



2021 | ENERGINET

ANNUAL MAGAZINE

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– turns power grid upside down.



ANNUAL MAGAZINE

Energinet's annual magazine 2021 provides an easy-to-read update of Energinet's activities, and the opportunities and challenges the company is facing.

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ENERGY ISLANDS

– GREEN ENERGY FOR MORE PEOPLE

Denmark is building the world's first energy islands. They collect wind power from multiple wind turbines further out to sea than previously seen – and distribute this as green energy to several countries.

Energy islands are a key next step in order to expand offshore wind at the rate necessary for Europe to fulfil the Paris Agreement by 2050.

Denmark and Europe can also lead the way for other regions of the world, where offshore wind power can be used for greener energy and provide better living standards without harming the climate.

ARTIFICIAL ISLAND IN
THE NORTH SEA

3 GW offshore wind power in 2033
or soon thereafter. To be later
expanded to 10 GW – or enough to
supply 10 million households.



BORNHOLM

2 GW offshore wind power
in 2030 or gradual expansion.
Power enough to supply
2 million households.



3 QUESTIONS FOR HANNE

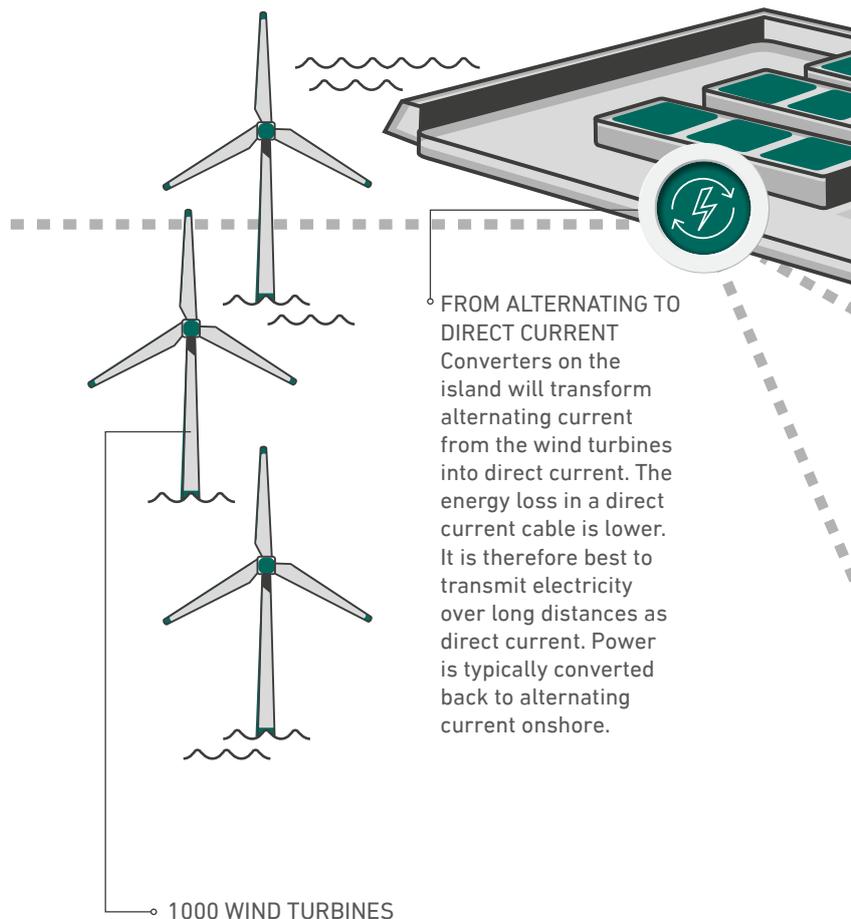
What is the point of energy islands? Why not just build a lot of normal offshore wind farms?
We need 30 times more offshore wind power in Europe in 2050 than we have today. We cannot achieve this without innovative new and cross-border solutions.

Climate action is good. But are energy islands economically viable?
I believe there will be huge benefits. From exporting green power and technology – and the potential global spread of energy islands in the years ahead.

Is it technically feasible to build energy islands?
Yes. At Energinet, we have been working since 2017 with German and Dutch partners in North Sea Wind Power Hub to document that hubs or energy islands are possible and beneficial.

Hanne Storm Edlefsen
Vice President of Energinet

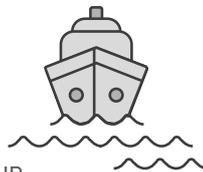
ENERGY ISLANDS



In the 2030s, there could be 1,000 wind turbines in operation around the energy islands, supplying green power and hydrogen to Denmark and other countries. The energy islands will kick-start a massive expansion of offshore wind power in Europe in the coming years, with the North Sea and Baltic Sea playing key roles.

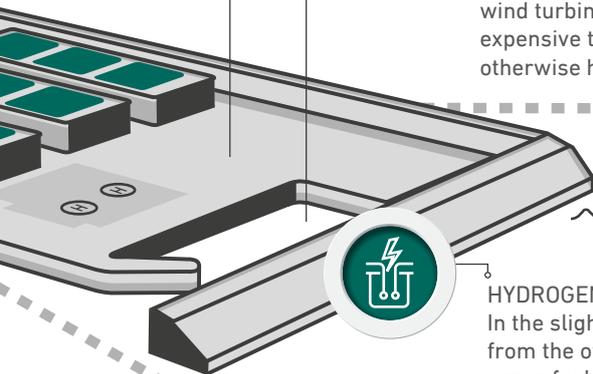
OTHER THINGS ON THE ISLAND?

Options include energy storage (hydrogen storage facilities or batteries) and some types of data centres, which can use huge amounts of green electricity but do not need frequent manual maintenance.



MAINTENANCE HARBOUR

Ships sail out from the island's harbour carrying crews and equipment, to erect and maintain the wind turbines. These ships are smaller and less expensive to operate than the kind that would otherwise have to sail from coastal ports.



HYDROGEN AND POWER-TO-X

In the slightly longer term, we will use power from the offshore wind to produce hydrogen and green fuels on the island. This is also known as Power-to-X. This is a smart initiative, as Europe is the continent with by far the greatest potential surplus of energy from offshore wind power in relation to current electricity consumption. And many energy applications cannot be electrified (such as process energy for steel production or fuel for ocean-going vessels).

SEVERAL COUNTRIES TO BE CONNECTED

Offshore wind power will be distributed from the energy islands to consumption centres deep in neighbouring countries, where it will be used as green power and to produce green fuels for heavy industry, planes and ships. Denmark is currently coordinating possible interconnections via the energy islands with Belgium, the Netherlands and Germany.



In February 2021, a broad majority in the Danish Folketing decided that two energy islands are to be established in Denmark. One will be an artificial island in the North Sea, the other will be on Bornholm, as a natural centre in the Baltic Sea. Read more about Energinet's role at www.en.energinet.dk/energyislands. Read more about the concept of energy islands at www.northseawindpowerhub.eu



IRENA'S INNOVATION DIRECTOR DISCUSSES ENERGY ISLANDS

Dolf Gielen is Director of the IRENA Innovation and Technology Centre in Berlin. He is responsible for IRENA's work in advising Member States on technology, energy planning, costs, markets and innovation policy frameworks.

In their World Energy Transitions Outlook 2021, IRENA predicts there will be 2,000 GW of offshore wind power globally in 2050, compared to approx. 30 GW in operation today. We asked Dolf Gielen to give us his thoughts on the potential impact of energy islands on the massive rise in offshore wind capacity in the coming years.

What do you think of the idea of building energy islands?

"What is happening in Denmark right now is very innovative. Several countries in north-western Europe are looking at energy islands or hubs as a solution, and we need a cohesive system of hubs in the North Sea. IRENA is currently receiving a huge number of enquiries about green hydrogen from all over the world. So green hydrogen is also a clear trend, and it is broadly accepted that offshore wind power will play a key role in relation to this. Energy islands fit perfectly into this picture, and someone needs to kick off this development. So it's good that Denmark is taking this step."

How do you see the global potential for scaling-up offshore wind capacity using energy islands or hubs?

"If you define energy islands as hubs with converter stations, they will have a clear role and potential, because they reduce the capital costs of expanding offshore wind power on a large scale. Another issue is what role will be played by hydrogen islands, or islands with other activities – say where you also have a harbour, an airport or activities related to marine technologies, energy technologies etc. There are all sorts of ideas in the melting pot. But we will have to wait and see exactly how things develop. I think it's a bit too early to say."

At what locations on the planet do you think energy islands or hubs may be useful in the future?

"The North Sea and Baltic Sea are somewhat unique in that they are not very deep. There are a limited

number of locations worldwide where the sea is so shallow. There is considerable wind potential around Japan, but floating offshore wind turbines will be needed in order to exploit this, as the sea is deep. I do not know if it is possible to build floating islands. However, the water along the Chinese coast is not so deep, so perhaps there are locations here where hubs can be used. In USA, the western and eastern coastal seabeds are both very steep – but there may be potential for energy islands in the Gulf of Mexico. There may be no need to develop offshore wind power there, however, because USA also has very extensive land-based wind potential. So my expectation is that Europe, for some time at least, will be the place where energy islands and hubs are developed."

ABOUT IRENA

IRENA, the International Renewable Energy Agency, supports countries in their transition towards a future with sustainable energy. It is a platform for international collaboration, and provides knowledge and analyses in relation to policy, technology and financing renewable energy.



Dolf Gielen
Director of the IRENA
Innovation and
Technology Centre

“

Someone needs to kick off this development. So it's good that Denmark is taking this step.”

”

OFFSHORE WIND IN THE EU

003

Three per cent of Europe's marine areas will have to be used for wind farms in order for Europe to fulfil its part of the Paris Agreement by 2050.

030

Europe's existing offshore wind capacity has to be increased almost **30-fold** over the next 30 years for Europe to fulfil its part of the Paris Agreement by 2050.

300

300 GW in 2050 is the target for offshore wind power proposed by the European Commission in November 2020. This is deemed necessary in order for Europe to fulfil its part of the Paris Agreement by 2050.



I see it as one of Energinet's most important tasks in the years ahead to closely monitor developments. 

Thomas Egebo
President and CEO of Energinet

ARE HYDROGEN PIPELINES COMING TO DENMARK?

Will there be large-scale hydrogen production in Denmark? Most energy experts agree the answer is 'yes' as they look ahead, and the 'yes' has become increasingly emphatic during the last few years.

Does this also mean that an underground pipe network will be needed to transport the hydrogen around Denmark? "Most likely," is the answer given, but a little more hesitantly.

"Most people seem to agree that given the rapid development we are seeing, and the hydrogen projects and volumes now being discussed, we are past the point where future production can simply be used locally or transported in trucks. But as to the scope, and when and where we might see excavators at work, laying hydrogen pipes in the ground, there is still much uncertainty," says Stine Grenaa Jensen, Director of Green System in Energinet.





The international 'European Hydrogen Backbone' study, which Energinet participated in, shows what a European hydrogen grid might look like in 2040. But it is still an open question as to whether hydrogen pipelines will be established in Denmark, and when and where if so.



Three factors may decide the outcome

It basically depends on three things: How much hydrogen will be produced in the future, where, and for what applications?

The map of Denmark already has several large hydrogen dots marking future projects in the gigawatt class. Various companies and consortia are forming 'hydrogen clusters', where wind and solar power will be converted to green hydrogen, green ammonia, etc. in Copenhagen, Fredericia, Esbjerg, Skive, Hobro and elsewhere. Several of the projects qualify for titles such as 'Europe's largest' and 'world's first'. A number of smaller demonstration projects and trials are also scattered around Denmark, with new ones continually being added.

