AC11/B8/2



## ALPINE CONVENTION PLATFORM WATER MANAGEMENT IN THE ALPS

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

#### IMPRINT

#### Author:

Platform Water Management in the Alps A Platform within the Alpine Convention

#### Members of the Platform Water Management in the Alps

Co-Presidency

#### Austria

Karl Schwaiger, Federal Ministry of Agriculture, Forestry, Environment and Water Management, Unit VII/2 – International Water Policy

#### Switzerland

Martin Pfaundler, Federal Office for the Environment, Water Division

National Representatives and further Participants of the Member States

#### Austria

Raimund Mair, Karl Kriechenbaum and Jakob Schrittwieser, Federal Ministry of Agriculture, Forestry, Environment and Water Management, Unit VII/2 – International Water Policy

#### France

Berengère Charnay

#### Germany

*Erich Eichenseer* Bavarian State Ministry of the Environment and Public Health, Unit Water Management in Rural Regions; in coordination with *Martin Popp*, Bavarian Environment Agency Unit 62, Dams and Reservoirs, Hydraulic Structures, Hydro Engineering Technology

#### Italy

Pietro Colonna, Donata Balzarolo and Andrea Bianchini, Ministry of Environment, Territory and Sea Liechtenstein

Egon Hilbe, Office of Environmental Protection, Unit Water Management

#### Slovenia

*Mitja Bricelj,* Ministry of the Environment and Spatial Planning, Spatial Planning Directorate **Switzerland** 

Patrizia Dazio and Hugo Aschwanden, Federal Office for the Environment, Water Division

#### Further Members and Participants to the Meetings

**AEM** (European Association of Elected Representatives from Mountain Regions) Andrea Mammoliti Mochet

**CIPRA International** (International Commission for the Protection of the Alps) *Cornelia Maier* 

#### Club Arc Alpin

Liliana Dagostin ESHA (European Small Hydropower Association) Martina Prechtl, Sara Gollessi, Luigi Papetti and Gema Sanbruno ISCAR (International Scientific Committee on Research in the Alps) Leopold Füreder MRI (Mountain Research Initiative) Klaus Jorde

#### Translation:

French, German, Italian and Slovenian translations: Intralp Original version in English English revision: Stephen Goodwin

#### Publisher:

Permanent Secretariat of the Alpine Convention Secretary General: Marco Onida Coordination: Regula Imhof and Marcella Macaluso

info@alpconv.org www.alpconv.org

Main office: Herzog-Friedrich-Straße 15 A-6020 Innsbruck Austria

Branch office: Viale Druso – Drususallee 1 I-39100 Bolzano – Bozen Italy

© Permanent Secretariat of the Alpine Convention, 2011

## INDEX

1	INT	RODUC	ΓΙΟΝ	3
	1.1	ASSIGN	MENT AND CONTENT OF THE GUIDELINES	3
	1.2	INITIAL	SITUATION	4
	1.3	OBJECT	TVES	5
	1.4	SCOPE	OF APPLICATION	6
	1.5	ADDRE	SSEES	6
2	GE		PRINCIPLES	7
	2.1	SUSTAI	NABILITY	7
	2.2		ON ALPINE WIDE PRINCIPLES AND SPECIFIC NATIONAL / REGIONAL ACHES	8
	2.3	REFERE	ENCE SITUATION	8
3	GE		RECOMMENDATIONS	9
	3.1	TYPES	OF SMALL HYDROPOWER PLANTS	9
	3.2	OFF-GR	ID SMALL HYDROPOWER PLANTS	10
	3.3	NEW CO	DNSTRUCTION OR REFURBISHMENT	10
	3.4	OUTLIN	E OF A TWO-LEVEL PROCEDURE ASSESSING NEW INSTALLATIONS	12
		3.4.1	The regional level: Strategic planning	13
		3.4.2	The local level: At-site assessment and authorisation of individual projects	15
		3.4.3	Implications from the regional strategic planning as prerequisite for the local assessment and authorisation	16
4	GUI	DANCE	FOR AN EVALUATION PROCEDURE FOR NEW INSTALLATIONS	17
	4.1	OVERV	EW	17
	4.2	THE RE	GIONAL STRATEGY: CLASSIFICATION OF RIVER STRETCHES WITH RESPECT TO FIAL APPROPRIATENESS FOR SHPS	18
		4.2.1	Criteria for the evaluation of the theoretical hydroelectric potential	18
		4.2.2	Criteria assessing the ecological and landscape value	19
	4.3	THE LO	CAL ASSESSMENT FOR NEW INSTALLATIONS: EVALUATING THE SITE- AND CT-SPECIFIC PROS AND CONS	
		4.3.1	Installation- and site-specific criteria	20
		4.3.2	Further socio-economic criteria	20

## ANNEX 1: GOOD PRACTICE EXAMPLES

## ANNEX 2: INSPIRING INTERNET LINKS ON SMALL HYDROPOWER AND GUIDANCE DOCUMENTS

## **1** INTRODUCTION

## 1.1 Assignment and content of the guidelines

Based on the Mandate from the X<sup>th</sup> Ministerial Conference of the Alpine Conference in Evian, March 2009 and referring to the Climate Action Plan approved at the X<sup>th</sup> 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<sup>1</sup>). 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.

<sup>&</sup>lt;sup>1</sup> See Table 1 of the Situation Report on hydropower generation in the Alps focusing on small hydropower

<sup>&</sup>lt;sup>2</sup> 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<sup>4</sup>) 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.

<sup>&</sup>lt;sup>3</sup> 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

<sup>&</sup>lt;sup>4</sup> 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<sup>5</sup> 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<sup>6</sup> (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

<sup>&</sup>lt;sup>5</sup> http://www.alpconv.org/NR/rdonlyres/77274D16-B20C-43F0-9E20-2C6DA92F68D4/0/EnergyProtocolEN.pdf

<sup>&</sup>lt;sup>6</sup> 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<sup>7</sup>;
- 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.

<sup>&</sup>lt;sup>7</sup> 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<sup>8</sup>, 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

<sup>&</sup>lt;sup>8</sup> 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; <u>http://daccess-dds-</u> 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<sup>9</sup>).

Recommendation 3<sup>10</sup>

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.

<sup>&</sup>lt;sup>9</sup> Overview of River Basin Management Plans: http://ec.europa.eu/environment/water/participation/map\_mc/map.htm

<sup>&</sup>lt;sup>10</sup> 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**

#### **Types of Small Hydropower Plants** 3.1

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.





Drinking water supply hydropower plant<sup>13</sup> Figure 4: Examples of small hydropower plants



Residual flow hydropower plant<sup>14</sup>

#### Recommendation 5<sup>15</sup>

<sup>&</sup>lt;sup>11</sup> Water abstraction on Dora Baltea river, Aosta Valley (Italy) ©A. Mammoliti Mochet

<sup>&</sup>lt;sup>12</sup> Hydro power plant Agonitz (Austria) © Energie AG Oberösterreich

<sup>&</sup>lt;sup>13</sup> Small hydropower plant on drinking water supply network of Troistorrents (Switzerland). © MHyLab

<sup>&</sup>lt;sup>14</sup> 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<sup>16</sup>

## 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:**

<sup>&</sup>lt;sup>15</sup> Various Good Practice Examples provided in Annex 1 illustrate this recommendation

<sup>&</sup>lt;sup>16</sup> 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<sup>17</sup>

## 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.

<sup>&</sup>lt;sup>17</sup> See e.g. naturemade certification: the quality mark for ecologically produced energy (naturemade star) and energy from renewable sources (naturemade basic). <u>www.naturemade.ch</u>

# 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 <u>without</u> 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<sup>18</sup> 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<sup>19</sup>

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 criteriabased procedure that combines a regional/strategic point of view with a local, projectspecific assessment should be applied.

<sup>&</sup>lt;sup>18</sup> 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.

