University of Basel

Sustainability tomorrow: Identifying challenges, analysing approaches and assessing future strategies

Audio Transcript

Challenges and Approaches: Switzerland as a Case Study

Part 1

[Prof. Dr. Ulf Hahnel] In this podcast, we will explore sustainability-related challenges and approaches in the case of the Swiss energy transition. The energy transition in general can be guided by the three sustainability strategies: consistency, efficiency and sufficiency.

As you will see, it is not enough to change energy production towards a sustainable energy supply, for example based on renewable energies. This would be referred to as a mere consistency strategy.

In addition to a consistency strategy, you also need a reduced energy demand through more efficient technologies. An example of this efficiency strategy would be to replace an old car with a more efficient new car.

Finally, in addition to consistent and efficient technologies, energy transition will only be sustainable if it is complemented by behaviour and corresponding societal changes. An example of this sufficiency strategy would be to use the bike instead of the car.

Before we take a look at the Swiss energy system, we would like to let you do your own research. What is Switzerland's energy mix in terms of electricity supply, general energy supply and energy demand? What are Switzerland's energy-related greenhouse gas emissions?

Follow the links provided in the text and write down your answers before you continue with the second part of this podcast.

University of Basel

Part 2

[Prof. Dr. Ulf Hahnel] Now that you have done your own research, let's take a look together at the Swiss energy system and its challenges and key elements according to the three sustainability strategies of consistency, efficiency and sufficiency.

First, if we have a look at electricity production, we can see that around 60'000 gigawatt hours of electricity were produced in Switzerland in 2021, with hydroelectric and nuclear power plants contributing 62% and 29% respectively.

Only 4% was produced by conventional thermal power plants, and 6% was produced by various renewable sources such as biogas, photovoltaic or wind energy plants.

This had implications for greenhouse gas emissions, which were quite low. Switzerland produced 29.6 grams of CO_2-equivalent per kilowatt hour for electricity. In comparison, on average, the European Union emitted 275 grams of CO_2-equivalent per kilowatt hour, according to data from 2021.

So does this mean that everything is fine? The answer is no.

If you take a look not only at the supply side, but also at how the supply meets the demands of electricity, we can see that the import-export balance is mostly positive in the sense that more electricity was imported than exported.

For a few years now, electricity has been imported into Switzerland in winter, while surpluses have been exported in summer.

Energy supply and demand includes more than electricity. It also includes heating and mobility, in other words, fuel; as well as embodied energy that we need for food, for consumption such as furniture, clothes, appliances and so on, for production, and for transportation of imported products.

Trends in energy demand have to be taken into account as well. Since 1950, Switzerland's final energy consumption has increased by a factor of almost five. Although this has stabilised since around the turn of the millennium, the changes are disproportional. In certain sectors, energy consumption is still increasing.

This is problematic, because about 60% of final energy consumption was still mainly covered by fossil fuels in 2021. A small but growing share was covered by renewables, including waste incineration, wood, district heating and so on.

Let's now take a look at the mobility sector. This sector has the biggest share of emissions in Switzerland, namely 32%. While Swiss energy consumption has decreased slightly since 2000 due to less heating and lighting, demand in the mobility sector has increased, although there was a decline in mobility in 2020 and 2021 because of the COVID-19 pandemic.

Air travel energy demand and emissions are mostly not included in national statistics, but have a significant effect. On average, the Swiss population flies twice as often as people in neighbouring countries and more often than residents of the United States.

In addition to this, total energy consumption also includes embodied energy, which further worsens Switzerland's energy balance from a sustainability perspective. This is in contrast to the goals of reducing greenhouse gas emissions. By ratifying the Paris Agreement, Switzerland committed itself to reducing greenhouse gas emissions by at least 50% by 2030, compared to 1990.

Next to greenhouse gas emissions, there are other challenges which need to be considered. The Russian invasion in Ukraine and the corresponding energy production issues in the European Union, including temporary shutdown of nuclear power plants in France, have raised concerns about energy security.

In Switzerland, the costs for energy demand have massively increased, like in many other countries. Fuel prices increased by 26% from January 2021 to October 2022. Gas wholesale prices went up between 50% and 300%. The electricity wholesale price was, at times, +1000%. For households, the price for electricity increased by 27% on average.

Of course, there are large differences in energy costs for different types of households and income groups. But the implications for energy poverty and justice remain. Hearn and colleagues (2022) found that even before the energy crisis and even in a rich country like Switzerland, about 12% of residents are energy vulnerable. The analysis shows that the energy vulnerable are, on average, less wealthy and are slightly more likely to be tenants who rent their homes rather than homeowners.

Taken together and for these reasons, the Swiss government and the electorate paved the way for the Swiss Energy Act in 2017 and the associated Energy Strategy 2050.

The Energy Strategy 2050 has the aim of increasing the production of renewable energies, excluding hydropower, from 4'700 GWh in 2020 to 11'400 GWh by 2035. It will also slightly increase and stabilise the production of hydropower.

Moreover, the aim is to decrease the overall energy consumption per capita by 43% and the electricity consumption per capita by 13% by 2035.

Key measures in the Energy Act include: firstly, measures to increase energy efficiency in buildings, mobility, industry and appliances.

Secondly, measures to expand renewable energies through funding instruments and improvements in the legal framework.

And thirdly, nuclear phase-out, which means that there will be no new general licenses and the existing plans will be gradually phased out, based on safety criteria.

In addition, as mentioned before, by ratifying the Paris Agreement, Switzerland committed itself to reducing greenhouse gas emissions by at least 50% by 2030, compared to 1990.

A total revision of the CO_2 Act would have defined the measures for achieving this target by 2030. However, on the 13th of June 2021, the Swiss electorate rejected this revised CO_2 Act. The energy transition in Switzerland is therefore still evolving, with many challenges and problems ahead.