New Jersey Institute of Technology
Center for Building Knowledge

GPIC R&D Scan Summary Report

(Subtask 4.4.2)

10 February 2012

Project Summary

The New Jersey Institute of Technology's Center for Building Knowledge ("NJIT CBK") has developed a web-accessible database documenting research and development (R&D) activities throughout North America focused on improving the energy performance of existing buildings in support of Greater Philadelphia Innovation Cluster (GPIC) efforts. The database serves to identify and organize the breadth of research activities with applicability to GPIC initiatives from three broad categories: academia; government; and private industry. The database provides GPIC members, partners, and the public-at-large with access to relevant, current research projects (typically within the last five years).

Bibliographic citations for a sample of several hundred research efforts were developed detailing technologies and systems relevant to retrofit existing commercial or multi-family residential buildings under 100,000 square feet. Each of these have been organized in a fashion so as to facilitate a quick review of relevant research efforts pertaining to the vast number of components incorporated in our building stock. That said it is but the start of what could be the basis of an ongoing effort which would allow researchers to communicate their efforts, facilitate collaboration, and advance knowledge about the built environment. As such, the database could be a useful tool to help guide the R&D undertaken by the GPIC HUB, ensuring that this R&D complements and extends existing research and development activities. It is anticipated that, the site will ultimately be hosted on GPIC HUB server space (http://gpichub.org/) and be integral to the allied efforts of the Knowledge Platform. The Knowledge Platform (AKA The Repository) being the name given to the efforts of the University of Pennsylvania's Institute of Urban Studies, which is intended to focus on policy research, and as such shall serve to complement CBK's scan of technology research.

The project has created an easily-administered website that addresses a variety of GPIC's audiences using varying degrees of privileges in order to allow for the ongoing maintenance and growth of the database content with minimal administration. GPIC Members will be permitted to edit and add citations; GPIC Partners will be permitted to add citations; and the public will be permitted to search and view citations. Non-technical staff will be able to easily update and maintain the features and content delivered by the site. Another key site feature is an advanced search function that allows users to select search criteria from menus of multiple areas including research category, type, source, availability and keywords. Similar to a retail website, this search method allows users to narrow or expand their search results as desired. The search feature relies largely on a taxonomy and list of keywords developed by CBK to classify data and ensure its integrity as multiple users enter citations.

CBK has captured hundreds of resources in the database that represent a vast cross section of current R&D activities. Additional opportunities to expand the database include developing a survey instrument to interview thought leaders identified amongst universities, national labs, and industry; developing an editorial summary of each category to identify current and emerging trends and leaders; and integrating the database citations with a web-interface case study of Building 661. Additionally, the website was designed so as to readily allow the following functions to be introduced at a future date: social networking, video posting, streaming, podcasting, comments & ranking, tagging & bookmarking, and blogs. The site can be accessed at the following url:

http://www.episolve.com/clients/gpic/

The following pages provide a quick overview of the key features of the database and site.

NJIT THE CENTER FOR BUILDING KNOWLEDGE
generating new knowledge to improve the built environment and enhance quality of life   GPICHUB

1

1. *Levels of Access*

The Home Page of the development website, located at http://www.episolve.com/clients/gpic-dev/, will welcome visitors and invite both Members and Partners to register so as to add and/or edit the site. Dependent upon their status,   the visitor will be directed to a unique website that will follow separate navigational paths in which administration rights are granted accordingly:

- GPIC Members will be permitted to add new citations as well as search, view, and edit existing ones;
- GPIC Partners will be permitted to search, view and add citations, and finally
- the public will be able to search and view existing citations.

2. *Searching the Database (for Members, Partners and the public)*

The project developed an organizational taxonomy for the information in the database beginning with the following 7 broad groupings:

- Building Envelope
- Lighting
- HVAC
- Plumbing
- Electrical
- Furniture, Fixtures and Equipment (FF&E)
- Transportation Systems

These groupings were then broken down into more discrete categories and paired with other attributes to create a database that is sufficiently granular to allow targeted searches while also being straightforward and easy to navigate.

Category	Classification	Availability	Source
Cooling Daylight Integration Demand Management Elevators/Escalators Energy Management Equipment Exterior Lighting Fire Protection Fixtures Foundations Furniture General Heating Interior Lighting Power Generation Renewable Technologies Roofs Sewage & Stormwater Systems Ventilation Walls Water Supply & Distribution Windows & Doors	Product Literature Research Report Text Web Resource	Commercially Available Technology Emerging Technology	(Sources are too numerous to list here, comprised of all academic institutions, national labs and industry sources surveyed.)