With the Danish Folketing's decision to create an energy island servicing up to 10 GW of offshore wind Power in the North Sea, politicians also have their eyes on hydrogen, and the agreement allows for Power-to-X plants to be built in connection with the island. This could mean that hydrogen is produced on the island and then transported to shore, but initially it is more likely that the electricity is transmitted to a suitable onshore location – somewhere that is a node in the electricity grid and therefore suitable for hydrogen production, but also has a large city nearby that can utilise the surplus heat from the electrolysis plant for district heating.

Another factor could be the possibility of storing hydrogen, for example in underground caverns. The rationale for a possible hydrogen pipeline is largely linked to access to storage and a need for flexibility among market players.

What will we use the hydrogen for?

What the hydrogen is to be subsequently used for will determine what form a possible future hydrogen grid takes. Unlike Germany and the Netherlands, which currently use large amounts of hydrogen in industry – and need to switch from hydrogen made from fossil natural gas to hydrogen made using wind and solar power in the longer term – there is only a limited demand for hydrogen in Denmark today. While we certainly have one prerequisite for large-scale Power-to-X production (abundant green electricity and thus cheap MWs for hydrogen plants), there is still uncertainty as to how best to utilise it. Is it by refining the hydrogen in Denmark, producing ammonia for shipping and green fertiliser for agriculture, as Copenhagen Infrastructure Partners and a number of industries have major plans for in Esbjerg? Production of aviation fuel? Or will green hydrogen primarily



>>

be exported to Central Europe, where the industries already exist? All options are open, and it is likely that we will end up doing a bit of everything.

Stine Grenaa Jensen therefore predicts that we may initially see local hydrogen clusters, with an electrolysis plant that converts wind and solar power into hydrogen, which is subsequently transported in a local pipeline to one or more nearby companies or an underground storage facility. One can envisage the production of several different fuels in these clusters for use in the transport sector and chemical industry.

Over time, the largest clusters could be connected via a dedicated hydrogen grid, consisting of pipelines between important nodes, such as a north-south pipeline through Jutland, connected to a German hydrogen grid.

Ambitious plans in Europe

Just to the south of us, big things are happening with hydrogen. German legislation is currently being prepared for construction of the first hydrogen grids, to be completed as early as 2023. This is being done by converting existing infrastructure. The Netherlands is also making major investments, and the European Commission has presented an ambitious hydrogen strategy, containing plans to massively scale up electrolysis plants in Europe. Before the end of 2021, the Commission will present new legislation for hydrogen infrastructure. This aims to ensure free competition, ownership unbundling and third-party access to the infrastructure, as is the case for electricity and gas.

Thomas Egebo, President and CEO of Energinet, believes that the trend in recent years shows that things could happen very fast.

“A few years ago, not many people – even in energy circles – knew what Power-to-X was. Today, it is not just something many people talk about, it is starting to exist. I see it as one of Energinet’s most important tasks at the moment to monitor developments very closely and constantly analyse the interplay with the rest of the energy system and the other sectors that need green energy, so that when large-scale hydrogen production begins in the next 4, 5 or 8 years, we have helped to ensure that Denmark is at the forefront and ready,” he says.

Can gas infrastructure play a role?

As part of its analyses, Energinet also looks at whether any of the existing gas infrastructure can be

used in a hydrogen future. One of the two gas pipelines currently connecting the Danish and German natural gas systems – between Egtved, near Kolding, and Ellund on the German side of the border – is an example of this. As natural gas is phased out and the volume being transported across borders declines, this pipeline could be converted to transport pure hydrogen.

“Energinet is the transmission company for electricity and gas, and operates the critical infrastructure in the two sectors on behalf of the Danish government. It will be up to the Danish Folketing to decide who will be responsible for any future hydrogen grid. Hydrogen is new territory – also politically,” says Thomas Egebo.

“We have managed the critical common infrastructure historically, and ensured competition and third party access. If a future hydrogen grid becomes a collective, national grid, connected to the European grid, with system operation and grid balancing – and possibly even the need for underground caverns for seasonal hydrogen storage – this will be very similar to what we currently do with gas transmission and the gas storage facility in Lille Torup. But we don’t yet know what the final result will be, and who will end up being responsible for any hydrogen infrastructure. The most important thing for me is that we investigate the potential, on behalf of society, so that Denmark and Europe are ready and can undertake the best and most efficient green transition,” concludes Thomas Egebo.



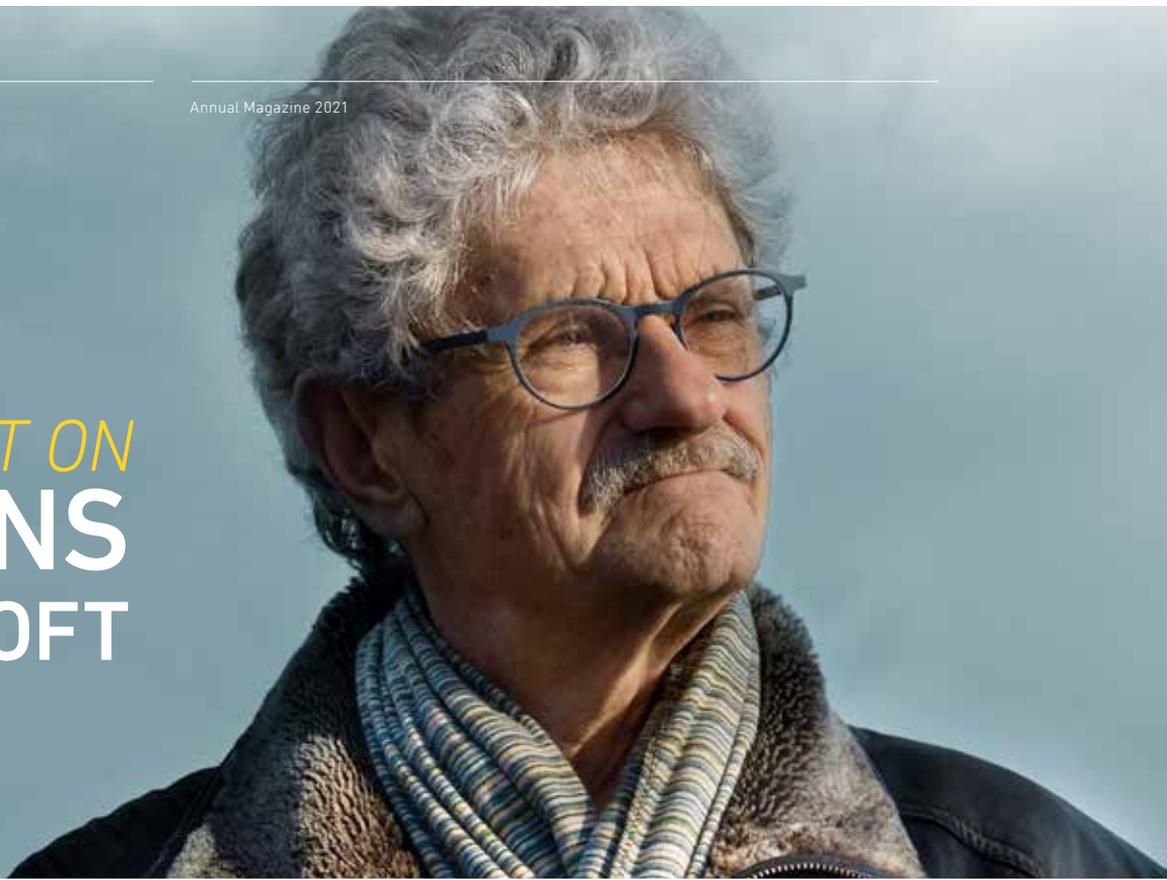
ABOUT POWER-TO-X AND GREEN HYDROGEN

Power-to-X refers to the conversion of renewable energy into hydrogen and other climate-friendly fuels. This is done using electrolysis – a process whereby water is split into hydrogen and oxygen using green electricity.



A POWERFUL
TEAM
FOR A BETTER WORLD

SPOTLIGHT ON MOGENS LYKKETOFT



01

What do you think is the most important task for Denmark to undertake in order to achieve the goal of a 70% CO₂ reduction in 2030?

It's very difficult to narrow it down to the most important task, as there are a large number of interconnected changes required that need to support each other. In addition to massive investment in new infrastructure, citizens and businesses have to be encouraged to make comprehensive changes in behaviour – and legislators need to set the framework for this through regulations, taxes and subsidies for technology development. Civil society needs to press for this to happen sufficiently quickly. And cities, in particular, need to invest in other infrastructure. Electrification of our vehicles will require an extensive network of charging stations.

It has to be attractive to act sustainably – as a consumer, company, investor, urban society, etc. It has to be clear to everyone making an investment that the sustainable choice is also the most profitable in the long term.

02

What do you see as the greatest obstacle to all Danes being supplied with green energy by 2030?

It will impede an adequate transition if the price of green energy does not become lower than the price of black energy. Fortunately, green energy prices are seeing a rapid downward trend. A solar cell that cost DKK 100 eight years ago, now costs only DKK 5. Wind energy has also become much cheaper. However, to make absolutely sure that green energy out-competes black energy, we also need to raise the price of fossil fuels via a gradually rising carbon tax. The larger the market that is created for green technologies, the cheaper and more widespread they can become.

But Danes will only continue to support the green transition if we ensure that small incomes are spared from footing the extra bill – and that special assistance is given to companies most burdened by the transition. As black technology is phased out, employees must also be assisted into new green job opportunities.

03

How can you contribute, as Chairman, to ensuring that Energinet is best equipped to have a big impact in the green transition?

I have worked closely with the climate and sustainability for many years – particularly in my work with Svend Auken in the Nyrup Rasmussen government in the 1990s. However, it became foremost in my awareness in 2015 when I chaired the UN General Assembly, at which we adopted the global goals and landed the climate agreement in Paris. In the years since then, I have spent most of my time urging and calling for action, through hundreds of annual meetings and lectures. Mostly in Denmark, but also abroad.

I see the chairman role at Energinet as a useful position, at a very practical level, for advancing the transition and the investments needed to maintain a leading position for Denmark in the green transition.

“ I see the chairman role at Energinet as a useful position, at a very practical level, for advancing the transition and the investments needed to maintain a leading position for Denmark in the green transition. ”



Mogens Lykketoft
Chairman of Energinet

04

If things work out as you hope, what will cross-border energy cooperation look like in ten years' time?

We are already seeing rapid growth, but we are sure to see the volume of green energy crossing our borders multiply, depending on where the wind is blowing and the sun is shining. There will be much larger volumes of electricity than we are currently seeing, and the surplus production will be used in part to advance the production of green hydrogen, which will in turn be used to develop liquid green fuels for heavy transport, ships and aircraft. What we call Power-to-X.

Several nearby countries, particularly Germany, are working hard on hydrogen development. By being at the forefront and investing heavily, Denmark can play an important role in this trend. Construction of the energy islands on Bornholm and in the North Sea represents a huge investment. The aim is to reap the benefits of large volumes of offshore wind power, including the export of large quantities of green electricity to our neighbours in the

05

Speaking of energy: How do you recharge in your free time? What do you immerse yourself in when you are not busy in your role as Chairman of Energinet?

Since I left the Danish Folketing in 2019, I have been in semi-retirement – but with a very full speaking calendar. This kept me quite busy until the Corona pandemic put a temporary stop to most of it. In fact, late last summer I was thinking that my semi-retirement had become a bit too complete, but then the Danish Ministry of Climate and Energy called and asked if I wanted to be chairman of Energinet.

