Small Hydropower Roadmap

Condensed research data for EU-27

European Small Hydropower Association

STREAM MAP

The Stream Map project
Year of Implementation: 2009-2012
Web: http://streammap.esha.be/

A project supported by

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KEY MESSAGES

For the past ten years, SHP potential has been greatly affected by environmental legislation that falls under designated areas such as Natura 2000 and the Water Framework Directive. For some countries, the SHP economically feasible potential was reduced by more than a half.

Yet, there is still a ***large potential for SHP development*** *in the EU-27. Less than half of the potential has already been tapped - some 44 TWh/ year. More than 50 TWh/year can be brought on line in the future, if the current conditions are improved. Thus, SHP must be designed site by site in order to comply with all the environmental requirements to take advantage of the remaining potential.*

The most promising countries for SHP further expansion in the EU are Italy, France, Spain, Austria, Portugal, Romania, Greece and Poland.

It is beyond any doubt that the European hydropower industry is quite ***mature and highly developed*** *at technological level. Nevertheless, the whole hydropower sector requires* ***stable policies and regulations****, both at national and EU level, for its development.*

The sector can be ***financially sustainable if fair market rules are provided*** *- financial schemes for hydropower projects should account for multipurpose features of hydropower, not only production of green electricity, but also its incomparable high efficiency, its contribution to grid stability, and other benefits related with water resource management, as flood protection.*

In fact, SHP has specific characteristics that are quite different from other renewable technologies, like time availability of the resource, long life time (up to 100 years), higher unit power investment and the multipurpose use of water.

However, like other renewables, ***SHP needs regulatory stability and fair market rules****, especially concerning permit granting, technical rules and in the financial environment (tariffs).*

It is also important to recall that the licensing procedure for SHP is a time consuming and bureaucratic procedure as numerous permits are necessary to be issued. On top of that, most of the time this process is dependent on poorly coordinated entities from different public authorities.

Therefore, the future ***licensing should rely on simple, fair, solid and transparent criteria*** *suitable with SHP scale promoting a faster, and more predictable result in the outcome.*

FOREWORD

Small hydropower has been a source of electricity generation in many European countries already since the beginning of the 20th century. Nowadays, it contributes to around 8% of electricity production within the renewable energy mix. The European Commission has already recognised the importance of small hydropower in 1989, when it initiated the foundation of the European Small Hydropower Association (ESHA) to stimulate the increase of electricity production from this source.

The Commission's 2050 Energy Roadmap indicates that an increasing share of its energy must come from renewable sources in the future, in order to secure sustainable energy production and energy independence as well as contributing to climate change mitigation.

This Hydropower Roadmap, successfully compiled by ESHA in cooperation with key stakeholders, provides decision-makers for the first time with a crucial knowledge base about the energy sector in the 27 EU Member States. It further lists the necessary prerequisites to exploit the full potential of small hydropower through refurbishment and new site development.

I therefore congratulate ESHA to this Roadmap, which should serve as a tool to monitor and guide small hydropower development to contribute successfully to the Renewable Energy Directive's target of 20% renewable energy in 2020 and to the EU's 2050 climate change objective.

Philip Lowe
Director General for Energy
European Commission

1. AN INTRODUCTION: The Role of SHP in the EU Electricity Sector

For centuries, civilizations have taken advantage of the power of water. Once used by Greeks to grind wheat into flour, the water wheels of the past have been updated to today's highly efficient turbines that generate electricity by a spin of water. Small hydropower, defined by installed capacity of up to 10 MW, is for many years the backbone of electricity production in many countries in the EU.

Hydropower can be one of the most reliable and cost-effective methods to generate electricity. The concept is designed in a way that it can immediately respond to fluctuations in electricity demand meeting both base-load and peak-load demand. Hydropower's main advantage is that it provides a ***steady and secure source of electricity supply****. Because it is fuelled by water, it* ***does not pollute*** *the air or produce any other liquid or solid waste. Other benefits may include* ***water supply*** *during dry summer months and* ***flood control****, which are growing in importance with regards to climate change effects. A well-designed small hydropower system can* ***blend in with its surroundings*** *with no environmental impacts. SHP schemes are mainly run-of-river with little or no reservoir impoundment. SHP is not simply a reduced version of a large hydropower plant, but specific equipment is necessary to meeting fundamental requirements with regards to simplicity, high energy output, environmental measures and maximum reliability.*

As a backbone for renewable energy production in Europe hydropower has a key role in meeting both the 2020 renewable energy targets as well as the greenhouse gas reduction targets. Small Hydropower generates 46,000 GWh of electricity and accounts to over 13,000 MW of installed capacity in EU-27 which is enough to supply electricity for over 13 million households. This contributes to annual avoidance of CO^2 *by 29 million tonnes, which translates into annual avoided* CO^2 *cost of about 766 million euros.*

However, the growth rates of SHP during the past years both in terms of production and capacity have been rather disappointing. This is due to the many barriers that the sector is facing mainly focused on growing environmental requirements and timely administrative procedures, in particular the issue of concessions. Indeed, environmental issues in general and the implementation of the Water Framework Directive in particular are endangering the future development and realisation of the potential hydro in the EU. This development threatens the European leadership in the sector.

With this Roadmap, the SHP sector has made a first step to put down its current status, issues and requirements on paper. It will help decision makers to assess the situation in their country better and untap the potential of small hydropower.

2. PROJECT DESCRIPTION & METHODOLOGY

At present, it is difficult for policy makers to define the future of the small hydropower sector and to incorporate it into the national energy action plans. Therefore, the objective of the SHP STREAM MAP project is to gather and consequently make available for EU Member States, relevant energy, market and policy data on hydropower, with special emphasis in the SHP sector; data which is presented in an concerted way for the first time.
All the data will contribute to raise awareness and to supply the best available information to the national and local decision-makers, in order to promote political impact and lobby action to remove barriers and improve the conditions to develop SHP in the EU.

A consortium composed by eleven partners, led by ESHA, was built in order to develop the SHP STREAM MAP project:

Participant name	***Participant short name***	***Country code***	***Main Role in Consortium***
European Small Hydropower Association	*ESHA*	*BE*	*Co-coordinator ; Input data Germany, Bulgaria Austria and Greece Set up and running of HYDI*
Lithuanian Hydropower Association	*LHA*	*LT*	*Leader WP3 plus input data Baltic countries and national workshop*
Italian Association of Renewable Energy	*APER*	*IT*	*Partner : input hydro data Italy plus national validation workshop*
France Hydroélectricité	*FHE*	*FR*	*Leader WP5 plus input data France and national workshop*
Slovenian Small Hydropower Association	*SSHA*	*SI*	*Partner : input hydro data Slovenia, Hungary and some Balkan countries plus national workshop in Slovenia*
Swedish Renewable Energy Association	*SERO*	*SW*	*Partner : input Nordic countries hydro data and national workshop in Sweden*
Institute for Hydro and Design	*IHSD*	*RO*	*Partner; input for Romania hydro data plus national workshop*
British Hydropower Association	*BHA*	*UK*	*Leader WP4 plus input data on UK and IRL and national workshop*
Portuguese Renewable Energy Association	*APREN*	*PT*	*Partner input data on hydro for Portugal and Spain plus national workshop in*

			Portugal and Spain
Polish Hydropower Association	*PHA*	*PO*	*Partner input data on hydro for Poland, Slovakia and the Czech Republic and national workshop in Poland*
Belgium Renewable Energy Federation	*EDORA*	*BE*	*Partner input hydro data for Benelux and national workshop*

Additionally, the "Bundesverband Deutscher Wasserkraftwerke" (BDW), the German Association of Hydropower Plants has been covering Germany, for ESHA.

The Project also counted with an advisory board, composed by important European organisations: EREC, Eurelectric, Eur'Observer, Eurostat, HEA.

Each partner had the responsibility of collecting the necessary data to feed the main deliverables of the project: a roadmap for the EU's SHP sector (the present strategic document) and a unique database, the Hydro Data Initiative (as from now on HYDI).
Also, over the last three years, a detailed contact network for the hydropower sector within the EU has been constructed. This allows to reach a large number of stakeholders via the different national workshops, press articles, listings in media quoting the projects and statistical releases and the website http://streammap.esha.be/ where the database is available free of charge.

The input collected from the 27 EU-Member States consisted of three main parts: hydropower ***energy***, ***market*** *and* ***policy*** *data. The energy data included current, forecast and potential data. The market section included industrial and economic. The policy data was mostly related with support schemes, concessions and legislation. The reference years chosen were 2005 and 2007. In the collection process, the partners got in touch with all different stakeholders to receive the needed data. A large contact network in form of a register has been developed as result to this research. However, due to the lack of SHP in Malta and Cyprus, those two Member States have been left out in this Roadmap.*

The data collected was validated through internal and external data quality control by cross-checking: (i) the sources consulted supplied the best publicly available information; (ii) each partner checked the data collected before send it to each workpackage leader; (iii) each workpackage leader check the information received and confirmed if it was according to the objectives of the project and with the methodology established; (iv) finally, the data was also compared with the information made available by the advisory board.
The results of this database have been collected and put together in this Roadmap. this strategic document describes the current state of play for SHP sector, the needs, challenges, barriers, potentials and trends for future, aiming to constitute a key document for the promotion of small hydropower.

The use of several communication and dissemination tools and activities also took part in order to maximize the impact of the project and to reach the main key actors. It is intended that the results of the SHP STREAM MAP project contributed to reach the targets established for 2020, by the incorporation of relevant shares of SHP in the National Renewable Energy Action Plans (NREAP) of the Members States with high potential to deploy this technology, through the dissemination of the information collected and produced by this project.

3. STATE OF PLAY OF THE SHP IN THE EUROPEAN UNION

This section is continuing the idea of the HYDI database which is divided into three parts: energy, market and policy. Three short summaries on those topics describe the development of the European small hydropower sector in the following text.

ENERGY

In 2010 nearly 21,800 SHP plants have been in operation (Fig. 1). The biggest number of SHP facilities is installed in Germany (more than 7,500). Then follows Austria (some 2,590), Italy (2,430), France (1,900), Sweden (1,900) and the Czech Republic (1,450). It is expected that the overall SHP number should reach up to 24,000 by 2020. The average installed capacity of a SHP plant varies between 0.6 - 0.7 MW.

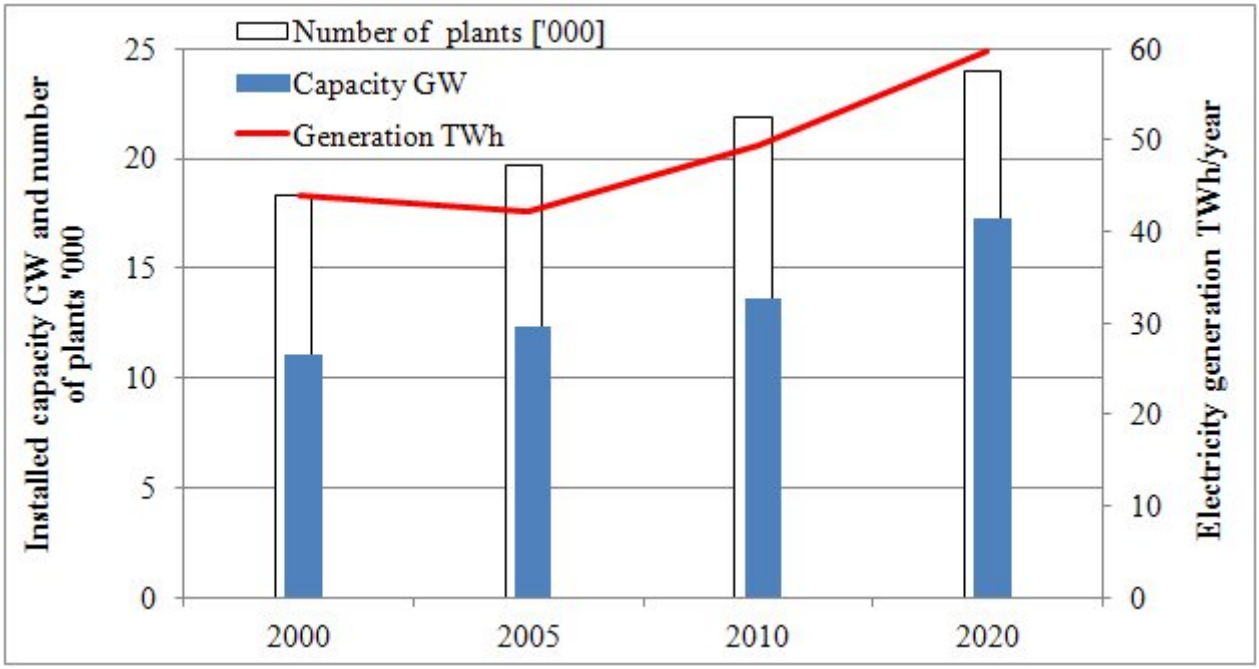

Fig. 1 Number of SHP plants, their installed capacity and electricity generation between 2000 and 2020 in the EU.

The projected installed capacity increased from 12.4 GW to 17.3 GW and electricity generation from 42.1 to 59.7 TWh/year over the period 2005 to 2020. This results in an augmentation of nearly 40%.

Taking a look at individual countries Italy is the country with the largest SHP installed capacity (2,735 MW) and electricity generation (10,958 GWh). In addition to that in the years ahead this country will be a clear leader in both of these fields (Fig.2 and 3). It is followed by France, Spain and Germany. The lowest installed capacity and electricity generation are observed mainly in low lying countries (Eastern Baltic, Hungary, Denmark, and Ireland).

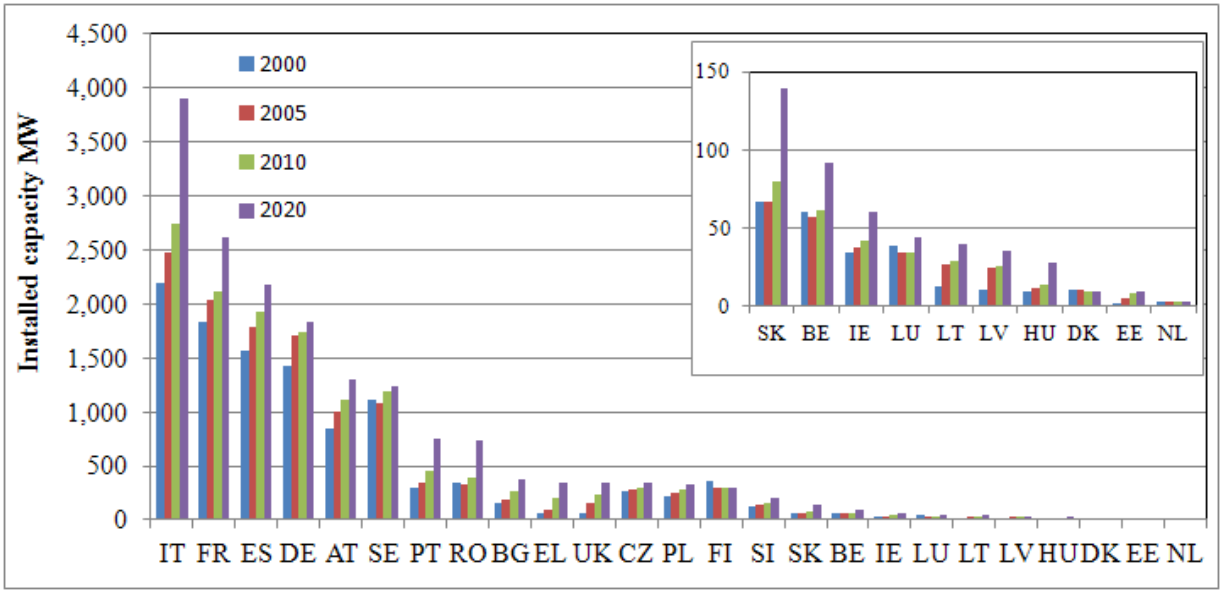

Fig.2 SHP installed capacity in the EU countries (MW).

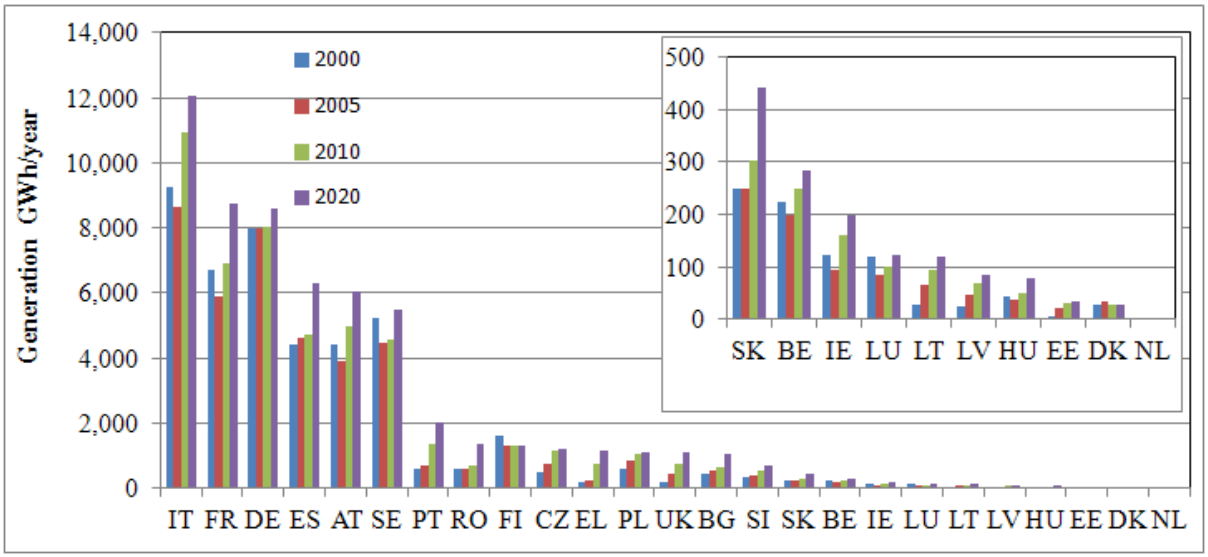

Fig.3 SHP electricity generation in the EU countries (GWh/year).

The load factor determines the efficiency of using SHP turbines and is a measure of a power plant's output compared to the maximum output it could produce. It can be expressed by an average number of full load hours. For SHP plants operating in the EU it amounts to 3,252 hours (Fig 4.). The largest one is observed in Germany (nearly 4,900 hours) and the lowest value in Romania (1,810 h). According to the NREAPs the load factor is 2,000 hours for onshore and offshore wind plants, and 914 hours for solar installations. These facts shows that SHP less disturb the stability of the grids.

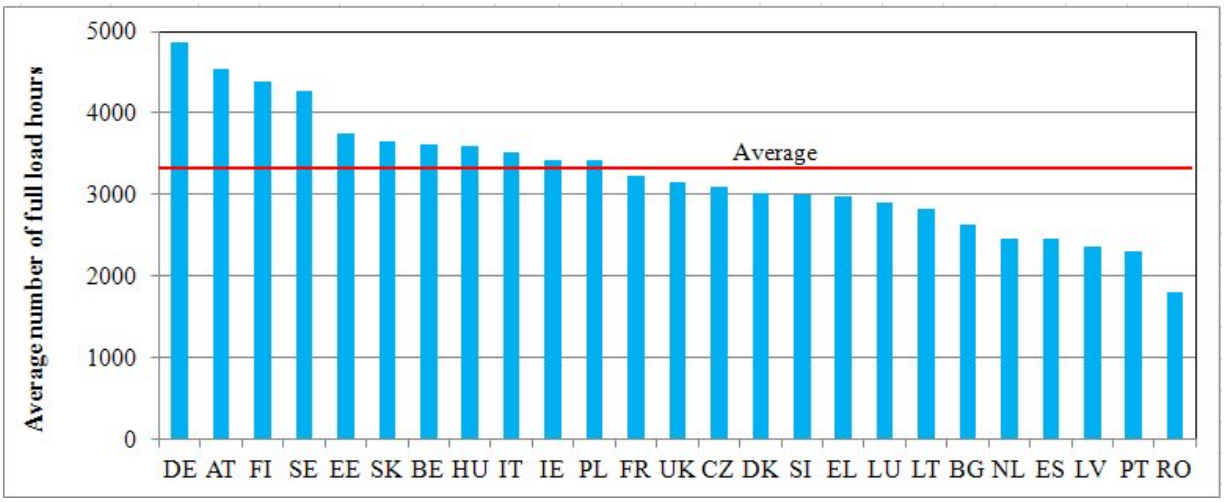

Fig. 4. Calculated average number of full load hours for SHP plants in the EU countries.

As a general rule SHP potential diminishes from the gross theoretical to the economically feasible potential and finally the realisable potential or available for development (Fig. 5).

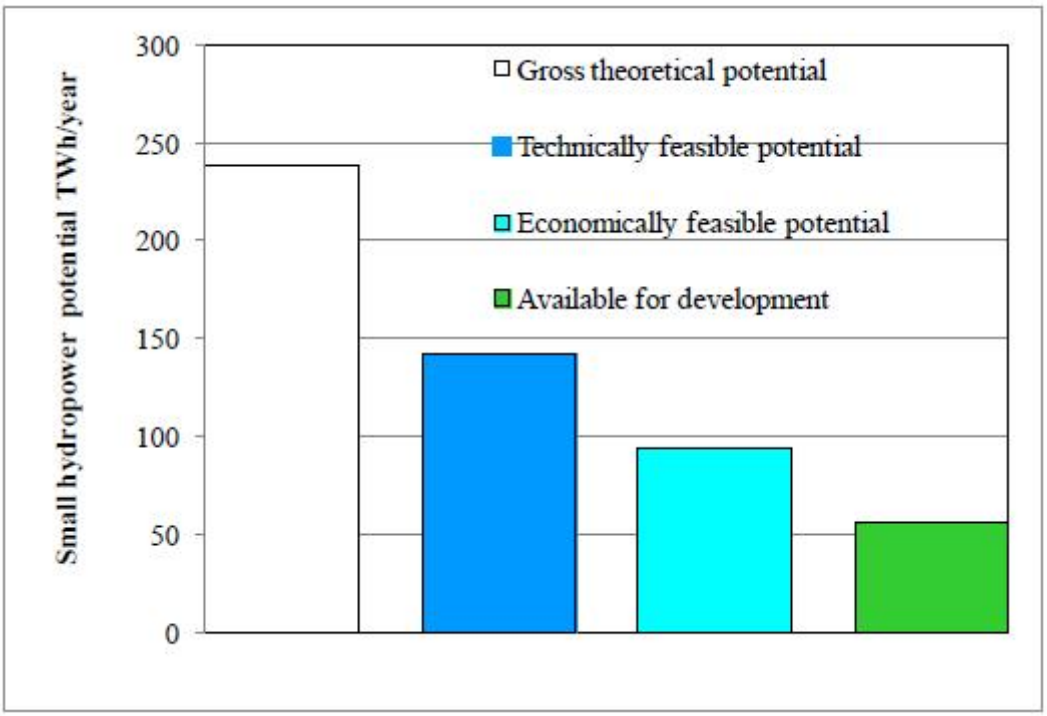

Fig. 5. Total SHP potential in the EU (TWh/year).

The potential is unevenly distributed across the Member States. It can be best described by water stream energy generated per unit of area, usually – km². Austria, Italy, Luxembourg and Portugal are the countries with the most powerful water streams (Fig.6). To the contrast, Denmark, Estonia and Hungary's water stream's energy are relatively low. Hydropower has not been developed in Cyprus (only one SHP plant is operating) and Malta.

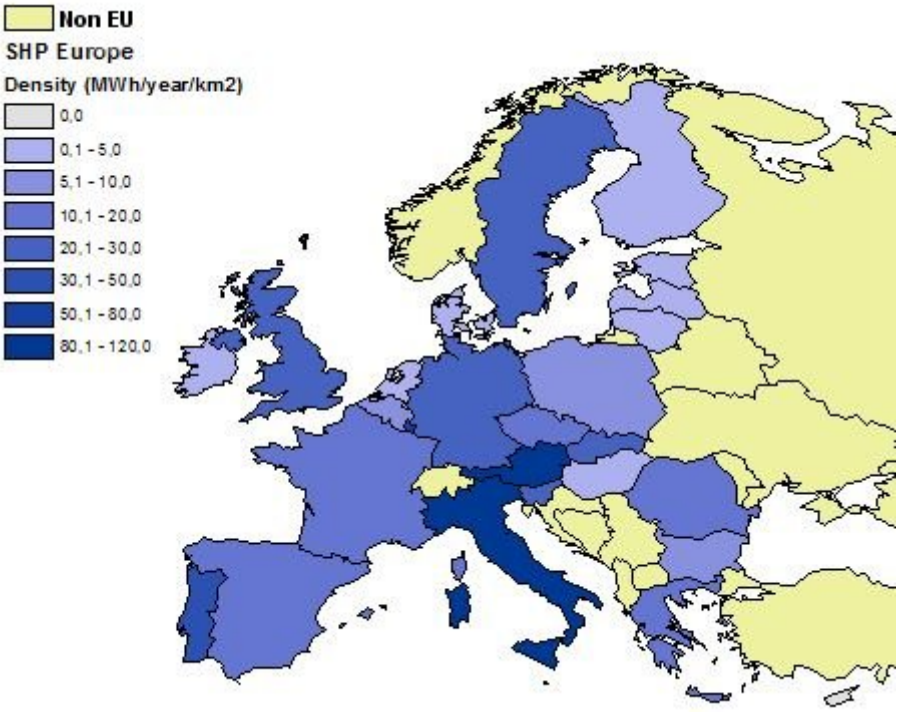

Fig. 6. Density of the economically feasible potential in the EU countries (MWh/year/km²).

It is commonly known that the economically feasible potential is less stable than the technical one, and is subject to considerable fluctuations, mostly has a decreasing trend over years when no new incentives are introduced. Changing economic competitiveness among power options and the status of energy and environmental legislation can greatly alter it. For instance, recently suspended support for SHP plants in Finland resulted in a reduction of the economically feasible potential almost six times; it decreased from 1200 to 220 GWh/year.

The economically feasible potential for development of SHP plants amounts to some 93 TWh/year (Fig.1). This estimate includes also the current SHP electricity generation - 44.1 TWh/ year. This fact shows that in average less than a half of this potential has already been tapped all over the EU. Taking into account any limitations imposed by legal provisions such as geographical designations, legislation and regulations that mostly exclude the SHP potential in specified areas, one can specify the environmentally compliant potential. Its value is estimated at some 55 TWh/year, if a positive component is taken into account: upgrading/modernisation of existing facilities, exploiting non-hydroelectric dams (up to 5 to 10% of actual power generation).

This study reveals that during the last ten years new SHP potential has been greatly affected by environmental legislation that fall under areas that are designated, such as Natura 2000, the Water Framework Directive and others. Mitigation measures will add to the costs of electricity generation, further limiting the economic potential.

Germany, the 4th largest country with regards to SHP installed capacity within the EU, experiences the biggest reduction of its hydropower resource; only 7% of the economically feasible potential can be realisable in the current situation. Heavy environmental limitations are imposed in Baltic countries (e.g., Lithuania 43%), Greece (35%) and

Slovakia (38%). Slightly larger environmentally compliant potential has been identified in France, Italy and in the UK (some 50%).

