TOURS NETWORK DENMARK

Experience Danish green solutions - live

In this paper, you will meet the ten partners behind Tours Network Denmark and find inspiration for site visits across energy efficiency, renewables, waste and resource management, clean air, water and climate adaptation.

State of Green

Join the Future. Think Denmark

TOURS NETWORK DENMARK
Version 1.0
Printed in June, 2017

Front page photo
Kollision ApS

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DENMARK – THE STATE OF GREEN

Since the 70s, Danish governments have had policies in place for the country's limited natural resources, concentrating on using them wisely and pushing for energy efficiency measures. As a nation, we are known for our ability to collaborate, and our expertise lies in helping customers and stakeholders reach highly efficient and 'smart' solutions, while in turn developing their ability to profit from that knowledge. We see great opportunities for mutual benefits in the transfer of knowledge, spurring growth in both partners' businesses – holistically, with a healthy amount of respect for different perspectives and agendas, as well as for the environment.

Explore, learn and connect online
State of Green gathers all the leading players within energy, climate, water and environment in Denmark. Stateofgreen.com is the official platform for Denmark's green solutions and knowhow. The web portal is an online entry point for all relevant information about Danish companies and institutions and their expertise within Denmark's green strongholds.

Come visit us in House of Green
House of Green is an interactive visitors' and exhibition centre located in the heart of Copenhagen. House of Green uses a combination of guided storytelling and self-exploration to showcase green Danish integrated solutions and scenarios, as well as an overview of the whole Danish story within energy, climate, water and resources. Danish representatives act as hosts that both inspire and inform delegations before they move on to on-site visits.

Take part in our network
Take advantage of lessons learned by leading Danish companies and institutions to solve the challenges in your industry and society. Through an extensive network of contacts, State of Green arrange business meetings and site visits suited to your needs. Find inspiration for your tour, explore green solutions and connect with profiles at: www.stateofgreen.com/tours

STATE OF GREEN

State of Green is a public-private partnership founded by the Danish Government, the Confederation of Danish Industry, the Danish Energy Association, the Danish Agriculture & Food Council and the Danish Wind Industry Association. H.R.H. Crown Prince Frederik of Denmark is patron of State of Green. As the official green brand for Denmark, State of Green gathers all leading players in the fields of energy, climate, water, and environment and fosters relations with international stakeholders interested in learning from the Danish experience. Connect through: www.stateofgreen.com

FOREWORD

Danish companies and organisations are at the forefront of the green transition. A cornerstone of the Danish vision is to inspire others and demonstrate how the transition to a sustainable society is both possible and profitable - and we invite you to come and see for yourself

by Brian Mikkelsen, Minister for Industry, Business and Financial Affairs

Since 1980, the Danish economy has grown by more than 70% while our energy consumption has remained the same. We wish to demonstrate that it is possible to combine economic growth with increased amounts of renewable energy and subsequently reduce CO_2 emissions and phase out fossil fuels.

Sustainable economic growth and security of energy and water supply are among the greatest global challenges today. Denmark is determined to find solutions to meet these challenges and become a green and resource-efficient economy entirely independent of fossil fuels by 2050. This ambitious goal is set by the Danish Government and rests on a solid foundation.

We are well on track towards a greener future, but the transition is global and therefore requires cross-border cooperation. That is why we collaborate with international peers across the green landscape; businesses, knowledge institutions, investors, politicians, cities and citizens. We wish to inspire, educate, test and develop new solutions and services, and we want to demonstrate how they work in local contexts across continents. By working together, we can secure green growth for all.

That is why we are taking a new initiative to develop an even stronger collaboration between central Danish players working with the planning of professional tours to Denmark's green landscapes. We call it the Tours Network. The partners of the Tours Network are all experts within their respective areas and have close ties with local frontrunners across the green Danish landscape.

In this paper, you will meet the ten partners behind the Tours Network and find inspiration for site visits across energy efficiency, renewables, waste and resource management, clean air, water and climate adaptation. If you are interested in visiting Denmark to explore these solutions and learn more about the concrete technologies, as well as connect with Danish stakeholders and share knowledge about green growth development, I encourage you to contact the Tours Network.

Image credit: Helle Moos

We hope you will feel inspired and look forward to welcoming you on a tour in Denmark.

Image credit: State of Green

TOURS NETWO

		Energy Academy on Samsø (page 10)	City of Aarhus (page 12)	Energisafari.dk (page 14)	Energy City Frederikshavn (page 16)
Geographic area					
Showcasing - Sector Focus	Bioenergy	●		●	●
	Climate Adaptation		●		
	Energy Efficiency	●	●	●	●
	Environment & Resources	●	●		
	Heating & Cooling	●	●	●	●
	Intelligent Energy	●	●		
	Small Wind Energy				
	Smart City		●		
	Sustainable Transportation	●	●		●
	Solar & Other Renewables	●		●	●
	Water		●		
	Wave Energy				
	Wind Energy	●	●	●	
Showcasing - Sustainable Transition Models	3P-models		●		
	Education	●	●	●	
	Energy solutions for developing countries				
	Financing	●	●	●	●
	Policy & Planning	●	●		●
	Sustainable Business Hubs	●	●		
	Sustainable Business Models		●	●	●
	Sustainable Community	●	●	●	
	Sustainable R&D	●	●	●	
	Sustainable & Safe Food Production		●		
	Test & Demonstration		●	●	●

ORK PARTNERS

House of Energy (page 18)	Nordic Folkecenter for Renewable Energy (page 20)	One-Point Entry (page 22)	Bright Green Business (ProjectZero) (page 24)	Agro Business Park (page 26)	State of Green (page 4)
					
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An efficient transportation system is the backbone of our economy and society and is essential to establishing long-term growth. It enables trade and allows citizens to travel to work and school as well as journey from one place to another during their free time

Infrastructure
Denmark is considered a small country on a global scale, and this perception is enhanced when visiting the country and experiencing the speed with which one can travel from one end of the country to the other.

The transport infrastructure in Denmark is highly developed due to continuous improvements through governmental infrastructure projects. This enables you to move quickly around the entire country, making it possible to see many different regions of Denmark within a relatively short amount of time. Storebælt Bridge opened in 1998, allowing road and train traffic to flow between Denmark's two major islands, Funen and Zealand. This also made it possible to drive from the northernmost point of Denmark to its southernmost point in as little as 6 hours.

Public transport
Denmark's railway network covers 2,667 km of track, encompassing most of the major cities and connecting the country to its two closest neighbours, Germany and Sweden. Railway transportation is supported by a network of bus lines that link less-populated parts of Denmark to the urban areas.

The Greater Copenhagen Area is home to its own S-train system that runs on busy routes to and from the capital's surrounding areas, effectively bringing more areas into proximity of Copenhagen. In addition to this, Copenhagen also has a metro that currently spans 22 stations within the central areas of the city, with more to come.

Air and sea travel
Copenhagen (CPH), Aarhus (AAR), Aalborg (AAL), Billund (BLL) and Karup (KRP), with a number of smaller airport (e.g. SGD in Sonderborg) spread around the country serving various purposes (mainly domestic flights, with a few exceptions). In addition to this, numerous ferry routes with daily departures connect Denmark's many islands, including the popular islands of Samsø and Bornholm, the latter also has its own airport with several daily flights to Copenhagen and Billund.

Cycling in Denmark
It is hard to overlook the importance of bikes, and Denmark is known for its bike-friendly cities.
Bikes are an important part of many people's daily commute in Denmark, and therefore many urban development projects in Denmark take into consideration how conditions for cyclists can be improved. Encouraging cycling is part of Denmark's green transition, as it reduces traffic congestion in the cities while also improving public health.

