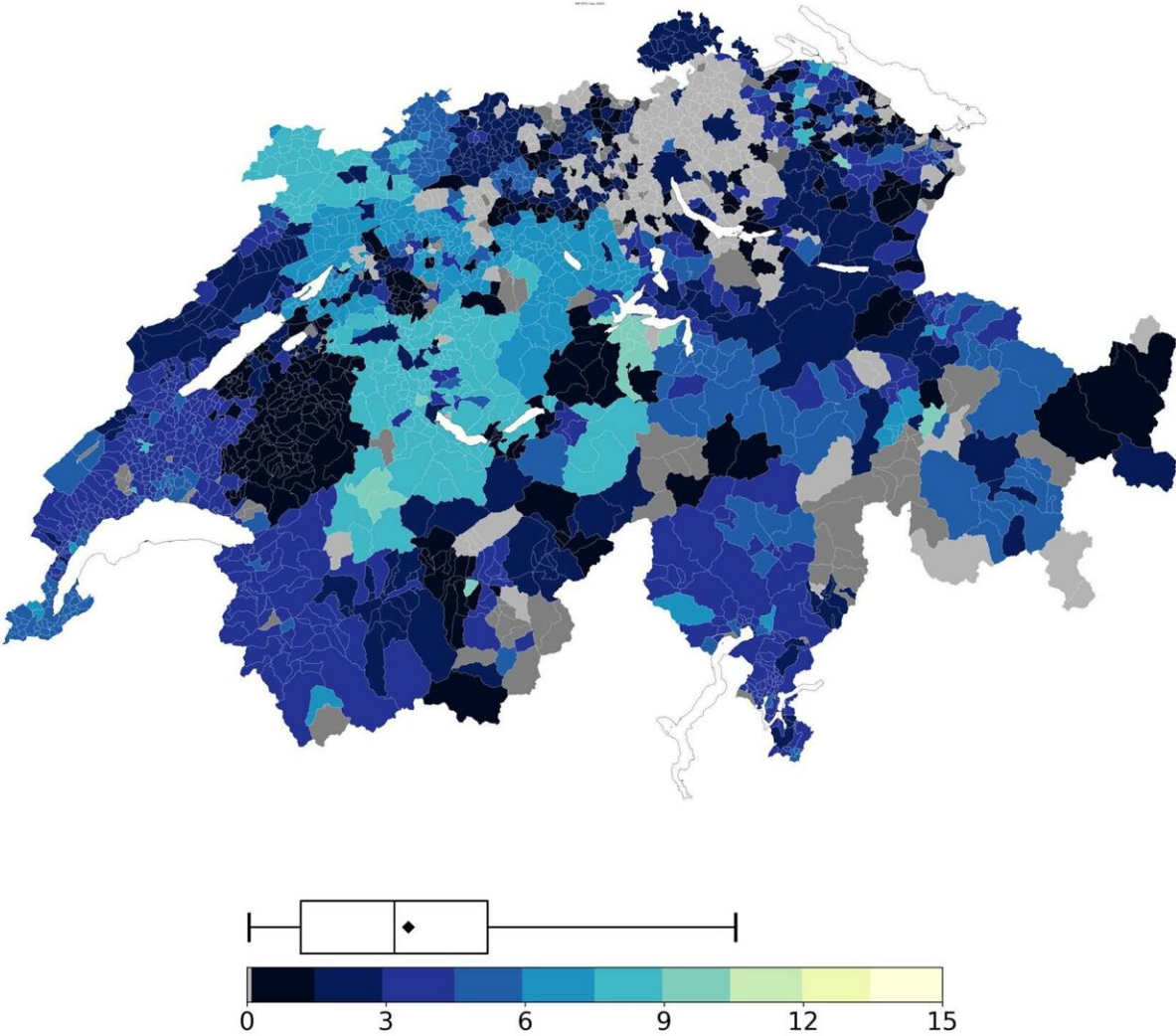


# Patchwork of issues limits solar expansion in Switzerland

February 2 2023



The expected return on a solar installation for a single-family home with gas heating in almost all Swiss communes and cities. The brighter the commune, the greater the return over a period of 30 years. Communes with returns of zero or

less are shown in light grey. Communes for which returns could not be calculated are shown in dark grey. The box above the colour scale corresponds to the area containing the middle 50 percent of the results. SC stands for self-consumption. Credit: Tobias Schmidt / ETH Zurich

Whether rooftop solar panels are worth the cost is largely dependent in Switzerland on local compensation rates for solar power and on electricity prices in general—these are the findings of a study by researchers at ETH Zurich and the University of Bern. Many power grid operators pay too little, thereby limiting the expansion of solar power.

