WP T4 Replication and Knowledge Transfer

Activity A.T 4.1 Recommendations for low carbon winter tourism regions

EUSALP Recommendations and contribution reports

D.T4.1.3.3 – Alpine strategies for Action Group 9: Energy efficiency

Project acronym:	**Smart Altitude**
Project name:	**Alpine winter tourism territories demonstrating an integrated framework for a low-carbon, high-impact and resilient future**
Programme priority:	**Priority 2 - Low Carbon Alpine Space**
Programme specific objective:	**SO2.1 - Establish transnationally integrated low carbon policy instruments**

Document: Public			
Responsible partner: UMIL as WP leader for overall coordination, strong involvement of Les Orres/EDF **Involved partners: All**			
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0.0	Structure of report	11/11/2020	UMIL
1.0	Complete report	16/02/2021	Les Orres/EDF
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Notes:			

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1. Executive summary / Brief

Given the present and future challenges related to the impacts of climate change that the tourism sector operating in the Alpine Region will have to deal with, a stronger collaboration and effort on R&I actions is needed. Setting up an Alpine energy efficiency cluster and greening the Alpine infrastructures are two key specific objectives of EUSALP Action Group 9 (AG-9) directly related to implementing energy efficiency measures in the Alpine area. By its actions implemented in its four technical workpackages, the Smart Altitude Alpine Space project generated a detailed process to deploy energy efficiency measures within a network of 26 mountain resorts engaged in a common action toward sustainable mountain tourism and economic development.

By its actions and replication program, Smart Altitude has paved the way for future developments that could usefully serve the strategy developed in the framework of EUSALP, in particular AG-9's contribution to the implementation of the EU Energy Efficiency Directive in the Alpine area.

2. Introduction

Three short reports aim to assess the convergence and contributions of the Smart Altitude project to EUSALP AG-9 with regard to **energy efficiency**, EMS and the deployment of smart grids respectively. Firstly, the work of AG-9 on these different topics will be reviewed. This will be followed by a brief review of the state of the art referring to other deliverables of the Smart Altitude project, then by a review of the work carried out in the project's Living Labs and their potential in relation to the themes addressed. Finally, the relevance of the outcomes of Smart Altitude's work for AG-9 will be highlighted and a series of recommendations will be made.

This first report focuses on **Energy Efficiency.**

The mission of EUSALP AG-9 is, by focusing on the promotion of energy efficiency and the production and use of local renewable energy in the Alpine Region, especially in the public and private sectors, to support a significant reduction of energy consumption in the housing and mobility sector, as well as in small and medium enterprises, promoting energy management and monitoring systems at different levels. AG-9 lists five specific objectives: 1) Setting up an Alpine **energy efficiency** cluster; 2) Greening the Alpine infrastructure; 3) Setting up an Alpine renewable energy cluster; 4) Support energy management systems in the Alpine Region; 5) Support a better use of local resources and increase energy self-sufficiency while reducing impacts on climate and the environment.[1]

Smart altitude, for its side, aims at enabling and accelerating the implementation of low-carbon policies in winter tourism regions. It will demonstrate the efficiency of a decision support tool integrating all challenges into a step-by-step approach to energy transition and deploying a comprehensive approach of low-carbon policy implementation based on impact maximization accounting for technical, economic and governance factors. It is based on common performance indicators, monitoring systems (snow processes, municipal infrastructure, renewables, buildings etc.) and Energy Management Systems (EMS) in mountain territories, to build a shared situational

[1] https://www.alpine-region.eu/action-group-9

awareness and take impactful decisions. The approach is implemented in four real-field demonstrations and prepares for replication in 20 other Alpine Space territories.

The project targets policymakers, infrastructure operators, investors, tourism and entrepreneurship organisations. Its outputs are as follows: 1) Territorial diagnosis method; 2) Online Smart Altitude Toolkit; 3) Living Labs; 4) Planning model for adaptation strategy implementation; 5) Replication roadmap and network of low-carbon winter tourism regions. The partnership and activities ensure the approach suitability across the Alpine Space, promote new innovations and skills, and enable policymakers to plan and prioritize measures increasing the resilience of mountain areas.

