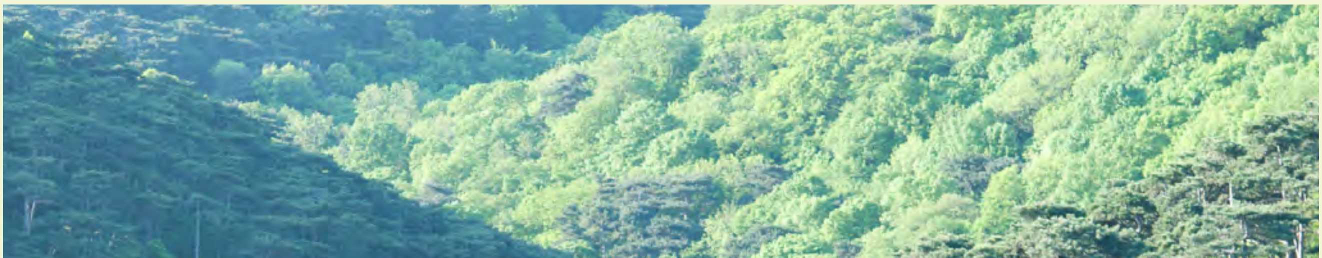
BALANCING ALPINE ENERGY AND NATURE

2015

Recommendations and lessons learned for a renewable energy strategy in the Alps



recharge green

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Authors: © Florian Kraxner, Sylvain Leduc, Hernán Serrano León (Ecosystems Services and Management Program, IIASA, Laxenburg, Austria); Jessica Balest, Giulia Garegnani, Gianluca Grilli, (Institute for Renewable Energy, EURAC research, Bozen, Italy); Marco Ciolli, Francesco Geri (Department of Civil Environmental and Mechanical engineering, University of Trento, Italy); Alessandro Paletto (CRA-MPF, Trento); Aleš Poljanec (Department for forestry and renewable forest resources, University of Ljubljana)
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Editorial

The Alps have a significant potential for the use of renewable energy (RE) and can make a valuable contribution to mitigating climate change. However, exploiting this potential may increase the pressures on nature if the potential environmental impacts and spatial requirements of the different RE technologies are not considered. Therefore, it is crucial that the expansion of RE production is planned taking in mind environment conservation for mutual benefit. The sustainable potential for RE production in the Alps is determined by the large number of protection areas, with almost 40% of the Alpine area under different types of environmental protection. Protection areas vary from national and regional parks to different designations of particular protection. On top of this, there is an overlap with international conservation designations such as UNESCO Biosphere Reserves and World Heritage sites, or the European Union network of Natura 2000 sites. In practice, this variety of protected areas is subject to a complicated web of administrative and management regulations that is implemented differently among countries and regions. In some areas, certain levels of renewable energy from wind and solar constructions as well as forest biomass extraction are allowed, while in other areas any energy production is strictly prohibited. The recharge.green project studied the potential for RE generation in the Alpine Bow region and in a number of dedicated pilot areas, taking into account the need to balance any possible installations with ecosystem services. In the pilot areas, specific questions needed to be reviewed in collaboration with stakeholders or/and local communities. For both approaches, a Decision Support System (DSS) was developed and the results from a series of scenarios were uploaded to a user-friendly interface, JECAMI. Users of the interface can vary a number of scenario parameters and see the different impacts of these changes in a geographically explicit way. The models and the DSS have been presented at various conferences and workshops where the methodology and results have been discussed. From the experience gained in the course of the project, many recommendations can be made, not only regarding the RE potential of the Alps, but also on the i) application of the model, ii) interpretation of the results, iii) interaction with local partners and how to provide them the right tool for their needs, and most importantly iv) the reproducibility of the approach. The following presents the lessons learned from the work carried out at the Alpine and pilot-area level over the life time of the project.

F. Kraxner and S. Leduc

Recommendation/lessons learned at the Alpine level

01

Authors: Florian Kraxner, Sylvain Leduc, Hernán Serrano León

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BeWhere model
www.iiasa.ac.at/bewhere

