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Master Thesis Abstract

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Pumped hydro energy storage in Chile, Peru and Bolivia-Technical potential, cost, and economic feasibility

Pumped hydro energy storage (PHS) is the most widespread and mature energy storage technology currently available, constituting 97% of worldwide electricity storage. Yet, an assessment locating suitable sites with water availability in countries like Chile, Peru, and Bolivia with foreseeable great storage potential, given its location and topography, are not done.

Here we provide an assessment locating the suitable theoretical and technical sites in the three countries using a GIS-tool. We considered different PHS topologies that connect reservoirs/lakes, rivers and coastlines with suitable upper reservoir sites, locating potential theoretical sites. To assess the technical potential, we used two constraints that consider a minimum distance of 500 m from inhabited and protected areas, the sites that fulfill this requirement reach the technical potential. And by using a multicriteria approach (MCQA), we selected the most suitable sites per lower reservoir, and feed the cost equations found in the literature to get a closer look on foreseeable estimates in the different PHS topologies. This way we identified over 28,146 theoretical sites and 18,038 technical sites, which represent a theoretical potential of 33 TWh and a technical potential of 20 TWh.

Regarding the cost calculation, cost-storage curves are made for each of the studied topologies, using an accumulated total cost per suitable project over the accumulated installed stored energy from the cheapest capital power cost (\in /kW) to the expensive one, considering the case that more than one project can be economically attractive. At the end of the study, to gain sensibility over cost range, and the energy potential displayed in the different zones of Chile, and to give future guidelines regarding storage planning an optimization was made with LEELO for the case of Chile.

Auslandsorientierter Studiengang "Water Resources Engineering and Management - WAREM"

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