



An integrated approach to SHP development: from R&D to market deployment

P. Beutin, Head of the Renewable Energy Department, ADEME, France

Drawing on experience of France, a leading European country for small hydropower development and potential, the author reviews approaches to integrated planning and promotion of SHP, from R&D to enhancing public awareness. This article is based on a paper being presented by the author at a Small Hydropower Workshop hosted by ESHA in Lausanne, Switzerland (30 June/1 July).

Small hydro is well represented in France: 1700 small hydropower plants are installed, representing a capacity of 1800 MW. The annual power production is 7.5 TWh, which represents 10 per cent of the hydroelectric production in France, and nearly 1.5 per cent of the national electricity production.

1. Need for an integrated approach: from R&D to long term investment

Small hydro has to play a very important role to meet the objective of the European Directive on renewable energy sources in the electricity market. The main renewable energy sources which should cover the future additional contribution of renewable energy are: wind energy, biomass and small hydropower.

Marketing renewable energy activities in France is a key issue, as many barriers have to be overcome, in the light of such problems as administrative pressures (time necessary to get the exploitation permits for new powerplants), and the behaviour of opponents.

According to the opponents to SHP development, the construction and operation of hydropower can cause severe environmental impacts at local and regional levels. The debate on how to reach the quality levels required by the European Water Framework Directive promotes the argument that SHP deployment should be completely reassessed with regional and local mapping of water quality standards. The feeling that SHP could be leading to the extinction of fish populations, a loss of aquatic habitats, and a fundamental change of natural flow regimes is highlighted in this context. Significant opposition and public debates are developing in many European countries, such as Sweden, Norway, Finland, France and Switzerland.

Achieving the targets which are linked to the increase of the renewable energy contribution by 2010 or 2020 to cover 21 per cent of electricity consumption from RES is a challenge in this context for SHP. A combined

and integrated approach should be defined and adopted, from R&D activities and market support, to identifying key steps for promoting activities.

The main lines of action are as follows. R&D activities aimed at more innovation and limited environmental impacts have been developed in France, with the objectives of:

- promoting turbine design which would help achieve better productivity with a more compact design and limited civil works, the final outcome being to lower production costs; and,
- exploiting resources which are not feasible technically and economically (very low head, for instance). Partnerships between public agencies like ADEME and the private sector could help reach these targets. The result expected is a better technology for a wide range of applications, from a few hundred kW to several MW per units installed.
- Information and communication activities to develop public awareness on SHP activities: identifying the main benefits, and how environmental impacts are tackled, reaching high environmental integration standards, and so on. The objective is to develop communication tools such as leaflets, brochures but also to promote activities by site visits with media being present.
- Developing sound criteria for hydropower plants: these are challenging issues, as SHP has its own particularities. Encompassing and adopting sound assessment procedures for hydropower plants have only been developed in a limited number of countries such as Switzerland, USA and some others. The idea to develop a labelling or certification activity for small hydropower (in the ISO 14000 framework) has been developed in France.
- Territorial integration is a key issue, as the Water Framework Directive is leading to a water quality assessment on a larger scale than has been done in the past: local plans and territorial approaches should be developed to identify where new SHP plants could be implemented, without having a damaging impact. The SPLASH project was designed and run to offer a perspective in this respect: local plans have been developed for key water basins (case studies). France has been working on a 'multi-criteria' approach to tackle environmental impacts on a regional scale.
- Having long-term objectives for new capacities could help, giving the private sector a visibility in the long term. France has committed itself to offering such perspectives with the long-term investment plan (2015) which gives a clear message that small hydropower should be developed as a key renewable energy source. Cost evaluations in the long term, moreover, are demonstrating that SHP is competitive when compared with other electricity supply sources.



A mini hydro scheme in France.

2. French achievements in the field of small hydro deployment

Having long-term objectives for new capacities is giving a framework for future investments.

An assessment of the potential for SHP has been undertaken by several entities, and these are leading to a positive answer in terms of the targets which should be defined in the long term.

Realistic objectives (to 2015) are to develop 1000 to 1500 MW of additional capacity, without taking into account at this stage the very low head technologies (technologies being developed).

3. R&D activities

Public/private partnerships are designed to offer the answer to limiting environmental impacts, and at the same time lowering investment and exploitation costs in the long term.

