R4.2 – Database/informative factsheet of the project results & achievements

Work Package 4

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1. Introduction

Within the objective of increasing the share of renewable energy sources (RES-Directive), hydropower (HP) is still considered to be the most important source in the European Alps. On the other hand, it is proven that HP water use creates serious environmental impacts. Hydropower production influences and affects the morphological character, the hydrological regime and consequently negatively affects the aquatic biota of the aquatic ecosystem, which in many cases leads to a deterioration of the ecological status of water bodies, contradictory to the objectives of the EU Water Framework Directive (WFD). These recognized conflicting issues have been addressed in various projects and activities across the Alps in the past years. Nevertheless, there is still a need to harmonize objectives of water resources management, hydropower production and aquatic ecosystem conservation, 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 a 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 and cooperation among institutions as well as commonly agreed decision making tools for the water-energy nexus.**

To support the elaboration of the above-mentioned guidelines for the ASP programming period 2014-2020 in terms of the water-energy nexus, the following activities/deliverables were proposed and approved within Work Package 4 of the 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's results and ASR targets.

In order to elaborate the deliverable **R4.2 Informative factsheet table of selected project results and achievements - with the most important tools & instruments available to stakeholders**, results and outcomes of selected project were reviewed, which is presented in the following section.

2. Informative factsheet database of the project results and achievements

To track the accomplished results of the Alpine Space Programme projects (2007-2013) in the thematic fields of renewable energy production, water resources management and aquatic ecosystem conservation and to identify the transnational needs of the entire Alpine Space Region, six relevant projects were selected by AIM already at the beginning:

Finished

Alp-Water-Scarce

http://www.alpine-space.eu/projects/projects/detail/Alp-Water-%20Scarce/show/

econnect
Restoring the web of life

http://www.econnectproject.eu/

share

http://www.share-alpinerivers.eu/

In progress

recharge green
BALANCING ALPINE ENERGY AND NATURE

http://www.recharge-green.eu/

SEAPAlps
Sustainable Energy Action Plans

www.seap-alps.eu

SEDALP

http://www.sedalp.eu/

Fig.1: Logos and web page addresses of selected projects with their status

To conduct a review of relevant projects, the following basic data were gathered:

- **General information:** *duration, budget, keywords, short description, partners, pilot areas, results.*
- ***Type of result/project outcome with short description*** *– e.g. guidance, tool, method, etc.*

Information on the project results is given in the Table File attached (***R4.2 - Informative factsheet of selected projects.xlsx***).

On the basis of available documentation presented and accessible online and in downloadable documentation, the following main objectives of the selected projects are recognized:

1. **AlpWaterScarce - Water Management Strategies against Water Scarcity in the Alps:**
   - Support to establish local early warning systems to monitor water scarcity in the Alps. Perennial monitoring and modelling are anchored strongly and actively within a stakeholder forum linked across comparative and contrasting regions across the Alps.
   - Awareness raising and stakeholder interaction to identify directly connected impacts caused by water scarcity events (impacts on current water use, on good ecological status, etc.).
   - Dissemination of results and implementation of new approaches.

2. **ECONNECT - Improving Ecological Connectivity in the Alps - Restoring the Web of Life:**
   - Envision an enduringly restored and maintained ecological continuum (for both, terrestrial and aquatic Alpine ecosystems), consisting of interconnected landscapes across the Alpine Arc region, where biodiversity is conserved for future generations and the resilience of ecological processes is enhanced.
   - Give a direct and major contribution to the implementation of Article 12 of the Nature Conservation Protocol of the Alpine Convention, which encourages the enhancement of ecological connectivity in the Alpine Space.
   - Harmonization of geographical data on ecological and habitat areas across participating countries.
   - Analysis of existing physical and legal barriers for the establishment of ecological corridors.
   - Definition of migration corridors between higher biodiversity areas in the Alps and links to other ecoregions.

3. **SHARE - Sustainable Hydropower in Alpine Rivers Ecosystems:**
   - Development, testing and promotion of a decision support system (DSS) to merge river ecosystems services and hydropower requirements.
   - Development of scientific tools, which are based on multi-criteria analysis methods, adjustable to transnational, national and local norms and carried out by a network of administrators and stakeholders.

