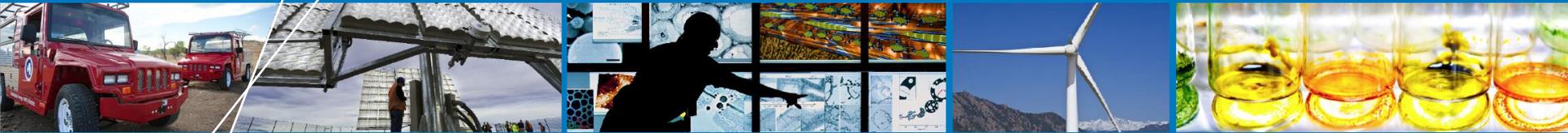
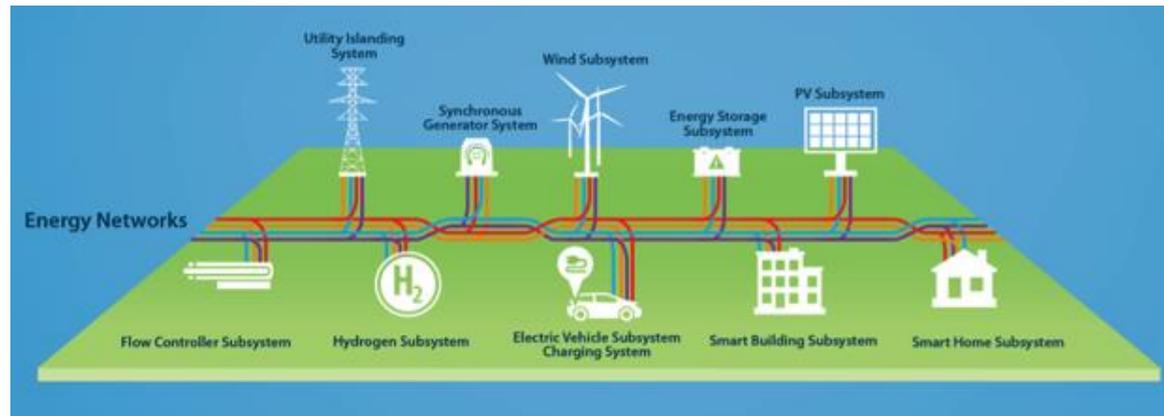


# Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE) RFP



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The objective of the INTEGRATE project is to enable clean energy technologies to increase the hosting capacity of the grid by providing grid services in a holistic manner using open source/open standard, interoperable platforms.

Under the INTEGRATE project, NREL issued an RFP to support the development and validation of technologies under three topics:

Topic Area 1 – Connected Devices

Topic Area 2 – Communication and Control Systems

Topic Area 3 – Integrated Systems

**Technologies developed under all three Topic Areas will be installed and evaluated at the Energy Systems Integration Facility (ESIF), which serves as a hub for clean energy technology grid integration activities.**

## Topic Area 1 (Connected Devices):

**EPRI** : Project will test the ability of a set of connected devices to provide grid services. The primary focus is on standardizing device services for various clean energy technology types and developing communication interfaces to improve the ability of intelligent electronic devices to supply grid services.

**University of Delaware** : The project will evaluate the ability of V2G capable bidirectional electric vehicles to provide grid services, as well as to implement and test open protocols for coordination of those services.

## Topic Area 2 (Communication & Control Systems):

**EPRI** : This project will provide and demonstrate an end-to-end framework of communication, information, and computation (CIC) technologies, integrating operation of different domains within distribution systems (DMS, demand response service, residential appliance scheduling) through open source software tools.

## Topic Area 3 (Integrated Systems):

**Omnetric Group** : The project will demonstrate an Open Field Message Bus (Open FMB) platform that will enable the grid to effectively support large-scale complex operations, such as with distribution systems at electric utilities, which allow for an integration and wider penetration of renewable, clean energy resources.

**Smarter Grid Solutions** : The project will deploy and demonstrate an integrated distribution grid management solution, using Active Network Management (ANM), to enhance grid capacity and services for renewable energy by more fully utilizing existing network assets.

