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ABBREVIATIONS

List of abbreviations

CHP	Combined Heat and Power
EEG	Renewable Energy Act (Ger.: Erneuerbare-Energien-Gesetz)
eG	registered cooperative (Ger.: eingetragene Genossenschaft)
EV	Electric vehicle
GbR	Partnership under the civil code (Ger.: Gesellschaft bürgerlichen Rechts)
GmbH & Co. KG	limited partnership with a limited liability company as general partner (Ger.: Gesellschaft mit beschränkter Haftung & Compagnie Kommanditgesellschaft)
HES	Hybrid energy systems
NBG	NORDSEEHEILBAD BORKUM GMBH
PV	Photovoltaics
REC	Renewable Energy Community
RES	Renewable energy sources
RESS	Renewable Energy Storage System
SME	Small and medium-sized enterprises

1 INTRODUCTION

With the agenda 'Borkum 2030', Borkum has committed to becoming climate-neutral, sustainable, and emission-free by 2030. Numerous projects such as the car sharing project 'Elektro Ahoi' ([Weblink](#)) and the 'Quartierskonzept KfW 432' ([Weblink](#)), a project towards building climate-neutral offshore buildings, have already been introduced to achieve this goal. By developing a guide for the complete decarbonisation of the island, the ISLANDER project supports the renewable energy transition on Borkum. The four-year EU-funded project is developing an efficient energy management platform that tightly integrates and centrally manages the different energy resources to balance fluctuations in energy production and demand. Local flexibility options such as storage technologies and load management are combined with renewable energy sources.

To succeed with Borkum 2030, the high investment costs related to the decarbonisation of energy systems must be shared between public and private sectors. Indeed, many single-family houses now have integrated renewable energy generation capacity, but there are major benefits available when stakeholders work together on larger scale installations that can provide multiple benefits for the population, and which could not be achieved on an individual basis. Within ISLANDER, the creation of a REC on Borkum will be facilitated to empower local citizens to support and participate in Borkum's energy transition and to trigger future investments on community-owned RES.

To start a REC on Borkum, the ISLANDER partners have proposed a set of stages and related dissemination activities, which are centered around dedicated workshops to be held in close collaboration with partner NBG:

- **Stage 1 - The Preparatory stage**

It provides the planning of all activities related to the creation of a REC, defining the

basic parameters in close coordination with the local utility, identifying interested stakeholders and citizens and ways of reaching them (Deliverable D7.1).

- **Stage 2 – Technical feasibility and economic viability analysis**

An in-depth study will be undertaken in close cooperation with NBG, clarifying which renewable RES+HES solutions and technologies to consider in order to reach Borkum's decarbonisation targets. Risks, opportunities, and benefits for the community will also be analysed to serve as a basis for further investment decisions (Deliverable D7.2).

- **Stage 3 – Launch of the citizen engagement process**

This process will entail a series of workshops/community events and other activities aimed to ensure local buy-in for ISLANDER in general, inform local citizens and other stakeholders about all necessary aspects of creating a REC, get feedback on their level of involvement and provide an ongoing forum in which to facilitate and guide the creation of the REC. The activities performed will rely on the outcomes of this deliverable, preparing information material for the creation of an energy community.

- **Stage 4 - Accompanying citizens and Borkum 2030 roadmap**

The last stage is about accompanying citizens through all necessary steps of Borkum's energy transition process. Based on the inputs of the previous deliverables a roadmap outlining the further steps to be reached to achieve Borkum's full decarbonization objectives will be developed (D7.4).

The purpose of this deliverable is the preparation of material for stakeholder engagement as part of the action plan for citizen engagement. This involves e.g. a presentation for personal meetings, an official letter describing the intention to initiate contact and a poster to visualize information on the engagement process.

In order to create valuable information material for the engagement process, this deliverable will first outline background information on energy communities in Germany and on the energy system on Borkum. From this input, possible concepts and projects for an energy community on Borkum were derived and examples from other energy communities are given. In a next step, possible channels for the engagement of the citizens will be identified. This involves social media and local channels, the citizen engagement workshops, online resources and a questionnaire, that will be used to review existing knowledge on energy communities and readiness to engage in them. This is followed by the communication materials developed such as main messages to be disseminated, text materials (letters to the citizens e.g.), infographics e.g.

With the help of these materials the engagement process will continue by contacting players and context setters to shape and deepen the possibilities for an energy community on Borkum. With a more precise idea about the form and purpose of the energy community, citizens and tourists will be informed about the actions. The goal is to keep them informed and to offer a channel to involve them. Following this, a series of workshops will be organized on Borkum to generate a platform for the stakeholders to get involved. The whole process is visualized in Figure 1.



Figure 1 – Action plan for citizen engagement process from deliverable D7.1.

2 BACKGROUND INFORMATION

2.1 Energy communities in Germany

Energy communities are a new concept in the energy market, introduced by the ‘Clean Energy for all Europeans’ package to organize collective and citizen-driven energy actions that help pave the way for a clean energy transition. Two directives play an important role for the establishment of energy communities in the EU: the Renewable Energy Directive (RED II) and the Electricity Market Directive (EMD)¹. Both put consumers at the center of the energy transition.

Energy communities can have environmental, economic, and social benefits for the community. By helping to implement local sustainability projects, they can achieve energy independency, reduce carbon emissions, and fuel poverty, as well as contribute to the local economy. Through organizing collective and citizen-driven energy actions, energy communities increase public acceptance of renewable energy projects and make it easier to attract private investments in the clean energy transition.² By becoming co-owners of renewable installations, citizens have democratic control over energy investments and have local control over profit sharing. Surpluses can be reinvested in further energy projects, generating local jobs, and attracting new investments. Furthermore, energy communities can help make the energy system more flexible, reliable, resilient, and secure.³

In Germany, citizen energy projects have been a driving force of the clean energy transition. Already in 2000, the Renewable Energy Act (EEG), was introduced, guaranteeing a fixed feed-in tariff for renewable power generation⁴. This encouraged the installation of PV modules and the formation of energy cooperatives. With the new government's goal of increasing

¹ https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en

² https://energy.ec.europa.eu/topics/markets-and-consumers/energy-communities_en

³ https://knowledge4energy.eu/fileadmin/user_upload/Resources/NewcomersHandbook_spread_fin.pdf

⁴ <https://www.iea.org/policies/3858-renewable-energy-sources-act-erneuerbare-energien-gesetz-ee>

renewable energy capacity to reach 80% of the electricity mix by 2030⁵, the engagement of citizens has become even more important. Even though the European directives have not yet been transposed into German law, their possible realisation (especially of energy sharing) brings hope for easier implementation and economic viability of energy communities.

In the upcoming EEG 2023 (§ 3 No. 15), the term "citizens' energy communities" (BEG) will be legally defined by the following criteria⁶:

- Citizens' energy communities consist of at least 50 natural persons as voting members or voting shareholders
- At least 75 percent of the voting rights are held by natural persons who have their registered main place of residence in the city or district
- The remaining maximum of 25 percent of the voting rights are held by SMEs or local authorities. SMEs are companies with fewer than 250 employees and less than 50 million euros in turnover or less than 43 million euros in total assets.
- No member or shareholder is allowed more than ten per cent of the voting rights.
- Those entitled to vote must be given an actual opportunity to influence the citizens' energy company and to participate in decisions of the shareholders' meeting.
- If several actors join together in a joint project to form a citizens' energy company, each individual actor must fulfil the legal definition of a citizens' energy company.

If a citizens' energy community meets the above requirements, it may realize a ground-mounted photovoltaic project or a photovoltaic project on a built structure (so-called first-segment solar plants) with an installed capacity of between one and six megawatts (MW) or a wind project with an installed capacity of between one and 18 MW without having to participate in a tendering process beforehand. However, each citizen energy community may only realize a first-segment solar plant or a wind project once in five years. This also applies to SMEs that are members of the citizen energy cooperative or hold shares, as well as to their affiliated companies. Instead, the privileged projects are remunerated on application according to a subsidy rate that results from the results of the corresponding tenders.⁶ Even though this reform is a step forward in the direction of the European directives on energy communities, criticism has been raised, for example, about the lack of implementation of energy sharing as provided for in the European law.⁷

Business fields

Energy communities can operate in different areas: Generation of energy e.g. through photovoltaics, wind power or biogas, energy and heat supply, distribution, energy storage, acquisition and operation of grids and providing services like consultancy.⁸

In Germany the dominant business field is still electricity production from photovoltaics (PV)⁹. In 2016, 42% of the installed renewable energy capacity in Germany was owned by citizens including households and farmers, while the four biggest power providers accounted for only 5.4% (Figure 1). Investment funds, banks, project providers and other investors owned another 41.2%¹⁰. The main reasons for German citizens to join community energy projects were the contribution to the energy transition, the protection of the environment and the local economy¹¹. However, the number of new energy communities has stagnated in Germany.

