



Unit commitment and economic dispatch optimization on a full range of complex assets and transactions

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Energy Planning & Trading

Portfolio Optimization

# Portfolio Optimization

## Overview

Hitachi Energy Portfolio Optimization on the e7 platform optimizes a portfolio's operation by modeling detailed unit operating constraints and market conditions to:

- Provide a generation schedule for energy and ancillary services and fuel nominations
- Support the evaluation and pricing of potential short-term transactions
- Facilitate the analysis and simulation of deterministic scenarios

It provides comprehensive modeling and excellent optimization capabilities, which enable generating companies to schedule resources, meet a wide range of operating and business constraints, minimize operating costs, and/or maximize profitability.

Portfolio Optimization globally optimizes thermal units, combined cycle units, combined heat and power stations, independent and pump storage hydro units, cascaded hydro systems, and renewables in a single solution. Portfolio Optimization also optimizes a combined portfolio of supply resources (traditional generation) and demand response/ distributed generation assets modeled as virtual power plants (VPPs).

A comprehensive fuel and pipeline model is provided, including multi-fuel units and volumetric/flow limitations. The solution also includes a robust transaction model that embraces energy, reserves, emission allowances, and fuel products, and supports both purchases and sales of each. Multiple areas with transmission limitations are supported, as are system constraints.

“Our technical people, operations group, and trading team are connected in a new and far superior way. Aside from optimising our operations, it's enabled other improvements like guiding decisions about when to schedule outages and maintenance. While implementing the software was a necessity to operate in our new business arrangement, [the e7 platform] has provided many additional and unexpected benefits.”

– Thijs Paes, Manager, Capacity Transfer  
Uniper Benelux



## Portfolio Optimization

For asset owners responsible for balancing their portfolio, running load-based unit commitment/economic dispatch simulations offers a deterministic solution for running their generation assets. For asset owners that participate in a market, executing price-based optimization scenarios that output generation-in-the-money schedules provides an indication of probable market awards. Thus, it can be further used for fuel planning, plant staffing, and trading support.

The mixed-integer linear programming (MILP)-based solution provides rich modeling capabilities to truly optimize the most complex problems, e.g., combined cycle gas turbines (CCGT), combined heat and power (CHP), cascading and pumped storage hydro, and the simultaneous optimization of all energy assets, reserves, and transactions. The solution architecture easily accommodates the set of ever-changing modeling requirements.

## Decision support for physical trading

Reduced costs, improved profitability and the ability to manage risk are all integral components of operations management software. Portfolio Optimization is able to price both standard and non-standard power blocks.

The solution allows traders to evaluate bidding strategies in order to maximize profit when bidding in a competitive market. When operating against a fixed position or demand, the solution will produce the operating schedule that minimizes total fuel burn and total production costs.



“The upgrade to Portfolio Optimization allowed us to streamline crucial tasks and focus on what’s important: modeling and generating results that can save more money. We are now able to step through a workflow and interact with our data in a much more efficient fashion. Additionally, when combined with the new platform, the upgraded solver included provides significant run performance improvements.”

– Jose Aponte, MSME, PMP,  
Resource Planning  
Tampa Electric Company

### Fuel management and pipeline modeling

Reducing fuel costs and risk through enhanced Portfolio Optimization to determine the best use of scarce fuel is a key operational requirement. Portfolio Optimization produces hourly and aggregated fuel nominations by Electric or Gas Day, which allows users to monitor gas consumption against fuel procurement. Portfolio Optimization can help you answer: Am I close to my procured amount? Can I purchase from the spot market? How will that impact profitability?

Fuel blending capabilities optimize the mix of available fuels, considering commodity cost, emission costs and limits. Modeling complex pipeline networks with multi-volumetric constraints and costs is necessary to achieve maximum profitability.

### Market bidding support

When the solution is enabled to generate offers for submission to an ISO/TSO, alternate bid strategies may be evaluated in light of potential locational marginal price (LMP) forecasts.

