CLEAN ENERGY TRANSITION AGENDA

Fur

Version 1: December 10, 2021

Preface

This Island Clean Energy Transition Agenda for Fur is the strategic and tactical roadmap for the transition process towards clean energy as desired by the stakeholders on the island.

This Island Clean Energy Transition Agenda was developed by ProEnergi with support from Fur Island Society and Fur Development Council, Skive municipality, N1 and Skive Water.

This Transition Agenda is a roadmap for the local stakeholders and residents on the island to achieve its vision for clean energy and become CO_2-neutral by 2050. It includes the island´s baseline, pathways and strategies for the clean energy transition.

Preface

CLEAN ENERGY
FOR EU ISLANDS

Table of contents

Part I: Island Dynamics

1. Geography, Economy & Population

1.1 Geographic Situation

Fur is located in The Limfjord and is a part of Skive municipality. The island is one of Denmark's 27 small islands with an area of 22 km². Branden is the nearest town on the mainland and connects to Fur via a mere 4 minutes´ ferry ride.
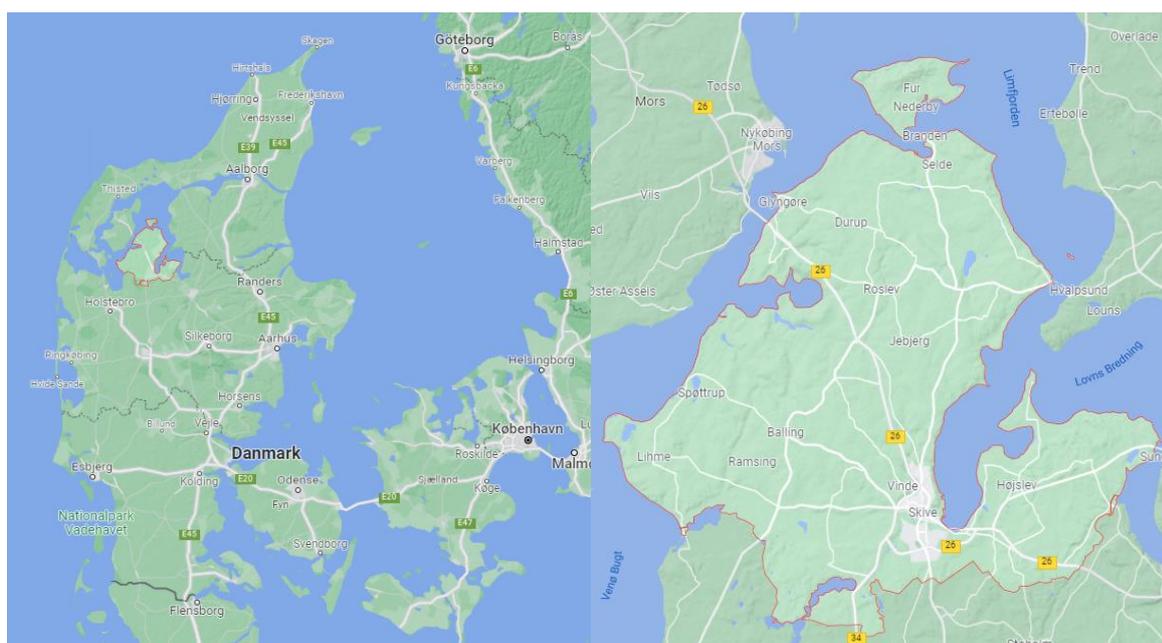

Figure 1: Skive municipality's placement in Denmark marked with red and Furs placement in Skive municipality (Source Google Maps)

Fur consists of diatomaceous earth deposit, called moler, that dates back 55 million years, when most of Denmark was covered by sea. The moler deposit consists of well-preserved fossils and approximately 200 layers of volcanic ashes. In 1919 the first breach of moler took place, which became the beginning of Fur´s export of moler in raw condition. Today the moler industry is Fur´s main economic activity and most of the moler is processed on the island.

The landscape on Fur´s northern side consists of heather-clad hills, cliffs with moler and iron-sandstones. The southern side is lower and more fertile, and the western side consists of cliffs with molar clay and meltwater sand.

The Danish Nature Agency (Naturstyrelsen), which is a part of the Danish government, owns approximately 247 acres of land on the northern side of Fur, which is protected by a status quo protection. The care of the protected areas is carried out by The Danish Society for Nature Conservation (Danmarks Naturfredningsforening), which is an association that can raise conservation cases and consists of members and volunteers. The preserved areas are Knudeklint, Langstedhuller, Stendal høje, Rødestenen and Stolleklint. Knudeklint is the largest moler cliff on Fur with its highest points at 30 meter above sea-level and extends 600 meters in the northern part of

Fur. The Danish Nature Agency and Skive Municipality have submitted a proposal, to the Danish government, for the protection of approximately 1470 acres of the hills on the northern side of Fur.
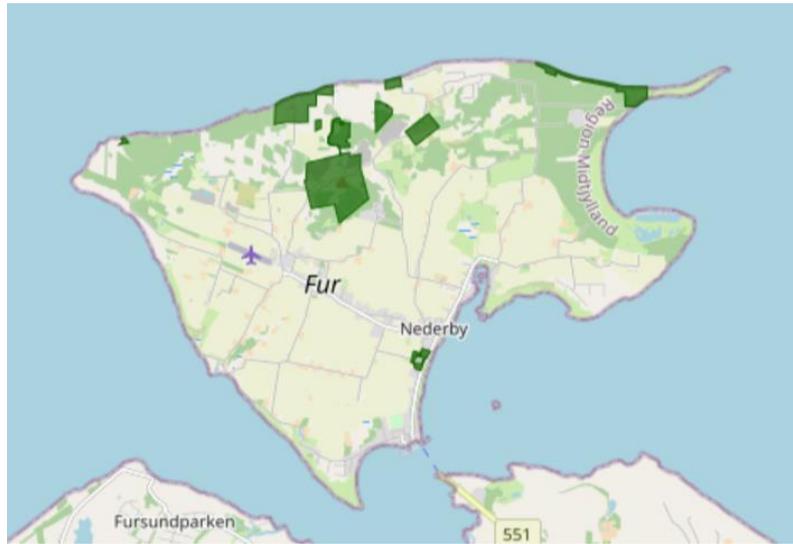

Figure 2: Status quo protected areas by The Danish Nature Agency, marked with green (Source: The Danish Society for Nature Conservation)

Fur is also on UNESCO´s list of potential World Heritage Sites, because of the fossils and moler cliffs on Fur that attract tourists to the island.

Areas that fall under nature protection interests and ecological connections cover half of Fur, which means that a special permission is required to implement a technical plant. In order to get a special permission, the technical plant may not damage nature or the biodiversity. Ecological connections are areas with organic connections in nature, which is set up to protect nature, plants and animals.

