Renewable Energies in Alpine Protected Areas

Technical Report

Entlebuch UNESCO Biosphere Park
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Together for the Alps

Renewable Energies in Alpine Protected Areas

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August 2023, Chambéry (F)

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Abbreviations:
EIA = Environmental Impact Assessment
RE = Renewable Energy
PA = Protected Area
PV = Photovoltaics

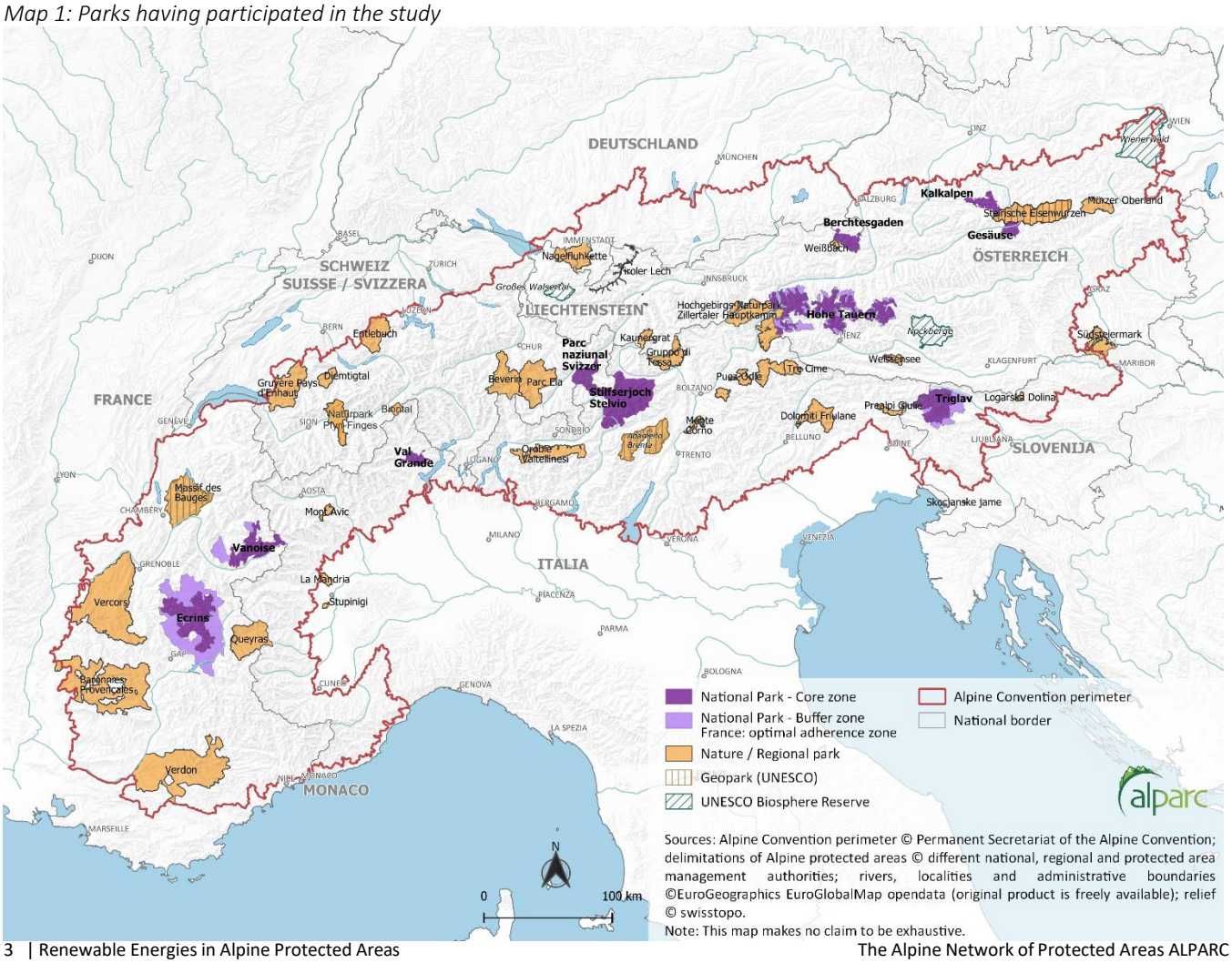
1.1 Context, objective and approach

The European energy market has become very dynamic since the 2022 energy crisis triggered by the Russian war of aggression on the Ukraine. Climate targets that the European Union originally set itself were changed and adapted within a few months to become more independent of Russian gas supplies as quickly as possible, and to ensure a diversified energy supply. Alongside the debate of nuclear power, renewable energies (REs) play the most important role in this transition. Since the expansion has not progressed fast enough in recent decades in most European countries, measures were initially decided in the EU, which entail a massive acceleration and simplification of approval procedures for REs. In concrete terms, this means that RE sources will from now on be in the "overriding public interest" in European countries, and will be prioritised to other uses, such as nature conservation.

Many nature conservation associations and protected area managements are worried about these developments, as high-alpine regions may also be affected. This creates concerns, especially in the photovoltaics (PV) sector, as it is likely to develop rapidly in the months to come. Energy infrastructure has different impacts on nature and the environment. Collisions of birds and bats against the rotor blades of wind turbines are often observed; the habitats of fish are severely affected by hydropower plants; biogas plants release unpleasant odors, and solar parks and wind power plants in open spaces are very controversial, due to their negative landscape aesthetics. In French regional nature parks, the construction of solar parks is permitted, and in Switzerland there are projects to implement high-altitude solar parks in the mountains. Some wind power projects close to National parks are also in discussion. Many protected areas (PAs), especially in France and Switzerland, do not have enough protection against such infrastructure projects. Therefore, there is reason to worry that RE could soon be extended to PAs.

ALPARC has therefore launched a survey among PAs of different categories (national parks, nature parks, biosphere parks, geoparks) to obtain information on the status quo of RE plants, and which conflicts came up during project realisations. Furthermore, the survey allowed us to determine which goals are formulated for the parks, and which funding programs for REs are granted in this context. The parks were also asked which energy sources will be expanded in the future, and how the PA managers view the development towards REs.

Map 1: Parks having participated in the study



1.2 Survey participants (parks)

A total of 78 PA administrations were contacted, of which 47 were completed, and one was returned unfilled. Most respondents are ALPARC members. Other parks are in regular contact with ALPARC, e.g. through joint projects. Some PA administrations are responsible for the management of several PAs, so the total number of parks is higher. One example is the Autonomous Province of Bolzano – South Tyrol, which manages 7 nature parks. In contrast, the National Parks Hohe Tauern and Stilfserjoch / Stelvio have several administrative units. The following map (Map 1) gives an overview of the participating parks and their categorisation.

For the sake of clarity, these are also listed in Table 1 below. The parks surveyed belong to the following categories: 28 (regional) nature parks (of which there is 1 in Germany, 5 in France, 7 in Italy, 8 in Austria, 6 in Switzerland and 1 in Slovenia); 15 national parks (of which there is 1 in Germany, 3 in France, 4 in Italy, 5 in Austria, and 1 each in Switzerland and Slovenia); 4 UNESCO biosphere reserves (of which 3 are in Austria and 1 is in Switzerland); 1 UNESCO Geopark (Austria) and 1 Landscape Park (Slovenia).

Only national parks and biosphere reserves have zoning, which allows a gradation of protection objectives. Nature parks, on the other hand, do not have any zoning models. However, if nature reserves are in the park perimeter, these areas are subject to strict protective measures. An example of this is the Hauts Plateaux du Vercors nature reserve, located in the Vercors park perimeter.

Table 1: Alpine Protected Areas participating in this publication survey

Country	Name / Category	Contact
Austria	Gesäuse National Park	Herbert Wölger
Austria	Hohe Tauern National Park Salzburg	Wolfgang Urban
Austria	Hohe Tauern National Park Carinthia	Katharina Aichhorn
Austria	Hohe Tauern National Park Tyrol	Hermann Stotter
Austria	Kalkalpen National Park	Josef Forstinger
Austria	Carinthia Nature Parke	Robert Heuberger
Austria	Tiroler Lech Nature Park	Isabella Hilti
Austria	Kaunergrat Nature Park	Ernst Partl
Austria	Mürzer Oberland Nature Park	Andreas Steininger
Austria	Zillertaler Alpen Nature Park	Willi Seifert
Austria	Southern Styria Nature Park	Matthias Rode
Austria	Weißbach Nature Park	Sandra Uschnig
Austria	UNESCO Nature and Geopark Styrian Eisenwurzen	Martin Gebeshuber
Austria	UNESCO Biosphere Reserve Nockberge	Dietmar Rossmann
Austria	UNESCO Biosphere Reserve Wienerwald	Andreas Weiß
Austria	UNESCO Biosphere Reserve Grosses Walsertal	Andreas Bertel
France	Mercantour National Park	Boris Opolka / Jean-Yves Biancheri
France	Vanoise National Park	Stéphane Martin
France	Nationalpark Les Ecrins	Julien-Pierre Guilloux
France	Baronnies Provençales Regional Natural Park	Audrey Matt
France	Bauges Regional Nature Park	Romane Girard
France	Queyras Regional Natural Park	Cécile Descampiaux
France	Verdon Regional Natural Park	Dominique Imburgia
France	Vercors Regional Natural Park	Emmanuel Jeanjean
Germany	Berchtesgaden National Park	Oliver Pohl
Germany	Nagelfluhkette Nature Park	Max Löther
Italy	Stelvio National Park - Lombardy	Andrea Zaccone
Italy	Stelvio National Park - South Tyrol	Stefanie Winkler

Country	Name / Category	Contact
Italy	Stelvio National Park - Trentino	Angiola Turella
Italy	Val Grande National Park	Noemi Comola
Italy	Naturpark Julian Prealps	Giulio Goi
Italy	La Mandria & Stupinigi Natural Park	Stefania Grella
Italy	Friulian Dolomites Natural Park	Graziano Danelin
Italy	Naturpark Orobie Valtellinesi	Claudio La Ragione
Italy	Mont Avic Natural Park	Daniele Stellin
Italy	South Tyrol Nature Parks	Leo Hilpold
Italy	Adamello Brenta Nature Park	Matteo Vivani
Slovenia	Triglav National Park	Tit Potočnik
Slovenia	Skocjana Caves Regional Park (Škocjanske jame)	Stojan Ščuka
Slovenia	Logar Valley Landscape Park (Logarska Dolina)	Hermina Prelesnik
Italy	Adamello Brenta Natural Park	Matteo Vivani
Switzerland	Swiss National Park	Ruedi Haller
Switzerland	Beverin Nature Park	Reiner Schilling
Switzerland	Binntal Landscape Park (Nature Park)	Moritz Clausen
Switzerland	Pfyn-Finges Nature Park	Andreas Gattlen
Switzerland	Gruyère Pays d'Enhaut Nature Park	Yves Baechler
Switzerland	Diemtigtal Nature Park	Norbert Schmid
Switzerland	Parc Ela	Veronika Widmann
Switzerland	UNESCO Biosphere Entlebuch	Christian Ineichen

2 Basics of Protected Areas, Energy policies, Objectives and Support Measures

2.1 Alpine Protected Areas

In the following, PA categories and zoning are examined in more detail. They allow an initial assessment of the extent to which energy policy measures can be implemented in the respective parks. Table 2 gives an overview of the most important categories of PAs and their protection status.

