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The SERENE project participation in the European Bridge initiative

When participating in European projects within the area of smart energy systems, the project should take advantage of cooperation via the EC's Bridge initiative. It stimulates cooperation between H2020 project's working on Smart Grids, Energy Storage, Islands and digitalisation. The idea is to identify synergies between these different projects by fostering continuous knowledge sharing to make conclusions and recommendations about the future exploitation of project results. A high focus is placed on enabling the future energy system to gain flexibility in sector coupled systems and the future digitalization and application of energy storage in different forms – i.e. power to X, thermal storage and electrical storage.

The BRIDGE Initiative has 4 working groups each of which is followed by a representative from SERENE:

- **Data Management**, which is working on communication infrastructure, cybersecurity and data privacy, as well as data handling. The focus is on flexibility, standard use cases, frameworks and storage. Our participating member is prof. Birgitte Bak-Jensen, Aalborg University.
- **Business Models**, which is working with defining common language for business model descriptions and valuation, evaluation of business models as well simulation tools for the comparison of business models. Here Timber Haaker from University of Saxion coordinates our input.
- **Regulation**, working with regulator frameworks for energy storage and smart grids for instance in relation to demand response, commercial arrangements, ownerships, smart meter data etc. Frans Coenen from University of Twente is our representative.
- **Consumer and Citizens engagement**, which looks into consumer segmentation, analysis of cultural, geographical and social dimensions, engagement activities and what triggers behavioral changes, including ideas for regulatory innovations to empower consumers. Ewa Domke from IMP PAN is our representative.

During the Bridge General Assembly, which was held in March'22, the SERENE project was introduced and presentations of the conclusions and recommendations from the Bridge working groups were given. Finally, there were also presentations

from projects, which have now ended.

The project's representatives felt that not only will SERENE greatly benefit from participation in BRIDGE, but also the project will be able to make a number of positive contributions to the four different working groups:

Data Management

SERENE's work package 2 on *Models and evaluation of storages, energy flexibility and networks to enable smart integrated community energy islands based on renewable energy* can contribute to this group.

In addition, the experiences SERENE will gain from the demonstration sites will be of direct relevance since we will be exploring use cases and architectures with cross-sector coupled systems and flexibility, i.e. heat-pumps, EV and PV systems in private households and municipal buildings.

Business Models

SERENE's work package 7 on *Establishing the impacts of technical and social innovations in the local energy system and design benchmark models* will provide relevant findings to this working group.

Business models will be seen from the perspective of private, utility and industry points of view, and in relation to the Bridge initiative a lot of focus will be placed on the flexibility, digitalisation and application of storages.

Regulation

SERENE's work package 3 on *Identifying socio-economic, governance and regulator factors for*





SUSTAINABLE AND INTEGRATED ENERGY SYSTEMS IN LOCAL COMMUNITIES

economically viable citizen centered local integrated energy systems is relevant here.

Regulatory factors influence the realisation of low

carbon citizen centered integrated energy systems. This includes regulatory issues related to sector-coupling, flexibility market issues, barriers for local market access, regulation of harmonisation standards for energy services and products, as well as the formation of local communities and their energy services.



bridge

BRIDGE GENERAL ASSEMBLY - 2022

22nd, 23rd and 24th March

www.h2020-bridge.eu



Consumer and Citizen Engagement

SERENE's work packages 3 and 7 will provide relevant input on the socio-cultural drivers and indicators as well as smart tools for engagement, since the project's focus is on the formation of local communities, activation in relation to demand response as well as digitalisation and storages.

We therefore look forward to this cooperation and will actively contribute with our findings.

prof. Birgitte Bak-Jensen, Aalborg University, SERENE Coordinator

Follow-up on the SERENE activities undertaken in rural villages in the Skanderborg Municipality in Denmark

The objectives behind the Danish case in SERENE is to carry out test and demonstration activities by working closely with local citizens, property owners, utilities and local stakeholders for establishing the “green” transition of existing heating supply from fossil fuel (natural gas and oil boilers) to electric heating from heat pumps in residential buildings. Furthermore, the goal is to increase self-consumption from renewables. Let's find out what steps were taken during the last 6 months of the SERENE project?

