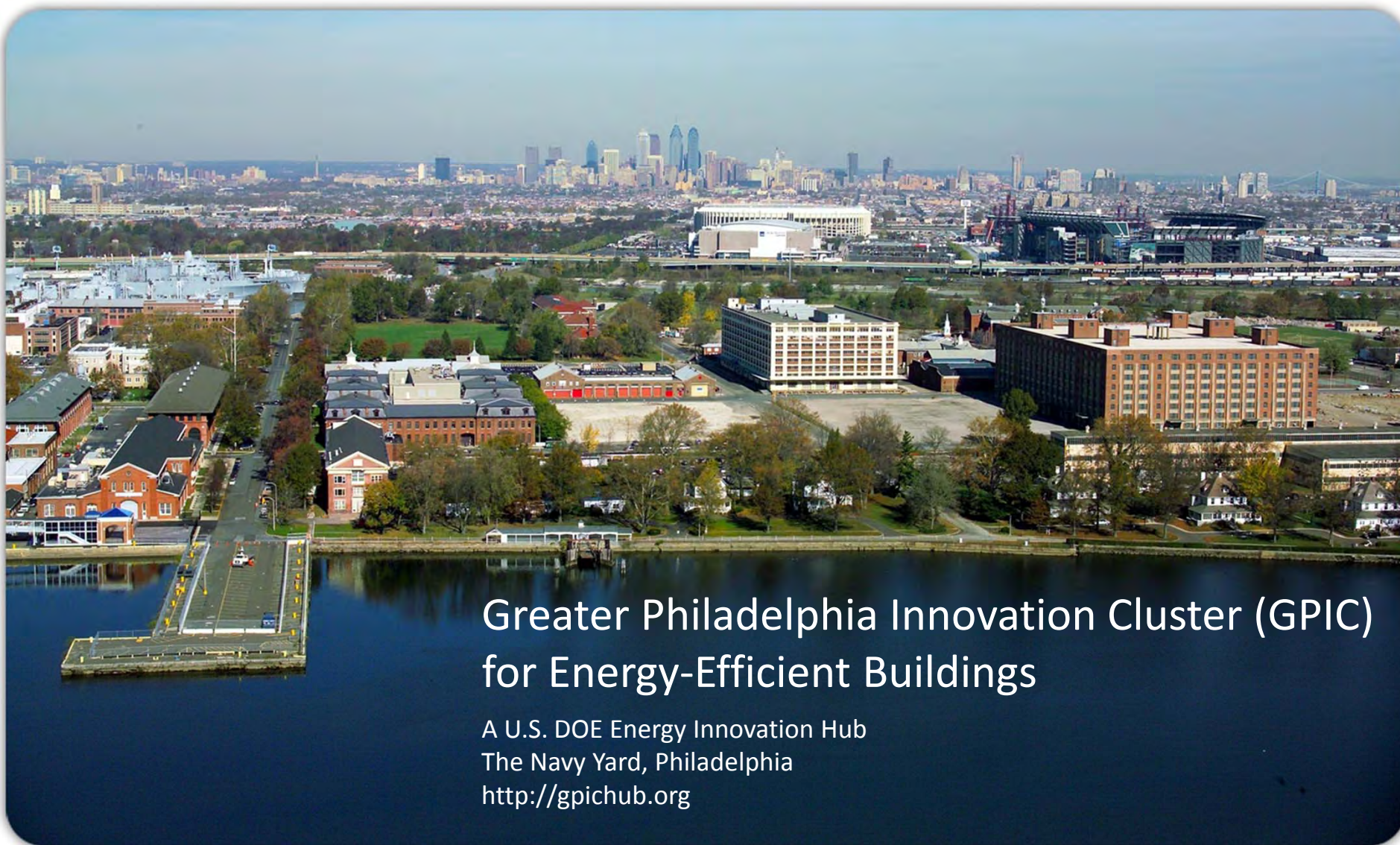




Greater Philadelphia Innovation Cluster  
for Energy-Efficient Buildings  
A U.S. DOE Energy Innovation Hub



## Greater Philadelphia Innovation Cluster (GPIC) for Energy-Efficient Buildings

A U.S. DOE Energy Innovation Hub  
The Navy Yard, Philadelphia  
<http://gpichub.org>