# Electric Power Research Institute (EPRI)

Topic Area	Technology Area(s)
1 – Connected Devices	Thermostats, pool pumps, EV chargers, photovoltaic (PV) inverters, community battery energy storage

## Approach / Strategy

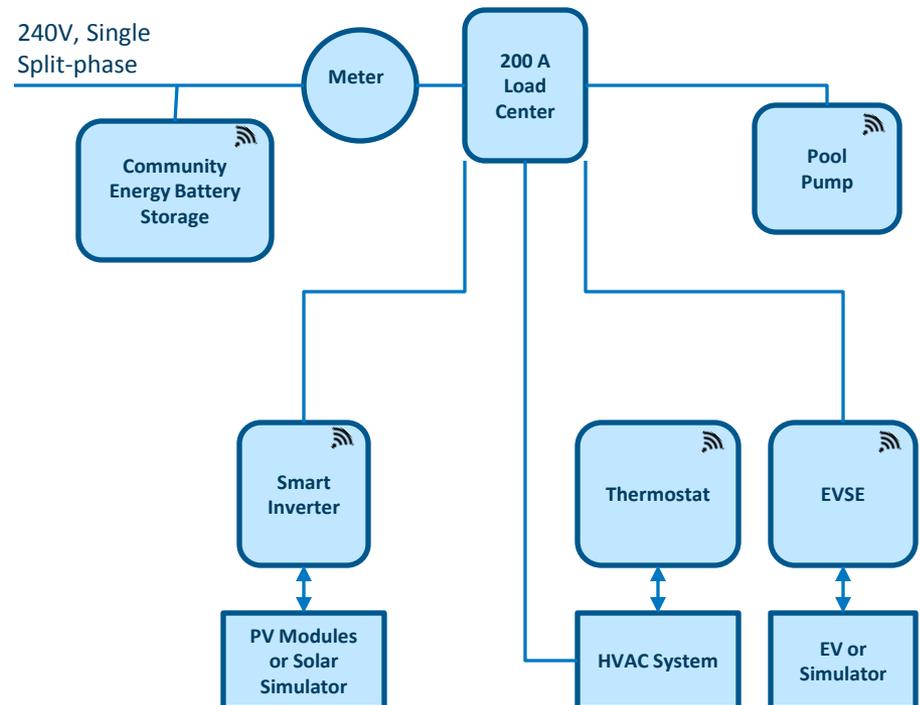
**Project Title:** Cohesive Application of Standards-Based Connected Devices to Enable Clean Energy Technologies

**Project will provide and test a set of key connected devices in terms of their performance of needed grid-supportive services.** Connected devices include thermostats, pool pumps, EV chargers, PV inverters, and community battery energy storage. The individual grid-supportive functionalities provided by these products will be tested in the context of higher-level goals, in which the devices are capable of functioning in concert, working together to enable more clean energy technologies on the grid.

**Focus on standardization of device services and communication interfaces (CEA-2045 & DNP3) will improve the ability of intelligent electronic devices to supply grid services.**

## Project Partners

- Community Battery Energy Storage Manufacturer
- PV Inverter Manufacturer
- EVSE Manufacturer
- Thermostat Manufacturer
- Pool Pump Manufacturer



# University of Delaware

Topic Area	Technology Area(s)
1 – Connected Devices	Electric Vehicles

## Approach / Strategy

**Project Title:** Open V2X at ESIF

The project will perform tests to evaluate the ability of V2G-capable bidirectional EVs to provide grid services, as well as to implement and test open protocols for coordination of those services. The goals of the Open V2X at ESIF project are:

- 1) to **characterize the ability of V2X assets to increase the hosting capacity** of the grid and to provide grid services, and
- 2) to **support open, practical, interoperable platforms** in a way that enables renewable power and sustainable transportation technologies.

