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ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

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

IMPRINT

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A Platform within the Alpine Convention

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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 a 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 from 1 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].

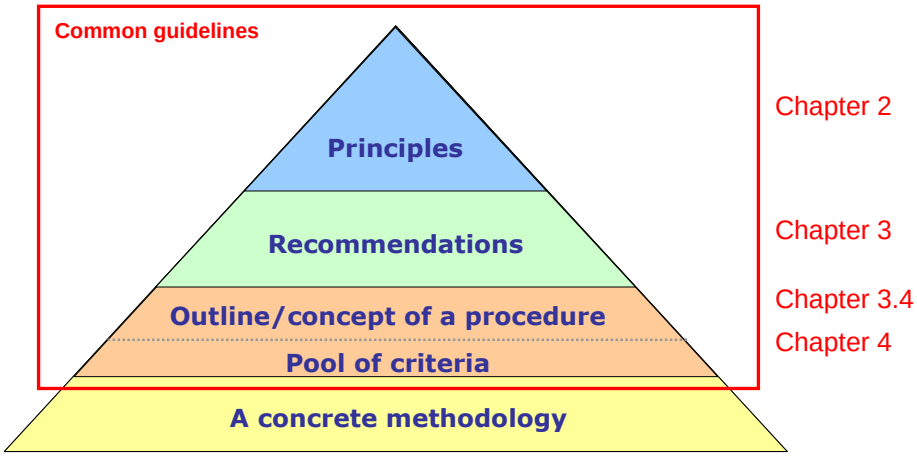

Figure 1: Potential levels of detail for guidelines. The red box indicates the target of the common guidelines

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 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 Alps 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 accordance with norms and operated by permanent panels 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 a genuinely natural state have become increasingly rare.

In order to reduce emissions of greenhouse 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 unutilised river stretches and discharge, thus entering into potential conflicts with the conservation of ecosystems and landscapes. Given the rarity of remaining unexploited rivers, strategic reflection is of the utmost importance in order to avoid irreversible impacts.

Given the multiplicity of pressures and conflicting expectations with respect to small hydropower in the Alpine region (see figure 2), this is why decision makers and authorisation bodies are in need of, and have asked for, guidelines to tackle this challenging issue. This has also been outlined in the conclusions of the situation report on hydropower generation in the Alps focusing on small hydropower.

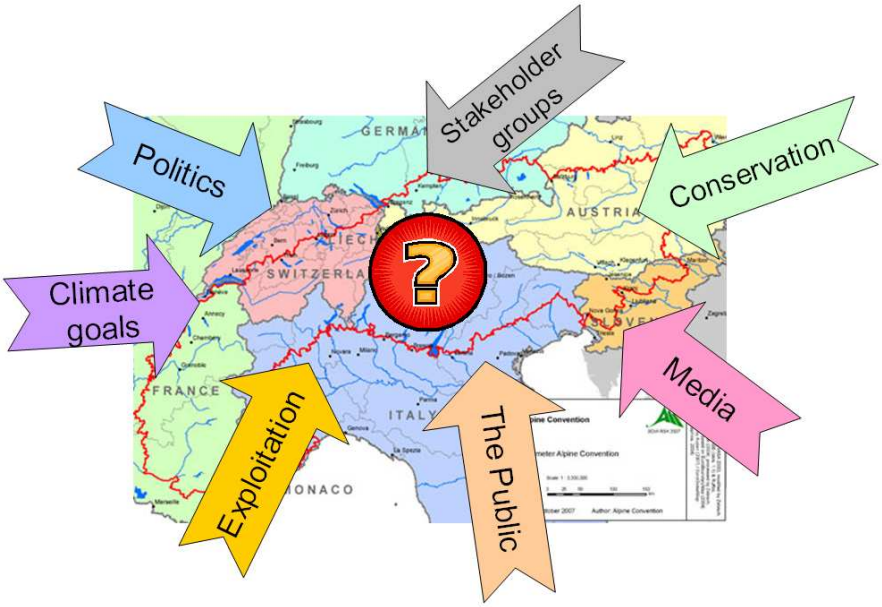

Figure 2: Hydroelectric potential and ecosystem potential in the Alpine region: Area of conflict with different pressures and expectations.

[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	Minimising the impairment of the aquatic ecosystem and landscape

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

In many cases this raises a conflict of interest that requires a balance to be struck between these two objectives. This implies the search for locations that are potentially favourable for hydropower and the identification of locations that are ecologically sensitive, rendering them less favourable for hydropower use. The appropriateness of locations for small hydropower plants is thus in principle based on an assessment of utilisation 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 optimisation task between the two objectives falls also within the responsibility of the public authority. This requires assistance through guidelines both for the public authority responsible for taking the decision and for potential applicants by making the decision process transparent in advance and providing an indication on the prospects of a project being realised.

In general terms, the specific objective of the guidelines is therefore to provide general guidance for the identification of potential favourable locations for small hydropower plants and the subsequent authorisation decision in accordance with 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, which aim to establish sustainable development in the energy sector 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 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 its 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 potentially favourable locations for small hydropower plants and for the subsequent authorisation 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 consolidate the principles of integrated water resources management. Furthermore, this document may also contribute towards the objective of highlighting effective and sustainable ways on how to make the Alpine area climate neutral by 2050, as indicated in the Climate Action Plan of the Alpine Convention.

The guidelines in hand are intended to address the described conflict of interest. Depending on the particular area under scrutiny it has to be kept in mind that other water uses may be relevant as well and need to be considered within this optimisation 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 authorisation 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' principles may also have validity

- outside the Alpine region 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, etc), which are not dealt with in these guidelines;
- for analysing the optimisation potential of existing installations;
- in their character of common Alpine-wide guidelines they serve as an 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 authorising small hydropower plants

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

Furthermore, they may serve as orientation for applicants of small hydropower projects about the chances of getting an authorisation and more specifically about aspects that should be considered in the design of projects (i.e. support for potential investors and efficient planning) and also as common vision for the realisation 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.

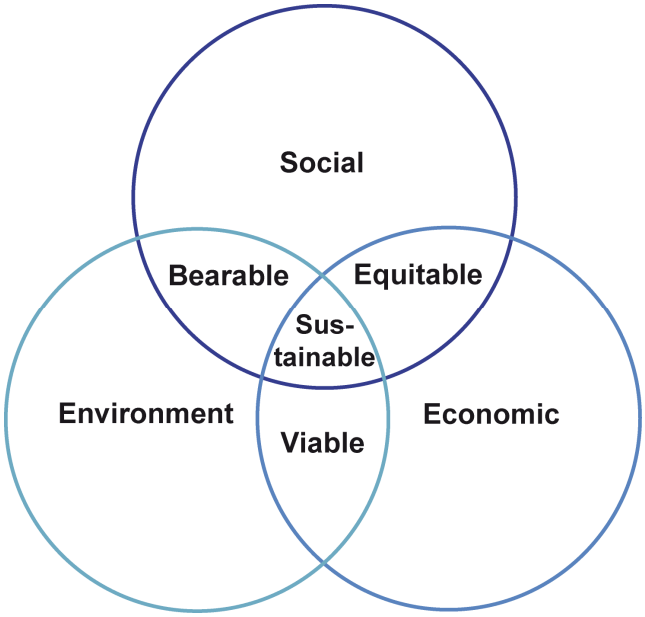

Figure 3: The three components of sustainability

To strike a balance between the general objectives of "increasing the production of renewable energy from hydropower generation" and "minimising 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; the role of small hydropower within this sector is to be considered under the framework of the guidelines in hand.

Alongside 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 etc);
- socio-economic aspects: allocation of revenues, decentralised approaches, employment, social development of the region, tourism etc

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 standard aspects for the whole Alpine region, specific national / regional approaches built on the basis of common principles have to be established.

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 region. Rather, the idea is to agree on general principles - including a common understanding of the most important evaluation criteria - for the whole Alpine region 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 regarded as the base reference situation. To consider only the existing situation would be to neglect potential improvements of the ecological value due to, for example, planned river revitalisation 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 changes to the ecological condition if e.g. rehabilitation projects are foreseen

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 involving 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, waste water disposal infrastructure or irrigation infrastructure as well as residual flow hydroelectric plants or for the creation of flows to aid fish migration). This type of SHP is understood as being located in installations that primarily have a goal other than electricity production and that are exploiting for hydroelectric purposes 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

Recommendation 5[15]

[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.

Infrastructure-related hydropower plants, exploiting only the water that is already used by the primary purpose of the plant, 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 connection to the public electricity grid would lead to disproportionate costs and better environmental options are not feasible, there is a need for self-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 self-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, the provision of electric self-supply, where connection to the public grid would be at disproportionate cost and no better environmental options are given, constitutes a strong argument in favour of building SHP in remote individual locations, such as, for example, alpine huts and farms.

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

3.3 New Construction or Refurbishment

The construction or refurbishment of small hydropower facilities can be driven by a variety and combination of motives, such as an increase in the contribution towards renewable energy supply, the achievement of climate objectives or the self-supply of individual remote locations.

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

Existing installations:

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

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

- 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 usually do 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 prioritised 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 periodic examination as to whether further mitigation of negative impacts and better 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 optimise the production of hydropower while minimising ecological impacts should be promoted and prioritised. However there should be a periodic examination as to whether further mitigation of negative impacts and better 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 an area's ecological status and landscape should be 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 would not lead to a further environmental deterioration. Since the renewal of the water right would have to be in accordance with the current environmental legislation and best practice, its granting should in general entail a mitigation of negative impacts.

Given that over a period of time, technical approaches, views and environmental standards can change, concessions and licenses should be time limited 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 in 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 be considered appropriate where 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 to **new installations** described in chapter 3.4.

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 energy legislation. To achieve these goals and the environmental goals also set out in existing legislation, favourable locations and technical solutions for hydroelectric production have to be identified. The key question is therefore: **where** are the most favourable locations to build and operate SHP in order to achieve those goals.

However, the evaluation for authorisation of small hydropower depends not only on a favourable location but also on the individual project application and specific local circumstances. 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 authorised in certain areas or not but also on **how** they should be realised.

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 realise most appropriately the increase in hydroelectric production by small hydropower plants and which individual solution should be the most suitable.

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

Recommendation 10[19]

In order to answer the questions about the "where", with respect to the most favourable 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. Such an approach is also foreseen by the national recommendation of Switzerland (www.umwelt-schweiz.ch/UD-1037-D)

In some countries of the Alpine Convention, authorities for strategic planning and for granting concessions are different. In such an 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 "where" question, the evaluation's horizon has to be broadened: it is about the search for the most favourable locations, which necessarily takes place on a **regional level.** Favourable locations are those that exhibit a high hydro-electric potential while also being of relatively low ecological and landscape value or where the ecological status would not be significantly degraded by appropriate hydropower use. "Regional" in this context 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, or in 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. Classification is e.g. in three categories: favourable, less-favourable and non-favourable 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 point of view, identifying the most favourable locations for SHP as well as those less and unfavourable.

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 hydro-electric potential, ecological and landscape value and areas under special protection).

The actual exploitation level of hydropower production in the Alpine area is significant. The remaining hydro-electrical potential depends on the extent of unutilised river stretches and discharge and on

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

further specific functions of the river stretch that limit exploitation. Therefore, if there remain only a few areas (e.g. sub-basins) that 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 provides a framework for the assessment and authorisation of individual projects. Such a regional strategy is an effective and transparent decision making instrument which can also be used for communication purposes, indicating the chances and potential requirements for an authorisation. It is recommended that the regional strategy should be of a binding character. To this end, consideration should be given to integrating the strategy into existing instruments like the WFD-river basin management plans[21] or into 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 regional pre-planning meets 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 recognises therefore the need to address this issue at a strategic – regional level[22]. In consideration of the "no better environmental option" not only the single project and locality but also the whole region or catchment has to be taken into account. The regional strategy outlined above is therefore in line with the WFD provisions. A regional strategic planning based on a weighing of interests and classifying river stretches as favourable, less favourable and not favourable 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 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.

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[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

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

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 its 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 streamline the authorisation process and lead to faster implementation. For this pre-planning a categorisation of areas with respect to suitability for hydropower use is proposed, with all stakeholders to be involved in the identification of the categories.

3.4.2 The local level: At-site assessment and authorisation 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 hydroelectric 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 classified as non-favourable 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 consideration of project- and detailed site-specific information. If a request for authorisation of a specific project is submitted to the competent authority, the regional strategy does of course not substitute any authorisation decision but is only the frame for the local assessment since the scale is too wide to allow for final decision about a specific 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. Further, combining the local level with the regional perspective enables consideration of the cumulative effects of several facilities.

To sum up, the result of the local assessment is the **decision about authorisation 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

Authorisation 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 carried out.

The authorisation is not just about judging if projects should be allowed in certain areas or not but also about how projects should be realised.

[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 Alps 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 authorisation

The proposed procedure for the evaluation and authorisation process for hydropower plants foresees the strategic planning on a regional level as a first step and prerequisite for the local assessment as a second step. This implies that the second step – which includes the actual authorisation – 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 authorisation 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 failing to reach those goals in due time. Therefore, a pragmatic approach is suggested, where the normal authorisation 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) that would not require the results of a regional planning exercise prior to the site-specific authorisation procedure.

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

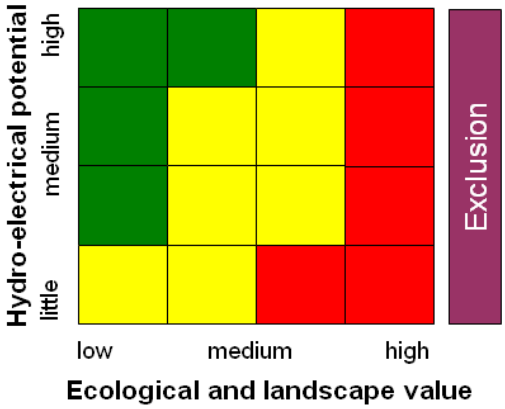
This chapter provides more in-depth guidance for the two-level procedure (that has been outlined in chapter 3.4) for the assessment of new installations[29].

