



University of Pittsburgh

# Partnering for Microgrid Success

University of Pittsburgh  
Center for Energy and Energy GRID Institute

IDEA Annual Conference 2017

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Swanson School of Engineering  
University of Pittsburgh





## Overview

Pittsburgh's energy challenges and trends

Current Pittsburgh initiatives in energy and microgrid applications

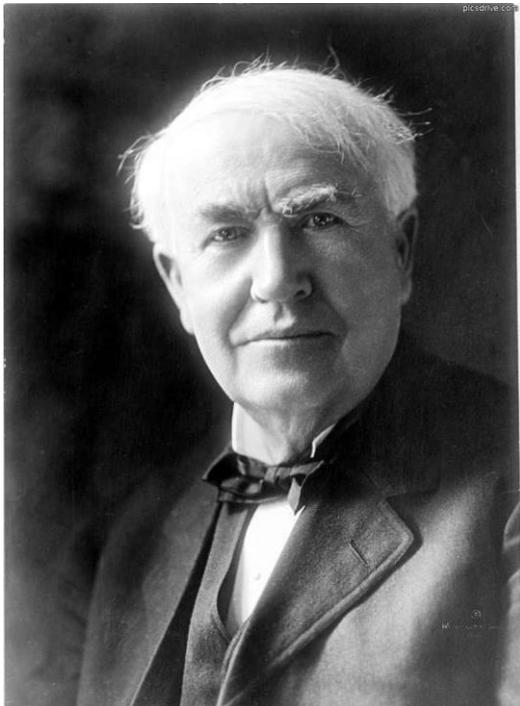
The Role of the University of Pittsburgh's Center for Energy and Energy GRID Institute

Current collaborative projects - from ideas to deployment

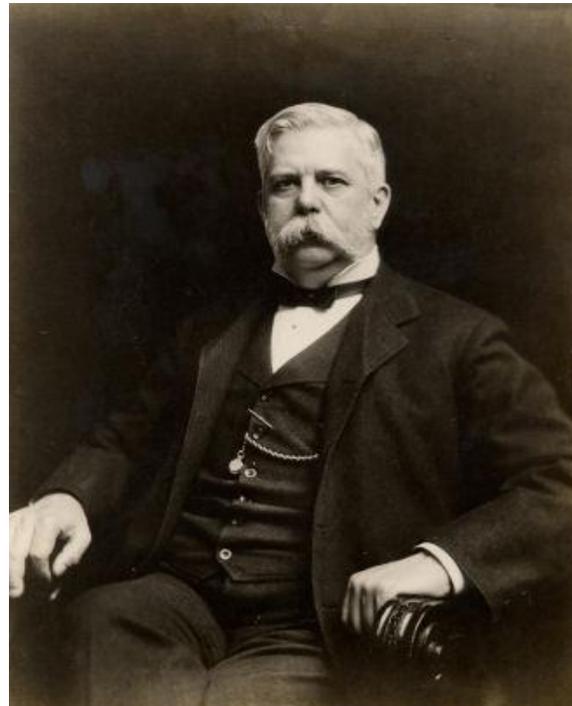
The University of Pittsburgh's new energy laboratories at the EIC



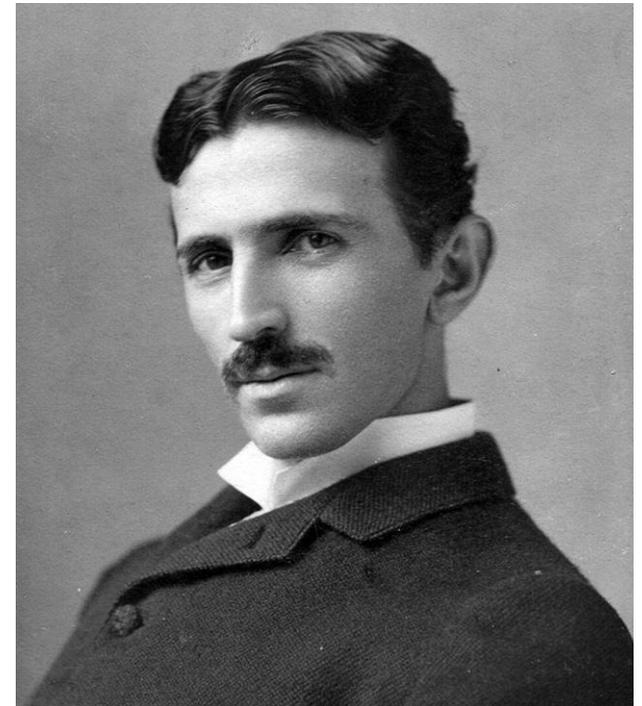
In the late 1800s and early 1900s, Pittsburgh was at the center of the war of the currents