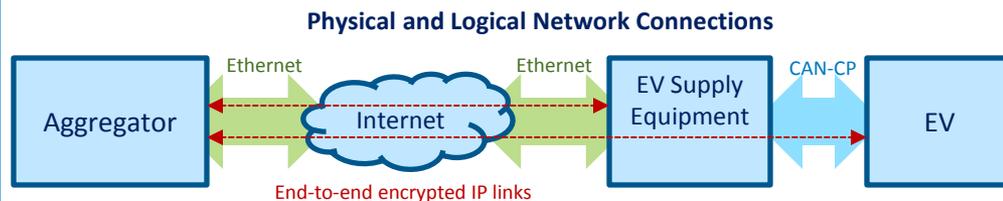
## Project Partners

- Electricity Provider
- Heavy-duty Vehicle Manufacturer
- Vehicle Conversion and Service Company

## EV Testing

The project will carry out the following tests of grid-integrated vehicles (GIV):

- Basic Device Characteristics (e.g., power quality, harmonics, and power factor as a function of battery state of charge)
- ISO-controlled response to signal (utility control of active power)
- Autonomous, local-measurement response to grid conditions
- Integration with solar PV system
- Efficiency of GIV system (measure of cost of providing a grid service)
- Robustness to transients and faults
- Usability of standard Application Programming Interface
- Standards-based tests: Compliance with IEC 61851-1 Annex D, SAE J3068, IEEE 1547, J3072, and final J3068 standard



# Electric Power Research Institute (EPRI)

Topic Area	Technology Area(s)
2 – Communication and Control Systems	Communications Data Management Energy Management Systems

## Approach / Strategy

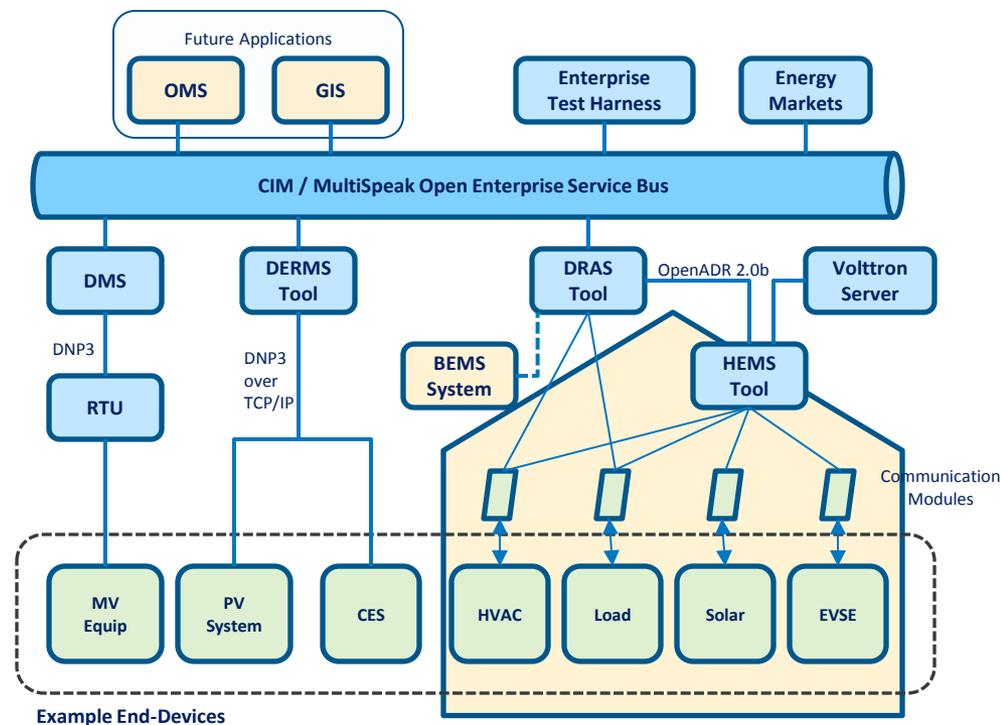
**Project Title:** End-to-End Communication and Control System to Support Clean Energy Technologies

**Project will advance intelligent control of devices by integrating operation of different domains within distribution systems (DMS, demand response service, residential appliance scheduling) through open source software tools.**

The proposed CIC system is architected in a fashion that is consistent with that of an electric utility.