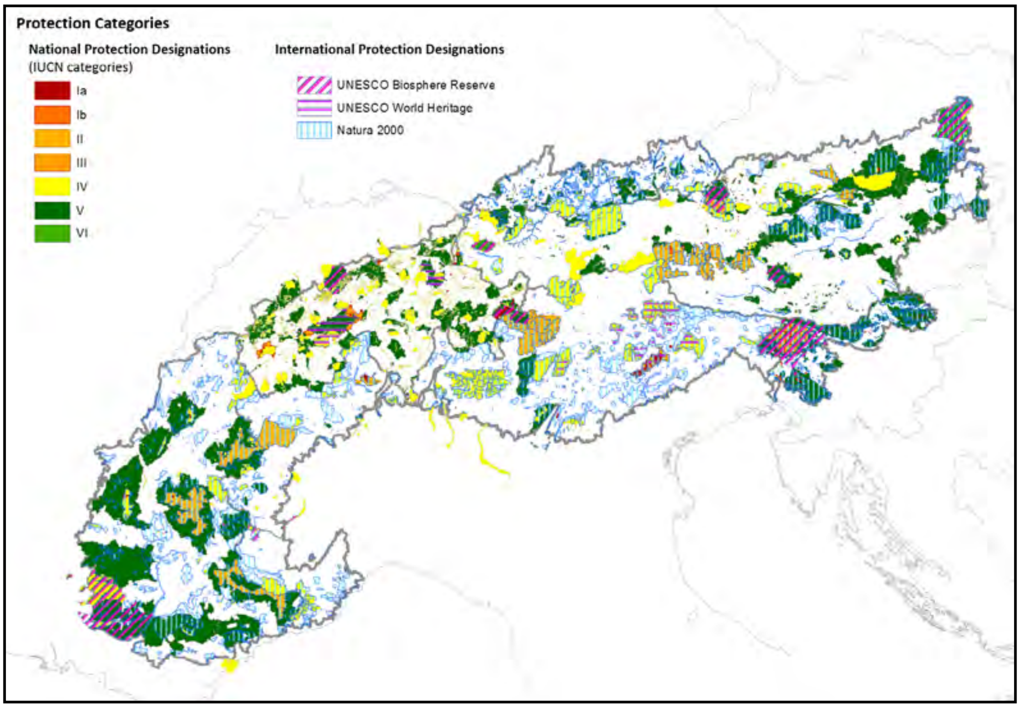
The renewable energy (RE) potential in the Alpine Bow was studied using the techno-economic-systems optimization model, BeWhere. The model identified the optimal localization of bioenergy production plants, solar PV plants, wind parks, and hydropower stations by minimizing the total cost of the supply chain. On top of the costs, emission reductions and ecosystem services protection were considered. The emissions were added to the cost of the supply chain via a carbon cost, and the protection of the ecosystem services was considered by including the locations and the classifications of the protected areas. Each protected area has a specific classification, and therefore may or may not allow the installation of new RE systems or the extraction of a certain amount of biomass.
By running diverse scenarios with varying fossil fuel prices, carbon cost, or level of environmental protection, the user can get a feel for the RE potential in the Alps under the selected conditions. The results from BeWhere were uploaded to the web interface, JECAMI. Here the user can vary the parameters in question and visualize the results on a map of the Alps. Various layers, such as protection areas or topography, can be added to the results map.
For each technology, the theoretical, technical, and economic potential were estimated. The theoretical potential represents the full capacity that is carried in the Alps when no constraints are applied. The technical potential reduces the theoretical potential to what is actually feasible; this means that access to certain areas is impossible because of the steep gradient or lack of road network infrastructure. The economic potential reduces the technical potential by including the cost of each segment of the supply chain.

Bioenergy

The theoretical potential of bioenergy in the Alps is about 60 TWh. This is considerably less than the existing woody-based industries that are already in place, which require more than 50% of woody resources. The network of protected areas in the Alps covers almost 40% of the Alpine area. Thus, limiting the use of biomass in protected areas has a major impact

FIGURE 1

Overview of the protected areas and IUCN categories.



on the bioenergy potential. Each type of protected area is subject to different thresholds of allowed biomass extraction. For instance, in highly protected areas no extraction is allowed, while most of the yearly biomass increment could be extracted in low protection areas based on sustainable forest management criteria. This constraint differences therefore has an impact on the final cost of bioenergy production: it can increase by a factor of four to six when more restrictions are placed on the use of the biomass in the protected area.