4. **recharge.green - Reconciling Renewable Energy Production and Nature in the Alps:**
   - Development of tools and an integrated strategy for renewable energy production, sustainable land use systems as well as the conservation of biodiversity and soil across the Alpine region.
   - Provide support to the implementation of relevant EU directives.
   - Valorization of Alpine biodiversity, land use patterns and related ecosystem services, and modelling of the carrying capacity of the Alpine ecosystems with

respect to all aspects of renewable energy production and also energy consumption.

5. **SEAPAlps - Supporting local authorities in the implementation of Sustainable Energy Action Plans in the Alpine Space Area:**
   - Establishment of a coherent methodological approach for the whole Sustainable Energy Action Plan (SEAP) process (drafting, implementation, monitoring and improvement).
   - Training of the partners and local authorities on how to use the methodology and tools.
   - The review of existing SEAPs and preparation of new SEAPs with the start of its implementation.

6. **SedAlp - Sediment management in Alpine basins - integrating sediment continuum, risk mitigation and hydropower:**
   - Contribute to the integrated management of sediment transport in Alpine river basins directed to an effective reduction of sediment-related risk, while promoting the enhancement of riverine ecosystems and reducing the impacts of hydropower plants (balancing the implementation of EU directives, e.g. RES Directive, Floods Directive and Water Framework Directive).
   - Pilot actions in various representative Alpine river basins of all involved countries.
   - Strategy policy development and implementation actions for the improvement of sediment continuity in Alpine river basins.
   - Development of warning and predictive tools regarding sediment and wood management, including recommendations for hazard mitigation and protection of people.
   - Improving mitigation and management of sediment-related natural hazards (floods and debris flows).

Within the selected projects, several tools, methods and guidance were developed or are under development. For example, within the SHARE project, a **Handbook - A problem-solving approach for sustainable management of hydropower and river ecosystems in the Alps** was elaborated, printed and disseminated among relevant stakeholders. The intention of the handbook was to guide the reader in a simple way through the SHARE methodological approach, and the different tools and resources, which were developed and tested during the SHARE project. The report is a brief hypertext overview conceived as a tool to support sustainable river and hydropower management undertaken by local administrators, public and private consultants as well as other relevant stakeholders.

The following tables give more detailed information on elaborated reports, guidelines, methods and tools of the six projects on the basis of the information available on project web pages and in downloadable documents.

AlpWaterScarce (accomplished results):

Report	Water Management in a Changing Environment - Strategies against Water Scarcity in the Alps - Project Outcomes and Recommendations	This is a common comprehensive report, which summarizes the AlpWaterScarce outputs (developed early warning systems adapted to the challenges at the local level) and recommendations for the Alpine Convention in the field of modelling and determination of ecological flow.
Recommendation	Water Resources Management and Water Scarcity in the Alps - Recommendations for Water Resources Managers and Policy-makers	Recommendations for Water Resources Managers and Policy-makers to preserve the water resources of the Alps for future generations, to meet increasing water demand and to cope with climate change-induced stress on those resources.
Guideline	Monitoring and Modelling of Mountain Water Resources - A short guideline based on the results of Alp-Water-Scarce	The aim is to list the main questions that should be addressed when undertaking both the monitoring and the modelling of the water resources of an Alpine region for the purposes of sustainable water scarcity management. These questions are not fully answered in this booklet; however, complementary references are provided in the text.
Guideline	A climate scenario guideline	Two future time-windows (highly probable case and severe case) that may occur are disscussed for two future time-windows 2040-2060 and 2080-2099, with description how could meteorological forces evolve in these two warmer climate conditions.
Report	Generalization of drought effects on ecosystem goods and services over the Alps provided for AlpWaterScarce - WP7 "Optimal Ecological Discharge"	The report summarizes the most probable consequences of droughts for ecosystem services with a focus on the Alps. The report concentrates on some of the most relevant ecosystem goods and services as agricultural production, forestry, water resources and tourism. For each group of service, a discussion of drought effects worldwide, in Europe and in the Alps is presented. In addition, an overview of some adaptation options is given.
Report	Summary of the stakeholder survey	A stakeholder survey was performed to collect information on the perception of water scarcity (main problems, solutions).
Informatics simulation model/platform	Development of an Early Warning System - Arly Catchment (Haute Savoie, France)	The main aim of establishing this early warning system was to improve long-term water reconciliation. The focus was a proper model development and calibration. In order to improve the descriptions of the various flow components, a process-based model was derived by the EDYTEM laboratory (http://edytem.univ-savoie.fr). The model can be used as a decision support tool for both, short-term management and long-term planning.
Informatics simulation model/platform	Early Warning System for Drinking Water Supply (Province of Carinthia, Austria)	The early warning system is dedicated to ensuring a sustainable drinking water supply. It can be separated into two parts: 1) a scenario catalogue for drought and water scarcity conditions; 2) an estimation tool for drinking water resources.