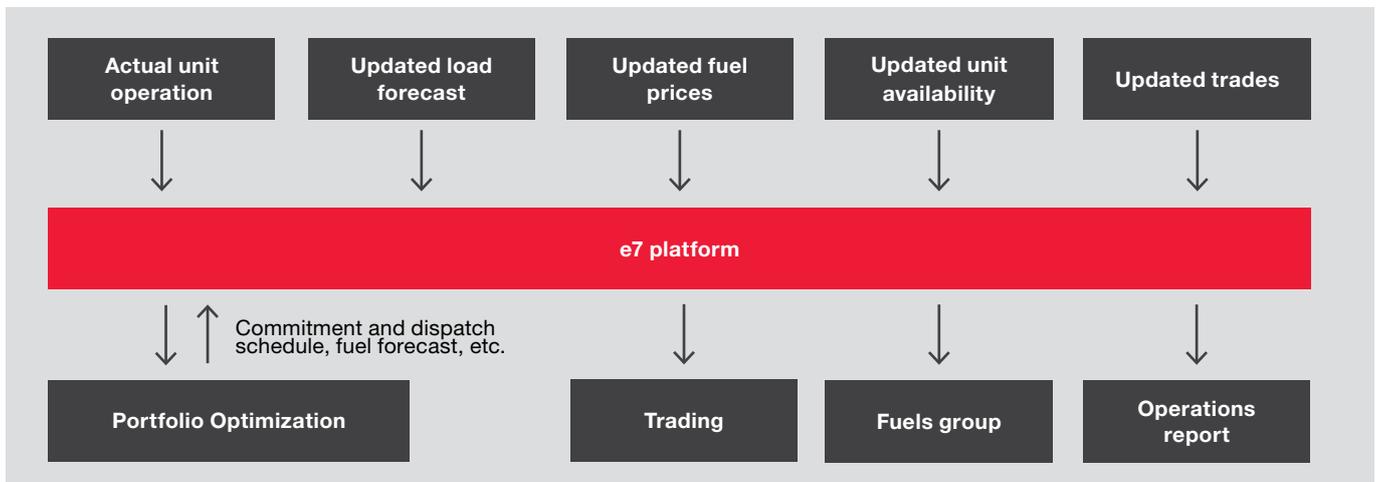
### Simulation scenarios

Scenario analysis allows generation companies to determine outcomes based on ‘what if’ and provides substantial analysis and actionable information to make sound, profitable business decisions regarding their portfolio, resolving the unknowns related to generation modeling. Portfolio Optimization offers an easy-to-use interface to analyze and compare sensitivity studies.

### Post-analysis for improved operations

The ability to import and simulate, using actual data, and compare this data with forecasted scenarios enables feedback into the operational processes to improve efficiency.

### Hitachi Energy Portfolio Optimization



# e7 platform

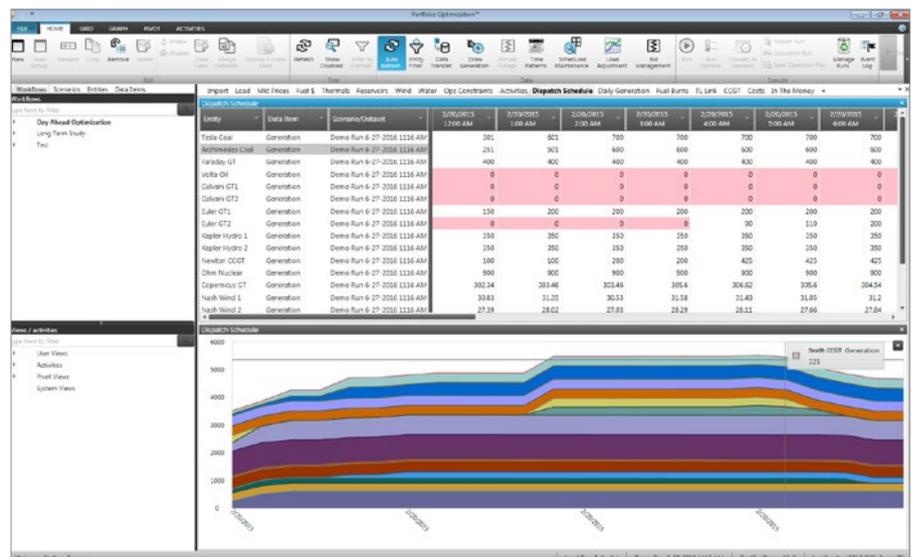
## Data management system

Portfolio Optimization is built upon our latest technology platform, e7, which has been completely refreshed to address the changing needs of the modern customer. It utilizes a common interface that is shared by Hitachi Energy's other market and portfolio solutions, allowing a consistent look and feel across many products (Capacity Expansion, PROMOD and SENDOUT). New workflow management features, configurable reporting and an in-application formula tool provide users the

flexibility to mold the application to their specific needs. Easy-to-configure activities can be automated, resulting in a seamless integration with upstream and downstream systems. All of these features have been developed to optimize the user experience, regardless of whether they are modeling a small portfolio deployed on a single machine or modeling multiple markets in the cloud on thousands of nodes.