3. Definition and State of the art

Energy efficiency means using less energy to provide the same level of energy services.[2] In 2018, as part of the 'Clean energy for all Europeans package', the new amending Directive on Energy Efficiency (2018/2002) was agreed to update the policy framework to 2030 and beyond, with an energy efficiency target for 2030 of at least 32.5% relative to the 2007 modelling projections for 2030, to be achieved collectively across the EU.[3]

In its specific objectives, AG-9 mentions as main targets three priority sectors: building/housing, energy management systems, and mobility. Among these, mobility is out of the scope of Smart Altitude and EMS is the subject of a specific report.[4] In terms of geographical outreach, Smart Altitude focuses on a specific target, namely mountain resorts and the local communities that support them, thus contributing to the wider reach of AG-9.

As mentioned in Smart Altitude D.T3.1.1.[5] "Decision-making tree" deliverable, The strategies that could be set in place to improve the energy usage in a ski resort are: (i) Calculate the specific electricity consumption – Audit Process, (ii) Monitor the consumption data – through the implementation of an Energy Management System (EMS), (iii) Implement energy savings measures, (iv) Implement renewable energy sources (RES) (Motiva, 2008). The following table lists the types of measures (highlighted in **bold**) that could be taken to improve **energy efficiency** (EMS implementation excluded) in mountain resorts:

Climate Mitigation Measures		Energy efficiency linked to EMS deployment	Energy efficiency EMS excluded
Ski resort	Monitor and implement an EMS	√	
	Implement renewable energy sources		
	Assess ski lifts energy efficiency and implement speed control measures	√	
Snowmaking equipment	**Replace snow-making cannons with modern technology and automation**		**√**
	Implement an automated snow-making system	√	

[2] EIA–https://www.eia.gov/energyexplained/use-of-energy/efficiency-and-conservation-in-depth.php.
[3] https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en.
[4] Smart Altitude deliverable D4.1.3.4. See : https://www.alpine-space.eu/projects/smart-altitude/en/project-results/replication-and-knowledge-transfer/a.t4.1-recommendations.
[5] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/smart-altitude-toolkit/decision-making-tree

	Plan which kind of snow-cannon is the most effective for the ski resort (Fan gun, Hybrid/tower, Hybrid/high-pressure)		**√**
Grooming and slope maintenance	Implement automatic systems (pump stations, compressed air production, snow-making equipment)	√	
	Plan which kind of snow mobile is most suited for the ski resort (two-stroke snowmobiles, four-stroke snowmobiles)		**√**
	Replace old grooming machines with newer ones		**√**
Buildings (tourism housing, operational & public buildings)	Assess the energy consumption of the ski resorts building and **improve the heating system and ventilation**	√	**√**
	Replace indoor and outdoor lighting with energy-efficient lightbulbs and an automated lighting control	√	**√**
	Improve the energy efficiency of building envelopes		**√**
	Implement renewable energy sources for heating and electricity		
	Implement building EMS	√	

Table 1 – Energy efficiency measures, adapted from D.T3.1.1. Table 2

Common to most of these measures is the deployment of an EMS, that allows both to collect precise energy consumption data and automate or perform real-time control and optimisation measures. For more information on EMS, you can refer to D.T1.2. Report "Live monitoring systems specifications"[6] and D.T3.2.1. Report "Territorial Maximization"[7], section 4-1 to 4-3 for EMS and 4.7 for smart metering, where the state of the art of EMS systems are explored in detail.

Regarding specific equipment energy optimization, we also refer the reader to the following sections of the very exhaustive D.T3.2.1. Report:

- Snow making: 4.4
- Ski lifts: 4.5
- Snow groomers: 4.6

4. Deployment of energy efficiency measures in Smart Altitude

Several types of buildings have been subject to the deployment of energy efficiency solutions in the framework of Smart Altitude: operational buildings, public buildings and tourism housing. Operational buildings are generally included in the resort EMS (Les Orres, Madonna di Campiglio), and solutions deployed for operational buildings are applicable to public buildings in the framework

[6] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/measuring-visualizing-performance/live-monitoring-system-specifications.
[7] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/smart-altitude-toolkit/territorial-maximization-report.

of general energy management services offered by public organizations (Les Orres) or private companies.

Tourism housing energy efficiency at Les Orres living lab

The main point of interest is tourism housing for which systems have been deployed in livings labs Krvavec (hotel) and Les Orres (UCPA – tourism hosting for the youth).