# Energy – Regional Innovation Cluster

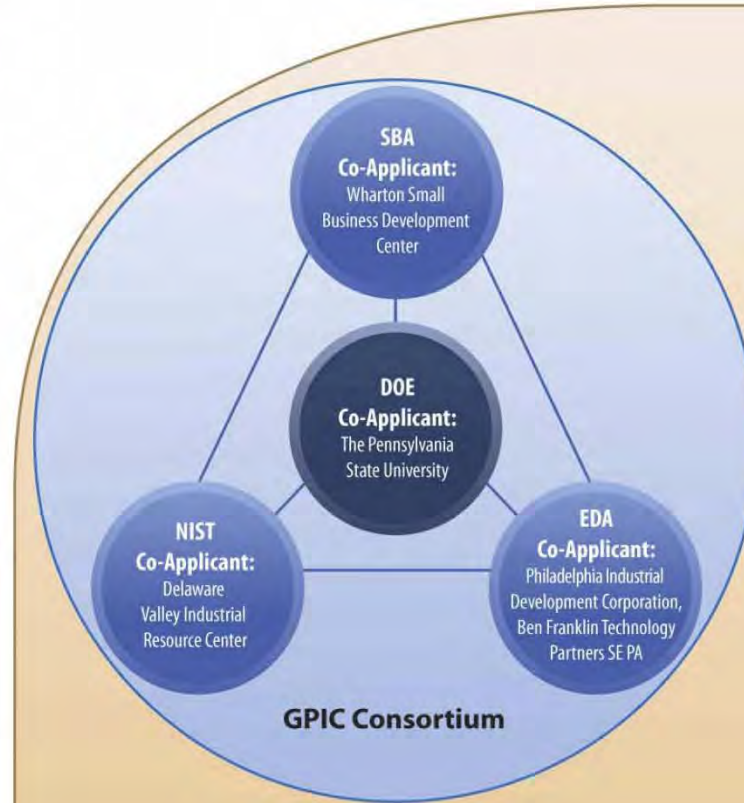


- The GPIC was awarded more than \$129 million from a federal multi-agency funding opportunity to support an Energy Regional Innovation Cluster (E-RIC)
- The Federal Agencies:
  - Department of Energy
  - Economic Development Administration
  - National institute of Standards and Technology
  - Small Business Administration
  - Department of Education
  - Department of Labor
  - National Science Foundation
- The GPIC Consortium:
  - The Pennsylvania State University
  - Philadelphia Industrial Development Corporation
  - Ben Franklin Technology Partners of Southeastern PA
  - Delaware Valley Industrial Resource Center
  - Wharton Small Business Development Center



## GPIC Members

The Pennsylvania State University (lead)  
 Bayer MaterialScience  
 Ben Franklin Technology Partners of SE PA  
 Carnegie Mellon University  
 Collegiate Consortium  
 Delaware Valley Industrial Resource Center  
 Drexel University  
 IBM Corporation  
 Lawrence Livermore National Laboratory  
 Lutron Electronics, Inc.  
 Morgan State University  
 New Jersey Institute of Technology  
 Philadelphia Industrial Development Corporation  
 PPG Industries  
 Princeton University  
 Purdue University  
 Rutgers University  
 Turner Construction  
 United Technologies Corporation  
 University of Pennsylvania  
 University of Pittsburgh  
 Virginia Tech  
 Wharton Small Business Development Center



## GPIC Stakeholder Groups

- Local STEM Community
- Apprenticeship Programs
- Secondary Schools
- Career and Technical Institutes
- One-Stop Career Centers
- Workforce Investment Boards
- Community Organizations
- Local and State Agencies
- Economic Development Agencies
- Philanthropic Foundations
- Venture Capitalists
- Banks and Financial Institutions
- Publicly and Privately Held Businesses
- Industry Associations
- Labor Organizations

## GPIC Partners

### Industry Partners

- Air Products and Chemicals
- ALSTOM Power
- Ametek
- Armstrong World Industries
- Boeing Company
- C.B. Richard Ellis
- CertainTeed Corporation
- Construction Specialties
- Deloitte Services LP
- Dow Chemical Company
- DuPont Building Innovations
- Flad Architects
- HOK
- Horton Lees Brogden Lighting Design
- Johns Manville
- Lafarge
- Lam Partners
- Larson Design Group
- Linc Lighting and Electrical
- Lockheed Martin
- PECO
- Pfizer Global Engineering
- PJM Interconnection
- Pittsburgh Corning
- Rose Companies
- Saint-Gobain
- Sauer, Inc
- Schneider Electric
- Siemens
- Thornton-Tomasetti Group
- URS Corporation
- Viridity Energy
- Weber Murphy Fox, Inc.