⁵ https://come-res.eu/fileadmin/user_upload/Resources/Factsheets_policybriefs/COME-RES-policy-brief-2-DE.pdf

⁶ https://www.bmwk.de/Redaktion/DE/Downloads/Energie/04_EEG_2023.pdf?__blob=publicationFile&v=8

⁷ https://www.dgrv.de/wp-content/uploads/2022/03/Stellungnahme_EEG_2023_REFE_DGRV.pdf

⁸ https://knowledge4energy.eu/fileadmin/user_upload/Resources/Factsheet_EC_ICLEI_Final.pdf

⁹ https://wilabonn.de/images/PDFs/Genossenschaften/Brgerenergiegenossenschaften_als_Promotoren_der_Energiewende_GESAMT_EPaper_komprimiert.pdf

¹⁰ <https://www.unendlich-viel-energie.de/media-library/charts-and-data/infographic-dossier-renewable-energy-in-the-hands-of-the-people>

¹¹ https://www.unendlich-viel-energie.de/media/file/3591.89_Renews_Spezial_Community_energy_LECo.pdf



Reasons for that are high bureaucracy and administrative burdens, too large for community actors to carry. Lack of time and missing competencies, assets and capabilities for the implementation of energy projects are further barriers¹².

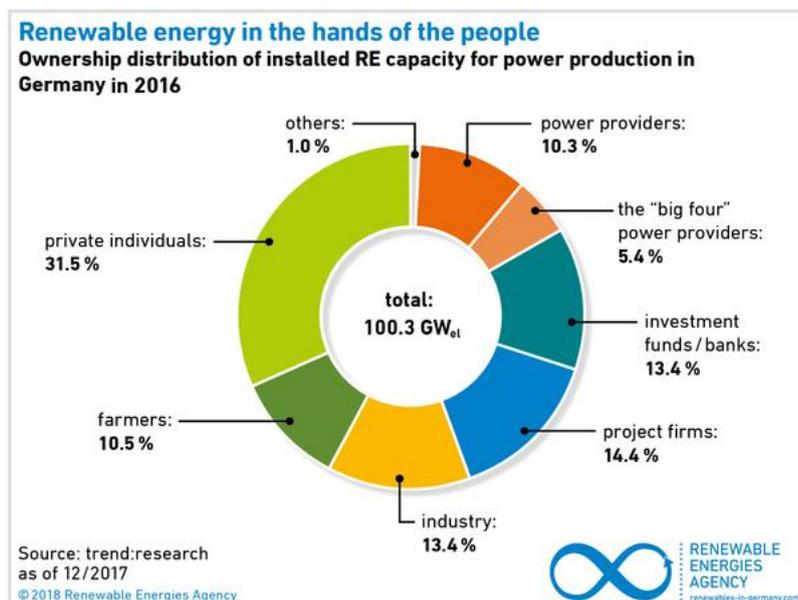


Figure 1 - Distribution of the ownership of installed renewable energy capacity in Germany in 2016. Source: <https://www.unendlich-viel-energie.de/media-library/charts-and-data/infographic-dossier-renewable-energy-in-the-hands-of-the-people>

Legal form of companies

The most common legal forms for citizens' energy companies in Germany are the registered cooperative (eingetragene Genossenschaft - eG), the GmbH & Co. KG (Gesellschaft mit beschränkter Haftung & Compagnie Kommanditgesellschaft) and the GbR (Gesellschaft bürgerlichen Rechts)¹³.

An overview of the three different forms is given in Table 1. The choice of the most suitable legal form depends on the energy project to be realized. From the more than 1,700 citizen lead energy projects in Germany, more than half make up **energy cooperatives (eG)**¹⁴. Between 2006 and 2020, 896 renewable energy cooperations were founded in Germany, involving around 200.000 members. The total amount of money invested in renewable energy sources through these cooperations sums up to a total of € 3.2 billion euros. 3 million tons of CO₂ equivalents of greenhouse gases were avoided in the electricity sector through cooperatives in 2020.¹⁵ In this legal form, each member of a cooperative has one vote. The core of a cooperative is to promote the economic viability of its members or their social or cultural concerns through joint management. This can be done, for example, by focusing on energy saving, income from energy production or favorable ecological electricity purchase. Equally relevant can be the promotion of participation, citizen involvement and climate protection in the region¹⁶. The formation of an eG is associated with some administrative burden. It must consist of at least three members and have articles of association with the minimum content required by law. Both a business plan and an adequacy of the articles of association are examined. After an expert opinion by the auditing association, the eG must be entered in the register of cooperatives at the district registration court. The additional audit step is

¹² https://come-res.eu/fileadmin/user_upload/Resources/Deliverables/COME_RES_D2_3_synthesis_case_studies_of_drivers_and_barriers.pdf

¹³ [63b3ac45d33a63dadd291f363e12f530.pdf \(nrw.de\)](https://www.nrw.de/63b3ac45d33a63dadd291f363e12f530.pdf)

¹⁴ Kahla, F., L. Holstenkamp, J.R. Müller, and H. Degenhart, Development and State of Community Energy Companies and Energy Cooperatives in Germany, 2007.

¹⁵ https://www.dgrv.de/wp-content/uploads/2021/06/20210621_Kurz_DGRV_Umfrage_Energiegenossenschaften_2021.pdf

¹⁶ https://www.energiegenossenschaften-gruenden.de/fileadmin/user_upload/downloads/Gruendungsbrochuere_Energiegenossenschaften_A4_WEB.pdf

accompanied by the advisory services of the cooperative association. This intensive support makes the eG the most insolvency-proof legal form in Germany. Although the founding process is time-consuming, new members can be accepted without complications and (as with a GmbH & Co. KG), the members are only liable with their capital contribution. Unlike a GbR or GmbH & Co. KG, the legal form of the eG is designed for the implementation of several projects. This means that many projects can be carried out simultaneously within the eG without having to establish new project companies each time.¹³

Another legal form for citizens' participation in Germany includes limited partnerships, with a limited liability company as a general partner (**GmbH & Co. KG**). This model is suitable for larger projects with high investment volume for example citizen-owned wind parks in Germany.¹⁷ It makes it possible to involve many investors as limited partners and to limit the liability of the participants to their capital contribution. At the same time, the project initiators can be involved not only financially, but also organisationally and act as managing partners in the form of a limited liability company. This legal form is thus particularly suitable for linking groups of people with different motives.¹³

If a project is to be set in an uncomplicated and quick manner with a fixed (manageable) number of people, the **GbR** is a good choice. However, since all partners in a GbR are fully liable with their private assets, only low-risk and small projects should be implemented.¹³

Table 1 – Overview of the three most common legal forms of company for energy communities in Germany.

	Cooperative	GbR	GmbH & Co. KG
Objective	Promotion of the acquisition or the economy of its members or their social and cultural interests by means of a joint business operation.	Any permissible common purpose	Operation of a commercial enterprise by equal partners who are usually all active in the company.
Foundation	Establishment of the articles of association in written form (without notarial certification); incorporation audit; formation with entry in the register of cooperatives.	informal	Informal or written partnership agreement, GmbH as general partner, additionally one limited partner; arises with commencement of business, at the latest with registration in the Commercial Register
Shareholder liability	Limitation to cooperative share	unrestricted	Limited to the capital of the Company
Suitable for many participants with small investments	... small projects / small investment sums	... different shareholder interests

¹⁷ https://publications.jrc.ec.europa.eu/repository/bitstream/JRC119433/energy_communities_report_final.pdf

2.2 Energy transition on Borkum

Situation on Borkum:

The energy transition on Borkum is required to handle the energy needs of all citizens and the main area of business, which is tourism. On a yearly average, Borkum currently is using 234.8 GWh of energy. Ca. 60 % is attributed to heat production, mainly via burning fossil natural gas, 19 % is needed for electricity and 21 % is required as fuel for maritime and car transport (80 % maritime transport). To serve these needs, a power cable with a capacity of 10 MW and a gas pipeline is supplying Borkum from the mainland.

Some efforts have already been taken to increase energy efficiency and incorporation of renewable energy on Borkum. There are already two heating networks available, the heating network "Marienhof" and "Gezeitenland". The heating network "Gezeitenland" is supplying the spa and wellness buildings, as well as surrounding public buildings with heat produced in a combined heat and power (chp) plant. The heating network "Marienhof" is supplying a newly build village of tourist accommodations. Additionally, new energy reduced and climate neutral accommodations are planned near the harbor. The initiative called "Quartierskonzept KfW 432" will build off-shore accommodations that will utilize innovative heat pumps for heat generation¹⁸.

For production of renewable power, Borkum holds one solar power plant, the SB Solarpark Borkum and two wind turbines. The solar power plant is operated by the SB Solarpark Borkum GmbH & Co. KG¹⁹, a group of private shareholders mainly from Borkum. The plant started operation in 2011 and has a yearly production of 1.3 GWh (capacity 1,387 kWp). In addition, there are 122 registered PV plants on private, public and commercial buildings with a combined capacity of 1,240 kWp²⁰.

