

Scenarios of a net-zero energy supply

ETH Energy Week
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Prof. Dr. Gabriela Hug
Power Systems Laboratory

We need a joint consideration of energy, climate and biodiversity.



zg.ch

Risks to biodiversity under different climate extremes and land/water use scenarios

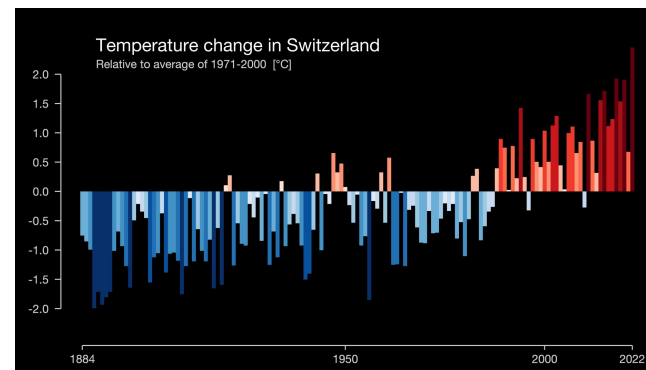
Sustainable energy systems to preserve biodiversity and CO₂-negative materials



Photo by [Markus Spiske](#) on [Unsplash](#)

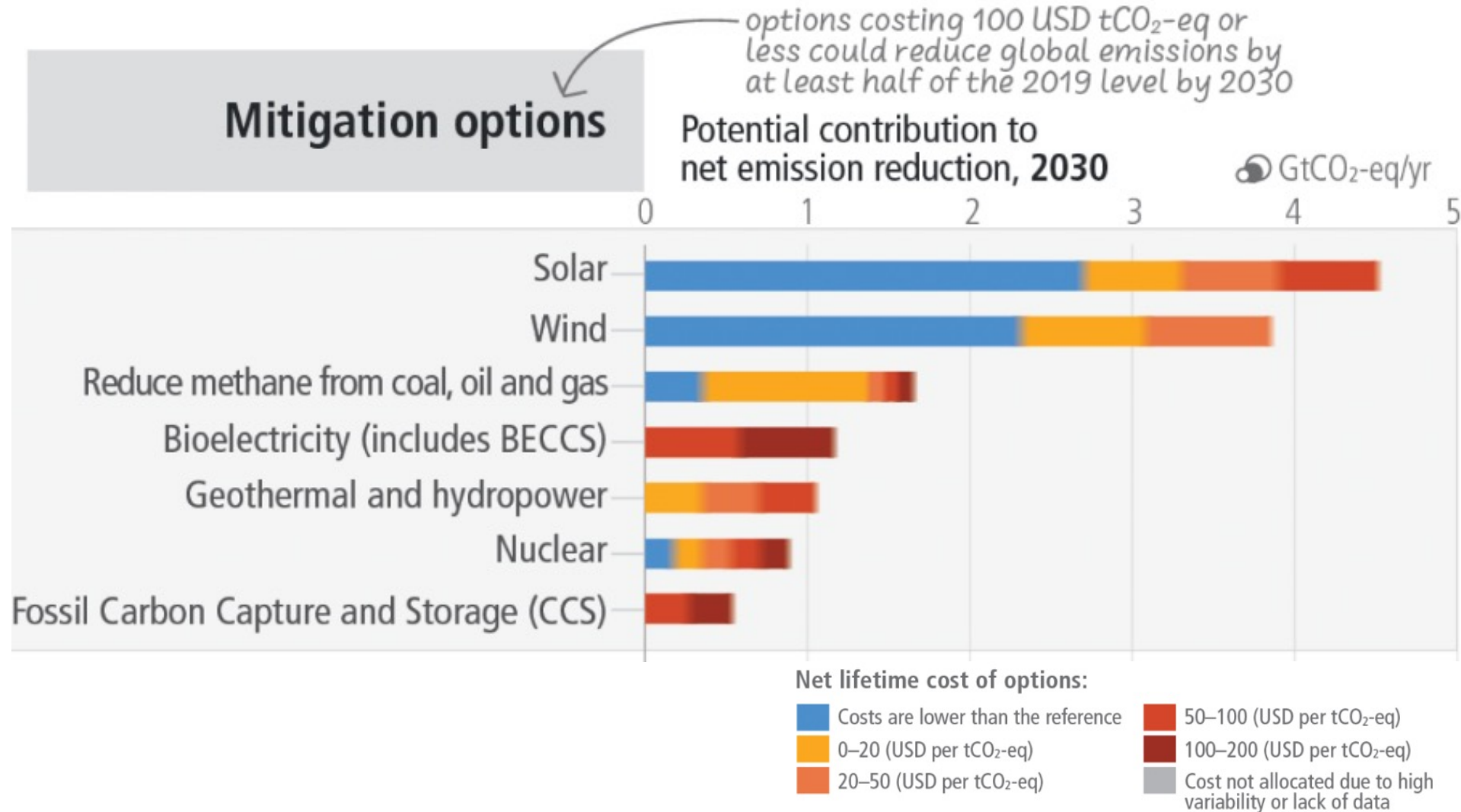
Synthesis, Integration and Public Relations

