



NATIONAL ENERGY TECHNOLOGY LABORATORY

5th Military & Commercial Microgrids Summit

Microgrid Research, Development and System Design Funding Opportunity Announcement

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**November 20, 2014
San Diego, CA**



Topics

Background

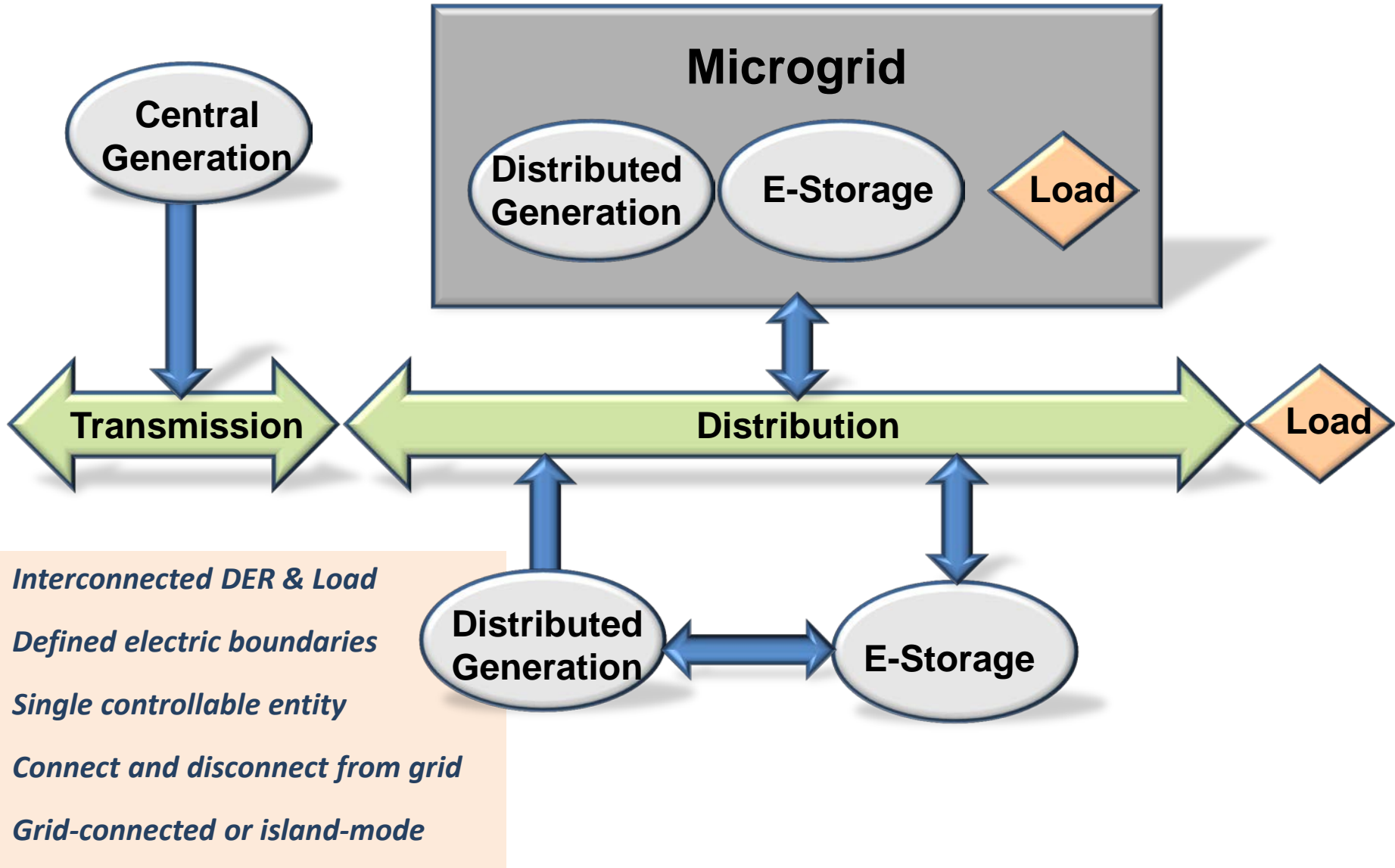
Funding Opportunity Announcement

- Schedule
- Objectives

Microgrid Project Selections



Microgrids & Smart Grids



Funding Opportunity Announcement

DE-FOA-0000997

Microgrid Research, Development and System Design

**U. S. Department of Energy
Office of Electricity Delivery and
Energy Reliability**

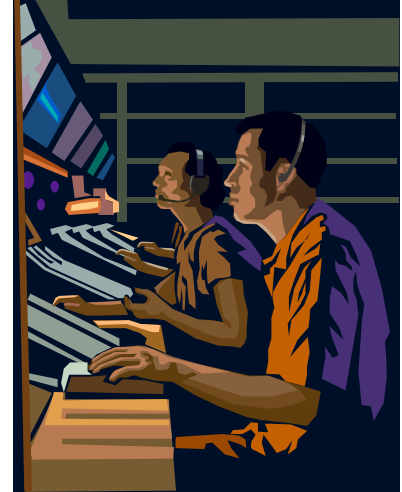
Schedule

- **FOA released on January 31, 2014**
- **Proposals due on April 27, 2014**
- **Seven projects announced on September 8, 2014**
- **Two-year projects**
 - 18 months of R&D
 - 6 months of testing



Objectives

- **R&D of advanced commercial-grade microgrid controllers**
 - 1 to 10 MW of aggregated generation capacity
- **Testing and validation**
- **Enable communities to develop commercial-scale microgrids**
- **Improve resiliency of electric power infrastructure**
 - “building stronger and safer communities and infrastructure” (President’s Climate Action Plan)
 - prepare for impacts of climate change (E.O. 13653)



FOA Financials

- **\$8,400,000 available from Federal Government**
- **Up to 25% to DOE National Laboratories**
- **Up to \$1,200,000 for each project**
- **Minimum of 20% cost-share**



DOE Microgrid Targets

- **> 98% reduction in outage time of critical loads at a cost comparable to non-integrated baseline solutions (e.g., UPS with backup generator)**
 - Basis for outage reduction is SAIDI
 - Baseline cost is UPS, generators, automated transfer switches, installation costs, and O&M costs
- **> 20% reduction in emissions**
 - Basis for emissions in carbon dioxide
 - Determined by simulation
- **> 20% improvement in system energy efficiencies**
 - CHP



Technical & Functional Requirements for Microgrid Controller

- **Capable of sensing grid conditions & monitoring and controlling microgrid operation to maintain electricity delivery to critical loads**
 - Grid-connected, islanded, and transition between both
 - Comply with IEEE 1547 interconnections standards
 - Dispatch microgrid assets
 - Interface with external parties
 - Coordinate with grid protection schemes
 - Requirements for disconnection; resynchronization & reconnection; steady-state frequency, voltage, and power quality; protection; dispatch; and resilience

