

Smart Grid Subcommittee Report

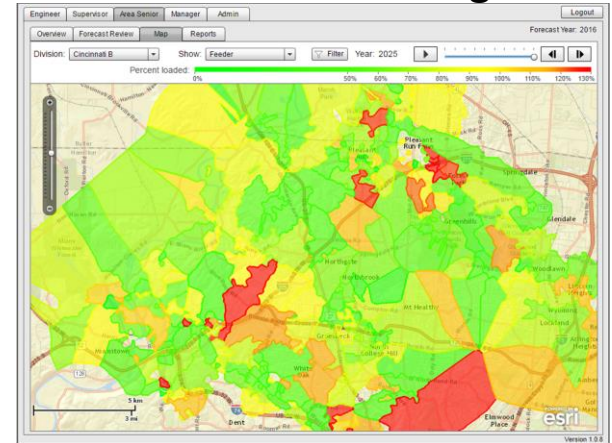
Paul Centolella
Subcommittee Chair

Electricity Advisory Committee
March 30, 2017

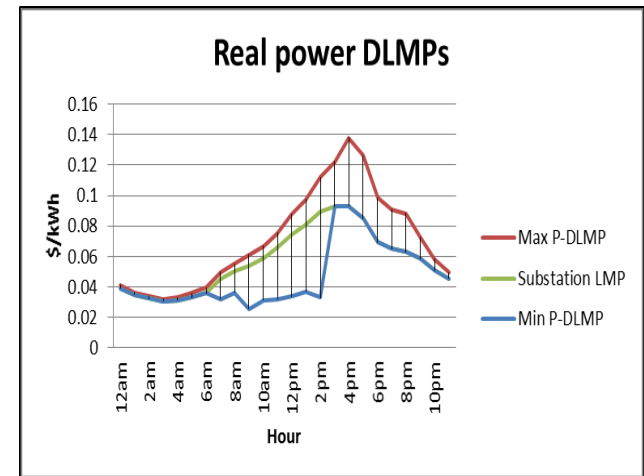
DER Value & Distribution Level Markets

- Bill Kallock, Integral Analytics:
 - Need Granular analysis to capture full utility benefits of DER at the edge of the grid
- Prof. Michael Caramanis, Boston University
 - Centralized Market Clearing for system with high DER NOT Tractable
 - Distributed Market Clearing Tractable
 - Issues that require further study:
 - Interplay of real and reactive power with provision of reserves
 - Market power issues
 - Communication architecture & Security

Spatial Distribution Planning Forecasts



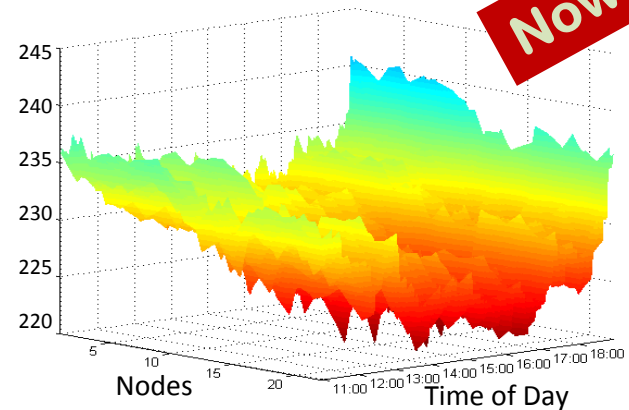
Modeling: Summer Day, High DER for 800 Bus Distribution Feeder



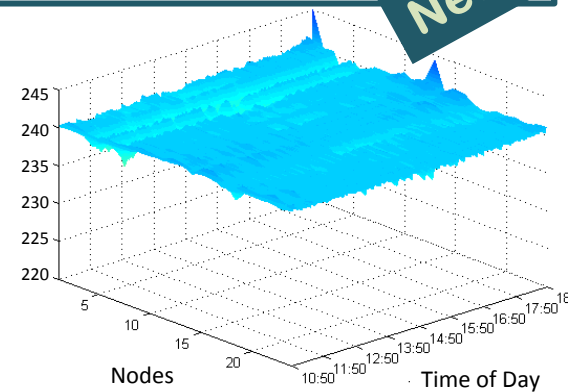
Distributed Control with Autonomous Devices

- Prof. Deepak Divan – Georgia Tech Center for Distributed Energy
- Recommendations included:
 - Enhanced dynamic and distributed grid models and simulation tools needed to understand system behavior – *new tools to manage the new system*
 - Interaction of massively distributed autonomous assets with each other & with existing grid control poorly understood – *research initiative needed*
 - Mixed market model – *centralized dispatch, transactive at mid-level, autonomous at edge*

