Pairing technologies to achieve a higher Green Score

24/7/365 renewable energy solutions for U.S. corporate customers

Ørsted

Our renewable energy solutions are leading the green transition

orsted.com

Let's create a world that runs entirely on green energy

Ørsted is committed to creating a world world that runs entirely on green energy. We completed our own green business transformation from a heavily carbon intensive energy company to a renewable energy major in just over a decade. By 2025, our own energy generation and operations will be carbon neutral, making us the first major energy company to achieve this. By 2040, our supply chain will be carbon neutral. Our next step of the journey is to leverage our experience to help other companies set and achieve similarly ambitious sustainability and decarbonization objectives.

The lessons we have learned through years of experience as a developer, owner, and operator of renewable energy projects have prepared us to support other industries and corporations as they work to meet their sustainability targets. We understand firsthand the challenges and opportunities and realize that partnering is the best path to success. We want to contribute globally by scaling and accelerating existing solutions, as well as leverage our strong culture of innovation to craft new solutions. Our ambition is that our contributions to solutions like 24/7, load-following, storage, and green hydrogen will enable other industries to accelerate decarbonization of their load, fleet, and supply chains.

By matching renewable generation with customer load, 24/7 products can help companies take a significant step toward fully decarbonizing their operations. While matching 100% of customer load with renewable products on an interval or hourly basis remains challenging, there are opportunities available today to begin a shift away from traditional virtual PPAs.

This is just one of the many tools we will need to create a world that runs entirely on green energy. We look forward to continued engagement with other industries and corporations to create partnerships in support of realizing our vision.

Vishal Kapadia
Chief Commercial Officer, Onshore
Orsted A/S

Willow Creek Wind, Butte County, South Dakota

Growth of the corporate renewable market in the U.S.

When the first commercial wind turbines were being installed in the United States in the 1980s and 1990s, few predicted that 20 years later corporate customers – such as Walmart, Microsoft, Target, Pepsi and others – would be driving the growth of renewable energy across the United States through ambitious procurement programs. Over the last five years, as the Virtual Power Purchase Agreement (VPPA) has gained traction as an enabling financial tool, the industry has seen tremendous growth; more than 32 GW of projects have been installed in the U.S. to meet the sustainability needs of large corporate buyers since 2015. Yet we are still only at the beginning of this corporate market growth. These large customers are continuing to advance their emissions offset initiatives and accelerating those goals beyond Scope 1 emissions to include both Scope 2 and Scope 3 emissions. This means there are still many hundreds of gigawatts of projects needed to meet the demands of the market.

