Geophysical Research Abstracts
Vol. 16, EGU2014-5581, 2014
EGU General Assembly 2014

Optimal water allocation in small hydropower plants between traditional and non-traditional water users: merging theory and existing practices.

Lorenzo Gorla, Benoît Crouzy, and Paolo Perona
EPFL, IIE, AHEAD, Lausanne, Switzerland (lorenzo.gorla@epfl.ch)

Water demand for hydropower production is increasing together with the consciousness of the importance of riparian ecosystems and biodiversity. Some Cantons in Switzerland and other alpine regions in Austria and in Süd Tiröl (Italy) started replacing the inadequate concept of Minimum Flow Requirement (MFR) with a dynamic one, by releasing a fix percentage of the total inflow (e.g. 25 %) to the environment. Starting from a model proposed by Perona et al. (2013) and the need of including the environment as an actual water user, we arrived to similar qualitative results, and better quantitative performances.

In this paper we explore the space of non-proportional water repartition rules analysed by Gorla and Perona (2013), and we propose new ecological indicators which are directly derived from current ecologic evaluation practices (fish habitat modelling and hydrological alteration). We demonstrate that both MFR water redistribution policy and also proportional repartition rules can be improved using nothing but available information. Furthermore, all water redistribution policies can be described by the model proposed by Perona et al. (2013) in terms of the Principle of Equal Marginal Utility (PEMU) and a suitable class of nonlinear functions. This is particularly useful to highlights implicit assumptions and choosing best-compromise solutions, providing analytical reasons explaining why efficiency cannot be attained by classic repartition rules.
Each water repartition policy underlies an ecosystem monetization and a political choice always has to be taken. We explicit the value of the ecosystem health underlying each policy by means of the PEMU under a few assumptions, and discuss how the theoretic efficient redistribution law obtained by our approach is feasible and doesn't imply high costs or advanced management tools.

For small run-of-river power plants, this methodology answers the question "how much water should be left to the river?" and is therefore a simple but effective step towards eco-sustainability.

References

- Perona, P., Characklis, G., Dürrenmatt, D.J., 2013. Inverse parameters estimation of simple riparian benefit economical models. Journal of Environmental Management .
- Gorla, L. and Perona, P., 2013. On quantifying ecologically sustainable flow releases in a diverted river reach. Journal of Hydrology.