For more information go to:
www.visitdenmark.com/search/planning

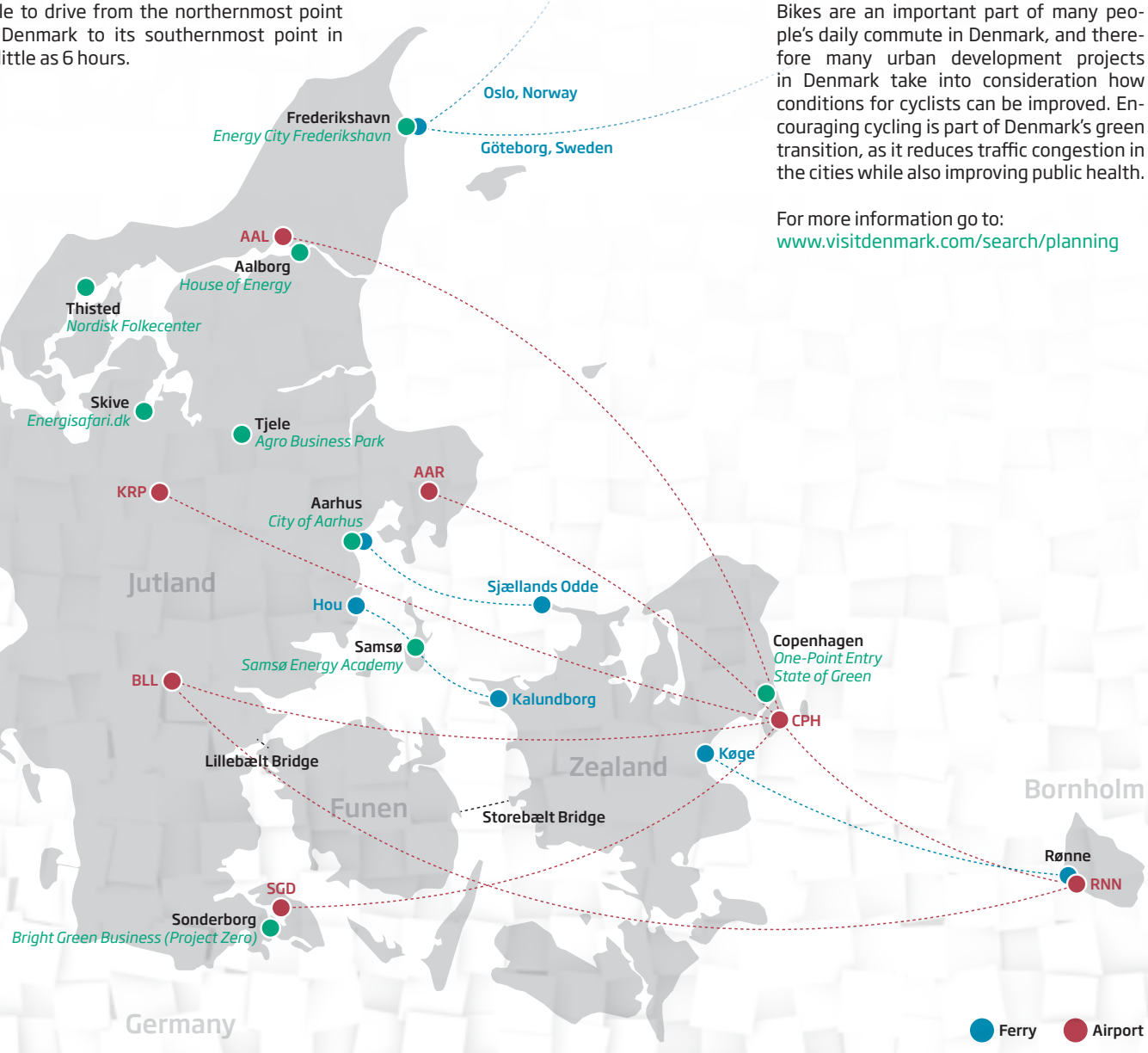

Image credit: State of Green

HOW TO DEVELOP A PIONEER SOCIETY

Identifying local resources for the sustainable transition beyond renewable energy

Twenty years of hands-on experience on Samsø - Denmark's Renewable Energy Island - has shown that developing sustainable energy systems depends on collaboration between the public, private, and citizen sectors through deliberate processes

How do we develop an "energy commons" within society? On the small agricultural island of Samsø, the local community is working to answer this question as pioneers at the forefront of the global transition to renewable energy.

Samsø: Denmark's Renewable Energy Island

In 1997, Samsø won a national competition hosted by the Ministry of Environment to become Denmark's Renewable Energy Island. The challenge: to systematically identify Samsø's local energy resources in wind, solar, and biomass, and to become 100% self-sufficient with renewable energy in 10 years using proven technology facilitated by public participation and the existing energy policy. By 2007, Samsø had become a self-sufficient energy exporter through the construction of land-based and offshore wind turbines, installation of biomass district heating plants and improvements in energy conservation and transportation. Local investment in the Renewable Energy Island project was key to its success. 70% of the total DKK 468,000,000 invested in the transition came from local investors.

Master Planning for Sustainability

Practical experience from renewable energy investments on Samsø has demonstrated that creating a sustainable energy system depends on collaboration between the public, private, and citizen sectors as well as deliberate processes for community participation. In 2007, the Samsø Energy Academy opened its doors as a public space for renewable energy development, focused on the new mission of creating partnerships, capacity building and connecting global initiatives to local ones to go beyond the original 100% renewable energy goal for the island.

"A strong, sustainable and robust community must share locality, activity and mentality!"

HERE - a guide for local pioneer communities, Samsø Energy Academy

After in-depth analysis of the Renewable Energy Island project, the Energy Academy developed a new Samsø 2.0 vision to make Samsø independent from coal, oil, gas, and diesel by 2030, identifying sustainable transportation as the next major challenge. The Energy Academy uses public participation to identify local energy resources that can help Samsø achieve the goal of becoming a fossil-free island and has developed tools such as "open space" and "shared space" forums and the Pioneer Guide to facilitate this process. For more information: www.pioneerguide.com

Samsø 3.0

The community of Samsø is still working beyond to go from "best practice" to "next practice" in sustainable development, both locally and abroad. Ongoing collaboration between the Samsø Energy Academy and the local municipality focuses on integrating the concept of "biocircular economy" into the island's agricultural systems, with a major local biogas project to fuel the municipally-owned ferry to Jutland in the works. Based on two decades of local experience and a wide range of international partnerships, Samsø Energy Academy is also currently working with the support of the KR Foundation to bring their planning and design process to other pioneer communities working internationally on community energy initiatives in Japan, Australia, Europe and the United States. Through creating a global network of renewable energy innovation hubs, Samsø seeks to shift the conversation from the technical "how" to achieve a global renewable energy transition, to a community-focused mindset of "why."

ENERGY ACADEMY ON SAMSØ

An information hub for community energy

Since their inception, the Renewable Energy Island and Samsø 2.0: Fossil Free Island projects have inspired countless other communities to strive to create their own renewable energy systems. Given the high demand for data and information about the projects' implementation on Samsø, all materials regarding Samsø's renewable energy transition including publications, audio and video, articles and reports are open-access and can be found on the Energy Institute website: http://arkiv.energiinstituttet.dk/

Image credit: Thomas Mølvig

Samsø Energy Academy, Samsø, Denmark

The Samsø Energy Academy is a non-profit organisation serving as a project house for many renewable energy and sustainable development projects on Samsø, including those related to the goal of becoming a fossil-free island by 2030. Designed by the Danish architecture firm Arkitema and built by local workers, the Energy Academy is home to the Samsø Energy and Environment Office, Samsø Energy Agency and the Samsø branch office of the Energy Service. It is geared towards providing a broad spectrum of energy counselling for public, commercial and private interests. Over 5,000 researchers, corporate representatives, politicians, students and renewable energy advocates visit the Energy Academy each year to take part in organised workshops, seminars and "energy tourism." From a position of education, knowledge-sharing and capacity building, the Energy Academy is also working to establish a network of energy self-sufficient local communities across the globe.