Project Selections

DE-FOA-0000997

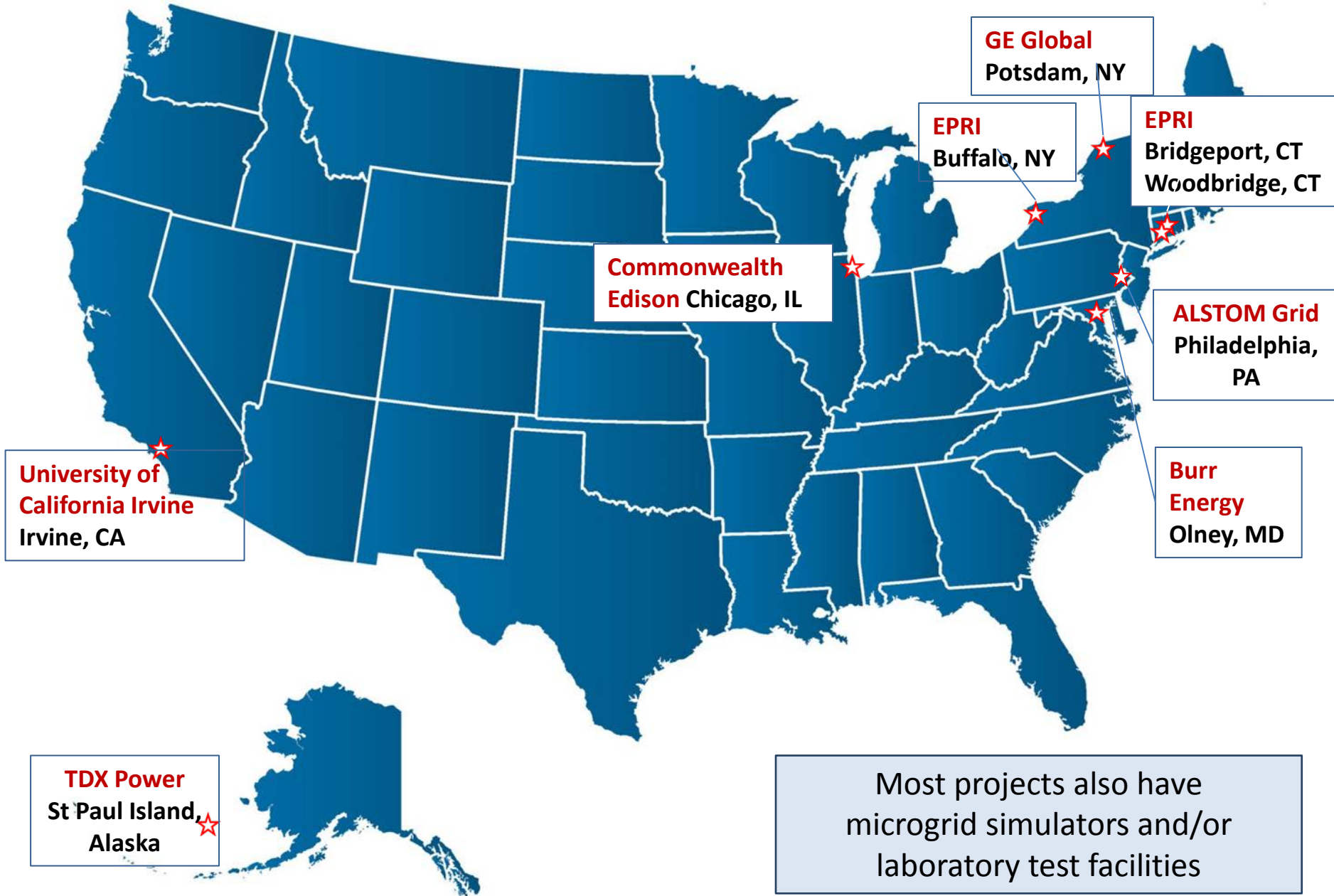
Microgrid Research, Development and System Design

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Projects in Seven States to Help Communities Become More Adaptive With Microgrids

- **More than \$8 million for microgrid projects to help cities better prepare for extreme weather events**
- **Seven awardees in AK, CA, IL, MN, NY, TN, and WA**
- **Allows communities to become more resilient and adaptive**
- **“Building in grid resiliency has gained greater urgency in recent years, as demonstrated by the economic and personal losses from electricity outages due to severe weather,” said Energy Secretary Ernest Moniz. “Keeping the power on during extreme weather events and other electric grid disruptions is essential, particularly so that critical facilities such as hospitals and water treatment plants can continue operating.”**

Locations of Microgrid Controller Projects






Alstom Grid Inc.

- **Community Partners**
 - Philadelphia Water Department
 - Philadelphia Industrial Development Corporation
 - Commercial and industrial customers (e.g., Urban Outfitters)
- **Others**
 - Burns Group, PNNL, California Institute of Energy and Environment, Washington State University

Research

- Islanding, synchronization & reconnection, protection, voltage, frequency, and PQ management, dispatch

Alstom Grid Inc.

