

12th ISE 2018, Tokyo, Japan**COST-EFFECTIVE MITIGATION MEASURES IN REGULATED RIVERS**

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*SINTEF Energy Research, P.O.Box 4761 Torgarden, 7465 Trondheim, Norway***ABSTRACT**

Hydropower is the world's largest renewable energy source, and further development is expected. Hydropower plants have also been installed world-wide many decades ago, and these plants need refurbishment and upgrading. Hydrological as well as market and grid situations are changing, leading to a need for re-design of many hydropower facilities. Further, modern requirements to include environmental and social aspects of hydropower re-design, re-licensing and expansions will lead to new solutions. At the same time the environmental consequences need to be carefully evaluated and in many cases mitigated. In order to achieve cost-efficient mitigation of negative impacts on the fish fauna in regulate rivers, it is important to identify the bottlenecks for improved conditions for fish. This can be done by finding a diagnosis for the fish population. A number of tools and methods are developed to assess the river regulation and its fish species with classification systems for characterisation of the ecological state of river stretches and identification of the main bottlenecks to give the diagnosis. Having a suite of different mitigation measures to choose from, we have developed tools to evaluate the most cost-efficient mitigation measure aiming at improving conditions for fish without reducing hydropower production significantly. The aim of optimizing hydropower production as well as fish production with the most cost-efficient combination of mitigation measures and environmental flows will be demonstrated in several examples.