Most of the PAs that have been surveyed are nature parks and national parks. The primary goal of national parks is to protect nature and biodiversity, which always have priority over other park functions. Human activities are limited to scientific or touristic purposes. Activities with economic interests are, in most cases, prohibited. The installation of energy systems is therefore mainly limited to island systems, for the self-sufficiency of Mountain Huts & Co. Zoning is only applied in national parks and biosphere reserves. Both have core and buffer zones, and biosphere reserves also have development zones. A special kind of zone includes landscape protection areas (Landschaftsschutzgebiete), which exist in this form only in Germany and Austria, and serve to preserve the landscape.

Table 2: Categories of Protected Areas in the Alps

Category	Description	Example from the Alps
National park	• Main objective: Protection of ecological processes and species and ecosystems characteristic of the area • Active parking management required • Use for scientific purposes permitted • Uses for economic purposes often prohibited • Largely fulfil the requirements of nature reserves • Their area is in a condition not or only slightly influenced by humans • Zoning usually in the form of core and buffer zones	Gran Paradiso National Park (IT)
Nature reserve	• In many countries, the strictest form of protection • Nature conservation has priority over other types of use • Usually have a smaller area than national parks	Passy Nature Reserve (FR)
Nature park	• Areas that are predominantly also landscape protection areas or nature reserves • Objective: sustainable regional development and tourism, diverse land use and species/habitat diversity, education for sustainable development, recreational purposes	Nagelfluhkette Nature Park (DE)
UNESCO Biosphere Reserve/Park	• Areas to be uniformly protected and developed • Conservation of natural resources and regional development measures • Zoning: core, buffer and development zone	Entlebuch Biosphere Reserve (CH)
UNESCO World Heritage Site	• Worldwide significance due to uniqueness • Rarely found in the Alps	Swiss Alps Jungfrau Aletsch (CH)
UNESCO Geopark	• Internationally recognized due to geological peculiarities • Nature conservation, education and sustainable development as essential concepts	Steirische Eisenwurzen Nature and Geopark (AU)

2.2 Energy policies in Alpine countries

Due to changing political framework conditions in the European Union and in Alpine states, the question arises as to what extent new objectives and legislative changes will affect PAs. To answer this question, it is necessary to look at the current legal situation. There have been numerous energy-related amendments, especially in Germany, Austria, and Switzerland. These are particularly aimed at massively expanding the share of REs in the coming years. This is to be achieved primarily through accelerated and simplified approval procedures. One of the most important measures is to avoid a duplication of environmental checks in the future. There are also other measures, such as the simplification of participatory procedures, as well as setting RE plants in the "overriding public interest". The latter action gives less weight to all other uses, including nature conservation. These actions not only lead to the acceleration of approval procedures, but they also harbour conflicts, as nature and landscape conservationists fear that ecologically sensitive areas (e.g. nature parks) will now have to succumb to being equipped with solar plants or wind farms.

The current political debates on REs are controversial. In Germany, a target area for wind power has been set for 2032 (at least 2.2 % of the federal territory should be designated for wind power). Austria is aiming for climate neutrality by 2040 and, in addition to wind power, also opts heavily on PV, which means that open spaces also will need to be used. France wants to massively expand its PV potential, whereby infrastructure projects in the mountains (apart from nature conservation) come into conflict with other uses, such as tourism. Switzerland has also launched a solar offensive that envisages a massive expansion of PV plants in alpine terrain. The development and emergence of the RE sector is uncertain as to which PA managers and nature or landscape protection associations it is concerned about.

2.3 Targets related to renewable energy and sustainability

2.3.1 State/regional/municipal strategies and programs

Germany

No specific RE targets were formulated for the two German parks Berchtesgaden and Nagelfluhkette.

France

In Baronnies Provençales, the target is to reach a RE production of 25 % of total energy consumption by 2025. The priority is given to wood energy, solar heating and PV (rooftop installations) in the context of shared governance projects (such as village power plants). In Vercors Nature Park, the aim is to develop REs to produce as much as is consumed by the end of the next charter (2039).

Italy

Among the Italian parks, no objectives have been formulated. A guideline was set out by the region of Lombardy, which also concerns the Orobie Valtellinesi Nature Park. It identifies the environmental aspects of the use of electricity generation systems from REs in PAs. Furthermore, the report contains examples from the different Lombard PAs on sustainable energy use, such as a water management plan for hydropower in the provinces.

Austria

Generally, the expansion of REs for economic purposes in PAs is prohibited in Austria. It therefore comes as no surprise that no concrete RE targets have been formulated at all in National Parks such as Hohe Tauern, Gesäuse or Kalkalpen. The Austrian region of Southwest Styria has published a Guide to the expansion of PV in the region of Southwest Styria. It includes a guide to location planning, an assessment of environmental impacts (EIA), recommendations for the management of PV expansion in the municipalities, and much more. Another aspect is the definition of local exclusion zones, such as nature parks. Weissbach Nature Park has a spatial development concept which is carried out by the municipality, which highlights the preservation of existing facilities. Wienerwald Biosphere Park does not have its own regulations, but the “Klima- und Energieprogramm 2030” of Lower Austria and the “Wiener Klimafahrplan 2040” also apply to the park. These programmes cover themes such as building and living, mobility, sustainable economy, and energy supply. Very ambitious objectives were set for Grosses Walsertal Biosphere Park. Accordingly, 100 % of REs will be reached by 2030.

Switzerland

In the 2 Swiss PAs Diemtigtal Nature Park and Parc Ela, concrete objectives have been formulated at a communal level. The Ela region has drawn up the energy concept „Ela Energiestadt“. It supports the goals of the Federal Government, and the 2050 Energy Strategy. The quantitative objectives refer to the concept of the 2000 watt society. The objectives of Diemtigtal Nature Park are formulated by the municipality of Diemtigen, and the goals include a reduction in demand by means of implementing efficiency measures, and a coverage of the remaining demand by local REs. In addition, an export surplus for REs is targeted.

Slovenia

There is an energy strategy for the Logar Valley Landscape Park, which is based on the strategy for sustainable development in the Solčava 2030 municipality. Accordingly, 100 % self-sufficiency of REs shall be reached.

Solar park in the Alps © G. Plassmann

St. André les Alpes © G. Plassmann

2.3.2 Initiatives and programs of the protected areas

Germany

Berchtesgaden National Park has formulated goals regarding environmentally friendly energy supply. They have also issued an environmental statement that records all energy consumption (buildings, vehicles, service providers) and greenhouse gas emissions.

France

All French parks have so-called charters that address sustainability and energy issues. These also include initiatives, projects, or programmes on these subjects.

The Massif des Bauges and Vercors Nature Park have drawn up mission statements based on so-called "TEPOS" projects (Territoire à Énergie positive). Cities, municipalities, regions or agglomerations can join forces, and become energy regions with this project. The Massif des Bauges Park leads the energy region of the agglomerations of Annecy, Chambéry, and Grand Lac (Lac du Bourget).

Park	Measures and initiatives
La Vanoise National Park	- No longer use of generators
Les Ecrins National Park	- Use of pico hydropower plants for isolated regions that are not connected to the public electricity grid
Massif des Bauges Nature Park	TEPOS Energy region: - Becoming an autonomous energy region - Achieving energy balance and improving the carbon balance - Reduce the energy poverty of residents and reduce the energy costs of communities by becoming a model territory for energy transition - Improve the positive emission/storage balance of greenhouse gases of the park
Queyras Nature Park	- Energy autonomy desired by 2050
Vercors Nature Park	TEPOS Energy region: - Reduction of energy consumption
Verdon Nature Park	- Objectives for the preservation of outstanding natural and agricultural areas (mentioned in the next charter) and other subjects such as green and blue infrastructure

Italy

There are no sustainability or energy projects/initiatives in Italian parks.

Austria

A position paper was created by federal representatives, experts from the federal government, Länder representatives, NGO representatives, and advisory members/experts of the National Parks. It includes energy-politics such as energy-saving measures, improvement of the energy efficiency, and an expansion of REs in an ecologically and socially acceptable manner. It also highlights the exclusion of wind and water power in Austrian national parks.

Switzerland

4 out of 8 Swiss parks surveyed, have formulated targets: in the Entlebuch Biosphere Park and Park Ela, for example, these are set out in energy mission statements. The Pfyn-Finges and Diemtigtal nature parks have set strategic goals, together with the municipalities. Gruère Pays d'Enhaut Park has drawn up a management plan to raise awareness among the population about energy issues, and to implement measures to promote energy efficiency and REs.

Park	Measures and initiatives
Pfyn-Finges Nature Park	- Strategic goals are formulated in the park contract with the municipalities and in the 10-year management plan of the park, for example: - promoting the development towards climate-adapted and landscape-friendly mobility systems, buildings, and facilities
Beverin Nature Park	Energy vision: - The park aims to demonstrate the existing potential of REs and possible measures to increase the energy efficiency - Vision: cover its own energy needs from local, renewable resources.
Gruyère Pays d'Enhaut Nature Park	Park Management plan 2020 – 2024 : - Communities and private persons carry out more measures regarding energy efficiency or REs - Awareness-raising measures for the public concerning energy problems
Entlebuch UNESCO Biosphere Park	- Regional climate and energy model - Increasing energy autonomy; long-term goal = self-sufficiency - European Energy Award Gold

Slovenia

Of the 3 Slovenian parks, Triglav National Park and Logarska Dolina have set up several targets which are listed below:

Park	Measures and initiatives
Triglav National Park	Replacement of less suitable energy sources by transition to the use of RE sources (environmental acceptability, accessibility), taking into account local characteristic and limitations
Logarska Dolina	Several measures are planned/desired: - Optimisation of the hydropower plants - Heat most of the buildings with REs - Increased use use of biomass for heating

