FinalReport

EUROPEAN TERRITORIAL COOPERATION

Alpine SPACE

Project Short Title

AlpEnergy

Priority 1 Competitiveness and Attractiveness

Priority 2 Accessibility and Connectivity

Priority 3 Environment and Risk Prevention

Project Long Title

Virtual Power Systems as an Instrument to Promote Transnational Cooperation and Sustainable Energy Supply in the Alpine Space

Lead Partner

Allgäuer Überlandwerk GmbH

Project Partners

- Lead Partner: Allgäuer Überlandwerk GmbH (D)
- Allgäu GmbH (D)
- B.A.U.M. Consult GmbH (D)
- Provincia di Mantova (I)
- Fondazione Politecnico di Milano, Settore Pianificazione, Ambiente e Energia (I)
- Rhônalpénergie-Environnement (F)
- Institut National Polytechnique de Grenoble (F)
- Regionalna razvojna agencija Gorenjske d.o.o. (SI)
- Elektro Gorenjska, podjetje za distribucijo električne energije, d. d. (SI)
- Consorzio BIM Piave Belluno (I)
- Regione Autonoma Valle d'Aosta / Région Autonome Vallée d'Aoste Assessorato Attività Produttive (I)
- ALaRI - Advanced Learning and Research Institute all'Università della Svizzera italiana (CH)

Project Website

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Abstract

AlpEnergy developed and tested means to balance power generation and consumption in subsets of the entire system. To that end, the consortium described the concept of Virtual Power Systems (VPS). A VPS is a system that integrates, manages and controls distributed energy generators and storage capacities and links their technical operation to the demand of consumers and the energy market. While the definition does not restrict the concept to renewable energies, the pilot projects put emphasis on the incorporation of resources such as biogas, PV and wind.

Power utilities and grid operators can use a VPS to better handle intermittent energy sources on a local level and to make best use of existing power grids. The technology can also be used for implementing self-contained energy cells whether it be fully integrated plus energy homes, smart factories or clusters of those forming a micro grid in a mountain village.

Various elements of a VPS have been developed, implemented and tested in six distinct areas of the Alpine Space: the Allgäu region in Bavaria (Germany), the Autonomous Region Aosta (Italy), the Province Belluno (Italy), the Belledonne chain area in the region Rhône-Alpes (France), the region of Gorenjska (Slovenia) and the City of Mantova in the Lombardia region (Italy). The results together with clear recommendations have been published in a guideline for decision makers and practitioners. Together with various studies it is available from www.AlpEnergy.net.

Relevance

Fossil energy resources are finite and the confidence in the security of nuclear power is shrinking in many societies. Furthermore, the prices for energy appear to be ever increasing. On a global scale, limited access to energy can become a threat for welfare and peace. In the Alpine Space it can further deepen existing territorial discrepancies. On the other hand, the rich endogenous renewable energy sources (RES) such as hydropower, solar and wind energy, wood and other biomass offer an opportunity to overcome this problem.

While the Alpine Space is predestined for multifaceted decentralised generation of power RES, many of these energy sources are intermittent. Generation and consumption must be carefully balanced in time and space to protect the existing grid infrastructure and to make best use of it. This is of utmost importance in areas with weak electricity distribution grids which have not been designed for vast distributed power feed-in. Better controlling generation and consumption using information and communication technology (ICT) can be more cost-effective than conventional grid repowering.

Low carbon future is a challenge that can only be met on a transnational base: Joint international efforts searching for sustainable solutions to make optimised use of our resources are required. The entire European energy system is interlinked. Thus transnational alignment of concepts, technological solutions and regulatory frameworks need to be achieved.

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Key Achievements

Major achievements of AlpEnergy have been the definition and pilot implementations of the Virtual Power System concept. AlpEnergy partners could not only prove the technical feasibility of the VPS concept but also describe business models related to it. Moreover, they could show that society is open to adopt such innovative approaches and to accept new tariff options if they are carefully introduced and well explained.

Every AlpEnergy pilot region developed a long term scenario for its energy supply. These strategic plans describe a reasonable mix of power generation, storage and distribution in the very region together with options to better adapt consumption to generation. In pilot tests every sub-consortium implemented a critical piece of the masterplan and described it as a case study:

- Allgäu: control system and dynamic tariffs to foster consumption balanced with generation
- Aosta: "shift&store boxes" to flatten load curve of private homes at a given level
- Belluno: energy management system for public facilities (e.g. schools) and intelligent regulation of public lighting
- Gorenjska: smart meters with remote reading and comprehensive information on power usage
- Mantova: joint management of biogas plants and balancing with PV systems
- Rhône-Alpes: electric heating systems as buffers in the grid

Lessons Learnt

It was a key learning that managing the entire system does not only imply demand side management. Better managing the complex distributed generation park and introducing ancillary services to small generation facilities may be even more effective in terms of technology and cost.

Key factors for the successful implementation of VPS are:

- involvement of local stakeholders as a group to define the objectives, select the right implementation approach and help approaching the end consumer
- multidisciplinary approach and use of modelling methods that have been applied in the field of ICT development
- modular and flexible architecture comprising simple metering devices and flexible to use energy management devices, data and control centres, prognosis and clearing systems
- easy to use technical solutions (including attractive human-machine-interfaces, e.g. smart phones) and personal support in the initial phase of the implementation
- incentive models that include dynamic tariffs as well as other means such as bonus systems for the improvement of "consumer behaviour"
- information and education activities targeted to the customers and population in total as well as to implementing professionals from crafts and SME
- acceptance of power customers as new market players offering their flexibility and the power produced in their local generators (“prosumers”).

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Replication / Roll out

The VPS approach and technology have proven to be a smart answer to the challenges imposed by distributed and renewable power generation. The concept helps to
- introduce more RES into the existing grid infrastructure in a cost-effective way
- involve power customers as active consumers
- create local energy markets with new market functions and market roles.

In that sense it would be beneficial to the Alpine Space to replicate the experience of AlpEnergy. Pilot implementations have shown where further development of technology and legal framework is necessary:
• ICT to implement a VPS is – at least partially – not yet mature. Smart meters, energy management and control devices including the communication technology to link them together will be available in the next few years from local and global suppliers.
• In the future, VPS need to include storage systems to overcome the long term buffering requirements due to seasonal discrepancies between power demand and RES based generation.
• The regulatory framework in some of the Alpine countries does not (yet) allow to introduce attractive dynamic tariffs. Even worse, some of the remuneration mechanisms (feed-in tariffs) do not stimulate smart use of distributed resources.

While the feasibility of the VPS concept could be proven, it is up to local decision makers to introduce this approach in their strategic regional energy plans. And it is up to legislative and regulatory bodies to create a beneficial framework for it.

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