Edison

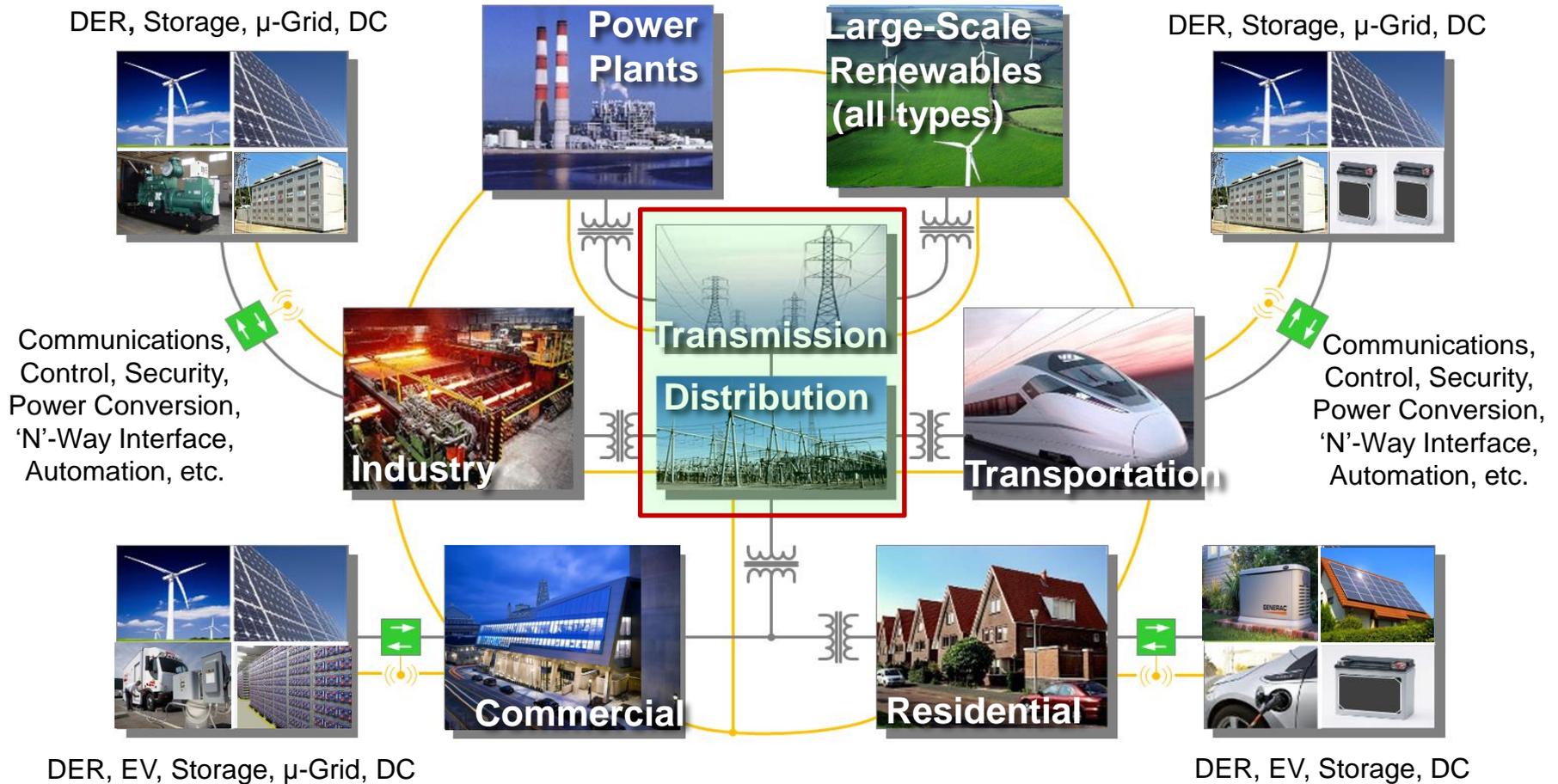


Westinghouse



Tesla

# The 21<sup>st</sup> Century Grid and Its Interactions





# The need for a focus on a resilient energy infrastructure





Energy is critical to our everyday life...