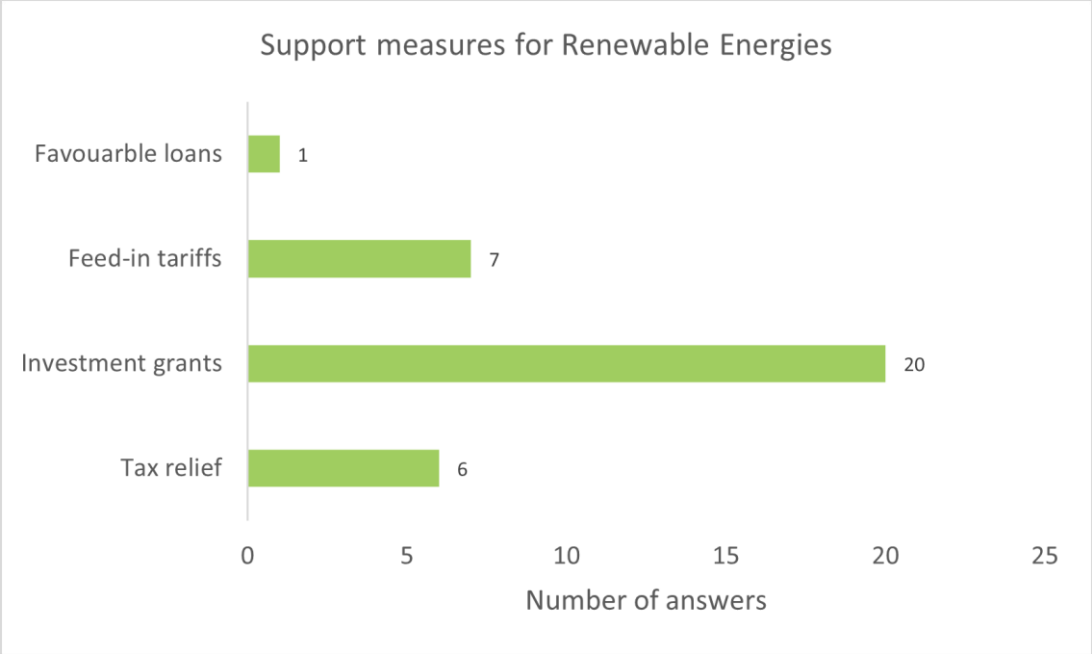
Wind mills in the Entlebuch Biosphere Park © *C. Ineichen*

Wind park on the Nufenpass in Valais, Switzerland © G. Plassmann

2.4 Support measures and compensation

The countries follow different approaches to enhance the investment in REs. These government support programmes can be divided into two categories: programmes and incentives for private persons, and competitive tendering procedures. The latter procedure applies only to large facilities. For individuals and private persons, REs are subsidised in the form of tax relief, investment grants, attractive feed-in tariffs, and favourable loans. Although the programmes are, in most cases, supported by the states or regions/federal states, they can often be reflected in PAs. Figure 1 shows the support measures for REs which are applied in the PAs:

Figure 1: Support measures for Renewable Energies



Undoubtedly, investment grants are the most common form of financial support for investing in REs. In Germany and Switzerland, investments in REs are often supported in the form of attractive feed-in tariffs, and Italy grants a tax relief on RE plants. Funding rates vary from country to country. However, besides the governmental fundings, a closer look should be made at park-specific programmes. Pfyn-Finges Nature Park supports pilot projects or landscape-related studies. Energy communities are supported in some Alpine parks, such as the Vercors, or Weissbach Nature Park, and also in some Italian parks. In Vercors, there are some power plants owned by the energy communities. The establishment of energy communities may play a major role in the future, since it enables a local use which is essential for remote Alpine regions.

In general, there is a high political will to incentivise RE production in the Alpine states. It remains to be seen to which extent new projects will be developed, and if REs will also be installed in open spaces within park areas. Zillertaler Alpen Nature Park, for example is worried about the very attractive feed-in tariffs.

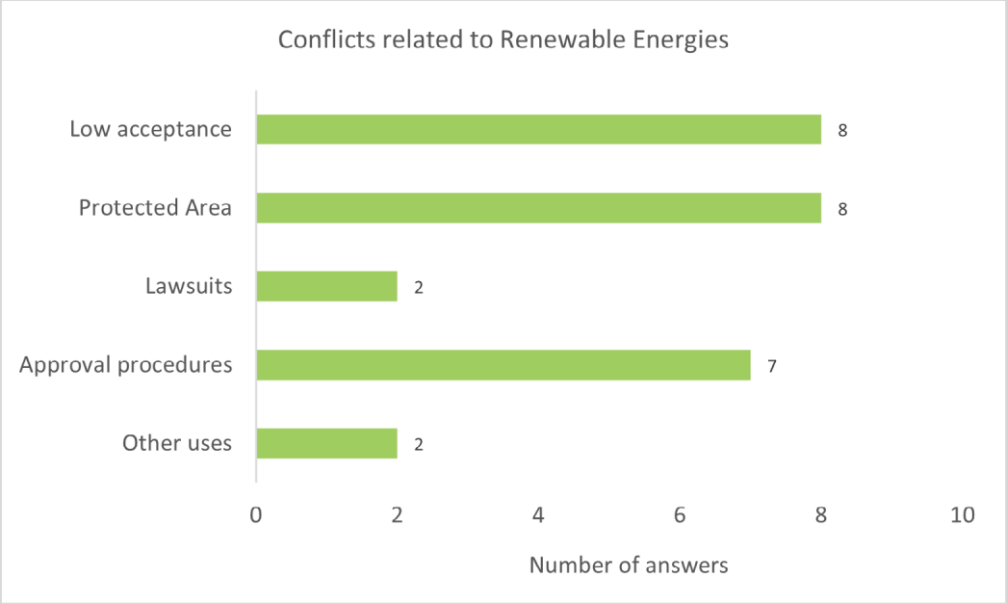
2.5 Conflicts related to Renewable Energies in Alpine protected areas

Both nature conservation measures and the generation of RE take up land. On the one hand, the plants themselves and the infrastructure they require contribute to landscape fragmentation; on the other hand, large RE facilities can pose a threat to biodiversity, consequently causing conflicts of interest. The main areas of conflicts are listed in the table below:

Renewable Energy Source	Conflicts
Hydropower	- Many conflicts with hydropower in the past (even with small hydropower plants) - Small and especially big plants influence water ecosystems and habitats for aquatic organisms - Habitats can be destroyed, and fish migration interrupted
Wind power	- Wind farm projects are generally rejected by nature conservation and landscape protection associations - Impacts: change to landscape, the risk of collision for flying animals due to the rotors, dangers to bird migration, noise production, and the loss, degradation, and fragmentation of habitats
Photovoltaics	- Impacts on landscape aesthetics through open-space facilities - Soil sealing and fragmentation of habitats
Biomass	- Negative impacts on the forest ecosystem - Degradation or even loss of habitats in case of mismanagement

In the survey, the parks have been asked which conflicts came up with past projects on REs. The figure 2 shows the different conflict issues:

Figure 2: Conflict issues in connection with Renewable Energies in past projects



Low acceptance and resistance from the PAs are mentioned most. Also, long and complex approval procedures have led to disputes. Some projects were sued by nature conservation associations. Other conflicts relate to other uses, such as agriculture and fisheries (e.g., in the Massif des Bauges and Mürzer Oberland Nature Parks). In the Vercors Nature Park, a wind farm project was rejected in the planning stage due to opposition from the population and associations. In total, 19 parks did not have any problems at all.

Acceptance problems occured mostly in France, whereas conflicts with the PAs were recorded especially in Italy,

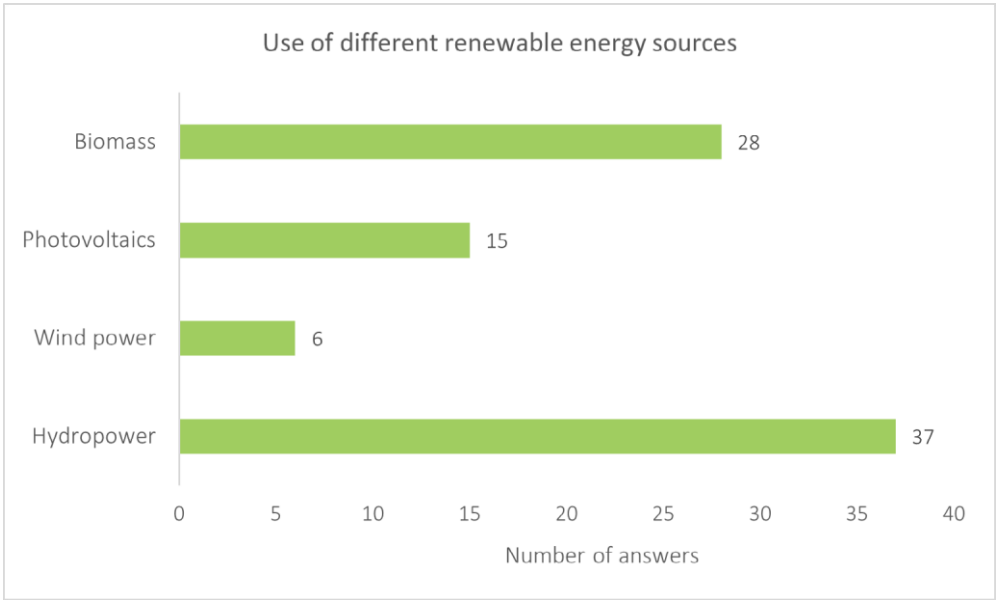
Switzerland, and Slovenia. Long and complex approval procedures came up in Austria, Switzerland and Slovenia.

3. Renewable energy projects and potential conflicts

3.1 Status quo and planned projects

41 of the 48 parks surveyed, report that electricity is produced from RE sources in the park perimeter. However, it is important to differentiate here, as in most PAs, renewable electricity comes from rooftop PV systems or mini hydropower plants for self-supply.

Figure 3: Use of different Renewable Energy sources in the Protected Areas

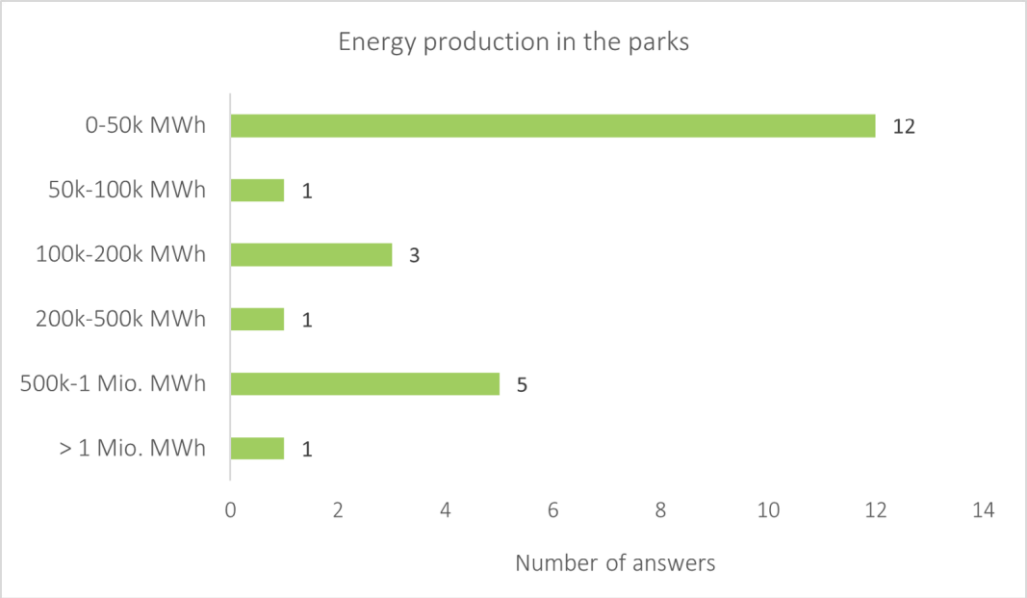


Hydropower is represented in most of the parks. Large-scale hydropower plants are located in several parks, for example in the Stelvio (IT), and Swiss National Park (CH), as well as in Vercors (FR), Verdon (FR), Queyras (FR), Adamello Brenta (IT), Julian Prealps (IT), Orobie Valtellinesi (IT), and Zillertaler Alpen (AU) Nature Parks. Smaller plants for self-supply are especially found in large national parks such as Berchtesgaden (DE), Hohe Tauern (AU), Kalkalpen (AU), Vanoise (FR), and Les Ecrins (FR).

