GECO ENELYTIX®

SaaS Modeling Environment for Gas -- Electric Co-Optimization (GECO)

GECO ENELYTIX

GECO ENELYTIX is the first of its kind modeling environment for realistic simulation and co-optimization of multi-day and intra-day operations of the electric and natural gas networks. Electric systems are modeled using optimization engine performing Security Constrained Unit Commitment and Economic Dispatch (SCUC and SCED). Natural gas systems are modeled using dynamic optimization of physical flows of gas within the pipeline network.

GECO ENELYTIX can realistically assess physical impact of day-ahead scheduling and real-time dispatch of gas-fired electric generators on the operation of natural gas pipelines serving these generators. Similarly, the modeling can assess and anticipate day-ahead and real-time demand for natural gas of connected generating units and pipeline's ability to meet that demand day-ahead and in real-time.

With GECO ENELYTIX users can model alternative market mechanisms for co-optimization of electric and natural gas systems and markets. These mechanisms are based on the exchange of highly granular economic information between gas and electric systems. The development and timely exchange of such information is made possible by using realistic physics-based optimization engines both on the electric and gas side.

GECO ENELYTIX is organized as a Software as a Service (SaaS) implemented within AWS cloud.

APPLICATIONS

GECO ENELYTIX can be used within the natural gas industry for:

- natural gas trading support,
- asset management,
- operational analysis,
- delivery scheduling,
- system expansion analysis,
- economic valuation and benefit assessment.

Generating companies with gas-fired generation in their portfolio can use GECO ENELYTIX for:

- asset management,
- fuel deliverability assessment,
- project development planning.

RTOs, pipeline planners and operators, NERC, federal and state regulatory agencies can use GECO ENELYTIX for:

- system coordination planning,
- concurrent gas-electric operational analysis,
- market design,
- reliability and resilience assessment studies.

GECO MACHINE

At the heart of GECO ENELYTIX solution is the GECO Machine schematically depicted in Fig. 1. GECO Machine is a single compute instance running three principal modules – Power System Optimizer (PSO), Gas System Optimizer (GSO) and Kördinator.

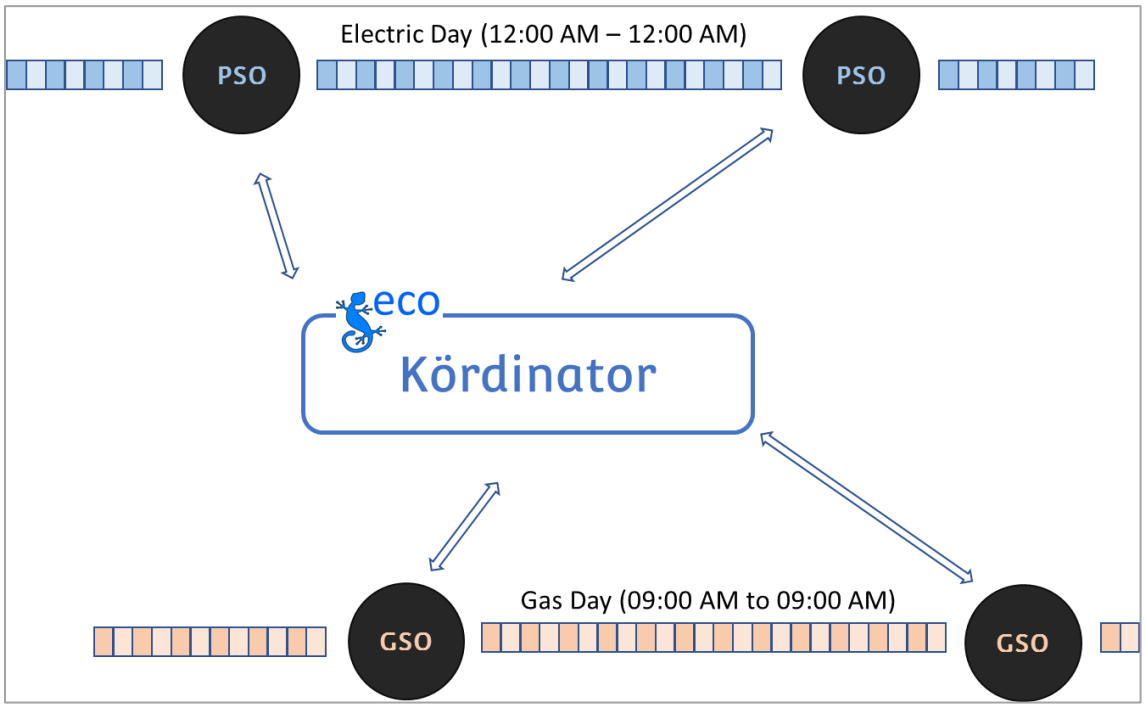

Figure 1. GECO Machine

PSO is a production cost market simulator that supports the modeling of multi-level, nested time intervals that simultaneously optimize energy and ancillary services commitment and dispatch. PSO has all the capabilities of traditional nodal simulation tools and is unique in a number of features. Unique PSO features critical for representing gas-electric coordination include elaborate logic for rolling horizon modeling of multiple decision cycles and PSO's Open Library capability. Decision

cycles span overlapping time frames, e.g. weeks, days, hours, minutes and reflect system response to changing forecast and operational conditions. Open Library allows other application to exchange results and input with PSO at any decision cycle.

