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| **Project name:** | Data-Driven Approach for Hydropower Plant Controller Prototyping using Remote Hardware-in-the-Loop (DR-HIL) |
| **Project leader and partners:** | US: NREL, Auburn University, Cordova Electric Cooperative, MIT  Norway: Univ. of South-eastern Norway, NTNU |
| **Finalization year:** | 2021 |
| **Type of project/ main topic:** | Research and hardware evaluation of data-driven controls for hydropower based on actual field data. |
| **Main relevance to US-Norway MOU:** | The establishment if US-Norway collaboration and its outcomes would be very helpful to perform high-fidelity evaluation and help reduce the technological barriers in adoption of data-driven hydropower controls for electric grid services. |
| **Short project description:**  To serve the rapidly changing electric grid requirements for more flexible and dynamic operation of hydropower, real-time prototyping of hydropower plant controls has gained importance, primarily for reducing the cost and the risk of field deployment. NREL-led project titled ‘Data-Driven Approach for Hydropower Plant Controller Prototyping using Remote Hardware-in-the-Loop (DR-HIL)’ from US Department of Energy–Water Power Technologies Office (WPTO), and University of South-eastern Norway (USN)-led SysOpt proposal share strong synergistic research activities between them. Both projects will be developing physics-based and data-driven models for hydropower applications, as defined in the SysOpt objective for hybrid modelling, and in DR-HIL project to develop physics-informed machine learning (PIML) hydro models. NREL’s Advanced Research for Integrated Energy Systems (ARIES) – Hybrid Energy Real Time Emulation Hub (HERTH) will be utilized for the development of the DR-HIL and will also be made available for joint research activities. The integrated data-driven hydro-plant emulation platform with Controller Hardware-In-the-Loop (CHIL) will be used to prototype hydro-governor controls, and provide an opportunity to test hydropower integrated with various technologies (e.g. conventional and renewable generation, energy conversion, storage, etc.) as HIL/CHIL. Once SysOpt is funded, further refinement of the collaborative research activities will be done. Based on the DR-HIL project and SysOpt proposal, the following collaboration activities are anticipated:  • data-driven hydropower plant control representations in system-level optimization,  • evaluate the applicability of PIML approach developed in DR-HIL for other hydro design and control topologies in SysOpt proposal,  • define a research topic for a Ph.D. student from USN/NTNU in line with SysOpt proposal objectives and NREL’s capabilities developed through DR-HIL project,  • conduct joint HIL experiments at NREL ARIES HERTH facility.  The established collaboration and its outcomes would be very helpful to perform high-fidelity evaluation and help reduce the technological barriers in adoption of data-driven representations in hydropower applications for electric grid services. | |
| **Other comments:** | |
| **Available resources:** | |