ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

COMMON GUIDELINES FOR THE USE OF SMALL HYDROPOWER IN THE ALPINE REGION

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1 INTRODUCTION

1.1 Assignment and content of the guidelines

Based on the Mandate from the Xth Ministerial Conference of the Alpine Conference in Evian, March 2009 and referring to the Climate Action Plan approved at the Xth Ministerial Conference of the Alpine Conference in Evian, March 2009, the Platform Water Management in the Alps (PWA) has worked out **common guidelines on the use of small hydropower** including good practice examples.

At first, this requires defining the term small hydropower. 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 economical aspects (legal frame for environmental impact assessments (EIA), entitlements for subsidies, etc.)

Currently there is no international consensus on a technical threshold value defining the boundary between small and large hydropower (see e.g., the different thresholds set in the individual Alpine countries, varying between 1 up to 10 MW[1]). Therefore, this document refers to small hydropower in principle with respect to the thresholds of installed capacity as defined in the legal frame of the individual countries.

The present guidelines on the use of small hydropower include common principles and recommendations, an outline for an assessment procedure as well as a pool of evaluation criteria. However, no concrete methodology is proposed since sufficient flexibility for implementation of the guidelines is needed in order to pay attention to regional differences and varying national boundary conditions. To underpin the guidelines, Good Practice Examples with concrete methodologies are presented in Annex 1[2].

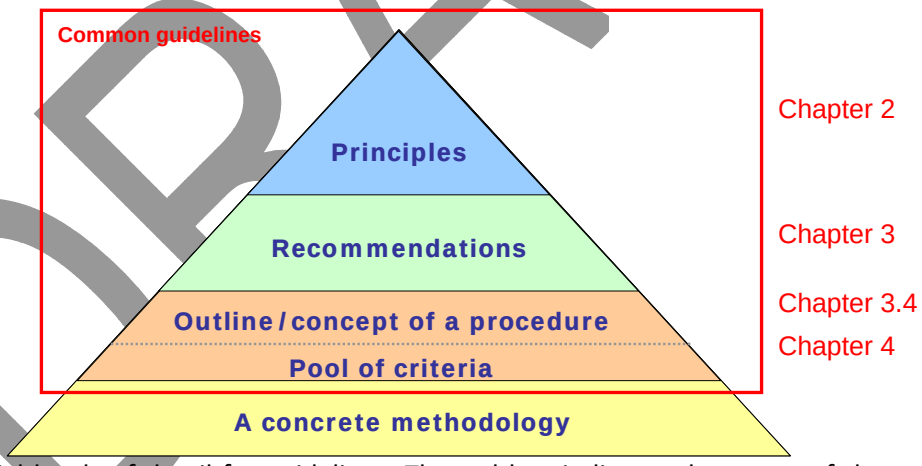


Figure 1: Potential levels of detail for guidelines. The red box indicates the target of the common guidelines

The common guidelines have to be considered along with the existing national/regional legal frameworks and instruments. To that end, Annex 2 provides a compilation of links to national and regional guidance documents.

As guidelines they do have the character of recommendations but do not exert any legally binding force.

[1] See Table 1 of the Situation Report on hydropower generation in the Alpine region focusing on small hydropower

[2] As an example of concrete methodology, the Interreg Alpine Space Project "SHARE" (Sustainable Hydropower in Alpine Rivers Ecosystems) is going to develop, test and promote a decision support system to merge river ecosystems and hydropower requirements in accord with norms and carried on by permanent panel of administrators and stakeholders - http://www.share-alpinerivers.eu/

1.2 Initial Situation

Due to the high hydroelectric potential on the one hand and the important value of ecosystems and landscape on the other hand, the use of small hydropower in the Alpine area results in a conflict of interests between the use of renewable energy and the protection of the aquatic ecosystems and landscapes. A further aspect is that river stretches which are in or near natural conditions have become more and more unique.

In order to reduce emissions of green-house gases, energy legislation (RES-e[3] / EnG[4]) contains quantitative goals for renewable energy growth. For the Alpine area, the contribution of hydropower production is considered to be particularly important for electricity production by using renewable energy resources. This is why in most Alpine countries specific national goals for the growth of hydropower production are set and an increasing pressure on remaining river stretches can be perceived.

The actual exploitation level of hydropower production in the Alpine area is significant. The remaining hydro-electrical potential depends on the still remaining idle river stretches and discharge, thus entering into potential conflicts with the conservation of ecosystems and landscapes. Given the rarity of remaining unexploited rivers, it is of utmost importance for strategic reflections, avoiding irreversible impacts.

Overall there is a bunch of pressures and conflicting expectations with respect to small hydropower in the Alpine perimeter (see figure 2). This is why decision makers and authorization bodies are in need and ask for guidelines to tackle this challenging issue, as it has been also outlined in the conclusions of the situation report on hydropower generation in the Alpine region focusing on Small Hydropower.

Figure 2: Hydroelectric potential and ecosystem potential in the Alpine perimeter: Area of conflict with different pressures and expectations.

[3] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[4] Swiss Federal Energy Act dated 26 June 1998 (SR 730.0)

1.3 Objectives

Derived from both the energy and environmental legislation, **the general objectives** with respect to the use of small hydropower are

Increasing the production of renewable energy from hydropower generation	Minimizing the impairment of the aquatic ecosystem and landscape

The main challenge for the forthcoming years are to put in place the amount of renewable energy enshrined in national plans, respectively to identify those locations which dispose of the necessary hydroelectric potential and where the impairment of ecosystems and landscape is low or at least acceptable.