Climate scenarios, overlapping extreme events and impacts on resilient energy systems



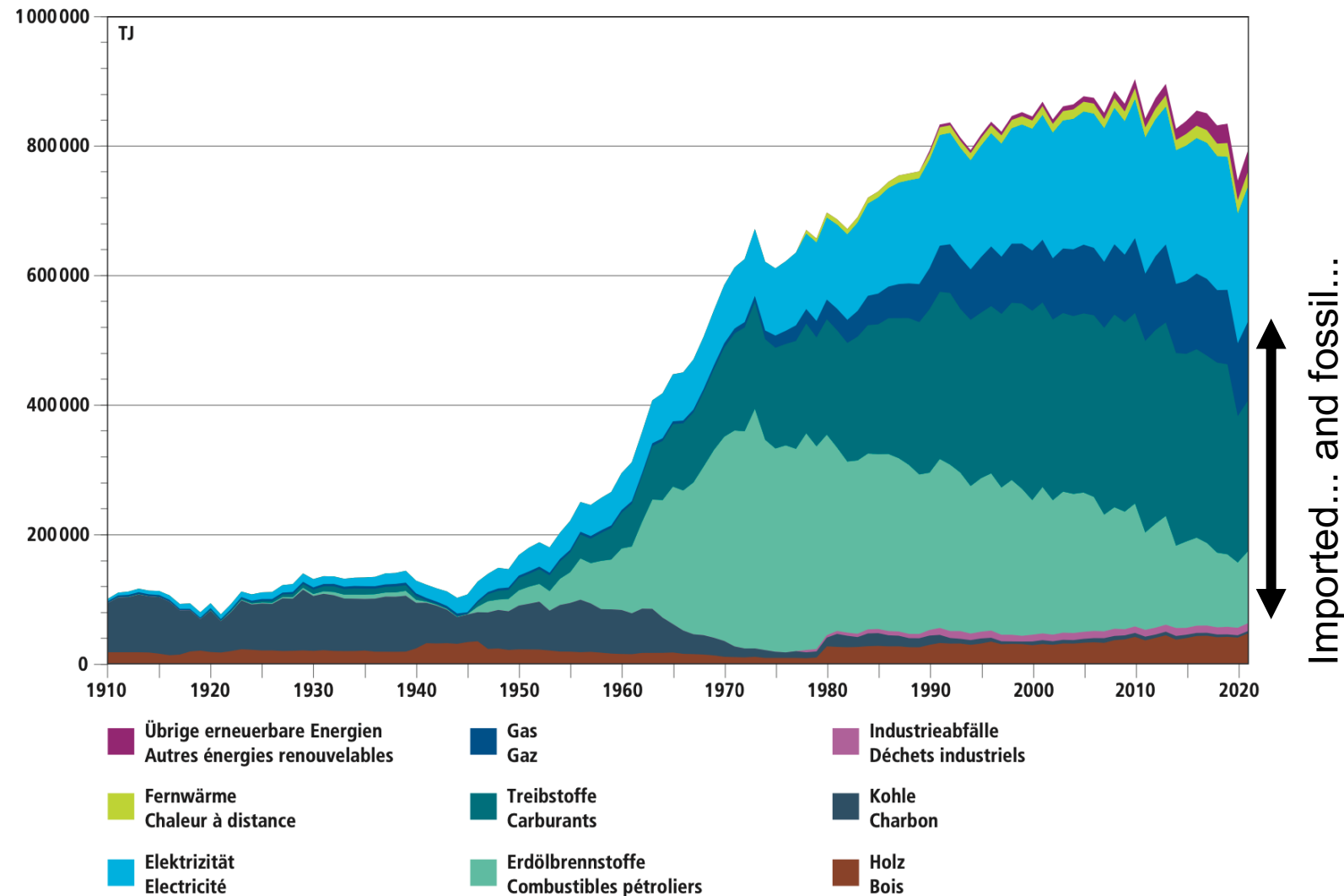
showyourstripes.info

Half of emission reductions needed by 2050 cost less than 100 US\$/t.