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.



FAVOURABLE for hydro-electrical exploitation	LESS-FAVOURABLE for hydro-electrical exploitation	NON-FAVOURABLE 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

[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

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 authorisation decision with a more in-depth 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 [30].

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[30] of the criteria - being intrinsically a political decision - as well as the determination of classification boundaries should be chosen individually by the competent authority at regional level (province, canton or other competent authorities) or national level in order to give proper 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*	kWh/m	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))
Specific potential power output *or*	kW/m	Potential power output divided by the length of the river stretch (see above).
Necessary length of water diversion for producing a certain power output	m/kW	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 that 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 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*	
Fish waters	*Waters suitable to sustain natural fish populations*
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-favourable for hydropower use"

Even if no limitation for hydropower is set by law, sites with high ecological and landscape value should get special protection and therefore be considered as "non-favourable 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
Revitalised or river stretches foreseen to be revitalised
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 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 Plan (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 authorisation.

At the regional level neither socio-economic nor installation specific criteria have been considered. In order to base the authorisation 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 authorisation can only be taken according to the existing national / regional instruments and legal framework (e.g. environmental impact assessment,…), this non exhaustive list of evaluation criteria should be adjusted in accordance with the aspects considered by 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.
Minimisation 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

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

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

ANNEXES

15.12.2010

The annexes in hand are part of the report

"Common Guidelines for the Use of Small Hydropower in the Alpine Region"

published by the Platform Water Management in the Alps.

ANNEX 1

GOOD PRACTICE EXAMPLES FOR THE USE OF SMALL HYDROPOWER

Annex 1 comprises a collection of good practice examples focusing on small hydropower in the Alps. Next to examples of concrete projects for new installations or refurbishments of existing installations, the annex further includes examples of strategies, decision aid methods, certifications and national platforms.

The examples provided in this annex are intended to support the contents of the Common Guidelines providing concrete examples. Furthermore they aim at an exchange of inspiring examples among the Alpine countries.

ANNEX 2

PERTINENT INTERNET LINKS ON SMALL HYDROPOWER AND GUIDANCE DOCUMENTS

Annex 2 comprises a collection of national or international links and guidance documents pertinent to the topic of small hydropower

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Common Guidelines
for the use of Small Hydropower
in the Alps

ANNEX 1

GOOD PRACTICE EXAMPLES FOR THE USE OF SMALL HYDROPOWER

15.12.2010

INDEX

1. AUSTRIA

Country:	Province / Canton:	Name of the project:
Austria	Upper Austria	Revitalisation Programme Upper Austria

Description:

The increase of electricity production by environmental-friendly development and modernisation of the hydroelectric power is goal of this support program. Thus, the Revitalisation Programme Upper Austria provides two options to achieve this goal:

- Modernisation of power plants in place
- Installation of new power plants at environmental acceptable locations

Status in Upper Austria:

- 616 small hydro power plants (installed capacity up to 10 MW)
- SHP bottleneck capacity of more than 130 MW in total

There is a need for financial incentives for small hydro power plants (< 1MW). Ecological measures can be realised faster with financial support schemes.

Method:

- Small hydro power operators get advised about the optimisation potential (since April 2003)
- Development programme especially considering ecological issues
  - Enforcing modernisation of small hydro power plants up to 1 MW
  - Installing new small hydro power plants up to 1 MW
- Subsidy rates:
  - Investment grant of 25% maximum (one-time)
  - Maximum of 50.000 Euro per hydro power plant/operator

Criteria:

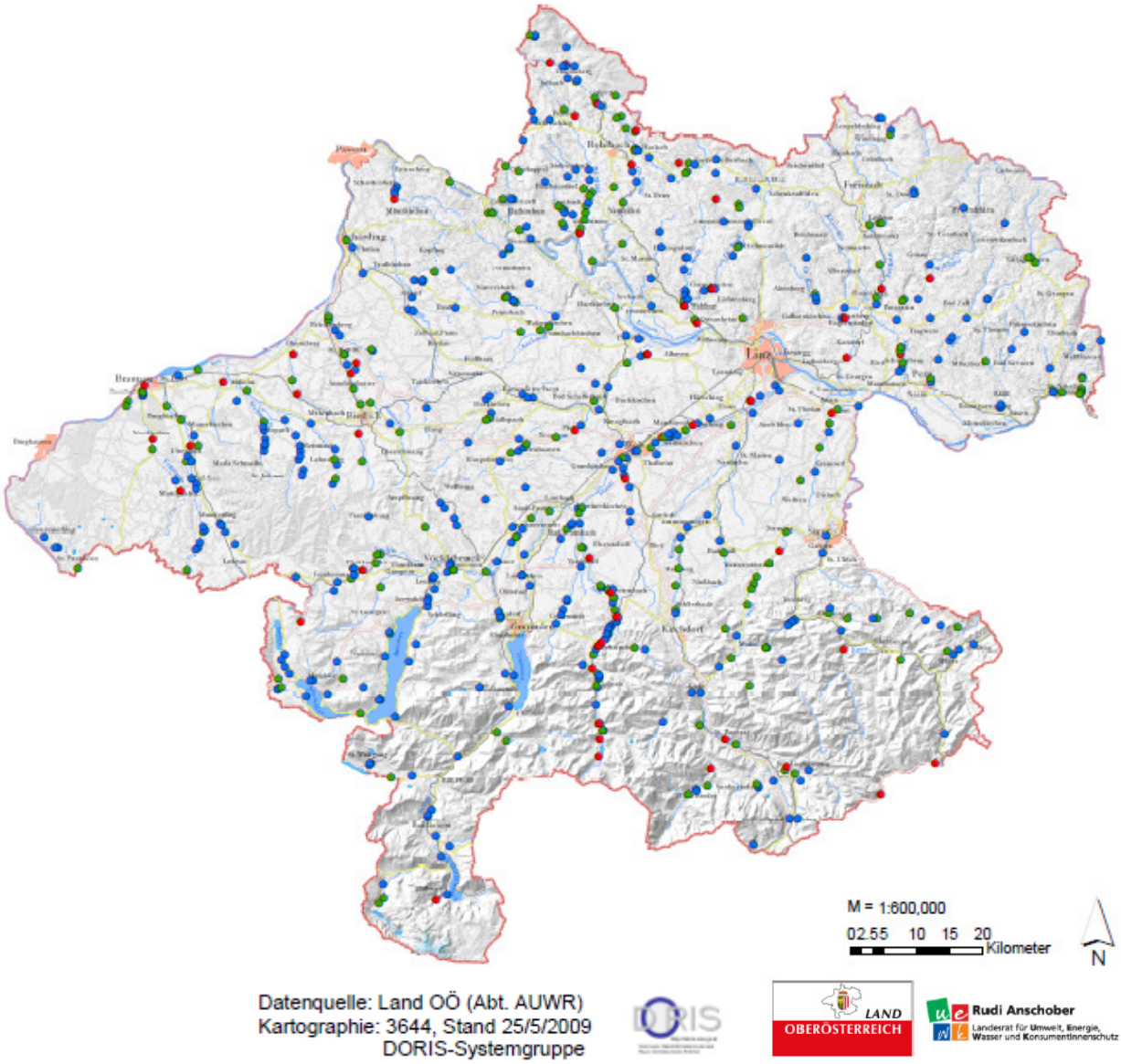
- Small hydro power generation ≤ 1 MW
- Relevant investment costs have to be at least 7.500 Euros
- The power plant has to be designed in an environment-friendly way

Results:

Achievements of the Revitalisation Programme Upper Austria (Summer 2009)

- 258 small hydro power plants have been either modernised or completely new installed(2004-2009)
- Total investment of 45 million Euros
- The electricity production of these plants has been increased on average by more than 40%
- Total increase in electricity production: 76 GWh/year
- Ecological improvement of the rivers in Upper Austria due to obligatory ecological measures

Country:	Province / Canton:	Name of the project:
Austria	Upper Austria	Revitalisation Programme Upper Austria



Legend:

- 358 small hydro power plants in place
- 202 refurbished small hydro power plants (increase of energy production by 15% up to 50%)
- 56 new small hydro power plants (Complete new installations or revitalisations which are comparable with new installations)

Map 1: Revitalisation Programme Small Hydropower in Upper Austria (2009) © Amt der OÖ. Landesregierung

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

- Consulting provided for operators
- ecological and economical optimisation
- Subsidy rates up to 25% of total costs

Links: http://www.esv.or.at/foerderungen/oekostrom/oekop-kwkw/ (DL Folder, FAQs, …):
www.energiesparverband.at O.Ö. Energiesparverband, Landstraße 45, A-4020 Linz
www.land-oberoesterreich.gv.at Amt der OÖ. Landesregierung, Kärntnerstraße 12, A - 4021 Linz

Country:	Province / Canton:	Name of the project:
Austria	Tyrol	List of Criteria (Draft) - Further Development of Hydropower in Tyrol

Description:

- The Tyrolean Ministry of Environment establishes criteria as basis for an assessment of the compatibility of new hydropower plants with ecological requirements; this is in line with provisions already in place for exemptions of the provision of “non deterioration”.

Method:

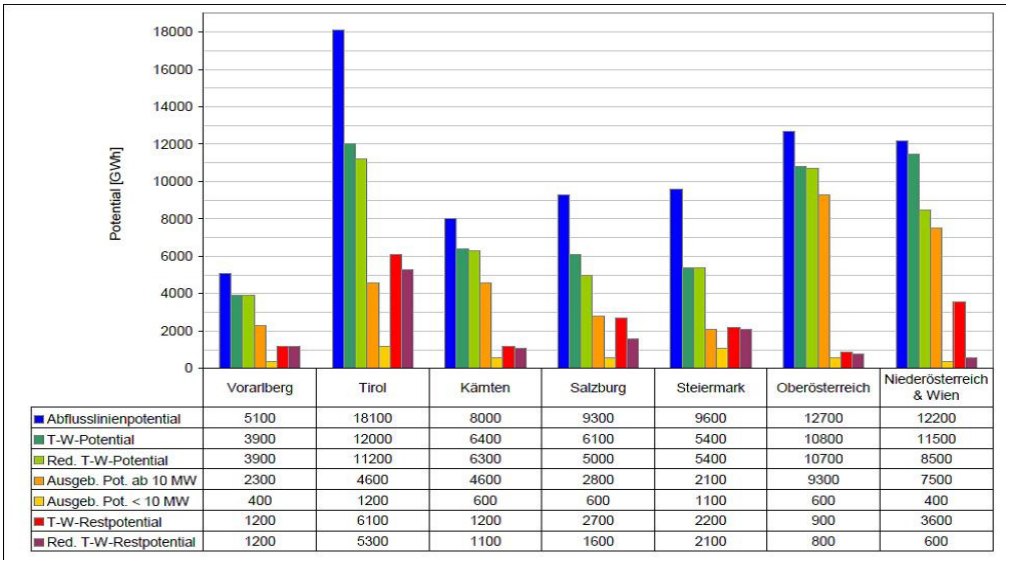
- Development of criteria for 5 special issues by a multidisciplinary group of 15 experts and 1 coordinator
- Further development of this list for future development of Hydropower in Tyrol including all relevant stakeholders

Criteria:

Specification of 5 topics/criteria with following weighting	Quantification
1. Criteria of Energy management	25 %
2. Criteria of Water management	18 %
3. Criteria of Spatial planning	12 %
4. Criteria of Water ecology	22 %
5. Criteria of Nature protection	23 %

Results:

- A concept to solve conflicts between hydropower generation and prevention of water degradation
- Each considered project should be assessed in a fully transparent way by weighting the results of the criteria groups



	Vorarlberg	Tirol	Kärnten	Salzburg	Steiermark	Oberösterreich	Niederösterreich & Wien
Abflusslinienpotential	5100	18100	8000	9300	9600	12700	12200
T-W-Potential	3900	12000	6400	6100	5400	10800	11500
Red. T-W-Potential	3900	11200	6300	5000	5400	10700	8500
Ausgeb. Pot. ab 10 MW	2300	4600	4600	2800	2100	9300	7500
Ausgeb. Pot. < 10 MW	400	1200	600	600	1100	600	400
T-W-Restpotential	1200	6100	1200	2700	2200	900	3600
Red. T-W-Restpotential	1200	5300	1100	1600	2100	800	600

Legend:

- total run off (hydrograph) potential
- technical-economic potential
- reduced technical-economic potential
- “large” hydropower potential (≥ 10 M W) already in place
- “small” hydropower potential (< 10 MW) already in place
- Unexploited hydropower potential
- Reduced unexploited hydropower potential

Figure 1: Overview of Hydropower Potentials in the different provinces of Austria © Amt der Tiroler Landesregierung

Status: ☐ Idea ☒ Project ☐ Realized ☐ Enacted ☐ ……..

Milestones:

- Installed expert group proposed criteria
- The proposal was presented to the general public (December 2009) and was

Country:	Province / Canton:	Name of the project:
Austria	Tyrol	List of Criteria (Draft) - Further Development of Hydropower in Tyrol

opened for comments

Next steps:

- Discussion of proposal incorporating the public comments with relevant stakeholders and politicians
- Finalise the list of criteria

Links:

http://www.tirol.gv.at/fileadmin/www.tirol.gv.at/regierung/downloads/Nutzen_Kriterienkatalog_Website_final.pdf

http://www.tirol.gv.at/fileadmin/www.tirol.gv.at/regierung/downloads/kriterienkatalog.pdf

Amt der Tiroler Landesregierung

Eduard-Wallnöfer-Platz 3

A-6020 Innsbruck

Photo 1: List of Criteria Tyrol (Draft) © Amt der Tiroler Landesregierung

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment of HPP Magerlmühle

Description:

Hydro Power Plant: Wagner KG
River: Große Mühl
average discharge - MQ = 9 m³/s
minimum discharge - NNQ= 0,8 m³/s

Status before refurbishment:

River Power Station at the "Große Mühl" has been operating since 1922. Wagner KG purchased the power station in 2004.

