ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

SITUATION REPORT ON HYDROPOWER GENERATION IN THE ALPINE REGION FOCUSING ON SMALL HYDROPOWER

IMPRINT

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INDEX

EXECUTIVE SUMMARY

The Second Report on the State of the Alps has revealed a high number of hydropower stations already in place as well as their considerable impacts on ecology of waters. Nevertheless the Alps as a whole still possesses the technical potential for further hydropower generation. This holds true for small as well as for large hydropower.

The goal of this report is thus to provide substantial background information on hydropower (with a focus on small hydropower) in order to provide the basis for the elaboration of "Common Guidelines for the Use of Small Hydropower in the Alpine Region" mandated by the Xth Ministerial Conference of the Alpine Conference in Evian, March 2009.

The basis of this report is information received from Austria, Germany, Italy, Liechtenstein and Switzerland (for details please see annex 1) based on templates circulated to all countries within the Alpine area (Monaco has no hydropower sites and has thus been excluded).

This report covers a broad range of issues; however – acknowledging the complexity of the issue – it refrains from going into very detail by focusing strictly on the goals of the report to provide a brief orientation and a frame for drafting the common guidelines.

Key findings and conclusions are:

- **No need for new guidance with regard to residual flows and fish passes at present:** all countries – answering the templates – have appropriate national provisions for environmental residual (minimum) flows as well as provisions for fish passes to be applied to new projects. However, it may be necessary in the future to revise those provisions in-place to take into account changes in river flows due to climate change. Therefore no further work was undertaken with regard to residual flows and fish passes in order not to duplicate national efforts already in place. No major added value was seen in drafting general guidances covering the whole Alpine area. Work thus focused on providing the basis for the guidelines covering the use of small hydropower including common principles and recommendations, on an outline for an assessment procedure as well as on evaluation criteria.

- **High number of requests for licenses / authorisations:** Several hundred applications for new small hydropower stations have been reported across the whole Alpine area (with considerable differences of number between countries), which if realised will add to the high number of facilities already in place. This boom is understood to have been triggered, in particular by the financial incentives and support schemes in place in all the Alpine countries. The most widespread support is via feed-in-tariffs; however the form as well as the amount of subsidies differ considerably between countries.

  This boom presents a challenge to competent authorities in handling the huge amount of applications and deciding on authorisations for new facilities due to variety of aspects that have to be taken into account (energy generation, CO2 emission reduction, ecological impact).

- **Need for common guidelines:** A factor adding to the difficulties presented by the high number of applications for new facilities is that there are no criteria for a general approval in place. Decisions on new facilities are mostly determined for sites individually (with the exception that in some countries, projects within National Parks, Nature2000-Sites, etc. are generally rejected). So far authorisations seem to be based mainly on the assessment of impacts of the individual facility on the actual site. In line with provisions of the EU Water Framework Directive together with ecological needs and cumulative effects, a more holistic assessment needs to be carried out for new modifications affecting water status. This includes the impact on the ecological status of the river stretch in which the project is situated, the impacts on other river stretches, and, in case of several projects in the same river catchment, the cumulative effects of the various projects.

  Master Plans, action plans or strategies for the development of hydropower (in EU countries driven by the "20-20-20 targets") are mostly not yet in place. The same holds true for pre-planning mechanisms with regard to the identification of both the remaining potential and ecological compatibility. However, feedback provided indicates that efforts in this direction are under way. The forthcoming common guidelines will certainly support these ongoing efforts.

- **Try to acitivate the hydroelectric potential of facilities in place via refurbishment and modernisation:** One of the main results of the report on "Water and Water Management Issues – Report on the State of the Alps" was that quite a number of facilities in place (having got authorisations in the past without approriate environmental provisions) do not meet up-to-date ecological criteria with regard to fish passes, minimum residual flows, etc., as now imposed on new projects. Legal provisions in place to enhance ecological status go hand-in-hand with the provision of economic incentives to make such enhancements. These incentives include direct grants and increased feed-in-tariffs as well as "green labels" to get higher prices on the market. Good practise examples reported include initiatives to refurbish and modernise facilities in place leading to both improvement in ecological status and enhanced output of hydropower generation.
- **Contribution of small hydropower to overall hydropower generation:** The term "small hydropower" is frequently used in discussions on the generation of renewable energy and usually defined according to the characteristic figure for the bottleneck capacity. However the threshold for small hydropower is tailored to national needs and thus differs from less than 10 MW to less than 1 MW.

  From the collected data on hydropower plants it is evident that the larger plants contribute by far the major share of total electricity production from HP , i.e. over 95% of the total production comes from facilities with > 1MW power output. Plants with a capacity of less than 1 MW constitute around 75% of all HP plants within the Alpine area but contribute less than 5% to the total electricity production. The smaller the capacity class, the greater is the ratio between number of plants and contribution to the total hydroelectric production.

Based on the facts and findings presented in the report, the key conclusion is that due care and planning on a regional basis is considered necessary when deciding about new SHP facilities in order to ensure that further development of hydropower is compatible with environmental protection requirements as well as with the ambitious targets set for renewable energy. This explains the need for decision aid and common guidelines.

1 INTRODUCTION

1.1 Initial Situation and motivation of the report

The Second Report on the State of the Alps has revealed a high number of hydropower stations already in place as well as their considerable impacts on ecology of waters. Nevertheless the Alps as a whole still provide technical potential for further hydropower generation. This holds true for small as well as for large hydropower thus providing the prerequisites for further development; this is in spite high level of exploitation already achieved and the impacts on riverine ecology.

The development of the hydropower sector is strongly driven by the need to achieve the objectives of climate and energy policies by promoting renewable energy. The Renewable Energy Source Directive (RES) (Directive 2001/77/EC) aims at a significant increase in the contribution of renewable energy to electricity production. The most recent development in this respect at EU level was the adoption of Directive 2009/28/EC which sets ambitious targets for all EU Member States, in order to reach a 20% share of energy from renewable sources by 2020. Analogous, the Swiss Federal Energy Act stipulates growth targets for production from renewables. In order to achieve these objectives, most of the Alpine countries have established comprehensive support schemes for renewable electricity production.

In this context, Alpine countries have recently experienced increasing demands for the development of hydropower, leading to increasing applications for new hydropower facilities, in particular for small and micro hydropower stations. The support schemes provided seem to be sufficiently attractive financially to have triggered the present boom of small hydropower facilities (including micro hydropower plants).

While the development of renewable energy, including hydropower, should be strongly supported, it is equally important that such development takes place in a manner compatible with environmental protection requirements as well as encouraging a more efficient, and therefore more sustainable, use of energy.

At the Xth Alpine Conference in March 2009, the Ministers and High Representatives of the Alpine countries decided to set up the platform "Water Management in the Alps". Due to the importance of the above developments, one of the topics listed in the platform's mandate is the elaboration of recommendations for the sustainable use of hydropower generation with a focus on small hydropower. Additionally, the Climate Action Plan of the Alpine Convention, which was also adopted at the Xth Alpine Conference, requests the development of guidelines for the construction, optimisation and refurbishment of small hydropower facilities in order to lessen the impact on the aquatic biocenosis and biodiversity.

Hand in hand with decisions at the Alpine Conference, the "ArgeAlp" (Arbeitsgemeinschaft Alpenländer / Comunità di Lavoro delle Regioni Alpine) proposed at the 40th Intergovernmental Conference in June 2009 to "differentiate, concretise and optimise environmental regulations in order to enable customised solutions for individual hydropower stations" together with "promotion of small hydropower through information on the possibilities and by identification of suitable sites, taking into account the particular ecological sensitivity of the Alpine area."

Hence, while developing guidelines for the use of small hydropower, the work of the "Platform Water Management in the Alps" can

- Help to develop a common understanding on the topic hydropower in the Alps;
- Contribute to increase the efficiency of facilities and lessen their impact on the aquatic environment and the landscape via the exchange of good-practice examples;
- Support the competent authorities in deciding on appropriate ways for granting permission for new hydropower stations;
- Increase transparency, accelerate approval procedures and consequently facilitate the achievement of objectives of energy policies;
- Help to preserve river stretches in pristine condition and therefore
- Contribute towards policy integration by striking a balance between economic requirements and ecological and landscape needs while taking into account social concerns.

These aims also correspond with one of the main conclusions drawn in the frame of the European-funded SHERPA project - Small Hydro Energy Efficient Promotion Campaign Action: "Other essential elements are an increase of transparency in decision making, not only in data and procedures, but also in economic considerations, and an enhancement of the dialogue and the co-operation between the different competent authorities, stakeholders and NGOs, to achieve a good balance between water uses and protection".[1]

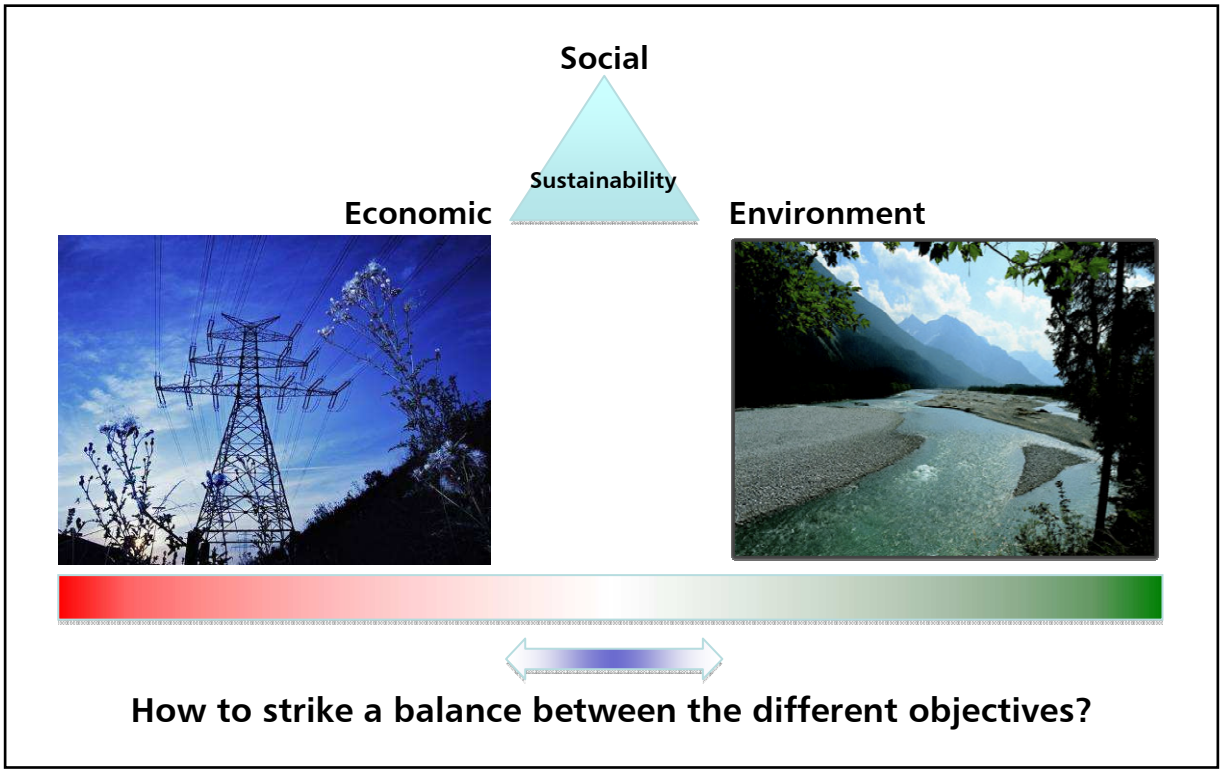


Figure 1: Striking the balance represents a challenge

1.2 Goal of the report

Achieving the objective of raising the share of renewable energy requires not only measures increase the generation from renewable sources but simultaneously an increase in energy efficiency and further efforts on the demand side. However, since this report is directed at the development of guidelines for small hydropower generation in the Alps, its focus is mainly on hydropower generation and therefore on the production side.

[1] SHERPA, 2008a. HYDRorPOWER? Assessment, at river basin level, of possible hydropower productivity with reference to objectives and targets set by WFD and RES-e directives. SHERPA project – Small Hydro Energy Efficient Promotion Campaign Action.

The report endeavours to provide substantial background information mainly on small hydropower in order to

1) Highlight the motivation and rationale behind the task of developing guidelines on small hydropower;
2) Facilitate the development of the guidelines by providing data on the situation of the hydropower sector and the policy framework in the individual Alpine countries;
3) Act as a supporting tool with additional information to enable a better understanding of the overall situation and the guidelines themselves.

Figure 2: The Situation Report as the fundament of the Common Guidelines on Small Hydropower

Finally, different policies need not necessarily conflict; there is room for significant progress in policy integration by enhancing the recognition of the different interests, fostering co-operation between the different competent authorities and stakeholders and promoting more integrated development strategies. This will require effort and understanding from all parties involved. The Platform "Water Management in the Alps" aims at contributing towards the achievement of those objectives by providing the following deliverables (cf. fig. 2):

- the present situation report
- common guidelines for the use of small hydropower in the Alpine region[2] and last but certainly not least

[2] Alpine Convention - Platform water management in the Alps (2011): Common guidelines for the use of small hydropower in the Alpine region.

- a set of Good Practice Examples covering a broad range of issues including planning mechanisms, strategies, innovative concepts and refurbishment of hydropower plants.

1.3 Definition 'Small Hydropower'

The term 'small hydropower' is frequently used in discussions on the generation of renewable energy although there does not exist a common international definition. The same is also the case for the countries of the Alps.

As a general rule, small hydropower is defined according to the installed bottleneck capacity. Such a technical definition of small hydropower is also used as threshold value for legal and economic aspects (legal frame for environmental impact assessments (EIA), entitlements for subsidies, etc.). The term small hydropower is used here with respect to the thresholds of installed capacity as defined in the legal frame of the individual countries.

The table below provides an overview of the different threshold values in the Alpine countries.

COUNTRY	THRESHOLD VALUE FOR DEFINITION SHP [MW]
Austria	< 10 MW
Germany	< 1 MW
France[3]	Multiple definition: < 4,5 or < 10 or < 12
Italy	Double definition: < 1 or < 3 MW
Slovenia	< 10 MW
Switzerland	< 10 MW
Liechtenstein	< 10 MW
Monaco	No hydropower

Table 1: Overview on the threshold values for the definition of "Small Hydropower" in the Alpine countries

As represented in Table 1, currently there is no international consensus on a technical threshold value defining the boundary between small and large hydropower. The most common threshold value in use in the Alpine countries is the bottleneck capacity of 10 MW. This value is also used by statistical agencies at European level (i.e. Eurostat).

[3] SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

However, although a defined threshold value can be of relevance e.g. for gaining investment support or guaranteed feed-in tariffs, environmental legislation such as the EU Water Framework Directive does not differentiate between small and large hydropower stations. The same environmental obligations (e.g. sufficient residual water or fish migration aids etc. in order to achieve the 'good ecological status' or the 'good ecological potential') have to be fulfilled in the same way for river stretches utilised for small or large facilities.

For the sake of this report and the development of guidelines, a unique definition of SHP within the Alps is not considered to be of major relevance since small and large hydropower in principle cause similar environmental impacts and can therefore be addressed by similar criteria. Exceptions from the rule are environmental impacts caused by hydro-peaking, which mostly result from storage power plants fed by alpine reservoirs.

1.4 Data base

1.4.1 Data request from Alpine countries

The collection of data from Alpine countries served as the main information basis for the development of the report. For this purpose, a data template (Annex 1) on statistical information, the regulatory as well as the policy framework has been developed and sent out to the country representatives. Figure 3 provides an overview on the received feedback, split up for the different countries regarding the individual shares of the Alpine area respectively the individual shares of the total Alpine population. Most of the analyses in the following chapters build on this received information.

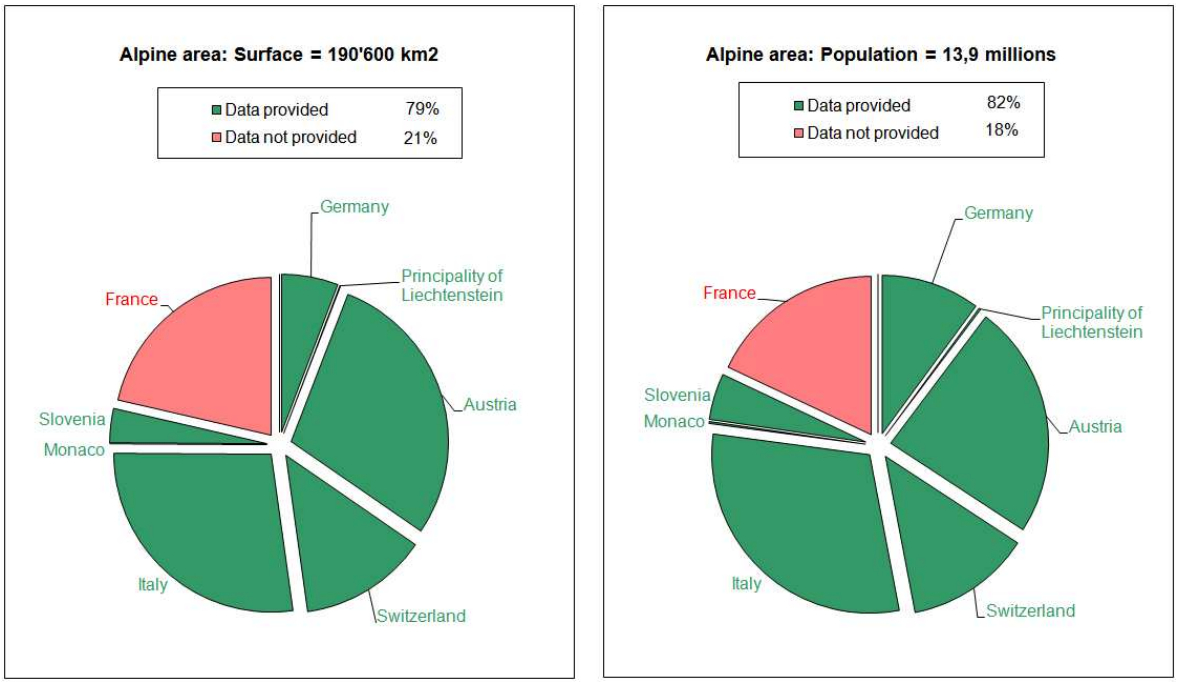


Figure 3: Overview on data delivery from Alpine countries (Status: April 2010) - left: surface pro rata; right: population pro rata

1.4.2 Data from other sources

Along with the data request from the Alpine countries, additional sources for information have been consulted. The main sources in this respect are the results of the European-funded SHERPA project - Small Hydro Energy Efficient Promotion Campaign Action, running from 2006 to 2008 as well as publications of the European Small Hydropower Association (ESHA), which was also the coordinator of the SHERPA project.[4]

[4] ESHA, 2006. State of the Art of Small Hydropower in EU -25. European Small Hydropower Association. Brussels. Other related material can be obtained from the ESHA website (http://www.esha.be/).

2 BACKGROUND INFORMATION

2.1 Key data for the use of Small Hydropower in Europe

In the year 2010 more than 21.000 Small Hydropower plants were in place in the 27 EU countries, according to information contributed by ESHA, with a total installed capacity of over 13.000 MW bottleneck capacity. They produce 41.000 GWh electricity per year.

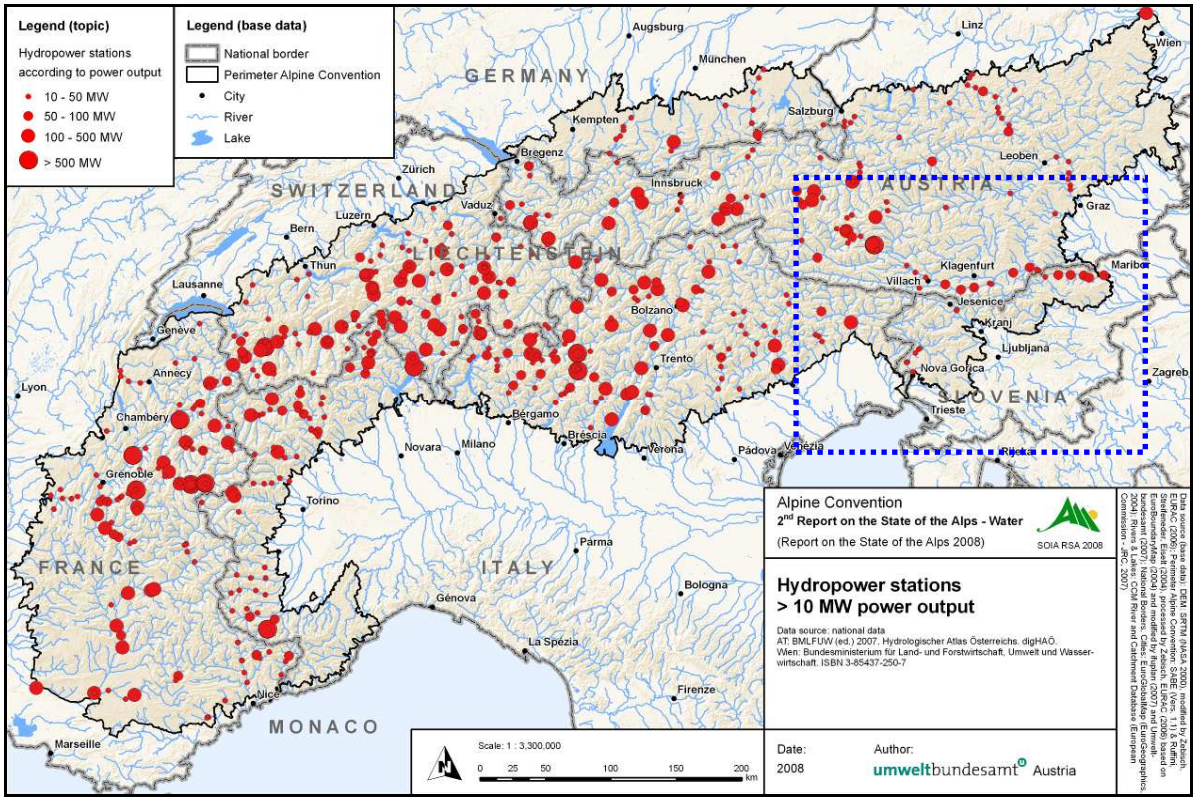
According to the ESHA data, in the EU-27 countries more than 90 % of the installed capacity is concentrated in six member states. The leading countries with respect to installed capacity in the EU-27 are Italy (21 %), France (17,5 %), Spain (15,5 %), Germany (14 %), Austria (9,4 %) and Sweden (7,7 %). Small hydropower has also great importance in the Non-EU countries Switzerland and Norway.