<sup>&</sup>lt;sup>19</sup> 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<sup>20</sup> 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 twolevel 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

<sup>&</sup>lt;sup>20</sup> 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<sup>21</sup> 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<sup>22</sup>. 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)<sup>23</sup> as well as the Note of the EU Water Directors on "Hydropower Development under the Water Framework Directive"<sup>24</sup> and by the Policy Paper from 2007 on "WFD and Hydro-Morphological pressures"<sup>25</sup>, 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.

 <sup>&</sup>lt;sup>21</sup> Overview of River Basin Management Plans: http://ec.europa.eu/environment/water/participation/map\_mc/map.htm
 <sup>22</sup> See e.g. the conclusions from the 2007 Berlin Workshop on Water Framework Directive and Hydropower:

http://www.ecologic-events.de/hydropower/

<sup>&</sup>lt;sup>23</sup> <u>http://ec.europa.eu/energy/res/biomass\_action\_plan/doc/2005\_12\_07\_comm\_biomass\_electricity\_en.pdf</u>
<sup>24</sup>

http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework\_directive/thematic\_documents/hydromorphology/development\_dir ectivepdf/\_EN\_1.0\_&a=d

http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework\_directive/thematic\_documents/hydromorphology/hydromorphology <u>EN 1.0 &a=d</u>

Also the SHERPA project (Small Hydro Energy Efficient Promotion Campaign Action<sup>26</sup>) – 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<sup>27</sup>.

#### 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.

<sup>&</sup>lt;sup>26</sup> www.esha.be/sherpa or more precisely:

http://www.esha.be/fileadmin/esha\_files/documents/SHERPA/D22\_Report\_WFD\_RESe\_EN.pdf

<sup>&</sup>lt;sup>27</sup> 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<sup>28</sup>

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.

<sup>&</sup>lt;sup>28</sup> 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<sup>29</sup>.

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.



Ecological and landscape value

FAVOURABLE	LESS-FAVOURABLE	NON-FAVOURABLE	EXCLUSION
for hydro-electrical exploitation	for hydro-electrical exploitation	for hydro-electrical exploitation. Strong interest for conservation	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

<sup>&</sup>lt;sup>29</sup> 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 <sup>30</sup>.

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<sup>30</sup> 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<sup>30</sup>.

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	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<sup>31</sup>.

<sup>&</sup>lt;sup>30</sup> 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): <u>http://www.bve.be.ch/site/ wassernutzungsstrategie.pdf</u> or in the list of criteria of the Province of Tyrol (Austria): <u>http://www.tirol.gv.at/fileadmin/ www.tirol.gv.at/regierung/downloads/kriterienkatalog.pdf</u>

 $<sup>^{31}</sup>$  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 <sup>32</sup>
Hydrologic regime Morphology Biology (qualitative and quantitative)	Minimal flow, flow fluctuation, impounded length Natural structure and barrier free flow path, longitudinal connectivity 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	e water body type
Importance as habitat	
Rare / protected habitats Importance for protected species Rich species spectrum / diversity	Importance; fish spawning area, etc. Fauna and flora Fauna and flora
Possible additional criteria: longitudinal connectivity transversal connectivity	
Fish waters	Waters suitable to sustain natural fish populations
Landscape value	
Protected areas Recreation value	Depending on the protection level and the interaction with the water body
Beauty Importance for the whole river system	Scenic attraction, symbolic value, local identity 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" <sup>33</sup>. 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 <sup>34</sup>

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.

<sup>&</sup>lt;sup>32</sup> http://www.modul-stufen-konzept.ch/e/index-e.htm

<sup>&</sup>lt;sup>33</sup> 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.

<sup>&</sup>lt;sup>34</sup> 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.

CRITERIA	UNIT	DESCRIPTION
Energy balance		Energy input for the construction of the installation and operation
or "energy payback ratio"		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		Infrastructure plants or existence of a deactivated plant
infrastructures		
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	compariso	n 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

#### 4.3.1 Installation- and site-specific criteria

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 <sup>35</sup> Other socio-political considerations	e.g. green energy labels; ISO 14000 ;

<sup>&</sup>lt;sup>35</sup> 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	1
	REVITALISATION PROGRAMME UPPER AUSTRIA	1
	LIST OF CRITERIA (DRAFT) - FURTHER DEVELOPMENT OF HYDROPOWER IN TYROL	3
	REFURBISHMENT OF HPP MAGERLMÜHLE	5
	REFURBISHMENT HPP CUMBERLAND – RIVER ALM	7
	REFURBISHMENT AND OPTIMISATION OF THE HPP STEINBACH	9
	REFURBISHMENT – OPTIMISATION OF THE HPP AGONITZ	11
	AUTOMATIC REGULATION OF RESIDUAL FLOW E.G. SHPP THURN – RIVER: SAALACH	13
2.	GERMANY	15
	INNOVATIVE HYDROELECTRIC CONCEPT	15
	INFRASTRUCTURE POWER PLANT ESTERBERG GDE. GARMISCH-PARTENKIRCHEN	17
	ILUP-PROJECT: HYDROPOWER PLANT VILS, MUNICIPAL UTILITIES OF VILSHOFEN	19
	EXTENSION OF A DIVERSION PLANT IN OBERSTOORF	21
3.	ITALY	25
	TERRITORIAL PLAN FOR THE PROVINCIAL COORDINATION; WATER BALANCE PLAN OF THE PROVINCE OF	
	Sondrio	25
	ITALY AND SLOVENIA: $CH_2OICE$ - CERTIFICATION FOR HYDRO: IMPROVING CLEAN ENERGY	27
	THE REFURBISHMENT OF THE TARTANO VALLEY ELECTRICITY PRODUCTION SYSTEM THROUGH THE USE OF A	L.
	SMALL HYDROPOWER PLANT (INCREASE OF PRODUCTIVITY AND BEST/OPTIMAL ENVIRONMENT OUTCOMES)	28
4.	PRINCIPALITY OF LIECHTENSTEIN	32
	SMALL HYDROPOWER PLANTS ON DRINKING WATER SUPPLY SYSTEMS	32
5.	SWITZERLAND	33
	EVALUATION AND MANAGEMENT OF THE HYDROELECTRIC POTENTIAL OF THE CANTON OF FRIBOURG	33
	WATER-AGENDA 21: WORKING GROUP "DIALOGUE HYDROPOWER"	35
	SMALL HYDROPOWER PLANT- DRINKING WATER SUPPLY OF TROISTORRENTS	36
	SMALL HYDROPOWER STATION BUCHHOLZ	37
	SMALL HYDROPOWER PLANT USING A WASTEWATER NETWORK - LE CHÂBLE - PROFAY IN BAGNES	38
	Strategy "Water Use" of the Canton of Berne	39

## 1. AUSTRIA

Country:	Province / Canton:	Name of the project:
Austria	Upper Austria	Revitalisation Programme Upper Austria
Description:	The increase of electricity product modernisation of the hydroelectric Revitalisation Programme Upper • Modernisation of power • Installation of new power Status in Upper Austria: • 616 small hydro power p • SHP bottleneck capacity There is a need for financial incer Ecological measures can be reali	tion by environmental-friendly development and c power is goal of this support program. Thus, the Austria provides two options to achieve this goal: plants in place r plants at environmental acceptable locations plants (installed capacity up to 10 MW) of more than 130 MW in total ntives for small hydro power plants (< 1MW). sed faster with financial support schemes.
Method:	<ul> <li>Small hydro power opera (since April 2003)</li> <li>Development programm         <ul> <li>Enforcing moder</li> <li>Installing new sr</li> </ul> </li> <li>Subsidy rates:         <ul> <li>Investment gran</li> <li>Maximum of 50.</li> </ul> </li> </ul>	ators get advised about the optimisation potential e especially considering ecological issues misation of small hydro power plants up to 1 MW nall hydro power plants up to 1 MW t of 25% maximum (one-time) 000 Euro per hydro power plant/operator
Criteria:	<ul> <li>Small hydro power gene</li> <li>Relevant investment cos</li> <li>The power plant has to b</li> </ul>	ration ≤ 1 MW ts have to be at least 7.500 Euros be designed in an environment-friendly way
Results:	<ul> <li>Achievements of the Revitalisatio</li> <li>258 small hydro power pl installed(2004-2009)</li> <li>Total investment of 45 million</li> <li>The electricity production more than 40%</li> <li>Total increase in electricity</li> <li>Ecological improvement of ecological measures</li> </ul>	n Programme Upper Austria (Summer 2009) ants have been either modernised or completely new illion Euros of these plants has been increased on average by ty production: 76 GWh/year of the rivers in Upper Austria due to obligatory



