THE ENERGY GRID INSTITUTE
GRID RESEARCH AND INFRASTRUCTURE DEVELOPMENT
UNIVERSITY OF PITTSBURGH
The GRID Institute was announced in June 2016. This new entity, grounded in research from Pitt’s Center for Energy, will leverage the University’s public and private partnerships with new laboratory space at the Energy Innovation Center in Downtown Pittsburgh to create a comprehensive international solution center for industry.

*The Energy GRID Institute will serve as the nexus for collaborative research that encourages economic growth and job creation and enhances Pitt’s incubator, start-up, and commercialization potential.*
Building the intelligent grid of the future is a monumental task for all of the stakeholders involved in electric power. Utilities, device manufacturers, and regulators are navigating a number of dynamic issues at the same time, including:

- aging, legacy systems and infrastructure;
- the development and integration of new technologies, including distributed energy resources, energy storage, power electronics, microgrids, and the rise of direct current power;
- and consumer expectations for increased reliability, resiliency, sustainability, and flexibility, along with the need for cybersecurity to protect connected systems.

**Demand:**

- Estimated $16 trillion to be invested globally in electric power over the next 20 years.
- Immediate local and regional opportunities are needed to modernize legacy systems and infrastructure.
THE TASK AT HAND

• Building the 21st century grid network is a monumental challenge.
• Stronger collaboration is needed between industry stakeholders, policy-makers, and community members to understand how to design and build the systems needed to support a sustainable energy future and the corresponding infrastructure.
• The utility of the future will be dynamic and consumer-centric; this requires evolving and adapting technologies and business models.
• Ongoing policy-expertise is needed to better support the deployment, development, and stability of new energy markets.
• Ongoing grid modernization technical efforts are needed to better understand the integration of distributed and renewable energy resources and energy storage systems, design of next generation power electronics technologies, direct current (DC) grid architecture (including the role of new systems designs such as microgrids and nanogrids), and related developments.
• There is a need for advanced facilities to test the performance and behavior of emerging technologies beyond traditional simulation methods to demonstrate effectiveness through hardware implementation.
THE VISION

The Energy GRID Institute acts as a grounded research center for all key stakeholders involved in the grid transition.

• Provides unique opportunities for collaboration and partnership with leading University academics, in a manner that is both industry-focused and industry-led.

• Manufacturers can develop one-on-one research collaborations or tests needed for market viability

• Utility owners and operators are able to work in a consortia-model for better understanding and developing the solutions that are needed across the electricity industry

• Regulators can work alongside technical experts to road-map the policies needed for a market transition

PROVIDING NEW WAYS FOR THESE STAKEHOLDERS TO COLLABORATE WILL MOVE ENERGY RESEARCH FORWARD — AND ESTABLISH PITT (AND PITTSBURGH) AS A GLOBAL LEADER IN THE FIELDS OF ELECTRIC POWER AND ENERGY DEVELOPMENT.
The solutions to these challenges require both technical and market support — to devise new technologies as well as implement them successfully.

Existing institutes focus exclusively on either the technical or the policy aspect of energy in general — or focus on traditional grant-funded research rather than direct industry engagement.

The GRID Institute builds off of Pitt’s technical academic excellence in electrical power engineering, energy systems, power electronics, energy storage, and direct current to provide a wider range of stakeholders with an expanded set of offerings beyond R&D and testing.

The GRID Institute acts as one-stop shop for understanding the design, development, and deployment of next generation energy solutions.
STATE OF THE ART FACILITIES

GRID’s lab-space is a high-voltage, high-capacity infrastructure and multiple use facility. Testing capabilities range from residential electrical supply to large-scale industrial supply to utility distribution levels. Ring bus configuration allows for more flexible testing needed within new systems architecture. Lab features both AC and DC testing capabilities, including 15 kV-ac, 5 MVA and 1.5 kV-dc, 1 MW

ALLOWS COMPANIES TO WORK ALONE OR COLLECTIVELY ON PRODUCT DEVELOPMENT
ELECTRIC POWER TECHNOLOGIES LABORATORY: LAYOUT DIAGRAM