Samsø Energiakademi

Samsø 2.0: Fossil Free Island 2030

Going beyond renewable energy, Samsø's current vision is to be independent of fossil fuels by 2030, where the use of coal, oil, gas and diesel will be replaced by sustainable energy systems through cooperative efforts between the Samsø Energy Academy and the local municipality. The Samsø 2.0: Fossil Free Island 2030 masterplan lays out the major objectives for this transition. This includes the maintenance of Samsø's decentralised renewable energy system (wind, photovoltaic solar, bioenergy municipal heating and heat pumps), shifting the transportation sector towards goals, such as 50% local electric car usage and a ferry fuelled by locally produced biogas, and encouraging savings in electricity and heat consumption. Key to achieving the fossil free island vision is the active participation of local people in identifying their local energy resources and strong partnerships across the public and private sectors.

Samsø Energiakademi

Image credit: Erik Paasch Jensen

DRIVING THE GREEN TRANSFORMATION OF AARHUS

New climate action plan as Aarhus moves towards CO_2-neutrality by 2030

Aarhus is Denmark's second-largest city and the financial centre of the Central Denmark Region. The city has a catchment area of 1.2 million people within a one-hour travel range and is well-connected to Copenhagen and Hamburg

In close collaboration with the business community and Aarhus' many knowledge institutions, the City of Aarhus aims to reduce the city's CO_2 emissions, create intelligent solutions and encourage green growth. Innovative demonstration projects help ensure the exporting of homegrown climate solutions abroad, attract international investment and contribute towards the target of becoming CO_2-neutral by 2030.

Aarhus boasts a unique position in the global wind energy market, and the city is home to some of the world's largest manufacturers of wind turbines. In 2014, the city reinforced this position by establishing Incuba Science Park Navitas, a new and inter-disciplinary innovation centre within energy and environmental technology.

A green and energy-efficient city
The city's heating system is highly energy-efficient, and Aarhus is internationally renowned for its district heating system, in which heat and electricity production are combined to utilise the surplus heat from electricity generation in district heating. Over 95% of the inhabitants of Aarhus use district heating, resulting in energy-efficiency which not only benefits the environment, but also reduces private heating costs.

Many of the components in the system have been developed by Danish businesses, universities and other educational organisations that are leaders within their fields. For example, the city's more than 2,000 kilometres of district heating pipes suffer minimal heat loss, and with more than 53,000 intelligent heat meters placed directly with the consumers, a vast amount of data can be used to control and streamline heat production.

The potential of phasing in wind energy into the district heating system is huge, as the Aarhus area hosts a number of international market leaders and higher education centres within the field.

"Aarhus and the Central Denmark Region in general possesses a great deal of capacity and competencies that we can develop further in cooperation with partners from all over the world"

Mayor of Aarhus Mr. Jacob Bundsgaard

Wind in the heating grid
The high degree of efficiency of the district heating grid makes it possible to facilitate a transition to green energy over the next few years. Initially, the Studstrup plant north of Aarhus was converted in 2016 from coal to wood pellets, and a new straw-fired plant in Lisbjerg started production in 2017.

Looking ahead, the phase-in of wind energy into the heating system by 2030 will reduce dependence on biofuels. The development of new heat reservoirs, heat pumps and other technologies designed to provide better integration with the electricity grid will also contribute towards this goal.

A blue city
Aarhus has been a leader in the separation of rainwater and sewage for some years, which is also why increased rainfall does not pose a threat to the city infrastructure. In fact, more rainwater opens up the possibilities for developing new recreational areas in and around the city. Additionally, innovation is a big part of the water sector in Aarhus; through development of innovative processes, the project partners hope to demonstrate that Egaa wastewater treatment plant can generate 50% more electricity than it uses for daily operation and at the same time recover 50% of the phosphate load as a fertiliser with easy availability of nutrients.

CITY OF AARHUS

An innovative city
GoGreenWithAarhus is a platform for public-private partnerships and projects. More than 40 climate partners represent the local cleantech sector and science institutions, connecting science to business and generating new innovative products, business models and startups that can lead the green agenda of the future.

The aim of Go Green with Aarhus is to create an international showcase that will help pave the way for green growth in Aarhus.

Image credit: Ole Hartman Schmidt

Intelligent, sustainable and efficient water solutions in Aarhus

Located just a few kilometres outside Aarhus, Truelsbjerg Waterworks is an example of a new, innovative research and pilot project on how to develop the waterworks of the future.

The project for the Truelsbjerg Waterworks has been developed as a turnkey contract based on the utility company Aarhus Vand's ambitious vision for future waterworks. Aarhus Vand has allocated 7 million Euros to supporting the technical and architectural implementation of the project.

As something completely new, the 2,000 m3 clean water tanks are made of stainless steel and adjoined to the waterworks in a separate building constructed into a hillside and covered with earth. The technical facilities and the actual construction work was carried out with great respect for the surrounding environment and landscape.

Truelsbjerg Waterworks serves as Aarhus Vand's research and pilot facility where new technologies can be tested. The project focuses particularly on adaptable solutions, sustainability and flexibility in relation to supply structure and requirements on the quality of supplied water.

Aarhus Vand, Grundfos, SILHORKO,
Hoffmann, CUBO Architects, Moe , Xergi , NIRAS ,
DTU (The Technical University of Denmark) , VIA University

Green district heating for Denmark's second-largest city

One of the biggest biomass-fueled combined heat and power (CHP) stations in the world is located in Aarhus. The Studstrup plant began burning wood pellets instead of coal in the autumn of 2016, bringing green heating and electricity to more than 100,000 residents and businesses in the city, whilst reducing CO_2 emissions by 1 tonne per resident.

The switch from coal to wood pellets has not only resulted in the biggest total CO_2 reduction in Aarhus to date, but is also the biggest conversion to green energy in Denmark.

Furthermore, the city's Department of Waste and Heating built two massive electric boilers at the Studstrup power plant. These boilers can produce green district heating from electricity when the wind turbines are running at full capacity and electricity prices are low.

With an electricity capacity of 360 MW (condensation) and 515 MJ/s heat, Studstrup is one of the biggest biomass-fueled power stations in the world. The silo is 43 metres high, reaches a diameter of 70 metres and holds up to 65,000 tonnes of wood pellets.

DONG Energy, Waste and District Heating in Aarhus,
Rambøll, Ea, Energianalyse, MOE, Gottlieb Paludan Architects

Image credit: Ole Hartman Schmidt

A SHOWROOM FOR FUTURE ENERGY SYSTEMS

Create your green transition through Danish know-how and show-how

The Central Denmark Region is home to all major solutions, technologies, production plants and implementation sites concerning district heating and wind energy. This know-how is available to you through a customised specialist tour with Energisafari.dk

The region's clean energy infrastructure is the result of years of experience and research which has been transformed into the production and management of energy - for the benefit of both the environment and the economy at home and abroad.

District heating
Denmark has a history of district heating going back over 100 years. In 2007, district heating covered over 60% of Denmark's total heat requirement. In 2011, the Central Denmark Region received the District Heating Award for its extraordinary efforts to promote the use of renewable energy and district heating in the region as well as for backing several visionary projects that support conversion to renewable energy technologies. Most recently, a common strategic energy plan has been implemented for the entire region of central Denmark, linking the district heating plants in the eastern part of the region. The Central Denmark Region's many years of experience in this area makes it a first mover when it comes to know-how and technologies regarding energy efficiency, handling of big data, cooling, working with 4th generation district heating, energy planning and much more.

READY, an EU cross-border project based in Aarhus Municipality is looking at ideas such as heat recycling from wastewater and how recycled batteries can be used to store solar energy. The project will use relatively large housing areas to test theory in practice. The objective is to gain experience and develop business models that are realistically scalable when applied to even larger urban areas. READY also looks at how using surplus heat from cooling can help a hospital become self-sufficient in heat supply. The project's other focus areas are 'smart metering in district heating' and 'low-temperature district heating', all of which is being looked at in collaboration with leading companies and universities.