<u>Project / Community Objective</u>	<u>DOE Objective</u>	<u>Project Methodology and RD&SD scope of work</u>	
<p><u>PIDC service reliability objective</u> support agreement for 100% guaranteed supply to URBAN (3MW load) a C&I Client</p> <p><u>PWD service reliability objective</u> 100% guaranteed supply to waste water plant</p>	<p><u>DOE (98%)</u> <u>Grid Resilience</u></p> 	<p><u>PIDC</u> -Network 6MW DG and 1 MW solar /storage and support islanded operation</p> <p><u>PWD</u> - Network CHP & BIO-Gas Plant and support islanded operation</p>	<p>RD&SD for MG Ops-Planning, Islanding Reconnection Protection Dispatch</p>
<p><u>PIDC and PWD Sustainability Objective</u> Develop renewable portfolio for local generation as economical viable alternative</p>	<p><u>DOE (20%)</u> <u>Emission Reduction</u></p> 	<p><u>PIDC</u> –Operate 1 MW community solar / 300 KW storage in the community microgrid</p> <p><u>PWD</u> – Operate Biogas plant together with CHP</p>	<p>RD&SD for MG Ops-Planning, Portfolio Dispatch Ops & Control</p>
<p><u>PIDC Capacity Expansion Objective</u> Develop 20% of local generation as economical viable alternative to meet capacity needs per Energy Master Plan</p>	<p><u>DOE (20%)</u> <u>System Energy Efficiency</u></p> 	<p><u>PIDC</u> – Optimize import and local generation consisting of 6MW DG, 1 MW solar , 600 KW Fuel cell, 300KW storage, and 3 KW CHP</p>	<p>RD&SD for MG Ops-Planning, Portfolio Dispatch Ops & Control</p>

Microgrid Institute

Olney Town Center Microgrid team

Prime Contractor	Microgrid Control Technology	Power Systems Engineering and Analysis	Simulation and Testing	Utility and Community Partners
<i>Microgrid Institute</i>	<i>Green Energy Corp.</i>	<i>Schneider Electric</i>	<i>NSF FREEDM Systems Center, North Carolina State University</i>	<i>Pepco Holdings Inc., Maryland Energy Administration, Montgomery County, Metropolitan Washington Council of Governments, NAI Michael Companies</i>

Olney Town Center Microgrid Project

- Montgomery County, Maryland
- Hospital, two fire stations, police station, two schools, and city water tower within 1 sq mi
- Will also test MG controller at Ritchie Station Marketplace
- Testing at NCSU NSF FREEDM microgrid test laboratory
- Cloud-based open source systems – rapid deployment

Commonwealth Edison

Partners: Illinois Institute of Technology, University of Denver, ANL, Alstom Grid, Quanta Technology, S&C Electric, Schneider Electric, OSIsoft, Microsoft

Location: Bronzeville, Chicago, IL

Chicago Police and Fire HQ, De La Salle Institute, Bronzeville Nursing and Living Center, Illinois College of Optometry, Chicago Military Academy, churches, library