Biomass is represented as the second most common, followed by PV (15), and wind power (6). Most PV plants are installed on rooftops, and do not have any ecological or aesthetic impacts. 8 parks have few (between 0-5) plants. 3 parks each have between 6-10 and 11-15 installations, and in 2 PAs there are between 16-20. More than 20 facilities exist in 5 parks. There are no installations at all in 7 PAs.

In the following, the amounts of energy produced in the PAs are presented, in order to get an idea of the dimension.

Figure 4: Energy production in the Protected Areas



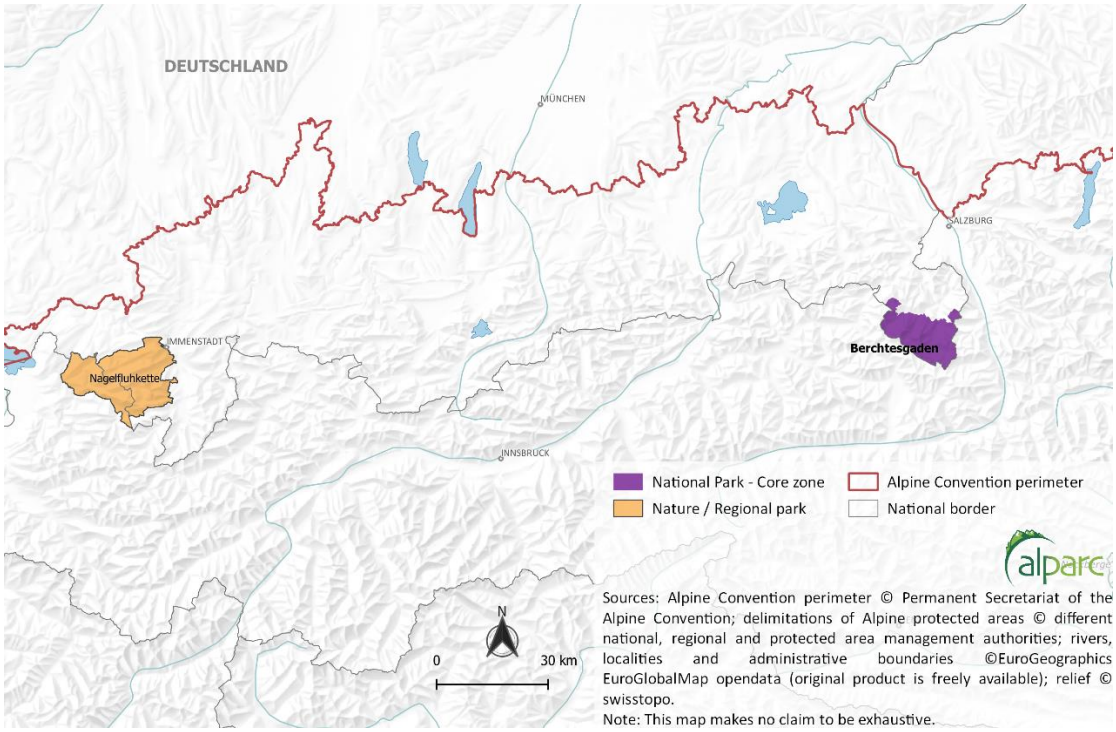
Most PAs produce smaller amounts of electricity; more specifically between 0 and 50 MWh. Most of these installations are small-scale (stand-alone systems for self-supply, PV systems on roofs, wind turbines, etc.). It can be assumed that these installations do not have a large negative impact on biodiversity and landscape, due to their small size.
However, 6 parks generate more than 500,000 MWh: Verdon, Vercors, Orobie Valtellinesi, and Zillertaler Alpen Nature Parks, the Stelvio Lombardy National Park, and the Steirische Eisenwurzen UNESCO Geopark. The Zillertal Alps, in particular, stand out with their numerous hydroelectric power plants.

In the following, the parks are presented in tabular form ordered by country. A distinction is made between past and planned projects, and which conflicts were/are/will be associated with them. The statements should be considered in a differentiated manner, as most of the information is about smaller facilities that serve, for example, the self-sufficiency of houses, huts, restaurants, etc.

3.1.1 Germany

In the German parks Nagelfluhkette and Berchtesgaden, electricity is mostly generated from hydropower and PV. In Berchtesgaden, there is a hydroelectric power plant that supplies a restaurant. Some houses, like the National Park Centre, or a mountain hut, are equipped with PV systems.

Map 2: Alpine Protected Areas in Germany participating in this publication survey



National Parks

Berchtesgaden National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		- 2 hydropower plants (locations: Obersee, Hirschbichl) - PV plants on roofs - PA buildings such as information centre, administration and accommodation are supplied with 100 % green electricity - Share of REs: 62,65 % (2021)	- Installation of PV plants on roofs - Expected share of REs in 2023: 80 %
Zoning		Core & buffer zone	No data
Conflicts		Conflicts with the hydropower plant	No conflicts are expected

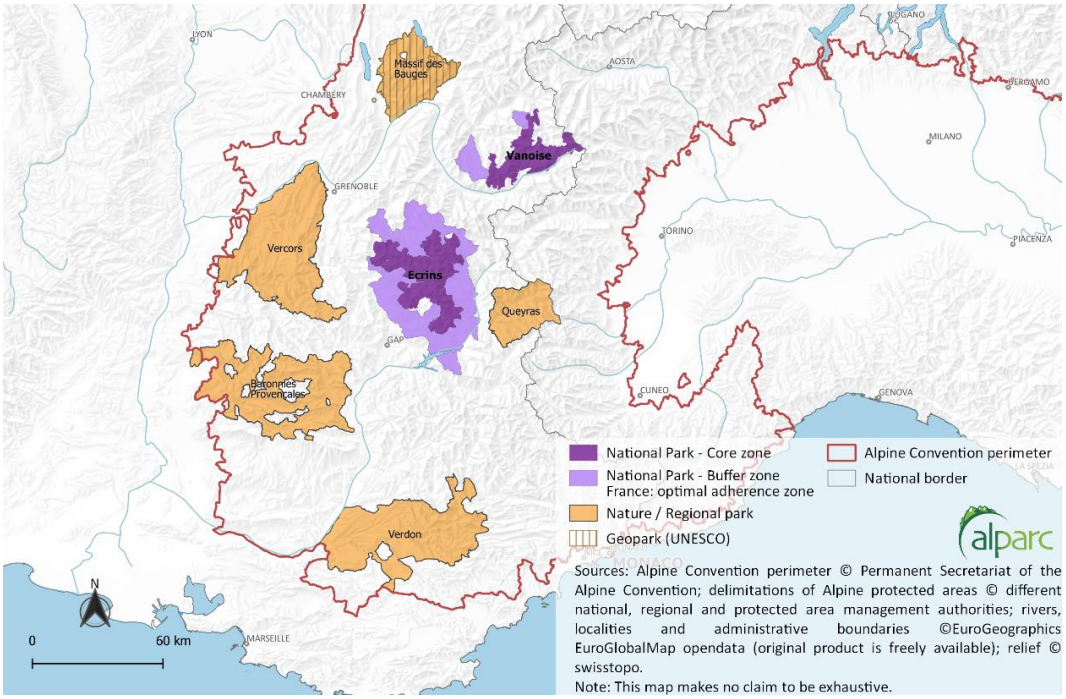
Nature Parks

Nagelfluhkette Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	Yes	No
Energy Production		No data available	-
Zoning		Nature park without fixed zoning	-
Conflicts		No conflicts	-

3.1.2 France

Hydropower plays a major role in all French parks. In addition, electricity production from PV is becoming more and more important, even if these are mostly roof-mounted PV systems. In the two southern nature parks Baronnies Provençales and Parc du Verdon, some solar parks are installed in open spaces. This is unique, and conclusions can be drawn about the relatively low protection status of French nature and regional parks. Biomass is also traditionally used a lot in many French parks. Five PAs indicated that electricity or heat is produced from this source. In the Massif des Bauges park, biomass is by far the most important resource with a share of around 80 % of REs, followed by heat pumps for private households, solar thermal energy, and PV.

Map 3: Alpine Protected Areas in France participating in this publication survey



National Parks

Les Ecrins National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	Yes	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		Micro projects (pico power plant, mini wind turbine)	-
Zoning		Core zone, Aire d'adhésion	-
Conflicts		Yes, low acceptation by the population	-

Vanoise National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		- 13 mountain refuges are equipped with PV-modules (Annual production: 88 MWh) of which 3 are equipped with hydroelectric turbines (Annual production: 24 MWh)	-

Zoning	Core zone, Aire d'adhésion	-
Conflicts	No	-

Nature Parks

Baronnies Provençales Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	Yes	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		- 5 hydropower stations (21,446 MWh) - 73,514 MWh of wood energy, 21,446 MWh of hydraulic power (5 installations) - 4 large ground-mounted PV projects (10,247 MWh) - Only some small private wind power plants (17 MWh)	- PV: development of new plants (15 MWh)
Zoning		Aire d'adhésion	-
Conflicts		- Conflicts with ground-based PV projects on forest land - Some resistance against 2 wind projects (projects were abandoned)	- New projects may bring tensions on the territory because they are located in „less favourable" areas (low acceptability for environmental, landscape reasons, etc.). - The question of the development of PV installations on agricultural land (agrivoltaics) is of great concern

Massif des Bauges Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No, 2 projects were rejected
Energy Production		Share of RE sources: 80 % biomass, 11 % heat pump, 2,9 % PV and solar heating	-
Zoning		PNR (Parc naturel régional)	-
Conflicts		No, 2 biogas projects were cancelled due to rejection of the agricultural community	- Integration of installations in the landscape, competition between pastoralism-livestock fodder resources and food resources - Resource/demand balance in the wood/energy sector

Queyras Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	Yes	No
Energy Production		-5 hydroelectric plants - PV panels of the SCIC Ener'Guil, energy production in 2020: 300MWh) - 6 collective wood heating networks	-
Zoning		Core zone	-
Conflicts		No	- Multiplication of projects of this type which hinder the proper ecological functioning of the main river (Guil) - Impact on the ecological continuity for fish species and white water sports.