"The Central Denmark Region accounts for more than 50% of the total Danish exports of energy technology."

Source: North Denmark Region, Central Denmark Region, Region of Southern Denmark & Statistics Denmark

The Central Denmark Region has a number of inspiring and unique district heating plants such as Studstrupværket, Maabjergværket, Skive Fjernvarme, Silkeborg Fjernvarme and Brædstrup Fjernvarme. All of the plants enjoy international attention and are open for visits through Energisafari.dk.

Wind energy
Businesses in the Central Denmark Region have developed and manufactured wind turbines and components for the production of renewable wind power for over 40 years. Most of Denmark's trade in wind technology is generated in this region. Several of the largest wind turbine manufacturers in the world, such as Vestas and Siemens Wind Power, are based here. Consequently, it is home to a very strong wind power industry, with all the associated sub-suppliers also being based here and a vast amount of expertise in the implementation of wind projects at all levels concentrated in the region.

The abundance of expertise and experience gathered here means that it has become an area, where you can find technologies and practises from all stages of production surrounding wind turbines and management of wind energy. The world's largest wind turbine to date was developed in this region. Based on know-how from the production of large wind turbines, companies such as KVA Vind A/S and Solid Energy A/S have developed and produced small, specialised wind turbines. These turbines can run off-grid, boast a unique design and operate in rough, remote areas without electricity.

Energisafari.dk's aim is to showcase green transition initiatives and solutions through state-of-the-art cases and know-how from the Central Denmark Region.

ENERGISAFARI.DK

Energisafari.dk is a non-profit organisation that aims to showcase solutions from the Central Denmark Region to interested delegations. The region is home to a number of companies and research centres, in which a great deal of know-how in the fields of district heating and wind energy is concentrated.

Mutual collaboration
Through collaboration with private and public companies, energy companies, research centres, universities and local authorities, Energisafari.dk can customise a tour programme tailored to any delegation's objectives, needs and requirements.

Image credit: Vestas

Denmark's largest wind turbine farm combined with land-based solar park

The west coast of Denmark is where the world's wind industry was born. In the municipality of Ringkøbing-Skjern, a number of local companies and internationally well-known companies have built a full-scale demonstration plant for wind and solar energy. The plant is the largest wind turbine park and land-based solar park in Denmark and demonstrates how to generate a balance of wind and solar energy for the Danish energy system. It covers 26.5 hectares and produces 15MW and 15 kWh of power per year.

The project was planned and supported by the municipality, and in 2013, 20 local investors erected 22 turbines, towering 150 m into the air and producing enough power to cover the needs of 57,000 households. The municipality carried out the project in collaboration with its citizens and thereby avoided years of delay due to public disruption. This model of public involvement is an outstanding example of how to simplify the process of implementing a wind farm in active cooperation with the local community and by creating co-ownership with the public.

Vestas, Municipality of Ringkøbing-Skjern, BroCons

Demonstration of future district heating system with solar energy and heat storage at Braedstrup District Heating

Braedstrup Cogeneration Plant has many years of experience in integrating solar heat into the district heating system. The system consists of solar panels, seasonal storage and heat pumps, amounting to an annual production of 8,700,000kWh, which corresponds to 20% of the total annual production. This enables Braedstrup District Heating to be one of the cheapest suppliers of district heating in Denmark.

Braedstrup District Heating was the first company to implement the borehole storage technology in Denmark. The store consists of 48 boreholes that are 45 metres deep. Hot water powered by solar heat is pumped into a pipe system to heat the store's 19,000 m3 of soil. In the winter, the store's temperature drops by 20% and is therefore boosted by a newly-developed heat pump. The pump is an ammonia-cooled screw compressor, developed in collaboration between Braedstrup District Heating and Johnson Controls, and it sets new standards for huge heating pumps used in district heating.

Braedstrup District Heating, Johnson Controls ,
Arcon Sunmark, Plan Energi, Horsens Municipality,
VIA University College, Horsens, Per Aarsleff A/S

Image credit: Planenergi.dk

ENERGY CITY FREDERIKSHAVN 100% RENEWABLE

From importing fossil energy to local green energy and job creation

The vision for the local council in Frederikshavn is to transition to 100% renewable energy by 2030 in the municipality as a geographic area. The main goal for this vision involves local renewable energy production followed by local job creation

To realise this in practice, the project 'Energy City Frederikshavn' was created in 2007. Energy City Frederikshavn is a business development project initiated and owned by the local council in the municipality of Frederikshavn.

The roadmap for this transformation in practice is described in the 'Masterplan 100% Renewable 2030'. It includes an annual evaluation followed by different specific actions. Three main tools are used to implement the transformation:

- Energy production based on local renewable resources
- Energy reductions
- Energy optimisation

The transformation from fossil energy sources to green energy is estimated to cost 1 billion Euro. All the individual projects are financed privately, which makes the plan financially sustainable.

The transition in practice

The local university, Aalborg University, has been involved in the transition since the early days of the project by designing different energy scenarios, and is still participating today through quality assurance of the annual evaluation of the progress that has been made.

A broad range of initiatives are needed for this renewable energy project to be successful:

"Energy sites can be seen in a 1:1 scale in Energy City Frederikshavn. The visits are organised through collaboration with embassies and trade associations"

Poul Rask Nielsen
Project Director
Energy City Frederikshavn

Currently, district heating is one of the main tools in the transition from fossil fuels to green energy. Approximately 67% of the buildings in the municipality are heated by district heating. There are 10 district heating companies in the municipality, which provide a very flexible system for using different types of heat sources: Surplus heat from waste and industry, cheap electricity from wind turbines, solar panels, local straw, wood chips and biogas. Finally, the companies also use natural gas, which is going to be out phased in a few years. It will be replaced by energy storage, more solar panels, heat pumps and surplus heat from industrial plants, along with an expansion of the heat grid. All the 10 district heating companies are owned by the citizens in the cities and villages.

Transportation is the main headache, and from the beginning the idea has been to trial upgraded biogas as a pilot project, mainly as a fuel source for regional and local buses. Waste trucks and a few of the municipality's own cars were included in the project in 2017. The next big step will be the establishment of a liquefied natural gas (LNG) and liquefied biogas (LBG) terminal at the harbour of Frederikshavn.

Energy reduction is another primary focus area. There is a close collaboration with the local bank, craftsmen, energy advisors, real estate agents, private householders and social housing companies to launch and start energy renovation projects. The incentives differ; energy loans offered by the local bank make it easier to sell renovated, energy-efficient houses, for instance, while social housing companies have successfully been working with their tenants' behaviour and awareness of their consumption patterns by allowing them to keep track of their consumption of heat, electricity, water and humidity on digital panels, leading to cost savings through a reduction in energy consumption.

ENERGY CITY FREDERIKSHAVN

The purpose of Energy City Frederikshavn is to attract businesses and investors, support local businesses, offer test and demonstration facilities, host delegation visits, participate in export promotion events and international renewable energy conferences . The main goal is not to sell products, but rather to show and document how the municipality's installations function and work in practice in the smart energy system (technology and grid). In 2016, it received one of the most distinguished Danish awards in the field of sustainability, the Sven Auken Prize.

Image credit: MAN Diesel & Turbo

Sharing the surplus heat

In Frederikshavn, there is a partnership between MAN Diesel & Turbo and Forsyningen (the local district heating company), which involves delivering surplus heat from MAN's test centre in Frederikshavn. The heat consumers in the area benefit from the surplus heat.

At MAN Diesel & Turbo, the surplus heat generated from the test centre's water cooling systems, exhaust gas and electricity is converted to hot water, which heats up 250 private homes in Frederikshavn.

