



R4.1 - Database and report on the Alpine Space Region's needs regarding the water-energy nexus

Work Package 4

FINAL VERSION

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1. Introduction

Within the objective of increasing the share of renewable energy sources, hydropower (HP) is still considered to be the most important one in the European Alps. On the other hand, it is proven that HP production creates serious environmental impacts, e.g. affecting the morphological character, the hydrological regime and consequently the biota of the aquatic ecosystem. This mostly goes along with a deterioration of the ecological status of water bodies and is contradictory to the objectives of the EU Water Framework Directive (WFD). These recognized conflicting issues have been addressed, analysed and discussed within different activities/projects in the past years.

However, there is still a need to harmonize activities and decision making between objectives of water resources management, hydropower production and aquatic ecosystem conservation, which is hereafter termed as the **WATER-ENERGY NEXUS**.

To provide an overview of past and present attempts on this matter and to propose future activities in the water-energy nexus with the focus on the Alpine Space Region, the project **Alpine space In Movement - targeted to water and energy capitalization (AIM)**, was granted by the Alpine Space Programme (ASP). AIM should capitalize the achievements of the numerous ASP projects. Furthermore, on the basis of stakeholder discussions and the overview of relevant documents on EU, regional and local levels, the goal of the AIM project is to produce **guidelines for the Alpine Space (AS) transnational programme and the next programming period 2014-2020**. The core issue is to define **needs and propose future activities to improve comprehensive planning, cooperation among institutions and commonly agreed decision making for the field of the water-energy nexus**.

To support the elaboration of the above-mentioned guidelines for the ASP programming period 2014-2020 in the terms of the water-energy nexus, the following activities/deliverables were proposed and approved within Work Package 4 of AIM project:

- **R4.1 Database and report on the ASR needs regarding “renewable energy, resource efficiency & ecosystem management” or “water-energy nexus”**.
- R4.2 Informative factsheet table of selected project results and achievements - with the most important tools & instruments available to stakeholders.
- R4.3 Evaluation and assessment of accomplished and foreseen results of selected projects.
- R4.4 Report on project results in terms of economic valorization of ecosystem services.
- R4.5 Database/report on weak points from the interconnection between selected project results and ASR targets.

Relevant documents were selected and reviewed for the elaboration of the deliverable **4.1 Database and report on the ASR needs regarding “renewable energy, resource efficiency & ecosystem management” or “water-energy nexus”**. The process and outcomes are presented in the following section.

2. Database and report on the Alpine Space Region’s needs

For the purposes of the task, relevant documents were selected and stakeholder discussions were organized. When selecting relevant documents, three spatial levels (EU, national and regional) and their relevancy to the **water-energy nexus** were considered. In total, 34 documents (directives, legislations, blueprints, plans, guidelines, reports) were reviewed (see Reference section and **WP4_R4.1 - Factsheets table of selected documents.xlsx**). Figure 1 presents the main documents considered, listed according to their spatial level.

EU level	Regional level	National level
<ul style="list-style-type: none"> • Directives (Habitats, WFD, RES) • Blueprint to Safeguard Europe's Water Resources - assessment of status and pressures • EU strategy for the Alpine Region (in progress) • Energy Roadmap 2050 • Energy 2020 - A strategy for competitive, sustainable and secure energy • Horizon 2020 • ... 	<ul style="list-style-type: none"> • Strategy Development for the Alpine Space - Final Report • Environmental report of Strategic Environmental Assessment • Common guidelines for the use of small hydropower in the alpine region • Guiding Principles on Sustainable Hydropower Development in the Danube Basin • Alpine Convention - Energy Protocol (Energy platform) • ... 	<ul style="list-style-type: none"> • National Renewable Action Plans for 5 Alpine countries • Reports on the implementation of the Water Framework Directive River Basin Management Plans for 5 Alpine countries

Fig.1: The documents considered on the basis of relevancy to the water-energy nexus

To verify a proper selection of relevant documents, a meta-analysis of these documents with the help of “tag clouds”, i.e. the frequency of words appearing in these documents, was performed (Havre et al. 2002). In Fig.2 it can be observed that selected documents are well-balanced in terms of the **water-energy nexus** since those three words are the most frequent ones in the pool of selected documents.