# Energy at the center of the region's growth

- Mayor is committed to 100% renewable consumption
- Member – 100 Resilient Cities
- 2030 District adopter
- Climate Action Plan 3.0 – July, 2017
- University of Pittsburgh Downtown expansion





## University of Pittsburgh (Pitt) Center for Energy

University-wide Research Center; Dedicated to improving energy technology research, development, and implementation, including:

- Resources
- Delivery and Infrastructure
- Utilization
- Materials and Storage
- Markets
- Education and Training



# The Pitt Center for Energy

## Recent areas of growth:

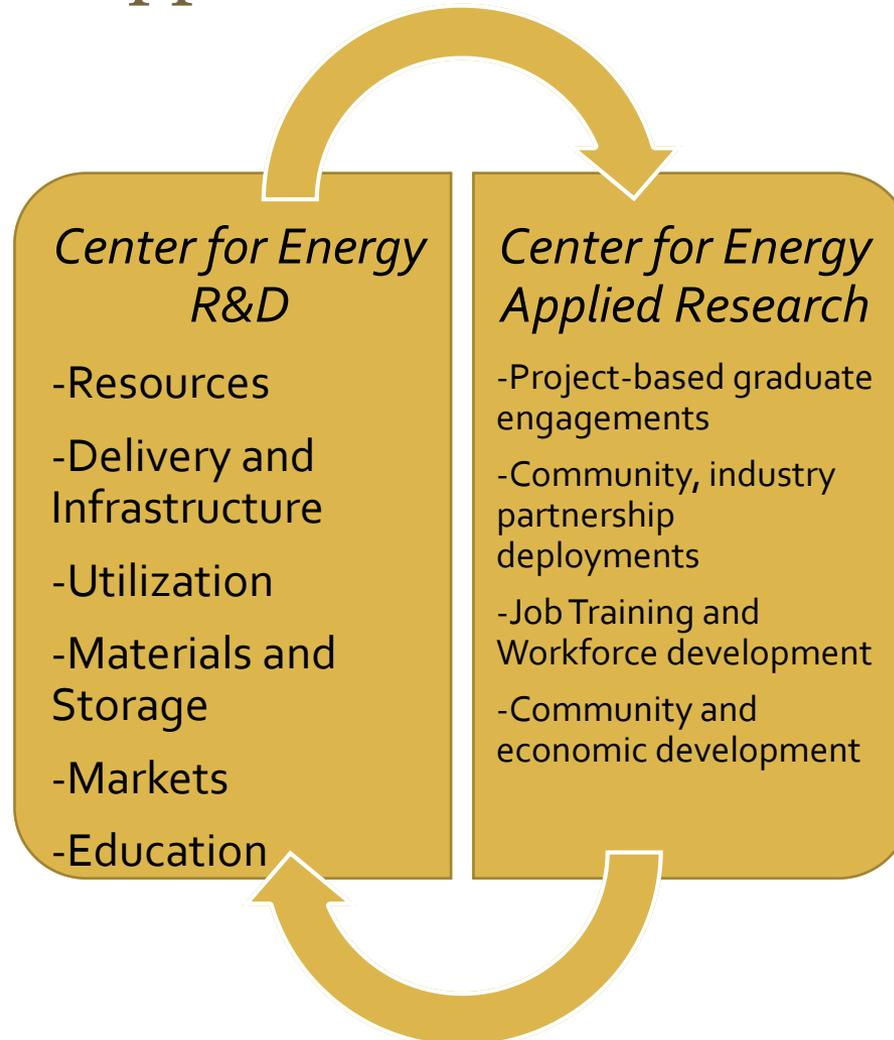
- Microgrids
- Resilient / Secure Energy Systems
- Renewable Energy Technology Development and Integration
- Direct Current (DC) Infrastructure, Technologies, and Standards
- Hybrid AC/DC Systems and Integrated Energy Networks
- Electric Vehicle-to-Grid / Transportation Electrification Concepts
- Energy Policy, Regulation, and Economics