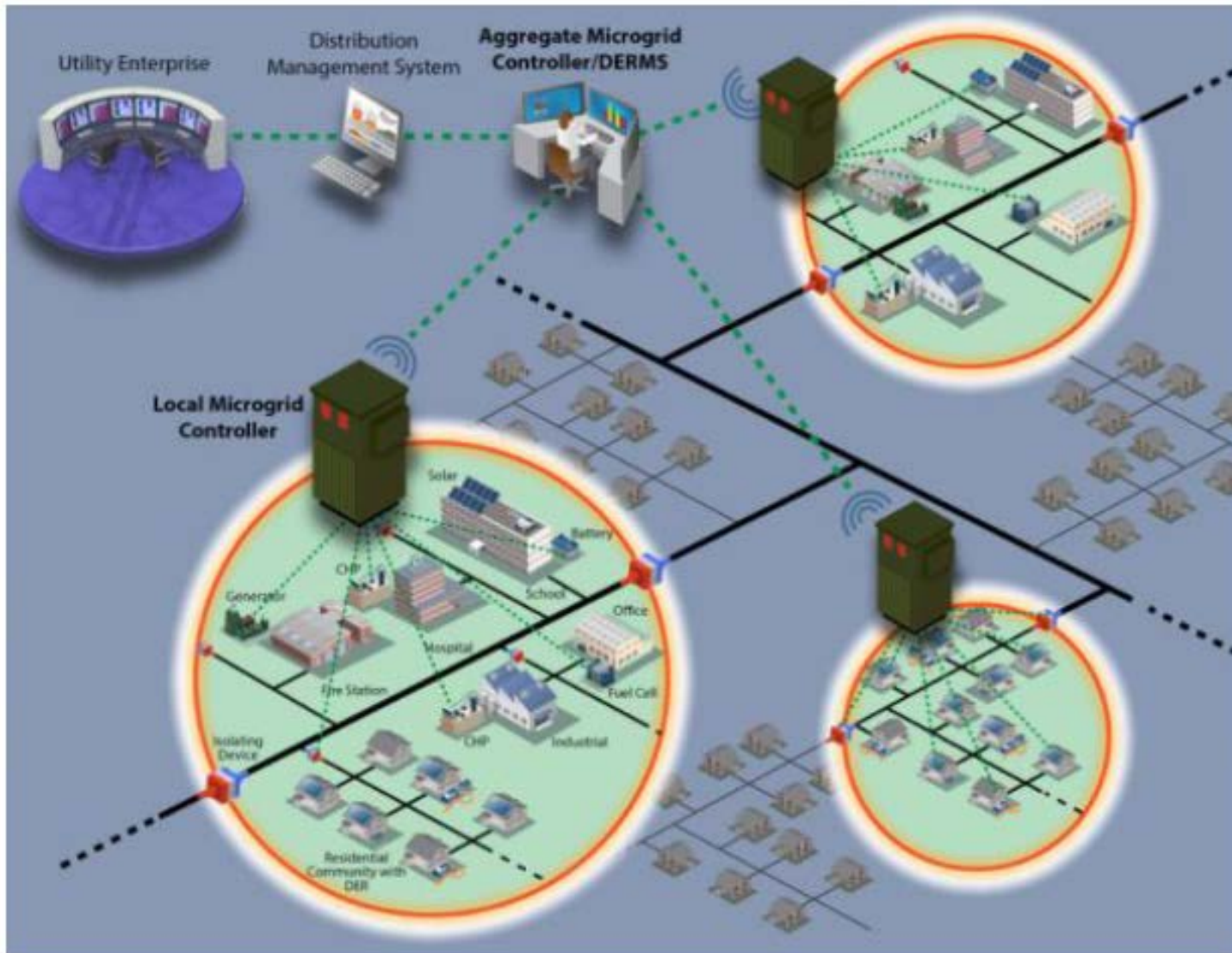
10MW Bronzeville microgrid adjacent to IIT 12MW MG

Test fault tolerance and self healing, emergency DR, islanding and resynchronization, voltage and frequency regulation, distribution system restoration

Electric Power Research Institute

Research Companies	Utility Participants			Target Communities	Collaborating Organizations
EPRI	Central Hudson	NYPA	National Grid (NG)	Bridgeport, CT <i>Serving utility UI</i>	NYSERDA
Spirae	O&R	(UI) United Illuminating	Duke Energy	Woodbridge, CT <i>Serving utility UI</i>	West Virginia University
NREL	Entergy	Tri-State	Southern	BNMC, NY <i>Serving utility NG</i>	
Enernex	TVA	PEPCO Holding	PNM		
Nova Energy Specialists	Hydro Quebec	Excel Energy			