Technical Data (before 2004):

Francis turbine

vertical with cogwheel and belt drive

- capacity: Q = 5,5 m³/s
- head: H = 2,6 m
- turbine output: 110 KW
- capacity: 95 KW
- production/year: 450.000 KWh

Total production/year: **450.000 KWh**

Ecology:

- minimum flow:
  residual flow reach of 300 m
  no minimum flow
- fish pass
  no fish pass built

Status after refurbishment:

Initial Operation: 30.3.2004

Technical Data (since 2004):

Kaplan turbine

Vertical, double regulated

- capacity: Q = 6,0 m³/s
- head: H = 2,5 m
- turbine output: 135 KW
- capacity: 120 KW
- production/year: 750.000 KWh
- The old installation is still in use and produces 350.000 KWh

Total production/year: **1.100.000 KWh**

Ecology:

- minimum flow:
  not necessary
- fish pass
  Vertical slot fish pass with 150l/s

Method:

- Investment costs: 520.000 €
- Subsidy: 50.000 € by Revitalisation Program Upper Austria

Criteria:

- Revitalisation, ecology, increase in efficiency

Results:

- Increase of power production in average by 650.000 kWh/year

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment of HPP Magerlmühle

Photo 1: Vertical slot SHPP Magerlmühle © Christoph Wagner	Photo 2: Power station SHPP Magerlmühle © Christoph Wagner

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

- Increase in efficiency from 450.000 KWh/year to 1.100.000 KWh/year
- Ecology – fish pass constructed

Links: http://www.esv.or.at/foerderungen/oekostrom/beispiele/kleinwasserkraftwerk-magerlmuehle/

www.wws-wasserkraft.at

Wagner KG, Christoph Wagner, A - 4171 St. Peter, Auberg 13

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment HPP Cumberland – River Alm

Description: Hydro Power Plant: Cumberlandstiftung

River: Alm

Status before refurbishment:

Hydro power plant has been in operation since 1899.

Status of refurbishment:

Initial operation: 20.12.2005

Technical Data (before 2005):

Francis turbine

vertical with cogwheel and belt drive

- capacity: Q = 2,0 m³/s
- head: H = 2,5 m
- turbine output: 35 KW
- capacity: 28 KW
- production/year: 170.000 KWh

Ecology:

- minimum flow:
  no minimum flow

Fish pass:

- no fish pass built

Technical Data (since 2005):

Kaplan turbine

vertical double regulated

- capacity: Q = 8,0 m³/s
- head: H = 3,0 m
- turbine output: 214 KW
- capacity: 197 KW
- production/year: 1.000.000 KWh

Ecology:

- minimum flow:
  800 to 1400 l/ s

Fish pass:

- bypass channel at weir to allow migration of fish

Method:

- Investment costs: 960.000 €
- Subsidy: 50.000 € by Revitalisation Program Upper Austria

Criteria:

- Revitalisation, ecology, increase in efficiency

Results:

- Increase of power production in average by 800.000 kWh/year

Photo 1: Power station SHPP Cumberland

© Herzog von Cumberlandstiftung

Photo 2: Weir system SHPP Cumberland

© Herzog von Cumberlandstiftung

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ……..

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment HPP Cumberland – River Alm
Milestones:	• Increase in efficiency from 170.000 KWh/year to 1.000.000 KWh/year • Ecology – fish pass constructed	
Links:	http://www.hydro-energy.com/_downloads/pdf/Referenzen_Zek/Auingersaege_Juni07.pdf http://www.neueenergie.net/index.php?id=1515 Herzog von Cumberlandstiftung, Helmut Neubacher, Landstraße 17, A - 4645 Grünau	

Country:	Province / Canton:	Name of the project:
Austria	Upper Austria	Refurbishment and Optimisation of the HPP Steinbach

Description:

Hydro Power Plant: Steinbach

River: Steyr

Status before reconstruction:

- The old HPP consisted of two separate plants. One was built in 1910, with an installed capacity of 25 kW and the other one in 1942, with an installed capacity of 75 kW. With gross head of 2.8 m and a maximum discharge of 4.1 m³/s per plant, an annual average of 0.8 GWh was produced.
- River continuum disrupted - Fish migration not possible (=Ecological shortcoming)
- Due to poor condition and the long life-span of the facility a refurbishment study was carried out in 1999. The results proposed following measures:
  - Removal of the old plants and replacement by a single power-station with two generators. Increase of maximum discharge from 4.1 m³/s to 50 m³/s and enhancing capacity from 100 kW to 1.000 kW
  - Alteration of bottom weir gate

Method: Reconstruction by refurbishment / ecological mitigation measures

Criteria: Reconstruction, ecology, increase in efficiency

Results:

- Increasing maximum discharge and enhancing efficiency have resulted in an average annual power generation of 5,3 GWh - more than six times the production before refurbishment.
- Total costs: 5.000.000 € (several floods during construction period resulted in extra costs of 1.200.000 €).

Execution of measures:

Hydromorphological improvements:

- River continuum established

Ecological improvements:

- Providing fish migration ensured by a vertical slot fish pass

Assessment of ecological efficiency:

- Experts of limnology assisted designing the plant and supervised the construction process of the fish pass
- The fish pass is integrated in the partition wall between bottom weir gate and powerhouse. Tests proved functionality of fish ladder.

Effects on operator:

- Costs for ecological improvement have been compensated by increasing power generation

Costs of the measure (€):

- Investment: Fish pass: approximately € 70.000 €

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment and Optimisation of the HPP Steinbach

Photo 1: Vertical slot SHPP Steinbach © Energie AG Oberösterreich

Status:	☐ Idea	☐ Project	☒ Realized	☐ Enacted	☐ ……..
Milestones:	Increase in efficiency Ecology – river continuity ensured by fish pass				
Links:	http://www.energieag.at/eag_at/resources/257501226587649392_399384431324350784.pdf Energie AG Oberösterreich, Böhmerwaldstr. 3, A-4021 Linz				

Country:	Province / Canton:	Name of the project:
Austria	Upper Austria	Refurbishment – Optimisation of the HPP Agonitz

Description:

Hydro Power Plant: Agonitz

River: Steyr

Status before reconstruction:

- The HPP was built in 1924.
- The old plant had a gross head of 7 m and a maximum discharge of 20 m³/s. It used two generators with an installed capacity of 990 kWand produced an average of 6,4 GWh/year.
- River continuum disrupted - Fish migration not possible (=Ecological shortcoming)
- Due to poor condition and long life-span of the facility a refurbishment study was carried out in 2001. The results of the study proposed the following measures:
  - Replacement of power station and generators. Increase of maximum discharge from 20 m³/s to 45 m³/s
  - Alteration of bottom weir gate
  - Increase of hydraulic head to 8,3 m by an excavation of river bed downstream by 1,3 m
  - Total costs: 7.600.000 €

Method: Reconstruction by refurbishment / ecological mitigation measures

Criteria: Reconstruction, ecology, increase in efficiency

Results:

- Increasing the maximum and hydraulic head has resulted in an average annual power production of 15,8 GWh - more than twice the amount before refurbishment.
- Ecological measures were planned by experts of limnology who also supervised the construction works.

Execution of measures:

Hydromorphological improvements:

- River continuum established

Ecological improvements:

- Fish migration provided by setting in place a fish pass designed as a combination of nature orientated creek and a vertical slot fish pass.

Assessment of ecological efficiency:

- High

Effects on operator:

- Costs for ecological improvement have been compensated by increasing power generation

Costs of the measure (€):

- Investment: Fish pass: 380.000 €.

Country:	**Province / Canton:**	**Name of the project:**
Austria	Upper Austria	Refurbishment – Optimisation of the HPP Agonitz

Photo 1: SHPP Agonitz © Energie AG Oberösterreich

Status:	☐ Idea	☐ Project	☒ Realized	☐ Enacted	☐ ……..
Milestones:	Increase in efficiency Ecology – fish pass constructed				
Links:	http://www.energieag.at/eagat/resources/257501226587649392_326146398573391687.pdf Energie AG Oberösterreich, Böhmerwaldstr. 3, A-4021 Linz				

Country:	Province / Canton:	Name of the project:
Austria	Salzburg	Automatic regulation of residual flow e.g. SHPP Thurn – River: Saalach

Description:

- Prevention of malfunctions and controlling residual flows are the prerequisites for good ecological status of rivers.
- Inspections revealed that the specified residual flow was frequently not observed by the owner in the past. An automatic system for the regulation of the residual flow has been considered.
- Installing a technical regulation system ensured the required residual flow.
- The protocol system documents the residual flow values.

Method:

- Automatic regulation of residual water
- Technical solution – no manipulation possible

Criteria:

- Regulation of residual water

Results:

- better ecological status for the river

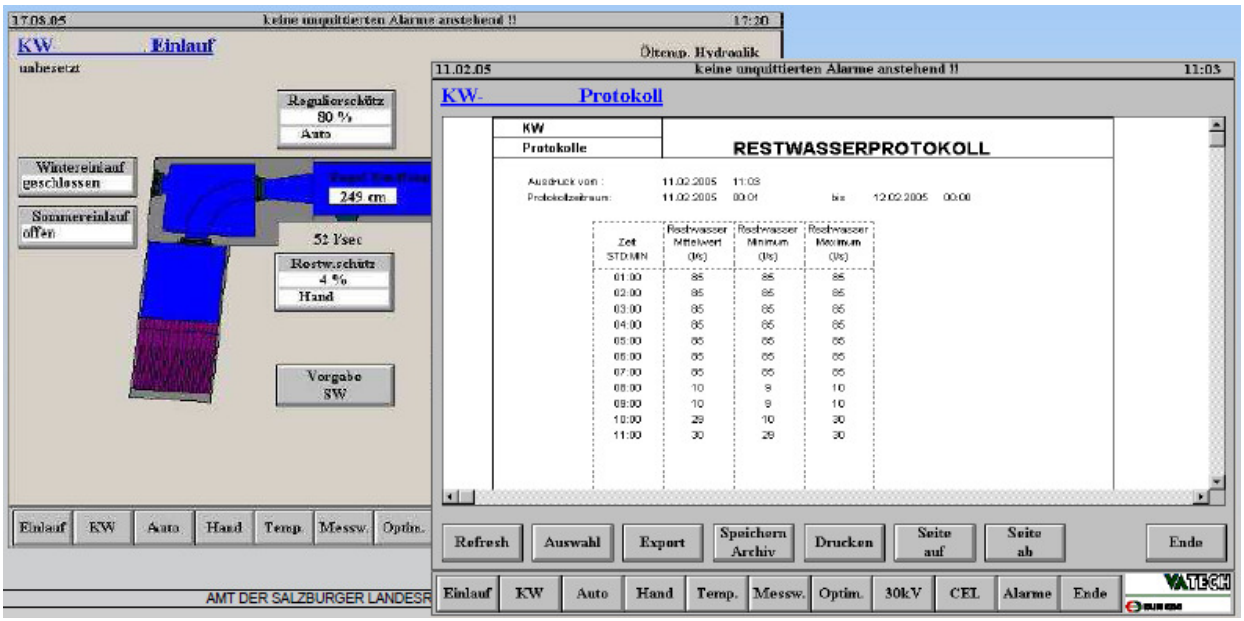


Figure 1: Interface of the programme regulating the residual water including data recording © Land Salzburg

Figure 2: Regulation of residual flow © Land Salzburg

Figure 3: No residual water © Land Salzburg

Status: ☐ Idea ☐ Project ☐ Realized ☒ Enacted (Salzburg) ☐ ……..

Milestones:

- No manipulation by operators possible because of technical solution including a protocol tool

Country:	**Province / Canton:**	**Name of the project:**
Austria	Salzburg	Automatic regulation of residual flow e.g. SHPP Thurn – River: Saalach
	• Guaranteed residual flow	
Links:	http://www.salzburg.gv.at/jaeger_automatische_restwasserregulierung_und_fischpassdotation_grafik_komprimiert-3.pdf http://www.salzburg.gv.at/gewaesserschutz Land Salzburg, Referat 13/04 - Gewässerschutz Mag. Renate Schrempf, Tel:+43(0)662 8042-4492, e-mail: renate.schrempf@salzburg.gv.at Dr. Andreas Unterweger, Tel:+43(0)662 8042-4582, e-mail: andreas.unterweger@salzburg.gv.at	

2. GERMANY

Country:	Province / Canton:	Name of the project:
Germany		Innovative Hydroelectric Concept

Description:

At the TU Munich development work is ongoing to create a new inlet concept particularly suited to existing, fixed weirs. The new concept's main innovation is a change from the vertical to the horizontal inlet plane, resulting in significant economic, hydraulic, noise-emission and aesthetic advantages. An additional and important benefit lies in the special consideration of ecological components in the flow and bed load regions. Fish-friendly flow conditions in the inlet plane can be achieved with an increase of the effective surface area of the rake without affecting the third dimension.

The power plant is situated in front of and within the weir, submerged, equipped with a DIVE turbine, requires no powerhouse and no intervention on the banks. Furthermore it is inconspicuous and emits no noise. To prevent vortices drawing air into the vertical shaft a flap gate positioned at the face will be over-flowed. This will also allow fish migrating downstream a wide corridor.

Method:

So far the concept is designed theoretically and a rough hydraulic dimensioning has been done. In the course of a research project the design will be tested in a physical model equipped with turbines. In a second phase a large pilot project will be built. Applicable hydraulic and construction assessments can be expected in the summer of 2010.

Criteria:

More efficient and therefore economically viable even at weirs with small heads of water, at the same time achieve high ecological standards.

