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A wind hydro hybrid system with water storage capacity: Comparison between conventional reservoir and reversible operation

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Hydropower reservoirs (of conventional and pumped storage plants) can provide dispatchable power and large scale energy storage. They can be a suitable technology in autonomous power systems with high levels of energy supplies obtained from renewable energy resources, because of their capacity to buffer intermittencies and high variability of renewables such as wind and solar power. This panel presents a study focused on a wind hydro hybrid system with water capacity storage, both as a conventional reservoir and as a reversible plant. This study compares the hybrid system including a conventional hydropower with a water reservoir with the hybrid system including a pumped storage hydropower plant. This comparative study was carried out based on the adaptation of software Homer (The Micropower Optimization Model), version Legacy, to simulate hydropower plants with conventional reservoir and to simulate pumped storage hydroelectric plants. The case study of this paper arose from data related to the State of Rio Grande do Sul, in southern Brazil. The case study is based on a river basin in southern Brazil for which two sites were identified; one below where can be installed the power house of a hydroelectric plant and where there is a reasonable area to implement a water reservoir; other above where a reservoir may also be implemented to be operated as an upper reservoir for the case of pumped storage hydropower plant. The results show that the system with pumped storage plant naturally has the highest initial costs, but the optimal solution of the hybrid system with pumped storage option require a smaller flooded area (considering the operation of upper and lower reservoirs) than the system with conventional reservoir, thus representing a lower environmental impact. The hybrid system with the pumped storage option also has the lowest cost of energy.

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Smart grids, smart communities or smart consumers: Contributions from the social sciences to the analysis of energy transformations

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The introduction of disruptive energy technologies (DG, MG, RETs) have opened the door for interdisciplinary collaborations between engineering and the social sciences. These developments converge traditional power and electrical engineering "visions" of electrical systems with social science concepts such as governance (from public administration), environmental justice (sociology), community engagement and participation (community psychology). The interest on microgrids and the push for "smart" electrical systems provide us with the opportunity to expand the analysis of such systems beyond the usual techno-economic approach. This paper discusses the ways in which the social sciences can contribute to the design and implementation of sustainable policies towards the transformation of electric systems. It also links innovations at the electric system level with changes in the institutional and regime levels to foster improvements in energy policy design and a more sustainable implementation process. The paper uses case study methodologies to concentrate on energy transformation efforts in Puerto Rico, a US Island Territory in the Caribbean. This example presents, how on one hand technological innovation is being promoted as the precursor of systemic change, and in the other, social political and economic actors push for the capture of the policy process based on sectorial interests. This paper is based on the research on smart grids open access electric system by an interdisciplinary group at University of Puerto Rico-Mayaguez and funded by the US National Science Foundation.

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