2.2 Hydropower generation in the Alps

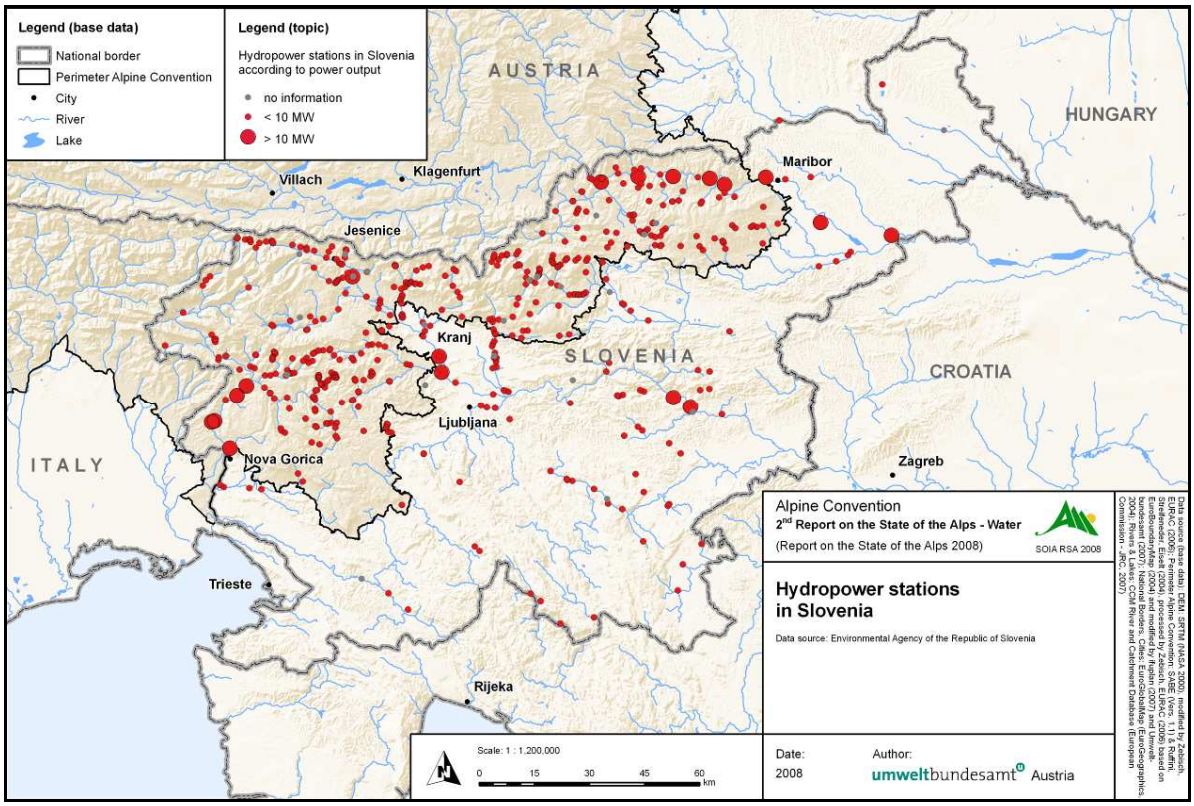
The Alps are poor in terms of natural resources like fossil oil or coal compared to other regions of Europe. Therefore, the use of the "mechanical power" of water has always been of vital interest for the Alpine population in order to meet energy needs.

Using the energy potential of water is not new to people living in the Alps. For centuries water was used to power flour, saw or hammer mills – technologies, which were introduced in order to substitute human manual labour. Later on, during the 20th century, this early form of use of hydropower was replaced by modern hydropower plants for electricity production as we know it today. Potentials for hydropower generation were further developed in the Alps, resulting in the present situation which is illustrated in Map 1, showing approximately 550 large hydropower stations with a power output greater than 10 MW in the Alps.

In addition to large hydropower stations, there are thousands of smaller hydropower stations with capacities of less than 10 Megawatt in place. Map 2 gives an example for the Slovenian situation which is fairly representative of the entire Alpine arc.



Map 1: Large hydropower stations with capacities of more than 10MW in the Alps. The blue frame indicates the section of the map which is displayed in Map 2. (Source: 2nd Report on the State of the Alps)



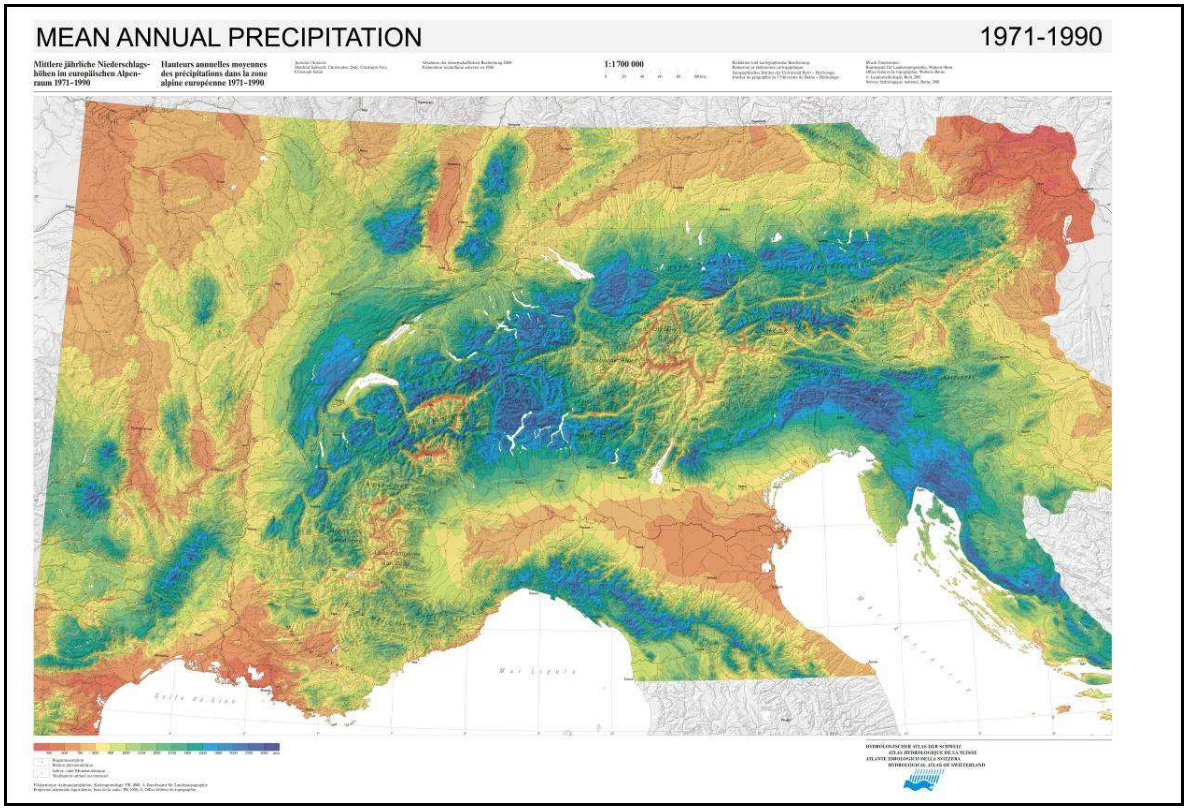
Map 2: Large and small hydropower stations in Slovenia. (Source: 2nd Report on the State of the Alps[5])

The reason for the attractiveness of hydropower generation in the Alps can be found in the perfect pre-conditions.

Steep slopes in combination with high precipitation (Map 3), which can exceed 3.500 mm per year in some areas, result in perfect site conditions for electricity production and make hydropower generation an important economic factor for Alpine countries. For additional information on hydropower generation in the Alps, see chapter B 3.4 of the 2nd Report of the State of the Alps[6].

[5] http://www.alpconv.org/documents/Permanent_Secretariat/web/RSAII/20090625_RSA_II_long.pdf

[6] http://www.alpconv.org/documents/Permanent_Secretariat/web/RSAII/20090625_RSA_II_long.pdf



Map 3: Precipitation (Source: 2nd Report on the State of the Alps)

Growing energy demand, increased electricity prices as well as targets for reducing greenhouse gas emissions act as drivers for further expansion of hydropower generation and additional facilities. However these developments in turn put pressure on the ecological status of river systems and the preservation of characteristic landscapes and natural scenery. In this context, new projects for hydropower generation can arouse controversy; difficulties also arise in trying to balance the objectives and targets of different policies like, for instance, the Directive on Electricity Production from Renewable Energy Sources (RES-e Directive) and the Water Framework Directive of the European Union and comparable legislation in Switzerland.

2.3 Potential Benefits and potential impacts

Development activities are motivated by the potential benefits for human well-being. However, modification of natural conditions can also have negative impacts which have to be taken into account when deciding on the way projects are implemented or whether to carry out such projects at all. This is clearly the case in respect of hydropower generation. In the following paragraphs a qualitative description of the benefits and

impacts is provided (cf. 2nd Report of the State of the Alps[7]). More information and qualitative data on benefits and negative impacts (e.g. on river hydromorphology) of hydropower generation can be obtained from later chapters and from national sources[8] e.g. the River Basin Management Plans[9].

2.3.1 Benefits of hydropower generation

Most of the benefits of hydropower generation are self-evident since the consumption of electricity in one form or another is central to our daily life. Since hydropower has the benefit to be an almost emission-free form of electricity generation, the requirement to reduce greenhouse gas emissions acts as an additional driver for its further development. Below, the main benefits for both, small and large hydropower generation, are grouped according to three categories, economic benefits, social benefits and environmental benefits.

Economic benefits

An assured supply of energy is a key prerequisite for a modern economy and civilisation. However, considerable shares of energy demand are at present met by imports of oil, natural gas, coal or uranium from regions of the world with sometimes rather fragile political stability. Hydropower – being a domestic and renewable source of energy – can contribute to reduce energy dependency from external sources. Furthermore, investments in this sector are characterised by a long lifespan, relatively low operational and maintenance costs, attractive long term payback ratios, and a low need for support schemes (compared with other renewable energy sources) thus contributing further to security of energy supply.

Hydropower can cover parts of the base load but more particularly can contribute to covering peaks of demand thus contributing strongly to guarantee stability of the transmission grid and to the stability of supply. This contribution becomes all the more important as an increasing share of supply comes from other, less reliable renewables such as wind or solar power with their high variability which has to be compensated in order to avoid "black outs". Hydropower has here a crucial role, as variations in demand

[7] http://www.alpconv.org/documents/Permanent_Secretariat/web/RSAII/20090625_RSA_II_long.pdf

[8] see Annex 2 of the Common Guidelines for the use of Small Hydropower in the Alpine Region

[9] Overview of River Basin Management Plans: http://ec.europa.eu/environment/water/participation/map_mc/map.htm

can be compensated at very short notice, much faster than thermal power stations may be able to do. In this respect, (pump) storage schemes in combination with the high volumes of the Alpine reservoirs as well as the high head in the Alps will play an ever increasing role; they are able to feed in times of peak demand as well as to store energy by pumping up water to reservoirs in periods of surplus electricity.

Last but not least hydropower plants, and in particular small hydropower plants are highly decentralised and close to the consumer, thus contributing further to security of supply; furthermore, losses due to the transmission grid are low due to the short distances involved. These 'local' benefits stand in contrast to, for example, nuclear power plants.

Development and manufacturing of hydropower components, planning, construction and operation of hydropower facilities and the transmission grids require considerable technological knowledge and research. This contributes to the creation of new and safe (green) jobs and to the growth of domestic economies as well as bringing a positive net fiscal contribution to national budgets. The EU (mostly in Alpine Countries) and Switzerland are world leaders in the hydro industry. The export of technology and knowledge creates additional income for the national economies of Alpine states.

Social benefits

Hydropower plays a major role at the local and regional level because of its importance for the socio-economic development of peripheral alpine regions. Whenever hydropower facilities are built, this is done in combination with new infrastructure (e.g. to ensure accessibility…). If charges are levied for the use of water by regional administrations, considerable contributions to local or regional budgets may result.

Further benefits may come from the multi functionality of reservoirs used for hydropower generation. E.g. in periods of low flows (or drought), water stored in reservoirs can contribute to enhance flows for downstream regions, in periods of flood, reservoirs may contribute to water retention and mitigation of floods. Reservoirs may be further used for tourism and recreational purposes, as well as for drinking water, irrigation or other needs.

Hydropower plants also become part of the historical cultural landscape (like old mills or historical monuments of industry) and therefore a specific feature for the community.

Environmental benefits

The key environmental benefit of hydropower generation is the positive contribution to climate change mitigation through the avoidance of burning fossil fuels. Hydropower allows the generation of electricity from a renewable source virtually without emitting carbon dioxide. This acts as driver for further exploitation of the remaining limited potential of hydropower, in particular as so far this seems to be the least expensive form of renewable energy.

Hydropower can also lead to positive affects in river restoration, for example by raising the river bed and the associated groundwater level.

Figure 4: Employment creation for the green industry (© Camenzind + Co. AG[10])

Figure 5: Employment creation for the green industry: Here during the revision of the hydropower station of Luterbach in Switzerland (320kW) (© Hydroelectra AG[11])

Figure 6: St.Martin, a settlement in the alps without existing grid connection. Electricity production by a small hydropower installation. (© Programm Kleinwasserkraftwerke[12])

A further benefit of hydropower as a form of energy generation is that there are hardly any emissions of pollutants, neither to the atmosphere nor to the water bodies. However, despite the fact that hydropower can be considered a clean form of energy generation with regard to emissions of pollutants, it is clear that there also exist negative impacts which will be highlighted in the following paragraph.

2.3.2 Impacts of hydropower generation

Despite its clear benefits, hydropower generation can also have substantial negative impacts on the aquatic ecology, natural scenery and ecosystems which are not always

[10] http://www.natural-yarns.com/default.asp?nav=energie

[11] http://www.hydroelectra.ch/joomla/index.php?option=com_ponygallery&Itemid=1011&func=detail&id=37#ponyimg

[12] http://www.smallhydro.ch/bdb/displayimage.php?pos=-182

perceived by the wider public. This is not only the case for large dams, reservoirs and related hydropower facilities but also for small and very small hydropower stations, indeed the high number of such facilities already in place in the Alps, have a cumulative effect which is already impacting on a considerable number of river stretches (quantitative information on the amount of hydropower stations in the Alps and related electricity generation can be obtained from chapter 3).

The main environmental concerns in connection with hydropower generation include the following:

- Interruption of river continuity

  Dams and weirs used for hydropower generation cause an interruption of the longitudinal river continuity, which can have significant adverse effects on the river's biocoenosis. Migrating species like fish are heavily affected by the fragmentation of their habitat.

An effective way to reduce these negative effects of hydropower plants is the installation of fish migration aids.

Figure 7: Wires and dams can fragment habitats and be obstacles for fish migration by causing an interruption of the longitudinal river continuity (© H. Mühlmann, BMLFUW)

Figure 8: Near-natural fish pass at a smaller river in Austria. Fish migration aids reduce the negative effects of the fragmentation of rivers (© Verbund)

- Changes in river morphology, loss of habitats

  Hydropower plants can cause changes to a river's morphology. The morphological degradation affects not only the composition of natural structural elements and the loss of dynamic processes in the riverbed but can also cause fundamental changes to the river type.

- No residual water or lack of sufficient residual water - A high number of hydropower plants in the Alpine region are diversion plants. Therefore the problem of no or non sufficient residual water in the affected reaches of Alpine rivers is an important issue causing a number of negative effects on the river ecology notably: homogenisation of the flow character and degradation of habitat, continuity disruptions for migrating fish and changes of the natural temperature conditions.

To mitigate such negative impacts it is necessary to ensure sufficient residual water in the downstream stretches of diversion plants.

Figure 9: No water – no life. Insufficient residual water beneath a Tyrolean weir for water abstraction for hydropower generation is causing an obstacle for fish migration and a loss of habitats (© H. Mühlmann, BMLFUW)

- Hydro-peaking: Mainly caused by large hydropower plants in combination with reservoirs. The demand for electricity varies strongly during the day as well as over the year. Reservoirs with their huge storage volume and their high head provide the perfect means to adjust production to variations in demand. Hydro-peaking can have severe ecological effects on a river. Depending on the rate of discharge acceleration benthic invertebrates and also juvenile and small fish can get washed away with the flush, which results in decimation of soil fauna, reduction of fish biomass and also changes to the structure of fish populations. During the down-surge benthic invertebrates and fish can get trapped in pools that might dry out later on so the animals either die or become easy prey for predators.

Figure 10: River stretch influenced by hydro-peaking during the flushing event (© H. Mühlmann, BMLFUW)

Figure 11: The same river stretch influenced by hydro-peaking during the downsurge (© H. Mühlmann, BMLFUW)

- Impoundment - Impounded river stretches, which can occur over a longer distance especially at large hydropower stations, show a significant reduction of flow velocity which can cause an increase of water temperature and decrease of oxygen content, increased deposition of fine sediment in the impoundment as well as disturbed bed-load discharges and sediment transport, leading to erosion and deepening processes underneath the impounded section.
- Flushing of reservoirs and impounded river stretches - In reservoirs and impounded river stretches the reduced flow velocity leads to an increased deposition of fine sediment that makes periodical flushing of the reservoirs necessary. Both can cause a number of negative effects on freshwater ecology.

Figure 12: Alpine reservoirs and impounded river stretches – reduced flow velocities lead to increased depositions of fine sediments while periodical flushings can cause severe negative impacts of downstream river stretches (© Verbund)

To sum up, the generation of electricity by hydropower can have severe impacts on the aquatic ecology and the natural landscape. Innovative technologies, improved methods of operation and the willingness of all actors to integrate environmental concerns in the planning process, and also by the adaptation of already existing hydropower stations, can mitigate negative effects and make hydropower a more sustainable way for generating electricity. This has to be assured through a legislative framework that has regard to these environmental concerns and is backed up by integrated planning processes.

3 HYDROPOWER SECTOR – STATISTICAL INFORMATION

3.1 Total electricity production

Hydropower contributes a significant share of total electricity generation in the Alps.

Figure 13 provides an overview of total electricity production (all sources – renewables including hydropower and non-renewables) and the electricity production solely from hydropower (small and large) in the reference year 2005 for individual Alpine countries (total area).

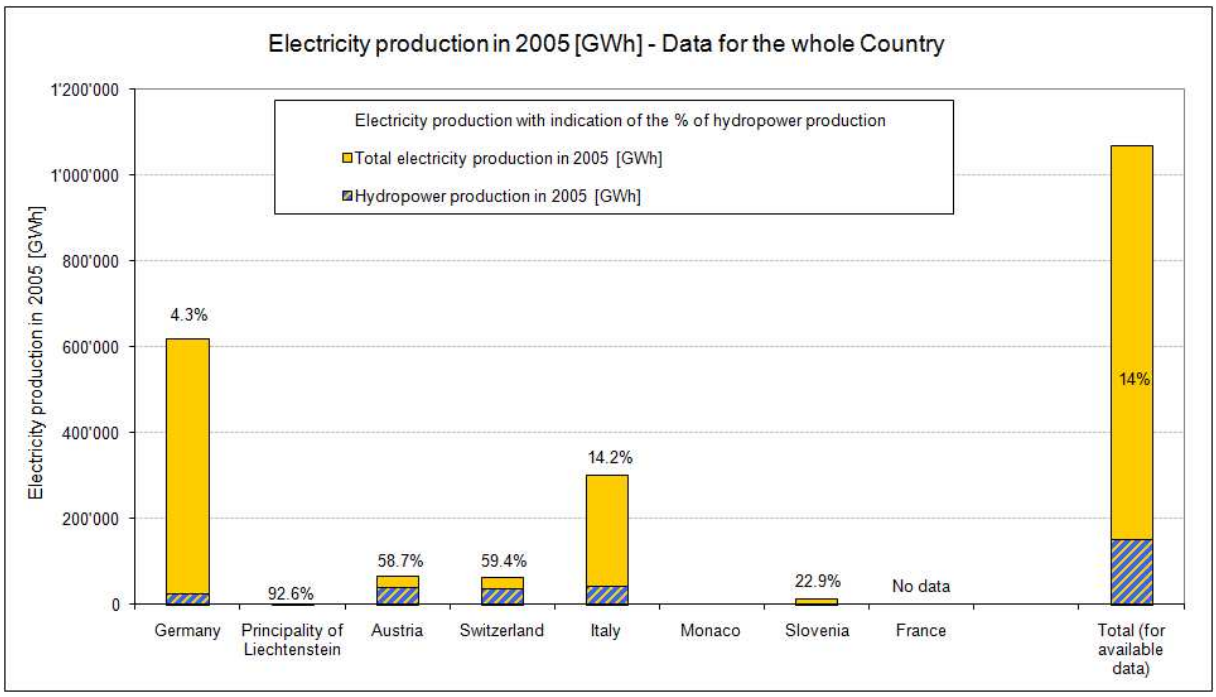


Figure 13: Overview of the electricity production by country in the year 2005 showing the percentage of hydropower production

Figure 13 shows that in countries where the topography is dominated by mountainous landscapes, hydropower provides the most significant contributions to electricity generation; nearly 60% in the case of Austria and Switzerland and more than 90% for Liechtenstein.

3.2 Electricity generated by hydropower and facilities in place

The following figures provide an overview of hydropower production and the number of facilities in place in Alpine countries, focusing on their share within the Alpine area. The data is split into five categories based on the bottleneck capacity of the individual hydropower stations.

The most significant contribution to the generation of electricity by hydropower comes from stations in the category larger than 10MW. The contribution of these large facilities range from 70% of total electricity generated by hydropower up to more than 90% in Switzerland and Slovenia (Figure 16).