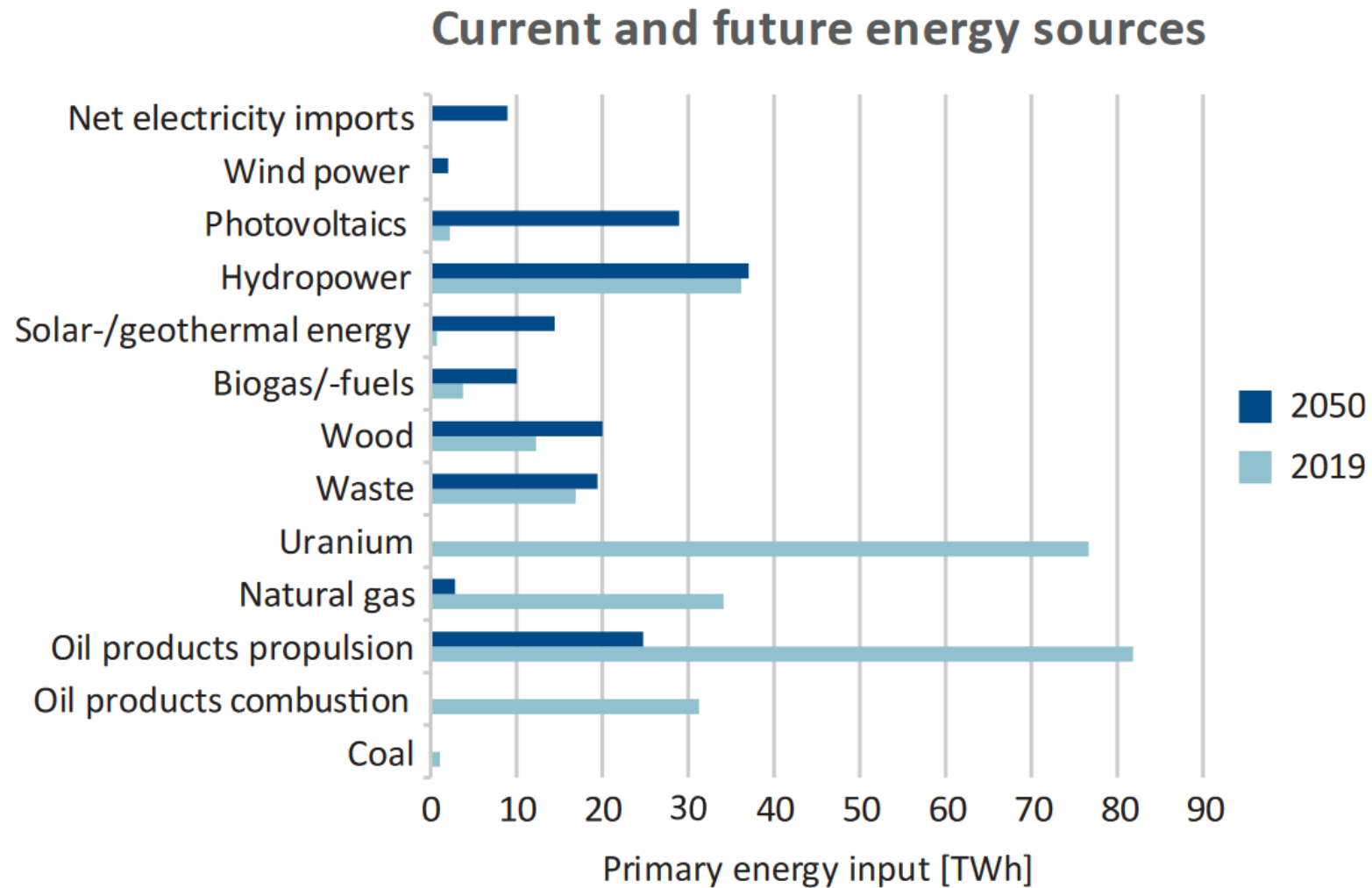


(IPCC AR6 SYR, Figure SPM.7a)

Today, imported fossil fuels account for a large