Results:

Figures:

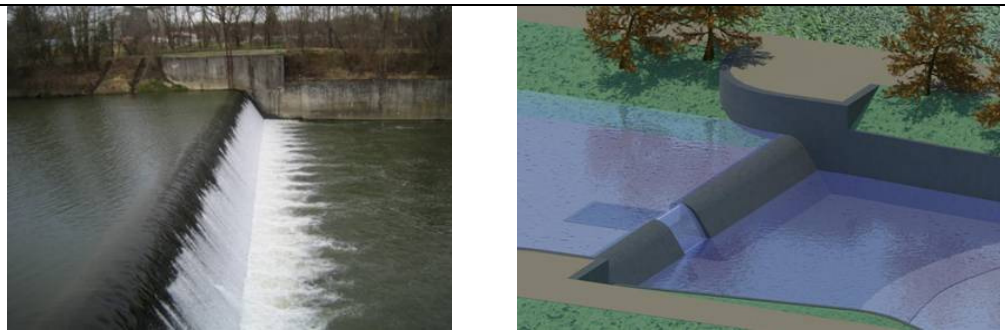


Figure 1: Existing weir (left), and the corresponding power house at this location (right) © Department of Hydraulic and Water Resources Engineering TU München

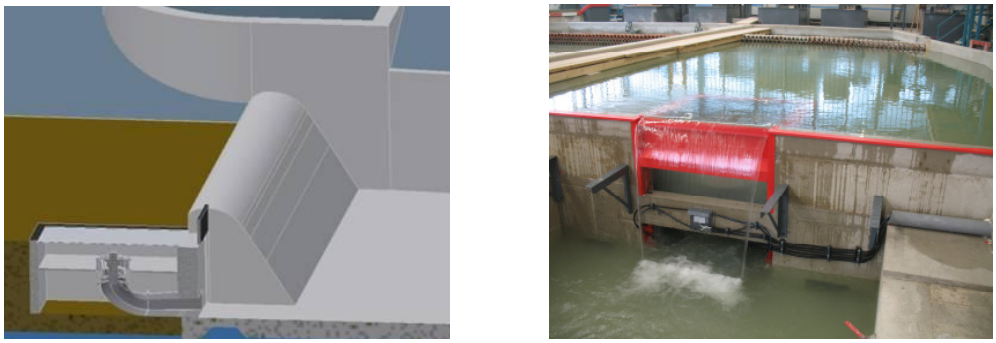


Figure 2: Section of the powerhouse (left) and physical model (right) © Department of Hydraulic and Water Resources Engineering TU München

Country:	Province / Canton:	Name of the project:
Germany		Innovative Hydroelectric Concept

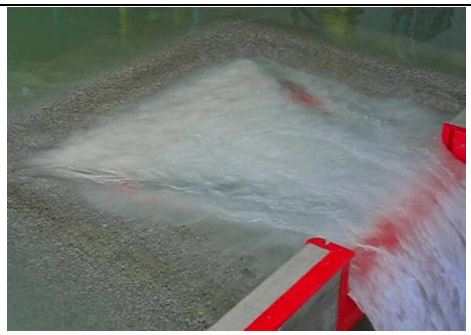


Figure 3: Position of shaft power plant within the weir © Department of Hydraulic and Water Resources Engineering TU München

Figure 4: Transversal structure with power plant © Department of Hydraulic and Water Resources Engineering TU München

Remarks:

Status: ☐ Idea ☒ Project ☐ Realized ☐ Enacted ☐ ……..

Milestones:

Links:

Country:	Province / Canton:	Name of the project:
Germany		Infrastructure Power Plant Esterberg Gde. Garmisch-Partenkirchen

Description: On behalf of the Bavarian State Ministry of Economic Affairs, Infrastructure, Transport and Technology experts of the Technical University Munich, Dep. Hydraulic Engineering and Water Management, have been examining the potential of existing water supply systems for generating electricity. Result: the water supply structure of Esterberg Springs, which has been in existence for many decades, is suitable.

Method:

Criteria:

Results: Hydropower plant Esterberg
Construction of a new infrastructure hydropower plant for using the discharge of drinking water springs.

Data:

- former drinking water supply system (3,6 km pressure pipeline DN 400 newly run)
- head max. 502 m (highest in Bavaria)
- twin-jet Pelton turbine with 44 -154 l/s
- capacity 636 kW, electrical work 3,1 GWh p.a.
- Costs about 1,7 Mio. €
- built in 2008
- very good acoustic insulation of the power plant
- in case of power failure isolated operation possible
- inconspicuous integration within townscape

Figures:

Fig. 1/2: Power house

© Bavarian Environment Agency © Gemeindewerke Garmisch-Partenkirchen

Country:	Province / Canton:	Name of the project:
Germany		Infrastructure Power Plant Esterberg Gde. Garmisch-Partenkirchen

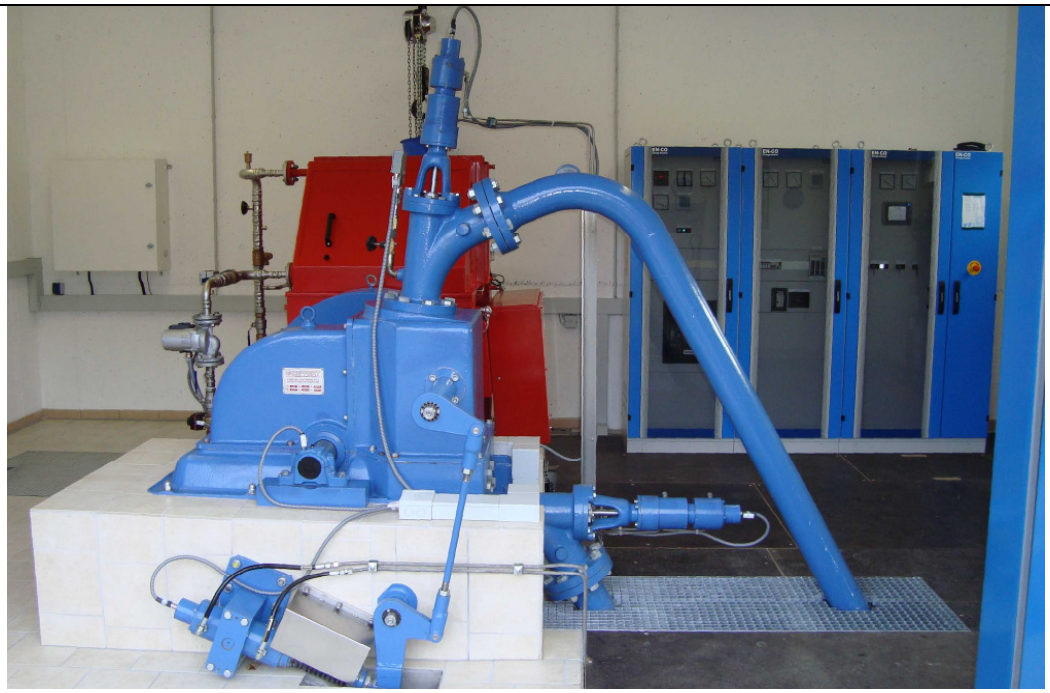


Fig. 3: Pelton turbine © Gemeindewerke Garmisch-Partenkirchen

Fig. 4: Interior panorama (Hydroelectric generating set with Pelton turbine, synchronous alternator and electrical equipment) © Gemeindewerke Garmisch-Partenkirchen

Remarks:

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

Links:

Country:	Province / Canton:	Name of the project:
		ILUP-Project: Hydropower Plant Vils, Municipal utilities of Vilshofen

Description:	ILUP (Integrated Land Use Planning and River Basin management) is a project initiative within the loan programme INTERREG III B of the European Union. Austria, Czech Republic, Hungary and Bavaria want to compile transferable results for a European-wide river basin management. The Free State of Bavaria has selected the two rivers Vils & Rott belonging to the catchment area of the Danube as planning areas of the ILUP. One component is an investigation for sufficient residual water delivery and re-establishment of river continuity as criteria in order to achieve „the good status of water bodies " after European Water Framework Directive (WFD). In the underflow of the river Vils these specifications are already implemented on a length of approx. 10 km. Municipal utilities of Vilshofen also made a substantial contribution to modernisation of their Hydropower Plant Vils .
Method:	In many places fish migration is obstructed by technical structures, as for instance hydroelectric power plants. This is a serious problem in the conflict between river ecology and renewable energies. The evaluation of technical, hydrologic and economic data helps to provide suitable technical and economic proposals to re-establish river continuity. In the project area there are 147 transversal structures within the river Vils, 102 of these are a serious obstacle to fish migration. At the river Rott there are 114 transversal structures, 75 of those are classified as being problematic. On the Vils 35 of them are hydroelectric power plants, on the Rott 26. For each individual hydroelectric power plant and transversal structure applicable solutions have been examined on the basis of an evaluation pattern. For the most favoured option a draft plan has been compiled.
Criteria:	For hydroelectric power plants the energy and financial consequences of a residual water delivery were evaluated as well as the effects of an increased feed-in tariff after the renewable energy Act (EEG). Thus the cost effectiveness has been examined from the plant operator's point of view.
Results: (Example)	In coordination with the specialised authorities for fishery, nature protection and water management the ecological condition of the Vils within the range of the HPP Vils HPP (municipal utilities of Vilshofen) was substantially improved. Now 1,300 litres per second of residual water are delivered into the previously dry river-bed between the existing weir system and the inlet of the tailwater channel. A river stretch of approx. 210 m has been revitalised and ecologically enhanced. The discharge is provided by a residual water turbine and by a fish ladder, which at the same time provides continuity for aquatic organism migrations. The 85 m long fish ladder is designed for a discharge of 300 litres per second, so that existing fish and water organisms can reach the headwater. With the help of 27 small basins they can overcome the difference in height of 4 meters in order to reach the traditional spawning grounds upstream. The new residual water turbine was implemented as a reversed water auger and is considered to be very fish friendly, causing no harm to passing fish. The plant (electrical output 26.5 KW, discharge of 1.000 litres per second) is operated all year. On the one hand it guarantees the ecologically necessary minimum water discharge in the old river bed and on the other produces renewable energy from hydro power. The new hydropower snail produces additional renewable, CO2-free electricity of more than 200,000 kWh per year. Together with the existing production plant, municipal utilities of Vilshofen calculate the generation of 2.2 million kWhof electricity per year from renewable hydropower of at this location. This quantity of electricity is sufficient to supply about 630 households with renewable energy. The described measures were supplemented with a fish-suited transformation of the screening unit. In the future small organisms sticking to the floating debris remain in the water and can thus survive. Moreover the flat iron bars were provided with welded on round steel bars, in order to minimize the danger of fish injury. The ecological improvements by providing residual water discharge and re-establishing river continuity fulfil the condition for an increased feed-in tariff after the EEG. The transacted investments will thus amortise in the medium term. The modernisation of the HPP Vils is a very good example of how ecological and economic interests can be brought together.

Country:	Province / Canton:	Name of the project:
		ILUP-Project: Hydropower Plant Vils, Municipal utilities of Vilshofen

Figures:

Fig. 1: Fish ladder © State Office for Water Management Deggendorf

Fig. 2 Reversed water auger © State Office for Water Management Deggendorf

Remarks:

Status:	☐ Idea	☒ Project	☒ Realized	☐ Enacted	☐ .....
Milestones:					

Links:

Country:	**Province / Canton:**	**Name of the project:**
Germany	Bavaria / Oberallgäu	Extension of a diversion plant in Oberstdorf

Description:	EVO GmbH requested permission for the extension of an existing hydroelectric power plant at the river Faltenbach. Both the length of the diverted river stretch and the diverted discharge should be extended. The max. diverted discharge of the existing power plant was intended to be increased from 100 l/s up to 1.0 m^3/s. MQ of the Faltenbach is about 345 l/s, MNQ 30 l/s, HQ_1 approx. 10 m^3/s.
Method:	For the determination of the ecologically necessary minimum discharge in the diverted river stretch of Faltenbach (a trained torrent), a privately owned expert office for river ecology accomplished a limnological investigation from July 2005 to April 2006. The emphasis of the investigation was mainly upon the collection of hydraulic-morphologic parameters at different discharges and the stocktaking of the aquatic river-bed fauna (macro zoo benthos).
Criteria:	The extension of the hydroelectric power plant has to consider the abiotic boundary conditions to an extent widely compatible for the occurring species of the macro zoo benthos in order to ensure the good to very good ecological status after EU-WFD (AQEM-method). This can only be the case by providing a minimum discharge appropriate both in amount and dynamics.
Results:	The limnological expert report resulted in a dynamic minimum discharge of 40 l/s in the winter half year (mid of Nov. to mid of March) and of 100 l/s plus an additional 20% of the overall supply in the Faltenbach in the summer half year. The delivery of the fixed contingent is attained by appropriate openings in the Tyrolean weir, the dynamic 20% by appropriate cover of the grid bar surface. After evaluation of the survey by the official expert (= State Office for Water Management Kempten) and consensus on the proposed arrangement of minimum discharge, the district administration authority completed planning approval despite former civil protest against this project. This year construction of the new power plant will take place.

Country:	Province / Canton:	Name of the project:
Germany	Bavaria / Oberallgäu	Extension of a diversion plant in Oberstdorf

Figures:

For investigation the torrent stretch was divided into 14 characteristic sections.

