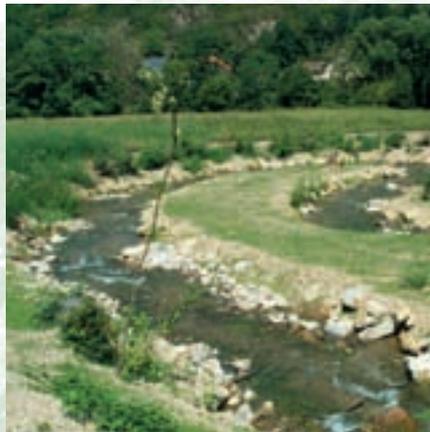


HYDROPOWER RESPECTS THE ENVIRONMENT

*A clean and indigenous
Renewable Energy*

Energy is a key issue for sustainable development. The European Commission estimates that the global energy demand will increase by 70% over a period of 30 years (2000-2030). The growth in energy demand will cause a considerable increase in greenhouse gas emissions. CO₂ emissions are projected to increase by 18% in 2030 compared to the 1990 level, in the EU. Renewables are 'the' solution to climate change.

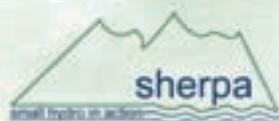
Hydropower is the first renewable energy in terms of global production, and therefore has a key role to play in the production of renewable electricity, which will allow it to make a significant contribution to future energy needs, offering an excellent alternative to carbon-based sources of electricity.



- Renewables contribute to increasing security of supply
- Renewables have the lowest Environmental impact of all energy sources.
- Renewables offer sustainable energy development world-wide.
- Renewables reduce the risk to public health
- Renewables reduce the costs of the supply chain of centralised conventional energy production.

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SMALL HYDROPOWER



Development of RES is a necessity



Trash rack devices

Climate change has been defined as the major international problem faced nowadays by the international community, indeed, its effects are already being seen around the world through rising temperatures, melting ice caps and volatile weather patterns. Climate Change is a direct result of the greenhouse effect caused by an increase of greenhouse gases

in the atmosphere. Carbon dioxide from conventional fuel power plants, industry, and transport is by far the largest contributor.

Climate change mitigation outlined in the various intergovernmental conferences on climate change and the Kyoto protocol legitimates itself through a major development of renewable energies. However, it is not the only argument: renewables contribute to increasing security of supply by reducing dependence on imported fossil fuels. This import dependency results in economic, social, ecological and safety policy problems. Energy supply is a vital service of public interest.

Small hydropower contributes to climate change mitigation because:

It is an inexhaustible energy source

Small hydropower cannot be depleted unlike fossil fuels, for example, of which there are a finite supply. Among all renewable energies hydropower is the leading renewable source in the European Union.

It does not produce green house gas emissions

Hydropower does not involve any combustion, and therefore does not release any oxide into the atmosphere; in particular it does not release carbon dioxide which is the principal gas responsible for global warming.

	Petroleum (tons)	Coal (tons)	Natural gas (tons)	Hydropower
Carbon dioxide	3000	3750	2250	0
Nitrogen Oxide	3,7	0,6	2,2	0
Sulphur dioxide	4,5	4,5	0,02	0

Comparative emissions from a small hydropower plant of 1000 MW, working 4500 hours/year and other sources of production of electricity

It has a high-energy payback ratio:

For each power generation system, the "energy payback" is the ratio of energy produced during its normal life span, divided by the energy required to build, maintain and fuel the generation equipment. If a system has a low payback ratio, it means that much energy is required to maintain it and this energy is likely to produce major environmental impacts.

Small hydro respects the environment

Water from a river has different uses: potable water, water for agriculture, water for industry activities, fishing, aquatic sports. SHP is one of those activities and, like any human activity, has some impact on the natural environment. However, new technical developments-environmental mitigation techniques that are technically and economically viable and most of them are socially acceptable offering a good compromise with others river's users-, the regulatory framework and the willingness of project developers to integrate the environmental concerns of the hydropower production have considerably decreased these environmental impacts. There are good successful cases in the EU where the use of appropriate technologies, measures or methodologies has minimized potential environmental impacts.