Figure 15 and Figure 17 highlight the considerable number of smaller facilities, especially of those very small (micro) stations with a bottleneck capacity of less than 300 kW.

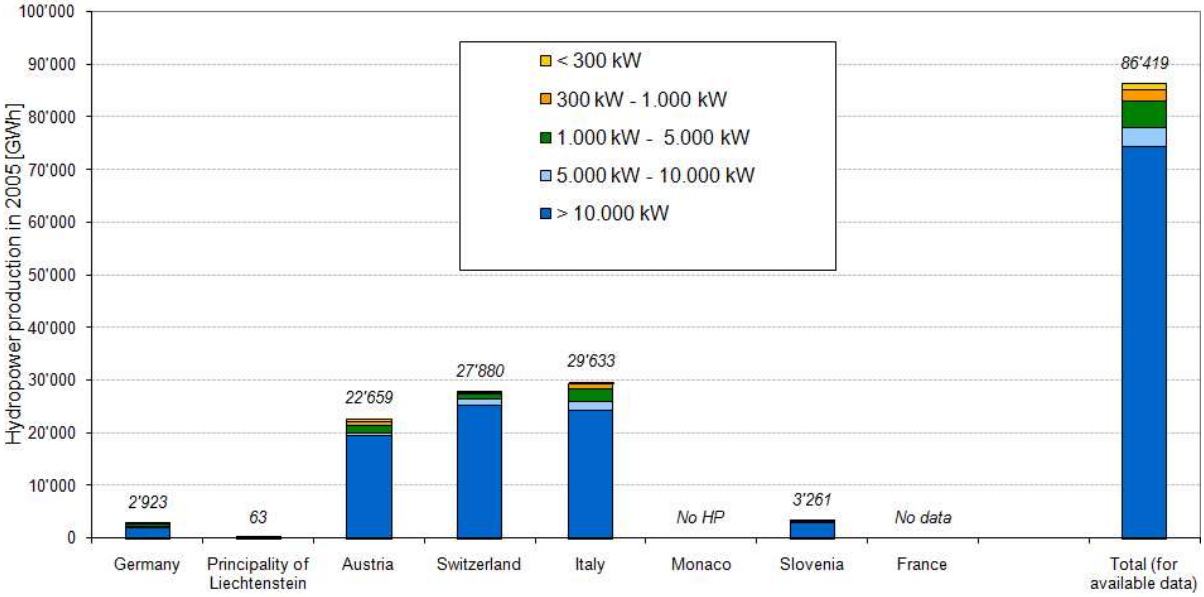


Figure 14: Absolute distribution of hydropower production (GWh) in Alpine countries, focusing on their share within the Alpine area[13] (reference year 2005) for different categories of hydropower stations[14]

[13] SL figures refer to the whole Country

[14] AT figures for installations smaller 10MW are based on certified SHP (data from E-Control). Not included are those plants without SHP certification, such as self-supply plants, which would increase the contribution of facilities smaller 10MW in Figure 14 but also considerably increase the number of facilities as indicated in Figure 15.

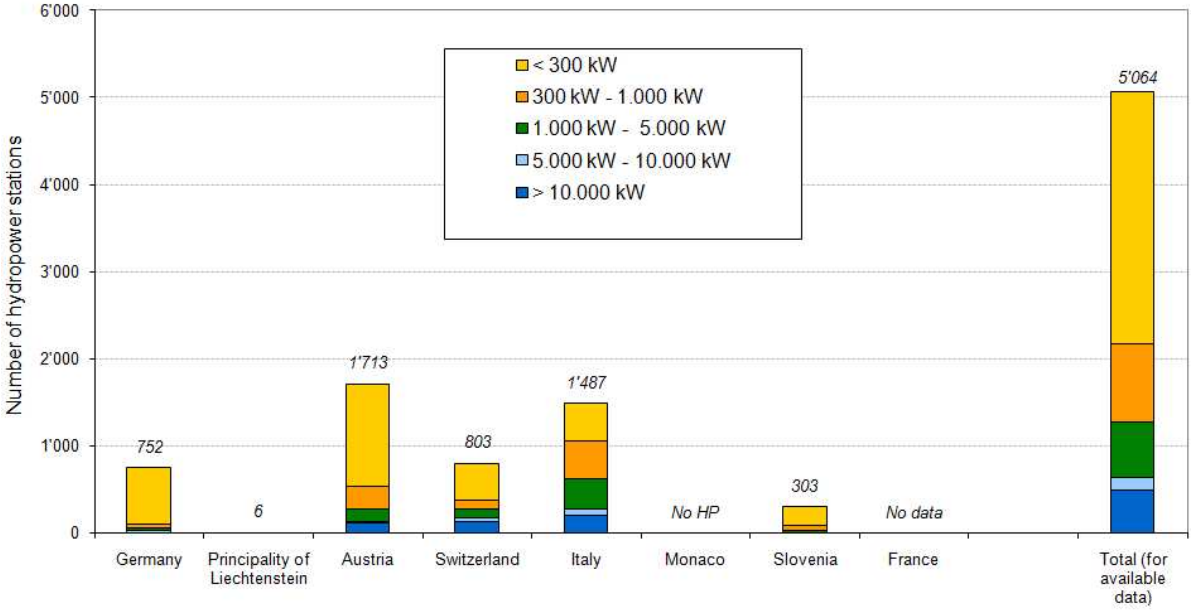


Figure 15: Absolute distribution of the number of hydropower stations in Alpine countries focusing on their share within the Alpine area[15] (reference year 2005) for different categories of hydropower stations[16]

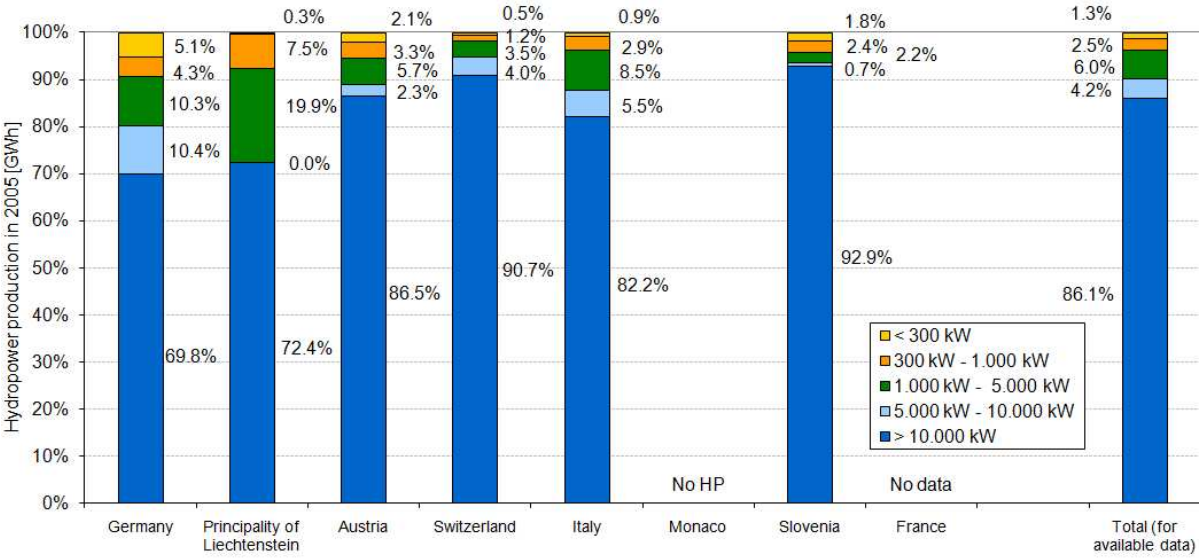


Figure 16: Relative distribution of hydropower production (GWh) in Alpine countries, focusing on their share within the Alpine area[15] for different categories of hydropower stations[16] (reference year 2005)

[15] SL figures refer to the whole Country

[16] AT figures for installations smaller 10MW are based on certified SHP (data from E-Control). Not included are those plants without SHP certification, such as self-supply plants, which would increase the contribution of facilities smaller 10MW in Figure 14 but also considerably increase the number of facilities as indicated in Figure 15.

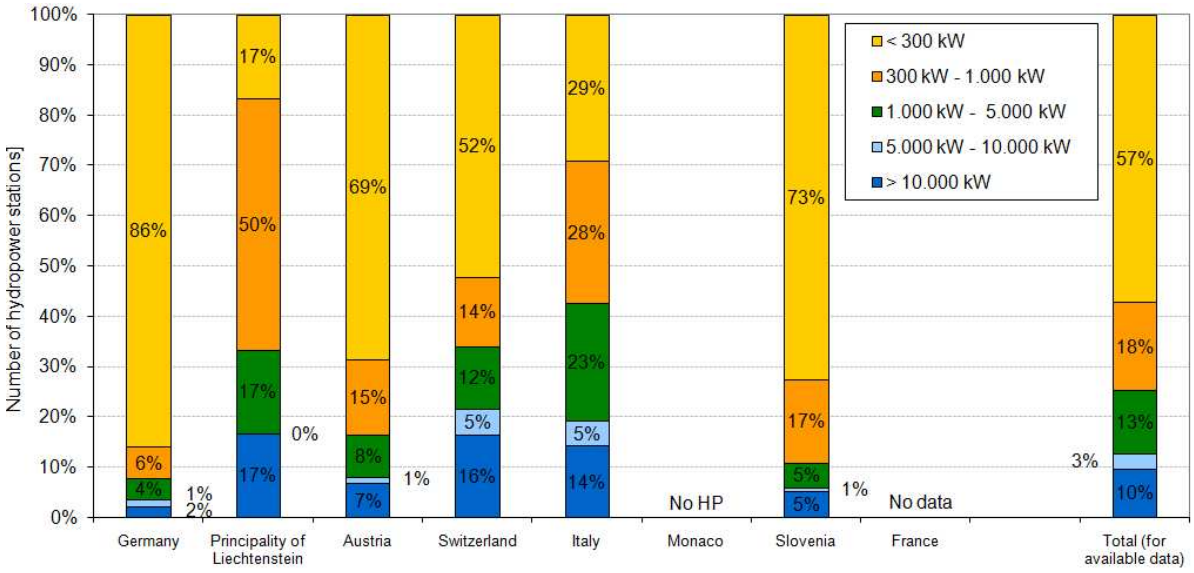


Figure 17: Relative distribution of the number of hydropower stations in Alpine countries, focusing on their share within the Alpine area[17] (reference year 2005) for different categories of hydropower stations

Figure 18 and Table 2 provide information on the number of facilities and the contribution to the total electricity generated by hydropower for different size categories of hydropower stations within the Alpine area.

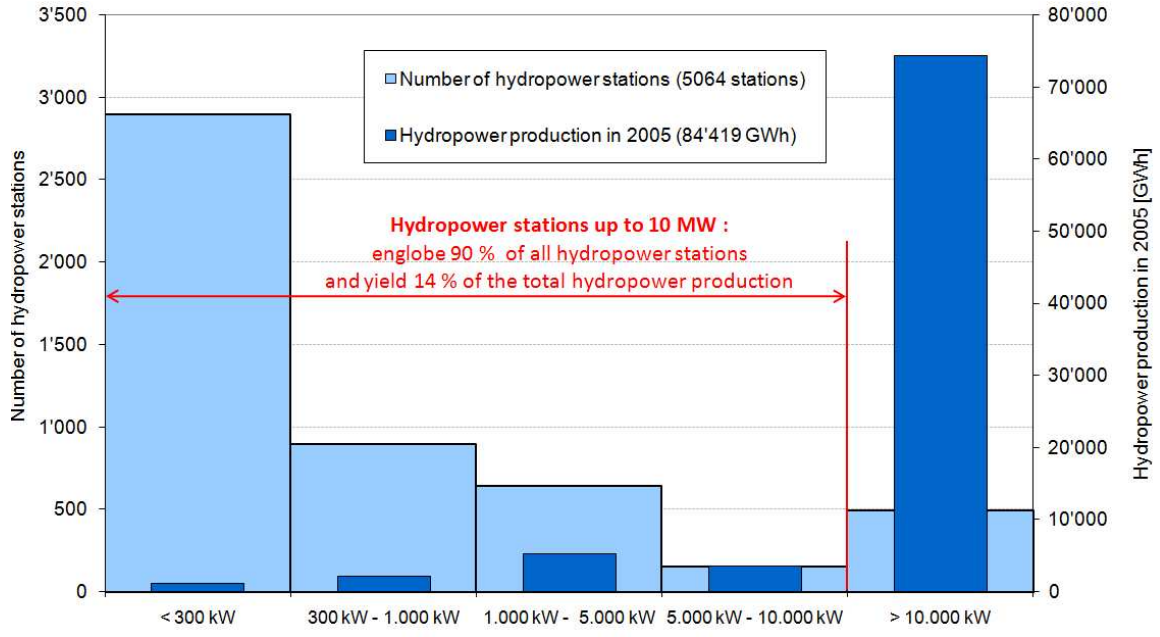


Figure 18: Relation between number of stations and hydropower production for the Alpine area[17] (available data)

[17] SL figures refer to the whole Country

	CATEGORY OF HYDROPOWER STATIONS (BOTTLENECK CAPACITY)				
	< 300 kW	300 - 1.000 kW	1.000 - 5.000 kW	5.000 - 10.000 kW	>10.000 kW
Production [%]	1,3%	2,5%	6,0%	4,2%	86,1%
Stations [%]	57,2%	17,6%	12,6%	2,9%	9,7%

Table 2: Relation between number of hydropower stations and hydropower production for the Alpine area[17] (available data)

By far the most significant share (86,1%) of electricity is generated by large facilities (representing 10% of the total number of hydropower stations) with bottleneck capacities of more than 10 MW (see Table 2).

Hydropower stations with bottleneck capacities of less than 10 MW (representing about 90% of all stations) produce about 14% of the total electricity generated by hydropower. Within this category, middle-size stations between 1 and 10 MW contribute about 10% of the total electricity generated by hydropower, while the most numerous type, that is the 57% of facilities with bottleneck capacities of less than 300 kW, contribute a share of about 1% to electricity production.

While figure 13 shows the share of hydropower (14%) of total electricity production in Alpine countries, figures 14 to 18 show the rather limited contribution of very small hydropower plants to overall electricity generated by hydropower. The data raises the question as to whether the financial incentives provided at national level for very small hydropower plants contribute significantly to increase the share of renewables. A potential need for optimisation of those economic incentives already in place may be derived from this data.

However, from a more local point of view, electricity production from SHP can represent a more significant contribution, e.g. for a small village a considerable share of the households may be supplied by a local SHP.

3.2.1 Green house gas emissions

Carbon dioxide is the most important anthropogenic greenhouse gas (GHG). The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use.[18]

Carbon dioxide emissions from fossil fuel use also occur in the course of the generation of electricity, mainly due to combustion processes in thermal electric power plants and gas power plants, whereas the generation of electricity from hydropower can be considered as a form of electricity generation that is nearly free from GHG emissions.

Therefore, the substitution of hydropower for electricity generation within the European energy mix[19] with is often used in calculating the "savings" of GHG emissions. Expressed in CO_2 equivalents, every kilowatt hour from hydropower (emissions of 4g CO_2/kWh) would therefore replace one kilowatt hour from the UCTE mix (emissions of 500 g CO_2/kWh). Based on these figures hydropower would result in approximately 100 times less CO_2 being emitted compared to the current UCTE mix.

As indicated in Figure 19, 32% of the total GHG emissions in the Alpine countries (available data) occur due to the production of 1'070 TWh electricity[20]. Since hydropower causes approximately 100 times less GHG emissions, it can be assumed, approximately, that the 559 Mio.t of CO_2 equivalent (orange in the left pie chart) are principally caused by the 919 TWh of electricity produced from sources others than hydropower.

[18] IPCC, 2007. Contribution of Working Group I to the Fourth Assessment Report of the Inter-governmental Panel on Climate Change. Cambridge University Press. Cambridge, United Kingdom.

[19] UCTE - Union for the Coordination of Transmission of Electricity; the UCTE mix includes all sources for electricity generation and is based on a statistical mean value

[20] Data from Germany given for total energy industry. Data from Switzerland include emissions from domestic fuel combustion activities for public electricity and heat production, being most of the emissions generated form waste incineration plants.

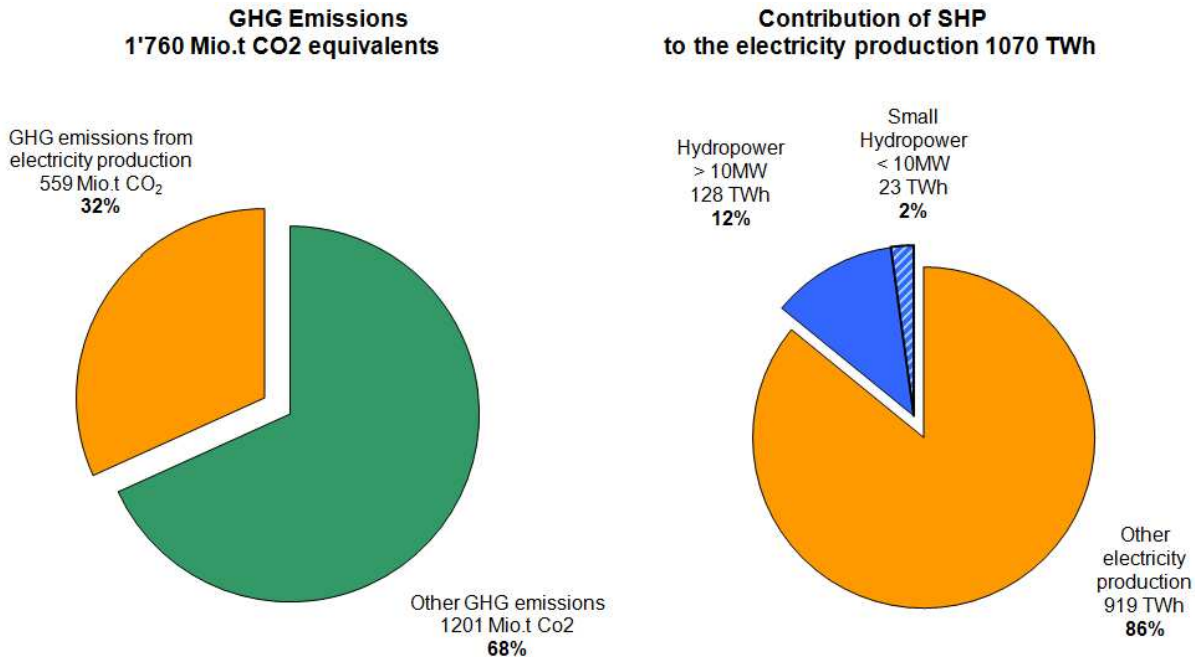


Figure 19: Left: Greenhouse Gases emissions from electricity production in Alpine countries (available data); Right: Electricity production in Alpine countries (available data) with indication of % of hydropower[21]

Assuming that the total electricity produced by hydropower (according to available data: 14% of the total electricity production – 151 TWh), would be generated by forms of power generation based on the UCTE mix, this would then cause additional 75,5 Mio. t CO_2 (151 TWh * 0,5) of the total CO_2 emissions caused by electricity generation.

Breaking down those figures for small hydropower facilities in place with capacities of less than 10 MW[18] (available data), the contribution of those facilities to "CO_2 emission reductions" from electricity generation would be about 11,5 Mio. t CO_2 (23 TWh * 0,5), equivalent to around 0,5 % of overall GHG emissions of Alpine countries (available data).

However, what has to be taken into account is that replacing electricity produced by sources from the UCTE mix with hydropower can only achieve a meaningful reduction in GHG emissions provided total electricity consumption remains at least stable. Hence,

[21] For Germany and Italy, the threshold value for SHP is not set at 10 MW. Thus, for those countries no specific data for installations < 10 MW were collected in the data template. Therefore for the present evaluation German and Italian data have been taken from the following source: SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

with regard to the reduction of GHG emissions, it is in any case be essential to achieve a stabilisation or in fact reduction of the total energy consumption.

4 OVERVIEW ON POLICY FRAMEWORK

4.1 Protocols of the Alpine Convention

The Alpine Convention is a multilateral framework treaty signed in 1991 by the eight states of the Alpine arc as well as the European Community.[22] Water management is one of the topics in relation to which the Parties of the Alpine Convention committed to take adequate measures (Article 2.2 of the Convention, listing the fields in relation to which the Parties agreed to take measures), with the objective of preserving or re-establishing healthy water systems, in particular by keeping lakes and rivers free from pollution. Natural hydraulic engineering techniques should be applied and the use of water power should serve the interests of both the indigenous population and the environment alike.

Eight protocols have been adopted and are now in force in the countries of the Contracting Parties which have ratified them. Each of these has some bearing or influence on water management in the Alps.

The energy protocol[23] aims to establish sustainable development in the energy sector that is compatible with the Alpine region's specific tolerance limits. According to this protocol, remaining energy needs should be met by making a wider use of renewable energy sources, encouraging the use of decentralised plants. However, negative effects of new and existing hydroelectric plants on the environment and the landscape have to be limited by adopting appropriate measures to ensure that the ecology of watercourses and the integrity of the landscape are maintained.

4.2 Specific European Union legislation

Water policy and the hydropower sector in the area of the Alpine Convention are, to a considerable extent, influenced by the legislation of the European Union (EU). The most important parts of this legislation are the directives on the promotion of energy and

[22] The principality of Monaco signed the Alpine Convention in 1994.

[23] http://www.alpconv.org/NR/rdonlyres/77274D16-B20C-43F0-9E20-2C6DA92F68D4/0/EnergyProtocolEN.pdf

electricity from renewable sources along with the EU Water Framework Directive. The content of these directives is described as follows:

4.2.1 The RES-e Directive - Promotion of electricity from renewable sources

The promotion of electricity from renewable energy sources (RES) is a high EU priority for several reasons, including security and diversification of energy supply, environmental protection and social and economic cohesion. It also constitutes an essential part of the package of measures needed to comply with the commitments made by the EU under the Kyoto Protocol on the reduction of greenhouse gas emissions.

The RES-e directive (directive 2001/77/EC) aims at a significant increase in the contribution of renewable energy sources to electricity production, including hydropower together with all other renewable energy sources, and at creating a basis for a more comprehensive framework for the development of electricity from renewable energy sources.