PSO's modeling approach is based on the use of Mixed Integer Programming (MIP) algorithms, not heuristics, and is consistent with those used by most ISO/RTOs in actual market operations.

GSO is designed to optimize dynamic scheduling and operation of a natural gas pipeline network. GSO finds optimal flow, delivery schedules and concurrent operations of compressor stations and line pack dynamics. In parallel, GSO determines economic value of natural gas at any point in time and at any location on the network.

GSO has a solid foundation in physics of compressible gas turbulent flow dynamics and in representation of key engineering constraints of pipeline network operations. GSO became possible due to a highly scalable and precise computational method developed at the Los Alamos National Laboratory (LANL) for simulating and optimizing the dynamic of compressible gas flows within a network.

A unique feature of GSO is its capability to compute the economic value of natural gas assessed with an unparallel locational (any node, any pipe) and temporal (hourly or sub-hourly) granularity – the Locational Trade Value (LTV). GSO values natural gas consistently with the physics of gas flow and subject to engineering constraints of pipeline operation.

LTVs combine the economic value of:

- natural gas supplies received by the pipeline;
- shadow prices of pipeline constraints associated with limitations of compressor capabilities, maximum allowable operating pressure limits and minimum pressure requirements;
- compression costs; and
- opportunity costs of line pack.

The **Kördinator** module orchestrates control and data exchange between PSO and GSO thus emulating interactions between gas and electric markets and systems. Typical data transmitted by Kördinator include generator's need, and willingness to pay, for gas transferred from PSO to GSO and instantaneous value of natural gas at the pipeline node serving specific generating unit transmitted from GSO to PSO.

ARCHITECTURE

The solution is built upon ENELYTIX cloud-based architecture supporting the single-click experience of automatic bulk generation of multiple simulation cases, parallelization, scalable on-demand provisioning of GECO machines, run management post processing and reporting analytics. Fig. 2 highlights key services delivered with GECO ENELYTIX SaaS.

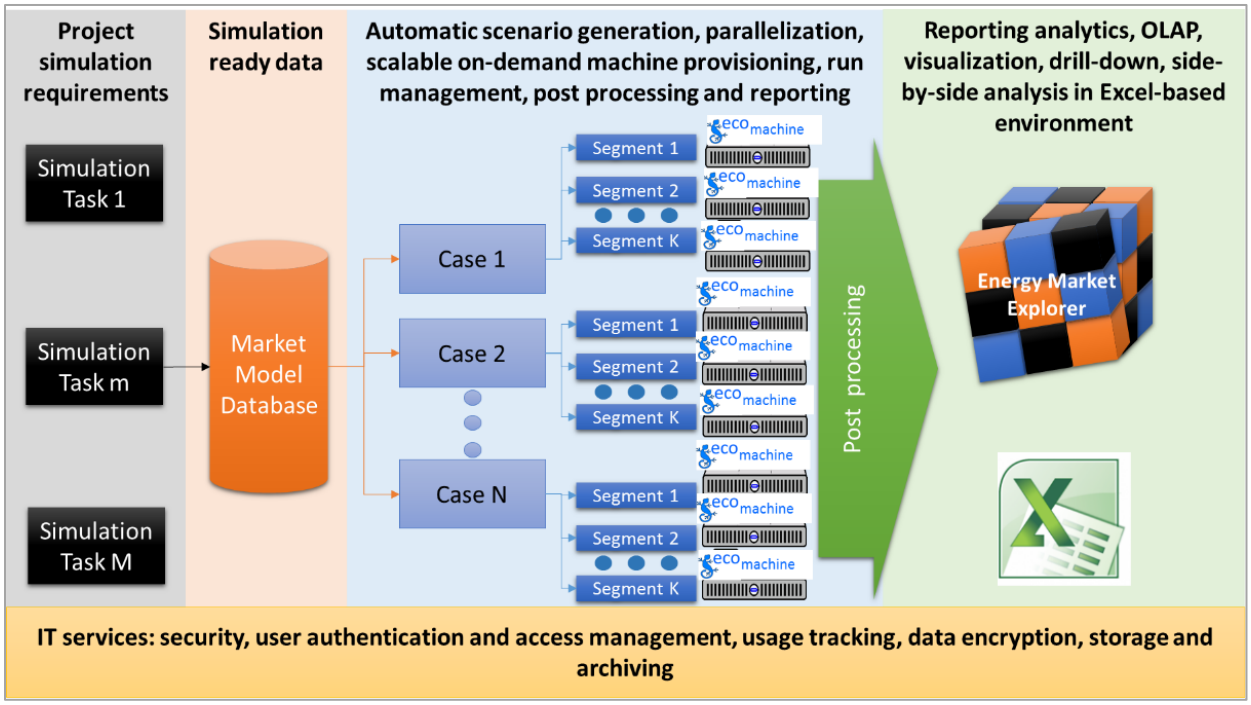

Figure 2. GECO ENELYTIX Architecture

CONTACT INFORMATION

For more information about GECO ENELYTIX, contact info@enelytix.com

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