



University of Pittsburgh

Center for Energy and Electric Power Initiative 2014 Highlights and Activities

November 18, 2014
9th Annual Pitt EPIC – University Club

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Center for Energy – Fall 2014 Up-Date

- New Research Grants, Programs, and Initiatives
- New Facilities and Major Equipment
- Major Proposals and Collaborations
- Conferences and Symposia
- Educational Programs
- Seminar Series
- Outreach Activities
- Personnel
- Future Activities and Goals



Center for Energy Mission

- Facilitate campus-wide energy-related research programs and initiatives
- Support educational program development and curriculum across energy disciplines
- Promote Pitt's energy-related research and education through outreach and orchestration of activities
- “Rise to the Challenge” of positioning our region for the future in the energy sector, working collaboratively with industry and community partners



2014 Center for Energy Highlights

- \$15+ Million in new research grants year-to-date
- 4 major conference/symposia events
- 2 capital investments – new lab and major equipment
- 1 new RK Mellon faculty fellow hire
- 7 RK Mellon graduate student fellows
- 8 PROMAG (Preparation of Major Grants) support efforts
- Detailed end-of-year report in draft





New Grants, Programs, and Initiatives

- **Advanced Manufacturing Grants (Energy Related)**
 - Sponsors: America Makes, NSF, RAMP – 5 projects
 - Amount: \$3.7 Million total
(Center for Energy cost-sharing on \$1.7 Million NSF MRI grant)
 - SSOE Dept. of Mechanical Engineering and Materials Science and various collaborators (ChemE, IE, Industry partners)
- **Mechanisms of Hydraulic Fracturing**
 - Sponsors: Chevron, Schlumberger, Shell – 3 projects
 - Amount: \$820,000 total
(Center for Energy provided faculty start-up for lab capabilities)
 - SSOE Dept. of Civil & Environmental Engineering



New Grants, Programs, and Initiatives

- High Spatial Resolution Distributed Fiber-Optic Sensor Networks for Gas Flow Measurements
 - Sponsor: U.S. DoE - Nuclear Energy University Program
 - Amount: \$1.1 Million
 - Partners: Corning Inc., Westinghouse Electric
 - SSOE Dept. of Electrical & Computer Engineering
- DC-AMPS – Direct Current Architecture for Modern Power Systems and Micro-grid/-energy Developments
 - Sponsor: Henry L. Hillman Foundation
 - Amount: \$800,000
 - SSOE (Depts. of Electrical & Computer Engineering and Industrial Engineering), and KATZ School of Business



New Grants, Programs, and Initiatives

- Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County, PA
 - Sponsor: U.S. Dept. of Energy – NETL
 - Partners: NETL, WVU, Oak Ridge Institute
 - A&S Dept. of Geology and Planetary Sciences
- Solar to Electrical Energy Conversion (Nanocrystal-based Dyads)
 - Sponsor: U.S. Dept. of Energy
 - Amount: \$750,000
 - A&S Dept. of Chemistry



New Grants, Programs, and Initiatives

- **CO₂ Thickener to Improve Flow through Rocks and for Increasing Viscosity for Oil Recovery**
 - Sponsor: U.S. Dept. of Energy – NETL and ARPA-e
 - Amount: \$3.6 Million
 - SSOE Dept. of Chemical and Petroleum Engineering

- **Lithium Sulfur Batteries Development**
 - Sponsor: U.S. Dept. of Energy – Vehicles Technologies Office
 - Amount: \$1.25 Million
 - SSOE Dept. of Chemical and Petroleum Engineering



New Grants, Programs, and Initiatives

- Renewable and Distributed Energy Resource Integration
 - Sponsor: FirstEnergy Services Co.
 - Amount: \$165,000 (project extension)
 - SSOE Dept. of Electrical & Computer Engineering
- Feasibility Demonstration of Laser Manufacturing on Silicon Photonic Crystals for Solar PV Cells
 - Sponsor: NSF Materials Processing and Manufacturing
 - Amount: \$110,000
 - SSOE Depts. of Industrial Engineering and Electrical & Computer Engineering