Recycling energy from the test centre results in:

- Reduction of energy waste
- Reduction of water consumption
- Reduction of CO_2 emissions

"MAN Diesel & Turbo is proud to contribute to a more sustainable society. We are working on ways to better exploit the use of surplus heat that our test centre generates when testing engines. We expect there to be more activity at the test centre, which will increase the heat production. We hope that in the future, MAN Diesel & Turbo will account for 15-20% of the heat production for the district heating company in Frederikshavn, a symbiosis that makes sense," says Poul Knudsgaard, Director for MAN Diesel & Turbo in Frederikshavn.

MAN Diesel & Turbo, Danish Branch of MAN Diesel & Turbo SE, Germany, www.mandieselturbo.com
Frederikshavn Forsyning A/S, www.forsyningen.dk

Green transportation

A collaborative partnership between Frederikshavn Municipality, the North Denmark Region, Aalborg Municipality, North Jutland Transport (NT) and HMN Natural Gas has been formed to introduce biogas for public transport in the north of Jutland.

The first stage was the opening of a regional bus connection between Frederikshavn and Aalborg and the establishment of a biogas station in both cities. The next stage incorporated city buses in Frederikshavn, part of the municipal vehicle fleet, and finally the local waste company into the project, using waste trucks driving on biogas.

"Four of our waste trucks run on biogas, which is a big step in terms of reducing CO_2 emissions, since biogas is a CO_2-neutral energy source. Aside from the environmental benefits, the biogas-fuelled waste trucks also make less noise", says the director for the waste company, Tore Vedelsdal.

The next step will be the establishment of an LNG/LBG terminal at the harbour of Frederikshavn, which can service the 100,000 container ships passing through every year. This will amount to a significant step in reducing CO_2 emissions.

HMN Naturgas, www.naturgas.dk
NT, Nordjyllands Trafikselskab, www.nordjyllandstrafikselskab.dk
Frederikshavn Kommune, www.frederikshavn.dk
RN, Region Nordjylland, www.rn.dk
Stiholt Sæby, www.scania.com/dk/da/stiholt
Frederikshavn Forsyning A/S, www.forsyningen.dk

Image credit: Energibyen

HOUSE OF ENERGY – THE NORTH DENMARK ENERGY CLUSTER

Creating innovative green energy solutions through collaboration

House of Energy is an energy cluster located in the North Denmark Region. House of Energy works within five focus areas: district heating, wind power, green gases, energy-efficient solutions and integrated energy systems

Welcome to Denmark and the North Denmark Region. Denmark as a whole as well as the region in particular is a dynamic, world-leading lab that develops innovative, green energy solutions. The region is home to large manufacturing companies as well as an ecosystem of subcontractors for the energy sector. It is known for well-established partnerships between industry, research institutions and the public sector. Furthermore, it is known for special facilities and a geographical location that provides unique opportunities for the testing and demonstration of energy technology. House of Energy is a single point-of-entry to a region where you will find:

- One of the world's largest solar heating systems, located at Dronninglund District Heating Plant. The solar heating system covers an area of 37,500 sq. m.
- The world's largest wind turbine, located at the test centre Østerild. The test centre can test up to seven large wind turbines at a time with options for testing turbines with a total height of up to 250 metres.
- One of Europe's biggest hydrogen production plants, located at Hobro. The facility is designed to deliver hydrogen to 1,000 fuel cell vehicles.

Furthermore, Aalborg University, a House of Energy partner, has 400 energy researchers developing the intelligent energy solutions of the future. For example, researchers at Aalborg University have written key parts of the EU Strategy on Heating and Cooling and are used as advisors by the EU Commission.

"House of Energy includes among its membership several foreign companies that have established themselves in Denmark to initiate production in areas such as hydrogen and fuel cell solutions."

Preben Birr-Pedersen,
Cluster Manager, House of Energy

Cooperation is key
Manufacturers, suppliers, advisors, consulting engineers, district heating utilities, scientists and energy suppliers are all members and meet often in House of Energy. They network, share know-how and implement state-of-the-art solutions in Denmark and abroad.

The common goal is to phase out fossil fuels in favour of sustainable energy sources. This ambition corresponds to our region's collective and ambitious environmental goals, and as a result, it has created an energy industry with great potential in Denmark and abroad.

As a business partner, House of Energy is dedicated to helping its members export their solutions to the world, while at the same time bringing the world to Denmark and the North Denmark Region. House of Energy also assists with funding.

House of Energy
– a single point-of-entry
House of Energy consists of 400 energy researchers from Aalborg University and 400 member-companies. Every year, the secretariat of House of Energy visit 200 members, which results in a close collaboration and up-to-date knowledge about the actors in the energy sector. This knowledge enables House of Energy to customise visits to the North Denmark Region as well as other parts of Denmark. Furthermore, it enables them to present companies' competences and state-of-the art solutions to visitors all over Denmark.
Essentially, House of Energy provides a point-of-entry and overview of the competences and resources within the field of energy that you can find in Denmark.

HOUSE OF ENERGY

Your one-stop-shop to a collaboration within the field of energy
House of Energy is an energy cluster located in the North Denmark Region. House of Energy operates within the field of energy systems and technologies, dedicating special focus to district heating, wind power, green gases, energy-efficient solutions and integrated energy systems. House of Energy's goal is to create new products and solutions, more businesses and jobs and increase sales and exports. Read more at house-of-energy.dk/en

Image credit: Hydrogen Valley

One of Europe's biggest hydrogen facilities under construction

By the end of 2017, Northern Denmark will be producing renewable hydrogen, thanks to key players that have joined forces via the EU-funded project HyBalance to convert wind power into hydrogen. The hydrogen will be used for clean transportation and in the industrial sector, and will help balance the Danish electricity grid.

Foreign countries have begun to take notice of Denmark's expertise and ambitions in the field of renewable energy. This also applies to the specific know-how in North Jutland in terms of how hydrogen can play a role in future energy systems. The city of Hobro in North Jutland is the location for this innovative project.

As a result of the HyBalance project and owing to the location of the facility, the decision was made to invest in three hydrogen buses in North Jutland in 2018. The buses will use hydrogen produced by the HyBalance advanced hydrogen plant.

Ballard Power Systems Europe in Hobro is one of several companies in North Jutland that will benefit from the project. The company specialises in integration and servicing of fuel cell systems such as those used in hydrogen buses.

EU's Fuel Cell and Hydrogen Joint Undertaking and ForskEL, which is administered by Energinet.dk

One of the world's largest solar thermal plants

Dronninglund District Heating Plant invested in a renewable energy system to phase out 50% of their yearly consumption of fossil fuels, a decision that turned this district heating plant into one of the world's largest solar thermal plants.

The plant consists of a heating water storage facility containing 60,000 m3 of water as well as 2,982 solar panels covering an area of 37,573 sq. m. The plant supplies 1,350 households with heat, and the solar thermal system accounts for 50% of the yearly heat production.

The benefits of solar panel energy

The excess heat, which is produced in the summer is used to heat the water storage, thereby creating a heat storage for colder periods. The system is easy to operate and has low operating costs. Because of the new plant, the heating price for a standard household dropped by 265 Euros annually.

Cooperation within the cluster

Several member companies provided important products and advice in connection with the construction of the solar thermal plant.

Arcon-Sunmark, Dronninglund District Heating Plant, NIRAS A/S

Image credit: Dronninglund Fjernvarme

NORDIC FOLKECENTER FOR RENEWABLE ENERGY

Working for a world running on 100% renewables since 1983

Nordic Folkecenter is a non-profit organisation that provides research, development and testing of technology, training and information to promote the implementation of renewable energy technologies and energy savings in Denmark and internationally

Nordic Folkecenter's aim is to achieve measurable increases in the utilisation of renewable energy technologies and thereby significant reductions in environmental pollution in Denmark and elsewhere. The ultimate long term goal is a complete replacement of fossil fuels and atomic power with renewable energy sources, while promoting the sustainability, resilience and development of local communities around the world.

