

ISBN: 978-3-906521-77-0



- PERPETUAL CALENDAR -

# Energy & nature in the Alps:

*a balancing act*



recharge  green

# recharge.green

## balancing Alpine energy and nature

The recharge.green project has contributed to achieving sustainably used landscapes where ecosystems and their services to people continue to function, and where energy production is optimised for this purpose.

The Alps have great potential for the use of renewable energy. 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 recharge.green project brought together 15 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 recharge.green experts assessed the potential of renewable energy production from wind, water, forest biomass and solar power in the Alpine countries. They used scenarios to identify where this potential might conflict with nature conservation, environmental protection and other ecosystem services. As a central outcome, the recharge.green partners developed a decision support tool that permits politicians and energy producers to make sensible decisions in economic and ecological terms in order to enable optimum land use.

To ensure that the project results can be put into practice and optimised on the basis of experience, the recharge.green project partners selected six pilot areas where tools and models have been tested and checked for transferability to other Alpine regions. The pilot areas communicated their results to interest groups at local and regional levels as well as to the general public.

The recharge.green project also raised the awareness of energy producers, politicians, consultants, authorities, NGOs and young people on how to meet the demand for renewable energies without causing damage to nature. The project organised international conferences, training courses and implementation workshops on this topic. The results have been published in several reports, available on the project website.

This perpetual calendar explains the main project findings, in particular to decision-makers from local to Alps-wide level. It takes readers through the decision-making process that the fictional town of "Alpine Vale" goes through when discussing the potential use of renewable energy.

### FACTS

**Partnership:** 15 partners from six Alpine countries. Lead partner: Research Institute of Wildlife Ecology, Vetmeduni Vienna. 15 observers

**Runtime:** October 2012 to June 2015

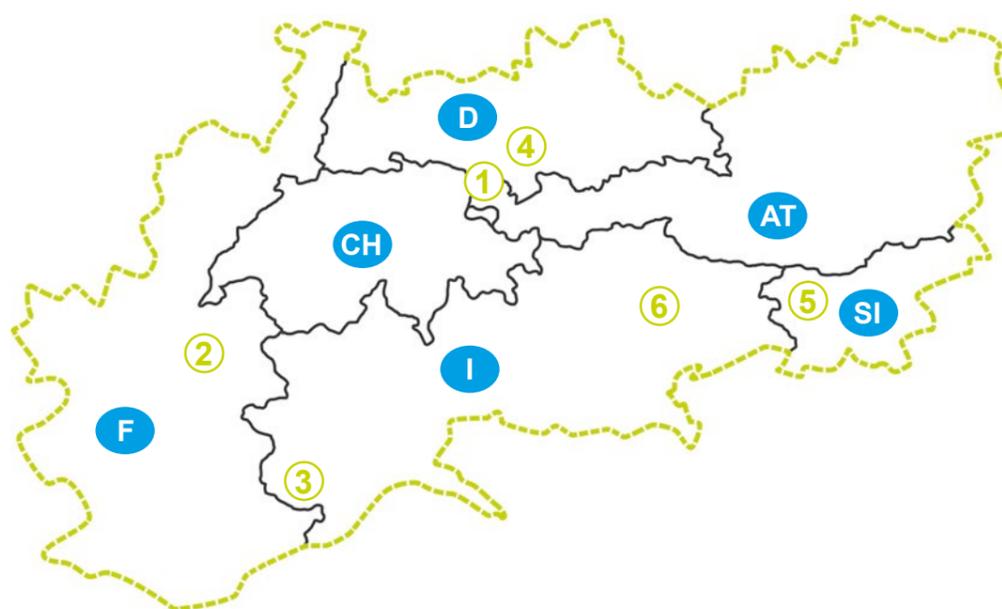
**Budget:** 2.7 million euros. recharge.green was co-financed by the European Regional Development Fund in the framework of the European Territorial Cooperation Programme Alpine Space.

**More information:** [www.recharge-green.eu](http://www.recharge-green.eu)



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## THE PILOT AREAS



### ① Vorarlberg

Vorarlberg addressed the development of renewable energies in the context of its ecological and social consequences. The "Sample Hectare" method was developed and tested. It will be applied in the energy concept for the Leiblachtal region.

### ② Northern French Alps

This pilot area tested integrated spatial decision support systems on expected levels of territory management, with significant uncertainties and sensitivity of hydrological regimes to climatic changes.

### ③ Maritime Alps

The Gesso and Vermenagna Valleys focused on the use of wood biomass and hydropower by examining and discussing the effects on natural capital, social and economic aspects and environmental consequences.

### ④ Upper Iller

In Bavaria the sustainable use of hydropower on the River Iller was investigated and different measures to improve existing fish habitat structures such as gravel banks, shallow slack waters and deadwood have been developed.

### ⑤ Triglav National Park

The Triglav National Park focused on the sustainable use of wood biomass, with the project partners verifying availability and the level of woody biomass demand.

### ⑥ Province of Belluno

The main aim in this pilot area was to evaluate the use of hydropower and forest biomass with regard to biodiversity and other ecosystem services. These analyses have been compared with feedback from the local community to achieve integrated results.