The RES-e Directive identifies general principles and outlines strategies to direct Member States towards the achievement of their own national targets. Its provisions will be repealed by Directive 2009/28/EC from 1 January 2012.

4.2.2 The new EU directive on renewable energy 2009/28/EC

Directive 2009/28/EC is part of a package of energy and climate change legislation that provides a legislative framework for Community targets for greenhouse gas emission savings. It encourages energy efficiency, energy consumption from renewable sources, the improvement of energy supply and the economic stimulation of a dynamic sector.[24]

Each Member State has a target calculated according to the share of energy from renewable sources in its gross final consumption for 2020. This target is in line with the overall '20-20-20' goal for the Community, which means a saving of 20% of the Union's primary energy consumption and greenhouse gases, as well as the inclusion of 20% of renewable energies in energy consumption by 2020.

[24] http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm

Member States are to establish national action plans. These must take into account the effects of other energy efficiency measures on final energy consumption (the higher the reduction in energy consumption, the less energy from renewable sources will be required to meet the target). These plans will also establish procedures for the reform of planning and pricing schemes and access to electricity networks, promoting energy from renewable sources.

4.2.3 The EU Water Framework Directive

Directive 2000/60/EC[25] was adopted in 2000 with the intention of creating a legal framework for water management within the EU and beyond. Its objectives are:

- to achieve/maintain good status for all waters, as a rule by 2015, to prevent the further deterioration of water, and protect and enhance the aquatic and terrestrial ecosystems;
- to ensure coordination and cooperation in shared river basins across administrative and political borders;
- to promote the sustainable use of water, based on long-term protection of the available water resources;
- to enhance the protection and improvement of the aquatic environment through the progressive reduction of discharges and the phasing-out of discharges, emissions and losses of particularly hazardous substances;
- to progressively reduce groundwater pollution, and
- to contribute to the mitigation of the effects of floods and droughts and
- to ensure widespread information and consultation of the public when developing and reviewing river basin management plans.

The Directive applies to surface and groundwater, as well as to coastal waters. By the end of 2004, EU Member States had to provide, an analysis of the characteristics of the district, an analysis of the impact of human activities on the state of surface water and of groundwater, an economic analysis of the use of water, a register of the areas which require special protection and all those water bodies which were used for the abstraction of drinking water.

[25] Directive 2000/60 establishing a framework for the Community measures in the fi eld of water policy, OJ EU 2000, L 327 p.1

By the end of 2006, EU Member States had to establish programmes for monitoring the status of the surface waters and groundwater of each river basin district, in particular the ecological and chemical status of surface waters and the chemical and quantitative status of groundwater.

On the basis of the analyses and the findings of the monitoring measures, EU Member States had to develop, by the end of 2009, a programme of measures for each river basin district.

These programmes of measures shall be reviewed and, if necessary, updated in 2015 and every six years thereafter. Furthermore, all the previous elements are summarised in a River Basin Management Plan that contains all measures in place or foreseen, in order to reach the objectives of Directive 2000/60[26]. These management plans had also to be established by 2009; they will be reviewed and updated in 2015 and every six years thereafter.

All plans and programmes have to be the subject of intensive public participation, in order to ensure that the balancing of diverging interests in the different stages of implementing Directive 2000/60/EC is fully taken into consideration and, furthermore, to ensure that the different plans, programmes and measures are subsequently effectively put into operation.

Article 4.7[27]

For new modifications to the physical characteristics of water bodies, WFD Article 4(7) exceptionally allows the deterioration of water status or failure to achieve good water status provided certain strict conditions are satisfied. This provision lies at the heart of new sustainable developments in river basins.

- Assessment: For new modifications affecting water status, an assessment according to the WFD definition of water status should be carried out. This includes:

  a) impacts on the quality elements for the classification of ecological status

[26] Overview of River Basin Management Plans: http://ec.europa.eu/environment/water/participation/map_mc/map.htm
[27] Information Note for Water Directors, European Commission, November 2009

b) impacts on other water bodies than the one in which the project is situated,

c) in case of several projects in the same river basin, cumulative effects of the various projects.

- 4(7)b – justification in RBMPs: The risk of deterioration of status occurring should be assessed at the time a new modification or alteration is being considered. This means that a modification should be included in the river basin management plan when it is still in the planning stage, and not only when a final consent is reached.
- 4(7)(c) – weighing benefits: Balancing the benefits of the new modifications to the foregone benefits of water protection or to the public interest should be done in the very early stages of the project's development. Foreseen benefits of the project in the early stage may not be fully achieved when the project is planned in more detail. For example, a certain potential of hydropower may not be feasible to develop because of water / nature legislation.
- 4(7)(d) – better environmental options: Any available alternatives, or better environmental options, should be assessed at an early stage of developing the project. Those alternative options could involve alternative locations, different scales or designs of development, or alternative operational processes. In case of several developments in the same river basin, best environmental options need to be addressed at a strategic - regional level.

The common implementation strategy of the WFD recognises the need to address the issue of the better environmental options at a strategic – regional level[28]. When arguing the case of "no better environmental option" not only the single project and locality but a whole region or catchment should be considered.

Article 4(7) is of especial relevance for EU Member States in the context of hydropower generation and has to be taken into account with regard to planning procedures for potential further developments. This has been reconfirmed by the Note of Water Direc-

[28] See e.g. the conclusions from the 2007 Berlin Workshop on Water Framework Directive and Hydropower: http://www.ecologic-events.de/hydropower/

tors "Hydropower Development and the Water Framework Directive", May 2010[29]. Detailed information can be obtained from the CIS Guidance Document No. 20[30] on exemptions to the environmental objectives.

[29] Note of the Water Directors "Hydropower Development and the Water Framweork Directive", May 2010 http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/hydromorphology/development_directivepdf/_EN_1.0_&a=d

[30]http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/documentn20_mars09pdf/_EN_1.0_&a=d

4.2.4 Policy framework in Switzerland and Liechtenstein

According to the European Economic Area Agreement[31], Liechtenstein implements the EU Water Framework Directive whereas the RES-e Directive shall not apply to Liechtenstein. The Swiss Federal Energy Act and Water Protection Act are the equivalents to RES-e and EU-WFD.

4.2.5 The Swiss energy policy and the Federal Energy Act

Based on the energy article in the Swiss Constitution (Article 89) the Federal Energy Act (EnG, dated 26 June 1998; SR 730.0), the Nuclear Energy Act, the Electricity Supply Act and the CO2 Act - along with their confirming ordinances - form the legal basis for a sustainable and modern energy policy. In particular the Federal Energy Act lays down the regulatory framework for renewable energy.

The revised Energy Act (in force since 1.1.2008) stipulates that the production of electricity from renewable energy sources must be increased by at least 5'400 GWh by 2030 in order to stabilise or reduce CO2 emissions as quickly as possible. For hydroelectricity the goal is to increase Swiss hydroelectricity production by at least 2'000 GWh by 2030. It also contains a package of measures for promoting renewable energy and efficient electricity use.

The most important measure for the promotion of electricity from renewable sources concerns the cost-covering remuneration for feed-in to the electricity grid[32] (CRF). For small hydropower plants, the subsidy period for compensatory feed-in remuneration is stipulated as 25 years. To finance the CRF scheme, the Energy Act introduced a surcharge on the electricity supply lines, which is levied per kWh on the final electricity consumption[33]. Further details on the CRF-scheme plus information on the antecedent financial incentive system are described in Annex 1 in the data template for Switzerland.

[31] http://www.efta.int/legal-texts/eea.aspx - Annex 4 (Energy) and annex 20 (Environment)

[32] http://www.bfe.admin.ch/themen/00612/02073/index.html?lang=en

[33] Currently the EnG stipulates a maximum surcharge of 0.6 CHF per kWh, for the year 2009 it was fixed at 0.45 CHF per kWh. There are ongoing political initiatives to increase the max. surcharge. This financing mechanism provides several hundreds of millions CHF per year for promoting renewable energy facilities.

4.2.6 The Swiss water policy34 and the Federal Water Protection Act

Based on the water article in the Swiss Constitution (Article 76), the Federal Water Protection Act (GSchG, dated 24 January 1991; SR 814.20), the Hydropower Act and the Federal Act on Hydraulic Engineering - along with their confirming ordinances - form the legal basis for a sustainable and modern water policy. With respect to hydropower exploitation, the Federal Water Protection Act and the Hydropower Act in particular lay down the regulatory framework. Further relevant regulations are provided in the Federal Fishery Act and the Nature and Cultural Heritage Act.

A study comparing the Federal Water Protection Act (GSchG) as Swiss equivalent to the EU-WFD, came to the conclusion that in essence these two pieces of legislation are pursuing the same main goals[35], following a holistic approach. The GSchG establishes a series of qualitative, quantitative and ecological targets for the protection of water bodies and water resources. More specific to hydropower, the GSchG specifies the requirements for authorisation of water abstractions, including minimum flow regulations. Recently a major GSchG amendment[36] has been approved by the Swiss Parliament specifying river restoration goals, regulations for hydro-peaking and activation of the bed load transport plus flexibility in regard to water abstractions. GSchG also lays down planning obligations and fixes deadlines for achieving specific goals. The procedure for granting concessions is laid down in the Federal Hydropower Act.

4.3 Others

Depending on specific circumstances, other directives or regulations not primarily addressing water issues may become relevant for water management. The 2nd report on the State of the Alps[37] contains a compilation of the existing legal framework concerning water management, both, EU legislation relevant for EU menberstates as well as similar national legislation in Switzerland. The compilation comprises references on directives or regulations for issues like flood protection, environmental impact assessment, specific uses of water, release of substances and bi- or multilateral agreements for transboundary and basin-wide water management in the Alps.

[34] www.giweh.ch/files/watermanagement.pdf

[35] http://www.bafu.admin.ch/wasser/01444/01995/index.html?lang=de

[36] http://www.parlament.ch/d/dokumentation/dossiers/wasser/Seiten/default.aspx

[37] http://www.alpconv.org/soia/soia03_b_en.htm

Furthermore, the following international agreements may be of relevance for hydro-electricity related programmes and activities:

- United Nations Framework Convention on Climate Change (UNFCCC)
  Link: http://unfccc.int/2860.php
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
  Link: http://www.ramsar.org
- The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)
  Link: http://www.unece.org/env/water/welcome.html)
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)
  Link: http://www.unece.org/env/eia/)
- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)
  Link: http://www.unece.org/env/pp/)

Finally, at national or provincial level, there are specific nature protection laws in place that have to be taken into account as well. These laws can be of considerable relevance for further hydropower development.

5 SUPPORTING POLICIES AND SHP PROMOTION

5.1 Renewable Energy targets

There are well recognised reasons for increasing the share of electricity from renewable energy sources. It can improve energy security, mitigate greenhouse gas emissions along with other regional and local pollutants from the power sector and it has the potential to increase competitiveness in renewable energy technologies.

For these reasons, each state has set targets for renewable energy sources. With regard to EU Member States, those national overall targets are specified in Annex I of the new directive on renewable energy 2009/28/EC and have to be met by 2020. In order to achieve these ambitious targets, each Member State had to establish national action plans by 30 June 2010 which address inter alia the production of electricity from renewables.

Furthermore, the Swiss Parliament has decided to increase the production of renewable energies by at least 5'400 GWh by 2030 in order to stabilise or reduce CO_2 emissions as quickly as possible. For hydroelectricity the goal is to increase Swiss hydroelectricity production by at least 2'000 GWh by 2030.

Targets for renewable energies[38]		
Country	**Share of energy from renewable sources in gross final consumption of energy, 2005 [%]**	**Target for share of energy from renewable sources in gross final consumption of energy, 2020 [%]**
Austria	23,3	34
France	10,3	23
Germany	6,7	20
Italy	5,2	17
Slovenia	16,0	25
Switzerland	The goal of Switzerland's energy policy is to increase the proportion of electricity produced from renewable energy by at least 5'400 GWh by 2030, which corresponds more or less to an increase of 10% of the country's present-day electricity consumption. To this target, the contribution from hydroelectricity production shall be at least 2'000 GWh.	
Liechtenstein	17	For 2020 no precise goals are set at the moment.

Table 3: Targets for renewable energies in the Alpine countries

[38] Targets for renewable energies as set for EU Member States in Annex I of directive 2009/28/EC and in Swiss Federal Energy Act (EnG, dated 26 June 1998; SR 730.0)

The main challenge resulting from these targets is to increase hydro-electric production in a manner which is compatible with environmental protection requirements.

5.2 Financial Support Schemes

In order to achieve the above objectives, most of the Alpine countries have set up support schemes for renewable electricity production. Different policy tools are in use, including guaranteed feed-in tariffs, investment grants, green certificates, tax exemptions, public procurement policies or research and development. These policy tools provide important incentives and seem to have been financially sufficiently attractive enough to trigger the present boom of small hydropower facilities (including micro hydropower plants).

Type of economic development schemes[39]							
Country	AT	FR	DE	IT	FL	SL	CH
Investment grants	x	?	-	x	-	-	-
Tariff subventions	(x)	?	x	x	-	x	x
Others	-	?	-	x	-	-	-

Table 4: Type of Financial Support Schemes

The support schemes (Table 4) differ partly because support has traditionally been linked to other national priorities and also because national electricity markets still can have very different characteristics and remain nationally segmented.[40] Therefore, further information on support schemes for renewable electricity production in the individual Alpine countries can be obtained from the individual national data templates annexed to this report. In most cases guaranteed feed-in tariffs are in place.

Summarising, support schemes are intended to act as a driving force for further developments in the hydropower sector. The magnitude of this driving factor is strongly

[39] More detailed information can be obtained from the individual national data templates annexed to this report

[40] Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan COM(2005) 628 {COM(2009) 192 final}

linked to the level of support provided but can in some cases also depend on the level of market prices for electricity from renewable sources (i.e. in case the level of market prices is higher compared to the guaranteed feed-in tariffs).

5.3 Incentives for environmental adaptation and refurbishment of existing facilities

Environmental legislation has developed significantly in recent decades. Residual water (or environmental minimum flows) as well as fish passes are now seen as basic provisions of new hydropower plants. However, many old facilities do not meet modern environmental standards. For instance, older hydropower facilities may not provide sufficient residual water or be equipped with fish-passes, hence causing a fragmentation of river stretches and habitats. In such cases, adaptations to the facilities may be required in order to meet environmental objectives.

However in some countries, once a water licence or authorisation has been granted, this legal right can only be varied during the set period of the licence or authorisation (according to chapter 6.1 between 30 to 90 years) if it is economically bearable for the owner or for reasons of higher public interests and against compensation. Furthermore, some water rights from the past do not have a license or authorisation period at all, i.e. the right is for an unlimited time period.

When licences or authorisations have to be renewed, or when a new one is granted, the conditions for the water use are based on the current environmental legislation. Thus, if existing hydropower facilities request and need a renewal, extension or a new licence or authorisation then they have to comply and adjust to the new requirements of the actual environmental legislation, such as the residual water flow conditions.

Due to the length of time for which a licence or authorisation is granted, the effectiveness of new regulations on upgrading existing facilities in order to enhance the ecological situation can be limited. In order to allow for progress, some countries have set up promotion schemes and incentives to support operators or licensees in upgrading existing facilities with the aim of fulfilling environmental objectives [41].

[41] More information can be obtained from the individual national information annexed to this report

This is the case in Austria for instance, where through the "Umweltförderungsgesetz" (Environmental Promotion Act) EUR 140 Mio. the federal state is providing investment grants until 2015 for environmental measures like restructuring morphologically modified river beds, enhancement of river continuity and habitat connectivity or mitigation measures in case of hydro-peaking.[42]

There also exist examples of an effective "double-strategy", whereby the refurbishment of existing facilities (e.g. renewal of turbines and technical equipment) is combined with the implementation of environmental measures (e.g. sufficient residual water and fish-passes). In such a way upgraded hydropower facilities can generate more electricity while at the same time fulfilling modern environmental standards.

In the Austrian province of Upper Austria, for instance, 258 small hydropower facilities were modernised in the last five years, resulting in a 40% increase of electricity production (76 GWh per year) while at the same time respecting environmental needs.

In Germany, if existing facilities are modernised and thereby the ecological status is going to be improved significantly, tariff subvention schemes can be increased up to 12,67 ct/kWh for hydropower plants < 500 kW and up to 8,65 ct/kWh for power plants < 5 MW. Similar (degressive) regulations also exist for power plants up to 150 MW: increased tariff schemes are applied to the amount of electricity which is additionally generated due to the modernisation of the power plant.

[42] http://wasser.lebensministerium.at/article/articleview/71821/1/26045/

Another example comes from Switzerland. Certification of electricity with labels that get a higher price on the electricity market can serve as an economic incentive for enhancing the ecological impact of hydropower plants, with the granting of the label tied to ecological criteria. The "Naturemade" labelling scheme[43] was developed and organised by a private organization. The certificate system has two levels:

- The first level, "Naturemade Basic", needs a declaration of the source and origin of electricity (requiring that plants use renewable energy). Large hydropower plants (>10 MW) have to establish an environmental management system within five years of receiving the "Naturemade Basic" certificate.
- The second level, "Naturemade Star", was defined for environmentally preferable electricity. Power plants can be granted the "Naturemade Star" label if they fulfil "Naturemade Basic" criteria plus additional criteria. To achieve this level, hydropower plants must have a lower environmental impact than traditional hydropower plants. For example, they have to leave sufficient water in the rivers (i.e. respect residual flow limits) and allow fish to pass through weirs.

However, since framework conditions for licensing or authorisation can differ considerably between the Alpine countries, respective approaches for achieving environmental adaptation and refurbishment of existing facilities can also vary significantly and therefore a range of different solutions can lead towards achieving the environmental objectives.

5.4 SHP development and obstacles

A factor for evaluation of the effectiveness of support schemes for further hydropower development is the assessment of figures on intended new projects. Table 5 provides an overview of the situation in the Alpine countries, based on the received feedback. Since exact quantitative information is not always available, the table contains largely qualitative descriptions on the situation.

[43] http://www.naturemade.ch/Englisch/Label/label_e.htm

Country	Intended/Planned/Projected new small hydropower stations[44]
Austria	A considerable number of small hydropower projects are trying to get an approval. No precise number is available as authorisations are provided at district level.
Germany	The Renewable Energy Sources Act shows positive effects especially on the modernisation of existing small hydropower facilities in combination with ecological improvements Further Information given by Renewable Energy Sources Act (EEG) Progress Report 2007 by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).
France	No indication
Italy	The amount of new small hydropower stations which are intended / planned / projected to be realised within the Italian area of the Alps is high. No precise number is available as authorisations are provided at provincial level.
Slovenia	A substantial number (200) of hydropower plants below 10 MW are expected to be realised.
Switzerland	More than 600 applications were received for tariff subventions for the whole country (more than 400 than of them within the Alpine area). The available data refers to received applications at 22.4.2009. These applications have to be submitted to various evaluation processes, so the number of new small hydropower stations that will be finally realised could still undergo important changes.
Liechtenstein	There are no new installations planned but the hydropower station "Samina" is planned to be modified to a pump-storage power station in 2010/2011.
Monaco	No hydropower

Table 5: Information on intended, planned or projected new small hydropower stations in the Alpine area

Competent authorities in the Alpine countries are currently confronted with a considerable high number of applications for new small hydropower projects, what is inter alia a result of support policies for the sector in order to realise targets for renewable energy developments. This situation has implications for decision-makers since fast progress in the development of the renewables can only be achieved if procedures do not constitute an obstacle to balanced and sound decisions in due time. Table 6 presents a picture of the situation and how it is perceived in the individual Alpine countries.

[44] More detailed information can be obtained from the individual national data templates annexed to this report

Country	Difficulties in the decision procedure[45]
Austria	The main challenge is to cope with the non-deterioration provision of the EU-Water Framework Directive, respectively to comply with article 4.7 WFD (exemptions). So far only limited practical experience with these approaches is in place.
Germany	Approval procedures for new hydropower plants are mostly difficult due to variety of aspects and interests.
France	No indication
Italy	Approval procedures for new hydropower plants are mostly difficult due to variety of aspects: a) Lack of a territorial planning for hydropower. b) Lack of a diffused monitoring system: Often there is no comprehensive data base with information about all diversions; c) There is no substantial difference between the concession for small hydro and large hydro diversions, so even for very small power plants the procedure is very complex. d) Two procedures: To build a hydropower plant it is first necessary to obtain a concession for the use of water and secondly an authorisation to set up and run the plant. e) Competition procedure can be indefinitely long.
Slovenia	Problems are caused by lengthy proceedings.
Switzerland	The evaluation processes for tariff subventions and for authorisation are made independently and by different competent institutions/authorities. Subsidies are often granted to projects that are not yet sufficiently developed, that are located on natural river stretches and that do not consider cantonal planning. Increasing volume of submissions and an overload of work for the competent authorities. Guidelines, recommendations and instruments are needed.
Liechtenstein	No remarks
Monaco	No hydropower

Table 6: Overview on perceptions in Alpine countries with regard to authorisation procedures on new projects

As can be derived from the above information, many competent authorities in the Alpine countries are confronted with a range of difficulties in performing decision procedures for new projects. Frequently mentioned is the variety of aspects which have to be taken into account or difficulties over how to balance different interests. The need for decision procedures on new projects to take into account differing interests is, of course, not a new phenomenon.

However, due to progress in the frameworks on renewable energy generation already described and in environmental legislation, the pressure on the competent authorities has certainly increased in recent years. Hence, it seems vital to provide support to the

[45] More detailed information can be obtained from the individual national data templates annexed to this report

authorising bodies by backing up decision procedures with strategic planning instruments, since different aspects of the "(overriding) public interests" basically have to be defined on a higher level and cannot generally be decided on a case-by-case basis.

Last but not least, strategic planning is imperative for a sound implementation of the EU Water Framework Directive. As described in chapter 4.2.3, Article 4(7), which exceptionally allows the deterioration of water status under strict conditions, lies at the heart of new sustainable developments in river basins. According to Article 4(7)(d), alternatives for projects or better environmental options should be assessed at an early stage when better alternatives are available (e.g. alternative locations for hydropower stations). In instances of several developments in the same river basin, which is often case with regard to hydropower projects, best environmental options need to be addressed at strategic level as in such circumstances no adequate decision can be made at project level without strategic guidance.