The documents were analysed according to the following priority topics:

- Relation to water and ecosystem management issues.
- Relation to renewable energy production (focus on hydropower production).
- Relation to the water-energy nexus.

In this document the discussed environmental issues are: Soil, Water, Climate/Air, Fauna/Flora/Biodiversity, Landscape, Human Health/Population and Material Assets/Cultural Heritage. In the context of renewable energy with a focus on hydropower, related environmental issues are recognized with impact assessment (scope of the impact and directions how to reduce the impact are given):

- **Water:** Under consideration of proper location, only slight to medium negative impacts to be expected, implementation of possible mitigation measures reduces impacts to slight negative.
- **Fauna, Flora and Biodiversity:** Depending on the measures, location (including former land use) and technical solution (including mitigation measures), slight negative or medium negative impacts are likely.
- **Landscape:** Slight to medium negative impacts. Careful selection of location as possible form of mitigation measure reduces the impact.

Moreover, when cumulative impacts of all considered programme objectives are assessed, the same slight to medium negative impacts are recognized as for the above-mentioned environmental issues.

To reduce and mitigate the impacts of hydropower implementation/production as part of the 4e.1 objective, the Environmental Report foresees the following possible strategies and actions (Mitigation and Compensatory Measures):

- **Green innovation**, sustainable spatial planning including **sparing greenfield development**, hence a focus on **brownfield development** (e.g. already deteriorated areas/river sections which can actually benefit from the implementation of mitigation and compensation measures).
- Special attention needs to be paid to **avoid the construction in sensitive areas**; the planning should be **concentrated on and in combination with the existing infrastructure**. This relates to a **thoughtful selection of the type and location** of these installations with special regard to rare habitats and endangered species.
- Special attention should be paid to the negative consequences resulting from hydropower. In general, mitigation measures cannot fully compensate the negative impacts resulting from the interference in water balance and natural dynamics of water bodies.

In general (as stated in the Environmental Report), amelioration of the impacts of the objectives on environmental issues can be achieved by paying special attention to the selection of:

- **The beneficiaries and target groups** – to ensure that the projects will focus on innovation and knowledge exchange and not on building measures.
- **The indicative actions** – strategically guiding the projects.
- **The target area** – to ensure that sensitive areas are excluded, if the objective is likely to cause negative impacts on environmental issues.

On the Alpine Space Region level, supporting guidelines for strategic planning in terms of the water-energy nexus are the **Common guidelines on the use of small hydropower** (no. 16) approved by the XI Alpine Conference in 2011, organized by the Water Management Platform of the Alpine Convention. In 2013, a similar document was also

approved by the International Commission for the Protection of the Danube River (ICPDR) for the Danube basin (**Guiding Principles on Sustainable Hydropower Development in the Danube Basin**). The latter does not distinguish between small and large HP plants.

The process of the implementation of approaches proposed and described in the above-mentioned guidelines (or similar approaches) has already started in some Alpine countries. A clear need for elaboration and adoption of a sort of a Masterplan that considers and harmonizes objectives in the field of water and aquatic ecosystem issues and in the field of hydropower implementation is recognized on the national level. Elaboration and adoption of such a Masterplan would also support decision making when exemptions to the environmental objectives (Article 4.7 of the WFD) are argued and justified. The basis for such a process is the Common Implementation Strategy (CIS) for the WFD (Guidance document on exemptions to the environmental objectives no. 20).

To support the elaboration and adoption of such a Masterplan, the activities or needs from AIM's perspective are as follows:

- Improved involvement and full commitment of decision makers, who are competent in implementing the objectives in the field of renewable energy production with a focus on hydropower, water resources management and conservation of (aquatic) ecosystems and in the process of analysis, assessment and common decision making.
- More detailed preparation of criteria sets, their evaluation and importance determination as well as supporting data acquisition with establishment of appropriate geographical databases.
- Development and application of a more detailed methodology that is objective, repeatable and applicable. It is also important to establish comprehensive models, allowing also instant upgrade input (new acquisitions, inclusion of new data, changes in relevancy, etc.).
- A need to test and prepare more detailed support to the process of implementation of the mentioned CIS in ASR is recognized.