Figure 3: Protected ecological connections [left] and protected Nature interest (Naturbeskyttelsesinteresser) [right], the coloured areas are the current protected areas and the striped area is potentially protected area (Source: Miljøministeriet, Green Map of Denmark (Grøn Danmarkskort))

1.2 Demographic Situation

There are approximately 800 permanent residents on the island and the majority are living in Nederby. The ferry route makes it possible for the residents and businesses on Fur to get to the mainland. This means that the residents can live on the island and work or go to school on the

mainland. There are therefore both summer cottages, single-family houses, businesses, industry and agriculture on Fur. Fur has a childcare and a school that runs from 6 to 13-years-old children, which makes it possible for children to stay on the island. Also, Fur has a lot of different associations managed by and for the residents that makes a good social community on the island. Furthermore, Fur has restaurants, a museum, a gas station, and a grocery store that makes the island attractive for both residents and tourists. Annually 150.000-200.000 tourists visit the island. Due to the many tourists, the energy consumption fluctuates during a year.
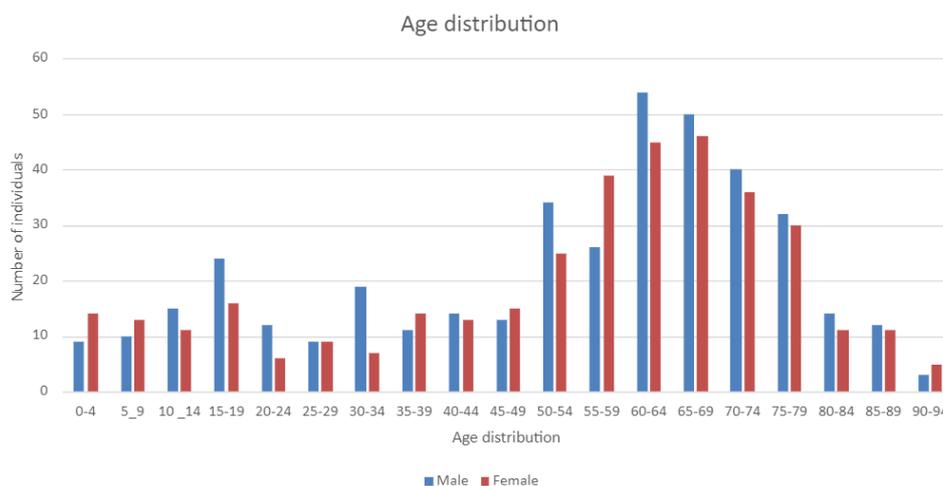

Figure 4: Age distribution on Fur (Source: John Brinch Bertelsen)

Fur has a committed community and they have arranged many energy projects on the island. The latest energy mapping on Fur was obtained in 2015 in relation to the project Innovation Fur. The project took place form 2011-2015 and was a joint vision (Furs, Skive municipality´s and EnergiMidt) for a sustainable community on Fur distributed over nine subprojects. One of the subprojects was energy inspections of the houses on Fur, where energy consultants visited the residents and their houses.

The latest project on Fur set up by Fur Island Society (Fur Ø-Forening) and Fur Development Council (Fur Udviklingsråd) is Fur EVER. The plan for Fur EVER is to ensure its transition in the future focusing on energy efficiency, renewable energy and resources. Fur EVER was launched in connection with the EU-project. In 2020 Fur EVER and the Clean Energy for EU Island secretariat prepared a proposition to Skive municipality about a solar cell system on Fur - This is a part of Skive municipality´s 2029 plans to become self-sufficient with renewable energy as well as decreasing the CO2 emissions with 10%, decreasing the energy consumptions with 20% and becoming more aware of resources and recycling.

1.3 Local Government

Fur is a part of Skive municipality and there is therefore no local government on the island. However, the island has Fur Island Society (Fur Ø-Forening) and Fur Development Council (Fur Udviklingsråd), representing the island and its interests. Fur Island Society (Fur Ø-forening) is part of The Association of Danish Small Islands (SaDS). SaDS is an organization founded and governed by Denmark's 27 small islands whose purpose is to preserve and develop the communities on the islands. Fur Development

Council (Fur Udviklingsråd) takes care of the local vision and projects, to ensure development on the island.

1.4 Economic Activities

The main economic activities on Fur come from moler factories Imerys and Skamol, along with tourism and the brewery Fur Bryghus. The moler factories mine and process the moler on Fur, which leads to transportation of the moler both on the island and to the mainland. Fur Haulage Business (Fur Vognmandsforretning) is the mining contractor for Skamol and Imerys, and besides that there are smaller transport companies on the island. Also a few carpentry companies.

Fur Brewery (Fur Bryghus) is a local microbrewery on Fur that brews beer in an old moler factory. The beer is sold in the brewery's restaurant and all around in Denmark and is a highly touristic place on Fur. The tourism on the island also creates the foundation for many other economic activities such as:

Profession	Companies
Hospitality and restaurants	Summer cottages, Fur Færgekro I/S, Fur Museet, FUR Camping, FURS NATUR and Café På Herrens Mark ApS.
Retail	Galleries, Fur Brugs and Fur Havnekiosk

Figure 5: Table over companies (Source: Fur Development Council (Fur Udviklingsråd) and Fur Island Society (Fur Ø-forening))

Besides tourism, there are many residents on the island which means that there are many minor economic activities on the island. These economic activities are agriculture, forging companies, carpenters, Fur Kraftvarmeværk AMBA (combined power and heating plant), Fur Skibs-Bådebyggeri (ship and boat building company), Fur Børnehus (childcare), Den Selvejede Institution Fur Friskole (Fur Free School) and fishing.

1.5 Connection to the mainland

Fur is connected to the mainland through a ferry route that takes 4 minutes across Fursund from Branden in Skive municipality on the mainland to Fur harbour. The ferry can take up to 30 passenger cars or 14 passenger cars and 2 semi-trailers pr. route, and it sails every 15-30 minutes at daytimes and every hour at night times. A bus route comes to Fur 4 times a day on workdays via the ferry. In 2020 the ferry sailed 103.680 rides in total to and from Fur. The table below shows an overview of total passengers in 2020 on the ferry to Fur.

Ferry routes in 2020 103.608 Category	Number pr. category
Passenger cars	138.630
Trailers and caravans	2.941
Passengers	203.956
Busses	1.340*
Motorcycles	1.033
Truck with trailer	5.105

Truck without trailer	3.399
Tractor without trailer	158
Tractor with trailer	451

Figure 6: Table over passengers on the route to Fur (Source: Fursund Færgeri)

*The number of buses in 2020 was lower than previous years because of the COVID-19 pandemic. However, the number of ferry rides was the same as the previous years.