### Industry Associations

- AIA Philadelphia
- Alliance to Save Energy
- Center for Environmental Innovation in Roofing
- CEO Council of Growth
- Chamber of Commerce Southern New Jersey
- Cleantech Alliance Mid Atlantic
- Delaware Valley Green Building Council
- Greater Philadelphia Chamber of Commerce
- National Electrical Manufacturers Association
- New Jersey Technology Council
- Sustainable Business Network of Greater Philadelphia
- World Business Council for Sustainable Development
- World Trade Center of Greater Philadelphia

### Education and Workforce Partners

- Bucks County Workforce Investment Board
- Camden County Workforce Investment Board
- Chester County Workforce Investment Board
- Delaware County Workforce Investment Board
- Franklin Institute
- Garrison Institute
- Greater Philadelphia Regional Compact for STEM Education
- Liberty Science Center
- Montgomery County Workforce Investment Board
- Philadelphia County Workforce Investment Board

### Banking and Finance Partners

- Emerald Stage2 Ventures
- Minority Angel Investor Network
- Mid-Atlantic Angel Group

### Community and Economic Development Partners

- Economy League of Greater Philadelphia
- Citizens for Pennsylvania's Future
- Select Greater Philadelphia
- University City Science Center

### Government Partners

- Commonwealth of Pennsylvania
- Delaware Valley Regional Planning Commission
- City of Philadelphia
- Naval Surface Warfare Center Carderock Division
- New Jersey Economic Development Authority

### Labor organizations

- National Roofing Contractors Association
- Penn-Del-Jersey Chapter of NECA

### Philanthropic Foundations

- William Penn Foundations

### International Partners

- Lund University, Sweden
- Tsinghua University, China

# Goals and Mission



- **Strategic Market Focus:**
  - Full-spectrum retrofit of average-size commercial, institutional, and multi-family residential buildings
- **Transform building retrofit environment from serially fragmented method to integrated systems approach.**
- **Provide methods that can be implemented in the marketplace over the next 10 years to improve energy efficiency by 50 percent.**
- **Stimulate private investment and quality job creation in the Greater Philadelphia region and beyond.**



# Metrics

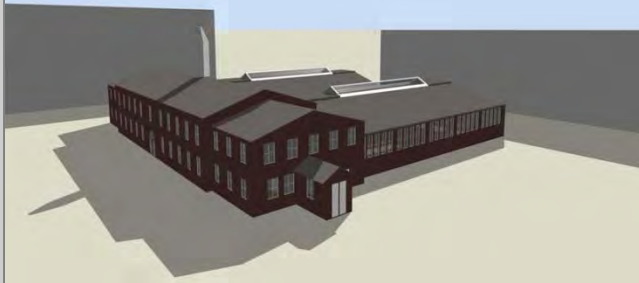
- **Energy Efficiency**
  - Annual energy savings per square foot
- **Scalability**
  - Installed cost of energy saving retrofit
- **Constraint**
  - Ensure good indoor environment
- **Regional Transformation**
  - Industry cluster development
- **Economic Development**
  - New jobs created or retained



# Commercial Building Retrofit Challenge



## Statistics on buildings located in the U.S. mid-Atlantic region



EIA/CBECS 2003 data

### Construction Date

47% built before 1960  
(25% before 1960 nationally)

### Building Use

25% Offices  
14% Education  
11% Warehouse  
8% Lodging

### Building Size

38% buildings < 50,000 sq ft  
54% buildings < 100,000 sq ft  
63% are between 1-3 floors

### Enclosures

67% brick, stone, stucco, concrete  
~50 % windows single glazed (<1960)  
34% built up roofs  
31% synthetic/rubber  
24% skylights/atrium

### Heating

48% boilers  
26% furnaces  
23% packaged heating  
10% district heat

### Cooling

52% packaged AC  
28% window AC  
21% 'residential' AC  
15% central chillers  
6% district chilled

### Lighting

~50% w/out electronic ballasts

### Renovations

36% no renovations since 1980  
58% no HVAC renovations  
58% no lighting renovations  
64% no window replacement  
76% no insulation upgrade