A reasonable threshold of these limitations cannot exceed 20 to 30% of the economically feasible potential. To the contrast of these environmental constraints a large number of SHP plants are operating successfully in environmentally sensitive areas.

A comparison of independent assessments, the NREAPs and HYDI, exhibits that both data sets fall into the confidence interval (Fig. 7) showing that there is no large difference for SHP totals. The HYDI assessment is more optimistic than the one given in the NREAPs. A forecast value for SHP installed capacity and electricity generation is larger by 6% and 9%, respectively. It turns to 17.3 GW in capacity and 59.7 TWh/year in generation. EurObserv'ER' previsions are less optimistic for the target years in terms of the installed capacities.

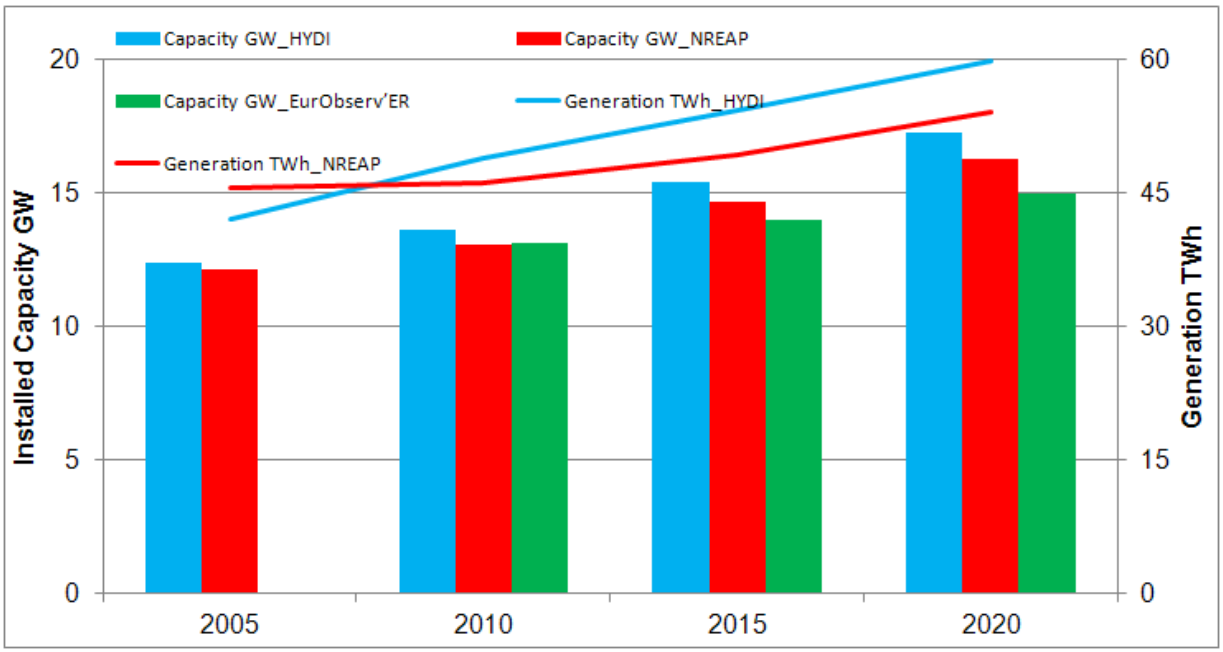

Fig. 7. Comparison of assessments provided by the NREAPs, EurObserv'ER and HYDI *(note: lacking NREAPs data were completed or corrected).*

Despite the fact that SHP projected generation increases by 9% up to 2020 its contribution to the overall RES-E mix diminishes from 9 to 5% (Fig. 8). This can be explained by a spectacular increase in electricity generation of wind power, biomass and other RES-E.

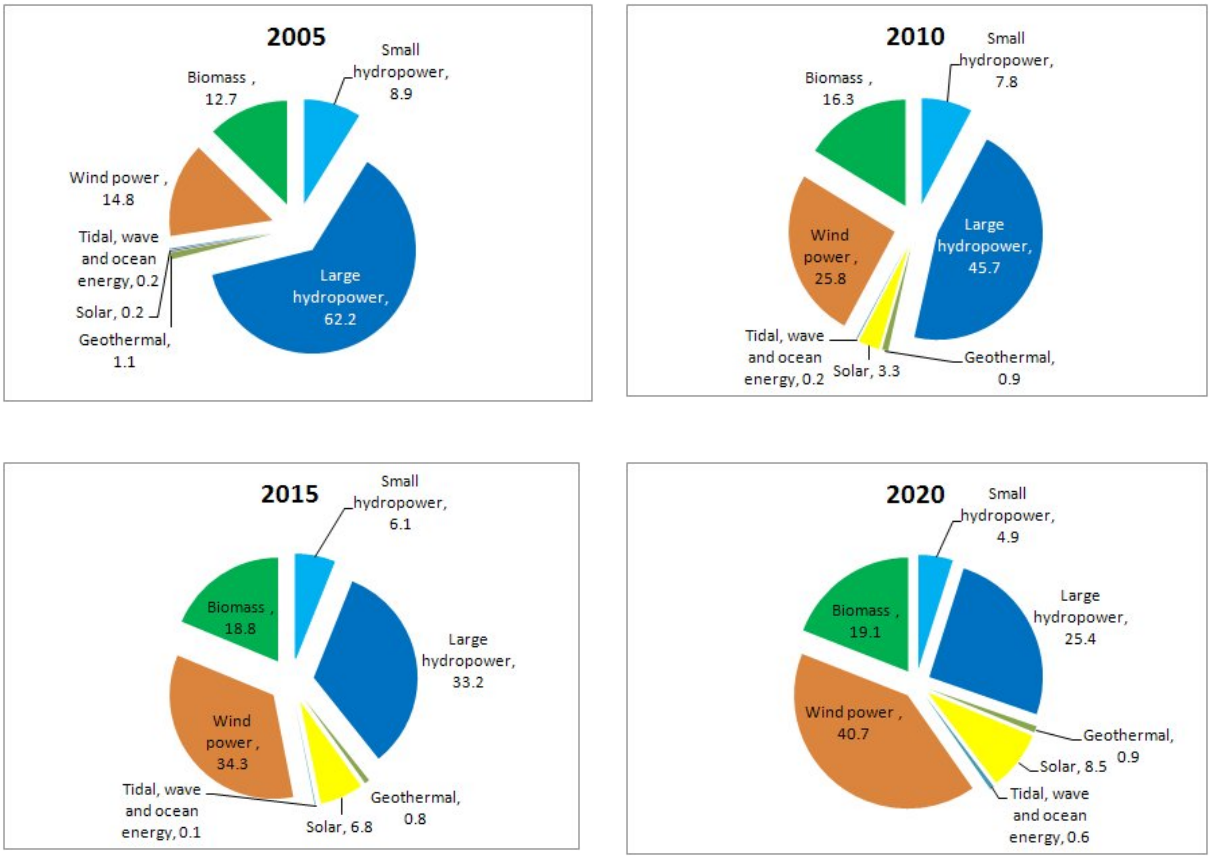

Fig. 8. SHP contribution to RES-E mix (% of total electricity generation in GWh/year). (Other RES-E estimates according to the NREAPs).

MARKET

The Market analysis was undertook under two broad headings – Industrial and Economics. Data was collected from EU member states initially during 2010 providing the status of both these topics up to and including 2009. For reasons given below, changes in the results have been negligible for 2010 and 2011.

Changes are slow in taking place and are completely reliant on the economic status of a country, its policies concerning Renewable Energy development and consequent market forces. The general overall effects of each of these factors can be summarised as follows:

- *Economic status – the economic problems of all European states since 2007/8 are well known. The immediate effect on hydropower development was as a result of uncertainty caused by the economic conditions. Financing of projects was, and is, a major concern.*
- *RE Policies – the economic problems are affecting, or will affect, individual country policies. This drives the rate of development. As a result of the RES directive and national renewable energy targets for 2020 the effects are somewhat cushioned but a worsening of the economic climate and radical government changes could easily cause dramatic changes to the size of the supporting industry and*

employment. It is unfortunately impossible to predict these changes and their consequences.

Market forces – the amount of manufacturing and services required for the hydropower market is a result of the two factors detailed above. It is further complicated by industry's ability to serve the global market. For the last decade the world hydropower market has been very buoyant and many of the larger European companies have benefited. As the world's economy swings this has an effect on these companies and their need for support manufacturing and services. Most of the export market is for the large hydropower sector and it can be assumed that the effect of the global small hydropower market is considerably less important to European companies. However, as rural electrification in developing countries becomes politically and environmentally more important, the market for small hydropower products and experience will increase.

The same three factors affect the economics of a hydropower project. There are, however, two other unique factors which need to be accounted for when considering the economic efficiencies of hydropower development – reducing viability and increasing costs:

- *Reducing viability – as a country's hydropower facilities continue to be built, it is the "easier" ones which are developed first. The ease of development includes aspects such as site accessibility, distance from grid connection/load concentrations, working in more environmentally sensitive areas and reliable water availability.*
- *Increasing costs – a part of which is directly proportional to the effect of reducing viability since the "harder" it is to build a project, the more costly it is. Added to these are general increases in labour and material costs which are common to any industry. Unique to the hydropower sector is the increasing cost of satisfying environmental directives and regulation. Increased monitoring before, during and after construction, increased mitigation measures for fish passage and screening and reduction in water availability all serve to drive up costs and reduce project viability. Other cost increases being experienced are in the areas of insurance, business rates, grid interconnection and "maintenance" due diligence, community charges/payments and rates.*

The balance between policy and incentives is therefore critical for the development of hydropower projects and the consequent effect on industry and employment. Cost of building and generating from hydropower will naturally rise but some control over the unique costs of this technology and its implementation will be necessary to guarantee continued development. One major misconception of many governments is that hydropower is just "another renewable technology". Hydropower is dependent on topography and rainfall and, as such, has a wide range of scheme size and type. It must therefore be incentivised and regulated in a proportionate manner.

Referring to the HYDI, more than 4,200 companies were identified related to the small hydropower sector. This number should be greater but the data for Austria and Germany has, so far, been unavailable. As expected, the original EU members show the greater number of companies but, with the requirements of hydropower development under RES up to 2020, there should be new companies joining the list. In terms of employment, the total value in the SHP sector in the EU is around 29,000.

It is beyond any doubt that the EU hydropower industry is quite mature and highly developed at technological level. There is a great added-value throughout the sector: the know-how within the EU SHP companies is recognized worldwide. At present, many of those companies are exporting this know-how outside the EU border, to countries that are investing in this sector.

Nevertheless, the entire hydropower sector requires stable policies and regulations, both at national and EU level to maintain / improve a healthy growth. The regulatory stability is one of the most important aspects related to attracting investment on a sector that can be financially sustainable if fair market rules are provided. Financial schemes for hydropower projects should account for multipurpose features related to hydropower and its infrastructure – not only production of green electricity, but also its incomparable high efficiency, its contribution for grid stability, and other benefits related with water resource management, as flood protection.

POLICY

The main types of support existing in the Member States for small hydropower are: investment aid, tax (fiscal) incentives (deductions), green certificates or certificates for renewable electricity production, green bonus, net-metering, market based support systems. Existence of combined systems such as FIT and Premium are possible in certain countries.

Table 1. Resume of the support schemes for SHP in the EU

	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
FIT	X*		X	X	X		X	X		X	X	X	X	X	X	X	X			X				X	X
Premium (FIP)				X		X	X	X										X					X		
Quota Obligation/ Green Certificates		X												X	X				X		X	X			X
Investment Grants		X		X					X		X					X			X					X	
Tax Exemptions/ Deductions		X									X							X							
Fiscal Incentives					X													X							
Tendering		X								X															

**Existing plants will continue having a FIT for another several years. But since ~ 2010, small plants will receive an investment support of up to 30%.*

PRICE-BASED INSTRUMENTS

<u>Feed-in Tariff (FIT): AT, BG, CZ, EE, GR, HU, IE, LT ,LU, LV, SK, UK, FR, PT, ES, IT, DE</u>

Guarantees the generator of renewable electricity a certain price per kWh at which electricity is bought. The tariff is set over a long period of time, commonly 20 years.
This system gives very long term visibility for investors (except in case of retroactive decisions that should be avoided). But FIT are disconnected from market needs and could create competition distortions.

Feed-in Premium (FIP): CZ, DK, EE, SI, NL, ES

Feed in premiums offer a premium above the average spot electricity market price.

- *Variable (e.g. based on the LCOE (levelized cost of electricity)) in BE or contract for difference in UK): Feed in Premium will vary according to market price. As the market price increases, the premium amount can be designed to decline (and vice versa). The risk is for the budget of the State.*
- *Fixed: With a constant adder on the top of the spot market price (the bonus remains unresponsive to changes over time and continues to be offered even if electricity prices increase (but the State can introduce caps and floors). The risk is for the investor. This system gives long term visibility for investors and with FIP; the operators shall react to market signals. Also, FIP must be encouraged as they give an incentive to producers to be connected to the market price.*

QUANTITY-BASED MARKET INSTRUMENTS

Green certificates/Quota obligations: LT, SE, IT, BE, PL, RO, UK

Suppliers are obliged to show that a certain amount of electricity delivered to the end consumers stems from RES. Producers of electricity from renewable energy sources receive an electricity certificate, a so called green certificate, for every MWh of green electricity produced. However, in some cases it is also possible to put in place a banding mechanism, which facilitates the State to assign more or less than one certificate per unit of energy according to the production technology.

By selling these green certificates, the producer receives an extra income in addition to the sale of electricity. Green Certificates schemes usually include a penalty (or buyout price) that the entities under the obligation, have to pay if they fail to get or buy enough certificates by the end of the year.

In this way, the system is connected to the market and the price is based on supply and demand. This approach gives investors a better perspective on better technologies to develop. But as designed today, the lack of European integration, in addition to States' interventions, disturb the system. However to avoid a system's collapse such as in Austria, or disturbance in wood industry as, for instance. In Poland, a need of careful supervision of the system by always keeping demand higher than the supply and avoiding unwanted effects resulting out of energy market distortion is inevitable.

Investment grants: FI, LU, GR, BE, CZ, PL, SK

One main task of the investment support is not to improve energy production, but technologies as such. The state makes grants available for research and investment projects that involve the generation of renewable energy or the application of RES technologies. Among other costs, the preparation and planning costs and the cost of materials can be eligible for subsidies. Support is granted on a certain percentage rate of the investment, based on the planned investment of the application, not on the original investment, meaning that rising costs during project conduction are not eligible.

In Finland, costs for feasibility studies, licensing acquisition of ownership are not included in the term investment. Nevertheless, demands set by others than energy authorities, such as water authorities or museum officials are accounted as energy investment. Support of SHP has been applied to the full sector <10MW. The investment grant has proven to be non-sufficient for small plants with high unit investment costs (Euro/kW) and common technologies. The grant is sufficiently in use by the larger SHP

sector (1-10 MW) or project serving direct use of the produced energy by the owner of the SHP plant.

In Belgium, investment grants are reserved for small and middle sized companies, and limited to a certain number of sectors. With its range of eligible companies and investments (from 25.000€ upwards, with a limit of up to 1, 5 million€ in 4 years), it excludes a number of companies being eligible to this form of support, creating some distortion in the market. Due to demands from other administrations (fish passes), extra investment costs are not eligible to this support.

Poland, the Czech Republic and Slovakia, use both, own resources and the Structural (Cohesion) Funds. In Poland, there are "Innovative economy" and "Infrastructure and environment" funds. Similar funds exist also in two other countries. Grants from the Environmental Protection and Water Management Funds are generally available for environmentally oriented infrastructure (mainly fish paths and fish ladders).

Tax exemptions/deductions/ Fiscal Incentives: BE, GR, NL

The Energy Investment Deduction is a tax scheme offered by the State. In addition to the normal write-off, a certain percentage rate of the investment costs can be deducted from the taxable profits. The income tax is therefore reduced.

Tendering: FR, BE

Regulatory authority announces that it wishes to install a determined capacity of a given technology or suite of technologies. Project developers then apply to build the project and name the price at which they are willing to develop the project. Tenders commonly contain specific requirements (e.g. shares of local manufacturing, details of technological specifications, maximum price per unit of energy). The bidder with the lowest offer is selected and can go ahead with the project. Usually the parties sign a long-term contract (power purchasing agreement).

In Belgium, a tendering procedure is foreseen for some navigable waterways under public ownership. The system is equivalent to the French system: the developer who is able to develop the best project, and hence bid the higher price for a fee/kWh gets the concession. In this business plan, the developer takes all the financial incentives (listed above) into account that he has the right to.

This system is a good way for governments to avoid windfall profits and to give enough security to investors. It seems to be the best system for mature technologies but is more appropriate for large installations. For both main financial instruments that were identified above, fiscal incentives, tax exemptions or tax reductions are applicable as well. In general, these mechanisms exempt producers of renewable energy from certain taxes in order to incentivize the deployment of new and highly efficient technologies. The applicable tax rate in each Member State will influence on the effectiveness of such fiscal incentives.

Common remarks

Need for stabilisation of the incentive schemes. An incentive system should be clearly set out and all changes should be scheduled and timed, so that producers can plan properly their investments. Hydropower developers need to know the rules at an early stage, for instance how and under which conditions their projects will be sustained.

In the last months, a very strong barrier has been raised in some Member States: the regulatory risk, related to the latest legislative changes in the remuneration rules of the

Special regime, the so called "moratorium" for new RES-E power plants, which includes even retroactive measures.

Banks have some difficulties financing plants. All the uncertainty is leading to a greater difficulty on achieving financial support for new projects.

Need for suitable incentive support for the rehabilitation and upgrading of old plants, to avoid in the future to loss the present energy production and, in many cases, to get the chance to increase it improving the schemes performances also from the environmental point of view.

Special need for the following issues:

- *Regulatory stability and governmental support to help achieving financing for developing new projects;*
- *Adequacy of the FIT and the concession period in relation with the specificities of the country;*
- *Decrease the investment insecurity by stabilizing the prices within the support system on a long-term period and take care of the relatively low buy-back rate;*
- *Reducing the extremely bureaucratic licensing environment.*

Concession

Any Member State gets the same kind of authorisation procedure which consists of several individual procedures based on different legislation (water law, environmental law, electricity law, construction law, etc.). These procedures have to be passed consecutively and rather independently.

The licensing procedure of a SHP plant takes in average 0.5 to 12 years (there are inclusively cases of SHP that took two decades to be licensed), being quite costly and with an unpredictable outcome. The main reason for this is the dependency from entities tutored by different Ministries which are not properly coordinated, implying a slow and bureaucratic process. Also a lack of authority of some states on decentralized administration services.

The classical power granting scheme is more or less the following:

- *Inclusion on the regional spatial planning;*
- *Permit for the special use of water;*
- *Environmental impact assessment;*
- *License for the construction;*
- *Permit for use of construction works;*
- *Technical prerequisites;*
- *Inspection before commissioning;*
- *Assessment and attestation of conformity;*
- *Market license;*
- *Accession agreement with network utility;*
- *Power purchase agreement.*

The procedure sometimes depends on the capacity, the height of the dam, the characteristics of the power plant, the civil engineering structure.

The administrative procedures have become more difficult due to additional requests from the governments executing the Water Framework Directive (WFD) that hinders significantly the exploitation of SHP and the duration of the procedure lasts for many years sometimes without any success.

The simplification of administrative procedure is needed at least for SHP plants located on irrigation channels, on water supply systems, integrated in existing dams or wastewater treatment facilities, and for the rehabilitation of the old schemes. Since these plants are located in artificial contexts, their environmental impacts are very limited. Moreover they also guarantee a multiple use of water resource.

One main barrier is that a lot of decision criteria or/and delays are not clear, or not binding, and result in delayed authorization (or no authorization at all), with extremely strict conditions. The authorisation procedure must be simplified, shortened and accelerated.

There is a specific need for the following issues;

- *Setting up clear rules and timeframes in the licensing process;*
- *Better coordination between the national and regional authorities responsible for this process;*
- *Simplifying procedure for small-scale power plant permits to reduce the administrative and bureaucratic burdens;*
- *Establishment of solid criteria to concede licences to develop SHP – example, the quality of the projects and the experience of the promoter;*
- *Establishment of the "one-stop shop" type of procedure for SHP investors. The authorities may perform all necessary legal and technical actions with the potential sites in order to allow one-stop-shop type of procedure;*
- *Standardise the application forms and make possible the electronic applications and procedure follow-up, also to ensure transparency;*
- *In case of tenders, analysis of the already delivered requests for licensing, instead of launching new tenders taking advantage of the studies already produced on several locations.*

Legislation

In many Member States, stakeholders complained about environmental requirements, in particular the Environmental Impact Assessments (EIA) and the Water Framework Directive (WFD).The criticism refers also about the fact that the environmental benefits of the renewable energy systems are not taken into account properly.

The environmental requirements for SHP are too restrictive and do not apply criteria that considers its benefits; an incoherent implementation of the WFD has also become a strong impediment for the SHP sector, by assuming hydropower as a menace for the water bodies and their ecological status, and by imposing restrictive administrative and environmental requirements, that lead to a decreasing number of hours of production and therefore to a lower profitability. This can be dramatic, especially taking into account that the current tariff level is quite low, particularly for rehabilitation, and that there is also a lack of knowledge about the water resources available; nevertheless, a diminishing of the water availability has been registered mainly affecting run-of-river SHP, resulting in a decrease in equivalent operating hours. Member States should deliver a more proportionate programme of measures of implementation of WFD.

a) Impact of WFD on hydropower development

Environmental issues have become the main barrier to the development of SHP, with sometimes very unbalanced consideration given to the global and environmental advantages of renewable energy development.

Implementation of the WFD has resulted in rising the environmental requirements and investment costs.

In the context of making improvements to water bodies via specific measures, a majority of European States has agreed national or local criteria for determining what impact on hydropower generation is acceptable (i.e. not a significant adverse effect). However, in many countries, no criteria on impact determination could be determined so far.

WFD is most of time currently only implemented in very general legislation, which gives the floor to interpretation of "prevent any supplementary degradation, preserve and improve the quality of the aquatic ecosystems".

The obligation to comply with more stringent environmental requirements (for example, the imposition of more demanding environmental flows and significant compensatory measures, which often go beyond the dimension of the investments and the scope of activity of the promoters) leads to a limitation of the technical characteristics and potentially to a reduction in the profitability of SHP plants.

Concerning the main environmental topics like reserved flow and fish bypassing the requests from the government are continuously increasing and sometimes the consensus already reached is not stable and reliable. The planning process has become a kind of gambling.

In some member states a dogma of "river continuity" prevails on a well-balanced use of water.

There is a need for research and objective scientific approach and for sharing experiences about what is done in other European countries.

The energy losses of hydropower due to ecological improvements are in particular due to:

- *Minimum flow requirements;*
- *Fish pass and bypass installations discharges (typically combined with minimum flow requirements;*
- *Head loss at fish protection screens;*
- *Requirements on mitigation of surge operation (especially for peak load and storage plants);*
- *Turbine management: reduction of the operational time of the hydropower plant, for instance by putting the turbines out of operation for ten hours at twenty days of the year;*
- *Reduction of the utilizable height of fall caused by increased losses at mechanical fish protection barriers with small distance of bars.*

b) Residual flow regulation

Some Member States are using fixed thresholds; others are more pragmatics and give more importance to the case by case study (hydro biological study).

WFD is in course of implementation and in general its implementation causes higher residual flow for SHP and an increase in their operating costs.

There is a need for analysis and discussion of the imposition of minimum ecological flows and compensatory measures for the implementation of SHP - involving a joint force between national authorities and the promoters.

As far as exiting plants are considered, the increase of reserved flow values, not always justified from a scientific point of view, are causing the shutdown of some SHP and creating problems also to bigger plants.

Extensive research on minimum flows is being conducted in different EU Member States, but there are still gaps mainly as to the ecological responses to minimum flows and interaction with morphology. It is recognised that European standards at general level are needed.

c) SEA Directive

One important issue is the application of the Strategic Environmental Assessment directive on certain plans and programmes, which is causing big delays in the implementation of a series of concessions given in 2009 and 2010.

It was reported that the EIA procedure is not conducted in a uniform way. A frequent request in the national reports is that clearer guidelines should be published, determining if and how an EIA has to be carried out.

There is a need to introduce in the composition of the commissions for environmental impact assessment of a delegate from the promoter (as an observer, with no voting rights).

Local administrations are identifying a lot of "no go areas" and an expensive and time consuming EIA is requested also for very small plants with negligible impacts.

d) Technical approaches for good practice in hydropower use

For upstream migration, many solutions are available (e.g. fish passes and fish ladders, but also fish lifts, fish stocking, catch & carry programmes etc.) to mitigate the negative impact of migration barriers – but more work needs to be done on evaluation and monitoring of effectiveness. Much research leading to technical innovations has still to be undertaken, especially related to downstream migration in combination with turbine damage.

There is no one-size-fits-all approach. The use of compensating measures together with mitigating measures is recommended.

Standardisation at European level is desirable, but solutions for mitigation measures will have to be largely site-specific. Exchange of information should be promoted on standards that have been developed by different countries or organisations (e.g. for continuity).

e) Conflict between river protection and hydropower development is rising

Many critics about the «go - no go» principle have been registered.

River classification is sometimes a dogmatic way to prevent from damming without any scientific approach. As each project is unique and does not have the same impact on the river, an environmental impact assessment of each project should be the base and the only one criterion to authorise or not a project.

It is incorrect to introduce general rules of absolute prohibition of establishment of RES in areas governed by any specific or general protection regime, without considering the specificities of the installation area and the proposed project at a time.

The introduction of these general exclusions is contrary to the RES Directive. It is required to review Management Studies of the protected areas to effectively take into account the special land-planning for RES.

There is a need for completing the knowledge about the real status of the river and define clear methodologies to be used in the respect of the principles of cost and effectiveness of measures, ecologically acceptance and economically reasonable approach.

Likewise, there is a need to obtain adequate confidence and precision in the classification of the quality elements. There are no agreed guidelines on the elements considered sensitive for certain pressures.

It is essential to promote economic studies and cost-effectiveness analysis which are essential for WFD implementation. Authorities shall give attention to proportionality and cost-efficiency, be pragmatic, prioritize and motivate their demands. There is a need for more dialogue and pedagogy.

Make significant progress in administrative adaptations, data gathering and analyses, public information and stakeholders' involvement, setting of monitoring networks, etc.

The re-evaluation of the SHP potential for all rivers is definitely a major issue. Not all Member States have studies that investigated the potential while considering technical, economical and environmental restrictions. Most data on forecasts for SHP are based on assumptions and are presumed to be relatively uncertain.

An important aspect to highlight is that the size of the project is not the most relevant criteria when assessing a hydropower project. The relevant approach is to assess if a given project will result in deterioration of the status of a water body. An cost-benefit analysis of the project is necessary to enable a judgement on whether the benefits to the environment and to society preventing deterioration of status or restoring a water body to good status are outweighed by the benefits of the new projects.