New Facilities and Major Equipment

- **Electric Power Systems Laboratory**
 - Sponsor: Eaton-Pitt Partnership in Electric Power Engineering
 - Amount: > \$1 Million total value (\$150-k from CfE)
 - Dedication Ceremony – January, 2014
 - SSOE Dept. of Electrical & Computer Engineering
- **Additive Manufacturing Equipment and Capabilities**
 - Sponsor: Part of “America Makes” and NSF Program
 - Amount: > \$1,300,000 total (\$400-k from CfE)
 - SSOE Depts. of Mechanical Engineering and Materials Science and Industrial Engineering



Major Proposals and Collaborations

- **NIST Community Resiliency Program Proposal**
 - Sponsor: National Institutes of Standards and Technology
 - Amount: \$17 Million (SSOE/CfE related - \$5.1 Million)
 - Partners: Campus-wide effort – lead by GSPIA, including participation from the Center for Energy, MCSI, others
- **Other Center for Energy PROMAG Supported Efforts:**
 - DoE Energy Frontier Research Center (EFRC) proposals (2)
 - NSF Materials Research Science and Engineering Center (MRSEC) proposal
 - DoE Nuclear Energy University Program (NEUP) proposal
 - America Makes additive manufacturing proposals



Conferences and Symposia

- **31st Annual International Pittsburgh Coal Conference**
 - Dates: October 6-9, 2014
 - Location: David L. Lawrence Convention Center, Pittsburgh PA
- **9th Annual Electric Power Industry Conference (EPIC)**
 - Dates: November 17-18, 2014
 - Location: University Club, Pitt Oakland Campus
 - Morgan O'Brien – Conf. Keynote; John Swanson – Evening Keynote
- **Nuclear Night**
 - Dates: November 18, 2014
 - Location: O'Hara Student Center, Pitt Oakland Campus
- **Nuclear Research Symposium**
 - Dates: January 8, 2014
 - Location: Benedum Hall, Pitt Oakland Campus



Educational Programs

- Energy-related Concentrations and Certificates
 - Nuclear – certificates continuing to remain steady at both undergraduate and graduate levels
 - Mining – steady enrollments in the undergraduate and graduate certificate programs (despite recent/current downturn in industry)
 - Power – undergraduate concentrations represent 1/3 of all graduating EE's; new SDL post-bacc certificate exceeding targets
 - Advanced Manufacturing – new M.S. program in development
 - Honors College 'Energy Course' in collaboration with NAS/NAE
 - Energy Today / Energy Tomorrow program with Univ. of New South Wales (Australia) being revived
 - 'Energy Certificate': campus-wide graduate certificate program being considered – early discussions with Katz and other Schools



Seminar Series

- Fall 2014
 - Dr. Aziza Benaboud
 - Asst. Professor, Royal Navy School of Morocco (Casablanca) – Sept. 12
 - Dr. Al Hefner
 - Leader, NIST Smart Grids Program (Washington, D.C.) – Oct. 10
 - Mr. Doug Condon
 - Managing Director, Three Rivers Energy (Pleasanton, CA) – Oct. 24
 - Dr. Romain Prioul
 - Manager, Geomechanics, Schlumberger-Doll (Cambridge, MA). – Nov. 7
- Near-term goal: formalize a more ‘regular’ series starting Spring 2015, remaining flexible for special events and requests



Outreach Activities

- Pitt Science Outreach Program – Sciencepalooza 2014
 - K-12 STEM program targeting under-represented youth
 - summer long program at local Ys, culminating with fair at WPU
- Land Art Generator Initiative (LAGI)
 - Renewable generation project at Schenley Plaza
- National Academies – Energy Ambassador Program
 - “Grid Academy” program under development in collaboration with Allegheny Conference and NAS/NAE – October launch
- Global Learning Council
 - Pitt-CMU lead on national program to develop scientific learning principals applied in engineering disciplines – September
- National Engineering Forum
 - Pitt-CMU lead on ‘regional dialogue’ addressing the national crisis of engineering capacity, capability, and competitiveness – October



Personnel

- Executive Director Position Recruitment
 - Job description currently being finalized
 - Recruitment plans established
- RK Mellon Faculty Positions
 - 2 Faculty Fellow positions hired
 - John Keith – 2012
 - Alexis Kwasinski – 2014
 - 2 Chair positions remain open
 - Recruitment on-going
- Other 2014 faculty hires in Energy:
 - Brandon Grainger (ECE), Andrew Bungler (CEE), ...