To reach its climate goals, Switzerland needs to massively increase its solar energy production. Photovoltaic panels on single- and multi-family homes play an important role in this regard as they represent 42% of potential roof space. However, the [cost-effectiveness](#) of investing in such panels is highly dependent on location and on the local power grid operator. Precisely how dependent can be seen in a new study by researchers at ETH Zurich and the University of Bern. The study was conducted as part of the "Sweet Edge" project and commissioned by the Swiss Federal Office of Energy.

## **Factors that make solar panels profitable**

Of the 2,067 Swiss cities and communes examined in the study, installing rooftop solar panels only paid off for just under half of the owners of single-family homes with gas heating. The researchers considered a solar installation profitable if its anticipated profits over a 30-year lifespan exceeded 3%. Besides installation and maintenance costs, they considered the system's performance capacity, the compensation rate for energy fed back into the grid, the cost of electricity saved by using the solar panels and the tax rate.

Depending on the electricity supplier, homeowners in Switzerland in 2022 received between 5 and 22 Swiss cents per kilowatt hour for solar power generated at home. They paid between 12 and 34 Swiss cents per kilowatt hour of electricity. These dramatic local differences led to a huge variation between communes with regard to the size of the most profitable solar installation and the amount of electricity produced at home and used by the same household.

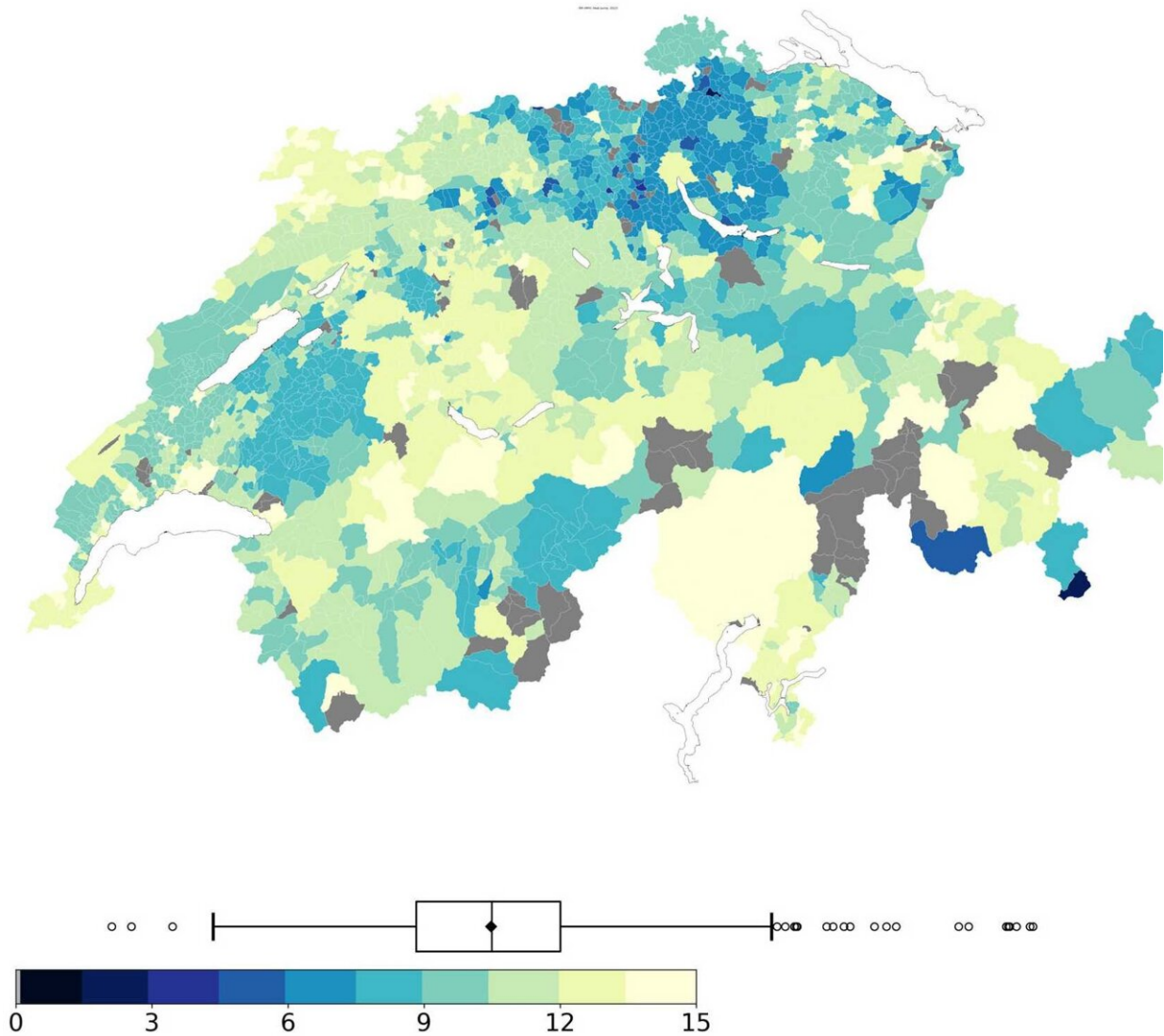
"The less the local power grid operator pays for the solar power fed into the grid and the more it charges for the power it provides, the more likely homeowners are to match the size of their solar installation to their own usage. In some cases, this means that they build smaller systems and produce less electricity than they might actually have room for," explains ETH Professor Tobias Schmidt, one of the authors of the study. A larger solar installation that feeds more [solar power](#) into the grid than the household uses pays off mainly in locations where the rate of compensation for that energy is high.