**The framework includes an enterprise integration test environment, commercial, Advanced Distribution Management System (ADMS), open software platforms, open Home Energy Management System (HEMS) platform, communication modules, and applications.**

Project Partners
<ul style="list-style-type: none"> <li>ADMS Provider</li> <li>HEMS Provider</li> <li>OpenDERMS Provider</li> <li>Business Management Consultant</li> </ul>



This project incorporates open standards in a mixed standard environment. OpenADR2.0b, Common Information Model (CIM), MultiSpeak®, CEA-2045, IEC61850-90-7, and DNP3 will co-exist, much as they might at a utility in the near future.

# Omnetric Group

Topic Area	Technology Area(s)
<b>3 – Integrated Systems</b>	Grid Management System Controls Communications

## Approach / Strategy

**Project Title:** Open Field Message Bus (OpenFMB)  
Reference Architecture Demonstration

The project will demonstrate an Open FMB platform that will enable the grid to effectively support large-scale, complex operations, such as with distribution systems at electric utilities, which allow for an integration and wider penetration of renewable, clean energy resources. The proposed solution will be validated using two use cases:

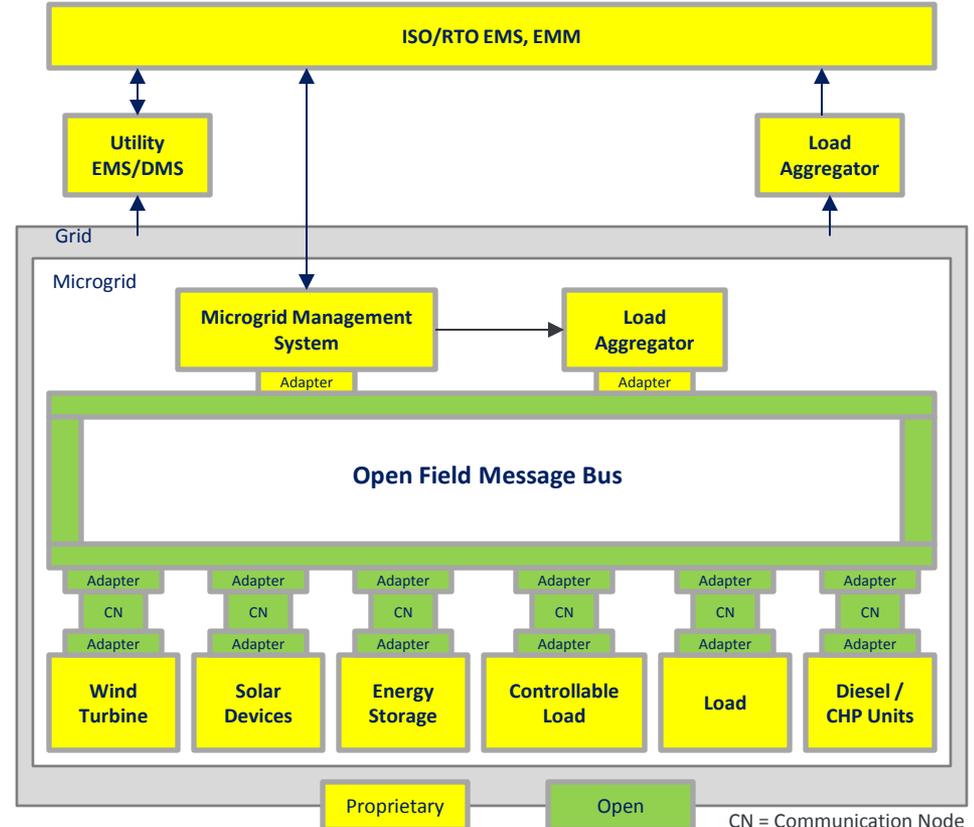
**Use Case 1:** Cost/benefit analysis comparing the baseline system with different designs incorporating the Open FMB architecture/control.

**Use Case 2:** Demonstration of Open FMB with load and power forecasting to improve operations of the distribution grid (e.g., load balancing).

\* In addition to the ESIF demo, the Open FMB platform will be tested at two utility sites.

