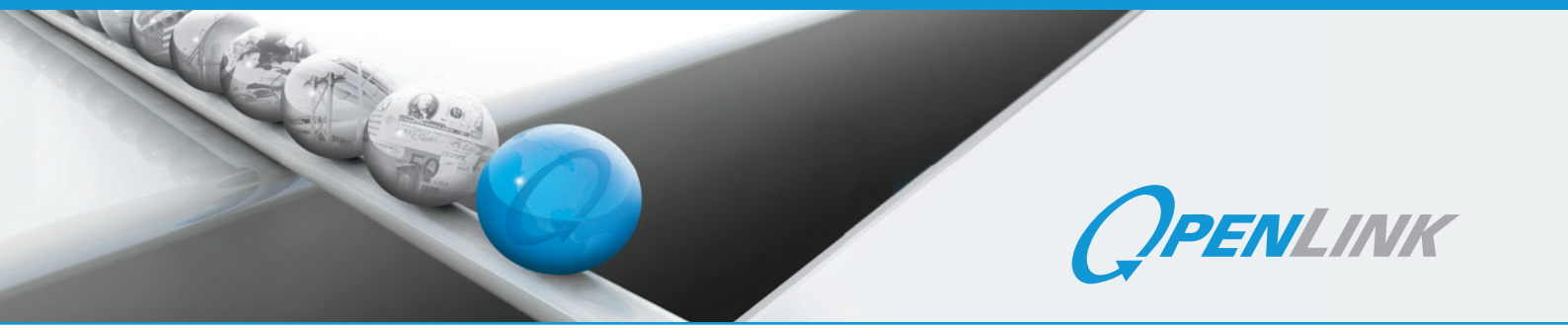


iOPT_*OPTIMIZATION*

The Multi-Commodity Optimization Solution

The requirements for optimization in the energy sector are becoming more and more complex. The deregulation of the energy market is fueling competition and requires constant adjustments to changing conditions. All these factors make high demands on an optimization software regarding flexibility, scalability, and performance. Due to the increasing volatility of input parameters, the number of calculations required is increasing as well—thus, "classic" optimization has to be enhanced with methods for sensitivity analysis, risk assessment and risk hedging.

With **iOPT**_*OPTIMIZATION*, OpenLink offers a broad spectrum of functions ranging from the optimization of complex thermal and hydro power plant structures and contracts, the handling of markets and taxes and additional commodities such as certificates, to the optimization of complex national and international gas systems in the upstream and midstream range including transport routes, storages, blending stations, etc.

Summing-up, **iOPT**_*OPTIMIZATION* is the solution for the physical multi-commodity optimization of secondary and primary energy trading as well as for the utilization of physical assets—from power plants to complex gas models including the relevant financial products.

iOPT_*OPTIMIZATION* covers all areas from high-end requirements such as long-term planning to the daily disposition of plants and therefore takes into account the different demands on an optimization, planning and operation management system. Due to its modular setup it is used by industrial firms, energy trading companies, utility companies, and public services.

The method used is based on Mixed Integer Programming (MIP), which allows the free parameterization of the system, an evaluation of the quality of the solution and the utilization of standardized solution algorithms.

KEY CHARACTERISTICS

- Efficient utilization planning and optimum use of physical and contractual portfolio assets

  Evaluate portfolio assets including technical, economic, contractual, and legal characteristics.

- Risk evaluation for portfolios with Monte Carlo simulations

  Provide key figures for various risks based on optimization runs for each scenario. An intelligent post-processing derives compressed results.

- Profitability analyses of portfolios and portfolio adaptations

  Investigate the profitability of an asset and contract portfolio by including additional assets or changing the conditions; the flexibilities of portfolio components are applied.

- Hedging against risks

  Perform an evaluation of the portfolio including the underlying risks to provide hedged solutions. An expression of the risks may be constrained or minimized.

- Sensitivity analyses for system parameters

  Analyze the portfolio for various sets of parameters to investigate sensitivities and search for stable solutions. A kind of stress test shows how the portfolio reacts to changes in input parameters such as prices, volumes, capacity, etc.