*Within the recharge.green project, six pilot areas tested tools and models to ensure that the results can be put into practice.*

# An Alpine town's story

*Alpine towns and villages are surrounded by multi-use landscapes. Well-functioning ecosystems are important to people's physical, psychological, and economic well-being.*

The (fictional) Alpine town of "Alpine Vale" is idyllically situated between a lake and surrounding mountains, fed by the river Bubblebrook. Its economy is mainly driven by tourism (winter and summer) and agriculture, and there is a relatively vibrant small business sector – with local craft manufacturers and retailers catering to residents and tourists, hotels and restaurants. There is also a start-up high-tech firm that employs about ten people from the surrounding area. Two fairly large protected areas are located east and west of the town outside the municipal boundaries.

The mayor's office is considering options to produce energy from local renewable sources. There is potential to dam sections of the river to produce hydropower, and to log the forest to produce biomass for heating. This is currently happening on a very small scale for private consumption by forest owners, but could be expanded. A processing plant could be built to produce pellets, which could be exported to supply energy to areas beyond Alpine Vale. The mayor also wants to hold consultations on the possibility of exploiting wind power, especially

outside town where there are fields used for farming, and is looking into installing solar panels on the roofs of several public buildings.

Renewable energy exploitation can bring many benefits – the town would benefit from the jobs a new production plant would provide and the income from surplus energy production. Environmental benefits in the form of reduced carbon emissions would accrue in switching from the current, mostly oil-based energy forms to renewables.

Local people are on the other hand aware that different renewable energy sources affect nature and the environment in various ways and can disrupt ecosystem functions. The potentials and possible consequences therefore have to be looked at carefully and plans will have to take into consideration all of the socio-economic and environmental factors.

In this calendar we take you on a journey to Alpine Vale to show you various aspects in this decision-making process.

## GLOSSARY OF TERMS

**Biodiversity** is the variety of life. This includes diversity within species, between species, and of ecosystems. Biodiversity underlies all ecosystem services.

**Ecosystems** are communities of organisms interacting with each other and with their environment.

**Ecosystem services** are the benefits that people obtain from ecosystems.

**Renewable energy** is generally defined as energy that comes from resources which are naturally replenished on a human timescale. For the purposes of recharge.green, we focused on solar, wind, hydro, and biomass as the energy forms most commonly found in the Alps.

**Sustainability** is used here in the sense of human sustainability on planet Earth.

**Decision support systems** are (usually) computer-based models that support decision-making activities.

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*Alpine towns and villages are surrounded by multi-use landscapes. Well-functioning ecosystems are important to people's physical, psychological, and economic well-being.*

# Hydropower



*Hydropower has only limited expansion potential in the Alps, which already produce large amounts of it. Biodiversity and water quality improvement must guide all interventions in both the modernisation of old plants and planning of new plants.*

*In Bavaria, the potentials for the use of hydropower on the larger Alpine rivers are mostly exhausted. Today's standards for mitigation measures are higher than in past decades when many plants were built. The negative impacts on nature of a few medium-size power plants are less than those of many small ones.*

People in Alpine Vale are questioning the possibility of developing hydropower energy on the river Bubblebrook. The recharge.green experts offer them the explanations gained from interviews with the local population and stakeholders, as well as from modelling the potential for hydropower production in the Alps under different scenarios.

and biodiversity. Few areas are still available to build big dams in the Alps and the economic cost of environmental compensation measures would be enormous. Small and micro hydropower plants may have a limited impact but they have already been over-developed in many areas. The recharge.green experts, after carefully considering the economic and environmental constraints, reckon with a maximum potential increment of five per cent compared to the current level of production.

*An investigation was conducted in the pilot area on the River Iller as to how the negative impact of existing hydropower plants on ecosystems can be minimised without decreasing energy production. Different measures to improve fish habitat structures for different stages of life and seasons, such as gravel banks, shallow slack waters and dead-wood have been developed and implementation has started.*

Hydropower energy generation depends on the shape and gradient of the valleys and on the amount of rain that falls and reaches the streams. A healthy forest cover is also important to guarantee hydropower production in the long term since forests protect soil and have a levelling effect on the water cycle.

The municipality of Alpine Vale expresses an interest in hydropower, in particular whether sections of the Bubblebrook river can be dammed and small and micro hydropower plants installed instead of one big plant. The municipality is aware of the importance of water streams for its wellbeing. It therefore suggests exploring new technologies to modernise existing plants. If new plants are to be built in Alpine Vale, it must be guaranteed that they do not harm the river's ecological functionality and that they comply with ecological standards.

Hydropower energy in the Alps produces a large amount of the total energy produced at local and national level. It is also crucial because it can store the energy surplus accumulated during the day by other renewable energy sources and can redistribute it on demand to national energy networks.

Exploiting hydropower will however not provide enough energy for the future needs of Alpine Vale. What potentials are there to use wind energy?

Current production in the Alpine area is about 100 Tera-watt-hours per year. Hydropower energy exploitation changes and shapes the mountain landscape and affects water quality

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**Hydropower** has only limited expansion potential in the Alps, which already produce large amounts of it. Biodiversity and water quality improvement must guide all interventions in both the modernisation of old plants and planning of new plants.

