energy innovation austria

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Current developments
and examples
of sustainable energy
technologies

klima+ energie fonds

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Innovations for energy communities

Research and technology development for their successful implementation in Austria

Energy communities let citizens participate in the energy market and proactively shape the energy transition. In various RTI projects, new solutions are being developed that will help optimise, further advance and spread the idea of energy communities.

Photo: stock.adobe.com

Energy communities

A game changer for the energy transition

Decentralisation, digitalisation and democratisation are essential building blocks to successfully advance the transformation of the energy system towards a climate-neutral energy supply. All three of these aspects come into play in energy communities. Energy communities create new opportunities for citizens to actively participate in the energy transition by collectively producing, consuming and trading energy.

EUROPEAN AND NATIONAL FRAMEWORK CONDITIONS

With the "Clean Energy for all Europeans Package" (CEP)[1] the European Union has created a legal framework that strengthens the activities and rights of consumers and communities in the energy sector at the local level. The goal is for citizens to be able to get involved in innovative business areas such as peer-to-peer energy trading, energy sharing and flexibility trading in the energy market. They should also benefit financially.

The national climate targets envisage converting Austria's electricity supply to be 100 per cent electricity from renewable energy sources (national balance) by 2030 and to achieve climate neutrality by 2040. With the Renewable Energies Expansion Act (EAG)[2], important european targets were implemented in Austria in 2021. The possibility of establishing energy communities is a central part of this. Energy communities represent a new milestone for the Austrian energy industry. They enable proactive participation in the energy transition, promote the expansion of decentralised energy systems, offer economic incentives and strengthen regional value chains.

TWO MODELS FOR ENERGY COMMUNITIES

The national laws define two energy community models: the renewable energy community (EEG/Erneuerbare Energiegemeinschaft), which is limited to local communities and the citizen energy community (BEG/Bürgerenergiegemeinschaft), which is geographically unrestricted throughout Austria.

A renewable energy community (EEG) may jointly generate, store, consume and sell energy (electricity and heat) from renewable sources across property boundaries. Members or shareholders of a renewable energy community can be private or legal entities, local governments, local authorities or even SMEs.

The main purpose of a renewable energy community is not financial gain; the focus is on regional benefits and the advantages for the members. In contrast to the renewable energy community, the citizen energy community (BEG) may only generate, store, consume or sell electrical energy. It is not limited to renewable sources and can extend over the concession areas of several grid operators throughout Austria. The members or partners of citizen energy communities can also be private individuals and/or legal entities. Large companies can also participate here, but they are not allowed to exercise any control. It applies in the same way that making a profit should not be the priority.

Since the EAG 2021 was passed, more than 100 energy communities have been founded in Austria. Another 290 EEGs and 10 BEGs are planned (2/2023).

[1] energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en
[2] oesterreich.gv.at/Gesetzliche-Neuerungen/archiv-bgbl-2021/eag-paket.htmlen

ÖSTERREICHISCHE KOORDINATIONSSTELLE FÜR ENERGIEGEMEINSCHAFTEN

The independent service centre offers all important information, documents and contact addresses on the topic of energy communities on its website. The coordination office works closely with the energy agencies and institutes in the federal states, which offer on-site advice in the region. The offer is constantly being expanded and supplemented with the latest facts, tools and videos.

>> energiegemeinschaften.gv.at

Photos: Climate and Energy Fund

INNOVATIONS FOR THE ENERGY SYSTEM OF TOMORROW

In order to spread the idea of energy communities even more broadly, role models and best-practice examples are needed. Research and technology development as well as new digital solutions can help drive the optimisation, further development and successful implementation of energy communities and initiate a new dynamic for the decentralised energy transition. Core technologies for use in energy communities include smart metering and control systems, digital platforms, data management systems and blockchain technologies.

In addition to sharing energy, other functionalities for energy communities are increasingly being considered and integrated. RTI projects deal, among other things, with efficient energy management systems, storage technologies, concepts for sector integration (electricity, heat and e-mobility) or the grid-compatible operation of energy communities.

By integrating storage systems, the energy community can be made more self-sufficient; at the same time these storage systems serve as security in the event of a blackout. Through the systematic control of generation and consumption, the energy communities can offer flexibilities on the energy market and thus contribute to the system stability of the power grid. Digitalisation is a fundamental prerequisite for this and provides the basis for optimised operation of energy communities and new economically attractive business models.

In this issue we present some RTI projects from Austria that are developing new (digital) technologies, concepts and solutions for energy communities and are thus making a contribution to the successful implementation of the energy transition.

