DLR creates country energy scenarios, commissioned by Greenpeace

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Almost 100 and 90 percent of electricity from renewable sources possible for Switzerland and Poland

Switzerland will be able to obtain 98 percent of its electricity needs from renewable energy sources by the year 2050, while the corresponding figure for Poland reaches nearly 90 percent. In the long term, a sustainable energy supply is possible in both countries. These figures are shown by energy scenarios that German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) researchers have prepared on behalf of Greenpeace. Following a global energy scenario published in 2012, DLR is preparing various country studies that show how a sustainable energy supply at a national level is possible while carbon dioxide emissions are drastically reduced.

The scenarios describe development paths whereby the energy supply in individual countries can be sustainably designed with the resources available there. "In the report, we calculate which investments are necessary for a successful transition to renewable energy and the corresponding costs and savings for the economy," says Thomas Pregger, Project Manager at the DLR Institute of Technical Thermodynamics, describing the task of systems analysis. In addition, the studies show the potential for increasing energy efficiency in the target countries.

"The country scenarios are a good way to show national decision-makers that sustainable energy supply is not only ecologically, but also economically viable," says Sven Teske of Greenpeace International. "This is even possible in countries such as Poland, whose energy supply up to now has been heavily dependent on fossil energy sources." In addition to DLR, Greenpeace is working together with national experts on renewable energy sources in the various countries.

Switzerland – mix of renewable energies

Even today, thanks to abundant hydroelectric power, almost 57 percent of the energy supplied by Switzerland is produced using renewable energy sources. By the year 2050, this proportion could be at 98 percent, according to the Energy Transition scenario in the DLR system analysis. This can be achieved by a rapid development of photovoltaics and a moderate, nature and landscape-based development of wind power, geothermal energy, hydroelectric power and biomass fuel sources. In addition, the scenario envisages a limited import of wind power from the north and solar power from the south. The phasing out of nuclear power in Switzerland is planned for 2025.

Balance between capacity and demand

On behalf of Greenpeace, the researchers have simulated the power supply in Switzerland on an hour-by-hour basis. The results show that during the day, in the summer months, excess electricity will be available in a large proportion of photovoltaic systems. The capacity of pumped-storage power plants in Switzerland is large, but not sufficient to absorb this surplus. Part of the excess electricity can be exported to Switzerland's neighbours, while another part can be diverted using load management during demand periods. "In times of surplus, power can be used to recharge electric cars and for heat generation," explains Pregger. "In addition, synthetic fuels such as hydrogen can be produced from renewable electricity, which can then replace fossil fuels in transportation and industry. So the surplus can be transferred not only from day to night, but also from summer to winter."

Changes for heating and transportation

Heating, which is at present almost 75 percent based on fossil fuels, must be restructured to achieve climate goals. Energy from renewable sources now provides about 21 percent of the heating demand in Switzerland, where domestic wood is the main contributor. In the Energy Transition scenario, the heat requirement is greatly reduced. By increasing the use of geothermal and solar thermal energy, the heating demand supplied using renewable energy sources can increase to 66 percent in 2035, and to 97 percent in 2050.

Transport must be included when building a sustainable energy supply. The scenario envisages expanding public transport, while private transport continues to play the largest role. At 54 percent, electricity could be the most important source of energy for transportation by 2050. In the Energy Transition scenario, electricity consumption for transportation increases from today's 11 petajoules to around 54 petajoules, which corresponds to about 25 percent of electricity demand in the year 2050. The mix of road vehicles is what changes in the transportation sector; in addition to electric vehicles, biogas, liquid biofuels and synthetic fuels, such as renewable hydrogen, replace petrol and diesel. Through the conversion of vehicle fleets, the final energy consumption of transportation drops dramatically – by about 60 percent compared to today.

Poland – green electricity 3.6 cents per kilowatt-hour cheaper than coal power in 2050

Ninety percent of Poland's energy supply is currently based on lignite and coal, unlike that of Switzerland. The study shows that even with such a starting point, the share of renewable energy can increase from just under seven percent (in 2010) to nearly 90 percent of electricity generation and from currently just under 11 to over 75 percent of heating energy. In the long term, this makes economic sense, although the cost of generating electricity increases in comparison to the reference scenario when following the current trends of energy mix and consumption in Poland. The costs for the Energy Transition increase slightly until 2020, but by 2050, the cost of electricity generation is lower than by about 3.6 cents per kilowatt-hour in the reference scenario. With a conversion to renewable energy, the country can save a total of 98 billion euros in fuel costs for power generation by 2050. These savings cover almost three-quarters of the additional investments necessary for the development of renewable energies. "Although Poland has no single outstanding source of renewable energy – solar radiation is not particularly high and the potential for wind power on land or in the Baltic Sea is not as high as, for example, in the United Kingdom – the conversion of the energy system to use largely renewable sources is possible. The requirement is the use of a broad mix of renewable energy sources, while at the same time exploiting the potential for increased efficiency," says DLR researcher Tobias Naegler, who was responsible for the country scenario for Poland.

