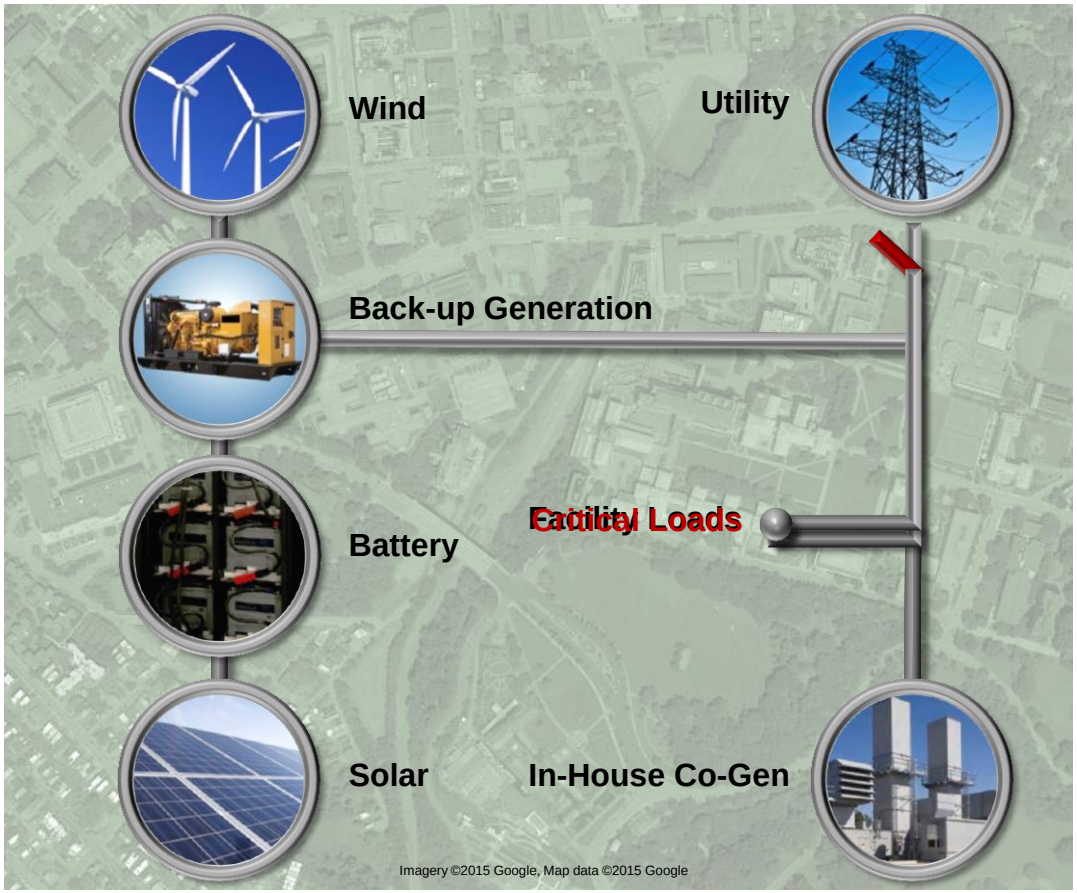
Socially Responsible Microgrid

Electric Power Industry Conference / University of Pittsburgh
Drew Chidester – UPMC
John Vernacchia – Eaton
November 16, 2015

Powering Business Worldwide

The microgrid concept



A group of generating assets and defined loads that can operate within the utility grid or islanded from the grid, as a self-sufficient stand alone application

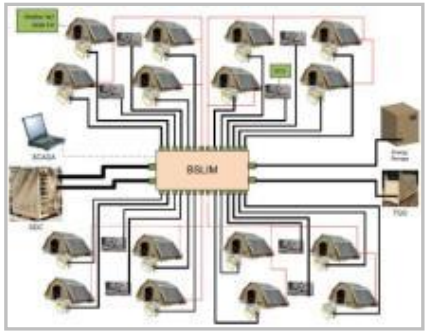
- **Local "Grid Within a Grid"**
  - Delivers Power Resilience, Reliability and Uptime
- **Distributed Energy Sources**
  - Backup Generation
  - In-House Co-Gen
  - CHP (Combined Heat and Power)
  - On-Site Renewables and Fuel Cells
  - Energy Storage (Batteries)
- **Microgrid Applications**
  - Islanding & Synchronization
  - Black Start
  - Generation/Load Balance Control
  - Battery Energy Storage & Frequency Regulation
  - Load Control / Demand Response