There are a great variety of restoration/ mitigation measures that can be applied to reduce (local) impacts from hydropower passes, fish protection facilities and downstream fish ways, minimum flows and debris and sediment management. Several mitigation measures have already been applied for a long time.

f) Difficulties related to electricity grid access:

With the increasing amount of intermittent renewable energy production by wind and solar energy facilities, energy storage and grid stabilization will become prominent issues.

There is a need to improve synergies between SHP and smart grids: hydropower has an increasing role in supporting transmission and distribution grids by his proper capability to regulate frequency and to integrate other discontinuous renewable sources like solar and wind. Besides large hydropower, also SHP can play a role, especially where is possible to combine it with small basins and integrate it in hybrid systems. More research should be promoted on this aspects and a dedicated regulatory framework should be enforced.

Reduce the barriers for development of very small hydro concerning technical requirements of grid connection and allow direct SHP-born energy deliveries to nearby users.

SHP role (standby energy, storage capacity) in future smart grids is not yet sufficiently recognized and therefore not supported by legislative and administrative activity.

g) Lack of support of RES directive on hydropower development :

Although the RES directive is implemented in national law the positive consequences are poor and the political support does practically not exist. There is no positive impact seen so far on RES directive but negative impact from WFD directive.

There is a need for clear recommendations on how to interpret the Renewable Energy Directive 2009/28/EC and the WFD that appears to be contradictory.

General comments about improvement of legislation:

There is a need for:

- *More cooperation among the Ministries when issuing new laws, decisions, regulations;*
- *Reduction of the legal risk: a major problem in several countries is that everyone has the ability at any stage of the licensing process to appeal the investment in The Court of State, thus causing very long delays and with the great danger not only an investment to be cancelled but the investor companies and the manufacturers of these projects to suffer a serious economic damage or even an economic destruction. Change the procedure for example by setting high deposit amounts in order to do such an appeal that will be lost if the appeal is lost;*
- *Many producers have to pay lawyers and sometimes go to the court in order to see their rights respected;*
- *Further simplification and unification of administrative procedure;*
- *Setting standards for project development;*
- *EU good practice guide to hydropower construction and operation;*
- *Integrated approach for refurbishment of old mills.*

Need for political, media and social incentive

Some initiatives exist, like tenders for the development of SHP with new FIT incentives (like in Portugal and Spain). Developing hydropower cannot any longer be based only on individual initiatives. The state must support hydro development by determining favourable areas. Partnership with all stakeholders is a condition of success.
While pre-planning mechanisms allocating "no-go" areas for new hydropower projects is sometimes criticized, pre-planning mechanisms can facilitate the (proper location) identification of suitable areas for new hydropower projects. This designation should be based on a dialogue between the different competent authorities, stakeholders and NGOs.
The use of such pre-planning systems could assist the authorisation process to be reduced and implemented faster. Small and large hydropower should be treated equally with regard to promotion.

The National Renewable Energy Action Plans (NREAPs) do not always provide figures on the number of additional large, small and micro hydropower facilities which are intended by the Member States to be constructed in the coming years. There is a need in compiling the figures on potentials for different countries and keeping them up to date; State administrations shall do the job.

In several countries, the lack of specific expertise in dealing with renewable energies has been identified as an important barrier for their development. The civil servants dealing with the permitting procedures are not familiar with renewables. This leads to confusion, delays or unmotivated denials of authorisations. Member States shall invest the necessary resources to train and motivate their civil servants dealing with renewable energy authorisations. Specific guidelines and training programs could be envisaged.

Continuation of the process of giving access to the state owned dams to the hydropower investors and starting erection of new multitask installations within the framework of partnership between water management authorities and hydropower investors.

Introducing regulation redirecting the incomes resulting from green certificates in state owned hydropower plants to support investments within the sector.

Use socio-economic analysis to define a cost-effective programme of measures. This work should ideally be undertaken at a catchment or sub-catchment level, so as to maximise the ecological potential and the energy production.

Improve the understanding of both environmental concerns, given by the WFD, and the development of hydropower, encouraged by the RES Directive, and the possible approaches for a coordinated implementation of both this water protection policy and energy policy. In most of the Member States, the Ministry of Environment remains under strong influence of the "pro-ecological" lobby.

Opposition to SHP is concentrated within a few people and organisations, amongst fishermen, civil servants and academics. Public has usually little interest in this subject. Media, including the public ones, usually sympathise with pro-ecological NGOs. There is also a lack of social approach of the sector.

4. CHALLENGES & PROSPECTS FOR 2020

As mentioned earlier, hydropower has a key role in meeting both the 2020 renewable energy targets as well as the greenhouse gas reduction targets. There is also still a large potential for SHP development in the EU-27, where more than 50 TWh/year could be put on line in the future and important positive impacts on employment and the economy in Europe.

Since the growth rates of SHP during the past years both in terms of production and capacity were rather disappointing, it is expected that the figures until 2020 would follow the same path, unless the main challenges for the sector outlines below are properly addressed.

Putting SHP (back) on the European agenda

It has already been mentioned above that hydropower is a reliable and cost-effective method to generate electricity, which provides a steady and secure source of electricity supply. SHP is also a sustainable technology that helps mitigating climate change and a valuable technology for decentralised and local energy production. It provides additional benefits to local communities through its multipurpose applications. SHP has therefore an important economic value for Europe, including in remote areas.

Policy makers both at national and European level fail to give consideration to these advantages and tend to give more credits to less proven or stable technologies. The prospects for the SHP industry will therefore depend on the ability of decision-makers to give further consideration to the sector and to understand how it is complementary with growing intermittent technologies.

Addressing the environmental challenges

For the past ten years, SHP potential has been greatly affected by environmental legislation that falls under designated areas such as Natura 2000, the Water Framework Directive, and the Strategic Environmental Assessment Directive. For some countries, the SHP economically feasible potential was reduced by more than a half due to the increase of related costs (mitigation measures for fish passage, residual flow, screening and reduction in water availability, etc.). Though, a reasonable threshold of these limitations cannot exceed 20 to 30% of the economically feasible potential in the future with endangering the whole sector.

For operators and investors, it is also crucial that policies and regulations are stable, both at national and EU level. The framework needs to be based on sound scientific evidence, unambiguous terminology, standards (e.g. on residuals flows), cost-benefit analysis and a site specific approach (rather than river classification) to allow for any smooth adaptation.

It should be mentioned however that a large number of SHP plants are currently operating successfully in environmentally sensitive areas. They do not usually cause deterioration to the water status and are committed to constantly improving their environmental performance. Such good practice should be better promoted.

Finally, environmental challenges should be addressed in more a comprehensive way, giving more credit to the environmental benefits of renewable energy systems from SHP as well as to its social and economic aspects which should be equally weighed in a sustainability analysis. A comparative overview of national implementing measures of the

WFD and European environmental policy by EU Member States and their effects could help finding proportionate policies better in line with the objectives of the RES Directive and of other policies. Cooperation between water resources management and energy planning bodies is also crucial to optimize the existing resources.

Financing Small Hydropower

It has been mentioned previously that like other renewables, SHP developers and investors need regulatory stability and fair market rules, especially in the financial environment (tariffs).

Those rules should take into account the multipurpose features of hydropower, not only its production of green electricity, but also its incomparable high efficiency, its contribution to grid stability, and other benefits related with water resource management, as flood protection. Financial schemes for hydropower projects need to address these specific characteristics that are quite different from other renewable technologies.

As it is the case for environmental measures, a comparative overview of public support schemes for energy production would be a first step in the determination of efficient and fair support mechanisms.

A good scheme should in particular address the rehabilitation and upgrading of old plants to avoid energy production losses and to increase the environmental performance of the sites. It should also align the support period with the concession period and look at the long term and relatively low buy-back rate.

Finally, alternative financing solutions, such as mechanisms to facilitate granting of loans from the banks, policies to increase public financial earmarking to renewable energy production (linked to regional targets for RES) or any measure to promote investment in the SHP sector should be further promoted to ensure the viability of the industry in 2020.

Other administrative barriers & support

The licensing procedure for SHP is currently a time consuming and bureaucratic procedure as numerous permits are necessary to be issued. On top of that, most of the time this process is dependent on poorly coordinated entities from different public authorities and leads to overshooting demands to operators.

Therefore, a beneficial future licensing for the sector should rely on simple, fair, solid (i.e. scientifically defined) and transparent criteria suitable with SHP scale promoting a faster and more predictable result in the outcome, especially when power plants are located in artificial contexts and have very limited environmental impacts. 'One-stop shops' with electronic application procedure should be the aim.

Authorities can also provide non-financial support to the SHP which could significantly help the industry. Measures such as granting an effective primary access to the grid, allowing to directly selling electricity to third parties, developing labels for 'green' SHP plants or developing net-billing mechanisms would facilitate operations and might trigger further deployment by 2020. Developing hydropower cannot any longer be based only on individual initiatives. The state must support hydro development through support measures and also by determining favourable areas for operations, in cooperation with relevant stakeholders. With this regard, a priority is to develop an integrated approach for the refurbishment of old mills, with the involvement of local communities.

Preparing for the future

The prospects of SHP for 2020 will greatly depend on the capacity of the industry, public authorities and relevant stakeholders to take appropriate measures to address the current challenges and prepare for the future.

Besides the need to develop and deploy new financial and non-financial support mechanisms for SHP, public authorities should promote relevant research activities for the sector by dedicating appropriate funding.

Much technical innovations have still to be undertaken on fish-friendly technologies, especially related to downstream fish migration in combination with turbine damage, as well as debris and sediment management. Although standardisation at European level is desirable, solutions for mitigation measures will have to be largely site-specific. Exchange of information should therefore be further promoted on standards that have been developed by different countries or organisations (e.g. for continuity).

Similarly, more research needs to be carried out on low head technologies, as well as on possible applications of SHP in future smart grids (standby energy, storage capacity). It should be recognised that hydropower can have an increasing role in supporting transmission and distribution grids by its capacity to regulate frequency and to integrate other discontinuous renewable sources like solar and wind. Research on these aspects should be also a dedicated to an adequate regulatory framework.

Finally, preparing the future means also further promoting the exchange of good practice and the creation of practical guides on construction, operation on hydropower and its water use, developing practical guides and increasing training programmes, especially for the civil servants dealing with renewable energy authorisations. This will require the involvement and collaboration of all relevant stakeholders.

5. ANNEX: Overview by Member State

AUSTRIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*1,000*	*1,051*	*1,109*	*1,300*
Generation (GWh)	*3,893*	*4,659*	*4,983*	*6,050*
Number of power plants	*2,200*	*2,354*	*2,589*	*2,870*
Potential (GWh)*	*8,766*	*8,000*	*7,676*	*6,609*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*90*
Employment	*1,057*
Civil works (estimation)	*275*
Average investment cost (€/MW)	*3,000,000 - 4,500,000*
Average O&M cost (as % of total investment cost)	*2 - 2.5*
Average civil works cost (as a % of total investment cost)	*50 - 70*
Average cost per kWh produced (€)	*0.065 - 0.1*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

The entire authorization procedure consists of several individual procedures based on different legislation (water law, environmental law, electricity law, construction law, etc.). These procedures have to be passed consecutively and rather independently. Time needed to pass all these steps is between 2 and 10 years. The average is around 3 to 5 years.

Residual flow regulation

Since 2010 there is a regulation in force (Qualitätszielverordnung) giving the following recommendations:
There are three criteria:

Criteria1: Qres ≥ NQtnatural
(The residual flow has to be more than the natural daily low flow, which indicates the absolute natural minimum flow)

Criteria 2: Qres,min ≥ 0,33 MJNQtnatural
(The minimum residual flow has to be more than a third of the natural mean low flow, a value of course being higher than the absolute minimum flow)

Criteria 3: If MQ(mean flow) < 1 m^3/s: Qres,min ≥ 0,50 MJNQtnatural
(The minimum residual flow in small creeks – mean flow less than 1 m^3/s – has to be more than half of the natural mean low flow)

The formulas provide values being suitable to meet the ecological demands. If an owner is willing to carry out a more detailed hydro biological study, proving that less residual flow will provide sufficient ecological quality, the values calculated by the formula may be lowered.

Support scheme

Before 2003 the federal countries of Austria had individual tariff regulation. Since 2003 a country wide FIT system was implemented. The amount varies between 33 and 62 €/MWh depending on the amount of production and renovation efforts of the owner. The tariff was guaranteed for 13 years. Starting with 2010 an investment support system has been installed replacing the FIT system:

- *<50 kW: 1,500 €/kW;*
- *50 – 500 kW: 30% of investment (max. 1,500 €/kW);*
- *500 – 2,000 kW: 20 – 30% of investment, (max. 1,000 – 1,500 €/kW);*
- *2 – 10 MW: 10 – 20% of investment (max. 400 – 1,000 €/kW).*

Existing plants running under the FIT system will continue getting the tariff. The new system is only valid for new plants erected and set into operation after 2010.

Power granting scheme

The leading law in hydropower development is the water act regulating everything dealing with water. The WFD is implemented there. Additional requests are based on the environmental protection law, the forest law and the spatial planning laws. Finally the green electricity act regulates support questions.

4. Summary of the Current Status of Small Hydropower Development

- *The support scheme has been changed two years ago from FIT to investment support. Recently it has become possible to choose among these two options. SHP operators prefer FIT. The administrative procedures have become more difficult due to additional requests from the government executing the WFD. The budget*

dedicated to the support scheme is limited and in some years the requests coming from the owners exceed the money available.

- *WFD hinders significantly the exploitation of SHP and the duration of the procedure lasts for many years sometimes without any success. Although the RES directive is implemented in national law the positive consequences are poor and the political support does practically not exist.*
- *Concerning the main environmental topics like reserved flow and fish bypassing the requests from the government are continuously increasing and sometimes the consensus already reached is not stable and reliable. The planning process has become a kind of gambling.*
- *The development of SHP is far behind the targets and there is no indication that the situation will change. There is a deep gap between the general political obligation to increase the RE production also coming from SHP and the reality of granting procedures very often blocked by individual experts from the government.*
- *The general opinion of mass media is very critical and obviously against the development of SHP. The local population does not have a unique position but is predominantly in favour of SHP. In detail the social acceptance depends on the individual project and the benefits deriving from the project.*

5. Prospects for Future and Recommendations

- *Higher economical support to cover the additional environmental costs;*
- *Efficient political support during individual granting procedure;*
- *Speeding up the governmental procedure and shorten the duration to max. 2 years.*

BELGIUM

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*60*	*61*	*61*	*92*
Generation (GWh)	*181*	*188*	*191*	*285*
Number of power plants	*55*	*68*	*92*	*134*
Potential (GWh)*	*307*	*300*	*297*	*203*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*15*
Employment	*67*
Civil works (estimation)	*8*
Average investment cost (€/MW)	*4,000,000 - 9,000,000*
Average O&M cost (as % of total investment cost)	*3 – 4*
Average civil works cost (as a % of total investment cost)	*40 – 50*
Average cost per kWh produced (€)	*0.016 - 0.047*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

5 months – undefined (∞)

Residual flow generation

Case by case.

Support scheme

Green certificates: Minimum price 0.065 €/kWh; Market price (2010) 0.085 €/kWh. Duration 15 years. Investment support is given to some small and medium sized companies, up to 30% of the initial investment. Height of support is calculated case by case depending on the profitability of the project. Support is only given if green certificates do not allow to reach a sufficient profitability. This mechanism is currently under revision.

Power granting scheme

- *If located on the public domain, the plant will need to obtain a concession or authorization delivered by the public authority; if on private domain, it will need a 'droit de riveraineté'.*
- *On navigable waterways, the plant will also need a water take 'authorization' delivered by the Minister.*
- *On non-navigable waterways, an 'authorization for modifying the water course' will be needed.*
- *Regarding the environmental permit: it is required for every plant above 100 kW; The permit will list the conditions of exploitation for every project (case by case). This regulation is currently under revision: all plants, including those from 0 to 100 kW, will most probably by submitted to environmental permit or environmental declaration (legislation in preparation).*
- *For the injection of electricity on the grid, the producer needs a connection contract with the distribution or transport network operator.*

4. Summary of the Current Status of Small Hydropower Development

a) *Considering the limited potential of SHP in Belgium (materialised in the NREAP's objectives), there has been/is very little discussions on the role of this form of energy production, and even less regard given to role of it in a balanced energy mix, or as a source of socio-economic development. The main remaining potential will be done on 3 - 4 main waterways, under public concessions. Environmental issues have become the main barrier to the development of SHP, with sometimes very unbalanced consideration given to the global and environmental advantages of renewable energy development. Small scale environmental issues are often given more weight in the decisions than global climate change issue or the renewable energy objectives.*

One main barrier is that a lot of decision criteria or/and delays are not clear, or not binding, and result in delayed authorization (or no authorization at all), with extremely strict conditions, leading to important production losses.

Support mechanism is not adapted to very small hydro <10 kW. Investment support is only given to certain companies, for investments above 25.000€.

b) *WFD is currently only implemented in very general legislation, which gives the floor to interpretation of "prevent any supplementary degradation, preserve and improve the quality of the aquatic ecosystems".*

There is no clear rule regarding the financing of the environmental equipment (like fish passes), leading to discussions on the repartition of costs, between developer and public administration (eventually helped by EU funding). This leads to enhanced delays in the realization of small hydro plants, or to non-go's if the costs to be held by developer are too high.

RES directive has been implemented at national level, but no specific target for hydro, nor small hydro has been decided for the Walloon region (main region for hydro), which gives no clear signal to administration nor investors.

c) *One important issue is currently the application of the SEA directive on certain plans and programmes, which is causing big delays in the implementation of a series of concessions given in 2009 and 2010.*

d) *The government is wanting to adopt a modification of the classification of SHP installations in the framework of the environmental legislation, which will 'classify' all ranges of installations from class 1 to class 3 (i.e. also the smaller ones <10 kW that were not classified). The positive effect of this project-legislation will hopefully be that*

permitting will happen within binding delays, and should be linked with clear sectorial conditions. Potentially negative effect is that it will discourage very small operators. The sectorial conditions will be the key element in this new regulation, in which the SHP sector should be consulted. We do not expect finalization of these legal texts before 2013.

The whole support mechanism (green certificates) is currently under revision. Discussions should take another year before there is clarity on the level of support for small hydro. We do not expect finalization of the new legal framework before mid-2013. In the meantime, the whole renewable electricity sector is facing a major crisis in the GC-market, leading the GC-price under the guaranteed minimum. New investments will only be made today if the profitability of a project is reached with this minimum price, which is generally not the case for small hydro. This situation, combined with the administrative and environmental difficulties will have as impact that investments will probably go through a period of moratoria for a year or two.

e) *Opposition to SHP is concentrated within a few people and organisations, amongst fishermen, civil servants and academics. Public has usually little interest for the subject.*

5. Prospects for Future and Recommendations

- *Elaboration of **clear and balanced exploitation conditions** ('sectorielles et intégrales'), in close collaboration with main stakeholders, in order to balance the interests of ecosystem and fish protection with the socio economical interest of SHP. A good equilibrium should be found, in the environmental constraints imposed, between the costs that should be supported by the operator, and the costs that are inherent to the regions obligation to fulfil the WFD.*
- *In this debate, **more weight to the importance and objectives of renewable energy development** should be given in order to balance and improve the public perception of SHP.*
- *Linked to the previous issue, the fact that all installations will be submitted to **environmental permit** would be beneficial as it imposes strict binding delays for decisions. One recommendation is that all other discussions or procedures related to the authorization process ('AMCE', authorization of modification of the waterway, for example) should be included within the same binding delays as the environmental permit procedure.*
- *SHP equipment could be given **a clear SHP development framework**, as it is the case for wind energy development ('Cadre de Référence'), on the basis of an exhaustive inventory of the potential, a regional equipment programme, and if necessary a public call for developers.*
- *In the discussions on the level of support for all green electricity sources, special attention should be given to small hydro, and **extra support for sufficient profitability** should be examined. The costs of extra environmental equipment, imposed by the framework of the WFD should be fairly shared between the developer and the public support (be it on national or European level).*

BULGARIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*184*	*255*	*263*	*380*
Generation (GWh)	*540*	*549*	*630*	*1,050*
Number of power plants	*95*	*127*	*136*	*200*
Potential (GWh)*	*1,009*	*1,000*	*919*	*499*

**Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*15*
Employment	*695*
Civil works (estimation)	*450*
Average investment cost (€/MW)	*2,970,095 - 4,600,093*
Average O&M cost (as % of total investment cost)	*9-10*
Average civil works cost (as a % of total investment cost)	*50%*
Average cost per kWh produced (€)	*0.09-0.11*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

- *For Water utilization and the Right of water usage permits are needed from 2 to 6 months, interrelated with the issuing of preliminary Decision on EIA, Decision on the compatibility with the subject and purpose of conservation of protected areas, which alone could take from 6 months to 24 months.*

- *The Approval of a Detailed Spatial Plan concerns the acquisition of properties and takes from 12 to 24 months. Building permit is issued within 7 days of Investment projects' approval.*

The timely preparation and approval of the Investment Projects are the sole responsibility of the Investor/Developer.

By and large, the average duration of the authorization procedures from A to Z are about 36 to 60 months.

Residual flow regulation

- *According to the plans, the hydroelectric facilities are to provide 1,700 Mm3 water for irrigation and over 850 Mm3 for industrial and potable water.*
- *Concession regime is applied for the larger water abstractions and a Compensation flow is set as a fraction of the long-term average flow or alternatively minimum mean flow. The losses in SHP electricity production resulting from maintaining CF are important (>10%).*
- *The Water Framework Directive is in course of implementation and it might cause higher residual flow for SHP and increase in their operating costs.*
- *Basin Directorate is charged to issue a 10-years-permit for water use the procedure for the issuing of which could take up to 2,5 months.*
- *License for power generation is granted for up to 35 years. The term of the either of the above mentioned documents could be extended for an additional period of up to 15 years (or more, in some cases).*

Support scheme

The Renewable and Alternative Energy Sources and Biofuels Act (ERSA in force years 2007-2010, amended by the Renewable Energy Act in April 2011) is the statutory basis for the feed-in tariff which is the main element of the Bulgarian support system. The ERSA also establishes an obligation to purchase and dispatch electricity from renewable sources.

Power granting scheme

For installing and commissioning SHP in Bulgaria you need to follow the following steps/stages. Additional documentation might be required on every step, depending on the authorities.

1. *Water utilisation permit - valid for up to 35 years*
2. *Right of water usage and/or Utilization of water permit*
3. *Documentation certifying the capacity "Assigner of investment plan" - Notary Deed, Agreement establishing the right to build or Conceded the right to use*
4. *Certificate of "Irrigation systems" JSCo*
5. *Decision under Chapter Six of the Law on Environmental Protection (EIA)*
6. *Admission order for preparing of Detailed Spatial Plan-Construction plan*
7. *Admission order for preparing of Detailed Spatial Plan - Plot plan*
8. *Admission order for preparing of Detailed Spatial Plan-Plot plan for road infrastructure for the HPP's construction*
9. *Concordance of the conceptual design for Detailed Spatial Planning - Construction plan and DSP Plot plan with the local Electricity company, Basin Directorate for Water Management.*
10. *Decision on approval of a site layout and design for the design by the Regional Directorate "Agriculture" / Ministry of Agriculture and Food*
11. *Detailed Spatial Plan, Construction plan*
12. *Detailed Spatial Plan, Plot plan*
13. *Decision of the Municipal Council for approval of DSP - Construction and Plot plans*
14. *Certificate of entry into force of the approved DSP-CP and DSP-PP*
15. *Application for accession to the Grid Operator*

16. *Decision on approval of a Site layout permanent way to design and change the designation of land by the Regional Directorate "Agriculture" / Ministry of Agriculture and Food and registering at the Agency of Geodesy, Cartography and Cadastre of abovementioned designation*
17. *Preliminary grid contract*
18. *Design visa*
19. *Project of "Road Infrastructure"*
20. *Project of "Electricity"*
21. *Project of "Surveying"*
22. *Project of "Geology"*
23. *Project of "Architecture"*
24. *Project of "Constructions"*
25. *Project of "Health and Safety Plan"*
26. *Project of "Management and Road Safety"*
27. *Comprehensive report or Conformity Assessment of the Project*
28. *Building Permit*
29. *Final grid connection contract with the operator of the electricity distribution grid*
30. *Commissioning permit (Use permit)*
31. *Contract for purchase of energy*
32. *Contract for access to the transmission or distribution grid*
33. *Contract with a Coordinator of a balancing group*

4. Summary of the Current Status of Small Hydropower Development

- *SHP are viewed as part of the whole "renewable energy sources" lot and use the same support schemes (price driven: preferential prices), same permitting process (with slight alterations concerning the water usage). The authorities disregard the fact that contrary to the intermittency of wind, the water serves as good means for balancing of the electricity system.*
  Although the one-stop-shop idea is set in Directive 2009/28 /EC it has not been done neither for SHP project developers nor for the other RES projects.
  Still there is a need for development of more integrated use of economic analysis (e.g. for justifying derogations, for developing cost-effectiveness and cost-benefit approach)
- *In 2010, the River Basin Management Plans had been adopted (available in Bulgarian at http://www3.moew.government.bg/?show=top&cid=66)*
  Bulgaria has four river basin districts for basin management, three of which are international sharing water courses with Greece and Turkey to the south, Romania to the north (Danube River is the border), Serbia and Former Yugoslavia Republic of Macedonia to the west and one national river basin - Black Sea RBD:
  Danube RBD; Black Sea RBD; East Aegean Sea RBD; West Aegean Sea RBD
  More information available at:
  http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/implementation_documents_1/information_consultation/bulgaria&vm=detailed&sb=Title
  The stress in the River Basin Management Plans is put on the environmental conservation while the other aspects of the rivers and waters as utilization or use for production of energy are put aside.
  The main matter with the implementation of the WFD is the lack of professionalism and/or experience in the state and local authorities, which causes more harm than

benefit. At the same time there is no follow-up and no addressing of discrepancies between the WFD and the local legislation, the latter one often imposing much more obligations than initially given in the Directive.