The Danish SERENE demonstration activities are taking place in the villages of Hylke and Laasby in the Skanderborg Municipality. In case of Hylke, Neogrid - in close cooperation with social housing company building owner, Skanderborg Andelsbolig Forening, has developed central heating systems for replacing existing oil boilers in one building (with 6 apartments) and replacing existing individual buildings' electric panels system in one building block (with 5 apartments) - with 1 common air-to-water heat pump with salt-hydrate PCM¹ heat storages together with PV-power

production and smart DSM² system for each building block. Installation is expected to take place in the autumn 2022 (Fig 1).

Meanwhile, in Laasby, Neogrid - in close cooperation with the building developer and owner, dinBOLI A/S - has developed a dedicated central system solution. It assumes an air-to-water heat pumps are connected with the salt-hydrate PCM heat storages together with PV-power production and smart DSM-systems

¹ PCM – Phase Changing Material

² DSM – Demand Side Management



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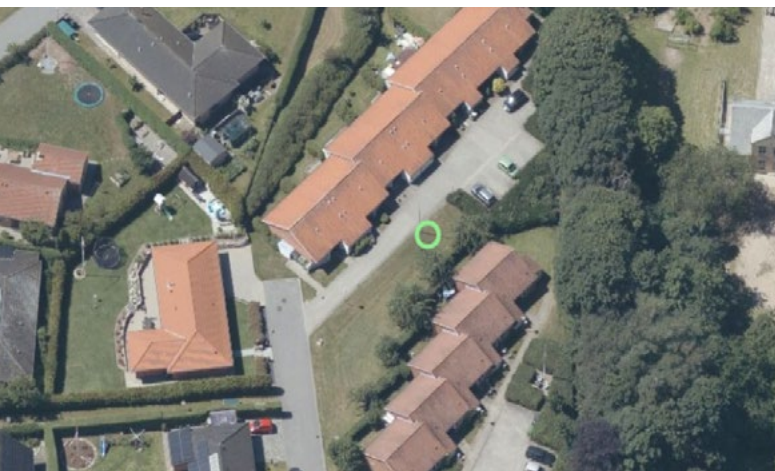


Fig. 1 The existing housing in Hylke with 2 rows of houses are part of the SERENE demonstration project. Green circle indicates placement of the new energy supply system.

for 8 houses (4 x 2 double houses). Installation in this case is expected to take place in the spring 2023, but planning is still ongoing (Fig. 2). Private EV-charger stations will also be established.

Furthermore, the Danish Team is currently looking for the replacement for the second demonstration in Laasby, where it is planned to include also a smart charging station with PVs and a battery storage.

The SERENE team in Denmark comprises local stakeholders from: Skanderborg Municipality and its Climate and Green Transition team; the local

energy provider Aura Energy; Neogrid Technologies – a private provider of the smart control systems and Bjerregaard Consulting, who supports collaboration for innovation actions. This multidisciplinary team provide complimentary skills and expertise suited to the locality. Finally, they are all supported by researchers from AAU's Energy Department, led by Professor Birgitte Bak-Jensen, who is simultaneously SERENE's project Coordinator.

Susanne Skårup, Skanderborg Municipality and Hans Bjerregaard, Bjerregaards Consulting



Fig. 2 - 4 x 2 demo houses in Laasby

Energy Monitoring Systems and first steps towards e-mobility in Olst in the Netherlands

Within the Dutch demonstration of the SERENE project, two implementation steps were recently achieved. First, to obtain insights into the energy consumption of the inhabitants as well as the energy production of the household PV systems, Energy Monitoring Systems (EMS) were installed in several homes in the Aardehuizen neighbourhood (Fig. 1). Secondly, the infrastructure for the EV charging station was installed in Vriendenerf (Fig. 2). Both actions are critical in terms of identifying current electrical consumption patterns and determining the future optimisation of energy balance through the smart control of the time shiftable loads available in neighbourhoods.