Business cases can be challenging

May not address social needs

Powering Business Worldwide

Microgrid US DOD and DOE projects

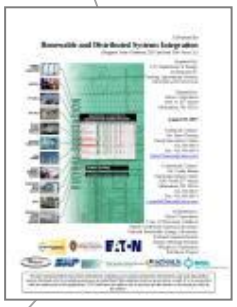


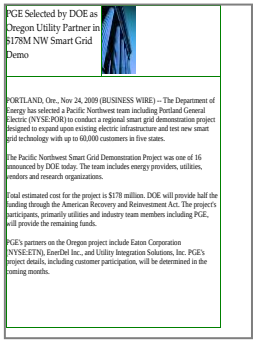
US-DOD

Department of Defense

US-DOE

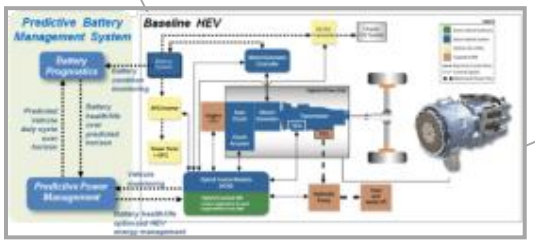
Department of Energy





ARPA-E

Advanced Research Projects Agency



US Army Corps of Engineers®
Engineer Research and Development Center

Powering Business Worldwide

US DOD military base example

Natural Gas Generators

Project Focus: Energy Surety / Resiliency for a military campus

Solution developments:

- Manage multiple generation sources – natural gas generators, solar pv, wind, battery storage
- Optimized capital and operating costs via microgrid system design
- Seamless islanding and reconnection to the grid

Military campus experience transferable to hospital / university campus microgrids

Powering Business Worldwide

US DOE utility feeder example

5MW Inverter System

5MW Li-ion Batteries

Project Focus: Utility feeder reliability for commercial and residential customers

Solution developments:

- Control 20 inverters and batteries to provide 5 MW of energy storage in both grid-connected and islanded modes
- Design of electric power distribution and controls to connect energy storage system to utility grid
- Islanding without loss of power and reconnection to the grid
- Interface to diesel generators, solar pv and wind on the same electrical grid

Utility feeder microgrid provides uninterrupted power to commercial and residential

Powering Business Worldwide

Benefits

- Economic
  - Direct
  - Indirect
- Reliability & Power Quality
- Environmental
- Security & Safety

Traditional barriers

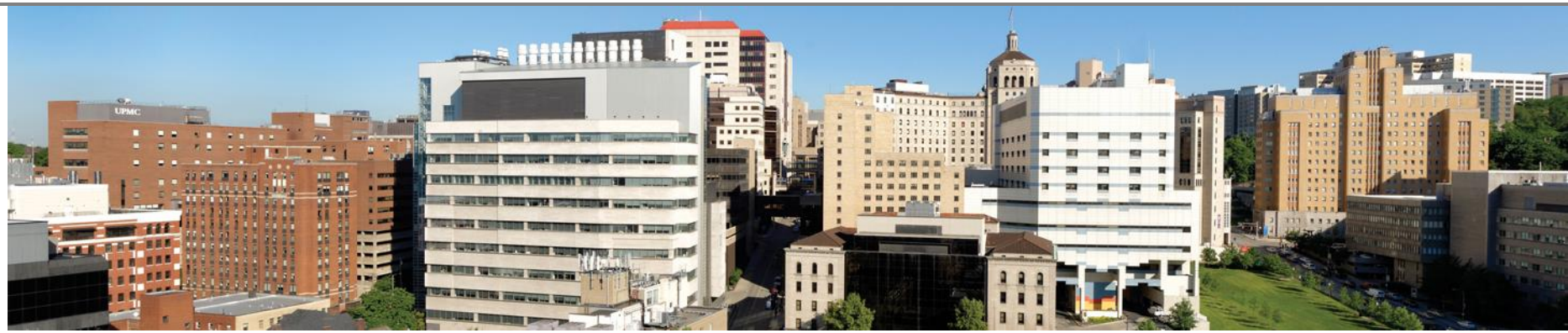
- Financial “ROI”
- Asset limitations
- Regulatory
  - Environmental
  - Zoning Restrictions
  - Existing Codes and Recommended standards and or Practices

Flawed decision making process

- Emphasis on Finance
- Structured on 20th century needs
  - Electrical distribution systems
  - Building design
  - Emergency response
- 21st century needs
  - Electricity is considered as an essential need
    - A Social Responsibility