Besides the ferry one can come to Fur via boat to Fur harbor or by a small airplane to a privately owned aerodrome. 80-100 small airplanes visit Fur by the aerodrome each year, which has an annual maintenance consumption of 100 Liter diesel to mow the lawn.

Fur Power and Heating Company (Fur Kraftvarmeværk) has 243 households and 9 businesses connected to the district heating distributed over a 11 km long pipeline on the island. The heat for the district heating comes from excess heat from a Skamol factory, located at Branden on the mainland. This means that the excess heat comes to Fur Power and Heating Company (Fur Kraftvarmeværk) via a pipeline drilled under Fursund. The heat primarily comes from Skamol´s excess heat, but as a backup Fur Power and Heatng Company (Fur Kraftvarmeværk) has a natural gas burner that can be used when necessary. The excess heat from Skamol covers the need for heat during summer and winter times. This means that the natural gas burner only is used when Skamol is closed down 2-4 weeks during the summer. The CHP plant does not produce electricity anymore, which means that Fur receives electricity from the mainland.

Skive Water (Skive Vand), which is under Skive Municipality, owns and operates 1 sewage treatment plant and 11 pumps on Fur in order to clean the wastewater and deliver drinking water to the island.

Fur receives electricity from a station in Risum, owned by N1, which comes to Fur via two 10 kV cables. The electricity company N1 supplies 547 residents, 403 summer cottages, 30 businesses, 23 farms and 57 others.

Figure 7: Electricity cables on Fur and the station in Risum (RSM) (Source: N1)

2. Energy System Description

2.1 The energy system

The energy system is mapped using available data and estimates when data wasn't available in the year 2020. This means that the final energy consumption and CO2 emissions on Fur will be an estimate based on available data and knowledge. The mapping of the energy system is broken-down per sector and the final consumptions and CO2 emissions are shown in the figure and tables below.

The figure shows the consumed and produced energy on Fur for transportation, electricity, and heating mediums.
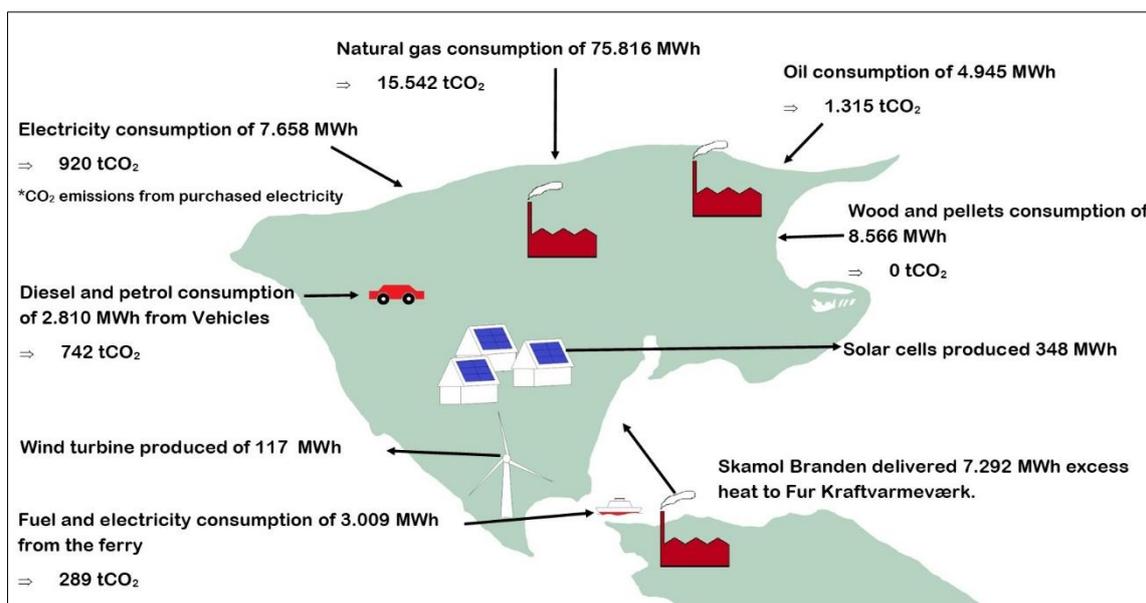
Figure 8: Energy system on Fur in the year 2020 (Source: ProEnergi)

The figure above shows the final energy consumption and production on Fur, where the tables below show a more detailed overview.

Data for 2020	Final energy consumption [MWh]	CO_2 emissions [tonne]
Electricity consumption*		
Residential	1.910	233
Summer cottages	1.174	143
Primary sector	168	20
Secondary and Tertiary sector	4290	523
Total	**7542**	**919**
Transport on the island		
Cars	2.292	604
Lorries	407	108
Motorbikes	19	5
Tractors	45	12

Buses	*47*	*13*
Total	**2.810**	**742**
Transport to and from the island		
Maritime transport	*3.009*	*289*
Total	**3.009**	**289**
Heating and cooling**		
Oil burner	*4.945*	*1.315*
Wood and pellets	*8.566*	*0*
District heating	*4.400*	*396*
Natural gas	*75.816*	*15.542*
Electricity for heating	*3.809*	*465*
Total	**97.536**	**17.718**
TOTAL	*107.088*	*19.203*

Figure 9: Energy system: consumptions in the year 2020 (Source: ProEnergi)

*The electricity consumption is the final electricity bought from the electricity company, without the consumption from its own produced energy on the island, which also includes the electricity used for heating. The consumed electricity from its own produced energy on the island is estimated to 115,9 MWh, based on the capacity of the Solar Photovoltaic and electricity sold back to the electricity company.

**The district heating and natural gas consumption is data directly from the distributor.

´Electricity consumption´ and ´Transport to and from the island´ are data directly from the distributor. ´Transport on the island´ and ´Heating and cooling´ are estimated data based on registered data and standard numbers for consumption per sector.

Data for year 2020	Total energy production [MWh]	CO_2 emissions [ton]
Solar Photovoltaics	*348*	-
Wind	*117*	-
TOTAL	*465*	-

Figure 10: Energy system: production in the year 2020 (Source: ProEnergi)

The island´s energy production comes from 69 solar photovoltaics and 1 onshore wind turbine. From the total production of energy 349,47 MWh was sold back to the electricity company.

2.2 Electricity consumption

The main consumer of electricity is ´Secondary and tertiary sector´, which also has the main activity and economic activities on the island during a year from tourism and the moler industries. It consumes about half of the final electricity consumption on the island in 2020. Where residential households consumed around 25%, summer cottages consumed around 16% and the primary sector consumed around 2% of the final electricity consumption. The electricity company has 547 different households, 403 different summer cottages, 30 different primary buildings and 80 different ´Secondary and tertiary sector´ registered for electricity consumption. This means that the two

moler industries and Fur Brewery (Fur Bryghus) are the main consumers of electricity, followed by the residential households and summer cottages. Approximately 106 MWh of the electricity consumed from ´Secondary and tertiary sector´ went to pumping of wastewater and drinking water. Skive Water (Skive Vand) has 1 sewage treatment plant and 11 pumps at Fur in order to clean the wastewater and deliver drinking water to the island.