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Professor Richard van Leeuwen, from Saxion explains that *researchers and community members work together to create value for the community from their renewable energy generation. The result of that cooperation is that the first investigations and home monitoring systems are launched and the first steps to use the flexibility offered by smart charging are taken.*



Fig. 1 The Energy Monitoring System prototype used in the Aardehuizen neighbourhood [Saxion, 2022]

The research teams of Saxion UAS² and the University of Twente together with both communities organise regular events. These events are used to investigate the current situation in both neighbourhoods as well as to exchange ideas for possible actions to take in the coming phases of the project. An important step is the realisation of a community battery at Aardehuizen, for which technical requirements were developed and possible brands and vendors are currently being investigated. Another step is the control of heating systems, for which a feasibility study is being conducted by the research team. The study provides



Fig 2. (a) Vriendenerf community houses, (b) moving towards e-mobility: the first EV charging infrastructure. These chargers are to be upgraded at a later stage to controllable EV chargers (11kW)¹ [Saxion, 2022]

lessons including how the energy balance can be improved by smart control of the heating systems and how to achieve this in practice.

The hybrid heating systems and other sustainable practices that we observe at Aardehuizen are quite unique, providing us with a rich learning & testing environment of our optimisation algorithms states professor Johann Hurink from the University of Twente. His colleague Gerwin Hoogsteen, PhD, adds that these observations are currently being analysed to understand how technical factors and optimisation algorithms will influence the consumption patterns at Aardehuizen. These patterns are essential to learn and understand how the renewable energy transition can be accelerated, whilst being embraced by the community.

Cihan Gercek, PhD, Project Manager of Sustainable Energy Systems, Saxion University of Applied Sciences

¹ Chargers procured waiting to be supplied in April/May 2022

² UAS – University of Applied Sciences



Advanced Measuring Infrastructure (AMI) helps Przywidz Municipality in Poland rethink its energy system and make it “smarter”

The SERENE project aims to demonstrate cost-effective and consumer-centric solutions. The first step is to obtain knowledge of actual energy usage, specifically the profile. This profile answers the questions: in which times of the day does a household consume more, and at which times is there an excess of available energy? In this article, some of the activities undertaken in Przywidz by the Polish team in SERENE are presented.

The benefits of the AMI – smart electricity meters

AMI (Advanced Measuring Infrastructure, Fig. 1) allows the consumers to connect to the e-portal “My energy meter”, operated by Energa Operator SA (further EOR, the local energy distributor and SERENE’s partner), where they can see a detailed profile of their data: the energy usage is visible in 15 minute intervals.

This knowledge permits users to see when they use the most power. The meter does not convey which devices are active, but combined with the user’s knowledge it allows him/her to gain insights into which devices use the most electricity. This is very useful when trying to limit ones’ power usage or establish a saving goal. Such energy usage profiles are of high interest to the SERENE project, as they allow partners to analyse more accurately the actual needs of the Przywidz Municipality (Fig. 2). However, there is a legal limitation that renders this data inaccessible for anyone, except for EOR (that gathers data for billing purposes). To allow the other partners in the project to access the data, a formal consent from the citizens is required. The collection of these consents is ongoing but once gained, the aim is to combine the profiles of multiple households and perform an in-depth analysis of short-term energy usage to provide better insights in the cause of problems, such as potential blackouts. Furthermore, the profiles can be compared against the energy-generation of the photovoltaic (PV) installations to determine to what extent the solar energy supply can meet (or not) the actual energy demand. Such information is the basis of the possibilities regarding future planning, which not only involves renewable energy sources but also energy storage.