The principle of energy management for a tourism building at Les Orres is presented below:

Figure 2—Principle of a tourism housing building heating regulation in Les Orres by EDF

The expected energy consumption reduction of the building is as follows:

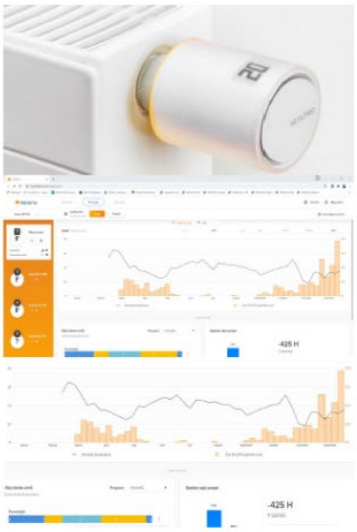
- Electric consumption: 20%, 120 MWh/year
- GHG emissions: 6 tCO2eq/year

Tourism housing energy efficiency at Krvavec living lab

A detailed heating cost reduction solution for a hotel has been implemented in the Kravec Living Lab. The solution and its results are summarised as follows[8]:

"A series of energy efficiency solutions were installed. In the hotel, thermostatic valves, controlled via a computer or mobile application, were installed on radiators. Through the program, each room is heated according to a pre-set temperature. If the room is not booked, the system itself switches off the room heating via the hotel program. In case of a reservation, the room starts to be heated an hour before the arrival of the guest. The SELTRON WDC20 system, which controls the temperature of the water that flows into the heating system depending on the outside temperature, has been installed in the boiler room. If the environmental temperature is low, the regulation system will deliver a higher temperature to the heating water. In the boiler room, the circulating pumps were also replaced for economy reasons. The Clausius application has been installed along with the GWD communication module. Receptionist, hotel management and maintenance staff can manage hotel heating entirely via the Clausius mobile application and/or as a web application. These changes have resulted in an approximate 20%reduction in oil/gas consumption, improved customer comfort and easier management of the heating system, leading to higher customer satisfaction and reduced staff working hours."

[8] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/smart-altitude-living-labs/krvavec/heating-costs-reduction.



BEFORE UPGRADE

Thermostatic valves on all radiators were manual which lead to higher heating costs due to unnecessary heating and discomfort of the hotel guests because of regular higher or lower than desired room temperature.
Boiler room was controlled by simple thermostats.

UPGRADE 1 - DIGITAL THERMOSTATIC VALVES

In the hotel, we installed a thermostatic valve on each radiator, which is controlled via a computer or mobile application. Through the program, each room is heated according to a pre-set temperature. The system itself switches off the room heating via the hotel program, if the room is not reserved. In case of reservation, the room starts to be heated an hour before the arrival of the guest.

Figure 3A

UPGRADE 2 – SELTRON WDC20

The SELTRON WDC20 system has been installed in the boiler room, which controls the temperature of the water that will flow into the heating system in relation to the outside temperature. If the environmental temperature is low, higher temperature of the heating water in the system will be regulated.

The SELTRON system sends a signal to the valves in the boiler room how much hot water must be let into the system.

In the boiler room, we also replaced the circulating pumps due to economy.

Figure 3B

UPGRADE 3 - CLASIUS APPLICATION

Together with the GWD communication module the Clausius application was installed. Receptionist, hotel management and maintenance can manage hotel heating entirely via Clausius mobile application and/or as a web application.

RESULT

Approx. 20% lower heating oil consumption, higher comfort of the guests and easier managment of the heating system leads to more satisfied guests and reduction of our staff working hours .