Besides solar power, there are also two wind power plants near the harbor with 1.8 MW of capacity each. One is owned by NBG, the local energy provider, and one is in private ownership. Both have been built in 2001-2002 and will lose subsidiaries in 2021-2022. Even though there is interest in having wind power produced on the island, the future of the windmills is still unclear since the German weather service has declared interest in installing a weather radar on the island. For this, the windmills would have to be removed and no additional wind power plants could be installed in a radius of 5 km around the weather station afterwards.

Lastly, there are several offshore wind parks located roughly 50 km to the north of Borkum. Despite their name, those wind parks, e.g. Trianel wind park Borkum, Borkum Riffgrund I and II, are however only connected to the main land and there is no connection with Borkum. There is also no involvement of Borkum in the ownership of these wind parks. Trianel wind park is mainly owned by the company Trianel and mainland electricity providers, the wind parks Borkum Riffgrund I and II are owned by private companies.

Potential production of renewable energy:

Geothermal energy was found to be feasible around the harbor of Borkum. Most of the area on the island cannot be considered due to drinking water protection and due to water reserves. Only vertical ground loops are suitable to contribute to Borkum's heat requirements. For this, holes with a depth of around 100 metres are drilled in the ground and piping is then placed inside. In an external study, a potential capacity of 34 MW and a yearly production of 82 GWh was estimated. A heating system connecting the harbor with the main town would be necessary.

Solar thermal energy can be used as heating source. However, it can only serve in a limited time frame throughout the year due to seasonal and daily fluctuations. On the other hand,

¹⁸ https://www.borkum.de/wp-content/uploads/2017/10/Borkum2030_November_Emissionsfrei2030.pdf

¹⁹ <https://www.solarpark-borkum.de/>

²⁰ <https://www.marktstammdatenregister.de/MaStR/>

using buffer storages during summer heat is also available at night. Solar thermal collectors can be installed on building's roofs, over parking lots or on flat grounds. For Borkum, the potential of available parking lots was estimated to be 2.7 GWh per year, which could cover roughly 10 % of the heating demand during summertime. For ground-based installations, roughly 1.1 km² are available. 128,000 m², 12 % of the available area, would be sufficient to produce heat needed during summertime. One suitable area is located south-west of the airport (140.000 m²). Similar to the geothermal energy, a heating network connecting the plant with the town would be needed.

Seawater heat pumps can be used to harvest the low-level heat available in the North Sea to supply heat at higher level. For this purpose, the North Sea is offering a nearly inexhaustible source of heat, which makes this technology especially interesting for Borkum. In the process, heat is transferred from the sea water to the heating network in a heat pump. During the process, sea water is cooled down and fed back to the sea. Suitable filter systems make sure the equipment is not damaged and more importantly, also ensuring protection of the natural habitat. There are several things to take into consideration for installing a sea water heat pump on Borkum: 1.) Water quality, 2.) legal framework, especially in regard to environmental protection and the main business on Borkum, 3.) Impact of temperature change on wildlife. However, all hazards can be prevented through proper planning. Taking these factors into account, the external study developed two alternative sites that might be suitable for this technology: the inner harbor "Reede" and the south beach. At the harbor site, there is already a small sea water pump in operation for testing purposes. Both alternatives have pros and cons. While the harbor solution would require a heating network connecting the main town, for the south beach option the drilling of the bore hole is much more complex. In the end, both options are very likely able to serve most of the islands heat needs and implementation will mainly be determined by economics and legal frameworks. Within the project ISLANDER the feasibility and technological readiness is further evaluated.

Air source heat pumps offer the potential to serve 90 % of Borkum's heat demand, assuming a minimal air temperature of 5 °C. Function is similar to the sea water heat pump, instead of water, air is used as heat source. For the realization, large air coolers with a 20 MW heat pump would be required. Therefore, an area of roughly 3,000 m² is needed for the air coolers. These large ventilators have the downside of producing acoustic emissions. Consequently, they would need to be placed away from the residential development. A possible location would be close to the rainwater reservoir at "Upholmdeich" street, which is 300 m away from the next housing.

Wastewater heat recovery is potentially possible at the wastewater treatment plant in the eastern part of the island. Depending on the time of the year, the water has a temperature of 8 – 21 °C and volume flow of 3000 – 4000 m³ per day. The heat could be used in a water-water heat pump to produce ca. 1 MW of heat. The only downside is the distance to the town, which would require a piping system to transport the heat.

Wind energy has great potential on Borkum but given the current circumstances of fading subsidiaries of the two existing windmills and the plans of the German weather service, it is unlikely that there will be windmills on the island in the future. Instead, the potential for offshore wind energy (minimum distance if 5 km from the island) is worthwhile to keep in mind. Another alternative would be a partnership with and connection to the Trianel wind park.

Solar energy has not been evaluated in the external study. The potential for solar power is yet to be developed and can e.g. be estimated by assuming available roof surface area and free land on the island. The solar power plant SB Solarpark Borkum can act as role model for follower projects.

As stated above, there are 122 PV plants besides the SB Solarpark Borkum. Thereof 106 (in total 850 kWp) are owned by natural persons. Hence, only roughly 6.3 % of 1-2 family homes are equipped with solar power. This indicates that there is plenty of free roof area available that could be equipped with PV plants in the future.

In Figure 2, the number of registered PV plants are shown for the last 20 years. Ca. 50 % of the active PV plants have been built between 2010 and 2014 and the other 50 % have been built in the recent 4 years.

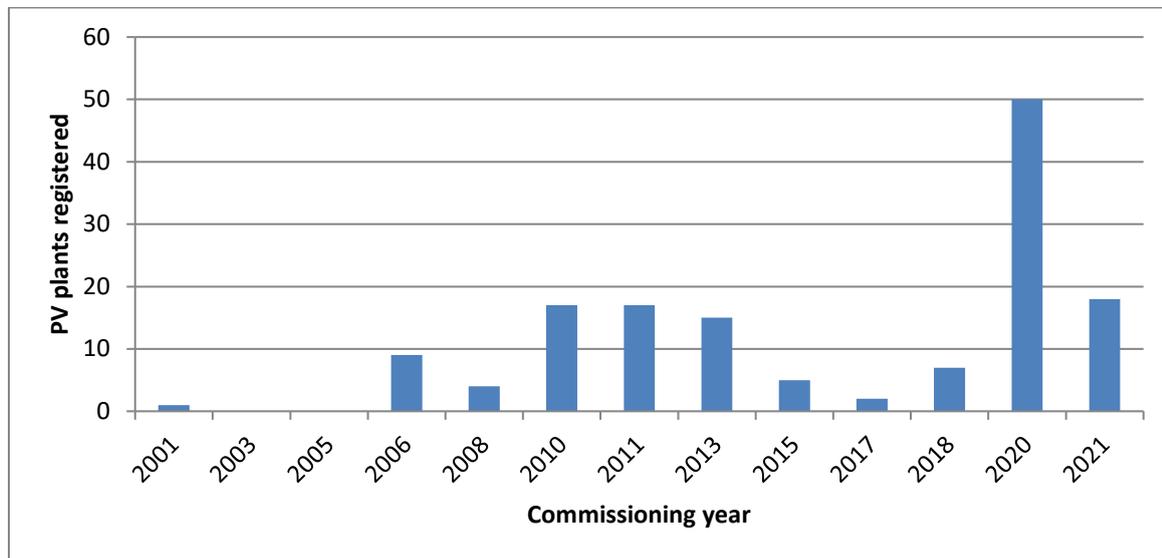


Figure 2: PV plant registrations on Borkum from 2001 to 2021²¹.

Hydrogen can be produced from renewable energy by water electrolysis. The renewable fuel can be burned in chp plants and is suitable to supply additional electricity and heat during times of peak load or as support during winter season. Dependent on the maximum load for the islands power cable, an electrolyzer with a maximum load of 4 MW could currently be installed on the island. 12 GWh or 4 million m³ of hydrogen could be produced, assuming 5,000 h of annual full load hours. This could cover ca. 10 % of the total heat demand and hence would be suitable for supply during peak load. For storage of the hydrogen, a pressure vessel would be needed to allow for seasonal storage, e.g. production in summer time and usage during winter season.

Natural gas chp plants can be used as bridging technology during the energy transition. The coupled production of heat and power increases the efficiency of fuel energy use and already saves CO₂-emissions in comparison to traditional systems. In addition to that, the plant can be operated to support the grid as they have short ramp up and shut down times. The plants can be built as hydrogen ready, allowing the use of hydrogen as fuel in the later stages of the transition.

Overall system for Borkum:

The energy supply for Borkum has to balance security of supply, economy and sustainability in order to achieve the vision for Borkum 2030. The core of the concept for future heat supply on the island are heat pumps powered by renewable energy that are connected through a heating network that will supply all appliances. The system can potentially be complemented with a natural gas chp plant that is able to be operated to cover peak loads and support the grid. H₂ readiness of the chp plant guarantees the possibility to switch to hydrogen as fuel in the future.