share of final energy consumption.

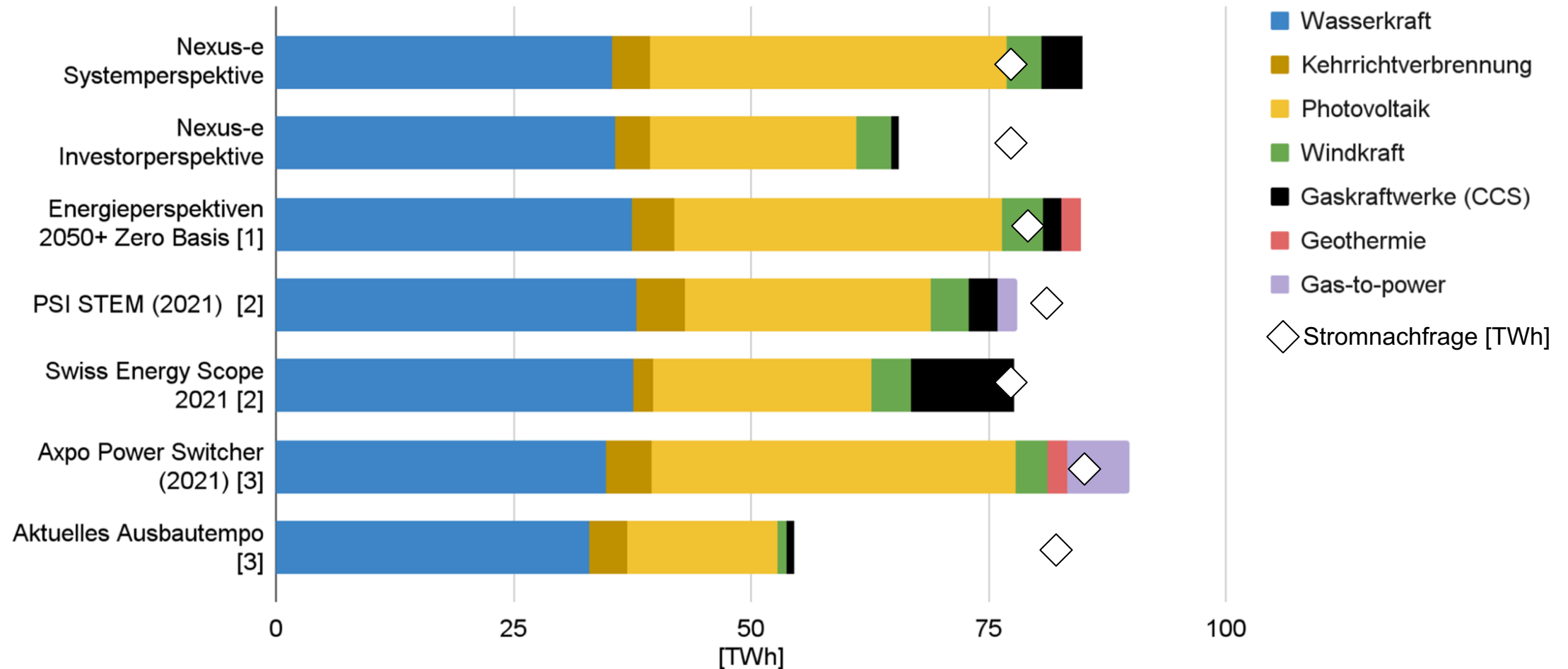


Demand for primary energy carriers decreases.