Figure 3C

Figure 3 A, 3B, 3C—Hotel energy efficiency system implemented in Krvavec (Slovenia)

Energy efficiency at the Verbier living lab

The figure below, taken from the Living Lab Verbier approach, illustrates the drivers for implementing an energy efficiency policy at the ski area level.[9]

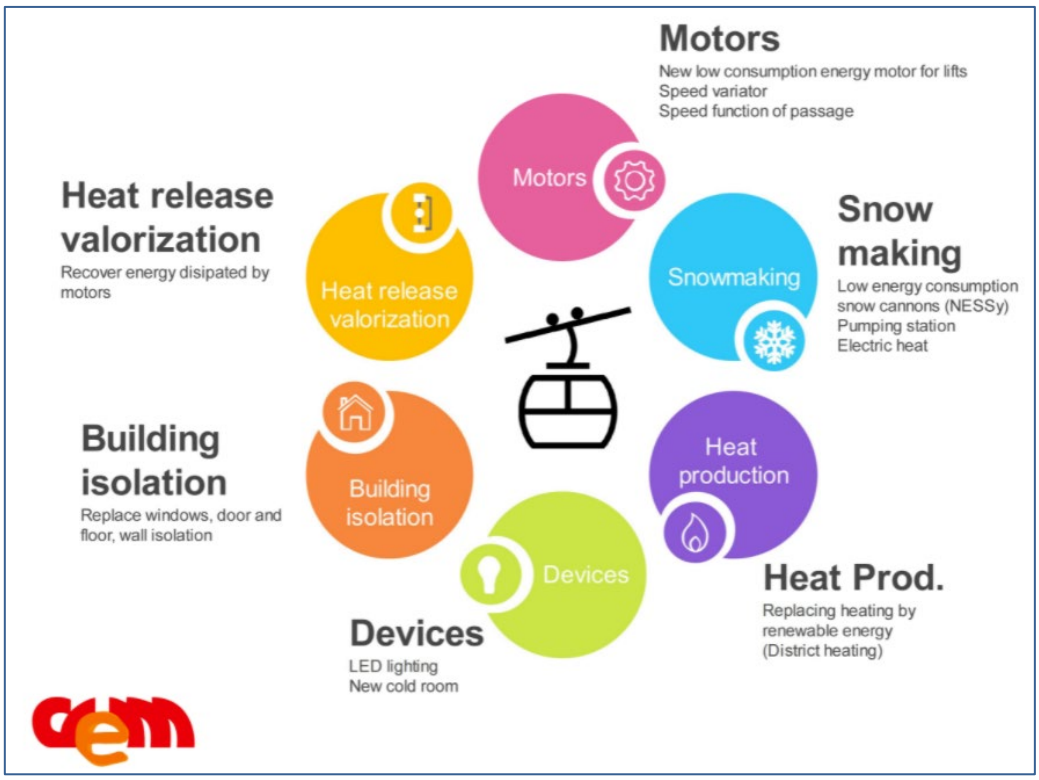


Figure 4—Energy optimization drivers at Verbier

Figure 5 below illustrates CREM/Verbier's approach of the energy efficiency implementation process in the ski resort.