# Wind power



*Wind energy potential is relatively high in the Alps, but only on exposed ridges or at very high altitudes. Windmills may however have a negative impact on landscape quality and biodiversity, especially when located near protected areas.*

*The recharge.green project interviewed selected experts in the pilot areas about the potential of wind power. In order to obtain responses unbiased by personal considerations, experts were identified on the basis of proven experience in their field, as well as a lack of political ties or any personal interest in the expansion of renewable energy. Some experts underlined the high potential for wind power in the Leiblachtal area in Vorarlberg, Austria. Intensive discussions focussed on the ability of this renewable energy source to meet regional energy demand. In other parts of Vorarlberg, as well as in the Italian Mis, Maè, Gesso and Vermenagna valleys (Italy) and the Triglav National Park in Slovenia, wind power potential was held to be negligible by the experts, as well as on the basis of the results achieved by modelling.*

The people of Alpine Vale are discussing the possibility of producing wind power. They question the recharge.green experts about the potentials for different situations and possible conflicts with other interests, such as nature and landscape protection.

locations for new wind power plants lie within protected areas. The wind potential in the Alpine countries is mostly located in non-Alpine areas.

European laws on renewable energy development, as well as the EU goals for 2020 and 2030, support the installation of wind energy plants through economic incentives and tax breaks. In the European Union, wind power covers more than ten per cent of total renewable energy production but most of the production is concentrated outside mountain areas. The potential for renewable energy production from wind differs substantially across the Alpine countries. Wind turbines can be an interesting option to produce renewable energy in the Alps, especially on exposed ridges or at very high altitudes, where more wind can be expected than in the valleys. Often however, even on such exposed sites, only a moderate energy output can be achieved compared to the wind-intensive sites on Europe's northern coasts. Current wind energy production in the Alps is less than four Terawatt-hours per year. In the Alps, many of the potential

The recharge.green experts recommend achieving a greater balance between energy and the environment in the sensitive Alpine context. Windmills can drastically change the landscape and thus modify the perception of such areas by locals and tourists. They can also influence local and overall Alpine biodiversity, affecting local and migratory birds and fauna in particular. The installation of windmills should therefore be carefully planned, balancing ecological, landscape and energy demands while considering local conditions.

Following these explanations, the municipal representatives of Alpine Vale suggest considering wind energy only after having explored local acceptance of landscape changes and possible biodiversity impacts. The recharge.green experts also mentioned the possibilities of using solar energy. What are the prospects for this in Alpine Vale?

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## MARCH

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*Wind energy potential is relatively high in the Alps, but only on exposed ridges or at very high altitudes. Windmills may however have a negative impact on landscape quality and biodiversity, especially when located near protected areas.*

# Solar energy

*Solar energy potential is extremely high, but large solar fields conflict with the local landscape and biodiversity. Where applicable, rooftop solar panels are a better solution.*

The Alpine Vale community is discussing the possibility of using solar energy from rooftop panels or from ground-installed solar fields. They want to know more about the potentials and possible conflicts and thus ask the recharge.green experts for advice.

Current production from ground-installed photovoltaic panels in the Alps is less than two Terawatt-hours per year. The solar energy potential depends mainly on how many hours the sun can reach solar panels. Climatic, geographical and morphological conditions mean that the potential for renewable energy production from solar power differs substantially among the Alpine countries. France and Italy have greater energy potential due to the southern exposure of their valleys. The shadow effect of mountains also leads to a clear relationship between altitude and solar potential. Developments in technology are considerably improving solar panel performance year on year.

While the use of solar panels on buildings is widely accepted and developed, there is resistance to the creation of large

solar fields in Alpine areas as they could affect landscape quality and biodiversity. Many of the potential locations for new solar field power plants in the Alps lie within protected areas. Since, to be effective, solar fields must be installed in areas that remain sunny for most of the day, they have unavoidably high visibility and can drastically change the landscape of Alpine valleys and thus the perception of these areas both by local people and tourists. Local conditions and people's perceptions must therefore be considered in planning interventions in order to balance ecological, landscape and energy requirements.

The Alpine Vale experts decide to investigate the landscape perception within their community and the possible effects of solar fields on biodiversity before planning any such intervention. They suggest the expanded use of rooftop solar panels.

The town is also surrounded by many forested areas – could they be better used for renewable energy production?



*The recharge.green project interviewed selected experts in the pilot areas about the solar power potential. In Vorarlberg, residents view ground-installed solar fields in a critical light due to the impacts on landscape aesthetics and the loss of productive land. However, solar fields might be an option in areas with steep slopes that are difficult to cultivate. The solar field constructed in the "Großes Walsertal" biosphere park can be regarded as a best practice example, for instance regarding the approach to public participation and funding. In other project pilot areas the experts see little potential for developing large solar fields, instead recommending the further installation of rooftop solar panels.*

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**Solar energy** potential is extremely high, but large solar fields conflict with the local landscape and biodiversity. Where applicable, rooftop solar panels are a better solution.

# Biomass

*Producing energy from forest biomass must rely on material that is sourced locally. Sustainable forest management will preserve soil and protect biodiversity. Technical optimization of plants and infrastructure are needed.*

People in Alpine Vale are investigating the possibility of using part of their forest biomass to produce energy. They wonder about the potentials and consequences. The recharge.green experts explain the issues and the impacts, along with the pros and cons.