## Expanded Facilities and Operations

Focus on applied research through community and industry partnerships

Off-Campus focus at the Pittsburgh Energy Innovation Center

## District Energy as an R&D and applied research thrust

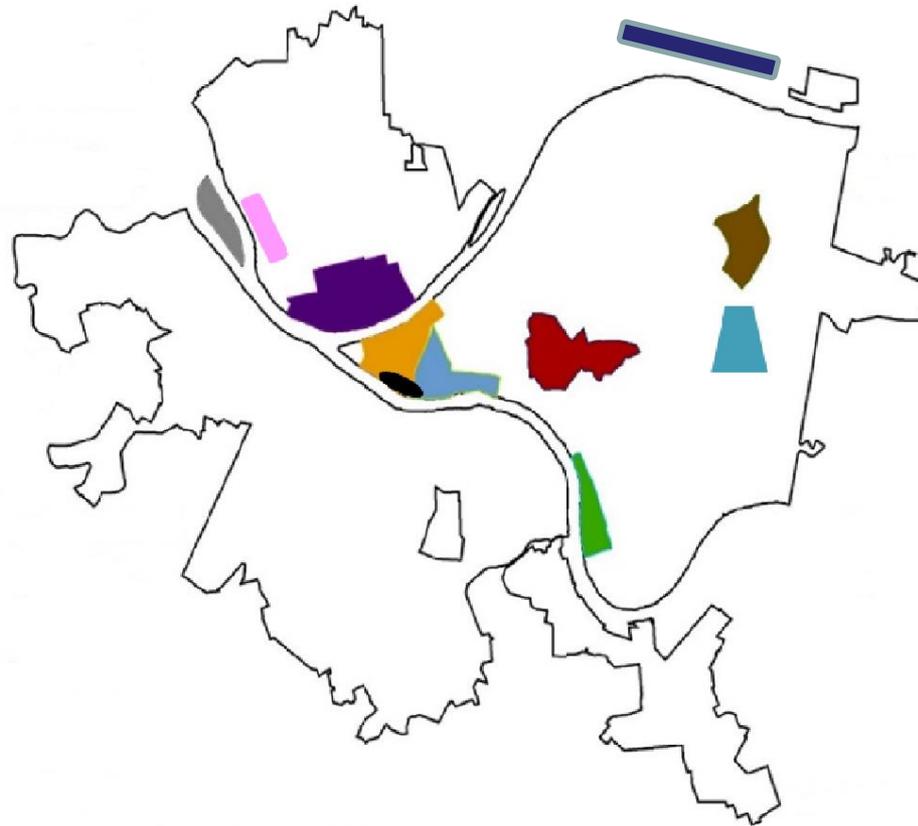


# District Energy Ecosystem

Goal: Largest District Energy Eco-System in North America

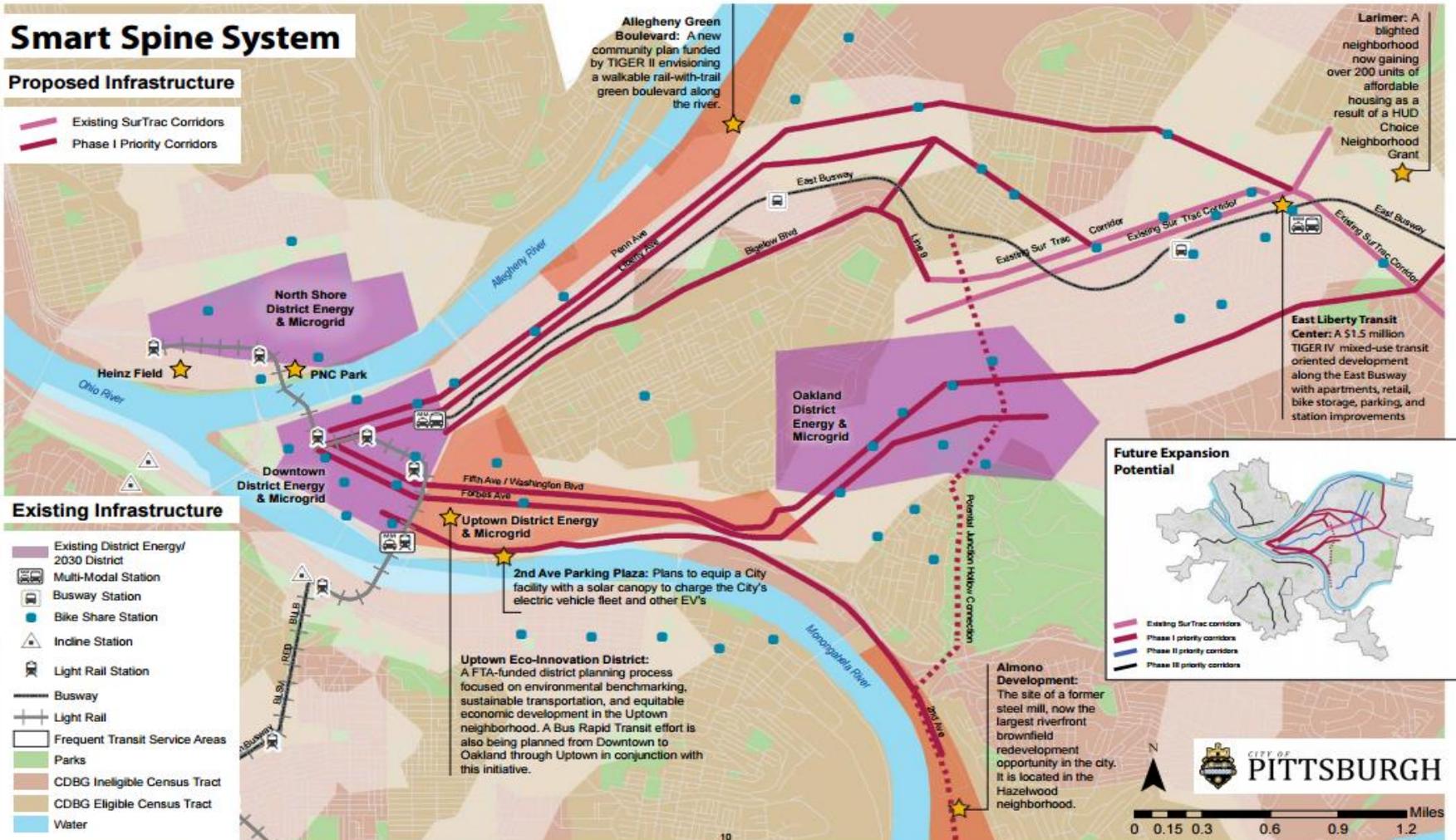
Focus on: Resiliency, Reliability, Sustainability, Security, Economics