How do I recharge? I keep a balance between debating online and having a much richer home life than I have had during the last 40 years. My wife and I enjoy hiking in the fantastic scenic areas around us. And kayaking. Most recently, we have even begun winter bathing. I never had an electric train when I was a child. I have acquired one now!

I also read a lot. I am currently immersed in the first volume of Barack Obama's memoirs. This is very interesting, because USA - for better or worse - has such a big impact in the world.

I have also tidied up my basement and my attic. That took a few months, as I had 30 boxes of archive materials to sort out.

ENERGY DATA COOPERATION ACCELERATES GREEN TRANSITION

Huge volumes of data pass in and out of Energinet's special DataHub IT system every day. The system records all the electricity both consumers and companies draw upon – and the production of energy from wind turbines, solar cells and other sources. This is important data that provides the basis for correctly calculating electricity bills, and which also has lots of potential for advancing the green transition, if it is used to drive innovation and cooperation.

“It is clear that our raw material, in the form of energy data, has an enormous green potential. But it is essential that we are able to launch and cooperate on new initiatives. ELOprindelse and Ento Lab's artificial intelligence are strong examples of this”

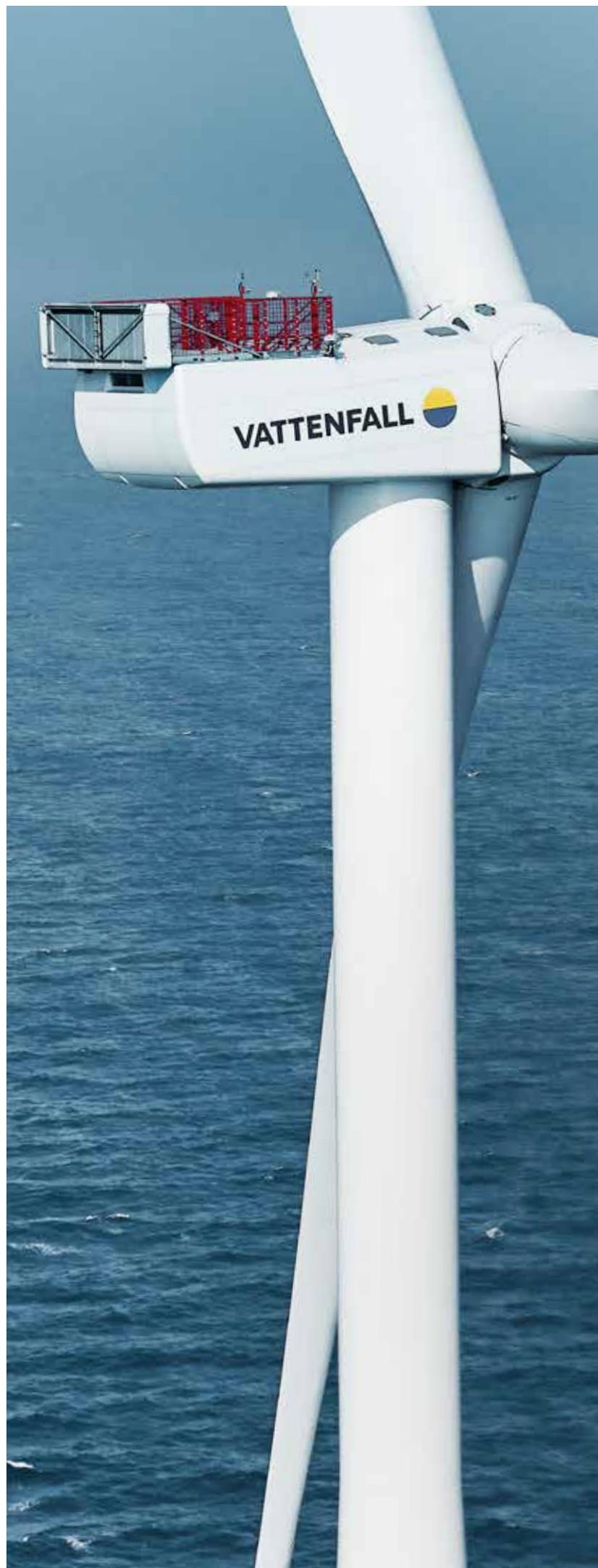
Martin Lervad Lundø
CEO, Energinet DataHub

Throughout Energinet, a number of digital experts work to convert the extensive energy data into relevant services, that process and present the data so that it makes sense to consumers and businesses. They also ensure that it is made available to other parties, with the greatest possible respect for privacy and security. They are also constantly seeking to form digital partnerships with innovative entrepreneurs, market players and others who can add value to the extensive energy production and consumption data.

Energinet's ELOprindelse project (Project Origin) and a joint project with Ento Labs are good examples of how cooperation, innovation and artificial intelligence have helped make it possible to address some of the challenges of the green transition.

Find out more at www.en.energinet.dk/Project-origin

Learn more about available energy data at:
www.en.energinet.dk/Energydata



NEW SERVICE PROVIDES DOCUMENTATION FOR GREEN POWER ON AN HOURLY BASIS

A brand new service is in its final phase of testing. It is called EIOprindelse (Project origin), and has been tested by over 50 players across the energy sector. The system can document where power comes from and show the climate impact - hour by hour. This can offer new opportunities for companies that want to be sustainable. One of the test players that took part in the project is the Vattenfall energy company.

Vattenfall, based in Sweden, generates and sells electricity and heating to companies and consumers throughout much of Europe. The company owns and operates a number of onshore and offshore wind farms in Denmark. Marcus Melin, Strategic Energy Advisor, has contact with some of the companies that use the most energy. He has been involved with the nuts and bolts of EIOprindelse, and has given feedback for the ongoing development of the system. We invited him to virtual lunch on a frosty winter's day in February, where he shared some insight into his preliminary experiences with EIOprindelse, and how he sees the system benefiting the green transition.

"I find that sustainability and responsibility are generally high on the agenda of many companies today. Our customers want to know whether the electricity powering their production and providing office lighting and ventilation originates from renewable energy sources. They use this in their CSR reports and green accounts. This requires documentation, which is currently provided primarily via 'guarantees of origin'. EIOprindelse is taking these a step further."

The existing guarantees of origin, also known as Green Certificates, ensure that an amount green power corresponding to what the company draws is generated somewhere in the electricity grid during the current year. But the green power could be produced on a stormy day in December, while the company uses the electricity on a quiet summer's day in August. The existing guarantees of origin apply to a whole year, and are traded in the same way as other types of securities.

"Our customers seek greater certainty and transparency in relation to their energy consumption than they receive today. In other words - they want to be able to match their energy consumption, hour-by-hour, with the power being generated,

>>

whether or not it originates from renewable energy sources. They want to be able to choose green power from the electricity grid, on an hourly basis, even on a day with no wind. Then their products will also be green.”

This is the information that ELOprindelse can provide – and Vattenfall wants to offer it to its customers when the system is ready.

ELOprindelse is actually not unique in its functionality. There are many people who think along these lines, and Vattenfall had already developed and introduced a similar system in cooperation with Microsoft, when they joined the ELOprindelse project.

“We had already rolled out our own system in Sweden when Energinet reached out, seeking partners to test their solution. ELOprindelse is exciting because it is a project being run by the TSO. With such a key player driving the project, we can offer our Danish customers something unique – greater credibility and sustainability. Energinet can retrieve data directly from its own data centre, ensuring its reliability.”

Does Marcus Melin see other opportunities with the hourly-based documentation for renewable energy?

“Vattenfall aims to make a fossil-free existence possible within a generation. We work broadly across many areas to help our customers achieve this – and by helping them become aware of their own consumption, we are well on our way. I see a clear potential in the hour-based documentation. The trend is gaining momentum internationally, and has applications extending beyond the electricity market.”



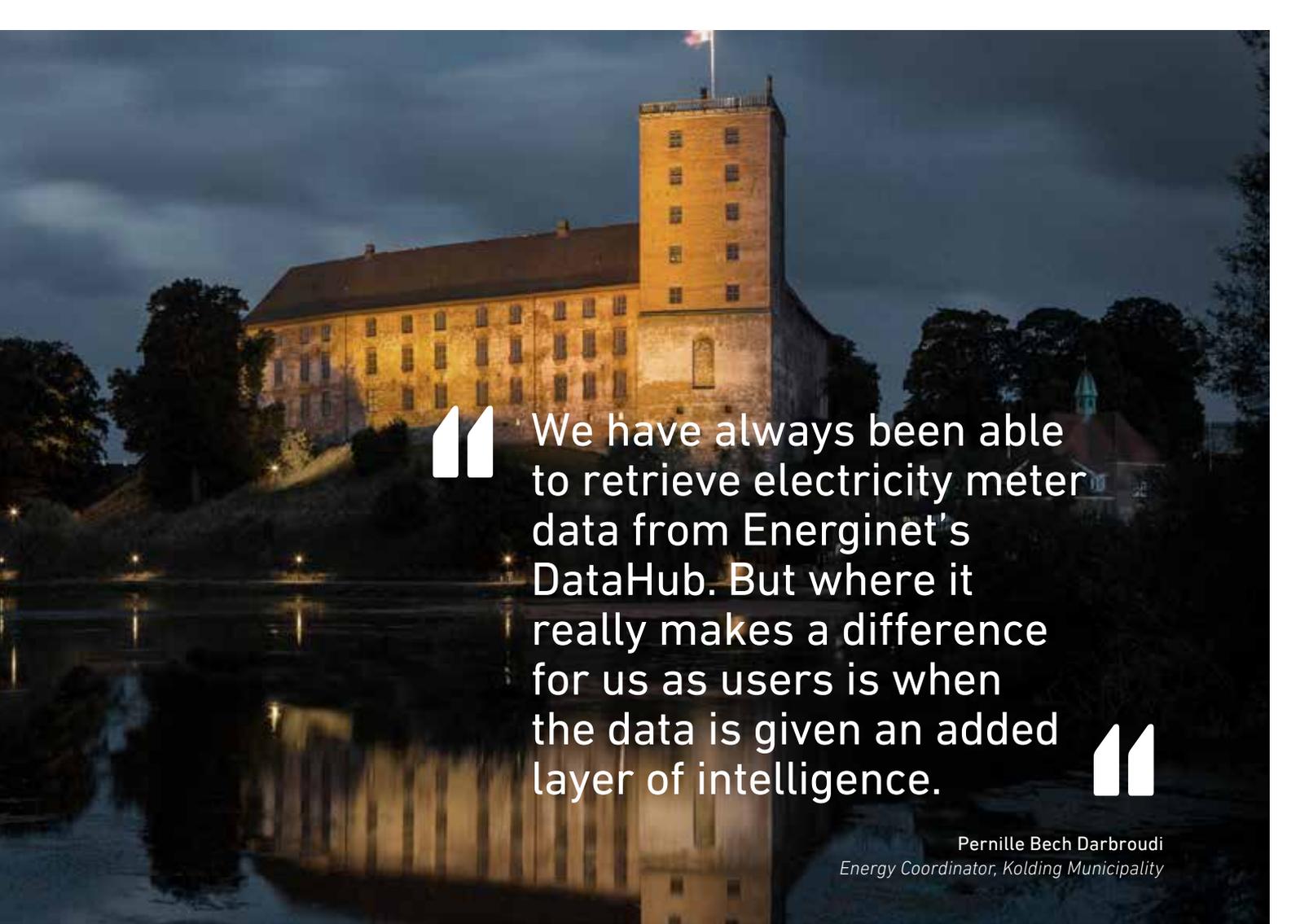
Marcus Melin
Strategic Energy Advisor, Vattenfall

ARTIFICIAL INTELLIGENCE HELPS KOLDING MUNICIPALITY **ENERGY** **OPTIMISE** ITS BUILDINGS

Kolding Municipality has ambitious energy saving goals. A new system has therefore been implemented which uses artificial intelligence to identify climate offenders among the municipality's buildings. This has reduced CO₂ emissions and operating costs. The innovative solution is the initiative of Ento Labs – a young entrepreneurial company that has successfully created value using energy data.

