

Special Session title: Small-scale hydropower generation in urban and rural areas: the hydraulic and mechanical analysis of Energy Recovery in water systems

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Brief Description and topics

During the last decades, the development of effective systems for energy production has entailed increasing interest in the scientific community, as a consequence of the risk of energy crises caused by the exploitation of fossil fuels, coupled with huge greenhouse gas emissions.

As a consequence of these matters, significant attention has been paid to the use of Renewable Energy Sources (RES), by detecting energy resources within water systems, not generally contemplated as traditional sources of energy production.

With particular reference to hydroelectric plants, if during the last decades the design of large plants has been halted (at least in Italy), the trend toward installation of small-scale plants has increased, including the restoration of old existing facilities. However, compared with other FERs, a hydroelectric plant presents criticalities in drafting investment plans, coupled with the complexity of an effective and reliable estimation of annual productivity.

In this field, the estimation of small-scale Energy Recovery (ER) in urban and rural areas represents a major technological innovation, involving both pressurized and free surface water systems.

In reference to water supply systems, the small-scale hydropower generation can be coupled with the active control of pressure to reduce water losses. The ER in water supply systems can be done by using reacting microturbines or Pumps As Turbines (PATs). These latter, in particular, allow to take advantage of a wide range of commercial models with limited investment costs and ease of installation and maintenance. On the contrary, their main limitations regard both the difficulty of predicting the performances and the generally lower operational performances. However, although able to generate lower producible power than conventional systems, the ER in water supply systems assures a hydroelectric exploitation and, more generally, an overall energy optimization, because it combines the reduction of both excess pressures and electrical costs, which represents one of the main rates of water service expenses.

Regarding the free surface water systems, the main issues in small-scale ER concerns the estimation of riverbed outflows, directly correlated with the produced energy and the selection of proper machines that, against low investment and maintenance costs, could assure effective exploitation of water power. The use of traditional machines is enhanced by the design of innovative devices, able to improve the effectiveness of the produced power.

Operating in this field, the Special Session entitled “*Small-scale hydropower generation in urban and rural areas: the hydraulic and mechanical analysis of Energy Recovery in water systems*” aims at representing a convergence point to share researches and experiences on models, technologies and technical approaches devoted to the small-scale hydropower generation both in water supply systems and in natural and artificial free surface systems. Thus, it operates in the topics of the hydraulic and mechanical engineering, focusing on the evaluation of small-scale energy production. Correlated topics, such as Real Time Control models for water systems, economic analyses on the abovementioned applications and further correlated perspectives, will be also part of the discussion.

Scientific contributions on theoretical, experimental and numerical models will be included, as well as papers on applicative approaches from industry experts and technicians.