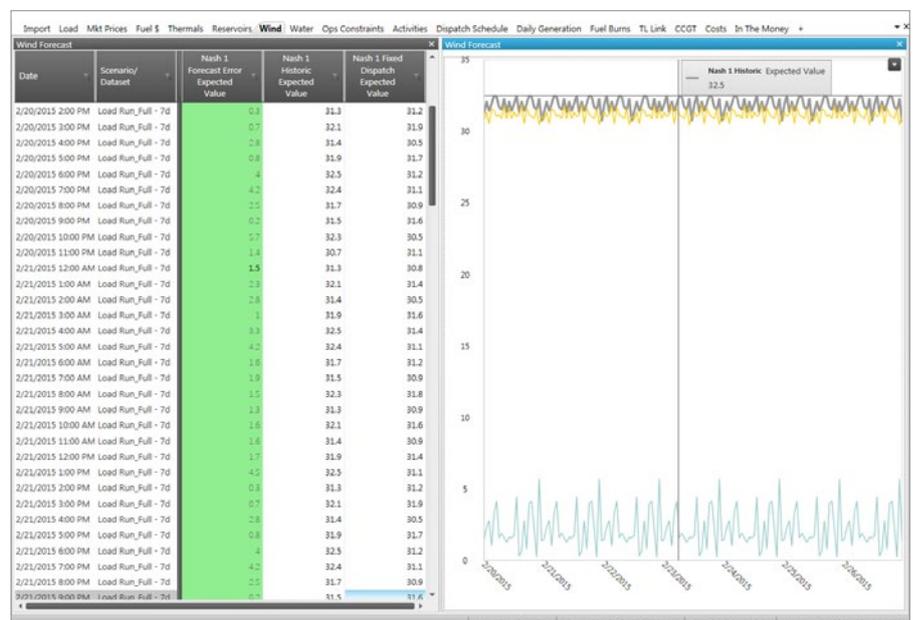
## Workflows

A workflow is a collection of user-defined views including data entry views, activities, pivot tables, and output reports. These views are easily defined, customised and ordered creating a consistent and repeatable user experience that reduces time spent searching for data and allows for a greater focus on modeling.



## Data views

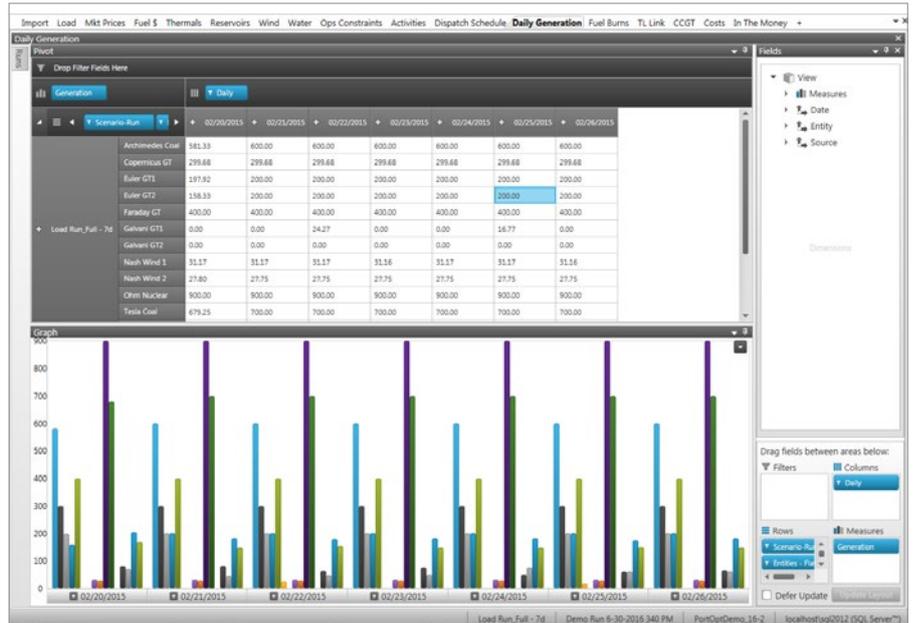
Data views are configured by the user and can include both input and output data items. Input values can be displayed in unique datasets or as the fully resolved data exactly as it is sent to the engine. Views allow full data entry and editing as well as simple graphing and reporting. Creating a new view is as easy as selecting a scenario, entity(s) and data item(s).



