Already today, the North Sea Island Pellworm stands for a potential energy mix of the future. While the local decentralized systems generate more than 22 million kWh of electricity a year, the bare 1200 islanders use only 7 million kWh. The population on the North Sea Island is committed to renewable energy for decades: As early as 1983 the hybrid power plant was built in Pellworm, at that time it was the largest of its kind in Europe. Despite the large number of decentralised energy producers, the power link to the mainland continues to be essential, on the one hand, for balancing the local surpluses, on the other, for importing energy from the mainland in certain time periods if needed.

The innovation study

Identifying the implementation potential of Smart Grids on the island of Pellworm was the main objective of the innovation study. Therefore not only the technical conditions (power requirements and generation, constraints, options for energy storage) were analyzed, but also the acceptance of the citizens and technological components available on the market were scrutinized. The results showed that a combination of central energy storage and a more flexible load management could reduce the energy procurement from the mainland up to 90 percent. The innovation study was conducted by a cooperation between the E.ON Hanse AG, the Schleswig-Holstein Netz AG, the Westcoast University of Applied Sciences, Germany, the centre of excellence for wind energy (CEwind) and the Fraunhofer AST. The Innovationsstiftung Schleswig-Holstein supported this study.
**Results**

- With an installed capacity of around 9 MW, Pellworm produces almost three times of electricity per year, which is required by the local consumers in the same period of time.
- The high proportion of electric heatings, which corresponds to approximately 10 percent of the annual power consumption, is appropriate for usage as flexible load (DSM, Demand side management).
- More than 75 percent of the population showed open-mindedness towards the idea of renewable energy and the expansion of the electricity grid.
- The development of the infrastructure (information and communication technologies used in homes, automation technology for more than 50 local network stations) is mandatory for the implementation of a Smart Grid.
- Due to the implementation of a Smart Grid, the network structure in Pellworm and the upstream electricity grids may be relieved.

**Recommendations**

- As part of a first step, the establishment of a „Core-Smart-Grid“ is recommended, which comprises the information and communication technology, an energy storage device with moderate size, the hybrid power plant and the integration of electric storage heaters for a load management.
- The specification and implementation of the Core-Smart-Grid should be performed in close consultation with system and component suppliers, because information about standardization, engineering standards and practical experiences are limited for a real Smart Grid.
- The gradual implementation increases the investment security, as gained experiences and future developments (e.g. standardizations) are taken into consideration.
- Subsequently the „Core-Smart-Grid“ may be extended to a „Full-Smart-Grid“ by implementing further controllable energy generators, storage systems and loads.
- Pellworm provides a suitable platform for responding key issues in the future energy supply with its structure of electricity generation and the information obtained in the study.

**Project funding and support**

**Project partners and initiators**

![Flow chart showing the implementation of a Full-Smart-Grid in Pellworm](image-url)