Designing an Eco-Friendly Swiss Haven While Cutting Back Emissions

With an optimized urban energy plan, the town of Yverdon-les-Bains is on track to reduce yearly emissions by up to 83% in 2040.

Yverdon-les-Bains, a Swiss municipality of around 30,000, is located on Lake Neuchâtel and is known for its history, thermal springs, commerce, and tourism. It was awarded the Wakker Prize in 2009 for the way the city handled and developed the public areas and connected the old city with Lake Neuchâtel.

Industry: Government
Location: Europe
Use Cases: Resource Optimization, Planning
Website: yverdonlesbainsregion.ch

Results

- 83% reduced carbon emissions expected by 2040
- Identified optimal, reliable energy concepts

Partner Spotlight

sympheny
urban energy. optimized.

Sympheny's cloud-based platform supports the planning of renewable-based decentralized energy systems for neighborhoods, districts, and cities. Their combination of digital twin technology and intelligent algorithms allows them to support the needs of planners, facility managers, and site owners with software that is globally scalable and locally adaptable.

Learn more at www.sympheny.com

In line with Switzerland's efforts to reach a net-zero emissions target by 2050, the Swiss municipality Yverdon-les-Bains is redeveloping 'Gare-Lac.' This strategic site will be a mixed-use, eco-friendly neighborhood that will house roughly 3,800 inhabitants and 1,200 workspaces.

Following an urban planning competition hosted by the city, a local master plan was laid out to transform the neighborhood into one characterized by open spaces, ease of mobility, and sustainability.

The master plan's urban energy concept aims to employ the municipality's geothermal and low-temperature heat potentials and implement a solar installation strategy. The usage of fossil fuels will be restricted to ensure good air quality and a pleasant urban climate.

Two engineering consulting firms, Eicher + Pauli (E+P) and enersis suisse ag, used Sympheny's urban energy planning software to develop the plan for Yverdon-les-Bains.

Identifying Optimal Energy Planning Solutions

An understanding of the synergies among energy sectors is required to identify an optimal and reliable energy system. Sympheny's software, supported by Gurobi's exceptional performance, is able to tackle this complex analysis. The software is used to assemble a "digital twin" of the current energy system and conduct techno-economic analysis through optimization.

Using powerful optimization algorithms, Sympheny allows users to quickly identify integrated energy system designs with minimal lifecycle costs and carbon dioxide emissions. Users waste no time on suboptimal solutions while making informed decisions.

For example, Sympheny helped Yverdon-les-Bains determine:

- How building standards would impact the costs of lifecycle systems and CO2 emissions

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> “Upon comparing multiple solvers, we observed higher performance by Gurobi, both in solving time and the number of problems solved.”

Julien Marquant
CPTO & Co-founder, Sympheny

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- How geothermal and wastewater low-temperature heat potentials can be integrated within the concept
- The pre-sizing and routing of the possible thermal networks
- The optimal sizing of photovoltaic panels, as well as the role that they should play within the concept
- Estimates of on-site fossil fuel usage, as well as the amount of waste heat rejected by chillers (data directly linked to urban climate and air quality)

These data points can be used for making policies around minimum installation requirements.

In addition to identifying optimal energy systems, Sympheny aggregates and organizes various data sources into one reliable model. It serves as an ideal collaboration platform among project stakeholders.

By collaborating on a single platform, stakeholders can easily engage new project partners. The intuitive, easy-to-use interface presents projects in a clear way. It also helps reduce human error, while speeding up the project cycle and facilitating the evolution of projects from the planning phase to construction and operation.

Gurobi Delivers the Speed and Solving Power to Keep Energy Goals on Track

Sympheny is a powerful energy system optimization platform that abstracts how models are created and solved, thereby allowing users to focus on designing the best system possible. At a click of a button, a user can set up tens of thousands of system constraints. The underlying optimization algorithm allows the user to consider the whole solution space.

In multi-objective optimization problems, optimal trade-offs between conflicting objectives are identified. Greater emission reduction is usually accompanied by higher costs. Since the fulfilment of one objective comes at the expense of another objective, solutions must quantify the trade-offs between conflicting optimization goals and identify the optimal cost of achieving a particular emission reduction target.

Different solutions might come with different system designs and operations; users can then select their preferred designs with tangible trade-offs in mind.

Using Gurobi as the underlying solver, Sympheny can achieve optimal results while effectively handling large-scale systems.

“Gurobi’s performance has been key in addressing complexity within a short amount of time. Upon comparing multiple solvers, we observed higher performance by Gurobi, both in solving time and the number of problems solved,” explained Julien Marquant, CPTO & Co-founder of Sympheny.

With the Gurobi solver, Sympheny evaluated three possible scenarios that could help Yverdon-les-Bains reach its energy goals. In the CO2-minimal scenario, which uses energy systems with the lowest operational emissions, the municipality could reduce its yearly CO2 emissions by 83% by 2040, while meeting increased electricity and heat demand at the same time.

“The tools provided by Gurobi for tuning the solver parameters and detecting infeasibilities were extremely helpful for us, and improved our performance in terms of granularity and solving time,” said Marquant. “We also appreciate the Gurobi team’s expert support and collaboration—since it allows us to tackle current and future challenges together as partners.”

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