SHP Certified with ISO 14001 in France.



Refurbished plant in Spain. Also used for education.



The quality of water

SHP schemes are mainly run-of-river with little or no reservoir impoundment. Therefore, SHP is not simply a reduced version of a large hydro plant (LHP). Specific equipment is necessary to meet fundamental requirements with regard to environmental integration, simplicity, high – energy output, maximum reliability, and easy maintenance. Besides the production of electricity, SHP does not produce any harmful discharge to the river. The water downstream the turbine is of exactly the same quality and quantity than before. A proof is that some SHP schemes dispense potable water downstream. In addition, SHP schemes assist in the maintenance of river basins by allowing recovering waste that flows in the river stream, monitoring hydrological indicators and refurbishing old SHP plants.

— **Trash rack material management:** Almost all modern small hydropower plants have a trash rack-cleaning machine, which removes material from the water to avoid it entering the plant waterways and damaging electromechanical equipment or reducing hydraulic performance. Each year tons of material (mainly plastic bags, bottles, cans as well as leaves, branches etc.) are removed from the river. Moreover biodegradable oils are more and more used in SHP plants.

The river ecosystem

In order to ensure that the environmental impacts of small hydro power schemes are kept to a minimum, SHP operators are required to conduct environmental impact assessments for any small hydropower project. These assessments allow hydro-biological analyses to measure the impacts to the flora, and to the fauna in order to avoid irreversible damage and to define environmental impact mitigation measures. It is also required to establish a minimum **reserved flow** to maintain the quality of the river ecosystem with any significant alteration due to the small hydro plant. All definitions of reserved or minimum flow place emphasis on the protection of the existing ecology of the river.

— Among these measures the installation of **fish by pass systems** has lead to a considerable increase of the environmental performance of small hydro plants. Indeed, fish ladders help to avoid harm to the fish stock population migrating upstream the river , to their breeding sites.

— **Fish Friendly turbines** The installation of turbines in a river system may in certain circumstances endanger fish (fish migrating downstream the river). Research work, carried out at large hydropower stations has shown that fish can and do get into the turbine, especially in periods of intensive fish movement along the river. To help minimize fish injury, turbine manufacturers have been carrying out studies based on computational fluid dynamics (CFD), with good results. Small hydropower plants also can take advantage of this



Fish bypass system



research with methods developed for minimizing impact on fish from conventional turbines (Francis and Kaplan turbines). Meanwhile new concepts of turbines and re-invention of old concepts (hydrodynamic screws, water wheels) are typical of micro and mini hydro plants, allowing better integration into and preservation of the river life.

The landscape

By using local materials and local architecture techniques the visual impact of small hydropower plants can be minimised in order to integrate the powerhouse into the landscape. **Noise** can be minimized by proper noise abatement measures or underground works. At the same time the refurbishing and upgrading of old and abandoned mills contributes to cultural heritage protection.

Multipurpose Hydro Schemes

Competition for use of water has always been strong, but especially in the last years it has become even stronger. A solution is the multi-use of water resources. This means combining electricity production with other water uses such as irrigation, recreation, and drinking water supply. This results in multiple use of water connected with small hydropower plant realization. Multipurpose schemes allow the best compromise among different public interests while reducing the environmental impacts.

ISO 14001 – environmental management systems

The small hydropower producers are concerned about the environmental protection and impacts minimisation. For example the French association of Small Hydropower producers (GPAE) is continually promoting the voluntary environmental certification with ISO 14001 for the small hydropower plants in France. The principal objective of this international recognised environmental certification system is the continuous improvement of environmental performance of small hydropower plants.

Energy is neither created nor destroyed. It is wasted- Ecologistas en Acción, Spanish Environmental NGO asking to make use of existing water irrigation infrastructure in Spain to produce hydro-electricity.