Wind farms

The location of wind farms is dependent on altitude, area available, type of protection area, and distance to residential areas and road network. Operation and maintenance of wind farms at high altitudes is limited by the lower accessibility of mountainous areas, due to their abrupt topography and insufficient access to roads and grid connections. Moreover, wind farms located at high altitudes are associated with increased visual intrusion at longer distances. Further negative environmental and visual impacts are considered by limiting the location of wind farms in protected areas and surroundings, as well as in the vicinity of residential areas and roads. These considerations are included in two different scenarios. In a business-as usual-scenario, it has been assumed that wind turbines would not be built above 2,000 m, in strict protected areas and within a buffer of 500 m around municipalities and roads; while limited projects would be considered in low protection areas. In an increased constrained scenario, limitations to wind farms are increased to altitudes above 1,200 m, a distance buffer of 2.5 km around strict protected areas and 5 km around residential areas. The estimated potential decreases drastically as the buffer area increases in the different scenarios. The theoretical potential of power output of 6 PWh decreases to some 4 PWh for a no-go zone in the protected areas. Adding a 500 m buffer zone where no wind turbines could be installed would reduce the potential down to 2 PWh, and down to 0.5 PWh with a 5 km buffer zone.

FIGURE 2

Windmill park on the border of the Alps in Austria.

Solar PV fields

Solar plants have comparatively low impact on the ecosystem if ecologically important sites and forest areas are avoided. The environmental effect of solar PV fields strongly depends on former land uses. It was assumed that solar PV plants would be installed on grasslands, agricultural areas or degraded lands, mainly on steep south-facing slopes. The theoretical potential in the Alps from PV plants is the most important in comparison with the other three renewable technologies with about 40 PWh. Nevertheless, it faces some problem in terms of competition, due to higher installation costs and competition with farmland. The economic potential can reach 2 PWh a year under a very conservative scenario. Note that installing one technology does not stop another one being installed at the same location provided that there are optimal production conditions. Solar plants compete only with the land and have fairly small impact on the ecosystem in comparison with the other technologies.

Hydropower stations

The hydropower potential in the Alps can theoretically be increased consistently. Nevertheless the approach assumed that no new hydropower plants would be set up on catchment areas where stations were already operating, and that a “no-go” zone would be allowed in any protected areas to be on the conservative side. Taking into account the technical and economic potential for the hydropower stations, the power generated from hydropower would have the capacity to increase by 10% (see Figure 3). Nevertheless, the age structure of the existing power stations also needs to be included so that decisions can be made on whether the operating stations should be renovated. The power output of those stations could certainly increase, without new ecosystems needing to be altered.

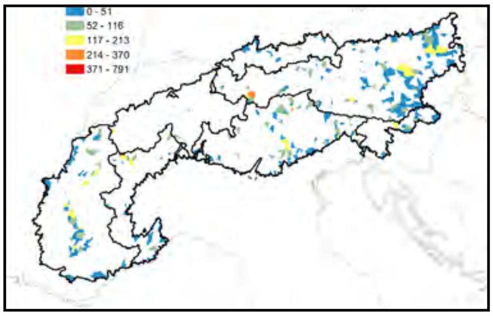


FIGURE 3

Remaining locations of catchment areas outside any protected areas and without any running hydropower station.

How to interpret the results

Each project to build a new hydropower station or any other renewable energy system has to face major accessibility challenges due to the topology of the Alps, which cannot be highlighted in the model. Therefore, each possible renewable energy location has to be discussed on the ground with the local administration and communities and also take into consideration various parameters such as accessibility to the site for construction and future maintenance, construction costs taking into account the local circumstances, access to the power grid, setting up of a new power grid, and the environmental constraints involved. Moreover, as each model has its own assumptions and a specific research question to answer, the results of one model or DSS can only be compared with the results of the same model. The results provide information on the capacity that can be reached. They also provide indications of the type of policy that could be applied in the Alps to reach a certain level of power production or emission reduction; it could also indicate the type of technology needing to be applied to protect a specific area and having as little impact as possible on its ecosystem.

Recommendations/lessons learned for some selected pilot areas

02

Authors: *Jessica Balest, Giulia Garegnani, Gianluca Grilli, Alessandro Paletto Marco Ciolli, Francesco Geri, Aleš Poljanec*

WEB

http://www.recharge-green.eu/wp-content/uploads/2012/12/RV_Focus-groups_-Report_05_2015.pdf

In the recharge.green project, there were several lessons learned about the use of renewable energy sources and the valorisation of ecosystem services for specific pilot areas. In all the pilot areas, we performed a stakeholder analysis, involving local people in several meetings, and we asked them to fill in several questionnaires to assess the impacts of possible RE installations on ecosystem services. A deeper analysis of the results for all the pilot areas can be found in the report "Renewable Energy and Ecosystem Services in the Alps: status quo and trade-off between Renewable Energy expansion and Ecosystem Services valorisation." Stakeholders were also involved in round tables, focus groups, and workshops on energy exploitation and ecosystem services valorization.
The main points arising from round tables In the Mis and Maè valleys in the Veneto Region (Italy), have already been summarized in the special "Report about round tables for the pilot areas of the Mis and Maè Valley" . In this report, we focus on forest biomass and report recommendations and lessons from Triglav National Park in Slovenia and the Gesso and Vermenagna valleys in the Maritime Alps Nature Park in Piedmont, Italy. These two locations were chosen because in these areas the discussion about the use of forest biomass went deeper and still continues after the end of the project.