- *After the selection of particular water object and the following due diligence stating the economic benefits of the project, the investor shall follow the order of the procedure for issuing of Permit of water usage, regulated by the Water Act and Environmental Protection Act.*
  The issues at this stage:

  a. *The investor is obliged to provide the authorities with large volumes of specific documentation that contains* ***information unavailable for the investor*** *at this early phase of the process; additionally more often than not the officials are subjectively deciding on the need of yet more extensive information, wherefore the investor has* ***to pay repeatedly times for one and the same document*** *– firstly prior(for information on the possible impact) and secondly following its issuing (for the actual impact assessment).*
  b. *The Environmental Impact Assessments are usually* ***not ready in the 30-days' statutory time*** *and contain the* ***same set of information with slight changes in style and wording****, restating the well-known facts and* ***not fulfilling its main purpose****: to assess the environmental impact of the particular investment project, to suggest preventive measures which will avert, decrease or eliminate the potential negative effects.*
  c. *The EIA reports are not complying with the legislation in:*
     - *providing an assessment on the* ***concrete installation****;*
     - *containing efficient and effective measures for diminution of the potential negative effect of the* ***concrete installation****.*
  d. *The term and price of an EIA report are groundlessly long/high.*
  e. *Moreover there is no competition among the EIA expects which leads to low quality of the output documentation and results.*

- *The share of the SHP energy of the RES produced electrical energy for 2010 is 14.31%. SHP growth has followed a steady upward trend over the past 10 years as they are more flexible in their entry requirements for environmental protection. SHP has a good horizon for development if there are favourable tariff conditions, political will and transparent legislation.*
- *The SHP installations are favourable to the electrical grid and have low negative impact on the Environment, while at the same time sparing CO2 emissions. Yet, these benefits are not well-known to the general public who is interested mainly in the energy price for the end consumer.*
- *The general atmosphere is of* ***denial of the whole RES sector, SHP included.*** *The government receives strong pressure from the coal and nuclear lobbies and conduct press campaigns against the green energy and technologies.*

5. Prospects for Future and Recommendations

- *The simplification of the procedures for permitting and licensing process is of utter importance. Although there are River Basin Management plans, there is no common plan for management or development which leads to patchwork project*

and no control over the sector. The non-complying with the statutory terms creates additional unnecessary burdens on the investors.

- *By 2016 all the SHP build in the boundaries of Natura 2000 (60% of the rivers in Bulgaria) should work on 30% or their nominal capacity. That means that a good 90% of the SHP owners would be forced to stop energy producers due to the technical requirements/insufficiency.*
- *Additionally there is practically no transparency in the creation of legislation e.g. Laws and Ordinances for the SHP. Even decisions taken on Public discussions are not included in the final version of legislative pieces. In this regard there are proceedings against the involved national institutions.*

THE CZECH REPUBLIC

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*283*	*286*	*297*	*340*
Generation (GWh)	*735*	*1,012*	*1,159*	*1,210*
Number of power plants	*1,372*	*1,405*	*1,452*	*1,645*
Potential (GWh)	*1,578*	*1,300*	*1,153*	*1,102*

2. Industry and Markets

Small hydropower	2010
Number of companies	*640*
Employment	*n/a*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*6,450,000*
Average O&M cost (as % of total investment cost)	*2 - 3*
Average civil works cost (as a % of total investment cost)	*n/a*
Average cost per kWh produced (€)	*n/a*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure/ *Residual flow regulation*

When setting the residual flow, minimum mean flow and hydro-biological parameters are taken into account. Typically, the residual flow is established as that maintained naturally 355 down to 330 days pro year (SHPs).

Support scheme

Selectable guaranteed tariff or green bonus schemes dependable on the time period since commissioning.

According to the Act on the Promotion of Electricity Production from Renewable Energy Sources, the prices should enable achieving a fifteen-year period of recovery of investment. In praxis, the guaranteed tariffs range between 7.4 and 12 c€/kWh for run-of-river plants and between 5.7 and 15 c€/kWh for storage plants (with substantial differences between the peak and off-peak operation); respective values for green bonuses

are 3.6 and 8 c€/kWh for run-of-river plants and between 2.6 and 9.6 c€/kWh for the storage plants).
The tariff is announced on an annual basis by the Energy Regulatory Office (ERU).
The SHP operator, intending to offer his electricity for purchase to the grid operator, should notify the relevant operator in advance about his desire.

Investment projects are supported using the means ECO-ENERGY Programme within the Operational Programme Enterprise and Innovations (OPEI) 2007-2013. 18 projects were supported in 2010. The total amount of support was over 11 M€ and the mean value was 35% of the investment cost.

Power granting scheme

A detailed description of the whole scheme for SHPs to be erected at new sites is available now from the website of the Czech Republic Hydropower Association (http://www.asociacehydroenergetikucr.cz/). Below find please a rough outlay of the procedure.

Plant erection

Following the Czech Water Law, the permit for erection of any hydraulic structure is issued by the relevant Water Legal Office basing on:

a. *Documents following from the Building and Spatial Planning Law rules (including opinion of the relevant local administration department)*
b. *Design documentation, which includes also:*
    - *Proposed or already accepted water legal action plan and description of the possible impact on the water body and ecosystems;*
    - *Assessment of possible impact on protected areas, if any;*
    - *Information on main discharge indicators, including Q355, Qav, Q100 years.*
c. *Opinion of the relevant water basin administrator*
d. *Opinion of the specific water course administrator (e.g. Water Basin Administration, County Office, Forests of the Czech republic, Reclamation Bureau, Angling Associations)*
e. *Relevant erection permits or water use concessions if issued previously by some other offices.*

In case of planned flooding additional documents are required (e.g. maps, excerpts from the estate evidence etc.)
For power plants with capacity below 30 MW there is no need to apply for a special permission from the Ministry of Trade and Industry (Energy Law).

Connection to the grid

The potential investor is expected to apply to relevant electrical power enterprise for grid connection conditions already at the stage of applying for erection permit. Producers of electricity from renewable energy sources enjoy preference in connection to the grid.

Operation

Any activity in the electrical energy sector requires a licence issued by the Energy Regulatory Office (ERU). The professional qualification conditions for operation of a power plant with an up to 1 MW capacity include a certificate of apprenticeship and 3 years' experience in the area concerned or a certificate of retraining for the operation of small

energy generating units. In case of higher capacity plants complete university education in a technical area plus 3 years' experience in the area concerned or complete secondary vocational education in a technical area with the award of the General Certificate of Education plus 6 years' experience in the area concerned are required.

Electricity supply to the grid takes place according to a contract agreed between the SHP and local grid operators.

4. Summary of the Current Status of Small Hydropower Development

The support system reflects some economic aspects of the small hydro investment process and its significance for the grid. The regulatory role of small storage hydropower plants is acknowledged by differentiated energy prices in the grid load peak and off-peak zones.

The Czech Republic has already developed a major part of its small hydro potential. Nevertheless a systematic growth in installed capacity of 2.5 MW/year could be observed over the last 10 years. Even faster growth (up to 372 MW in 2020) can be expected in this decade according to the RES National Action Plan. While this prediction may be considered fairly optimistic the NAP electricity generation estimation is fairly conservative.

5. Prospects for Future and Recommendations

There exists a risk that, the Czech Republic will stop supporting new renewable energy sources in the near future in order to avoid too high prices of electricity. Such a policy follows from the statement issued on July 9th 2012 by the current Czech Minister of Trade and Industry, Mr Martin Kuba.

The new RES Promotion Law will probably allow stopping further support of the new RES installations after the Czech indicative target for 2020 is fulfilled. This is quite realistic already in 2014 due to intense support of photovoltaics (now 500 MW of installed capacity) so far. The decision may hit severely the SHP sector hampering any further development.

Under this situation the following may be recommended to the Czech policy maker :

- *Please consider the multipurpose significance of most SHPs and their true O&M costs (unavailable for the authors of this report) in order to avoid closing of the already existing plants.*
- *Make sure the owners of the plants erected or refurbished before the new regulation have a chance for a pay-back of their investment.*
- *If you are not going to stop completely the hydropower development, do concentrate on the most promising and rational investments by creating a hydropower development plan.*
- *Concentrate your support on multi-purpose schemes and reconsider further development of large hydro schemes with the flood protection function as a priority.*

The last recommendation seems especially significant as the Czech Republic is a country regularly suffering from severe floods.

DENMARK

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*11*	*9,3*	*9,3*	*9*
Generation (GWh)	*33*	*28*	*28*	*28*
Number of power plants	*39*	*39*	*35*	*35*
Potential (GWh)*	*0*	*0*	*0*	*0*

** Only economic potential (GWh) with environmental constraints*
There is no potential for more hydro power in Denmark due to environmental constraints.

2. Industry and Markets

Small hydropower	2010
Number of companies	*5*
Employment	*10*
Civil works (estimation)	*0*
Average investment cost (€/MW)	*No new plans being built.*
Average O&M cost (as % of total investment cost)	*No new plans being built.*
Average civil works cost (as a % of total investment cost)	*No new plans being built.*
Average cost per kWh produced (€)	*No new plans being built.*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

Not applicable

Residual flow regulation

*Yes, individual judgment. Please see example of change of conditions below from Karlsgårdeværket.**

Support scheme

Feed in tariffs approximately 8 c€/kWh.
§ 5 Additional charge for electricity generated by hydropower, see § 47 and 48 of the Law on Renewable energy, can not exceed DKK 1,500,000 annually.
www.retsinformation.dk/

Power granting scheme

Not applicable. No hydropower built in Denmark.

** Karlsgårdeværket – Denmark's second largest hydroelectric power station - run by the water in Karlsgårde Lake. The lake gets its water from Varde and Holme river through a 17 km long canal system. It has been decided to close Karlsgårdeverket. The water from the plant will be fed back to Varde and Holme river as part of a major restoration. (http://www.snaebel.dk/NR/rdonlyres/385E974F-9596-4565-A0D2-F23320C8E779/130868/Christensen.pdf)*

4. Summary of the Current Status of Small Hydropower Development

- *The situation for SHP in Denmark is unchanged or has decreased to the worse for hydropower. There are no changes expected for permitting, simplification of admin procedures, SHP role with grid development etc.*
- *The Renewable Directive (2020-directive) has not meant any changes for SHP in Denmark which from the beginning has a very small potential. The water directive is implemented in Danish law and under application. The effect of the directive in reality will be known after there has been a trial in the Danish court.*
- *Development from 2007 onwards with prospects in the view of 2020 targets are non as the potential for hydropower is small in Denmark.*
- *General atmosphere –The situation for small hydropower is tough in Denmark. Residual flow and the coming interpretation for WFD are tough challenges.*

5. Prospects for Future and Recommendations

- *Decrease the requirements for residual flow.*
- *Evaluate models to retain water power when WFD is implemented.*
- *Clear recommendations on how to interpret the Renewable Energy Directive 2009/28/EC and the WFD Directive that appears to be contradictory.*

ESTONIA

1. Key Figures

Small hydropower	2005	2007	2010	2020**
Total installed capacity (MW)	*5*	*5*	*8*	*9*
Generation (GWh)	*22*	*22*	*30*	*33*
Number of power plants	*37*	*40*	*47*	*55*
Potential (GWh)*	*50*	*50*	*42*	*39*

** Only economic potential (GWh) with environmental constraints*
***According to the NREAP*

2. Industry and Markets

Small hydropower	2010
Number of companies (working in the hydro sector)	*26****
Employment (number of people)	*42*
Civil works (estimation) (number of people)	*10*
Average investment cost (€/MW)	*1,900,000*
Average O&M cost (as % of total investment cost)	*2*
Average civil works cost (as a % of total investment cost)	*30*
Average cost per kWh produced (€)	*0.03*

**** Most of the companies are small ones operating only one or two small plants.*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

From 4 months to 4 years.

Residual flow regulation

Residual flow value is fixed in the water use licensing procedure. It is set on a fraction of flow duration curve (95%). Fishways are requested.

Support scheme

Feed-in tariff or a fixed premium (in addition to the electricity price) that the utility is legally obligated to pay. The Feed-in tariff is 73.39 €/MWh, the fixed premium is 53.61 €/MWh sold. This is valid for 12 years from commissioning a plant.

Power granting scheme

a. *Permit for the special use of water;*
b. *License for the construction;*
c. *Permit for use of construction works;*
d. *Technical prerequisites;*
e. *Inspection before commissioning;*
f. *Assessment and attestation of conformity;*
g. *Market license;*
h. *Accession agreement with network utility;*
i. *Power purchase agreement.*

4. Summary of the Current Status of Small Hydropower Development

- *There was no current discussion about change of support schemes, permitting, and simplification of administrative procedures for SHP. In Estonia, access of renewable energy systems to the grid is subject to the general legislation on energy and electricity from renewable sources is not given priority. Thus, system operators are entitled against the grid operator to the connection of their systems to the grid and the transmission of electricity according to non-discriminatory criteria. On the other hand the grid operator is obliged to upgrade his grid if it is necessary to connect a plant to the grid. The costs of such an upgrade shall be borne by the operator of the system in question.*
- *A list of watercourses (112 rivers or their reaches) of migrating fish preventing from damming has been introduced. It adversely affects small hydropower potential.*
- *A most conventional mitigation measure is fish pass construction for migrating fish watercourses.*
- *A marginal role is designated for SHP in energy supply. Some 3 MW of additional capacity is planned up to 2020.*
- *In general public support and social acceptance can be described as positive.*

5. Prospects for Future and Recommendations

- *Financing: It is difficult to get long-term soft loans due to their relatively small volumes*
- *Regulatory and administrative: Shortcomings in legislation – particularly in provisions regulating the use of water in cascade of plants on the watercourse and fishery conservation aspects as well.*
- *Social barriers: Unclear land proprietary relations in many cases. Political obstacles (border with Russia) in realization of the Narva river hydropower potential.*

FINLAND

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*296*	*300*	*302*	*305*
Generation (GWh)	*1,288*	*1,305*	*1,314*	*1,330*
Number of power plants	*149*	*150*	*152*2*	*160*
Potential (GWh)*3	*48*	*31*	*22*	*10 *4*

** Only economic potential (GWh) with environmental constraints*
**2 The number of plants, 152 can be divided into the larger sector (1-10 MW) with 73 plants and the smaller mini-sector (<1 MW) with 79 plants. In addition to these plants there are approximately 40-50 small plants (micro <50kW) operated without connection to the national grid*
**3 the potential is given in GWh/yr*
**4 The SHP sector has lately been facing decreasingly conditions, where the support is stepwise withdrawn. (Support Law 2012 concerning SHP) Considering this change in support the potential has recently decreased with up to 90%.*

2. Industry and Markets

Small hydropower	2010
Number of companies	*272*
Employment	*370*
Civil works (estimation)	*45*
Average investment cost (€/MW)	*2,700,000 – 7,000,000*
Average O&M cost (as % of total investment cost)	*0.5-3%*
Average civil works cost (as a % of total investment cost)	*55%*
Average cost per kWh produced (€)	*0.025 - 0.08*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

Approximately 2 – 8 years, Average 5 years.

Residual flow regulation

In Finland the residual flow issue varies a lot. A Minimum bypass flow can be stated in the hydropower permit, but in many (older) permits there isn't such a requirement.

Authorities can try to change the permit, should the conditions have changed significantly, but the court may decide against it.

Most of Finland's small hydro plants are Run off River Plants who have no or relatively small water storage capacity. These installations normally operate on base load and use cumulative flow continuously. Water used by the hydropower plant is spilled back into the river at the plant's and its dam's tail-water. Such installations commonly does not use headwater or tail-eater canals, Penstocks or tunnels, causing river reaches to dry out.

Only very few numbers are penstocks or canal plants. The residual flow is therefore of secondary importance. In Finland is the residual flow in many cases assumed to be the flow required for the fish-way. If there is a requirement for a fish-way set by the water license the right to control of its design and construction is given to the fishery resources authority!

Support scheme

Investment. support is granted in the range of 15% - 25% of the planned investment of the application. This may consider new plants or considerable refurbishments. Projects of high and new technologies and supporting Finnish export receive higher support. Valid until 1.1.2013! After this the budget will be cut significantly and most probably only on-going projects will be supported. According to the RES-production support law of 2010 Small hydro 0.1-1 MW received a support of 4.2 euro/MWh, produced in the year of concern. This support was nevertheless withdrawn by an adjustment to the law stepping into force on 1.1.2012.

Power granting scheme

A description of the project, an economic calculation and an EIA. The time to get a license from the date the application is given to the Finland's environmental administration can vary from two to eight (average five) years, depending on the amount of complaints have to be resolved. The permit will go to court if some party complains about the permit decision done by the authorities. Very often this is the case. Problems are created by the decisions of the medium and higher court to return the application to the lower court level for re-consideration. This creates time-consuming loops which finally enforces decisions by the highest court anyway. Cases with runtimes of up to 8 years are known.

4. Summary of the Current Status of Small Hydropower Development

- *The situation for SHP in Finland has decreased especially for smaller plants. A new subsidy scheme (feed-in tariff scheme) has been established in Finland on 31.12 2010 and ratified by the EU on the 25.03.2011, to promote the production of electricity based on wind power, biogas and wood-based fuel. SHP as well as small scale wind power and bio-electricity fell under the fixed energy support part of the act. In addition to the fixed production support an improvement of the energy investment grant was foreseen. The act on production subsidy for electricity produced from renewable energy sources, approved by the President of the Republic on 30th December 2010, entered partially into force on 1 January 2011. It was ratified by the EU in the second half of March 2011. The energy marketing authority has been appointed by the law and introduced a RES-production controlling system, using authorized consultants. The costs hereby, created a mock support because the application costs became more expensive for small production as the support itself! Only half a year after this RES-Production support law stepped*

into force the new government started to change it. The feed-in tariff support for large wind power and bio-energy has been kept valid, for the time being, but the fixed production support for small hydro (<1MW) ended with 31.12.2011.

- *There are no changes expected for permitting, simplification of admin procedures, SHP role with grid development etc. The New Water Law stepped into force on 1.1.2012. There are nevertheless only minor changes and major problems with unclear judgments of old licenses have not been changed in the new law. The licensing procedure will not become easier and faster as in former time! The lower level dealing with licensing is not any independent court level, but is under the ministry for the environment. The licensing procedure will not become easier and faster as in former time.*
- *The Renewable Directive (2020-Directive) has not meant any changes for SHP in Finland. The Water Framework Directive, WFD, is implemented in Finnish law and under application. The effect of the directive in reality will be known after there has been a trial in the Finnish court.*
- *Development from 2007 onwards with prospects in the view of 2020 targets are few. Refurbishment is being made including upgrading mainly at plants of the larger sector (1-10 MW). This work was boosted by the decision, made in 2010 to raise the upper limit for the energy investment support from 1 MW to 10 MW.*
- *General atmosphere –The situation for especially very small hydropower is so difficult that any development is practically impossible in Finland. Some associations questions hydropower and SHP are not given the same support as other renewable as wind power and bio-energy. When discussing this matter with officials of the ministry the opinion was that the investment grant combined with the production support would provide the SHP sector more efficiently (serving the high capital costs of SHP) as the time limited feed-in tariff. Now all support is withdrawn from SHP.*

5. Prospects for Future and Recommendations

- *Modify the Finnish Feed-in tariff system to fulfil needs and remove byrocrzy, which is too heavy to be fulfilled by small plants*
- *Include SHP in the Feed-in tariff system as defined in the existing Finnish RES production support law of 1.1.2012 and already applied to the other RES-sector in Finland.*
- *Decrease the barriers for developing SHP by setting up clear rules and time frames in the licensing process.*
- *Clear recommendations on how to interpret the Renewable Energy Directive 2009/28/EC and the WFD Directive that appears to be contradictory. The new water law does not deal with this. The conflict in the judgment of both will be remaining. The recommendations have to be issued by the authority responsible for the EU-Directives!*
- *Reduce the Barriers for development of small scale PICO (smaller as 10 kW and MICRO (10-100 kW) SHP, concerning technical requirements of grid connection and allow direct SHP-born energy deliveries to near-by users, in addition to the SHP-owner. In spite of SHP-problems in Finland an increasing interest to renovate small sites for private use can be noticed.*

FRANCE

1. Key Figures

Small hydropower	2005	2007	2010	Potential 2020**
Total installed capacity (MW)	*2,030*	*2,053*	*2,110*	*2,615*
Generation (GWh)	*5,899*	*6,117*	*6,920*	*8,730*
Number of power plants	*1,710*	*1,825*	*1,935*	*2,355*
Potential*	*5,220*	*5,000*	*4,200*	*2,389*

Small Hydro only < 10 MW in Mainland France only (Data from French overseas department are not included)
** PPI= Multi-annual Investment Programming for energy Production (not binding)*
*** Only small hydro potential with economic and environmental constraints (based on "UFE identification of potential" http://www.ufe-electricite.fr/IMG/pdf/potentiel_hydro.pdf : Total SHP potential – 1/3 for economic and technical constraints – 1/3 for environmental constraints).*

2. Industry and Markets

Small hydropower	2010
Number of companies	*3,000*
Employment	*12,000*
Civil works (estimation)	*55*
Average investment cost (€/MW)	*2,500,000*
Average O&M cost (as % of total investment cost)	*33*
Average civil works cost (as a % of total investment cost)	*60*
Average cost per kWh produced (€)	*0.06-0.064*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

It takes from 5 to 7 years to get an authorisation. The duration of permits is maximum 75 years for big concessions. For relicensing, the duration is 20 years if there is no particular investment and around 30 to 40 years if there is much investment. France has a lot of perpetual old permits for former mills subject to new environmental prescriptions.

Residual flow regulation

10% of inter-annual average flow and for modules over 80 m3/s, 5% of the module is admissible.

Ecological minimum flow is the addition of the following:

- *Minimum ecological flow through turbines (to prevent total stop of river water flow in daily or seasonal regulation).*
- *Minimum ecological flow to old dry river channels (to maintain ecology/landscape)*
- *Minimum ecological flow through fish passes or bypass channels through the year or a part of the year (for migration)*

The minimum is set by the law (10 or 5%) but the adapted minimum ecological flow is set case by case through the environmental assessment. The most used method is the "micro-habitats method, EVHA" (Souchon & al.), but there are other possible methods adapted when this one does not fit with the type of river.

Since 1984, the reserved flow was around 10% of the average annual flow. Since 2006, 10% is the minimum, and local administrations often ask for more (12 – 17%), without any justification on improvement or maintenance of good ecological status.

About 2 000 GWh lost by minimum flow raising in 2014 for existing plants and few dams removals. Through the Law about minimum flow, producers accepted a certain loss of production. The loss of production will be compensated by refurbishment (1000 GWh) and modernisation (1000 GWh).

Support scheme

Feed in tariff for installed capacity under 12 MW:

- *H97 is a contract signed in 1997 for 15 years. It ends in October 2012 and may be renewed in October against a plan of investment (the amount and the modalities of the investment are still under negotiation). H97 Feed in tariff is between 55 and 65 €/MWh.*
- *H07 is a 20 years contract for new SHP or for the plants which are renewed (investment of 1172 €/kW). H07 Feed in tariff is between 60 and 100 €/MWh. The tariff is not interesting over 400 kW of installed capacity (threshold effect).*

For both contracts, the gap of the tariff depends on the quality of the production and the size of the plant (installed capacity in MW).

French producers who cannot or do not wish to invest to benefit of a new Feed in Tariff contract will have to sell their production on the market. This new situation worries the small producers who are not able to value their production on a market which does not take into account specificities of the small hydroelectric production (the green value and the decentralized production are not valued).

Power granting scheme

According to the Law of 16 October 1919 regarding the use of water energy, energy facilities of a power rating greater than 4.5 MW fall under the regime of concession, and a single application enables in a single act the receipt of the declaration of public use (for compulsory purchase), planning authorisations for the dam and auxiliary structures, the

operating authorisation and the authorisation as required by the law on water (act of concession constituting authorisation as required by the law on water).

1) Need for an authorization to build a new plant or to renew an existing plant :
- *Authorization from the Ministry of Environment for Hydro Power plants under 4, 5 MW (authorization regime). These authorisations are not easy to obtain and the environmental requirements continue to increase.*
- *Authorization from the Ministry of Energy for Hydro Power plants above 4.5 MW (concession regime).*

2) Getting access to the grid: CARD I
3) Validation from the local administration before entering into operation.

The authorisation procedures for energy production installations are drafted and applied at national level by the Ministry of Energy. The cases are mainly examined by the decentralised State services at departmental and regional level depending on the regulatory aspects considered. The authorisation procedures include aspects relating to:

- *Town planning with the application for planning permission or prior declaration of building work;*
- *Electricity regulations. Any electricity production facility must be the subject of a notification according to the electricity regulations: prior declaration, or application for authorisation to operate if the power rating of the facility is greater than 4.5MW;*
- *The environment, under the regulations relating to the protection of the water resource or by the execution of environmental evaluations. Where necessary, this will involve the execution of impact studies, impact studies specific to the regulations on installations classified for the protection of the environment, or impact assessment for Natura 2000 sites;*

These procedures, considered lengthy, should ensure the compatibility of the projects with the other architectural, landscape and environmental requirements. However the procedures are proportionally adapted to the characteristics (size, installed power, environmental impact) of the renewable energy production facilities.

The Regional Directorates for the Environment, Land-use Planning and Housing (DREAL – regional levels of the Ministry of Ecology, Energy, Sustainable Development and Sea – MEEDDM) inform and accompany the project sponsors in the administrative process. The Internet site of the General Directorate for Energy and Climate (DGEC), and the Internet site of the Environment and Energy Management Agency (ADEME) describe the applicable administrative procedures. Finally, the Energy Information Spaces are also required to provide project sponsors with the necessary information in terms of administrative procedures.

4. Summary of the Current Status of Small Hydropower Development

a) Hydro Potential in France

In 2012, Union Française de l'Electricité (UFE) in association with France Hydro Electricité carried out a map of residual sites for hydro development. A potential of 10.6 TWh was set up.

However technical feasibility of each one is not analysed as the opportunity of creating a reservoir for hydro peaking. Moreover UFE French hydro potential does not include improvements on existing hydro plants as it does not calculate energy losses due to WFD implementation.

Most of the hydro potential is in green field new schemes. Around 500 sites from 300 kW to 50 MW could generate 9.5 TWh. Existing small weirs can be equipped generating 1.1 TWh and be an opportunity to enhance ecological continuity. The Alps, Massif Central and the Pyrenees are the main locations.

***For small Hydro only**, we consider the total potential around 527 new sites in green field (1214 MW and 4,368 GWh) and 734 equipment of existing small weirs (303 MW and 1,068 GWh). Concerning the feasible potential, we shall apply the following ratio: cut by a third for economic and technical constraints and another third for environmental constraints (revision of classification in course)= + 419 power plants + 525 MW + 1.812 GWh by 2020*

b) Conflict between rivers protection and hydro development is rising

The French government is carrying out pre-planning mechanisms. On one side government classifies the rivers in order to determine absolute protected rivers for very good status water bodies or great migration species or "biodiversity reservoirs". On the other side the Regions are designing renewable potentials. UFE French hydro potential has been addressed by the government. The target is to prevent conflict between these two mechanisms and to ensure future generation have the choice concerning energy sources by preserving hydro potential.

Developing hydropower cannot any longer be based only on individual initiatives. The State must support hydropower development by determining favourable areas. Partnership with all stakeholders is a condition of success.

c) Main obstacles to the development of SHP:

***A plan for the restoration of river continuity** to achieve the good status objectives laid down by the Water Framework Directive is actually implemented. This plan organises the destruction of any "obstacle" which includes the small dams and wires which are not in operation anymore. River continuity is now a goal for itself, no longer a mean to achieve good status. The cost/benefit ratio would not be in favour of refurbishment.*

The production of small hydro is not considered as sufficient to justify to maintain such weirs. In practice it is also difficult to obtain an authorization for larger power plants.

***Revision of the river classification:** The purpose of river classification is to protect rivers from any human activity (unless fishing). River classification places the rivers or segments of rivers into categories or classes based on water quality goals. Each class is then managed according to the goal. The problem is the missing data to justify the classification. These categories should have been identified with the involvement of all stakeholders based on transparent criteria and it's not the case. They should be monitored and revised within a period of time.*

In theory the use of such pre-planning systems could assist the authorisation process to be reduced and implemented faster but in fact, the classification is used to avoid entertaining applications for new projects.