Vercors Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No, very difficult with conflicts related to avifauna and chiropterans	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes
Energy Production		- Hydroelectricity: 650,000 MWh (no or little development) - Wood energy: around 40 wood-fired heating plants and heating networks (150,000 MWh) - PV Solar energy in full development: 8,000 MWh - Methanisation (2 installations): 36,000 MWh	- 7 citizen cooperatives are setting up PV projects by mobilising local savings - These represent around 1,000 shareholders - Facts: hundreds of solar roofs are built for a total investment of €3 million, representing just over 1.5 MWp (1,500 MWh) of PV power
Zoning		Within the perimeter of the 83 municipalities classified as NRP	-
Conflicts		- Low acceptance by the population - A wind farm project was highly controversial in 2017-18, with opposition from the population and the association LPO (Project was abandoned)	- Possible conflicts with biodiversity preservation issues for solar and wood - Landscape issues must be taken into account in RE projects - Acceptance by the population (citizen support is a major issue for the proper realisation of projects)

Verdon Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	- PV project developers are prospecting the territory and new projects are regularly presented - The intermunicipalities and the Park are trying to oversee their development, taking into account the issues in terms of preserving biodiversity and landscapes
	Biomass	No	No
Energy Production		- 5 waterpower plants (energy production: 600,000 MWh /an) - 11 PV ground-mounted PV plants (power 305,000 MWh)	-
Zoning		Nature park without fixed zoning	-
Conflicts		- With certain hydraulic dams at the time of their creation. - The rare large wind projects met strong opposition from the inhabitants and could not be carried out.	- Concerns about the pressure on private land - The advent of the agrivoltaism - Impact on the rural landscapes that contribute directly to the Park's attractiveness as a tourist destination

Solar park in Gréoux, Verdon Nature Park
© PNR du Verdon

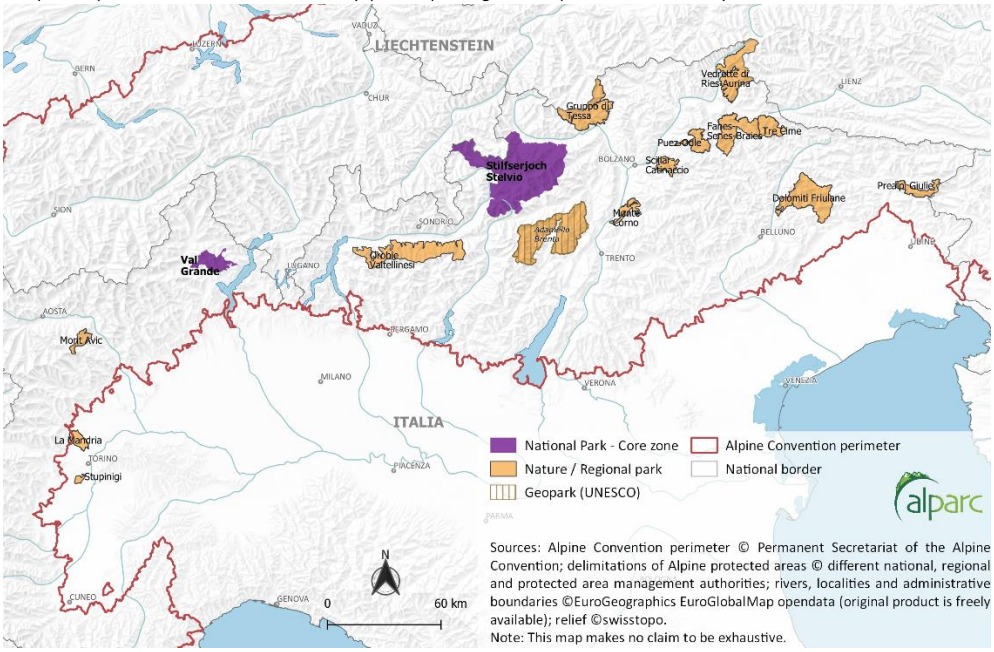
Solar park in Valensole, Verdon Nature Park
© PNR du Verdon

3.1.3 Italy

The Italian PAs, both national and natural parks, are subject to strict regulations prohibiting the construction of any energy infrastructure. These regulations are laid down in the laws of the regions or provinces. Despite the regulations, electricity is generated from hydropower in almost all parks, except the nature parks of South Tyrol, and Mont Avic, as well as the Val Grande National Park. The reason for this is that most of the power plants were already built before the park foundation. For example, the Orobie Valtellinesi Natural Park has several large, and small hydroelectric power plants that would no longer be eligible for approval.

The most widely used RE source in the Italian parks is hydropower. Furthermore, PV play an important role in the form of isolated plants of a certain size, to supply private individuals or public institutions. In Adamello Brenta Nature Park, for example, plants with an output of > 20 kW are not allowed. In the parks of Stelvio South Tyrol and Mandria/Stupinigi, biomass is also an important energy source.
The Stelvio National Park is managed by the provinces of Trento, Lombardy and South Tyrol. The three administrative units are considered separately. Hydropower is generated in all 3 territories.

Map 4: Alpine Protected Areas in Italy participating in this publication survey



National Parks

Stelvio National Park (Lombardy - Südtirol - Trentino)

		Realised projects	Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	Yes	No
Energy Production		Lombardy: - Hydroelectric power plant and two reservoirs (San Giacomo and Cancano, total power: 620 GWh) South Tyrol: - 133 water concessions in the South Tyrolean National Park municipalities, not all of them are located in the National Park - 5 reservoirs in the National Park Trentino: - Waterpower plants built before the establishment of the park - Since the implementation of the General Plan for the Use of Public Waters (2006) in the Province of Trento, the construction of hydroelectric plants in nature parks has not been allowed	-
Zoning		Lombardy: Riserva integrale Südtirol: Buffer zone, Transition zone, D-Zone (only in Südtirol) Trentino: Riserva generale orientata, Area di promozione economica e sociale	-

Conflicts	Resistance from the population and the park (Trentine part)	- Debate on the compatibility of ground-mounted PV plant projects with the landscape and environmental values of the Park - According to the park regulations wind turbines and ground-mounted PV plants are ruled out

Val Grande National Park

Realised projects			Future projects
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		No projects realised so far	No projects are planned
Zoning		-	-
Conflicts		-	-

Nature Parks

Friulian Dolomites Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		- 2 energy-producing reservoirs	-
Zoning		Area di promozione economica e sociale	-
Conflicts		No, the lakes were already built when the Park was established	-

Julian Prealps Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		- 1 plant for hydroelectric production (annual production: 200,000 kWh)	-
Zoning		Zona 'RG di tutela generale'	-
Conflicts		No	-

Mont Avic Nature Park

Realised projects	Future projects

RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	No	No
Energy Production		- 2 PV systems on building roofs (alpine hut and alpine pasture) (power: 26 kW) - 1 PV system on building roofs under construction (power: 21 kW)	-
Zoning		Riserva integrale	-
Conflicts		No	Ongoing debates on constructing high-altitude reservoirs for multi-purpose uses - Aim: mitigating the scarcity of water availability during long drought periods and increasing the potential for hydroelectric exploitation. - Fragile environments are mainly affected

Orobie Valtellinesi Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		- 4 large plants (dams, canals, pipelines and hydropower plants): 825,000 MWh - 8 small plants: Total output of 25,500 MWh	-
Zoning		Area di protezione, Area di promozione economica e sociale	-
Conflicts		- Almost all facilities were built before the establishment of the park. - Disputes with the local communities, sports fishermen, the Province and the Park.	-

Autonome Provinz Bozen - Naturparke Südtirol

Realised projects			Future projects
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		-	-
Zoning		-	-
Conflicts		-	-

Mandria/Stupinigi Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		No data	-
Zoning		Riserva Naturale	-
Conflicts		No	-

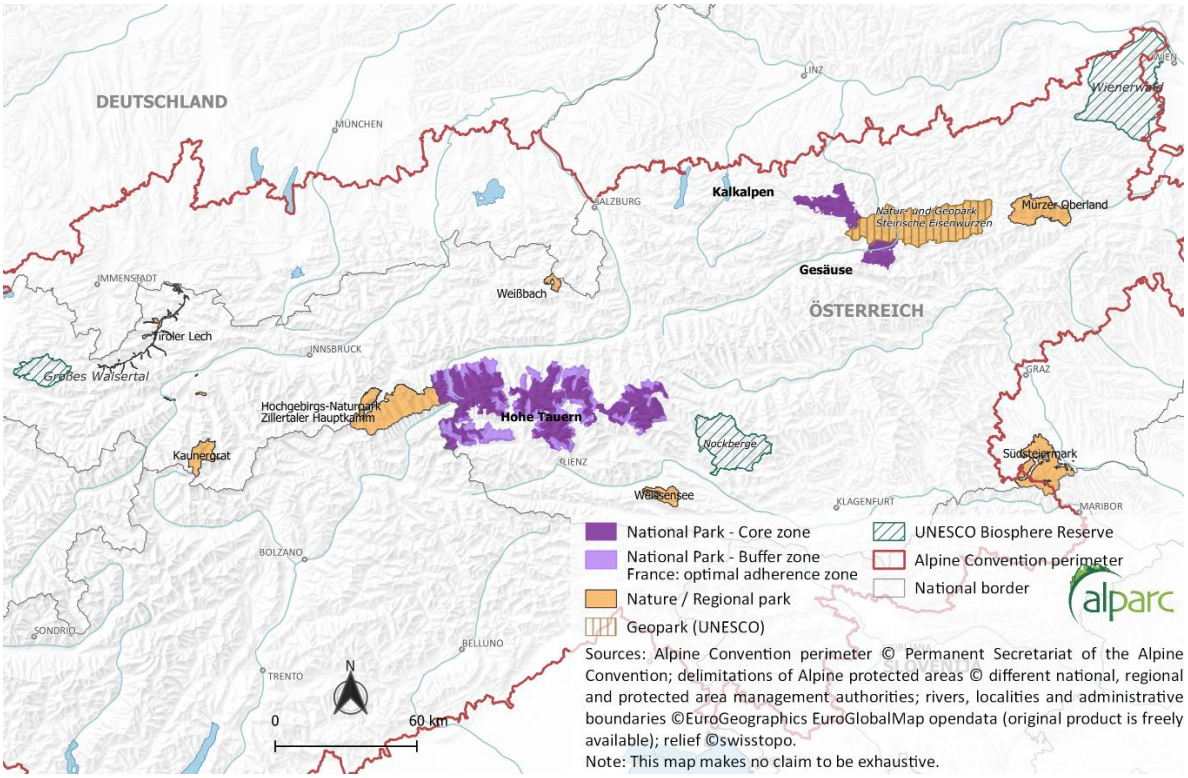
Adamello Brenta Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	No	No
Energy Production		- There are systems for individual consumers with a maximum of 20 kW - Installations < 20 kW for supplying public facilities (refuges) exceptionally authorised - Large hydroelectric plants existed before the Park Plan came into force	-
Zoning		Riserva integrale, Riserva generale orientata, Area di promozione economica e sociale	-
Conflicts		- Conflicts with plan regulations in the case of plants > 20 kW, requiring derogation authorisation for public utility (supply of alpine huts) - Environmental impact on streams	- Environmental impact on the watercourses affected by water abstraction

3.1.4 Austria

In Austrian PAs the highest quantities of REs are generated by water and biomass. However, among the parks surveyed, the majority (12) states that PV is most used. So, there is a clear upward trend for PV. In general, any expansion of REs for economic purposes is prohibited in the Austrian national parks, and mostly in the nature parks. For example, in the Federal State of Carinthia, these regulations are laid down in the Carinthian National Park and Biosphere Reserve Act and in the Carinthian Nature Conservation Act. In the Kalkalpen National Park, there are restrictions due to monument protection, and legal restrictions due to Federal State law.