RK Mellon Graduate Student Fellows

<u>Graduate Student</u>	<u>Home Department</u>	<u>Faculty Advisor</u>	<u>Expected Graduation</u>
Barry, Matthew	MEMS	Chyu	Summer 2015
Bloom, Brian	Chemistry	Waldeck	Summer 2017
Bohna, Nate	MEMS	Gleeson	Fall 2015
Franconi, Nicholas	ECE	Sejdic	Summer 2015
Lai, Yungchieh	ChemE	Veser	Summer 2015
Lewis, Patrick	ECE	Reed	Spring 2017
Zorn, Erich	Geology	Harbert	Summer 2015

Grainger, Brandon *ECE* *Reed* *Summer 2014* *1st RK Mellon Graduate Student Fellow Ph.D.*



Future Activities and Goals

- Host a campus-wide ‘Energy Retreat’
- Lead continued collaborations on research, education, and outreach initiatives across departments and schools
- Sponsor additional conferences and events
- Support key laboratory/equipment investments
- Begin joint sponsorship of seed grants (e.g., with MCSI)
- Establish a successful start to the off-campus labs
- Enhance university partner relationships
- Strengthen and expand industry collaborations
- Continue to establish a stronger national/international reputation for leadership and contributions



Center for Energy

Proposed Off-Campus Research Facilities

Proposed Plans for the Energy Innovation Center (EIC)



Pittsburgh Energy Innovation Center

- **Old Connolly Trade School (Bedford Avenue)
– aka, the Energy Innovation Center**
- **Built in 1930 and closed as a school in 2004.**
- **Consists of a 5-story tower, with a single-story, high bay former technical shop extension.**
- **Building currently under renovation by Pittsburgh Gateways (non-profit with private and public funding)**
- **~ 23,00 sq. ft. of space available, built to suit**