Examples:

Fig.2 Section 1

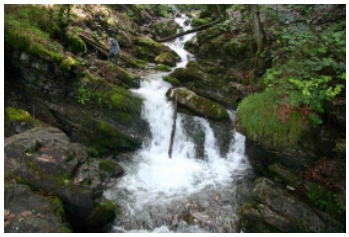


Fig.3 Section 5

Fig.4 Section 6

Fig.5 Section 8

Fig.6 Section 14

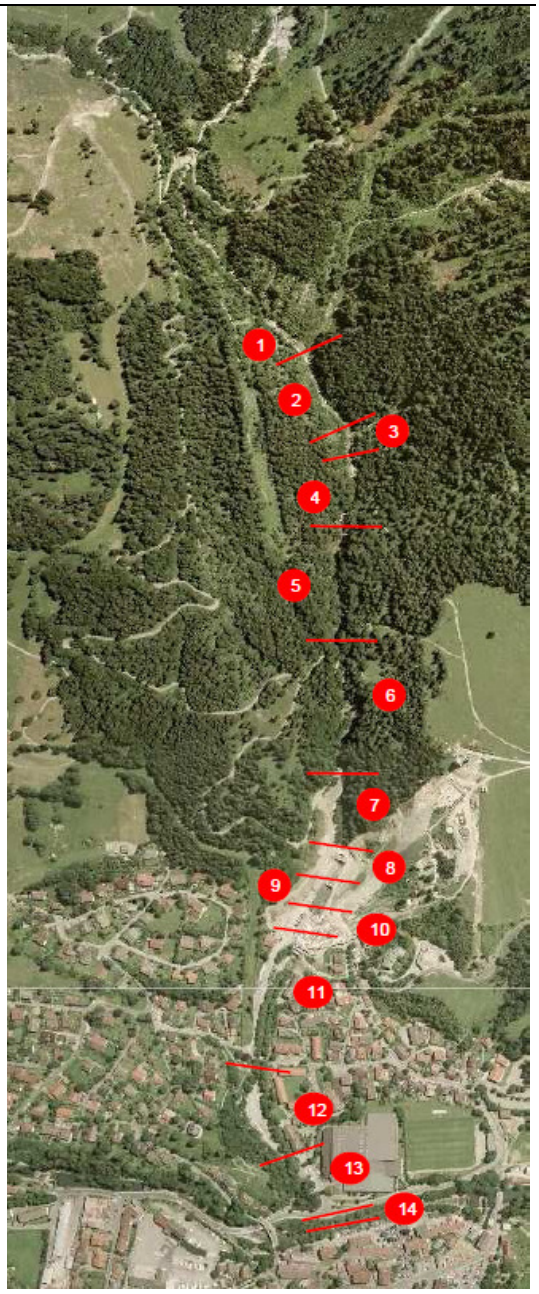


Fig.1 Torrent stretch

Foto documentation: section 1 with different discharge

Fig.7 20 l/s

Fig.8 40 l/s

Fig.9 100 l/s

Fig.10 250 l/s

Country:	Province / Canton:	Name of the project:
Germany	Bavaria / Oberallgäu	Extension of a diversion plant in Oberstdorf

Fig.11 400 l/s

Parameter	Verbaute Staffelstrecke		Unverbaute Fließstrecke	
	Winter	Sommer	Winter	Sommer
Benetzte Breite	40 l/s	100 l/s	40 l/s	40 l/s
Mittlere Wassertiefen	40 l/s	k.A.	40 l/s	150 l/s
Fließgeschwindigkeiten				
bodennahe Fließgeschwindigkeiten	40 l/s	150 l/s	20 l/s	150 l/s
Häufigkeitsverteilung Strömungsklassen (bodennah)	40 l/s	zwischen 100 und 250 l/s	40 l/s	150 l/s
Mittlere Fließgeschwindigkeiten	40 l/s	250 l/s	40 l/s	100 – 150 l/s
Grenzwert 30 cm/sec (LAWA)	-	(250 l/s)	-	150 l/s
Verweildauer	40 l/s	100 l/s	40 l/s	100 l/s
„Optik" - Landschaftsbild	40-100 l/s	150 l/s	40 l/s	150 l/s
Sonstiges:				
Wasserfall:	40 l/s (Winter) / 150 l/s (Sommer)			
Ökomorphologie:	hohe Ansprüche wegen des streckenweise hohen Natürlichkeitsgrades			
Aquatische Bodenfauna:	hohe Ansprüche wegen zahlreichem Vorkommen von Rote-Liste-Arten und Dominanz rheophiler/rheobionter Taxa			
Versickerungsstrecke:	ab 40 l/s zumindest durchgehend benetzt			

Fig.12 Overview of minimum discharge to ensure parameters most similar to natural conditions

Remarks: Also nature protection aspects could be met by the limnological investigation, e.g. to protect 10 Bavarian red list species. Fish fauna could be ignored due to many (natural) drop offs.

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

Limnological investigation

Links: www.limnologie.at
http://www.wwa-ke.bayern.de/

3. ITALY

Country:	Province / Canton:	Name of the project:
Italy	Province of Sondrio	Territorial Plan for the Provincial Coordination; water balance plan of the Province of Sondrio

Description:

The territory of the Province of Sondrio is characterised by a very high water exploitation rate due to the presence of a large number of hydropower plants. The risk of deteriorating water quality and the protests by the population over a long time period prompted local authorities to implement a new legislative instrument to better regulate authorisations for the water use.

Because the Plan represents the first Italian example of application of the 2000/60/EC principles at local scale, an ad-hoc working group was established with all the authorities involved in the concessions grant process (Ministry for the Environment, Po river basin Authority, Lombardia Region, Province of Sondrio and APAT). All the authorities signed the Agreement "for the sustainability of the uses of water in the Province of Sondrio through the integration of the planning instruments" and participated in the implementation of the necessary steps.

The Agreement envisaged integration of the "Territorial Plan for the Provincial Coordination" with an "at small scale" water balance, the individuation of a set of indicators suitable for the implementation of the WFD principles and the submission of this new plan to Strategic Environmental Evaluation, as expected from the national legislation.

The new plan, adopted on July 2009 and approved the 25 January 2010, with the associated set of rules will constitute the instrument used by the water authorities for the grant of new concessions.

Method:

The authorisation of new applications is subject to an ad-hoc set of rules that takes into account both hydrological, environmental and morphological aspects, the used indicators are carried out using the WFD clues.

The adopted method is based on a multi-criteria evaluation intended to exclude or limit new concessions in those parts of the basin where there is a significant detrimental risk to the water quality status or failure to reach the good ecological status required under the 2000/60/EC directive. The aggregation approach used for the implementation of the multi-criteria procedure was the overlapping of five different maps, where any of these maps represented the risk of failing to reach the good ecological status due to a single critical aspect. In those part of the basin where at least one of the critical aspects show a high risk rate the water concessions were refused, while in the areas showing a medium or a low risk rate the water concessions were allowed, but only if there would be no deterioration to the ecological status of the river stretch.

The method provides a simple evaluation scheme that consists of a "risk map" whereby different colour represent the risk of river streches not reaching the good ecological status by 2015.

Criteria:

The five indexes used to identify the different river stretch criticalities are listed below:

a) An index representing the impact of the cumulated withdrawals with respect to the mean annual natural discharge;

b) An index representing the impact of the cumulated withdrawals with respect to the mean annual low flow considering the human activities impact;

c) An index representing the interruption risk in the river regime due to the presence of discharges from reservoirs;

d) An index representing the LIM pollution risk in the "mean annual low flows considering the human activities impact" scenario;

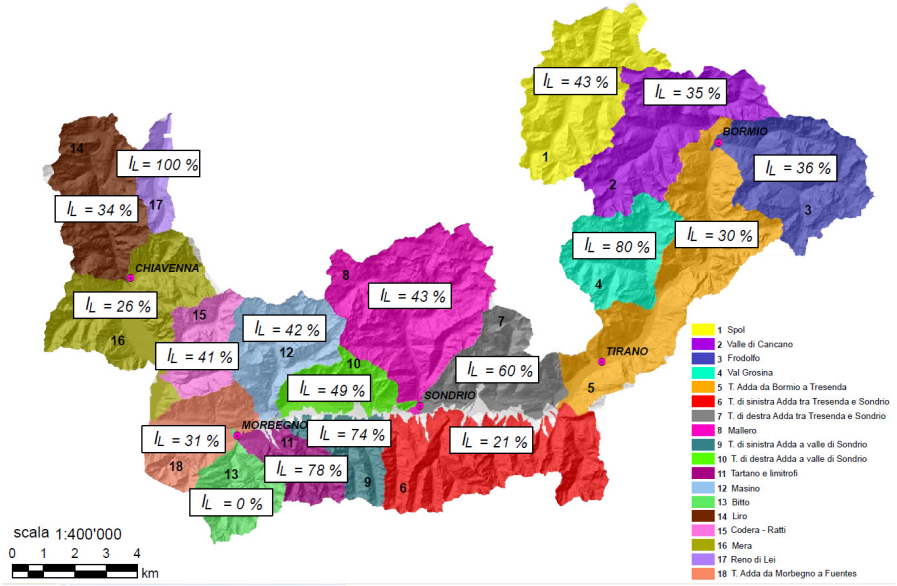
e) The FFI (Fluvial Functioning Index), for the connectivity and the ecological functionality.

Results:

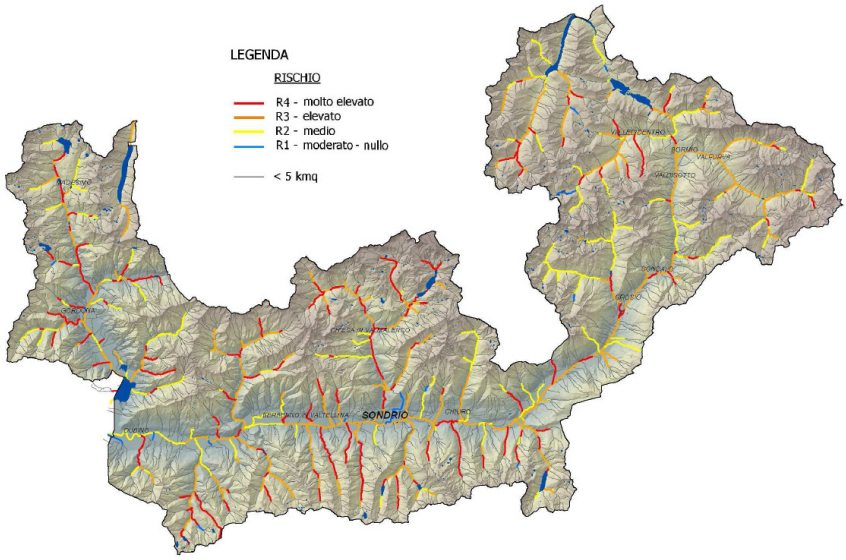
Results from this method have been integrated into the Territorial Plan for Provincial Coordination and have also updated the Water Quality Protection Plans at regional level and the Transitional plan for the Hydrogeological Settlement (PAI) with regard to granting water use concessions..

Country:	Province / Canton:	Name of the project:
Italy	Province of Sondrio	Territorial Plan for the Provincial Coordination; water balance plan of the Province of Sondrio

Figures:



Map indicating for each sector the percentage of river stretches (length) free from hydroelectric water withdrawals. © Province of Sondrio



"Risk Map" where the different river stretches colour represent the risk of not reaching the good ecological status by 2015 (river basins < 5 km^2 excluded). © Province of Sondrio

Remarks:

Status: ☐ Idea ☐ Project ☐ Realized ☒ Enacted ☐ ……..

Milestones:
Spring 2006: Establishment of Working Group;
Spring 2006-spring 2008: Development of the methodology;
Summer 2007-end of 2008: Water uses analysis and Strategic Environmental Evaluation;
July 2009: Adoption of the Plan
January 2010: Approval of the Plan by the Province of Sondrio
Spring 2010: Adoption of the Plan with the function of ordinary planning instrument

Links: http://www.provincia.so.it/territorio/piano%20territoriale/default.asp

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH_2OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy

Description: The CH_2OICE project aims at developing a technically and economically feasible certification procedure for hydro power generation facilities of a high environmental standard in line with the requirements of the Water Framework Directive. It is to be implemented in labeled electricity products and integrated, as much as possible, with existing EU tools such as EMAS, EIA and SEA. The project is co-founded by Intelligent Energy Europe Working Program 2007.

Method: After a preliminary review of national HP laws of the countries involved in Ch2oice project (IT, ES, FR, SK, SL) a draft methodology for certification has been defined, based upon the literature review and on the results of dedicated workshops. During the year 2010 this methodology will be tested on several HPPs in Italy and in Slovenia in order to finalise the operational methodology.

The testing phase, started in January 2010, may bring new insights and so at the end of this period (around October 2010) there will be a new discussion and debate on contents of the methodology developed, based upon the results of the experimentation. The certification methodology will primarily refer to existing plants. However, to allow a wider use of the results of the project, the issue of new hydropower plants licensing is being considered. Following the same logical approach used for the certification of existing plants, a set of guidelines was produced to help decision makers during planning and licensing procedures and HP developers in their EIA and SEA studies.

Criteria: The developed methodology provides two kinds of procedures: a standard and a simplified procedure. For some types of hydropower plants operating in totally artificial networks and not entailing impacts on water-related ecosystems, for examples HPPs in sewage and aqueduct networks, it is possible to adopt a simplified procedure in order to facilitate certification. All the other types of plants have to follow the standard procedure. The certification procedure is strictly in line with the requirements of the WFD and integrated as far as possible with existing EU tools such as EMAS.

Results: Expected results:

- Reports on main technical tools and regulatory frameworks related to hydropower certification
- General methodological approach for WFD-coherent certification agreed by project partners
- Guidelines for Decision-makers and hydropower generation companies for siting, construction and management of new hydropower plants of higher environmental standard
- Analysis document for Spain including a roadmap for the development of volunteer certification of hydro power generation facilities of high environmental standard in Spain
- Proposals and feasibility analysis on the integration of the label scheme in existing procedures, with focus on Italy and France.
- Proposals for rules and criteria for an independent body issuing the hydro power label

Figures:

Remarks:

Status: ☐ Idea ☒ Project ☐ Realized ☐ Enacted ☐ ……..