With this objective in mind, the centre works on 3 major fronts:

1 - Development and implementation of renewable energy systems and energy policy recommendations
Nordic Folkecenter carries out research and development projects in collaboration with Danish and international universities, research centres, small and medium enterprises (SMEs), Mali Folkecenter, and Uganda Folkecenter. New energy solutions, tools for local authorities and energy policy recommendations are some of the outcomes of these projects.
The testing facilities of Nordic Folkecenter play an important role in technology and system development projects. Testing possibilities include small wind turbines, wave energy technology, solar photovoltaic panels, solar thermal collectors, sustainable transportation (fuelled by hydrogen, biofuels and electricity) and off-grid solutions, among others. Furthermore, Nordic Folkecenter is an accredited certification centre for small wind turbines.
The organisation is well-regarded for its technological expertise and dissemination of best practices both in the Global North and the Global South.

2 - Support and consultancy to manufacturers, local citizen/consumer groups and relevant initiators within renewable energy
Nordic Folkecenter supports SMEs in product development and testing, idea-to-market processes, funding applications, market analysis, business strategy, internationalisation, training of staff and teams, networking and event organisation.
Nordic Folkecenter also advises local citizen/consumer groups on local energy projects, local energy planning and suitable technology choices.

3 - Information and training in renewable energy in Denmark and elsewhere to trainees, concerned citizen groups, SMEs and political decision-makers
Thousands of visitors come to Nordic Folkecenter every year to see the demonstration facilities at the Village for Green Research, for which guided tours may be booked. Visitors often arrange meetings and interviews with the energy experts at Nordic Folkecenter.
The centre organises and hosts conferences, seminars and workshops attendeded by speakers, trainers and audiences from Denmark and abroad. These events are often part of or combined with study tours to renewable energy installations, companies and local administrations in the Green Circle of 100% Renewable Energy.
Since 1986, Nordic Folkecenter's Trainee Programme has attracted hundreds of young people with different backgrounds from all over the world that want to improve their skills and knowledge within the field of renewable energy.
Furthermore, Nordic Folkecenter publishes informative material (books, reports, brochures, etc.) and is present in the Danish media and public discourse.
The organisation is also very active in national and international renewable energy networks, where the focus is on informing and advising decision-makers.

"Everyone who works with renewables should visit Nordic Folkecenter at least once in their lifetime"

NORDIC FOLKECENTER FOR RENEWABLE ENERGY

Decision-makers, researchers, businessmen, professionals in the field, entrepreneurs, concerned citizen groups, students, journalists... more than 6,000 people from Denmark and abroad visit Nordic Folkecenter every year to learn about and discuss renewable energy.

The centre is well-known among people working in the renewable energy field all over the world, and it is considered a reference point for many of them.

Image credit: Nordic Folkecenter for Renewable Energy

The Green Circle of 100% Renewable Energy, a full-scale implementation

All types of renewable energy sources are present within a radius of 15 km from Nordic Folkecenter: Big wind turbines, household wind turbines, large-scale solar district heating, solar energy in households (PV panels and solar thermal collectors), single-farm-size biogas plants, biomass-fired CHP and boilers in district heating plants, biomass gasification, power-to-heat (in district heating plants and in households), large electric boilers in district heating plants and technology providers (household wind turbine producers and highly-efficient window manufacturers).

Expanding the radius up to 50 km, it is possible to find even more examples: The national Test Centre for Big Wind Turbines, the Wave Energy Test Centre in Hanstholm, geothermal energy for district heating, large heat pumps for district heating, waste-to-heat for district heating, large-scale biogas plants, district cooling and technology providers (such as an architectural firm specializing in nearly zero-energy buildings and passive house concepts).

The Village for Green Research

Nordic Folkecenter's living lab demonstrates practical examples of integration of several energy solutions as an experimental and functional example of a future green society. Facilities include a small-scale energy system where electricity, heating and transportation are integrated; test centres for small wind turbines, PV panels and wave energy; a small district heating system with CHP, an electric boiler, a biomass boiler, heat pumps and solar collectors; a control system that ensures the best utilisation of the excess power for heating; the centre for e-mobility and green transportation, including pure plant oil and hydrogen; 4 nearly zero-energy buildings which use different concepts of solar housing; the Biodome (a resource-efficient concept for agriculture); 3 different types of biological water cleaning facilities; a permanent exhibition about the history of wind power; solutions and information about energy solutions for developing countries; and a conference hall with a capacity of 150 people, ideal for conferences, seminars, workshops and meetings.

Image credit: Nordic Folkecenter for Renewable Energy

GREATER COPENHAGEN: SPURRING SMART CITIES

Walking the talk - urban sustainability and the smart city of tomorrow

Ambitious green goals, efficient 3P models and state-of-the-art technology are turning Greater Copenhagen into a green growth catalyst and an ideal living lab for showcasing the smart, green and liveable city of tomorrow

Urbanisation and climate change represent major challenges for cities around the world. Cities are growing, and so are the challenges to make them liveable. Greater Copenhagen is a frontrunner within sustainable urban development, as well as a world-leading hub for smart city technologies and concepts, and represents an ideal model for how smart sustainability, growth, and quality of life can go hand in hand.

Frontrunner in green and smart growth
An ambitious green agenda at both national and local levels has sparked a strong commitment to a comprehensive green transition in Greater Copenhagen. As a result, cities in the region can present a number of leading-edge competencies from policies, strategies and planning, to innovative 3P solutions and implementation of smart urban development schemes.

In Greater Copenhagen, cities are combining sustainability and liveability with technology and innovation. Through public-private cooperation and long-term holistic planning, the region can showcase state-of-the-art approaches on how to rethink urban development and implement urban solutions that not only make cities prosperous, but also healthy, smart and attractive places to live.

Greater Copenhagen's ecosystem of living labs
Greater Copenhagen's approach to realising a green transition is through 1:1 test facilities and 3P models. One-Point Entry is the one-stop service facilitator and matchmaker of international interests with regional demonstration projects and solutions, some of which include the following:

- DOLL – world-leading living lab and test centre for smart city solutions and intelligent LED-lighting
- Copenhagen Solutions Lab – innovation hub for smart city development and winner of the World's Best Smart City award for its concept Copenhagen Connecting
- Climate-Smart Hyllie – a global role model for sustainable urban development in Malmö, incorporating everything from smart energy infrastructures to climate-resilient green-blue oases
- EnergyLab – a leading full-scale smart city energy lab for future energy solutions
- Vinge – the city of the future epitomising the spirit of IoT with digital infrastructure and smart city solutions

This ecosystem of living labs provides international showrooms for the industry to accelerate public demand for new, green and smart technologies. In addition, it brings valuable research and knowledge into play with industry and society and ensures possibilities for increased citizen involvement.

"Greater Copenhagen has numerous showcases for delegations looking for plug-and-play solutions and for those interested in R&D and testing facilities."

Claus Lønborg,
CEO of Copenhagen Capacity

Ultimately, it creates smarter and more sustainable solutions through co-creation. In Greater Copenhagen, creating the smart and liveable city of tomorrow entails a public-private partnership approach with companies, regional decision-makers, planners and developers by using the city as a showcase lab for relevant solutions.

ONE-POINT ENTRY

A single point of entry to Greater Copenhagen
One-Point Entry is a professional entry-point for international delegations to Greater Copenhagen, a metropolitan region of 4 million inhabitants spanning Eastern Denmark and Southern Sweden. The main objective is to introduce visitors to the region's core competencies and expertise in a professional manner that promotes growth and creates value for the visitors, as well as the region, by engaging leaders, industry experts, 3P solutions, public authorities and the strategies supporting them.