## **Major differences between cantons**

A comparison between the cities of Zurich and Lucerne demonstrates how the various factors in the model play out with regard to profitability: although there are comparatively high subsidies and tax deductions in Zurich, in 2022 it did not pay off for an owner of a single-family home with gas heating to invest in a relatively small solar installation with a capacity of 4 kilowatts (kW). Neither high subsidies nor low taxes could make up for the poor compensation rate for solar energy (7.9 Swiss cents/kWh) and the relatively high cost of electricity (26.4 Swiss cents/kWh) in Zurich.

In Lucerne, on the other hand, the subsidies are smaller than in Zurich and investments in solar installations are not tax-deductible. However, a compensation rate of 14.4 Swiss cents/kWh and electricity costs of 22.7

Swiss cents/kWh make it profitable to invest in a solar system with a capacity of 12 kW.



Installing solar panels on a multi-family home with nine residents spread across four apartments and a heat pump pays off in almost all Swiss cities and communes. The median lies at a return of 10.5 percent. On average, 63 percent of the solar power generated is consumed at home. Credit: Tobias Schmidt / ETH Zurich

## The local grid operator decides

Despite standardized cantonal regulations and requirements, it is often a matter of only a few kilometers and a different grid operator that determine whether one's own solar installation is financially viable. Such is the case in the canton of Zurich: in Rümlang, at the current rates, a solar panel system with a capacity of 12 kW for a single-family home would yield a return of 6%—or CHF 7,000—over a lifetime of 30 years.

In the town of Kloten, only 6.5 kilometers away, the same installation would result in a slight loss. The decisive factor in this case—besides the cost of electricity—is once again the dramatic difference in rates of compensation among local grid operators: in 2022, the rate was 16.97 Swiss cents/kWh in Rümlang, but only 6.10 Swiss cents/kWh in Kloten.

## Larger solar installations with heat pumps more profitable

It looks much better for multi-family homes, according to the study. Such installations are viable in nearly all cities and communes. "In the case of multi-family homes with larger roofs, solar panels nearly always pay off—and even more so for buildings with a heat pump, as that raises the building's need for electricity and saves more on purchased energy," says ETH Professor Schmidt.

In Rümlang, a solar installation with a capacity of 16 kW would yield a return of 10%—or CHF 22,000—over 30 years. This variant would also be profitable in Kloten, with a return of 5.5%—CHF 7,000. However, because compensation for energy produced is lower in Kloten, a smaller installation with a capacity of 12 kW that primarily serves the building's own energy needs would be more profitable than one that covers the

entire roof. "If Switzerland is aiming to maximize the capacity of solar installations on multi-family dwellings, we must strengthen the incentives accordingly, for example, by raising feed-in tariffs," Schmidt explains.

## Accelerating the expansion of solar power

In order to speed up the expansion of solar energy, the authors of the study recommend aligning the various rules and compensation rates in Switzerland. "Switzerland is like a patchwork quilt in this regard. It's unfair and incomprehensible that the profitability of solar installations varies so widely from region to region," Schmidt says. Isabelle Stadelmann, professor at the University of Bern and co-author of the study, adds: "In the case of photovoltaics, the federalist structures mean that a majority of cantons do not actively promote its expansion. Harmonization through binding and more ambitious standards would be necessary."

The authors of the study see various possibilities: for example, solar installations could be tax-free in all cantons. Additionally, investments in buildings that are less than five years old should be tax-deductible. But the question of whether rooftop [solar panels](#) are a good investment mainly depends on the feed-in tariffs and the cost of electricity. These are defined by more than 600 power grid operators. The study shows which grid operators would need to raise their rates and compensation in order to promote solar expansion.

**More information:** Quantifying the degree of fragmentation of policies targeting household solar PV in Switzerland, *ETH Zurich* (2023). [DOI: 10.3929/ethz-b-000596612](https://doi.org/10.3929/ethz-b-000596612)

Expected Internal Rate of Return (IRR) for Solar PV Rooftop Installations in Switzerland, *ETH Zurich* (2023). [DOI: 10.3929/ethz-](https://doi.org/10.3929/ethz-)

[b-000596623](#)

EDGE Website: [www.sweet-edge.ch/en/home](http://www.sweet-edge.ch/en/home)

Provided by ETH Zurich

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