Country:	Province / Canton:	Name of the project:	
Austria	Tyrol	List of Criteria (Draft) - Further Develo Hydropower in Tyrol	oment of
Description:	<ul> <li>The Tyrolean Ministry of assessment of the com requirements; this is in the provision of "non de</li> </ul>	of Environment establishes criteria as patibility of new hydropower plants w line with provisions already in place f eterioration".	basis for an th ecological or exemptions of
Method:	<ul> <li>Development of criteria experts and 1 coordina</li> <li>Further development of including all relevant statement of the statement of t</li></ul>	for 5 special issues by a multidiscipli tor this list for future development of Hy akeholders	nary group of 15 dropower in Tyrol
Criteria:	<ol> <li>Specification of 5 topics/crit</li> <li>1. Criteria of Energy mana</li> <li>2. Criteria of Water manag</li> <li>3. Criteria of Spatial plann</li> <li>4. Criteria of Water ecolog</li> <li>5. Criteria of Nature prote</li> </ol>	Specification of 5 topics/criteria with following weightingQuantif1. Criteria of Energy management252. Criteria of Water management183. Criteria of Spatial planning124. Criteria of Water ecology225. Criteria of Nature protection23	
Results:	A concept to solve cont water degradation	licts between hydropower generation	and prevention of

Each considered project should be assessed in a fully transparent way by • weighting the results of the criteria groups



Legend:

reduced technical-economic potential

Unexploited hydropower potential

Reduced unexploited hydropower potential

"large" hydropower potential ( $\geq 10 \text{ MW}$ ) already in place

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

Status:	🗌 Idea	🛛 Project	Realized	Enacted	
Milestones:	<ul> <li>Insta</li> </ul>	lled expert group p	roposed criteria		
	• The	proposal was prese	ented to the general	l public (Decemb	er 2009) and was

Country:	Province / Canton:	Name of the project:				
Austria	Tyrol	List of Criteria (Draft) - Further Development of Hydropower in Tyrol				
	opened for comme	ents				
	Next steps:					
	<ul> <li>Discussion of proposal incorporating the public comments with relevant stakeholders and politicians</li> </ul>					
	Finalise the list of	criteria				
Links:	http://www.tirol.gv.at/fileadmin ds/Nutzen Kriterienkatalog V	1/www.tirol.gv.at/regierung/downloa Vebsite_final.pdf				
	http://www.tirol.gv.at/fileadminds/kriterienkatalog.pdf	1/www.tirol.gv.at/regierung/downloa				
		Wasserkraft in Tirol Krimein für die weitene Naturie der Wasserkraft in Förd				
	Amt der Tiroler Landesregien	Ung Downer 200, Br. 1				
	Eduard-Wallnöfer-Platz 3					
	A-6020 Innsbruck	Photo 1: List of Criteria Ty (Draft) © Amt der Tiroler Landesregierung				

Country:	Province / Canton:	Name of t	the project:		
Austria	Upper Austria	Refurbish	ment of HPP Magerlmühle		
Description:	Hydro Power Plant: Wagner K River: Große Mühl Status before refurbishment River Power Station at the "Gr has been operating since 1922 KG purchased the power station	G <u>:</u> oße Mühl" 2. Wagner on in 2004.	average discharge - MQ minimum discharge - NN <u>Status after refurbishm</u> Initial Operation: 30.3.20	= 9 m³/s IQ= 0,8 m³/s <b>eent:</b> 04	
	Technical Data (before 2004)Francis turbinevertical with cogwheel and bell• capacity:• head:• head:• turbine output:• capacity:• production/year:450Total production/year:	t drive = 5,5 m <sup>3</sup> /s = 2,6 m 110 KW 95 KW 0.000 KWh	Technical Data (since 2 <u>Kaplan turbine</u> Vertical, double regulated • capacity: • head: • turbine output: • capacity: • production/year: • The old installation is and produces Total production/year:	2004): d Q = 6,0 m <sup>3</sup> /s H = 2,5 m 135 KW 120 KW 750.000 KWh s still in use 350.000 KWh 1.100.000 KWh	
	Ecology: • minimum flow: residual flow reach of 300 no minimum flow	) m	<ul> <li>Ecology:</li> <li>minimum flow: not necessary</li> </ul>		
	<ul> <li>fish pass no fish pass built</li> </ul>		<ul> <li>fish pass Vertical slot fish pas</li> </ul>	s with 150l/s	
Method:	<ul> <li>Investment costs: 520.000</li> <li>Subsidy: 50.000 € by Revi</li> </ul>	€ talisation Pro	gram Upper Austria		
Criteria:	Revitalisation, ecology, inc	Revitalisation, ecology, increase in efficiency			
Results:	Increase of power product	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: Vertica	l slot SHPP Magerlmühle	Photo 2: Power station SHPP Magerlmühle	
© Christoph Wag	gner	© Christoph Wagner	
Status:	🗌 Idea 🛛 Project	Realized Enacted	
Milestones:	<ul><li>Increase in efficier</li><li>Ecology – fish pas</li></ul>	ncy from 450.000 KWh/year to 1.100.000 KWh/year ss 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	f the project:			
Austria	Upper Austria	Jpper Austria Refurbish		hment HPP Cumberland – River Alm		
Description:	Hydro Power Plant: Cumb River: Alm	perlandstiftung				
	Status before refurbish	ment:	Status of refurbishme	ent:		
	Hydro power plant has be since 1899.	en in operation	Initial operation: 20.12.	2005		
	Technical Data (before 2	2005):	Technical Data (since	2005):		
	Francis turbine		<u>Kaplan turbine</u>			
	vertical with cogwheel and	d belt drive	vertical double regulate	ed		
	<ul> <li>capacity:</li> </ul>	$Q = 2,0 \text{ m}^{3/s}$	<ul> <li>capacity:</li> </ul>	Q = 8,0 m <sup>3</sup> /s		
	head:	H = 2,5 m	head:	H = 3,0 m		
	turbine output:	35 KW	turbine output:	214 KW		
	<ul> <li>capacity:</li> </ul>	28 KW	<ul> <li>capacity:</li> </ul>	197 KW		
	• production/year:	170.000 KWh	<ul> <li>production/year:</li> </ul>	1.000.000 KWh		
	Ecology:		Ecology:			
	• minimum flow:		minimum flow:			
	no minimum flow		800 to 1400 l/ s			
	Fish pass:		<u>Fish pass:</u>			
	<ul> <li>no fish pass built</li> </ul>		<ul> <li>bypass channel at of fish</li> </ul>	weir to allow migration		
Method:	Investment costs: 960	).000 €				
	• Subsidy: 50.000 € by	<ul> <li>Subsidy: 50.000 € by Revitalisation Program Upper Austria</li> </ul>				
Criteria:	Revitalisation, ecolog	Revitalisation, ecology, increase in efficiency				
Results:	<ul> <li>Increase of power production in average by 800.000 kWh/year</li> </ul>					



Photo 1: Power station SHPP Cumberland © Herzog von Cumberlandstiftung



Photo 2: Weir system SHPP Cumberland © Herzog von Cumberlandstiftung

Enacted

🛛 Realized

.....

