CASE STUDY

sympheny

Gare-Lac in Yverdon-les-Bains

Authors: A. Chevrier, S. Hsieh

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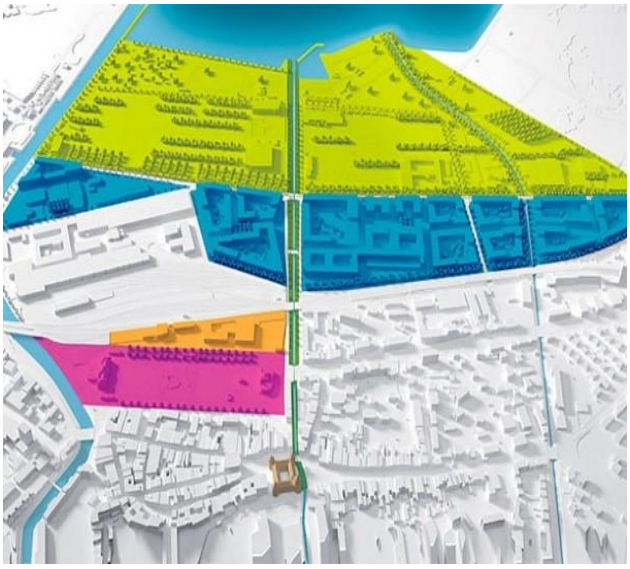

Credit: Jean-Pierre Bosiger and Ben Bender, via Wikimedia Commons
Conceptual view of the site 'Gare-Lac', source: https://www.yverdon-les-bains.ch/grands-projets/autres-projets-urbains/gare-lac

Introduction

The municipality of Yverdon-les-Bains is redeveloping a strategic site 'Gare-Lac', which will become a new mixed-use eco-quartier. Mandated by Yverdon-les-Bains energies, Eicher and Pauli used the Sympheny software to conduct analyses of the future energy concepts for the site. The Sympheny software was the backbone of the project, which tackles the complex analysis and results in various decarbonization roadmaps until the year 2050.

Key facts

- Site: Mixed-use eco-quartier
- Size: 3'800 inhabitants and 1'200 workspaces
- System highlight: high and low temperature network expansion

What was achieved

- Optimal decarbonization roadmaps under various expansion and retrofit scenarios
- An emission reduction of up to 83% by 2040

Challenges faced

Balancing environmental targets and costs

All aspects of the energy concepts mentioned in the localized master plan are directly analyzed using Sympheny. For example, the impact of the building standard on the life cycle systems costs and the CO_2 emissions can be calculated as well as the integration of the geothermal and the wastewater low temperature heat potentials within the concept or/and the pre-sizing and routing of the possible thermal networks. .

Utilizing on-site solar irradiation

The optimal sizing of photovoltaic panels as well as the role that they are playing within the concept is also part of the analysis. These quantitative data can serve as the basis for policy makers when making decisions on minimum installation requirements.

Factoring climate and air quality

With Sympheny's analyses, the potential waste heat to the environment from equipment operation on-stie are also quantified. These information provides insights to the impact of energy systems on urban climate and air quality.

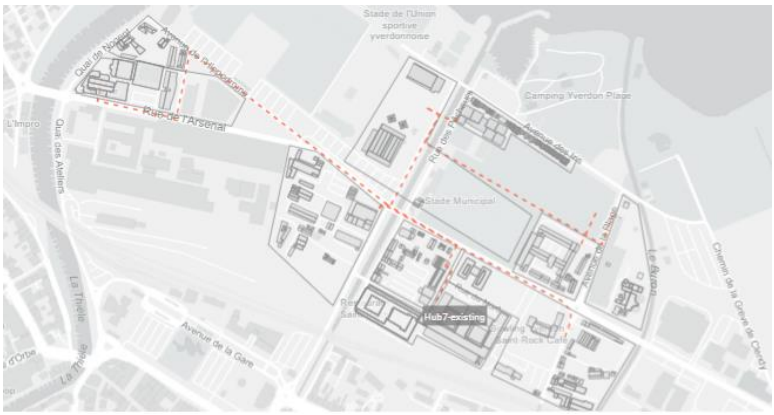

Figure 1 - Visualisation of the site, directly within Sympheny web-application.