Pernille Bech Darbroudi is Energy Coordinator at Kolding Municipality. She is responsible for energy optimising the municipality's 450 properties, and hence for reporting electricity, water and heat consumption.

“We have an ambitious energy action plan, so one of my key responsibilities is to ensure that we use electricity and heat as efficiently as possible. The way we operate our buildings is one of the areas with the greatest potential for energy savings in the municipality, so it is something we have a major focus on.”



“ We have always been able to retrieve electricity meter data from Energinet’s DataHub. But where it really makes a difference for us as users is when the data is given an added layer of intelligence. ”

Pernille Bech Darbroudi
Energy Coordinator, Kolding Municipality

The municipality already has an energy management programme, but it is becoming outdated. It is too inefficient and time-consuming to manually analyse data from electricity meters etc. and try to use it to identify energy fluctuations at the municipality’s many schools, sports halls etc.

Pernille decided to search for new tools, and began discussions with Ento Labs, a Danish entrepreneurial company which has completed similar energy optimisation projects for other municipalities and companies using artificial intelligence.

“I was most impressed by the level of detail with which energy consumption in each property was monitored. In the past, when I contacted the janitor at one of our schools, for example, due to an unexpected increase in their energy consumption, it was difficult for me to precisely indicate what ‘leak’ he should look for. I can do that better now. The system detects the exact time the usage pattern changes, and how.”

The artificial intelligence automatically analyses consumption and suggests potential energy savings - and Pernille has access to an overview via a portal. The system is based on electricity data from Energinet’s DataHub, and includes a number of other sources to give the artificial intelligence a deeper understanding.

“One of the special things about the platform is that data for things like the weather, holidays, the building and even information about the Coronavirus lockdown is automatically read in. This avoids an alarm being raised, for example, when school children return from the summer holidays. At the same time, it automatically detects increases in the usage pattern. This is something I greatly appreciate, as I no longer have to go in and search directly.”

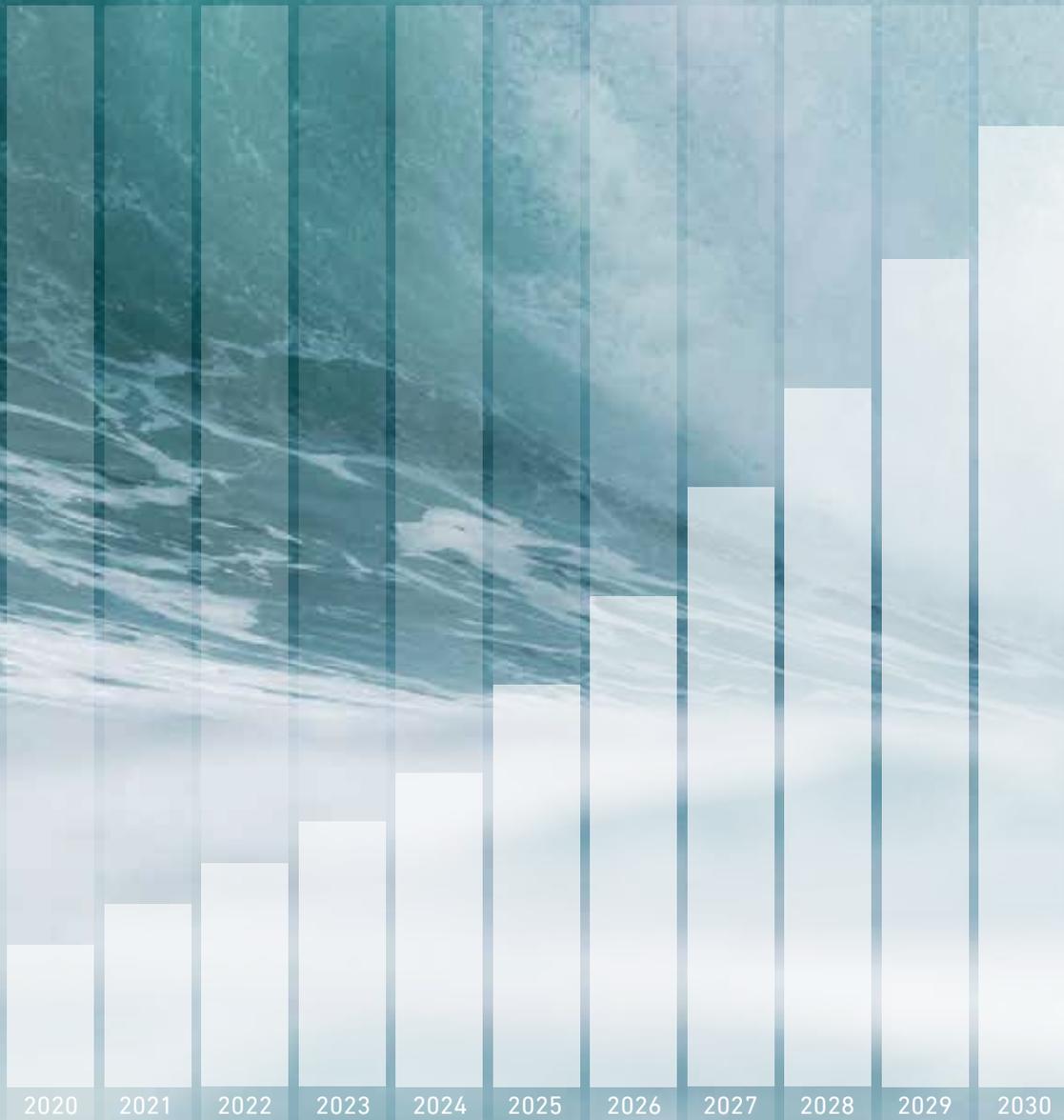
210 of the municipality’s 450 properties, which were deemed relevant to analyse, are being monitored. Artificial intelligence has also already highlighted the first climate offenders, and Pernille is expecting more energy savings along the way – both big and small.

“We have always been able to retrieve electricity meter data from Energinet’s DataHub. But where it really makes a difference for us as users is when the data is given an added layer of intelligence. This gives us more insight, so we can become more efficient at optimising energy as an organisation. It helps us achieve our energy saving goals faster, and ultimately advances the green transition.”

OFFSHORE WIND POWER **GROWING** GLOBALLY



OFFSHORE WIND POWER CAPACITY GLOBALLY (MW)



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 DANISH OFFSHORE WIND POWER EXPERTISE:

WE ARE HELPING ASIA
TO CUT
**250 MIO.
TONS**
CO₂ PER YEAR

The world has long been watching Denmark and our many offshore wind turbines. They have increased in number and size, and can supply almost half of Denmark's electricity consumption some days. Global attention has not become any less after the Danish Folketing decided to build energy islands and install up to 10 GW of offshore wind power in the North Sea - more than five times our current offshore wind power capacity.

Denmark also has a great interest in looking out into the world, notes Peter Markussen, head of Energinet's Associated Activities, which provides assistance with the green transition around the world – often in close cooperation with the Danish Energy Agency, the Danish Ministry of Foreign Affairs and Danish companies.

The reason is this – while energy islands in Danish waters hold considerable climate potential, they hold immense potential if we are able to share our knowledge and experience.

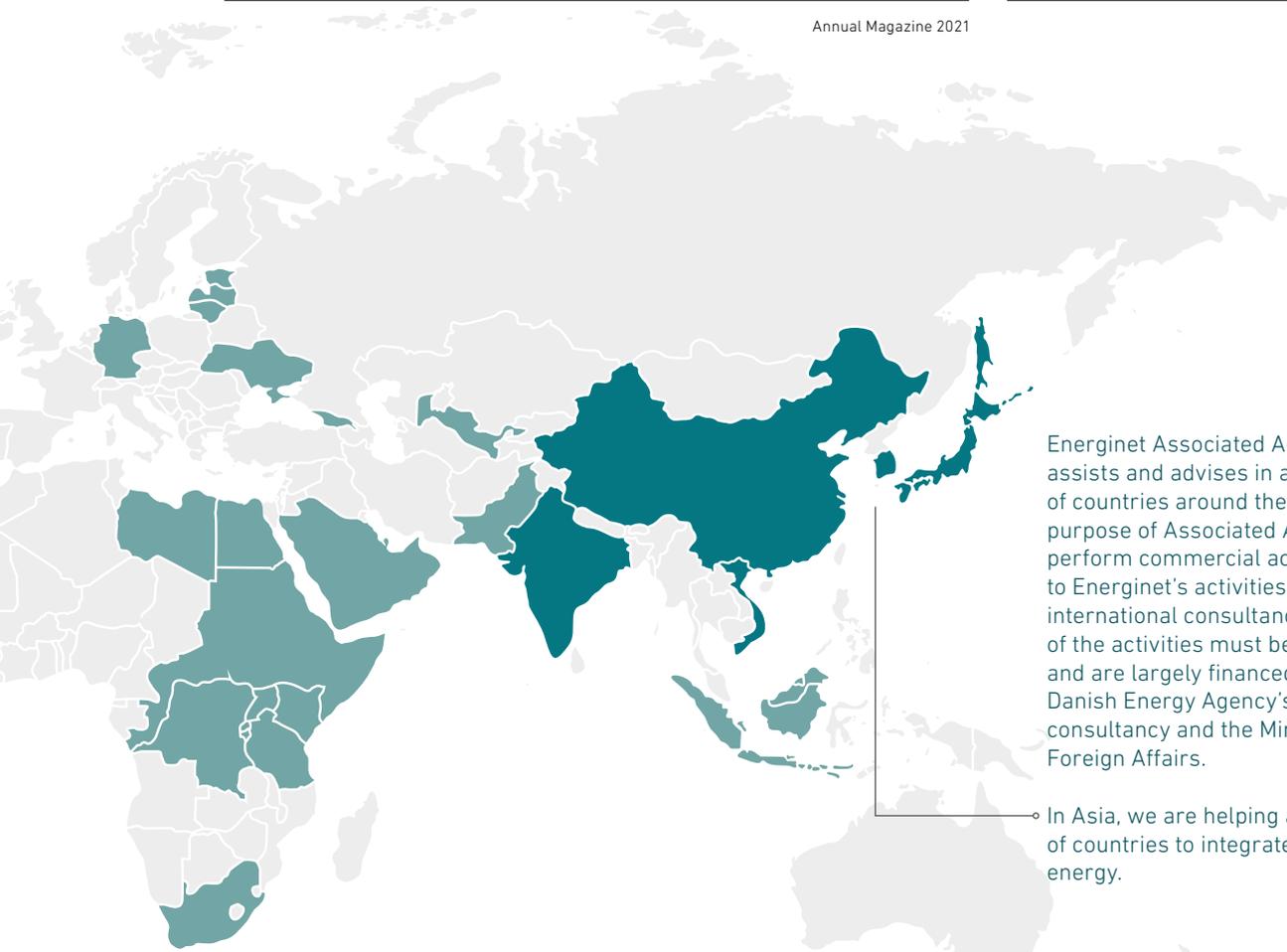
“We can really push the global green transition in the right direction if we help other countries fulfil their offshore wind goals. And there are big plans in a number of countries. If we can we contribute to reducing their costs, meeting their timetables and integrating the electricity in a way that preserves security of supply, so that there is no need to have old coal-fired power stations on standby in the background, there are great climate benefits to be gained,” he says, pointing to Asia.