Energy sources in 2019 (SFOE 2020) and 2050 (Guidati & Marcucci, 2023) calculated with the SES-ETH (SWEET-CROSS, 2022) energy system model.

Scenarios for electricity generation in Switzerland.

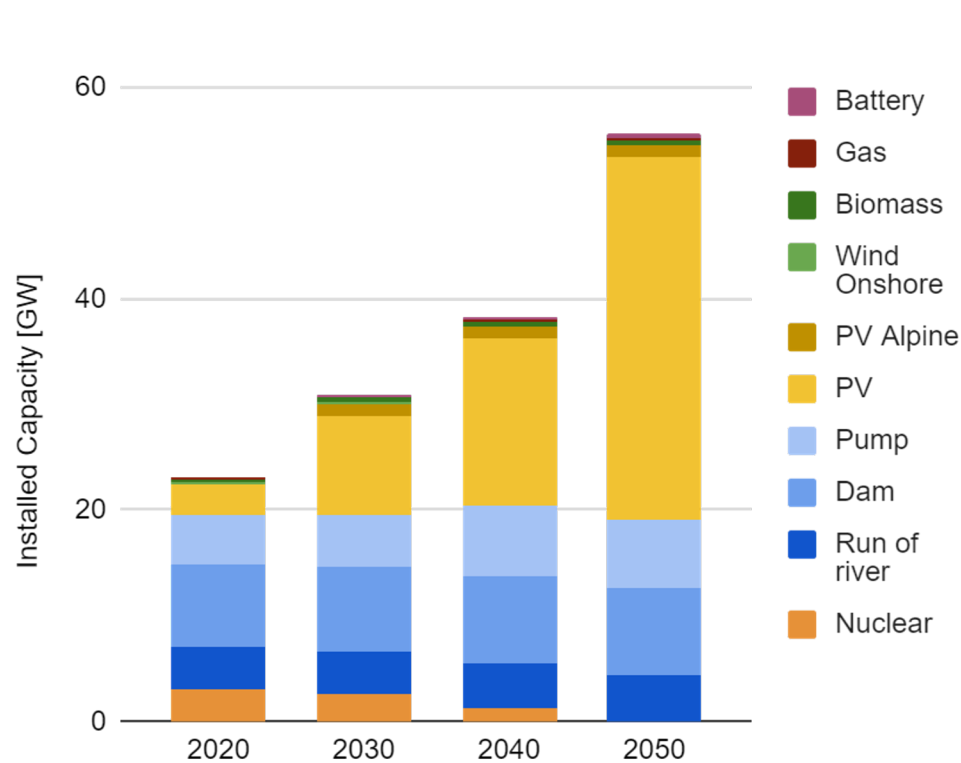


[1]: BFE Energieperspektiven 2050+, Szenario Zero Basis, <https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html>