Milestones: Begin: September 2008

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH_2OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy
	January 2010: starting of the testing phase	
Links:	www.ch2oice.eu	

Country:	Province / Canton:	Name of the project:
Italy	Sondrio	The refurbishment of the Tartano valley electricity production system through the use of a small hydropower plant (increase of productivity and best/optimal environment outcomes)

Description:

The Tartano river basin was characterised by the presence of a complex electricity production system founded by two large hydropower plants: the Talamona power plant, connected to the Campo Tartano dam, and the Monastero power plant, fed by the Ardenno reservoir. The two dams were built by two different companies in two different periods (Campo Tartano dam was built in the 1920s, while the Ardenno reservoir only in the 1960s). The result was a less than optimal energy production scheme. The scheme was also characterised by some environmental deficiencies, such as the presence of fish migration barriers, and by some difficulties in guaranteeing an adequate ecological flow along the river stretch.

Therefore the key aims of the project, using a comprehensive perspective on all the river basin aspects, were:

- to enhance the production scheme in order to obtain an economically profitable investment without increasing the amount of the water exploited,
- to guarantee the presence of the ecological flow and study the bed load transport mechanism in the river stretch (Interreg project),
- to solve the fish migration obstruction in the Ardenno reservoir (Interreg project).

Most of the production increase has been obtained by better exploitation of the fall between the Campo Tartano dam and the Ardenno reservoir (refurbishment of the existing Talamona 1 plant and building a new large hydropower plant, Talamona 2) (see figure1). A further increase was obtained by a new small hydropower plant. The small plant, although providing only a limited production increase, performs an essential ecological role, representing the only point were ecological flow is returned to the river (see figure 2).

Two specific Interreg Projects were launched on fish migration and bed load transport.

Method:

Utilisation of an unexploited fall.

Agreements with the institutions involved in the water concessions release process, participation in an internationally financed research project with research institutes and other institutions to deepen the environmental aspects.

Application of a participative process with the institutions to gain a comprehensive perspective on the discharge of the ecological flow (with the agreement of the Lombardia Region a cost/benefit analysis regarding the environmental aspects on the whole water path has been performed instead of applying the existing laws on the single concession).

Criteria:

Production increase:

Before the refurbishment:		**After the refurbishment:**	
Talamona 1		Talamona 1 (modified),	
installed capacity	10.5 Mw	installed capacity	18.5 Mw
height of fall	498 m	height of fall	577 m
		Talamona 2 (new)	
		installed capacity	2.9 Mw
		height of fall	106 m
		Talamona ecological flow station (new)	
		installed capacity	0.6 Mw
		height of fall	5.5 m
Total:		Total:	

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH_2OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy

installed capacity	10.5 Mw	installed capacity	22.0 Mw
height of fall	498 m	height of fall	688.5 m

Ecological flow

The analysis referred to the Ardenno dam section of the river Adda (just after the discharge of the Valmasino and Valtartano plant schemes and the starting point of the pipeline that feeds the Monastero powerplant) that represents the releasing point for the ecological flow in the river Adda. The choice was made in order to enhance the environment of the main corridor of the Adda river and the lateral Masino valley (kept as at high natural value) (see the Ardenno junction plan).

Bed load transport

In respect of the Campo Tartano dam an experiment on the water splays management was agreed between the Lombardia Region, the Sondrio Province and hydropower companies (Enel , A2A , Edipower). It aimed to define the operational parameters of the water releases and the consequent effect on the bed load movement and transport (management project, Ministerial decree 30/06/04).

The experiments and monitoring lasted two years and included a large area that comprises the Tartano valley and a wide area of Valtellina above the city of Sondrio. Parameters and reference conditions will be used to write a management plan for the dams involved.

The first results have been presented to the institutions and to the population with a conference and an ad-hoc publication by the Sondrio Province.

Currently, some of these activities are in progress within an Interreg Project (Parteners: Lombardia Region, Sondrio Province, Grigioni Canton, Enel , A2A , Edipower).

Removal of the fish migration barriers

The project also comprised a fish migration ladder. The Province of Sondrio specified the type and the features of the pass while the producer decided its location in connection with a small hydropower plant that releases the ecological flow. These and other actions regarding the specific criticalities in the Ardenno suburbs are in progress within an Interreg Project.

Results: Nearly 20 Gwh/year of production increasing.
Solving of the fish migration and ecological flow problems.

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH_2OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy

Figures:

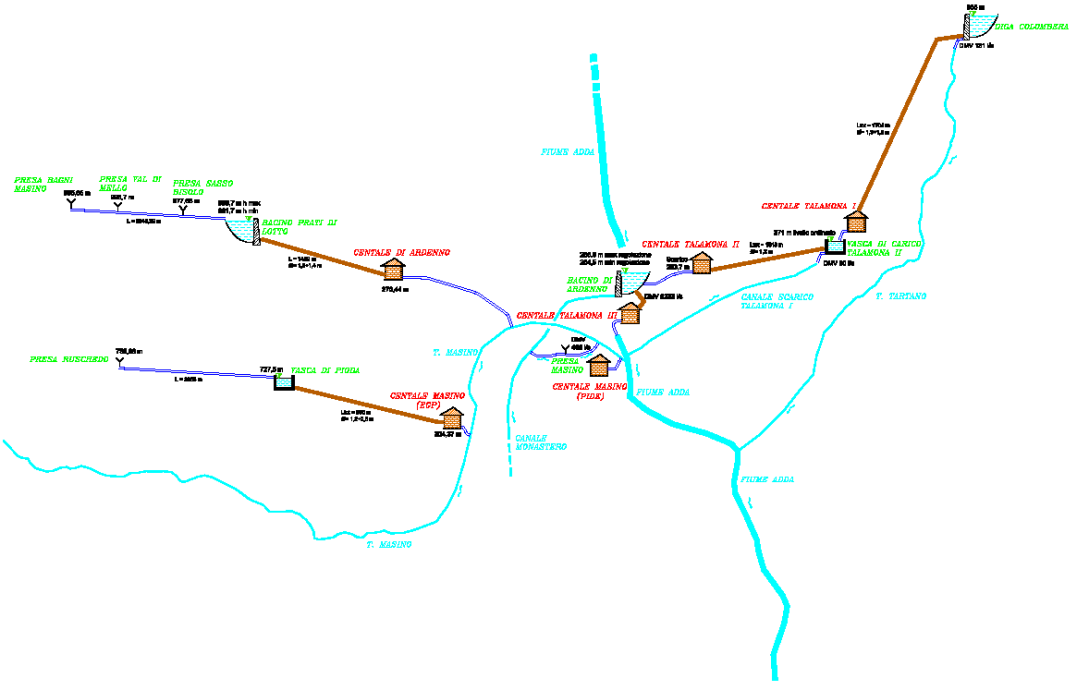


Figure 1, power plants scheme © Enel S.p.A.

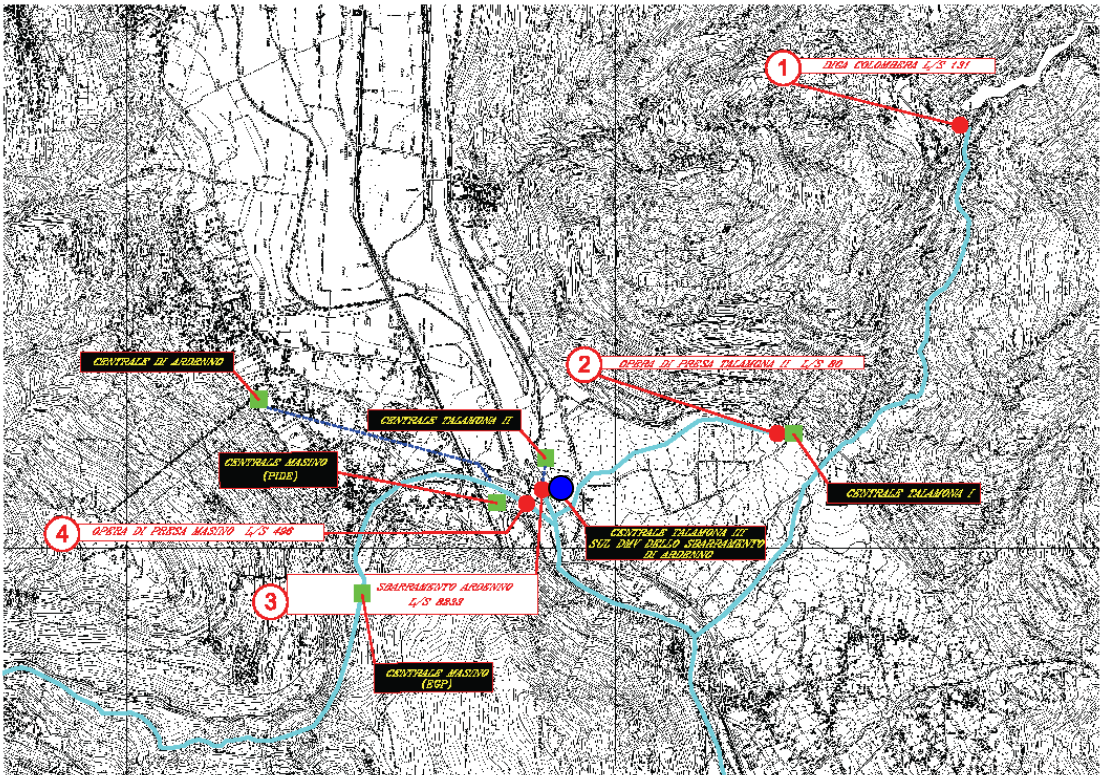


Figure 2, Ardenno junction plan (ecological flow release point in blue) © Enel S.p.A.

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH_2OICE - Certification for HydrO: Improving Clean Energy
Slovenia	Different places	

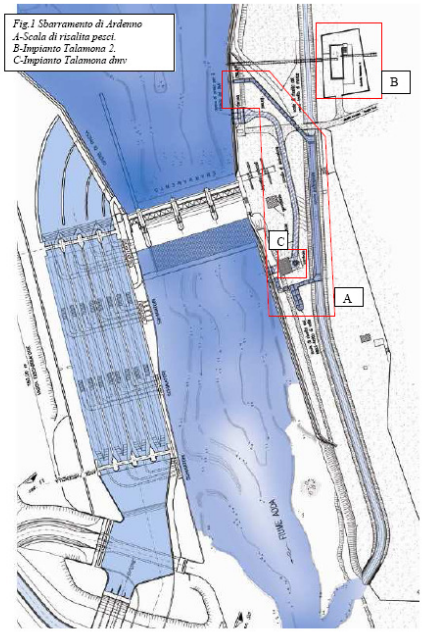


Figure 3, fish ladder scheme © Enel S.p.A.

Remarks:

Status: ☐ Idea ☒ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

Links:

4. PRINCIPALITY OF LIECHTENSTEIN

Country:	**Province / Canton:**	**Name of the project:**
Liechtenstein		Small hydropower plants on drinking water supply systems

Description: In 2009 in Liechtenstein there were seven small hydropower plants on drinking water supply systems, producing annually a total amount of 2.5 Mio KWh of renewable energy. A further plant of this type was being realised in 2010.

Method:

Criteria:

Results:

Figures:

Trinkwasser-Kraftwerke in Liechtenstein produzieren naturemade Ökostrom

Bezeichnung, Ort	Baujahr	Durchfluss max in l/s	Bruttohöhe m	Jahres-Stromproduktion Kilowattstunden
Schlosswald, Vaduz	1994	70	808	2'000'000
Steia, Maurerberg	2000	30	234	170'000
Stieg, Vaduz	2007	55	94	110'000
Maree, Vaduz	2007	42	94	100'000
Wissa Stä, Planken	2008	10	246	65'000
Wisseler Quellen, Schaan	2009	8	199	52'000
Rudabach-Quellen, Schaan	2009	4	82	12'000
Efiplanken Quellen, Schaan	geplant 2010	16	323	170'000
TOTAL				**2'679'000**

Mit dem produzierten Strom können zirka 550 Einfamilienhäuser mit Strom versorgt werden.
(durchschnittlicher Stromverbrauch eines Einfamilienhauses 5'000 kWh/Jahr)

Remarks:

Status: ☐ Idea ☒ Project ☒ Realized ☐ Enacted ☐ ……..

Milestones:

Links: Example: The hydropower plant on the drinking water supply system of Schlosswald, Vaduz/FL
http://www.lkw.li/CFDOCS/cmsout/admin/index.cfm?GroupID=159&MandID=1&meID=152&

5. SWITZERLAND

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of Fribourg	Evaluation and management of the hydroelectric potential of the Canton of Fribourg

Description:

With the introduction of the Cost-Covering Remuneration for Feed-in to the Electricity Grid (CRF) an increase of the water concession applications was observed. The Canton of Fribourg received 10 applications for small hydropower plants during the last quarter of 2008. In order to cope with both, energy and environmental requirements, natural water bodies with high ecological value have to be identified and protected, and the hydroelectric potential of the remaining water bodies has to be used in the most efficient way. For this, the standard method for the evaluation of the concession applications is no longer sufficient: a global management of the water resources is needed.

Method:

The assessment and authorisation of applications is suspended and an evaluation method based on exclusion criteria and on a multi-criteria evaluation is under development. This method will allow for evaluation of applications by a four-step approach:

1. **Evaluation of the water bodies**: Identification of exclusion areas (exclusion criteria) and evaluation of the hydroelectric potential of the remaining water bodies
2. **Preliminary project analysis (feasibility)**: Multi-criteria analysis of the projects (evaluation criteria) and classification into favourable, favourable under conditions, and not favourable.
3. **Concession project**: Evaluation of the preliminary analysis and technical reports of the projects. Definition and designation of specific conditions.
4. **Decision about the application**

Criteria:

Exclusion and evaluation criteria are defined for a range of themes. Exclusion criteria allow the identification of river stretches where hydroelectric utilisation will be excluded. Evaluation criteria are used for the comparison of different projects. The criteria are listed below:

Theme	Exclusion criteria	Evaluation criteria
Hydrology	River stretches with residual flow	Hydrological regime; Respect of residual flow; Influence on flood protection
Water quality	Drinking water protection (groundwater protection zones S1,S2)	Dilution of effluents of wastewater treatment plants
Morphology	Revitalised river stretches; river stretches to be revitalised.	Influence on bed-load transport; Eco-morphology of the river stretch; Respect of river space; Influence on river management
Biotopes	National biotopes; Seriously threatened animal or plant populations	Natural reserves; Cantonal or local biotopes; threatened animal or plant populations
Fish	Nationally inventoried spawning areas	Free migration; threatened species; Fish yields; Fish biodiversity
Landscape	National landscapes, sites and monuments; Rarity of the site	Natural parks
Hydroelectric potential	Energy efficiency: Recuperation of the energy used for the construction of the installation within < 5 years; Efficiency > 75%; Specific power < 0.1 kW/m	Efficient site use

Results:

Results from this method will be integrated into the following instruments:

- integrated in the cantonal master plan (binding for the administration)
- Maps indicating river stretches excluded from hydropower use and the hydroelectric potential for other stretches
- Classification of the projects into favourable, favourable under conditions (like “naturmade star”) and not favourable.