Increasing electricity demand

In the reference scenario, the researchers assume an increase of around 11 percent in final energy consumption in Poland by 2050. In the Energy Transition scenario, they assume that it can be reduced by 32 percent. "This is possible, among other methods, through insulation of buildings and a significant increase in efficiency of electrical appliances and in industry," says Naegler. This is not the case for the demand for electrical energy; in the Energy Transition scenario, the researchers assume that economic growth and living standards in Poland will rise. In addition, the use of electricity for heating and in the transport sector will increase. Both lead to a sharp rise in electricity demand, from 119 to 214 terawatt-hours per year. "However, since the power from renewable sources in the scenario replaces fossil fuels, the overall emission of greenhouse gases is reduced," explains Naegler.

The complete study for Poland with a summary can be found here (PDF, in English). The scenario for Switzerland has been published in German by Greenpeace and is available here.

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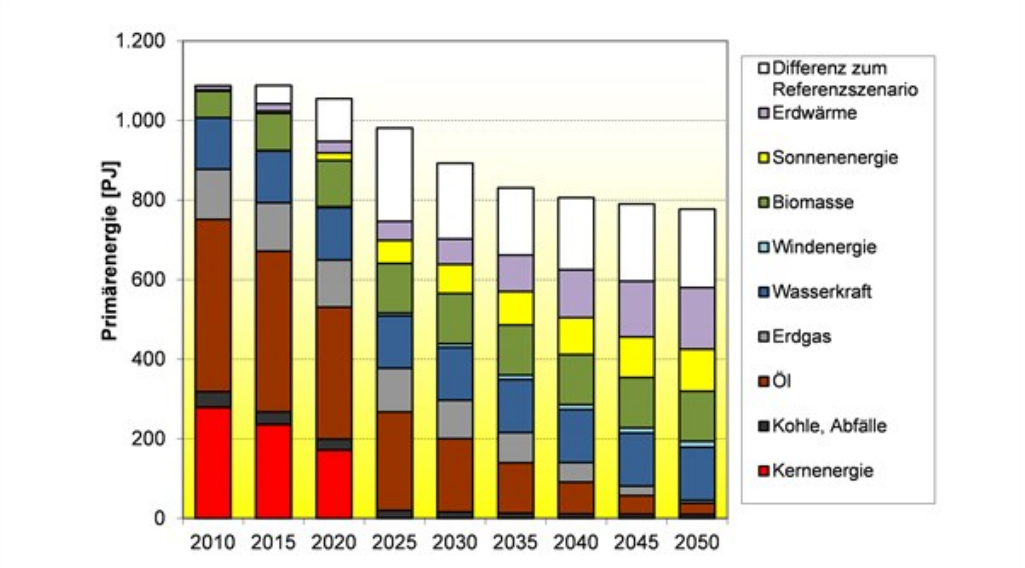
Emosson dam at Chatelard in Switzerland

Hydroelectric power is an important component of the energy mix in Switzerland. By 2050, the share supplied from renewable energy sources could be at 98 percent in Switzerland.

Credit: ClipDealer.

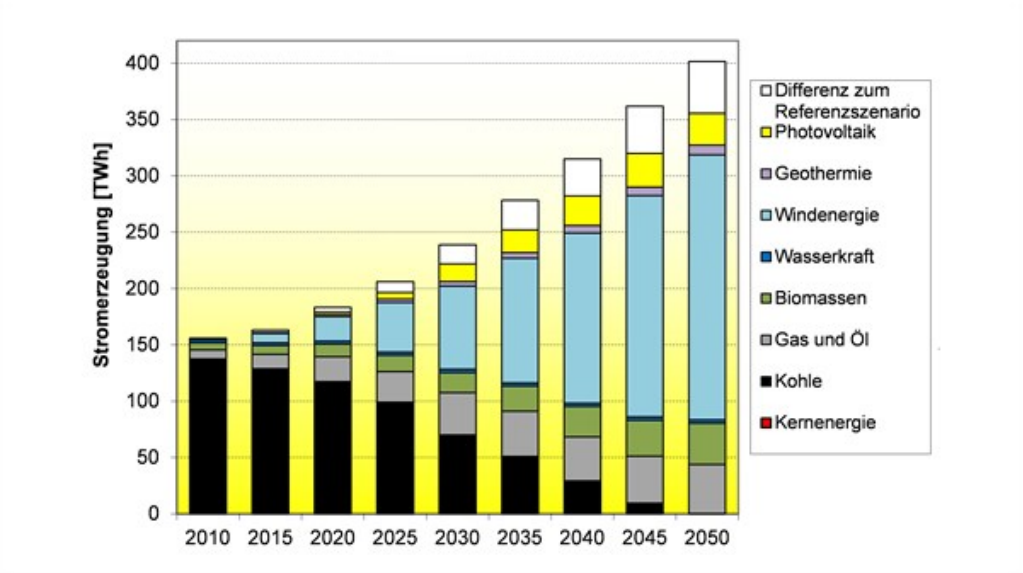
Primary energy consumption in petajoules (PJ) in the DLR energy scenario for Switzerland



Graphic from the DLR Energy Transition scenario for Switzerland. The annual energy output of a 1000-megawatt power plant is approximately 31.5 PJ.

Credit: DLR.

Electricity generation in terawatt-hours (TWh) in the DLR energy scenario for Poland



Graphic from the DLR Energy Transition scenario for Poland.

Credit: DLR.

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