In the external study, two general concepts were discussed, cold heating network and centralized heating network. Even though there are some benefits of pumping cold sea water through the network and withdrawing the heat using decentralized heat pumps, e.g. no heat loss in piping, a centralized systems has more potential benefits. The main pros are:

²¹ <https://www.marktstammdatenregister.de/MaStR/>

- Peak load producer can be incorporated as heat and power supplier.
- Economy of scale - Specific investment costs are lower for larger equipment.
- No additional upgrade of power network necessary, which would be the case for decentralized heat pumps.
- A centralized system using heat pumps complemented with hydrogen technology can better respond to the challenges of a future fully renewable electricity system.

Several combinations of technologies were deemed to be feasible to supply Borkum with renewable heat, including mainly one or more solutions for main load heat generation with a combined capacity of ca. 20 MW like sea water district heating, air source heat pumps and solar thermal energy and a peak load heat source of ca. 15 MW, like hydrogen production and combustion or natural gas chp plants, both combined with a seasonal storage.

The main sites for the technologies were identified to be the street “Upholmdeich” for heat production through hydrogen or natural gas and for centralized air source heat pumps, including gas and heat storage. Sea water district heating is possible at the harbor and the south beach. By connecting these possible sites through a heating network spanning from the harbor to the town of Borkum almost all heat users could be supplied, assuming the heating network is installed in every street and over 2,000 households are connected.

The financial estimation of the external study is forecasting prices similar to the already available offer for the heat provided by the heating network Marienhof, as provided by the Stadtwerke Borkum, the local energy provider. With the likely increasing electricity and natural gas prices, as well as reductions of equipment costs through further development and adoption of relatively new renewable energy technologies, the economic feasibility will increase.

Finally, the sustainability of the discussed overall system solution can be measured by specific CO₂ emissions per kWh of thermal energy produced. The different combinations of technologies are estimated to have a CO₂ emission of ca. 70-80 g_{CO2} per kWh of heat produced. This can be considered low and sustainable in comparison with burning fossil fuels (300 g_{CO2} per kWh) and burning renewable fuels, e.g. biogas (60 g_{CO2} per kWh).

2.3 Analysis of Borkum

This section contains important facts about Borkum, the citizens and the infrastructure available, to better understand the situation and how to best define the information material to be generated.

Citizens of Borkum

As of 2019, there are 5,078 citizens living on the island, not considering any tourists. The distribution between women and men is balanced, as can be seen in Table 2.

Table 2 - Population of Borkums (2019)²².

Population	Number of people
Women	2,698
Men	2,380
Total	5,078

²² <https://www.nls.niedersachsen.de/gemeinden/G457002.html>

The age distribution of the islands citizens is displayed in Table 3. The average age on Borkum is 47 years^{Fehler! Textmarke nicht definiert.} which is only little over the German average of 44,5 years.

Table 3 - Age distribution of Borkum's citizens (2019)²³.

Age range	Percentage	Number of people
< 18 years	13 %	660
18 – 25 years	7 %	356
25 – 45 years	22 %	1,117
45 – 65 years	35 %	1,777
> 65 years	23 %	1,168

The citizens mostly live in 1-2 family homes. Only 17 % of the buildings contain 3 or more flats. In addition to the private households, there are roughly 1,000²⁴ commercially used buildings. About 80 % of these are hotels and other housings used to accommodate tourists visiting the island. The remaining part is roughly equally split between retail, restaurants and workshops.

Table 4 - Family homes on Borkum^{Fehler! Textmarke nicht definiert.}

Type of house	Number of houses
1-2 family homes	1,672
3 and more family homes	336
Total	2,008

Even though tourists are no citizens of Borkum, they are present most of the year and are of high importance for the economy of the island. The main facts are²⁵:

- 300,000 guests/arrivals before the pandemic, 200,000 in 2020,
- 2,5 million overnight stays before the pandemic, 1,9 million in 2020 and
- 60,000 day tourists before the pandemic, 33,000 in 2020.

19,000 beds are available for tourists, meaning that during high times of tourism the population and hence also the resource demand of the island is five times as high in comparison to some low tourist times.

Transportation on Borkum

The number of individual vehicles on Borkum is listed in Table 5. Since 2011, the total amount of cars, trucks and motorcycles increased by ca. 13 %. In 2019, there were 20 EVs registered on Borkum, which is ca. 1 % of all vehicles on the island. The district of Friesland where Borkum

²³ <https://www.komsis.de/ler-si/de/profile/SI-40451>

²⁴ https://www.stadt-borkum.de/city_info/display/dokument/show.cfm?region_id=347&id=412458

²⁵ https://cdn.borkum.de/wp-content/uploads/2020/09/210518_NBG_Jahresbericht2020_A4_44S_DH_12_Screen.pdf

belongs to and which in total is home to 98,971 (2020) people, in total has 761 (2022) registered EVs of in total 67,519 vehicles²⁶. Hence, the amount of EVs is representative for Germany at the moment and is neither high nor low in comparison.

Table 5 - Cars, trucks and motorcycles on Borkum²⁴.

Vehicle type	2011	2015	2019
Cars	1,676	1,752	1,865
Trucks	209	248	272
Motorcycles	289	329	331

Besides private and public/commercial vehicles as means of transport there are also flights and fairies used to travel from and to the island. Fairies by AG EMS travel between three towns, Emden, Emshaven and Ditzum (only on Sunday), from the mainland and Borkum 8 – 11 times per day. Based on the information below it can be estimated that 8,000 people and 350 vehicles can be transported from and to the island daily. The four main fairies of the fleet travelling between the mainland and Borkum are described and shown in the following²⁷. Additionally, there are two more fairies that are being used as support in times where the capacity is not sufficient due to the large number of tourists.

MS "Münsterland"

The fairy MS "Münsterland" was converted in 2020 to use LNG. It was the third fairy of the fleet being converted to use the environmentally friendly fuel.

Construction	1986 (Conversion 2022)
Passengers	1,200 people
Cars	max. 75
Speed	15,5 knots
Engine power	2 x 1050 kW
Length	94,00 m
Width	12,60 m
Draught	2,35 m



MS "Nordlicht II"

The hightech catamaran only needs 60 minutes to travel between Borkum and the mainland. This is twice as fast as the other conventional fairies take for the same distance.

Construction	2021
Passengers	450 people
Speed	35 knots
Engine power	2x 2960 kW
Length	46,80 m
Width	11,00 m
Draught	2,40 m



²⁶ <https://www.kba.de>

²⁷ <https://www.ag-ems.de/die-flotte>

MS "Ostfriesland"

The MS "Ostfriesland" became Germany's first LNG ship with its conversion in 2015. LNG stands for liquified natural gas and it's a gas, mainly consisting of methane, cooled to -162 °C, which makes it liquid and increases energy density. LNG helps to reduce the environmental impact. In comparison to shipping diesel, emissions of sulphur components and nitrogen oxides are reduced by 80 % and carbon dioxide emissions are reduced by 20 %. Particulate matter is avoided almost completely.

Construction	1985 (Conversion 2015)
Passengers	1.200 People
Cars	max. 70
Speed	16 Knots
Engine power	2x 1.564 HP
Length	94,00 m
Width	12,60 m
Draught	2,40 m



MS „Nordlicht“

MS "Nordlicht" is a high speed catamaran for passenger transportation similar to the MS „Nordlicht II“.

Construction	1989
Passengers	272 People
Cars	-
Speed	38 knots
Engine power	2x 2.774 HP
Length	38,80 m
Width	9,44 m
Draught	1,55 m



Flights are another important transportation for Borkum. Yearly, there are over 10,000 starts and landings for ca. 25,000 to 30,000 passengers. The flight from Emden to Borkum takes only 15 minutes, which is substantially shorter in comparison to travelling by ferry. The flight is offered 3 times per day. The planes used have a capacity of 6 – 9 passengers per flight²⁸.

²⁸ https://de.wikipedia.org/wiki/OFD_Ostfriesischer_Flugdienst



Figure 3 – Borkum airport (left) and typical airplane used at the airport for transportation (right).

Stakeholders on Borkum

Several stakeholders are involved when it gets to energy transition on the island. The topic was initially studied as part of deliverable D7.1²⁹. The main groups of stakeholders are: municipalities, public utilities, political parties, local initiatives, housing companies, roof owners (municipalities, schools, churches, associations, companies, universities, etc.), banks, cooperative associations as well as project developers and other cooperatives for the exchange of experience.

In regard to forming energy communities, active citizens, the local energy provider and the public bodies are especially of importance. While active citizens are at the heart of renewable energy communities, the local energy provider and the public bodies are the two parties with probably highest interest in the development and implementation of the energy transition and hold the highest amount of power too. It is therefore of highest importance to achieve consensus between those three parties.

Besides those three parties, there are many more stakeholders involved. The summarized result of the stakeholder analysis performed for D7.1 is shown in Table 6 below.

Table 6 - List of possible stakeholder contacts taken from D7.1²⁹.

