

EI&BD CORE COMPETENCY:

Modeling and Tools

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 **Modeling and Tools core competency** offers a set of independent and integrated grid and building modeling methodologies, tools, and advanced analytics capabilities. These resources help derive unique insights from models through simulation and analysis across a range of timescales.

The competency leverages PNNL's distinctive physical infrastructure and systems, including the Electricity Infrastructure Operations Center, high-performance computing resources, the Power Electronics Laboratory, and the 5G/Internet of Things Laboratory for hardware-in-the-loop testing and the exploration of emergent technology applications.

Modeling and Tools capability areas include:

Electrical Power Grid: EI&BD's capabilities provide state-of-the-art modeling and analysis to address a range of challenges, including complex, multi-resource renewable integration and extreme weather events. EI&BD incorporates emergent technologies, such as high-performance computing, power electronics simulation, wide-area oscillation assessment, and transactive control and demand response. Research staff deliver technical and economic analysis to support clean energy integration with

a rapid technological evolution, including renewable energy resources, energy storage, microgrids, and electric vehicles.

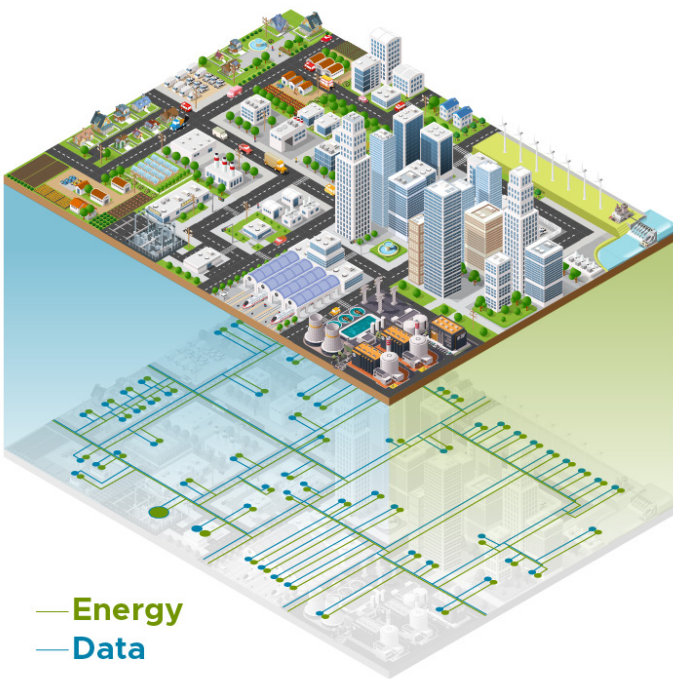
Buildings: EI&BD offers premier modeling, analysis, and tool development capabilities that are grounded in a deep understanding of building technologies and systems, as well as building models, market barriers, and policies. These capabilities include development and maintenance of widely referenced prototype commercial and residential building models by state



The Electricity Infrastructure Operations Center at PNNL is one of several key facilities that underpins the Modeling and Tools core competency.

and climate zones, representing new construction in the United States. EI&BD also provides large-scale parametric building energy modeling and applies a wide range of metrics to quantify the impacts of national and state building codes, standards, and technology adoptions. The division's development of industry standards and software improves modeling quality, workflow automation, and facilitates use by the design community for integrated high-performance buildings.

Buildings-Grid Integration: EI&BD has developed tools and analysis for building-to-grid interactions that realize information exchanges on demand,



EI&BD's modeling and simulation capabilities have been critical to a number of projects, including a 2018 large-scale study that explored transactive energy concepts. A team of engineers, economists, and programmers designed and executed the project, which delivered a seminal five-volume report, *The Distribution System Operator with Transactive study*.

supply, and control strategies between the two domains. EI&BD's large-scale, high-fidelity, and highly detailed simulation modeling enables independent and integrated grid and building simulation across timescales with increasing complexity of the grid and buildings. This capability includes co-simulation of interdependencies among multiple domains for integrated assessment modeling that ranges from individual buildings to substation, region, and national levels. EI&BD also conducts urban-scale building stock modeling.

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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