Country: Austria	Province / Canton:	Name of the project: Befurbishment HPP Cumberland – Biver Alm
	opportation	
Milestones:	Increase in efficiency from	om 170.000 KWh/year to 1.000.000 KWh/year
	<ul> <li>Ecology – fish pass con</li> </ul>	structed
Links:	http://www.hydro-energy.com/_downloads/pdf/Referenzen_Zek/Auingersaege_Juni07.pdf	
	http://www.neueenergie.net/index.php?id=1515	
	Herzog von Cumberlandstiftung	g, 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			
	<ul> <li>The old HPP consisted of two installed capacity of 25 kW at 75 kW. With gross head of 2. an annual average of 0.8 GW</li> </ul>	o separate plants. One was built in 1910, with an nd the other one in 1942, with an installed capacity of 8 m and a maximum discharge of 4.1 m <sup>3</sup> /s per plant, /h was produced.		
	River continuum disrupted - Fish migration not possible (=Ecological shortcoming)			
	Due to poor condition and the was carried out in 1999. The	e long life-span of the facility a refurbishment study results proposed following measures:		
	<ul> <li>Removal of the old plant generators. Increase of enhancing capacity from</li> </ul>	s and replacement by a single power-station with two maximum discharge from 4.1 m³/s to 50 m³/s and 100 kW to 1.000 kW		
	<ul> <li>Alteration of bottom weir</li> </ul>	gate		
Method:	Reconstruction by refurbishment	/ ecological mitigation measures		
Criteria:	Reconstruction, ecology, increase	e in efficiency		
Results:	<ul> <li>Increasing maximum discharge average annual power genera before refurbishment.</li> </ul>	ge and enhancing efficiency have resulted in an ation of 5,3 GWh - more than six times the production		
	<ul> <li>Total costs: 5.000.000 € (sev costs of 1.200.000 €).</li> </ul>	eral floods during construction period resulted in extra		
	Execution of measures:			
	Hydromorphological improvem	ients:		
	River continuum established			
	Ecological improvements:			
	Providing fish migration ensu	red by a vertical slot fish pass		
	Assessment of ecological effic	iency:		
	<ul> <li>Experts of limnology assisted process of the fish pass</li> </ul>	designing the plant and supervised the construction		
	The fish pass is integrated in powerhouse. Tests proved fur	the partition wall between bottom weir gate and nctionality of fish ladder.		
	Effects on operator:			
	Costs for ecological improver generation	nent have been compensated by increasing power		
	Costs of the measure (€):			
	Investment: Fish pass: appro	ximately € 70.000 €		

AustriaUpper AustriaRefurbishment and Optimisation of the HPP Steinbach	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 here used two generators with an of 6,4 GWh/year.	ad of 7 m and a maximum discharge of 20 m <sup>3</sup> /s. It installed capacity of 990 kWand produced an average		
	• River continuum disrupted - F	-ish migration not possible (=Ecological shortcoming)		
	Due to poor condition and lor carried out in 2001. The resu	ng life-span of the facility a refurbishment study was Its of the study proposed the following measures:		
	<ul> <li>Replacement of pow discharge from 20 m</li> </ul>	er station and generators. Increase of maximum <sup>3</sup> /s to 45 m <sup>3</sup> /s		
	<ul> <li>Alteration of bottom v</li> </ul>	veir gate		
	<ul> <li>Increase of hydraulic downstream by 1,3 n</li> </ul>	head to 8,3 m by an excavation of river bed ו		
	<ul> <li>Total costs: 7.600.00</li> </ul>	0€		
Method:	Reconstruction by refurbishment / ecological mitigation measures			
Criteria:	Reconstruction, ecology, increase in efficiency			
Results:	<ul> <li>Increasing the maximum and hydraulic head has resulted in an average annu power production of 15,8 GWh - more than twice the amount before refurbish</li> <li>Ecological macaurea were planned by experts of limpolagy who also supervise</li> </ul>			
	the construction works.			
	Execution of measures:			
	Hydromorphological improvem	ients:		
	River continuum establis	ned		
	Ecological improvements:			
	<ul> <li>Fish migration provided to combination of nature ori</li> </ul>	by setting in place a fish pass designed as a entated creek and a vertical slot fish pass.		
	Assessment of ecological effic	iency:		
	• High			
	Effects on operator:			
	<ul> <li>Costs for ecological impr power generation</li> </ul>	ovement have been compensated by increasing		
	Costs of the measure (€):			
	<ul> <li>Investment: Fish pass: 38</li> </ul>	30.000 €.		

Country:	
Austria	

**Province** / **Canton:** Upper Austria Name of the project: 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:	<ul> <li>Prevention of malfunction for good ecological status</li> </ul>	ns and controlling residual flows are the prerequisites s of rivers.	
	<ul> <li>Inspections revealed that observed by the owner in residual flow has been co</li> </ul>	the specified residual flow was frequently not the past. An automatic system for the regulation of the onsidered.	
	<ul> <li>Installing a technical regulation</li> </ul>	Installing a technical regulation system ensured the required residual flow.	
	The protocol system docu	uments the residual flow values.	
Method:	Automatic regulation of re	esidual water	
	Technical solution – no m	nanipulation possible	
Criteria:	Regulation of residual wa	Regulation of residual water	





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



Status:	🗌 Idea	Project	Realized	Enacted (Salzburg)	
Milestones:	<ul> <li>No pro</li> </ul>	manipulation by ope btocol tool	erators possible	e because of technical so	olution including a

Figure 3: No residual water © Land Salzburg

Country:	Province / Canton:	Name of the project:		
Austria	Salzburg	Automatic regulation of residual flow e.g. SHPP Thurn -		
		River: Saalach		
	<ul> <li>Guaranteed residual flow</li> </ul>			
Links:	http://www.salzburg.gv.at/jaeger_automatische_restwasserregulierung_und_fischpassdotatio afik_komprimiert-3.pdf			
	http://www.salzburg.gv.at/gewaesser Land Salzburg, Referat 13/04 - Gewa Mag. Renate Schrempf, Tel:+43(0)66 Dr. Andreas Unterweger, Tel:+43(0)66	<u>schutz</u> asserschutz 32 8042-4492, e-mail: <u>renate.schrempf@salzburg.gv.at</u> 362 8042-4582, e-mail: <u>andreas.unterweger@salzburg.gv.at</u>		

## 2. GERMANY

<b>Country:</b> Germany	Province / Canton:	Name of the project: Innovative Hydroelectric Concept
Description:	At the TU Munich development work is on fixed weirs. The new concept's main innov resulting in significant economic, hydraulic important benefit lies in the special consid Fish-friendly flow conditions in the inlet pla of the rake without affecting the third dime	going to create a new inlet concept particularly suited to existing, ation is a change from the vertical to the horizontal inlet plane, , noise-emission and aesthetic advantages. An additional and eration of ecological components in the flow and bed load regions. ne can be achieved with an increase of the effective surface area nsion.
	The power plant is situated in front of and no powerhouse and no intervention on the prevent vortices drawing air into the vertice will also allow fish migrating downstream a	within the weir, submerged, equipped with a DIVE turbine, requires banks. Furthermore it is inconspicuous and emits no noise. To al shaft a flap gate positioned at the face will be over-flowed. This a wide corridor.
Method:	So far the concept is designed theoreticall course of a research project the design will phase a large pilot project will be built. App in the summer of 2010.	y and a rough hydraulic dimensioning has been done. In the I be tested in a physical model equipped with turbines. In a second plicable hydraulic and construction assessments can be expected
Criteria:	More efficient and therefore economically achieve high ecological standards.	viable even at weirs with small heads of water, at the same time
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: Germany

Province / Canton:

Name of the project: 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 E experts of the Technical University Munich, D examining the potential of existing water support structure of Esterberg Springs, which has been	conomic Affairs, Infrastructure, Transport and Technology Dep. Hydraulic Engineering and Water Management, have been Dly systems for generating electricity. Result: the water supply en in existence for many decades, is suitable.
Method:		
Criteria:		
Results:	Hydropower plant Esterberg Construction of a new infrastructure hydropow	rer plant for using the discharge of drinking water springs.
	Data: former drinking water supply system head max. 502 m (highest in Bavar twin-jet Pelton turbine with 44 -154 capacity 636 kW, electrical work 3, Costs about 1,7 Mio. € built in 2008 very good acoustic insulation of the in case of power failure isolated op inconspicuous integration within too	m (3,6 km pressure pipeline DN 400 newly run) ria) I/s 1 GWh p.a. e power plant eration possible wnscape
Figures:		



Fig. 1/2: Power house © Bavarian Environment Agency

© Gemeindewerke Garmisch-Partenkirchen

## Country:

Province / Canton:

Germany

#### Name of the project:

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

#### 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: Milestones:	🗌 Idea	⊠ Project	⊠ Realized	Enacted	
Links:					

Country:	Province / Canton:	Name of the project:		
Germany	Bavaria / Oberallgäu	Extension of a diversion plant in Oberstdorf		
Description:	EVO GmbH requested permi the river Faltenbach. Both the should be extended. The ma	ssion for the extension of an existing hydroelectric power plan e length of the diverted river stretch and the diverted discharge x. diverted discharge of the existing power plant was intended 1.0 m <sup>3</sup> /s		
	MQ of the Faltenbach is abo	ut 345 l/s, MNQ 30 l/s, HQ <sub>1</sub> approx. 10 m <sup>3</sup> /s.		
Method:	For the determination of the ecologically necessary minimum discharge in the diverted rive 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 t investigation was mainly upon the collection of hydraulic-morphologic parameters at differ discharges and the stocktaking of the aquatic river-bed fauna (macro zoo benthos).			
Criteria:	The extension of the hydroel an extent widely compatible ensure the good to very good the case by providing a minir	ectric power plant has to consider the abiotic boundary conditi for the occurring species of the macro zoo benthos in order to d ecological status after EU-WFD (AQEM-method). This can o num discharge appropriate both in amount and dynamics.		
Results:	The limnological expert report half year (mid of Nov. to mid in the Faltenbach in the sum appropriate openings in the T surface. After evaluation of the survey Kempten) and consensus on administration authority comp	t resulted in a dynamic minimum discharge of 40 l/s in the win of March) and of 100 l/s plus an additional 20% of the overall mer half year. The delivery of the fixed contingent is attained b Tyrolean weir, the dynamic 20% by appropriate cover of the gr by the official expert (= State Office for Water Management the proposed arrangement of minimum discharge, the district pleted planning approval despite former civil protest against th		
	project. This vear construction of the	new power plant will take place.		

Country:	Province / Canton:	Name of the project:
oountry.		Nume of the project.
Germany	Bavaria / Oberallgäu	Extension of a diversion plant in Oberstdorf
Figures:	For investigation the torrent st	retch was
	divided into 14 characteristic s	ections.

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:

Germany

**Province** / **Canton:** Bavaria / Oberallgäu Name of the project:

Extension of a diversion plant in Oberstdorf



#### Fig.11 400 l/s

Parameter	Verbaute S	taffelstrecke	Unverbaute	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 Vs	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					

## 3. ITALY

Country:	Province / Canton:	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 due to the presence of a larg quality and the protests by the implement a new legislative ins	of Sondrio is characterised by a very high water exploitation ge number of hydropower plants. The risk of deteriorating we population over a long time period prompted local authorities strument to better regulate authorisations for the water use.		
	Because the Plan represents t at local scale, an ad-hoc work concessions grant process (M Region, Province of Sondrio sustainability of the uses of planning instruments" and part	the first Italian example of application of the 2000/60/EC princi- king group was established with all the authorities involved in finistry for the Environment, Po river basin Authority, Lomba and APAT). All the authorities signed the Agreement "for water in the Province of Sondrio through the integration of cicipated in the implementation of the necessary steps.		
	The Agreement envisaged inte an "at small scale" water ba implementation of the WFD Environmental Evaluation, as e	gration of the "Territorial Plan for the Provincial Coordination" alance, the individuation of a set of indicators suitable for principles and the submission of this new plan to Strat expected from the national legislation.		
	The new plan, adopted on July of rules will constitute the in concessions.	/ 2009 and approved the 25 January 2010, with the associated nstrument used by the water authorities for the grant of		
Method:	The authorisation of new appli both hydrological, environmen using the WFD clues.	cations is subject to an ad-hoc set of rules that takes into acc tal and morphological aspects, the used indicators are carried		
	The adopted method is base concessions in those parts of quality status or failure to re directive. The aggregation app was the overlapping of five d failing to reach the good ecol basin where at least one of the refused, while in the areas sh allowed, but only if there would	d on a multi-criteria evaluation intended to exclude or limit the basin where there is a significant detrimental risk to the w ach the good ecological status required under the 2000/60 proach used for the implementation of the multi-criteria proce ifferent maps, where any of these maps represented the ris logical status due to a single critical aspect. In those part of e critical aspects show a high risk rate the water concessions w howing a medium or a low risk rate the water concessions w d be no deterioration to the ecological status of the river stretch		
	The method provides a simple colour represent the risk of rive	evaluation scheme that consists of a "risk map" whereby different difference of the structure of the structu		
Criteria:	The five indexes used to identi	fy the different river stretch criticalities are listed below:		
	<ul> <li>An index representing the annual natural discharge;</li> </ul>	impact of the cumulated withdrawals with respect to the m		
	<ul> <li>b) An index representing the annual low flow considering the</li> </ul>	impact of the cumulated withdrawals with respect to the n e human activities impact;		
	<ul> <li>c) An index representing the discharges from reservoirs;</li> </ul>	e interruption risk in the river regime due to the presenc		
	<ul> <li>d) An index representing the human activities impact" scena</li> </ul>	LIM pollution risk in the "mean annual low flows considering ario;		
	e) The FFI (Fluvial Functioning	g Index), for the connectivity and the ecological functionality		
Results:	Results from this method have and have also updated the Wa plan for the Hydrogeological Se	been integrated into the Territorial Plan for Provincial Coordinater Quality Protection Plans at regional level and the Transit ettlement (PAI) with regard to granting water use concessions.		







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

Remarks:					
Status:	🗌 Idea	Project	Realized	Enacted	
Milestones:	Spring 2006 Spring 2006 Summer 200 July 2009: A January 201 Spring 2010	5: Establishment of 5-spring 2008: De 07-end of 2008: N Adoption of the Pl 10: Approval of th 9: Adoption of the	of Working Group; velopment of the m Vater uses analysis an e Plan by the Provi Plan with the functi	ethodology; and Strategic Envir nce of Sondrio on of ordinary plann	onmental Evaluation; ing instrument
Links:	http://www.p	provincia.so.it/terr	itorio/piano%20terr	toriale/default.asp	

Country:	Province / Canton:	Name of the project:
Italy	Different places	Italy and Slovenia: CH <sub>2</sub> OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy
Description:	The CH <sub>2</sub> OICE project aim certification procedure for standard in line with the re implemented in labeled el existing EU tools such as Intelligent Energy Europe	s at developing a technically and economically feasible hydro power generation facilities of a high environmental equirements of the Water Framework Directive. It is to be ectricity products and integrated, as much as possible, with EMAS, EIA and SEA. The project is co-founded by Working Program 2007.
Method:	After a preliminary review project (IT, ES, FR, SK, S based upon the literature the year 2010 this methoo Slovenia in order to finalis	of national HP laws of the countries involved in Ch2oice L) a draft methodology for certification has been defined, review and on the results of dedicated workshops. During lology will be tested on several HPPs in Italy and in e the operational methodology.
	The testing phase, started of this period (around Octor contents of the methodolo experimentation. The cert However, to allow a wider hydropower plants licensin approach used for the cert produced to help decision developers in their EIA an	I in January 2010, may bring new insights and so at the end ober 2010) there will be a new discussion and debate on ogy developed, based upon the results of the ification methodology will primarily refer to existing plants. use of the results of the project, the issue of new ng is being considered. Following the same logical tification of existing plants, a set of guidelines was makers during planning and licensing procedures and HP d SEA studies.
Criteria:	The developed methodolo simplified procedure. For artificial networks and not examples HPPs in sewag procedure in order to facil the standard procedure. T requirements of the WFD such as EMAS.	bgy provides two kinds of procedures: a standard and a some types of hydropower plants operating in totally entailing impacts on water-related ecosystems, for e and aqueduct networks, it is possible to adopt a simplified itate certification. All the other types of plants have to follow the certification procedure is strictly in line with the and integrated as far as possible with existing EU tools
Results: Figures:	<ul> <li>Expected results:</li> <li>Reports on main tech certification</li> <li>General methodologics partners</li> <li>Guidelines for Decision construction and mann standard</li> <li>Analysis document for certification of hydro pool</li> <li>Proposals and feasibil procedures, with focus</li> <li>Proposals for rules and</li> </ul>	anical tools and regulatory frameworks related to hydropower al approach for WFD-coherent certification agreed by project on-makers and hydropower generation companies for siting, agement of new hydropower plants of higher environmental or Spain including a roadmap for the development of volunteer ower generation facilities of high environmental standard in Spain ity analysis on the integration of the label scheme in existing on Italy and France. criteria for an independent body issuing the hydro power label
Remarks:		
0		
Status:	🔟 Idea 🛛 🖄 Project	LI Realized LI Enacted LI
Milestones:	Begin: September 2008	