Stakeholder	Possible Contacts
Player	
Industry	Tourism (hotels), Craft union, Union for gastronomy
Public institutions	Town and NBG
NBG	Project partner
Local politics	Mayor, City council, Working group „Kommunales Energiemanagement“
European Union	Rescoop EU project
Context Setters	
State Niedersachsen (Germany)	Innovation centre Niedersachsen GmbH
Subjects	
Citizens (active, want to participate)	Through local media and citizen engagement workshops
Crowd	
Citizens (passive, dont want to participate)	Through local media
Island guests	Tourist center

²⁹ <https://islander-project.eu/wp-content/uploads/2021/11/D7.1-Action-plan-for-citizen-engagement-process.pdf>

2.4 Possible concepts for Borkum

The findings of the previous analyses suggest several possible concepts for renewable energy communities on Borkum. In order to fulfil the criteria for citizen energy communities in Germany in the upcoming EEG 2023, the following conditions should be met:

- Consist of at least 50 natural persons as voting members or voting shareholders
- At least 75 percent of the voting rights are held by natural persons who have their registered main place of residence in the city or district
- The remaining maximum of 25 percent of the voting rights are held by small and medium-sized enterprises (SMEs) or local authorities. SMEs are companies with fewer than 250 employees and less than 50 million euros in turnover or less than 43 million euros in total assets.
- No member or shareholder is allowed more than ten per cent of the voting rights.
- Those entitled to vote must be given an actual opportunity to influence the citizens' energy company and to participate in decisions of the shareholders' meeting.
- If several actors join together in a joint project to form a citizens' energy company, each individual actor must fulfil the legal definition of a citizens' energy company.

Fulfilling these criteria will make sure that the energy community will receive further planned benefits by the German government. As main stakeholders, citizens, municipalities, and local energy providers play a key role in the energy transition of the region. The basis for a cooperation is the common goal of "Borkum 2030 – emission-free North Sea Island". Particularly a cooperation between the energy community and the local energy provider would be beneficial since both are locally connected and want to actively shape the energy transition locally. A cooperation between them could, for example, be such that the energy cooperative acts as partner of the local energy provider in the construction of renewable power plants. They can participate in the financing, construction, and operation of the plants. Another form is the participation of the local energy provider in the energy community.

Example 1: On the initiative of Volksbank eG in Lehrte, the local energy provider Stadtwerke Lehrte GmbH has founded the Lehrte-Sehnde eG energy cooperative together with the town of Lehrte and its subsidiaries. The aim is to offer the citizens the opportunity to actively support a sustainable and decentralised energy supply by participating in the energy cooperative. In this way, the civic commitment to co-determination and co-design of the local and regional energy future is strengthened. The main task of the Lehrte-Sehnde eG energy cooperative is to set up and operate photovoltaic systems on suitable municipal and private roof surfaces in order to expand electricity generation from solar energy. Stadtwerke Lehrte GmbH is a co-founder of the cooperative and is represented on the board by the managing director of Stadtwerke Lehrte GmbH.³⁰

Example 2: The local energy provider Stadtwerke Münster initiated the founding of the cooperative "UNSERE MÜNSTER ENERGIE" to give citizens the opportunity to actively support the energy transition in their region and to be able to benefit from it financially. The Stadtwerke Münster continue to be associated with the cooperative, as they are responsible for the technical management of the wind turbine but are not themselves shareholders in the cooperative. The investment costs of around 12 million euros for the three new wind turbines are financed by the cooperative to a quarter from membership shares and subordinated loans.³¹

³⁰ <https://www.eg-lehrte.de/homea61aaf2>

³¹ <https://www.stadtwerke-muenster.de/presse/pressemeldungen/energie/nachricht/artikel/stadtwerke-initiieren-genossenschaft-unsere-muenster-energie.html>

As part of the strategic goal Borkum 2030, the NBG is planning to build a sustainable local heating network in the district of Reede using innovative heat pump technologies³². The expansion of this heating network to other areas of Borkum could be a possible project to be implemented by a renewable energy community. The existing heat networks on Borkum are currently supplied with natural gas CHP and natural gas boilers. These existing heat infrastructures can serve as starting points for the expansion of the heat supply and at the same time quickly absorb large amounts of renewable heat. NBG will be a key player in the construction and operation of the heat network. However, it could provide its services on behalf of an energy community or a heat company, in which an energy cooperative can also participate in addition to NBG or the city of Borkum itself. By founding such a citizens' energy cooperative, equity capital can be raised on the one hand and on the other hand the citizens can benefit from a financial success of the heating company.

Example 3: One example of the construction of a local heating network is the energy cooperative Föhr eG. The island of Föhr is one of the North Frisian Islands and has more than 8,000 inhabitants. Föhr eG was founded in May 2014 to provide a regional and climate-friendly energy supply for the North Sea Island. The planned local heating network was originally intended to be much smaller. But due to the great interest, the heating network grew larger and larger during the planning. Today, 154 households are connected to the network. The necessary heat is produced in a combined heat and power plant, which is housed in the school building.³³

Another possible project for an energy community on Borkum could be the installation of PV systems on local roofs to increase Borkum's share of self-sufficiency and to provide additional local electricity potential in the summer months. This is the area in which the majority of energy communities are active. Direct consumption, leasing and tenant electricity models are possible options for this purpose. Possible customers for a roof acquisition include municipalities, small and medium-sized commercial enterprises, church, and social institutions (old people's homes, hospitals), schools, universities, housing associations, building owners etc.

Example 4: UrStrom eG is an initiative of citizens from Mainz and the surrounding area. They currently operate 15 photovoltaic systems in their region, producing clean solar electricity for around 220 4-person households. UrStrom eG focuses its PV systems on municipal roofs and the halls of private businesses. As much of the electricity generated as possible is to be used directly on site. When working with its project partners, UrStrom eG relies on trusting cooperation in an energy partnership.³⁴

The various examples of existing energy cooperatives show above all that an interaction between the energy communities, the municipality and the local energy providers has high potential for success.

In a first step towards the foundation of an energy community on Borkum fellow campaigners and cooperation partners (e.g. municipalities, public utilities, political parties, local initiatives, banks, cooperative associations as well as project developers and other cooperatives for the exchange of experience) should be informed about the added value of an energy community. This is followed by the elaboration of a business idea and the identification of various projects that the energy cooperation will carry out. ISLANDER will support this formation by providing several information materials, getting in contact with possible stakeholders and support with and conducting workshops and events.

³² https://cdn.borkum.de/wp-content/uploads/2020/09/210518_NBG_Jahresbericht2020_A4_44S_DH_12_Screen.pdf

³³ <https://energiegenossenschaft-foehr.de/>

³⁴ https://www.energiegenossenschaften-gruenden.de/fileadmin/user_upload/bildmaterial/Praxisplattform/UrStrom_PV_Augenhoehe.pdf

3 COMMUNICATION CHANNELS

This chapter summarizes the targeted communication channels used to engage the citizens and other stakeholders on Borkum.

3.1 Social and local media

Raising awareness among Borkum's residents about the benefits of an energy community will be an important step towards founding an energy community. Therefore, an overview of the social and local media on Borkum was made in Table 7. These media will be reached out to at the start of the citizen engagement campaign.

Table 7 – List of social and local media on Borkum.

Social / local media	Website
The website of the Nordseeheilbad Borkum GmbH has information on news and events on Borkum. They also have an Instagram, Facebook, and Pinterest account with a wide outreach. As the largest employer on Borkum they are able to reach not only tourists, but also citizens of Borkum.	https://www.borkum.de/
On the website of the municipality of Borkum current information like press releases and announcements are published. There is also a special section on nature, environment and transport.	https://www.stadt-borkum.de/
The daily newspaper Borkumer Zeitung informs about all sorts of news from Borkum and the surrounding area.	https://www.borkumer-zeitung.de/
The publisher Borkumer Werbeservice releases the weekly island newspaper Borkumerleben as well as Borkum-Aktuell 11 times a year. Additionally, they have an Instagram, Facebook, and Twitter account.	www.borkum-aktuell.de www.borkum-erleben.de
Radio Ostfriesland and Radio Borkum are two radio stations on Borkum, informing about local news on air and on their website.	https://ww2.radio-ostfriesland.de/ https://www.irabo.de/

3.2 Citizen Engagement Workshops

In the frame of ISLANDER, a series of workshops will be organized on Borkum to generate a platform for the stakeholders to get involved. The main focus is to involve the citizens of the island and to offer more opportunities for them to collect their concerns and needs. The aim is to bring all stakeholders together to achieve common ground for the creation of a REC. The series of workshops will likely start in the second half of 2022 and will continue with one event per year for a total of 3 events by the end of the project.

The series will contain three workshops. The first workshop is expected to mainly spread information on the energy transition on Borkum and additionally provide information on possibilities and benefits of renewable energy communities. The second workshop should

then be synchronized with the project's technology go-live to present technology solutions and possibly also impacts on the life on the island. Lastly, the third workshop is to be utilized to foster discussion between all stakeholders and to gather feedback to lay the foundation for a creation of a renewable energy community.