- Center for Energy and City of Pittsburgh partnership
- A sustainable and resilient Energy path for the region
- Focus on existing energy distribution systems and microgrid deployment
- Adoption of advanced resource strategies integrated via neighborhood microgrid networks and advanced delivery infrastructure (AC and DC electric power, along with gas and steam)





# Grid of Microgrids



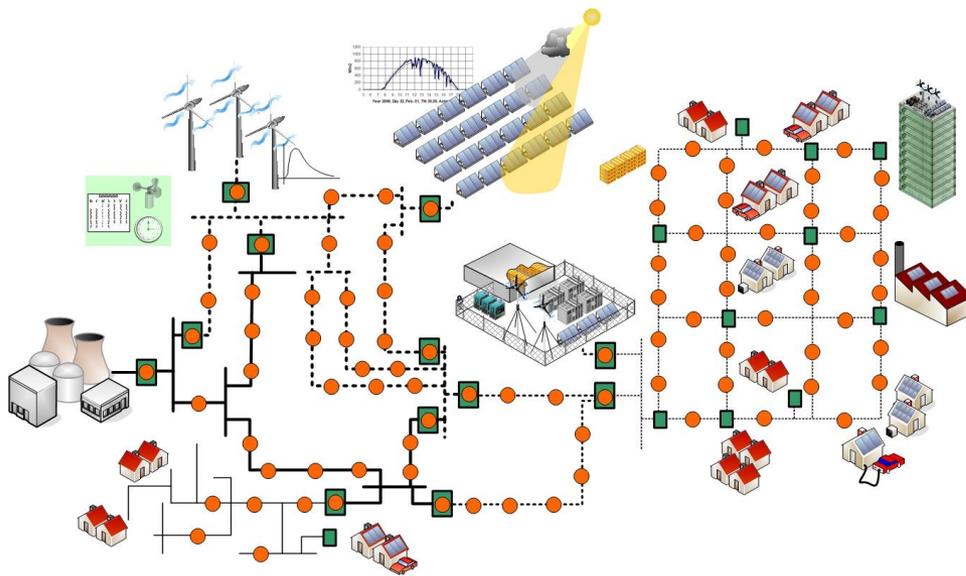


# City of Pittsburgh and Regional Projects

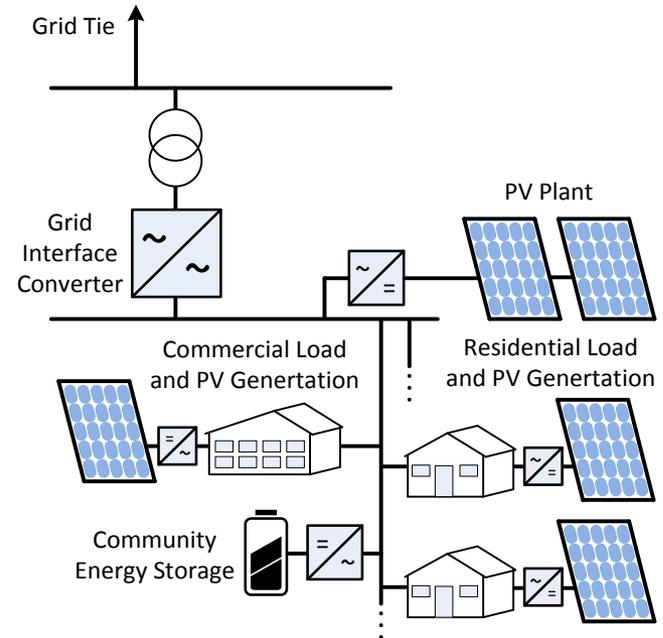
# DC-AMPS Program

HILLMAN FAMILY FOUNDATIONS

## - Direct Current Architecture for Modern Power Systems



Advanced Microgrid and DC Architectures  
(Feasibility and microgrid design studies)



Power Conversion Equipment Design, Fault  
Detection, and Reliability Assessments



# Pitt-Ohio Express Harmar – DC Architecture

- Renewable DC Energy (Solar/Wind) and Storage System
- One of the first all-DC Renewable Integration Project in the U.S.