## Project Partners

- Omnetric Group is a joint venture between Siemens & Accenture Company
- Duke Energy (MacAlpine Microgrid Site, Raleigh, NC)
- CPS Energy (Joint Base San Antonio, TX)
- University of Texas at San Antonio (solar forecasting)



# Smarter Grid Solutions

Topic Area	Technology Area(s)
3 – Integrated Systems	System Controllers Communications

## Approach / Strategy

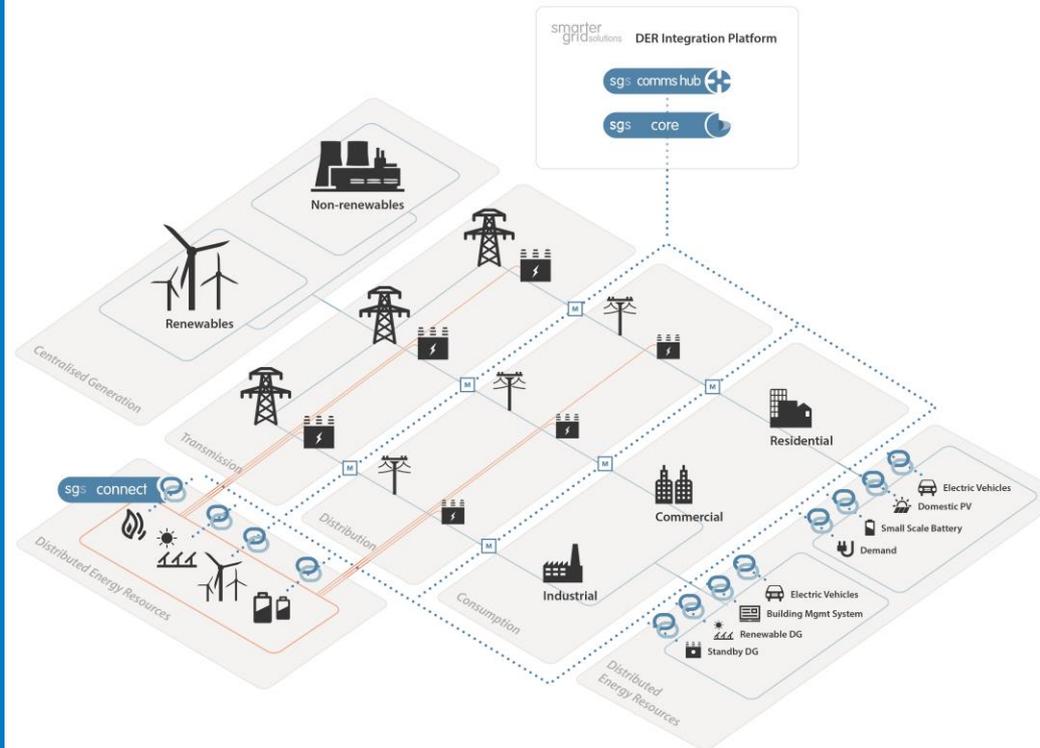
**Project Title:** Demonstrating Active Network Management INTEGRATION

The Project Team will build a flexible plug-and-play distribution grid management solution, using Active Network Management (ANM), to more fully utilize existing network assets. The proposed Distributed Energy Resource (DER) integration platform leverages an existing ANM system and Smart Energy Platform.

The Project Team will deploy and demonstrate an integrated distribution grid management solution to enhance grid hosting capacity and services for renewable energy through coordination of renewable energy generators and other forms of DER.

## Project Partners

- Pecan Street Research Institute
- Industry Advisory Board includes members from Pecan Street, Con Edison, NRG Energy, New York State Smart Grid Consortium, Iberdrola USA, National Grid, SIMARD SG Inc., SolarCity, and National Rural Electric Cooperative Association (NRECA).



- NREL is supporting the development and validation of technologies under the INTEGRATE RFP.
- Five projects selected under three Topic Areas (1 – Connected Devices, 2 – Communication and Control Systems, and 3 – Integrated Systems).
- The technologies developed under these projects will be installed and evaluated at NREL's ESIF.
- These demonstrations will take place over next 18 months.