Corporate buyers are driving the renewable energy transition

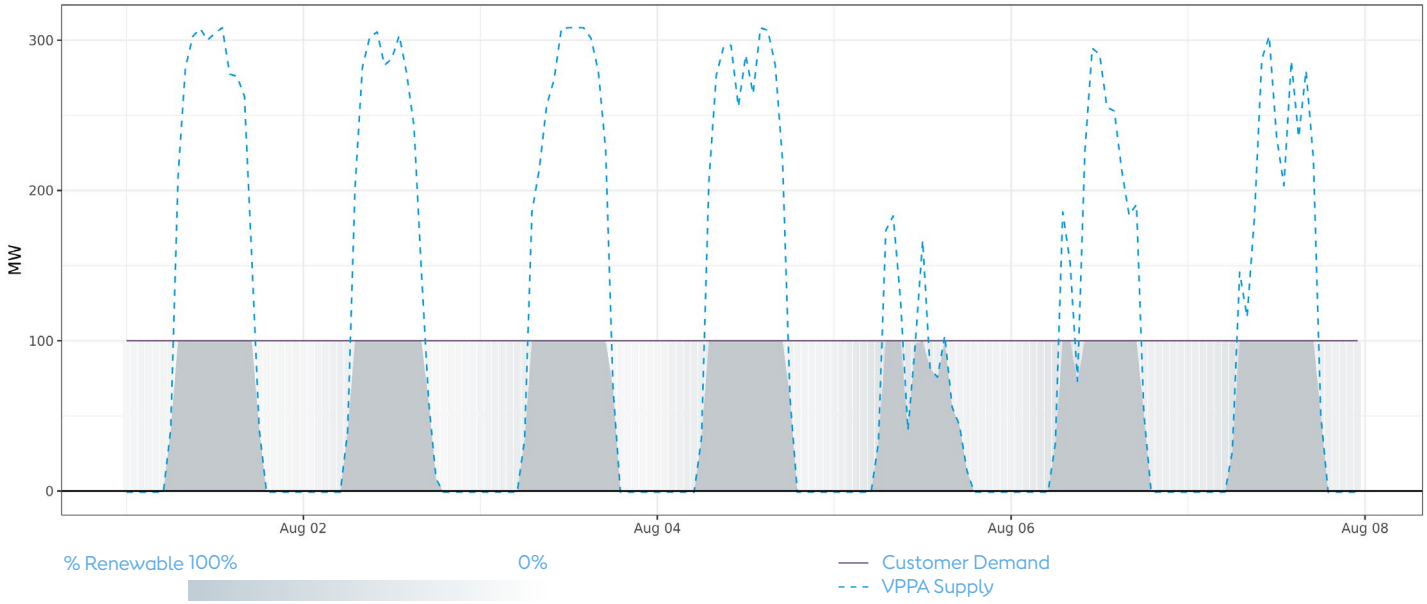
+32 GW

More than 32 GW of wind and solar PV projects have been installed to meet the sustainability needs of large corporate buyers since 2015.

FIGURE 1

Corporate buyer load profile

A hypothetical corporate buyer with a flat load profile, such as a chemical refiner, that has signed a solar VPPA must buy brown power from the grid overnight, meaning they have an implicit carbon footprint even if the annual balance of energy from the VPPA matches their load.



As large corporations continue to prioritize their sustainability initiatives, new tools are being developed by energy suppliers, such as Ørsted, to help them achieve their goals. The most common means by which corporations can reduce their carbon footprint is through execution of a Virtual Power Purchase Agreement with an energy supplier for renewable energy. Currently most VPPAs are tracked on an annual basis. That means that if a corporate customer wants to offset 100,000 MWh/year of electricity use, they will execute a VPPA for a project that will generate approximately 100,000 MWh/year. This annual matching ignores the nuances of monthly, daily, and hourly load fluctuations that lead the corporate buyer to rely on (often carbon-intensive) grid power to make up the difference. (See Figure 1.)

More experienced and ambitious buyers are beginning to ask the market for VPPAs that more closely resemble their load shape around the clock: a "24/7" load-following product. The promise of such a product is the generation of green power exactly when it is needed, but matching supply and demand like this is quite challenging.

24/7

What does 24/7 energy really mean?

To achieve 'true' 24/7, 365 renewable energy, a company must match its power consumption with renewable energy supply in real time. In practice, this means matching load with renewable energy generation, storage and flexibility on an hourly basis at least – sometimes even 15-min basis.

Even the most progressive companies currently don't expect to match 100% of their energy on an hourly basis today. Rather, they are looking for ways to increase their Green Score and, over time, reach 100% 24/7 matching between their load and renewable generation.

There are a number of challenges that make 100% renewable energy a challenge to achieve on a 24 hour, 7 days a week, 365 days a year basis, but corporate customers, project owners, and investors are working together to find solutions.

These challenges arise when trying to shape intermittent power generation into a natural customer load shape.

Matching generation fluctuations with load demands

To achieve a 24/7 renewable product, matching time of generation and load are critical. Renewable energy projects, including wind and solar, do not generate at designated times. They are valuable because the input cost of the generation is limited (wind and sunlight are a free resource), but their downside is an inability to generate on-demand. Battery storage is becoming a cost-effective solution to this lack of dispatchability, although batteries still need downtime to charge, and large batteries that are able to sustain a discharge for extended periods of time are still costly.

Locational Constraints

There are numerous customers who would be interested in more renewable energy powering their facilities, but often those facilities are located in areas with limited direct access to renewables and/or markets that are not designed to allow for retail choice by customers. These customers therefore have to rely on their local utilities to help deliver those renewables, which can limit their access to the products they would like.