This represents in most cases a conflict of interests, requiring an optimization task between these two objectives. It implies the question about potential favorable locations for hydropower, respectively locations which may be considered to be rather sensitive thus making them less favorable for hydropower. The appropriateness of locations for small hydropower plants is in principle based on a pondering of utilization and conservation criteria. The decision needs to be based on a holistic evaluation, i.e. considering socio-economic and ecological criteria.

Since the decision on a new project is usually within the responsibility of the public authority based on a request by the applicant, the optimization task between the two objectives falls also within the responsibility of the public authority. This requires assistance for the public authority responsible for taking the decision on a new project. On the other hand guidelines also give support to potential applicants by making the decision process transparent already in advance and providing indications on the chances for the realization of projects.

In general terms, the specific objective of the guidelines is therefore to provide general guidance for the identification of potential favorable locations for small hydropower plants and the subsequent authorization decision under consideration of the sustainability principles in order to reach the renewable energy growth goals.

This is in line with the objectives of the energy protocol[5] of the Alpine Convention, aiming to establish sustainable development in the energy sector which 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 decentralized plants. However, negative effects of new and existing hydroelectric plants on the environment and the landscape have to be limited by adopting appropriate measures ensuring that the ecological functions of watercourses and the integrity of the landscape are maintained.

Moreover, the specific objective of the guidelines is also supported by the proposed measures of the "ArgeAlp" at the 40th Intergovernmental Conference[6] (June 2009), recommending the 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.

The specific objective of the present guidelines can therefore be addressed as

To provide general guidance for the identification of potential favorable locations for small hydropower plants and for the subsequent authorization decision considering the principles of sustainable development in the Alps

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

[6] http://www.argealp.org/fileadmin/www.argealp.org/downloads/deutsch/Resolution_Energiepolitik_de.pdf

As an ambitious approach for the whole Alpine area, the guidelines have the potential to back up regional planning authorities and to concretize the principles of integrated water resources management. Furthermore, this document may also contribute towards the objective of highlighting effective and sustainable ways how to make the Alpine area climate neutral until 2050, as indicated in the Climate Action Plan of the Alpine Convention.

The guidelines in hand are focused and formulated in order to tackle the described conflict of interest. Depending on the respective area under scrutiny it has to be kept in mind that other water uses may be relevant as well and need to be considered as boundary condition for this optimization task.

1.4 Scope of application

The present guidelines' scope is

- geographically, the perimeter of the Alpine Convention (i.e. the Alps);
- addressing in particular small hydropower (according to the technical / legal definition in the individual countries[7];
- recommendations for the authorization of applications for new small hydropower plants (SHP);
- as guidelines they have the character of recommendations but do not exert any legally binding force

These points define the guidelines' scope of application in a narrow sense. In a broader sense the guidelines may contain in its principles also validity

- outside the Alpine perimeter for other countries and mountain areas facing the same conflicts;
- for hydropower in general; however, other aspects and criteria have to be considered with respect to large hydropower (e.g. grid stability, peak electricity supply, …), which are not dealt with in the present guidelines;
- for analyzing the optimization potential of existing installations;
- in their character of common Alpine wide guidelines they serve as orientation and reference document for developing comparable procedures and having similar standards in the Alpine Convention (AC) member states.

1.5 Addressees

These guidelines are addressed in the first place to the public bodies responsible for strategic planning and in charge of authorizing small hydropower plants

- for strategic planning activities;
- as decision support for assessing individual small hydropower plant projects.

Furthermore, they may serve on the one hand as orientation for applicants of small hydropower projects about the chances for getting an authorization and more specifically about aspects that should be considered in the design of projects (i.e. support for potential investors and efficient planning) and on the other hand as common vision for the realization of small hydropower throughout the Alps.

[7] The threshold value defining small and large hydropower is variable by country, ranging between 1 and 10 MW

2 GENERAL PRINCIPLES

2.1 Sustainability

In accordance with the principles of sustainable development[8], resources should be managed in a holistic way, coordinating and integrating environmental, economic and social aspects.

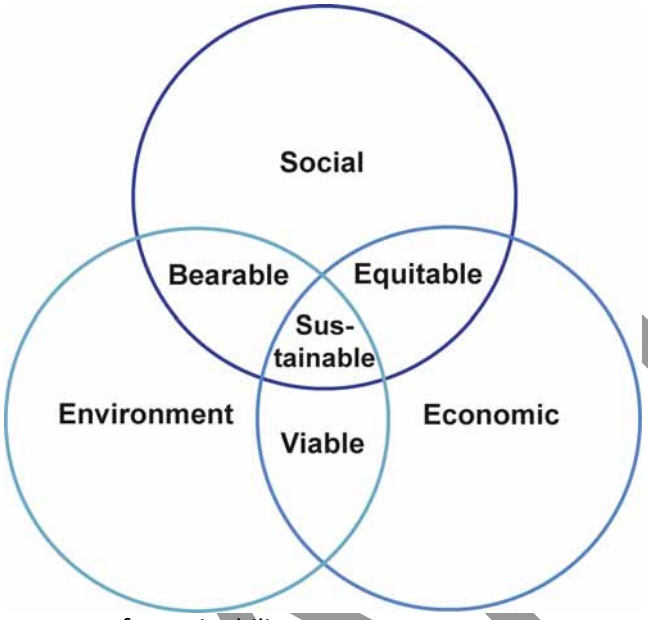


Figure 3: The three components of sustainability

To strike a balance between the general objectives of "increasing the production of renewable energy from hydropower generation" and "minimizing the impairment of the aquatic ecosystem and landscape", a weighing of the interests based on sustainability criteria has to be carried out. The whole hydropower sector has the potential to contribute towards the achievement of sustainable development, which is in need to be further specified for small hydropower in the frame of the discussions on the guidelines in hand.