### Pivot views

In-application reusable pivot tables allow for complex reporting and aggregation, with the ability to look at a single scenario or compare multiple runs. Configuration of a pivot table is consistent with any user-defined view and can be included in a workflow as described above.

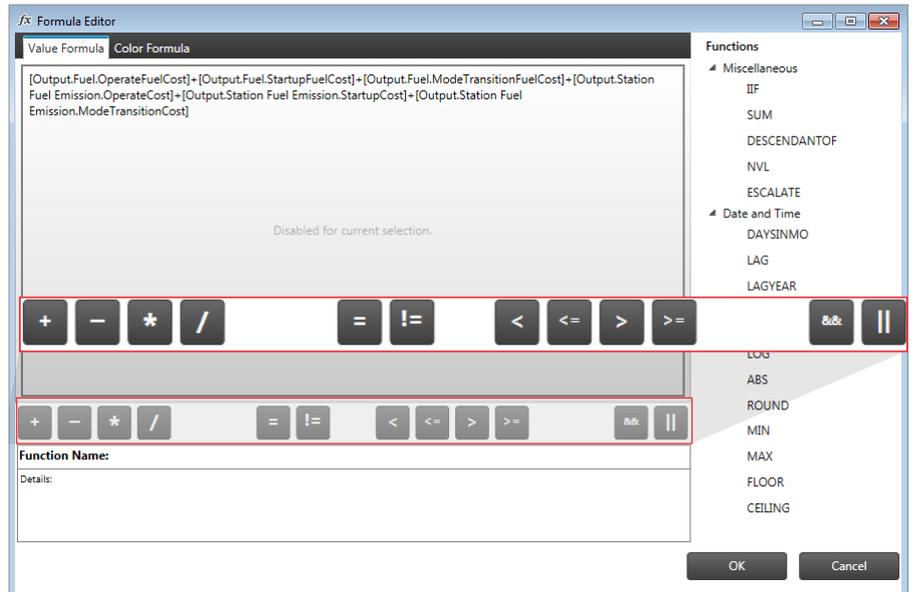
Pivot views facilitate graphing for quick and easy visualisation of results to better understand the information within the raw data.



### Formulas

Formula Editor functionality allows for basic adjustments of data such as patterns, escalations or reusable indexes to more complex calculations including conditionals and topology aggregations. Included in the formula capabilities are:

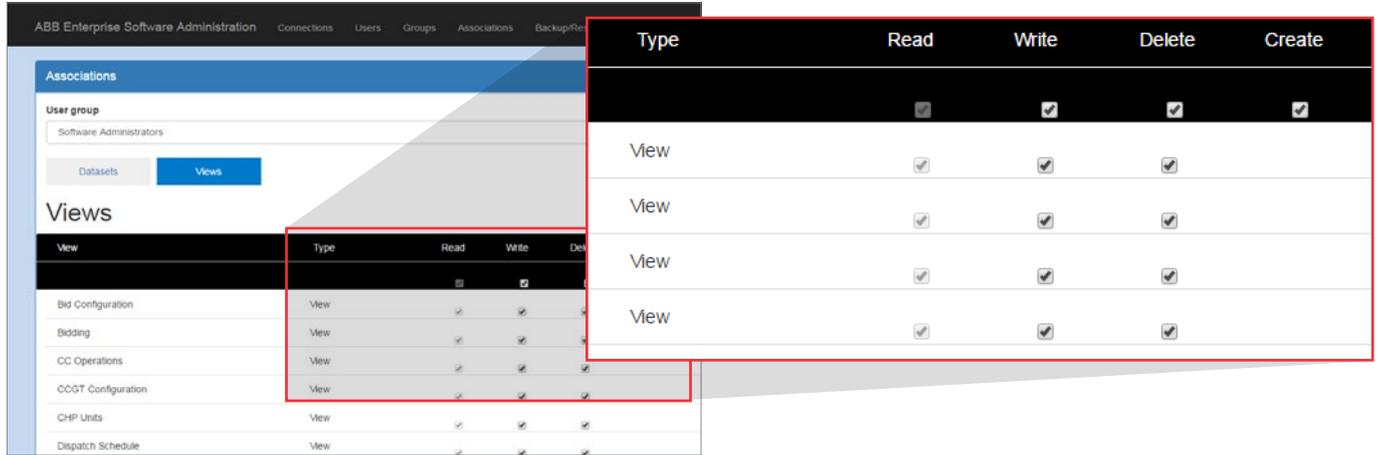
- Basic math functions (+, -, \*, /)
- Complex math functions (abs, sum, exp, log, round, min, max, floor, ceiling)
- Built-in functions (iif, decendantof, nvl, lag, lagyear, daysinmo)
- Inputs can derive their value from a combination of indexes, patterns or functions
- Custom outputs can be calculated based on inputs, outputs, indexes and functions
- Output cells can be shaded different colors based on conditional statements



## Security

With disparate groups using the software, there is a need for different groups to have permissions to different areas and data within the software. With the security capabilities groups of users can be limited to only editing and viewing data in

specified datasets and views within the software. This allows the same software to be deployed to numerous groups pointing to the same database and prevents groups of users from viewing and editing data they should not be permitted.

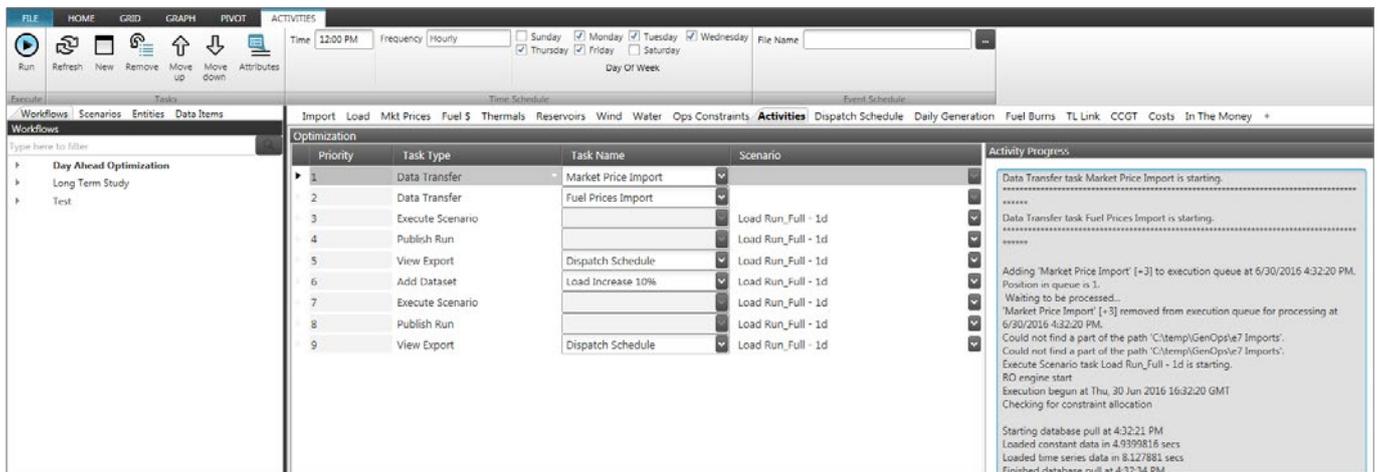


## Automation and activities

An activity is a user-defined, in-application set of steps built as part of a workflow. Automation of activities give users a simple way to define a set of tasks (activities) to execute automatically. These steps include items such as:

Once configured, automation can significantly reduce repeatable steps, reduce data input errors and ultimately reduce the time to obtain valid results.

- Executing a scenario
- Importing data
- Publishing a run to an output API
- Adding or removing datasets from a scenario
- Executing custom T-SQL for easy integration



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