



SERENE



**SUSTAINABLE
AND INTEGRATED
ENERGY SYSTEMS
IN LOCAL COMMUNITIES**



So far the focus of the “green transition” has been on larger cities and heavy industry, but since local communities are responsible for significant amounts of energy usage, it is important to work on making their consumption "greener" and more efficient.

Hence, SERENE aims to develop and demonstrate sustainable, integrated, cost-effective and customer centric energy solutions for local communities.

SERENE objectives:

Decarbonisation of local energy systems through the optimal integration of multi-energy carriers via smart control and balancing of grids.

Increase the use of renewable energy to enhance the environmental, social and economic conditions of the citizens.

Evaluation of the demonstration sites for replicability across Europe and worldwide.

Technical benchmarking and solutions matched with **business models tailored to the different challenges** identified in each country.

Strong focus on obtaining **user involvement**, including the identification of the conditions and socio-economic characteristics behind the willingness to participate.



About Project

The specific goal of SERENE is to establish integrated local energy systems ("energy islands") in different villages in **Skanderborg** (Denmark), **Olst** (the Netherlands) and **Przywidz** (Poland).

Such local community energy systems will contribute to the decarbonisation of local energy systems via the optimal integration of multi-energy carriers through smart control and the balancing of systems and grids at the local level. This approach will also increase the levels of renewable energy use, thereby enhancing the environmental, social and economic conditions of the citizens and establishing more business and trade.

The experiences gained at the demonstration sites will be analysed and evaluated for replicability across Europe. Technical benchmark models and solutions will be established alongside business models and evaluated against the different challenges identified by the countries involved. The levels of user involvement and their interest to participate will be evaluated from the geographical, social, environmental and economic conditions.





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Danish Demo

Hylke & Låsby villages in Skanderborg Municipality, Denmark plan to turn into “energy islands” & become CO₂-neutral communities

The overall objective at the Danish demonstrator is to carry out testing and demonstration activities in close collaboration with the local citizens, property owners, utility providers and other stakeholders to establish the transition of the existing residential heating supply from fossil fuels (natural gas and oil boilers) to heating from heat pumps and increase the self-consumption of renewables.

Further, it is supplemented by the electrical charging for vehicles, digitisation and smart control of integrated PV (photovoltaics), battery storage, heat and EV (Electric Vehicle) systems to effect local demand side management, maximising self-consumption from PV and provide local grid support. It will also include analysis on how the local electricity grid system is affected, identify possible bottlenecks and focus on how the local rural energy systems and the local grid system can be optimized.

The demonstration site in Låsby village takes the form of new residential buildings including one community with 8 apartments. At Hylke village, the demonstration sites consist of existing buildings owned by a social residential housing company where the present energy systems with oil and electric radiators will be replaced.





The specific objectives include:

- The optimal operation of centrally located intelligent heat pump installations with salt hydrate-based heat storages in the demonstration buildings with photovoltaic installations.
- The demonstration of a shared electric vehicle scheme powered by the local photovoltaic installations along with community-scale battery energy storage applying suitable demand response schemes.
- Demonstration of different socio-economic models for owning and operating the community based integrated energy systems at the demonstration sites.

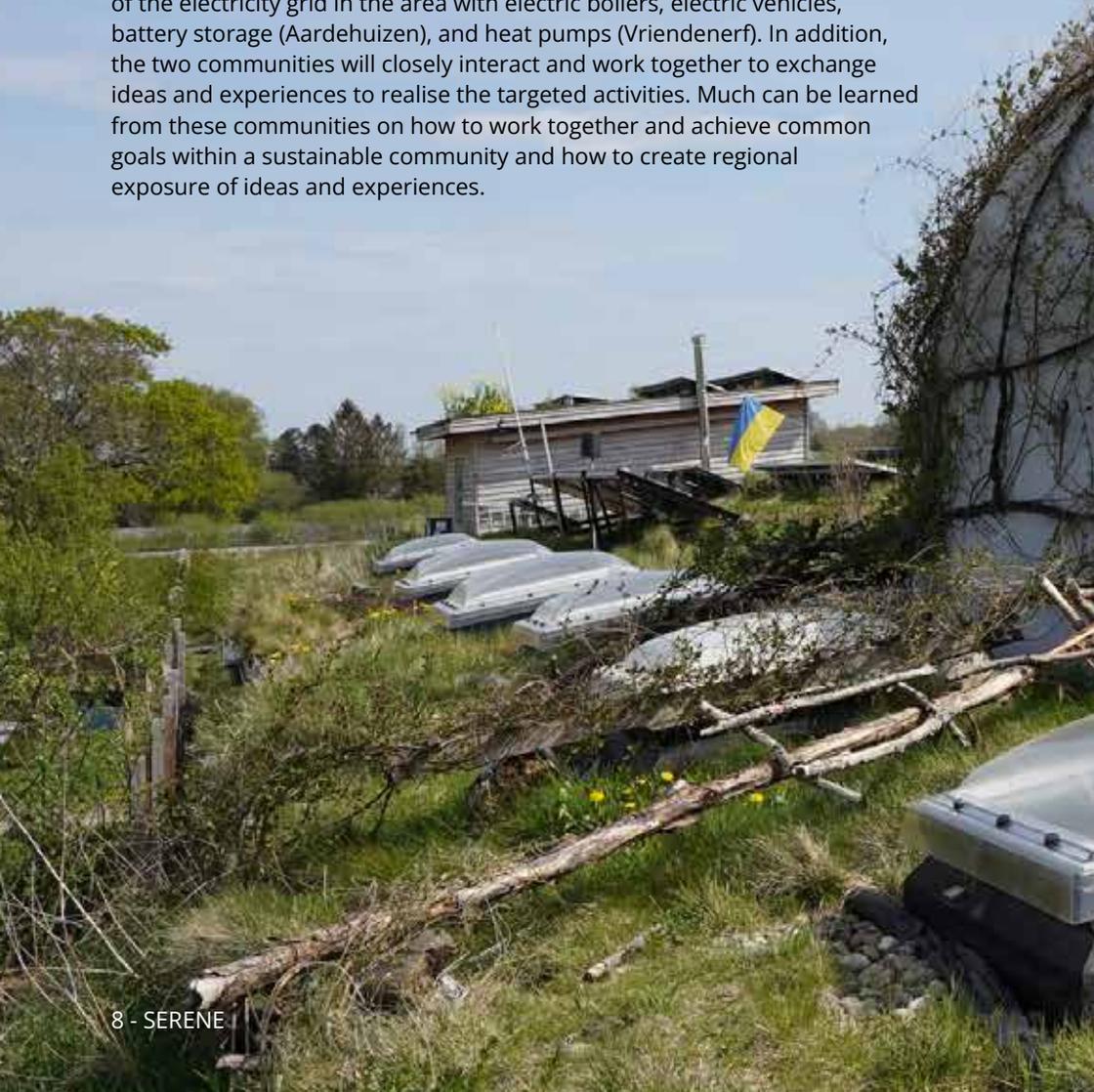
At each demonstration site, an intelligent control strategy will be used to activate suitable demand response and scheduling of the flexible demand and energy storage units. This control strategy is facilitated by an appropriate ICT infrastructure to relevant components in the system. Further, prediction algorithms of local PV and wind power (from the grids) generation, energy profiles and prices, optimal temperature, customer comfort and preferences, and local distribution grid conditions will be used in the intelligent control strategy. The residents in the buildings will have dashboards available on their phone/tablet/PC for monitoring and controlling the energy systems in the buildings.

