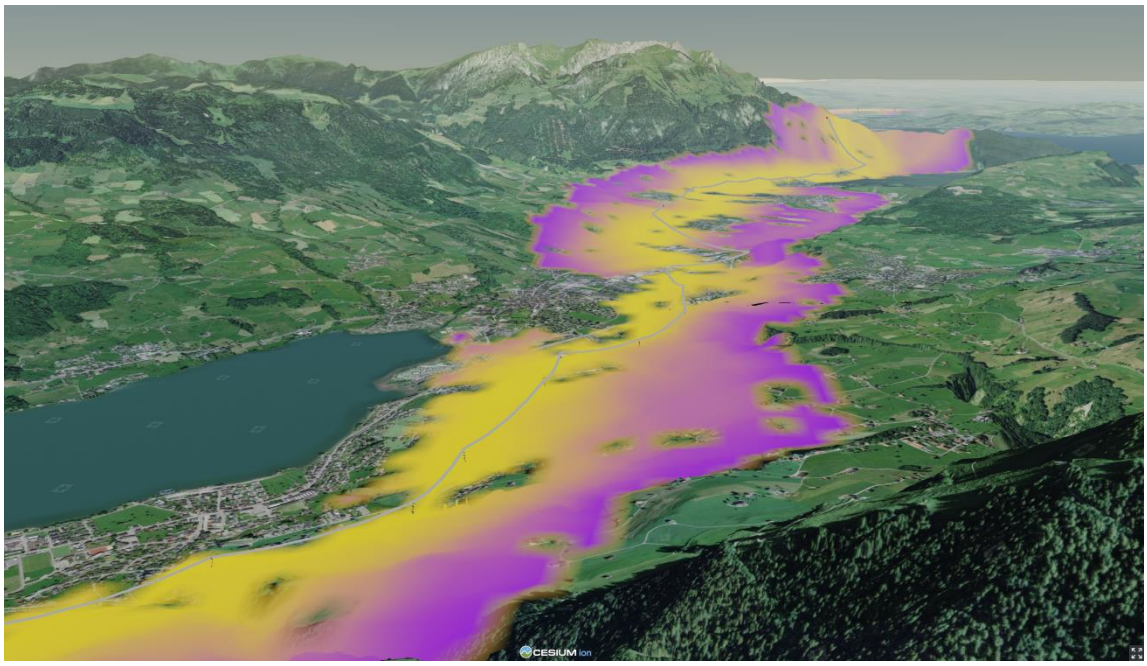
ETIP SNET

EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM

SMART NETWORKS FOR ENERGY TRANSITION



ENERGY STORY:

A new tool visualizes and models the routes for power line projects

The 3D Decision Support System developed at ETH Zurich supports the planning of the electricity grid in Switzerland by lowering time and costs needed for planning

PLAN. INNOVATE. ENGAGE.

Our world is in continuous change: with higher welfare and new technologies arising from advancing digitalization, the demand on electricity is steadily increasing. Simultaneously, the energy transition towards renewable energy sources – like solar or wind power – leads to more electricity being transported over the existing power grid, which might bring it to its capacity limits in the future. According to the European Network of Transmission System Operators for Electricity (ENTSO-E) ten-year network development plan, if the existing power grid is not extended, European citizens would waste 40 billion euros per year as of 2040. This is because more than 150 TWh electricity produced by renewable sources would be lost due to the current grid's infrastructure limitations. In contrast, investing in the grid would contribute to a high reduction of the greenhouse gas emissions by the power sector in the order of 80 percent until 2040. Thus, transmission system operators are aiming at extending their power grid in the near future.

However, where should future power lines go through? This is what many experts and decision-makers have been asking themselves in order to minimize the impact on the environment while offering a financially viable and technically feasible solution. To date, it takes a long time until a sketch from the desk can become real in form of lines and pylons.

Speeding up sustainable energy solutions through new ways of planning

There is a new, computational way of planning power lines, developed by ETH Zurich and Swissgrid, the Swiss transmission system operator. Their 3D Decision Support System (3D DSS) allows decision-makers to determine the optimal path for a new power transmission line based on the areas they want to protect. If, for instance, a decision-maker is especially interested to protect natural reserves and residential areas, the 3D DSS considers these specifications while respecting legal prerequisites. The resulting 3D map shows which areas meet these specifications best. As the 3D DSS is easy to handle and the computation takes only a few seconds, it allows to easily compare different alternatives from different stakeholders.

On the one hand, this tool makes it easier to plan a new power line, whereas on the other hand, it supports the communication with the major stakeholders, as e.g., the citizens living in the according region by visualizing it – said Joshu Jullier, communication manager at Swissgrid. According to a recent survey conducted by Swissgrid, overhead lines are perceived to be disturbing by most of the Swiss citizens. They mentioned health risks, landscape disruption, and audible noises as the three main problems. A best solution does not exist because of conflicting interests among different stakeholders, but the 3D DSS helps them to find a good compromise while considering all interests as far as possible.

On the technical side, the eligible routes highlighted by the 3D DSS can be refined through specified criteria, as for example, avoiding forests, lakes, or residential areas. Whereas the results from a recent study show that the 3D DSS is able to model overhead lines reliably, the developers are currently including earth cables alternatives into the 3D DSS as well. In this way, the 3D DSS could determine areas that are too sensible for an

overhead line, but feasible for earth cables, so that both line types can be combined and the overall impact on the environment can be minimized.

Impact

Project Benefits

- Social acceptance
- Enhanced stakeholder participation
- Economic profit

The Swiss electricity grid was mainly built in the 1950's and the 1960's. Obviously, these lines were not designed to handle renewable energy. Thus, Joshu Jullier underlined that the grid needs to be modernized to comply with the energy transition. For example, many hydropower plants, which produce a significant amount of clean energy, are located in the mountainous region in the south of Switzerland, while the electricity is mostly consumed in the northern flatlands of the country. Thus, the electricity must be transmitted from south to north, which, in turn, requires that the grid must be extended in order to prevent future capacity issues. In this way, the 3D DSS could increase public acceptance for new power lines and therefore, lower the time of the planning phase and the costs of grid projects compared to the traditional way of route planning.

Keywords: powerlines, stakeholder engagement, visualization

More info at: https://3ddss.ethz.ch/ + project video

Note: Project benefits based on specific criteria outlined in ETIP SNET monitoring exercise

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