Sound y.	Province / Canton:		Name of the project:	
Italy	Different places		Italy and Slovenia: CH <sub>2</sub> OICE	- Certification for HydrO:
Slovenia	Different places		Improving Clean Energy	
	January 2010: startin	ig of the testing	phase	
Links:	www.ch2oice.eu			
Country:	Province / Canton:		Name of the project:	
Italy	Sondrio		The refurbishment of the production system throug plant (increase of product outcomes)	Tartano valley electricity h the use of a small hydropower ivity and best/optimal environme
Description:	The Tartano river basis system founded by tw Campo Tartano dam, dams were built by tw built in the 1920s, wh optimal energy proceenvironmental deficie difficulties in guarante Therefore the key air basin aspects, were: - to enhance t investment wi - to guarantee mechanism in - to solve the fiss Most of the productio the Campo Tartano da plant and building a increase was obtained only a limited producti point were ecological Two specific Interreg	in was charact o large hydrop and the Mona o different com ile the Ardenn duction scher ncies, such a eing an adequ ns of the proj he production thout increasin the presence the river stret sh migration of n increase has am and the Ard new large h d by a new sm on increase, p flow is returne Projects were	rerised by the presence of a power plants: the Talamona astero power plant, fed by t inpanies in two different perio o reservoir only in the 1960 ne. The scheme was a s the presence of fish mig ate ecological flow along th ect, using a comprehensive scheme in order to obtain g the amount of the water of of the ecological flow and ch (Interreg project), pstruction in the Ardenno re- s been obtained by better of denno reservoir (refurbishm ydropower plant, Talamon hall hydropower plant. The erforms an essential ecological d to the river (see figure 2). launched on fish migration a	a complex electricity production a power plant, connected to the he Ardenno reservoir. The two lods (Campo Tartano dam wa los). The result was a less that also characterised by som gration barriers, and by som e river stretch. we perspective on all the rive atin an economically profitable exploited, I study the bed load transport eservoir (Interreg project). eservoir (Interreg project). eservoir (Interreg project). eservoir the existing Talamona ia 2) (see figure1). A furth- small plant, although providir gical role, representing the on
	-	-	<u> </u>	
Method:	Utilisation of an unexp Agreements with the participation in an inter- institutions to deepen Application of a partici- on the discharge of cost/benefit analysis r performed instead of a	loited fall. e institutions ernationally fin the environme pative process the ecologica egarding the e applying the es	involved in the water c anced research project with ental aspects. s with the institutions to gair I flow (with the agreemen environmental aspects on t kisting laws on the single co	oncessions release proces in research institutes and other in a comprehensive perspective t of the Lombardia Region the whole water path has been incession).
Method: Criteria:	Utilisation of an unexp Agreements with the participation in an inter institutions to deepen Application of a partici on the discharge of cost/benefit analysis r performed instead of a <b>Production increase</b>	loited fall. e institutions ernationally fin the environme pative process the ecologica regarding the e applying the es	involved in the water c anced research project with ental aspects. s with the institutions to gair I flow (with the agreemen environmental aspects on t kisting laws on the single co	oncessions release proces h research institutes and oth h a comprehensive perspective t of the Lombardia Region he whole water path has been ncession).
Method: Criteria:	Utilisation of an unexp Agreements with the participation in an inter- institutions to deepen Application of a partici- on the discharge of cost/benefit analysis of performed instead of a <b>Production increase</b> <b>Before the refurbishin</b> Talamona 1 installed capacity height of fall	loited fall. e institutions ernationally fin the environme pative process the ecologica egarding the e applying the ex : ment: 10.5 Mw 498 m	involved in the water c anced research project with ental aspects. s with the institutions to gain I flow (with the agreemen environmental aspects on t kisting laws on the single co <b>After the refurbishmen</b> Talamona 1 (modified), installed capacity height of fall	oncessions release proces in research institutes and oth in a comprehensive perspective t of the Lombardia Region he whole water path has been oncession).
Method: Criteria:	Utilisation of an unexp Agreements with the participation in an inter- institutions to deepen Application of a partici on the discharge of cost/benefit analysis r performed instead of a <b>Production increase</b> <b>Before the refurbish</b> Talamona 1 installed capacity height of fall	loited fall. e institutions ernationally fin the environme pative process the ecologica regarding the e applying the es : ment: 10.5 Mw 498 m	involved in the water of anced research project with ental aspects. s with the institutions to gain I flow (with the agreemen environmental aspects on the environmental aspects on the single aws on the single co After the refurbishmen Talamona 1 (modified), installed capacity height of fall Talamona 2 (new) installed capacity height of fall Talamona ecological floo	n a comprehensive perspective to f the Lombardia Region the whole water path has been necession).
Method: Criteria:	Utilisation of an unexp Agreements with the participation in an inter- institutions to deepen Application of a partici- on the discharge of cost/benefit analysis r performed instead of a <b>Production increase</b> <b>Before the refurbishe</b> Talamona 1 installed capacity height of fall	loited fall. institutions in	involved in the water c anced research project with ental aspects. s with the institutions to gain I flow (with the agreemen environmental aspects on t sisting laws on the single co <b>After the refurbishmen</b> Talamona 1 (modified), installed capacity height of fall Talamona 2 (new) installed capacity height of fall Talamona ecological flo installed capacity	n research institutes and oth n a comprehensive perspecti t of the Lombardia Region he whole water path has been ncession). <b>nt:</b> 18.5 Mw 577 m 2.9 Mw 106 m w station (new) 0.6 Mw

Country:	Province / Canton:		Name of the project:		
Italy	Different places	Different places		E - 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 <sub>2</sub> OICE - Certification for HydrO:
Slovenia	Different places	Improving Clean Energy
Figures		

-igures:



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



Country:	Province / Car	nton:	Name of t	he project:		
Italy	Different places	S	Italy and S	lovenia: CH <sub>2</sub> OICE	- Certification for HydrO:	
Slovenia	Different places	S	Improving	Clean Energy		
	Fig1 Sharawan di A Schaption Talawan 2 Common Schaption Schapting Schapting	der scheme	e © Enel S.p.A.			
Remarks:						
Status:	🗌 Idea 🛛 🛛	Project	Realized	Enacted		
Milestones:						
Links:						

## 4. PRINCIPALITY OF LIECHTENSTEIN

Country:	Province / Canton:	on: Name of the project:				
Liechtenstein		Small syster	Small hydropower plants on drinking water supply systems			
Description:	In 2009 in Liechtenstein the systems, producing annuall plant of this type was being	there were seven small hydropower plants on drinking water supp Jally a total amount of 2.5 Mio KWh of renewable energy. A furth ng realised in 2010.				
Method:						
Criteria:						
Results:						
Figures:						
	Trinkwasser-Kraftwerke	in Liechtenstei	n produziere	en naturem	ade 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 Wissa Stä, Plankon	2007	42	94	100'000	
	Wisseler Quellen, Schaan	2008	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 k (durchschnittlicher Stromverbra	<b>cönnen zirka 550 E</b> uch eines Einfamilie	<b>nfamilienhäus</b> nhauses 5'000	<b>er mit Strom</b> kWh/Jahr)	versorgt werden.	
Remarks:						
Status:	🗌 Idea 🛛 Project	🛛 Realized	🗌 Er	nacted		
Milestones:						
Linko	Example: The hydropowe	er plant on the o	Irinking wat	er supply s	system of	
LIIIKS.						