Pilot area for Slovenia

The primary objectives of protected areas such as Triglav National Park (TNP) are the conservation of nature, protection of environment, and preservation of the cultural heritage. The use of forest resources for energy, if properly planned and if the potential exists (e.g., if there are well-stocked productive stands), could fit within the management objectives of the protected areas. However, increased demands for energy use could have a significant negative influence on biodiversity and cause conflict with nature conservation objectives.

A: STAKEHOLDER ANALYSIS

A stakeholder analysis was performed to identify all groups of people—organized or unorganized— with a stake in renewable energy, forest management, and nature conservation. An analysis of stakeholders' interests, the conflicts between different users, and the relationships among them were also examined to classify stakeholders according to their interests.

The network analysis of TNP stakeholders showed that the key role in the decision process related to renewable energy is not in the hands not of one central stakeholder but of eight key stakeholders. Their involvement in the decisions related to renewable energy planning is thus crucial for the success of the participatory process.

B: DECISION SUPPORT SYSTEM

The development of different scenarios can help to evaluate possible interventions and support planning. In the TNP study area, the WISDOM tool was used to evaluate three scenarios of potential biomass use for energy. The main findings are:

- Fuel wood production could be in accordance with the management objectives of the protected areas, if there are properly planned forests which are kept well stocked.
- Careful planning and appropriate management regimes are needed to reduce the risks of biodiversity loss and avoid contradictory management objectives in the park.
- Close-to-nature forestry and an adaptive approach with constant monitoring, planning, and evaluation of measures carried out could be the most appropriate management approach.

C: ASSESSING THE IMPACT OF FOREST BIOMASS USE FOR ENERGY ON ECOSYSTEM SYSTEMS SERVICES (ESS) AND BIODIVERSITY

Thirteen experts were identified with expertise and local knowledge on ESS and/or bioenergy. The potential impact of forest biomass harvesting on ESS was quantified through a questionnaire survey administered to the local experts. Analysis of the questionnaire revealed the following main messages and suggestions regarding multi-objective forest management and ESS provision:

- A collaborative approach with forestry and other experts, the public, and land owners is needed to consider multiple objectives but there must be clear priorities among the objectives and conflicts in different ESS provision must be avoided.

- Forest functions and protected forest areas contribute greatly to the implementation of multi-objective forest management.

The main recommendations for decision and policymakers were:

- Clarify the terminology and understanding of the multi-objective forest management approach and the concept of forest functions as an important tool for planning management connected to multiple ESS.

- Reduce the number of forest functions.

- Simplify the maps of forest functions to make them clearer and increase their usability

- Increase the GIS database to improve transparency and data sharing among stakeholders.

- Improve criteria for designation of forest function areas

- Improve the relationship between forest function areas and measures to improve operational planning that aims to provide ESS on the designated lands.

Close-to-nature forestry and a cognitive approach with constant monitoring, planning, and evaluation of the measures carried could be the right way to deal with overlapping demands for various ESS. In the study area (and more widely in all Slovenian forests), close-to-nature forestry has been practiced for 50 years and no major conflicts between forestry and nature conservation have been noted. Within the recharge.green project, Slovenian partners complemented the currently available information on forests on a 2×2 km permanent sample plot grid (maintained by the Slovenian Forest Service [SFS]) with additional information on soil, vegetation, birds, fungi, etc. This expanded forest inventory allowed us to improve our knowledge of the impact of biomass use on biodiversity and thus improve the evaluation of forest management and biodiversity monitoring in the Triglav National Park.

Pilot Area for Piedmont

Strategic aspects and recommendations to improve the local forest-wood chain in the Gesso and Vermenagna valleys in Piedmont, Italy, were discussed in a public meeting with administrators, associations, public authorities, and inhabitants of the Gesso and Vermenagna valleys on 31 March 2015, in the commune of Valdieri During the meeting, starting from different scenarios from the recharge.green DSS for Pilot Areas , participants provide interesting recommendations about the forest biomass energy potential in their valleys:

- Forest biomass was used historically in the Gesso and Vermenagna valleys. The need to

FIGURE 4

The village of Roaschia in the Gesso and Vermenagna valleys.

start using it again is perceived as important by participants. Forests have been managed to maximize energy return, with the presence of beech and chestnut trees being increased.

