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Evaluating run of the river hydropower feasibility and efficiency under climate change for UK study sites

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As renewable energy generation has been encouraged by the UK Government, hydropower importance has also been highlighted. Moreover, the UK Environment Agency has mapped feasible run of the river (ROR) hydropower sites within England and Wales and small hydropower schemes have been provided with economic grants by the Government to support their initial operation. However, ROR hydropower schemes depend on the available river flow volumes and are therefore vulnerable to variations in river regimes. Therefore, an analysis of the impacts of climate change towards existing and feasible run of the river schemes is important and required.
The main objective of this research is to evaluate the impacts of climate change on river regimes and its implications to installed and feasible ROR hydropower operations by analyzing four study sites distributed across the UK. Study sites present different characteristics accounting for diverse properties of hydropower schemes including: catchment characteristics (topography, land use, climate, etc.), turbine type, turbine efficiency and head. Both feasible and currently operating schemes will be included in the analysis. Operating sites will be analysed according to their installed turbine type, hands off flow and maximum generation. On the other hand, feasible sites will be analysed considering different possible turbine types and changes in river flow that could affect the hands off flow and maximum generation thresholds.
Future climate is simulated based on the temperature and precipitation outputs from Global Climate Models. Due to their relatively coarse resolution, output from these models will be downscaled, bias corrected and coupled to previously calibrated and validated hydrological models for each of the study catchments (linked to poster in session CL5.5/CR3.7/HS4.8/SSS12.14). By coupling model simulations of future climate change and hydrological models, future river flow volumes will be estimated and used as inputs for the hydropower schemes to calculate the expected power generation. Mean, low and high flows will also be analysed to determine climate change impacts for the operation of ROR hydropower schemes. In addition, an uncertainty analysis will be included to identify the highest source of uncertainty from all the simulation parameters. The current progress of the research will be presented along with the following future steps.