The European Union countries are required to effectively manage their natural resources. Bioenergy could play an important role, but projections suggest that the available amount of forest biomass would not be enough to cover demand in heating plants over the next decades. On the other hand forests are experiencing constant expansion in Europe's mountains, encroaching on meadows and abandoned farmland. Part of this biomass can be used as bioenergy.

In many Alpine regions forest management has a long tradition that has permitted constant and varied wood usage together with the maintenance of forest coverage, with all the related ecosystem services. Although the use of forest biomass for energy production is less polluting than fossil fuels, this renewable

source also has potential impacts on the environment. To ensure forest management is economically viable there must be an adequate forest road network. It is expected that, due to the promotion of renewable energy use, the pressure to exploit forest biomass will also increase in protected areas. The use of forest biomass should be carefully balanced with the ecological demands of the species that live in parks and reserves.

The over-dimensioning of biomass plants has already led to some having to ship in forest biomass from distant locations. There are however many successful examples of biomass plants with short distribution systems.

After discussing the expert explanations of different sustainable forest cutting rates, the Alpine Vale stakeholders decide to explore the possibility of building a forest biomass energy plant, dimensioning it according to the sustainable forest biomass available locally. They have several times heard the experts use the term "ecosystem services". They have a rough idea of what this could mean for their situation, but want to find out more.



*Based on the results of stakeholder analysis and modelling, the recharge.green experts have made recommendations on forest biomass use for energy production in the Mis and Maè Valleys, the Gesso and Vermenagna Valleys and in the Triglav National Park. The biomass potentials amount respectively to approximately 7,900, 21,500 and 125,500 megawatthours per year. Balancing with ecosystem services means that sustainable potentials are lower.*

*Energy plants must be dimensioned in a way that they can rely on local biomass resources. Simulations show that more bioenergy can be sustainably produced from local biomass by improving exploitation methods and cut rates. However, decisions on exploitation rates must not conflict with biodiversity conservation and other ecosystem services.*

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*Producing energy from **forest biomass** must rely on material that is sourced locally. Sustainable forest management will preserve soil and protect biodiversity. Technical optimization of plants and infrastructure are needed.*

# Provisioning ecosystem services and hydropower



*Expanding the use of renewable energy needs to be balanced with the use of other resources.*

During the last few months the residents of Alpine Vale have analysed their potential energy sources. Now they are thinking about tapping into some of these, but are not sure about the possible impacts on the environment and on ecosystem services. They are asking themselves “what are these so-called ecosystem services?!”

Ecosystem services – as experts inform the residents – are the benefits provided by ecosystems to humans. These ecosystem services can be divided into three categories: “provisioning services”, such as the production of food and water; “regulating and maintenance services”, such as the control of climate, nutrient cycles, crop pollination or habitats for plants and animals; and “cultural services”, such as recreational benefits or the beauty of the landscape. To help inform decision-makers, values can be assigned to these services and contrasted with the values generated by producing renewable energy.

Starting from the idea of constructing a hydropower plant in Alpine Vale, the residents are thinking about the possible positive or negative consequences for provisioning services: all the nutritional, material and energy products we obtain from living systems, such as water, plants, fodder or wood, can be

called provisioning services. The construction of a new hydropower plant can negatively impact these benefits in various ways:

- Water diversions for hydropower generation can reduce water availability in the affected regions and impact fish populations. Fish populations might be affected by reservoir flushing and a less constant water level.
- Furthermore, flooding can cause land use conflicts due to a loss of productive land. This could lead to conflicts in Alpine Vale as some farmers would lose pastureland for extensive cattle grazing.
- On the other hand, reservoirs can also create beneficial provisioning services, such as a more constant water supply downstream. For instance, farmers could profit from this for irrigation.

Clearly there are trade-offs among different ecosystem services and between different user groups, and it is important to look at all of them carefully. Next month Alpine Vale residents will be looking at the regulating and maintenance services.

*In Bavaria, the potentials for the use of hydropower on the larger Alpine rivers are mostly exhausted. Today's standards for mitigation measures are higher than in past decades when many plants were built. The negative impacts on nature of a few medium-size power plants are less than those of many small ones.*

*An investigation was conducted in the pilot area on the River Iller as to how the negative impact of existing hydropower plants on ecosystems can be minimised without decreasing energy production. Different measures to improve fish habitat structures for different stages of life and seasons, such as gravel banks, shallow slack waters and dead-wood have been developed and implementation has started.*

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*Expanding the use of renewable energy needs to be balanced with the use of other resources. The residents of Alpine Vale examine the impacts on provisioning ecosystem services using the example of hydropower.*

# Regulating & maintenance ecosystem services and forest biomass



*Expanding renewable energy needs to be balanced with biodiversity conservation and a functioning ecosystem.*

In June the residents of Alpine Vale thought about the possible impacts of energy production on provisioning ecosystem services. However, we also benefit from other ecosystem services such as regulating and maintenance services. These cover all the ways in which living organisms can mediate or moderate their environment in ways that affect human performance, such as the degradation of wastes and toxic substances and the mediation of water flows.

