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Umwelt Bundes Amt
For our Environment

Decentralised renewable energy supply is ok, self-sufficient, individual solutions are not

UBA study: Autarkic energy systems only rarely a viable option

Decentralised energy systems which satisfy their own power demand without being connected to the grid are an option for cities and municipalities in a few isolated cases only. The electricity demand of industry and commerce in particular cannot be met with this approach. This is the conclusion drawn in a study by the Federal Environment Agency (UBA) which develops a scenario of a future electricity supply entirely based on renewable sources in Germany by 2050 ("*Modellierung einer vollständig auf erneuerbaren Energien basierenden Stromerzeugung im Jahr 2050 in autarken, dezentralen Strukturen").* With external expertise the technical and ecological feasibility in 2050 of small-scale, decentralised energy systems was analysed to use renewable energy sources available locally to cities, city districts or municipalities to satisfy their own power demand. These areas are not connected with each other or with outside suppliers via an electricity grid. This means that only the locally available potential of renewable energy sources is used to meet local power demand, and this requires electricity storage capacity. UBA President Jochen Flasbarth remarks, "The study shows that this type of local autarky may, under favourable circumstances, be realised in some cases and that local power generation can play a significant role in contributing to an energy supply system based on renewable energy. However, this concept is not a viable alternative for a renewables-based electricity supply for the whole of Germany. Decentralised energy supply could transform cities and municipalities into powerful players in the transformation of the energy system. Ensuring an efficient energy system in Germany that is based entirely on renewable energy makes it imperative to include local power generation structures in a higher order grid."

The study simulated two exemplary settlement structures in the year 2050: a rural community with a low population density and a town district with a high population and building density. These structures, one in northern and the other in southern Germany, were analysed to reflect the different meteorological conditions affecting the power generation from renewable sources, and from wind and solar power in particular. The simulations introduced variations that

concerned the share of electricity-powered private vehicles or the installed generation capacities per technology.

The simulation results show that the electricity demand of private households and private electric cars can be covered in rural communities by the assumed locally available potentials for photovoltaics and wind energy. However, very high storage capacity is required to make full use of the locally produced energy and to compensate for longer periods of windless conditions. In contrast to the northern location, the location in southern Germany requires additional effort concerning the installed capacity for both electricity generation as well as storage. The study could not establish a self-sufficient electricity supply for the town district with the given assumptions. In addition to private household demand, additional simulations modelled and considered the electricity demand for industry, trade and commerce. Meeting the electricity demand of all these consumers with a self-sufficient electricity supply system is then also no longer possible for the rural community.

It can be concluded that the concept of local energy autarky is feasible in the long term in certain cases and under favourable conditions, e g. when electricity can be produced locally from geothermal energy or hydropower. This may be useful in off-grid locations or other remote locations and islands. However, it is not a viable alternative for a renewables-based electricity supply for the whole of Germany since local energy potentials are often insufficient. On the other hand, in cases where potential is sufficient the necessary storage capacity cannot be installed at reasonable expense. Nevertheless, local generation can contribute a substantial share to a power supply based on renewable energy sources, as the UBA already demonstrated in the "Regions Network" scenario of a 2010 study titled *Energy target 2050: 100% renewable electricity supply*. According to the study, the potential of renewable energy sources must be tapped at the location where it is available and then fed to consumption centres. Jochen Flasbarth comments, "The conclusions of the study highlight the necessity of a well-developed transmission and distribution network that is adapted to a system of decentralised feed-in. We need this network if we are to achieve a renewables-based electricity supply for all of Germany." Firstly, this network would allow for taking advantage of the effects of large-scale temporal and local fluctuations in feed-in from renewables; and secondly, any differences in the spatial distribution of the potential of renewable energy sources could be overcome, e.g. high wind potential in north Germany with concurrent concentration of consumption centres in southern and western Germany.

Further information and links

The study Modellierung einer vollständig auf erneuerbaren Energien basierenden Stromerzeugung im Jahr 2050 in autarken, dezentralen Strukturen (in German) can be downloaded free of charge by clicking here: http://www.uba.de/uba-info-medien-e/4572.html. It was commissioned by the Federal Environment Agency to Stefan Peter, a freelance engineer.

The UBA study Energy target 2050: 100% renewable electricity supply is available here: http://www.umweltbundesamt.de/uba-info-medien-e/3997.html

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