**PITTOHIO**  
SUPPLY CHAIN • GROUND • LTL • TL

**PITT SWANSON**  
ENGINEERING  
ELECTRIC POWER SYSTEMS LAB

**UNIVERSAL**  
ELECTRIC CORPORATION

**WindStax™**  
Wind Power Systems

**ASR**  
ADAM SOLAR RESOURCES

**PCTI**  
A Power Conversion Company

**EAT•N**  
Powering Business Worldwide

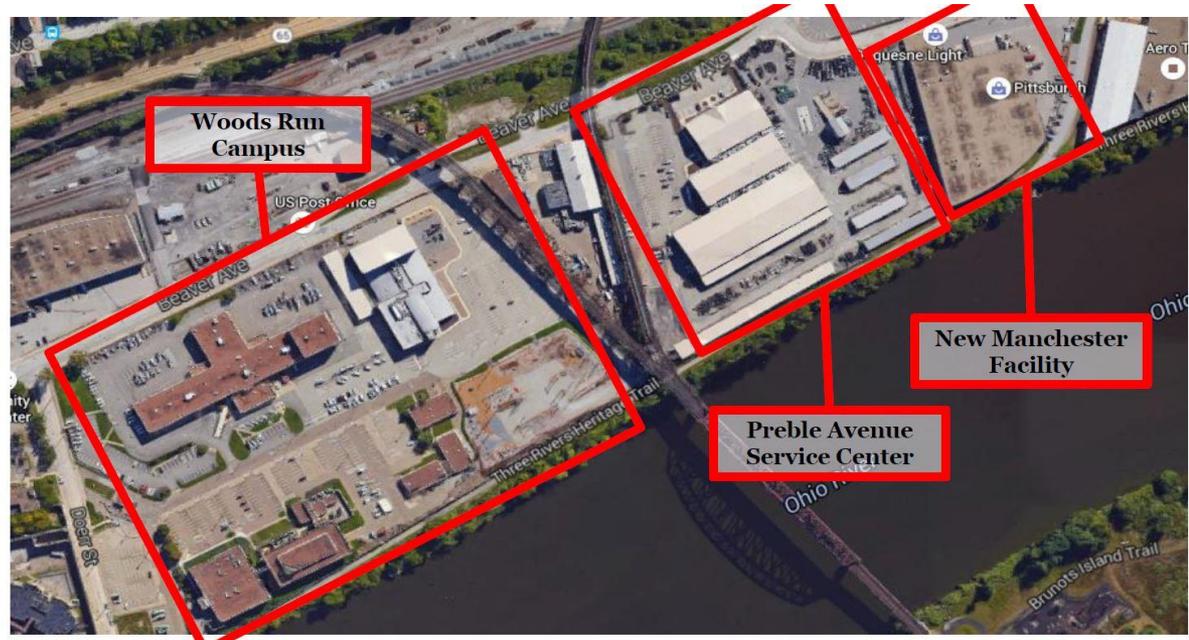
**AQUION**  
ENERGY

**SARGENT**  
Sargent  
Electric  
Company

**BDA**  
Engineering, Inc.

# Duquesne Light Woods Run Microgrid

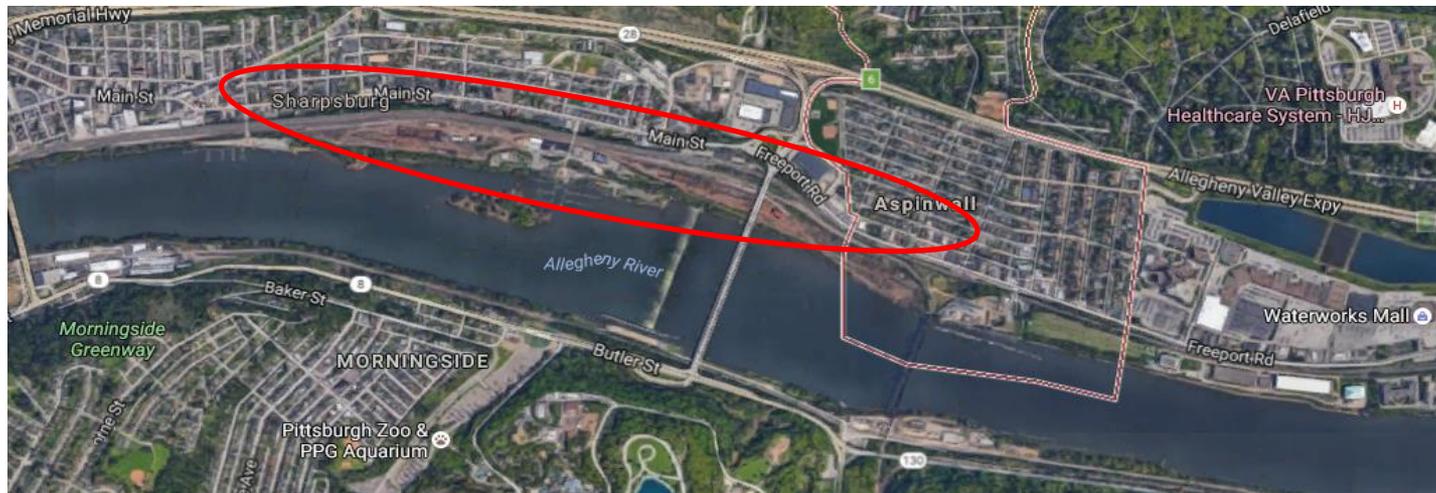
- Pitt – Duquesne Light collaboration
- Full microgrid buildout plan at DLC's Wood's Run Operations Facility\*
- Distributed generation, including renewables, natural gas, and diesel
- Advanced distribution network and control
- Full islanding capabilities
- AC and DC hybrid solutions
- R&D, demonstration elements



\* Pending PA PUC Approval

## Riverfront 47

- Center for Energy and Riverfront 47 LP initial partnership
- Goal: To provide an initial microgrid feasibility and design that can enhance the 'R47' master plan
- Opportunity for Pitt – applied research, showcasing technologies being explored within the Center for Energy, including DC and microgrid integration opportunities
- Also engage graduate student researchers in hands-on projects in the community