Most future developments will involve the upgrading of existing small hydropower plants, but also developing low-head turbines, working on reserved flows, or using potable water for producing electricity in micro-hydro applications.

Some recent studies have evaluated the potential development of the small hydropower sector. These developments only concern upgrading existing sites, and implementing new facilities. Low head turbines, reserved flows and micro-hydro applications are not considered at this stage.

The ADEME subsidy scheme for R&D activities is divided into three categories:

- *Prospective research*: research aimed at widening scientific or technical knowledge, not directly linked to industrial or commercial objectives;
- *Industrial research*: definition phase or feasibility studies for research projects aimed at developing new products or upgrading existing products; and,
- *Pre-commercial research*: implementation of industrial processes or products arising from research results, including development of a prototype.

The actual difficulties faced by the hydroelectricity sector are mainly linked to non-technical aspects, and can be summarized as follows:

- the best sites are already exploited;
- most of the remaining rivers are classified;
- strong environmental constraints (and investments) and actual pay-back tariffs make projects too expensive,
- there is local opposition from fishermen; and,
- administrative procedures are excessive.

Thus, R&D challenges in developing the small hydropower sector are mainly devoted to decreasing these difficulties by:

- increasing the social acceptance of the projects, by

Small hydro development potential in France			
Organization	Type of potential	Capacity (MW)	Generation (TWh/yr)
Electricité de France	Global potential	67 500	270
	Technical potential	25 000	100
	Bankable potential	4250	17
	Realistic objectives	1000	4 to 8
UFE, Electabel, CNR, SHM	Technical potential	2500	10
	Upgrades	750	3
	New projects	1750	7
	Realistic objectives	1500	6
SER	Realistic objectives	1000	4
	Upgrades	300	1.2
	New projects	700	2.8

lowering the impacts on the environment and on fish (examples are 'fish friendly' devices, compact design of turbines like the 'Ecobulb' developed under a VA TECH concept and supported by ADEME);

- evaluating the potential (new methodologies using multi-criteria approaches and easing site identification and development); and,
- developing new concepts for hydropower turbines, including low-head turbines for exploiting new sites. A 'startup' company has been set up to launch this project from basic design to full scale implementation.

4. Public awareness on SHP activities

A brochure dedicated to small hydro plant design and project implementation has been published by ADEME and distributed to help municipalities, project developers and all other stakeholders to understand and assess SHP concepts and constraints properly.

As increased public awareness is highly recommended to raise public acceptance of new projects, ADEME has launched partnership activities with a professional organizations in France (EAF, GPAE) to design leaflets which answer all the basic questions on small hydropower activities.

These leaflets are distributed to the public. Site visits for various media have been organized during 2005 to selected sites, to encourage a better understanding of issues relating to SHP.

5. Labelling and certification schemes

Hydropower activities are seen as having severe environmental impacts; thus, eco-assessment measures should be proposed to demonstrate that these activities have limited impacts and are well harnessed.

Considerable scientific knowledge on these issues and practical experience have been developed in Europe, particularly in Switzerland. General guidelines for comprehensive eco-assessment of hydro plants have been developed. This also provides a concrete way to proceed, to develop specific criteria. The Swiss Federal Institute for Environmental Science and Technology (EAWAG) has developed a Swiss 'green hydro' standard. This provides a unique standard in Europe for assessing ecological criteria of hydropower plants.

Furthermore, in France, ADEME has developed, with the GPAE organisation, a scheme based on the ISO 14 000 principles (sound exploitation of SHP) which is focused on small hydro activities. Guidelines are currently being produced in a brochure to provide tools for project developers to adopt such certification procedures (environmental management of SHP units).

6. Regional or local planning

The EU Splash project provides ways of tackling challenges of having more projects launched with the adoption of local mapping and planning. The aim is to integrate future projects at the basin level in respect with the EU Water Framework Directive.

A multi-criteria approach has been defined and adopted to address environmental criteria to define energy potential at local levels. Tables are available from the author giving more details about this. ◇

Philippe Beutin has been Head of the Renewable Energy Department of ADEME since 1997. From 1992 to 1997 he was involved in the energy and environment activities of EUREKA, within the French team of the Network. Before that, he was Deputy Head of the Industry Division of the AFME agency, in charge of energy efficiency programmes of the OPET Network.

ADEME, 500 Route des Lucioles, Valbonne 06560, France.