# Dave Tuttle
# Integration of PEVs and the Electric Grid

**Department of Electrical and Computer Engineering**
**Advisor Dr. Ross Baldick**

**Education:**

University of Texas at Austin: Research Fellow, PhD Student
- Coursework: Power Systems I/II, Power Electronics, Wind Turbine modeling, Power Quality, LMP

MBA, The University of Texas at Austin (Dean's Award)
Master of Electrical Engineering (Highest Honors) University of Louisville
B.S. (Highest Honors) University of Louisville

**Outreach:**

- PEVs and the Electric Grid
  - ASME, Architecture, Energy Technology and Policy
- Munich, Germany: foreign study at TUM (Technical University Munich) Summer 2011
  - Grid, Automotive, Computer Sciences groups
  - Meetings with BMW, Daimler, Fraunhofer Institute, FFE, SWM, Eon, Siemens, Infineon

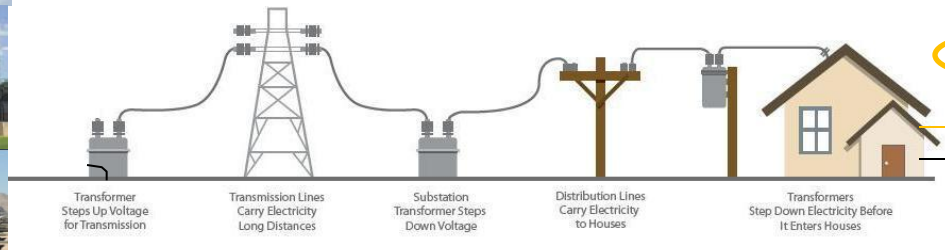
**Papers and Publications:**

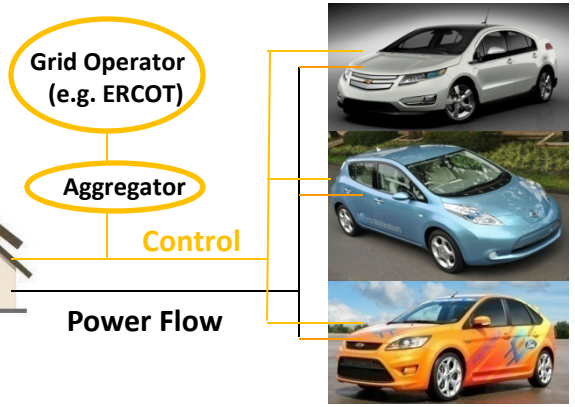
The Evolution of Plug-In Electric Vehicles-Grid Interactions, w/Dr. Baldick, accepted for publication in the *IEEE Transactions on Smart Grid Special Issue on Transportation Electrification and Vehicle-to-Grid Applications*.

Electrified Vehicle Technology Trends, Infrastructure implications, and Cost Comparisons w/Dr. Kockelman, accepted to be published in the *Journal of the Transportation Research Forum*

**Peer Reviews of IEEE and TRB papers**

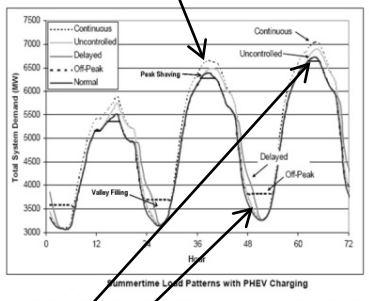
# Integration of Plug-In Electric Vehicles (PEVs) and the Grid

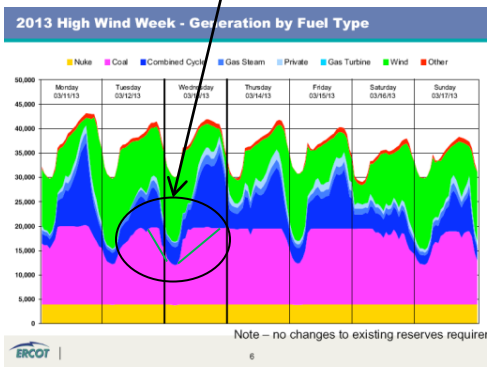


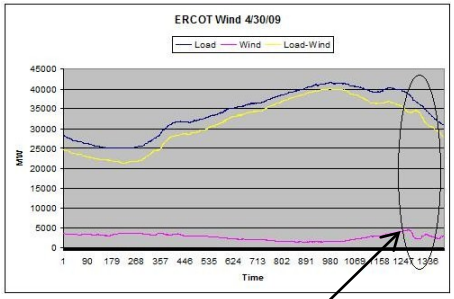



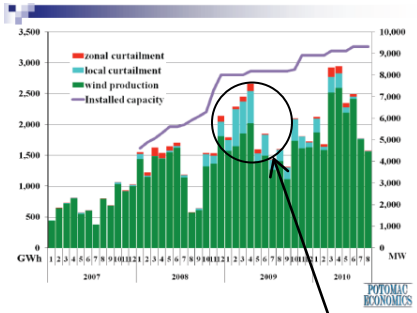

**4th Generation PEV**
- Two-way PowerFlow

**2nd Generation PEV**
- Ramp Rate moderation
- Ramp elimination w/rapid charging




**1st Generation PEV**
- Off-peak Valley filling
- Peak Avoidance

**2nd Generation PEV**
- Emergency Load Control
- Coincident Charging

# Integration of Plug-In Electric Vehicles (PEVs) and the Grid

**Research Goals:**

- Modeling, control, and optimization of intelligent charging such that the PEV
  - Avoids aggravating peak demand, energy storage for load shifting
  - Lessens ramp rate of thermal to compensate for wind or other renewables
  - Provides “curtailable load “when large wind/generation output reductions occur
  - Reduces wind turbine output curtailment (after transmission constraints removed)

**Challenges:**

- System communication and control
  - Across large numbers of distributed vehicles
  - Varied communications pathways & technologies
  - Varied grid-PEV interaction sophistication
  - Across varied utilities, terrain, & vehicles
  - Cost, security, reliability constraints