Informatics simulation model/platform	Early Warning System for the Piave Catchment (Province of Veneto, Italy)	The related purpose helps to prevent user conflicts between hydropower generation and agricultural use. The early warning system for water scarcity uses a methodology consisting of the analysis of the main hydro-meteorological parameters in 9 Alpine sub-catchments of the Piave River. This early warning system is a multi-criteria method focusing on a statistical analysis that considers the last 25 hydrological years as a reference period. The "Water Scarcity Index" (WSI) is estimated by comparing the current situation to the past flow/hydrological statistics.
Informatics simulation model/platform	Optimizing Irrigation – an Early Warning System for Agriculture in Slovenia	The system contributes to water-saving measures for agriculture. In order to optimize the amount of water used for irrigation, a short-term early warning system for agriculture was developed for the Pilot Sites of Dravsko polje and Ptujsko polje in Slovenia. This early warning system was based on the forecast of the quantity of water and the timing of its application to various crops using the IRRFIB (Irrigation Forecast Model in Slovenia).

ECONNECT (accomplished results):

Tool	Joint Ecological Continuum Analysing and Mapping Initiative (JECAMI)	This online mapping tool was developed to support decision-making processes concerning ecological connectivity on the local, regional and Alpine level. The JECAMI web service is a GIS platform and consists of four parts: the **Continuum Suitability Index (CSI)**, which is a combined analysis of structural landscape connectivity and landscape permeability; the **Species Mapping Application** (**SMA** - Analysis of umbrella species application to detect barriers and corridors between two spatially separated locations for one of the umbrella species on an Alpine scale); **Priority Areas Mapping** (**PMA** – visualizing different area types, e.g. with high biodiversity or extensive agricultural areas) and the **Connectivity Analysis of Riverine Landscapes** (**CARL**) – to identify barriers in all **four dimensions of the rivers** within the pilot regions, where habitats of water-related flora and fauna should be shown in the maps, the outcomes should show how a certain area is impacted by humans (barrier effects and fragmentation). JECAMI is a system based on Google Maps©, where .kml-files can be uploaded to calculate the connectivity and to identify barriers within the seven "pilot regions". The purpose of the results is to be used as an input for decision makers (e.g. distribution areas of certain species, with actual barriers shown).
Final Report/ Booklet	Alpine biodiversity needs ecological connectivity	The report summarizes the results from the ECONNECT project. Major project results can be summarized as follows: • Geographic data across the Alps were collected and harmonized with a novel and innovative tool; the ecological connectivity in the Alpine range and within the seven Pilot regions was assessed based on a common approach. • Six umbrella species were selected and their potential movements in the Alpine landscape were modelled based on their habitat requirements. • The first comprehensive study on legal barriers to connectivity in the Alps was carried out and related solutions on enhancing the connectivity were identified. • The most relevant barriers and corridors at the Alpine and the regional levels were identified; a number of concrete measures aiming to enhance connectivity within and beyond the cross-border Pilot regions of the project were implemented. • Knowledge concerning ecological connectivity, the key stakeholders and the general public was improved.