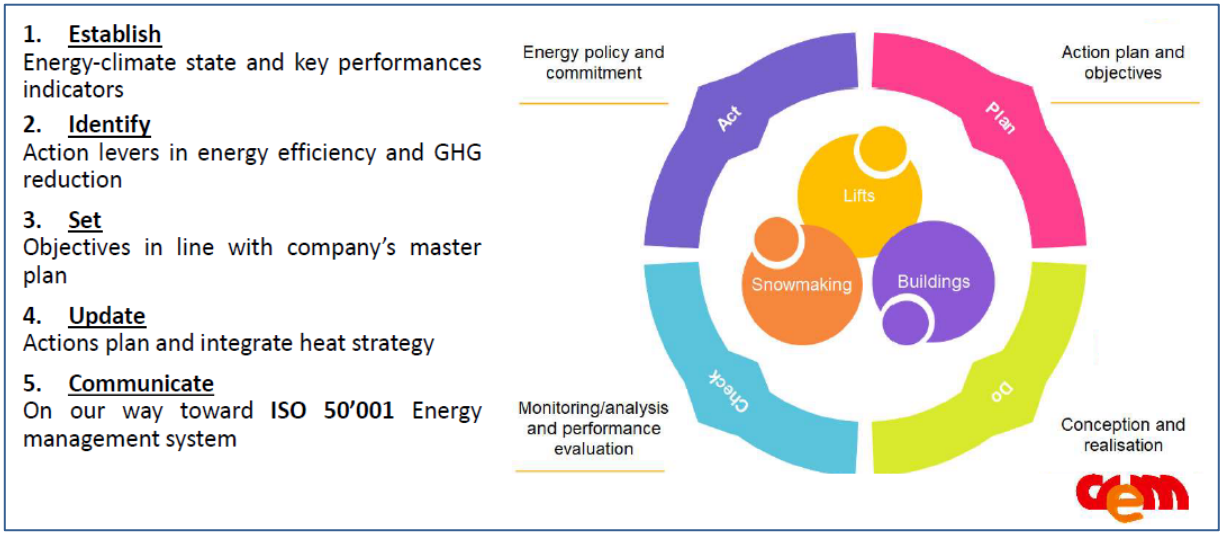


Figure 5—Energy efficiency implementation process at Verbier

[9] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/smart-altitude-living-labs/verbier.

Some of the most visible actions for energy efficiency and minimizing the environmental impact of the resort at Verbier are communicated to the general public, as presented in Figure 6 below.

Figure 6—Energy efficiency actions at Verbier as presented to tourists and ski practitioners

Some results of these actions:

- **Lift speed Regulation:** Depending on the crowd, the speed of the lifts can be adapted, allowing for the ***reduction of 10%*** of energy.
- **Optimization of the diesel engines of the Snow-Grooming Machines:** With the help of the company Alp Evolution, all the engines of grooming machines have been optimized, therefore d***ecreasing the consumption of fuel by 8%***.

5. Energy efficiency assessment tools

Smart Altitude WebGIS

Part of the Smart Altitude project is the development of a web-based GIS application to visualize territorial assets, untapped renewable energy potential and key performance indicators for the living labs and the 20 or more replication sites which together form the core of a community of Alpine sites committed to a common approach to energy efficiency. A geographic Information System (GIS) is a computer system designed to capture, store, manipulate and present spatial (or geographic) data. The Smart Alitude WebGIS[10] can show many different kinds of energy-related data on one map, using any information that includes a location. In this way, people can compare

[10]https://www.alpine-space.eu/projects/smart-altitude/en/project-results/measuring-visualizing-performance/webgis

different elements in order to understand how they relate to one another. The GIS application is one of the project tools that supports the prioritization of low-carbon operations. It is integrated into the Smart Altitude Toolkit for policy makers and other stakeholders.