Finally, a list of keywords was developed to facilitate even more granular searches.

Keyword		
Absorption	Evacuated Glazing	Plug Loads
Absorptive Refrigeration	Evaporative Cooling	Policy Change Material (PCM)
Accent Lighting	Façade	Policy
Accreditation	Facility Managers	Radiant Heating
Affordability	Fan	Rainscreen
Air Barrier	Fault Detection	Rainwater Harvesting
Air Handler	Finishes	Rapidly Renewable Materials
Air-Cooled Heat Exchanger	Fluorescent	Reflectivity
Air-Flow Windows	Gas Fill	Remediation
Appliances	Geothermal	Research Review
Assessment	Glare Control	Roof Top Unit (RTU)
Automation	Glazing	Sensors
Ballast	Green Roof	Shading
Behavior	Greenhouse Gas (GHG)	Sick Building Syndrome (SBS)
Benchmarking	Ground Source Heat Pump	Simulation
Biowall	Heat Pump	Smart Grid
Budget	Heat Recovery	Smart Meters
Building Energy Maintenance Management System (BEMS); Energy Information Systems (EIS)	High Albedo	Solar
	High-Intensity Discharge (HID)	Solar Gain
Building Information Modeling (BIM)	Hot Water	Solid State Lighting (SSL)
Building Operators	Humidity Control	Sound Absorption
Building Paper	Hygrothermal	Switchable Glazing
Chiller	Ice Storage	Tankless Water Heater
Cladding	Incandescent	Thermal Energy
CO2 Emissions	Incentive	Thermal Resistance (R-Value)
Codes and Standards	Indoor Air Quality (IAQ)	Thermal Transmittance (U-Value)
Combined Heat and Power (CHP)	Infiltration	Thermochromic
Commissioning	Infrared-Reflecting (IR) Coating	Thermoelectric
Component Technology	Insulation	Thermostats
Constant Volume	Life Cycle	Transparent Conducting Oxide (TCO) Films
Control Systems	Light-Emitting Diode (LED)	Triple-Glazed
Cool Roof	Load Shedding	Troubleshooting
Cooling Panels	Low Emissivity	Vacuum Glazing
Crawlspace	Market-Based	Vapor Permeability
Curtain Wall	Metal Halide	Variable Air Volume (VAV)
Design Guide	Metering	Volatile Organic Compound (VOC)
Details	Microgrid	Window Coating
Diagnostics	Microturbine	Window Frame
Drainage System	Moisture	Wireless
Dual-Glazed	Moisture Barrier	Zero Energy
Ducts	Monitoring	
Dynamic Glazing	Motor	
Education/Training	Natural Gas	
Electrochromic	Night Flushing	
Embodied Energy	Occupants	
Energy Auditing	Off Peak	
Energy Forecasting	Operations and Maintenance (O&M)	
Energy Recovery	Organic Light-Emitting Diode (OLED)	
Energy Storage	Passive System	
	Phase Photovoltaics (PV)	

A conventional search box can be found site-wide in which users can enter a keyword which the search engine will look for within the description of each citation. A thorough and easy-to-use advanced search feature allows users to select from a series of drop down menus with the options noted below. Users can highlight multiple choices from each category by holding down CTRL as they click. Users can select as few or as many choices as they like, thus narrowing or broadening their search results Search results will update automatically with each selection.

NJIT THE CENTER FOR BUILDING KNOWLEDGE
generating new knowledge to improve the built environment and enhance quality of life

5

3. *Editing an Existing Citation (for Members and Partners)*

Select the citation you would like to change and click the 'Edit' tab. A form will opened in which you can edit the name, URL, description, classification, availability, and date, as well as change or select additional category assignments, sources, authors, and keywords. You may also change or add an image to the entry.

4. *Adding a New Citation (for Members Only)*

To add a new citation, first ensure that it is not already in the database by clicking on "Find Content" then filter by type → Product. Alphabetize the list by clicking on "Title" and look for the reference in the list. If the resource is not there, members may add additional citations using the following procedure:

    i.   *Add New Author(s)*

        Determine if the author of the citation you would like to add is already in the database by clicking on "Find Content" then filter by type → Author. Alphabetize the list by clicking on "Title" and look for the author's name in the list. If the author is not there, click on "Add Content," then "Author" and complete the fields in the form.

    ii.   *Add New Source(s)*

        Determine if the source of the citation you would like to add is already in the database by clicking on "Find Content" then filter by type → Source. Alphabetize the list by clicking on "Title" and look for the source in the list. If the source is not there, click on "Add Content," then "Source" and complete the fields in the form.

    iii.   *Add New Citation*

        Click on "Add Content," then "Product" and complete the fields in the form. You may select multiple items in the "Category," "Source," "Author," and "Keyword" menus by holding CTRL as you click.

    iv.   *Add New Keyword*

        Click on "Structure", then "Taxanomy" and choose "add terms" under the "Project Keywords" option. Current keywords are chosen according to the frequency of reoccurrence of a term in the scanned literature. Other criteria can be applied for choosing the keywords.