Dutch Demo

Houses in harmony with nature: Aardehuizen (“Earthhouses”) & Vriendenerf (“Friends’ Garden”) in Olst, the Netherlands

The Dutch demonstrator involves two demonstration sites, the Aardehuizen community with 24 houses and the neighbourhood of Vriendenerf that consists of 12 houses, both in the village of Olst.

The overall goal is to implement solutions to enhance the smartening of the electricity grid in the area with electric boilers, electric vehicles, battery storage (Aardehuizen), and heat pumps (Vriendenerf). In addition, the two communities will closely interact and work together to exchange ideas and experiences to realise the targeted activities. Much can be learned from these communities on how to work together and achieve common goals within a sustainable community and how to create regional exposure of ideas and experiences.





The specific objectives are:

- The demonstration of smart control of heating devices (sector coupling between electricity and heat) in the form of (hybrid) heat pumps in conjunction with PV increasing levels of self-consumption and enabling peak shaving at the Vriendenerf neighbourhood.
- The demonstration of smart control of neighbourhood-scale battery storage and electric boilers in synergy with PV generation applying Demand Side Management at Aardehuizen.
- Enabling local demand response schemes and increased utilisation of PV generation by exchanging energy between citizens, using an automated administration technology that enables citizens to trade their energy within the community. For this, a dashboard available for residents on PC/phone for monitoring and control of energy and to keep track of the origin of the energy supply (local or from the connected grid) will be made available.
- Establishment of local EV-car sharing and charging as part of both neighbourhoods' energy systems.
- Establishment and testing of a working administrative system for local energy cooperation as part of the smart grid control in both neighbourhoods.

Polish Demo

The agro-touristic municipality of Przywidz in Poland takes the next steps towards becoming a sustainable energy community

The Municipality of Przywidz in Northern Poland is home to three cases that form the Polish demonstrator. Each of the cases focuses on a different type of facility and on different opportunities. The first is a household district where the high number of photovoltaic installations negatively influence the local low voltage grid. The second case is ARENA Przywidz - a school and sport centre complex, where an energy management system that combines heat pumps, energy storage and EV chargers will be installed and tested to improve the power profile of the facility and the auto-consumption from the PV. The last use case researches the potential of using energy management of the new sewage treatment plant to provide new services to the grid (e.g. DSR – Demand Side Response).

The project also considers non-technical innovations such as the concept of so called “energy clusters”, which is part of Poland’s renewable energy policies. The general idea is a social change, in which the local counties and municipalities will involve local citizens and stakeholders in the creation of sustainable energy communities. The aim of this is to meet and manage the energy demand locally by utilising local energy resources, creating local entrepreneurs and enabling socio-economic-environmental benefits.





The specific objectives are:

- Installation of measurement and instrumentation systems at various consumer and building premises to conduct data analytics of heat and electricity profiles and other relevant parameters for flexibility estimation and upgradation needed for integrated local energy systems.
- The implementation of smart control and operation of integrated solutions of heat pumps, energy storages (battery, heat exchangers) to increase the shares of PV generation at the energy complexes and buildings involved in the demonstration. The techno-economic impacts on the local electricity grid will also be analysed.
- Demonstration of flow battery storage and public EV charging stations (some with vehicle-to-grid possibility) at the school facilities, and testing of smart control with integrated energy management system that involves HVAC (Heating, Ventilation and Air-Conditioning) and PV systems.

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SERENE H2020 project
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STAY·ON

Budget: € 5,1 mln of EU contribution

Duration: May 2021 - April 2025



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957682. Any communication activities of this project reflect only this consortium's view and CINEA and the Commission are not responsible for any use that may be made of the information it contains.