6 FRAMEWORK AND GENERAL CONDITIONS FOR AUTHORISATION

The following chapters provide an overview of the varying general conditions with regard to the authorisation of new hydropower facilities in the Alps.

6.1 Competent authorities and legal status

Different competent authorities are responsible for granting authorisations, licences or concessions for new installations in the individual Alpine countries. Table 7 provides an overview of the responsible public bodies next to the legal status of the water use permissions.

Country	Competent authorities	System (legal status)
Austria	Facilities < 500 kW: Regional District Authority (= Bezirkshauptmannschaft) Facilities > 500 kW: Austrian Federal States (= Bundesländer) An environmental impact assessment (EIA) becomes obligatory above a 15 MW bottleneck capacity.	Authorisation system
Germany	District council; for some projects with supposed larger spatial effects there exist additional procedures	Authorisation system
France	No indication	No indication
Italy	Big concessions, with a nominal capacity >3MW, are generally granted by regional authorities, while small concessions, with a nominal capacity <3MW, are granted by provincial authorities. There is no substantial difference between the concession for small hydro and large hydro diversions. Producers have to make an EIA if there is a dam and they have to go through a screening procedure if the capacity is > 100kW or if the discharge is > 200 l/sec. However several Regions may ask for EIA even for smaller plants.	Authorisation system Licensing system
Slovenia	The competent authority is the government. There is no differentiation between the concession for small and large hydro power with regard to the competent authorities. An EIA must be carried out for reservoir plants where the reservoir volume exceeds 10000 m3, or for run-of-river schemes larger than 500 kW[46].	Authorisation system
Switzerland	International rivers: Confederation. Inland rivers: Cantons or Municipalities Installations > 3 MW have to be submitted to an EIA According to the Environmental Conservation Act, installations having a significant impact on the environment have to be submitted to an EIA. For hydropower, installations with a capacity of more than 3 MW are amenable to the EIA obligation in case of new construction, of significant changes of the installation, of significant changes of the existing concession and in case of renewal of the concession.	Authorisation system Water concession

[46] Source: SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

Country	Competent authorities	System (legal status)
Liechten-stein	Concession from the government, independently of size	Authorisation system
Monaco	No hydropower	

Table 7: Competent authorities and legal status in the Alpine countries[47]

Since the legal systems developed largely independently from each other in the Alpine countries, it is not surprising that the general conditions vary considerably. What can often be observed is that the competences are shifted to a higher level in case of larger hydropower facilities, since larger projects can bring along more complex and demanding procedures. In such cases an environmental impact assessment is necessary.

6.2 Granting periods and charges for water-use

The following table gives information on granting periods for new but also existing hydropower installations and the charges which may be levied for the water use in order to generate electricity.

Country	Granted period	Charges for water use small or lager hydropower
Austria	New facilities: Usually 90 years Existing facilities: Usually 90 years but there still a number of facilities in place with authorisations without any limitation in time.	No charges
Germany	New facilities: 30 years Existing facilities: Variable, up to unlimited period	< 1 MW: No charges > 1 MW: special charge for hydropower generation
France[48]	Length of licence normally 30-40 years	Yes. The system is very complicated
Italy	New facilities: max. 30 years Existing facilities: max. 30 years The concession for hydropower use lasts a maximum of 30 years, but recently authorities tend to allow shorter concessions as well. In Italy all the concession are temporary.	Concessionaries have to pay an annual charge calculated on the basis of the concession capacity (kW) and the unitary value (€/kW) is fixed by each Region and updated every year. For 2008 the medium value was around 12-14 €/kW. Concessionaries also have to pay two additional annual charges (only if the capacity of the plant is more than 220 kW).
Slovenia[49]	Water abstractions are authorised for a period of time up to 30 years. Construction permit of the scheme is not time specified.	There are two types of fees to be paid by SHP producer: 1) Water concession charges – 3% of T (where T is buy-back rate for 1 kWh) and 2) extra charges - 0.3% of T)

[47] More detailed information can be obtained from the individual national data templates annexed to this report

[48] Source: SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

Country	Granted period	Charges for water use small or lager hydropower
Switzerland	New facilities: Fixed by canton/municipality but never exceeding 80 years Existing facilities: Fixed by canton/municipality usually not exceeding 80 years. For some old installations unlimited periods are possible	< 1 MW: No charges 1 - 2 MW: linear increase to 80 CHF/kW (max.) > 2 MW: max. 80 CHF/kW (80 CHF ≈ ca. 50,- €/kW)
Liechtenstein	All plants constructed before 1976; no limitation for granted period	According to Water Act the yearly charges amount for 6,- CHF (ca. 4,- €) per gross horse-power
Monaco	No hydropower	

Table 8: Granted period and charges for the use of water for the hydropower generation in the Alpine countries[49]

The granting periods for new installations can vary between the countries from 30 years (e.g. Germany and Italy) up to 90 years (Austria). For existing facilities, water licences or authorisations already granted can range up to be time unlimited.

A certain period of licence or authorisation is essential for the operator of hydropower facilities in order to be able to reach the timeframe necessary for amortisation of the facility (which can vary depending on the type of station, interest rate, etc.) and therefore security of investment. However, too long granting periods can be problematic since management of water resources has to have the ability to adapt to changing conditions (e.g. natural, technical, political). Long granting periods for authorisations can make the system inflexible, especially in combination with strong user rights that do not allow any adaptations.

In all Alpine countries, with the exception of Austria, charges for water use have to be paid by the operator of the facility. The amount of charges often differs based on the size of the facility. Operators of smaller hydropower stations are often exempted from charges to a public body for the use of water for hydropower generation. Further information can be obtained from Table 8 or the national data templates annexed to the report. Nevertheless, the allocation of revenues from hydropower production and in particular an increase on the share of revenues that is return to the local level, seems to be an ongoing discussion.

[49] More detailed information can be obtained from the individual national data templates annexed to this report

6.3 Ecological licensing requirements and general criteria

In Alpine countries, the policy framework for the ecological licensing requirement generally does not make a distinction between small and large hydropower stations. The same environmental obligations (e.g. sufficient residual water or fish migration aids etc.) have to be fulfilled in the same way for river stretches utilised for small or large facilities. In Italy, the ecological requirements imposed are basically the same, but the compensation measures required by the environmental impact assessment are stronger for large hydropower.

In all Alpine countries the specific ecological conditions imposed for construction of new facilities include regulations on residual water and a guarantee of fish migration. With respect to fish migration generally no distinction between upstream- and downstream migration is made. In Alpine countries generally no specific ecological requirements for the maintenance of the bed-load balance are imposed for the authorisation procedure.

Imposed ecological conditions for fish migration[50]		
Country	Upstream migration	Downstream migration
Austria	Yes, but only in water bodies where naturally fish are living (natürlicher Fischlebensraum). This requirement is usually requested since the Wasserrechtsgesetz-Novelle 1990; but according to the Austrian River Basin Management Plan (March 2010) it s planned to strengthen this requirement by implementing a specific Ordinance (upstream migration has to be guaranteed for fish as being State of the Art concerning river continuity)	No, at present there are no specific legal provisions for downstream migration in place.
Germany	Substantial modification or operation of a power plant is only admissible if the continuity of the water body is maintained or restored where this is necessary to achieve the management goals.	
France	No indication	
Italy	Under certain circumstances, depending on the type of catchments and on the size of the water body and on the presence of fish. A fish pass is generally required	
Slovenia	Yes, fish migration has to be ensured for all new constructions that could cause continuity interruptions of rivers. This is regulated within the Freshwater Fishery Act. However, the Act does not define exactly the requirements for downstream migration.	
Switzerland	Yes, fish migration has to be enabled but no distinction between upstream and downstream migration. So far only facilities for upstream migration are generally provided (but efforts are made for downstream migration as well).	
Liechtenstein	Yes, fish migration must be guaranteed	
Monaco	No hydropower	

Table 9: Imposed ecological conditions for fish migration in the Alpine states

[50] More detailed information can be obtained from the individual national data templates annexed to this report

Country	Imposed ecological conditions on residual water[51]
Austria	Yes, good ecological status has to be guaranteed with specific regard to the biological elements. As for new installations the reaction of biology has to be predicted the "Qualitätszielverordnung Ökologie - BGBl. II Nr. 99/2010" (Ordinance on ecological quality standards) includes a guiding value for ecological minimum flow. This abiotic value means that with this minimum flow the good status of the biological elements can be guaranteed with high confidence.
Germany	Yes, Bavarian guideline for existing small hydropower facilities < 500 kW with ecologic and economic threshold value. According to the Bavarian guideline residual water in general limited by 5/12 MNQ for existing plants - idea of inventory protection. For new hydropower facilities special residual water studies are carried out including all concerned biotic and abiotic aspects. Often in situ discharge investigations. Individual survey considering single case circumstances rather than fixed threshold values. Often dynamic components such as percentage of actual supply are added (e.g. good practice example EV Oberstdorf). General approach for residual water studies is summarized in already conveyed sheets from Bavarian environment agency.
France[51]	Yes, normally 10% of inter-annual mean flow. For sites with inter-annual mean flow of more than 80 m^3/s it is reduced to 5% and also for some other cases. This rule is applicable to new projects, for existing plants at renewal or 1 January 2014 at the latest.
Italy	Yes, in order to make hydropower production more compatible with the natural life of rivers, a minimum flow must be released so as to assure the preservation of the hydrological continuity of the river and the consequent conservation of natural habitat and ecological life. For each river district the general criteria to evaluate residual flow are fixed by the basin authority within a wide range of possible methods. The effective value for each river stretch is regulated by the regions. A very common approach is to use parametric formulae, where the reserved flow is imposed as a fraction of the mean river flow. This fraction considered hydrological, morphological and environmental aspects.
Slovenia	Yes, conditions are defined in the decree on criteria for determination and on the mode of monitoring and reporting of ecologically acceptable flow (2009). An abiotic threshold value is applied.
Switzerland	Yes, minimum flow requirement in principal derived from Q347 flow rate with further specifications.
Liechtenstein	Yes (sufficient residual water after water abstraction required)
Monaco	No hydropower

Table 10: Imposed ecological conditions on residual water in the Alpine states

In Alpine countries the decision on approval of new facilities is mostly determined individually for the specific site, there are no "general criteria for approval". Nevertheless, as described in the following table, in some countries projects within National Parks, Nature 2000-Sites, etc. are generally rejected.

[51] Source: SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

Country	Criteria for sites where construction of new facilities is generally rejected[52]
Austria	Work on specific criteria is in progress. However no final list is in place. Up to now it has to be proved during the approval process that no public interests are infringed upon for every individual plant.
Germany	Always decision in each single case by weighting all pros and cons.
France[52]	Several areas, decided by "Conseil Superieur de la Peche"
Italy	Yes, as a rule, constructions of new facilities are forbidden in areas like Nature2000 sites, Sites of Community Importance (SCI) and Special Protection Areas (SPA). There are also areas classified as exposed to high natural hazards, where the construction of new hydro-power plants is not allowed.
Slovenia[52]	The rivers are classed in 4 categories. 1st and 1-2nd are regarded as preserved (non-regulated or used for any economic activity) and are not intended for power production. In addition there are preserved territories under Natura2000.
Switzerland	If sites are located in inventoried national or cantonal sites with strong relation to water/groundwater/fish (alluvial zones, mires, spawning areas, …), this is normally taken as a strong argument by the competent authority for rejecting applications.
Liechtenstein	No remarks
Monaco	No hydropower

Table 11: Existence of criteria for sites where construction of new facilities is generally rejected

6.4 Further Hydropower development – pre planning mechanisms and strategic planning

In the Alpine countries, there is in general no strategic planning for further hydropower development in place. However, in most countries a discussion on planning instruments is ongoing and surveys of hydroelectric power potential are under preparation or in some cases already in existence.

Development Plans - Existence of concrete plans for future development		
Country	Plans	Description[53]
Austria	Not yet. Work in progress:	In the Austrian River Basin Management Plan (March 2010) the Austrian Federal States (Bundesländer) are supposed to proceed with regional planning which i.e. may lead to an assignment of water bodies where the high status will be protected in any case for the future
Germany	No concrete intentions	New Federal Water Act contains provisions for surface waters aiming at an examination of existing transversal structures being suitable for hydropower use; Criteria have to be defined under which hydropower use is conceivable at existing transversal structures Survey of hydroelectric power potential for promoting large hydropower (> 1 MW) has been done by large hydropower companies. Reflections on spatial prioritisation for hydropower use have been made.
France	No indication	

[52] More detailed information can be obtained from the individual national data templates annexed to this report

[53] More detailed information can be obtained from the individual national data templates annexed to this report

Development Plans - Existence of concrete plans for future development		
Country	Plans	Description[54]
Italy	Few plans at provincial level	At the moment there is a general lack of a territorial planning for hydropower. Only a few public authorities, generally at the province level, made a territorial plan for hydropower development. Based on WFD criteria, the Province of Sondrio identified suitable and less suitable areas for the construction of hydropower plants. Outside the Alps, the Province of Florencedeveloped a territorial planning indication that new hydroelectric plants must utilise the existing weirs.
Slovenia[55]	Under preparation	Local spatial plans are being produced in which SHP have to be included to apply for the concession. However, there is no intention to develop local spatial plans to guide the development of SHP project by highlighting suitable areas.
Switzerland	In some Cantons under preparation, a national recommendation foreseen for the beginning of 2011	In the "strategy for hydropower utilisation in Switzerland" the contribution of new small hydropower to the evolution of Swiss hydropower until 2050, is estimated at 1100 GWh/year. The strategy remarks that appropriate potential sites should be determined, but does not include specific geographical information. Competent authorities are demanding instruments and strategies for global evaluation of incoming applications. Some Cantons are about to prepare strategies. At national level a recommendation on the use of small hydropower is under preparation and is to be published by beginning of 2011[56].
Liechtenstein	No	No plans
Monaco	No hydropower	

Table 12: Development Plans - Existence of concrete plans for future development (e.g. Strategic Planning or Surveys of hydroelectric power potential) based on geographical information

[54] More detailed information can be obtained from the individual national data templates annexed to this report

[55] Source: SHERPA, 2008b. Strategic Study for the Development of Small Hydro Power (SHP) in the European Union. SHERPA – Small Hydro Energy Efficient Promotion Campaign Action.

[56] www.umwelt-schweiz.ch/UD-1037-D

7 MAIN FINDINGS AND CONCLUSIONS

One of the main findings drawn from feedback received from countries answering the template, was that appropriate national provisions for environmental residual (minimum) flows as well as provisions for fish passes are required for new projects; in general no distinction between small and large hydropower seems to be made with regard to imposing ecological conditions. Therefore no further work was undertaken with regard to residual flows and fish passes in order not to duplicate national efforts already in place, nor was any major added value seen in drafting general guidances to cover the whole Alpine area; this is in light of of the necessity to pay attention to regional differences and to varying national conditions. Work thus focused on providing the basis for the guidelines covering the use of small hydropower including common principles and recommendations, on an outline for an assessment procedure as well as on a pool of evaluation criteria.

Several hundred applications for new small hydropower stations have been reported across the whole Alpine area (with considerable difference of numbers between countries), thus potentially adding to the high number of facilities already in place. This boom has been triggered in particular by the financial incentives and support schemes in place in all countries of the Alps. The most widespread form of support are feed-in-tariffs; however the form as well as the amounts of subsidy differ considerably between countries. The allocation of revenues from hydropower production, and in particular the increase of the share of revenues returned to local level, is an ongoing discussion.

Nearly all countries levy charges for water use in hydropower generation (except AUT), for some Alpine regions this constitutes a major source of income. Some countries make a differentiation between small and large hydropower, exempting SHP from charges.

This boom in applications presents a particular challenge for competent authorities in handling the huge amount of applications and deciding on authorisations for new facilities, due to variety of aspects to be taken into account (energy generation, CO2 emission reduction, ecological impact etc).

Adding to the difficulties of the high number of applications for new facilities is the fact that there are no criteria for a general approval in place. The decision on new facilities is mostly determined for sites individually (with exception that in some countries projects within National Parks, Nature2000-Sites, etc. are generally rejected). So far authorisation seems to have been based mainly on the assessment of impacts of the individual facility on the actual site. In line with the provisions of the EU Water Framework Directive as well with ecological needs and cumulative effects, a more holistic assessment needs to be carried for new modifications affecting water status. This includes the impact on the ecological status of the river stretch, the impacts on river stretches other than the one on which the project is situated and, in the case of several projects in the same river catchment, cumulative effects of the various projects.

Master plans, action plans or strategies for the development of hydropower (in EU countries driven by the "20-20-20 targets") are mostly not yet in place. The same holds true for pre planning mechanisms with regard to the identification of the remaining potential and with regard to ecological compatibility. However, the feedback provided indicates that efforts in this direction are under way. The forthcoming common guide-lines will certainly support these ongoing efforts.

One of the main findings of the report on "Water and Water Management Issues – Report on the State of the Alps" was that quite a number of facilities in place (having got authorisations in the past without approriate environmental provisions) do not meet up to date ecological requirements with regard to fish passes, minimum residual flows, etc. While legal provisions are now in place to enhance ecological status so too are economic incentives to provide for such enhancement. These incentives include direct grants and increased feed-in-tariffs as well as "green labels" to get higher prices on the market. Good practise examples reported back include initiatives to refurbish and modernise facilities in place leading both to improvement in ecological status and an enhanced output of hydropower generation.

Last but not least two further findings shouldf be highlighted: the definition of small hydropower plants and their contribution to overall hydropower generation. Feedback provided revealed that the term "small hydropower" is frequently used in the discussions on the generation of renewable energy and defined usually according to the

characteristic figure for the bottleneck capacity. However the threshold for small hydropower is tailored to national needs and thus differs from less than 10 MW to less than 1 MW.

From the collected data it is evident that of the total electricity production from hydropower the larger plants contribute by far the major share, i.e. more than 95% of the total production comes from facilities with > 1MW power output. Meanwhile stations with a capacity of less than 1 MW constitute around 75% of all HP plants within the Alpine area yet contribute less than 5% to total electricity production. The smaller the capacity class the more contrasting is the ratio between number of plants and their contribution to the total hydroelectric production. This raises a question as to whether financial incentives provided at national level for very small hydropower plants contribute significantly to increase the share of renewables; a potential need for optimising current economic incentives may be derived from this data. However small hydropower plants play a crucial role in meeting electricity demand in more remote regions and provide important economic stimulation at local level in less favoured areas. Furthermore, when taken together, they go some way towards meeting ambitious goals on increasing the share of renewable energies.

Based on the facts and findings presented in the report, the key conclusion is that due care and planning on a regional basis is necessary when deciding about new SHP facilities in order to ensure that further development of hydropower is compatible with environmental protection requirements as well as with the ambitious targets set for renewable energy. This explains the need for support for decision-making and common guidelines.

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

SITUATION REPORT ON HYDROPOWER GENERATION IN THE ALPINE REGION FOCUSING ON SMALL HYDROPOWER

ANNEX
NATIONAL QUESTIONNAIRES ON HYDROPOWER GENERATION IN ALPINE COUNTRIES

The annex in hand is part of the document

"Situation Report on Hydropower Generation in the Alpine Region focusing on Small Hydropower"

published by the Platform Water Management in the Alps.

The annex includes national questionnaires with data and information on different aspects of small hydropower generation in the individual countries. This was used as a basis for the elaboration of the Situation Report on Hydropower Generation in the Alpine Region focusing on Small Hydropower.

The national questionnaires are subdivided into 3 different categories of information: (1) statistical data, (2) promotion for the development of small hydropower and (3) the general framework conditions for authorisation. Statistical data provided refer to the year 2005, except where annotated differently.

INDEX

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION AUSTRIA

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1. Statistical Data on Hydropower Generation in Alpine Countries

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

AUSTRIA

X Whole territory

X Share within Alpine perimeter of the country *- in particular for table 1.2 (see figures [ ])*

1.1 Basic statistical data

Country	Description	Unit	Value	Comment
Austria	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	66.479	Whole territory
	Total electricity production from hydropower in 2005	[GWh]	39.019 [22.659]	Smalls and large hp Whole territory [Alpine perimeter]
	Threshold value for hydropower stations considered as "small hydropower"	[kW]	10.000	10 MW
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]	9,2 [13,5]	Whole territory [Alpine perimeter]
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	93,2	Whole territory
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio. t	ca. 14 - 16	Whole territory

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

1.2 Classification of hydropower stations

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
Austria	--	--	--	Indicated in [ ]: Figures for the share within Alpine perimeter of the country. See indication below the table
	< 300 [1]	1.656 [1.176]	568,9 [484]	
	< 1.000 [1]	362 [257]	879,7 [748]	
	< 5.000 [1]	201 [143]	1.515,1 1.288]	
	< 10.000 [1]	31 [22]	623,4 [530]	
	> 10.000 [2]	146 [115]	35.432 [19.609]	
	Total	**2.396 [1.713]**	**39.019 [22.659]**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

[1] Data Basis for the energy output as well as number of hydropower stations of each class are based on http://www.e-control.at/ for the territory of Austria. These figure result from the entire territory of Austria. No precise data can de provided for the Alpine Perimeter. To get a rough approximation for the Alpine Perimeter, energy output as well as number of hydropower stations for all small hydropower plants (< 10 MW) has been calculated according to the share of the Alpine Perimeter within the entire territory of each individual "Bundesland" (federal state).

[2] The energy output and number of large hydropower stations (> 10 MW) outside the Alpine Perimeter is known from different sources. Hydropower Stations >10 MW outside the Alpine Perimeter: 9x Danube (without Greifenstein), 6x Mur, 3x Enns, 3x Traun, 5x Inn, 3x Kamp, 1x Große Mühl, 1x Ranna
The number of Hydropower and energy output of the Alpine Perimeter has been calculated by subtracting those figures from the total provided via e-control.

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005: 23,3 %

- Target for Share of energy from renewable sources in gross final consumption of energy, 2020: 34,0 %

Comments:

Targets for renewable energies as set for EU member States in Annex I of directive 2009/28/EC.