As the people of Alpine Vale want to expand their use of forest biomass, they are thinking about the possible impacts on regulating and maintenance ecosystem services. Plant and animal habitats are strongly affected by the intensification of forest management in unmanaged or extensively managed forests. In particular, a decrease in deadwood ratios or stands of old wood affects many species for which these are a habitat. These landscape elements also serve as a biodiversity indicator. Furthermore, forests play an important role in natural hazard protection against landslides or avalanches. Their protective function can be impacted negatively or positively, depending on forest management strategies:

- Soil-related ecosystem services such as water filtration may benefit if the increased use of bioenergy favours a shift to-

wards more diverse forests, particularly more broadleaved species.

- Heavy full tree harvesters and tree residue removals also impact groundwater and fertility. They can cause soil compaction or decrease the capacity of soils to buffer harmful substances.
- If emissions related to the burning of biomass are insufficiently filtered, they can cause cardiopulmonary morbidity and mortality.
- An increased use of forest biomass furthermore decreases the overall amount of biomass and thus also the carbon sequestration rate of forests and thereby counteracts the climate benefits of standing forests.

However, such negative impacts could be compensated through sound forest management, balancing long rotation periods aiming at maximising carbon sequestration against short rotation periods targeting biomass harvesting.

Next month we will take you on an exploration of Alpine Vale's cultural ecosystem services.

*Triglav National Park is Slovenia's only national park and its largest protected area. It is divided into three protection zones: in the first protection zone no commercial use of forests is allowed, whereas in the second and third zones sustainable forest activities are possible. Forests in the park provide a variety of ecosystem services such as nature conservation, protection of the cultural heritage and tourism. These services must be carefully investigated and balanced with forest biomass use. It is only possible to recommend a specific level of use when knowledge of biodiversity and habitat impacts is available. The recharge.green experts therefore complemented the forest inventory with information on biodiversity and soils. This will help to improve forest management and biodiversity monitoring in the Park.*



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*Expanding renewable energy needs to be balanced with biodiversity conservation and a functioning ecosystem. The residents of Alpine Vale examine the impacts on **regulating & maintenance ecosystem services** using the example of biomass.*

# Cultural ecosystem services and wind power

*Expanding renewable energy needs to be balanced with human wellbeing.*

The residents of Alpine Vale have already discussed the potential impacts of energy production on provisioning and regulating & maintenance ecosystem services. However, renewable energy could also impact intangible outputs of ecosystems that affect people physically or psychologically. Things you do in nature, such as recreational activities (e.g. hiking, climbing, skiing, etc.) or the enjoyment of landscape beauty are so-called cultural ecosystem services. This month the people of Alpine Vale are discussing the impacts related to a wind power project on cultural ecosystem services.

High wind energy potentials can typically be found on exposed terrain, at higher altitudes and on mountain ridges. However, the citizens of Alpine Vale associate the mountains surrounding their town with unspoilt nature, cultural identity, and space for recreational activities. Therefore, both the physical (e.g. lines of sight) and intangible dimensions (e.g. personal attitudes towards environment, cultural ideals and past experiences) of landscapes have to be taken into account to avoid

conflicts concerning cultural ecosystem services. Debates on this issue typically range from an added value resulting from the positive connotations of windmills as landmarks to their incompatibility with traditional images of Alpine landscapes that are important for tourism. Besides, to reduce potential health risks and avoid disturbance caused by noise, shadow and flicker effects, minimum distances from residential areas need to be respected. On the other hand, during the past decades both mechanical and aerodynamic noise have been substantially reduced.

The last few months have shown local people the broad range of impacts that various forms of renewable energy can have on ecosystem services. Depending on local characteristics and management strategies these impacts can be positive or negative. Due to these additional insights the stakeholders of Alpine Vale have decided to organise a meeting to thrash out different ideas and priorities. You can read more about this stakeholder meeting next month.

The Leiblachtal valley is located in the westernmost part of Austria, close to Lake Constance and the border with Germany. The moderately high mountain ridge of the Pfänder is currently being investigated as a potential location for windmills in Vorarlberg. Wind speed measurements are being carried out in a remote area of this mountain ridge to comply with the required minimum distances from settlements. Nevertheless, the population of the Leiblachtal is divided into supporters and opponents of the project. Fears have arisen in particular regarding landscape impacts and the future value of the mountain ridge for recreational activities. To overcome this split, the municipalities of the Leiblachtal are now working on a regional energy plan and strengthening their communication activities towards the public.



AUGUST

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*Expanding renewable energy needs to be balanced with human wellbeing. The residents of Alpine Vale examine the impacts on cultural ecosystem services using the example of wind power.*

# Local stakeholders



*Renewable energy development generates global benefits and local impacts in mountain areas. To avoid and resolve social conflicts one needs a participatory approach that includes local stakeholders.*

The residents of Alpine Vale live every day on their territory, considering its potentials and vulnerabilities, and they ask themselves what advantages and disadvantages can be produced from a further development of renewable energy. The proposal to increase forest cutting for energy purposes can help the local economy, and some of the local companies involved in this activity are planning to create new job opportunities. On the other hand, some representatives of environmental associations worry about the possible effects on air quality and on biodiversity. And what about dam construction? This can be a source of water for irrigation, especially in low-lying areas, but even taking increased electricity production into account the benefits for residents are not obvious.

