

Planning and Market Design for Using Dispatchable Loads to Meet Renewable Portfolio Standards and Emissions Reduction Targets



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Research objectives

- Identify the needs for different types of power system services
- Examine the engineering/economic feasibility of aggregating dispatchable loads to provide system services
- Evaluate the performance of a unified market for multi-timescale power system services

Research approach

- Develop an integrated environmental/power systems analysis using a reduction of the NPCC network
- Develop engineering models for intelligent EV charging and controllable HVAC systems
- Compute power system simulations for different renewable penetration levels and market designs.

Research accomplishments to date

- We proposed an intelligent PEV charging scheme that significantly improves upon the widely discussed valley-fill method of aggregated charging in the early morning.
- Our results show that intelligent charging assigns roughly 80% of PEV load to valley hours to take advantage of low steady-state cost, while placing the remaining 20% equally at shoulder and peak hours to reduce ramping cost.
- Compared to unregulated PEV charging, intelligent charging reduces system cost by 5% to 16%; a 4% to 9% improvement over the flat valley-fill approach.

Importance for the future grid

- Utility-scale energy storage systems are providing valuable systems services making the power system more reliable and efficient.
- More systems services are needed to maintain the power system reliability while increasing the penetrations of intermittent renewable energy.
- However, almost all types of utility-scale storage systems require very high capital costs.
- Aggregating a large number of dispatchable loads can potentially provide a wide range of cost-effective systems services.
- This project focuses on two types of dispatchable loads: plug-in electric vehicles (PEV) and building thermal storage systems.

Research deliverables

- A matrix listing the requirements for different types of system services in the Northeast region
- New market products for incorporating dispatchable loads
- Evaluation and recommendations on how to improve current market designs and environmental quality

Potential uses of this research

- Evaluate whether or under what conditions it makes sense to aggregate dispatchable loads to provide systems services.
- Propose new market products for accommodating the participation of dispatchable loads in whole-sale electricity markets.

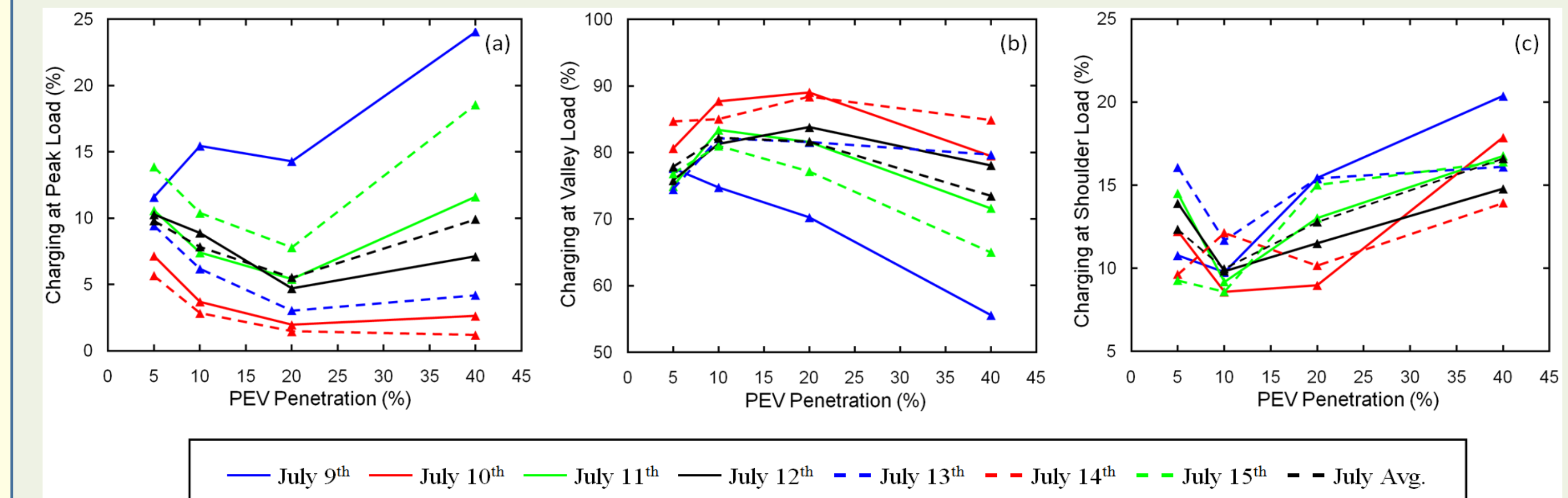


Fig. 1 Percentage of intelligent charging at: (a) peak-load hours, (b) valley-load hours, and (c) shoulder-load hours for July 9th to 15th for NYISO system. Publication: Valentine, K., Temple, W. and Zhang, K. M. Intelligent Electric Vehicle Charging: Rethinking the Valley-Fill, Journal of Power Sources, 196 (24):10717-10726, 2011