Two lists of rivers fixed by the state authority in the basin:

- *one of protected rivers against new dams (no-go rivers). The list of no-go rivers is based on three criteria: high status water bodies, migratory fish rivers, biological reservoirs.*
- *one of rivers where continuity restoration is a priority (dams must be managed or equipped in 5 years, to ensure upstream and downstream migration of species and a sufficient transfer of sediment).*

The list of rivers where the restoration of continuity is a priority is based on migratory fish rivers and at risk of failing the environmental objectives due to hydromorphological pressures, determined in the basin management plan.
In theory, both lists of rivers are fixed after an assessment of the impact on the existing water uses or on the potential of new hydropower and after stakeholders and NGO's consultation.

***Need for more scientific data**, adequate confidence and precision in the classification of the quality elements, more R&D results and share experiences about what is done in other European countries.*
Scientists can hardly define good indicators of the ecological status, and responsibilities in the river status, but administration calls for always more efforts from the producers.

d) Other main action:

***A regional plan for the climate, air and energy (SRCAE)**, developed jointly by the State and the regional authorities. In particular, this plan defines, for 2020 and by geographical area, qualitative and quantitative regional targets for the valorisation of potential territorial renewable energy, taking into account the national targets. In practice, this means identifying all sources for the production of renewable energies and of energy savings according to socio-economic and environmental criteria, and defining, in association with the local stakeholders (infra-regional authorities, companies, citizens), the level of regional contribution in achieving the targets set by France. These plans represent a strategic planning tool to guide the activities of local and regional authorities. SRCAE are in process. SRCAE, for hydropower potential, are based on producers' data and compatibility with lists of no go rivers and restoration of continuity' priorities.*

***A commitments agreement for the development of sustainable hydropower in compliance with aquatic environments restoration** has been signed in June 2010 to promote hydroelectricity when it is suitable with environment preoccupation. A part of the engagement concerns directly the equipment of existing wires. We need to precise the methodology and the "suitable conditions" to build a power plant on an existing wire.*

*France Hydro Electricité wrote a **guidebook for the development of small hydroelectric plants with due respect to the natural environment named « Towards the hydroelectric plant of the 21th century ».** It defines standards for the conception of a high environmental quality plant. This guide is recognised and disseminated by national administrations.*

*ONEMA (French water administration) is drafting **an inventory of obstacles in rivers named « ROE ».** The goal of this database is to draw up an inventory of all obstacles blocking flows in all French rivers and to assess the degree to which those obstacles block the movement of species and sediment. A list of more than 60 000 obstacles, including dams, locks, weirs, mills no longer in operation, etc., on French rivers has been drawn up to date. This vast project, bringing together a large number of partners, will identify the installations causing the greatest problems and make it possible*

to set priorities for corrective action. It will be also a good tool to identify new potential for SHP.

5. Prospects for Future and Recommendations

- *Stop the dogma of "river continuity" and return to a well-balanced use of water. Need for research and objective scientific approach.*
- *Assure the hydropower development up to 3 TWh net by reducing the classification of rivers.*
- *Need for a new economic support scheme for small hydropower which is neither well adapted nor considered by the emerging French electricity market.*
- *Complete the knowledge about the real status of the river and define clear methodologies to be used in the respect of the principles of cost and effectiveness of measures, ecologically acceptance and economically reasonable approach.*
- *Make significant progress in administrative adaptations, data gathering and analyses, public information and stakeholders' involvement, setting of monitoring networks, etc.*
- *We need to promote economic studies and cost-effectiveness analysis which are essential for WFD implementation.*
- *Remember the principles of proportionality, cost-efficiency, pragmatism, prioritization and motivation of the administration demands. We need for more dialogue and pedagogy.*

GERMANY

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*1,714*	*1,705*	*1,732*	*1,830*
Generation (GWh)	*7,996*	*8,000*	*8,043*	*8,600*
Number of power plants	*7,400*	*7,500*	*7,512*	*7,800*
Potential (GWh)*	*604*	*600*	*557*	*0*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*n/a*
Employment	*1,900*
Civil works (estimation)	*1,000*
Average investment cost (€/MW)	*2,000 - 10,000*
Average O&M cost (as % of total investment cost)	*1.5 - 2.0*
Average civil works cost (as a % of total investment cost)	*65 - 75*
Average cost per kWh produced (€)	*0.03 - 0.1*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

1.5 years.

Residual flow regulation

Generally 30% of mean low water flow. No water use fees. Concession fees differ from Federal State to Federal State, e.g. 10,000 € for 150 kW concession in the state of Hesse.

New concession duration: minimum 20 years, maximum 30 years.

Support scheme

Starting: 1 January 2012. FIT:

- *12.7 c€/kWh < 500 kW*

- *8.3 c€/kWh < 2 MW*
- *6.3 c€/kWh < 5 MW*
- *5.5 c€/kWh < 10 MW*
- *5.3 c€/kWh < 20 MW*
- *4.2 c€/kWh < 50 MW*
- *3.4 c€/kWh > 50 MW*

Duration of FIT: 20 years (tariffs are revised every 4 years)

Power granting scheme

Ancient water rights exist with no time limit.
New licenses are granted for revitalization and/or any water head change or water flow increase. Permits for 20 to 30 years duration.
They are granted with high restrictions because of WFD. No support from RES so far.

4. Summary of the Current Status of Small Hydropower Development

- *FIT will be slightly increased starting 1 January 2012 (~ 10%). No further change of support schemes. No permitting ease. No simplification of administration procedures. SHP role (standby energy, storage capacity) in future smart grids not yet sufficiently recognized and therefore not supported by legislative and administrative activity.*
- *No positive impact seen so far on RES directive but negative impact from WFD directive (see upon "barriers" for development.*
- *Extremely slow development of further increase of hydropower capacity and/or power output. Since 2007 official increase figures up to 2020: 18%.*
- *Social acceptance of SHP is rather high, but strong influence of ecologically powerful administration and NGOs as well as strong influence of fishery and angler clubs which blame SHP to harm fish live.*
- *The WFD directive will be transferred into German law until 2015. The following mitigation measures regarding environmental impacts are currently focused on: (i) upstream/downstream fish ladders, (ii) smaller distance between bars of rake cleaners (15 mm) and (iii) river bed management/naturalization of water flow*
- *No support of the Renewable Energy Framework Directive (RES) so far for new licenses or power increase of existing SHP.*

5. Prospects for Future and Recommendations

- *Investment support (subsidy) for reactivation of 1,000nds SHPs in former flower and saw mills as recognition of the important role of hydropower (standby energy and storage capacity)*
- *Establishment of the RES directive in German legislation as strong as they did it in case of the WFD directive.*
- *Establishment of standardized guidelines for the administrative handling of the permitting & licensing procedures in Germany.*

GREECE

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*89*	*96*	*195*	*350***
Generation (GWh)	*220*	*223*	*753*	*1,148*
Number of power plants	*50*	*61*	*96*	*175*
Potential (GWh)*	*6,306*	*6,303*	*5,773*	*5,378*

** Only economic potential (GWh) with environmental constraints*
*** According to the Low for 20-20-20*

2. Industry and Markets

Small hydropower	2010
Number of companies	*70*
Employment	*443*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*2,000,000*
Average O&M cost (as % of total investment cost)	*1 - 3*
Average civil works cost (as a % of total investment cost)	*50*
Average cost per kWh produced (€)	*0.019*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

~5 years.

Residual flow regulation

The Residual water supply that legally must be allowed downstream of the SHP will be equal to at least to: the 50% of the daily average water supply for the month of September.
The 30% of the daily average water supply for the three summer months (June, July and August). The absolute value 0.030 m^3/s.

Support scheme

In Greece, the support scheme that is in place for small hydro is the Feed-in tariff (FIT). The respective Law says that there is a FIT of 87.7 €/MWh, up to 20 years, which could be extended in time, after the renewal of the operation licence. In case that the SHP plant is constructed without any grants from the state, then there is a 20% increase in the FIT. Every year, there is a small increase in the FIT according to a percentage of the yearly inflation and depending on the justified opinion of the Minister of Environment.

Power granting scheme

In Greece, in order to receive a permit for a SHP plant you have in general to apply for a Production License to RAE. There are some minor exclusions such as for SHP less than 50 kW, in which case you do not need a Production License, but these SHP are a small percentage only. After you receive the Production License (in average one needs 1 year time to receive it), you have to apply for the Approval of Environmental Terms, either in EYPE (a central division in the Ministry of Environment) or to the Decentralized Authorities, depending on specific law articles. On average, one needs 2 years time to receive the Approval of Environmental Terms.

In this mean time of 2 years, you apply to PPC/DESMHE for a Non-Bound Grid Offer, and on average you need ½ years time to receive it. After that, you apply to the Decentralized Authorities for the Water Usage License (3/4 years time to receive it) and in parallel, you apply to the Local Forest Department for the Approval of Intervention (½ years time to receive it).After you receive the Approval of Environmental Terms, you ask to PPC/DESMHE in order the Non-Bound Grid Offer to become a Bound Grid Offer.

Then, you apply either to the Ministry of Environmental (RES division) or to the Decentralized Authorities for the Installation License (½ years time to receive it).
With the Installation License in hand, you can start building the SHP plant and in average you needs 2 years to finish all the installations. Within these 2 years time, you sign a Connection Treaty with PPC and you start building the grid infrastructure in order to connect the public grid with the private SHP. After you finish all the above works, you sign a Buy & Sell Electrical Power Treaty to/from DESMHE.

After that, you can start the operation of the plant and you operate for 3 months in a testing environment in order to check you SHP plant and correct any problems. If everything is ok at the end of the 3 months period you receive the final Operation License from the Ministry of Environment (RES division) and you start to receive money from DESMHE.

4. Summary of the Current Status of Small Hydropower Development

The last three years, there is a slowing down in the trend of putting SHP plants into operation. The main reasons are difficulties in financing of the plants on behalf of the banks, the extremely bureaucratic licensing environment, and the fact that on 31/12/2009 the time limit for Greece to adopt the European water framework expired. It resulted in the Greek legal framework to face problems with the Water Usage Framework. As a result, less than ten installation licenses were issued in the last three years, stopping the excellent marching of the SHP sector, which was a very dynamic sector up to 2008.

- *There is a long discussion in Greece for improving the support schemes and many new laws and ministerial decisions have been voted in order to enforce the RES development and consequently the SHP development. Although there is an obvious trend to unification and simplification of the legal framework, time is still needed in order this to be achieved.*
- *Concerning the Grid development in Greece, since the SHP are small plants and no extended new Grid is needed, there are no major problems with that.*

- *The Low for the 20-20-20 targets of Greece, passed in 2010 has set a very low target for SHP, i.e. 350MW, despite of the high potential that is estimated at 2,000 MW.*
- *Moreover a new Ministerial Decision (Ministry of Environment, Energy and Climate Change/518/05.04.2011) that arbitrarily set limits on the magnitude of the MWs of a SHP according to the length of the stream diversion, has been voted, and this Decision cancels more than 50 MW SHP that were already in the queue for receiving licences. Moreover, the potential of energy exploitation of small water currents (which can produce around 1.5 MW approximately, each) that adds to a total of green energy capacity of approximately 500 MW (an invalidated investment of around 1 billion €) is cancelled, as well, since this Ministerial Decision was applied retroactively to investments that had been submitted before three or more years under a different law of environmental licensing regime. This Ministerial Decision substantially cancels the "Special Land-Planning Law for RES" (December 2008), introducing unscientific, arbitrary and extreme criteria and was not based either on scientific analysis, or in statistical data. This Ministerial Decision was finally signed, although it went into a public consultation in the summer of 2010. The outcome of the rich and excellent level of the public consultation was apparently against the draft of the Ministerial Decision (171 of 174 reviews), although concrete proposals from the League and our many participants on these issues were provided. HSHA asks constantly that the Ministerial Decision 518/05.04.11 to be totally abolished.*
- *The aforementioned two legal documents have put strict limits to the SHP sector, and HSHA works hard to raise them. Moreover, HSHA believes that increasing the target of the 20-20-20 to 1,000 MW by the year 2020 in the National energy mix is entirely justifiable.*

Concerning the transposition and implementation of the WFD Directive (60/2000) in Greece and the completion of management studies of water districts under this Directive, there is a big effort to gain the lost ground, and in 2011, there will be some public consultations for certain Greek areas for the ruling of the Streams.

The continuous enactment of new special management plans to protect more and more mountainous areas which can site Small Hydro (for example Rodopi, Pindos, Tzoumerka, etc.) leads to the creation of very extensive exclusion zones for Small Hydro, since all these areas prohibit projects of environmental category A1 and only in peripheral areas of these regions projects of environmental category A2 are allowed (with the current classification of projects, this means projects with diversion less than 1,000 m, but this classification changes these days), resulting in substantially zero possibility of siting Small Hydro in all these areas. From HSHA point of view, it is incorrect to introduce general rules of absolute prohibition of establishment of RES in areas governed by any specific or general protection regime, without considering the specifics of the installation area and the proposed project at a time. The introduction of these general exclusions is contrary to the Community Law and the specific Directive 2009/28/EC, which includes legally binding targets for the penetration of RES in all Member Countries of the EU.

It is required to review Management Studies of the protected areas to effectively take into account the special land-planning for RES, as it is provided in the Law 3851/10.

Finally, there is the major problem that everyone has the ability at any stage of the licensing process to appeal the investment in The Council of State, thus causing very long delays and with the great danger not only an investment to be cancelled but the investor

companies and the manufacturers of these projects to suffer a serious economic damage or even an economic destruction. HSHA asks for that asymmetry to the costs has to be totally eliminated.

5. Prospects for Future and Recommendations

- *Further simplification and unification of administrative procedure.*
- *Radically change the procedure of appealing the SHP investment or licensing procedure in The Council of State, and eliminate this ability of everyone in doing so. Set high deposit amounts in order to do such an appeal that will be lost if the appeal is lost.*
- *The Ministerial Decision 518/05.04.11 should be totally abolished, even today.*
- *The limits of the Low for the 20-20-20 targets of Greece (2010) for SHP should be revised from the current 350 MW for 2020 to 1,000 MW for 2020, thus exploiting the high potential that is estimated at 2,000 MW.*
- *Finally, accelerate the transposition and implementation of the WFD Directive (60/2000) in Greek legal system and complete the management studies of water districts under this Directive, the soonest possible, since this should had been finished at 31.12.2009, but is not in place yet.*

HUNGARY

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*12*	*12*	*14*	*28*
Generation (GWh)	*39*	*40*	*67*	*80*
Number of power plants	*34*	*34*	*36*	*42*
Potential (GWh)*	*69*	*68*	*58*	*28*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*11*
Employment	*476*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*2,900,000*
Average O&M cost (as % of total investment cost)	*1,5*
Average civil works cost (as a % of total investment cost)	*50*
Average cost per kWh produced (€)	*0.013*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

In the period 2007 – 2010, only 5 small hydro power plants have been commissioned with a total capacity is 0.3 MW. Permitting is not really a key issue.
Oppositely, the process to obtain the permits for the new plant with a 12.1 MW capacity (not SHP) on the Maas river, which has been initiated in 2004, is far to be finalized.

Residual flow regulation

There is no general residual flow regulation in the Netherlands.
Every hydro power plant needs to obtain separate permits, and this issue is arranged individually in each permit."

Support scheme

Hungary has introduced a sustainable (non-central-budget-based) feed-in-tariff scheme which is guaranteed until 2020.
The system was modified in favour of smaller plants and those providing remote heating in 2008. Rates are to be adjusted yearly in line with the inflation rate.
FIT Peak- and off-peak
*Average tariff ≈ 9 c€/kWh *k (k = last year inflation rate (-1)*
To avoid excessive support, guaranteed tariffs should be provided until the investment is recouped, taking into consideration any investment aid for this purpose.

Power granting scheme

For small-scale renewable energy investments that are still subject to a permit and have a capacity of over 0.5 MW, the Office issues combined small-scale power plant permits in a simplified procedure. This permit contains both an establishment and a production authorisation. The authorisation process is independent of the type of the power plant

4. Summary of the Current Status of Small Hydropower Development

Hungary is one of the less mountainous countries in Central Europe, and therefore has only limited hydroelectric potential. There are all together 31 installations with a total capacity of 55 MW. They have generated 228 GWh electricity in 2009. There are only four commercial hydroelectric power plants in the country, Kesznyéten (Hernadviz), Ikervar, Kiskore and Tiszalok. The power plant in Kesznyéten is owned by Hernadviz Hydropower Ltd., while the Kiskore and Tiszalok power plants are owned by Tiszaviz Hydro Power Plants Ltd. A small 1.5 MW capacity hydropower station in Kenyeri was financed by the Environment and Infrastructure Operational Programme and started its operation in 2009.

The Government is committed to reducing the administrative and bureaucratic burdens on enterprises in the future. Energy regulations and authorisation constitute a significant part of this process. Authorisation procedures are currently complicated, complex, and in some cases require the participation of several high authorities and special authorities. The possibilities for making authorisation procedures faster and simpler are already the subject of an ongoing comprehensive governmental review. Hydroelectric plants at protected natural sites of national importance. Based on Annexes 1 and 2 to Government Decree No 314/2005 (XII. 25.)

On environmental impact assessment and uniform environmental use authorisation procedures, this activity is conditional on an environmental impact assessment. Investors can obtain support via tender schemes. The aid intensity of schemes promoting renewables ranges from 10% to 80%; the final aid intensity is established for each project after an analysis of cost efficiency. Support is provided only for the portion of the investment which cannot be recouped under market conditions. This methodology takes into account the support for electricity from renewable sources which is incorporated into the off-take price of such electricity, and only provides investment support to projects which cannot be recouped even when selling at such subsidised price.

There is no green certificate system in Hungary. Setting up and gradually introducing a green certificate scheme is among the long-term plans of the Government. The approved 2009/28/EC Directive on Renewable Energy sets binding targets on the share of renewable energy in gross final energy consumption. In the EU the target is 20% by 2020 and Hungary has to reach a rather moderate target, 13% but Hungarian Government set an even more ambitious target to reach 14.65%.

Hungary is one of the less mountainous countries in Central Europe, and therefore has only limited hydroelectric potential. From the energy producing potential 66% belongs to the Danube, 10% to the Tisza and 24% for the other rivers. It is estimated that only 5 - 6% of the potential hydro energy can be exploited. New hydropower projects consist primarily of small plants, with the possibility of re-use of water from existing hydropower plants. Since 1970s there have been only a few SHP developments in Hungary. The same tendency has been kept till 2003. There are all together 31 installations with a total capacity of 55 MW. They have generated 228 GWh electricity in 2009. There are only four commercial hydroelectric power plants in the country, Kesznyéten (Hernadviz), Ikervar, Kiskore and Tiszalok. Rivers have 990 MW theoretical power out of which 7,446 GWh /year energy could be generated theoretically. On the small streams 308 GWh/year is the theoretical production.

In the Renewable Energy Action Plan Hungary is not counting on large scale hydropower installations but is rather willing to support miniature size plants below 10 MWe and 100 - 500 kWe turbines using the energy of river currents.

Hydropower has long been a much debated topic in Hungary. Plans to construct such facilities on a larger scale have always been opposed by the members of the current governing coalition, to the disappointment of many experts who regard hydropower exploitation as a feasible way of generating power. The government still does not consider high-capacity hydroelectric power a real option compared to other sources of energy. It claims that the topographic conditions of Hungary do not allow for favourable and economic utilization of hydroelectric power. A large part of the country is flat, although there are some low hills, but even at smaller mountains there are hardly any areas with a significant change in elevation. Rivers with high water output do not have marked drops in elevation either. In the government's view, instead of constructing large dams, it makes much more business sense to establish small-scale hydropower generators (of which there are a few dozen in Hungary, representing total capacity of only around 50 MW). Mini hydroelectric plants with an output of less than 10 MW and turbines installed in river beds could provide energy-efficient solutions for smaller towns and rural areas. According to the government, the establishment of only such smaller plants is in the national interest.

5. Prospects for Future and Recommendations

- *The long authorisation period*
- *Relatively low buy-back rate*
- *Difficulties related to electricity grid access*

IRELAND

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*38*	*38*	*42*	*60*
Generation (GWh)	*93*	*150*	*160*	*200*
Number of power plants	*40*	*47*	*50*	*60*
Potential (GWh)*	*294*	*237*	*227*	*187*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*31*
Employment	*124*
Civil works (estimation)	*20*
Average investment cost (€/MW)	*3,000,000 - 12,000,000*
Average O&M cost (as % of total investment cost)	*4.7*
Average civil works cost (as a % of total investment cost)	*55*
Average cost per kWh produced (€)	*0.083*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

Experience is limited but for a new small hydro project, the time taken to obtain environmental consents, planning permission and accreditation should take about 1 year.

Residual flow regulation

The Department of Communications, Energy and Natural Resources' "Guidelines on the Planning, Design, Construction & Operation of Small-Scale Hydro-Electric Schemes and Fisheries" covers residual flow requirements. It stipulates that residual flow must be decided on an individual basis and is dependent on river type and fish requirements.

Support scheme

The Department of Communications, Energy and Natural Resources operates Ireland's RE incentive scheme "Renewable Energy Feed in Tariff" (REFIT). The first REFIT

scheme ('REFIT 1') was announced in 2006 and state aid approval was obtained in September 2007.
The current REFIT 2 scheme covers onshore wind, small hydro and landfill gas and was opened in March 2012. The scheme covers projects built and operational between 1/1/10 and 31/12/15.
The "Reference Price for the hydro tariff is €83.81 per MWh. This price is subject to market price and a balancing payment which could effectively increase the value by up to 30%.

Power granting scheme

The Commission for Energy Regulation (CER) licenses and regulates the generation, distribution, transmission and supply of electricity in Ireland. The CER the authorisations to construct or reconstruct electricity generating stations. A generating scheme not greater than 1 MW is exempted from authorisation to construct or reconstruct a generating station. An Authorisation will be valid for 5 years or until completion of the construction/reconstruction project. The CER, at its discretion, may extend the Authorisation beyond the period of 5 years
To grant the authorisation, the following may be required:

- *Environmental Impact Statement*
- *Construction and commissioning programme giving major milestones in the project development, from authorisation to completion*
- *Statements of accounts for the last 2 years*
- *An outline 5-year business plan in relation to application, including information on project finance*
- *Water extraction Licence*
- *Accepted Connection Offer from the Transmission System Operator or Distribution System Operator for the generating station*
- *Power Purchase Agreement*
- *Planning permission or confirmation of planning exemption from planning authority.*
- *IPC Licence or confirmation that an application has been submitted to the Environment Protection Agency.*

4. Summary of the Current Status of Small Hydropower Development

Hydropower development in Ireland has been slow since some large projects, including pumped storage, were developed in the mid-20th century. Attempts have been made to encourage the development of small hydropower at either new sites or refurbishing old projects, predominantly mill sites. However, the investment cost has generally been too high to take advantage of the incentive programmes.

Added to this the exceptionally strong fishing lobby in Ireland has attempted to stop any development which may have an effect on fish and fish habitat despite suitable mitigation measures. Environmental consenting has therefore developed with some very stringent measures regarding impact assessments and flow availability. A flow split requirement on flows available to a hydro scheme was adopted at a very early stage of consenting requirements. This was despite questioning of the scientific base for this requirement.

It is hoped that the recently introduced REFIT2 programme of feed-in tariffs will produce more confidence and accelerate micro and small hydropower development in Ireland.

Hydro targets for hydropower in the National Renewable Action Plan for Ireland are modest. This will cause little government attention to be paid to hydro development. There is, however a growing movement of individual and community projects which could herald a better future.

5. Prospects for Future and Recommendations

- *Urgent review of the environmental regulations is required especially with regard to the "flow-split" requirements for water use in a hydropower plant.*
- *Review is also required of the Irish RE incentives system since there are suitable incentives to develop wind energy. The hydro potential in Ireland is much greater than the NREAG plans indicate and this could be the cause. Internal viable potential should be reviewed and this might "kick start" future development.*
- *Individual and community benefits of hydropower development and re-development must be emphasised.*

ITALY

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*2,468*	*2,523*	*2,735*	*3,900*
Generation (GWh)	*8,649*	*7,100*	*10,958*	*12,077*
Number of power plants	*1,799*	*1,835*	*2,427*	*2,250*
Potential (GWh)*	*12,312*	*13,860*	*10,002*	*8,883*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*400*
Employment	*3,000*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*4,500,000*
Average O&M cost (as % of total investment cost)	*1 - 4*
Average civil works cost (as a % of total investment cost)	*50 - 60*
Average cost per kWh produced (€)	*0.076 - 0.15*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

2 - 3 years.

Residual flow regulation

The environmental law 152/06 identifies the fields of application of the Reserved Flow and the allocation of competences. The River Basin Authorities have to identify the general criteria for Reserved Flow definition (within the specific competence of water balance planning). The Regions have the regulatory competence; they introduce the Reserved Flow regulation in the Water Protection Plans. There is a wide range of methods of calculation suggested by the River Basin Authorities (e.g. based on hydrological and morphological parameters or environmental conditions) and adopted by the Regions, so there are very different RF values. Also along the same water body, going from one Region to another, RF values can be very different.

Support scheme

Hydro plants of <1 MW are guaranteed a minimum tariff of 150.0 €/MWh for the first 250 MWh, 95.0€/MWh between 251st - 500th MWh, and 82.0 €/MWh between 501st – 1.000th MWh of production and 76.2 €/MWh between 1.001st – 2.000th MWh of production. Plants >1 MW but <10 MW, sell their energy at the hourly zonal price. Since January 2008 hydropower plants of < 1 MW can choose, instead of Green Certificates, a "comprehensive Feed-in tariff" FIT (electricity price + incentive) which has been set to 22 c€/kWh for 15 years. A new support scheme will came in force in January 2013.

Power granting scheme

The Legislative Decree No. 387/2003 (implementation of the RES-e Directive) has introduced the "single permit", that is a one-stop shop for all RES project developers. The license for the use of water isn't generally integrated with the authorization. So, commonly, to build up a SHP plant in Italy you need to ask for both the concession for the water use (if an EIA is required, it is done at this stage) and for the permit to build and run the plant, which in fact includes all the necessary permits that are not already included in the concession for the water use. For the access to the grid a request to the grid operator is necessary and the authorisation of the new grid infrastructures is generally included in the authorisation of the plant itself.

4. Summary of the Current Status of Small Hydropower Development

The RES energy in Italy is growing also thanks to great performance of hydropower production that represents more than 70% of RES-E. The last three years (2008-2009-2010), thanks to the extraordinary hydrological conditions occurred, were very positive for HP production that reach record values, among the highest in the last 10 years. SHP, especially plants up to 1 MW, is growing more than LHP, thanks to a good incentivation system enforced at the moment, which recognize to the energy produced by these plants a comprehensive tariff of 220 €/MWh for the first 15 years. The NREAP foresees a global steadiness of the HP sector between 2005 and 2020. This does not mean a complete paralysis of the sector, since if we go deep into the figures, we can see that the SHP sector (up to 10 MW) will grow of about 1,500 MW and will in fact compensate the production decrease of the LHP, due to the loss of efficiency of the old plants.

