



Task D

Model development

In order to understand and predict physical and ecological impacts from hydropeaking and increased variation in river regulation, modeling tools need to be developed. The model development will focus on i) large scale hydraulic assessments including wave propagation and local factors like erosion, substrate dynamics, water temperature and ice; ii) refining and adapting empirical stranding models; iii) population dynamics to predict short and long term impacts of rapid flow variations on the production of salmonids, and iv) large scale empirical models. More simplified modeling will also be performed to quantify alteration in biomass production of invertebrates in rivers affected by hydropeaking.

The stranding model will be developed based on seasonal habitat use of river margins, stranding and fate of fish affected by frequent ramping, and physical habitat alteration caused by hydropeaking. Large scale river profiles/morphology, hydraulic measurements and river specific flow conditions will be used to set up these models for rivers on a catchment scale. Environmental impacts of hydropeaking KMB proposal for RENERGI 2008 5 Modeling of losses in production of salmonids due to various flow and dewatering regimes will be based on further development of the Norwegian salmon population model NORSALMOD. Based on modeling output, we will establish scientifically based environment friendly operational guidelines for operation of hydropeaking hydropower stations throughout the year.

Based on international collaboration, large scale empirical models will be developed to assess and predict impacts of hydropeaking using standardized sets of pressure (peak/low flow ratio, peaking frequency, ramping rates, etc.) and fish response criteria. These models will help to identify general mechanisms acting in similar ways across different bio-geographical regions. Response of fish communities will be quantified by fish indices recently developed for the Water Framework Directive (e.g. European Fish Index) as well as individual metrics (species traits, density, biomass, population age structure, etc.). Data reflecting gradients from undisturbed to heavily impacted rivers will be collated from published and unpublished case studies (mainly Norway, Austria, Canada, USA) following international database formats (FAME-consortium 2004). This work will be carried out in close cooperation with the EU-project "EFI+", focusing on hydromorphological pressures in European rivers.