Next to hydropower production and conservation of the aquatic ecosystems and landscapes, the following aspects also have to be considered:

- other national or regional objectives and constraints (social, legal, economic, financial);
- general environmental aspects including objectives regarding climate protection (e.g. ecosystem services);
- other water uses (e.g. water supply, irrigation, …);
- socio-economic benefits: decentralized approaches, employment, social development of the region, tourism…

Recommendation 1

To strike a balance between an increase of hydropower generation and environmental protection, a transparent weighing of the interests based on sustainability criteria has to be carried out

[8] United Nations General Assembly (2005). 2005 World Summit Outcome, Resolution A/60/1, adopted by the General Assembly on 15 September 2005. Retrieved on: 2009-02-17; http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N05/487/60/PDF/N0548760.pdf?OpenElement

2.2 Common Alpine wide principles and specific national / regional approaches

The present guidelines suggest some general recommendations and standard aspects for the whole Alpine region. However, in order to be in line with existing legal frameworks and instruments, national and regional factors and conditions have also to be considered. Thus, next to consider standard aspects for the whole Alpine Region, specific national / regional approaches built on the basis of common principles have to be set up.

Nevertheless, as indicated in chapter 1, the ambition of this document is not to develop and recommend one single specific method or concrete procedure for the whole Alpine Perimeter. Rather, the idea is to agree on general principles - including a common understanding of the most important evaluation criteria - for the whole Alpine Perimeter that permits a flexible implementation in accordance with the specific national or regional situation.

Recommendation 2:

National / regional approaches dealing with small hydropower in the Alps should be built on the basis of common principles, general considerations and standard aspects for the whole Alpine region but should also consider specific national and regional factors.

2.3 Reference Situation

When evaluating the ecological value of a location, the question arises if the status quo or a potential status should be taken into account as reference situation. Only considering the actual situation would neglect improvements of the ecological value due to e.g. planned river revitalization projects or any other ecological enhancement plans (as may be foreseen as objectives in River Basin Management Plans[9]).

Recommendation 3[10]

When assessing the ecological value of river stretches, not only the status quo needs to be taken into account but also foreseeable changing ecologic conditions if e.g. rehabilitation projects are foreseen in the analyzed perimeter

When evaluating the ecological value of a location, not only the individual situation of the river stretch itself, but also its ecologic importance within the whole river system has to be considered.

Recommendation 4

When assessing the ecological value of a river stretch it needs to be considered whether it has a specific ecologic importance for the other stretches in the river basin.

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

[10] Good Practice Example “Evaluation and management of the hydroelectric potential of the Canton of Fribourg” provided in Annex 1, illustrates this recommendation

3 GENERAL RECOMMENDATIONS

3.1 Types of Small Hydropower Plants

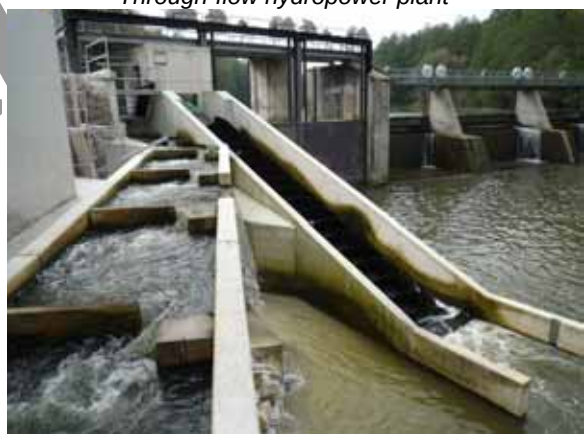
Considering the differences of ecological impacts depending on the plant type, a distinction between the following types is proposed:

- Run-of-river power plants;
  - Diversion hydroelectric plant: plants related to an abstraction and diversion of water;
  - Through-flow power plant: plants with no diversion but run-through regime;
- Infrastructure-related power plants, also called multipurpose plants (integrated in the network of the drinking water supply respectively, waste water disposal infrastructure or irrigation infrastructure as well as residual flow hydroelectric plants or for the creation of attracting flows at fish migration aids). This type of SHP is understood as located in installations primarily having another goal than electricity production, exploiting in hydroelectric terms the water that is already used by the primary goal but not additionally abstracting water. Compared to run-of-river power plants, the power output of these plants is marginal.

Diversion hydropower plant[11]

Through-flow hydropower plant[12]

Drinking water supply hydropower plant[13]



Residual flow hydropower plant[14]

Figure 4: Examples of small hydropower plants

[11] Water abstraction on Dora Baltea river, Aosta Valley (Italy) ©A. Mammoliti Mochet

[12] Hydro power plant Agonitz (Austria) © Energie AG Oberösterreich

[13] Small hydropower plant on drinking water supply network of Troistorrents (Switzerland). © MHyLab

[14] Hydropower Plant Vils, Municipal utilities of Vilshofen; Hydro Power Snail; © State Office for Water Management Deggendorf.