Centralized Control

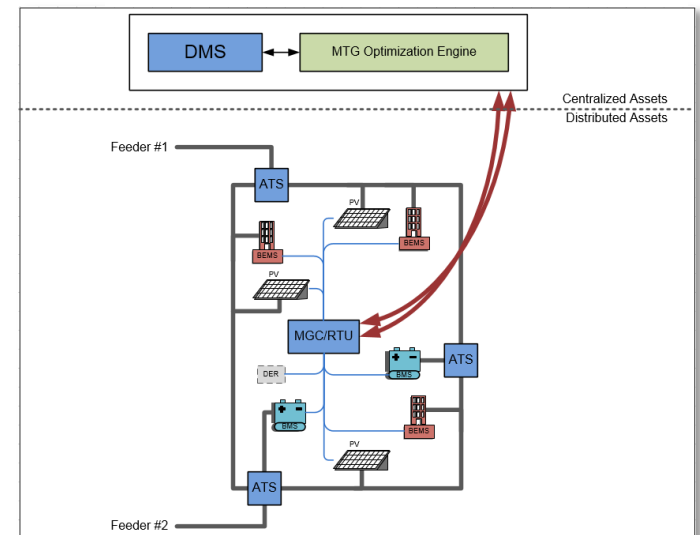
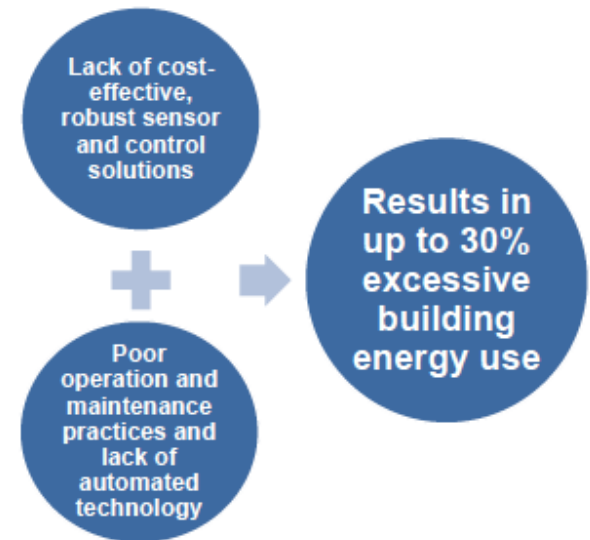


Distributed Control



Transactive Energy

- Dr. Srinivas Katipamula – PNNL
 - Potential of Transactive Energy to Manage Flexible Building Loads
 - Key is favorable market Structure
- Curtis Kirkeby – Avista: Smart Grid Pilot and Transactive Microgrid
 - Intelligent Agents
 - Peer-to-Peer Transactions
- Dr. Richard Tabors – TCR: Platform Markets
 - Transactional Forward Financial Market
 - Increasingly Granular Ex Post Balancing Market
 - Services Platform Animate New Products

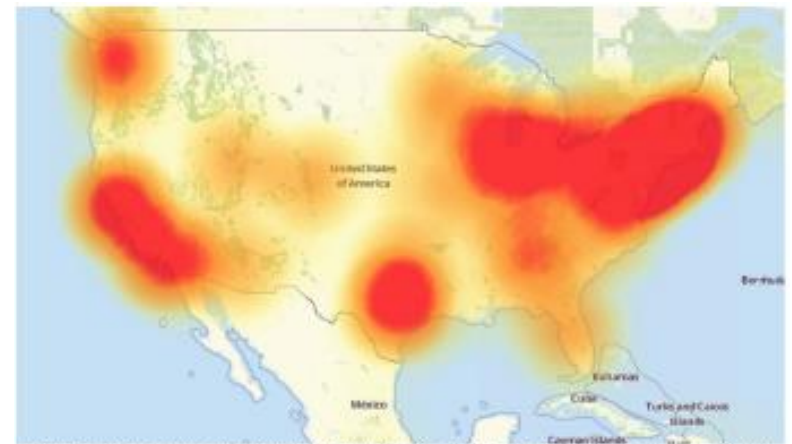


Prof. Bill Sanders – A Internet of Risky Things?

- Risks:
 - Lack (in consumer IoT) of any real standardized security approach
 - Significantly larger attack surface due to everything being connected and accessible
 - Exponential growth of number of potential attack paths in infrastructure
 - Potential attack paths from large number of consumer devices to the bulk electric power grid
 - Lack of standardization hampering interoperability
 - Lack of standardization creating interaction vulnerabilities
 - Privacy
 - Complexity of infrastructure making validation of security and resiliency practically impossible.
- Recommendation: Caution!



October 2016 Webcam Hack Impact On the Network Outages



A depiction of the outages caused by today's attacks on Dyn, an Internet infrastructure company. Source: Downtime.com.

Recent Work & Plan for 2017

- Review of Grid Mod Work related to Valuation and Integration of DER
 - DER Valuation & Integration - Plan to Complete Report by June Meeting
 - Importance of the Grid and Need to address the integration of a range of DER (PV, Storage, Back-up generators, Flexible Demand, Distributed Control / Power Electronics)
 - Building on Grid Modernization
 - Tools for and evaluation of variability in time-, location-, & product-specific Value of DER and Development of more granular, efficient Markets
 - Additional R&D on grid control and integration of autonomous devices
 - Cyber / Physical Security – Impacts of IoT & Resilience
 - Continue to Follow-up on IoT Security Concerns and Potential Applications and Benefits
 - Infrastructure investment in the Grid
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Paul Centolella
President, Paul Centolella & Associates, LLC
P.O. Box 67136
Chestnut Hill, MA 02467
(614) 530-3017
centolella@gmail.com