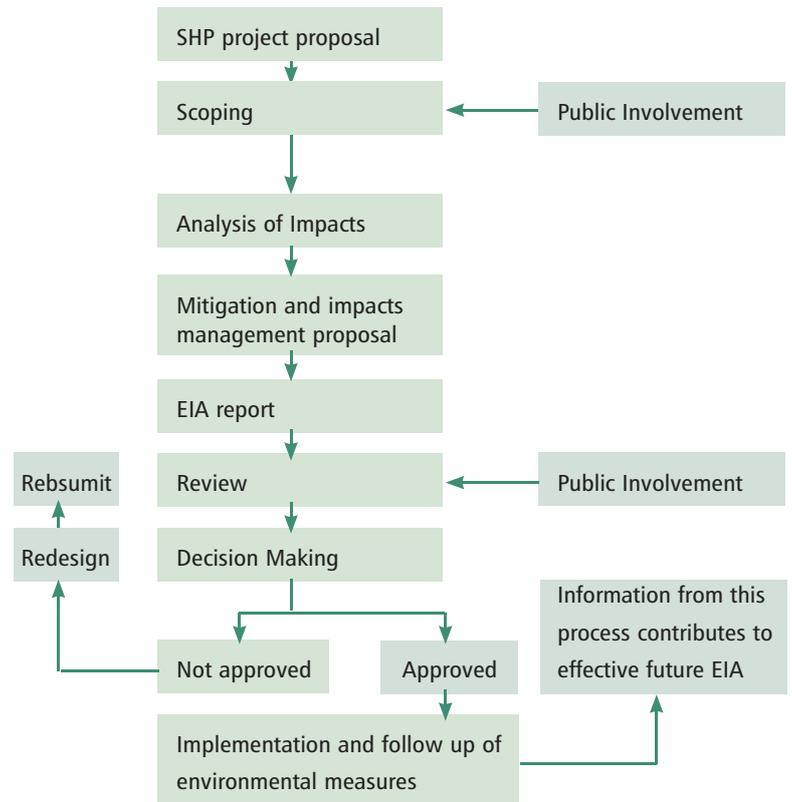
Small Hydropower and Environmental Impact assessments

The Council Directive 85/337 of June 27, 1985, describes the legal framework of environmental impact assessments. The Environmental Impact Assessment is a procedure to support decisions. The objective is the identification and analyses of the negative and positive effects that a project might cause to the environment and health, to assist the decision among various possibilities and solutions. The carrying-out of the environmental impact assessment is the responsibility of the project developers, usually through specialised consultants. The control, monitoring and verification of the results are done by the National Bodies responsible for this. Small hydro project plants are subject to environmental impact assessments that identify their potential impacts and propose feasible solutions. An Environmental Impact Assessment is a repeatable process and therefore needs to be as transparent as possible: this is a very important requirement which must reflect in the clarity of data and in methods of approach accepted both by the proponent and the relevant authorities. The agreement of the parties involved in the process on the general methodology forces each part to follow a path made of precise and defined steps avoiding as far as possible arbitrary evaluations.

An EIA has three main purposes:

- ❑ Protection of the environment.
- ❑ Information for the public authorities and the public.
- ❑ Help for decision.

THE EIA PROCESS



Information and involvement of all the actors

It is essential to involve and inform all the actors concerned throughout all the project: especially, the local populations. Public information will allow to bringing together all the actors with different interests on the river uses towards a common agreement. Local populations will understand the benefits that the installation will bring to their communities showing the willing to share the benefits of the project with all the actors involved.

The public information is a transparent an ongoing process carried out through the entire project mainly through:

- ❑ Public meetings
- ❑ Press releases
- ❑ Workshops on renewable energies
- ❑ Explanatory sessions about the technical administrative and environmental issues concerning the developing of small hydro schemes.



WHAT IT IS NECESSARY TO KNOW

- ❑ Small hydropower respects the environment. It's a clean energy source, renewable, efficient and sustainable.
- ❑ The design, implementation and running phase of small hydro-power plants are ruled by a complete European and national legal framework, concerning the quality of the water, the fauna, the flora, and the landscape.
- ❑ It is indispensable to inform the populations involved throughout all the process to take into account all the interests that surround the development of a small hydropower plant.

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