Switzerland energy storage technologies

As is the case with several other countries, Switzerland"s climate policy towards a climate neutral energy policy (Energy Strategy 2050) makes the transition from the existing use of several types of energy (fossil, nuclear, renewable, etc) challenging. Given the intermittent production of certain renewable energies (wind, hydropower) or the geographical obstacles imposed (geothermal), a consistent energy transition is not possible without a performant energy storage.

That being said, to make energy storage technologies safe, secure, effective and efficient, innovation must be encouraged, market barriers reduced, and existing and future legal frameworks created to favour not discriminate against the development and use of innovative storage technologies. In accordance with a targeted CO2 neutral environment, all this will ultimately permit a reliable grid based on clean energies.

This article specifically covers indirect storage technologies (ie, storage by way of transformation in other forms of energy) given their demonstrated performance, but the technologies discussed below are by no means considered exhaustive.

Based on current scientific knowledge, leading Swiss researchers consider that where large amounts of energy need to be stored for the medium to long-term, technologies such as compressed air and pumped hydro storage as well as power-to-X systems are favoured in terms of performance.[1]

Although the Confederation and private sector funds encourage innovation in different types of technologies, a direct promotion for their use is currently lacking. Encouraging incentives and policies (eg, through loans or tax credits) would be more than welcome.

The capacity, performance, geographical limitations, costs etc, of current or future energy storage technologies depends on the physical process underlying the conversion and/or the storage, and its implementation. A technology-neutral approach may make sense so as not to create discriminations in terms of regulation and market access.

In addition, to secure the economic viability of energy storage companies, AEE Suisse further argued in favour of a clear delimitation between the grid exploitation (where a monopoly is not excluded) and the market participation in view of energy trading.[3]

Finally, given that certain provisions restrict in Switzerland the grid extension (ie, if safe, functioning and efficient grid cannot be otherwise obtained by optimisation or reinforcement of the existing grid),[4] the implementation of future regulatory measures shall not be jeopardised by this kind of provision, be it in practice or by law.

The chemical storage of energy is achieved by converting it into another energy source and releasing it by means of a chemical reaction (electrolysis), such as power-to-X systems or battery energy storage.

In the context of mechanical storage, energy (in particular electricity) is converted into kinetic or potential energy by means of a mechanical accumulator. This is tried and tested technology used for large-scale and long-term storage.

The best-known example in Switzerland (and probably the most widely used worldwide) is pumped storage. Whereas an upstream reservoir pumps water due to extra energy it receives, the downstream reservoir receives water (via pipelines connecting the system together) and produces energy using the water"s kinetic energy. This technology has been carried out for decades and will continue to be the cornerstone of Switzerland"s electricity production strategy, as shown by the recent commissioning of the Nant de Drance hydropower plant in 2022 (900 MW).

Another example is the compressed-air energy system where pressurised air (or heat generated by the compressed air) is stored in underground cavities or surface reservoirs and then returned back to the environment by a turbine which again produces energy.