Energy Innovation Center



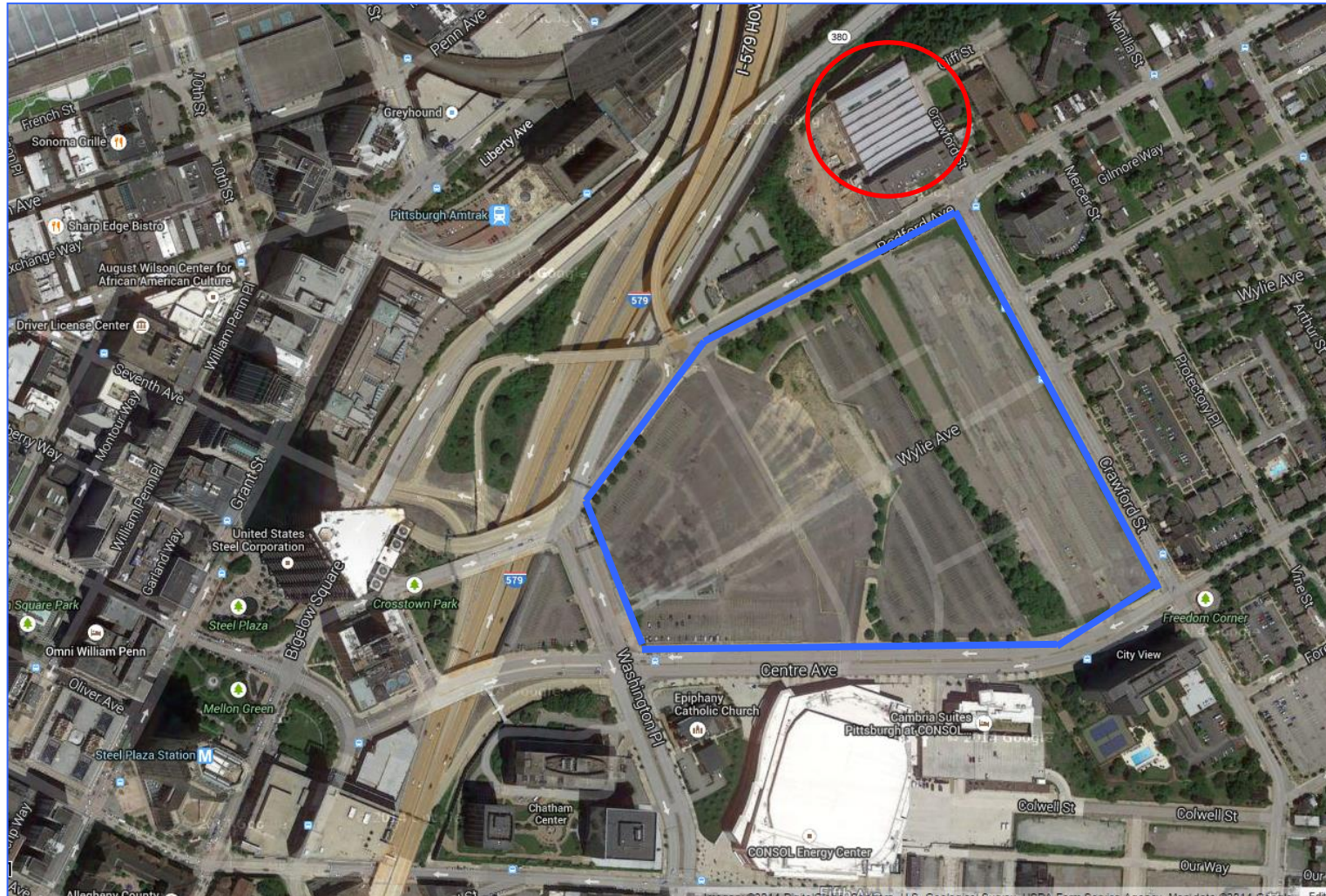
Available – 2014

Tours: Bill Miller – 412-802-0752

Promoting Energy-Sector Research, Innovation, Education and Jobs



Energy Innovation Center





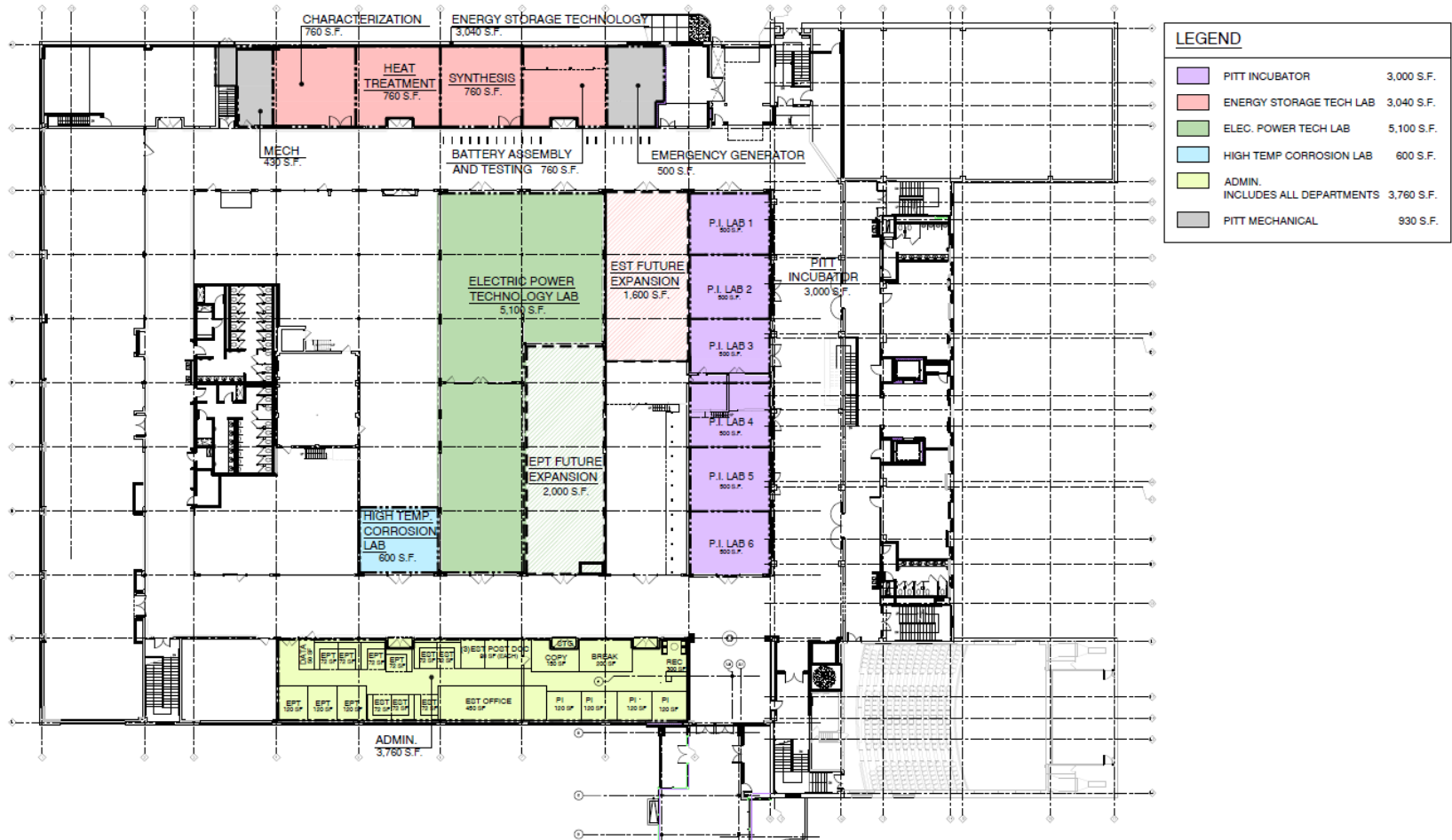
Center for Energy Laboratories Proposed to be Developed in the EIC

- **Electric Power Technologies Lab**
 - **Dr. Gregory Reed**
 - **Will complement the Eaton-sponsored Electric Power Systems Lab in Benedum Hall**
- **Energy Storage Technologies Lab & Biomaterials Manufacturing Laboratory**
 - **Dr. Prashant Kumta**
- **High-Temperature Corrosion Testing Lab**
 - **Dr. Brian Gleeson**
 - **Current facility at Iowa State University**
- **Energy-Related University Incubator Space**
 - **Dr. Mark Redfern**