Being aware of the importance of the energy demands and the impacts, which energy infrastructures can have on the Alps, the Energy Platform was set up by ministers at the XII Alpine Conference. The platform works based on the **Energy Protocol** (reference no. 34) of the Alpine Convention but also on the climate and energy strategies on national, regional and local levels. Energy-intensive sectors, such as transport and tourism, will be dealt with as a priority, in accordance with the objectives of the current Multiannual Programme of the Alpine Convention 2011-2016 (MAP 2011-2016), which provides the strategic framework to challenge globalization, including international economic competition, the consequences of climate change, demographic changes, sourcing energy supplies, managing water resources and access to the transit routes. Furthermore, the platform shall also contribute to the implementation of the Action Plan on Climate Change in the Alps, which focuses on the promotion of energy efficiency and climate-friendly energies. One of the objectives stated in the Protocol is also the **“harmonization of energy-saving plans with plans for the general development of the Alpine region”**.

2.2 EU level

On the EU level, three main legislative documents feed into the water & energy nexus and establish the framework for top-down activities on national and regional levels of activities:

- **Habitats Directive** (COUNCIL DIRECTIVE 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, no. 1),
- **Water Framework Directive** (DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a framework for community action in the field of water policy, no. 2),
- **RES Directive** (DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, no. 3).

Based on an extensive evaluation of the existing policies on the EU level, the **Blueprint to Safeguard Europe's Water Resources** (reference no. 7) and the accompanying **Impact Assessment Report** (reference no. 6) were prepared by the EU Commission in 2012. The Blueprint aims to tackle the obstacles which hamper action to safeguard Europe's water resources. It is based on a wealth of information and analysis, including the EEA State of Water report (reference no. 29), the Member States River Basin Management Plans (Report on relevant RBMPs, references no. 24-28) and also the Review of the Policy on Water Scarcity and Droughts and the Fitness Check of EU Freshwater Policy. Moreover, the Blueprint takes into consideration an extensive public consultation, both in the framework of its development and under the Fitness Check, where the general public, stakeholders, Member States as well as other EU institutions and bodies were involved.

The Blueprint recognizes **that the aquatic environments differ greatly across the EU and therefore does not propose any “one size fits all” solution, in line with the principle of subsidiarity.** It emphasizes **key themes, which include: improving land use, addressing water pollution, increasing water efficiency and resilience, and improving governance by those involved in managing water resources.**

The accompanying Impact Assessment Report (reference no. 6) identifies water management problems relevant at the EU level and specific objectives which the Blueprint should address:

- **Increasing the use of economic instruments for a better allocation of resources and internalization of external costs.**
- **Fostering integration of water concerns into sector policies by providing specific support to water management measures.**
- **Achieving a more efficient water governance and effective working relationships between institutions, fully integrating water quality, quantity and hydromorphology concerns in water management.**

- **Improving knowledge and tools available to water managers, enabling effective decision making and reducing administrative burdens.**

Moreover, the EU Commission elaborated the report **Energy 2020 - A strategy for competitive, sustainable and secure energy** (reference no. 31), focusing on five priorities and addressing more specific actions:

- Achieving an energy-efficient Europe.
- Building a truly pan-European integrated energy market.
- Empowering consumers and achieving the highest level of safety and security.
- Extending Europe's leadership in energy technology and innovation.
- Strengthening the external dimension of the EU energy market.

Under the priority “Extending Europe's leadership in energy technology and innovation” – Action 2, the ambition of the EU is to re-establish Europe’s leadership on electricity storage where **hydro capacity** is set out. Pumped hydro storage plants are proposed for its versatility. Storage ensures balancing the demand and supply due to the strong variability of wind and solar power production, voltage and frequency regulation, peak power generation, participation in the balancing market, energy time shifting, etc. However pumped hydro storage plants affect watercourses with hydropeaking and hamper reaching the WFD objectives, as the same harmonization approach as for other hydropower generation planning must be applied.

Another document, also important from the perspective of the energy and decarbonization objective, is the **Energy Roadmap 2050** (no. 30). Responding to a request from the European Council, the European Commission explores the challenges posed by delivering the EU's decarbonization objective while, at the same time, ensuring security of energy supply and competitiveness.