Due to the delay in the transposition and implementation of the WFD, its effects on the production of small hydropower are not yet clear. The RBMPs were adopted only at the end of February 2010 and many of the new measures planned are still at a draft stage. Anyway there are many obstacles hindering the future development of this sector.

1) *First of all, the long and complicated administrative procedures: to get the concession for the use of water and the authorization to build and manage the plant a producer needs at least between two to three years, but in some Regions the procedures are much longer and many producers have to pay lawyers and sometimes go to the court in order to see their rights respected.*
2) *Then there are the environmental barriers: local administrations are identifying a lot of "no go areas" and an expensive and time consuming EIA is requested also for very small plants with negligible impacts. As far as exiting plants are considered, the increasing of reserved flow values, not always justified from a scientific point of view, are causing the shutdown of some small plants and creating problems also to bigger plants.*
3) *Finally, the instability of the incentivation system: within the implementation of the new RES Directive (28/2009/CE), the Italian Government decided to implement,*

starting from 2012, and a new incentivation system for all renewable sources. The general framework of the new system has been outlined (D.Lgs. 28/2011), but many aspects should be defined in a Ministerial Decree that should be enforced by the end of September 2011. A strong debate is now on-going among producers, institutions and consumers. In particular for SHP there will be anyway a tariff, but is not clear yet if it will be a feed in tariff or a feed in premium. Probably the value of the tariff will be differentiated into three or more capacity ranges (e.g.: 0-200 kW, 200-1,000 kW, etc.), while producers think that a tariff based on energy ranges would be much more efficient. For plants exceeding 5 MW the value of the tariff could be based on tenders: APER, with support of other European Associations (ESHA and EWEA), pointed out some criticalities of tenders system, also related to experiences of other EU countries. Another critical point is incentivation for refurbishment, which will be probably cut to a very low level, stopping the positive trend launched some years ago.

The general atmosphere around SHP is not very positive at the moment, since many people think that the high level of incentives is pushing the sector too much, encouraging the realization of SHP plants anywhere. Moreover, local communities ask for a higher slice of the cake and want to enter directly in the hydropower business, obliging producers to create mixed public-private companies. This is not always a good solution, especially where the public subject is the same one who releases the water concession, since they can alter the market.

5. Prospects for Future and Recommendations

- *Stabilisation of the incentivation scheme: incentivation system should be clearly set out and all changes should be scheduled and timed, so that producers can plan properly their investments. In fact hydropower developers need to know at an early stage the rules: how and under which conditions their projects will be sustained.*
- *Simplification of administrative procedure: at least for SHP plants located on irrigation channel, on water supply system, integrated in existing dams or wastewater treatment facilities, and for the rehabilitation of the old schemes. Since these plants are located in artificial context, their environmental impacts are very limited. Moreover they also guarantee a multiple use of water resource.*
- *Suitable incentivation support for the rehabilitation and upgrading of old plants, to avoid in the future losing the present energy production and, in many cases, to get the chance to increase it improving the schemes performances also from the environmental point of view.*
- *Improvement of synergies between SHP and smart grids: hydropower has an increasing role in supporting transmission and distribution grids by his proper capability to regulate frequency and to integrate other discontinuous renewable sources like solar and wind. Besides LHP, also SHP can play a role, especially where it is possible to combine it with small basins and integrate it in hybrid systems. More research should be promoted on this aspects and a dedicated regulatory framework should be enforced.*

LATVIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*25*	*25*	*26*	*35*
Generation (GWh)	*46*	*65*	*69*	*85*
Number of power plants	*125*	*139*	*142*	*180*
Potential (GWh)*	*249*	*230*	*226*	*210*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*116**
Employment	*318*
Civil works (estimation)	*10*
Average investment cost (€/MW)	*2,600,000*
Average O&M cost (as % of total investment cost)	*3*
Average civil works cost (as a % of total investment cost)	*22*
Average cost per kWh produced (€)	*0.04*

**Most of the companies are small ones operating only one or two small plants.*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

1/2 - 3 years.

Residual flow regulation

An officially approved compensation flow (RF) setting methodology exists. RF is set as a mean monthly (30 consecutive days) low flow (return period of 20 years). The losses in SHP electricity production resulting from maintaining CF can reach up to 5%.
SHPs are not entitled to pay the fees for use of water.

Support scheme

SHP feed-in tariff provisions are presented in the rule of the Cabinet of Ministers of 24 February, 2009. Feed-in tariff (FIT) was related to the natural gas price using this formula:

FIT=159 x K x e.
K- coefficient depending on SHP installed power P; K=1.4 (P < 80 kW)
K=1.23 (P=80 -150 kW) etc.
e - exchange rate Lata/Euro =0.7028.

FIT=159 x 1.23x 0.7028 = 138.566 €/MW.

After 10 years FIT will be decreased by factor 0.8: FIT = 159 x k x 0.8

Power granting scheme

In total eight authorisations issued by different authorities are needed. It could take up between one to two years for developer to start building a SHP plant. SHP which capacity exceeds 1 MW must get the licence for power production, which lasts 10 years. Almost SHP plants, except only one, do not exceed this installed capacity in Latvia.

4. Summary of the Current Status of Small Hydropower Development

There are going hectic discussions about recently drafted renewable Energy Law. A main issue is a future support scheme. Government is not interested in promoting SHP plants. Only wind, biomass, solar power are on the agenda.

Support scheme and tariff are quite attractive. Despite some efforts made by SHP promoters until now there was no any simplification of administrative procedures for SHP development.

A marginal role is designated for SHP in energy supply. Prospects for large hydro (>10 MW) are entirely null. And this is due to disproportionate environmental requirements and inflexible enforcement and implementation of WFD and other EU legislation. Some 10 MW of additional capacity is planned up to 2020.

There is a clear public support for SHP development in the country.

5. *Prospects for Future and Recommendations*

- *Revise Regulation No. 27 as of 15 January 2002 issued by the Cabinet of Ministers of the Republic of Latvia preventing more than 200 water streams from exploitation hydropower potential in order to protect fish migration. Restoration of the old water mills in these water streams is out of discussions even if fish passes are proposed to be installed. In the result, some 150 to 200 GWh/year cannot be exploited.*
- *Introduce real simplifications of administrative procedures for SHP development.*

LITHUANIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*27*	*28*	*29*	*40*
Generation (GWh)	*66*	*96*	*93*	*120*
Number of power plants	*78*	*82*	*87*	*110*
Potential (GWh)*	*156*	*126*	*129*	*102*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*56**
Employment	*140*
Civil works (estimation)	*15*
Average investment cost (€/MW)	*2,500,000*
Average O&M cost (as % of total investment cost)	*3 - 5*
Average civil works cost (as a % of total investment cost)	*30 - 50*
Average cost per kWh produced (€)	*0.025 - 0.03*

** Most of the companies are small ones operating only one or two small plants.*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

0.5 - 2 years.

Residual flow regulation

It is set as a mean monthly (30 consecutive days) low flow (return period of 20 years). The losses in SHP electricity production resulting from maintaining residual flow are negligible. For diversions schemes RF is 10% of long term mean flow.

Support scheme

Support system is regulated by a recently promulgated law on Renewable Energy.

Feed-in tariff is guaranteed for 12 years commencing the year 2011. Actual FIT = 5.8 c€/kWh. For new plants a quota obligation system with FIT is in force. Auctions will be organised to ensure a least FIT value proposed by a proponent. Very small capacity plants (<30 kW) will have a different FIT.

Power granting scheme

There is no specific hydropower legislation in Lithuania. Small hydro is regulated by the laws, decrees, orders published by the Government, Ministries of Economy, Environment and Agriculture. In total 10 authorisations issued by different authorities are needed.

There are 2 types of concession:

- *Leasing of an existing dam and associated reservoir belonging to the State (local municipality) during auction procedure. Initial fee is fixed at 2% of annual revenues for power delivered to the grid. Duration of this type of concession varies from 50 to 99 years.*
- *Concession fee linked to leasing out of State land for impoundment (duration up to 99 years). If land is privately owned than it can be purchased.*

The licence (permit) for power production must be obtained independently from SHP size. It is authorised forever. SHP developers are responsible for covering the costs of extensions and of strengthening the grid, although 40% of these costs are subsidised.

4. Summary of the Current Status of Small Hydropower Development

After a very long debates (more than 2 years) a law on Renewable Energy has been introduced. For different power generation technologies the 2020 targets in terms of installed capacity are proposed. For the hydro sector - 141 MW (starting 128 MW in 2005). This contribution coincides with that given in the NREAP. Hydropower proponents wanted to see a bigger figure (up to 250 MW) but they failed. But environmental groups prevented them from this increase. Support scheme will be the same, guaranteed for 12 years, but complemented with auctions during which a least FIT value by a proponent might be offered. This law introduces simplifications of administrative procedures for RES technologies up to 350 kW. However hydropower of any size is excluded from this simplification. Only one exception is made for damless hydro technology which still has no commercial ground even in well developed countries. The law especially highlights using damless hydro technology. And this is despite a reasonable approach: Lithuania is a low lying country.

There was no a particular discussion about the SHP role in grid development. The SHP role in energy storage to cover intermittent RES technologies is very limited in a small country like Lithuania. Moreover, there is still an unfinished a large pumped storage plant (pure pumping) operating with a half of designed capacity.

A marginal role is designated for SHP in energy supply. Prospects for large hydro (>10 MW) are entirely null. And this is due to disproportionate environmental requirements and inflexible enforcement and implementation of WFD and other EU legislation.

Some 12 MW of additional capacity is planned up to 2020. After introducing the Law on RES small hydro and other renewables development has been temporally suspended. All RES proponents are now waiting for a Governmental order that will regulate auction procedures. It should be issued at the end of 2012.

There is a clear public support for SHP development in the country. This was proven by an inquiry to evaluate acceptance of different energy technologies launched a few years ago. In contrast to those findings the country's top officials are reluctant to see further hydropower development. Under pressure of international and local environmental groups they are suggesting to look for "more friendly RES technologies rather than hydro can offer", they are ignoring benefits associated with multipurpose hydropower schemes for other water and environment related sectors (navigation, flood defence etc.).

5. Prospects for Future and Recommendations

- *Revise a list of "no go areas", introducing "less favourable sites" where there are no environmental designations (protected areas under the law on Environmental protection).*
- *Prepare a governmental decree allowing restoration of old water mills and their dams in "no go areas" taking into account the best available environmental practice.*
- *For SHP apply the same simplifications of administrative procedures as they are in force for other RES technologies. Currently these simplifications are applied only for extremely small hydro schemes which capacity P<30 kW.*

LUXEMBURG

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*34*	*34*	*34*	*44*
Generation (GWh)	*85*	*108*	*100*	*124*
Number of power plants	*28*	*29*	*33*	*42*
Potential (GWh)*	*160*	*137*	*145*	*121*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*32*
Employment	*30*
Civil works (estimation)	*10*
Average investment cost (€/MW)	*Recent projects are not representative due to small size*
Average O&M cost (as % of total investment cost)	*n/a (confidential)*
Average civil works cost (as a % of total investment cost)	*50*
Average cost per kWh produced (€)	*n/a (confidential)*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

Only 231 kW of new capacity in the 2005-2010 period; not representative.

Residual flow regulation

Case by case.

Support scheme

FIT: Guaranteed for 15 year annual degression rate of 0.25% since 2008.

- *Up to 1 MW: 105 €/MWh*
- *From 1 to 6 MW: 85 €/MWh*

Investment subsidies: % of the eligible expenses which are the difference between the costs of the investment in hydropower and the costs of an investment in a gas power station with equivalent power. The % of the eligible expenses varies with the size of the company, from 65% down to 45%.

Power granting scheme

Permits are required as follows:

- *Authorisation for abstraction, impounding works and any other engineering works from the Water Management Administration*
- *Environmental licence from the Ministry of Environment*
- *Construction licence from the Municipality*
- *Electricity generation from the Institut 'Luxembourgeois de Régulation'*

4. Summary of the Current Status of Small Hydropower Development

Energy production

- *In 2005, 47% of the electricity from renewable sources has been generated by small hydro power plants; 24 micro hydropower plants have already been reactivated/upgraded in the period 1993 - 2005; nevertheless the electricity from renewable sources accounted for only 3.5 of the electricity generation.*
- *During the period 2005 – 2010, the hydropower capacity has increased by only 0.13 MW.*
- *The surface of Luxembourg is 2,586 km^2; the identified potential for producing more hydropower energy is limited:*
    - *One new site on the Sauer river: 5MW*
    - *Reactivation of 10 micro power plants*
    - *Upgrading of Seo's power plants; Seo is the main hydro electricity generator (95% of the installed capacity)*
- *In May 2011, the Minister has announced that 45 power plants will be operational in 2020*
- *The main project is to increase the capacity of the Vianden pumped storage from 1,096 MW to 1296 MW in 2013*
- *The renewable electricity consumption will be more than 4 times higher in 2020 than in 2005; the growth should mainly be sourced from photovoltaic, wind and biomass*

Support systems

- *SHP is mainly supported by FIT and investment subsidies; the FIT applicable since January 2008 are higher than in the previous system and guaranteed for 15 years; the investment subsidies applicable since January 2010 are more appropriate.*

Barriers related to hydropower development

- *The main limitation results from the hydrological potential; a very small number of potential sites are available for development*
- *Various permits are required from various authorities, both national and local: authorisations for water abstraction, impounding works, environmental licence,*

construction permits, electricity generation licence; but Luxemburg is a small country, where everyone knows everyone

- *As per the Water Management Administration, currently there are not open application for licence, despite appropriate financial supports*
- *As per the recent report "Non cost barriers to renewables, Luxembourg", issued by Ecorys in September 2010, there are no barriers indicated.*

5. Prospects for Future and Recommendations

- *Energy Agency should develop an action plan to achieve the 2020 objective as defined by the Minister in 2011*
- *A comprehensive study, using a GIS based computer model, should be carried out to provide a clear estimate of the practical potential for expanding hydropower production within Luxemburg.*

THE NETHERLANDS

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*2*	*2*	*3*	*3*
Generation (GWh)	*6*	*7*	*8*	*10*
Number of power plants	*10*	*12*	*17*	*25*
Potential (GWh)*	*34*	*30*	*29*	*27*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small Hydropower	2010
Number of companies	*10*
Employment	*195*
Civil works (estimation)	*10*
Average investment cost (€/MW)	*5,000,000*
Average O&M cost (as % of total investment cost)	*5 - 8*
Average civil works cost (as a % of total investment cost)	*50*
Average cost per kWh produced (€)	*0.013*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

In the period 2007 – 2010, only 5 small hydro power plants have been commissioned with a total capacity is 0.3 MW. Permitting is not really a key issue. Oppositely, the process to obtain the permits for the new plant with a 12.1 MW capacity (not SHP) on the Maas river, which has been initiated in 2004, is far to be finalized.

Residual flow regulation

There is no general residual flow regulation in the Netherlands. Every hydro power plant needs to obtain separate permits, and this issue is arranged individually in each permit.

Support scheme

***SDE**: Operating subsidy for the production of renewable electricity.*

- *Height < 5 meters: maximum 12.2 c€/kWh (minus the energy market price) maximum of 3,800 hours*
- *Height > 5 meters: 7.1 c€/kWh (minus the energy market price) maximum of 4,800 hours*

***EIA tax deduction**: 44% of the investment costs can be deducted from the taxable profit*

Power granting scheme

Permits are required as follows:

- *Permit from the Water Management Administration*
- *Environmental licence from the Ministry of Environment*
- *Nature protection permit*
- *Construction licence from the Municipality*

4. Summary of the Current Status of Small Hydropower Development

Energy production

- *Despite the fact that the Netherlands are a very flat country, hydropower contributes to the production of renewable electricity. The total production of hydroelectricity is dominated by three large power plants build in the eighties on the two major rivers, the Rhine and Maas. A fourth power station should be operational in 2014.*
- *SHP accounts for a minor part of the hydro electricity production, less than 8%: only 3 plants have a capacity between 0.1 and 10 MW; a few power plants have a capacity under 0.1 MW.*
- *Many small watermills still could be reactivated.*
- *As per a report issued by Deltares in April 2010, the hydro potential from rivers is 100 MW. SHP is not estimated.*
- *The renewable electricity production will be more than 7 times higher in 2020 than in 2005; the growth should mainly be sourced from wind, biomass and photovoltaic; hydropower to account for less than one per cent.*

Support systems

SHP is mainly supported by the SDE operating subsidy and the EIA tax deduction. The SDE + is in 2011 changed compared to the SDE subsidy that was started in 2008. The SDE offers long-term financial (hydropower: 15 years) security by covering the unprofitable component of projects. The subsidy is the difference between a basic amount (cost price of the renewable energy) and the energy market price. In 2011, one can apply for the SDE + during four different time slots open from July 1st to December 30th 2011. Each slot has a different maximum. The Dutch government has determined a maximum SDE+ budget for 2011. If this maximum is reached in a certain slot, no SDE+ is available for the next slots. This means: first come, first serve, and the projects that tender in the first slot (with lower subsidy) have the best chance to get the subsidy awarded. Hydropower: if height < 5 meters: maximum 12.2 ct/kWh (minus the energy market price) and a maximum of 3,800 hours; if height > 5 meters: 7.1 ct/kWh (minus the energy market price) and a maximum of 4,800 hours.

Barriers related to hydropower development

- *The main limitation results from the hydrological potential in a flat country.*
- *It's very difficult to obtain Waterwet (water law) and Natuur-beschermingswet (nature preservation law) permits, due to new fish mortality requirements.*

- *Almost all sites are government property; no government policy in place for allocation of sites to developers.*

5. Prospects for Future and Recommendations

- *SHP accounts for less than 0.1 % of the renewable electricity produced in 2010.*
- *Renewable electricity is mainly sourced from wind and biomass.*
- *Taking into account that almost all potential sites are government property, the Dutch Government should develop a plan to exploit its SHP potential.*
- *Then, the Government will have to balance on one side, the environmental protection, on the other side, its renewable energy targets*

POLAND

1. Key Figures

Small hydropower	**2005**	**2007**	**2010**	**2020**
Total installed capacity (MW)	*246*	*262*	*275*	*332*
Generation (GWh)	*860*	*964*	*1,036*	*1,130*
Number of power plants	*659*	*681*	*722*	*840*
Potential (GWh)*	*2,104*	*2,000*	*1,928*	*1,834*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	**2010**
Number of companies	*380*
Employment	*2,800*
Civil works (estimation)	*330*
Average investment cost (€/MW)	*6,400,000*
Average O&M cost (as % of total investment cost)	*6*
Average civil works cost (as a % of total investment cost)	*80*
Average cost per kWh produced (€)	*0.05*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

The water-legal consent for using water for hydropower purposes is to be issued within 14 days after submitting application with the so called water use concept and the water management instruction. In practice the procedure takes approximately 2 months if

no amendments to the attachments are needed. Concession for production of electric energy out of a renewable energy source is to be issued within 14 days if no additional obstacles occur.

Residual flow regulation

Current Polish law provides merely the following RF definition: "residual flow is the minimum flow necessary to support biological life in a watercourse". In practice, use is made of the methodology of the Polish Institute of Meteorology and Water Management, (IMGW) especially of the techniques developed by Prof. Kostrzewa and the so called Little Poland Methodology. According to a simplified version of Kostrzewa method, proportionality between the residual flow and the low flow average value is assumed. The proportionality coefficient is located between 0.5 and 1.5 and depends on river characteristics and catchment basin area. The IMGW has published the RF values for some Polish watercourses and these data are generally accepted by the water management authorities when assessing the drafts of water use concepts. Further information on the IMGW methodology is to be found in the Polish version of the Layman's Guide and in the cited bibliography.

Support scheme

Tradable green certificate system (~6,4 €c/kWh on top of 5 c€/kWh for "black" energy). The black energy price is announced annually by the Energy Regulatory Office (URE) basing on the free market price from the previous year. URE announces annually also the replacement fee to be paid by energy enterprises having failed to cancel sufficient number of certificates.

Power granting schemes

Plant erection: Permit for erection is issued basing on the following documents:

a) *Construction project*
b) *Decision on building conditions and spatial development plan (issued by local administration)*
c) *Decision on environmental constraints*
d) *Water-legal consent*
e) *Statement on the rights to manage the estate*

The decision on environmental constraints may require the Environmental Impact Assessment

The water legal-consent requires submitting the following documents:

a) *Water legal action plan*
b) *Water management guidelines (draft)*
c) *Decision on building conditions and spatial development*
d) *Description of planned activity*

Connection to the grid

Connection to the grid takes place according to the previously issued connection conditioning statement. Renewable energy suppliers with capacity up to 5 MW cover 50% of realistic connection costs. Grid impact assessment is required in case of RES-E plants with capacity over 2 MW connected to the grid with rated voltage exceeding 1 kV. All refusals have to be justified in writing.

Commissioning and operation

Concession of the Energy Regulatory Office is needed in order to produce electricity in all renewable energy sources. Investors often apply for concession promises at the early stages of their projects. No concession charge is imposed on RES-E owners with capacity up to 5 MW. Local grid operator has to check the equipment and seal the energy counters before plant operation is commenced.

4. Summary of the Current Status of Small Hydropower Development

The discussion on SHP future in Poland is induced occasionally by opponents to any development of civil engineering infrastructure of Polish rivers. Their actions are facilitated by lack of systematic plans for developing Polish hydropower potential. In 2009 such a discussion resulted in a memorandum demanding moratorium on erection of SHPs in Poland. The memorandum was supported by a number of institutions and media, but no ban on SHP was implemented. The discussion on changing the RES support mechanisms has been continued for several years now, as the large heat power plants co-firing biomass with traditional fossil fuels have appeared the main beneficiary of the current green certificate system. The changes in the support mechanisms are proposed in the draft of the RES Promotion Act, currently under preparation by the Ministry of Economy. Social consultations are expected this autumn. New regulations may appear highly unfavourable for large hydro. However, they are not expected to harm the SHP sector. Simplification of administrative procedures may be hardly expected. Since autumn last year the requirement of Environmental Impact Assessment may be imposed on any hydropower project, irrespective of its capacity.

The SHP role in development of the electric power grid, and especially in maintaining its parameters in the peripheral areas, is often raised during branch conferences and meetings. It is also somehow reflected by some reductions in the grid connection charges. However, SHPs are usually treated in the same way as other RES plants with capacity up to 5 MW. Generally, grid operators make no use any more of SHP grid regulation capabilities.

The 2001/77/EC RES Directive had a decisive influence on stipulations of the EU Accession Treaty which obliged Poland to reach the RES index goals in 2010. This has resulted in numerous positive actions, including introduction of the green certificate system and some SHP preferential stipulations in the Polish Energy Law. The 2009/28/CE Directive exerts surely a positive influence on preserving the above policy trend and new actions aimed at giving SHP investors access to water stages owned by the State Treasure. Both directives had an impact on the rules of awarding donations from EU structural funds although support for the SHPs concerned often solely the accompanying civil engineering structures (fish ladders). Current formulation of the rules of managing the structural funds results in SHP projects loosing competition with other RES due to too low interest rate. Implementation of the Water Framework Directive has resulted in rising the environmental requirements and investment costs. The requirement to erect a fish ladder or a pathway accompanying the already existing weir/dam is a typical example.

These issues represent the most significant barrier for development of whole the hydropower sector. The main opposition against SHPs comes from angling associations which aim at banning erection of new dams at main fish migration routes. Such initiatives are raised forward systematically despite applying ever more sophisticated measures compensating unfavourable environmental impact of damming structures. Provision of each new hydropower plant with a fish ladder or fish pathway has been has been required

for a long time now. The owners of hydropower plants provided with none or inefficient fish ladders are required to cover costs of introducing fry to the head and tail water. The hydropower plant owners are ever more interested in fish deterring devices to be installed at turbine inlets. Since autumn 2010 the Environmental Impact Assessment may be required when applying for construction permit of any hydropower plant. The requirements on compensation measures are written down into the environmental decisions taken by the Regional Environmental Protection Managements and other documents allowing erection and operation of a hydropower plant. Receiving such a decision is particularly difficult in case of Natura 2000 areas, as the investor has to prove necessity of his project and compensation of all undesirable side effects. Typical requirements resulting from other regulations include mandatory compensation of losses in forest areas in administration of the State Forests company in case of flooding needed to create storage ponds.

Over the past two decades the average annual rise in SHP installed capacity was 6 MW. However, much slower growth has been observed since 2005. According to available information, the plants of total capacity of 30 MW are currently under construction or in the phase of advanced construction preparations. Unfortunately, some of them have been remaining in this state since nineties of the last century. It is worthwhile to notice that in the end of 2009 there were 9 installations with valid electricity production concession promises (with total capacity of 5 MW) while 7 such promises were issued in 2010. In the coming years, small hydro development will be probably prompted by better access to the dams owned by the State Treasure and by development of technology enabling rational utilization of dams with head below 2 m. The hemming factor will be the decreasing number of really attractive and still unused stages of fall. In the beginning of 90-ies the total hydropower potential of these stages was ca. 200 MW. Since then SHPs with total capacity of 120 MW have been put in operation. Only a small fraction has been erected together with new dams. In general, erection of new dams proceeds slowly and encounters numerous obstacles.

The factors hemming further development of the sector include also implementation of the Water Framework Directive and Natura 2000 programme covering the areas of highest attractiveness for hydropower investors. In 2008, 11% of Polish territory was covered by the Natura 2000 programme. However, the pro-ecological NGOs require further widening of the current list of protected areas. While incorporating a territory into the Natura 2000 register does not imply immediate exemption from any hydropower investment, this may pose an invincible barrier for a prospective SHP developer if conservative interpretation of existing regulations is applied.

Under these circumstances reaching the target of 380 MW installed in small hydro in 2020 as declared in the RES National Action Plan may be considered doubtful. According to our predictions the installed capacity will reach the level of 330 MW. Our prognosis of annual energy production is by 80 GWh lower than that of the Action Plan.

The position of hydropower in the eyes of decision makers and highly influential circles is fable. The sector may count on some support from the Ministry of Economy which feels obliged to fulfil the tasks following from the 2009/28/EC RES Directive and climate package stipulations. The above attitude is manifested by establishing the Hydropower Development Advisory Group with representatives of the Polish Hydropower Association and the Polish Association for Small Hydro Development as members of this body. The Minister of Environment remains under strong influence of the "pro-ecological" lobby. Development of large hydro is generally opposed while the small hydro sector is often merely tolerated. Such an approach was presented especially frequently by the former

Minister of Environment, Prof. Maciej Nowicki. The poor position of hydropower sector is reflected also in the programmes of local and national development, research and development as well as RES related conferences and seminars. Unfavourable opinions about hydropower sector are often disseminated by media – including the public ones – which usually sympathise with pro-ecological NGOs. Generally, the hydropower sector is scarcely mentioned, and if it already happens then hardly anything positive may be expected. Under this situation the public opinion remains divided. There exists still strong sympathy to hydropower as a traditional technology of electricity generation. Substantial understanding of local communities to the profits resulting from the erection of the multitask hydro schemes can be also observed. This concerns in particular communities from areas affected by floods in the recent years which had an opportunity to compare the behaviour of a harnessed river with one neglected due to notorious lack of funds for maintenance of side dams. On the other side, in large municipal centres there exist well organised green NGOs. Their activity exerts an undoubted effect on the position of general public. When acting locally, the hydropower opponents try often to use the element of envy and to present the SHP investors as black and ruthless characters aimed only at multiplying their profits.