The district heating on Fur receives excess heat from Skamol in Branden. Pumping the excess heat from Skamol in Branden to Fur Power and Heating Company (Fur Kraftvarmeværk) consumed 98,2 MWh electricity, where 56,5 MWh was consumed at Skamol in Branden and 41,7 MWh was consumed at Stenøre on Fur. The consumption at Branden is not included in the energy mapping since it is consumed at Skamol on the mainland.

Table 1 and 2 show that the energy production on the island is far from enough to cover the island´s electricity consumption. When converting from fossil fuels to electricity, the energy production will need to be significantly increased to cover the electricity consumption. Today approximately 75% of the produced electricity on the island is sold back to the electricity company and therefore not consumed on the island.

2.3 Heating consumption

Heating is the main energy consumer and CO_2 emitter on Fur. The high consumption of energy comes from the high consumption of natural gas, which is mainly consumed at the moler industries. The moler industries use the natural gas for heating as well as industrial processes, both included in the natural gas consumption for heating. The high emissions come from the use of natural gas, where approximately 78% of the final consumed energy for heating was natural gas. Besides the use of natural gas at the moler industries, oil boilers are one of the main CO_2 emitters on the island, which comes from heating of residential households.

The district heating on Fur used 26415 m^3 natural gas in 2020 to produce 307 MWh and received 7292 MWh excess heat from Skamol in Branden. This means that the district heating delivered 4400 MWh to the consumers and had a line loss at 3199 MWh, due to the distribution of the pipeline.

The tables below show the final energy consumption and CO_2 emissions for each heating medium distributed per sector from estimated data.

Electricity for Heating	Final energy consumption [MWh]	CO₂ emissions [ton]
Residents	1490	182
Summer cottages	2295	280
Primary sector	0	0
Secondary sector	8	1
Tertiary sector	17	2

Figure 11: Distribution of electricity for heating (Source: ProEnergi)

Oil for Heating	Final energy consumption [MWh]	CO₂ emissions [ton]
Residents	3280	873
Summer cottages	523	139

Primary sector	8	2
Secondary sector	1107	295
Tertiary sector	26	7

Figure 12: Distribution of oil for heating (Source: ProEnergi)

Wood and pellets for Heating	Final energy consumption [MWh]	CO_2 emissions [ton]
Residents	4259	0
Summer cottages	4275	0
Primary sector	10	0
Secondary sector	16	0
Tertiary sector	7	0

Figure 3: Distribution of wood and pellets for heating (Source: ProEnergi)

District heating	Final energy consumption [MWh]	CO_2 emissions [ton]
Privates	3662	329,58
Businesses	668	60,12
Public sector	70	6,3

Figure 13: Distribution of district heating (Source: ProEnergi)

Natural gas for heating and industrial processes	Final energy consumption [MWh]	CO_2 emissions [ton]
Total	75.816	15.542

Figure 14: Distribution of natural gas for heating (Source: ProEnergi)

The main CO_2 emissions for heating and industrial processes comes from natural gas from the moler industries and oil for heating of residential households. Primary, the energy consumption primarily also comes from natural gas from the moler industries, as well as wood and pellet for heating of residential households and summer cottages.

2.4 Transportation to and from the island

The ferry´s CO_2 emissions constitute 1,5% of the total CO_2 emissions on Fur, due to the moler industries high CO_2 emissions. In 2020 the ferry consumed 108.344 litres of GTL diesel and 182.371 litres of biodiesel and sailed 103.680 trips in total to and from Fur.

2.5 Transportation on the island

Data for transportation are estimated based on the total number of transported vehicles to the island by the ferry in 2020 and an assumed route around Fur. Based on the estimates, passenger cars are the main CO_2 emitters from transportation on the island, that comes from diesel and petrol consumption from residents, tourists, and workers on the island. Under 2% of the total number of passenger cars are passenger cars with caravans that come to Fur camping sites.

The high emission from lorries come from transportation from the moler industries on the mainland and on Fur.

2.6 Conclusion

The main CO_2 emissions on Fur comes from natural gas from the moler industries and heating with oil burners. A transition of the energy system should consist of the following actions to reduce the CO_2 emissions on Fur.

- A lowering of CO_2 emissions from heating, by phasing out oil boilers and the use of natural gas.
- A lowering of CO_2 emissions from transportation on the island, by transitioning passenger cars and lorries.
- A lowering of CO_2 emissions from transport to and from the island, by transition the ferry.
- An increase of renewable energy production on the island, that can provide green electricity.

3. Stakeholder mapping

3.1 Civil society organizations

Fur Island Society (Fur Ø-forening) and Fur Development Council (Fur Udviklingsråd)

Fur Island Society (Fur Ø-forening) and Fur Development Council (Fur Udviklingsråd) are local development groups in which members are residents from the island. Their purpose is to carry out projects on the island and represent the island at local, regional, national, and European level. Their main project regarding energy transition is FUR EVER, which is a project containing smaller energy projects.

Fur Island Society (Fur Ø-forening) and Fur Development Council (Fur Udviklingsråd) are coordinating the CETA process, through Erik Wind Andersen and John Brinch Bertelsen. They are also involved in the process of collecting data, engagement on the island and getting in contact with stakeholders and the residents in order to prepare the CETA report.

3.2 Businesses

Skamol

Skamol is one of the main energy consumers on the island. They are informed of the CETA process and involved in the process of providing data on their energy consumption.

Imerys

Imerys is one of the main energy consumers on the island. They are informed of the CETA process and are interested to hear more on possible projects.

Fur harbour

Fur harbour will be informed and involved in the CETA process.

Fur Power and Heating Company (Fur Kraftvarmeværk)

Fur Power and Heating Company (Fur Kraftvarmeværk) delivers district heating to 243 households and 9 businesses on the island. They are informed of the CETA process and involved in the process of providing data on the district heating. Fur Power and Heating Company (Fur Kraftvarmeværk) is engaged in the transition process.

Fur Museum

Fur Museum is highly touristed museum on Fur. They will be informed and involved in the CETA process.

3.3 Public Sector

Governmental Actors

The Energy Town of Skive (Energibyen Skive) from Skive municipality

The Energy Town of Skive (Energibyen Skive) and Skive municipality is consulted in the CETA process, as they are preparing the climate action plan for the municipality in the DK2020 process, in order to coordinate the two processes. They are engaged in the process as it correlates with their plan for the municipality. The Energy Town of Skive (Energibyen Skive) is in the process of a district project on Fur and is engaged in the CETA process and collaborates in order to optimize the citizens´ engagement.