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

x Yes

☐ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

x Investment grants

Comments:

According to "Ökostromgesetz - BGBl. I Nr. 149/2002" (Eco-Electricity Act). Link: http://ris.bka.gv.at/Dokumente/BgblPdf/2002_149_1/2002_149_1.pdf and "Ökostrom-verordnung 2010" - www.oem-ag.at

Every project has to follow the European grant threshold value. There are just investment grants:

50 kW	50 - 500 kW	500 - 2.000 kW	2000 - 10.000 kW
max. 1.500 EUR/kW	max 1.500 EUR/kW	max. 1.000 - 1.500 EUR/kW	max. 400 - 1.000 EUR/kW
	max. 30% of investment costs	max. 20 - 30% of investment costs	max. 10 - 20% of Investment costs

(x) Tariff subventions

Comments:

Feed-in tariffs ended 2009.

☐ Others (please indicate): _____

Comments:

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?

In case quantitative data is available please fill the following table:

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
	< 50			
	< 300			
	< 1.000			
	< 5.000			
	< 10.000			
	> 10.000			
	Total			

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description of the situation:

A considerable number of small hydropower projects are trying to get an approval. No precise number is available as authorisations are provided at district level.

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

x Yes

☐ No

In case 'yes' please provide a brief description of the situation:

The main challenge is to cope with the non-deterioration provision of the EU-Water Framework Directive, respectively to comply with article 4.7 WFD (exemptions). So far only limited practical experience with these approaches is in place.

2.5 Legal regulation for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

The Austrian River Basin Management Plan was published in March 2010. The next step is to adapt the Austrian Water Act to the new requirements (autumn 2010). The remediation targets of the rivers are addressed in the § 33 of the Austrian Water Act.

Link: Nationaler Gewässerbewirtschaftungsplan / Austrian River Basin Management Plan: http://wisa.lebensministerium.at/article/archive/29367

2.6 Incentives for ecological upgrading of existing facilities

If incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

Measures to improve the ecological conditions of the rivers are promoted by the Austrian state. The relevant legal framework is constituted by the "Umweltförderungsgesetz" (§ 17a) (Environmental Promotion Act). 140 Mio. Euro are provided by the Federal State in form of investment grants up to 2015 for environmental measures such as restructuring of morphologically modified river beds, enhancement of river continuity and habitat connectivity or mitigation measures in case of hydro-peaking.

Furthermore there is a "double-strategy" in place in Upper Austria, where the refurbishment of existing facilities (e.g. renewal of turbines and technical equipment) is combined with the implementation of environmental measures (e.g. sufficient residual water and fish passes). In such a way upgraded hydropower facilities can generate more electricity while at the same time fulfilling modern environmental standards.
In the Austrian provincial state Upper Austria for instance, 258 small hydropower facilities were modernised in the last 5 years, resulting in an increase of electricity production by 40% (76 GWh per year) while at the same time respecting environmental needs.

Link: „Umweltförderungsgesetz BGBl. Nr. 185/1993" (Environmental Promotion Act).

http://ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010755

3. FRAMEWORK CONDITIONS FOR AUTHORISATION OF FACILITIES

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is to be allowed or rejected.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

x No

Work on specific criteria is in progress. However no final list is in place. Up to now it has to be proved during the approval process that no public interests are infringed for every individual plant.

If yes, please briefly describe applied criteria:

3.1.2 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

X Yes

☐ No

If yes, please briefly describe applied criteria:
No specific assignment of water bodies /types/ regions for small hp generation, but approval is given

- In case that no public interest are infringed;
- In water bodies with good status small hydropower plants (abstraction type) will not cause a deterioration of status class provided an ecological minimum flow and continuity is guaranteed: project can be approved therefore if no other public interests (i.e. drinking water supply,…) are infringed.

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in “High Status” according to WFD, etc.)?

☐ Yes

X No

If yes, please briefly describe applied criteria:

Comments:

Work in progress:
The Austrian River Basin Management Plan (March 2010) provides the framework for new installation of hydropower plants. The next step is to adapt this framework by the Austrian Federal States (Bundesländer).

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☐ Yes

X No

If yes, please briefly describe applied criteria:

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country ("master plan" or strategies) – on a national or regional level - based on geographical information like for specific rivers or river sections, specific regions or certain catchment areas for instance?

☐ Yes

☐ No

X Others (please indicate): _____

Comments:

Work in progress:
In the Austrian River Basin Management Plan (March 2010) the Austrian Federal States (Bundesländer) are supposed to proceed with a regional planning which i.e. leads to an assignment of water bodies where the high status will be protected in any case for the future.

3.2.2 If yes, please indicate the legal status of those plans.

☐ Statement of will by the competent authority but not legally binding

☐ Effective in law

X Still under preparation

☐ Others (please indicate): _____

Comments:

See above.

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments /

regions designated as “for hydropower use” (with e.g. less stringent ecological requirements) and conversely other areas designated as “not for hydropower use”?

See above.

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorisation / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).

Facilities < 500 kW: Regional District Authority (= Bezirkshauptmannschaft)

Facilities > 500 kW: Austrian Federal States (= Bundesländer)

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorisation procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?

Competent authorities see above:

In Austria small hydropower plants are plants < 10 MW bottleneck capacity and large hydropower plants are plants > 10 MW bottleneck capacity.

An Environmental Impact Assessment becomes necessary over 15 MW bottleneck capacity.

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

X Authorisation for the construction granted by competent authority

☐ Licensing system

☐ Others (please indicate): _____

Comments:

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?

Usually 90 years

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?

Usually 90 years but there still a number of facilities in place with authorisations without any limitation in time.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☐ Yes

X No

If yes, please briefly describe payments in further detail:

3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?

No dues/taxes/ … for any hydropower plant for use of water to the Austrian Water Act.

3.4 Ecological conditions imposed for new facilities

Please give brief information of ecological conditions imposed on construction of new small hydropower facilities.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

X Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:
But only in water bodies where fish naturally live (natürlicher Fischlebensraum). This requirement is usually requested since the Wasserrechtsgesetz-Novelle 1990; but according to the Austrian River Basin Management Plan (March 2010) it s planned to strengthen this requirement by implementing a specific Ordinance (upstream migration has to be guaranteed for fish as being 'state of the art' concerning river continuity)

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☐ Yes

X No

☐ Under certain circumstances (please indicate):

_____

Comment:
At present there are no specific legal provisions for downstream migration in place.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

x Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

Good ecological status has to be guaranteed with specific regard to the biological elements.
As for new installations the reaction of biology has to be predicted the "Qualitätszielverordnung Ökologie - BGBl. II Nr. 99/2010" (Ordinance on ecological quality standards) includes a guiding value for ecological minimum flow. This abiotic value means that with this minimum flow the good status of the biological elements can be guaranteed with high confidence.

Corner stones "Qualitätszielverordnung Ökologie":

- Residual water flow (dependent on the natural water flow)
- Fish migration measures (fish passes)
- Seasonal, dynamic water flow (spawning grounds)
- Typical oxygen and temperature conditions
- Proportion downsurge : flood = max. 1:3

Link Qualitätszielverordnung Ökologie (Ordinance on ecological quality standards)
http://wisa.lebensministerium.at/article/articleview/81496/1/29384

3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☐ Yes

X No

☐ Under certain circumstances (please indicate):

_____

Comment:

At present there are no specific legal provisions in place.

3.4.5 Is there any difference between small and large hydropower stations with regard to ecological conditions imposed on the construction of new facilities?

No – all have to meet the environmental objectives of WFD

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION GERMANY

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1. STATISTICAL DATA ON HYDROPOWER GENERATION IN ALPINE COUNTRIES

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

☐ Whole territory

X Share within Alpine perimeter of the country

1.1 Basic statistical data (whole territory)

Country	Description	Unit	Value	Comment
Germany	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	620600	Value for the **whole territory**. (Federal Ministry of Economics and Technology; www.bmwi.de)
	Total electricity production from hydropower in 2005	[GWh]	26700	Value for the **whole territory**. (Federal Ministry of Economics and Technology; www.bmwi.de)
	Threshold value for hydropower stations considered as "small hydropower"	[kW]	1.000	
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]		
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	1013	Data for the **whole territory**. (Umweltbundesamt; National Trend Tables for the German Atmospheric Emission Reporting - 1990 - 2008 (Version: EU-Submission 15.01.2010)
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio.t.	366	Data for the **whole territory** – The value refers to the emissions from energy industries. No data available for the domestic electricity production only. (Umweltbundesamt; National Trend Tables for the German Atmospheric Emission Reporting - 1990 - 2008 (Version: EU-Submission 15.01.2010)

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

1.2 Classification of hydropower stations

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
	< 50	468	35	These values (Energy Output) were calculated from estimated values and do not show the real electricity production of the year 2005. The indication of the number of hydroelectric power plants reflects the conditions of the year 2009.
	< 300	178	115	
	< 1.000	48	126	
	< 5.000	32	302	
	< 10.000	10	305	
	> 10.000	16	2040	
	Hydroelectric power plants without indication of the max. capacity	9	0	
	Total	**761**	**2923**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005: 6,7 %
- Target for Share of energy from renewable sources in gross final consumption of energy, 2020:

20%

Comments:

According to the current parameters (2009) of the Federal Environment Ministry. Source:

http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/leitszenario2009_kurzfassung_bf.pdf

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

X Yes

☐ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

☐ Investment grants

Comments:

X Tariff subventions

Comments:

Renewable Energy Sources Act (EEG, federal law) provides guaranteed tariff schemes for contributing to public energy supply.:

New plants: < 500 kW 500 kW < X < 2 MW 2 MW < X < 5 MW	 12,67 ct/kWh 8,65 ct/kWh 7,65 ct/kWh
Modernisation of existing plants: < 500 kW 500 kW < X < 5 MW	 11,67 ct/kWh 8,65 ct/kWh

An improvement of the ecological status is indispensable.

☐ Others (please indicate): _____

Comments:

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?

In case quantitative data is available please fill the following table:

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
	< 50			
	< 300			
	< 1.000			
	< 5.000			
	< 10.000			
	> 10.000			
	Total			

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description of the situation:

EEG shows positive effects esp. on modernisation of existing small hydropower stations in combination with ecological improvements.
Further Information given by Renewable Energy Sources Act (EEG) Progress Report 2007 by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

☐ Yes

X No

In case 'yes' please provide a brief description of the situation:

Remark: approval procedures for **new** hydropower plants are mostly difficult due to variety of aspects and interests.

2.5 Legal regulation for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

In principle there are the same or similar legal regulations and procedures as described in the Suisse template. Though we actually don't have a legally binding "protection & utilisation plan", similar approaches are being carried out at least in single cases. Those ideas are also picked up in some basic principles to deal with HP in Bavaria, as well as the task to ecologically optimise hydro-peaking (as yet no special legal regulation exists on this point).

In 2006 a voluntary agreement on general principles for the sustainable use of hydropower was made between the Bavarian state government and operators of large HP. The key points are:

- a building block for the implementation of the Bavarian climate protection, flood management and energy policy
- commitment to the implementation of the EC Water Framework Directive and Natura 2000 Directive in keeping with the principle of sustainability
- coordinated framework concept for promoting the use of hydroelectric power and for the development of best possible solutions for other environmental issues
- platform for working together in the development and use of water bodies – ongoing process

Although the key points primarily apply to large HP, many ideas and approaches behind can easily be transferred to small HP as well.

2.6 Incentives for ecological upgrading of existing facilities

If case incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

Incentives to improve the ecological status of existing hydropower plants are given by the Renewable Energy Sources Act (EEG, federal law) by providing guaranteed increased tariff schemes for contributing to public energy supply.

If an existing power plant is being modernised and thereby the ecological status is going to be improved significantly, tariff schemes can be increased up to 12,67 ct/kWh for power plants < 500 kW and up to 8,65 ct/kWh for power plants < 5 MW. There also exist similar (degressive) regulations of increased tariff schemes for power plants up to 150 MW. The restriction here is that the increased tariff schemes are only provided for the amount of electricity which is additionally generated due to the modernisation of the power plant (in order to avoid taking along effects).

Certificates where modernisation leads to a significant improvement of the ecological status are issued by state authorities or by certified private environmental consultants.

3. Framework Conditions for Authorisation of Facilities

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is allowed or being rejected.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

X No

If yes, please briefly describe applied criteria:

3.1.2 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

☐ Yes

X No

If yes, please briefly describe applied criteria:

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in “High Status” according to WFD, etc.)?

☐ Yes

X No

If yes, please briefly describe applied criteria:

Remark concerning 3.1.1 to 3.1.3: “go / no go” areas do not exist. Always decision in each single case by weighing all pros and cons.

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☐ Yes

X No

If yes, please briefly describe applied criteria:
Remark: economic criteria are up to the enterprise carrier.

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country (“master plan” or strategies) – on a national or regional level - based on geographical information like for specific rivers or river sections, specific regions or certain catchment areas for instance?

☐ Yes

☐ No

X Others (please indicate): New Federal Water Act (new Act on the Regulation of Matters Pertaining to Water - WHG, on the way) contains surface covering examination of existing transversal structures for being suitable for hydropower use (§35 (3) WHG).

Comments:
A master plan for promoting larger hydropower (> 1000 kW) is on the way.

3.2.2 If yes, please indicate the legal status of those plans.

☐ Statement of will by the competent authority but not legally binding

☐ Effective in law

X Still under preparation

☐ Others (please indicate): _____

Comments:

Criteria have to be defined under which hydro power use is conceivable at existing transversal structures.

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments / regions designated as “for hydropower use” (with e.g. less stringent ecological requirements) and conversely other areas designated as “not for hydropower use”?

Reflections have been made but no concrete intentions.

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorising / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).
District council.

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorising procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?
No. For some projects with supposed larger spatial effects there also exist additional area planning procedures.
By latest corresponding federal law (Feb. 2010) the following regulations apply: For reservoirs larger than 10 Mio. m^3 an EIA is compulsory. For smaller reservoirs a general preliminary survey has to be done on an individual basis, which is also the case for every other hydropower plant. EIA has to be carried out, if the project could have a substantial unfavourable impact on the environment in the estimatation of the responsible authority due to rough examination. Therefore special examination criteria have been defined in a legal annex and are binding.

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

X Authorisation for the construction granted by competent authority

☐ Licensing system

☐ Others (please indicate): _____

Comments:

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?
30 years at most.

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?

Varies, up to unlimited old permission.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☐ Yes

x No

If yes, please briefly describe payments in further detail:

3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?

From 1100 k'W upwards there is a special fee for hydropower generating.

3.4 Imposed ecological conditions for new facilities

Please give brief information on ecological conditions imposed on the construction of new small hydropower facilities.

On 1st March 2010 the revised water law entered into force. The extension of provisions on the management of surface water bodies is particularly relevant for the use of hydropower. Pursuant to Article 33 of the Federal Water Act, damming, abstracting or diverting water is only admissible if a sufficient minimum water flow is guaranteed. Article 34 of the Federal Water Act stipulates that the construction, substantial modification or operation of a dam is only admissible if the continuity of the water body is maintained or restored where this is necessary to achieve the management goals. Article 35 of the Federal Water Act specifies the ecological requirements for hydroelectric power plants. They may only be operated if adequate measures for the protection of the fish population are taken.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

x Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☐ Yes

x No

☐ Under certain circumstances (please indicate):

_____

Comment:
New federal water act (WHG, 03/2010) demands also fish protection measures for downstream migration. Problem: research work has still to be done to provide suitable solutions for practical use.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

X Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

Bavarian guideline for **existing** small hydropower facilities < 500 kW with ecologic and economic threshold value. According to the Bavarian guideline residual water in general limited by 5/12 MNQ for existing plants - idea of inventory protection.

For **new** hydropower facilities special residual water studies are carried out including all relevant biotic and abiotic aspects.

Often in situ discharge investigations. Individual survey considering single case circumstances rather than fixed threshold values. Often dynamic components such as percentage of actual supply are added (e.g. good practice example EV Oberstdorf).

General approach for residual water studies is summarised in already conveyed information from Bavarian environment agency.

3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☐ Yes

x No

☐ Under certain circumstances (please indicate):

_____

Comment:

Usually there are certain facilities within the weirs to drift bed-load downstream, e.g. in case of flood discharge.

3.4.5 Is there any difference between small and large hydropower stations with regard to ecological conditions imposed on the construction of new facilities?

No.

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION ITALY

1. STATISTICAL DATA ON HYDROPOWER GENERATION IN ALPINE COUNTRIES

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

☒ Whole territory

data for the whole national territory are reported only in tab. 1.1. in square brackets

☒ Share within Alpine perimeter of the country
territory of the Provinces inside the Alpine Convention

1.1 Basic statistical data

Country	Description	Unit	Value	Comment
ITALIA	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	[302.555 (gross)] 60.553 (gross)	Data source Terna spa
	Total electricity production from hydropower in 2005	[GWh]	[42.927 (gross)] 29.633 (gross)	Data source Terna spa
	Threshold value for hydropower stations considered as "small hydropower"	[kW]	1.000 3.000	Double definition
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]	[3,5] 3,8	Calculated for power plants <1.000 kW Data source Terna spa
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	[579,5]	Data source APAT/ISPRA
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio. t	[169,2]	Data source APAT/ISPRA

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

1.2 Classification of hydropower stations

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
ITALIA	< 50	54	22	
	50 - 300	379	232	
	300 - 1.000	422	871	
	1.000 - 5.000	347	2.529	
	5.000 - 10.000	74	1.625	
	> 10.000	211	24.354	
	Total	1487	29.632	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005: 5,2 %

- Target for Share of energy from renewable sources in gross final consumption of energy, 2020:

17 %

Comments:

Targets for renewable energy as set for EU member States in Annex I of directive 2009/28/EC.

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

☒ Yes

☐ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

☒ Investment grants

Comments:

In some regions, European funds are used to promote the development of renewable energy production schemes (including hydropower plants) according to the economic development policy of the area. These kind of incentives cannot be added to the other form of incentives on the production such as Green Certificates (see below).

☒ Tariff subventions

Comments:

CIP6/92: starting in 1992 the government began to support renewable energy production mainly by grants provided for the CIP6/92 Programme. These prices are based on the concept of "avoiding costs". The price includes a premium as an incentive for the higher cost of different conversion technologies.
The CIP6/92 is no longer in force, but there are plants that still benefit from this system. These are plants which came into operation or signed a preliminary agreement when the CIP6/92 was still in force.
The main problem with CIP 6/92 Programme concerned linking the incentive of plants to energy sources. Efficient plants powered by fossil origin sources with a low environmental impact were also boosted, indeed 70% or more of the contributions was directed to this type of plants, instead of to renewable source plants.

Green Certificates: under the system of the Green Certificates (GC) foresees, if a plant produces less CO_2 than a traditional plant, the management gets Green Certificates that

can resold to industries or initiatives that are forced to produce a quota of energy with renewable sources, but are not able to do it on their own.

All new hydropower plants and refurbished/re-powered plants qualified as Renewable Energy Plants receive a number of Green Certificates in proportion to their energy production (1 GC for each MWh). This incentive regime, that started in 1999 and was recently reformed in 2008, lasts from 12 to 15 years, depending on the law in force when plant was authorised (i.e., plants that were authorised in 2008 have right to 15 years, whereas plants that started their production in 2006 have right to 12 years of GC).

Comprehensive feed-in tariff: in order to simplify the financial accounting for micro-generation (GC market can be complex for the small producers), starting from the 1st January 2008 hydropower plants with P<1MW can chose instead of Green Certificates a "comprehensive feed-in tariff" (electricity price + incentive) which for the first 3 years (2008-2010) has been set to 22 €cent/kWh.

☒ Others (please indicate): Minimum tariff

Comments:

Minimum tariff: a special minimum tariff (decree n. 280/07 of the Energy Authority) is applied for the Renewable Energy Plants implemented as micro-generation (< 1 MW of installed power). In the decree of the Energy Authority it is clearly stated that the tariff isn't an incentive but an acknowledgement of the higher managing costs of the micro generation, which is important for the country as a consequence of the economic, social and environmental advantages brought about by these plants. Basically the Authority recognises the cost and the value of the socio-economic and environmental externalities of micro-generation. That's why the new micro-plant can add the incentives (i.e. Green Certificates for the first 15 years) to the above mentioned tariff. Basically the producers with plants (new and old) below 1 MW of capacity have right to a guaranteed minimum tariff, progressively structured as follow:

- 140,4 €/MWh for the first 250 MWh;
- 107,3 €/MWh between the 251st MWh to the 500th MWh
- 86,7 €/MWh between the 501st and the 1.000th MWh
- 80,5 €/MWh between 1001st and 2.000th MWh of production.

These values are valid for 2009, but there is now ongoing an administrative assessment about the amounts.

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?
In case quantitative data is available please fill the following table:

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
ITALIA	< 50			
	< 300			
	< 1.000			

	< 5.000			
	< 10.000			
	> 10.000			
	Total			

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description on the situation:

The number of new small hydropower stations which are intended / planned / projected to be realised within the Alpine Convention Italian area is high. No precise figure is available as authorisations are provided at Provincial level.

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

☒ Yes

☐ No

In case 'yes' please provide a brief description of the situation:

Approval procedures for new hydropower plants are mostly difficult due to variety of aspects:

- lack of a territorial plan for hydropower;
- lack of a diffused monitoring system: often there is not a comprehensive data base with information about all diversions;
- there is no substantial difference between the concession for small hydro and large hydro diversions, so even for very small power plants the procedure is very complex;
- to build a hydropower plant it is first necessary to get a concession for the use of water, and secondly an authorisation to set up and run the plant. The license for the use of water isn't generally integrated with the authorisation procedure to set up and run the plant. A discussion on the possibility to integrate them is ongoing;
- competition procedure: if two applications for a concession go into the competition procedure, there is no set term for presentation of the documentation and so the procedure can be indefinitely long.

2.5 Legal regulation for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

There are no legal regulations for upgrading existing facilities.

2.6 Incentives for ecological upgrading of existing facilities

If incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

There are no incentives for upgrading existing facilities.

3. Framework Conditions for Authorisation of Facilities

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is to be allowed or rejected.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

Low impact plants (e.g. HP in aqueducts, sewers, artificial canals) located within an artificial or antropic context, that have a limited environmental impact compared to the ones set up on natural rivers, are generally allowed.

