



Navy Yard Building 101 Test Bed for Assessing Technologies and Tools

Building 101 in the Navy Yard is the temporary headquarters of the U.S. Department of Energy's Energy Efficient Building Hub. The building, owned by the Philadelphia Industrial Development Corporation (PIDC), has become one of the nation's most highly instrumented commercial buildings.

Acquired data is continuously stored and is made available to Hub researchers and other building energy efficiency researchers for development, validation and calibration modeling and simulation tools, and for assessment of the impact of building energy technologies and systems on energy use. The detailed building performance database is being utilized by the EEB Hub as it seeks to catalyze the building industry in the Philadelphia region to become a systems solutions provider of energy efficient buildings as a matter of standard practice. Influencing the regional building industry in this way will help the Hub achieve its goal of reducing energy use in the U.S. commercial buildings sector by 20 percent by 2020 while measurably improving indoor environments.

Data calibrated inverse models, often used to establish potential retrofit strategies for a building, as well as forward models, preferred for new construction design, are included in the data-based continuous improvement loop. The effort is coordinated with National Renewable Energy Laboratory researchers who are establishing an open platform environment and user-friendly GUI interfaces for a suite of predictive forward models which aim to predict load demand, energy utilization, indoor environment conditions, and lighting levels.

Data points

The measurement and verification plan details the measured data to be collected at Building 101 to establish an energy, comfort, and indoor air quality (IAQ) baseline. This baseline will be used to calibrate and verify detailed simulation models of the building systems as well as to quantify the impact of any improvements. The points have been selected to:

- Quantify the major electricity and natural gas uses in the overall building
- Quantify the delivered heating and cooling capacity delivered by the HVAC equipment to understand the building loads and equipment efficiencies
- Quantify local weather conditions near the building
- Quantify the ventilation flow rates provided to the building, as well as the heating and cooling loads and IAQ issues associated with them
- Quantify the overall air leakage rates for the building, as well as the air flows and leakage rates induced by mechanical systems and natural forces
- Quantify the IAQ of the building by measuring contaminants and potential hazards entering the building, including temperature, relative humidity, CO, CO₂, particulates, and TVOCs

In addition, data points and measurements will be made to gain a comprehensive understanding of one zone in the building, the EEB Hub office suite on the north end of the second floor. Sufficient data are being collected to complete an airflow, energy balance, and IAQ parameters of the space. The specific

measurements are being selected to:

- Quantify the air flows, operating conditions, heating and cooling inputs supplied by the VAV boxes
- Quantify the return airflows from the space and the pressure-induced air flows between this zone and other neighboring spaces, as well as outdoors
- Quantify conduction losses across interior and exterior surfaces, as well as solar gains into the space
- Quantify internal gains in the space from plug loads and lighting
- Quantify occupancy levels with automated real time measurements
- Measure temperature stratification, as well as IAQ parameters and environmental conditions at multiple locations in the space

Building 101 is currently streaming over 1500 data points every 60 seconds. This information is made available to Hub staff, and will soon be displayed in a dashboard on a monitor in Building 101 and available to researchers via the EEB Hub website.

Impact

The Building 101 instrumentation project is determining a baseline for energy use in the building. This will allow the building to ultimately become a test bed, by which a company could install a new building system to measure its effect while holding constant for occupancy, weather and other factors. The ability to establish the precise impact of a new or emerging building system will be an excellent resource to the regional marketplace.