Country:	Province / Ca	nton:	Name of the project:			
Switzerland	Canton of Frib	ourg	Evaluation and of the Canton o	management of the hydroelectric potential f 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 evaluati exclusion criteria and on a multi-criteria evaluation is under development. This n evaluation of applications by a four-step approach:			ded and an evaluation method based on development. This method will allow for		
	<ol> <li>Evaluation of the water bodies: Identification of exclusion areas (exclusion criteria) a evaluation of the hydroelectric potential of the remaining water bodies</li> <li>Preliminary project analysis (feasibility): Multi-criteria analysis of the projects (evalu criteria) and classification into favourable, favourable under conditions, and not favourable</li> <li>Concession project: Evaluation of the preliminary analysis and technical reports of the projects. Definition and designation of specific conditions.</li> </ol>					
Criteria:	Exclusion and identification o are used for th	evaluation criteria are f river stretches where le comparison of differ	defined for a range hydroelectric util ent projects. The	ge of themes. Exclusion criteria allow the lisation will be excluded. Evaluation criteria 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 (gr zones S1,S2)	roundwater protection	Dilution of effluents of wastewater treatment plants		
	Morphology	Revitalised river stretches; ri revitalised.	ver stretches to be	Influence on bed-load transport; Eco-morphology of the river stretch; Respect of river space; Influence on river management		
	Biotopes	National biotopes; Seriously plant populations	threatened animal or	Natural reserves; Cantonal or local biotopes; threatened animal or plant populations		
	Fish	Nationally inventoried spawr	ning areas	Free migration; threatened species; Fish yields; Fish biodiversity		
	Landscape	National landscapes, sites a Rarity of the site	nd monuments;	Natural parks		
	Hydroelectric potential	Energy efficiency: Recupera used for the construction of < 5 years; Efficiency > 75%; kW/m	tion of the energy the installation within Specific power < 0.1	Efficient site use		
Results:	<ul> <li>Results from this method will be integrated into the following instruments:</li> <li>integrated in the cantonal master plan (binding for the administration)</li> <li>Maps indicating river stretches excluded from hydropower use and the hydroelectric potential for other stretches</li> <li>Classification of the projects into favourable, favourable under conditions (like "naturmade star") and not favourable.</li> </ul>					

## 5. SWITZERLAND

Figures:

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

Remarks:					
Status:	🗌 Idea	⊠ Project	Realized	Enacted	
Milestones:	Begin 2010:Development of the methodologySpring 2010:Validation of the methodology with the 10 applications				
Links:	http://admin.t	r.ch/spc/fr/pub/	lce.htm		

Country:	Province / C	anton:	Name of the project:				
Switzerland			Water-Agenda 21: Working group "Dialogue Hydropower"				
Description:	Water-Ageno together the network is to	la 21 ( <u>www.wa21.ch</u> ) most important actors support the actors in	) is a national platform in the form of an association, bringing is of the water resources management sector. The goal of this in providing answers to the major challenges.				
	One of the challenges is the development of hydropower use as a renewable, almost emission source of energy, frequently conflicting with the interests of water protection. In order to find protections to this conflict of interests, Water-Agenda 21 founded the working group "Dialogue Hydropower", bringing together stakeholders from both, the energy and the environmental signational and cantonal energy and environment administrations, hydropower representatives 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 with hydropower related conflicts between the use of renewable energy and the p aquatic ecosystems and landscapes.						
	The strategic	g group "dialogue hydropower" are:					
	<ul> <li>Imp</li> <li>Esta</li> <li>prot</li> <li>Dev</li> </ul>	rove the information exchange between the stakeholders. ablish a solution-oriented dialogue between the stakeholders and develop a common olem understanding relop, initiate and work on approaches for solutions.					
	To that end, the conflicting domains were identified and the general conditions allowing a "dialog hydropower" were established. These are:						
	<ul><li>Nee</li><li>Solu</li><li>Foc</li><li>Estate</li></ul>	ed of continuity and a ution-oriented approa us on macro-econom ablish and supervise	a certain binding character of the work ach: fair and transparent conflict resolution nic considerations, not on business/commercial aspects 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						
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 09.03.2009 27.04.2009	Foundation of the v Expert conference, Seminar "How to de protection interests'	working group "dialogue hydropower" "Hydro peaking - conflicts between power industry and ecology" eal with applications for hydropower – weighing of use and "				
	Oct. 2009 09.11.2009 2010	Evaluation method Expert conference installations – Ideas Developing a positio	I for the classification of river stretches – Final report e "cost-covering feed-in remuneration and new hydropower s for the spatial coordination" ion paper on "Hydropower use in Switzerland in 2030"				
Links:	Working grou Classificatior http://www.w	up "dialogue hydropo n of river stretches: a21.ch/index.php?se	wer": http://www.wa21.ch/index.php?page=213 ection=media9&path=/media/archive9/D_Wasserkraftnutzung/				

Country:	Province / Canton:	Name of th	e project:
Switzerland	Canton of Valais	Small Hydr of Troistorr	opower plant– Drinking water supply ents
Description:	This small hydropower plan the Canton of Valais, Switze Troistorrents and works on the surge tank, as a pressu destruction by-pass, guarar the case when the flow rate equipment has been manuf the site. Electricity from this distribution grid. Regarding to avoid any negative impact	is located on the territory of the land. The installation is set on the regulator device. The installation eeing the water supply whenever is insufficient, or during the revision ctured by a SME of 35 employe completely automatic power plan he drinking water quality, rigorou	municipality of Troistorrents, in he drinking water network of een the catchment chamber and on includes also an energy er the turbine stops. This may be ion of the power group. The es, located at 55 kilometers from ht is delivered into the local us specifications were met so as
Technical data:	Pelton turbine with one nozNet head:24Maximal discharge:33Installed capacity:73Output:23	e; Vertical axis 2.3 m I/s kW )'000 kWh/year	
Environmental Measures:	<ul> <li>The plant is set on a drir already built and that the (no need of fish ladders)</li> <li>As the plant is located in</li> </ul>	ing water network, which implie power plant operation does not han a usual drinking water netwo	s that the infrastructure was imply more environmental impact rork. al effort has been made to
	integrate the power plan different from a tradition	to the landscape. Looking from chalet.	outside, nothing appears to be
	<ul> <li>Because of nearby hous only when the plant door</li> </ul>	ng, a low ambient noise was req s open.	uired. The generator can be heard
	<ul> <li>The power plant is set in network and extracts en</li> </ul>	he charge chamber that provide gy that was previously wasted t	es the pressure in the water supply hrough a pressure reducer.
	<ul> <li>Energy is generated with CO<sub>2</sub> emissions reduction</li> </ul>	almost no environmental impact of 110 t per year.	which may be expressed in a
Figures:	The small hydropower plant of	Troistorrents. @MHyLab	75 kW power group. @ MHyLab
Remarks:	Owner, contractor and oper Manufacturer:	tor: Municipality of Troistorren ELSA SA, Sion, Switzerlan Switzerland : hydraulic des	ts, Valais, Switzerland nd : mechanical design; MHyLab, ign
Status:	🗌 Idea 👘 Proje	t 🛛 Realized	Enacted
Milestones:	Year of commissioning:	1998-1999	
Sources:	© MHyLab: <u>http://www.mhylab</u> © ESHA: http://www.esha.be	h/pages/pdf/despro6 Troistorrents.pd	treations/publications/Brochure_EN.pdf