Economic Activities

Skive Water (Skive Vand)

Skive Water (Skive Vand) is owned by Skive municipality and delivers water and handles sewage for residents in Skive and handles the sewage. They are informed of the process and provide data on the consumed energy from the water pumps on Fur.

N1

N1 is an energy distribution company that supplies electricity to Fur. They are involved in the process of providing data on the electricity consumption and production for Fur.

Fursund Ferry Company (Fursund Færgeri)

Fursund Ferry Company (Fursund Færgeri) is owned by Skive municipality. They are informed of the process and providing data on the consumed energy to transportation to and from the island.

3.4 Schools and Academia

Primary Education

Fur Free School (Fur Friskole)

Fur Free School (Fur Friskole) and childcare (Børnehus) is the local school and childcare on Fur. They are involved in the process of providing data on Fur Free School (Fur Friskole).

4. Policy and Regulation

4.1 Municipality policy and regulation

Recent municipality legislation on energy environment and climate

Energy and Sustainability Plan 2029 (Energi- og bæredygtighedsplan 2029)

In 2008 Skive municipality was appointed one of Denmark's first energy cities, which led to the development team The Energy Town of Skive (Energibyen Skive). The Energy Town of Skive (Energibyen Skive) develops projects that transform Skive municipality into a more sustainable municipality and makes sure that Skive municipality's 2029 Energy and Sustainable plan is obtained. The plan is set up to fulfill the EU-requirements, but also the Danish goal to reduce Denmark's greenhouse gas emission with 70 percent by 2030.

The 2029 plan is Skive municipality´s plan to become 100 percent self-sufficient with renewable energy by 2029. As well as reducing the energy consumption by 20 percent by 2019, reducing the CO_2 emission by 10 percent by 2029 and having 64% renewable energy by 2021. UN´s sustainable development goals (SDGs) number 7, 11, 12 and 17 are incorporated into the plan.

The Energy and Sustainability plan (Energi- og bæredygtighedsplan) is prepared upon the municipality's Planning Strategy (Planstrategien). The Municipality Plan (Kommuneplanen) and The Climate Adaption Plan (Klimatilpasningsplanen) are also prepared upon the Planning Strategy (Planstrategien), they however work with consequences of the climate changes, whereas the Energy and Sustainability Plan (Energi- og bæredygtighedsplan) work on reducing the climate changes.

In relation to the 2029 plans, Skive municipality is a part of a Danish project called Green Housing (GrønBolig). The goal with the project is to increase the energy efficiency of houses and use renewable energy to heat the houses instead of fossil fuels.

Planning Strategy (Planstrategi) 2019-2031

Skive municipality's Planning Strategy (Planstrategi) is built upon the Planning Strategy (Planloven), which is a national law. One of the regulations in the Planning Strategy (Planloven) is about coastal zones, which applies about 3 km from the edges of the beach. The law is determined by the municipalities, based on the government's laws, and affects almost the entire part of Fur.

Figure 15: Coastal zones on Fur marked with blue stripes (Source: The Municipality Plan of Skive (Skive Kommuneplan))

The Planning Strategy of Skive (Planstrategi) focuses on UN´ SDGs and incorporates them into the plan, where the overall incorporated goals are number 7, 9, 11, 12 and 15. As well as the UN SDGs the Agenda 21 is also incorporated into the Planning Strategy (Planstrategi) and the Municipality Plan (Kommuneplan). The plan focuses on sustainability, housing, business & tourism, and nature & landscapes.

Some of the goals in the Planning Strategy (Planstrategi) is to apply Fur and especially Knudeklints to UNESCO´s World Heritage Site, to preserve the hilly landscape on the northern site of Fur through The Danish Society for Nature Conservation (Danmarks Naturfredningsforening) and to expand Fur harbour.

The Municipality Plan (Kommuneplan) 2020-2032

The Planning Strategy (Planstrategien) is further the foundation for the 2020-2032 Municipality Plan of Skive (Kommuneplan) in which local plans are built upon the Municipality Plan (Kommuneplanen).

The Municipality Plan (Kommuneplan) focuses on reducing the municipality's CO_2 emissions and includes Green Map of Denmark (Grøn Danmarkskort), which states that natura areas must be preserved and improved as regards to biodiversity and quality in the existing areas. The Green Map of Denmark (Grøn Danmarkskort) covers half of Fur and therefore the northern side of the island. The plan also states that the same northern half of Fur has a specific geological conservation value that should be preserved. Further, the plan is to preserve the culture as well as nature, which on Fur can contribute to tourism.

A part of the Municipality Plan (Kommuneplan) is the project development of the area renewable on Fur, that includes the residents on the island in the process. The plan is to optimize areas and the infrastructure on the island, by keeping the residents as a part of the process in order to optimize the island for the residents and the tourists.

To adapt to the climate changes the plan also includes a 2020 Climate Adaption Plan (Klimatilpasningsplan), which is a climate adaptation plan. Among other aspects the plan focuses on protecting areas and buildings from rainwater and storm surge.

The Municipality Plan (Kommuneplan) includes a Wind turbine plan, which states that no new wind turbines may be placed on Fur.

DK2020

Skive municipality became part of the project DK2020 in 2020, whose purpose is to implement the Paris Agreement in Denmark. The project is developed by Realdania, C40 and CONCITO, where the partnership between Realdania, KL and the five Danish regions gives each municipality a possibility to participate in the DK2020 project. The project is based upon C40 and its international standard "The Climate Action Planning Framework", whose purpose is to implement the Paris Agreement at a local level. This means that Skive municipality is in the process of making a climate action plan.

4.2 National policy and regulation

Recent national legislation on energy environment and climate

2020 Climate law (Klimalov 2020)

In Juny 2020 the Danish parliament passed the Climate law. The law states that Denmark must reduce its emissions from greenhouse gas by 70% before 2030 compared to the emissions in 1990. Further it commits Denmark to be climate-neutral before 2050. The law builds upon the Paris Agreement and its goal to keep global warming under 1,5 degrees Celsius. The law also includes a grant when converting the heating medium from fossil fuel, as well as a grant for rural areas.

The national regulations also include 5 laws on planning, nature, the environment, building, and roads. The Planning law covers the Beach Conservation laws, that states to preserve the beaches approximately 300 meters from the edge of the beaches.

National Strategy for Sustainable Constructions (National Strategi for bæredygtigt byggeri)

In March 2021 the National Strategy for Sustainable Constructions was introduced with 21 initiatives distributes over the topics:

- Climate friendly constructions and facilities
- Durable buildings and constructions in high quality
- Resource efficient buildings and constructions
- Energy efficient and healthy buildings and constructions
- Digitally supported buildings and constructions

To ensure more sustainable buildings and constructions that focus on the entire life cycles of buildings and constructions in relation to the economy and the environment.