Figures:

Country:	**Province / Canton:**	**Name of the project:**
Switzerland	Canton of Fribourg	Evaluation and management of the hydroelectric potential of the Canton of Fribourg

Remarks:

Status:	☐ Idea	☒ Project	☐ Realized	☐ Enacted	☐ ……..
Milestones:	Begin 2010: Development of the methodology Spring 2010: Validation of the methodology with the 10 applications				
Links:	http://admin.fr.ch/spc/fr/pub/lce.htm				

Country:	Province / Canton:	Name of the project:
Switzerland	--	Water-Agenda 21: Working group “Dialogue Hydropower”

Description:

Water-Agenda 21 (www.wa21.ch) is a national platform in the form of an association, bringing together the most important actors of the water resources management sector. The goal of this network is to support the actors in providing answers to the major challenges.

One of the challenges is the development of hydropower use as a renewable, almost emission-free source of energy, frequently conflicting with the interests of water protection. In order to find possible solutions to this conflict of interests, Water-Agenda 21 founded the working group “Dialogue Hydropower”, bringing together stakeholders from both, the energy and the environmental side: national and cantonal energy and environment administrations, hydropower representatives of the Swiss Water Management Association and environmental NGO’s (pro Natura and WWF).

The working group aims at developing, at a national level, ideas and concepts of how to better deal with hydropower related conflicts between the use of renewable energy and the protection of the aquatic ecosystems and landscapes.

The strategic goals of the working group “dialogue hydropower” are:

- Improve the information exchange between the stakeholders.
- Establish a solution-oriented dialogue between the stakeholders and develop a common problem understanding
- Develop, initiate and work on approaches for solutions.

To that end, the conflicting domains were identified and the general conditions allowing a “dialogue on hydropower” were established. These are:

- Need of continuity and a certain binding character of the work
- Solution-oriented approach: fair and transparent conflict resolution
- Focus on macro-economic considerations, not on business/commercial aspects
- Establish and supervise the “dialogue hydropower” professionally.

Results:

The working group “dialogue hydropower” of the Water-Agenda 21 worked out the evaluation method: “classification of river stretches – protection versus use, as basis for spatial prioritisation of hydropower”, where ecological and economic criteria are considered by an integral approach (see link below). This project aims at evaluating conflicts of water use for hydropower by means of broadly supported solutions. Furthermore the method should support the cantonal authorities for the weighing procedure of use and protection interests.

Figures:

Remarks:

Alongside the project of classification of river stretches, the working group “dialogue hydropower” focused its activities in the year 2009 on hydro-peaking.

Status: ☐ Idea ☐ Project ☐ Realized ☐ Enacted ☒ Active

Milestones:

End 2008	Foundation of the working group “dialogue hydropower”
09.03.2009	Expert conference „Hydro peaking - conflicts between power industry and ecology”
27.04.2009	Seminar „How to deal with applications for hydropower – weighing of use and protection interests”
Oct. 2009	Evaluation method for the classification of river stretches – Final report
09.11.2009	Expert conference „cost-covering feed-in remuneration and new hydropower installations – Ideas for the spatial coordination”
2010	Developing a position paper on “Hydropower use in Switzerland in 2030”

Links:

Working group „dialogue hydropower“: http://www.wa21.ch/index.php?page=213
Classification of river stretches:
http://www.wa21.ch/index.php?section=media9&path=/media/archive9/D_Wasserkraftnutzung/

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of Valais	Small Hydropower plant– Drinking water supply of Troistorrents

Description: This small hydropower plant is located on the territory of the municipality of Troistorrents, in the Canton of Valais, Switzerland. The installation is set on the drinking water network of Troistorrents and works on the high difference in levels between the catchment chamber and the surge tank, as a pressure regulator device. The installation includes also an energy destruction by-pass, guaranteeing the water supply whenever the turbine stops. This may be the case when the flow rate is insufficient, or during the revision of the power group. The equipment has been manufactured by a SME of 35 employees, located at 55 kilometers from the site. Electricity from this completely automatic power plant is delivered into the local distribution grid. Regarding the drinking water quality, rigorous specifications were met so as to avoid any negative impact.

Technical data:

Pelton turbine with one nozzle; Vertical axis

Net head:	242.3 m
Maximal discharge:	35 l/s
Installed capacity:	75 kW
Output:	230'000 kWh/year

Environmental Measures:

- The plant is set on a drinking water network, which implies that the infrastructure was already built and that the power plant operation does not imply more environmental impact (no need of fish ladders) than a usual drinking water network.
- As the plant is located in a semi agricultural area, a special effort has been made to integrate the power plant to the landscape. Looking from outside, nothing appears to be different from a traditional chalet.
- Because of nearby housing, a low ambient noise was required. The generator can be heard only when the plant door is open.
- The power plant is set in the charge chamber that provides the pressure in the water supply network and extracts energy that was previously wasted through a pressure reducer.
- Energy is generated with almost no environmental impact which may be expressed in a CO_2 emissions reduction of 110 t per year.

Figures:

The small hydropower plant of Troistorrents. © MHyLab

75 kW power group. © MHyLab

Remarks: Owner, contractor and operator: Municipality of Troistorrents, Valais, Switzerland
Manufacturer: ELSA SA, Sion, Switzerland : mechanical design; MHyLab, Switzerland : hydraulic design

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ….

Milestones: Year of commissioning: 1998-1999

Sources: © MHyLab: http://www.mhylab.ch/pages/pdf/despro6_Troistorrents.pdf;
© ESHA: http://www.esha.be/fileadmin/esha_files/documents/publications/publications/Brochure_EN.pdf

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of St. Gallen	Small hydropower station Buchholz

Description:

In the canton of St. Gallen, at the border between the two municipalities Gossau and Flawil the river Glatt is interrupted by a 15 meter high, over 100 year-old dam. During more than 90 years of inactivity the initial basin of 250'000 m3 has been reduced by siltation, forming a wetland of national ecological interest.

With time, the dam became more and more unstable and something had to be done to ensure the safety of the downstream municipalities. Instead of partly demolishing the dam, it was decided to rehabilitate it and to integrate a small hydropower installation. The dam is reinforced and the powerhouse and a fish ladder are directly integrated in the dam.

Technical data:

Two propeller turbines with 5 rotors

Effective head:	14.5 m
Nominal discharge:	1.35 m³/s
Installed capacity:	140 kW
Output:	680'000 kWh/year
Duration of concession:	60 years

Environmental Measures:

- A fish ladder (water gate system) is installed to ensure fish migration. Because there is no space available for a fish ladder around the dam, an integrated technology, which has never been applied in Switzerland, was used and now serves as a showpiece. For the first time in 150 years fish migration is again possible in this part of the Glatt river.
- If the dam had been destroyed, the wetland upstream would have been lost forever. The rehabilitation of the dam allowed conservation of this wetland of national interest.
- Power production is located inside the dam; therefore no additional structures had to be built (e.g. powerhouse) and no downstream stretch of residual flow is created.

Results

The project is environmentally friendly and was well accepted by the municipalities and the environmental protection associations. Because of those reasons this project received special funding from the Swiss Federal Office of Energy (SFOE).

Figures:

The entire installation © SFOE

Schema of the fish ladder with a water gate system, integrated inside the dam.
© Naturschutzverein Flawil

Remarks:

Operator:	Glattstrom Buchholz AG
Constructor:	Entegra Wasserkraft AG

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ….

Milestones:

Initial construction of dam:	1892
Year of rehabilitation:	2006

Sources:

© Entegra AG: http://www.entegra.ch/entegraweb/index.php?option=com_content&view=article&id=8&Itemid=17

© SFOE: http://www.bfe.admin.ch/php/modules/enet/streamfile.php?file=000000009164.pdf&name=000000270024.pdf

© Naturschutzverein Flawil: http://www.nvflawil.ch/projekt6-seite2.htm

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of Valais	Small hydropower plant using a wastewater network - Le Châble - Profay in Bagnes

Description: The turbine is set in a wastewater treatment plant that operates on the outlets from a ski resort (Verbier) (photo 1). The wastewaters are collected in a decantation basin equipped with a 6 mm filter, used as a loading chamber for the penstock that goes to the treatment plant (photo 2). The first turbine set in 1993 was a prototype: horizontal axis, 2 nozzles, 240 l/s, 450 m, 665 kW. But it's dimensions were for the same maximal discharge as the wastewater treatment plant. Thus, the wastewaters had to be accumulated to reach the discharges in the range of the turbine operation. Such a constraint was not optimal for the water treatment. Therefore in 2007, the turbine was replaced by a new one with dimensions for a maximal discharge of 100 l/s, avoiding any accumulation.

Technical data: The main turbine specifications are: no jet deflectors, no guiding stars for the nozzles, manholes to clean the turbine, suppression of obstacles and zones where the wastes can accumulate.

Effective head:	449 m
Nominal discharge:	0.100 m³/s
Installed capacity:	380 kW
Output:	825'000 kWh/year
Investments:	375'000 €

Results: Apart from a too high dimensioning discharge, the first turbine has been operating properly for 14 years. The maintenance made by the treatment plant team is circa 40 hours per year. An important abrasion has been observed due to the particles from runoffs.

Figures:

Photo 1: Water intake in Verbier © MHyLab

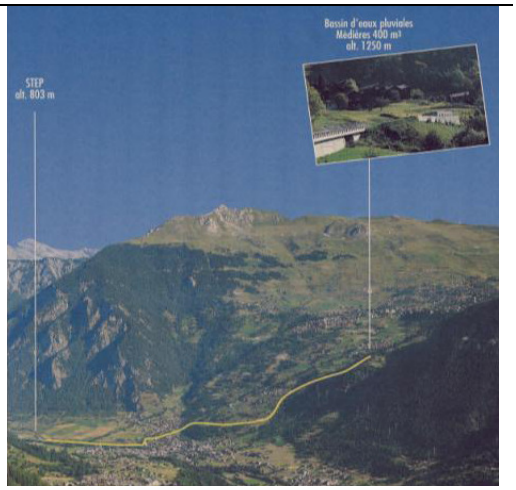


Photo2: Wastewater network, from collection to the wastewater treatment plant © MHyLab

Remarks:
Operator: Services Industriels de Bagnes
Manufacturer : Gasa SA, Switzerland : mechanical design; MHyLab, Switzerland : hydraulic design

Status: ☐ Idea ☐ Project ☒ Realized ☐ Enacted ☐ ….

Milestones:
1993 : Installation
2007 : Replacement of turbine

Sources :
© MhyLab : http://www.mhylab.ch/En/index_en.html
© Services Industriels de Bagnes: http://www.sibagnes.ch/services/eaux_egouts/production_energie.cfm

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of Berne	Strategy "Water Use" of the Canton of Berne

Description:

The Canton of Berne aims to increase hydropower production by approx. 10% (300 GWh/a) by 2035. Furthermore, water resources should be used in conformity with the requirements of sustainable development, maintaining near natural river conditions as they are important habitats and recreational spaces.

Hence, the Canton of Berne established a strategy "Water Use". The aim is to provide a decision-making aid based on a transparent and coherent weighting of utilisation and protection interests, established from a strategic, cantonal point of view.

Method:

In addition to the legal regulations for hydropower plants, the strategy "Water Use" of the Canton of Berne lays down that for a deliberate and selective granting of concessions certain requirements for prioritisation of suitable locations and prioritisation of larger plants have to be respected. Hence, the following decision making aids are provided:

- **A map representing the appropriateness of the water bodies for hydropower use:**

  As base information a "map of actual conditions" has been produced indicating for individual water bodies the hydropower potential, the ecological value as well as the importance as waters suitable to sustain natural fish populations. On this basis, a map representing the „hydropower exploitation categories" has been created. It details the appropriateness of the water bodies for hydropower exploitation according to the following classes:

  Green: Water bodies where, under observance of the legal requirements, hydropower is realisable

  Yellow: Water bodies where hydropower is realisable but additional requirements have to be met.

  Red: Water bodies where hydropower is not realisable. Interest for protection prevails.

- **Sustainability evaluation of the individual installation:**

  For hydropower installations (new plants but also already existing ones) – and apart from the aspects already mentioned - an evaluation of sustainability has to be realised in an early planning phase (preliminary study). This evaluation considers further aspects of society, economy and environment based on 22 criteria and indicators.

Along with a spatial prioritisation of suitable locations the strategy also comprises a prioritisation of larger power plants: The strategy proposes that new hydropower plants must have a minimum capacity of 300 kW, avoiding the impediment of more efficient exploitation by larger plants at suitable water body locations. Concessions for smaller hydropower plants are only given in justified cases (e.g. Alpine huts). Exempted are drinking water power plants.

The action plan of the strategy "Water Use" further defines that the optimisation of the hydro-electrical potential from existing installations is generally promoted.

Criteria:

- **Aspects specific to water bodies and corresponding criteria:**

  Theoretical hydro-electric potential, calculated for 50 m river stretches being based on hydraulic head and average monthly runoff.

