

iOPT OPTIMIZATION SCENARIO MANAGEMENT (OSM)

Efficient and Ergonomic Scenario Analysis and Comparison

One of the most common energy business tasks is to make optimal use of the available resources, such as:

- Taking advantage of contracted limits
- Determining the bookings of transports
- Making 'burn or sell' decisions for fuels
- Making the most efficient use of storages
- Committing and dispatching generation units

In complex systems with many commodities, transmission lines, hubs, units, and marketplaces, decision makers have to consider all interrelations between the portfolio assets as well as the interaction of the supply-demand situation.

An optimization software that models the supply-demand situation for multi-commodity portfolios allows to determine the most economical decisions and can usually increase profits from around half a percent for small portfolios up to a few percentage points for complex multi-billion dollar ones.

However, both planning and operational tasks have to be carried out in situations where many input factors are uncertain. Therefore, it is especially important to compare a wide variety of different scenarios with different assumptions about future developments of markets. The comparison of results of different scenarios after optimization provides a higher planning security with an overview of the profitability and also evaluates the risk connected with investment projects.

OpenLink's *OPTIMIZATION SCENARIO MANAGEMENT (OSM)* offers an integrated system framework to handle several scenarios of input data including their comparison with special focus on:

- What-if analyses
- Stress testing
- Price simulations
- Opportunity evaluations (e.g., new deals)

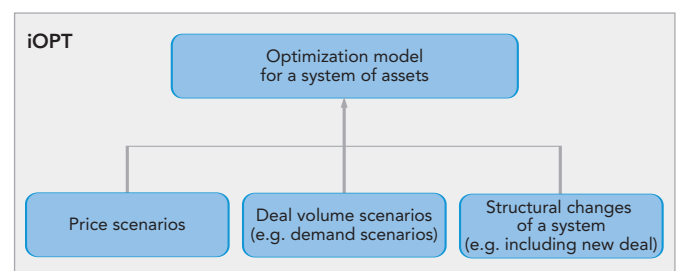


Figure 1: Different types of scenarios

SOLUTION SETUP

iOPT offers a first-rate optimization solution for energy portfolios and a flexible time series management tool including many interfaces for importing and exporting data.

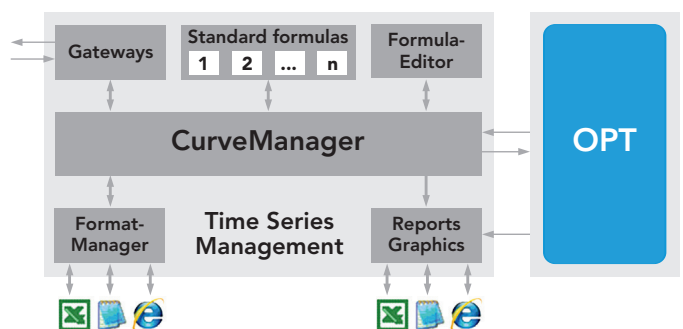


Figure 2: Solution setup

The sophisticated *iOPT_TIME SERIES MANAGEMENT (TSM)* encompasses a multitude of functions:

- The CurveManager serves as a central data hub for administrating and manipulating time series.
- Data in different standard formats can be imported and exported with the FormatManager.
- The GraphManager enables graphical analysis.
- Flexible and complex time series calculations are performed with the FormulaEditor.

Due to its flexible user-defined graphics, the easy-to-use data import and export in different formats and the time series calculation capabilities, TSM is the perfect tool for the exchange and analysis of time-dependent data and a central communication platform between Endur, or any other ETRM or PFM system, and **iOPT_OPTIMIZATION**.

iOPT_OPTIMIZATION allows the creation of multiple models of markets and portfolios including flexible assets, such as power plants with all associated technical details and flexible deals such as swing or ToP contracts. The complete portfolio asset topology and any operational logical conditions are also part of optimization models.

The multi-commodity optimization approach enables finding the global optimum for the utilization

of all system assets with respect to different commodity markets (power, ancillary services, fuels, emissions) and/or different geographical market places within one single model. Authorized users can easily create multiple models for different planning horizons and for the purpose of tentative asset evaluations, etc. The high flexibility of the optimization tool, its ease of use and intuitive GUI support different types of business tasks, ranging from the standard unit commitment problem to the scenario analysis of the supply-demand situation in large gas systems.

ETRM systems usually provide optimization with basic price and volume data as well as with deal information for deal analysis. Standard interfaces connect iOPT with Endur – OpenLink’s market-leading ETRM system for, among others, deal capture, billing, and risk management tools.