**EPTL Layout**

**Power Distribution Areas**

- **MV Grid Lab**: Reconfigurable lab for traditional or microgrid projects. Designed using utility-grade distribution equipment.
- **Test Lab**: Isolated testing facility for safe testing of industry technologies, and EPTML research projects.
- **AC and DC**: Flexible power architecture capabilities – AC, DC, and hybrid systems

**Specialty Areas**

- **Rapid Prototyping**: Advanced machine shop for development of professional grade components and projects.
- **SCADA Center**: Automation, metering, and control for distribution network.
- **Relaying and Controls**: Protective relaying technologies, Phasor-measurement, and advanced control
- **RTDS Center**: Real-Time Digital Simulator and hardware in the loop capabilities – research and testing on industry leading equipment.

**Laboratory Ratings and Features**

- 15 kV-ac, 5 MVA and 1 kV-dc, 1 MVA capacity
- Micro-Grid/Micro-Energy Environment at Electric Utility Distribution Level
- Distributed Energy Resource and Load Integration
- Renewable Technologies (Solar PV, Wind, etc.)
- Energy Storage, Electric Vehicle-2-Grid
- Distribution Feeder Infrastructure
- Real Time Digital Simulator (RTDS)
- SCADA and Systems Operations
- Protective Relaying and Substation Automation
- Advanced Control and Communications, PMU
- Forensics investigations
- Modeling, Simulation, and Analysis
- FACTS and HVDC Control Systems
- Power Electronics Converters (and other power technologies development, prototyping, and testing
- DC standards development
- Integration of feeder analytics
- Technology testing and certification
ENERGY GRID INSTITUTE SERVICES

- Testing, Certification & Evaluation
- Training
- Roadmapping
- Development Partnership
- Industry Consortia
- Center of Excellence
- Vertical Collaboration
- Data & Analytics
- Government R&D
- Graduate Course R&D
- Graduate Student R&D
- U-LAB
- I-LAB
TECHNICAL OFFERINGS

• **Consortia funded** research investigations
• **Sponsored research engagements** for specific project analysis
• **Fee-for-service agreements** for additional technical expertise
• **Forensic testing** and evaluation of power equipment and technologies
• **Contract support** needed for reliability/endurance testing of component behavior
• **Laboratory leasing** of GRID’s facilities for negotiated time periods for individual company usage
ENERGY ROAD-MAPPING

• Deploying the next generation of energy systems requires better **evaluation of the economic, environmental, and social impacts** of technologies
• Regulation is needed to ensure critical **technologies are brought to market** in a non-disruptive manner
• Better **risk mitigation** is needed to define and manage new financial and operational risks
• Evolving **business models** are needed to better deliver consumer demands
• **Cohesive policy development** is needed to synchronize environmental, social, and economic goals of energy stakeholders
### Current Partners

#### Strong Initial Partnerships
- ABB
- ANSYS
- Dominion VP
- Duquesne Light Co.
- Eaton, Electrical Sector
- Emerson Process Management
- EPRI (Electric Power Research Inst.)
- FirstEnergy Corp.
- Mitsubishi Electric
- OPAL-RT
- Pitt-Ohio Express
- Sargent Electric
- Siemens Energy and Industry
- Universal Electric
- RK Mellon and HL Hillman Foundations

#### Additional Engagements in Process
- Hyosung Corporation
- Quanta Technologies
- E.On
- ENEL
- Westinghouse
- S&C Electric
- GE-Alstom / GE Power Conversion
- Concurrent Technologies - Robert Bosch
- U.S. Dept. of Energy
- OSISoft
- Schweitzer Engineering Labs
- RTDS
- DNV GL – KEMA Laboratories
- EMerge DC Alliance

#### How can we partner?

- **a. Donated equipment value**
- **b. In-kind contributions**
- **c. RD&D engagements**
- **d. Fee-for-service activities**
- **d. Co-located lab-space at EIC**
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