Recommendation 5[15]

Infrastructure-related hydropower plants, exploiting only the water that is already used by the primary goal of the infrastructure, are in general not additionally affecting aquatic ecosystems and are economically favourable. Thus, from an environmental point of view, such multipurpose small hydropower plants are in general considered appropriate and desirable.

3.2 Off-grid small hydropower plants

For remote locations requiring electricity supply where the connection to the public electricity grid would lead to disproportionate costs and better environmental options are not feasible, there is a need for auto-supply by hydropower. This constitutes a prevailing argument in the weighing of interests. On the other hand, for locations that can be supplied from the public grid and for SHP that feed into the public grid, the argument of auto-supply production is not valid.

Recommendation 6

In the weighing of interests, the purpose of the SHP needs to be given due consideration: In particular providing electric auto-supply, where the connection to the public grid would lead to disproportionate costs and no better environmental options are given, constitutes a strong argument in favor of building SHP in such remote individual locations (e.g. Alpine huts, remote farming communities, etc.).

Figure 5: St. Martin, a settling in the Alps (Canton of Graubünden, Switzerland) without existing connection to a public electricity network. Electricity production by a small hydropower installation. © Programm Kleinwasserkraftwerke[16]

3.3 New Construction or Refurbishment

Different motivations or a combination therefrom can be the reason for the construction or refurbishment of small hydropower facilities. They can include an increase of the contribution towards renewable energy supply, the achievement of climate objectives or the auto-supply of individual remote locations.

For the evaluation of the impact of a small hydropower plant, the following cases need to be distinguished:

[15] Various Good Practice Examples provided in Annex 1 illustrate this recommendation

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

Existing installations:

- Refurbishment of an existing, operating plant (renovation, expansion, electrification) within the validity of the existing concession;
- Reopening / reactivation of a disused hydroelectric plant;
- Renewal of a concession / license for exploiting water resources;
- Important refurbishment or upgrading of an existing, operating plant (renovation, expansion, electrification) where a new concession is needed.

New installations:

- Construction of a new plant at a previously unused location;
- Reconstruction of a dismantled plant at a formerly used location.

Small hydropower plants already in place do usually not lead to further environmental deterioration when refurbished. Therefore **refurbishment of existing operating plants within the validity of the existing concession** can generally be considered as appropriate and should be prioritized before building new installations. Furthermore, according to article 7.4 of the energy protocol of the Alpine Convention, **reopening disused hydroelectric plants** should be recommended rather than building new ones.

However there should be a periodical examination if further mitigation of negative impacts and compliance with existing environmental legislation can be achieved by the application of best practice without entailing disproportionate costs.

Recommendation 7

Refurbishment of existing operating plants and reopening of disused plants in order to optimize the production of hydropower and minimizing the ecological impacts should be generally promoted and prioritized. However there should be a periodical examination if further mitigation of negative impacts and compliance with existing environmental legislation can be achieved by the application of best practice without entailing disproportionate costs.

Recommendation 8[17]

Ecological upgrading of existing operating plants in order to mitigate the impacts on the ecological status and on landscape should be generally promoted by means of incentives in order to accelerate the fulfillment of legal requirements earlier or even to go beyond these minimal requirements.

Existing and operating small hydropower plants that require a **renewal of the concession or license** can generally be considered appropriate, since it is expected that this does not lead to a further environmental deterioration. Rather, with the renewal of the water right, the current environmental legislation and best practice has to be applied and should in general entail a mitigation of negative impacts.

Considering that over a longer time period, technical approaches, views and environmental standards can change, concessions and licenses should be limited in time in order to enable an active management of water resources. However, this limitation has to be in balance with the necessary stability of granted rights in order to secure the protection of financial investments into hydropower facilities.

[17] See e.g. naturemade certification: the quality mark for ecologically produced energy (naturemade star) and energy from renewable sources (naturemade basic). www.naturemade.ch

Recommendation 9

Renewal of concessions or licenses can generally be considered appropriate in case it complies with the existing environmental legislation. Nevertheless the ecological potential of the site should be considered and concessions or licenses should be limited in time, being as short as possible without compromising the investment.

Important refurbishments or upgrading of existing operating plants (e.g. asking for an increased water abstraction), requiring a new concession may lead to further environmental deterioration; therefore such cases should be evaluated with the same procedure applied on **new installations** described in chapter4.3.

3.4 Outline of a two-level procedure assessing new installations

In most countries of the Alpine Convention, quantitative goals to increase hydroelectric production have been introduced in the energy legislation. To achieve these goals and the environmental goals set out in existing legislations as well, favorable locations and technical solutions for hydroelectric production have to be identified. The key question is therefore: **where** are the most favorable locations to build and operate SHP in order to reach the mentioned goals.

However, the evaluation for authorization of small hydropower does not only depend on the favorable location but also on the individual project application and the specific local situation. Different project concepts at one site may lead to different ecological impacts and exhibit different socio-economical benefits. Thus, a differentiation of the individual installation is necessary in order to judge not only if projects should be authorized in certain areas or not but also on the way **how** projects should be realized.