Without a thorough study of public opinion, with proper account of both the regions featured by high hydropower potential and inhabitants of large cities with university centres, we are unable to assess what is the real distribution of social approach to the sector. In the end of 2011 the RES Law draft was published. The desires of the legislator include sparing funds used for the public support for renewables. It is the policy of the legislator to support exclusively erection of new plants and major rehabilitation of the old ones.

The changes include:

a) *shortening the support to 15 years after erection or major rehabilitation (30 % of the initial value of the installation) leading to increase of installed capacity*
b) *applying coefficient system in which some green certificate owners are paid the market price of the certificate multiplied by a certain coefficient, dependent on technology and installed capacity*

The document has been considered a major blow to all RES sectors, giving rise to severe criticism. Some positive changes to the document were reported in the end of May 2012. However, it is clear that the older plants will lose a major part of their revenue. The plant owners having refurbished their installations few years ago are in fear of losing a chance for a payback of their investment – especially if no rise in installed capacity took place.

The positive modifications of the draft do account for economic analysis results, including SHP STREAM MAP findings as presented to the Ministry of Economy and showing clearly high specific investment costs. In contradiction to the general opinion the costs often rise with installed capacity due to extensive amount of civil works needed in case large low head installations. Nevertheless, there are opinions of some RES experts stating that the draft gives too many preferences for hydropower plants and especially the large ones.

In June 2012 the key assumptions for the new Water Law were published. In addition to fundamental changes in organizing the water management system, introducing a fee for using water for hydropower purposes has been proposed. There are significant fears that this might be another blow to the sector.

5. Prospects for Future and Recommendations

Only moderate development of the SHP sector may be expected if no far going changes in state policy are introduced. New low head technologies will hardly compensate deficit in attractive sites. The situation in large hydro will be even worse as stagnation has been observed in this sector for several decades.

The key recommendations for policymakers in order to overcome the barriers identified include:

- *Development of a national programme of harnessing the hydropower potential with possibility to revise the letter and practice of environmental regulations (including revision of Natura 2000 areas and less rigorous approach to the habitat directives)*
- *Continuation of the process of giving access to the state owned dams to the hydropower investors and starting erection of new multitask installations within the framework of partnership between water management authorities and hydropower investors*
- *Introducing regulation redirecting the incomes resulting from green certificates in state owned hydropower plants to support investments within the sector.*

Numerous changes proposed in the RES Law and Water Law drafts are really controversial and it is impossible to quote all the critical remarks in this document. Although the new RES Law draft implements a number of our suggestions it is still very risky for the sector. The Polish Hydropower Association and the Polish Association for Development of Small Hydropower argue for further modifications, including:

a) *using annual production criterion when establishing the coefficient value instead of that of the installed capacity*
b) *Taking proper care of the owners having refurbished their plants within the last 15 years*

Both associations are strongly against water use fee. If such a payment were unavoidable it should take rather a form of an additional tax for generated electrical energy than that of a charge proportional to the amount of water having passed the turbines. The last solution may hit especially severely the low head installations.

PORTUGAL

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*340*	*399*	*450*	*750*
Generation (GWh)	*689*	*895*	*1,370*	*2,032*
Number of power plants	*100*	*137*	*155*	*250*
Potential (GWh)*	*2,592*	*2,570*	*1,908*	*1,246*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*305*
Employment	*1,745*
Civil works (estimation)	*450*
Average investment cost (€/MW)	*2,000,000 - 2,500,000*
Average O&M cost (as % of total investment cost)	*0.5 - 1.5*
Average civil works cost (as a % of total investment cost)	*50 - 70*
Average cost per kWh produced (€)	*0.070 - 0.075*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

3 - 11 years.

Residual flow regulation

There is no regulation published establishing the residual flow. Yet, there are indications stating that the ecological flow in Portugal should be, in average, 5 to 10% of the modular flow. Also, this flow should be variable during the year, to enable a better adjustment to the differences on the natural hydrological regime and to the spawning seasons. The residual flow would be the sum of the ecological flow with flow necessary for the existing uses as irrigation and water supply.

Support scheme

In Portugal, the support scheme in place for SHP is the Feed-In Tariff (FIT). The Decree-Law 225/2007, of May 31, indicates an average reference FIT of 7.5-7.7 c€/kWh, with a limit to the first 52 GWh/MW or up to 20 years whatever is reached first, which could be increased to until 25 years in exceptional cases. In 2010, a new tariff was defined by the Decree-Law 126/2010, specific for the public tender launched in that year: 9.5 c€/kWh, up to 25 years.

Power granting scheme

There are two alternative procedures for granting a SHP plant: through private or public initiative. However, in the last years, the private initiatives have few results, due to the incapacity of response of the National Authorities responsible for these procedures.
In any case, there are three steps that must be taken: first of all, it is required the title for the private use of water resources in the public domain, in the terms of the Law 58/2005 (the Portuguese Water Law) and the Decree-law 226-A/2007; then, it is necessary to obtain power capacity to inject in the electric grid of public service; finally, it is necessary the identification of reception points on the electric grid for the electricity produced under special regime in the SHP.

Note that the public tender launched in 2010, foresaw an innovation: the simultaneous attribution of these first three authorisations. Then, as any other power plants, it is necessary to have several permits/authorisations granted in order to construct and start operating.

4. Summary of the Current Status of Small Hydropower Development

Portugal is under a slow stage of development of its SHP sector with only a few power plants being developed in the last decade. Several barriers were already identified as majors responsible for this lethargy, namely:

Licensing Procedure

The licensing procedure of a SHP plant takes in average 3 to 11 years (there are inclusively cases of SHP that took two decades to be licensed), being quite costly and with an unpredictable outcome. The main reason for this is the dependency from entities tutored by different Ministries which are not properly coordinated, implying a slow and bureaucratic process.

No significant room has been given for private initiatives concerning the development of new SHP plants in the last decade, generating a vast list of request by promoters. The Portuguese Government has launched a public tender in 2010, ignoring all the requests already presented, with the positive aim of implementing simplified licensing procedures to ensure the coordination and facilitation of obtaining the permits necessary to implement SHP. Nevertheless, the tender was subverted by its incorrect structure: the allocation of capacity had as single criterion the payment of a financial counterpart to the State.

Environmental, Technical and Financial Constraints

The obligation to comply with more stringent environmental requirements, particularly resulting from the implementation of the Water Framework Directive, (for example, the imposition of more demanding environmental flows and significant compensatory measures, which often go beyond the dimension of the investments and the scope of activity of the promoters) leads to a limitation of the technical characteristics and

potentially to a reduction in the profitability of SHP plants. Also, it is important to promote a better coordination between the water resources management instruments and the energy sector planning, in order to optimize the existing resources.
There is also a major concern with the current panorama of the financial market that is preventing any project to be funded.

Support Mechanisms

In 2005, the Decree-Law 33-A/2005, introduced amendments to the existing FIT previously established by Decree-Law 339-C/2001, lowering significantly its average value, leading to a much scarcer development of new SHP plants; it is estimated that only around eight SHP plants were developed after this revision. Taking this into account, it is possible to infer that nowadays there is a mismatch of the current tariff that barely covers the costs.
In the 2010 tender for the development of SHP, a new FIT was specifically established, higher than the current in place - 95 €/MWh, during 25 years. However the increase in the tariff did not mean higher profitabilities for the projects: the payment of a financial compensation to the State (in average, 332 €/kW), that was used to cover costs outside the electricity sector, induced higher initial costs for the promoters.

In terms of recent developments in the view of the 2020 targets, Portugal assumed in its National Renewable Energy Action Plan (NREAP) a contribution of 1.511 GWh of SHP in 2020, corresponding to a total installed capacity of 750 MW – an increase of around 300 MW. For this purpose, the NREAP foresaw the definition of a specific plan for SHP, to exploit the existing potential. However, no plan is already in place and the identified barriers are still in place.

Furthermore, in the Memorandum of Understanding for the bailout of the Portuguese Economy, signed in May 2011, it is stated that the possibility of agreeing a renegotiation of the existing contract of the renewable energy sources producing under special regime, should be evaluated with the view of reducing the subsidized tariff. This possibility brought speculation and instability, in addition to the existing negative impacts of the economic crisis. There is still no outcome of these negotiations, although SHP sector is not predicted to be affected by them.

In 2012, the Decree-Law 25/2012 was published stopping the award of connections to the grid for all projects for power plants under Special Regime. A month later, the Dispatch 3316/2012 came applying the referred Decree-Law specifically to the SHP sector, not only "freezing" it but also invalidating all private initiatives pending on the authorities responsible for the licensing of these power plants. Also, from the approximately 700 MW potential to be installed and the 250 MW foreseen in the referred Cabinet Resolution 72/2010 and Decree-Law 126/2010, until now only 150 MW were made available, and only a few projects took-off, being presently under environmental impact studies. There is, in this sense, a huge uncertainty regarding the possibilities of developing new SHP plants in Portugal, although in what concerns public support for SHP development and social acceptance for SHP development it is not noticed major opposition.

5. Prospects for Future and Recommendations

Licensing Procedure

- *Licensing procedure suitable for SHP projects – better coordination between the national authorities responsible for this process, with simplified administrative procedures.*
- *Analysis of the already delivered requests for licensing, instead of launching new tenders - taking advantage of the studies already produced on several locations.*
- *Establishment of solid criteria to concede licences to develop SHP – example, the quality of the projects and the experience of the promoter.*
- *Establishment of the "one-stop shop", including the figure of project manager.*

Environmental, Technical and Financial Constraints

- *Analysis and discussion of the imposition of minimum ecological flows and compensatory measures for the implementation of SHP - involving a joint force between the national authorities and the promoter.*
- *Introduction in the composition of the commissions for environmental impact assessment of a delegate from the promoter (as an observer, with no voting rights).*
- *Regulatory stability and Governmental support to help on achieving financing for developing new projects – urgency in solving the current constraints of the financial market.*

Support Mechanisms

- *Adequacy of the FIT and the concession period to the specificities of the country (Portugal has a large intra-annual variability in water run-off).*
- *Introduction of a specific tariff for pump storage on SHP plants in Portugal.*

ROMANIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*325*	*354*	*387*	*730*
Generation (GWh)	*608*	*599*	*719*	*1,360*
Number of power plants	*223*	*236*	*274*	*550*
Potential (GWh)*	*1,491*	*1,500*	*1,380*	*739*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*n/a*
Employment	*n/a*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*3,000,000*
Average O&M cost (as % of total investment cost)	*1.5*
Average civil works cost (as a % of total investment cost)	*65*
Average cost per kWh produced (€)	*0.03*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

The average duration of authorisation procedure could be considered to be 2 years. This is the viability of the water uses permit which could have a prolongation for another two years period if not all the permits are ready..

Residual flow regulation

The residual flow is imposed by the Ministry of Environment and Forests through his administration ANAR - The Romanian Waters National Association for each site in the permit of water use. As a common requirement the reserved flow is imposed to be greater than 10% of the mean flow.

Support scheme

The support scheme in Romania is mandatory quotas combined with tradable green certificates (GC). For the green electricity produced in SHP there three options to be sold: by bilateral contracts at negotiated prices, On Day Ahead Market or to distribution companies at a regulated price which is about 31 €/MWh.

For green certificates there are two options to be sold: by bilateral contracts or on the centralized GC market with prices in the range 27...55 €/GC until 2014 and with a minimum guaranteed price of 27 €/GC for the period 2015-2030.

The SHP receives GC according to the following scheme:

- *3 GC/MWh for new SHP for 15 years*
- *2 GC/MWh for refurbished SHP for 10 years*
- *1/2 GC/MWh for old SHP for 3 years*

Power granting schemes

- *Title to land / 1 month*
- *Certificate of urbanism - including specifications on all contain opinions to be obtained/ 1-2 month*
- *Construction permit in accordance with Law 50/1991/ 1- 2 month*
- *Environmental permit to give their holder the right to build the project and the right to exploit all or part of an installation in conditions which ensure the installation meets the requirements of integrated pollution prevention and control / 1-2 month*
- *In accordance with art. 13 of the Energy Law, construction of new power capacity (for example, an electricity generation capacity) as well as upgrading existing ones is based on a foundation permits. / 1-2 month*
- *Production, transportation, provision of ancillary services, distribution and supply of electricity, and all management activities for centralized energy market are under licenses issued by ANRE, based on which natural or legal persons, Romanian or foreign, are allowed to exploit the commercial power capacity. The term for which they are granted licenses for commercial operation of energy production capacity is 25 years/ 30 days*
- *Approval of water management, which allows starting a new project construction or equipment / facilities related to water, including construction of new hydroelectric plants / 1-2 month*
- *Contract of sale with the company dealing with distribution and supply of electricity / 15-30 days*
- *Priority production qualification for electricity production capacity / 15-30 days*
- *Subscriptions OPEE (SC OPCOM SA) - to sell E-RES in the market for the next day (DAM) / 15-30 days*
- *Subscriptions TSO (Transelectrica SA) - to obtain green certificates (VC) / 15-30 days*
- *Subscriptions OPCV (SC OPCOM SA) - to participate in the centralized market CV / 1-2 month*

4. Summary of the Current Status of Small Hydropower Development

- *There were no discussions regarding the change of support scheme (mandatory quotas combined with tradable green certificates). Since the beginning of year 2011 there were only changes in the number of GC for 1 MWh of produced energy (see point 3).*
- *The RES Directive push forward the SHP development. The WFD impose the environmental flow - which could be seen as a loss in energy produced, define water body statuses and protected areas, which completely block the SHP development. The harmonization of the two Directives remains one of most important goals of our government.*
- *For new projects, the developer must have an EIA in order to obtain the environmental permit where are stipulated all the demands to be fulfilled by the SHP developer in order that the plant respects the environment.*
- *There were important developments after the put into force of the RES Directive and the prospect is that in 2020 the number of SHP will double. The prevision is that Romania will fulfil the target.*
- *Unfortunately media is presenting SHPs as having a negative impact on the environment and as people are very sensitive on media the public support and social acceptance for SHP development is very low.*

5. Prospects for Future and Recommendations

- *Cooperation among the Ministry of Environment and Ministry of Economy, Commerce and Business Environment, respectively Romanian Water National Administration and Hidroelectrica, when issuing new laws, Decisions, regulations and for the re-evaluation of the SHP potential for all rivers.*
- *For every new law or GD very clear regulations of application and immediately after the law or GD is issued.*
- *Creation of a "One stop shop" for SHP investors.*

SLOVAKIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*67*	*70*	*80*	*140*
Generation (GWh)	*250*	*267*	*303*	*443*
Number of power plants	*201*	*203*	*279*	*380*
Potential (GWh)*	*397*	*380*	*344*	*204*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*135*
Employment	*n/a*
Civil works (estimation)	*n/a*
Average investment cost (€/MW)	*5,500,000*
Average O&M cost (as % of total investment cost)	*n/a*
Average civil works cost (as a % of total investment cost)	*n/a*
Average cost per kWh produced (€)	*n/a*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure
Not available information.

Residual flow regulation
Usually the Q355 value is applied. However, in the last sections of the watercourses it may be as low as 1/2 Qmin *month or even 1/2 Q364.*

Support scheme
The hydropower plant owners enjoy additional payment for supplied electricity within the period of 15 years from putting the facility into operation or from the year of reconstruction or upgrade of a technological part of the facility. The energy price resulting

from additional payment is calculated as a percentage of the base price announced by the Regulatory Office of Network Industries (URSO). The typical value of the base price is 6 to 11 c€/kWh depending on plant capacity. URSO establishes the price individually for each facility basing on the submitted proposal and taking into account various factors, including time having passed since (re) commissioning and investment assistance having been granted. The pricing decisions are published at the URSO website. The support is granted in full value in case of power plants with capacity up to 10 MW. In case of power plants with higher capacities the additional payment is granted for electricity production from the 10 MW. The maximum amount of energy eligible for additional payment is established in the above mentioned pricing decision. Electricity producer entitled to the support is obliged to:

a. *Submit to the regional distribution system operator a certificate of origin of electricity produced;*
b. *Notify the local system operator of the expected supply characteristics the total installed capacity of the facility exceeds 1 MW.*
c. *Notify the URSO and the regional distribution system operator of claiming the support as well as of the expected amount of supplied electricity in the following year.*

Till the end of 2008 investment support was available from the Operational Programme "Competitiveness and Economic Growth". No information of support having been granted since then could be found at the relevant websites.

Power granting schemes

Plant erection

The permit for erection is issued by the water management authority. Essentially, there are two kinds of planning documents needed:

- *Documents required for the spatial planning decision*
- *Design documentation required for the erection permit*

The spatial planning decision is issued by the local administration. SHP projects with capacity over 5 MW, dams with levelling height of over 3 m as well as reservoirs of sufficiently high volume capacity or free surface area may be subject of EIA or ascertaining procedure. In case of erecting of an SHP without changes in the civil engineering structures a water authority consent is sufficient. In case of installed capacity exceeding 1 MW a declaration of project compatibility with the long term energy policy concept is required.

Connection to the grid

The grid operator is obliged to connect an SHP to the grid on a priority conditions basing on the plant owner application. The plant owner pays ~ 40% costs of the connection.

Plant operation

The Slovak Energy Law considers electricity production an economic activity in the electrical power industry only in case the electricity is supplied to the national grid. In case

of installed capacity below 1 MW no permit for such an activity is required. However, in the latter case the plant operator is required to declare commencing his activity within a 30 days period. The URSO confirms fulfilment of this duty with a document valid as an operation permit. The Slovak law specifies the technical qualification certificates and other documents required when applying for an operation permit. Official commissioning is needed in order to put the plant into operation.

4. Summary of the Current Status of Small Hydropower Development

The SHP sector in this country is relatively weak as compared with that of the large hydro - dominated by the Slovenske Elektrarne, the main electricity supplier, controlled by the ENEL Group. There is also no representation of the SHP sector in Slovakia although some efforts to establish a national association have been reported by the Hydropower Association of the Czech Republic. So far, there has been also no sufficient support from the state as a major effort (50% of RES support) was directed on solar power plants, which has resulted in an unprecedented boom of this technology (480 MW in photovoltaic plants) and a noticeable rise of the electricity prices. This widely criticised policy has been already abandoned by the new government and better times for small hydro are quite realistic.

The strategy for higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 4th, 2007. The strategy of energy security of the Slovak Republic (Resolution No. 732/2008 of the Government of Slovak Republic). Act of 19 June 2009 on the Promotion of Renewable Energy Sources and High-efficiency Cogeneration and on amendments to certain acts, Coll. Acts of Law, 309/2009. National Action Plan on Renewable Energy Sources (the Slovak Republic), (Resolution No. 677/2010 of the Government of Slovak Republic). The concept of utilising the hydropower potential of water courses of the Slovak Republic till 2030. (Resolution No. 178/2011 of the Government of Slovak Republic). The significance of the last document is to be emphasised as it represents a detailed inventory of all existing and planned plants with their main parameters and assessment of environmental constraints included.

The Slovak Government is strongly committed to reach the 2020 target using the hydropower sector as a significant component of the renewable energy mix. This commitment can be clearly seen in the hydropower development master plan – a highly competent and comprehensive document developed by the Research Institute of Water Management and recently adopted by the Slovak Government (Resolution No. 178/2011) as a national policy strategic act. It can be seen from this and other official documents that the plans for further large hydro development on Danube and Vah are consequently supported and small hydro is ever more welcome. In this context it is worthwhile to notice that the government plans go far beyond the list of projects currently considered environmentally feasible.

There has been rising opposition against further development of cascades at some rivers to be observed over past years. However, after recognising high costs of solar plants and limited wind power potential, Slovakia has not too many alternatives available.

5. Prospects for Future and Recommendations

There are clear chances for further development of hydropower in Slovakia. However, the investment support granted so far to SHPs far can be hardly considered satisfactory.

Easing environmental procedures and resigning of the water use fee may be recommended.

SLOVENIA

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*103*	*111*	*117*	*192*
Generation (GWh)	*383*	*462*	*465*	*758*
Number of power plants	*445*	*456*	*535*	*568*
Potential (GWh)*	*530*	*450*	*447*	*154*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*27*
Employment	*2,325*
Civil works (estimation)	*25*
Average investment cost (€/MW)	*1,800,000 - 2,500,000*
Average O&M cost (as % of total investment cost)	*1.5 - 5*
Average civil works cost (as a % of total investment cost)	*60*
Average cost per kWh produced (€)	*0.08 - 0.15*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

5 - 10 years.

Residual flow regulation

Government's Decree (No. 97/2009, 30.11.2009. The Qres is calculated by formula:

*Qres = f * MNQ, where f is the factor, defined by the ecological type of the watercourse:*

- *Reversible use or not*
- *Length of the stretch from the intake to outlet*
- *Amount of water taken*
- *Group of ecological type of the watercourses*
- *Ratio between the MQ and MNQ*

MNQ is the annual mean low flow, MQ is the annual mean flow. The values, calculated by the formula may be changed due to the fishery/anglers regulations or demands. The Qres must be monitored (assured that it's not used when natural flow is lower than Qres) and reported.
Factor "f" varies from 0.7 – 1.9, depending on the above criteria.

Support scheme

Government's Decree (No. 37/2009, 18.5.2009). The scheme is a FIT with premium. The methodology for price calculation is based on total annual operational production costs. That includes the investment, operational and maintenance costs.

Parameters:

- *Depreciation period: 15 years*
- *Discount rate: 12%*

The SHPs are divided in 3 categories given their installed capacity: Pi < 50 kW, Pi < 1,000 kW and Pi < 10,000 kW.

The guaranteed purchase prices are (in €/MWh):

- *105 (< 50 kW)*
- *93 (< 1,000 kW)*
- *82 (< 10,000 kW)*

The premium was in 2009 determined by the reference market price 65 €/MWh, as:

- *55.9 (< 50 kW)*
- *55.9 (< 1,000 kW)*
- *58.5 (< 10,000 kW)*

The premium is already comprised within the guaranteed purchase price. Only the SHP, 'younger' than 15 years are eligible for the support.

Power granting scheme

First steps in deciding on the construction

a. *Planning information (lokacijska informacija)*
b. *Information on the grid connection possibility (pridobitev mnenja o možnosti vključitve v omrežje)*
c. *Analysis of the suitability of the location (analiza primernosti lokacije)*
d. *Conceptual design, preliminary design and feasibility study (idejna zasnova, idejni projekt in študija izvedljivosti)*
e. *Decision to build (odločitev o gradnji)*

Obtaining permits

a. *Energy permission; only for SHP > 1 MW (energetsko dovoljenje za naprave nad 1 MW)*
b. *Specific permissions (specifična dovoljenja)*
    - *<u>Water concession</u> for the electricity production (koncesija za energetsko izrabo vodotoka za rabo vode za proizvodnjo električne energije - le za hidroelektrarno, ki bo priključena na javno elektrodistribucijsko omrežje)*

- *Water permit - for HPP which is not directly connected to public electricity grid (vodno dovoljenje – za hidroelektrarno, ki ne bo neposredno priključena na javno električno omrežje)*
- *Water consent (vodno soglasje)*
- *Environmental impact assessment (presoja vplivov na okolje)*
- *Environmental consent (okoljevarstveno soglasje)*
- *Concession contract (koncesijska pogodba)*

c. *Obtaining project/design conditions (pridobivanje projektnih pogojev)*
d. *Consent to connect the HPP to the electricity grid (soglasje za priključitev proizvodne naprave na elektrodistribucijsko omrežje)*
e. *Permit for the construction design (projekt za gradbeno dovoljenje)*
f. *Construction permit (gradbeno dovoljenje)*
g. *Proof of the land rights (dokazilo o razpolaganju z zemljiščem)*

Construction Process (postopek izgradnje proizvodne naprave)

a. *Documents for tendering and selection of contractors (dokumentacija za razpis in izbira izvajalca)*
b. *Professional training for the operation of energy facilities (strokovno usposabljanje za upravljanje energetskih naprav)*
c. *Grid connection contract (sklenitev pogodbe o priključitvi na omrežje)*
d. *Implementation design (projekt za izvedbo)*
e. *Construction of power plant (gradnja elektrarne)*
f. *Construction of the grid connection (izgradnja priključka)*
g. *Design of implemented works and Operation instructions (projekt izvedbenih del in obratovalna navodila)*
h. *Contract for the electricity purchase and sale (pogodba o nakupu in prodaji električne energije)*
i. *Application and review the terms for grid connection (vloga in pregled izpolnitve pogojev za priključitev)*
j. *Contract on access to the electricity grid (sklenitev pogodbe o dostopu do elektroenergetskega omrežja)*
k. *Technical inspection (tehnični pregled)*
l. *Operating Permit (uporabno dovoljenje)*
m. *Connection to the electricity grid (priključitev na elektroenergetskega omrežja)*

4. Summary of the Current Status of Small Hydropower Development

After 2008-2009 when the new support scheme was introduced there was no such discussion. The complete lack of official and reliable data prevents any serious analysis of the remaining potential. The only reference to the development of the RES sector and thus to the removal of barriers is written in the RES Action Plan (2010). Up to 2012 there were no changes in the support scheme legislation, apart from the annual declaration of the expected market price for the next year which is a basis for the calculation of the premiums.

The RES Directive is already fully implemented in Slovenian energy legislation with the new Energy Act (30.9.1999), its secondary legislation and the RES Action Plan (July 2010). With its binding targets has a positive impact on the RES development. The WFD is only partially implemented with the regulation on the HMWB still missing. However, in case of SHP, it is obviously understood as a protective legislation which means that the authorisation procedures, especially for the concession, are blocked. The lack of the

Government's clear policy and harmonisation efforts to bring the two seemingly opposite interests closer together is the core cause for years-lasting blockage of the SHP development.

The Slovenian RES target for 2020 is 25%. There is a general understanding of the need of RES, and that all the potential needs to be used in order to reach the targets by domestic energy production. However, at the same time a big coal-fired TPP project is underway and most probably the new nuclear power plant will be built as well. The large hydropower projects are developing steadily, with large opposition from the local environmental NGOs. It is to be expected that all those projects will be developed, although not within the projected time-plan. The NREAP (July 2010) includes the following information:

- *The Ministry of the environment and spatial planning will ensure the solving of the blocked SHP concession applications,*
- *The Ministry of the economy will provide the study of the costs and benefits of the existing SHP that will serve as a basis for the sustainable criteria, considering environmental, social and economic effects. The Action Plan's estimation of the SHP contribution shows very low increase of installed capacity and annual generation from 2005 to 2020 - 22% and 33% respectively.*

***Issues regarding environmental impact and mitigation measures*

The Government Decree of RBMP for Danube and Adriatic see (29.7.2011, Official Journal 61/2011) prohibits the use of water for electricity production if the MNQ at the intake is less than 0,02 m3/s and MQ is less than 0,8 m3/s. At the same time, the catchment area has to be bigger than 10 km2. Such restriction is blocking not only the new SHP, but also the ones under refurbishment – namely, they need to get the new permits in order to connect to the grid and sell electricity again.