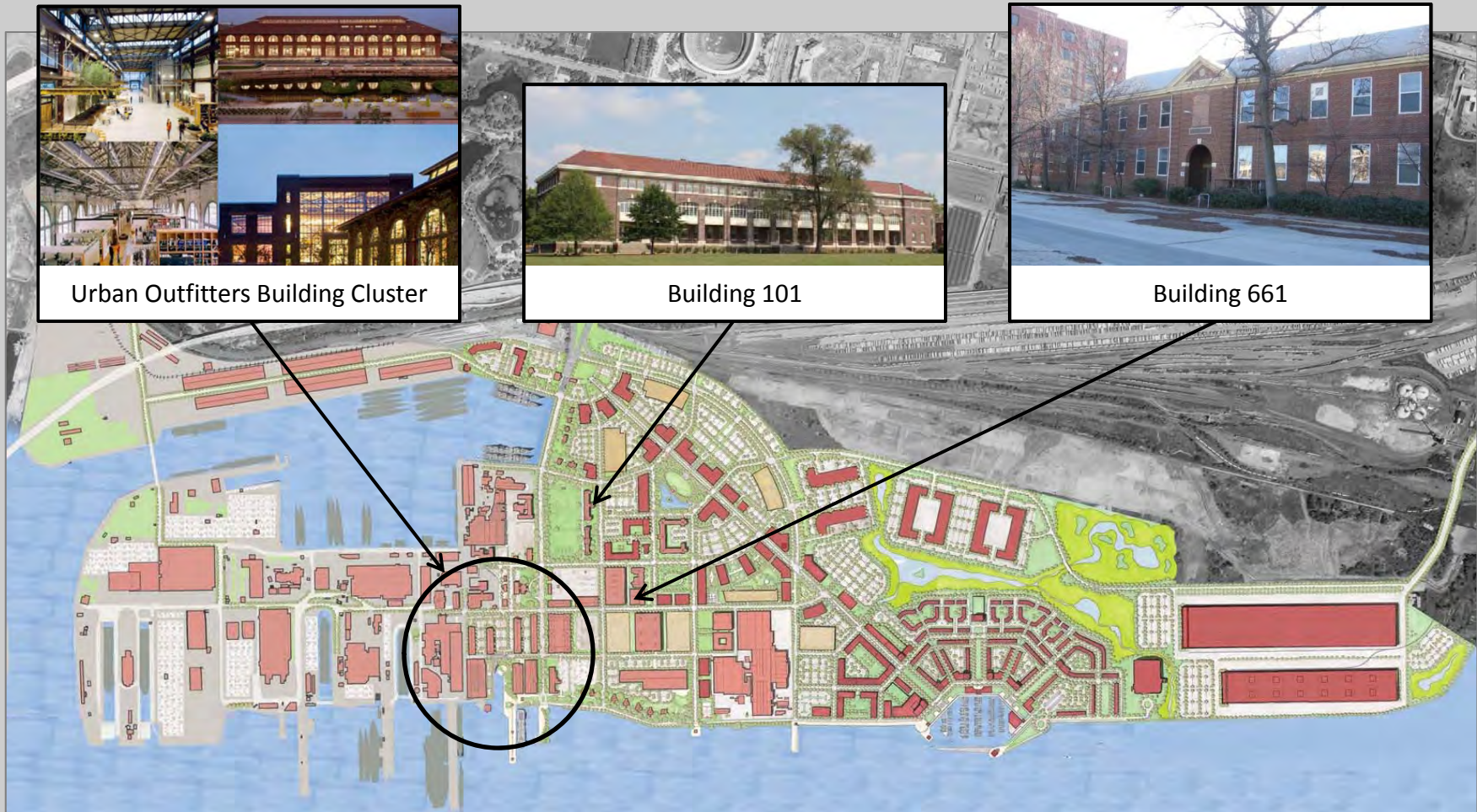


# The Navy Yard

- **\$30 million of new Commonwealth capital funding for GPIC facilities**
- **270 existing buildings and new buildings that can be utilized as test beds**
- **Independently owned utilities including electric distribution grid**
- **Five DOE research and education centers on site:**
  - DOE Mid-Atlantic Clean Energy Applications Center
  - DOE Northern Mid-Atlantic Solar Training Center
  - DOE GridStar Smart Grid Training Center
  - DOE Build America Residential Retrofit Center
  - GPIC for Energy Efficient Buildings
- **Zone 4A -5 climate that has four distinct seasons**



# Energy Retrofit Opportunities



# Building 661 Retrofit Project

- Full Spectrum Energy Efficient Retrofit
- Living laboratory to transform the industry's current fragmented serial process into system performance driven, integrated, parallel, team processes.