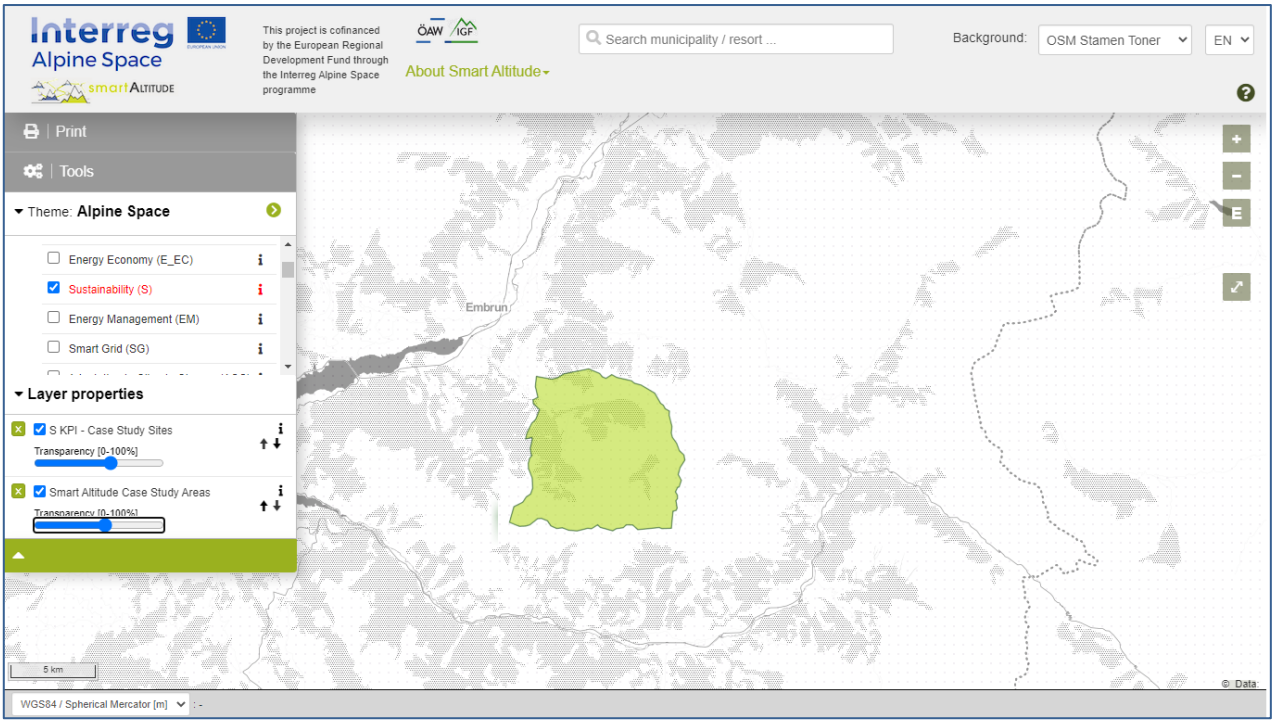


Figure 7—View of the WebGIS interface.
The green area represents the sustainability performance (green = good) of Living Lab Les Orres

As seen in figure 7, based on a set of key performance indicators (KPIs) [11] that have been defined in Smart Altitude, the level of performance of participating sites (here Les Orres living lab) can be color-coded. Numerous layers for renewable energy potential and other environmental indicators can be superimposed. This KPI set is part of a new audit tool, called "Wi-EMT" (Winter tourism Eco-energy Management Tool) that has been developed for this purpose[12]. A questionnaire divided in 7 sections collects the data necessary to assess the KPIs. From this questionnaire and the KPIs evaluation, an individual report is addressed to ski resorts operators participating to the Smart Altitude replication process.

KPIs and Wi-EMT assessment tool

Wi-EMT is an audit tool for the ski resort operators to evaluate the ecological, energetic and management status, identifying the priorities of intervention in a comparative perspective with other ski resorts. The input data are collected from a QUESTIONNAIRE filled by the ski resort. The questionnaire is a self-evaluation questionnaire, and it is not validated by any third part. Each ski resort doesn't know the specific parameters of others, keeping them confidential.

The outputs are as follows:

[11] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/measuring-visualizing-performance/key-performance-indicators-report.
[12] https://www.alpine-space.eu/projects/smart-altitude/en/project-results/smart-altitude-toolkit/wi-emt.

- SKI RESORT ID: main features that characterize the size, infrastructure and operation of the ski resort.
- SKI RESORT KPIs: measurable values that demonstrates how effectively the ski resort is achieving key business objectives.
- EVALUATION REPORT: it is a report that include the ski resort ID and the ski resort KPIs. In this way it provides supervision of the level of energy efficiency, sustainability and management in the ski resort and compares its performance with an Alpine Space reference. Beside a supervision and a comparison of the performance, the report provides a value database for further measurements of energy improvement, able to strengthen competitiveness at international scale. The Evaluation Report is divided into 9 main sections: Energy Efficiency, Energy Economy, Sustainability, Energy Management, Smart Grid, Adaptation to Climate Change, Self-Evaluation, Future Outlook, Overall Result.

