A Multi-Scale Design and Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Application to Vehicle-to-Grid Integration

(EFRI – RESIN, Award Number: 0835995)

Research Objectives

Project Description

Multi-Role Intermediaries (MRIs)

An infrastructure’s sustainability and resilience often depend on how strongly coupled it is to other infrastructures through the exchange of commodities, resources, services, or information. This exchange often takes place through Multi-Role Intermediaries which may be organizations, individuals, or intelligent devices.

Plug-in hybrid electric vehicles are an important MRI because they couple the personal transportation infrastructure with the electric power infrastructure. This is the project’s test bed application.

Status of Research

Task 1: Infrastructure Sustainability Modeling (ABM/LCA)

Task 2: Infrastructure Resilience Modeling

Task 3: MRI Design Optimization

Task 4: Intermediary Control

Task 5: Infrastructure Control

Task 6: Model Integration/Reduction

Enabling Potentially Transformative Results

Sustainability and Resilience

Vehicle to Grid (V2G) may potentially improve resilience by:

- Creating a redundancy of power sources and flow paths
- Improving grid integrity to disturbances through energy storage
- Decreasing the load through peak shaving and reactive power

V2G provides sustainability through increased energy storage:

- Allowing the grid to better absorb renewable electricity
- Redistributing power demand over time in both infrastructures
- Possibly decreasing use of expensive grid peaking units

Managing a Multi-Disciplinary and Multi-Institutional Project

Good and frequent communication and interaction is considered key to our project’s success and this occurs primarily at biweekly research meetings. At each meeting a presentation is given by one of the task area researchers. This allows team members to see what each task is focused on, what their results mean, how it affects all tasks projects, and the potential for task integration. Offsite team members attend via teleconferencing and receive slides via email. Offsite team members can visit U of M as often and for as long as they would to because office space has been made available for them.

People

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