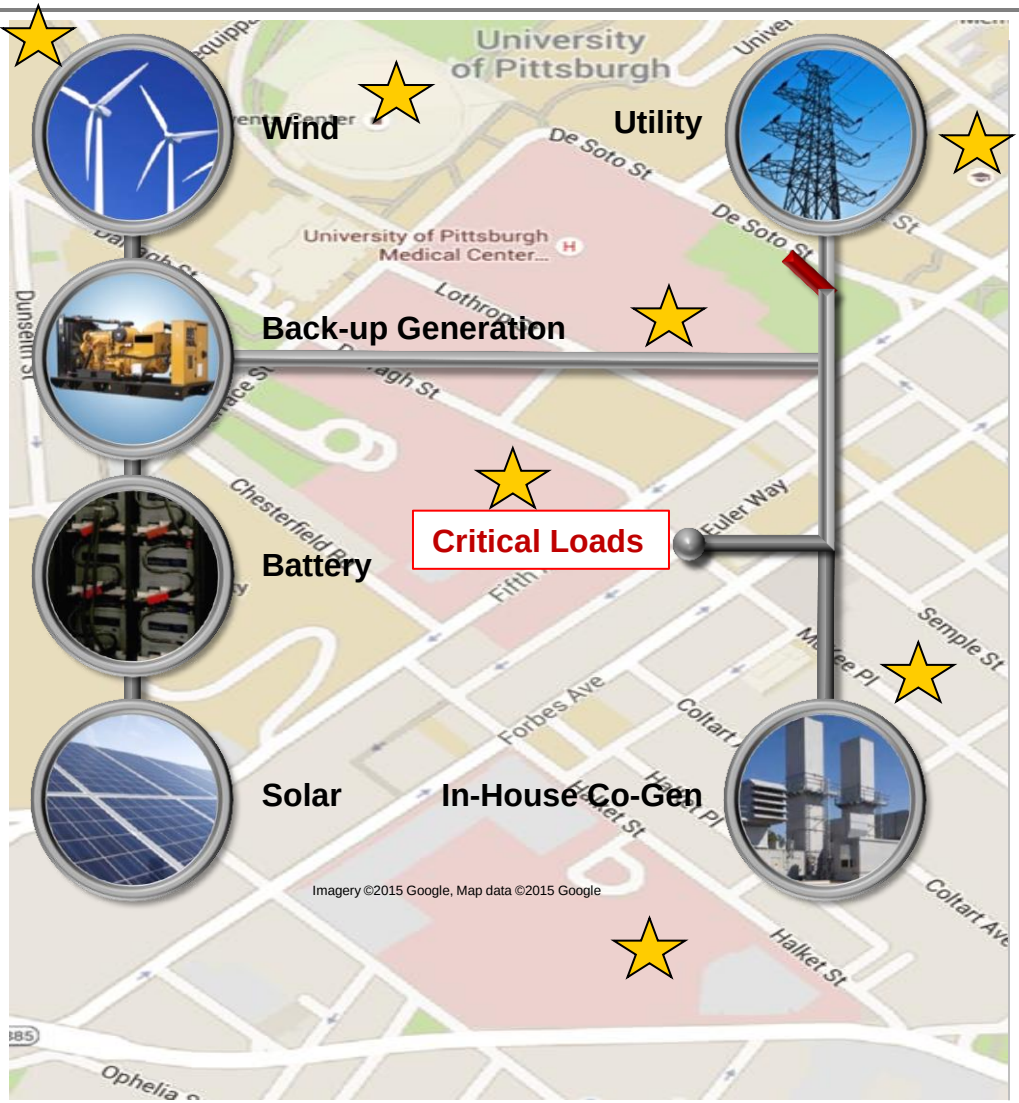
Powering Business Worldwide

Socially responsible microgrid

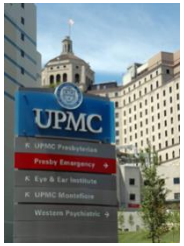


- Unifies public needs and brings together key partners
  - Non Profits / Institutions
  - Government
  - Private Sector
- Provides essential electricity during long-term outages resulting from a natural disaster or other emergency event
- Mandates the development of revised designed codes to support the greater public need during emergency response
- Requires a new funding process to meet public needs

Socially responsible Oakland microgrid **concept**



Healthcare



Presbyterian

Montefiore

Magee

Emergency Services

Station 14

Critical Infrastructure

Herron Hill

Emergency Shelter

The Pete

Soldiers and Sailors

Socially responsible Oakland microgrid - Challenges / barriers

- Apply emerging microgrid **technology** into a dense urban grid setting to meet critical social needs
- Grid to Microgrid - Tie **existing** and **new generation assets** to the current utility grid infrastructure
- Develop new utility and government agency **regulations**
  - Public Utility Commission
- Public **safety –** coordination with emergency response
- **Emergency** versus **normal** operating conditions / scenarios
- Alignment with community **environmental / sustainability** goals
- **Ownership** of the microgrid assets, how they might be **funded** and **“monetized”**

Bring together Pittsburgh's unique resources from academia, the private sector and the public sector to meet the challenge!

- Conduct a **feasibility study** for a **socially responsible Oakland microgrid**
- Develop new design guidelines for **critical infrastructure** to **meet community needs**
- Develop initial roadmap for overall "Grid to MicroGrid" design across the City, in coordination with the overall **District Energy Initiative**
- Utilize Pittsburgh's **Energy Innovation Center**
- Engage key **community stakeholders**
  - The City of Pittsburgh
  - Allegheny County
  - US Department of Energy
  - Duquesne Light
  - Eaton
  - University of Pittsburgh
  - UPMC

Create an urban energy model to meet 21st Century social responsibilities

Powering Business Worldwide


Powering Business Worldwide