The Blueprint time horizon is closely related to the **EU 2020 Strategy** (reference no. 31) and, in particular, to the **Roadmap to a Resource Efficient Europe** (EC 2011). The Blueprint is the water milestone on that Roadmap. However, the analysis underpinning the Blueprint covers a time span up to 2050, and is expected to drive EU water policy over the long term. Based on the related objectives and a more detailed overview, the following needs for the Alpine Space Region and its countries in the water & energy nexus are recognized:

- Improvement of economic analysis and the assessment of costs and benefits with increase in use of economic instruments in the field of ecosystem services and the “user pays” principle when multipurpose effects of projects are recognized.
- Knowledge exchange in the field of Strategic Environmental Assessment as an addition to the Environmental Impact Assessments (EIA) for specific projects to support elaboration, justification (e.g. assessment schemes according to the Article 4.7, WFD) and adoption of national Masterplans, which would harmonize the objectives in the fields of aquatic ecosystem conservation and hydropower production.
- Harmonization and standardization of approaches for mitigation measures planning (fish passes, restoration/improvement of flow conditions of

watercourses affected by water abstractions, hydro-peaking mitigation, etc.) and related efficiency assessment.

- Definition of common policies valid for the entire ASR, related to water management and hydropower projects including the role of water storage (hydro capacity), where also adaptation to climate change and energy-ecosystem sustainability is incorporated.

In order to achieve and assess the stated objectives to re-establish Europe's leadership on hydro capacity storage (Energy 2020 - A strategy for competitive, sustainable and secure energy), the following steps are foreseen:

- Research to improve the efficiency of systems with reversible variable speed machines (pumping and hydropower electricity production mode).
- Lowering the administrative barriers to encourage the planning and building of new storage capacities, adjusting the legislative framework to stimulate higher investments to better integrate the storage into the grid and compensate with storage incentives to ensure medium-term predictability in the investment and financial conditions, with a clear and solid legal supporting framework.
- Inclusion into the foreseen Masterplan to harmonize these objectives with water and aquatic ecosystem-related issues.

2.3 National level

The most relevant elaborated/adopted documents in the Alpine countries on the national level are the National Renewable Energy Action Plans (NREAP, references no. 19-23), which follow the national plans increasing RES share. Moreover, the River Basin Management Plans (RBMPs) represent the direct implementation measures of the WFD, focusing on the maintenance and improvement of the good status of Europe's aquatic ecosystems. On the EU level (EU Commission), an overview and reports on elaborated RBMPs have been elaborated (references no. 24-28). Since these reports also provide the recognition of weaknesses and recommendations, they were used in AIM to determine the needs in terms of water-energy nexus.

The most frequent recommendations to meet the WFD objectives given in the reports are:

- Foresee the mitigation of hydromorphological pressures by an ensured minimum ecological flow, operational modifications for hydropeaking, passages for aquatic organisms, bypass channels, and habitat restoration.
- Exemptions based on Article 4(4) and Article 4(5) must be thoroughly justified. The use of exemptions under Article 4(7) should be based on a thorough assessment of all the steps requested by the WFD. All conditions for the application of Article 4(7) in individual projects must be included and justified in the RBMPs as early as possible in the project-planning circle.

From the point of security of energy supply, all the considered NREAPs include activities

in the field of improvement of hydro storage capacities (this need is already pointed out in the previous paragraph on the EU level). However, the NREAPs do not directly deal with environmental issues, which are the most influential issues related to hydropower production planning (and hydro storage capacities planning). The NREAPs only foresee that environmental issues and protection must be taken into account when the “energy mix“ is planned, evaluated and justified, and foresee more consistent use of the Environmental Impact Assessment legislative.

To support the harmonization of water resource management, hydropower production and aquatic ecosystem conservation objectives and to improve their implementation in the European Alps, some important conclusions and needs can be highlighted:

- Processes to argue and justify exemptions under Articles 4(4) – 4(6) are not acceptable in accordance with process requirements. For example, a sound economic analysis in order to identify cost-effective programmes of measures and to properly justify the use of exemptions according to the WFD is missing and all conditions for the application of Article 4(7) in individual projects must be included and justified in the RBMPs - as early in the project planning as possible (application of relevant Common Implementation Strategy documents).
- The cost recovery should address a broad range of water services, including impoundments, abstraction, storage, etc. The cost recovery should be transparently presented for all relevant user sectors, and environment and resource costs should be included in the costs recovered. Information should also be provided on the incentive function of water pricing for all water services, with the aim of ensuring an efficient use of water. Information on how the polluter pays principle has been taken into account should be provided in the RBMPs.
- Improvement of communication and collaboration between competent authorities/decision makers for the implementation of the WFD, Habitat and RES Directives is required.