“For energy communities to function optimally, they need suitable energy management systems that efficiently control the generation and consumption of renewable energy, in line with demand. In my opinion, there is still a need for more research here, as well as in the area of load management and in energy storage systems. An important topic, especially for municipalities, is the security of supply. This will require technical solutions, for example, to be able to operate individual buildings independently in the event of a blackout.”

EVA DVORAK,
HEAD OF AUSTRIAN COORDINATION OFFICE FOR ENERGY COMMUNITIES

Photo: Klaus Ranger

ENERGY POINT

Open energy trading platform for all market participants

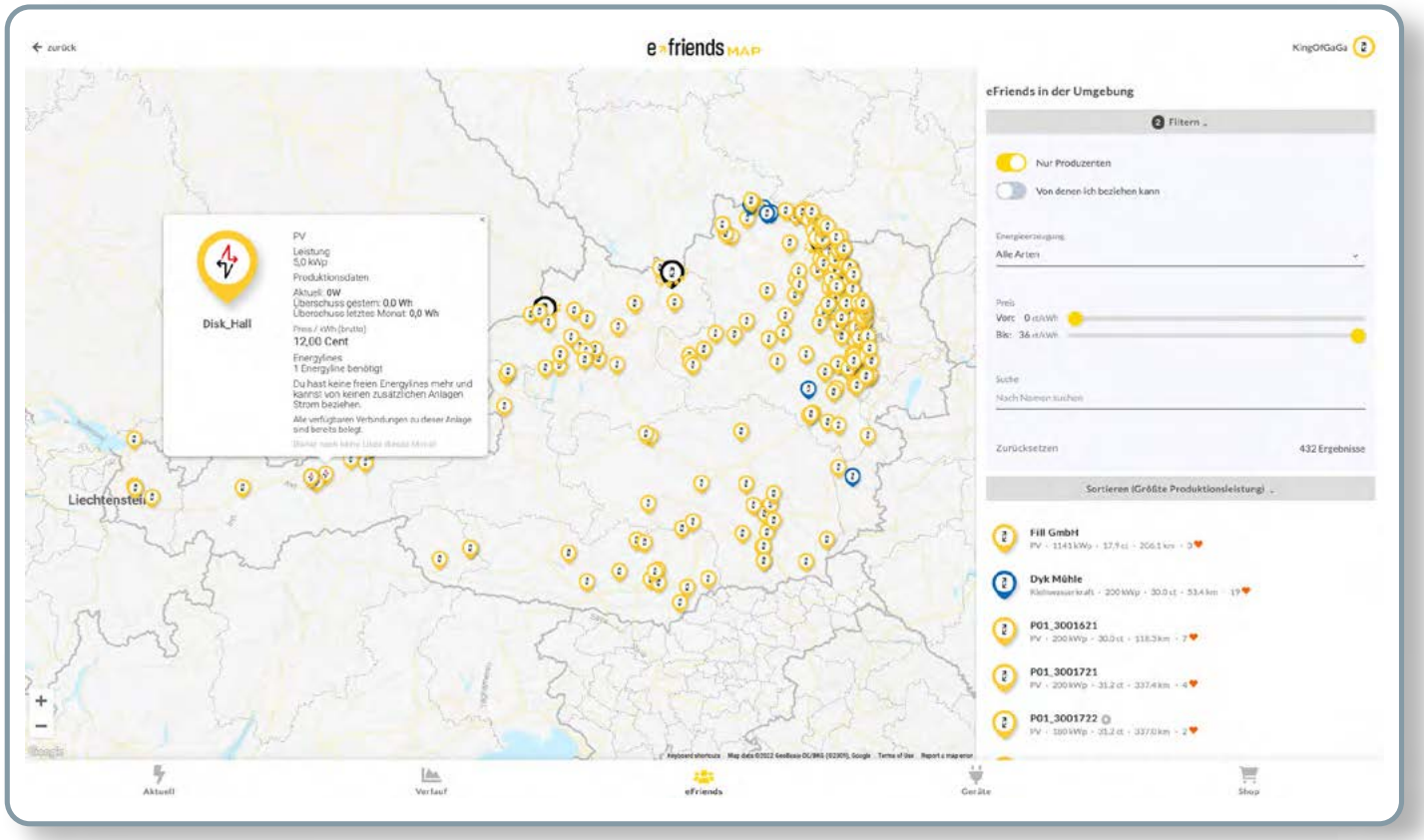


Fig.: eFriends Energy GmbH

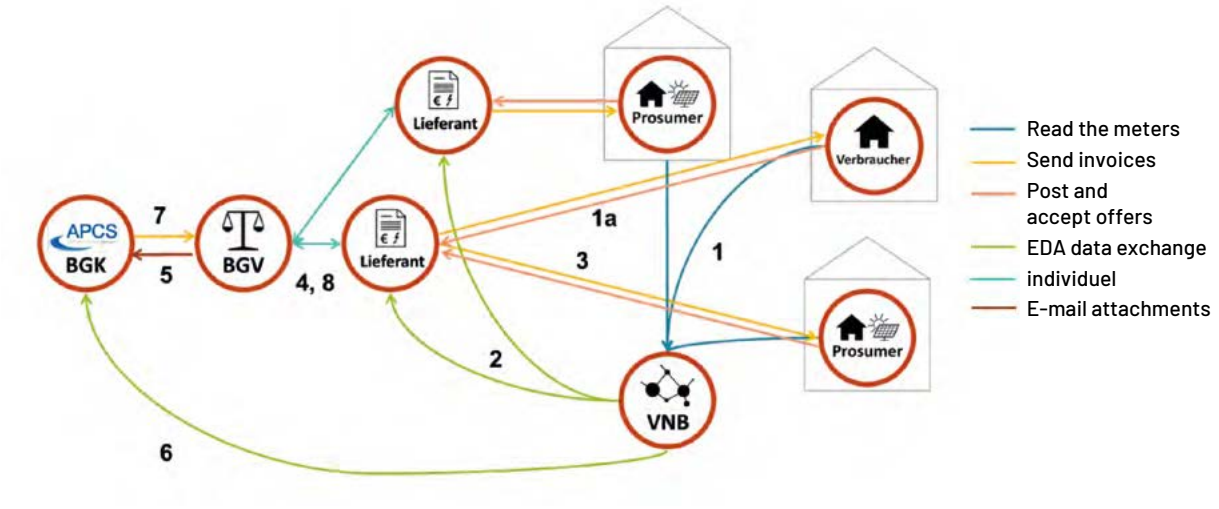
Our energy system faces the challenge of connecting a growing number of decentralised energy producers and private prosumers with each other and developing joint solutions, business models and market concepts for the renewable energy supply of tomorrow. The Austrian company eFriends Energy has been active as an energy provider on the Austrian market since 2018 and offers energy consumers and producers a platform for sharing and selling renewable energy on a private basis. eFriends uses technology developed in Austria to share regionally generated green electricity from photovoltaics, wind and hydropower in real time and independently of large electricity providers.

Photovoltaic systems benefit from this in a special way, since by connecting many private households, a large part of the energy generated can also be used within the same community.

EXPANDING THE PLATFORM

With the new legal basis for energy communities, eFriends now goes one step further: the Energy Point project expands existing solutions in order to open the platform to all innovative energy suppliers and other providers. eFriends Energy's patent for the optimised distribution of electrical energy within a single user group has been expanded to make it possible to optimise energy flows outside the balance group.

With Energy Point, a freely accessible energy trading platform was developed that enables a free choice of suppliers and operates across the balance group. The aim is to integrate energy communities, energy suppliers and grid operators on this common platform and to provide all market participants with easy, non-discriminatory access as a one-stop shop. Among other



Data flows on the energy platform
Fig: www.e-sieben.at/publikationen/21021_Energy_Point/Energy_Point_Whitepaper_final.pdf?m=1655125833&amp

things, interfaces had to be defined in order to be able to exchange the necessary data between the market participants in high resolution. The challenge was to find a sensible and suitable trade-off that would allow an optimal balance in terms of data protection, data security, and data use.

Based on selected case studies, the functionalities of the platform were tested for later large-scale implementation. The regional procurement of green electricity and the associated reduction in grid costs will also encourage new business models. The design of such models for the Energy Point platform was another focus of the project. By integrating other energy suppliers on the eFriends platform, Austria's first energy community across balance groups has been put to practice.