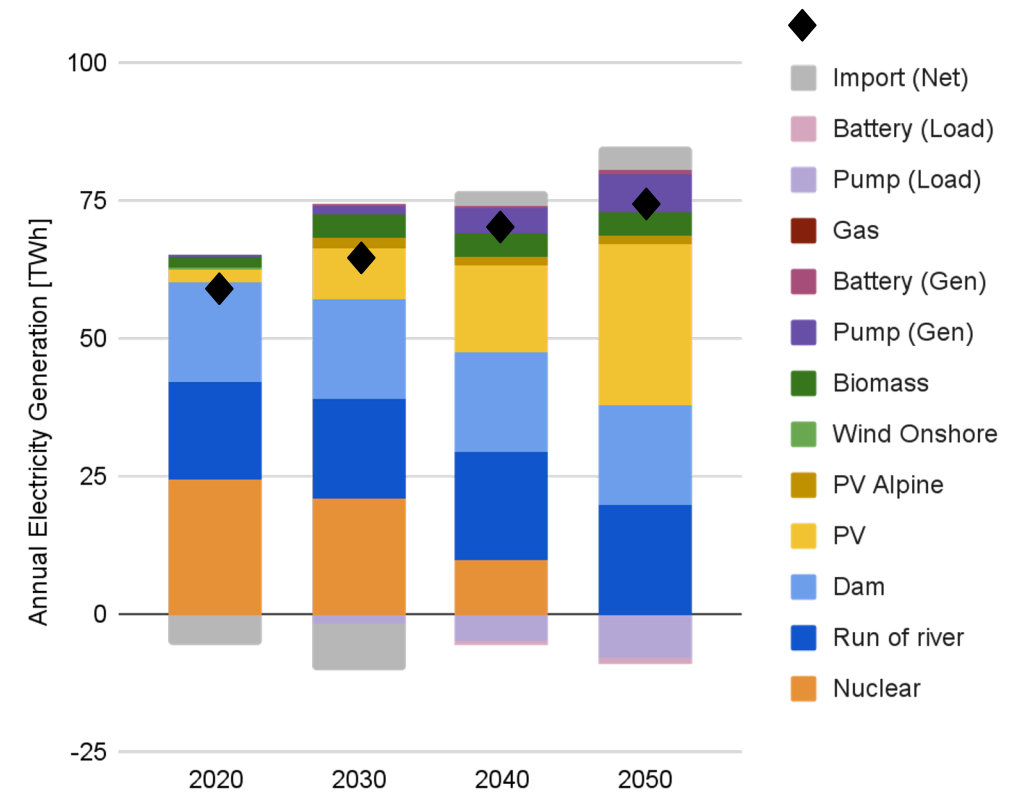
[2]: JASM (2021). Transformation of the Swiss Energy System for a Net-Zero Greenhouse Gas Emission Society. JASM synthesis report.

[3]: Axpo Power Switcher (2021). <https://powerswitcher.axpo.com/>

Reference scenario ESC – Switzerland 2020 – 2050.