3. References

3.1 Relevant documentation

- [1] EU.1992.COUNCIL DIRECTIVE 92/43/EEC on the conservation of natural habitats and of wild fauna and flora - EU Directive
- [2] EU.2000.DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a framework for Community action in the field of water policy - EU Directive
- [3] EU.2009.DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC - EU Directive
- [4] EU.in progress.EU strategy for the Alpine Region - EUSALP – Guidance
- [5] EU.2012.Science for Water - JRC thematic report – Report
- [6] EU.2012.COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT – Report
- [7] EU.2012.Blueprint to Safeguard Europe's Water Resources – Guidance
- [8] EU.2009.COMMISSION DECISION on establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC of the European Parliament and of the Council – Guidance
- [9] EU.in progress. Call texts & focus of HORIZON 2020 - Research programme
- [10] EU.2012.IMPACT ASSESSMENT Accompanying the document Proposal for a Directive of the European Parliament and of the Council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources - Report
- [11] Region. 2013. Strategy Development for the Alpine Space - Final Report – Report
- [12] Region. 2013. ENVIRONMENTAL REPORT OF THE STRATEGIC ENVIRONMENTAL ASSESSMENT OF THE "ALPINE SPACE" OPERATIONAL PROGRAMME – Report
- [13] Region. 2013. Guiding Principles on Sustainable Hydropower Development in the Danube Basin – Report
- [14] Region. in progress. SEE Capitalization Strategy – Report
- [15] Region.2009.Alpine Convention - WATER AND WATER MANAGEMENT ISSUES - Report
- [16] Region.2011.Alpine Convention - COMMON GUIDELINES FOR THE USE OF SMALL HYDROPOWER IN THE ALPINE REGION – Guidance
- [17] Region.2011.Alpine Convention - TOWARDS DECARBONISING THE ALPS – Report



- [18] Region.in progress.EU Strategy for the Danube Region - Flagship cluster fiche
- [19] National.2010.National Renewable Action Plan for Austria - Action Plan
- [20] National.2010.National Renewable Action Plan for France - Action Plan
- [21] National.2010.National Renewable Energy Action Plan for Germany - Action Plan
- [22] National.2010.National Renewable Action Plan for Italy - Action Plan
- [23] National.2010.National Renewable Action Plan for Slovenia - Action Plan
- [24] National.2012.Report on the implementation of the Water Framework Directive River Basin Management Plans for Austria – Report
- [25] National.2012.Report on the implementation of the Water Framework Directive River Basin Management Plans for France – Report
- [26] National.2012.Report on the implementation of the Water Framework Directive River Basin Management Plans for Germany – Report
- [27] National.2012.Report on the implementation of the Water Framework Directive River Basin Management Plans for Italy – Report
- [28] National.2012.Report on the implementation of the Water Framework Directive River Basin Management Plans for Slovenia – Report
- [29] EU.2012.European waters - assessment of status and pressures – Report
- [30] EU.2011.Energy Roadmap 2050 – Report
- [31] EU.2010.Energy 2020 - A strategy for competitive, sustainable and secure energy – Report
- [32] EU.2012.Bonn2011 Conference: The Water, Energy and Food Security Nexus – Solutions for a Green Economy – Synopsis
- [33] EU.2011.Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States – Report
- [34] Region.2005 (2012).Alpine Convention - Protocol on the implementation of the Alpine Convention in the field of energy - Energy Protocol (Energy platform) – Platform



3.2 Additional references

Havre S., Elizabeth H., Whitney P., and Nowell L. 2002. ThemeRiver: Visualizing Thematic Changes in Large Document Collections. IEEE, TVCG, vol. 8, no. 1, pp. 9-20.

European Commission. 2011. Roadmap to a Resource Efficient Europe. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

Alpine Convention. 2011. Multiannual Programme for the Alpine Convention 2011-2016 – Foundation Document.



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