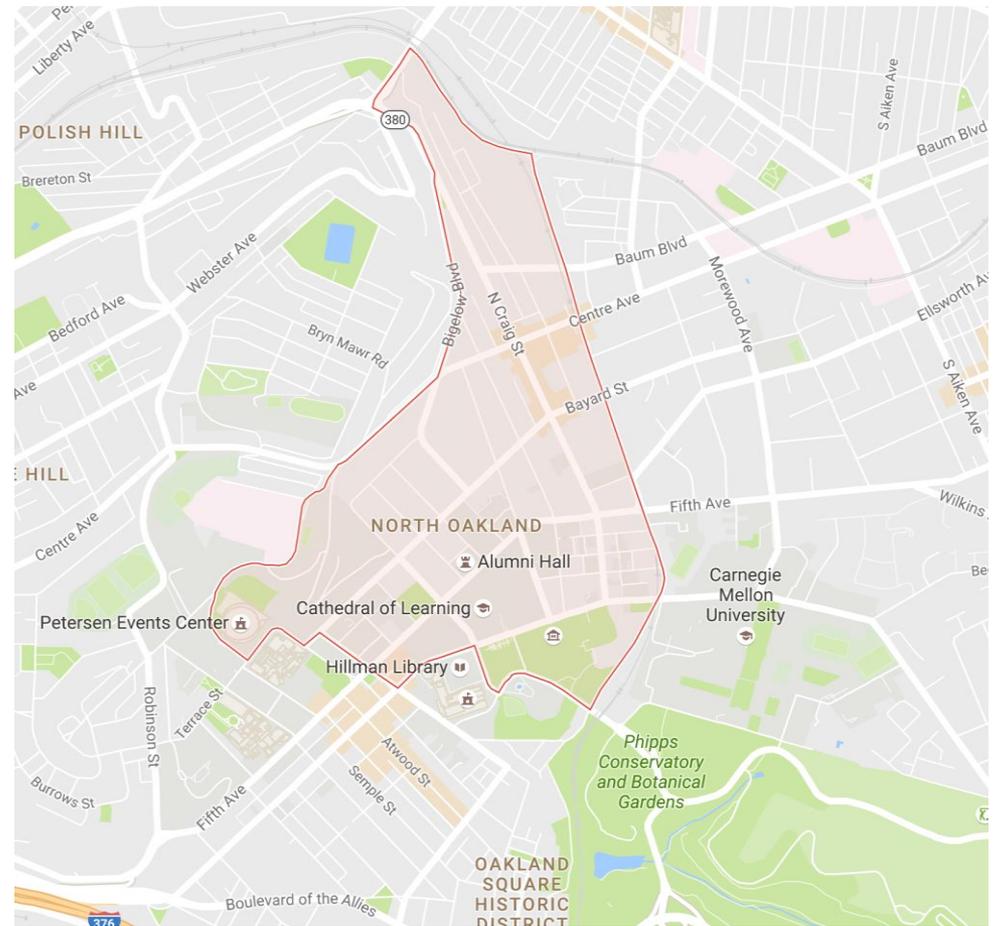
## ALMONO Site



- Former steel mill site, 178 Acres
- Multiple master planning processes to date – goal of net-zero mixed use development
- Purchased by local foundation community in early 2000's
- May, 2017: Almono LP issued a Request for Expressions of Interest for energy service providers at the site

# Socially-responsible Microgrid

- University of Pittsburgh, Carnegie Mellon University
- Critical infrastructure
  - 3 Major hospitals serving the larger tristate region
  - Large safe havens including Soldiers and Sailors Hall, Peterson Events Center
  - EMS, City Fire department, Police departments
- Nexus of energy infrastructure and social institutions



# Pitt – Oakland Campus Energy Master Plan

- Campus-wide energy and conservation master planning process
- Development of advanced “4<sup>th</sup> Generation” solutions to energy resources, delivery, and utilization.
- Improve Pitt’s energy footprint through innovative approaches to district systems, demand management, and other approaches
- Electrical, steam, and water systems; building programs; and more



Benedum Engineering Hall



Carrillo St. Steam Plant – Trees Hall



# Pittsburgh Energy Innovation Center (EIC)





## Energy GRID Institute

**The Challenge:** Adapt to growth of DERs, renewables, microgrids, DC, and disruptive technologies in the electric power and energy sectors

**The Goal:** Create a modern, reliable, resilient, sustainable, and secure energy infrastructure within the Pittsburgh region and nationally

**The Vision:** Work in collaboration with partners towards the development, demonstration, and first-generation deployment of solutions across a broad area of energy technologies, systems, designs, operations, and regulation, as well as addressing market forces and business considerations

**The Community Impact:** Cross-section of community engagement and public/private partnerships; co-location of industry and community partners. District Energy Program will spur regional economic development and increase resiliency across Pittsburgh's most underserved areas/neighborhoods



# The Energy GRID Institute Laboratories

- **Electric Power Technologies Lab**
  - High-Voltage/High-Capacity AC and DC Grid Facility and System Operations Center
- **Energy Storage Technologies Lab**
  - Nano-Materials for Conversion and Energy Storage
- **High-Temperature Corrosion Testing Lab**
  - Harsh-Environment, High-Temperature Materials Testing
- **Energy-Related University Incubator Space**
  - Lab Spaces for Start-up/Commercialization Activities, including industry colocation

## Pittsburgh's Challenges and Next Steps

- Positioning Pittsburgh and as a leader in energy research, development and demonstration
- Delivering on goals we have collectively set



- Pittsburgh's story is not unique, however if success is achieved in Southwest Pennsylvania, it can be achieved most anywhere in the country



Thank you

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