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PNNL-32297

HIPPO – A Software Platform for Electricity Market Research and Development

CRADA 485 (PNNL 75956/77056)

November 2021

Feng Pan

Midcontinent Independent System Operator, Inc. (MISO)

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99354

Abstract

The goal of this project is to provide Regional transmission organizations (RTOs) and independent system operators (ISOs) a market design and prototyping software, High-Performance Power-Grid Optimization (HIPPO), that they can evaluate electricity market design options, calculate market planning strategies and operational performance. With the high standards and strict reliability requirements for operating power systems, impacts of new technologies need to be fully investigated prior to any consideration for adoption. A market design and prototyping software tool which can be used to prototype electricity market design options, to calculate market planning strategies and operational performance with high precision, and to investigate the impacts for integrating future power grid technologies will be valuable to RTOs/ISOs who operate power systems, to vendors like GE and ABB who provide the market solvers, and to market participants and researchers who are actively doing market research. HIPPO is a such tool that can be used to improve the current market operations and provide capabilities for rigorous forward-looking design and prototyping of next-generation energy markets.

HIPPO has a high-resolution model for the day-ahead SCUC, which was validated with MISO and GE-Grid Solutions. HIPPO is built with parallel and distributed computing capabilities and can be executed in both multi-thread and high-performance computing (HPC) settings. This capability provides fast solution speed necessary to handle the larger and more complex SCUC problems of real-world cases and the potentially growing size and complexity of future scenarios. In addition, HIPPO has a concurrent optimizer (CO) which manages multiple algorithm executions simultaneously and leverages the advantages from different algorithms. This structure provides flexibility to better benchmark competing approaches. Highly accurate market model, fast solution technologies and flexible model and algorithm control are the features which will make HIPPO an extensible platform for developing and testing multiple approaches to meet a wide range of future market needs.

Pacific Northwest National Laboratory

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99354
1-888-375-PNNL (7665)

www.pnnl.gov