Title: Coupled modeling of hydrological fluxes, hydropower generation and electricity prices in a changing climate

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Synthetic description of the project and research outcome (see below):

Simulating hydropower generation is a challenging task requiring the simultaneous consideration of the long-term climate-dependent evolution of hydrological fluxes and electricity prices. A deeper understanding of the mutual interplay between these elements is urgently needed by hydropower managers and policy makers, as well as by the scientific community.

Hence, the main aim of this PhD project is to investigate the long-term evolution of hydropower generation in the Alpine region by integrating the explicit simulation of (i) snowmelt, glacier melt and streamflow generation, (ii) human infrastructures present in the hydrological system, and (iii) electricity prices. These aims will be achieved through the close collaboration with the research group of prof. Ravazzolo providing expertise in econometric modeling of energy markets.

Using the Adige river basin as a virtual laboratory for hydrological and econometric modelling, the activities of perspective candidate will benefit from well-instrumented test sites, excellent data availability and established collaborations with regional authorities. In addition, the high level of hydropower exploitation makes the Adige river basin an ideal case study for the entire Alpine area. Thus, the results from this PhD project are expected to have broad impact well beyond the region of investigation.

The expected outcomes of this activity are the following:
- Innovative long-term econometric models to predict the behaviour of electricity markets and able to assess: i) the impact of different energy policy scenarios; ii) the interplay between markets and changing climate conditions; iii) simultaneous dependencies between energy sources; and iv) population evolution.
- Improvement of an existing hydrological platform capable to simulate explicitly the management of storage reservoirs and water diversions.
- Accurate evaluation of future changes in hydropower generation under changing climate and economic scenarios, including uncertainty analysis.

Suggested references (to be not considered as exhaustive for the topic):


Curricula
1. Civil and Environmental Engineering, Agricultural Technologies
2. Mechanics, Materials, Chemistry and Energy
3. Modelling and Simulation
4. Architecture and Planning, Landscape

Provide a short description of the research project, including the expected research outcome (e.g., patents, papers, books, etc.). Research projects may include more than one proposed topic for PhD Thesis.