Potential Future Developments

The project has the potential for future improvements that will introduce new data analysis tools and geographical mapping options.

i.   *Data Analysis Tools*

The project can function as a comprehensive source of data which allows users to build relations among categories, keywords, researchers, institutions and geographical locations of citations. In the future, new data analysis tools can be added to the engine, which will build reports about the frequency of occurrence of each keywords, relations between these occurrences and (sub)categories, relational patterns between the citations and geographical locations, change in research topics through time, etc. Introduction of these new data analysis tools might also require new protocols to standardize and validate the data, which will contribute to the utility and the effectiveness of the project.

ii.   *Geographical Mapping Options*

Once new data analysis tools are integrated and data have been standardized, Geographical Information System (GIS) tools can be added to the engine, enabling users to visualize these analyses through actual maps. For example GIS tools can help users see how research interests are distributed geographically, identify clusters of similar research interests in certain regions or see how R&D has evolved through time in particular regions. Visualizing R&D through maps can be useful at the decision making level by showing current trends and future possibilities for the allocation of resources.

iii.   *Alternate Method of Navigation*

A potential way to enhance the site – and tie it more closely to the GPIC "brand" – might be to use an image of Building 661 for navigation/orientation. An example of this concept is outlined in the following images. It uses a roll-over function linked to the seven taxonomy categories for the database as the core navigational element.
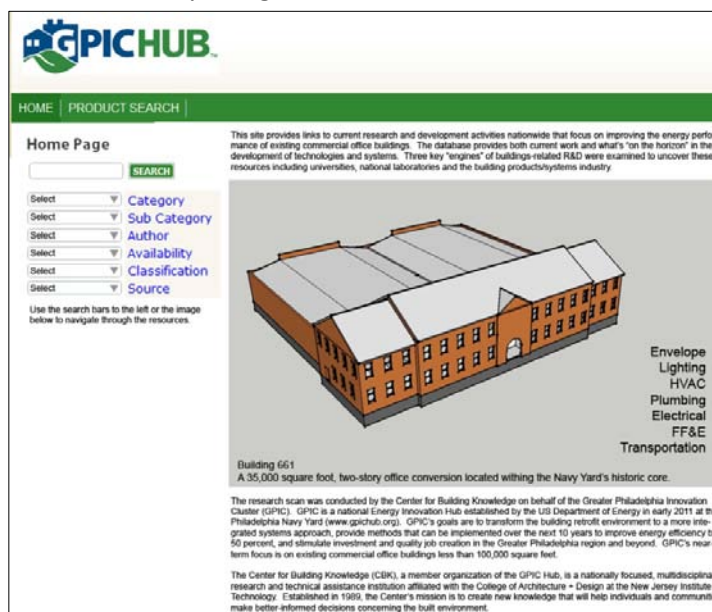
For example, rolling over the Envelope category reveals the core "envelope" components – foundation, walls and roof – in Building 661 and would provide a gross order link to R&D studies in the database that focus on envelope issues.
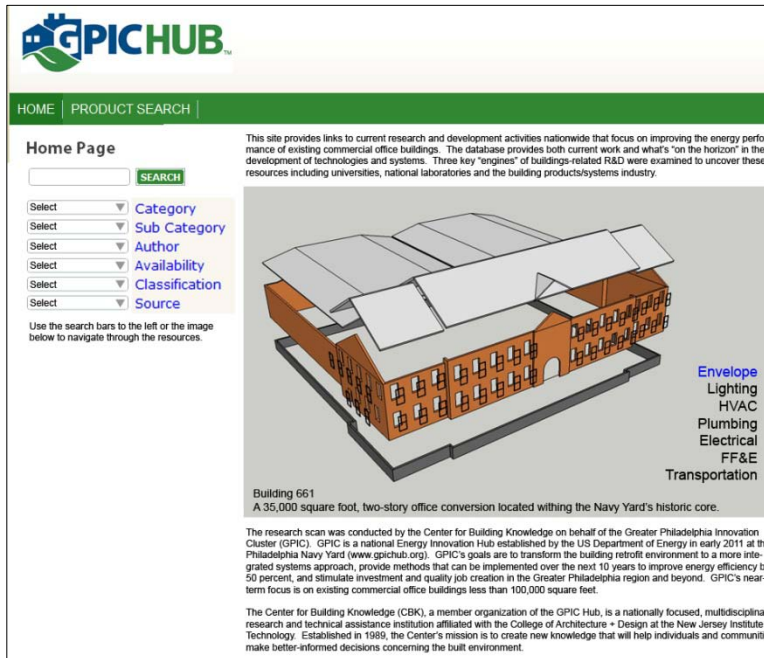
Delving deeper into Envelope would reveal additional subcategories, in this case Windows.
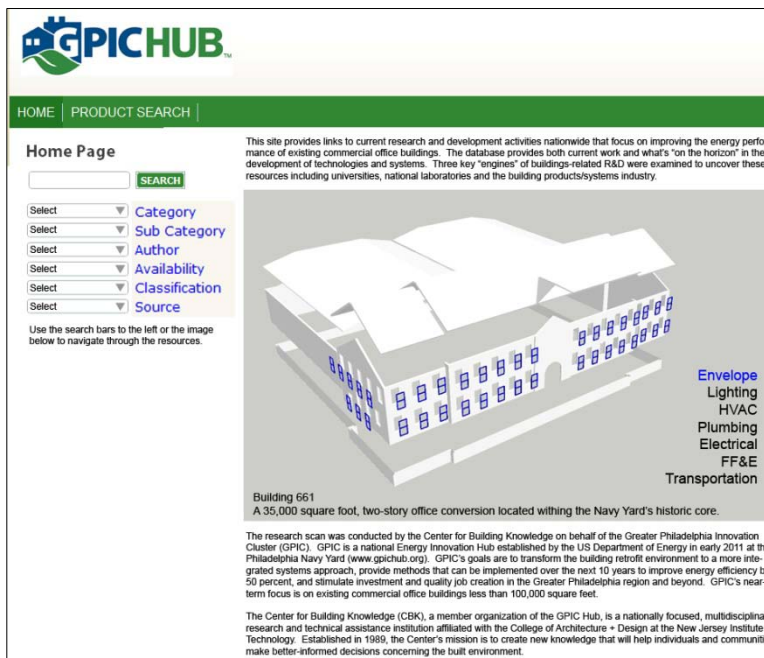
Further investigation would lead to specific subcategories of windows such as "glazing" and, in this case, "electrochromic glass."
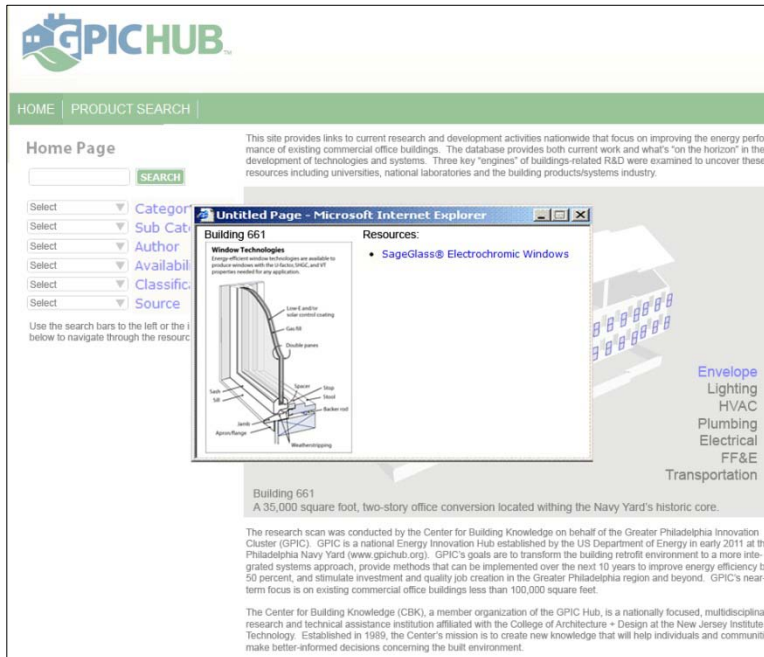
If this interface were eventually developed for the R&D database, it could also be for other GPIC resources – such as the overall GPIC data repository and/or a database of technologies used in Building 661 – as these resources come on line.

THE CENTER FOR BUILDING KNOWLEDGE
generating new knowledge to improve the built environment and enhance quality of life