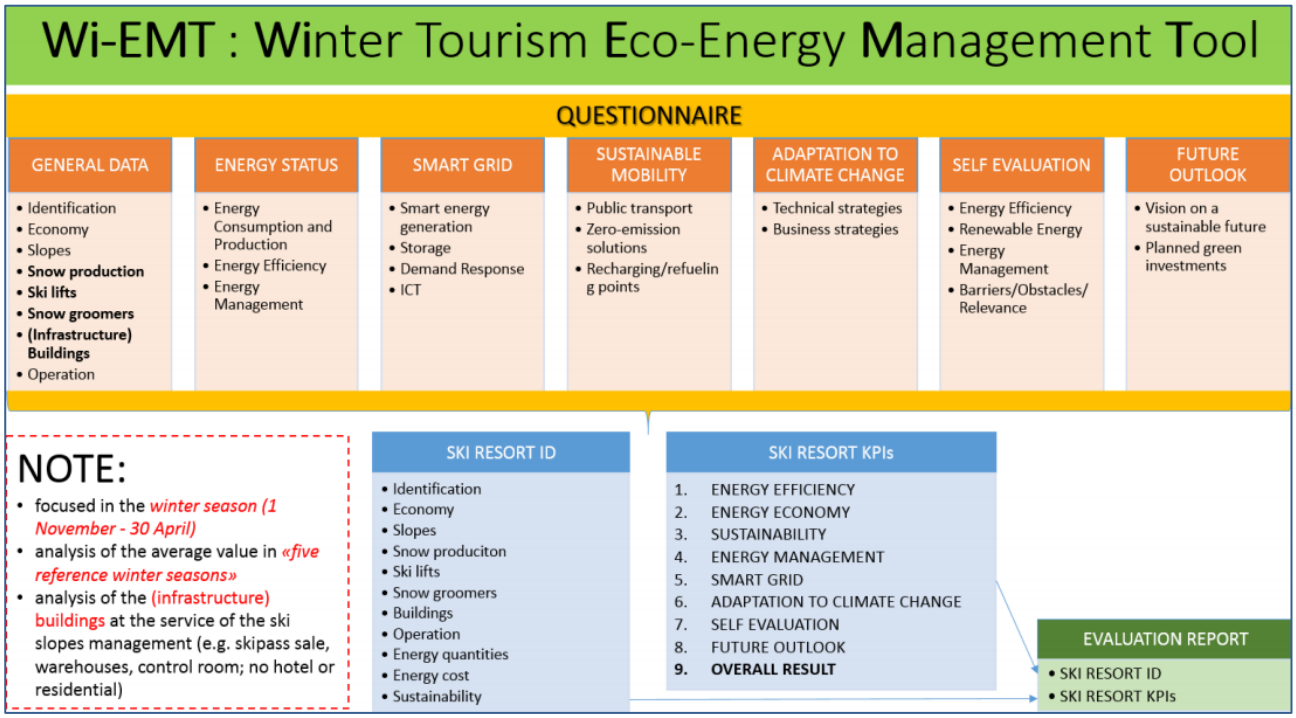


Figure 8—Overview of the Wi-EMT

6. AG9 specific objectives vs. Smart Altitude achievements

The table below presents the relation that can be drawn between the 5 specific objectives of AG9 and the Smart Altitude project's actions and achievements. **Grey cells indicate AG9 specific objectives and related Smart Altitude actions not examined in the present report**.

AG9 Specific objective	Smart Altitude action
Setting up an Alpine energy efficiency cluster. *This cluster should serve as a forum for cooperation and innovation, bring technical solutions for the specific energy needs of the Alpine Region, and develop* ***energy efficiency processes and products*** *particularly adapted to*	**Setting up a Replication roadmap and a Network of low-carbon winter tourism regions.** *This action has resulted in the* ***creation of a network of 26 Alpine resorts involved in a common approach to reducing energy consumption and GHG emissions****, and links with other network*

the Alpine Region, especially in the housing and mobility sectors	*initiatives (WikiAlps). The project has established* ***close links with the different categories of stakeholders****, i.e. local, regional and European (EUSALP) decision-makers, in order to draw up* ***a body of recommendations based on its studies and feedback on the scale of the Alpine space****.*
Greening the Alpine infrastructure: *focusing on* ***energy efficiency in the building sector*** *and promote harmonised, affordable and operational assessment tools to be used by public authorities in order to boost sustainable and low-carbon buildings in the Alpine Region.*	**Demonstrating the efficiency of a decision support tool integrating all challenges into a step-by-step approach to energy transition.** *Several initiatives have been deployed in Smart Altitude Living labs for* ***tourism housing energy efficiency****, especially in Krvavec (Hotel) and Les Orres (Youth Centre). In additions,* ***operational and public buildings have also been integrated in EMS solutions*** *(Kvavec, Madonna di Campiglio, Les Orres, Verbier). All these approaches are documented and made available.*
Setting up an Alpine renewable energy cluster while taking into account ecological, economical and land use issues and considering societal trade-offs	**Creation of a Network of low-carbon winter tourism regions supporting the attractiveness of sustainable winter tourism.** *It provides recommendations suited for regional, national, Alpine and European levels while developing guidance on the adoption of Sustainable Energy Action Plans (SEAPs) at local level. The integration of renewable energies in the sustainable development model is part of the smart grid approach developed in Les Orres, including hydroelectricity and photovoltaic energy. The Smart Altitude dashboard develops KPis and platforms (WebGIS) including the renewable energy potential of winter tourism areas.*
Support energy management systems in the Alpine Region *by developing, sharing and installing energy efficiency and decentralised monitoring systems at the local level and by promoting regional energy monitoring.*	**Monitoring system for live performance assessment and decision-making.** *This activity specifies the monitoring system on energy usage and production for the Living Labs. The integrated monitoring system agglomerates energy data from multiple sources (snow processes, buildings, renewables, municipal infrastructure) and performance indicators. It is developed for implementation in the three Living Labs to prioritize low-carbon operations.*
Support a better use of local resources and increase energy self-sufficiency while reducing impacts on climate and the environment.	**Visualizing clean energy potential against economic and governance factors:** *setting up the Smart Altitude WebGIS: Web-based GIS application development on energy infrastructure, uses and renewable potential.* **« Smart Mountain Grid" Living Lab (Les Orres):** *Test of a demand and production balancing system, based on user involvement with an 'energy management service' (B2B and B2C) and a self-production/consumption approach optimizing local renewables.*