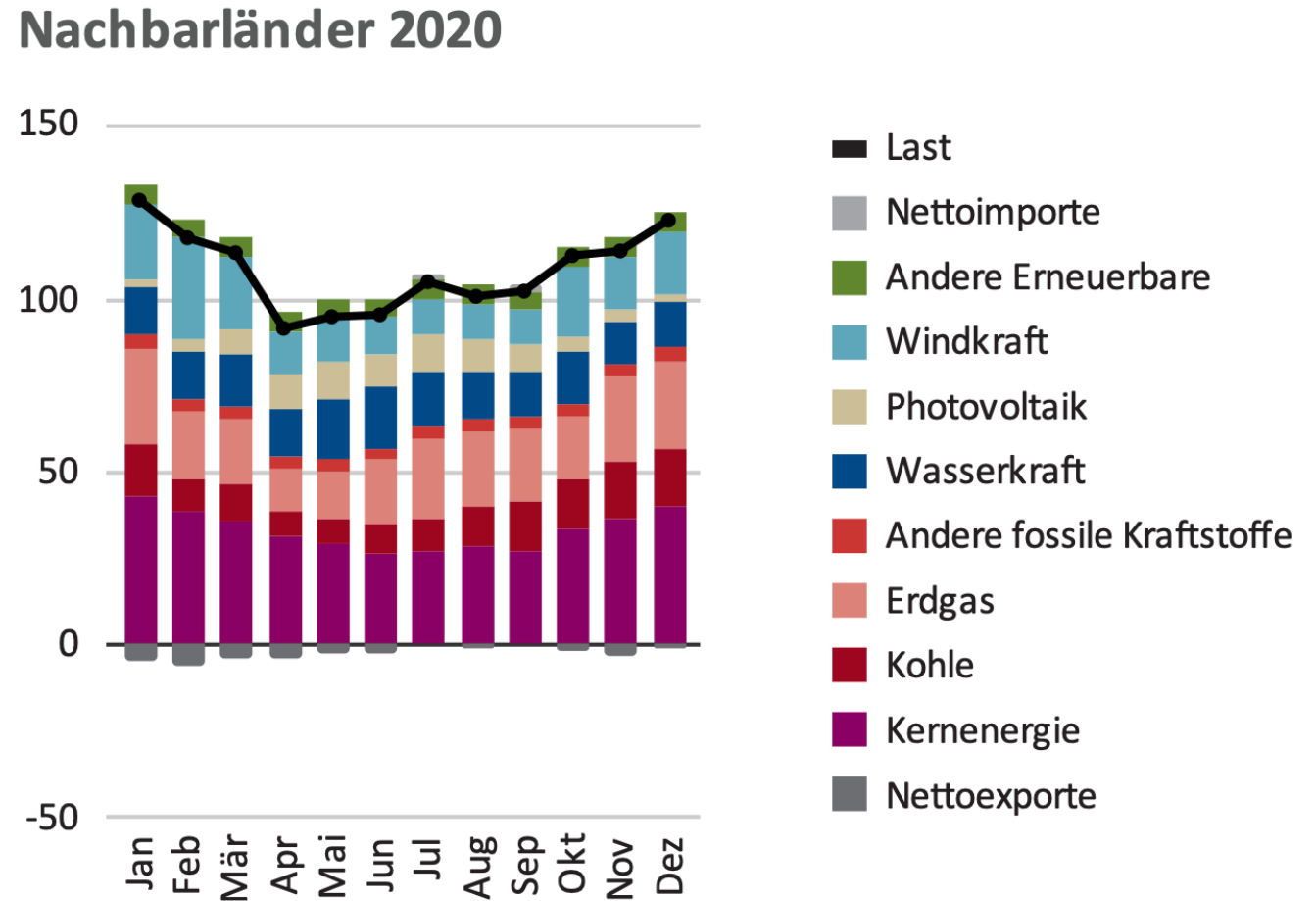
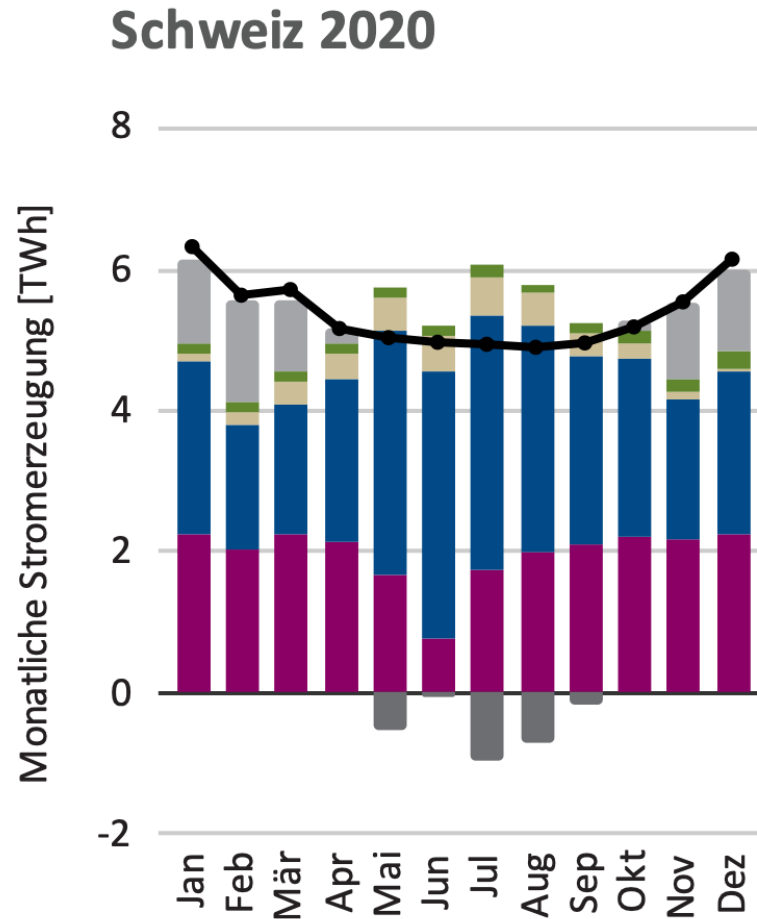


- Phasing out nuclear energy by 2050
- Sharp increase in PV capacity
- "Available" Alpine PV will be installed by 2030, as it is subsidized
- Slight increase in water, biomass and battery storage
- Gas-fired power plants only as a backup