EIC – Proposed Floor Plan

EXHIBIT A





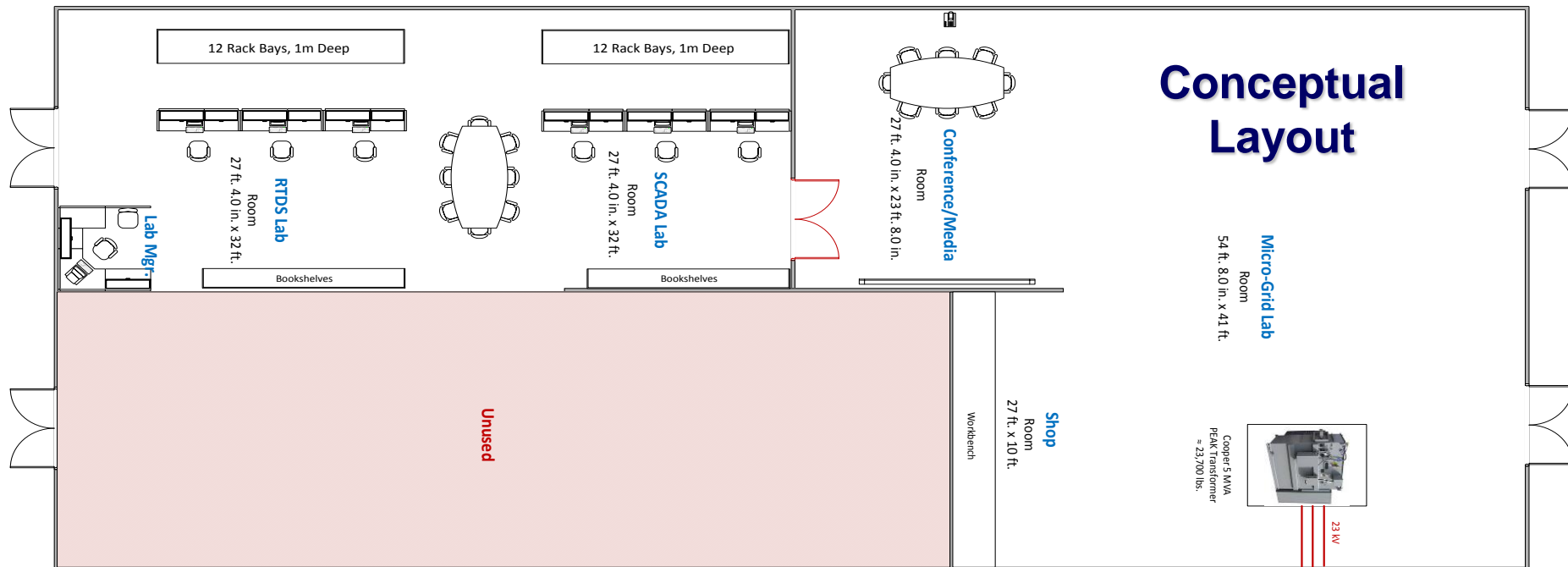
Electric Power Technologies and Micro-energy Laboratory (2015/2016)

- **University research & development ...and... independent industry activities**
- **Concept/vision is for high voltage capability and multiple use facility:**
 - Plan for **15 kV-ac, 5 MVA** and **1 kV-dc, 1 MVA** capacity
 - **Micro-Grid/Micro-Energy** Environment at **Utility Distribution Level**
 - Resource, **Distributed Energy Generation**, and **Load Integration**
 - Renewables (Solar PV, Wind, ...), Energy Storage, EV-2-Grid, etc.
 - Distribution Feeder Infrastructure
 - Real Time Digital Simulator (RTDS)
 - SCADA and Systems Operations
 - Protective Relaying and Substation Automation
 - Advanced Control and Communications
 - Modeling, Simulation, and Analysis
 - FACTS and HVDC control system testing and development
 - Power electronics converters and other power technologies development, prototyping, and testing (e.g., IEEE 1547 certification)
 - DC standards development (IEC SG 4)
 - Integration of feeder analytics, technology testing and certification, etc.