NEW PARTNERSHIPS

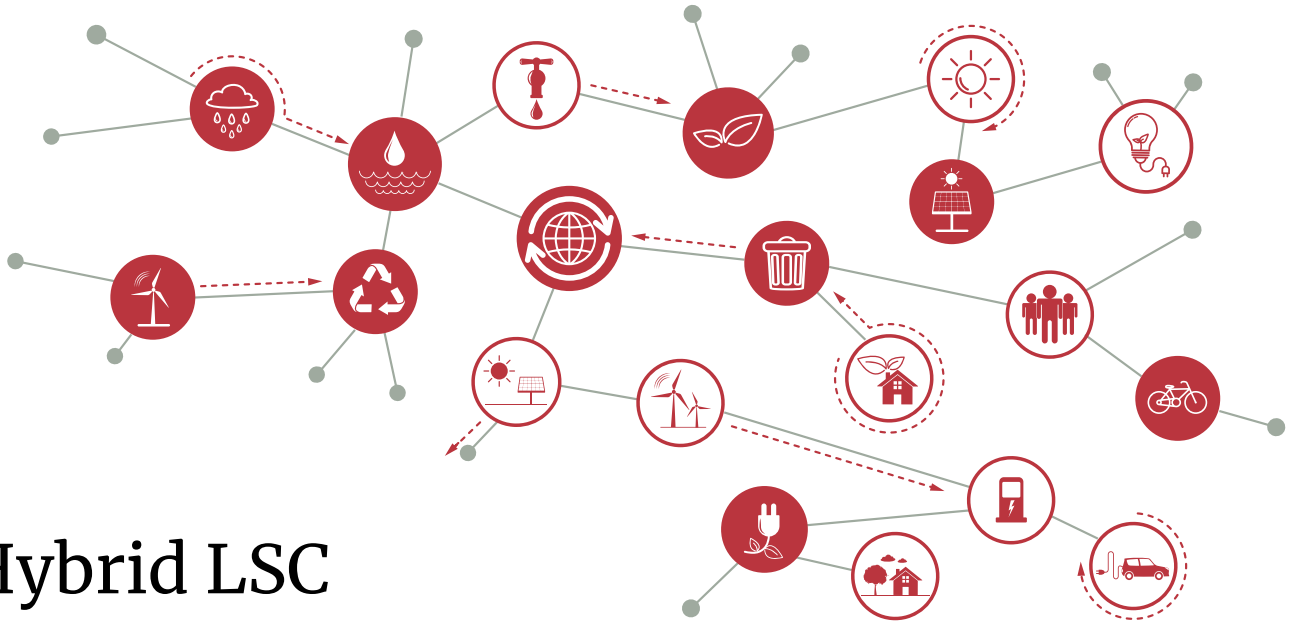
The Tyrolean company GUTMANN is the first energy provider to offer its own customers the opportunity to share and exchange energy via the eFriends platform. Participants of the GUTMANN electricity exchange are represented on the eFriends MAP and can therefore easily share surplus electricity from their own PV systems with other eFriends throughout Austria, or obtain electricity from them. On the eFriends MAP, they can see in real time how much green electricity is currently available from the community and how much it costs. All eFriends can determine the price among themselves. RWA Raiffeisen Ware Austria, which has a stake of around 24% in eFriends, also offers energy communities regionally via its platform "strom:teilen" on the eFriends MAP.

www.efriends.at

INNOVATIVE eFRIENDS TECHNOLOGY

Via the eFriends platform and managed by eFriends Energy Control, partners can obtain, share, exchange and sell the electricity they have produced. So, for example, eFriend 1, who owns a photovoltaic system, can feed surplus solar power into the grid. eFriend 2, who does not have an installation, can draw electricity in real time, regardless of location – throughout Austria. The two parties are linked via the eFriends MAP, where they can also agree on their own electricity price with each other. The energy balance of a household is displayed in the eFriends Watch function. Thanks to this real-time information, participants can check at any time whether it makes sense, e.g., to turn on additional household appliances.

Photo: stock.adobe.com



Hybrid LSC

Holistic strategy for local sustainable communities

Fig.: stock.adobe.com

The concept of local sustainable communities (LSCs) pursues a holistic sustainability approach for settlement areas that goes beyond the joint energy generation, use and storage in energy communities. The focus is on dealing with all local resources and includes other needs and requirements of the residents, from mobility to water supply and waste disposal.

The Hybrid LSC project, which is being carried out at TU Wien in cooperation with several research and corporate partners[1], focuses on a sharing economy. It analyses how energy communities can jointly use other resources or supply and disposal services in addition to sharing (electrical) energy, and which strategies and operating models would be suitable for this. The goal is to achieve the overall sustainability of settlement areas with an optimal mix of technical, economic and social measures.

Citizens and stakeholders (municipalities, planning authorities, property developers and other stakeholders) work together to develop these strategies. The concept will be applicable to all types of settlements, both in urban and rural areas, and will have many positive economic, socio-economic and environmental effects.