Who are Yverdon-les-Bains energies?

Yverdon-les-Bains energies are a local utility providing electricity, gas and water as well as managing the public lighting network of the city of Yverdon-les-Bains, Switzerland.

Who are Eicher and Pauli?

Eicher and Pauli is an engineering and planning office providing holistic energy concepts for buildings, areas, quartiers and cities, from strategy to operation.

The consulting company, Enersys, coordinated the project and maintain the visualization dashboard via their GRIDS energyCity Software.

Why Sympheny

Simplified data integration processes

Sympheny's advantages go beyond the identification of optimal energy systems solutions as it also aggregates multiple data sources into one reliable analysis, thus served as an ideal collaboration platform between project stakeholders.

Indeed, digital tool allows to structure the data gathering and to strongly increase the transparency of the models, leading to enhanced stakeholders cooperation. Working on a single platform offering a clear picture of the site minimizes the risks of manual error and easily engages new project partners, particularly compared to standard spreadsheet approaches.

Evolved energy planning

The models in Sympheny are none static, it can evolve as the project moves from the planning phase to construction and operation. Each of the step following the planning phase brings in a more detailed view of the project, and the updated data can be easily integrated within Sympheny. Experience has shown that gathering data, even from the very initial stage of the project, allows project partners to collaborate and to raise important points early on, leading to a smoother transition to the following phases.

Results and impact

Our analysis shows the pathway to 2040 with three scenarios, each of them with varied financial and emission trajectories. The Cost optimal scenario aims to identify energy systems with the lowest life cycle costs, the CO_2 optimal scenario aims to identify energy systems with the lowest operational emission, and the mid-way scenario aims to identify the best compromise between cost and emissions.

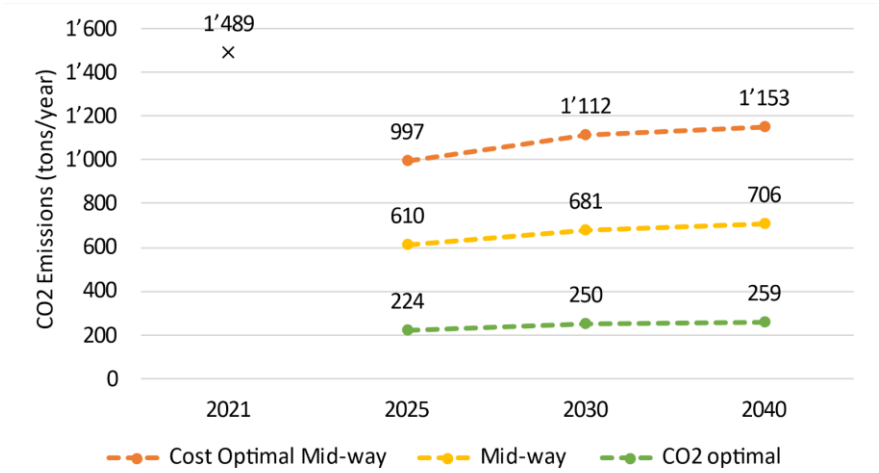

Figure 2 - Emission Timeline of the site for the different time steps and measures applied

Each system solution corresponds to a fully dimensioned energy system design, from which the answers to many questions can be derived. For example, whether the amount of wastewater is enough to supply the site with low temperature heat? What other sources would potentially make financial and environmental sense and should be considered within the further planning of the site? How is the role of PV strategy in the integrated energy system?

CO_2-optimal solution

The CO_2 optimal scenario shows promising low carbon system performance despite not achieving net-zero emission. In 2040, a reduction of 83% could be achieved compared to the status quo. This reduction is achieved through a collection of measures including refurbishing old buildings, using technologies like heat pumps and techniques like heat recovery. Moreover, as the analysis showed, the anergy network supplied by the wastewater treatment plant is key to lowering emissions. However, the integrated systems come with an increase of ca. 90% of life-cycle costs compared to the cost-optimal system solutions.