Recommendation	Implementation recommendation	1) Protected area administrations are starting points for the development of successful governance models of connectivity at regional level due to their interdisciplinary competences and know-how. 2) The JECAMI tool enables the pilot regions to identify their role and the potential for connectivity in the Alps and at regional level. 3) ECONNECT identified the landscape approach as a basis for ecological connectivity. Species serve as indicators for landscape functions and support detailed analysis steps as well as the evaluation of measures at local level. Additionally, they are valuable for communication purposes. 4) Embedded in an Alpine-wide context and common methodological approach, all actors at the pilot region level contribute, to get a clear picture on the existing framework conditions for connectivity in order to find adequate solutions for its specific regional context. 5) Pro-active efforts to analyse and counteract risks for biodiversity and connectivity must be tackled by joining forces with other relevant sectors – the instruments are territorial and include, in particular, spatial planning. 6) The existing national rules and regulations concerning connectivity need to be carefully analysed. Their potential for enhancing connectivity must be discussed and proposals have to be made as to necessary improvements and modifications.
Recommendation	Policy recommendation	1) Ecological connectivity has to be valorized as an irreplaceable element for biodiversity, ecosystem services with consideration of social and economic aspects. 2) The legal framework in support of ecological connectivity measures at various scales has to be established, supplemented and improved. 3) Ecological connectivity has to be included in spatial planning instruments at all levels (from the local to the international level), using multi-sectoral approaches. 4) Protected area managers should be supported and empowered by the administrative authority to take an active role in the process to implement a local and regional ecological network both within and outside protected area boundaries. 5) Publicly funded data and analyses have to be made openly available through a harmonized centralized data management platform.

SHARE (accomplished results):

Handbook	A problem solving approach for sustainable management of hydropower and river ecosystems in the Alps	The report is a brief hypertext overview conceived as a tool to support sustainable river and hydropower management undertaken by local administrators, public and private consultants and other river stakeholders. The intention is to guide the reader in a simple way through the SHARE methodological approach and the different tools and resources developed and tested during the SHARE cooperation project.
Software	SESAMO-SHARE	The SESAMO system is a stand-alone software application, which implements the classic multi-criteria analysis (MCA). This system is divided into several sections and may be used to assist the decision makers in the problem definition process, in the criteria analysis, in the alternatives selection, in the utility function and criteria weights assignment, and so on. **SESAMO - SHARE Project Customized Version:** This software assumes that one is already familiar with this type of methodology and general concepts related to decision-making processes. There are 7 phases in the MCA: - organization of criteria in a decision tree; - filling the evaluation matrix with alternatives; - determination of performance and normalized utility functions to performance evaluate/score the alternatives for selected criteria; - application of utility functions; - allocation of weights;