2018 Energy Agreement (2018 Energiaftale)

The Energy Agreement from 2018 states that 55 percent of the energy must be from renewable energy sources by 2030. It also states that 90 percent of the district heating must come from other energy sources than oil, gas and coal by 2030 and that the electricity must come from renewable energy sources.

Because of the moler and soil depositions in the underground the Archaeology and Museums law applies especially to Fur. The law can affect projects that include breaching the underground if archaeological finds are found before or during the breach.

The Electricity Supply Act (Elforsyningsloven) 2021

The Electricity Supply Act from 2021 has provided an opportunity for renewable energy communities and citizens´ energy communities with the 1069 executive order. The new bill implements the Electricity Market Directive (2019/944 EU) and opens up for a green transition of the Danish electricity market.

The 1069 executive order states that the same rights and obligations apply to renewable energy communities and citizens´ energy communities as to all other electricity consumers. When sharing the electricity in the communities, grid tariffs and taxes apply to the electricity flow as to all other electricity consumers. The communities can be run as an association, an interest network company, a cooperative or a capital company, and must have an electricity trading company to handle the distribution. However, renewable energy communities and citizens´ energy communities can handle the electricity trading, if setting up an electricity trading company themselves.

4.3 European policy and regulation

Recent EU legislation on energy, environment and climate

Fuel EU Maritime

Fuel EU Maritime is an initiative that currently is in a feedback period before the EU commission can pass the initiative. Fuel EU Maritime is an initiative for the maritime transport in the EU to increase the use of sustainable alternative fuels. The goal is that maritime transport becomes climate-neutral before 2050.

Next generation EU

The next generation EU is a temporary recovery plan after the COVID-19 pandemic, which is set up in 2020. The recovery plan also contains goals to optimize the European budget for 2021-2027. 30 percent of the total 2,018 billion euros budget is set aside to reduce the climate changes when restoring Europe after COVID-19. As well as 50 percent of the total 2,018 billion euros budget is set aside to promote the modernization of the EU. The goal is that the EU becomes greener, more digital, and even more resistant.

European Climate Law

In June 2021 the goals of the European Green Deal were implemented in a law by the European Climate Law. The law also contains the Fit for 55 package, which aims to reduce the net greenhouse gas emissions with 55% latest in 2030 compared to 1990. The law states that Europe should be climate-neutral in 2050 and obtain the Fit for 55 goals.

European Green Deal

The Green Deal was presented in 2019 as a goal to reduce the net greenhouse gas emissions by at least 55% by 2030, compared to 1990. As well as a goal to become climate-neutral by 2050. The goals are built upon the Paris Agreement, where Denmark and 195 other members of the UN signed the agreement in 2015, which is a legally binding climate-agreement. The goal is to keep global warming under 1.5 degrees Celsius by reducing greenhouse gas emissions. Through the Danish government and the municipalities, the climate-agreement is incorporated into the Danish policies and regulations. Besides reducing the net greenhouse gas emissions and improving the climate, the goal is also to improve the living conditions for all.

In September 2021 the commission adopted the concept of the New European Bauhaus. The goal with the project is to accelerate the transformation of the economic sectors, such as buildings, in order to provide goods that are circular and less carbon intensive for all citizens. The project is financed by 85 million euros by the Horizon Europa program, the LIFE program and the European Regional Development Fund.

Clean Energy for all Europeans Package

In 2019 the EU overhauled its policy on energy to reduce the use of fossil fuel and deliver on the Paris Agreement. The Clean Energy for all Europeans Package is the new energy guidebook consisting of 8 laws that EU countries must implement into national laws. The laws state to reduce

the energy consumption efficiently in buildings, to have 32 percent renewable energy sources by 2030, integrate a 10-year national energy and climate plan and establish a modern design for Europe's electricity market.

The Directive in common rules for the internal market for electricity (EU) 2019/994 states that civic energy communities is a cooperation between residents and local actors. The directive is a part of the modern design for Europe's electricity market in the Clean Energy for all Europeans Package. In all EU member countries, the rights for civic energy communities must be the same as for the electricity companies on the market. It also states that no other law or fee must reduce the development of the civic energy communities.

Winter package

As a part of the Winter package, adopted in 2016, each European country must publish a report on its total economic and social development.

Part II: Island Transition Path

5. Vision

Furs vision is to significantly lower its CO_2 emissions and become free of fossil fuels such as oil, diesel, and petrol by 2050. The strategy is to transition all oil burners, diesel and petrol vehicles into e.g., electricity such as a heat pump, expansion of the district heating and electric vehicles. This will increase the electricity consumption on the island. The strategy will be to implement renewable energy production, such as solar cells and wind turbines, that can supply the island with electricity as well as utilizing the excess heat from the moler industries.

6. Transition Governance

The clean energy transition is governed by different stakeholders and under Fur´s energy project FUR EVER. However, Skive Municipality will be the main governance of the clean energy transition of Fur. The stakeholders that will need to help Fur achieve its transition to clean energy are the moler industries, Fur Brewery (Fur Bryghus), the residents, Fur Island Society (Fur Ø-forening), Fur Development Council (Fur Udviklingsråd) and the municipality. The pathways for achieving the vision will be driven and administered under FUR EVER by Fur Island Society (Fur Ø-forening), Fur Development Council (Fur Udviklingsråd), residents and local stakeholders.

7. Pathways

The proposed pathways for Fur to achieve its visions are:

- To phase out oil boilers and the use of natural gas and replace it with renewable energy.
- To transition the ferry, passenger cars and lorries to electricity or hydrogen.
- To increase the renewable energy production on the island, in order to provide green energy to the island.
- To utilize the excess heat from the moler industries and the district heating, as well as optimizing the district heating pipelines and number of consumers.

8. Pillars of the Energy Transition

The tables below shows the objectives, strategies and actions to obtain the vision for Fur for each pillar ´transition to and from the island´, ´transport on the island´, ´heating´, ´electricity´, ´electricity storage and grid´, and ´utilizing the excess heat from the moler industries and the district heating´.

Pillar: Transport to and from the island	
Objective: • To become free of fossil fuels. • To ensure the same number of ferry departures. • To ensure that the transport to and from the island becomes CO2 neutral before 2050.	
Strategy:	Actions:

• Transform the ferry from fossil fuel to an alternative that is more CO2 neutral.	1. Examine what opportunities the ferry has for transformation.

Figure 16: Pillar for Transportation to and from the island (Source: ProEnergi)

Pillar: Transport on the island	
Objective:	
• To ensure alternative transportation, for fossil fuel vehicles. • To ensure that transport on the island becomes CO2 neutral before 2050.	
Strategy:	Actions:
• Sharing of passenger cars to reduce the consumption of diesel and petrol on the island e.g., by replacing diesel and petrol fuel vehicles. • Promote carpooling around the island and when driving to the mainland. • Create paths for walking and cycling as an alternative for cars on the island. • Implement public transportation (e.g., electric) on the island to ensure a reduction of consumed fossil fuel. • Implement car free days where it is illegal to drive around on the island.	1. Set up a system/technology for carpooling so the residents can communicate on carpooling. 2. Create and recreate old paths for walking and bicycling. 3. Examine the opportunities to set up a car sharing community. 4. Examine the opportunities for public transportation and consider whether it will reduce the consumption of fossil fuel. 5. Examine the opportunities for banning diesel and petrol vehicles on the island.