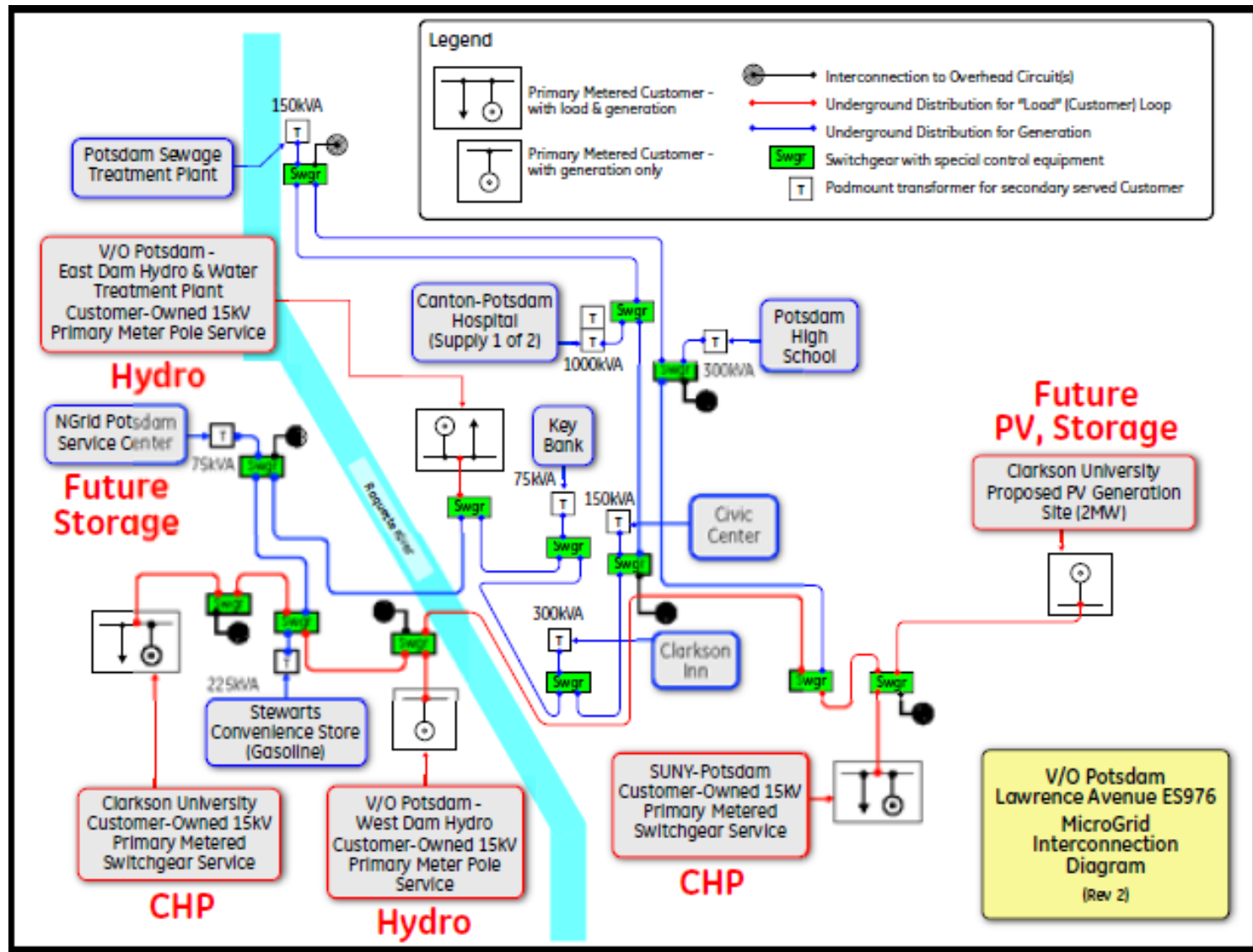
Electric Power Research Institute



GE Global Research

- **Partners**
 - GE Energy Consulting, GE Power & Water, NREL, Clarkson University, National Grid, Village of Potsdam, Buffalo Niagara Medical Campus
- **Leverage \$1.1M NYSERDA study on microgrid in Potsdam, NY**
- **3 MW CHP, 2 MW PV, energy storage, hydroelectric**
- **New underground distribution feeder**