Therefore, in the national parks of Hohe Tauern Carinthia, Salzburg, and Tyrol, as well as Kalkalpen, numerous island systems are operated to supply alpine huts. However, there are also examples showing that REs can indeed be produced on a large scale. In the Zillertal Alpen Nature Park, there is the Zemm-Ziller power plant group, whose plants generate a considerable amount of energy in this region. The project, however, was associated with conflicts.

Map 5: Alpine Protected Areas in Austria participating in this publication survey



National Parks

Gesäuse National Park			
Realised projects			**Future projects**
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		-	-
Zoning		-	-
Conflicts		Hydropower plant outside the PA with effects on the park	Concerns about planned wind farms nearby (distance 3.4 km to the national park)

Hohe Tauern National Park (Carinthia, Salzburg, Tyrol)			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		Use only for self-supply purposes (shelters and alpine huts)	-
Zoning		Core zone, buffer zone (Außenzone), special protection area,	-
Conflicts		Carinthia: Conflicts with the park Tyrol: Low acceptance by the population	-

Kalkalpen National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		Many plants (PV and hydropower) as island systems	-
Zoning		Bewahrungszone	-
Conflicts		No	-

Nature Parks

Mürzer Oberland Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		No data	-
Zoning		Core zone	-
Conflicts		Small hydropower plants versus fisheries.	-

Kaunergrat Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	Yes	No
Energy Production		One large power plant (Kaunertal) in the nature park region (outside the PA)	-
Zoning		-	-
Conflicts		No	Kaunertal II pumped storage power plant might lead to conflicts

Tiroler Lech Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	No	No
Energy Production		- A few small hydropower plants outside the PA, but there is a diversion power plant in the PA (stream). - Energy output is unknown.	-
Zoning		Ruhezone (exists only in Tyrol)	-
Conflicts		No	-

Nature Parks Carinthia (Dobratsch & Weissensee)			
Realised projects			**Future projects**
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		-	-
Zoning		-	-
Conflicts		-	-

Zillertaler Alpen Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		Power plant group „Zemm-Ziller“ (work capacity: 928,600 MWh) - 2 cogeneration plants in Ginzling and Hintertux and further 10 plants for self-supply - 10-15 mountain huts equipped with solar panels	-
Zoning		No zoning in this park	-

Conflicts	Low acceptance against the huge pumped storage power plant and lawsuits against some projects	Yes, these refer primarily to - the possible realisation of wind power in mountainous areas and - that areas valuable for nature conservation and only extensively used for agriculture will be sacrificed for PV plants and - attractive feed-in tariffs are tempting and there is a lack of corresponding regional planning regulations for the construction of PV systems in open areas

Weißbach Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	No	No
Energy Production		- 3 small hydropower facilities (power: 10 - 67 kW) - PV only on roofs	-
Zoning		Landschaftsschutzgebiet (Landscape protection area, only exists in Austria and Germany)	-
Conflicts		No	-

Südsteiermark Nature Park

Realised projects			Future projects
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	Yes
Energy Production		-	-
Zoning		Landschaftsschutzgebiet	Location and zoning not yet clear
Conflicts		No	The projects will lead to a change in the landscape

Styrian Eisenwurzen UNESCO Global Geopark

Realised projects			Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		- 2 larger PV plants (no data on the power) - 3 large hydropower plants along the river Enns (862,900 MWh)	-
Zoning		No zoning; the PV plants were set up on land formerly used for agriculture.	-
Conflicts		No	- Currently no fears - PV plants on open spaces are to be expected - No potential for wind power due to the topography

Biosphere Parks

Großes Walsertal Biosphere Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes
Energy Production		- 281 PV plants (output: 4,032 kWp) - 17 small hydropower plants (feed-in of about 15,000 MWh) - 1 cogeneration plant	-
Zoning		Buffer zone & Transition zone	-
Conflicts		No	-

Wienerwald Biosphere Park			
Realised projects			**Future projects**
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes
Energy Production		Installed PV-capacity: 62.852 MW (up to the year 2020)	-
Zoning		Buffer zone, Transition zone	-
Conflicts		No	-

Nockberge Biosphere Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	Yes, high pressure for the construction of wind farms closed to the biosphere reser- ve (according to the current legal situation, wind power is prohibited in the Biosphere Reserve)
	Photovoltaics	Yes	Yes
	Biomass	No	Yes
Energy Production		- 18 hydropower stations (work capacity: around 40 MWh) - many small plants	-
Zoning		Transition zone	-
Conflicts		Yes, long approval procedures	Yes, very high pressure for the construc- tion of wind farms closed to the biosphere reserve by corporations. Very controversial discussions among the population

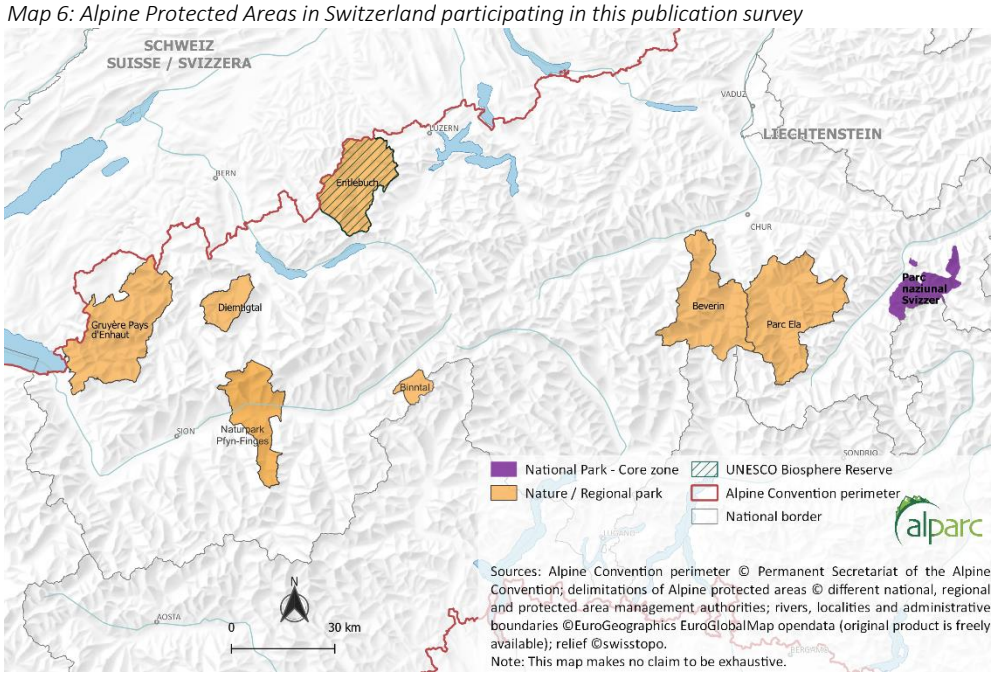
Due to the PA legislation and exclusion areas, the realisation of large projects is barely possible, or limited in the biosphere parks. Facilities are prohibited in the Naturzone and Pflegezone (buffer zones). There are plans for various RE sources in Nockberge. The plans for wind power are under discussion and are viewed very critically and controversially.

3.1.5 Switzerland

In Switzerland, a distinction should be made between national PAs in the Federal Inventory, and park perimeters, as they usually do not cover the same area. In this study, the entire park perimeter is examined. Hydropower is by far the most important energy source in Swiss parks, and except for Beverin Nature Park, every park has such plants. PV and biomass are also both important RE sources, with 6 parks reporting that energy is generated from either biomass or PV.

A trend is emerging that PV will be used much more in the future. This can be concluded from the survey results, as 6 out of 8 parks indicate that PV will play a role in their park in the future. In addition, wind power is used in two parks: Pfyn-Finges Nature Park and Entlebuch Biosphere Park. In Pfyn-Finges, there is only a small turbine on an alpine hut, whereas in the Entlebuch Biosphere Reserve, there have been large wind turbines for almost two decades, which are planned to be extended by new wind parks.

