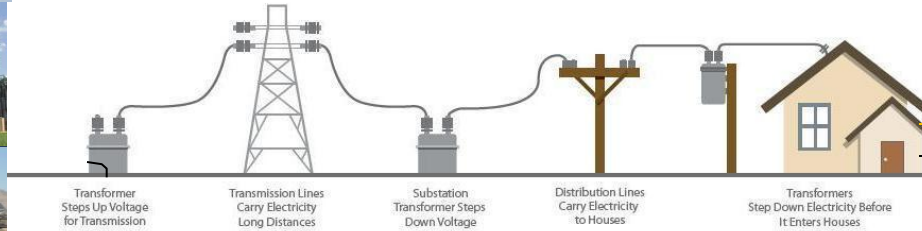


Integration of Plug In Electric Vehicles (PEVs) and the Grid

Dave Tuttle (Ross Baldick Advisor)



Generation



Transmission

Distribution

End-Use
Premise

Grid Operator
(e.g. ERCOT)

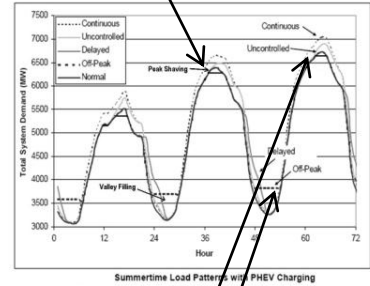
Aggregator

Control

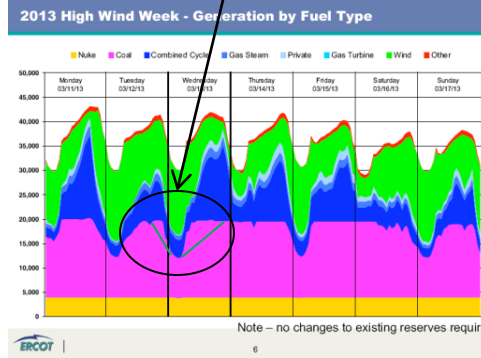
Power Flow



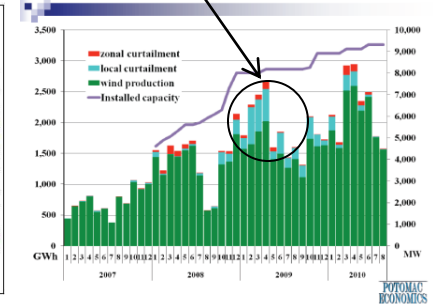
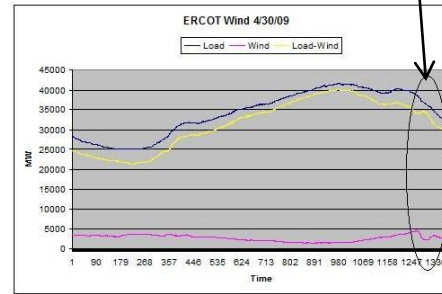
4th Generation PEV
- Two-way PowerFlow



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



2nd Generation PEV
- Coincident Charging
- Emergency Load Control



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

Research Goals:

- Modeling, control, and optimization of intelligent PEV charging
 - Avoid aggravating peak demand, energy storage for load shifting
 - Lessen ramp rate of thermal to compensate for Wind/other renewables
 - Curtailable Load when large wind/generation output reductions occur
 - Reduce 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