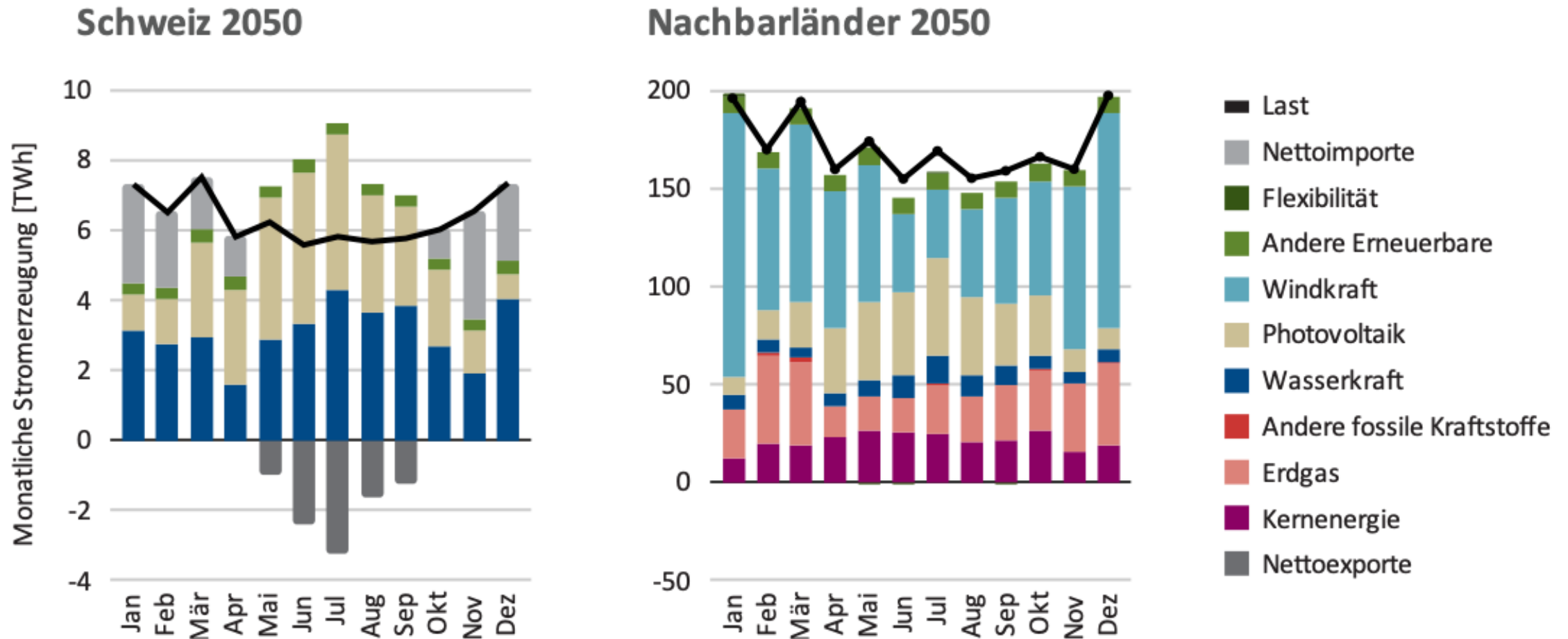
- PV generation does not completely replace nuclear energy and increase in consumption
- Switzerland will be a net importer in 2040 and 2050
- Pumped storage power plants are being used much more than in 2020

Today, Switzerland and neighboring countries complement each other in electricity trading.



Monthly power generation and load; Data from the European Association of Transmission System Operators (ENTSO-E), accessed via Swiss Energy Charts (Energy Charts).

Hydropower, Solar and electricity trading will be the main pillars of the Swiss electricity system of the future.



Scenario results of monthly electricity generation and load in Switzerland (left) and in neighbouring countries (DE, IT, FR, AT, aggregated; right) in 2050. Data source: Nexus-e scenarios (ESC 2023)

Is it possible to have a reliable, affordable and sustainable energy system by 2050?

Yes, but...

- We need to move away from fossil fuels
- We need flexibility in the system (e.g. storage)
- We need systems thinking (e.g. sector coupling)
- We need investment (a lot!)
- We need negative emissions (technologies, infrastructure)
- We have to decide today where we want to be in 20-30 years

The future will be different, and more complex!