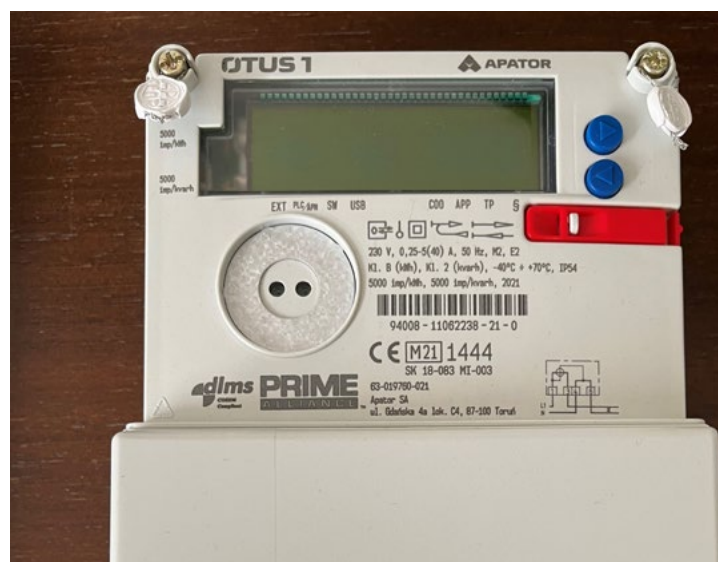


Fig. 1 Smart electricity meter called AMI [Energa, 2022]

Is there really an excess of solar energy in November in Poland?

The electricity usage profiles of Arena Przywidz and of the school, as well as the profiles of the generation of electricity from the installed PVs provided detailed insights in the different patterns. During November there were moments when more electricity was produced than consumed, but the profiles showed that the power is not consumed at the same time it is produced, making this an ideal case for electrical energy storage (Fig. 3)

Paweł Grabowski from STAY-ON outlines the concept his company has created, for improved electrical



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infrastructure in the area surrounding the Arena Przywidz and the school, by the introduction of two energy storage units with EV chargers to make optimal use of the electricity generated by the photovoltaics.

SERENE brings novel “Vehicle-to-Grid” (V2G) chargers into Przywidz and initiates e-bus transportation

The current transition towards electrical vehicles (EVs) is perhaps one of the most visible aspects of decarbonisation worldwide and it is also considered in SERENE. *The EV chargers in the area of Arena Przywidz are not randomly planned without a purpose: the project aims to introduce EVs, and an especially interesting case is the transport of children to schools – explains Tomasz Herbasz from GMINA Przywidz.* In January Gmina Przywidz arranged several test runs with an e-bus on one of the school-bus routes. The main goal was to examine the actual energy usage, which not only depends on distance but also on the speed, the landform and climate conditions. These tests also allowed for a proper estimation of the necessary charging time, how many times the bus can drive the route, whether the introduction of an e-bus would be beneficial and if it would be possible to match its charging profile with the profile of Arena Przywidz.



Fig. 2 Monitoring system vital AMI system parameters. [Energa, 2016]