Table 2—Evidence of relations between AG9 specific objectives and Smart Altitude actions

7. Recommendations

To maximise the deployment and impact of the Smart Altitude approach with regard to energy efficiency, the project recommends AG-9 to (most relevant recommendations for **Energy efficiency** in **bold**):

- **Support mountain resorts in their implementation of energy efficiency and self-sufficiency solutions by further developing the toolbox and support platform for replicators beyond the Smart Altitude project.**
- Invest in the recruitment of experts within the EUSALP structures to ensure the management and coordination of the network of European actors in the field of energy transition in resorts in order to **organise the sharing of good practices, data, training and the visibility of initiatives in this field**.
- Facilitate cooperation between energy innovation clusters with their R&I organizations and alpine areas.
- Facilitate cooperation between professional organizations for alpine sports and tourism and energy innovation clusters with their R&I organizations.
- **Facilitate the citizens' involvement in energy policy: building on the concept of energy communities introduced by the Clean energy for all Europeans package**, it could be desirable to define a model adapted to the energy specific characteristics of the Alpine space (seasonal consumption, geographical constraints, presence of big operators and individual consumers, …). Such framework would make it easier for citizens, together with other market players, to team up and jointly invest in energy projects. The network of these Alpine energy communities could be facilitated by EUSALP to ensure sharing of synergies and feedback about projects involving civil societies.
- Promote a **labelling logic specially designed for mountain resorts based on the data monitored by the observatory for the energy transition in the Alpine space: It would enable resorts to promote their efforts in terms of a low-carbon strategy to enhance their attractiveness and to mobilise internal stakeholders around good practices and a proven transformation model.** Thus, the work carried out in the framework of Smart Altitude could contribute directly to the effort undertaken in the framework of EUSALP to build a Charter for Sustainable Resorts by informing on the best practices identified and on the conditions of their transferability. While the environmental dimension of sustainable tourism drives the various analyses and actions, it seems **absolutely necessary to develop a concrete and operational contribution to mobilise as much as possible the alpine tourist destinations and resorts in the elaboration of their sustainable development strategies.** Smart Altitude therefore has a key operational role to play on the theme of labelling and certification.

Conclusion

Through its concerted action, based on the systematic exploration of the state of the art of energy efficiency technologies and their deployment in 4 pilot sites representative of the diversity of the Alpine space, the Smart Altitude project has demonstrated the interest and feasibility of reducing the carbon footprint and energy consumption in mountain resorts. This

work has resulted in the development of reliable common criteria and indicators to measure the efforts undertaken, the implementation of a detailed process to achieve the objectives, a collection of feedback from the 4 living labs and the organisation of a replication programme to which 26 Alpine resorts have already subscribed.

Reports have been written to develop recommendations for regional, national and European policy makers to facilitate the energy transition of mountain resorts in the Alpine region. Of these, five were specifically aimed at the EUSALP Action Groups, including three reports for AG 9, whose activity is dedicated to energy efficiency and renewable energies.

The present report was focused on energy efficiency. By exploring the characteristics of energy efficiency solutions and discussing their deployment conditions, issues and current limitations in mountain resorts, Smart Altitude lays the foundations for future advances in the energy transition in mountain territories.