The general atmosphere is quite tense regarding all renewable investments that are potentially causing any environmental impact. There is a public support towards the RES and lowering the GHG emissions, but when it comes to the particular projects the local community stands against it, even by principle and without waiting for and analysing the studies, assessments etc. Therefore, we could argue that the social acceptance is rather low which is due to the complicated administrative procedures, lack of knowledge and comprehensive information, as well as missing responsibilities of the investments opponents.

5. Prospects for Future and Recommendations

A)

- *The authorisation procedure must be simplified, shortened and accelerated.*
- *Some of the authorisation procedures could be transferred to the local authorities (e.g. for micro SHP under 100 kW).*
- *The authorities should do the preliminary work with identifying potential locations and perform all necessary legal and technical actions with these sites in order to allow one-stop-shop type of procedure.*
- *Standardise the application forms and make possible the electronic applications and procedure follow-up, also to ensure transparency.*
- *Standardise the grid access.*

B)

- *Compare the environmental demands with the positive impacts (energy, socio-demographic, local, employment, economy, environment...) of SHP. Then set the rule of using maximum of the available energy potential, limited by the minimum environmental requirements.*
- *No "go-no go" principle should be introduced in the planning approach at the ministry or government level.*
- *Harmonize the implementation of the WFD on the MS level with the RES-Directive declarations and Action Plans. No blockage due to the missing legislation should be allowed.*

C)

- *Decrease the investment insecurity by stabilizing the prices within the support system on a long-term, limit the duration of the administrative procedure*
- *Employ the financial responsibility for the opponents of the investments who are opposing them without solid grounds (like in the construction legislation).*
- *Increase the banking support and increase the trust among the banks and investors.*
- *Introduce the temporary excuse on taxes and other duties.*

SPAIN

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*1,788*	*1,837*	*1,926*	*2,185*
Generation (GWh)	*4,634*	*2,809*	*4,719*	*6,280*
Number of power plants	*900*	*937*	*1,047*	*1,100*
Potential (GWh)*	*3,215*	*5,040*	*4,757*	*1,569*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*384*
Employment	*1,485*
Civil works (estimation)	*371*
Average investment cost (€/MW)	*1,250,000 - 2,200,000*
Average O&M cost (as % of total investment cost)	*1.8 - 4*
Average civil works cost (as a % of total investment cost)	*50-70*
Average cost per kWh produced (€)	*0.075 - 0.11*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

6 - 10 years.

Residual flow regulation

There is no regulation published concerning the residual flow. A recommendation could be made in the sense that this flow should be variable during the year, to enable a better adjustment to the differences on the natural hydrological regime and to the spawning seasons.

Support scheme

There are two different support options (following the current promotion scheme as established through the Royal Decree 661/2007): a) feed-in tariff (FiT), b) market premium with a cap and a floor, on the sum of market price + premium.

For SHP with P<10 MW the FIT for the year 2012 is 8.6565c€/kWh for the first 25 years of operation and 7.7909 c€/kWh thereafter. For the premium option in 2012 the reference premium is 2.7795 c€/kWh for the first 25 years, and 1.4920c€/kWh thereafter. In 2012 the cap for the premium – independent from the plants operational lifetime - is 9.4557 c€/kWh and the floor is 7.2360 c€/kWh.

For SHP with 10 MW < P < 50 MW (which are still accounted as SHP in national statistics) the FiT in 2012 for the first 25 years is calculated by the formula {6.6+1.2 x [(50-P)/40]} x 1.125 c€/kWh, where P is the installed capacity. For the following years the tariff is given by {5.94+1.080 x [(50-P)/40]} x 1.125 c€/kWh. For the premium option in 2012 the reference premium is 2.2255 c€/kWh for the first 25 years, and 1.4920c€/kWh thereafter. The cap in 2012 for these kind of power plants – independent from the plants operational lifetime - is 8.8785 c€/kWh and the floor is 6.7921 c€/kWh.

For all existing and newly installed SHP, the tariffs, premiums and further complements are actualized annually following the inflation index IPC minus 0.25% until 2012 (inclusive) respectively -0.50% from 2013 onwards.

On the 27th of January 2012, the Spanish Council of Ministers approved a Royal Decree-Law "temporarily" suspending the FiT pre-allocation procedures and removing economic incentives for new power generation capacity involving cogeneration and renewable energy sources (RES-E).

Power granting schemes

New RES-E power plants must first inscribe their projects within the pre-allocation register (PAR) and to do so it is necessary to have (i) permits for grid access and connection for the total capacity to be installed, (ii) the administrative authorization for the RES-E plant (not necessary for power plants up to 100 kW of capacity), (iii) the building license to be issued by the corresponding local administration, (iv) a purchase agreement between the developer of the facility and the manufacturer or supplier of equipment for an amount equivalent to at least 50% of the equipment costs and (v) a proof of disposing of own economic resources or sufficient funding to undertake at least 50% of the investment of the facility, including the evacuation line and connection to the transmission or distribution grid.

4. Summary of the Current Status of Small Hydropower Development

In 1981, a first Royal Decree was approved establishing fixed tariffs for SHP and thereby paving the way for the Special regime for electricity production based on renewable energies, introduced in the mid-1990s in Spain. Besides, the development of SHP laid the ground for the involvement of the banking sector regarding financing renewables in Spain.

The installed capacity on SHP by the end of 2010 reached 1,926 MW. However, its average growth over the last 10 years barely reached 2.1% annually, which translates into a capacity increase of 36 MW per year, in average, due to a series of barriers that has been virtually paralyzed the sector. Thus it is not surprising that the goal of the previous Renewable Energies Plan (PER) 2005-2010 for SHP plants under 10 MW of 2,199 MW of total installed capacity in 2010 has clearly failed.

In Spain it is required six years in average to obtain the permits for construction and operation, and there are numerous requests for hydropower concessions pending for longer time, even reaching 20 years, resulting mainly from the lack of coordination between the different authorities responsible for the permit procedures. Furthermore, there are an increasing number of administrative and economic barriers for SHP through new preconditions for participating in the electricity market, such as the management of deviations, rules regarding the ride through of voltage dips and new flow measurement systems. Also, there is an increase of existing taxes, as building permits to introduce the electromechanical elements of the SHP, as well as new taxes and fees for the existence of reservoirs and later a qualified (real) property tax (IBI), royalties, land value taxes. Likewise there is a growing difficulty to obtain the necessary construction sites as the land owners are demanding higher compensations to make them available. It is important to also state the difficulty felt to obtain grid connection for affordable prices and that there have been problems with the expiration of concessions of existing plants with no solution on the horizon.

Other important administrative and economic hurdle is the pre-allocation register, where all renewable electricity production units must be included before being allowed to join the Special regime and that established a vast number of preconditions as described above (cf. Power granting schemes).

In the last months, a very strong barrier has been raising – the regulatory risk, related to the latest legislative changes in the remuneration rules of the Special regime, which includes even retroactive measures. All the uncertainty is leading to a greater difficulty on achieving financial support for new projects. Although the so called "moratorium" for new RES-E power plants adopted at the end of January 2012 does not affect facilities already in operation, or those already included in the pre-allocation registers, in the case of SHP, there have been several projects with investments already made to enter the FiT pre-allocation registers and which now see their investments made have lost their value from one day to the other.

It also important to state that in many cases, the environmental requirements for SHP are too restrictive and do not apply criteria that considers its benefits; an incoherent implementation of the Water Framework Directive (WFD) has also become a strong impediment for the SHP sector, by assuming hydropower as a menace for the water bodies and their ecological status, and by imposing restrictive administrative and environmental requirements, that lead to a decreasing number of hours of production and therefore to a lower profitability. This can be dramatic, especially taking into account that the current tariff level is quite low, particularly for rehabilitation, and that there is also a lack of knowledge about the water resources available; nevertheless, a diminishing of the water availability has been registered mainly affecting run-of-river SHP, resulting in a decrease in equivalent operating hours.

5. Prospects for Future and Recommendations

With the new moratorium in place, especially if it became effective for a longer period and having in mind the long lead times of new SHP facilities in Spain it is more than likely that the new national SHP target for 2020 (both in the Spanish NREAP as in the new PER 2011-2020) of 2.185 MW by 2020 won't be fulfilled. The new SHP target will lead in fact to a decrease concerning the share of installed SHP capacity in the RES power mix from 4.9% in 2010 to 3.4% by 2020 respectively from 5.5% in 2010 to 4.5% in 2020 regarding RES electricity generation.

In any case, even to fulfil these (very) modest SHP targets for 2020, besides maintaining a stable and foreseeable support scheme for SHP within the Special regime, it will be necessary to establish measures as the following:

New rules for administrative procedures and concessions

Streamlining of current procedures for water planning in the river sections where hydropower plants can be implemented under certain conditions, such as residual flows.

- Establish a new unified administrative procedure for water concessions, or modification of the existing ones, applicable for hydropower plants up to 50 MW.

Promotion of tenders in existing public infrastructures, with new rules for the renovation of concessions and the possibility of modification of concessions already granted.

Establishment of the possibility of modification of water concessions granted for electricity generation by the responsible authority, without having to begin the process of competition in those cases where the modification does not cause an increase or decrease of the maximum flow nor of the capacity installed greater than 50% of the originally amounts granted and consistent with the River Basin Management Plan in force.

New frameworks/incentives for new types of plants and for rehabilitation, modernization and replacement of facilities

Develop a regulatory framework to promote the development of new reversible hydropower plants or expanding existing ones, taking advantage of existing infrastructure, consistent with current water planning and preserving the environmental values.

Incentivize the rehabilitation, modernization and/or replacement of existing SHP.

New feasibility studies

Promote the rise of the available hydropower potential in the territory of the Hydrographic Confederations by conducting specific studies to analyse the technical, economic and environmental feasibility of up to 41 state-owned dams to be used as hydropower plants and drafting of the specifications that will serve as a basis to prepare tenders for those who finally will be classified as viable.

SWEDEN

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*1,073*	*1,093*	*1,194*	*1,230*
Generation (GWh)	*4,464*	*4,547*	*4,571*	*5,500*
Number of power plants	*1,860*	*1,882*	*1,901*	*1,960*
Potential (GWh)*	*2,540*	*2,450*	*2,450*	*1,500*

** Only economic potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*380*
Employment	*520*
Civil works (estimation)	*120*
Average investment cost (€/MW)	*3,120,000 - 3,500,000*
Average O&M cost (as % of total investment cost)	*3%*
Average civil works cost (as a % of total investment cost)	*50%*
Average cost per kWh produced (€)	*0.025 - 0.08*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

2 – 7 years, with an average of about 5 years.

Residual flow regulation

Not regulated in law in general. But for existing plants a trial may be made which mostly lead to demands on residual flow 5 – 20 % without any compensation to the owner.

Support scheme

The electricity certificate is a market-based support system for renewable electricity production. The system came into force on the 1st of May 2003 and is intended to increase the production of renewable electricity and also to make the production more cost-efficient. The objective of the Swedish electricity certificate system is to increase the

production of renewable electricity with 25 TWh by the year 2020 compared to the year 2002.

From January 1st 2012, Sweden and Norway have a common electricity certificate market. Over the period until 2020, the two countries aim to increase their production of electricity from renewable energy sources by 26.4 TWh. The joint market will permit trading in both Swedish and Norwegian certificates, and receive certificates for renewable electricity production in either country.

Producers entitled to certificates are in general new renewable and in detail for hydro power:

- *"small-scale hydro power which, at the end of April 2003, had a maximum installed capacity of 1500 kW per production unit, (a majority of the SHP in this group will be taken out from the system by the end of year 2012 if not refurbished to a standard similar to a new plant and have received the Energy Agency's acceptance)*
- *new plants,*
- *resumed operation from plants that had been closed,*
- *increased production capacity from existing plants,*
- *plants that can no longer operate in an economically viable manner due to decisions by the authorities, or to extensive rebuilding.*

The Bill submitted by the Government to Parliament in the spring of 2011 proposes tightening up the qualification requirements for hydro power."

On top of the incomes from selling power to the market producers of electricity in approved plants are allocated one certificate unit for each megawatt-hour (MWh) of electricity for up to 15 years. The price for certificates has so far varied approximately between 1.1 c€/kWh (June 2003) and 4.0 c€/kWh (August 2008).

Ultimately it is the end users that have to bear the cost for the certificates. Since some years it is the power traders that have to manage the quota obligation for their customers. The price for certificates is set by the interaction between the supply and demand like any other market. The certificate system will run until the end of 2035.

Source: Swedish Energy Agency

Power granting schemes

To get permission to build a hydroelectric power plant and to generate electricity requires control of more than 50% of the current case, an Environmental Impact Assessment and the recommendation of the Environment Court hearing the case.

Environmental Impact Assessment (EIA) is an important document that describes the overall consequences of the construction of hydropower plants and also a legal part. The document provides overall assessment of direct and indirect effects on humans, animals, plants, soil, water, air, climate, landscape, cultural heritage, conservation of land, water and other resource management of a hydroelectric power plant is built. The EIA also includes consultations, meetings with individuals and organizations. After completing the EIA and attached to the permit application for water activities it is sent to the Environment Court for trial.

The Environment Court receives the application that in addition to EIA also contains other information such as drawings and technical description. The application is sent to the county, and Administrative Services Agency, the Municipality, Environmental

Protection Agency and the affected parties for comment on the planned activities for comments. This is followed by a hearing and usually two months later a final judgment. The judgment can then be appealed to the Environmental Court.

The costs of environmental court's handling of a permit application is paid by the applicant and varies approximately between €150 to €10 000.

Review of the permit may then occur after 10 years. The review assesses the benefits of a measure compared to its consistency. This often leads to the water plant's owners forced to give 5 to 20 per cent of the water flow without compensation.

4. Summary of the Current Status of Small Hydropower Development

The situation for SHP in Sweden is unchanged or has decreased especially for smaller SHP, less than 100 kW, during the last years.

Support scheme: Many older SHP are now phased out of the Swedish support scheme if not undergoing large refurbishment. To be entitled for a new period of 15 years it is required that the plants must undergo total refurbishment of all essential parts. As this is very expensive and not economically viable for smaller SHP, approximately less than 100 kW, these are facing an uncertain future.

Administration: There are no changes expected for permitting, simplification of administration procedures, SHP role with grid development etc.

The Renewable Directive (2020-directive) has not meant any changes for SHP in Sweden. The Water Framework (WFD) Directive now implanted in the Swedish law in conjunction with other actions means greater demands on hydropower. Questioned experts of the hydropower industry in Sweden are of the opinion that specific points from WFD when taken in isolation may not easily be proven. However the cumulative impact of all the points when considering together do make it likely that this interpretation is correct.. In addition, on-going work as the Government's inquiry "Water Activities" to be reported June 30, 2013 is expected to lead to even more demands. But there is also ongoing work in order to create dialogue on renewable energy and environmental goals for water and water management. The Swedish Agency for Marine and Water Management is together with other national authorities and many NGOs to bring greater consensus on water power, together with representatives of different groups. In the work to be presented in October 31, 2012 participates among others the Swedish Hydropower Association.

Development: from 2007 onwards with prospects in the view of 2020 new targets are few. Not many new plants are built but refurbishment is being made including upgrading especially for larger SHP. For smaller SHP with higher cost per produced kWh the outcome for investment is more insecure and it can be assumed that for them less refurbishment will be made.

General atmosphere: from the public support for SHP development & social acceptance is still high according to public institutions as the SOM institute in Gothenburg. But there are also associations that are questioning hydropower and especially SHP. Some owners of hydropower plants experiencing that politicians and especially authorities are not asking for a dialogue. If the on-going dialog described above between different associations and opinions will change this is still to be seen

5. Prospects for Future and Recommendations

- *That no review of, or restriction on, the authorization or water permits may be made without: That it is done on a strictly factual basis, That full market*

compensation paid to the owner of hydroelectric power plant, All costs for investigations, etc. paid for by the person seeking review / restriction.

- *Decrease the barriers for developing SHP by setting up clear rules and timeframes in the licensing process. Especially for SHP temporarily stopped or for pounds or dams that can be used for generating electricity if adding turbine and other sufficient equipment.*
- *Clear recommendations on how to interpret the Renewable Energy Directive 2009/28/EC and the WFD that appears to be contradictory.*

UNITED KINGDOM

1. Key Figures

Small hydropower	2005	2007	2010	2020
Total installed capacity (MW)	*158*	*181*	*230*	*350*
Generation (GWh)	*443*	*603*	*750*	*1,100*
Number of power plants	*60*	*86*	*120*	*160*
Potential (GWh)*	*2,660*	*2,500*	*2,353*	2,003

** Only economical potential (GWh) with environmental constraints*

2. Industry and Markets

Small hydropower	2010
Number of companies	*226*
Employment	*4,526*
Civil works (estimation)	*200*
Average investment cost (€/MW)	*2,000,000 - 12,000,000*
Average O&M cost (as % of total investment cost)	*4.7%*
Average civil works cost (as a % of total investment cost)	*55%*
Average cost per kWh produced (€)	*0.07*

3. Legislation and Incentive Schemes

Average duration of authorisation procedure

For a new small hydro project, the time taken to obtain environmental consents, planning permission and accreditation from the electricity regulator (Ofgem) varies from

1 to 3 years. Appeals against refusal of environmental and planning permissions take from 6 months to 1 year.

Residual flow regulation

1) *England and Wales: The Environment Agency's "Good Practice Guidelines to the Hydropower Handbook" published August 2009 for low head sites relate residual flow to "Hands off flow" (HOF). A table is provided to indicate minimum HOFs for various river types and lengths of depleted reach. Values vary from Q95 to Q85. The guidance is being reviewed at present (Spring 2012) and will include high head applications.*
2) *Scotland: The Scottish Environmental Protection Agency (SEPA) published "Guidance for Applicants on supporting information requirements for hydropower applications" in December 2010. The default residual flow is Q95 but each project must be reviewed individually.*
3) *Northern Ireland: The Northern Ireland Environment Agency (NIEA) has "Guidance for Run-of-River hydropower schemes in Northern Ireland" published in July 2011. The default residual flow is Q95 but, under certain categories of river and river protection, this can increase to Q80.*

Support scheme

Renewables Obligation (RO)

The RO came into effect in 2002 in England, Wales and Scotland and in 2005 in Northern Ireland. It places an obligation on UK electricity suppliers to source an increasing proportion of electricity they supply to customers from renewable sources.
Renewables Obligation Certificates (ROCs) are green certificates issued to operators of accredited renewable generating stations for the renewable electricity they generate. ROCs can then trade with other parties. They are used by suppliers to demonstrate that they have met their obligation. ROCs are now available over 50kW plant capacity except in Northern Ireland. ROCs are due to be phased-out in 2027. A recent review of the ROC banding system proposed that hydro should, from 2017, receive only half the ROC value per MWh than is enjoyed at present. (See note in Sections 4 & 5 below)

Feed-in Tariffs (FiTs)

FiTs were introduced to all UK apart from Northern Ireland in April 2010. FiTs are available for RE projects up to 5 MW capacity. As a result of the UK Government spending review from late 2010, the FiT system is being subjected to an early review. Consultations on new proposals closed 26 April 2012 and implementation is expected about October 2012. Proposed 2013 tariffs for hydro are:

- *Up to15k W - €0.261*
- *15 to 100 kW- €0,245*
- *100 to 2,000 kW- €0.151*
- *2,000 to 5,000 kW- €0,560 or €0,286 (see note in Sections 4 & 5 below)*

Power granting schemes

Every hydro project must have three permissions before it can be built and generate electricity:
1) Environmental licence. This is normally covered by separate licences to abstract, impound and transfer water whichever apply to the project. (called a "CAR licence" in Scotland) Licences are granted by the relevant regional environment agency (see

"Residual Flow Regulation) and can include input from other environmental groups especially fishing interests.
2) Planning Permission. This is permission to build the project including any restrictions on design, construction and amenities which are relevant. Permission will also include compliance with the environmental permits as described above. Planning permission is administered by regional councils or National Park authorities. An appeal system can be followed if the developer feels that either the environmental or planning permissions are unjust.
3) Accreditation to generate and export electricity. This permit is provided through Ofgem, the UK-wide electricity and gas regulator. Permission will depend on the generator's technical ability to produce and deliver electricity. Ofgem then administers payment for electricity produced vie ROCs or FiTs.

4. Summary of the Current Status of Small Hydropower Development

Status of hydropower development in the UK and incentive programmes

From the 1960s to 2000 there had been very little new hydro development in the UK. Generation from gas and the resulting low electricity process and the monopoly of the three government-owned electricity utilities meant that the relatively expensive initial costs of hydro was non-conducive to tap remaining potential. In the 1990s the realisation that renewable energy was becoming more essential to offset the use of fossil fuels and the increasing desire for security of energy supplies caused the introduction of the "Non-Fossil Fuel Obligation" (NFFO). Generators had to provide part of their electricity from renewable sources. And higher than normal tariff incentives were introduced. This kick-started new hydro schemes but at a very slow pace and NFFO was eventually dropped and considered a fundamentally flawed scheme.

Since 2000 there has been a massive increase in the desire for new and refurbished hydroelectric projects to be built. This was as a result of the introduction of the "Renewable Obligation" with its associated Renewable Obligation Certificates (see above). The means by which RE developers benefitted via a government-lead initiative based on payment via the nation's electricity bills was seen as fair and resulted in a surge to generate RE power with wind being the biggest and quickest technology to benefit and develop. Hydro development also grew and new SHP schemes and refurbishment of old plant up to 20 MW capacity saw immediate benefits. In 2010 a Feed-in Tariff system was also introduced to incentivise the lower generation area (up to 5MW) and, in particular, to individuals and communities to promote RE projects. There was again a strong upsurge of interest in hydropower development. Unfortunately, a combination of economic recession and the introduction of an excessively high tariff for PV Solar threatened funding of the FiT system and a review was called by the Government in late 2010. Uncertainty followed and projects put "on-hold" indefinitely. Hydropower suffered most because banks refused to lend money and, with the very high initial costs and long gestation periods from project initiation to first generation, developers would be foolish to embark on any construction or order any generating equipment. In January 2012 the Department of Energy and Climate Change (DECC) started a consultation into a revised FiT system, the results of which should be implemented in late 2012 with new tariffs applicable from April 2013. Stability has been resumed and some of the uncertainty expelled for the hydropower sector but the overall effect of the review will not be known until the autumn of 2012.

Observations on the present position of hydropower in the UK

Effects of RES and WFD on hydropower

It is clear that within all permitting areas the WFD is well known but little is known or understood about RES. It could be that WFD has a direct impact on the ability of a hydro scheme to be developed or not but RES is basically a national target for renewable energy development and has very little impact on individual schemes. The incentives to develop RE are generally seen as a national need and are never related to meeting RES targets.

The Department for Food and Rural Affairs (DEFRA) administers the WFD in the UK. It is never clear whether DEFRA and DECC consider the conflict between the two directives with regard to hydropower development. DECC is certainly involved with development of guidance on water abstraction etc. at working-group level.

The environment agencies naturally quote WFD in their permitting process. Scotland and N Ireland also consider clause 4.7 but there is little evidence of it being considered in England and Wales.

Environmental permitting

The major issue on the development of environmental guidance for hydro and the permitting process is the opposition to hydropower by a very strong angling lobby throughout the UK. Attempts to have true evidence-based legislation are overridden by the lobbyists if they feel any threat to angling exists. One group had four very public campaigns against hydropower in 2011 alone.

The permitting process, in these effectively early days of new hydro development, can be long and tortuous. However there are signs that with attempts to speed-up the process and the familiarity brought about by increased numbers of applications permitting is getting more streamlined. However, this is not always the case.

Major issues which affect hydro developments are:

- *A desire to remove all "obstructions" in rivers to allow the free passage of fish. DEFRA has provided funds for Rivers Trusts to clean-up rivers and the removal of barriers is seen as the most effective means.*
- *Impending legislation on fish passage which will call for the removal of barriers or the instigation of fish passes at the landowner's expense.*
- *In England and Wales there is a growing requirement for "splitting" the flow above residual flow values between the hydro scheme and the river. This is being consulted on and reviewed by a working group comprising the Environment Agency and stakeholders (DECC, hydro and angling). Initially no evidence for flow splitting is apparent.*

UK Hydropower targets for 2020

From 2011, a further 485 MW was needed to be developed to meet the 2020 targets. This would all come from small hydro (up to 10 MW). With the delays in getting serious hydro construction started owing to the uncertainties surrounding the FiT, this means that approximately 50 MW per year is required. In deliberation with DECC, the UK hydropower industry has calculated that, with present capabilities, a maximum of 40 MW per year is possible. Discussions continue to see how the present rate of development could be accelerated.

Status of hydropower in the UK

Despite the issues which adversely affect the progress of hydropower in the UK, there is a general optimistic feeling within the industry. It always suffers from the very large amount of renewable energy which is promised from onshore and offshore wind and

this periodically affects the support which hydropower gets from Central Government. However, the ROC and FiT incentives have caused a real renaissance affecting all aspects and players in the industry. The number of interested parties from businesses, communities and individuals continues to grow. DECC now develops policies with the assistance of the industry and now realises that hydro is a unique renewable form of energy and, despite its position as a developed technology, is different from other technologies in many ways and still has room for innovation.

5. Prospects for Future and Recommendations

Consistency of environmental permitting

As indicated earlier, environmental permitting varies greatly between each of the UK'S nation states. Implementation of the WFD should be consistent through the development of standards by UK Technical Advisory Group (UKTAG) but, especially with regard to river environment standards this work is inconsistent owing to lack of scientific evidence. There is therefore a great deal of individual observational and assumed characteristics which is embedded within the permitting process. Similar hydro schemes in different parts of the country are suffering sometimes completely opposed regulations. There is therefore a need to:

- *Gather more evidence in sensitive areas (especially flows available to hydro schemes);*
- *Provide more consistent guidance;*
- *Ensure that stakeholders have their say but that they do not veer from their brief;*
- *Have more realistic talks between DECC and DEFRA on the effect of punitive regulation on UK hydro 2020 targets.*

Accelerate attention to grid issues

DECC and OFGEM should complete work urgently on how hydropower projects are defined in order to clarify the use of private wires, remove uncertainty which interconnector defines the FiT rate and issue plans for improving grid access mainly in Scotland.

Review proposals for ROC/Fit rate and tariff for hydropower above 2 MW

The review of ROC banding suggested halving the payment per MWh from 1 ROC to 0.5 MW for hydropower. The hydropower industry proved that the reason which DECC provided for this was based on incorrect evidence. There is a hope that this might be sufficient to return at least to 1 ROC on completion of DECCs review of the consultation. However, if it does not then no hydropower above 2 MW will be developed severely threatening the 2020 targets. It also threatens to halve the FiT tariff between 2 and 5 MW which will add to the same conclusion. The UK hydropower sector therefore strongly advises DECC that there must be no halving of tariffs for hydropower under either the FiT or ROC regimes.

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