The concept is therefore to go from general to detail (from regional to local). The following subsections describe the outline of a transparent procedure on two levels for identifying where to realize most appropriately the plus of hydroelectric production by small hydropower plants and which individual solution being the most suitable.

- In chapter 3.4.1 the procedure's first level is described: a general evaluation of the river stretches' appropriateness for hydropower use as strategic planning for a geographic region, independently from individual applications (regional[18] level).
- In chapter 3.4.2, as second level, the project specific evaluation of the local situation and the individual application is set out (local level).
- Chapter 3.4.3 sets out the implications from the regional strategic planning as prerequisite for the local assessment and authorization.

Recommendation 10[19]

In order to answer the questions about the "where" with respect to the most favorable sites to reach growth objectives for hydroelectric production and the "how" with respect to the individual project, a transparent, structured and criteria-based procedure that combines a regional/strategic point of view with a local, project-specific assessment should be applied.

[18] In this context the term "Regional" means to go beyond the local project-specific perspective and refers to a wider spatial context: be it in a geographical sense, e.g. a river basin, be it a provincial/cantonal territory.

[19] Good Practice Example "Strategy "water use" of the Canton of Bern" provided in Annex 1, illustrates this recommendation

In some countries of the Alpine Convention, authorities for strategic planning and for granting concessions are different. In such institutional context it is important that authorities responsible for granting concessions are also involved in the strategic process.

Recommendation 11

The development of the regional strategy is a process triggered by the competent authority. In order to ensure transparency and to find a solution that takes account of the different interests at stake, the relevant stakeholders' views must be adequately involved by means of a participative procedure.

This is also in line with Article 4 of the Energy Protocol[20] of the Alpine Convention, aiming at the participation of regional and local authorities in the process of applying energy policies in order to ensure coordination and cooperation. The regional and local authorities directly concerned shall be parties to the various stages of preparing and implementing energy policies and measures, within their competence and within the existing institutional framework.

While this chapter provides the outline, chapter 4 provides more concrete guidance for such a two-level evaluation procedure.

3.4.1 The regional level: Strategic planning

In order to provide an answer to the mentioned question about the "where", the evaluation's horizon has to be broadened: it is about the search for the most favorable locations, which takes necessarily place on a **regional level.** Favorable are locations that exhibit on the one hand a high hydro-electric potential and have on the other hand a relatively low ecological and landscape value or where the ecological status would not be significantly deteriorated by appropriate hydropower use. "Regional" in this context means exactly this: to go beyond the local project-specific perspective and refers to a wider spatial context: be it in a geographical sense, e.g. a river basin, be it a provincial/cantonal/national territory.

Within this wider spatial context the evaluation of the potential appropriateness for hydropower use of the river stretches of a given region is carried out, irrespective of concrete applications. This evaluation is based on the comparison of the theoretical hydro-electrical potential on the one hand with the ecological and landscape value on the other hand, leading to a classification of river stretches with respect to the potential appropriateness for hydropower use, e.g. distinguishing 3 categories: favorable, less-favorable and not-favorable for hydropower use.

The process to establish such a strategic planning is triggered by the competent authority and implies the involvement and consultation of relevant stakeholders (see recommendation 11). This constitutes the basis for a coordinated development of small hydropower for the given region and catalyses a transparent dialogue between the user's perspective and the conservation's point of view, identifying the most favorable locations for SHP as well as locations rather non-favorable for hydropower use.

Recommendation 12

Strategic planning on a regional level (regional strategy):

On a regional level, a transparent evaluation and classification of the potential appropriateness of river stretches for hydropower use shall be carried out (considering their hydro-electric potential, their ecological and landscape value and areas under special protection).

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

The actual exploitation level of hydropower production in the Alpine area is significant. The still available hydro-electrical potential depends on the remaining idle river stretches, on the remaining discharge and on further specific functions of the river stretch that are limiting an exploitation. Therefore, if there remain only few areas (e.g. sub-basins) which so far have not been used within a greater perimeter (e.g. a river basin, a province or a canton), there may be the wish to preserve such rare areas.

Recommendation 13

As part of the regional strategy, the designation of areas that are deliberately kept free from any exploitation, avoiding irreversible impacts, should be considered. This has to be based on a broad participation of relevant stakeholders as outlined in Recommendation 11.

The outcome of this regional pre-planning with classified river stretches is a **regional strategy** for the development of SHP and builds the frame for the assessment and authorization of individual projects. In terms of producing an effective and transparent decision making instrument which can also be used for communication purposes, indicating the chances and potential requirements for an authorization, it is recommended that the regional strategy should get a binding character. To this effect it should be examined if this may be established by integration into existing instruments like e.g. the WFD-river basin management plans[21] or in other spatial planning instruments.

Recommendation 14

Possible ways on how to integrate the elaborated results of the strategic planning in existing national / regional instruments shall be examined (e.g. river basin management plans or spatial planning instruments).

Such a regional pre-planning meets also the requirements of the WFD, where Article 4.7 sets out the conditions for exceptions for deterioration of water status or failure to achieve good water status. In particular letter c) of article 4.7 asks for a weighing of benefits, balancing the benefits of modifications with the benefits of water protection or to the public interest. Letter d) asks for the examination of better environmental options to reach the objective of the water body's modification.