BENEFITS

Companies which trade in energy or even produce/convert energy themselves can use the optimization models of **iOPT**_*OPTIMIZATION* to maximize the revenues from this business segment or to minimize the costs.

The multi-commodity ability offers flexibility and transparency, thereby providing for the inclusion of further commodities in the optimization. A comprehensive library of immediately available and usable model components allows a quick parameterization of complex energy systems.

Within the framework of integrated risk hedging, **iOPT**_*OPTIMIZATION* creates suggestions on how companies most effectively protect themselves against quantity, price, and production risks. Based on these results, they develop appropriate strategies.

The seamless integration within **iOPT** forms a comprehensive and efficient energy industry system. Thus, for example, time series data such as forward curves or load forecasts are transferred to optimization and the derived cost and revenue information is supplied to Trading and Forecasting. **iOPT** can be run as a standalone Endur solution that can be integrated into existing ETRM systems.

Furthermore, Endur clients benefit from the standard gateway as Endur data such as deal volumes, deal prices, and price curves is transferred to **iOPT** and used as input for optimization, with the optimization results being written back to Endur. This means that optimization is a fully integrated process as traders can get their optimum results in near real-time.

The search for stable solutions is of strategic importance in optimization. With sensitivity analyses, parameters such as prices or supply contracts (also several at once) can be varied and analyzed.

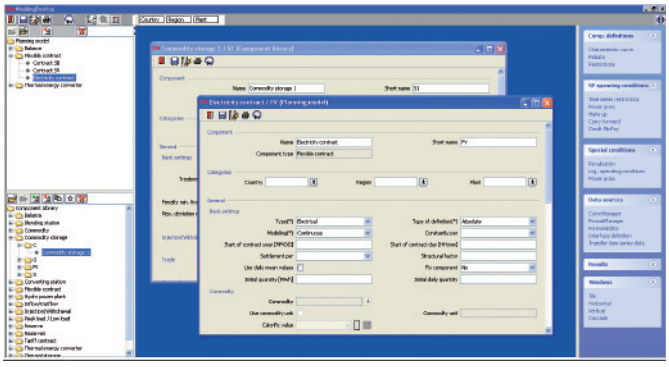
The coverage of all time horizons from the day and rest-of-day calculation to yearly and multi-year planning underlines the broad range of uses offered by **iOPT**_*OPTIMIZATION*. Thus, energy budgets can be created for several years, e.g., for the utilization of power plants, contractual obligations, and dispatchable contracts. The short-term utilization of resources, but also of contracts, is optimized for a period of up to 62 days.

FUNCTIONAL CHARACTERISTICS

With its ModelingDesktop, **iOPT**_*OPTIMIZATION* provides a convenient and efficient way for managing and editing components. Components with their basic definitions are stored in a library. When setting up new models, users can choose the required components from this library or from existing models, thus saving time and effort. By means of the integrated Topology-Editor the model topology is displayed; pictograms and colors identify the various components and commodities, providing a comprehensive graphical overview even of complex energy systems. Changes to components can also be made from within the topology.

Models are created by parameterizing model components. Among the basic elements are:

- Tariff contracts and flexible contracts (electricity, gas, district heat, fuels), e.g., for modeling hubs, spot markets, and long-term contracts
- Commodity and thermal storages
- Hydraulic elements (hydro power plants, storage power plants, pumped storage power plants)
- Thermal elements (thermal power plants, boilers for district heat generation, cogeneration, electrical heat boilers and heat pumps, steam boilers, or heat exchangers)
- Converting stations
- Blending stations
- Transmission and transport elements
- Balances (electrical and fuel balances, emissions, certificates, district heat, and steam)



In addition, there is an array of restrictions which can be applied to different model components, such as:

- Penalties
- Maintenance scheduling
- Reserve conditions
- Contract conditions with ToP, carry forward and make up specifications
- Logical operating conditions
- Power prices

