



OLNEY

Town Center
MICROGRID
Control System R&D

Public Webinar

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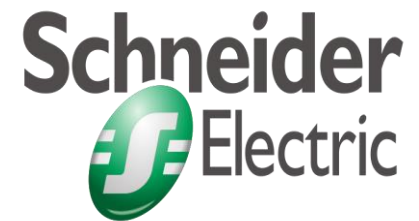
DOE Funding Opportunity Announcement 0000997

**DOE - National Energy Technology
Laboratory** \$8 million program
*supports research and development of
community microgrid control systems:*

- January 2014 solicitation
- 48 project submissions, 7 selected for funding up to \$1.2M each
- Control system R&D for community microgrids <10 MW
- Objectives to increase resilience and efficiency, reduce emissions



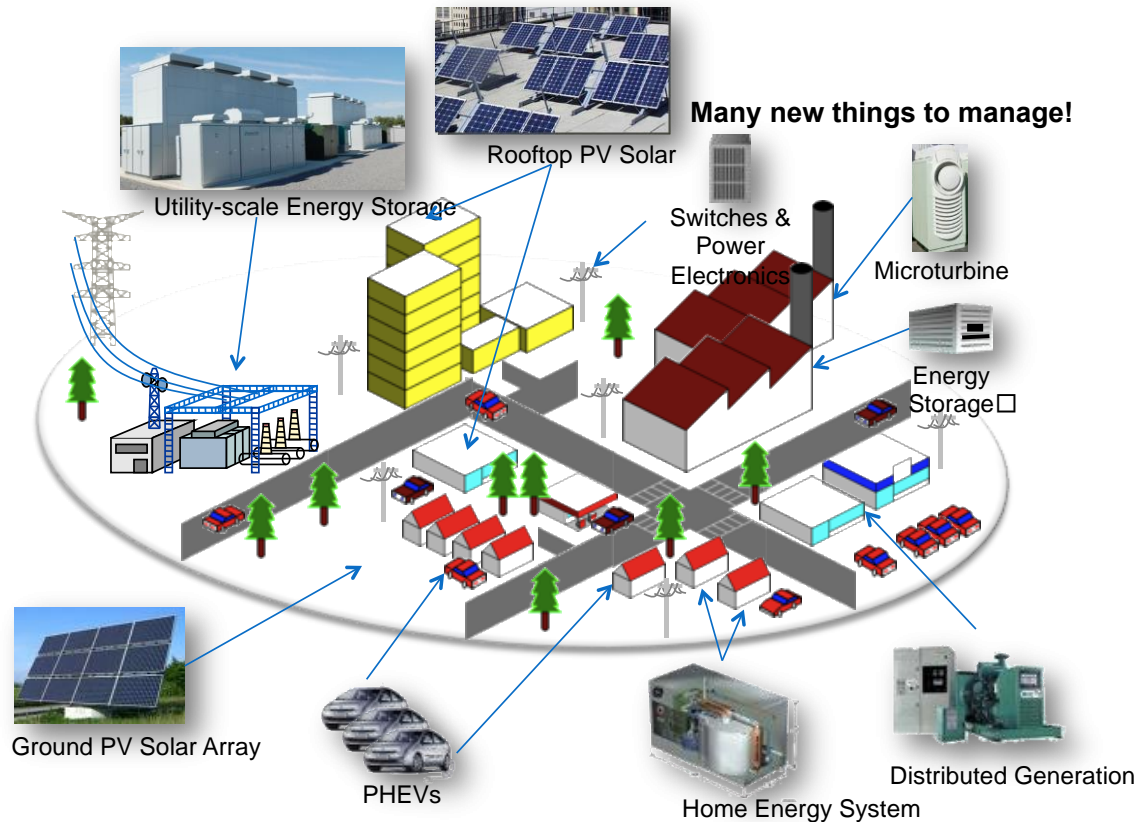
Introductions



What is a Microgrid?

“A **microgrid** is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.”