FUNCTIONALITY

OSM for Time Series Objects

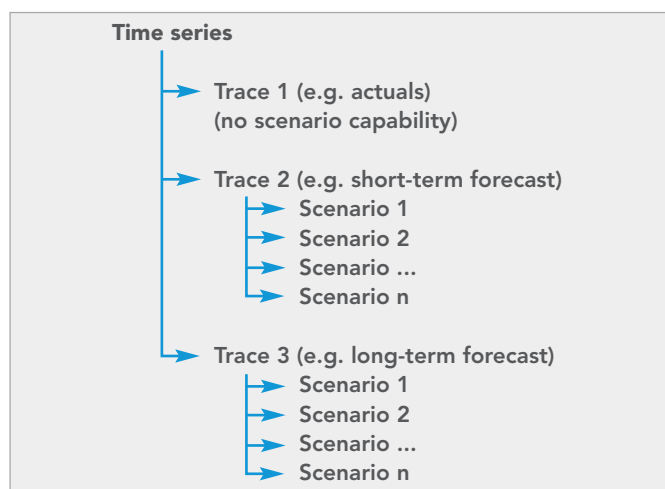


Figure 3: Time series objects

Multi-dimensional time series objects contain information about the data lifecycle in traces and their possible data variations in scenarios. Each trace represents a quality of time series values (e.g., historical values, nominated values, forecasted values, etc.). These traces are combined in a user-defined order to form a dynamic “Best Available Value” (BAV) trace encompassing the lifecycle of the time series values. The setup of scenarios can be done individually for each time series trace or for any subset of them. This allows a very flexible but still simple management for the analysis of different input scenarios.

Scenario Management in Calculations and Optimization – Scenario Rules

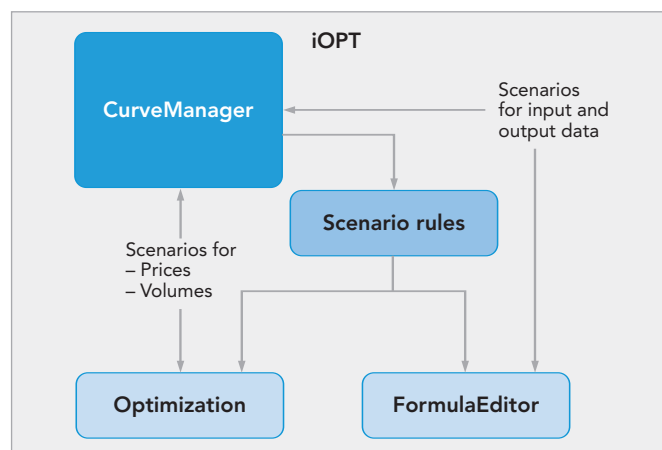


Figure 4: Building scenario rules

The **OPTIMIZATION SCENARIO MANAGEMENT** enables a streamlined scenario analysis including the FormulaEditor to perform complex time series calculations, the optimization module to perform corresponding optimization runs, and the GraphManager to compare the results. All these processes can be easily controlled for different scenarios. Thus, user definable iOPT scenario rules control the use of scenarios for individual time series or groups of time series. For example, a scenario rule called “Cold Winter” may include the scenario “High Price” for all related index and price time series and the scenario “High Demand” for the corresponding demand curves.

OSM for Evaluation of Opportunities

For the evaluation of a potential portfolio component (an opportunity, such as a new deal or storage, etc.), iOPT can be used to compare the total costs of the original optimization model with the total costs of the scenario model including the opportunity to be investigated. To study the robustness of the new component, this analysis can be combined with the **OPTIMIZATION SCENARIO MANAGEMENT** for price and volume scenarios of the related time series.

Statistical Scenarios

In addition to the OSM scenarios, iOPT offers the possibility to use statistical scenarios within the iOPT optimization module. These scenarios constitute a sound basis for a risk-hedged optimization solution as well as for a Monte Carlo analysis of the optimization portfolio. The number of these scenarios must be sufficiently high to enable a reliable statistical analysis of the distribution function. These statistical scenarios can be either created by the iOPT ScenarioGenerator or imported from an external system.

Monte Carlo Simulation

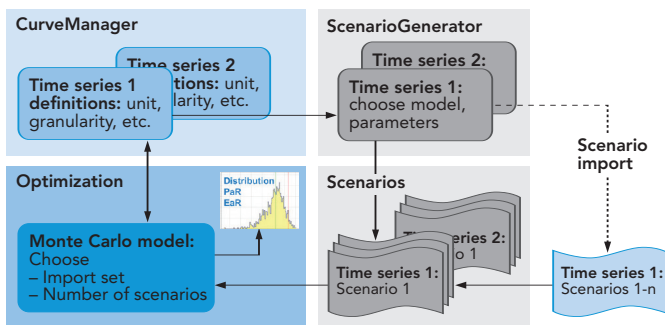


Figure 5: Monte Carlo simulations in optimization

The Monte Carlo simulation provides a probability distribution of the PnL results to determine risk key figures, such as expected PnL, PaR, and EaR. To reduce the CPU load, iOPT also enables a parallelization of the Monte Carlo optimization runs.