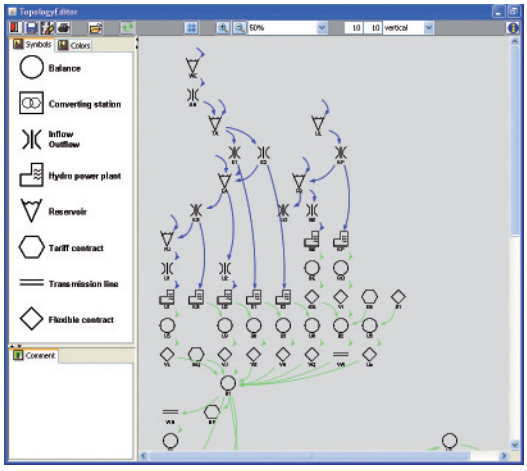
iOPT_*OPTIMIZATION* supports the following planning horizons:

- Medium- and long-term optimization (any duration)
- Short-term optimization (1 – 62 days)

Besides the deterministic optimization for identifying the most profitable use of resources such as flexible contracts, power plants, or balances for the various horizons, **iOPT**_*OPTIMIZATION* also provides sensitivity analyses, risk evaluations, and risk hedging.

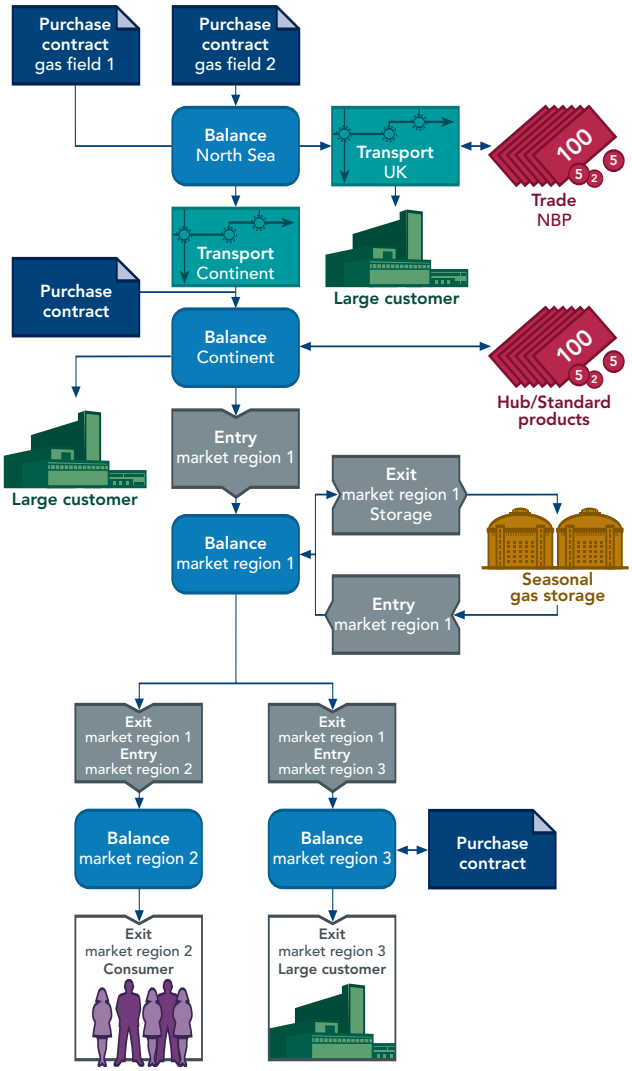
Sensitivity analyses are, for example, used to verify how long the planned use of optimum resources remains valid when the price is changed on the spot market or on the hub. In a sensitivity analysis a number of optimization runs can be executed by varying selected specifications. These show the influence on optimization results when one or more parameters are changed.

The integrated hedging against risks influences the energy disposition and the energy trade. Such risks comprise the purchase quantities of large customers, price risks in contracts with links to indices, production risks in relation to inflows or primary energy prices as well as forecast errors in the forecasts for demand, price, and inflow.



In Monte Carlo simulations—similarly to sensitivity analyses—several optimization runs are calculated with varied attributes of the model components. In this case, however, the attribute variations are controlled by means of scenarios. Scenarios are generated from curves for individual risk factors (time series or currencies) in the ScenarioGenerator and used both in risk hedging and Monte Carlo simulations.

Results of optimization calculations are displayed as reports or graphs and can also be used in other applications for further processing. Result data is also available for customer-specific reporting through Customer Views which provide access to the database, thus enabling flexible 3rd party reporting with external systems.



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