Energy
National Research Programmes 70 and 71

Project

Future energy infrastructure

Wind and solar energy: a renewable future for Switzerland

More imports than exports, changed electricity flows and a lower load: how renewable energies are changing the electricity grid.

A building in Interlaken: an area of one million house roofs for solar panels will be required for the potential of solar energy to be exploited. *Source:* Shutterstock/Dr. Ajay Kumar Singh

At a glance

- Renewable energies, which are set to shape the Swiss electricity mix over the coming decades, are dependent on the weather – this is leading to changes in the electricity supply.
- Researchers from the University of Basel and ETH Zurich have come to the following conclusion as part of a detailed analysis: the infrastructure of the Swiss electricity grid is equipped for these changes.
- Their calculations also show that solar energy in Switzerland has greater potential than wind energy: it is more cost-efficient and predictable and is more readily available.
- An interesting finding: renewable energies ease the load on the electricity grid and reduce the risk of outages. This is because the energies can be used locally (e.g. the energy generated by solar panels on roofs).

We're in the year 2052 and the FIFA World Cup is in full swing. An important match is about to begin and in bars and living rooms around the country people are sat in from of televisions and big screens. The weather: cloudy and still.

Why does this matter? Under Energy Strategy 2050, the Swiss electricity mix should be shaped by renewable energies such as wind and solar energy. But what happens when demand is high and the weather isn't playing ball?

This question is being addressed by researchers from the University of Basel and ETH Zurich. They have investigated how great the potential for renewable energies is in Switzerland – and whether supply security is assured.

Greater uncertainty, more reserves

To this end, the researchers have analysed Switzerland's grid structure, electricity mix and geographic and climatic conditions. They also identified the best locations for wind power and solar energy plants.

This is because the electricity grids in their current form can only take up renewable energy sources to a certain degree. At present, nuclear power plants supply electricity on a continual basis. This will change, however, if renewable energies are to account for a greater share of the supply: the quantity of electricity fed into the grid will increasingly depend on how much sunlight or wind is available at a certain point in time.

There may therefore be situations in which electricity requirements cannot be fully covered. In order to avoid such critical situations, the grid operators must have sufficient reserve energy at their disposal. The amount of available reserve energy is an important parameter for secure grid operations.

Hydropower can provide reserves

The good news: according to the researchers' calculations, the Swiss electricity grid is equipped for the upcoming changes. Hydropower will be able to provide the required reserves at all times up to 2050. In future, it will therefore not be necessary to miss out on World Cup games because of bad weather.

With respect to the question of which renewable energy should play the most important role alongside hydropower, the researchers have a clear recommendation: solar energy outdoes wind energy several times over.

On the one hand, solar energy is easier to predict: this means that the Swiss electricity grid is required to keep fewer constant reserves for possible outages and resulting supply bottlenecks.

On the other, the generation of solar energy is more cost-efficient and is even likely to reduce the load on the electricity grid (e.g. in cases in which it is produced using solar panels on building roofs). This is because this allows for the electricity to be used in the buildings directly, meaning households and businesses have to consume less electricity from the grid.

To allow solar energy to make a decisive contribution to the electricity mix of the future, solar panels will need to be installed on an area of around one million single-family-home roofs. The most space available for such systems can be found in Western Switzerland.

Lower risk of outages

The fact that it will in future be possible for solar energy to be used locally in many places has an interesting consequence: in 2050, despite the high share of renewable energies, the risk of outages in the Swiss electricity grid is likely to be lower. This is because the grid will be utilised to a smaller extent thanks to the direct use of renewable energies.

On average, imports and exports currently roughly balance each other out over the course of a year. In future, however, Switzerland will import more electricity than it exports over the long run. Firstly, this is due to the fact that solar electricity will increasingly be consumed locally. A further reason is that neighbouring countries will increasingly utilise local electricity generation and therefore have to purchase less electricity from Switzerland.

In order to calculate the potential offered by wind and solar energy, the researchers have created a detailed analysis with the help of geographic information systems (GIS): of the locations for wind power and all roofs for solar energy – the potential for solar parks was not taken into account.

The calculation revealed that the greatest potential for the generation of wind and solar energy lies in the western half of Switzerland – especially around the cities of Geneva, Lausanne and Berne.

The recommendation to politicians arising from this research project: construction legislation should be adjusted in a manner that does not hinder the installation of solar panels on roofs, but rather promotes it. Roof solar energy systems should also be taken into consideration during urban planning measures and by architects during the building design process.

Produkte aus diesem Projekt

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