- Most local forests are more appropriate for valorization of forest biomass power than for timber. Timber is available in some small areas where there is high quality larch and chestnut.

- Participants need to manage forests actively. There are greater cumulative benefits to be derived from managing forests than from not managing them.

- Participants identified the problem of forest mobility and the need to solve this through discussion with the Piedmont's regional government. To improve the local forest wood chain, the time taken to authorize forest mobility permits need to be shorter.

FIGURE 5

Forest biomass in the Gesso and Vermenagna valleys.

- Highly complicated and inefficient bureaucratic processes limit forest activities.

- A commercial market for wood exists but there is no guarantee of dedicated funding for a power plant. The siting of plants should ensure that there is a very short chain from forest biomass harvesting to energy consumption. A small power plant in each municipality would thus be better than one with more installed power.

- Most of the participants prefer internal local investments to cover incomes in the local area.

- The impact of biomass use for energy on the hydrological protection service is not positively perceived by participants, for example, locating power plants on river banks.

- Participants asked for there to be active management of private forests, and also of biomass use for energy production. The involvement of private owners in this is not simple because private ownership is fragmented. European Union Due Diligence (Reg. 995/2010) could improve the interest of private owners to stipulate contracts for forest management.

- Selling off wood that has been allocated for civic use causes problems in that it decreases the availability of wood to the local inhabitants and decreases market prices.

- The presence of a forest service favors legal work and legal production, as was well understood by participants.

- Biodiversity is an important element in a protected area. Improved environmental communication about the goals and actions of the Maritime Alps Nature Park is important to protect biodiversity and to avoid misunderstandings between the inhabitants and administrators of the area.

Remaining questions to be followed up

03

The recharge.green project analyzed the renewable energy potential in the Alps and in some specific pilot areas taking into account ecosystem services. The pilot areas are a basis for improved recommendations for renewable energy projects at local scale. For the pilot areas of the project, local partners are very much concerned about the development of their region with respect to job creation and, at the same time, with the valorization of nature. Poor energy planning can have undesired consequences for the ecosystem services and the local economy. That is why a participatory approach is important. In conclusion, a decentralized energy planning with stakeholder involvement can provide shared solutions to make energy needs compatible with regional sustainable development. Nevertheless, up-scaling of these recommendations to the Alpine level remains complicated, given the lack of detailed ecosystem services data, large complexity of protection legislation and regional acceptance to renewable energy projects, and differences between countries and regions. The sustainable use of the Alpine potential for renewable energy production requires both strategic planning at transboundary scale and detailed local assessments. Appropriate location of renewable energy projects will minimize environmental impacts while ensuring compliance with stakeholders' interests and conservation legislation. Although the question of renewable energy potential can be answered at the local level, it is more complicated at the Alpine level because the definition of the protected areas is complex not only from country to country but also from province to province in the same country; it is also complex because of the lack of data on the location of diverse ecosystem services to be protected at that level. To enhance the methodology at the Alpine level, more participation from the stakeholders and communities is needed. For this reason, the use of the JECAMI tool is open to a broad public. In this sense, JECAMI will hopefully facilitate understanding of RE development and production in the Alps and enhance the involvement of stakeholders and local communities in transparent decision-making process. This project had its focus inside the Alps, for the welfare of the Alps, but little has been tackled on the connection of the Alps with the rest of Europe: are the Alps independent of the rest of Europe, or can the Alps be called the battery of Europe? And can the methodology applied in recharge.green be applied in other countries with similar mountainous characteristics. If so, it would be interesting to identify how the development of renewable energy technologies is perceived, what the challenges are, and if solutions are replicable in the Alps, and vice versa.

recharge.green – balancing Alpine energy and nature

The Alps have great potential for the use of renewable energy. Thereby they can make a valuable contribution to mitigating climate change. This, however, means increasing pressures on nature. What could be the impact of such changes on the habitats of animals and plants? How do they affect land use and soil quality? How much renewable energy can reasonably be used? The project recharge.green brought together 16 partners to develop strategies and tools for decision-making on such issues. The analysis and comparison of the costs and benefits of renewable energy, ecosystem services, and potential trade-offs was a key component in this process. The project ran from October 2012 to June 2015 and was co-financed by the European Regional Development Fund in the frame of the European Territorial Cooperation Programme Alpine Space.

This publication gives an overview of the recomendations and lessons learned at the Alpine level as well as two selected Pilot Areas.
Together with other project publications, it can be downloaded from **www.recharge-green.eu**

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