Image credit: Magnus Franzén, Highshot

Climate smart Hyllie - a global role model for sustainable urban development

Hyllie is a scalable, 3P demonstration project that seeks to set an example internationally for testing and developing the new large-scale solutions and smart systems of the future. Malmö city, E.ON and the municipal authority VA SYD has signed a climate contract turning Hyllie into a zero-carbon district where the energy supply will consist entirely of renewable or recycled energy by the end of 2020. The project embraces a holistic approach to resource-efficient structures and involves integrated smart grids for a sustainable energy system.

Malmö is testing various "green tools" for cities to adapt to climate change, using Hyllie as the demonstration site to test and show solutions in a 1:1 scale and in real time. The project incorporates liveable blue-green infrastructures and design tools for managing global challenges and environment-related risks, such as open storm-water systems, green facades and green roofs to make Hyllie climate-resilient and at the same time enhance urban liveability.

City of Malmö, E.ON, SYSAV, VASYD

DOLL Living Lab - living laboratory for lighting and Smart City-solutions

Greater Copenhagen is a smart city frontrunner and home to a number of well-established living labs, encompassing municipalities, companies and universities. Lighting Metropolis is the first decisive step to realising a vision for Greater Copenhagen as the world's leading living lab for intelligent urban lighting and smart urban services.
Danish Outdoor Lighting Lab (DOLL) set out to create an innovative playground and transparency in the new complex markets. Since its opening in September 2014, DOLL Living Lab has demonstrated the industry's newest smart solutions in a full-scale real-life urban environment. The role of DOLL is primarily to support decision makers and city planners when deciding on outdoor intelligent lighting and Smart City solution as well as enable private providers of urban infrastructure, components and services to test and demonstrate new solutions in full scale.

DOLL Living Lab features:

- 80 unique solutions within outdoor lighting and Smart City technologies
- 435 LED-light sources
- 40+ partner companies
- 16 control systems
- DOLL Sustainable Lighting Park with self-powered lighting solutions
- A Cisco City WiFi creating access to all solutions.

Gate21, Albertslund Municipality, DTU Photonics
More than 40 different companies are showcasing their solutions in the lab, including Cisco, TDC, DONG Energy etc.
The full list can be found here:
www.lightinglab.dk/Living-Lab/Living-Lab-Partnere/

Image credit: Jeppe Carlsen

ENERGY EFFICIENCY AND WORLD-CLASS PRODUCTION OF RENEWABLE ENERGY

The Sonderborg area is a frontrunner on climate change and will be CO_2 neutral by 2029

Since 2007, its citizens, businesses and politicians have focused on implementing solutions rather than just talking about them. A public-private partnership - ProjectZero - was created to inspire and drive Sonderborg´s transition to a ZEROcarbon community by 2029, which already in 2017 had led to 37% reduction in CO_2 emissions for the entire area

Sonderborg's CO_2 reduction is the result of a coordinated effort
Climate change is an important issue to citizens of Sonderborg. The entire Sonderborg area is involved in the vision of creating a CO_2-neutral growth area by 2029, creating and demonstrating new solutions, robust measurable CO_2 reductions, new green jobs and a talented generation of young people. This initiative includes improved energy efficiency, conversion of energy sources into renewables and participation of all stakeholders to reach the municipality's ambitious goal: CO_2-neutral growth and sustainable urban development.

"On our journey towards a CO_2-neutral society, we share our experiences and showcase what we have done to increase Sonderborg's energy efficiency and production from renewables."

The new solutions being implemented in Sonderborg includes everything from houses that produce more energy than their residents consume, green district heating and ZERO+ companies, shops and schools. The city's residents are also collaborating on new green investments while farmers are erecting their own wind turbines, demonstrating the broad support for the ProjectZero vision among the local community.

Energy efficiency and renewable energy demonstration
On its journey towards a CO_2-neutral society, Sonderborg is sharing its experiences and showcasing what is being done in the municipality in connection with its pursuit for increased energy efficiency and production from renewable energy sources. Sonderborg offers guided tours, which can be tailored to meet the needs of the visiting delegations, and combines ideas and practice through so-called "show-how" throughout many of the area's energy-efficient facilities.

Tours are planned in cooperation with leading companies, the municipality, energy companies and knowledge institutions across the areas of CO_2 neutrality, waste management and recycling, district heating, bioenergy, wind energy, solar power, heat pumps, city planning, citizen involvement, energy-efficient buildings and energy renovations.

ProjectZero and SmartEnCity
ProjectZero is the the name of the vision to make the entire Sonderborg area CO_2-neutral by 2029. Through partnerships and by sharing solutions, ProjectZero aims to help make Denmark a global leader in CO_2-neutral growth and sustainable cities. Sonderborg continues to seek collaborations on new technologies, offshore wind turbines and climate-friendly projects.

The concept is based on energy efficiency improvements combined with renewable energy from the area´s own green sources, all of which is documented in the ProjectZero Masterplan. All stakeholders in the area are involved in the execution of ProjectZero, actively participating and sharing in the responsibility. The new climate solutions will demonstrate best/next practice and establish a market revolving around a growing demand for 'Bright Green Business'.
Several (local) companies have achieved two-digit growth figures on climate and energy technology/solutions. In spring 2010, Project Zero won the EU Commission's 'Sustainable Energy Communities' award, and Sonderborg is part of the Horizon 2020 SmartEnCity Project to develop smart solutions relating to mobility, energy saving and ICTs for the improvement of citizens' quality of life.

BRIGHT GREEN BUSINESS (PROJECT ZERO)

Putting Sonderborg on the path towards a ZEROcarbon society required changing the local community´s way of thinking and acting. Based on a "seeing is believing" approach and believing that change spreads like ripples on water, ProjectZero and its partners have developed a number of important showcase demonstration sites. These sites allow visitors to be inspired by best practices from local cases in the hopes that they will be replicated elsewhere.

Image credit: ProjectZero

100% CO_2-neutral district heating plant

In Graasten, the local district heating company has undergone a transition to a combined solar heating and biomass production that enables it to supply its customers with 100% CO_2-neutral district heating. The existing solar heating plant covers 16,000 sq. m of solar panels, but there are plans to nearly double its size to 30,000 sq. m. Solar heating currently accounts for 28% of Graasten District Heating's total heat production. In addition to this, the plant has a straw kettle that produces heat during the winter, when the solar heat production is low. The kettle is also designed to run on wood pellets to accommodate periods with a low supply of straw. To further limit the negative impact on the environment, the kettle is equipped with a DeNOx plant that significantly reduces NOx in the flue gas. Parts of the district heating plant's façade is covered with photovoltaic solar panels that produce app. 70,000 kWh pr. year, making the plant's energy consumption as green as possible.

SEG A/S, Arcon-Sunmark

Utilising geothermal heat for district heating

Sonderborg District Heating, along with the Danish District Heating Association and DONG Energy worked closely together on the establishment of a geothermal heating plant in Vestermark, Sonderborg. The plant utilises geothermal heat to supply district heating to the local community. By drilling two wells down to the geothermal reservoir, the water can be pumped up through one well so that the heat can be transferred to the district heating network, and the cooled water is pumped back to the reservoir through the second well.

The subsoil of Sonderborg is promising in terms of its potential geothermal energy, but also from an environmental, security of supply and economic point of view, geothermal energy is an attractive addition to district heating in Sonderborg.