Figure 17: Pillar for Transportation on the island (Source: ProEnergi)

Pillar: Heating	
Objective:	
• To become free from fossil fuels by 2050. • To use renewable energy for heating. • To reduce the energy consumption for heating.	
Strategy:	Actions:
• Make energy renovations in all relevant houses to reduce the energy consumption. • Expand the district heating and optimise the pipeline for district heating. • Create a dome • Renovate/rebuild the town hall to reduce its consumption for heating. • Replace all oil burners with a heat pump or other renewable energy sources.	1. Inform the residents on replacing their oil burner and how to get grants to replace it with a heat pump. 2. Apply for permission to renovate the town hall. 3. Examine each house in order to map and make energy renovations. 4. Examine the opportunities for expanding the district heating and optimizing the pipelines. 5. Examine the opportunities for setting up a dome

Figure 18: Pillar for heating (Source: ProEnergi)

Pillar: Electricity
Objective:
• To supply the island with electricity from renewable energy produced on the island. • To ensure that all electricity consumed on the island is CO2 neutral before 2050. • To reduce the electricity consumption.

Strategy:	Actions:
- Implement renewable energy in the form of solar cells on the roof, solar cell plant, water turbines and offshore wind turbines. - Make energy renovations on all relevant houses to reduce the energy consumption. - Examine the opportunities for implementing nuclear power. - Set up street lights that run on renewable energy.	1. Follow up on the Solar cell plant project. 2. Examine the opportunities for solar cells on the roofs and how much they can produce to the island. 3. Examine each house in order to map and make energy renovations. 4. Examine the opportunities for joint partner in offshore wind turbine 5. Examine the opportunities for using wave energy and jet streams. 6. Examine the opportunities for implementing nuclear power. 7. Apply for permission to set up streetlights and examine the opportunities for them to be powered by renewable energy.

Figure 19: Pillar for electricity (Source: ProEnergi)

Pillar: Electricity storage and grid

Objective:
- To supply the island with electricity from renewable energy produced on the island.
- To ensure that all electricity consumed on the island is CO2 neutral before 2050.

Strategy:	Actions:
- Balance the electricity grid. - To set up electric charge stations for electric vehicles. - Implement a solar-powered bicycle pump. - Set up a joint partner (community) in offshore wind turbines to ensure renewable energy to the island.	1. Apply for permission to set up an electric charging station and find investors. 2. Apply for permission to set up a solar-powered bicycle pump and find investors. 3. Examine the electricity grid on Fur. 4. Examine the opportunities for joint partners in offshore wind turbines.

Figure 20: Pillar for electricity storage and grid (Source: ProEnergi)

Pillar: Utilising the excess heat from the moler industries and the district heating

Objective:
- Ensure the use of excess heat on the island

Strategy:	Actions:
- Implement a car wash that reuses the water and utilises the excess heat. - Set up a Fur Blue Lagoon that uses the excess heat to heat up the beach water (the district heating comes back to Skamol and is still too warm) - Set up a Wellness centre heated up from the excess heat. - Utilize the excess heat for food production. - Use the excess heat for power generation via ORC technology.	1. Examine the amount of excess heat on Fur and the opportunities to utilize it. 2. Examine which strategies that can utilize the excess heat.

Figure 21: Pillar for utilising of the excess heat from the moler industries and the district heating (Source: ProEnergi)

9. Financing

Financing opportunities for developing

The European Life Program and the subprogram LIFE Clean Energy Transition

The European Life Program is a European funding program for environment and climate action projects and improvements. The program invests in project developing and implementing innovative solutions that offer clear benefits for the environment and the climate. One of the subprograms under the Life program is LIFE Clean Energy Transition, with a budget of approximately 1 billion EUR over the period of 2021-2027. The sub programme is set up to help the transitions towards energy efficiency, implementation of renewable energy and becoming climate neutral while strengthening the economy.

Typically, the co-financing happens between the EU and multiple small and medium-sized stakeholders. Projects under the Life program Clean Energy Transition are co-financed by the EU in the five listed areas below.

- Projects that support the clean energy transition.
- Projects that accelerate and support the development of new technologies, new services, and business models, as well as projects that enhance the professional skills available on the market.
- Projects that attract private finance for implementation of sustainable energy.
- Projects that support the development of local and regional investment projects.
- Projects that involve and empower citizens in the clean energy transition.

Currently open calls under the LIFE Clean Energy Transition subprogram are:

- LIFE-2021-CET-PDA: Project Development Assistance (PDA) that offers technical assistance to project developers to undertake energy efficiency and renewable energy investments of ambition and scale. Click here to read more.
- LIFE-2021-CET-HOMERENO: This topic aims at creating or replicating innovative local or regional "integrated home renovation services". Click here to read more.

Both calls are open until January 12, 2022 17:00:00 Brussels time.

Calls for proposal for the LIFE Program and the subprogram LIFE Clean Energy Transition are published on CINEA´s website and on the European Commission´s Funding & Tenders portal website. Rules for application, guidance and templates for proposals can be found European Commission´s Funding & Tenders portal. Proposals can only by submitted electronically on the Funding & Tenders portal.

The European Energy Efficiency Fund (EU)

The European Energy Efficiency Fund (EEEF) is a European funding program that supports and promotes climate protection and a sustainable energy marked. The EEEF technical support Facility

received ELENA funds under the European Horizon 2020 programme. European Local Energy Assistance (ELENA) offers funding and technical assistance to energy efficiency and renewable energy projects for buildings and innovative urban transport. EEEF offers funding for energy efficiency projects and small-scale renewable energy projects through technical in the public sector. The aim is to support the public sector through the necessary activities to prepare for investments in sustainable energy projects. Activities under the technical support are feasibility studies, energy audits, evaluation of the economic viability of the investments and legal support.

Projects funded by EEEF investments fall under the listed themes below:

- Energy saving and energy efficiency projects for public and private buildings.
- Renewable energy sources implementation projects.
- Clean urban transport for the public sector.

To apply for technical assistance, the project investment volume must be higher than EUR 5 million and have a saving of at least 30% of the primary energy and CO_2 equivalents. The public sector or privates working on behalf of the public sector can apply for their proposals by following the application format, which can be found here. There are no deadlines or calls for application, this means that the fund is open on a first-come-first-serve basis. It is advised that Venø and Fur apply together to fulfil the criteria.