Map 6: Alpine Protected Areas in Switzerland participating in this publication survey



National Parks

Swiss National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		- One hydropower plant operated by the Engadiner Kraftwerke	-
Zoning		Core zone	-
Conflicts		- Pollution of the river Spöl - Fish kill due to mud wave	- Debate on the construction of turbines could lead to more infrastructure in areas close to national parks

Nature Parks

Parc Ela			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes

Energy Production		47% of final energy comes from REs	-
Zoning		Transition area	-
Conflicts		Yes, partly low acceptance by the local population and long approval procedures	-

Beverin Nature Park

Realised projects			Future projects
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	No	No
	Biomass	No	No
Energy Production		-	-
Zoning		-	-
Conflicts		-	-

Diemtigtal Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	No	Yes
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes
Energy Production		Production of electricity from: - hydropower: 0.057 MWh - energy wood: 0.0092 MWh	-
Zoning		Transition area	-
Conflicts		Yes, conflicts with the PA	-

Pfyn-Finges Nature Park

Realised projects			Future projects
RE Source	Hydropower	Yes	Yes
	Wind power	Yes	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Productio		- Several storage and run-of-river power plants (no data on production). - only 1 small installation on an alpine hut - Solar potential on roofs is well utilised - Biomass: only 2 smaller plants	
Zoning		Core zone, Buffer zone, Transition area	-
Conflicts		No	- Simplification and shortening of approval processes for large-scale, alpine solar plants with significant impacts on the landscape and flora/fauna - No concrete projects in this area within the perimeter of the Pfyn-Finges Nature Park

Gruyère Pays d'Enhaut Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		- 16 large hydropower plants (around 310,000 MWh) - Biogas: 2,400 MWh electricity and 2,600 MWh heat - solar energy: 3,000 MWh electricity, 500 MWh heat	-
Zoning		Buffer zone	-
Conflicts		In the case of communal district heating systems, there have been objections during the authorisation procedure	- In PV there is a risk that demand will outstrip supply - Acceleration of change must be supported by politicians, and the role of municipalities in setting an example is not always understood by local councillors - The Park can only rely on public subsidies (cantons/federal government) to play its role as an accelerator in the transition

Binntal Nature Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	- A new large-scale project to build a reservoir is currently under discussion and is included in the structural plan of the Canton of Valais. - Data: 48.5 million cubic metres of water, dam height: 120 m
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	Yes
Energy Production		- 5 hydropower plants (power: 67.5 MW) - only small PV plants on roofs - 2 biomass facilities	-
Zoning		Regional Nature Park of National Importance	-
Conflicts		No	- PV: large-scale Grengiols Solar project, high alpine solar park, nature park not yet included - High conflict potential with the reservoir - Biomass: Biogas plant in the „Z'Brigg" industrial zone (Ernen), supported by the nature park

Biosphere Parks

Entlebuch UNESCO Biosphere Reserve			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	Yes	Yes
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		- Various small hydropower plants (power: 1.4 MW, work: approx. 6,500 MWh) - 3 wind turbines in operation (power: 4 MW) - PV obligation for public authorities, very many private PV plants - 1 biogas plant	- 3 wind turbines of 6 MW each in the planning stage
Zoning		Transition area	-

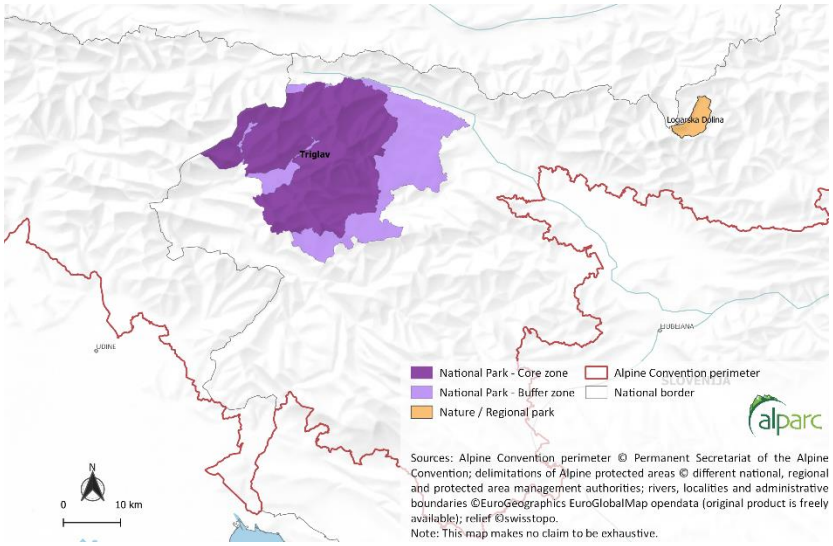
Conflicts	Yes, strategies of some nature conservation associations to prolong/ prevent some projects	If the Energy Strategy 2050 is to be implemented, the right of associations to complain (Verbandsbeschwerderecht) must be restricted

Recently, a legal framework has been established in Switzerland to massively simplify/shorten the approval process for large-scale, alpine solar plants with considerable impacts on the landscape and flora/fauna. Only strictly PAs, which also exist in the Pfyn-Finges Nature Park (Federal Inventory of National Importance), but not nature parks of national importance, are exempt from this. Lots of conservationists and PA managers are concerned about the possible ecological and landscape-aesthetic consequences of these political decisions.

3.1.6 Slovenia

In Slovenian PAs, biomass and hydropower are traditionally important energy sources. Surveys show that PV is increasingly being used here as well. Future projects will show whether the PV trend will also take hold here. There is a high PV potential due to favourable climatic conditions, especially in the south, and southwest of the country. In Triglav National Park, for example, electricity is produced from all RE sources. Bigger plants were mostly built before the establishment of the park. According to the surveys, problems often arise because of the approval procedures.

Map 7: Alpine Protected Areas in Slovenia participating in this publication survey



National Parks

Triglav National Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	No
	Wind power	Yes	No
	Photovoltaics	Yes	Yes
	Biomass	Yes	No
Energy Production		- 39 small hydroelectric power plants in the park (total annual amount of energy of 90.6 MWh) - Individual buildings (farms, residential houses, mountain huts) are partially supplied with RES- mostly with PV (small solar power plants on the roofs, some also with biomass). - Four mountain huts also have a windmill	-
Zoning		Transition area	-
Conflicts		Yes, conflicts with the PA	-

Logar Valley Landscape Park			
Realised projects			**Future projects**
RE Source	Hydropower	Yes	Yes
	Wind power	No	No
	Photovoltaics	Yes	No
	Biomass	Yes	Yes
Energy Production		- 13 hydroelectric power station (1,848.45 MWh) - 5 PV plants (1.3 MWh) - Biomass or heat energy in public buildings (schools, apartment buildings and in the premises of the Municipality)	-
Zoning		-	-
Conflicts		Yes, conflicts with the PA and long approval procedures	- Concerns regarding hydropower plants are that there are long approval procedures - For solar power plants the power grid is not strong enough, further development is not possible - Transition from fossil fuels to renewables (e.g. biomass for individual houses) is very expensive

Park škocjanske jame			
Realised projects			**Future projects**
RE Source	Hydropower	No	No
	Wind power	No	No
	Photovoltaics	Yes	Yes
	Biomass	No	No
Energy Production		- 1 PV power plant (power: 16 kW, production: around 15 MWh/an).	-
Zoning		Core zone	-
Conflicts		Yes, long approval procedures	-

Dam on the Grimselsee, Switzerland © G. Plassmann

Hydropower and biomass are still the most important RE sources. Large amounts of energy can be generated, especially from large hydropower plants. The trend for biomass is declining in parts of the Alps, even though this energy source is still used very intensive- ly in some French parks (e.g. for heating). For hydropower, the potential is largely exhausted in most parts of the Alps. However, more projects are planned: for example, a large reservoir in the Swiss park Binntal is under discussion. Strong growth is expected for PV, as there are large projects already planned for higher altitude areas in the alpine mountains.

Solar park in the Austrian Alps © G. Plassmann

3.2 Conflicts related to the projects

No conflicts are expected within the German PAs, as no projects here are planned that could have potential ecological impacts.

In France, conflicts often arose within wind farm projects (e.g., Vercors and Baronnies Provençales) with opposition from local populations. Studies have shown that wind power development is incompatible with the preservation of sensitive species (mainly chiropterans and large birds of prey). Wood energy may also pose risks to biodiversity. For Bauges Nature Park, conflicts could arise due to the competition between pastoral and livestock resources. Regarding PV, the pressure on private land increases as recent changes in regulations are linked to the acceleration of REs. In Verdon Nature Park, the advent of 'Agri-PV' may also have an impact on the landscape`s attractiveness, possibly provoking economic consequences for the park. In contrast, in the Queyras, large hydroelectric power projects hamper proper ecological functioning of rivers and contravene ecological continuity for fish species.

In Italian PAs in general, worries and fears concerning REs are much fewer than in other countries. With hydropower plants, there is concern about the environmental impact on the towers and the water courses affected by water abstraction. In Italy, there is an ongoing debate at a regional and national level, as to whether the construction of high-altitude water reservoirs for multi-purpose uses would be appropriate or not. The aim is to mitigate the water scarcity during drought periods. Since these are high-altitude sites, mainly fragile environments are affected. Moreover, many of the PAs are located at high altitude. In addition to this, there is an ongoing debate on the compatibility of PV plant projects with the landscape and environmental values of the park. Due to strong park regulations, the possibility of installing ground-mounted PV plants has been ruled out; the same applies to wind turbines.

In Austria, statements are very divided. Most of the PAs do not fear any further conflicts, as most of the projects are small. Other parks see problems with the expansion of wind power in mountainous areas. Ever since the new Austrian legislations regarding the expansion of REs, there has been very high pressure for the construction of wind farms in the vicinity of some PAs. There are also controversial discussions among the population. According to Kaunergrat Nature Park, conflicts may arise with the construction of further pumped storage power plants. Energy demand is expected to increase, however, so further PV systems on open spaces are to be expected. There are some fears that extensively used areas will be used for the construction of solar parks.

In some parks in Switzerland, concerns are great due to new energy policy framework conditions. These foresee to massively simplify and shorten the approval procedures for large-scale alpine solar parks in high alpine areas. Only strict PAs (Federal Inventory of National Importance) are exempt from this. Pfyn-Finges Nature Park is concerned about the impacts on the landscape and flora/fauna, and Binntal Landscape Park is also worried about a 5 km2 solar park which is planned to be installed in a high alpine area. According to information from the park, parts of the nature park perimeter are included in the planning. The current debate on the construction of such installations could lead to such infrastructure being built in areas close to the Swiss National Park.
In Slovenia, past projects were often linked to problems with the PAs, or long approval procedures. The latter may also cause conflicts in future projects. This is particularly the case with hydropower plants. For solar power plants,

there seem to be problems with the power grid, which, in parts of the country, is not strong enough (e.g., Logarska Dolina). This could further hamper PV-expansion. Another point is that heating with biomass is desirable. However, replacement is very expansive.

4 Need for action

In the following paragraphs, some measures are presented that can help to better reconcile the aspects of REs, nature conservation, and acceptance of such projects. Spatial planning instruments have proven to be key in protecting PAs from the new development of energy infrastructure. The results of this study also confirmed that the lack of spatial planning options can lead to uncontrolled expansion of REs. This can be seen in the fact that lots of hydroelectric power plants are in strictly PAs today, most of which were built before the park's establishment. It was only after the introduction of PA ordinances that such projects could no longer be approved. Therefore, one of the most important approaches is to increase the quality and quantity of PAs. In the COP 15 Conference in Montreal, Canada, governments across the world committed to conserving at least 30% of terrestrial and marine areas. This quantitative goal is almost reached in the Alps, with 28 % of its surface counting as PAs. However, there is still potential to protect some areas more strictly. Numerous measures can be taken to increase the quality of protection.

