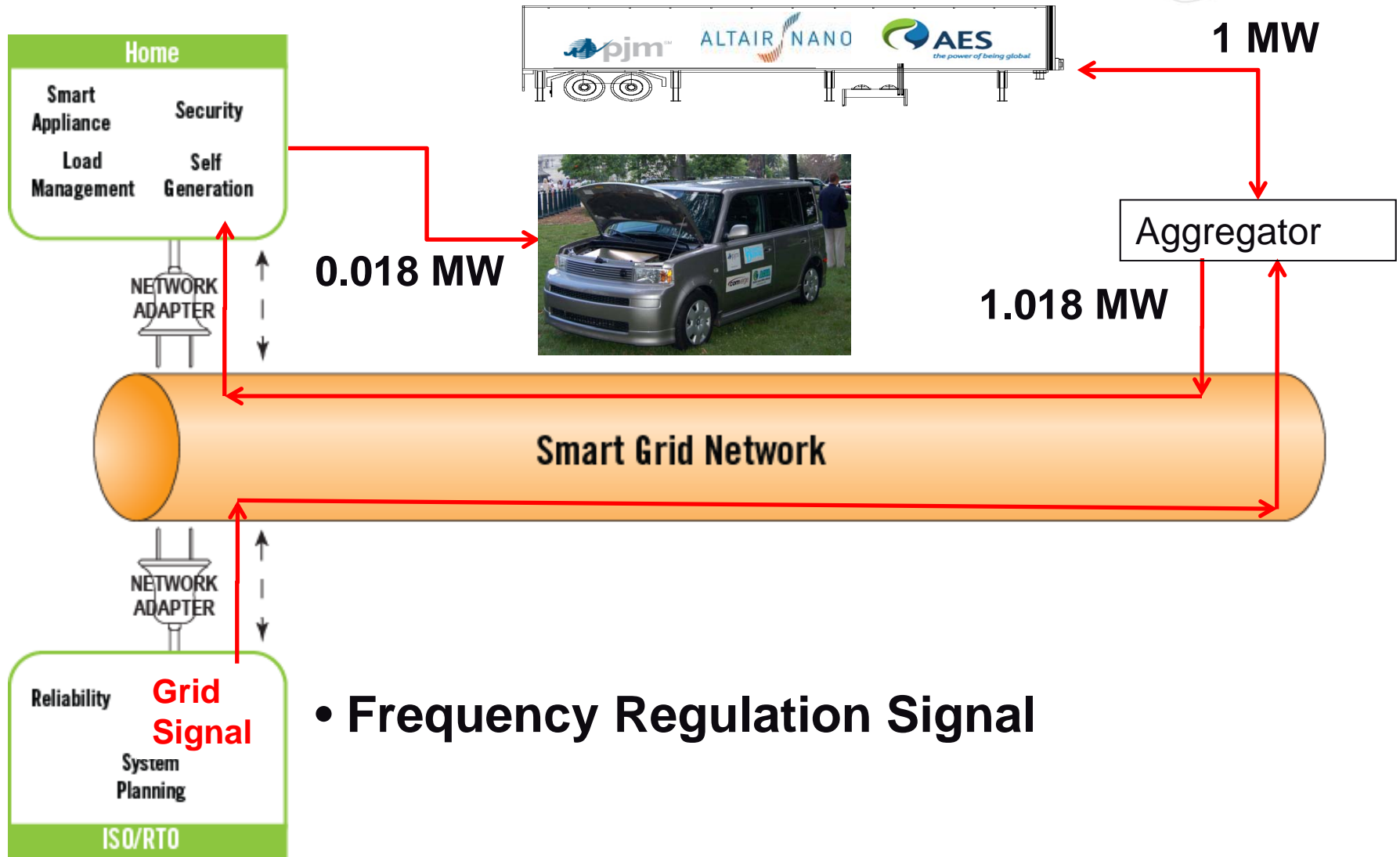
- Mid-Atlantic Grid Interactive Car Consortium (MAGICC)
- **Over 2 years experience** (since October 2007) with the MAGICC battery electric vehicle responding to the PJM market signals





Operational Details

- Altairnano, Inc – Lithium Ion nano titanate battery
- Power: 1 MW for 15 minutes
- Usable Charge Range: 5% - 99%
- Energy: 300 kWh
- Efficiency: 90% round trip



• Frequency Regulation Signal