INTELLIGENT CONTROL

The project will develop intelligent control strategies to optimise the demand for energy and other supplies such as heating, cooling, mobility, water and waste within a local community, in addition to providing the greatest possible flexibility for the energy system. The technologies needed for these LSCs are largely available on the market (depending on the application). Algorithms and interfaces for integrating and connecting various energy technologies and for further applications are being developed in the project.

FIRST DEMONSTRATION PROJECTS

Various intelligent control strategies are currently being tested at several locations in Austria. In the LSC Puchstraße demo project in Graz (project management: BAR Vermögensverwaltung GmbH), a former industrial area is being transformed into a flexible, efficient Local Sustainable Community. The focus here is on optimised interaction between locally generated renewable energy, energy storage systems and patterns in consumption behaviour. Highly innovative building technologies such as heat pumps that can be fed from different sources and façade-integrated photovoltaics are being used.

At the LCS Vienna demo site in a Viennese urban development area (project management: Wien Energie GmbH), a thermally activated building system is functioning, for the first time, as a storage system for the public district heating system. Further demo locations are planned for apartment buildings and housing schemes in Lower Austria and Burgenland.

greenenergylab.at/projects/hybrid-lsc

[1] **PROJECT PARTNERS:** Energy Economic Group / TU Wien (project management), AEE - Institute for Sustainable Technologies, BAR Vermögensverwaltung GmbH, Burgenland Energie AG, Forschung Burgenland GmbH, JOANNEUM RESEARCH Forschungsgesellschaft mbH, NÖ Energie- und Umweltagentur GmbH (eNu), Vereinigung der Österreichischen Zementindustrie, Wien Energie GmbH

The Hybrid LSC project is being carried out under the Green Energy Lab research initiative as part of the Flagship Region Energy innovation offensive.
www.greenenergylab.at

Photo: act4.energy

Andreas Schneemann

Innovation laboratory act4.energy Stegersbach

FROM RESEARCH TO PRACTICE

The act4energy innovation laboratory in Stegersbach has been researching and testing innovative solutions and concepts for regional, renewable energy systems for years. Is it also a pioneer in the field of renewable energy communities?

In my view, there is huge potential to developing energy communities in connection with regional renewable energy systems. That's why we dealt with the topic at a very early stage. With our R&D projects and our team4.energy initiative[1] for Austria's independent energy communities, we do also see ourselves as pioneers and trailblazers in this area.

How can the findings from research and pilot projects be put to practice on a large scale?

I think it is essential to focus on market-relevant findings and implementable innovations from the start of the research activities. We are able to transfer the developments from research and technology into practice because team4.energy already supports a large number of energy communities and can address all the relevant stakeholders.

What are some of the practical lessons have you learned? What are the challenges for renewable energy communities?

Apart from all the information that has to be submitted in advance, the organisational process (preparing the contract, finding participants and onboarding them, managing members, participating in the market, setting tariffs, managing data, billing, etc.) is one of the biggest barriers for individuals. We are trying to remedy this with team4.energy. In addition, despite of the difficult initial situation that renewable energy communities are faced with due to the market conditions, we need to find a way to not simply reduce the advantages of energy communities to their economic aspect.

What other further support is needed?

Support is definitely needed in raising awareness. Energy communities can do much more than just generate savings. In addition to the achievable ecological effects, they also strengthen the social community structure.

For me, energy communities are even infrastructure projects! Because energy communities will not unfold their true potential until we create new infrastructures (flexibilities & load shifting) so we can the use regionally generated energy in regional grid structures.

[1] **team4.energy** is an initiative of Energie Kompass GmbH. With a strong focus on the intelligent use of renewable energies, Energie Kompass GmbH, headquartered in Stegersbach in Southern Burgenland (founded in 2013 by Andreas Schneemann), develops sustainable, cross-sector energy solutions for companies, municipalities and private customers. On team4energy, Energie Kompass GmbH offers a comprehensive service for renewable energy communities. In addition to consulting and engineering services, the team4.energy platform also offers fully automated, digital billing for energy communities. www.team4.energy

Photo: stock.adobe.com

serve-U

Practical service platform for energy communities

In this project, under the management of the University of Applied Sciences Upper Austria[1], a digital optimisation platform for energy use is being developed where future energy communities will be able to flexibly control the use of renewable energy carriers in a demand-optimised manner, without too much technical effort or expense. The energy optimisation model serve-U will integrate high-resolution meteorological generation estimates, exchange-based price data and self-learning consumption forecasts. With a view to the specific requirements of the users, the economic and ecological potential of such low-cost optimisation approaches for energy communities is also examined.