The mayor is wondering how he can help to reach a common decision among the different factions in Alpine Vale. The enhanced use of natural resources – such as water, wind, forest biomass and solar radiation – for energy production requires a delicate balance to be found between the various uses of several eco-

system services. Exploitation of these resources for energy purposes will produce environmental and social impacts at the local scale, while the benefits will be distributed more widely. This is the basis of potential social conflicts that can be dealt with and resolved only through a participatory approach, involving local communities in the decision-making processes.

The mayor is now evaluating the installation of a wind turbine, but he would first like to meet the local people in order to present the project and understand their needs. He also wishes to discuss how to preserve the environment and mitigate the impacts with the technicians involved and with environmental associations. Taking both the knowledge and expectations of the inhabitants into account will allow the municipality of Alpine Vale to plan a sustainable future for its own territory.

And the mayor also asks himself... Are there any practical tools to help and encourage dialogue between parties in order to decide a planning strategy together?

Stakeholder involvement for Maè Valley was developed in two steps:

**1) Information:** a first meeting to present scenarios on renewable energy use and hear stakeholders' general comments. Representatives of local groups, administrations as well as leisure and environmental associations were invited. This gave them the opportunity to comment not only on the scenarios, but also on the whole structure of the process.

**2) Analysis:** a second meeting to obtain stakeholder feedback on the mapping of ecosystem services. Stakeholders were asked to assess the value of their territory and to identify areas with a particular need for protection. All suggestions were considered when formulating the final results and recommendations.

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*Renewable energy development generates global benefits and local impacts in mountain areas. To avoid and resolve social conflicts one needs a participatory approach that includes local stakeholders.*

# Supporting decision-making



*Decision Support Systems are needed for decision-makers and stakeholders to better understand complex system interactions so that they can make balanced decisions.*

Decisions have to be made in Alpine Vale on complex issues like renewable energy planning. Stakeholders such as energy experts, technical contractors, local people and also policymakers from local administrations, etc. need to discuss future options. A discussion of the options should be based on realistically possible choices. "Decision Support Systems" are tools designed to create plausible scenarios that can be used to feed discussions during consultation phases and to propose final scenarios once the main pathway is identified. Scenarios are like stories about the future, but can include detailed quantitative information about a system and its interactions. They are not predictions, but a way for people to understand the interactions between things, and to determine e.g. how much different future pathways may cost, and what impacts they may have.

In the case of Alpine Vale, a set of scenarios for the Alpine and local scales indicate the possible development pathways for four types of renewable energy – wind, hydropower, solar, and biomass – which need to be balanced with different levels of protection.

For Alpine Vale, the scenarios attempt to provide a holistic range of possibilities that could contribute to renewable energy development in the Alps. In addition to the renewable energy mix, policymakers and other stakeholders are able to set different levels of ecosystem protection, different energy targets, fossil fuel prices and carbon prices. Changing these variables allows them to see how their choices and possible outside influences fit with their goals. All these different scenarios can be visualised on the project website, where the recharge.green decision support system is available. This system was designed for users to define the best portfolio for renewable energy projects taking into account complex interactions.

At the Alpine level, the application of a decision support system to select the desired pathway between the different scenarios can support the definition of regional planning policies. At a more local level, like Alpine Vale, a decision support system can support the definition of specific local planning interventions in the frame of a broader Alpine vision. How this might look can be seen in November.

*The decision support system developed by recharge.green was applied in the Gesso and Vermenagna Valleys in the Maritime Alps pilot area. The recharge.green specialists first acquired knowledge and data on the current use of renewable energies with the support of local experts, who were also questioned about the potentials and who recommended forest biomass as the most promising energy source for further investigation. Consequently, the recharge.green experts prepared scenarios by means of the decision support system. In parallel, the list of stakeholders to be included in the decision making process was expanded and stakeholders were permitted to comment on the scenarios in meetings. Finally, a hypothesis was developed and discussed by participants involving a scenario for the building of a small biomass plant with a short-chain system.*



OCTOBER

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**Decision Support Systems** are needed for decision-makers and stakeholders to better understand complex system interactions so that they can make balanced decisions.

# Alps-wide stakeholders

*Multi-level governance matters! Stakeholders from different sectors and levels (from local to Alpine-wide level) need to be connected to best implement a sustainable Alpine Renewable Energy Strategy.*

The residents of Alpine Vale have developed a set of scenarios for their town and for the Alpine level that provides a holistic approach and a range of possibilities for sustainable renewable energy production in the Alps. Interest in this concept from other Alpine regions is high and many other mayors have contacted the administration to learn more about it. This has encouraged the town council to contact the national administration responsible for renewable energy to discuss the results obtained through the use of the decision support system and options for further improving the concept and transferring it to other regions of the Alps.