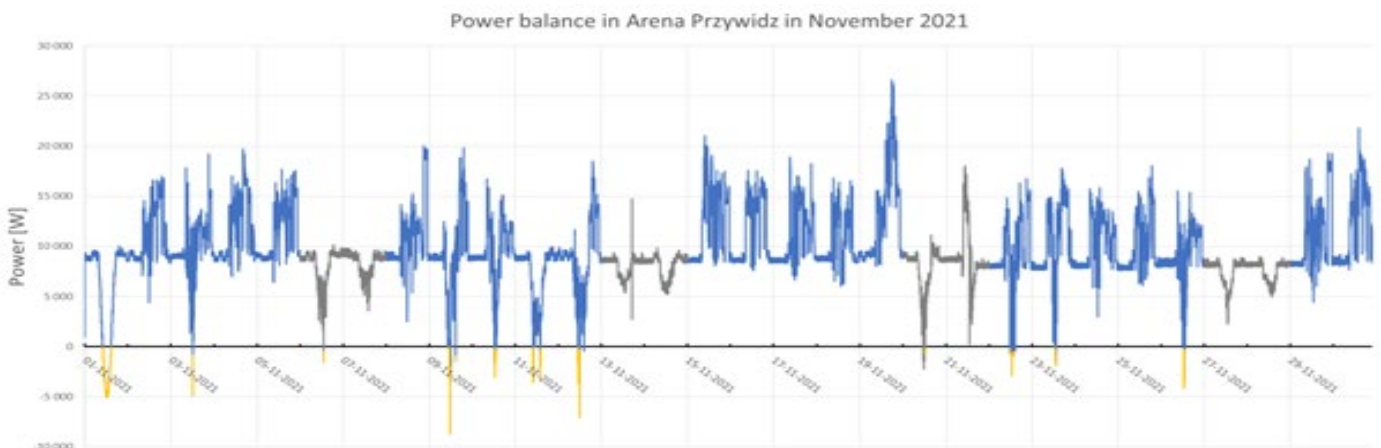


Fig. 3 Measurements of power balance in Arena Przywidz, November 2021. The grey colour marks the weekend days, the yellow colour shows overproduction of energy from PV modules.

Installing an EV charger on one hand can increase the power taken from the grid, while a vehicle is charging, but on the other hand can use the energy from the PV installation at times, when the production is higher than Arena Przywidz needs. SERENE aims to take this one step further by not simply considering a one-way charger (electric vehicle takes electricity) but using a “Vehicle-to-Grid” (V2G) charger. It not only allows to charge an

EV, but also allows for a suitable EV to supply energy back to the grid. In practise this means that it allows vehicles that support V2G to behave as a storage for electrical energy – explains Sebastian Bykuć, Head of KEZO Research Centre and co-leader of the Przywidz demo.

As a result, the first municipal e-bus route in Przywidz started its operation on the 1st of March 2022.



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Fig. 4 Part of the SERENE Team in front of the 1st school e-bus in Przywidz

The journey to establish a local energy community/ cluster in Przywidz has begun

Some aspects of the energy communities in the Netherlands or Denmark are less applicable in Poland given the different legal frameworks, social interactions, habits but also climate. However, some of the ideas and concepts behind them are of interest and may provide ideas for improving local energy clusters. Therefore, the Polish team organised a meeting with representatives of successful energy clusters in Poland to learn how it simultaneously matches with and differs from the Dutch and Danish energy communities in SERENE. Further, SERENE local meeting with citizens in Przywidz was held in November 2021. Please see the NEWS section to find out more.

Weronika Radziszewska, PhD, IMP PAN/KEZO Research Centre, Co-Leader of the Polish Demonstrator in Przywidz

PROJECT NEWS

The SERENE Consortium Meeting in Enschede, the Netherlands

One year after the start of the SERENE project we were finally able to meet each other physically in Enschede, the Netherlands (Fig. 1a). A moment we all have been longing for and immediately it became clear what we had been missing. The meeting on the first day, the 20th of April, were intense with fruitful discussions on the presented progress and outlook for the project. Also, networking during coffee breaks and the lunch resulted in new actions for collaboration between partners from different countries.

The second day of the meeting started with a visit among technical setups at the University of Twente. Here, a demonstration of the simulation software, through an interactive touch table, was given (Fig. 1b). Furthermore, the setup of a smart charging parking lot with a solar PV and battery, together with an energy management system that integrates the wishes of users, was presented.



Fig. 1b Demonstration of the simulation software at the University of Twente



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The second part of the day covered a visit to Olst, where an interactive sessions were organized to further strengthen the collaboration. But the highlight was the visit to the sustainable and ecological Aardehuizen community. An inspiring place where inhabitants show how a much more sustainable lifestyle is anything, except being dull. Many pictures

were taken as inspiration for solutions to be used in other places, or simply for their own DIY (Do-It-Yourself) hobby projects to create wonderful items by recycling everyday objects.