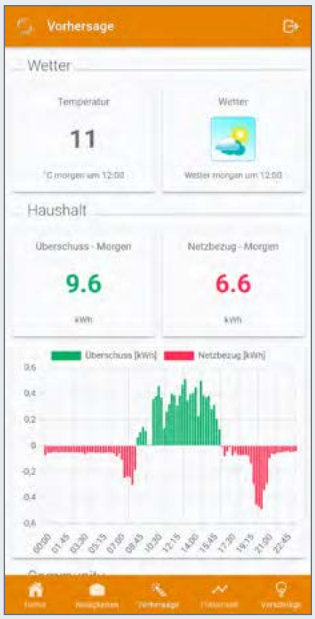
MONITORING AND IMPROVING THE DATA QUALITY

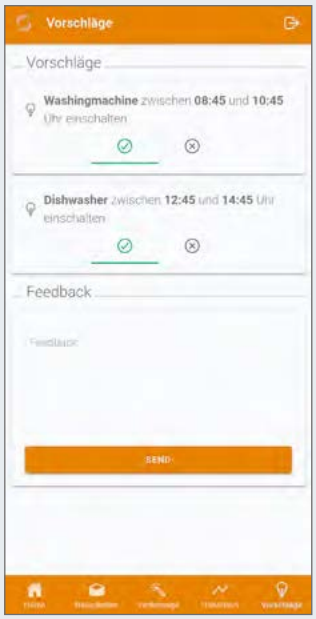
With the increasing number of energy communities and the ongoing digitalisation of the energy system, the amount of data that is transmitted, analysed and processed is growing. In order for an energy community to function properly, it is necessary to precisely measure the data flow on electricity generation and consumption and to bill it correctly. Data are also the basis for decisions such as which energy carrier should ideally be used at what time of day in the energy community. A high quality of the underlying data is essential for optimal operation. Poor data quality can lead to incorrect assessments and thus to high follow-up costs.

A central topic in the serve-U project is the evaluation and improvement of data quality. The project partner SCCH (Software Competence Center Hagenberg) has been researching methods for evaluating data quality for several years. In the course of this, two software tools were developed, which are now being adapted specifically for the energy domain.

For data management, first the requirements for the server infrastructure, database and interfaces were specified. Then it was defined which data need to be included on the service platform and in what form – as raw data or data already checked for quality. Factors taken into account include weather forecasts for the respective location, energy procurement from the in-house PV system, the energy community or the grid, data on energy consumption and the delivery of energy to the energy community, a storage system or the public power grid.

[1] **PROJECT PARTNERS**: University of Applied Sciences Upper Austria (project management), ATB-Becker, BLUESKY Wetteranalysen, Energy Institute at the Johannes Kepler University Linz, University of Applied Sciences Technikum Wien, Innsbrucker Kommunalbetriebe, coop, Software Competence Center Hagenberg GmbH, Sonnenplatz Großschönau, Vendevio





User interface serve-U platform
Fig.: serve-U

FORECASTING & OPTIMISATION FOR ENERGY COMMUNITIES

In actual implementation, the data model will become even more complex and integrate various influencing factors for all energy flows as well as the forecasted future energy consumption. The project partners are developing different forecasting tools for the generation, consumption and optimisation of energy flows in energy communities, which are compared, combined and further developed.

The most important parameters for energy generation are the forecasts of solar radiation (global radiation), which form the basis for forecasting the amount of electricity that will be generated with photovoltaics. Energy communities also own shares in wind and hydropower plants. Therefore, wind power and hydropower forecasts are also included in the model.

ACTIVE USERS

The aim is to develop a service tool that does not require any additional hardware components (electricity meter, home automation, etc.). This will enable low-threshold entry for participants and operators of energy communities. The users are addressed directly via digital interfaces (smartphone, tablet, PC, etc.) and encouraged to take active action, i.e. to control and optimise energy generation and consumption in their energy community. In the course of the project, various actions that users can take as well as any necessary restrictions will be developed together with the future users and adapted to their needs. The accompanying socio-technological research plays an important role in the serve-U project, the findings of which are incorporated.