Integrated Risk Hedging

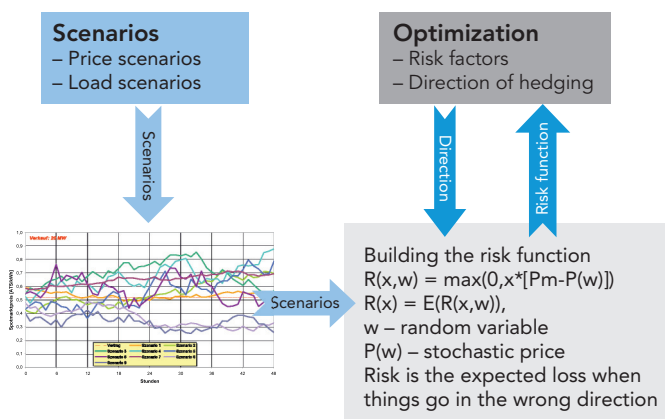


Figure 6: Integrated Risk Hedging

The application of integrated risk hedging allows the consideration of price and volume risks within a single optimization run. The risk is modeled by a risk-adjusted cost term based on statistical scenarios. This cost term is then part of the overall system costs to be minimized in the optimization run.

Endur iOPT Integration – Scenario Sets

The functionality and usability of the OSM rely on data on deal and market information. This information is usually supplied by an ETRM system. **iOPT_OPTIMIZATION** is tightly connected to Endur, the leading ETRM system. The integration between Endur and iOPT functionalities is achieved by:

- Time Series Gateway
Used for time series data transfers between Endur and iOPT.
- DealBridge
Designed to use Endur as single deal entry point; it creates, updates, or deletes deals in the iOPT optimization model selected by the user.

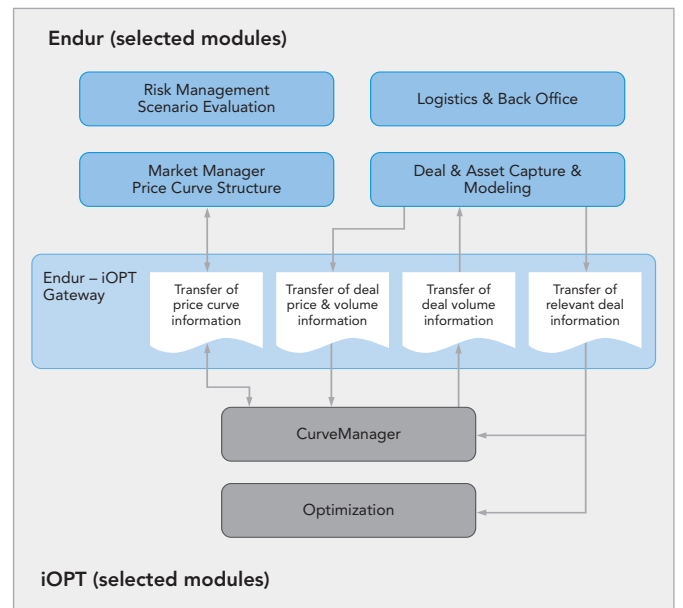


Figure 7: iOPT Endur interfaces

The setup of the interface between the two systems also allows Endur price simulations based on iOPT scenarios, with Endur taking the role of a pricing engine running in the background. For such price simulations, a so-called iOPT scenario set is created, allowing the assignment of scenario data to Endur objects.

A scenario set consists of

- an iOPT scenario rule
- a list of mappings of iOPT time series traces and Endur objects
- an Endur price simulation

The Endur price simulation based on iOPT scenarios consists of the following steps:

- Transfer of market prices from iOPT to Endur
- Deal price simulation in Endur
- Export of deal prices from Endur to iOPT

The simulated deal prices can then be used in a related optimization run to study its impact on the whole portfolio.

BENEFITS

- Clear view of interrelated data
The concept of traces for time series allows a comprehensive and unique association between data values and qualities. Moreover, the lifecycle of values is displayed in the "Best Available Value" (BAV) trace, which provides a natural basis for any further operations (time series calculations and optimization runs).

Scenario data is kept next to operational data (for each trace) in the CurveManager navigation tree, enabling a clear view of interrelated data.
- Comfortable scenario analysis
Traces and well-defined scenario rules control the application of alternative data sets on given time series formulas and/or optimization models.
- Easy comparison of scenario results
As the GraphManager can display traces, scenarios, and scenario rules, a convenient setup allows for the comparison of several traces and scenarios at a glance.
- Significant reduction of operational risk
The multi-dimensionality of time series objects (TSO) is reflected in the CurveManager navigation tree by corresponding TSO sublevels for traces and scenarios, respectively.

This concept avoids the cumbersome handling of multiple time series and hence significantly reduces the operational risk.
- Risk analysis support
Statistical scenarios are used for price and volume variations which serve as a basis for Monte Carlo analysis to determine risk key figures and for risk-hedged solutions of optimization models.
- Workflow automation
Scenario management is fully integrated in the iOPT workflow automation. Due to the multidimensional time series concept (time series objects with traces and scenarios), the workflow adaptations for any scenario analysis are straightforward.
- Endur iOPT integration
The Endur iOPT integration allows a consistent and seamless setup of the OPTIMIZATION SCENARIO MANAGEMENT to study, e.g., price scenarios using Endur price simulations based on iOPT.

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