3.3 Website(s), online resources

In order to give interested stakeholders the opportunity to better inform themselves and to quickly get an overview of the issues surrounding energy communities, helpful guides and websites on various topics have been compiled below.

Table 8 – List of useful information materials for the foundation of energy communities.

	Content	Weblink
Formation of an energy cooperative	Website of the cooperative federation (Genossenschaftsverband) with information on setting up a registered cooperative. The individual steps from the idea of formation to registration are described and explained in short videos. There are many sample documents and checklists	Weblink
	The brochure published by the EnergyAgency NRW provides an overview of citizen energy in Germany, possible forms of association, financing options and practical examples.	Weblink
	A brochure describing different possible business models for citizens' energy cooperatives and how to develop a business model for an energy cooperative	Weblink
	This guide explains in detail the individual steps needed to set up an energy cooperative.	Weblink
	This brochure deals with the ecosystem of citizen energy. With a stakeholder analysis, important reference groups can be analysed and corresponding strategies and activities can be derived from them. In addition, external actors such as municipalities are examined	Weblink
	Reasons for and advantages of cooperation between municipalities and citizens' energy cooperatives	Weblink
	Summary table comparing different business forms of an energy community	Weblink
Local heating network	Practical guide to setting up a community heating network from the start-up phase to technical components and implementation	Weblink
	Practical guide with implementation possibilities and advantages of local heating networks	Weblink

Useful contacts

The network **Energiewende Jetzt e.V.** promotes the establishment and further development of energy cooperatives as well as the cooperation and networking of actors in the field of citizen energy in Germany, Europe and worldwide.

[Weblink](#)

The cooperative association **Verband der Regionen e.V.** is an auditing and advisory association, training provider and lobby group for around 2,600 member cooperatives. To support the foundation of cooperatives they offer a lot of information materials on their website.

[Weblink](#)

The **EUCENA project** offers Open Learning courses to educate people on how to harness renewable energy and also offer sources of support and community that are essential for creating long-term sustainable energy systems.

[Weblink](#)

In addition to these online resources on the topic of energy communities, the ISLANDER project plans to use its website (www.islander-project.eu~~Fehler! Linkreferenz ungültig.~~) to provide the information materials produced. A new section "Renewable Energy Community on Borkum" is added, structured with the following subpages: Role of the ISLANDER project; energy communities in Germany; Borkum's energy transition; citizens, transport, and infrastructure; possible projects; Links to external information; frequently asked questions (FAQ); Questionnaire and Contact details. Within these sub-pages, the information from this deliverable is made available to the stakeholders in a clear and concise manner. Through the contact details, interested citizens get a chance to ask questions and get in touch with those responsible.

3.4 Questionnaire

A questionnaire will be conducted directed to the citizens, municipalities and SME's of Borkum to collect feedback on the motivation to join an energy community. The content of the first questions will be related to the current behavior of the citizens regarding renewable energies and incentives that would motivate to a more sustainable lifestyle. This will be followed by questions regarding existing knowledge about energy communities and the formation of cooperative, conceivable forms of participation as well as concerns and open questions. This information will be important for the design of the Citizen Engagement Workshops and can be used to better tailor the workshops to the citizens of Borkum. A first draft of the questionnaire can be found in the annex.

The platform EU survey will be used to create and host the questionnaire. It is the European Commission's official online survey management tool that can be used free of charge by all European citizens with a wide variety of features and high privacy standards.³⁵

In order to get as many responses as possible, the dissemination of the survey will be integrated into the communication campaign in preparation for the first Citizen Engagement Workshop. Therefore, the different social and local media mentioned in 0 will be contacted and asked to spread the information about the ISLANDER project and first information on energy communities (summarized in the infographics). Also, the network of ISLANDER and NBG will be used to reach the citizens of Borkum. The communication campaign will start roughly a months before the first Citizen Engagement Workshop, to make sure, that the information gained by the citizens during the communication campaign and the concerns and

³⁵ [EUSurvey - About \(europa.eu\)](http://EUSurvey-About.europa.eu)

questions raised in the questionnaire will be addressed quickly within the workshop.

4 MATERIALS

4.1 Main messages

Table 9 summarizes the main messages gained in the previous chapters. In the course of the citizen engagement process, they will be communicated to the citizens of Borkum through presentations, posters, workshops, etc. in order for them to get an understanding of the viability of an energy community on Borkum.

Table 9 – Main messages for the citizen engagement campaign.

	Main message
Energy communities in Germany	Energy communities can help make the energy system more flexible, reliable, resilient, and secure.
	Involvement of citizens to the energy transition leads to better acceptance of renewable energy project
	Trigger future investments on community-owned RESS-based solutions
	The implementation of local sustainability projects contributes to the local economy and generates local jobs
	Possible forms of company are: eG, GmbH & Co. KG, GbR
	From the more than 1,700 citizen lead energy projects in Germany, more than half make up energy cooperatives (eG)
Energy transition on Borkum	Borkum currently is using 234.8 GWh of energy. Ca. 60 % is attributed to heat production, mainly via burning fossil natural gas, 19 % is needed for electricity and 21 % is required as fuel for maritime and car transport (80 % maritime transport)
	There are already two heating networks available, the heating network “Marienhof” and “Gezeitenland”
	The energy supply for Borkum has to balance security of supply, economy and sustainability in order to achieve the vision for Borkum 2030
	Core of the concept for future heat supply on the island are heat pumps powered by renewable energy that are connected through a centralized heating network

4.2 Letter for citizens and stakeholder engagement

With a letter to the citizens of Borkum, initial contact is established. In the letter the ISLANDER project as well as the intentions to start an energy community are explained and the underlying background is illuminated. In this way, the citizens are made aware of energy communities for the first time and gather initial information on them. In a next step, they are asked to fill out the questionnaire, in which they can express questions and concerns that the letter has raised. Based on this, the first workshops are designed. The first draft of the letter can be found in A.2.

4.3 Infographics

A total of six infographics were generated to summarize the information generated in section 2 of this document. The infographics can be found in the annex A.3. The goal is to prepare graphical information for different kinds of communication activities. An example is provided in annex A.4, a draft of two posters for the citizen engagement workshop. A list of the six graphics can be found in the following:

- Energy community overview,
- Reasons to join a renewable energy project,
- Legal forms for the foundation of an energy community in Germany,
- Energy consumption and production on Borkum,
- Ongoing activities on Borkum,
- Main potential of renewable energies for Borkum.

4.4 Update of materials

To conclude this section, it has to be stated that all materials are living documents and will be subject to change based on interactions, feedbacks and additional information that will be discovered throughout the course of the project. The updated documents will be made available through the ISLANDER website.

5 MAIN CONCLUSIONS

An energy community on Borkum will have a lot of advantages for Borkum and its citizens. They allow citizens to participate in the energy transition and increase public acceptance of renewable energy projects. By implementing local sustainability projects, energy communities can achieve energy independency, reduce carbon emissions, and fuel poverty, as well as contribute to the local economy. By becoming co-owners of renewable installations, citizens have democratic influence over energy investments and have local influence over profit sharing. Surpluses can be reinvested in further energy projects, generating local jobs, and attracting new investments. Furthermore, energy communities can help make the energy system more flexible, reliable, resilient, and secure. To facilitate the creation of an energy community on Borkum, the ISLANDER project developed an action plan for the citizen engagement process. The first step in this plan was the preparation of materials and messages, provided in this deliverable.

In a first step a summary of general information on energy communities in Germany and on

the energy transition on Borkum was given. This led to possible concepts and legal forms of the energy community on Borkum. Much potential is seen in concentrating on the development of a local heating network together with NBG and the city council. These ideas will be elaborated in the course of the engagement processes and especially in discussions with NBG and the municipalities.

To communicate this information to possible stakeholders and participants of the energy community on Borkum, communication and information channels were identified. A questionnaire will identify existing knowledge and open questions of citizens that can be addressed in planned workshops.

The information collected is summarised in main messages and infographics. Additionally, a letter was drafted to engage with citizens and other stakeholders.

6 NEXT STEPS

With this deliverable the first step of the action plan for citizen engagement developed in D7.1 - the preparation of material for stakeholder engagement – was started. A first set of materials was prepared. Additional materials as well as updates of existing ones will be made available through the mentioned communication channels. The next steps will involve direct contact of players and context setters (e.g. city council). The experience of other EU projects (DECIDE, Rescoop) has shown, to first build a core team of ideally 4-12 people, willing to take responsibility for the project³⁶. Together with this core team, visions and projects for the energy community can be developed before informing the citizens and tourists through local media. These steps will be followed by the conduction of workshops and community events relying also strongly on the outcomes of this deliverable. They will cover the following topics:

- Fundamental information on RECs
- Successful case studies
- Background, context, planning of the founding of an energy community on Borkum
- Legal, regulatory and organisational implications

The inputs gained throughout this process will lead to the creation of a roadmap for the creation of the renewable energy community.

DEVIATIONS

Delivery of the content was delayed by 2 months to increase the quality of outcome. No deviations are expected for subsequent actions.

