

Methods, indicators and solutions for sustainable hydropower

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ABSTRACT: Planning, building and operation of hydropower must include considerations of technical, economic, environmental and social aspects in order to meet sustainability criteria. To address the environmental needs in a regulated river, we have developed the environmental design methodology. The method has previously been developed for only one species, Atlantic salmon, and it has been applied to several regulated rivers with hydropower and important salmon stocks. We are now developing similar methods for other species, activities and services.

The objective is to improve licensing, operation and mitigation measures in regulated rivers with hydropower to meet sustainability requirements.

We have defined a number of species, activities and services it is important to consider reaching sustainability in Norwegian rivers, adapted to the local conditions: the aquatic species salmon, trout, char, grayling, eel, river mussels, dune tiger beetle and benthic macroinvertebrates; the activities kayaking, swimming, fishing and aesthetics, the special nature type river delta as well as the services flood control, water supply and flexibility and energy services to the grid.

The first step is to establish a diagnosis on how hydro-morphological factors that are impacted by hydropower and river regulation. Key indicators for each species, activity and service about how they are impacted by alterations in hydro-morphology are defined and assessed. Typical indicators are changes in low flow and floods, water-covered area, water depth, water velocities, sediments, substrate, water temperature, water vegetation, riparian vegetation and the presence of barriers. Metrics to assess key indicators are developed for each species, activity and service to be able to identify effects and bottlenecks.

We have also developed a suggestion for classification of hydro-morphology to be used for Norwegian river and lake water bodies in the implementation of the EU Water Framework Directive. This method have been tested by researchers and water managers, and the method "HyMo 1.0" is now ready for use by the authorities. The HyMo 1.0 method will give fundamental indicators of how the hydromorphology is altered in hydropower rivers. Together with the environmental design methodology, it is possible to identify cost-effective mitigation measures to obtain sustainability in hydropower.

This presentation will outline the HyMo and Environmental Design methods, and we will show some examples of use.