Schaffhauserplatz, in Zurich’s District 6: as in so many other places, an apartment building is being refurbished. If you study the building a little closer, the facade stands out: cables are protruding from where matte-gray glass plates will soon be installed. This is no ordinary facade; it’s fitted with solar cells, which, together with a photovoltaic system on the roof, will provide all the electricity that the residents need – and more.

The production of renewable energy requires space. In the case of an apartment building, this space is provided by roofs and facades. Conflicts are unlikely as the solar panels are elegantly integrated into facades or roofs. But conflicts occur quite often: in many locations that are generally suitable for the production of renewable energy, the construction of wind turbines or photovoltaic systems would result in the curtailing of other ecosystem services. Thus, the aesthetic value of the landscape could be diminished or living space for plants and animals might be reduced.

If construction of infrastructure for renewable energy production is restricted to areas where the risk of conflict is low, total energy production will be significantly reduced. A balancing of interests is therefore necessary, as renewable energy sources also offer remarkable opportunities. As part of the Energy Change Impact research program, Janine Bolliger and her colleagues examined how much solar and wind energy could be produced in Switzerland with minimal conflict over land use, and the economic opportunities this might create. The researchers considered future land-use scenarios, taking into account expected advances in technology.

The opportunities of urbanization

The researchers carried out interviews with experts in order to find out the kinds of technological advances we can expect in the future. Technology experts believe that by 2035 wind turbines will be more efficient than today, even at low wind speeds. Their transport and set-up will also become simpler, making them suitable for installation in isolated areas. The efficiency of solar cells will increase by at least 20% compared to today’s levels. The design of solar panels will also become more appealing, either more colorful or invisibly integrated into windows – all contributing to higher acceptance by the public.

A daring vision of 2035: solar energy can be used more effectively, since all land-use scenarios see an increasing number of built-up areas in Switzerland. Increases in built-up areas will facilitate the installation of solar cells on buildings (roofs, facades), leading to an increase in solar electricity potential of 20% to 50% in 2035 compared to 2009. Solar energy should also make a higher contribution than previously assumed to compensate for some of the anticipated energy deficits.
The situation is different for wind energy, as wind turbines are more likely to cause conflicts compared to solar panels (noise, aesthetics and nature conservation concerns). There is a distinction, then, between the total power we can produce and the power we can exploit with a low risk of conflict. This conflict of interest is unlikely to be resolved in future, regardless of technological innovations. As both populated and wooded areas are due to increase by 2035, fewer suitable locations will be available for wind turbines. The improved efficiency of wind turbines may well offset this, but the difference between potential energy power production and low-conflict energy power production remains large in all future land-use scenarios, meaning that future projections for wind energy are comparable to the current situation.
Researchers are also assessing how wind and solar energy benefit the local economy in rural regions of Switzerland (Surselva, Goms, upper Emmental and Val de Ruz). Although the net added value varies by region, it remains 5% below today’s value in all cases. The reason is that the installations are primarily manufactured abroad, and, with the exception of maintenance, bring in very little additional business to the region.

**Calculating optimal locations for renewable electricity sources**

What are the future prospects for wind energy? Bolliger is keen to qualify: “Our results apply to Switzerland, where the beauty of the landscape is very highly valued. Many people prefer landscapes that are not visually or acoustically disturbed. It’s likely, though, that social acceptance may change in future.” What is clear is that not all potential locations are suitable for wind turbines. “In an optimal location for renewable energy, the impacts on the ecosystem are at least balanced out by the amount of electricity generated from renewable sources”, says Felix Kienast, head of the Landscape Research Center and Professor of Landscape Ecology at ETH. “Assessments of trade-offs between electricity gain and conflicts with other ecosystem services certainly facilitate the search for locations and the decision to build.” Such evaluations may be conducted using optimization software. Kienast and his colleagues used such an approach to determine the areas with the highest energy potential at the smallest possible cost for other ecosystem services.

At Schaffhauserplatz in Zurich, no conflict evaluation was needed. The apartment building will be completed in autumn 2016, ready to produce its own electricity from renewable sources. Its smooth facade will still stand out among the plastered walls of the neighboring houses – but perhaps not for much longer.

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