³⁶ https://decide4energy.eu/fileadmin/user_upload/Resources/D1.5_final.pdf

ANNEX

A.1 First draft of the questionnaire

General questions

1. How old are you?
2. Do you have a home of your own?
 - a. Yes, I do.
 - b. No, I live for rent.
3. How many people live in your household?
4. What measures do you already take to make your electricity and heat consumption sustainable?
 - a. Purchase of “green” power
 - b. Photovoltaic system
 - c. Heat pump
 - d. Energy storage system
 - e. Investments in renewable energy
 - f. Others: _____
5. Which of the following motivates you to reduce your energy consumption?
 - a. Climate change
 - b. Saving on energy bills
 - c. Saving natural resources
 - d. Showing a good example to others
 - e. Others: _____

General questions regarding energy communities

6. Please rate your current knowledge about renewable energies and/or their installation?
 - a. I've never heard about them before.
 - b. I've heard of it before, but I don't know the details.
 - c. I have a good understanding of renewable energies.
7. Please rate your current knowledge about Energy Communities.
 - a. I've never heard about them before.
 - b. I've heard of it before, but I don't know the details.
 - c. I have a good understanding of what energy communities are.
8. Do you know someone who is part of an energy community?
 - a. Yes, I do.
 - b. No, I don't.
9. Would you like to learn more about renewable energy technologies and/or their implementation?
10. Would you like to learn more about Energy communities in Germany? / Would you be interested in an information event on Energy communities?
11. Are you familiar with the cooperative form of business?
 - a. No, I don't know anything about it.

- b. Yes, I know roughly what it is.
 - c. Yes, I am part of a cooperative.
12. Did you ever take part in the foundation of a cooperative?
- a. Yes, I did.
 - b. No, I didn't

Participation

13. Are you interested in investing in renewable energies?
- a. Yes, I already do that.
 - b. Yes, I would like to, but I haven't found the right project yet.
 - c. No, I don't want to invest in renewable energies.
 - d. I don't know.
14. Could you imagine becoming part of an energy community on Borkum?
- a. Yes, that sounds interesting.
 - b. I would need more information on energy communities to decide.
 - c. No, I don't
15. Could you imagine taking part in the foundation of an energy community?
16. How could you imagine to communicate within the Citizen Energy Community participants/actors?
- a. E-mail
 - b. Social media
 - c. Direct contact (e.g. workshop, meetings)

Concerns and questions

17. What are your concerns regarding a participation in an Energy community?
18. What are your concerns regarding renewable energy?
19. Do you have any questions regarding the foundation of an energy community on Borkum?

Contact details (voluntary)

20. If you are interested in being contacted by us regarding the establishment of an energy company on Borkum, please enter your **email address**.

A.2 First draft of the letter to the citizens of Borkum

Dear citizens,

With the agenda 'Borkum 2030', Borkum has committed to becoming climate-neutral, sustainable, and emission-free by 2030. Numerous projects such as the car sharing project 'Elektro Ahoi' and the 'Quartierskonzept KfW 432' have already been implemented to achieve this goal. Citizens of Borkum have the opportunity to actively facilitate the energy transition by creation of energy communities. This benefits not only fight against climate change but also the participants by strengthening the local economy through job creation, having a word in how the transition is realized on the island and finally reducing costs of energy bills.

What is the Islander project?



By developing a guide for the complete decarbonisation of the island, the ISLANDER project supports the renewable energy transition on Borkum. The four-year EU-funded project builds strongly on its predecessor project NETfficient (2015-2019), which developed an energy platform integrating different storage technologies and renewable energy sources. The ISLANDER project is developing an efficient energy management platform that more tightly integrates and centrally manages the different energy resources to balance fluctuations in energy production and demand. Local flexibility options such as storage technologies and load management are combined with renewable energy sources.

Why energy communities and how are they beneficial?

Part of the ISLANDER project is the support to create a renewable energy community to involve the citizens of Borkum and strengthen their participation in the energy transition on the island. Energy communities are a new concept in the energy market, introduced by the 'Clean Energy for all Europeans' package to organize collective and citizen-driven energy actions that help pave the way for a clean energy transition. Energy communities can have environmental, economic, and social benefits for the community. By helping to implement local sustainability projects, they can achieve energy independency, reduce carbon emissions, and fuel poverty, as well as contribute to the local economy. Through organizing collective and citizen-driven energy actions, energy communities increase public acceptance of renewable energy projects and make it easier to attract private investments in the clean energy transition. By becoming co-owners of renewable installations, citizens have democratic influence over energy investments and have local control over profit sharing. Surpluses can be reinvested in further energy projects, generating local jobs, and attracting new investments. Furthermore, energy communities can help make the energy system more flexible, reliable, resilient, and secure. Energy communities can operate in different areas: Generation of energy e.g. through photovoltaics, wind power or biogas, energy and heat supply, distribution, energy storage, acquisition and operation of grids and providing services like consultancy.

What projects could the energy community on Borkum implement?

Borkum's energy needs are met by gas and electricity, with gas accounting for the largest share. Therefore, the heat demand, which is mostly covered by natural gas, is an important target for the renewable energy transition. One exemplary project could be a participation in the construction and operation of a local heating network together with the local energy provider and the city of Borkum. By founding this type of a citizens' energy cooperative, equity can be raised on the one hand, and on the other, citizens can benefit from a financial success of the heating company. Another initial project could involve equipping the local roofs with as many PV systems as possible to increase Borkum's share of self-sufficiency and to provide additional local electricity potential in the summer months could also be a possible first project of an energy community on Borkum.

How to move forward?

Within the frame of the ISLANDER project a series of workshops will be organized on Borkum to facilitate the foundation of an energy community. Within these workshops citizens will learn more about the advantages and organization of an energy community and get the chance to express concerns and questions. In order to prepare the workshops and get a better overview of needs of the citizens, a questionnaire has been created which each citizen is encouraged to fill in.

In addition, the ISLANDER website will offer a platform where information material and frequently asked questions can be found. The possibility to contact us via a form will be offered there as well.

Best regards

The ISLANDER team

Did we catch your interest? Here you can find additional information and possibilities to give your feedback:

Additional information on our website (english): <https://islander-project.eu>

We are highly interested in your opinion and level of interest in the topic, here you can find our questionnaire: <https://islander-project.eu>

Contact:

info@islander-project.de

A.3 Infographics for stakeholder engagement

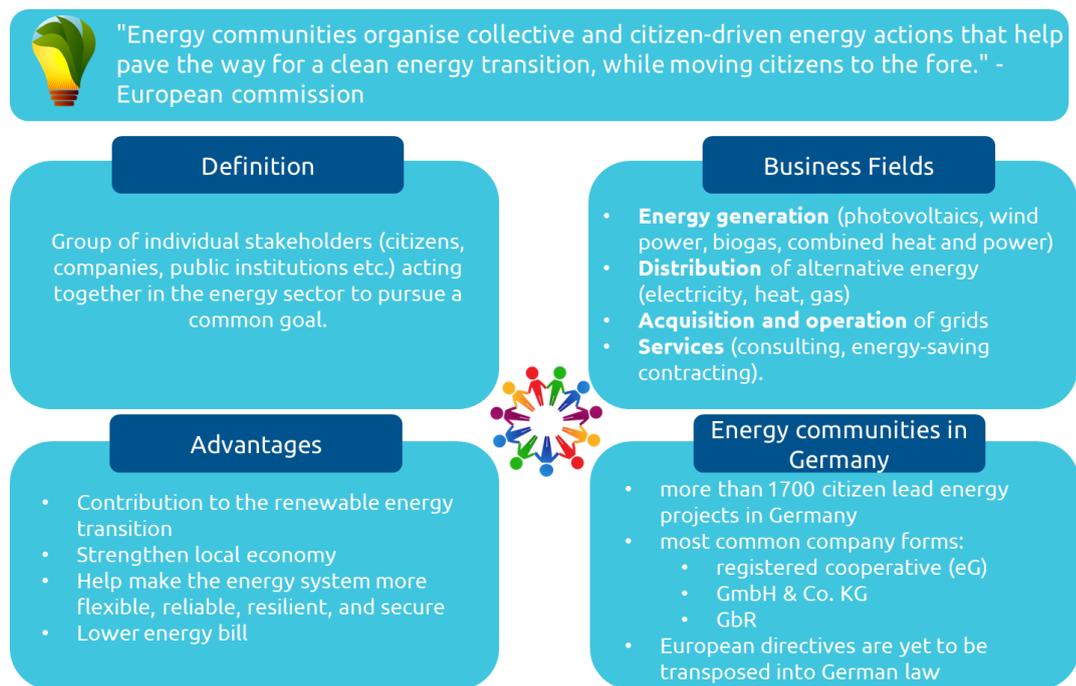


Figure 4: Energy Communities Overview.