SIMULATIONS AND TESTS IN A REAL ENVIRONMENT

The overall concept will first be implemented in a simulation environment, next it will be implemented in a real test environment where it will then be examined in a test operation lasting several months. The test phase will provide information about the actual load shifting potentials in energy communities and how the participants behave. In addition, the project team wants to test and analyse different business models and incentives for users to actively participate in this phase.

serve-u.at

Photo: Climate and Energy Fund/Thomas Preiss, KEM Weiz-Gleisdorf

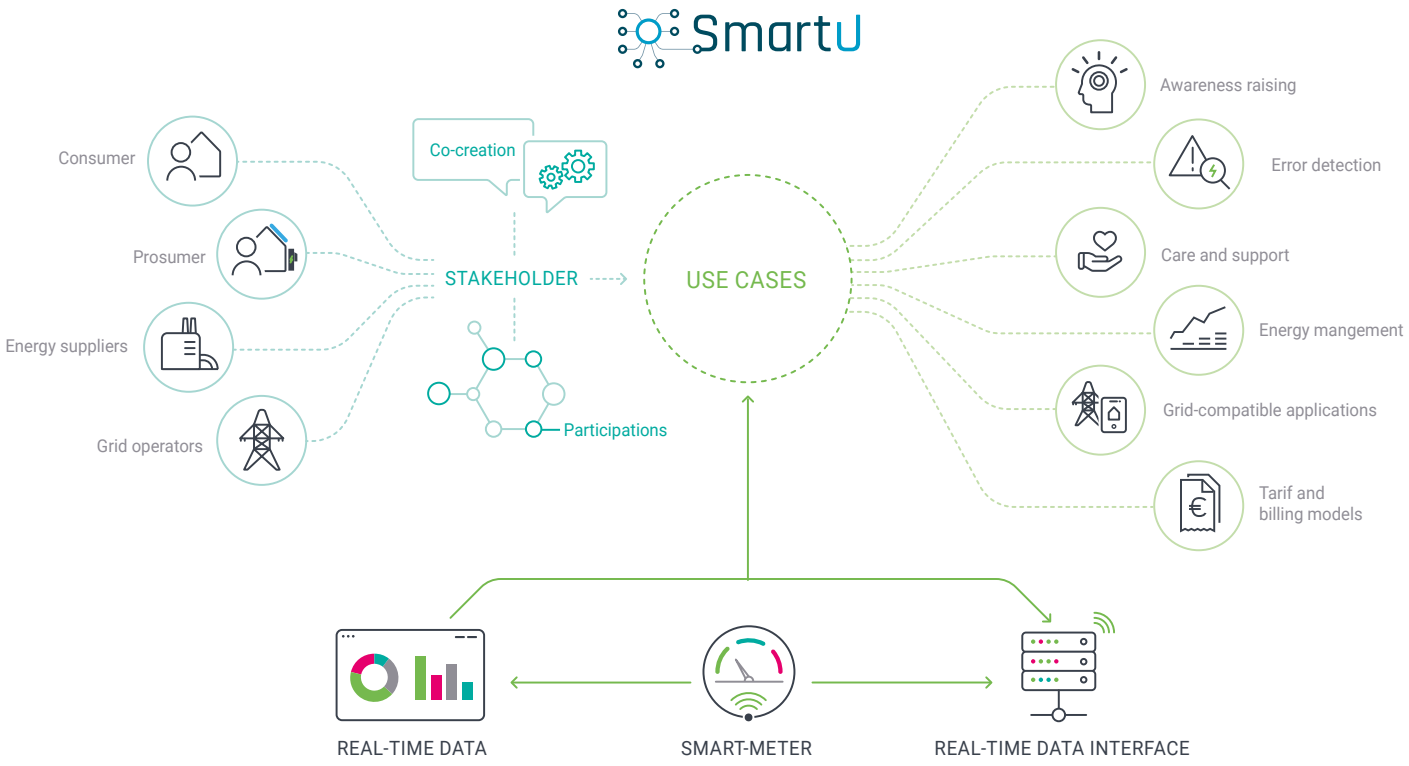


Chart: Green Energy Lab

SmartU

Intelligent use of energy data

Intelligent electricity meters in households are providing a basis for various new applications in the energy system. Smart meters are connected to the respective grid operator via a communication link and offer new possibilities for automated data collection and analysis.

With the temporal resolution and delay in the provision of the data, however, many applications that would require real-time data cannot be implemented yet. Smart meters presently measure and save the electricity consumption on the device every 15 minutes. These values are added up for each day, and this daily electricity consumption is automatically transmitted to the electricity grid operator. If desired, the electricity consumption values can also be sent to the grid operator at shorter intervals (but not faster than every 15 minutes).

