

EI&BD CORE COMPETENCY:

System Integration

The Electricity Infrastructure and Buildings Division (EI&BD) at Pacific Northwest National Laboratory (PNNL) accelerates the transition to a sustainable, efficient, resilient, and secure energy system through innovation and actionable solutions. To achieve success, the division applies a distinctive set of core competencies to its work.

EI&BD's **System Integration core competency** is based on a foundation in energy and water systems engineering, provides an unparalleled understanding and articulation of complex coupled energy systems, and helps incorporate new technologies and operational approaches that drive decarbonization, resilience, and innovation.

This competency leverages the relationship of individual elements to the multi-dimensional challenges of creating integrated and operable energy systems, and helps address obstacles to

- building system operations;
- integration of complex distributed systems;
- connection of buildings, energy storage, and electric vehicles to the grid; and
- planning alternative grids for sites and communities.

System Integration capability areas include:

Grid Architecture: EI&BD brings together methodologies from system engineering, control systems, and networks theory that are applied to represent, understand, and propose changes to the electric power system. This capability takes a multi-system view, including electrical structure, communications, controls, economics, and operations, to help manage the complexity of evolving the electric power system. Through grid architecture

modeling EI&BD can work with stakeholders, such as utilities and regulators, and provide them unique insights about structural changes in the grid and related systems.

Utility and Site Planning: The division provides distribution system planning tools and resources for utilities and regulators, and is known for characterizing the value of energy storage, distributed energy resources, and electrical vehicles to the grid, as well as understanding the important policy and regulatory issues associated with



The System Integration core competency leverages expertise to understand and solve challenges, such as distributed system integration and connection of buildings, energy storage, and electric vehicles to the grid.

different types of resources at the state and federal levels. This capability leverages diverse expertise in building performance evaluation, modeling, controls optimization, advanced analytics, economic analysis, distributed energy and water systems, risk assessment, and project execution planning in an integrated fashion.

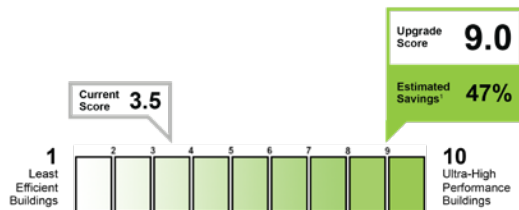
System Performance Evaluation: Recognizing that buildings, campuses, and the grid are systems of different scales with numerous external and internal interactions, EI&BD capabilities enable development, testing, and



BUILDING INFORMATION
Example Building - Mixed Use
 123 Example Street
 Chicago, IL 60606

Building Type: **Mixed Use**
 Gross Floor Area: **40,000 ft²**
 Year Built: **1980**

Score Date: **04/21/2020**
 Building ID #: **XXXXX**



Building Use Types	Estimated Source Energy Use (kBtu/ft ²)	Energy Use Intensity by Fuel Type
Office: 32,000 ft ²	Current Building 191	Site Energy Use (kBtu/ft ²) Source Energy Use (kBtu/ft ²) Fuel Type [Site EU, Source EU] Gas [15.7, 16.5] Electricity [55.6, 174.6] District Hot Water [0.0, 0.0] District Steam [0.0, 0.0] Propane [0.0, 0.0] Fuel Oil [0.0, 0.0] District Cooling [0.0, 0.0]
Retail: 8,000 ft ²	Upgraded Building 102	

This report includes a Score for the entire building as well as individual Scores for each of the separate use types.

The Building Energy Asset Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's Structure and Systems are individually evaluated and ranked. The Upgrade Opportunities page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

* Savings reflect the reduction in source energy that would result from undertaking all of the user-selected energy efficiency measures identified on the Upgrade Opportunities page. Actual savings will depend on a variety of factors including actual operating conditions.

This report is based on self-reported building information. <http://energy.gov/ee/bldgs/building-energy-asset-score>



The Building Energy Asset Score is used nationwide and provides building owners with pertinent efficiency information and recommendations. The tool is one of several innovations derived from System Performance Evaluation capabilities.

demonstration of advanced methods for evaluating and valuing system performance and identifying opportunities for improvement. Researchers develop and apply platforms and tools to help answer questions about the performance of hydropower, energy storage, energy and water planning at site and city scales, and more. The division's capabilities often produce new methodologies and tools, such as electric vehicle hosting capacity assessment, energy asset scoring for commercial buildings and homes, and site resilience assessment.

EI&BD STAFF AND PARTNERSHIPS

EI&BD's staff members offer expertise in electrical, mechanical, and systems engineering, data and computer sciences, cybersecurity, policy, economics, and other energy- and water-related areas. Staff represent the division's greatest resource and strength and are widely recognized internally and externally for their expertise and commitment to excellence. EI&BD also values its partnership with the Department of Energy and other federal agencies and collaborative relationships with a wide range of major companies, vendors, institutes, academia, and technical societies.

ABOUT PNNL

PNNL is a Department of Energy Office of Science laboratory located in Richland, Washington, with an enduring mission to transform the world through courageous discovery and innovation. Our science and technology inspires and enables the world to live prosperously, safely, and securely.

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