# Task Teams and Leaders



- **Design Tools**  
Task Leader: IBM
- **Integrated Technologies**  
Task Leader: United Technologies Corporation
- **Policy, Markets and Behavior**  
Task Leader: University of Pennsylvania
- **Education and Workforce**  
Task Leader: Princeton Plasma Physics Laboratory
- **Deployment and Commercialization**  
Task Leader: Ben Franklin Technology Partners of Southeastern Pennsylvania



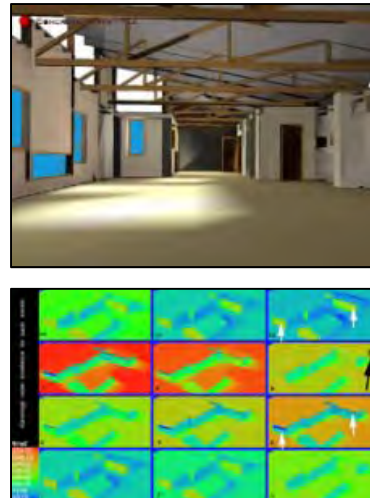
# Design Tools Task

- Define integrated process solutions for design, constructing and operating energy efficient buildings
- Develop a digital platform to enable rapid iterations of building simulation and control which leverages performance

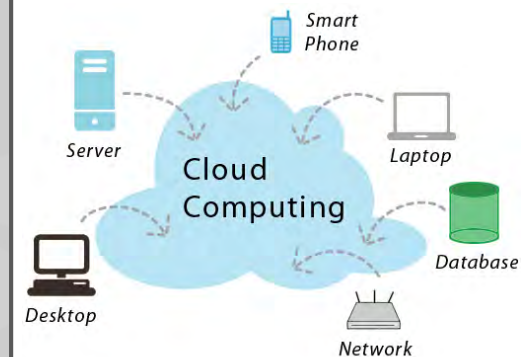
*An Integrated Process*



*Informed by Digital Tools*

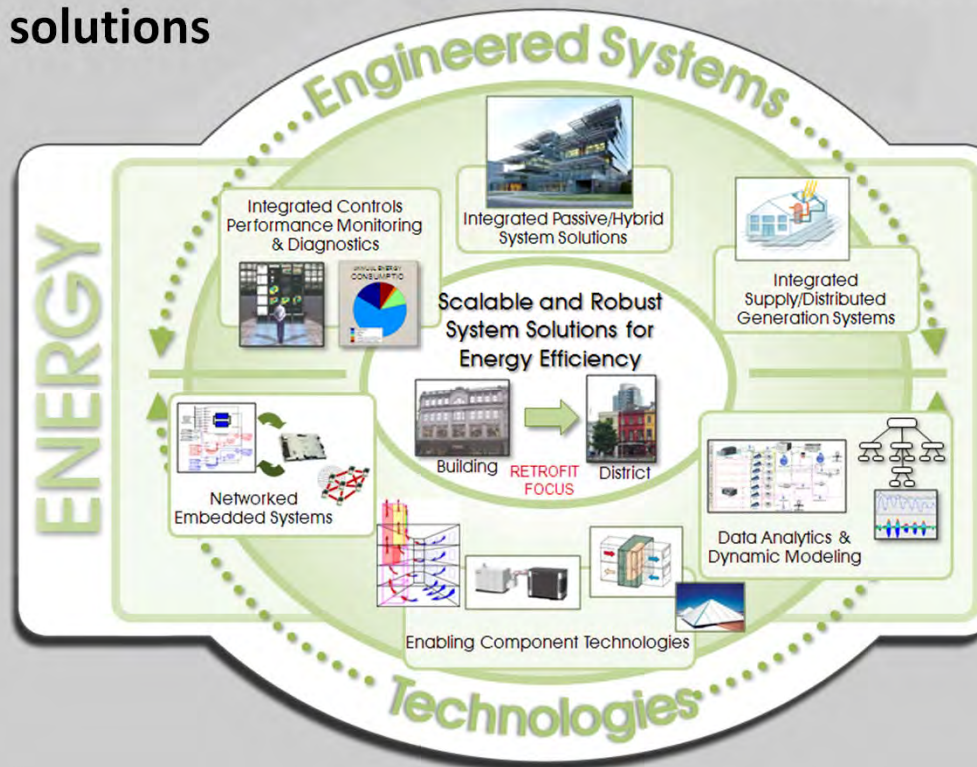


*Housed in 'The Cloud'*



# Integrated Technologies Task

- Develop scalable systems solutions for the full spectrum of building retrofits and the enabling component technologies
- Develop robust control and diagnostics implementation platforms realizing the system solutions