Sonderborg District Heating, DONG Energy,
Dansk Fjernvarme Geotermisk Company (DFG),
Siemens Flow

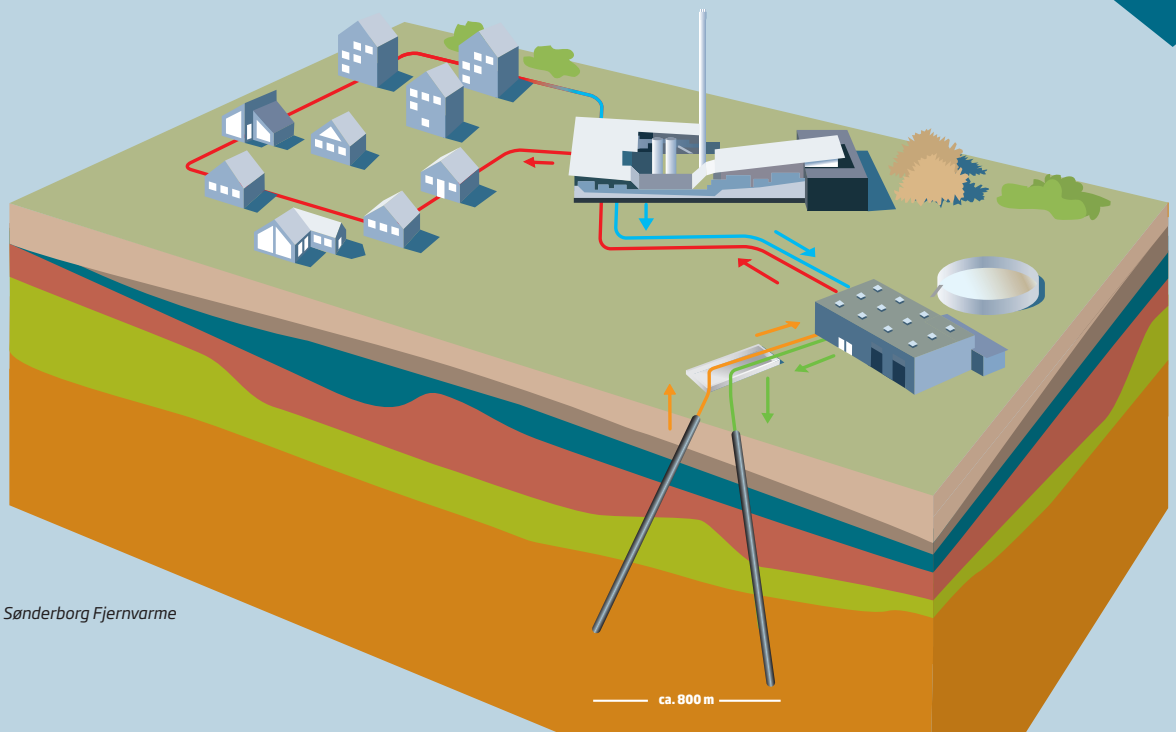

Image credit: Sønderborg Fjernvarme

DANISH AGRI-FOOD AND BIOENERGY SOLUTIONS

Access one of the most sustainable food and agricultural producing countries

The Danish agricultural sector is among the most efficient and knowledge-based in the world, producing high quality food products with minimal impact on the environment. Denmark is a global leader in livestock production, organic farming, food safety, bioenergy and waste handling

Agro Business Park is a cluster organisation working with innovation, incubation and investment activities at a national and international level. Agro Business Park focuses on supporting innovation processes, entrepreneurship, networking, commercialisation and business development in the bio-based economy, which includes agriculture, food, environmental technologies, biomass and bioenergy.

Much more than wind

Denmark is perceived by many as a wind-powered country. However, figures show that 2/3 of the renewable energy produced in Denmark comes from biomass and waste. Danish agriculture plays an active role in producing and securing sustainable energy sources. About 1/3 of the straw production is used in central heating and energy production, along with mainly wood and wood chips.

"Agro Business Park and INBIOM invites foreign stakeholders to get a first-hand experience of the Danish agri-food and bioenergy sectors"

Lars Visbech Sørensen,
CEO of Agro Business Park.

Biogas production is based on organic waste products, such as slurry and organic waste from industries, restaurants and homes. Biogas can be used as a fuel or to replace natural gas in central heating and electricity production. The residues from biogas production can be used as fertilisers, thus recycling plant nutrients while jobs are created locally.

Agro Business Park is the operator of the Danish Innovation Network for Biomass (INBIOM), an industry network that includes the majority of the Danish biomass to bioenergy stakeholders.

Agribusiness technology - Showcasing how Denmark became world leaders in sustainable pig production

The Danish agribusiness sector covers a wide array of innovative companies. High-tech machinery for use in the field, in stables and in other parts of the value chain is essential for productivity, sustainability and high-quality outputs. Advanced equipment to monitor food products, such as dairy and meat, during production enables homogenous quality and high food safety. Grain analysis by instruments developed and manufactured in Denmark ensures fair payment for farmers around the world. Animal breeding is another example of successful Danish agribusiness. The number of piglets per sow in a year has increased by 36% in 15 years, while the fat concentration has decreased by 30% since the 1970s.

Safe and sustainable - Experience Danish food products and solutions

Denmark is recognised internationally for its food safety. From farmer to supermarket, all products are traceable. This system makes it simple to control each part of the value chain. In case of irregularities, affected goods can be traced and withdrawn immediately, and corrective action in the previous parts of the value chain can be taken. The production of food and agricultural products is highly regulated. Most of the regulation is based on EU regulations, and often these rules are interpreted and implemented stringently in Denmark, leading to even higher standards. The areas of regulation include hygiene, animal welfare, medication, pesticides and fertilisers.

AGRO BUSINESS PARK

Our network, dedication and industry knowledge are our key assets

Through our wide network in the Danish bioeconomy ecosystem, Agro Business Park can help you find the right solutions, technologies and contacts in Denmark. This includes:

- Finding new knowledge from Denmark
- Identifying potential business partners and technologies
- Finding relevant scientists and researchers
- Putting together meeting programs and organise visits and tours to Danish bioeconomy sites
- Providing market reports based on your specifications

Image credit: Gemidan

Manufacturing high-quality biopulp from multiple organic waste sources

Since 2012, Gemidan has developed and improved a new pre-treatment technology to process source-separated food waste and produce high-quality pulp for Anaerobic Digestion (AD) plants producing biogas and fertilizer. For the past six years, the Gemidan facility in Holsted, Denmark has been testing and refining its ECOGI pulping system. During the last four years, the facility has also operated at commercial scale.

Following a Danish public procurement process, Gemidan Ecogi has now secured a contract to establish a 24,000 tonnes-per-year facility to process waste collected from six municipalities in South Zealand. Once operational, the plant will produce a high-quality pulp-based substrate, which will be distributed to local AD facilities. The site benefits from an onsite waste-to-energy operation and a supply of processed water from a nearby water treatment plant. Pulp from the new facility will mainly be used to generate clean biogas for the Danish natural gas grid, making it more sustainable.

Gemidan Ecogi A/S, www.ecogi.dk

Green Transition with Aalborg Energie Technik (AET)

AET is a leading engineering and contracting company supplying and servicing biomass-fired plants up to 170 MWth and with a solid reputation across Europe. The well-proven AET Biomass Boiler and AET Combustion System are based on more than 30 years of experience with steam generation and biomass combustion. The plants combust all kinds of biomass, i.e. wood, demolition wood, dust residues, agro residues, railway sleepers, MBM and poultry litter.

In the city of Randers (≈ 60,000 citizens), AET have performed a fuel conversion and boiler upgrade on a district heating plant. The two 95 MW boilers are able to burn 100% biomass fuel,100% coal or any combination of these. A similar fuel conversion has been implemented, also with AET Combi Spreader Stokers, in Rønne.

At other sites in Denmark, AET has supplied other types of services, such as emissions reduction (i.e. AET SNCR deNOx), control systems and combustion improvements.

Aalborg Energie Technik (AET), www.aet-biomass.com

Image credit: Jens Muff Hansen

Learn more about the Tours Network, Danish solutions, find more cases from around the world and connect with Danish expertise at:

www.stateofgreen.com/tours-network

State of Green is a non-profit, public-private partnership founded by:

Confederation of Danish Industry

DANISH ENERGY ASSOCIATION

Danish Agriculture & Food Council

DANISH WIND INDUSTRY ASSOCIATION

Ministry of Industry, Business and Financial Affairs

Danish Ministry of Energy, Utilities and Climate

Ministry of Environment and Food of Denmark

Ministry of Foreign Affairs of Denmark