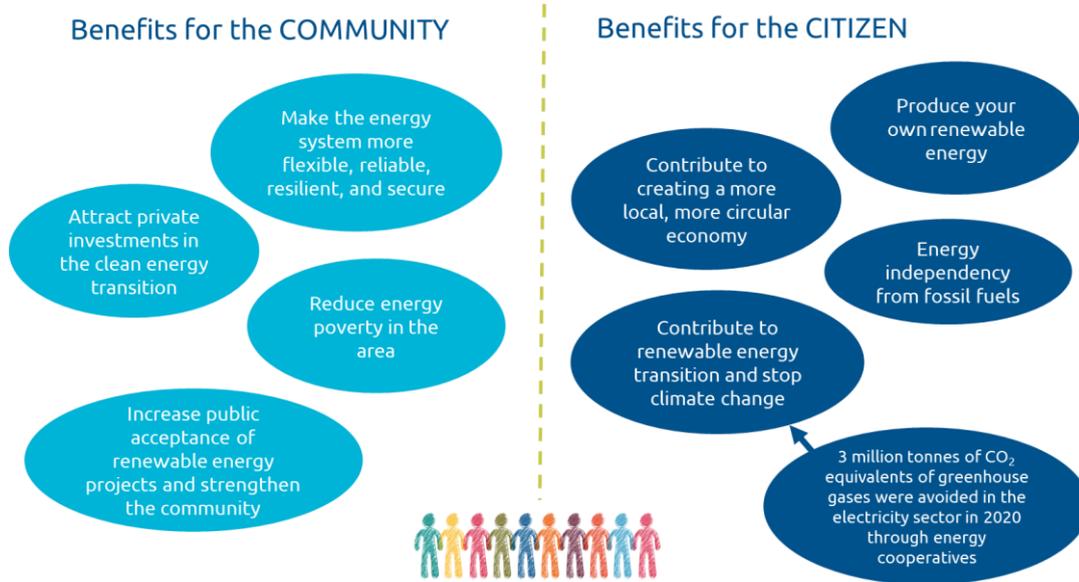
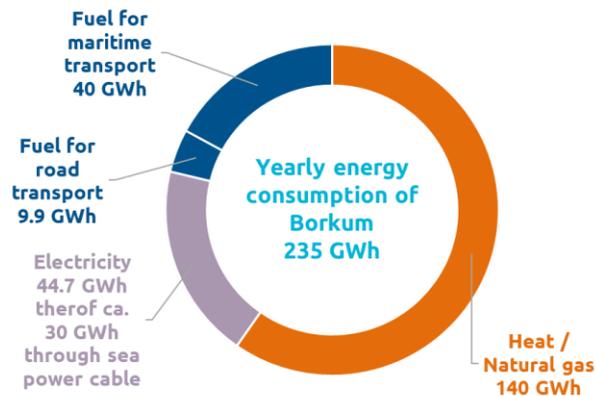


Figure 5: Reasons to join a renewable energy project.

	Cooperative	GbR	GmbH & Co. KG
Objective	Promotion of the acquisition / economy of members or their social and cultural interests	Any permissible common purpose	Operation of a commercial enterprise by equal partners
Foundation	<ul style="list-style-type: none"> - articles of association in written form - incorporation audit - entry in the register of cooperatives. 	informal	<ul style="list-style-type: none"> - Informal or written partnership agreement - registration in the Trade Register
Shareholder liability	Limitation to Cooperative share	unrestricted	Limited to the capital of the Company
Advantage	Suitable for projects with many participants with small investments	<ul style="list-style-type: none"> - Simple foundation - Suitable for small projects 	Suitable for different shareholder interests
Disadvantage	<ul style="list-style-type: none"> - complex foundation and accountancy - Commitment to the common purpose 	Full liability	High formalities due to the two forms of company

Figure 6: Legal forms for the foundation of an energy community in Germany.

Energy consumption on Borkum



60 % of the energy is used for heat production

Over 90 % of Borkums energy is imported

Figure 7: Energy consumption on Borkum.

Project	Description	Timeline
NETfficient (EU project)	Validation of several types of local storage technologies in combination with photovoltaic production on Borkum.	2015 - 2018
ISLANDER (EU project)	Installation of pilot technologies on Borkum for a fully decarbonised and smart geographical island and replication to other European islands.	2020 - 2024
H2 Watt (EU project)	H2 Watt provides the platform for the realization of various innovation projects for the implementation of hydrogen to prepare the economy on the Dutch and German border.	2020 - 2022
Housing Concept Reede (Quartierskonzept KfW 432)	Construction of climate-neutral new offshore buildings designed to reduce CO ₂ emissions, switching from conventional gas combustion to the use of innovative heat pump technology.	2018 - ongoing
Heating Network Marienhof	Local heating network to supply a holiday residence village with heat.	2021 - ongoing
Electro Ahoi Car Sharing	Car sharing on Borkum provided by the local energy provider.	2018 - ongoing
SB Solarpark Borkum	1.24 MW Solar power plant operated by the SB Solarpark Borkum GmbH & Co. KG.	2011 - ongoing
Private and public solar power plants	122 registered PV plants on private, public and commercial buildings with a combined capacity of 1.24 MWp.	Built between 2010 - today
Wind power plants	Two 1.8 MW wind mills located near the harbour. One is owned by the local energy provider and one is owned privately.	2002 - 2022

Figure 8: Renewable energy activities on Borkum.

Renewable energy technologies and their potential on Borkum

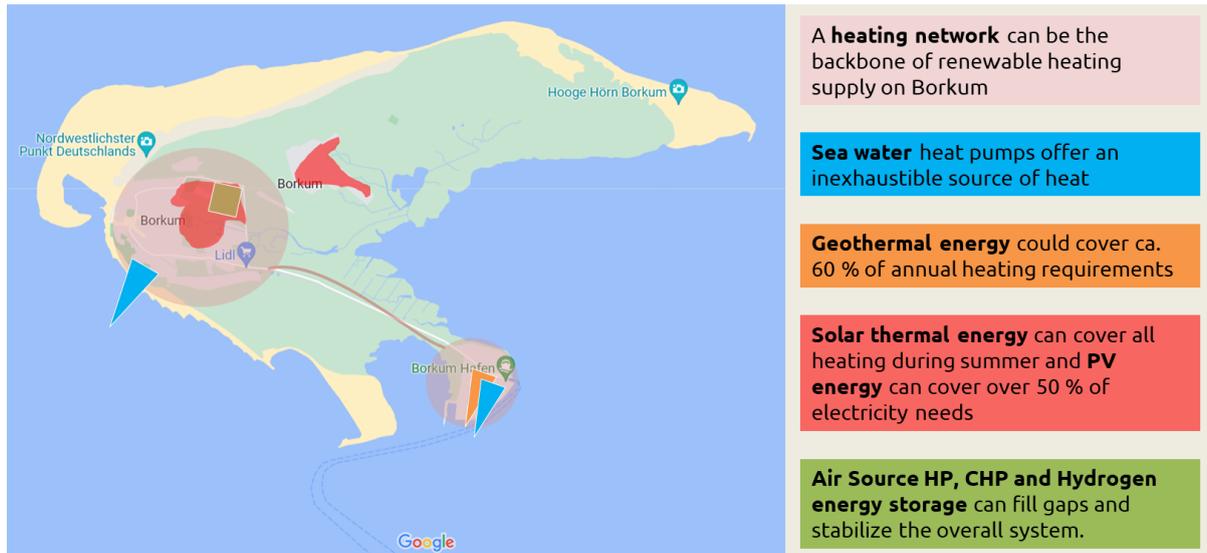


Figure 9: Main potential of renewable energies on Borkum.

A.4 Draft of posters for the first workshop

Energy Communities



"Energy communities organise collective and citizen-driven energy actions that help pave the way for a clean energy transition, while moving citizens to the fore." - European commission

Definition

Group of individual stakeholders (citizens, companies, public institutions etc.) acting together in the energy sector to pursue a common goal.

Business Fields

- **Energy generation** (photovoltaics, wind power, biogas, combined heat and power)
- **Distribution of alternative energy** (electricity, heat, gas)
- **Acquisition and operation of grids**
- **Services** (consulting, energy-saving contracting).



Advantages

- Contribution to the renewable energy transition
- Strengthen local economy
- help make the energy system more flexible, reliable, resilient, and secure
- Lower energy bill



Energy communities in Germany

- more than 1700 citizen lead energy projects in Germany
- most common company forms:
 - registered cooperative (eG)
 - GmbH & Co. KG
 - GbR
- European directives are yet to be transposed into German law



This project has received funding from the European Union's Horizon 2020 research and innovation under grant agreement No. 957669



Reasons to start or join a renewable energy project



Make the energy system more flexible, reliable, resilient, and secure



Contribute to renewable energy transition and stop climate change

3 million tonnes of CO2 equivalents of greenhouse gases were avoided in the electricity sector in 2020 through energy cooperatives

Contribute to creating a more local, more circular economy

Reduce energy poverty in your area



Attract private investments in the clean energy transition

Increase public acceptance of renewable energy projects and strengthen the community

Produce your own renewable energy

Energy independency



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