3.1.2 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in "High Status" according to WFD, etc.)?

☒ Yes

☐ No

If yes, please briefly describe applied criteria:

As a rule, construction of new facilities is forbidden in areas like Nature2000 sites, Sites of Community Importance (SCI) and Special Protection Areas (SPA). There are also areas classified as exposed to high natural hazards, where the construction of new hydropower plants is not allowed.

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☒ Yes

☐ No

If yes, please briefly describe applied criteria:

Security deposit: the Regio Decreto n. 1775 of 1933 (art. 11) establishes that the applicant must deposit a sum equal to 6 months fees when he signs the disciplinary of concession. This sum is due because there is a public interest which requires protection from the consequences of the default to perform the obligations under the concession contract.

Best and certain technical-financial and economic guarantee: If applications for a concession go into the competition procedure, between criteria for evaluating competing applications there is also an economic and financial criteria: between projects that are equivalent, the public administration gives preference to the application that offers higher and assured technical-financial and economic guarantee of immediate execution and use. (Regio Decreto n. 1775 of 1933 art.9).

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country ("master plan" or strategies) – on a national or regional level - based on geographical information such as for specific rivers or river sections, specific regions or certain catchment areas for instance?

☐ Yes

☐ No

☒ Others (please indicate): few plans at provincial level

Comments:

At the moment there is a general lack of a territorial planning for hydropower. Only a few public authorities, generally at the province level, have made a territorial plan for hydropower development.
On the base of WFD criteria, the Province of Sondrio identified suitable and less suitable areas for the construction of hydropower plants. Outside the Alps, also the Province of Florence produced a territorial plan indicating that new hydroelectric plants have to utilise existing weirs.

3.2.2 If yes, please indicate the legal status of those plans.

- ☐ Statement of will by the competent authority but not legally binding
- ☒ Effective in law
- ☐ Still under preparation
- ☐ Others (please indicate): _____

Comments:

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments / regions designated as “for hydropower use” (with e.g. less stringent ecological requirements) and conversely other areas designated as “not for hydropower use”?

Yes, at provincial level.

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorising / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).

Big concessions, with a nominal capacity >3MW, are generally granted by regional authorities, while small concessions, with a nominal capacity <3MW, are granted by provincial authorities (Regio Decreto n. 1775 of 1933).

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorisation procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?

There is no substantial difference between the concession for small hydro and large hydro diversions.
Producers have to make an EIA if there is a dam and they have to go through a screening procedure if the capacity is > 100kW or if the discharge is > 200 l/sec (D.Lgs. 152/06). However several Regions may ask for an EIA even for smaller plants.

Renewal: If the owner of a small concession asks for a renewal, the authority can decide to release it or not, when there is a public interest against it. If the owner of a big concession asks for a renewal, the authority calls for tenders, because in principle everybody can apply to use the water for hydroelectric purposes in place of the former concessionary. Up to now there's no significant example of such a situation, even though some concessions are going to expire by 2010.

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

☒ Authorisation for the construction granted by competent authority

☒ Licensing system

☐ Others (please indicate): _____

Comments:

To build a hydropower plant it is first necessary to obtain a concession for the use of water, and secondly an authorisation to set up and run the plant.
The D.Lgs. n. 387/2003 (implementation of the RES-e Directive) has introduced the "single permit", that is a one-stop shop for all RES project developers. Responsible for this rests with the Region, or the Province if the Region has delegated it. However, in some Italian Regions this process has not developed yet and also in some Regions where it has been developed there are often problems related to the difficulty of coordinating the different authorisation processes.

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?

The concept of concession was introduced by the law (Regio Decreto No. 1775/1933). The concession for hydropower use lasts a maximum of 30 years, but recently authorities haved tended to allow shorter concessions as well.

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?

In Italy all the concessions are temporary.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☒ Yes

☐ No

If yes, please briefly describe payments in further detail:

The Italian concessionaries have to pay an annual fee calculated on the basis of the concession capacity (kW) and the unitary value (€/kW) is fixed by each Region and updated every year. For 2008 the medium value was around 12-14 €/kW.

Concessionaries have also to pay two additional annual fees (only if the capacity of the plant is more than 220 kW):

a. one fee to the province and the municipalities located on the river between the intake and the tail race (for 2008 it was 5,09 €/kW),
b. one fee to the Bacino Imbrifero Montano, a consortium of the municipalities, which are included in the catchment area (usually only for mountain areas above 500 m. on the sea level) (for 2008 it was 20,35 €/kW).

These two additional annual fees have the same value all over Italy.

3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?

Also for large hydropower stations the same fees are due.

3.4 Imposed ecological conditions for new facilities

Please give brief information on ecological conditions imposed on the construction of new small hydropower facilities.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

☐ Yes
☐ No
☒ Under certain circumstances (please indicate):

_____

Comment:

All fish species present in the specific site must be able to pass into the structure in every discharge condition. So, the design of the passage geometry has to take into account the local fish characteristics and guarantee proper hydraulic conditions (i.e. flow velocities and water depths). If there are some anadromous species a hydropower plant needs to be equipped with some system that can make possible the upstream migration.

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☒ Yes
☐ No
☐ Under certain circumstances (please indicate):

_____

Comment:

A fish pass is generally required.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

In order to make hydropower production more compatible with the natural life of rivers, a minimum flow must be released so as to assure the preservation of the hydrological continuity of the river and the consequent conservation of natural habitat and ecological life.
For each river district the general criteria to evaluate residual flow are fixed by the Basin Authority within a wide range of possible methods. The effective value for each river stretch is regulated by the Regions. A very common approach is to use parametric formulae, where the reserved flow is imposed as a fraction of the mean river flow. This fraction takes into account hydrological, morphological and environmental aspects.

3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☐ Yes

☒ No

☐ Under certain circumstances (please indicate):

_____

Comment:

In general for small hydropower there are no mandatory conditions for the bed load management. Only for dams higher than 10 m or with a basin storage with a volume of more than 100.000 m^3 does the hydropower plant owner have to prepare a management plan for dam addressing requirements on base load managing.

3.4.5 Is there any difference between small and large hydropower stations with regard to imposed ecological conditions in case of the construction of new facilities?

In general the compensation measures required in EIA phase are more important for big plants, because of their bigger impacts.

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION LIECHTENSTEIN

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1. STATISTICAL DATA ON HYDROPOWER GENERATION IN ALPINE COUNTRIES

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

☒ Whole territory **PRINCIPALITY OF LIECHTENSTEIN**

☐ Share within Alpine perimeter of the country

1.1 Basic statistical data – Whole territory

Country	Description	Unit	Value	Comment
	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	**67.7**	
	Total electricity production from hydropower in 2005	[GWh]	**62.7**	
	Threshold value for hydropower stations considered as "small hydropower"	[kW]	**10'000**	
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]	**72**	
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	**0.27**	
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio. t	**0.003**	

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

1.2 Classification of hydropower stations

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
	< 50	**1**	**0.18**	
	< 300			
	< 1.000	**3**	**4.67**	
	< 5.000	**1**	**12.44**	
	< 10.000			
	> 10.000	**1**	**45.37**	
	Total		**62.66**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005:

  ...

- Target for Share of energy from renewable sources in gross final consumption of energy, 2020:

  ...

Comments:

The share of renewable energies from hydropower in gross final consumption of energy was about 17% in 2005. For 2020 no precise goals are set at the moment.

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

☐ Yes

☒ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

☐ Investment grants

Comments:

☐ Tariff subventions

Comments:

☐ Others (please indicate): _____

Comments:

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?

In case quantitative data is available please fill the following table:

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
	< 50			
	< 300			
	< 1.000			
	< 5.000			
	< 10.000			
	> 10.000			
	Total	**0**	**0**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description of the situation:

No new hydropower stations are projected. The hydropower plant Samina is supposed to be transformed into a pumped-storage power station in 2010/11.

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

☐ Yes

☒ No

In case 'yes' please provide a brief description of the situation:

2.5 Legal regulations for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

At present there are no legal regulations.

2.6 Incentives for ecological upgrading of existing facilities

If incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide information relevant.

At present there are no incentives for upgrading existing facilities.

3. Framework Conditions for Authorisation of Facilities

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is to be allowed or rejected.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.1.2 Do criteria existfor sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in “High Status” according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country ("master plan" or strategies) – on a national or regional level - based on geographical information such as specific rivers or river sections, specific regions or certain catchment areas for instance?

☐ Yes

☒ No

☐ Others (please indicate): _____

Comments:

3.2.2 If yes, please indicate the legal status of those plans.

☐ Statement of will by the competent authority but not legally binding

☐ Effective in law

☐ Still under preparation

☐ Others (please indicate): _____

Comments:

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments / regions designated as "for hydropower use" (with e.g. less stringent ecological requirements) and conversely other areas designated as "not for hydropower use"?

No

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorising / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).

According to the Water Rights Act, the use of hydropower requires a concession from the government.

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorisation procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?
No

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

☒ Authorisation for the construction granted by competent authority

☐ Licensing system

☐ Others (please indicate): _____

Comments:

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?

All hydropower plans were built before the entry into force of the Water Rights Act in 1976. Their authorisations are not limited in time.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☒ Yes

☐ No

If yes, please briefly describe payments in further detail:
According to the Water Rights Act, the annual water charge for the use of water for hydropower generation is CHF 6 per gross horsepower.

3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?

No

3.4 Imposed ecological conditions for new facilities

Please give brief information on ecological conditions imposed on the construction of new small hydropower facilities.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

According to the Water Conservation Act, fish migration has to be ensured.

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

According to the Water Conservation Act, fish migration has to be ensured.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

The Water Conservation Act demands that for water derivations a sufficient residual flow remains in the waters and it describes criteria for the determination of the minimum acceptable flow.

3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☐ Yes

☒ No

☐ Under certain circumstances (please indicate):

_____

Comment:

3.4.5 Is there any difference between small and large hydropower stations with regard to ecological conditions imposed on the construction of new facilities?

No

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION SLOVENIA

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1. Statistical Data on Hydropower Generation in Alpine Countries

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

☒ Whole territory

☐ Share within Alpine perimeter of the country

1.1 Basic statistical data

Country	Description	Unit	Value	Comment
	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	15116	Gross electricity generation
	Total electricity production from hydropower in 2005	[GWh]	3460	Gross electricity generation
	Threshold value for hydropower stations considered as "small hydropower"	[MW]	10	Up to 10 MW
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]	11,07	Gross electricity generation
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	20,37	
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio. t	5,89	

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

1.2 Classification of hydropower stations

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
	< 50	107	6,916747	
	< 300	113	50,7659058	
	< 1.000	50	79,756736	
	< 5.000	15	73,140143	
	< 10.000	2	22,553719	
	> 10.000	16	3.027,942416	
	Total	**303**	**3.261,0756668**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005:

  ...

- Target for Share of energy from renewable sources in gross final consumption of energy, 2020:

  ...

Comments:

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

☒ Yes

☐ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

☐ Investment grants

Comments:

☒ Tariff subventions

Comments:

Support for the production of electricity from renewable energy sources (RES) is based on the stipulations of the Energy Act:
If the cost of production of electricity from RES including a proper market return on investment exceeds the price of electricity that can be achieved in the market for this type of electricity, the electricity producers may be granted support.
Support from the scheme is available for those units producing electricity from renewable energy sources that do not exceed the nominal power capacity of 125 MW.
Support is implemented as:

- the guaranteed purchase of electricity produced, supplied to public electricity network at a price fixed by the Government for the units producing electricity from renewable energy sources with nominal power capacity below 5 MW;
- financial support for the current operations of other producers.

Support may be obtained only for the net generated electricity for which a valid guarantee of origin was submitted.
Support may be implemented for 15 years.

☐ Others (please indicate): _____

Comments:

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?

In case quantitative data is available please fill the following table:

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [MW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
	< 10	200		
	> 10	7		
	Total	**207**		

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description of the situation:

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

☒ Yes

☐ No

In case 'yes' please provide a brief description of the situation:

We have problems due to lengthy proceedings.

2.5 Legal regulation for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

2.6 Incentives for ecological upgrading of existing facilities

If incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

3. Framework Conditions for Authorisation of Facilities

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is to be allowed or rejected.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

Construction of new facilities potentially can be approved in all areas except areas defined with criteria listed in 3.1.3.

3.1.2 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

Construction of new facilities potentially can be approved in all areas except areas defined within criteria listed in 3.1.3.

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in “High Status” according to WFD, etc.)?

☒ Yes

☐ No

If yes, please briefly describe applied criteria:

Criteria for sites / certain type of rivers or river stretches / catchments / regions where the construction of new facilities is generally rejected are:

- areas of highest morphological preservation according to the ecomorphological classification (1. class);
- reference reaches, delineated by WFD provisions;
- wetlands;
- drinking water protection areas;
- catchment areas of less than 10 km^2.

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country ("master plan" or strategies) – on a national or regional level - based on geographical information such as specific rivers or river sections, specific regions or certain catchment areas for instance?

☐ Yes

☒ No

☐ Others (please indicate): _____

Comments:

Draft of National action plan for renewables 2010-2020 (Akcijski načrt za OVE 2010-2020-osnutek) in measure 45 defines, that Ministry of the Environment and Spatial Planning should define areas where the placement of small hydropower plants is an unacceptable interference in the aquatic environment.

3.2.2 If yes, please indicate the legal status of those plans.

☐ Statement of will by the competent authority but not legally binding

☐ Effective in law

☒ Still under preparation

☐ Others (please indicate): _____

Comments:

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments / regions designated as “for hydropower use” (with e.g. less stringent ecological requirements) and conversely other areas designated as “not for hydropower use”?

The “go “– “no go” areas approach is under development for diverse water uses, among them hydropower use. See answer 3.1.3. for details.

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorising / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).

The competent authority is the government.

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorisation procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?

There are no differences between small and large.

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

☒ Authorisation for the construction granted by competent authority

☐ Licensing system

☐ Others (please indicate): _____

Comments:

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?

The authorisation is granted for max. 30 years.

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?

The authorisation was granted for max. 30 years.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☒ Yes
☐ No

If yes, please briefly describe payments in further detail:

We have payments for water rights and for use of water.

3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?

There is differentiation between small and large hydropower stations.

3.4 Imposed ecological conditions for new facilities

Please give brief information on ecological conditions imposed on the construction of new small hydropower facilities.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

☒ Yes
☐ No
☐ Under certain circumstances (please indicate):

_____

Comment:

The Freshwater Fishery Act demands fish passes on all new constructions which could interrupt the continuity of rivers. The Act does not relate this demand specifically to upstream migration.

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☒ Yes
☐ No
☐ Under certain circumstances (please indicate):

_____

Comment:

The Freshwater Fishery Act demands fish passes on all new constructions which could interrupt the continuity of rivers. The Act does not relate this demand specifically to downstream migration.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

Yes, conditions are determined according to the Decree on Criteria for Determination and the Mode of Monitoring and Reporting of Ecological Acceptable Flow, 2009. Abiotic threshold value is applied.

3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☐ Yes

☒ No

☐ Under certain circumstances (please indicate):

_____

Comment:

3.4.5 Is there any difference between small and large hydropower stations with regard to ecological conditions imposed on the construction of new facilities?

Yes. However, with the proposed measure on assessment of impact on water status, the procedures and demands will become same regardless to the size of the planned hydropower station.

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Situation Report
Hydropower Generation in the Alpine Region
focusing on Small Hydropower

Annex

NATIONAL QUESTIONNAIRE ON HYDROPOWER GENERATION SWITZERLAND

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1. STATISTICAL DATA ON HYDROPOWER GENERATION IN ALPINE COUNTRIES

Please indicate if given figures for point 1.1 and 1.2 refer to the whole territory of your country or the share within the Alpine perimeter (with a preference for the latter):

☒ Whole territory

☐ Share within Alpine perimeter of the country *if available, estimated values given in [ ]*

1.1 Basic statistical data

Country	Description	Unit	Value	Comment
Switzerland	Total electricity production in 2005 (all sources, e.g. hydropower, solar, biomass, nuclear energy, thermal power plants, etc.)	[GWh]	65'000	Average value. 2005 was a dry year, the actual electricity production for the whole territory was 57'918 GWh
	Total electricity production from hydropower in 2005	[GWh]	38'600 *[27'900]*	These values correspond to the estimated production for 2005, but do not show the real electricity production of the year 2005. The actual hydropower production of 2005 was 32'759 GWh for the whole territory.
	Threshold value for hydropower stations considered as "small hydropower"	[kW]	10'000	In Switzerland, the term small-scale hydropower plant refers to facilities that have a mean mechanical gross capacity of up to 10 MW.
	Share of electricity production from small hydropower compared to total electricity production from hydropower in 2005	[%]	9.1% *[9.2%]*	
	Total national emissions of greenhouse gases (CO_2 equivalents) in 2005*	Mio. t	53,7	
	Emissions of greenhouse gases from domestic electricity production in 2005*	Mio. t	2,6	The value refers to the emissions from domestic fuel combustion activities for public electricity and heat production. No data available for the emissions of electricity production only. In Switzerland, electricity production is dominated by hydroelectric power (56.6%) and nuclear power stations

				(38%). There are no major GHG-emissions from the operation from this type of electricity production. Most of the indicated emissions originate from waste incineration plants.

* **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

[…] Values corresponding to the Alpine Perimeter only

1.2 Classification of hydropower stations

Whole territory

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
Switzerland	~~< 50~~	No data	No data	These values refer to approximated output estimates for the year 2005. There are no official statistical data for hydropower stations with a maximum capacity up to 300 kW. The indicated number of hydropower stations in this category gives only an order of magnitude, however the indications about energy output can be considered as being more exact.
	< 300	700	250	
	301 - 1.000	175	510	
	1.001 - 5.000	130	1’400	
	5.001 - 10.000	46	1’340	
	> 10.000	175	35’100	
	Total	1’226	38’600	

Only Alpine Perimeter

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output 2005** [GWh] (sum for each category)	Comment
Switzerland	~~< 50~~	No data	No data	These values refer to approximated output estimates for the year 2005. There are no official statistical data about hydropower stations with a maximum capacity up to 300 kW. The indicated number of hydropower stations in this category gives only an order of magnitude, however the indications about energy output can be considered as being more exact.
	< 300	420	150	
	301 - 1.000	110	330	
	1.001 - 5.000	100	980	
	5.001 - 10.000	41	1’120	
	> 10.000	132	25’300	
	Total	803	27’880	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Indicate if other reference year**

2. PROMOTION OF THE DEVELOPMENT OF SMALL HYDROPOWER

2.0 Targets for renewable energy

Please indicate targets for renewable energies as set in national legislation (for EU Member States, targets as set in Annex I of directive 2009/28/EC)

- Share of energy from renewable sources in gross final consumption of energy, 2005:

16.2%[1]

- Target for Share of energy from renewable sources in gross final consumption of energy, 2020: ....

Comments:

The Swiss Parliament has decided to increase the production of renewable energies by at least 5'400 GWh by 2030 in order to stabilise or reduce CO_2 emissions as quickly as possible. For hydroelectricity the goal is to increase Swiss hydroelectricity production by 2'000 GWh by 2030. (Swiss Federal Energy Act; EnG, dated 26 June 1998; SR 730.0).

The goal of Switzerland's energy policy to increase the proportion of electricity produced from renewable energy by at least 5'400 GWh by 2030; this corresponds more or less to an increase of 10% of the country's present-day electricity consumption.

2.1 Existence of economic development schemes for small hydropower

Do there exist economic development schemes (subsidies) for the promotion of small hydropower in your country?

☒ Yes

☐ No

2.2 Type of economic development schemes and amount of payments

If such schemes do exist in your country, what kind are they and what is the amount of payments granted (including details on the grant and tariff schemes, e.g. with respect to power output)?

☐ Investment grants

Comments:

☒ Tariff subventions

Comments:

[1] http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_915766185.pdf&endung=Schweizerische Statistik der erneuerbaren Energien

Energy Act (EnG; dated 26 June 1998; (Status 1 January 2009; SR 730.0) and corresponding Energy Ordinance (EnV; dated 7 December 1998; Status 1 January 2009; SR 730.01) provide for renewable energy production a cost-covering remuneration for feed-in to the electricity grid (CRF). New installations (plants put into operation after 1 January 2006) are entitled to apply for the CRF as well as extended and renewed plants. The conditions for extended and renewed plants are laid down in the revised energy ordinance. The compensatory feed-in remuneration will not be paid until electricity is actually fed into the grid.

To finance the compensatory feed-in remuneration scheme, the Energy Act stipulates that, with effect from 1 January 2009, a maximum surcharge of 0.6 cents per kilowatt hour for Swiss electricity final consumption will be levied, corresponding to a potential budget of 320 millions Swiss Francs per year. E.g. in 2009 the surcharge was fixed at 0.45 cents per kWh. The Energy Act (EnG, Article 7a, para 4) stipulates a cost cap for each technology, corresponding to the maximum percentage of the total amount of compensatory feed-in remuneration to which a particular technology is entitled. The cap for hydropower generation from small hydropower plants (< 10MW) is 50%. For small hydropower plants, the subvention period for compensatory feed-in remuneration is 25 years.

For small hydropower installations, the CRF is composed by a base compensation and different bonuses calculated as follows:

Base compensation:

The base compensation depends on the equivalent capacity of the installation. The equivalent capacity of an installation corresponds to the electricity fed into the grid in one calendar year divided by the number of hours of the calendar year less the hours before the entry into service of the installation or following the cessation of the service. The base compensation is calculated based on the equivalent compensation of the installation, pro rata according to the following capacity classes:

Equivalent capacity class	Base compensation [SFr./kWh]
≤ 10 kW	0.26
≤ 50 kW	0.20
≤ 300 kW	0.145
≤ 1 MW	0.11
≤ 10 MW	0.075

Example:

Installed capacity of 100 kW; Electricity fed into the grid: 540'000 kWh.

Equivalent capacity = 540000 kWh / 8760 h = 61,6 kW

Base compensation:

(10 * 0,26+ 40*0,2 + 11,6*0,145) / 61,6 = 0,199 SFr./kWh

Hydraulic engineering bonus:

Analogous to the base compensation, the hydraulic engineering bonus depends on the equivalent capacity of the installation and is calculated pro rata according to the following capacity classes. If costs of hydraulic engineering are less than 20% of total capital outlays (including pressure pipes), this value is zero. If the costs of hydraulic engineering are more than 50% of the total capital outlays, the bonus amount corresponds to the maximum (full hydraulic engineering bonus). Between 20% and 50% the bonus amount is calculated by linear interpolation.