Mid-way solution

Compared to the cost optimal system solutions, a further reduction in CO_2 emissions can be achieved, with only a slight increase in the life-cycle costs (ca. + 6%).

Below in the pareto front diagram, the information allows decision makers to connect the CO_2 emission (y-axis) to the energy system life-cycle costs (x-axis) and to examine the trade-offs between costs and emissions.

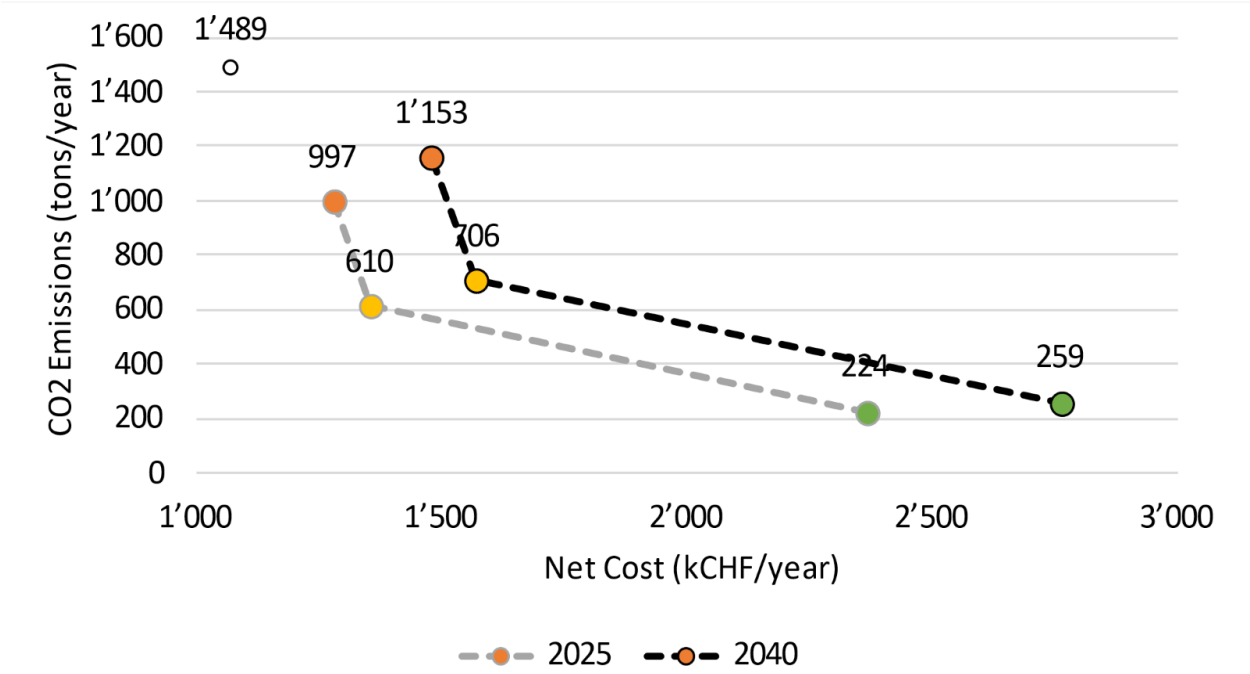

Figure 3 - Pareto front showing the optimal costs and emissions of the optimal system variations (2021, 2025 and 2040), allowing to identify optimal trade-offs between costs and emissions.

The future

Sympheny's intuitive WebApp enables comprehensive analysis for a complex site in a short amount of time. The focus of the project was on demonstrating a method for digitalized urban planning by integration of different data sources. In the next step, the project team recommends deepening some aspects of the analysis, such as refining the databases to local conditions and integrating detailed technical feasibility aspects. The energy system digital twin in Sympheny can be seamlessly adapted and evolve as the client expands the level of detail for their analyses.