Gerwin Hoogsteen, PhD, University of Twente



Fig. 1a The first „real life” meeting of the SERENE Consortium (after lifting of COVID restrictions)



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The 1st local SERENE meeting with citizens in Przywidz in Poland

On November 19, 2021, a citizen-oriented meeting about the SERENE project, interlinked with the opening of the new sewage treatment plant in Przywidz, took place. The Open Day of the treatment plant which acts as one of the research objects in SERENE, was a unique opportunity to visit the new investment in the municipality (finished on July 31, 2021, Fig. 1). The information meeting about the SERENE project was held in Arena Przywidz (Fig.2), which is another research object for the Polish demo. The aim of the meeting was to present the citizens with the goals and scope of the SERENE project and to encourage their



Fig. 1 E-mini bus in front of the newly opened sewage treatment plant in Przywidz [photo by Tomasz Herbasz, Przywidz]



Fig. 2 Sebastian Bykuć presents the objectives of SERENE project to the residents of Przywidz [photos by Jarosław Kizło, Energa – Operator SA]

active participation. Residents can support the project by allowing their energy consumption data to be used to help diagnose the condition of the network and to define priority actions that will improve the network's parameters. Furthermore, citizens could become potential members of an energy community (cluster), which is planned to be set up in Przywidz under the SERENE project. Many people decided to support SERENE, which shows how active and engaged the citizens of the Municipality of Przywidz are.

Read more about the event at www.h2020serene.eu



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Aalborg University (AAU), founded in 1974 in Denmark differentiates itself via a focus on interdisciplinary studies and problem-based learning. AAU's department of Energy (AAU Energy) is dedicated to research, innovation, and education within the broad field of energy. AAU Energy strives for excellence and impact by establishing strong, collaborative partnerships with industrial and academic stakeholders within the energy field and engaging in the public debate concerning one of the major challenges of our time: the green transition.

AAU Energy proudly hosts three Villum Investigator centres and one Poul Due Jensen Foundation centre. One of their research areas, power electronics, has consistently been rated in the global top 3 over the last 3 years. AAU Energy has several researchers among the top 1% most cited, and many more in the top 2%. Within their staff and guests, they count 30 nationalities, and potential PhD students with prestigious scholarships from their home countries actively seek them as a host institution.

AAU Energy are engaged in approximately 200 research, innovation and training projects funded by EU Horizon 2020, Innovation Fund Denmark and EUDP, the Danish Energy Development and Demonstration Program amongst others.



Skanderborg
Kommune

<https://www.skanderborg.dk>

Skanderborg Municipality has approximately 60.000 inhabitants. The administration consists of approx. 600 employees within both economically, socially and environmentally affairs. The work consists of both administration of laws, coordinating the work in all the about 200 institutions in the municipality and to perform the politics of the local City council.

The City council has an ambitious climate policy with the aim to reduce CO₂ emissions with 70% for the whole community before 2030. This work is coordinated by employees in the technical department, and steered by an interdisciplinary steering group. Some of this work can be solved by planning and rules, but much of the work is communication and cooperation with the public.



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AURA

<https://www.aura.dk/>

AURA is a cooperative-owned energy and communications company. We are locally based in Jutland just south of Aarhus, and we have more than 100 years of experience in building and delivering critical infrastructure to our customers. We contribute to the development of the local community, energy-efficiently and digitally.

We develop and operate three critical infrastructures; an electricity distribution network (60 kV, 10 kV and 0,4 kV), a digital fiber network and a public network of EV charging stations. Furthermore, develops and operates renewable energy plants, e.g. wind farms, solar parks and biogas plants. In addition to this, we offer our customers services within electricity trading, electrical installation work, sales of EV charging solutions and EV car sharing concepts.

Our latest initiative is about establishing AURA Ventures, where we invest in small digital and sustainable start-up companies and interact with the start-up environment in Denmark.

Being a cooperative means that our more than 109,000 members - who are thus owners - benefit from the company's profits when we invest in local infrastructure, innovation and sustainability, and when we support local initiatives.

Electricity distribution: More than 5,500 km of electrical cables connected to 29 pcs. 60/10 kV-transformer stations and more than 2,600 pcs. 10 / 0.4 kV transformer substations. 33,460 cable cabinets and 110.000 electricity meters.

Our annual turnover is approx. 260 million Euro.



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PROJECT FACTSHEET



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Project Coordinator: Birgitte Bak-Jensen, AAU, Denmark
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3 DEMO SITES in Denmark, the Netherlands & Poland

PROJECT PARTNERS



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