Equivalent capacity class	Hydraulic engineering bonus [SFr./kWh]
≤ 10 kW	0.055
≤ 50 kW	0.04
≤ 300 kW	0.03
> 300 kW	0.025

Example:

Equivalent capacity = 61,6 kW;

Full hydraulic engineering bonus:
(10*0,055+40*0,04+11,6*0,03)/61,6=0,041 SFr./kWh

Costs of hydraulic engineering = 30% total capital outlays

Hydraulic engineering bonus = 0,333*0,041 = 0.014 SFr./kWh

Hydraulic head bonus:

Analogous to the other parts of the CRF, the hydraulic head bonus is calculated depending on the hydraulic head, pro rata according to following hydraulic head classes:

Hydraulic head [m	Hydraulic head bonus [SFr./kWh]
≤ 5	0.045
≤ 10	0.027
≤ 20	0.02
≤ 50	0.015
> 50	0.01

Example:

Hydraulic head = 23 m

Hydraulic head bonus:

(5*0,045+5*0,027+10*0,02+3*0,015) / 23 = 0,026 SFr./kWh

The maximal value of the CRF, including bonus is fixed at 0,35 SFr./kWh.

Please note that before the introduction of the compensatory feed-in remuneration scheme, small hydropower installations with a nominal capacity smaller than 1 MW being operated by independent producers were already benefiting from an additional cost financing system with an incentive of 0.15 SFr./kWh. The Swiss Energy Act foresees that these cost financing agreements will remain in force until 2035. However, from 2009 accounts will be settled using the compensatory feed-in remuneration surcharge and the settlement schedule will change from annual to quarterly payments. The transition of the incentive scheme will result in one-off costs for additional cost financing being much higher in 2009 than in previous years: on the one hand because the additional costs for the whole of 2008 will have to be increased, and on the other hand because the additional costs for 2009 have already been increased. As of 2010, these additional costs will once again be within the normal range. However, accumulated costs will decrease since some of the previously authorised parties will have to switch to the new scheme.

☐ Others (please indicate): _____

Comments:

2.3 New applications for small hydropower stations

Do you have figures on the number of new small hydropower stations which are intended / planned / projected to be realised as a consequence of the development schemes mentioned under 2.1?

In case quantitative data is available please fill the following table:

The only available data refer to received applications (state 22.4.2009) for tariff subvention. On the one hand, these applications are being submitted to the national institution granting the tariff subventions. The decision about the economic support is not part of the regular authorisation procedure. On the other hand these projects need to be submitted to the whole regular authorisation procedure by the competent authorities (cantons and municipalities) in order to get a concession.
Due to the uncertainty of the authorisation procedures' outcomes, the actual number of new implemented small hydropower stations will probably be quite a bit smaller than the number of received applications.

Entered applications for tariff subvention (whole territory):

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
Switzerland	< 50	241	35.0	The only available data refer to received applications (state 22.4.2009). These applications have to be submitted to various authorisation processes, so the number of new small hydropower stations that will be realised could still undergo important changes.
	< 300	193	167.3	
	< 1.000	100	330.2	
	< 5.000	72	834.7	
	< 10.000	13	480.5	
	> 10.000	0	0	
	Total	**619**	**1847.7**	

Entered applications for tariff subvention (alpine perimeter only):

Country	Classification Bottleneck Capacity (= Maximum Capacity) of Hydropower Stations [kW]*	Number of Hydropower Stations	Energy Output projected** [GWh] (sum for each category)	Comment
Switzerland	< 50	152	24.1	The only available data refer to received applications (state 22.4.2009). These applications have to be submitted to various authorisation processes, so the number of new small hydropower stations that will be realised could still undergo important changes.
	< 300	129	120.7	
	< 1.000	77	267.2	
	< 5.000	55	654.6	
	< 10.000	11	379.4	
	> 10.000	0	0.0	
	Total	**424**	**1446**	

* **In case data is not available according to the proposed classification, please try to provide data for alternative classification and change table accordingly.**

** **Figures are needed for calculation of contribution of electricity production from small hydropower to reduction of greenhouse gas emissions (conversion factor: 1 GWh = 500 t CO_2 – gas turbine).**

In case no quantitative data is available please try to provide a qualitative description on the situation:

2.4 Problems with new applications for competent authority

Does an (in case) increase in the number of applications for new small hydropower plants pose any problems to the competent authority (e.g. difficulties during approval procedure, lengthy proceedings due to unclear legal requirements, etc.)?

☒ Yes

☐ No

In case 'yes' please provide a brief description of the situation:

The evaluation processes for tariff subventions and for authorisation are made independently and by different competent institutions/authorities, so the approval for subventions does not mean that this same project will be authorised for implementation. The compensatory feed-in remuneration will not be paid until electricity is actually fed into the grid, which means that remuneration will only take place if the project has been authorised by the competent authority and the subsidies have been approved by the competent institution.

Approval for subsidies by the competent institution comes generally earlier than cantonal/municipal authorisation. The decision about the approval or not of the described tariff subvention does not consider aspects of cost-benefit analysis, local planning and environmental protection. Only general capacity criteria and the registration date are considered. Thus, subsidies are often granted to projects that are not yet sufficiently developed, that are located on natural river stretches and that do not take into consideration cantonal planning.

All the projects, independently of the evaluation procedure for tariff subvention, have to be submitted to the competent authorities (cantons or municipalities) for the authorisation procedure. The authorisation procedure will consider legal conditions, local planning, and environmental protection. This situation can present conflicts of interests between the production of renewable energy (willingness to subsidise) and the environmental protection and local planning (authorisation).

The Swiss Parliament's decision to increase Swiss hydroelectricity production by 2'000 GWh by 2030 and the subsidies for small hydropower plants has caused an increasing volume of applications and substantial extra work for the competent authorities. National guidelines, recommendations and instruments for the adequate and efficient evaluation of all the received applications according to the cantonal priorities are needed.

2.5 Legal regulation for ecological upgrading of existing facilities

If legal regulations for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

For all hydropower plants, new ones and existing ones, the protection of water bodies and of the environment is guaranteed by the measures required by the corresponding laws, where requirements concerning the following aspects are defined:

- Residual water flow
- Maintenance of the natural line and structure of the water bodies
- Flushing and emptying dammed-up waters
- Removal of floating debris
- Fish migration measures
- Submission to an environmental impact assessment
- Permission for construction outside the building zones

For existing facilities, the water concession already granted provides, according to the specific conditions of the Water Concession Act, a legally consistent rightfully-acquired water utilisation right. This means that during the period for which the concession has been granted, this right can be diminished only for reasons of higher public interests and against full compensation. For this reason, the effectiveness of the application of new

regulations for upgrading existing facilities in order to enhance ecological situation is limited.
With respect to existing facilities, it is noteworthy to mention that there exists also a class of water rights from the past that have no concession period at all, i.e. water rights for an unlimited time period.
In the following, the different regulatory possibilities for upgrading of existing facilities in order to enhance ecological situation are described:

Granting a new concession, renewal or extension of the concession
For water abstractions from watercourses a concession is required. The conditions for granting the concession are fixed according to the legal instruments applicable at the time when the decision about the concession is taken. The maximum duration of the concession fixed by national law is 80 years. For some old installations concession periods are unlimited.

When an existing concession has to be renewed or extended (significant changes of the concession's scope e.g. changes on water quantity, head, type of use), or when a new concession for water use is granted, the conditions for the water use are set based on the actual environmental legislation. Thus, if existing hydropower facilities request and need a renewal, extension or a new concession then they have to comply and adjust to the new requirements of the actual environmental legislation, such as, for example, the actual residual water flow conditions.

From an economic point of view, the most relevant adjustments will probably concern the increased residual water requirements and for ensuring free fish migration. For the residual water requirements, some specific exceptions are foreseen by the law: for example in the framework of a so called "protection and utilisation plan" for a limited area forming a topographical-hydrological unit. The idea is that in parts of this area more water can be used if at the same time in other parts less or no water is used. Thus, this regulation aims for a given area at an appropriate balance between protection and utilisation. E.g. within the planning area lower minimum residual water flow rates can be applied or existing facilities can continue to be operated with the ancient residual water flow rates if in other parts of the area there is refraining from water abstractions. These protection and utilisation plans need the approval of the Federal Council.

Rehabilitation of river stretches with residual water flow without changes of the existing water concession
The federal law on water protection stipulates the following regulations with respect to existing facilities:
In cases where a watercourse is substantially affected by existing water withdrawals, it shall be examined if rehabilitation below the point of the water abstraction is possible according to the specification of the authorities in so far as such rehabilitation is economically bearable and does not cause an infringement of the existing water utilisation right which would require compensation.
The authorities shall specify more extensive rehabilitation measures in cases which concern watercourses situated in landscapes or including biotopes which are listed in national or cantonal inventories, or in case of other overriding public interest. The procedures for ascertaining whether indemnities must be paid and fixing their amount shall be based on the procedures contained in the Federal Law on Expropriation.
The authorities shall ensure that the rehabilitation of river stretches with residual water flow is completed at latest by end 2012.

Hydro-peaking regulations
According to the Federal Water Protection Act amendment (GSchG) recently (Dec. 2009) approved by the Swiss Parliament, regulations for river stretches affected by hydro-peaking are foreseen in order to prevent new impairments and reduce existing

impairments. In order to respect existing rights for hydropower facilities, the necessary measures for hydro-peaking rehabilitation will be fully compensated (only structural measures like retention basins to attenuate the peak flows are required but no interventions in the operation of the plant itself).

2.6 Incentives for ecological upgrading of existing facilities

If incentives for upgrading existing facilities in order to enhance the ecological situation exist in your country, please provide relevant information.

Certification of electricity with labels that get a higher price on the electricity market can be regarded as an economic incentive for reducing the ecological impacts of hydropower plants, provided that granting the label is based on ecological criteria.
In this respect Switzerland recognises the “Naturemade” labelling scheme, developed and organized by a private organisation. The certification system has two levels:
The first level, Naturemade Basic, needs a declaration of the source and origin of electricity (requiring that plants use renewable energy). Large hydropower plants (>10 MW) have to establish an environmental management system within five years of receiving the Naturemade Basic certificate.
The second level, Naturemade Star, was defined for environmentally preferable electricity. Power plants can be granted the Naturemade Star label if they fulfil Naturemade Basic criteria as well as additional criteria. To achieve this level, hydropower plants must have a lower environmental impact than traditional hydropower plants. For example, they have to leave sufficient water in the rivers (i.e. respect residual flow limits) and allow fish to pass through weirs.

Hydropower installations with more than 0.1 MW capacity must establish a fund to improve the ecological situation of the power plant site or in its vicinity. The funds are financed from a levy on certified electricity; Naturemade Star producers pay CHF 0.009/kWh whereas Naturemade Basic producers pay only CHF 0.001/kWh.
Specific provisions were developed to protect other renewables from competition with large hydropower plants and to create an incentive to develop non-hydro renewables. The marketers of Naturemade certified electricity must guarantee that at least 5% of their certified electricity sales have the Naturemade Star certificate.
[Source: http://www.iea.org/Textbase/pm/?mode=re&id=1169&action=detail]

3. Framework Conditions for Authorisation of Facilities

3.1 Criteria for decision on sites for construction of new facilities

Please indicate criteria applied in your country for the decision on whether the construction of new small hydropower plants is to be allowed or rejected.

Please note that the evaluation and authorisation criteria can vary depending on the canton where the small hydropower plant will be located. Hence only general criteria can be given hereafter.

3.1.1 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally approved (e.g. Heavily Modified Water Bodies according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:
Infrastructure hydropower plants (residual flow plant, water supply plant and sewage system plant) have very good chances of being approved since they normally do not lead to additional environmental deterioration.

3.1.2 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities can be approved under certain circumstances (e.g. under application of Art. 4(7) of the WFD)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.1.3 Do criteria exist for sites / certain type of rivers or river stretches / catchments / regions, where the construction of new facilities is generally rejected (e.g. Nature2000 sites, river stretches in “High Status” according to WFD, etc.)?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:
If sites are located in inventoried national or cantonal sites with strong relation to water/groundwater/fish (floodplains, moorland areas, spawning areas, …), this is normally taken as a strong argument by the competent authority for rejecting applications.

The Federal Act on the Protection of Nature and Cultural Heritage (NCHA) and its corresponding ordinances provide a particular protection of alluvial zones of

national importance and moorland areas. According to this legislation applications for projects located in such zones are generally rejected.

3.1.4 Do economic criteria exist for not granting authorisation for the construction of new small hydropower facilities?

☐ Yes

☒ No

If yes, please briefly describe applied criteria:

3.2 Development plans

3.2.1 Do concrete plans exist for future development of small hydropower in your country ("master plan" or strategies) – on a national or regional level - based on geographical information such as specific rivers or river sections, specific regions or certain catchment areas for instance?

☒ Yes

☐ No

☐ Others (please indicate):

Some cantons have already elaborated or are elaborating strategies based on geographical information.

Comments:

With the entry into force of the new Energy Act which provides the cost-covering remuneration for feed-in to the electricity grid (CRF), a "strategy for hydropower utilisation in Switzerland" was elaborated and can be downloaded on this page: http://www.bfe.admin.ch/themen/00490/00491/index.html?lang=de&dossier_id=00803

In this strategy the contribution of new small hydropower to the evolution of Swiss hydropower until 2050 is estimated at 1100 GWh/year. For the promotion of small hydropower, the strategy only remarks that the database of small hydropower should be updated and appropriate potential sites should be determined.

Considering the important number of applications for new small hydropower plants, the competent authorities for authorisation are demanding instruments and strategies for the global evaluation of the incoming applications. Thus, diverse institutions are working on the development of new decision-making aids such as a classification system of river stretches, inventory of hydropower potential or recommendations for assessment criteria.

The federal administrations are developing a guidance document for cantonal strategies on small hydropower. This national recommendation on the use of small hydropower[2] is to be published by the beginning of 2011. At cantonal level, the situation is different from canton to canton: some cantons have already developed strategies for the use of hydropower, some are developing such a strategy and others have not yet started.

3.2.2 If yes, please indicate the legal status of those plans.

[2] http://www.bafu.admin.ch/UD-1037-D

☒ Statement of will by the competent authority but not legally binding

☐ Effective in law

☒ Still under preparation

☐ Others (please indicate): _____

Comments:

The guidance document under preparation by the federal administrations will correspond to a statement of will at national level aiming to guide the competent authorities in the development of cantonal / regional strategies of how to deal with small hydropower. This national document is to be published by the beginning of 2011.

At cantonal level, the situation is different from canton to canton: in some cantons (e.g. canton of Fribourg, canton of Berne) the developed strategies are binding for the administrations. In other cases the strategies may have only the status of "statements of will".

3.2.3 Has your country expressed any intentions or reflections aimed at a spatial prioritisation for hydropower generation, i.e. to delineate areas / catchments / regions designated as "for hydropower use" (with e.g. less stringent ecological requirements) and conversely other areas designated as "not for hydropower use"?
Yes, see 3.2.1.

3.3 Authorisation / licensing of new facilities

3.3.1 Please indicate the competent authority for granting authorising / licences for new small hydropower facilities (e.g. cantons, provincial government, regional authority, district council, etc.).
For international rivers: the Confederation, cantons or municipalities for inland rivers

3.3.2 Is there any difference between small and large (e.g. larger than 5 / 10 MW) hydropower stations with regard to the granting / authorisation procedure (e.g. different competent authorities)? In which cases is an Environmental Impact Assessment (EIA) needed?

The authorisation is the same, but the procedure can vary according to the gross capacity: stations with a capacity between 300 kW and 3 MW have to be audited by the Federal Office for the Environment FOEN, stations with a gross capacity of more than 3 MW have to be submitted to an environmental impact assessment (EIA).

According to the Environmental Conservation Act, installations having a significant impact on the environment have to be submitted to an EIA. For hydropower, installations with a capacity of more than 3 MW are amenable to the EIA obligation in case of new construction, of significant changes of the installation, of significant changes of the existing concession and in case of renewal of the concession.

3.3.3 What is the legal status for the owner/constructor of new small hydropower facilities?

☒ Authorisation for the construction granted by competent authority

☐ Licensing system

☒ Others (please indicate): water concession

Comments:

3.3.4 For how long is the authorisation / licence / others for new facilities granted (please describe)?
Duration is fixed by canton or municipalities but never exceeding the maximum duration of 80 years, fixed by national law.

3.3.5 For how long was the authorisation / licence / others for existing facilities granted (please describe)?
Duration is fixed by canton or municipalities but usually not exceeding the maximum duration of 80 years, fixed by federal law. For some very old installations unlimited periods still exist.

3.3.6 Does the competent authority charge dues / taxes / levies / payments / etc. for the use of water for small hydropower generation?

☒ Yes

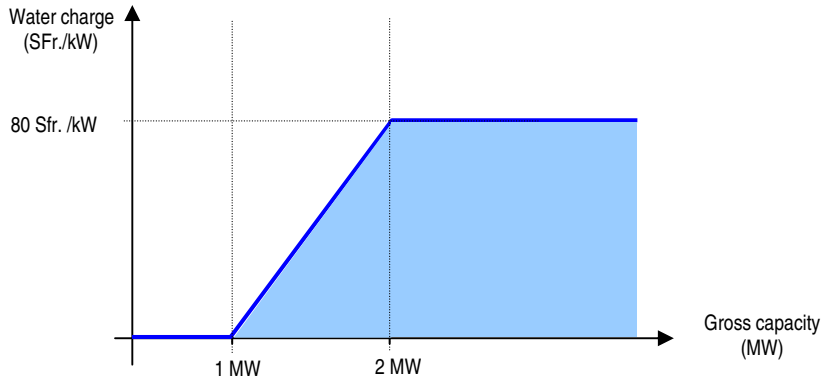
☐ No

If yes, please briefly describe payments in further detail:

In Switzerland a water charge must be paid by the holder of a concession to abstract and use water for hydropower purposes. This water charge is paid to the competent authority (canton or municipalities) that grants the concession.

The federal government establishes the maximum water charge per kilowatt gross capacity, which currently amounts to 80 Sfr./kW gross capacity. Small hydropower plants with less than 1 MW gross capacity have been exempt from the water charge since 1997. The water charge for plants with capacities between 1 and 2 MW can maximally be increased linearly until reaching the maximal water charge of 80 Sfr./kW.

Within this limit, the competent authorities are free to demand the payment based on their principles (blue zone in the following graphic).



3.3.7 Is this also the case for large hydropower stations (e.g. larger than about 5 / 10 MW) or is there a differentiation between small and large hydropower stations?
There are no differences at federal level. Cantons are free to choose other specifications if respecting the conditions described under point 3.3.6.

3.4 Imposed ecological conditions for new facilities

Please give brief information on ecological conditions imposed on the construction of new small hydropower facilities.

3.4.1 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for upstream migration?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

The Swiss Fishery Act from 21 June 1991 (SR 923,0) stipulates that in case of water uses, appropriate arrangements have to be foreseen to allow free fish migration. However no distinction between upstream and downstream migration is made.

3.4.2 Do newly constructed small hydropower facilities need to be equipped with fish migration aids for downstream migration?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

The Swiss Fishery Act from 21 June 1991 (SR 923,0) stipulates that in case of water uses, appropriate arrangements have to be foreseen to allow free fish migration. However, no distinction between upstream and downstream migration is made and downstream migration is not explicitly mentioned. So far, only facilities for the upstream migration are generally provided. Efforts are actually being made for the implementation of the equipment with facilities for downstream migration as well.

3.4.3 Are conditions imposed for residual water for newly constructed small hydropower facilities (if yes, please indicate if a biotic or abiotic threshold value or guidance value is being used)?

☒ Yes

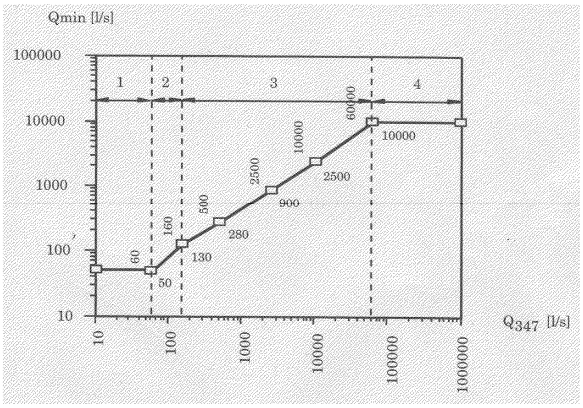
☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

The minimum, residual water flow requirements (Q_{min}) are in principal derived from the Q_{347} flow rate (see following graph) with further specifications to increase resp. decrease this value. Thus, the main reference value for Q_{min} is based on abiotic grounds, deviations therefrom can also consider biotic-ecologic criteria and further socio-economic concerns.



3.4.4 Are conditions imposed for the maintenance of the bed-load balance for small hydropower stations?

☒ Yes

☐ No

☐ Under certain circumstances (please indicate):

_____

Comment:

Under the Federal Water Protection Act amendment (GSchG) recently approved by the Swiss Parliament, the bed-load balance has to be maintained so that no significant impact will result for the endemic fauna and flora, for habitats, for the groundwater balance and for the flood protection. Harmful modifications of the morphological structures or the morphological dynamics of the river stretch will have significant consequences for an installation.

Necessary measures have to be taken by the installation's owner. In the watershed of the affected river, measures for the installations concerned have to be coordinated. Measures for maintenance of the bed-load balance depend on following aspects:

- the impact's intensity
- ecological potential of the river stretch
- proportionality of the investments necessary for rehabilitation measures
- interest for flood protection
- energy goals for renewable energy

For hydropower installations, the bed-load should pass through the installations to the extent deemed possible.

The installations' owners have to grant access to the competent authority and provide all necessary information on bed-load handling, measures, and operational and structural changes.

3.4.5 Is there any difference between small and large hydropower stations with regard to ecological conditions imposed on the construction of new facilities?
No