The common implementation strategy of the WFD recognizes therefore the need to address this issue at a strategic – regional level[22]. For arguing about the "no better environmental option" not only the single project and locality but a whole region or catchment has to be considered. The above proposed regional strategy is therefore in line with the WFD provisions. A regional strategic planning based on a weighing of interests and classifying river stretches as favorable, less favorable and not favorable for hydropower use can be seen as response to the requirement of examining better environmental options to justify exemptions according to article WFD 4.7.

Such an approach is endorsed by the communication on the support of electricity from renewable energy sources (COM(2005) 627)[23] as well as the Note of the EU Water Directors on "Hydropower Development under the Water Framework Directive"[24] and by the Policy Paper from 2007 on "WFD

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

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

[23] http://ec.europa.eu/energy/res/biomass_action_plan/doc/2005_12_07_comm_biomass_electricity_en.pdf

[24] http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/hydromorphology/development_directivepdf/_EN_1.0_&a=d

and Hydro-Morphological pressures"[25], recommending the development of pre-planning mechanisms to allocate suitable areas for new hydropower projects. Practical examples could be allocating suitable areas for hydropower development by identifying sites where new plants would be both acceptable in terms of water protection and economically beneficial. Such pre-planned hydropower areas could be the target of financial support schemes for hydropower development.

Also the SHERPA project (Small Hydro Energy Efficient Promotion Campaign Action[26]) – a project funded by the EU in the framework of the Intelligent Energy for Europe Programme with – amongst others - a number of small hydropower associations as partners, points out in their conclusions the advantage of pre-planning mechanisms at river basin level to facilitate the identification of suitable areas for new hydropower projects. The use of such pre-planning systems could also assist the authorization process to be reduced and implemented faster. For this pre-planning a categorization of areas with respect to suitability for hydropower use is proposed, recommending the involvement of all stakeholders in the identification of the categories.

3.4.2 The local level: At-site assessment and authorization of individual projects

Going from general to detail, the regional strategy and pre-planning provides the information on the general appropriateness of a river stretch for hydropower exploitation. As pointed out in chapter 3.4.1, this classification considers the hydro-electric potential on the one hand and the ecological and landscape value on the other hand. This may in many cases already provide the necessary information to decide if projects located at specific river stretches should to be assessed in more detail or not. Especially for projects situated along areas which are classified as not-favorable for hydropower exploitation the procedure may in many cases stop at this point.

The regional pre-planning is however still a general, coarse assessment without considering project- and detailed site-specific information. If a request for authorization of a specific project is submitted to the competent authority, the regional strategy does of course not substitute any authorization decision but is only the frame for the local assessment since the scale is too wide to allow for final decision about a concrete small hydropower project. Built on the general appropriateness of the river stretch, a more in-depth assessment using project- and site-specific characteristics and further socio-economic aspects is necessary, also looking at the "how" of the project.

To sum up, the result of the local assessment is the **decision about authorization of a project**, considering all sustainability aspects with a broad weighing of all relevant criteria.

Such local assessments have of course to be in line with existing assessment instruments like e.g. environmental impact assessments[27].

Recommendation 15

Authorization decision on a local level - For individual applications only:

The second level of the proposed evaluation procedure is a local in-depth assessment of the concrete project application, considering installation- and detailed site-specific criteria and further socio-economic aspects such that a holistic weighing of all relevant criteria is being carried out.

The authorization is not just about judging if projects should be allowed in certain areas or not but also about the way how projects should be realized.

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

[26] www.esha.be/sherpa or more precisely: http://www.esha.be/fileadmin/esha_files/documents/SHERPA/D22_Report_WFD_RESe_EN.pdf

[27] See also Annex 1 of the Situation Report on Hydropower Generation in the Alpine Region focusing on Small Hydropower - Data Templates from Alpine Countries, Point 3.3.2.

3.4.3 Implications from the regional strategic planning as prerequisite for the local assessment and authorization

The proposed procedure for the evaluation and authorization process for hydropower plants foresees the strategic planning on a regional level as first step and prerequisite for the local assessment as a second step. This implies that the second step – which includes the actual authorization – should wait until the results from the regional pre-planning are available in order to avoid irreversible impacts. Strictly speaking this would mean a suspension of any authorization in the meantime, since the strategic planning requires a certain time span.

However, given the defined goals concerning the increase in electricity production from small hydropower within certain time limits, such a general suspension would risk to reach the goals in due time. Therefore, a pragmatic approach is suggested, where the normal authorization procedure can be carried out for "evident cases" without regional pre-planning. Such cases comprise SHP-projects where it is evident that they do not cause a significant impact on and deterioration of the ecosystem or where SHP-plants even lead to an ecologic improvement compared to the status quo. These cases mainly refer to infrastructure-related facilities and refurbishment projects (see Recommendation 5 and Recommendation 7) which do not require previously to the site-specific authorization procedure the results of a regional planning.

Recommendation 16[28]

Being a prerequisite for the local assessment and decision about an individual project application, the regional strategy /planning should be carried out as soon as possible.