European City Facility

European City Facility (EUCF) is a European funding for technical support for municipalities and local authorities. The EUCF is set up under the Horizon 2020 program for research and innovation of the EU to accelerate investments in sustainable energy projects in the municipalities. The funding grant is a lump sum of EUR 60.000 for technical support such as feasibility studies, market analyses, stakeholder analyses, legal, economic and financial analyses, risk analyses and further supporting tasks.

To receive funding, the municipalities and local authorities must apply to become a beneficiary here. The next open call is the 4th call in May-June 2022.

Financing opportunities for implementation

LAG Small Islands (LAG Småøerne)

LAG Small Islands (LAG Småøerne) is a Danish fund for small islands through local associations that generates development and innovation in the community by granting investments. Through the LAG Small Islands local businesses, associations and communities can apply for funding from the European Rural Development Program, which is funded by the European Agriculture Fund for Rural Development (EAFRD). When the LAG Small Islands has approved the proposal the Housing- and Planning Agency (Bolig- og Planstyrelsen) has to give the final approval in order to get the grant.

Projects funded by LAG Small Islands investments fall under the listed themes below:

- Business and tourism development

- Housing: establishment of workplaces and new forms of housing.
- Collaborative development: to create local development strategies and projects that strengthen the local communities.

The aim is local anchoring, innovation and cooperation with the local communities.

LAG Small Islands also has a grant for fishing and marine development called N-FLAG with funding through the European Marine and Fisheries Fund (EMFF).

To apply for funding the proposal must fulfill the LAG Small Islands, European and the Housing- and Planning Agency (Bolig- og Planstyrelsen) criteria and policies. The criteria, policies and how to apply can be found here. The next call for LAG is open until March 22, 2022, and N-FLAG is open until February 25, 2022.

The Rural Fund (Landdistriktspuljen)

The Rural Fund (Landdistriktspuljen) is a Danish fund that aims to promote rural development by funding the listed projects below.

- Pilot projects in rural areas: Aims at increasing employment, business development, living conditions, housing and improving the local cultural and leisure activities in rural areas. The next call opens again in 2022. How to apply and when the call opens again can be found here.
- Research projects: Aims at enlightening the development terms and opportunities in rural areas. The next call opens again in 2022. How to apply and when the call opens again can be found here.
- Projects on the small islands: Aims at supporting initiatives and projects that create development and workplaces on the small islands, also known as Island Support (Ø-Støtte). The next call opens again in 2022. How to apply and when the call opens again can be found here.
- Projects in areas with onshore wind turbines: Aims at supporting non-profit social and cultural projects that improve the experience of the immediate areas as well as strengthening the local community and giving compensation for the inconvenience of the onshore wind turbines. The next call opens again in 2022. How to apply and when the call opens again can be found here.

Other financial opportunities for implementation are private investments, the European LIFE program, local banks and stakeholder investments, such as Fur Cooperative Bakery Fund (Andelsbagerifond), Sparekassen Fur and Fur Brand association (Foreningen Fur Brand).

10. Monitoring

Indicator 1: Clean Energy Transition Agenda

Score: 4

A Clean Energy Transition Agenda for the island has been developed and approved by the transition team in December 2021. The vision shared in the agenda is developed by the transition team and multiple stakeholders. The Clean Energy Transition Agenda has yet to be approved by the Clean Energy for EU Islands Secretariat.

Indicator 2: Vision

Score: 4

There is a long or medium-term island-wide vision on clean energy that includes clear objectives.

Indicator 3: Community – Stakeholders

Score: 2

There are individual stakeholders working on clean energy transition with little collaboration between them.

Indicator 4: Community – Organisation

Score: 4

An island-wide Transition Team drives the energy transition. It is formed and supported by actors from multiple stakeholder groups. (E.g. a community initiative with the support from academia).

Indicator 5: Financing concept

Score: 3

A list of possible national and European funding has been listed.

Indicator 6: Decarbonisation plan – Island diagnosis

Score: 5

A technical and economic analysis of the island's energy system exists that includes a final energy consumption breakdown covering electricity generation, heating, cooling, transport on the island and transport to and from the island.

Indicator 7: Decarbonisation plan – Data

Score: 4

A recent inventory of consumption and CO_2 emission data exists for all sectors based on local reporting. There is no periodic reporting process in place.

Indicator 8: Decarbonisation plan – Action Plan

Score: 4

There is an island-wide Action Plan on clean energy that describes the necessary actions to achieve

the vision.

Indicator 9: Multi-level governance

Score: 4

There is interaction with some other levels of governance on clean energy transition to align the island's CETA/decarbonization strategy with existing plans.

References

[1] Skive municipality´s Energi- og bæredygtighedsplan – 2029. https://skive.dk/media/ny0dwniu/skive-kommune-klima-energistrategi-2029-enkeltsidet-dk.pdf . Accessed December 10, 2021.

[2] Skive municipality´s Planstrategi 2019-2031. https://skive.dk/media/e0qd5iio/planstrategi-2019-2031.pdf . Accessed December 10, 2021.

[3] Skive municipality´s Kommuneplan 2020-2032. https://skive.viewer.dkplan.niras.dk/plan/68#/ . Accessed December 10, 2021.

[4] The Danish Climate law 2020. https://www.retsinformation.dk/eli/lta/2020/965. Accessed December 10, 2021.

[5] The Danish National Strategy for sustainable construction and buildings. https://im.dk/publikationer/2021/apr/national-strategi-for-baeredygtigt-byggeri. Accessed December 10, 2021.

[6] The Danish 2018 energy law. https://kefm.dk/media/6646/energiaftale2018.pdf. Accessed December 10, 2021.

[7] Elforsyningsloven 2021. https://www.retsinformation.dk/eli/lta/2020/119. Accessed December 10, 2021.

[8] Next generation EU. https://europa.eu/next-generation-eu/index_en. Accessed December 10, 2021.

[9] European Climate Law. https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en. Accessed December 10, 2021.

[10] European Green Deal. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en. Accessed December 10, 2021.

[11] Clean Energy for all Europeans package. https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en. Accessed December 10, 2021.

[12] Winter package. https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/european-semester-timeline/winter-package_en. Accessed December 10, 2021.

[13] European Energy Efficiency Fund. https://www.eeef.lu/eeef-ta-facility.html. Accessed December 10, 2021.

[14] European City Facility. https://www.eucityfacility.eu/home.html. Accessed December 10, 2021.

[15] LAG Småørene. http://lag-smaaoerne.blogspot.com/. Accessed December 10, 2021.

[16] Landdistriktspuljen. https://www.livogland.dk/ministeriets-egne-puljer-stoetteordninger/landdistriktspuljen. Accessed December 10, 2021.

[17] Island Transition Handbook. https://euislands.eu/document/islands-transition-handbook. Accessed December 10, 2021.