Energinet is currently active in China, Japan, Vietnam, South Korea and India. These countries are together planning to install a total of 90 GW offshore wind power by 2030. This will make it possible to reduce global CO₂ emissions by 250 million tonnes annually. By comparison, Denmark has to reduce its CO₂ emissions by approx. 20 million tonnes by 2030 in order to meet its 70% target.

“If the expansion is delayed by one year, this will potentially lead to an extra 250 million tonnes of CO₂ emissions from coal-fired power stations. The efforts by Energinet and the Danish Energy Agency to exchange experience and support the national authorities and TSOs could therefore have a very real impact on the global climate,” says Peter Markussen.

Energinet and the Danish Energy Agency are assisting with the expansion of offshore wind power and the green transition of the electricity systems in all five of the above Asian countries. Energinet's role includes sharing its experience from tender processes for offshore wind, integrating the power into the electricity grid and preparing the rules and technical regulations required for the offshore wind turbines to be connected to the electricity grid.

“It may sound simple: Erect some turbines and connect them to the power grid – and you have green electricity. However, there are many factors to consider for the



Energinet Associated Activities assists and advises in a number of countries around the world. The purpose of Associated Activities is to perform commercial activities linked to Energinet's activities, including international consultancy. The costs of the activities must be covered and are largely financed through the Danish Energy Agency's global consultancy and the Ministry of Foreign Affairs.

○ In Asia, we are helping a number of countries to integrate renewable energy.

countries that are only just beginning to seriously install offshore wind power," says Peter Markussen. He points out that these countries must decide on everything from tender models to who will be responsible for connection, and how to generate good wind forecasts and thus ensure the electricity system operates securely, because it is not just a single wind turbine being connected, but entire wind farms that can produce as much as a large power station.

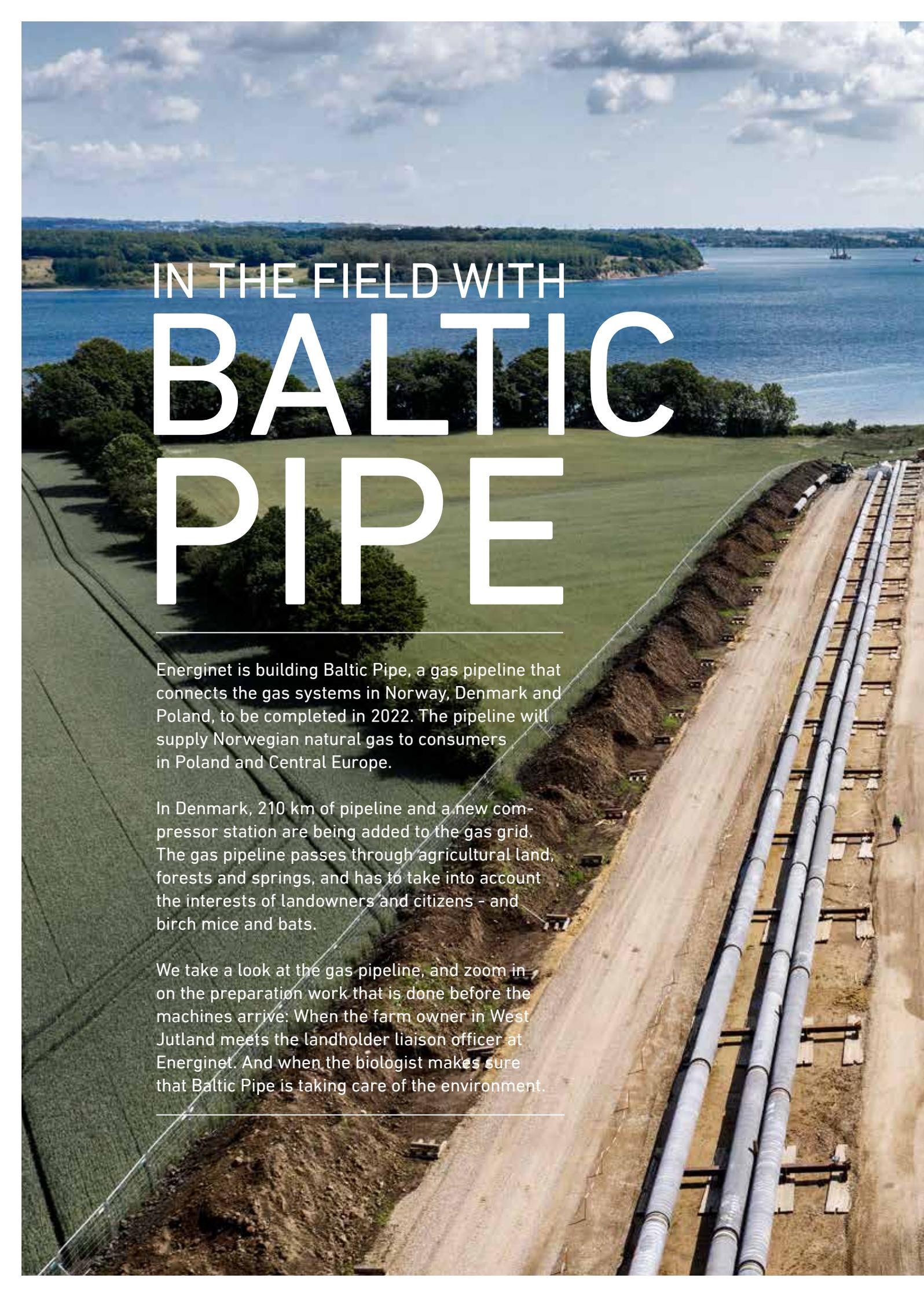
"Denmark has shown that it is possible to combine a green transition, affordable electricity prices and exceptionally high security of supply, and this knowledge is highly sought after. Since the first Danish wind turbines at sea were established back in 1992, the Danish policy aim has been to reduce costs and make offshore wind competitive with other green alternatives – and we have succeeded," says Peter Markussen. He also highlights another major benefit.

"Danish players in the wind turbine industry currently have a market share of approx. 30% in the offshore wind power sector in Asia. If this share can be maintained towards 2030, it corresponds to revenue of more than DKK 250 billion – i.e. an ongoing export success based on experience from the Danish offshore wind power expansion objectives, which in addition to benefiting the green global bottom line also creates jobs and profits in Denmark."



"Energinet is an indispensable player in the regulatory cooperation project the Danish Energy Agency has established with 16 partner countries, which account for over 60 per cent of global CO₂ emissions. In the offshore wind sector, the Danish model for proactive, government-driven planning is also attracting much attention in the many new countries that are introducing the technology. The integration of fluctuating wind power generation presents major challenges in daily production planning. Energinet also provides much assistance and capacity building to our partners in this area. We look forward to expanding our cooperation with Energinet in the coming years, as interest in offshore wind power in Denmark's partner countries rapidly increases".

Anton Beck
Head of Global Cooperation, the Danish Energy Agency



IN THE FIELD WITH BALTIC PIPE

Energinet is building Baltic Pipe, a gas pipeline that connects the gas systems in Norway, Denmark and Poland, to be completed in 2022. The pipeline will supply Norwegian natural gas to consumers in Poland and Central Europe.

In Denmark, 210 km of pipeline and a new compressor station are being added to the gas grid. The gas pipeline passes through agricultural land, forests and springs, and has to take into account the interests of landowners and citizens - and birch mice and bats.

We take a look at the gas pipeline, and zoom in on the preparation work that is done before the machines arrive: When the farm owner in West Jutland meets the landholder liaison officer at Energinet. And when the biologist makes sure that Baltic Pipe is taking care of the environment.

I WOULD HAVE PREFERRED TO ESCAPE THIS

Thomas Høj Arnum's property has provided a thoroughfare for several large-scale energy projects over the years. The Baltic Pipe gas pipeline is now joining them. "We are standing up for our rights, but we will get through this," he says.

It was not a complete surprise to Thomas Høj Arnum that his land would be impacted by Baltic Pipe. He owns 650 hectares of land in west Jutland, and already has a gas pipeline from 1998 and electricity cables from large offshore wind farms passing through his fields. Another electricity cable from Energinet's Viking Link will soon be added.

"As we understand it, there are not many options for running cables and gas pipelines from the North Sea across the country. We can see that you cannot avoid involving us, as we have a large agricultural landholding here," he says.

Thomas Høj Arnum first heard about Baltic Pipe at an information meeting in Varde in January 2018. His first thought was: "This is going to take up a lot of my time." The farmer also feels that the project has consumed a lot of his time over the years.

Yet he says that he has trouble being opposed to the project.

"Of course it's a pain, but we also know that we cannot stop it. So we need to make the best of the situation," says Thomas Høj Arnum, who emphasises that there has been a constructive dialogue with Energinet from the beginning.

Wet shoes in summer

But he would prefer to have escaped it – to not have Baltic Pipe on his land. He is concerned about what it will be like to work his fields afterwards: "It will be a few years before the soil settles and I can return to somewhat normal operations again."

The area is very low-lying, and the gas pipeline will pass through old seabed in part.

"If you come in mid-summer, you can get wet shoes. It's no simple matter to excavate and restore the site,

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so we are a little wary and demanding a lot of drains and groundwater lowering along the way," says Thomas Høj Arnum.

He notes that they still have problems on his fields where the old gas pipeline was buried when his father ran the property. The soil has not settled properly, and Thomas Høj Arnum believes that the drains were not done well enough. Fortunately, the laying teams appear to have become better at making drains since that time. The drains for Energinet's electricity cables on his land function properly.

"We have also become much more skilled in how we operate the farmland. We have people who focus only on managing our fields. They will notice pretty quickly if something is wrong."

Important to have a contact person

Thomas Høj Arnum emphasises that it is important to clearly inform landowners whom they should contact if problems arise later.

"We'll be sure to respond to such matters. We're very aware that such large-scale construction work has a significant impact – and that we must take responsibility for any inconvenience we cause," says Søren Peschardt. He is the landholder liaison officer at Energinet, and is currently busy visiting the landowners in Jutland that will have Baltic Pipe pass through their land.

Drainage is a key focus

"If the construction timing is optimal and there is good teamwork, it is possible to install such a pipeline so that it almost cannot be seen afterwards. Energinet decided that drains should be a main focus very early in the project, with a more proactive approach. And this was also emphasised at the public meetings. It is important that the drains work, and we have a dedicated drainage team that monitors that the restoration work is done by the book," says Søren Peschardt.

Of course it's a pain, but we also know that we cannot stop it. So we need to make the best of the situation.

Thomas Høj Arnum
farm owner

After construction, each landowner will receive a digital map showing the location of the gas pipeline, the re-established drains, and any other cables or pipelines on the property.

Thomas Høj Arnum sent a response to consultation to the authorities, suggesting that the gas pipeline should follow a slightly different route. Not through a neighbour's field, and around a newly established forest and some marshland. However, having the new pipeline run parallel to the old one was given more weight. Half a hectare of forest will be lost, and Thomas Høj Arnum will receive compensation or reforestation. But he is a bit disappointed that no-one came to his field to look at his proposal.

Two growing seasons impacted

Baltic Pipe has already impacted two growing seasons, because there were archaeological studies in 2020. These had to be completed well in advance of the project commencing, so there would be time to excavate any important ancient monuments.

Thomas Høj Arnum grows beets, corn and grain. Farmers are told to just cultivate their fields normally, without taking into account that a gas pipeline will soon be coming. Detrimental impacts and additional costs will be compensated, but Thomas Høj Arnum was reluctant to put effort into sowing fields which would be dug up before harvest anyway. Over 12 hectares of his land will be affected, where 3.8 kilometres of gas pipeline is being laid.

