Energy
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Project

Future electricity market models

How wind and solar energy impact the Swiss electricity market

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Without nuclear power, Switzerland's electricity supply will look different to how it does today. Researchers from ETH Zurich examined the risks posed by these changes.



Switzerland will in future be more reliant on electricity imports. *Source:* Shutterstock

At a glance

- In various scenarios, researchers from ETH Zurich show what the switch to renewable energies might look like in Switzerland.
- If the generation of renewable energies is promoted with subsidies, Switzerland is likely to be less dependent on imports.
- Such subsidies will allow for the achievement of the objectives stated under Energy Strategy 2050. Here, solar energy is set to play a much bigger role than wind energy.
- The volume of wind or solar power that can be generated in one day depends on the weather. This does not lead to bottlenecks in Switzerland, however, as hydropower provides sufficient stability.

There will be plenty of change on the Swiss electricity market. While nuclear energy is slowly being phased out and greenhouse gas emissions are to be reduced, renewable energies such as wind and solar energy will take on a bigger role.

A team from ETH Zurich investigated how all of this may impact the electricity market and the economy as part of a research project.

The researchers used new market models of the future electricity supply to analyse the extent to which the existing system as well as alternative market approaches can contribute to achieving the goals of Energy Strategy 2050. Focus here was placed on electricity consumption, production, the relevant networks and the storage of electricity.

Subsidies for renewable energies?

In order to determine what the electricity market might look like in 2050 and in the period prior to this, the team simulated two different future scenarios. The first scenario sees a situation in which renewable energies receive no additional support from the state and everything continues as things are today. In the second scenario, producers of electricity from renewable sources receive subsidies. Here, the researchers worked on the assumption that the subsidies are the same for all energy forms – irrespective of whether this is wind, solar or biomass energy. The subsidies would be financed by means of a tax levied on energy consumption.

The analyses drew the following conclusions: in the absence of promotion measures, the phasing out of nuclear energy, which in the calculation was set to be completed in 2035, will be almost fully offset with electricity imports. In the early years, there will be minor investments in biomass. In 2050, solar energy will be able to compete with other technologies, leading to greater investments in this segment. With respect to hydropower, run-of-the-river power plants are set to produce around the same amount of electricity up to 2050, while the production of pumped-storage power plants will fluctuate. This is because they are more dependent on prices, which are likely to increase up to 2035.

Different results are generated in the second scenario in which renewable energies receive government support. In this scenario too, electricity imports from neighbouring countries will increase during the phasing out of nuclear energy. However, the earlier growth in the share of renewable energies will cushion this effect. Under this scenario, the objectives of Energy Strategy 2050 can be achieved – primarily thanks to a marked increase in the share of solar energy. Wind energy is likely to only make a minimal contribution.

Incentives for certain technologies

The researchers also examined various types of subsidies for renewable energies. One option is to promote all renewable energies equally. Another would see greater incentives created for certain technologies relative to others.

In the relevant literature, a uniform system under which all technologies are promoted equally is often described as superior. More recent analyses show, however, that specific incentives may make sense with a view to achieving certain objectives. For example, Germany could save on investments in electricity storage if particularly strong incentives were created for wind energy. Due to the country’s large storage options, however, this would achieve nothing in Switzerland as shown by the analyses from this project.

Impact of various market models

Unlike nuclear energy, renewable energies such as wind and solar energy do not provide electricity on a constant basis – they are dependent on the weather. This can theoretically lead to short-term supply bottlenecks.

The researchers therefore examined two mechanisms for the allocation of electricity capacity. The first mechanism is a so-called capacity market: here, producers make available a certain capacity over a period of time and are paid for doing so. With this model, it can be assured that sufficient capacity is available in the overall market at all times. However, as pumped-storage power plants and water reservoirs already cover more than enough capacity for the maximum possible electricity requirements, a capacity market of this kind would not offer any incentive for investments in Switzerland.

The second model is a strategic storage requirement. Here, pumped-storage power plants and reservoirs would have to keep available a minimum amount of energy. But this scenario would also only have a minimal impact on the electricity market.

Stability through hydropower

The researchers also calculated another two scenarios in order to examine the impact of renewable energies on the balance between supply and demand on the electricity market. Two extreme situations were created in the simulation: in the first, renewable energies cannot be predicted at all, while in the second they are completely predictable. There is also no reason for concern here: hydropower provides enough stability, meaning that the market and electricity prices are barely impacted in both cases.

The team comes to the following conclusion: the phasing out of nuclear energy will not put the Swiss electricity system at risk – irrespective of whether the loss of electricity from this source is covered by imports or renewable energies in Switzerland. Subsidies for renewable energies will mean that more is invested in these technologies and Switzerland will be less dependent on electricity imports.

Produkte aus diesem Projekt

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