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Project work
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Floating photovoltaics and hydropower reservoirs: mooring system design

Photovoltaics (PV) play a major role in the Swiss Energy Strategy 2050. Compared to a conventional installation in urbanized areas, high-alpine PV may produce a 30% higher annual yield due to stronger solar irradiation and lower panel temperatures. Several Swiss hydropower reservoirs are located at high altitudes and already offer a good accessibility. Therefore, they could provide an ideal base infrastructure for the installation of PV. There are two main options for PV operations at reservoirs: PV panels mounted to the dam structure and floating PV panels on the reservoir lake. Due to less demanding installation requirements, there are already some dam-mounted PV systems installed and under regular operation in Switzerland. In contrast, floating PV systems are still in the pilot or demonstration stage. While some solutions for floating PV exist on lakes with near-constant water level (Fig. 1), one of the main challenges for combining floating PV with storage hydropower reservoirs are strong variations in reservoir level. To compensate for the vertical movement of the floating arrays while keeping them in place, advanced mooring systems are required. In addition, as reservoirs are multi-purpose infrastructures, the operation of floating PV should have no negative impacts on other uses such as hydropower production, and dam safety must not be impaired.

Fig. 1: Floating PV in Suvereto IT (left, photo: Upsolar Floating) and photomontage of similarly sized systems on Muttsee reservoir CH (right, photos: TomTom / Vexcel Imaging)

Within this project work, the technical feasibility of high-alpine floating PV installations at reservoirs in Switzerland will be assessed. A special focus will be given to the mooring system design and its adaptability to special reservoir operation states, e.g. drawdowns and flood discharge. Also, potential advantages of floating PV compared to dam-mounted systems, e.g. adjustable alignment with the sun, are to be investigated. For selected reservoir sites, a pre-design for a floating PV system shall be developed. The results of the work may contribute to a successful implementation of the Swiss Energy Strategy 2050.

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Remarks: Group work possible, English or German