Country:	Province / Canton:	Name of the	ne project:	
Switzerland	Canton of St. Gallen	Small hydr	opower station Buchho	lz
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.			
	safety of the downstream rehabilitate it and to integ powerhouse and a fish la	n municipalities. Instead of grate a small hydropower in dder are directly integrate	partly demolishing the nstallation. The dam is d in the dam.	e dam, it was decided to s reinforced and the
Technical data:	Two propeller turbines wi Effective head: Nominal discharge:	th 5 rotors 14.5 m 1.35 m <sup>3</sup> /s		
	Output: Duration of concession:	680'000 kWh/year 60 years		
Environmental Measures:	<ul> <li>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.</li> </ul>			
	<ul> <li>If the dam had been d rehabilitation of the data</li> </ul>	lestroyed, the wetland ups am allowed conservation o	tream would have been f this wetland of natio	en lost forever. The nal interest.
	<ul> <li>Power production is lo powerhouse) and no or</li> </ul>	ocated inside the dam; the downstream stretch of resi	refore no additional st dual flow is created.	ructures had to be built (e.g.
Results	The project is environmen environmental protection from the Swiss Federal C	ntally friendly and was wel associations. Because of office of Energy (SFOE).	l accepted by the mur those reasons this pro	nicipalities and the bject received special funding
Figures:	The entire installation © S	FFOE	Schema of the fish l	adder with a water gate
			© Naturschutzvereir	nside the dam. 1 Flawil
Remarks:	Operator: Glattstro Constructor: Entegra	om Buchholz AG Wasserkraft AG		
Status:	🗌 Idea 🛛 🗌 Projec	t 🛛 Realized	Enacted	□
Milestones:	Initial construction of dam	n: 1892		
	Year of rehabilitation:	2006		
Sources:	© Entegra AG: http://www.ente © SFOE: http://www.bfe.admin	gra.ch/entegraweb/index.php?op .ch/php/modules/enet/streamfile.	tion=com_content&view=a php?file=0000000009164.pd	rticle&id=8&Itemid=17 f&name=000000270024.pdf

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

Country:	Province / Canton:		N	ame of	the project:	
Switzerland	Canton of Valais		S	mall hyc etwork -	lropower plant usin Le Châble - Profay	g a wastewater / 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 spe clean the turbine, su Effective head: Nominal discharge: Installed capacity: Output: Investments:	ecifications are: no jet c ppression of obstacles 449 m 0.100 m³/s 380 kW 825'000 kWh/yea 375'000 €	deflectors, no gui and zones where r	ding sta e the wa	rs for the nozzles, astes can accumul	manholes to ate.
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	P to	STP	Vastewater network stewater treatment	A, from collection plant @ MHyLa
Remarks:	Operator: Manufacturer :	Services Industriels Gasa SA, Switzerla design	de Bagnes and : mechanical	design;	MHyLab, Switzer	land : hydrauli
Status:	🗌 Idea	Project	🛛 Re	alized	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 establish provide a decision-making aid based o utilisation and protection interests, est view.	Canton of Berne established a strategy "Water Use". The aim is to lecision-making aid based on a transparent and coherent weighting of and protection interests, established from a strategic, cantonal point of		
Method: In addition to the legal regulations for hydropower the Canton of Berne lays down that for a deliberate concessions certain requirements for prioritisation prioritisation of larger plants have to be respected. making aids are provided:		hydropower plants, the strategy "Water Use" of r a deliberate and selective granting of prioritisation of suitable locations and e respected. Hence, the following decision		
	<ul> <li>A map representing the appropr hydropower use:</li> </ul>	iateness of the water bodies for		
	As base information a "map of actu for individual water bodies the hydr as the importance as waters suitab basis, a map representing the "hyd created. It details the appropriaten exploitation according to the follow	ual conditions" has been produced indicating ropower potential, the ecological value as well ble to sustain natural fish populations. On this Iropower exploitation categories" has been ess of the water bodies for hydropower ing classes:		
	Green: Water bodies where, und hydropower is realisable Yellow: Water bodies where hyd requirements have to be Red: Water bodies where hyd protection prevails.	der observance of the legal requirements, ropower is realisable but additional met. ropower is not realisable. Interest for		
	<ul> <li>Sustainability evaluation of the i</li> </ul>	ndividual installation:		
	For hydropower installations (new apart from the aspects already me be realised in an early planning ph considers further aspects of societ criteria and indicators.	plants but also already existing ones) – and ntioned - an evaluation of sustainability has to ase (preliminary study). This evaluation y, economy and environment based on 22		
	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:	<ul> <li>Aspects specific to water bodies</li> </ul>	and corresponding criteria:		
	Theoretical hydro-electric potential based on hydraulic head and avera	, calculated for 50 m river stretches being age monthly runoff.		
	Ecological importance, being base Water quality (10%), Rarity value o morphology/structure (20%) (perce	d on the following criteria: Hydrology (20%), of the water body (50%) and entages indicate the relative weight)		

<b>Country:</b> Switzerland	Province / Canton: Canton of Berne	Name of the project: Strategy "Water Use" of the Canton of Berne		
	Importance as waters suitable to s following criteria: priority species ( (20%), importance as habitat (20%	ustain natural fish populations, based on the 30%); species spectrum (20%); fish water and potential for rehabilitation (10%).		
	<ul> <li>Installation specific aspects and corresponding criteria:</li> </ul>			
	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 essentia categories" and a sheet for the sustair	lly the map of " hydropower exploitation nability 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 l	avdronower exploitation is possible because of		

prevailing conservation objectives. Figures: Bestehende Nutzung Zielbereich Kriterien Nutzung Erschwert reali imtypische ge Keine Moorlandschaft ebensraum, ielfalt (Fische Schützenswerte me nach NHV UMWELT Natur und Land-schaft Klima Anteil Stromproduktion Oktober bis u mit März (Winterstrom) an der Jahres produktion Jahreszeitliche Schr gen in der Produktio Energiequalität n, Ö her H IDTSCUAET Volksein Arbeitsmarkt Wirtscha produktie Lärm und Wohr Lärmbel Lokale Beteiligung an Ar Partizipa GESELLSCHAFT Landschafts- und Ort Kultur Fischerei he Nutzung Freizeit ssung der Nutzung als Kanu-recke Kanusport Beei Regio Überregio Map "hydropower exploitation categories ". @ Bern - AWA Evaluation of sustainability © Bern - AWA In public Status: 🗌 Idea Project Realized Enacted consultation **Milestones:** 2009 - Elaboration of the strategy "Water Use" Mid January - mid march 2010 - Public participation and consultation process

Council

Links:

Along 440 km (classified as "red") no hydropower exploitation is possible because of

December 2010 - Decision on the water-strategy by the members of the Cantonal

© 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

#### 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	R 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	http://www.direttivaacque.minambiente.it/distretti_idrografici.html
Ministry of the Environment, Land and Sea – River Basin Management Plans links (only in Italian)	http://www.direttivaacque.minambiente.it/distretti idrografici.html

#### SWITZERLAND

http://www.bafu.admin.ch/UD-1037-D
http://www.bfe.admin.ch/themen/00490/00491/00493/index.html?lang=en
www.smallyhydro.ch
http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en
http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en&dossier_id=03892
http://www.bfe.admin.ch/kleinwasserkraft/03870/03874/index.html?lang=en&dossier_id=03891
http://www.bfe.admin.ch/kleinwasserkraft/03875/03877/index.html?lang=en&dossier_id=04174
http://www.bfe.admin.ch/infrastrukturanlagen/index.html?lang=en
http://www.bfe.admin.ch/infrastrukturanlagen/index.html?lang=en&dossier_id=02222
http://www.bfe.admin.ch/forschungwasserkraft/index.html?lang=en
http://www.bfe.admin.ch/themen/00612/02073/index.html?lang=en
http://www.bafu.admin.ch/gewaesserschutz/01284/index.html?lang=en
http://www.bafu.admin.ch/publikationen/publikation/00402/index.html?lang=de
http://www.bafu.admin.ch/publikationen/publikation/01071/index.html?lang=de
http://www.kwkatlas.ch/
http://www.repowermap.org/index.php
http://www.netzwerkwasser.ch/aktivitaeten/projekte/aktuelle-projekte/wasserkraftpotential/
http://www.bfe.admin.ch/energie/00458/00597/index.html?lang=en
www.naturemade.ch
http://www.greenhydro.ch/level0/index_e.html
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_ho
	w 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	http://www.sepa.org.uk/about_us/idoc.ashx?docid=fb2a7978-95c1-49e1-a78a-
schemes - Draft for public consultation	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