"I can certainly understand that. There's a general timetable, in principle, but the contractor may change it within certain limits if something happens with the weather or other working conditions. We're only interested in one thing – getting the gas pipeline established as smoothly as possible. If adjusting the timetable helps ensure this, we are very willing to do so," says Søren Peschardt.

Thomas Høj Arnum approaches it all with classic Jutlandish calm: "It'll be okay. We are standing up for our rights, but we will get through this."





We are very aware that such large-scale construction work has a significant impact - and that we must take responsibility for any inconvenience we cause.

Søren Peschardt
Landholder Liaison Officer, Energinet



Thomas Høj Arnum
farm owner



SMALL ANIMALS – BIG CONSIDERATION

Birch mice and bats. Ancient monuments and amphibians – and springs. At first glance, they do not appear to have much in common – but they do. The major Baltic Pipe construction project takes into account fauna, ancient monuments and the environment in general.

Some citizens may feel that Energinet comes charging in and lays the Baltic Pipe gas pipeline where it is most practical for Energinet.

But prior to the construction work, there are extensive preparations involving public meetings, public consultation, archaeological studies and expropriations.

Anni Berndsen is a biologist who works in Energinet's Environment and Geoscience department. Once the Danish Environmental Protection Agency has given permission following an EIA (Environmental Impact Assessment) report, Anni and her colleagues must

obtain the necessary permits for the construction work from the 13 municipalities Baltic Pipe passes through, and from the Danish Coastal Authority and Nature Conservancy Board.

Even before the EIA permit was issued, they held a number of meetings with the municipalities to get their input.

"If they say that they will never grant permission to dig through a given watercourse, it would be foolish to continue working with that angle. So we try to adapt the project to the actual conditions as early as possible. We ask them how we should do it, so that it can go as smoothly as possible, while respecting nature and the environment, as well as what is technically feasible. There were many things we had not thought about, even though we are used to large-scale projects. No two situations are the same."

"I feel we have an important job – to help ensure that Energinet does things correctly and complies with all the requirements and restrictions. We are a state-owned public organisation, and our credibility is at stake," says Anni Berndsen.

BALTIC PIPE ROUTED AROUND SVANMOSEN BOG

In 2018 and 2019, citizens, government authorities and other parties had the opportunity to submit comments and objections to the project during two public hearing phases. Several hundred took advantage of the opportunity, and the routing of the gas pipeline was changed in several locations before the Danish Environmental Protection Agency issued an EIA permit for Baltic Pipe in summer 2019. For example, the route was changed south of Vonsild near Kolding, to avoid Baltic Pipe passing through the Svanmosen area of scenic beauty. Read more about Baltic Pipe at www.baltic-pipe.eu

Listening out for bats

For example, doing things correctly means that Energinet employees go through the entire Baltic pipe route in advance to see where bats might be living.

"Old trees of a certain trunk thickness and height, which could have cavities in the wood, can be homes to bats. We send out a bat expert with listening equipment. If it turns out that there are bats in the trees, we can only cut them down in September and October, when the bats are not breeding or sleeping," says Anni Berndsen.

The birch mouse is another good friend of the project. It is a very small rodent which only has two habitats in Denmark. One is in South Jutland, where Baltic Pipe is being laid in 2021. In order to avoid birch mice choosing to hibernate right where the gas pipe is to be laid, the excavators began their work at Lunderskov



Anni Berndsen
Biologist, Energinet

in autumn 2020, so the mice could find other places to sleep. Early excavation was also done at a bog near Egtved, where the birch mouse is active during the breeding season in spring. The birch mouse has a cousin - the hazel dormouse - which is found in area where an access road had to be constructed. Dormouse-friendly vegetation will be planted along the road, so the mice can remain. Good solutions such as these can generally be found.

If there are ancient monuments in an area, Energinet must apply for a permit to work within a 300-metre protection zone.

Springs and amphibians

When the Environmental Protection Agency grants an EIA permit, it is conditional upon the project complying with a number of requirements. Anni Berndsen helps to ensure that this happens.

Energinet has to measure the water level in the sand layer around some springs near Odense river - six months before excavation work and for five years afterwards. The EIA permit stipulated six months after the excavation work, but the municipality wanted five years.

"This is a Natura 2000 area, so we need to monitor whether the pipeline affects the springs in the area. Under EU legislation, we have to be able to document that the gas pipeline is not negatively impacting the spring - it must remain as it was," says Anni Berndsen.

And then there are the amphibians. On her map showing the pipeline routing, Anni has marked in a lot of Bs and As. B stands for birch mouse and A for amphibians:

"If there are amphibians in an area, the contractor must erect an amphibian fence, or inspect the pipeline trench each morning, lift out the creatures and place them at a designated location. Nature and the environment play an important role. It's not something that we can or want to simply ignore."

TIMELINE

2018

DECEMBER 2017 – 22 JANUARY
First public consultation

JANUARY

Information meetings in six towns

SUMMER

Supplementary consultation due to changes to the route

JULY – NOVEMBER

Energinet visits more than 550 landowners

JANUARY – AUTUMN

Energinet and Polish GAZSYSTEM prepare a report on the impact of the project on the environment and people

2018-2019

Energinet reads the 186 responses to consultation and adjusts the route

2019

2019

Geotechnical surveys

15 FEBRUARY 2019 – 12 APRIL

Second public consultation

MARCH

Public meetings in six towns

12 JULY

Danish Environmental Protection Agency issues an EIA permit

JULY

Danish Business Authority issues a national planning directive

25 OCTOBER

Danish Energy Agency authorises construction work at sea

2020

2019-2021

Archaeological investigations

2021

SUMMER 2019 – FEBRUARY 2021

Inspections and expropriations in relation to approx. 550 landowners

2022

DECEMBER 2019 – SUMMER 2022

Construction work

END OF 2022

Baltic Pipe starts transmitting gas

“

We do not yet have the complete solution, but we have a clear direction, and that is what will make us successful.

”

Bjarne Gellert
Chief Engineer, Energinet



SF₆-FREE BY 2050
SF₆ gas is a strong greenhouse gas with a climate footprint approx. 23,000 times greater than CO₂. Energinet registered 763.84 kg of SF₆ emissions in 2020.

In 2020, Energinet changed its previous objective of CO₂-neutral SF₆ emissions in 2050, to being completely SF₆-free by 2050.



COMBATTING CLIMATE GASES

– STEP-BY-STEP

The objective of a climate-neutral society in 2050 is clear, but in some areas the necessary technology is not yet available to fully reach the target. We must therefore move towards the goal one step at a time. This applies, for example, to phasing out the use of SF₆ gas in power systems, as it has a high climate impact.

Components containing SF₆ gas have been in use at Energinet's high-voltage substations around Denmark for many years. The gas serves as an efficient insulation medium in gas-insulated power systems. In circuit breakers, the gas also ensures that the arc that occurs upon disconnecting power is extinguished.

The problem with SF₆ gas is that it is a strong greenhouse gas, and it is impossible to avoid minor leakage from the plants because the components cannot be totally sealed. There is also a risk of breakdowns, which could lead to major emissions of the gas. There is therefore a pressing need to find SF₆-free solutions. But even though technological development is well underway, there are still no alternatives on the market that can be used at the highest voltage levels above 145 kV.

Clear signals advance green technology

"Energinet has a goal of more than halving SF₆ gas emissions by 2030, and being completely SF₆-free in 2050. This is a challenging task, which involves replacing hundreds of components and introduce new technology in our plants. We have a clear pathway towards the goal, but because the technology is not mature, we do not yet know what the complete solution will be," says Bjarne Gellert, Chief Engineer in Plant Optimisation at Energinet.

Energinet's desire to phase out SF₆ gas is shared by the transmission companies in other countries, and this will help a small country like Denmark to succeed in its goal.

"When the whole world sends the same clear signal about the need for SF₆-free components, it supports market development of green alternatives. We expect suppliers to have technology ready at all voltage levels by 2030," says Bjarne Gellert.

A step in the right direction

Some of the key tools at the moment are close dialogue with suppliers, and a flexible procurement policy that favours plants with the least gas leakage, according to department head Kim Sogaard Mikkelsen, whose employees are responsible for plant expansion and reinvestment at high-voltage substations.

"In our calls for tenders, we now also give weight to how well the component is sealed – i.e. its ability to keep the gas inside. We are also signing shorter framework agreements with suppliers, so we don't commit to buying the same standard component for years. This allows us to quickly begin using greener new components when they are developed," he explains.

SF₆-free components are already being substituted at the lower voltage levels, but even here things need to be done one step at a time.

"SF₆-gas is a mature technology that we know inside out. Things are more complicated with the new green solutions, which we have to integrate into our plants. No market standard yet exists for the new technologies, and much like the old battle between VHS and Betamax video cassettes, we hope for a clear winner in the market, so we can more easily optimise our processes," explains Kim Sogaard Mikkelsen.

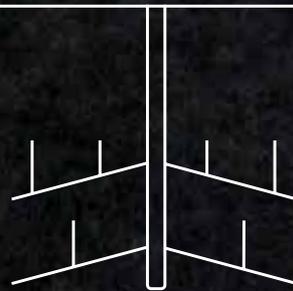
In addition to the ongoing replacement of components, plant monitoring is being improved, so that emissions can be identified and stopped more quickly.





SOLAR AND WIND TURN POWER GRID UPSIDE DOWN

We have seen a massive expansion of wind and solar power in recent years – often in areas with very little consumption and where the electricity transmission grid is not designed to transmit away large amounts of power. We can together find suitable locations for new solar cells and wind turbines.





Danish solar cells supplied 3.4 per cent of Denmark's total electricity consumption last year, and this figure is expected to rise to 15 per cent by 2025.

Even though wind turbines cannot deliver the same growth rate (wind turbines generated 47 per cent of consumption last year, and this is expected to rise to 64 per cent by 2025), there will be very large volumes of green energy flowing into the grid and out into our power outlets in the coming years.

The enormous growth means that the Danish electricity transmission grid is being turned upside down.

"Many of the new projects are shooting up in parts of Denmark where there is land available, ample space and few neighbours, but often also a low level of electricity consumption to take up new production, and where the electricity grid is not designed to transmit large amounts of power away," says Rikke Bille Gaardestrup, Chief Planner in Grid Planning in Energinet.

Historically, the Danish electricity transmission grid has had large central power stations as nodes. Power flowed from Copenhagen, Aarhus, Odense, Aalborg, Esbjerg, Aabenraa, Skærbæk Power Station at Fredericia, Stignæs Power Station at Skælskør and Kyndby Power Station at Hornsherred, to all parts of Denmark. The further you went from the nodes, the smaller the consumption and hence the thinner the power lines.

Green power heading to the cities

Electricity is already flowing the other direction for most hours of the day, from rural areas and offshore wind turbines to the cities and large consumption centres. This traffic flow will only increase as we have to make our electricity consumption completely green and also double electricity consumption when electric vehicles replace petrol and diesel, electric heat pumps supersede oil and natural gas boilers, and we start making hydrogen and green fuels from renewable energy.

"It's really good for the green transition that wind and solar power are so competitive now that they no longer need subsidies, and that solar cells are shooting up around the country. But it also gives rise to challenges. For example, a solar cell entrepreneur may be able to get his whole project up and running over just a few years, while expanding the electricity grid often takes much longer," says Rikke Bille Gaardestrup, noting that Lolland and West and North Jutland are areas where the electricity grid is under strain during certain periods.