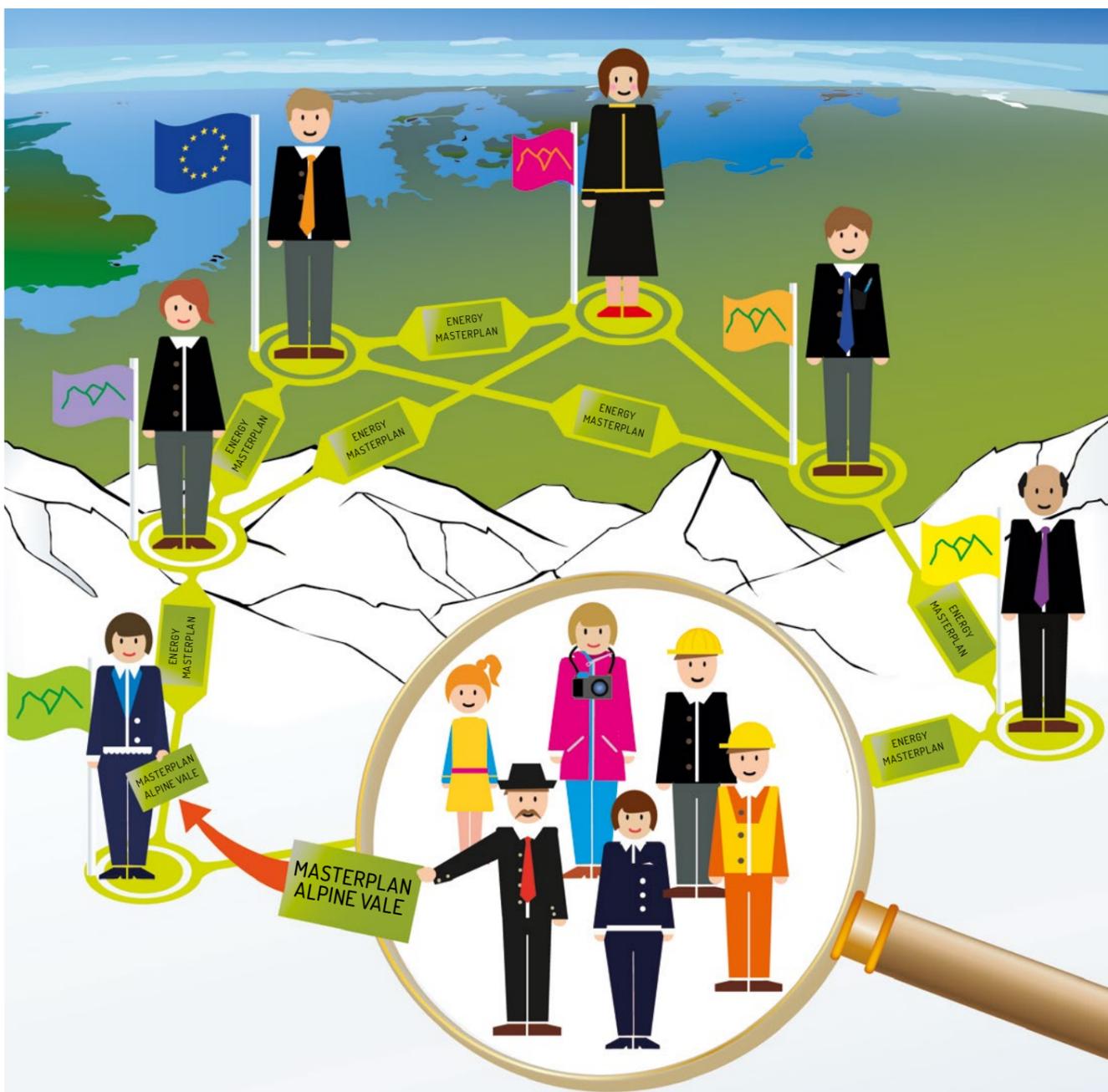
Because a harmonised regional planning policy for renewable energy is desirable in the Alps, the national representatives of the Alpine Vale area are discussing the renewable energy scenarios with various national Alpine and European representatives. As a first step, an analysis of the pros and cons of the renewable energy concept is necessary to get a clearer picture of how best to apply the methodology to other regions. The next logical step would be a 'Sustainable Alpine Renewable Energy Strategy' in accordance with the Renewable Energy Directive and other relevant Directives and strategies of the European Union.

The various Alpine countries have different renewable energy production approaches and a diverse stakeholder setting. Consequently, stakeholders at Alpine level will discuss Alpine Vale's results with national and regional stakeholders to harmonise and adapt the concept. Moreover, at European level the Macro-regional Strategy for the Alps calls for solutions that consider regional aspects when establishing a future-oriented energy policy for the entire Alpine arc.

These factors necessitate an integrated discussion of all energy-related aspects in order to determine the best multi-level governance model to manage renewable energy production, nature protection and human wellbeing in the Alps.

For Alpine Vale, being part of a wider strategy on renewable energy production is highly motivating and has helped achieve the objective of optimised land-use planning while reconciling energy production and the benefits of nature conservation. But can Alpine Vale get public acceptance for its promising ideas? Find out how the story ends in December.