# Policy, Markets and Behavior Task

- Discover effective mix of incentives, mandates, and policies that can be flexibly deployed in cities and states to achieve energy efficiency in buildings
- Improve energy utilization efficiency of renovated buildings
- Measurably improve the human-centered quality of the built environment
- Elicit proactive occupant preferences and actions in dynamic building operations
- Blend science, engineering, behavioral studies, and fine arts to strengthen design quality



# Education and Workforce Task

- **Assure that the new, innovative energy efficiency technologies and systems created by the GPIC are supported by a robust human capital infrastructure.**
  - Establish GPIC education and workforce development advisory board
  - Inventory of regional EEB education and workforce development programs
  - Emphasis on associate degree level technician training
  - Outreach to secondary schools and underrepresented groups
  - 2+2+2 education and career pathways
  - Possible program development areas:
    - Solar energy systems
    - Smart grid management
    - Energy storage
    - Integrated design management
    - Building energy efficiency auditing



# Deployment & Commercialization Task



- **Outreach and engagement of the building industry**
- **Workshops for industry and others on energy efficiency for buildings**
- **Assessment and marketing of energy efficient building technologies**
- **New business models for integrated retrofit projects**
- **Manages proposal process for GPIC Opportunity Research Fund**
- **Unique Intellectual Property (IP) Management Agreements:**
  - Protects members exclusive and sole IP equal ownership rights
  - Allows open sharing of unprotected discoveries and proprietary information
  - Enables Ben Franklin Technology Partners marketing of undeveloped GPIC inventions



# Partnership Challenges



- **Competing program goals-** GPIC's different goals are not always compatible, requiring an approach that pursues activities for multiple accomplishments
- **Organizing competitors for collaboration-** Managing competition both among GPIC membership and from outside groups that we want to engage
- **Managing organizational change-** Catalyzing change while also preserving the existing, creative diversity in the building industry
- **Budgeting and accounting issues**
- **Disparity in team member capabilities-** The team ranges widely from global industrial firms with \$60 million in annual sales to small, regional economic development agencies
- **The role of politics-** Includes members jockeying for influence, interagency rivalry among the sponsoring agencies, bureaucratic politics within the major sponsor, intergovernmental politics involving state, local and federal government, and even partisan politics
- **Intellectual property management-** Different industries also approach IP differently, with some viewing IP protection as a vehicle for new-product and market development and others using patents as a tool to ward off competition.



# Opportunities and Implications



- **Job creation in energy efficiency fields such as auditing, installation, integrated design team leadership, building system operators and more**
- **Transformation of building industry and emergence of new industry**
- **Buildings in region have opportunity to serve as demonstration project or benefit from GPIC models**
- **Business grow through Request for Proposals, Opportunity Research Fund and demonstration opportunities**
- **Reduced energy bills means financial savings, cleaner air, less carbon output**
- **Further establishment of Philadelphia and Navy Yard as sustainability center**
- **Network and education through GPIC workshops, seminars, and other events**

*Click "Get Involved" at <http://gpichub.org>*



# Thank You



## Follow the GPIC Hub:



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[info@gpichub.org](mailto:info@gpichub.org)

The screenshot shows the GPIC HUB website homepage. At the top, there is a navigation menu with links for Home, About Us, HUBlog, Research & Development, Education & Workforce, Technology Transfer, Facilities, and Get Involved. A search bar is located in the top right corner. Below the navigation menu, there is a large banner image of a person wearing a hard hat and looking at a computer monitor displaying a 3D architectural model of a building. To the right of the banner, there is a section titled "Design Tools Team" with a brief description and a "Learn More..." link. Below the banner, there is a "Share" section with social media icons for Facebook, Twitter, LinkedIn, and HUBlog. The main content area features a headline: "Greater Philadelphia Innovation Cluster (GPIC) for Energy-Efficient Buildings, a U.S. DOE Energy Innovation Hub led by Penn State University." Below the headline is a paragraph describing the GPIC's goals and focus. There are three columns of content below the main text: "Follow the GPIC Hubs" with social media icons, "Press Releases" with a list of recent news items, and "Upcoming Events" with a list of future events. On the right side, there is a "HUBlog - The Official Blog of the GPIC" section with a link to "Presentations are available from the April GPIC Members and Partners Meeting".