		- final ranking; - sensitivity analysis. The program deals with the MCA and allows the user to manipulate all the objects of the MCA itself in a graphical way, including e.g. criteria and alternatives, utility functions or weights. Therefore, all phases of a decisional process are represented by specific panels. This software allows one to derive the final ranking of alternatives and to analyze the composition of results. The SESAMO program operates on projects. A project is an independent entity that contains all the data and structures that are related to the description of a decision-making process applied to a specific problem. Each project is stored in a single file that can reside anywhere on the hard disk of the user's machine. Within the program, projects are managed through a multiple document interface, in which each project is opened and maintained in a dedicated window.
Software	CASiMiR	Customized software to assess habitat conditions along the river channel and bank areas with a specific module for the evaluation of economic effects for hydropower production (www.casimir-software.de/). The CASiMiR Model Concept for riverine ecosystems and their habitats is inherently complex and contains a large number of relationships between biotic and abiotic components. Habitat models can be an appropriate instrument for studying ecological functions of these systems. They allow for the qualitative assessment of habitat conditions for species that are under consideration, most commonly for indicator species such as fish. Since the late 1990s, the University of Stuttgart has pioneered the development of fuzzy logic based habitat simulation software, resulting in the creation of the CASiMiR software suite: Fish, Benthos, and Hydropower.
Software	VAPIDRO ASTE	A **GIS tool** to evaluate the **hydropower residual potential** in a watercourse, taking into account its catchment, the actual withdrawals and restitution schemes as well as the application of the Minimum Instream Flow constrains. VAPIDRO-ASTE calculates the river network and belonging catchment areas automatically. The user chooses a river branch where to calculate the potential hydropower production, which is sectioned on equal segments and corresponding sub-basins are generated. A series of chained sub-basins are generated by the model. The tool is able to guide the user to identify the best hydropower configuration, maximizing the energy and minimizing investment costs. The tool is developed based on a DEM model (Digital Elevation Model), addressed mainly to support decision makers and stakeholders for the evaluation of potential sites addressed to the SHP implementation in the territory. The new version is able to work with 13 structural lengths for a more accurate hydro plant optimization and has the ability to use automatic satellite photo maps as background during the GIS representation of results and optimized exploitation schemes.
Report	River Functionality Index report	The report describes the IFF index (Fluvial Functionality Index) and the two main sub-indices, which can be derived by extracting sets of questions from the main IFF questionnaire. The River Functionality Index IFF (Indice di Funzionalità Fluviale) is a powerful tool for the evaluation of the functionality of river environments. The IFF Index can be applied to all the watercourse typologies in the national territory. The environmental reference value of the IFF index is the river functionality, while within the EU Directive 2000/60/CE methods are based on the use of naturalness as a reference value. The application of the IFF Index allows formulation of an overall assessment which is useful for characterization purposes and for the monitoring of events and activities affecting the water body in a set period. The application of the IFF Index during field surveys involves the use of a specific form to answer 14 questions for each homogeneous reach. For each question, 4 possible answers are possible. The 14

		questions are about different compartments: · Surrounding landscape; . Perifluvial vegetation; · Hydrology; · Hydromorphology; · Biotic communities. The use of the indices allows the evaluation of the global functionality of the rivercourse, giving information useful not only for analysing and characterising river ecosystems, but also in supporting environmental planning activities.

recharge.green (foreseen results):

Method/ model	Decision Support System (DSS) for renewable energy deployment	This system (online tool) will consider economic and ecological trade-offs. The partners will mainly use the geographically explicit "BeWhere model", developed by the project partner IIASA, and the Italian tool "BIOMASFOR" to optimize size and geographic distribution of bioenergy production plants. Hydro-, wind- and solar potentials will be integrated into the model as well. Designing the DSS is the main task within Work Package 5, "Economic dimension of renewable energy." To explore economic and ecological trade-offs, the partners will develop and apply a new concept, termed the "Marginal Protection Cost Curve". They will use the rankings of e.g. biodiversity hotspots to progressively exclude areas of concern. In an area with a higher level of protection, the per-unit costs for achieving energy production from renewables will be relatively higher than in a less protected area. This information feeds into the DSS. Decision makers can use this tool online for help in forming plans according to their preferences. The DSS tool will be integrated into an already existing map-based survey tool on biodiversity and ecological connectivity, JECAMI, which was developed in the now completed Alpine space project ECONNECT. The partners plan to apply the DSS in the pilot areas on a case-by-case basis, when sufficient data are available.
Upgrade of exiting model and application in DDS	"JECAMI" - existing map-based survey tool on biodiversity and ecological connectivity	Online mapping tool developed to support decision-making processes concerning ecological connectivity on local, national and regional Alpine levels.
Application of the model in DDS	"BeWhere" – determination of optimal spatial distribution and size of bioenergy polyproduction plants	Bioenergy model - BeWhere - which determines the optimal spatial distribution and size of bioenergy polyproduction plants given the locations of biomass supply, actual biomass based industries and energy demand. The economy of the supply chain is calculated with regard to the economy of scale of the bioenergy production plants.
Application of the model in DDS	"BIOMASFOR" - size and geographic distribution optimization of bioenergy production plants	An open-source spatial analysis model to quantify the availability of forest wood-energy biomass in terms of ecological and economic sustainability. Application of multi-functionality parameters for evaluation of the potential impact of biomass extraction on different forest functions. The multistep approach and the model's internal structure permits the use of the model with highly differentiated input datasets. The introduction of biomass demand evaluation allows the quantification of the wood-energy supply/demand.