*The recharge.green project presented regional and Alps-wide scenarios to various stakeholders. At first, possible development pathways for renewable energy at regional level were identified and discussed with regional stakeholders in pilot areas. In 'transnational implementation workshops', regional and Alps-wide renewable energy scenarios were communicated to national stakeholders and guidance for a sustainable Alps-wide renewable energy strategy was provided. recharge.green visualised all four renewable energy sources and their Alps-wide potential, making them accessible to stakeholders. Dissemination events like an 'implementation workshop for the decision support system' and the 'final conference' saw national stakeholders coming from various sectors to discuss the results.*



NOVEMBER

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*Multi-level governance matters! Stakeholders from different sectors and levels (from local to Alpine-wide level) need to be connected to best implement a sustainable Alpine Renewable Energy Strategy.*

# Eco-Town Alpine Vale

*All forms of energy have some impact on the environment – but by using the right planning processes and tools you can minimise this impact and protect ecosystems and landscapes enough to safeguard biodiversity and human well-being.*

Alpine Vale has gone through a thorough strategic environmental impact assessment procedure, which has included the use of various decision support tools. The mayor's office has held several meetings with concerned stakeholders, including environmental groups, the local business association, the tourism office, town planners, and representatives of different renewable energy producers. All potentials for renewable energy production were examined and the pros and cons evaluated, including impacts on nature. A web-based decision support tool developed by recharge.green helped the municipality in this process.

Because many Alpine Vale residents were concerned about environmental factors and maintaining the beautiful landscape that attracts tourists, the town planners were instructed to find a solution that would limit the impact of new developments on major ecosystem functions, but that would nevertheless create additional income for the administration while also bringing jobs and improving the town's carbon budget.

The planners came up with a "sustainability package" that includes unlimited use of solar power on building surfaces, the

use of some five wind turbines distributed around town in easily accessible agricultural and pasture areas outside town that are subject to high winds, and for which compensation will be paid to farmers for the partial loss of their cultivable land surface. Rather than building its own biomass production plant, the town will open up some of its forest for logging, and transport logs for processing to a nearby existing processing plant. At the same time, the environmental groups and the tourism association were successful in arguing for the creation of a small protected area that will function as a stepping stone between two larger nearby protected areas. One potential co-benefit of this comprehensive sustainability package is certification as an "Alpine Eco-Town", which the town planners hope will attract additional environmentally-minded visitors.

The town planners of course arrived at other possible sustainable scenarios using the recharge.green decision support system. This is the solution that Alpine Vale has opted for – which solution would be the most suitable for your town?

## FURTHER INFORMATION

In addition to this calendar, recharge.green has produced a series of results and outcomes which are all available at [www.recharge-green.eu](http://www.recharge-green.eu).

- Decision Support System
- Renewable energy and ecosystem services in the Alps - Status quo and trade-off between renewable energy expansion and ecosystem services valorisation.
- Report on modelling and visualisation of optimal location of renewable energy production in the Alpine Space with special focus selected pilot areas.
- Recommendations for an Alpine Renewable Energy Strategy.
- Sustainable Renewable Energy Planning in the Alps: A handbook.

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## DECEMBER

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*All forms of energy have some impact on the environment – but by using **the right planning processes and tools** you can minimise this impact and protect ecosystems and landscapes enough to safeguard biodiversity and human well-being.*

# IMPRESSUM

**Publisher:** recharge.green project

**Editorial responsibility:** blue!, CIPRA, EURAC, FIWI, IIASA, University of Innsbruck, Veneto Region

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**Copy editing/Translation:** Gareth Norbury

**Layout:** Patrick Reinhardt

**Illustrations:** Amaury Baumgärtner

**Print:** EOS PRINT, Germany. Printed in a resource-friendly way on FSC-Mix paper.

**Project partners:** Research Institute of Wildlife Ecology (FIWI) of the University of Veterinary Medicine Vienna, lead partner; Agricultural Institute of Slovenia; Agroscope – Swiss research into agriculture, nutrition and the environment; Bavarian electric power company (BEW); Department for forestry and renewable forest resources, University of Ljubljana; Environment Agency Austria; Institute for Geography, University of Innsbruck; European Academy of Bozen/ Bolzano (EURAC); International Commission for the Protection of the Alps (CIPRA); International Institute for Applied Systems Analysis (IIASA); Mountain Institute; Regional Development Vorarlberg; Slovenia Forest Service; Triglav National Park; Veneto Region / Office for Economics and the Development of Mountain Areas

**Observers:** Alpine Town of the Year Association, Austrian Institute of Economic Research, ARPAV/ Veneto Regional Agency for Prevention and Environmental Protection, Austrian Biomass Association, Canton St. Gallen/Office for Environment and Energy, Consorzio Bim Piave, Eawag/Swiss Federal Institute of Aquatic Science and Technology, Institute for Ecological Energy at the Bavarian Environment Agency, Office of the Lower Austrian Government/Department of Rural Development, Permanent Secretariat of the Alpine Convention, Platform Ecological Network of the Alpine Convention, Province of Bolzano, Regional Governmental Office of the Land Salzburg/Department of Spatial Planning, Regional Governmental Office of the Land Vorarlberg, Veneto Region

**With support of:** Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany; Bavarian State Ministry of the Environment and Consumer Protection

This publication is also available in French, German, Italian and Slovenian

**May 2015**

Order information/download: [www.recharge-green.eu](http://www.recharge-green.eu)

**ISBN: 978-3-906521-77-0**