  Ecological importance, being based on the following criteria: Hydrology (20%), Water quality (10%), Rarity value of the water body (50%) and morphology/structure (20%) (percentages indicate the relative weight)

Country:	Province / Canton:	Name of the project:
Switzerland	Canton of Berne	Strategy “Water Use” of the Canton of Berne

Importance as waters suitable to sustain natural fish populations, based on the following criteria: priority species (30%); species spectrum (20%); fish water (20%), importance as habitat (20%) and potential for rehabilitation (10%).

- **Installation specific aspects and corresponding criteria:**

  For the project-specific sustainability evaluation further aspects of society, economy and environment on the basis of 22 criteria and corresponding indicators are considered. Such criteria are e.g. nature and landscape, flow regime, income for public bodies, noise pollution, recreational importance, added economical value for the region….

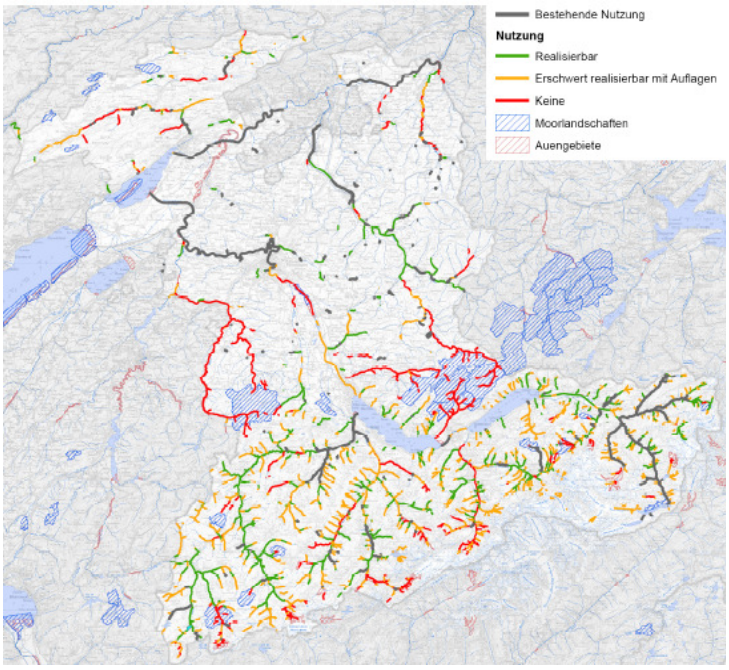
Results:

Results from this method are essentially the map of „ hydropower exploitation categories“ and a sheet for the sustainability evaluation.

According to the Water Use Strategy, the exploitation of hydroelectric power can be further increased. From the 12’600 km rivers of the canton, 10’600 km are not interesting for hydro-electric exploitation. 230 km are already exploited. Theoretically another 1’800 km would be suitable for hydropower. Of these, 570 km are classified as “green” and 770 km as “yellow”. From these river stretches an additional annual electricity production of 300 GWh might be obtainable.

Along 440 km (classified as “red”) no hydropower exploitation is possible because of prevailing conservation objectives.

Figures:



Map “hydropower exploitation categories “. © Bern - AWA

	Zielbereich	Kriterien	Indikator
UMWELT	Biodiversität	Lebensraumtypische Artenvielfalt (Gefässpflanzen)	Anzahl lebensraumtypischer Arten (Gefässpflanzen) / Grad der Beeinträchtigung durch das Vorhaben
		lebensraumtypische gefährdete-/ geschützte Arten (Gefässpflanzen)	Anzahl belegter Vorkommen lebensraumtypischer gefährdeter / geschützter Arten (Gefässpflanzen)
		Lebensraumtypische Artenvielfalt (Fische)	Prioritäre Arten und Artenvielfalt
	Natur und Landschaft	Schützenswerte Lebensräume nach NHV	Vorkommen schützenswerter Lebensräume nach NHV / Grad der Beeinträchtigung durch das Vorhaben
		Inventare	Vorkommen von Inventarobjekten / Grad der Beeinträchtigung durch das Vorhaben
		Kantonale und kommunale Naturschutzgebiete	Vorkommen von Naturschutzgebieten
		Aquatische Lebensraumqualität (Fische)	Lebensraumqualität und Aufwertungs- / Entwicklungspotenzial
	Klima	Klimaneutrale Energieproduktion	Stromproduktion
	Energiequalität	Jahreszeitliche Schwankungen in der Produktion	Anteil Stromproduktion Oktober bis und mit März (Winterstrom) an der Jahresproduktion
	Wasserhaushalt	Restwassermenge	Zusatzabfluss
		Restwasserstrecke	Gewichtete Restwasserstrecke
WIRTSCHAFT	Steuern, Öffentlicher Haushalt	Einnahmen der öffentlichen Hand	Gebühren, Steuern und Wasserzinsen
	Volkseinkommen	Wertschöpfung durch Anlage	Bruttoertrag
	Arbeitsmarkt	Kraftwerkinduziertes Arbeitsvolumen	Arbeitsplätze in der Region
	Investitionen	Investitionen	Gesamtinvestitionen
	Ressourceneffizienz	Wirtschaftlichkeit der Stromproduktion	Gestehungskosten
GESELLSCHAFT	Lärm und Wohnqualität	Lärmbelastung	Bewohnte Gebäude in Anlagenähe
	Partizipation	Lokale Beteiligung an Anlage	finanzielle Beteiligung der Standortgemeinde
	Kultur	Landschafts- und Ortsbild	Qualität der Landschaft (oder des Ortsbilds) / Einsehbarkeit der Anlage
	Freizeit	Fischerei	fischereiliche Nutzung
		Kanusport	Beeinflussung der Nutzung als Kanu- / Raftingstrecke
	Überregionale Solidarität	Regionales Steueraufkommen	Steuersitz der Betreibergesellschaft

Evaluation of sustainability © Bern - AWA

Status: ☐ Idea ☐ Project ☐ Realized ☐ Enacted ☒ In public consultation

Milestones:

2009 – Elaboration of the strategy “Water Use”
Mid January – mid march 2010 – Public participation and consultation process
December 2010 – Decision on the water-strategy by the members of the Cantonal Council

Links:

© Bern – AWA: http://www.bve.be.ch/site/wassernutzungsstrategie.pdf
http://www.bve.be.ch/site/index/awa/-14.content_awa-newpage

ALPINE CONVENTION
PLATFORM WATER MANAGEMENT IN THE ALPS

Common Guidelines
for the use of Small Hydropower
in the Alpine region

ANNEX 2

PERTINENT INTERNET LINKS ON SMALL HYDROPOWER AND GUIDANCE DOCUMENTS

15.12.2010

AUSTRIA	
Federal Ministry of Agriculture, Forestry, Environment and Water Management	http://wasser.lebensministerium.at/
River Basin Management Plan (NGP 2009)	http://wisa.lebensministerium.at/article/archive/29367
Hydropower in Austria	http://www.wassernet.at/article/archive/6402/
Environment Agency Austria (Eco-Energy)	http://www.umweltbundesamt.at/umweltschutz/energie/erneuerbare/oekostrom/
Austrian Association of Electric Utility Companies (VEÖ)	http://www.veoe.at/start.html
Austrian Association of Small Hydropower	http://www.kleinwasserkraft.at/
Austrian Energy Strategy (only in German)	http://www.energiestrategie.at/
Austrian Energy Strategy report (only in German)	http://www.energiestrategie.at/images/stories/pdf/longversion/energiestrategie_oesterreich.pdf
Austrian Hydropower Potential Study (only in German)	http://www.energiestrategie.at/images/stories/pdf/36_veo_08_wasserkraftpotenzial.pdf
Technical-Economic Assessment of Small and Micro plants for Generation of Electricity (only in German)	http://www.energiestrategie.at/images/stories/pdf/37_bmlfuw_endberichtmikrotech.pdf
Assessment of impacts of EU Waterframe Directive on Hydropower Generation (only in German)	http://gpool.lfrz.at/gpoolexport/media/file/Auswirkungen_WRRL_auf_Wasserkraft-Studie.pdf
Energy-Control GmbH	http://www.e-control.at/de/publikationen
Austrian Energy Agency	http://www.energyagency.at
GERMANY	
FEDERAL MINISTRY FOR THE ENVIRONMENT, NATURE CONSERVATION AND NUCLEAR SAFETY	
Renewable Energies - Hydropower	http://www.erneuerbare-energien.de/inhalt/42608/
Report about the admission of installations for the use of renewable energies (pages 77-80)	http://www.erneuerbare-energien.de/inhalt/36326/4592/
The Renewable Energy Sources Act entered into force on 1 August 2004	http://www.bmu.de/english/renewable_energy/doc/6465.php
Legal and ecological aspects of hydropower as a renewable energy (available in German only)	http://www.umweltbundesamt.de/wasser/veroeffentlich/Wasserkraftanlagen.pdf
Guidance document for the remuneration of electricity from hydropower	http://www.wasserkraft-deutschland.de/mediapool/54/540883/data/broschuere_leitfaden_wasserkraft.pdf
AGENCIES, ASSOCIATIONS, …	
German Environmental Help - Small Hydropower	http://www.duh.de/757.html
RESIDUAL FLOW	
Approach of residual flow studies (available in German only)	http://www.bestellen.bayern.de/shoplink/lfw_was_00173.htm
ITALY	
Ministry of the Environment, Land and Sea – River Basin Management Plans links (only in Italian)	http://www.direttivaacque.minambiente.it/distretti_idrografici.html
Province of Sondrio - Water Balance Plan - (only in Italian)	http://www.provincia.so.it/territorio/piano%20territoriale/default.asp

SWITZERLAND	
CONFEDERATION OF SWITZERLAND	
National recommendation on the use of Small Hydropower	http://www.bafu.admin.ch/UD-1037-D
FEDERAL OFFICE OF ENERGY (SFOE)	
Small Hydropower	http://www.bfe.admin.ch/themen/00490/00491/00493/index.html?lang=en
The Swiss Small Hydropower Programme	www.smallyhydro.ch
Overview of the previously existing programmes PACER and DIANE	http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en
Publications of the previously existing PACER program – especially on dimensioning of SHP (documents in German or French)	http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en&dossier_id=03892
Publications of the previously existing DIANE program (documents in German or French)	http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en&dossier_id=03891
Infrastructure-related hydropower plants	http://www.bfe.admin.ch/kleinwasserkraft/03875/03877/index.html?lang=en&dossier_id=04174
SwissEnergy for infrastructure plants - Campaign promoting the efficient energy use and the production of renewable energy	http://www.bfe.admin.ch/infrastrukturanlagen/index.html?lang=en
SwissEnergy publications on infrastructure plants	http://www.bfe.admin.ch/infrastrukturanlagen/index.html?lang=en&dossier_id=02222
Swiss Hydropower Research Programme	http://www.bfe.admin.ch/forschungwasserkraft/index.html?lang=en
Cost-covering remuneration for feed-in to the electricity grid (CRF)	http://www.bfe.admin.ch/themen/00612/02073/index.html?lang=en
FEDERAL OFFICE FOR THE ENVIRONMENT (FOEN)	
Information on residual flow	http://www.bafu.admin.ch/gewaesserschutz/01284/index.html?lang=en
Appropriate residual water flows: How can they be determined?	http://www.bafu.admin.ch/publikationen/publikation/00402/index.html?lang=de
Protection and utilization plan, according to the water conservation act. Experiences, evaluation criteria and factors of success. 2009 (in German)	http://www.bafu.admin.ch/publikationen/publikation/01071/index.html?lang=de
MAPPING SERVICES	
Swiss Atlas for Small Hydropower Plants	http://www.kwkatlas.ch/
Renewable energies and energy efficiency in your neighbourhood	http://www.repowermap.org/index.php
Small Hydropower potential in Switzerland	http://www.netzwerkwasser.ch/aktivitaeten/projekte/aktuelle-projekte/wasserkraftpotential/
CERTIFICATIONS / LABELS	
Labels in the energy sector - a list of links	http://www.bfe.admin.ch/energie/00458/00597/index.html?lang=en
Naturemade certification	www.naturemade.ch
GreenHydro: Standardised and scientifically certification procedure for Hydropower Plants	http://www.greenhydro.ch/level0/index_e.html
AGENCIES, ASSOCIATIONS, …	
Agency for renewable energies and energy efficiency (AEE) - Hydropower	http://www.aee.ch/de/erneuerbare-energien/wasser.html

Association of small hydropower plant owners	http://www.iskb.ch/
Association for energy production from wastewater, waste, waste heat and drinking water	http://www.infrawatt.ch/
Water-Agenda 21: Working group “Dialogue Hydropower”	http://www.wa21.ch/index.php?page=213
Revita Foundation: Preservation and revitalisation of small-scale hydropower plants.	http://www.revita.ch/
Swissgrid - Registration for small-scale hydropower plants	http://www.swissgrid.ch/power_market/renewable_energies/registration_crf/hydropower/
INTERNATIONAL	
European Small Hydropower Association (ESHA) - Publications	http://www.esha.be/index.php?id=39
ESHA - Guide on How to Develop a Small Hydropower Plant	http://www.esha.be/fileadmin/esha_files/documents/publications/publications/Part_1_Guide_on_how_to_develop_a_small_hydropower_plant-_Final.pdf
ESHA – Stream map project	http://www.streammap.esha.be/
Scottish Environment Protection Agency – Guidance for developers of run-of river hydropower schemes - Draft for public consultation	http://www.sepa.org.uk/about_us/idoc.ashx?docid=fb2a7978-95c1-49e1-a78a-a883e04df9fe&version=-1
EU Project SHARE - Sustainable Hydropower in Alpine Rivers Ecosystems	http://www.share-alpinerivers.eu
EU project CH2OICE	http://www.ch2oice.eu/
UK - Opportunity and environmental sensitivity mapping for hydropower	http://www.environment-agency.gov.uk/shell/hydropowerswf.html