~DOE Microgrid Exchange Group, October 2010



Clean, resilient energy for communities

Microgrid systems help local communities to achieve greater resilience using local energy resources – solar, wind, and biomass:

- Reducing dependence on distant power sources and transmission lines
- Modernizing local utility networks
- Conserving energy and using local resources
- Shrinking environmental footprint



Team Roles

- **Microgrid Institute** – provides comprehensive project management and administration; research and advisory services; and responsibility for deliverables
- **Green Energy Corp** – leads all R&D, system planning, and design activities for the project, and leads analysis of test results; Microgrid controller development
- **N.C. State Univ.** – Future Renewable Electric Energy Delivery and Management (**FREEDM**) Systems Center leads and executes all microgrid control systems testing for the project, and supports engineering analysis and test results reporting
- **Schneider Electric** - provides power engineering analysis, supports equipment data and modeling efforts, and key equipment for use in the microgrid system
- **Pepco Holdings, Inc.** – collaborating with the team, engaging state & local gov't and business leaders, assisting with network modeling and test analysis

Stakeholder Roles

- **Montgomery County Executive Office & Council**
- **Maryland Energy Administration**
- **Maryland Emergency Management Agency**
- **Metropolitan Washington Council of Governments**
- **Energy Future Coalition, *etc.***

Collaborate with Olney project team by providing information and input on design objectives, energy resources, and plans, and facilitating communication with government representatives and local stakeholder groups.

Project Objectives

The Olney Town Center Microgrid project will research, develop, model and laboratory test microgrid control system technology options that will be designed to increase resiliency, reduce emissions, and improve efficiency in accordance with Maryland and Federal goals. The Olney Town Center Microgrid project will be conducted in two primary phases.

Phase 1: *Research, development, and modeling of advanced microgrid controls for both the Olney Town Center and the Ritchie Station Marketplace.*

Phase 2: *Laboratory testing of the Olney Town Center control system.*

Functional Design Objectives

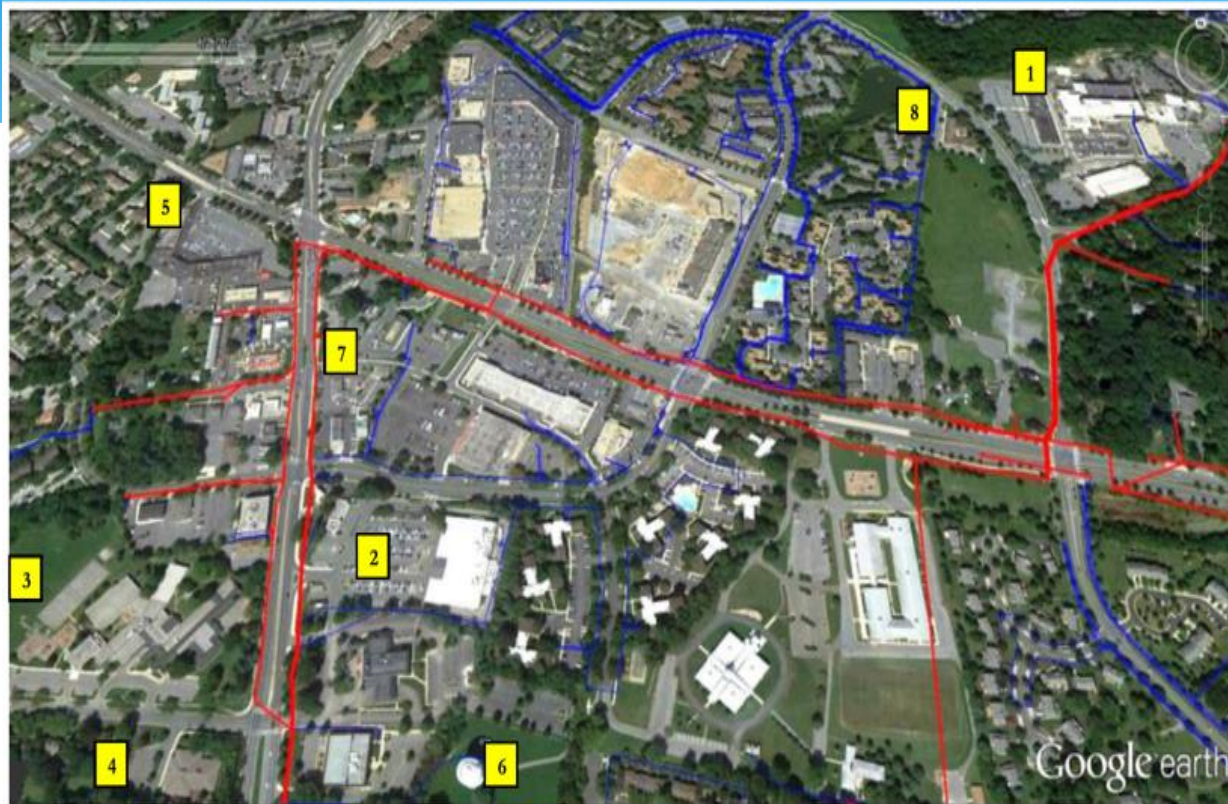
Design a microgrid control system capable of integrating distributed renewable energy resources, natural gas CHP units, energy storage, and demand-side management technologies in near-real-time optimization schemes to achieve the community's objectives:

- Obtain a Olney Town Center average reliability measure of SAIDI < 2 minutes for critical loads
- Reduce Olney Town Center CO2 footprint by 20% from current baseline
- Improve Olney Town Center average system energy efficiency > 20%

Olney Town Center Microgrid Overview

- Primary services to a community of 33,000 residents
- ~7 MW load
- Contains a hospital, police station, two fire stations, two schools, grocery stores and gas stations, and the community's water tower, and many commercial businesses
- Long-term: significant growth in PV and EV likely; steady growth in residential communities around the Olney Town Center
- Community microgrid approach (crossing streets)

Olney Town Center Overview



Services

1. Montgomery General Hospital
2. Montgomery County Police Department
3. Olney Elementary School
4. Julia Brown Montessori School
5. Olney Library
6. City Water Tower
7. Auto Repair and Service Center
8. Winter Growth Adult Day Care

Gas Stations

Exxon Mobil
BP Gas
Sunoco
Shell

Grocery

Shoppers Food & Pharmacy
Safeway
Giant
Harris Teeter
CVS Pharmacy

Banks

PNC Bank
Capital One
M & T
Suntrust

Medical Services

Olney MRI Center
Potomac Valley Orthopedic
Dental Clinic
Medical Eye Center

Food & Beverage

The Greene Turtle
GrillMarx Steak House
Five Guys
Yogiberry
Café Rio Mexican Grill
Panera Bread
Starbucks
McDonald's
Moby Dick
Sakura (and more)

Overview of Approach

Mo

1

12

Mo

24

Project Management

Use Cases, Data Collection, Requirements, & Advanced MG Controller R&D

- Use Cases
- Site Details
- Boundaries & Behaviors
- Requirements
- Power Engineering
- Develop Applications
- Data Model
- Policy/Regulatory
- Mod/Sim/HIL
- Define Metrics

Go/No-Go Decision Point

Design Microgrid Systems for Olney Town Center

- CEFM
- Power Engineering Analysis
- Fault & Transient Analysis
- Operator Dispatch

Prepare Control System Tests

- Test Scripts
- Pre-test Simulation Runs
- Modify Test Scripts
- Simulation Testing
- Prep for Lab. Testing

Control System Tests

- Lab. Requirements
- Revise Test Scripts
- Prep Environment
- Prep Controls
- Run Tests
- Analyze Results
- Lessons
- Briefs & Reports
- Briefings

Report Results

DOE FOA 997 Projects

- * **Olney Town Center** (Maryland) – open-source, cloud-based controller; clean resilient microgrid for vital community assets; comparison and contrast of use cases and design objectives
- * **Bronzeville** (Chicago) – adjacent to IIT 12 MW microgrid; fault tolerance and self-healing; cost-benefit analysis of the microgrid
- * **Bridgeport, Woodbridge, BNMC** – 14 utilities / EPRI; 3 microgrids coordinated
- * **Potsdam** (N.Y.) – microgrid available for 2 week island operations; new underground distribution feeder
- * **St. Paul Alaska** (island) – flexible controller with modular component libraries; existing wind, diesel, flywheel, CHP; Native Alaskan firm
- * **UC Irvine** – nested microgrids concept (20 MW UCI microgrid + 10 MW UCI Medical Center microgrid); modules with “fill-in-the-blanks” format for characterization; SCE RTDS testing
- * **Philadelphia Navy Yard** – community microgrid systems for the Philadelphia Industrial Development Corp. and the Philadelphia Water Dept., using portions of former Philadelphia Navy Yard as test bed.

Unique Project Factors

- * **Open-source** software; scalable **cloud-based** solution
-- rapid deployment, avoid vendor lock-in
- * Compare and contrast microgrid objectives, designs, and control schemes between **two different microgrid project models**, to provide **use-case solutions** applicable in a variety of scenarios.
- * FREEDM advanced microgrid testing laboratory (includes RTDS)
- * Prototype **advanced smart inverter** (4-quadrant, black start, and ride-through capable) **built for microgrids**

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