Foreseen Reports		Within the framework of foreseen project activities (method development, pilot case studies, stakeholder involvement, etc.), additional reports, recommendations and guidelines should be prepared and elaborated.

SEAPAlps (accomplished and foreseen results):

Methodology	Action Plans for Public Investment (APPI)	The "SEAP ALPS" project aims to develop and share a methodology for the development of the "Investment Plans for energy efficiency in public buildings" at the municipal level. It will address the following aspects: 1. The definition of a set of indices useful for categorizing the municipality-owned public structures based on their energy performance and total consumption. 2. Drafting a guide on how to calculate the proposed indices, gain the data and keep the monitoring system updated. 3. Definition of a methodology for specifying intervention priorities in accordance with the requisites mentioned in the Energy Efficiency Directive (2012/27/UE Directive) and the timeframes in which these interventions must be planned. 4. Ways in which it will be possible to assess necessary economic resources for their implementation and to identify the parameters for discovering the best ways to guarantee financing, drawing from public and private resources according to the size and type of the investments.
Tool (online platform)	SEAP_ALPS Action Tools	The Action Tool provides help for the following issues: a) Select projects that help reducing the energy consumption of a municipality and foster the use of renewable energy. Suitable adaptation measures also need to be included in the task list. The projects or campaigns should be focused on all target groups and should include citizens as well as companies, etc. b) For each project or campaign, a short description is provided, listing responsibilities, costs, envisioned energy savings, relevant actors and target groups and CO2 emission reductions (as far as possible).
Tool (online platform)	Training Platform for Local Authorities	The SEAPAlps Training Platform provides detailed information about the following topics: • Development of a Sustainable Energy Action Plan, according to the Covenant of Mayors. • Development of a Climate Change Adaptation Plan. • SEAPAlps methodology. Subsequent to the training, the user can re-examine her/his knowledge with a test. After having completed the questionnaire, the results are obtained immediately.

SedAlp (foreseen results):

Reports	- Technical monograph on sustainable sediment management in Alpine rivers. - Policy recommendations on sediment management to support River Basin Management Plans. - Recommendations on good governance on sediment-related issues across the Alpine Space.
Guidelines	- Guidelines for estimation of sediment and wood budgets in different hydro-climatic and geological settings. - Guidelines for determining scenarios to be used for flood risk mitigation. - Guidelines for the identification of morphological impacts related to existing and new hydropower plants as well as gravel extraction.
Methods & Guidelines	- Improved concepts of responses of torrent/river control structures to floods and debris flow impacts (including wood). - Guidelines for planning/designing efficient torrent control structures with low impact on sediment continuity between upstream torrential headwaters and downstream river reaches. - Guidelines for improved planning of hydropower plants aimed to improve the longitudinal sediment continuity between upstream torrential headwaters and downstream river reaches. - Guidelines for planning and designing effective flood protection systems and training about restoration projects that have lower impact on sediment continuity. - Report on guidelines for ranking basins and channel reaches in terms of geomorphic activity and hazard potential, including identification of critical stream sections.
Database & Methods	- Dataset on sediment and wood transport rates and volumes for different regions in the Alps (Study areas). - Protocols on standardized data collection methods in sediment transport monitoring for transboundary exchange. - Improved process understanding of spatial-temporal variability in sediment transport. - Improved equations and models for predicting sediment and wood transport rates. - Evaluation of restoration projects with respect to measured sediment fluxes.
Database, GIS tools & models	- Four pilot case geo-referenced databases of sediment sources. - GIS-based tool for mapping catchment-scale sediment connectivity including a manual for stakeholders. - GIS-based Fluvial Information System for detecting sediment availability/transfer and for characterizing channel-reach response potential - with one manual for stakeholders. - Conceptual soil erosion model that can be used for the description of long-term variations in suspended sediment yields.
Foreseen reports	Within the framework of foreseen project activities (method development, pilot case studies, stakeholder involvement, etc.), additional reports, recommendations and guidelines could be prepared and elaborated.

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