[28] Good Practice Example "Evaluation and management of the hydroelectric potential of the Canton of Fribourg" provided in Annex 1, illustrates this recommendation

4 GUIDANCE FOR AN EVALUATION PROCEDURE FOR NEW INSTALLATIONS

4.1 Overview

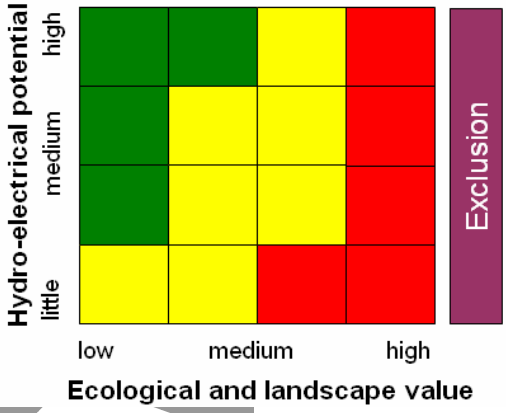
This chapter provides more in-depth guidance for the two-level procedure (that has been outlined in chapter 3.4) for the assessment of new installations[29].

The first, regional level is based on the comparison of the ecological and landscape value on the one hand with the hydro-electrical potential on the other hand. Such a strategic planning on a regional level considers these two aspects and provides a gross classification of river stretches with respect to their potential appropriateness as location for small hydropower plants.

Criteria and suggestions

- to determine the hydro-electric potential are set out in chapter 4.2.1.
- to evaluate the ecological and landscape value are set out in chapter 4.2.2.

Figure 6 illustrates the classification scheme defining the potential appropriateness resulting from the comparison of the two considered aspects.



FAVORABLE for hydro-electrical exploitation	LESS-FAVORABLE for hydro-electrical exploitation	NON- FAVORABLE for hydro-electrical exploitation. Strong interest for conservation	EXCLUSION hydro-electrical exploitation forbidden by law
complying with the legal environmental (and other) standards, construction of SHPs in general possible	additional aspects and in-depth assessment weighing all relevant criteria indispensable Next to complying with legal environmental standards, possibly further or stricter requirements may be necessary	SHPs possible only in exceptional cases (e.g. auto-supply)	No hydro-electrical exploitation possible since protected areas where any interventions are forbidden by law

Figure 6: Classification scheme regarding the potential appropriateness of a river stretch as location for small hydropower plants from a regional, strategic perspective

This first level provides a coarse assessment from a regional and strategic point of view that needs to be considered at the local level, where the actual authorization decision with a more in-depth

[29] Important refurbishments or upgrading of existing operating plants, requiring a new concession can lead to further environmental deterioration; therefore such cases should be evaluated with the same procedure applied on new installations

assessment takes place. For the evaluation of the individual application all sustainability aspects have to be considered and all relevant criteria of the project have to be weighted [23].

The aspects considered at regional level have therefore to be complemented at the local level with installation- and detailed site-specific criteria (see chapter 4.3.1) and further socio-economic criteria (see chapter 4.3.2)

The following subchapters provide a non exhaustive list of suggestions for common criteria and for possible additional criteria. Whereas a selection of a set of Alpine-wide common criteria is desirable, the final selection and weighting[23] of the criteria - being intrinsically a political decision - as well as the determination of classification boundaries are to be chosen individually by the corresponding competent authority at regional level (province, canton or other competent authorities) or national level in order to pay attention to the specific situation and national and regional factors[30].

Some of the suggested criteria are quantitative, some of qualitative nature, some need expert judgment.

4.2 The regional strategy: classification of river stretches with respect to potential appropriateness for SHPs

4.2.1 Criteria for the evaluation of the theoretical hydroelectric potential

The theoretical hydroelectric potential of the individual river stretches within a region can be estimated and evaluated by way of the following criteria:

CRITERIA	UNIT	DESCRIPTION
Specific potential energy production *or* Specific potential power output *or* Necessary length of water diversion for producing a certain power output	kWh/m kW/m m/kW	Potential energy production divided by the length of the river stretch (Subdivision of the river system can be done e.g. from junction to junction or for a fixed length of river (e.g. 1 km)) Potential power output divided by the length of the river stretch (see above). Inverse of the specific potential power output (e.g. calculated for a fixed power output of 500 kW or 1MW)
Specific head	m/m	Head divided by the length of the river stretch. Can be designated for the length of river stretches, for river stretches from junction to junction or for a forgone length of river (e.g. 1 km).

The necessary input variables for calculating the above criteria for the hydroelectric potential are runoff, head and length of the river stretch which can be established on the basis of spatial data by application of geographic information systems. With respect to runoff, uncertainties and temporal variability have to be appropriately taken into account.

The final evaluation classifies the theoretical hydroelectric potential of the river stretches into categories ranking from „high“ which means particularly apt for hydropower use from a hydroelectric potential point of view, to „little“ meaning not apt for hydropower user from a hydroelectric potential point of view[31].