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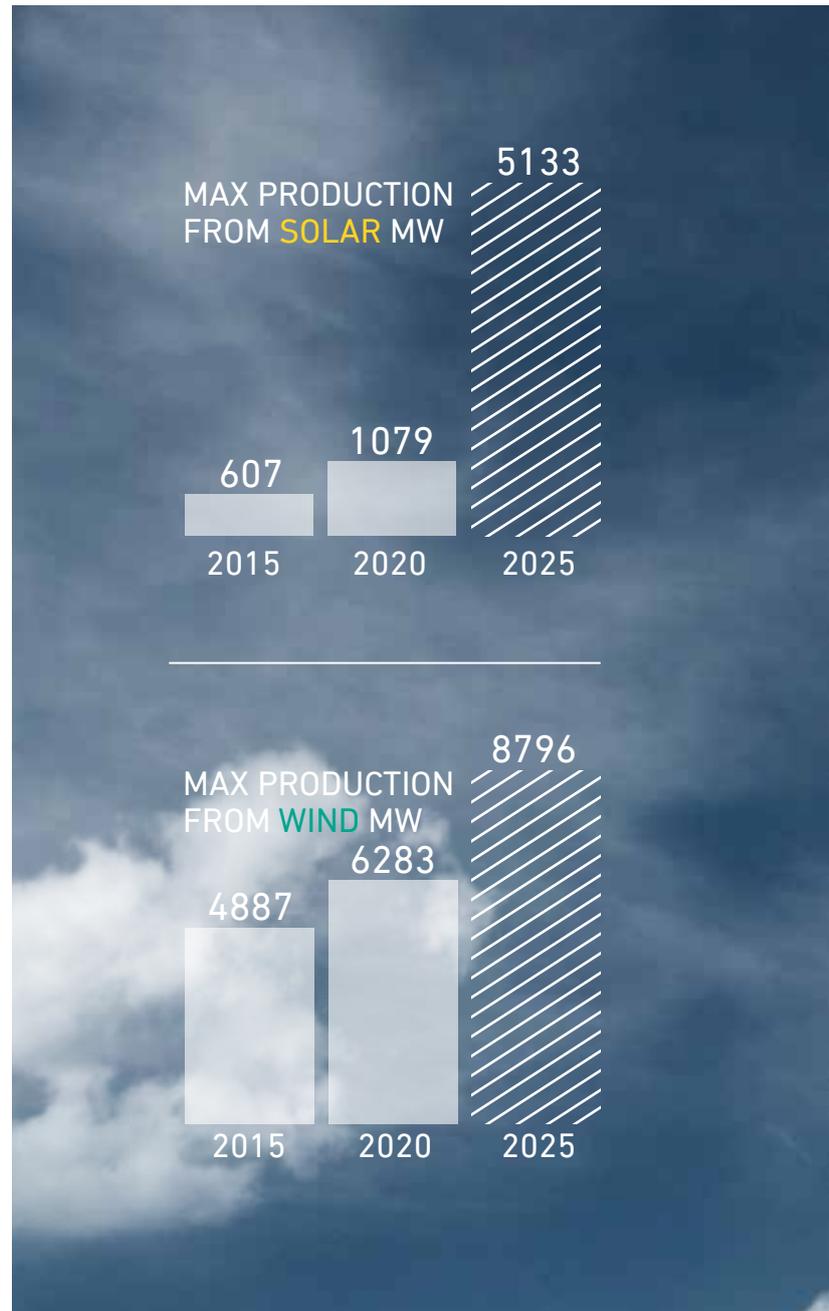
In addition to expanding the electricity grid as more green energy is developed, Energinet is working on many fronts to prepare the electricity market and power system for a greener future. One of the many initiatives is a capacity map, which shows where the grid is already fully utilised, and good locations for placing new electricity generation.

Rikke Bille Gaardestrup stresses that Energinet will not use the map to impose specific locations on municipalities or solar cell companies.

“But we are seeing that both municipalities and wind and solar power companies have a strong desire to find good locations for their plants. The municipalities want to prioritise projects that can help them become green and meet their climate targets as quickly as possible. RE developers seek quick clarification, so they can decide whether to proceed with a given project,” she says. She also notes that the capacity map has led to Energinet being in dialogue with a number of municipalities. This includes participating in meetings discussing the local expansion of green energy.

“This dialogue is also very rewarding for Energinet. If we better understand each other’s processes, possibilities and limitations, we may be able to work more in parallel, thereby shortening some of the execution time from project idea to more green power in Danish homes. This will help ensure both a fast and efficient green transition,” says Rikke Bille Gaardestrup.

Since the launch of the capacity map in September 2020, Energinet and the Danish Energy Association have created an even more detailed capacity map showing available capacity for the connection of new solar and wind power generation at individual substations in the transmission and distribution grid. You can see the map here (in Danish): www.kapacitetskort.dk



REGULATION AND MARKET

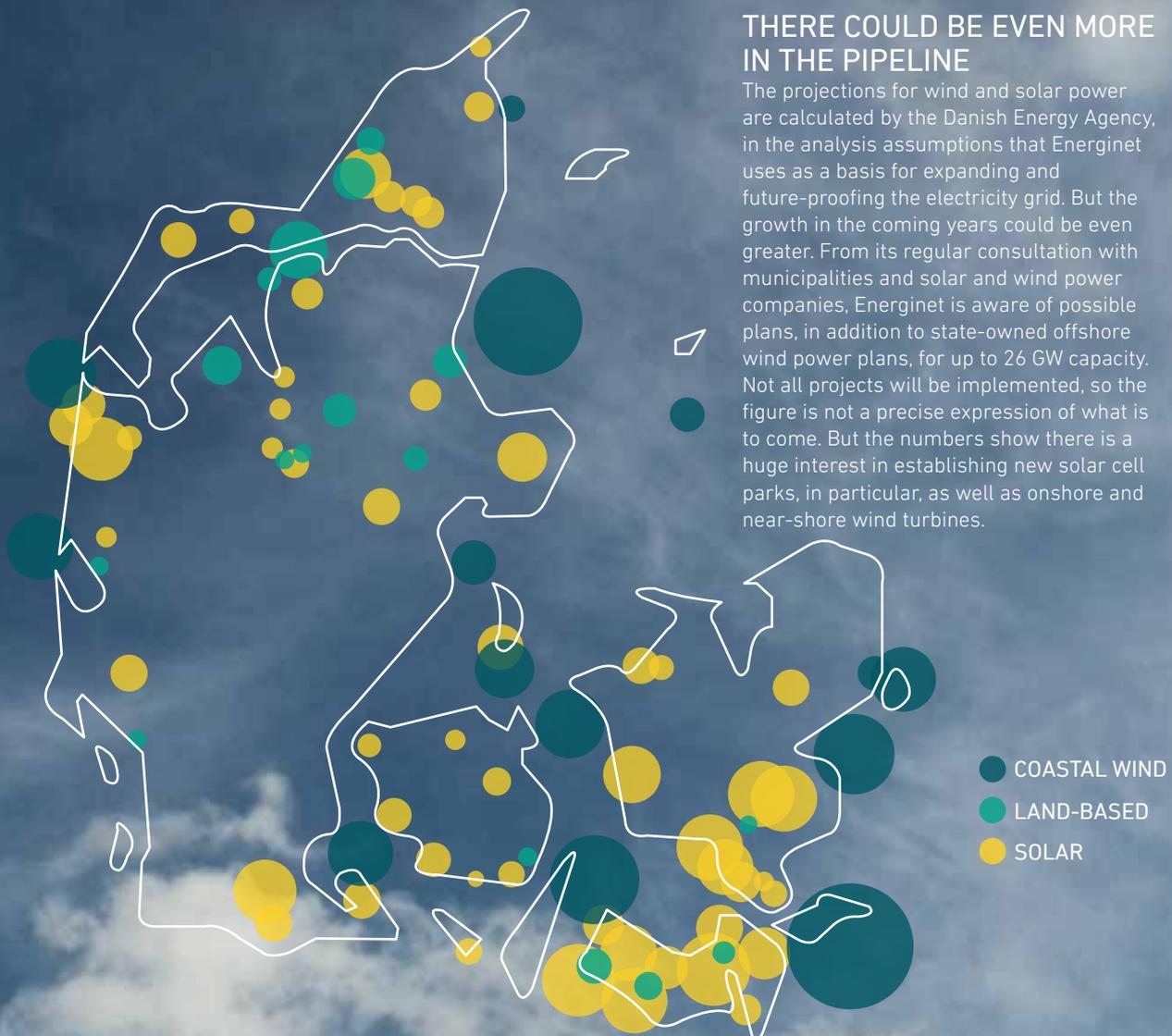
The location of electricity consumption has traditionally determined the capacity in the high-voltage grid – i.e. where power is used.

But it is now increasingly the geographical location of electricity generation and the large fluctuations in production from wind turbines and solar cells

that determine expansion requirements in the electricity grid – i.e. where power is generated.

In future, there may be considerable value in providing incentives for positioning new consumption, and wind turbines and solar cells, in such a way that it does not result in excessive grid expansion costs.

Energinet is therefore working with government authorities, the energy sector and others to establish new regulations and market measures that can better ensure the fast and efficient integration of green energy into the grid. For example:



- Differentiated prices for electricity transport (tariffs): For example, a company with a large and flexible electricity consumption that draws this at times when there is free capacity in the electricity grid could pay a lower tariff for electricity transport in the transmission grid.
- Differentiated prices for connection to the electricity grid (connection contribution): If you invest in new electricity generation, the price of connecting to the electricity grid could more highly reflect the investments in electricity grid capacity required at the given location.
- Models which encourage electricity generation and consumption to be placed at the same location, such as new Power-to-X plants in connection with large-scale production of renewable energy, so that the electricity grid is not burdened.
- Local markets for balance services in the electricity grid: New possibilities for local electricity generators and flexible electricity consumers to earn money by reducing production or increasing consumption at times and places where the grid is highly congested.



BIOGAS CAN SERVE AS A KEY PIECE OF THE CLIMATE PUZZLE

As Denmark pieces together the complicated puzzle to ensure it becomes climate neutral, biogas can serve a key role.

Reductions must be found in many parts of society in order to meet the Danish Folketing's ambitious target of a 70 per cent CO₂ reduction in 2030 compared to 1990 emissions, as well as the long-term goal of an entirely green society in 2050.

The Danish Government's climate partnership for energy-intensive industry has proposed that some of Denmark's largest energy consumers, and hence CO₂ emitters, replace their existing consumption of oil, coal, etc. with biogas. Together with carbon capture and other reductions and efficiency improvements, the partnership reports that this will lead to an annual reduction of 1 million tonnes of CO₂. For comparison,



Aalborg Portland and Nordic Sugar have both decided to replace coal and oil with gas – 100 per cent biogas in the long term. Both are among the largest CO₂ emitters in Denmark.



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Denmark needs to find total reductions of approx. 14 million tonnes by 2030 in order to have total CO₂ emissions of 22 million tonnes annually (70 per cent of the 1990 level).

For many highly energy-intensive companies, direct electrification is not an option or only partly possible. For example, high-temperature processes need more than what solar and wind power can offer. Biogas is ideally suited here, according to Torben Brabo, Director of Energinet Gas TSO.

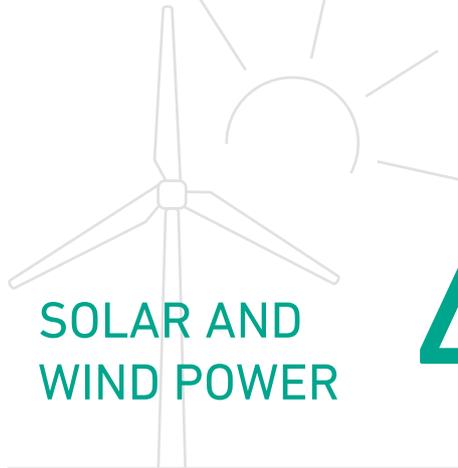
“Even though we are currently seeing enormous growth in Danish biogas production, biogas will become a limited resource in the future, and must therefore be used where it creates the most value. In addition to using it as a fuel for peak-load electricity and heat production, it is in industry that biogas will be of most benefit. Far from all companies will need biogas, but it will be a clear and necessary option for some, and it is among such companies that there will be great climate potential for society,” says Torben Brabo.