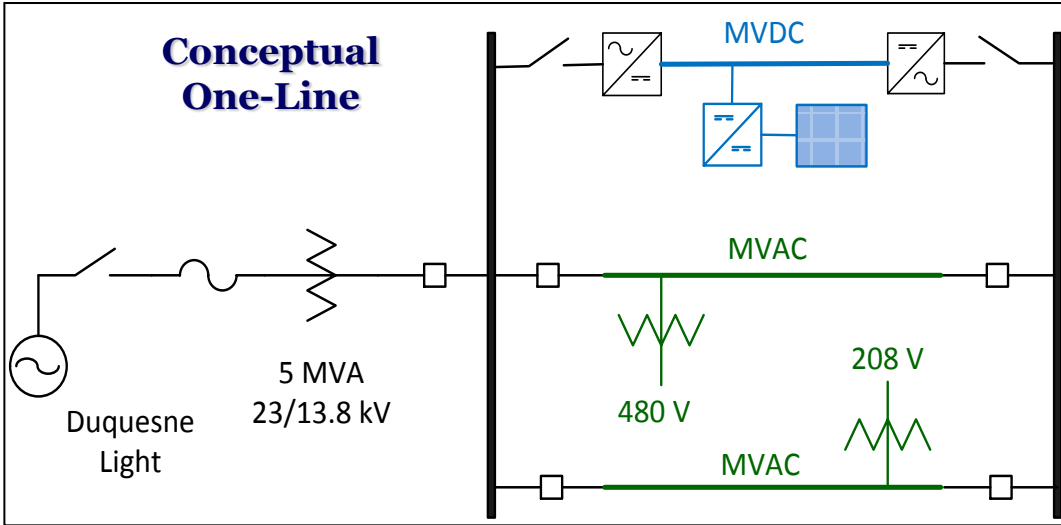


Electric Power Technologies and Microgrid Laboratory (2015/2016)

Conceptual Layout of Lab – Approx. 7,500 sq. ft.
(5,000 sq. ft. initial build out)

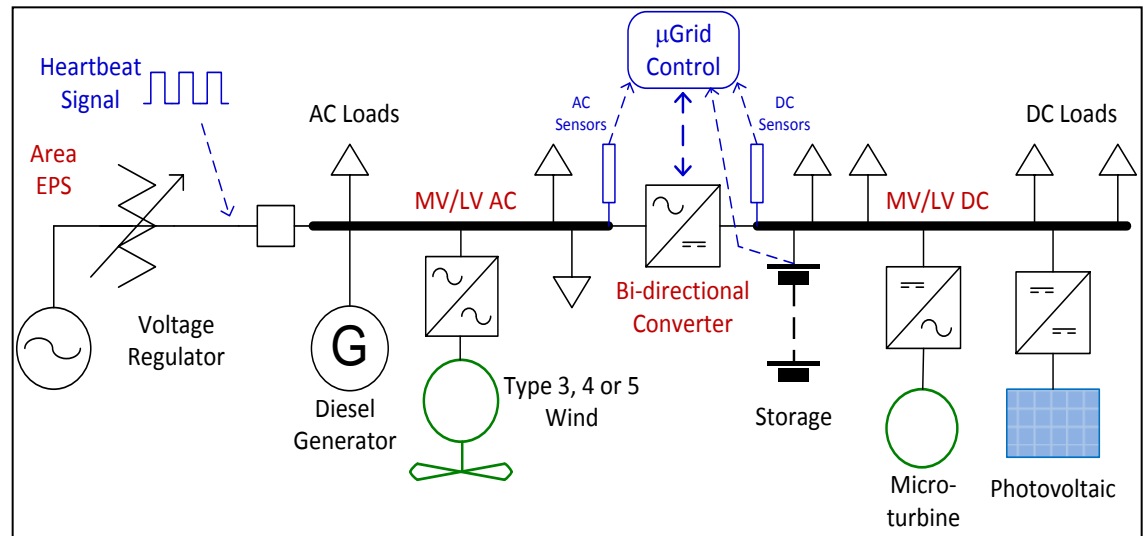


Conceptual One-Line



Conceptual One-Line Diagram

Example Test Configuration



Example Feeder Configuration



Electric Power Technologies and Microgrid Laboratory (2015/2016)

Opportunities:

- **Industry collaborative research & development**
- **DOE (OR, EERE), ONR, DoD, and other energy-related programs e.g., Regional grid hub, Microgrid/energy center, DER, Renewables, DC technologies, Power electronics, etc.**
- **NETL-RUA Grid Technologies Collaborative growth**
- **NSF (I/UCRC or ERC in electric power technologies)**
- **NIST (standards and testing activities)**
- **Technology prototyping, development, and commercialization**
- **Standards development, testing, and certification**
- **Witness testing services and third party verification**
- **Training and courses / distance learning / certificate programs**
- **Other Services – consulting, business development, etc.**



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Thank You