4.1 Zoning

An important feature is the zoning of PAs. RE installations are generally not permitted in core and buffer zones, and only under strict regulations in the development zones of biosphere parks. Nature parks usually do not have such zoning models. Such an instrument should also be considered to continue the protection of ecologically valuable regions in the Alps. According to the survey results, French and Swiss PAs are hardly protected from energy projects. In Germany, too, the placement of wind turbines in nature parks is not automatically excluded. Nature parks therefore need a zoning concept in order to define potential construction and exclusion areas. A clear definition of zones and the attribution of IUCN categories and, as a complementary step, the attribution of Alp-wide categories agreed upon by all Alpine states, would be a significant step toward allowing a more targeted policy, and more concrete measures to preserve biodiversity, and to protect habitats from large infrastructure projects.

4.2 Common Borders/Transboundary Protected Areas

A stronger cooperation between transboundary PAs is a crucial step to better the incorporation between them. The French Mercantour National Park, and the Italian Alpi Marittime Nature Park form transboundary Pas between the borders, and a common management structure has been created. In the case of a common border between PAs, an intensive cooperation and common management in monitoring the existing specie populations, common rules for visitors, and harmonised objectives of the conservation's goals, should be standard. If no common border exists, but the distance between two PAs is close, the incorporation of wildlife corridors and a general improvement of ecological connectivity should be established. This measure could ensure that zones between parks remain free of RE installations.

4.3 Minimum distances

According to the study results, there are projects for wind turbines that are to be located very closely to park areas. Park managers have expressed their concerns about this. Within the Alps, rules should be implemented to ensure a minimum distance between large RE installations and park areas. As PAs often have an important ecological status and a distinct biodiversity, wind turbines in proximity can be a threat to important bird species. The National Parks of Austria have drawn up a position paper (https://www.nationalparksaustria.at/files/Inhalte/downloads/Positionspapier-NP-und-erneuerbare-Energie-07052014.pdf), in which they demand a greater distance between wind farms and national parks. Not only for ecological and aesthetic reasons, but also for touristic reasons, a minimum distance would be worth implementing. Depending on the topography, these regulations could extend over several tens of kilometers. The distances would have to be defined separately for each area, or individual parts of it. Such zones can be defined in the form of exclusion areas for infrastructure.

4.4 Environmental Impact Assessment (EIA)

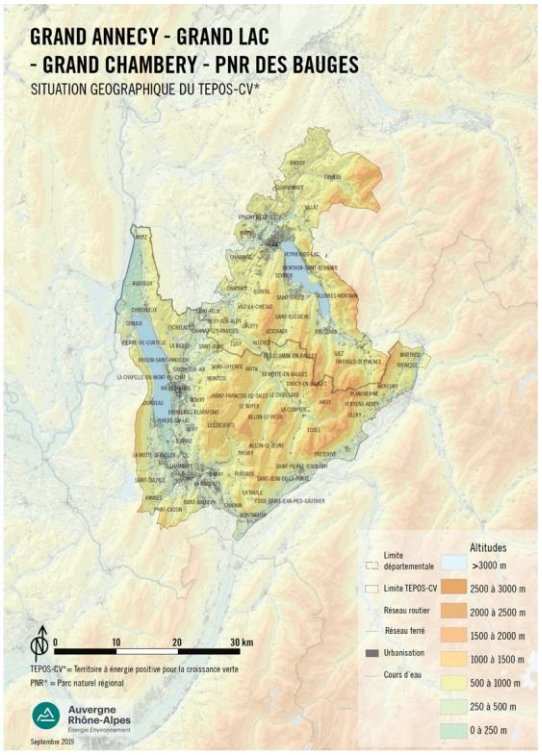
Environmental assessments are tools used in planning stages to evaluate the impacts of infrastructure projects, e.g., wind farms. There are various instruments, such as the Environmental Impact Assessment (EIA), and the Strategic Environmental Assessment (SEA). Such instruments are used to determine the impact of such infrastructure projects on humans, animals, plants, biodiversity, etc. The new programme carried out by the EU to accelerate the planning and approval procedures for RE projects, aims for a slight simplification of the environmental assessments in order to avoid double assessments. It is, and remains indispensable, to carry out an EIA. Parts of PAs should not be designated, based on an accelerated procedure as a so-called 'go-to area', that is supposed to give RE priority over all other uses. In order to maintain ecological diversity, human significance, landscape uniqueness, and conservation objectives, strict PAs should always be excluded from major projects. If there are nevertheless plans, the ecological and social impacts should be assessed.

4.5 Energy saving and energy efficiency before installing new infrastructure

When talking about RE sources and nature conservation, it is often demanded that energy be saved, before new plants are built. Before open spaces are used for large-scale projects, the issues of energy-saving and energy efficiency should first be discussed. Energy can be saved in numerous areas, for example in the building sector, transport, agriculture, or tourism. Energy consumption can be reduced by better insulating buildings or by using energy-efficient lighting systems such as LED lamps. In addition, local public transport should be promoted in alpine regions. This should be implemented, especially in tourist areas that have to cope with individual transport. Such and other energy-saving measures can be implemented by raising awareness among the population, as well as other stakeholders. Raising awareness is the first step towards change.

5 Model Regions

This section presents examples of parks that play a special role in the issue of REs.



TEPOS Territory Massif des Bauges, Annécy, Chambéry & Grand Lac,
Source: Auvergnerhonealpes

TEPOS Territory in Massif des Bauges Regional Nature Park and Global Geopark

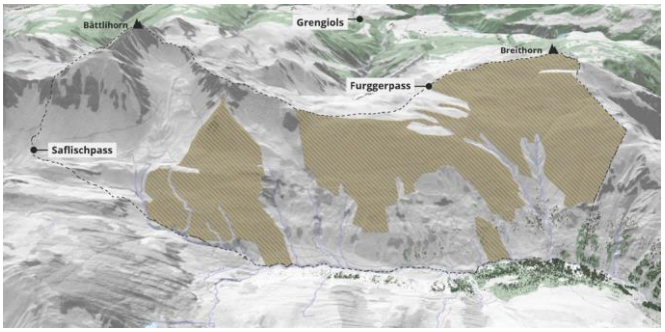
This park should be presented here because it has set targets in the energy sector together with the urban clusters of *Grand Chambéry*, *Grand Annécy* and *Grand Lac*. The designation of these 4 areas is called TEPOS (Territoire à Energie POSitive) and is the first energy region in France. The aim of this initiative is to implement a territorial energy planning and to identify energy-saving measures and the potential of RE production.
Each territory with this label will receive an initial fund of at least 500,000 euros for energy projects. This amount may also increase depending on the quality of the projects.

The general objectives for this energy region are formulated:
- Becoming an autonomous energy region until 2050
- Developing REs
- Reduction of greenhouse gases and fine particulate emissions
- Reduction of the energy consumption
- Becoming a model territory for energy transition
- Protection of biodiversity

The financial support will entail a large number of measures. For the renewable energy sector a local RE deployment program is necessary. This includes biomass heat networks, agricultural and industrial methanizers, solar thermal, wind and PV farms, cogeneration, heat recovery and geothermal energy. There are many more of these TEPOS regions. Another example is the Vercors Nature Park, which forms a territory together with the agglomeration of Grenoble.

Solar parks in Swiss mountainous areas

In Switzerland, the debate on REs is a very conflicting issue. Project promoters, politicians and conservationists agree that more renewable energy is needed. In Switzerland, due to recent legislative relaxation, high-alpine areas are now also possible locations which many conservationists are very worried about. According to experts, high-alpine locations are more suitable than the Swiss Mittelland, as significantly higher energy production is possible in winter.
Some PV projects are currently being planned, the most controversial of which are Gondosolar and Grengiols Solar. The latter one would supply around 200,000 households with electricity.



Sketch plan of the Grengiols Solar plant,
Source: Grengiols-Solar


Picture of the area with a sketch of the PV plants,
Source: Grengiols-Solar

The location of the solar park would be very close to the Landschaftspark Binntal. According to the park management, some parts of the nature park perimeter and cantonal PA are also included in the plannings. Nature conservation associations, PAs, conservationists and other stakeholders are worried about the emergence of the PV industry and the fact that projects for the production of RE will be given priority to other uses such as nature protection.

Power plant group „Zemm-Ziller“ in Zillertaler Alpen Nature Park

In the Austrian Zillertaler Alpen Nature Park is located the „Zemm-Ziller“ power plant group, which produces a significant amount of energy (around 1 mio. MWh annualy). It consists of several types of plants such as reservoirs or pumped-storage power plants. The planning and construction of these latter plants were linked to conflicts. The low acceptance and the protests addressed only the large pump-fired power plants. This is by far the largest power plant group within this study. The construction of such facilities in Austrian PAs would no longer be possible with today’s nature conservation regulations.

Schleigeisgrund reservoir in the Zillertaler Alpen Nature Park,
Source: Naturpark Zillertal

6 Conclusion

In the Alps, the production of renewable energy will play a more and more important role. In countries like Germany, Austria, or Switzerland, planning and approval procedures have been massively accelerated and shortened by the government. At the same time, the quality and quantity of protected areas in the Alps is aimed to be improved. Both uses - the designation of PAs, and the construction of RE sources - are land intensive. Therefore, both uses are often in conflict with each other. These developments entail numerous uncertainties for PAs, as it is often uncertain whether (and to what extent) these governmental projects will have an impact on alpine PAs. This report has shown the results of a survey amongst alpine PAs dedicated to energy production from RE sources on the current status, future projects, and resulting conflicts. At the end, recommendations for action in spatial planning were proposed in order to better reconcile both uses.

A total of 47 PA managers from Austria, France, Germany, Italy, Slovenia, and Switzerland were interviewed. Among them include national parks, nature parks, biosphere parks, and one geopark. The results have shown that the emergence of the RE industry is putting increasing pressure on alpine regions and PAs. On the one hand, there are many PA categories that have strong conservation status. These particularly include national parks in all states, as well as nature parks in Italy, or in most parts of Austria. French and Swiss nature and regional parks, on the other hand, are less protected from major projects. This can be seen from the fact that large solar parks have already been installed in 2 French nature parks. In Switzerland in particular, this issue is very controversial, and two planned high alpine solar parks are causing concern for PA managers and nature conservationists. In some parts of the Alps, the expansion of renewable sources is to be further promoted. In PAs, this mostly takes the form of PV systems on the rooves of alpine huts or refuges. Some parks continue to increasingly use small hydropower plants for self-supply. Designated areas for wind power plants are increasingly closer to PAs, including national parks. In Switzerland, there are already projects for large-scale solar parks, which are being met with great protests.

On the one hand, the impacts can be attributed to species protection and biodiversity; on the other hand, PV and wind power projects are often met with a lack of acceptance among local residents, conservationists and park managers. However, such conflicts can be limited, or even prevented altogether by using certain spatial planning instruments. These include, for example, zoning in the form of exclusion zones, development of transboundary PAs, minimum distances, and the implementation of Environmental Impact Assessments (EIA). One of the most important measures is, however, to save energy and make existing plants more efficient, before new plants are installed. In this way, it will be possible to reconcile the expansion of REs with the preservation of ecological diversity and social acceptance.

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