Several large companies have already announced that they will replace coal and oil with gas, including Denmark’s largest CO₂ emitter, Aalborg Portland, Nordic Sugar’s factories on Lolland and Falster and Rockwool, and others are on the way. Energinet’s collaboration partner, Evida, which operates the gas distribution grid and integrates new biogas plants, has made agreements with several companies in recent years that will switch from coal and oil to gas. The number of agreements may not seem very impressive, but because they are energy-intensive companies, conversion to gas will lead to considerable CO₂ reductions.

Torben Brabo notes that the share of biogas rose to approx. 21-22 per cent of the gas in the Danish gas system in 2020. When companies convert from oil and coal to gas in the years ahead, it will therefore be both natural gas and biogas, but it makes good climate sense to change now, according to Torben Brabo. This is because natural gas emits approx. half as much CO₂ as coal, and because so much biogas is being added to the Danish gas grid in the years ahead that it will not be long before biogas accounts for the majority of Danish gas consumption.

According to the Danish Energy Agency’s analysis assumptions, there will be 34 per cent biogas in the system in 2024, increasing to 60 per cent in 2030. In 2040, it will be possible to meet all gas consumption in Denmark using biogas.

2020 IN FIGURES

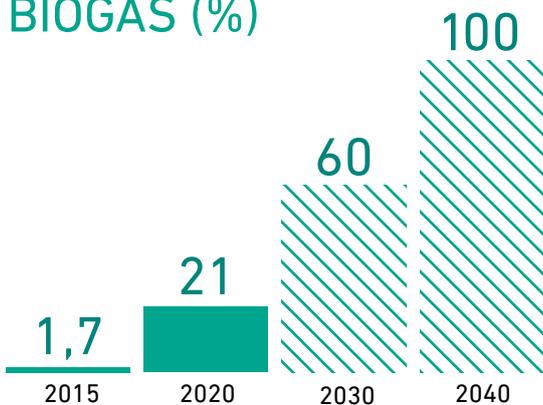


SOLAR AND
WIND POWER

49,9%
2015: 40%

In 2025, 80 per cent of our electricity consumption is expected to be met by solar and wind power.

BIOGAS (%)



HIGH SECURITY OF SUPPLY FOR ELECTRICITY

25 sec.
WITHOUT POWER

Danish security of electricity supply was in the European top class again in 2020.

SAME ELECTRICITY PRICE AS ABROAD

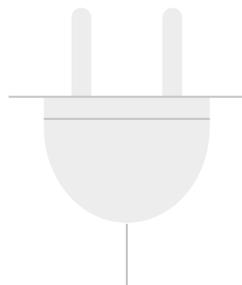
(PERCENTAGE OF HOURS)

West Denmark:

91%

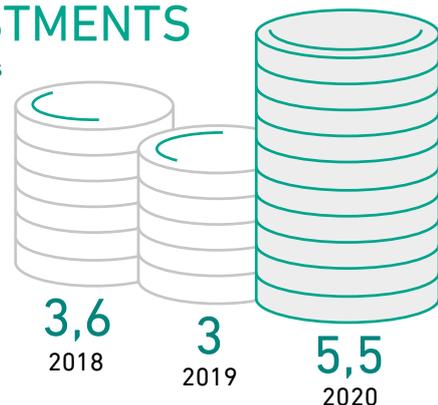
East Denmark:

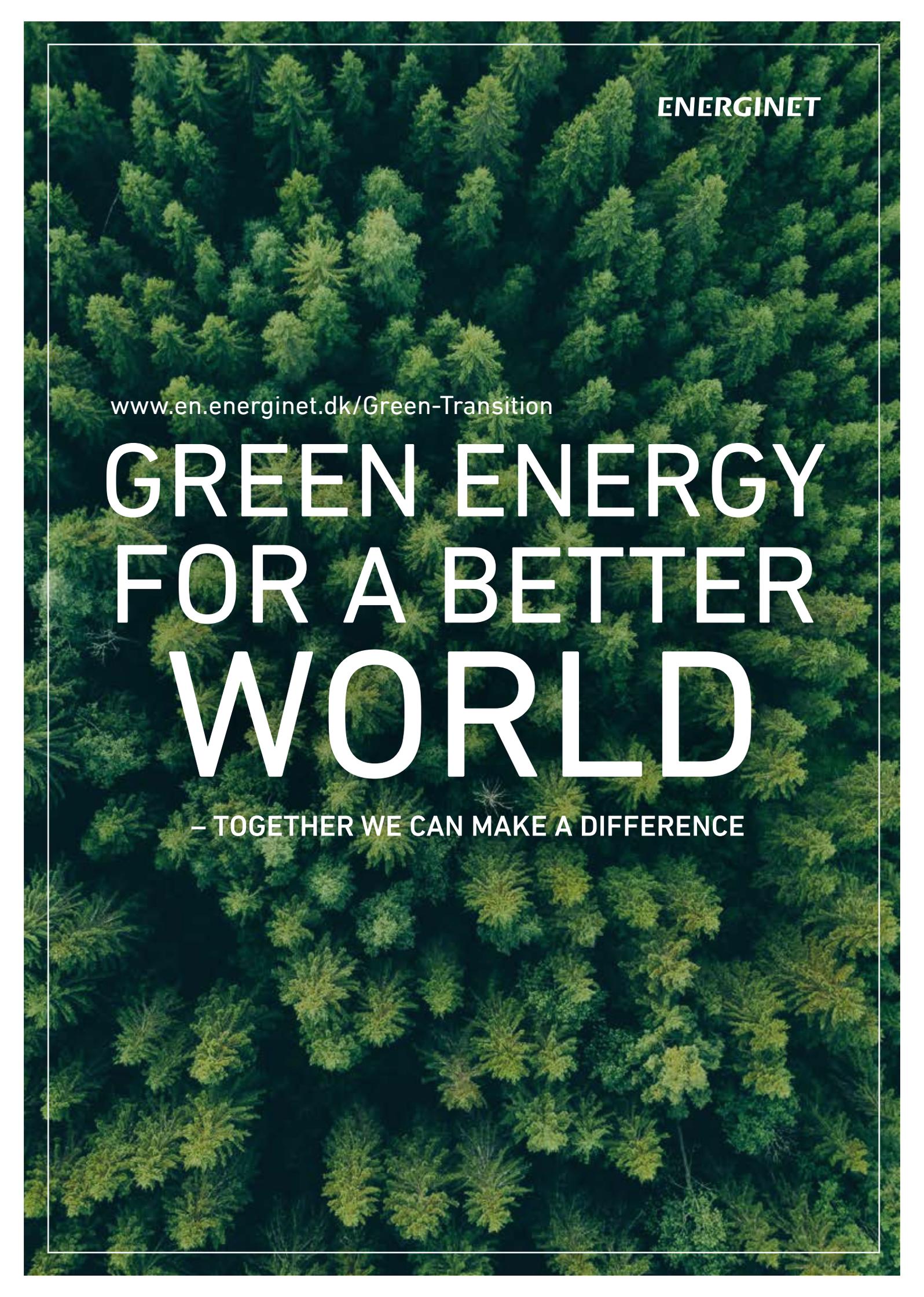
94%



FIXED ASSET INVESTMENTS

DKK billions



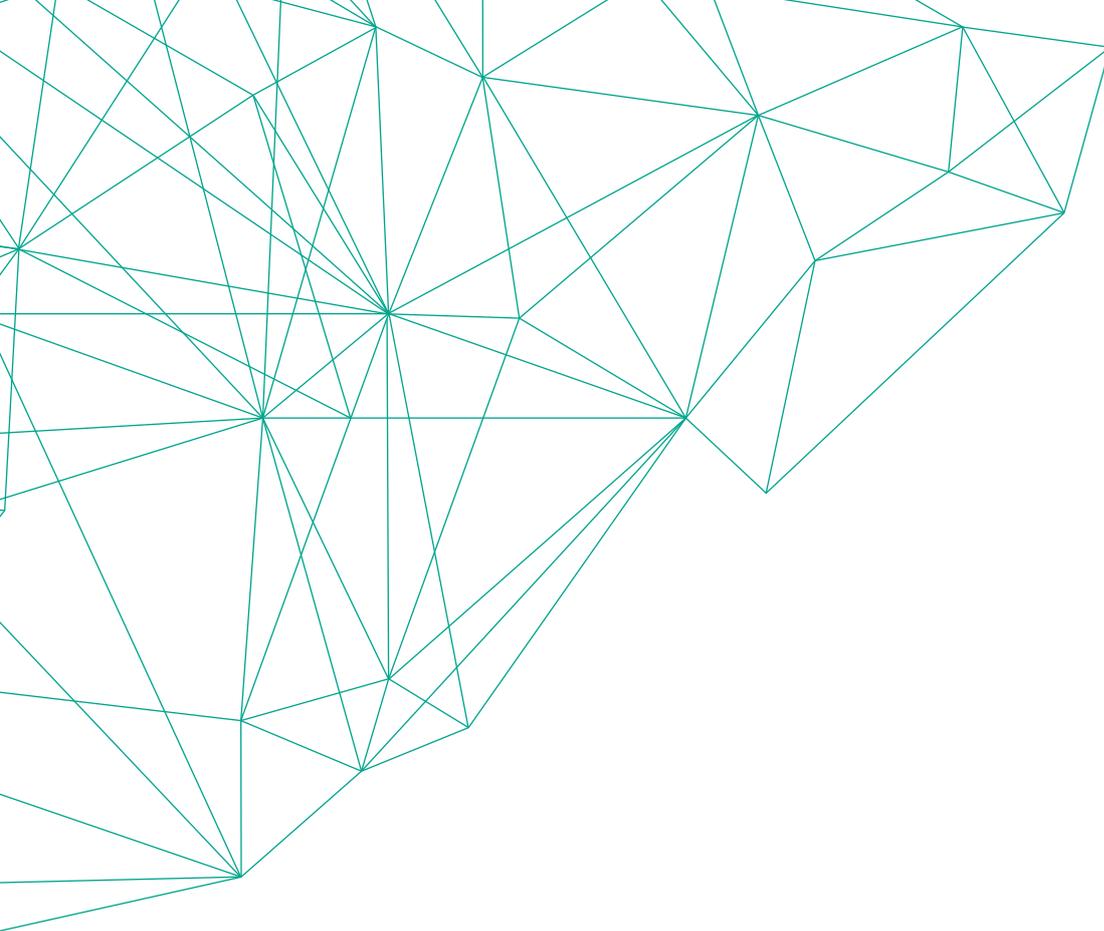
An aerial photograph of a dense, lush green forest, likely a coniferous forest, filling the entire background. The trees are packed closely together, creating a rich, textured canopy of various shades of green.

ENERGINET

www.en.energinet.dk/Green-Transition

GREEN ENERGY FOR A BETTER WORLD

– TOGETHER WE CAN MAKE A DIFFERENCE



ENERGINET

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www.energinet.dk

Energinet is an independent public enterprise owned by the Danish Ministry of Climate, Energy and Utilities.

We are working towards a green transition of the energy systems, so that citizens and businesses can use renewable energy for everything, with a high level of security of supply and at an affordable price.