NEW HARDWARE SOLUTION FOR REAL-TIME SERVICES

Grid operators are currently working on a standardised hardware solution that will convert smart meter data into a uniform format and make them available via an interface. The aim is to create a low-cost hardware environment for real-time services that connects end users, energy suppliers and distribution network operators. The solution should be transferable to all systems that can be based on the standardised near-real-time smart meter interface.

DEMONSTRATE SPECIFIC APPLICATIONS

In the SmartU[1] research project of Forschung Burgenland GmbH, specific use cases are being developed in a participatory process that require high data resolution and timely availability of smart meter data. For the first time, interacting applications will be demonstrated, in parallel and holistically, in real-life situations and their technical, economic, and social impacts will be analysed.

The different applications took into account energy supply companies, grid operators and end-users (both pure consumers and prosumers, i.e. households that also generate their own energy). Possible applications range from the visualisation of data (in order to create more awareness for the households' own con-

[1] **PROJECT PARTNERS**: Forschung Burgenland GmbH (project management), Burgenland Energie AG, Wien Energie, EVN AG, EVN KG, BEENIC GmbH

The SmartU project is being carried out under the research initiative Green Energy Lab as part of the Flagship Region Energy innovation offensive.
www.greenenergylab.at

> **Digitalisation plays a key role in the energy system of the future. Many different energy sources must be intelligently integrated into the overall system and new types of tariff models for producers and consumers implemented. The individual sectors and industries must be increasingly interlinked in order to utilise all existing potentials and boost efficiency. Data-driven processes and digital technologies are therefore also a focus of innovation in the Green Energy Lab's project portfolio, which is not only examined technologically, but also with regard to user requirements – see for example energy communities."**
>
> SUSANNE SUPPER
> CLUSTER MANAGER, GREEN ENERGY LAB

Photo: Green Energy Lab

sumption) and integration into energy-relevant processes using Demand Side Management (DSM) or Demand Response (DR) to security and convenience features.

With Demand Side Management, consumer-side systems are controlled directly by the energy supply company or grid operator via ripple control receivers, for example, while Demand Response relies on the independent change in consumer behaviour through incentives, such as price signals. These functions make it possible to achieve greater grid stability.

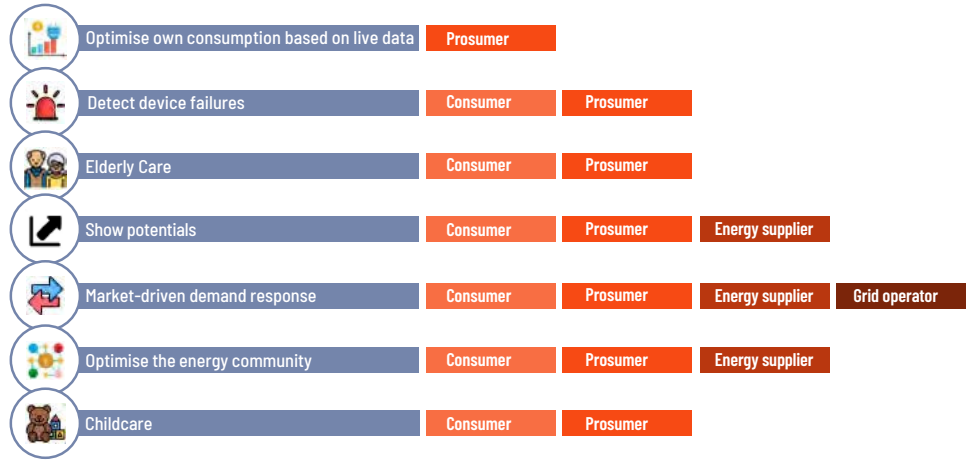
The goal is to develop 15 specific real-time applications and to demonstrate at least eight of them. Furthermore, the project team wants to develop a standardised user interface as well as various rollout plans for the broad implementation of the solution. 225 end-users, i.e. Austrian households, are to be involved.

ENERGY FEEDBACK IN REAL TIME

Real-time information about one's own electricity consumption has the potential to create awareness among consumers and motivate them to rethink their consumption behaviour and household activities. The project's user-centred approach aims to reach the population at large with these solutions. In particular, households with photovoltaic systems can benefit economically from these services by incorporating the real-time data from the smart meters into their own consumption optimisation. The applications will offer particular added value by helping energy communities to operate efficiently.

greenenergylab.at/projects/smartu

STAKEHOLDER INVOLVEMENT



SmartU Use Cases, Fig: SmartU

Photos: stock.adobe.com (above)
Waldhör KG (below)

You can also visit us at:

www.energy-innovation-austria.at

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