GE Global Research



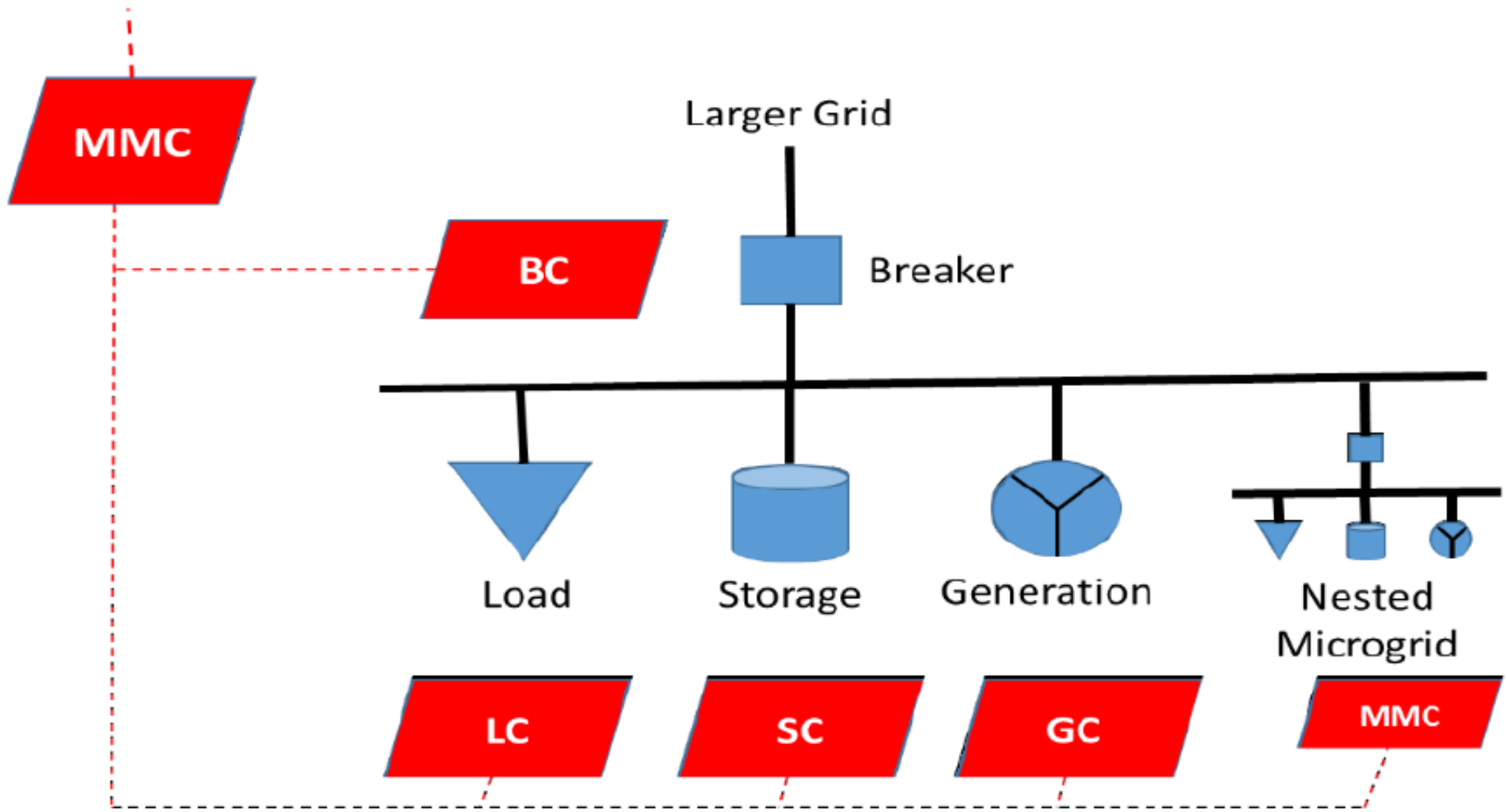
TDX Power

- **Partners: City of St. Paul, Alaska (island); Schweitzer Electrical Laboratory**
- **Microgrid controller**
 - modular component libraries
 - flexible controller to integrate diverse range of energy resources in grid-connected and islanded modes
- **Integrate into existing infrastructure of traditional and renewable energy generation sources**
 - 1.2 MW (wind, diesel, flywheel)
 - Trident fish plant is 2 MW CHP
- **Goal of 80% renewables by 2020**

University of California, Irvine

- **Partners: Southern California Edison, ETAP, MelRoK, UCI microgrid**
- **Microgrid Collaborating partners: UCI Medical Center, Port of Los Angeles, Irvine Ranch Water District**
- **Generic Microgrid Controller**
 - Master Microgrid Controller with load, storage, generation and breaker controllers
 - Each module includes “fill-in-the-blanks” format to characterize its microgrid element to its MMC
 - Includes concept of nested microgrids
- **Applied to 20 MW UCI MG and 10 MW UCI Medical MG**
- **First test on Real-Time Digital Simulator (SCE)**
- **Second test on UCI microgrid**

UCI Generic Microgrid Controller Concept



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Some Key Microgrid Resources:

DOE OE www.oe.energy.gov

Smart Grid www.smartgrid.gov

DOE Microgrid Workshops:
www.e2rg.com/reports