[30] Indications of classification boundaries and examples of how to aggregate and weight different criteria can be found in the annex's good practice examples, e.g. in the strategy "water-use" of the Canton of Berne (Switzerland): http://www.bve.be.ch/site/ wassernutzungsstrategie.pdf or in the list of criteria of the Province of Tyrol (Austria): http://www.tirol.gv.at/fileadmin/ www.tirol.gv.at/regierung/downloads/kriterienkatalog.pdf

[31] In the strategy „water use“ of the Canton of Berne (Switzerland), e.g. the following categories of theoretical hydroelectric potential, defined by the specific power output, are used: 3 – 300 kW/m – high hydroelectric potential; 0.3 – 3 kW/m – medium potential; 0.1 – 0.3 kW/m – small potential; < 0.1 kW/m – very small potential (not represented)

4.2.2 Criteria assessing the ecological and landscape value:

The ecological and landscape value of the individual river stretches within a region can be evaluated by way of the following criteria:

CRITERIA	DESCRIPTION
Classification of the ecological status	*Classification of river stretches according to WFD or Swiss Modular Stepwise Procedure*[32]
Hydrologic regime	Minimal flow, flow fluctuation, impounded length…
Morphology	Natural structure and barrier free flow path, longitudinal connectivity
Biology (qualitative and quantitative)	Fish, macrozoobenthos, diatomea…
Possible additional criteria: *Chemical water quality* *Thermal regime* *Bedload*	
Type of water body	
Rarity of the water body type	
Sensibility of the water body type	
Rarity of the high status class within the water body type	
Importance as habitat	
Rare / protected habitats	Importance; fish spawning area, etc.
Importance for protected species	Fauna and flora
Rich species spectrum / diversity	Fauna and flora
Possible additional criteria: *longitudinal connectivity* *transversal connectivity* *Fishing waters*	
Landscape value	
Protected areas	Depending on the protection level and the interaction with the water body
Recreation value	
Beauty	Scenic attraction, symbolic value, local identity
Importance for the whole river system	Considering the specific function for the other stretches in the river or (sub)basin

Sites / zones that can justify the classification "non-favorable for hydropower use"

Even if no limitation for hydropower is set out by law, sites with high ecological and landscape value should get special protection and therefore be considered as "non-favorable for hydropower use" [33]. Such sites are listed below:

Sites located in one of the following zones:
National parks
Water related Nature2000 sites
Water related landscapes or natural monuments of national / regional importance
River stretches and biotopes of national / regional importance e.g. according to the rarity of type or naturalness or specific function for the river system
Revitalized or river stretches foreseen to be revitalized
Sites with one of the following characteristics:
Floodplains (wetlands, marshlands, riparian zones, dynamic and braided river stretches …)
Important spawning areas
Residual flow stretches[34]
River stretches with fish and crayfish populations of national importance
Interference with the protection of water resources for drinking water supply (drinking water protection zones)

Exclusion areas

Based on the applicable legislation, there may be sites where, due to their unique ecological and landscape value or to the local spatial planning, any further use for hydropower generation is forbidden by law. These cases represent "Exclusion areas" and depend on the locally valid legislation, thus they are not explicitly listed as criteria.

[32] http://www.modul-stufen-konzept.ch/e/index-e.htm

[33] E.g. in the Austrian National River Basin Management Plans (March 2010) the Austrian Federal States (Bundesländer) are supposed to proceed with a regional planning which may lead to an assignment of water bodies where the river stretches having been classified in a very good status (class 1 – high status) will be protected in any case for the future.

[34] River stretches are considered as residual flow stretches as long as they are significantly affected by the withdrawal.

4.3 The local assessment for new installations: Evaluating the site- and project-specific pros and cons

Whereas at the regional level the evaluation of the appropriateness is carried out irrespective of concrete applications, the local assessment is necessary only in response to an application for authorization.

At the regional level neither socio-economic nor installation specific criteria have been considered. In order to base the authorization decision on all sustainability dimensions, the following list of criteria for the local assessment complements the ones of the regional level with installation-specific and further socio-economic aspects including impacts on other sectors. For some criteria uncertainties and temporal variability of the underlying data have to be appropriately taken into account.

Considering that the final decision about authorization can only be taken according to the existing national / regional instruments and legal framework (e.g. environmental impact assessment,…), this non exhausting list of evaluation criteria should be adjusted in accordance with the aspects considered by already existing instruments.

4.3.1 Installation- and site-specific criteria

CRITERIA	UNIT	DESCRIPTION
Energy balance or "energy payback ratio"		Energy input for the construction of the installation and operation compared to the energy production (e.g. expressed as number of years until energy output > energy input);
Specific investments	€/kWh	Euros (or Swiss Francs) per expected annual production of the installation
Use of hydroelectric potential	%	Extent of use of available potential including consideration of residual flow requirements and qualitative description of the reasons if the available potential is only partly used.
Minimization of impacts		Measures going beyond minimum legal requirements (e.g. with respect to ecological flow, fish pass, bed load, aesthetics, natural scenery, etc.)
Synergies with existing infrastructures		Infrastructure plants or existence of a deactivated plant
Sewage dilution coefficient on the residual flow stretch		
Ecological impacts downstream and upstream		
Integration in the landscape		
Grid relevancy		e.g. Importance for the grid stability
Possible additional criteria for the comparison of applications competing on the same river stretch:		
Specific power output	*kW/m*	*Power output related to the length of the residual flow stretch and impounded river length.*

4.3.2 Further socio-economic criteria

CRITERIA	DESCRIPTION
Conflicts with other water users	Locally, downstream and upstream
Conformity with local spatial planning	
Necessity of further infrastructure for construction and operation	Access, power-lines, etc.
Effect on tourism	Potential positive and negative effects on tourism
Regional economic effects	Taxes, income for the public; investments in local economy, induced employment
Self supply necessity	If distance to the public grid too long and no better environmental option is given.
Relevant certifications[35]	e.g. green energy labels; ISO 14000 ; …
Other socio-political considerations	

[35] Good Practice Example "CH2OICE"" provided in Annex 1, illustrates this criteria