Cost Limitations

The cost of renewable generation from wind and from solar is already on par with traditional generation sources on a levelized cost of energy basis. However, corporations will have to couple their solar and wind purchases with adequate amounts of storage and/or other distributed energy resources to truly achieve a 24/7 product, ultimately increasing the total cost, as projects would have to be overbuilt to protect against variable load.

Permian Energy Center, Andrews County, Texas

Pairing renewable technologies can improve a Green Score

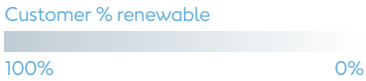


FIGURE 2

Portfolio: 100% solar PV

The same customer from Figure 1 has contracted perfectly clean energy throughout the whole year, but only realizes the full benefits in the afternoon when the sun is shining. Because of the overnight mismatch between supply and demand, the customer's average hourly Green Score is just 62% for the year.

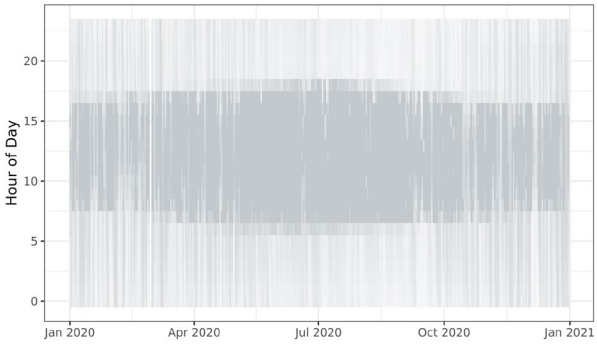
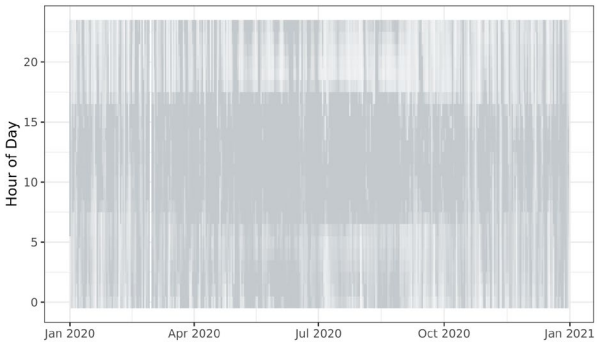


FIGURE 3

Portfolio: 50% onshore wind, 50% solar PV

Swapping from a 100% solar VPPA to a 50% solar, 50% wind PPA improves the customer's Green Score to over 80%.



Permian Energy Center, Andrews County, Texas

Exciting opportunities for 24/7 products are emerging despite challenges in the market. Most large corporations are already comfortable that VPPAs can help them achieve their goals by matching renewable generation against customer load on an annual basis under most ESG reporting standards. But in response to feedback from customers, shareholders, and the sustainability community, many companies are now looking to do even better and looking to 24/7 products as away to increase real-world impact and reduce emissions more effectively.

Providers that have robust and diverse operating portfolios of renewable projects coupled with the ability to manage market fluctuations and volatility are well suited to help corporations achieve their 24/7 goals. To illustrate how the ability to design and deliver diverse sets of projects can help corporate buyers, we look more deeply into two of the largest markets in the United States: ERCOT and PJM.

ERCOT, the grid operator for most of Texas, manages more renewable energy (wind & solar) than any other regional grid operator in the U.S., but the overall power mix is still quite brown, especially on hot summer afternoons when gas- and coal-fired generation are keeping systems running. What if our hypothetical customer from Figure 1 with 100 MW of flat load wanted to improve their carbon footprint? Figure 2 shows the percentage of annual energy consumed that is green over the entire year from just the solar VPPA (which is sized to meet annual energy demand in aggregate). The average hourly Green Score for the year, estimating the percentage of energy consumed that is from green sources, is 62%.

Plum Creek Wind,
Wayne County, Nebraska

A good option for the customer to improve their Green Score for little added cost is to take advantage of the tremendous wind resource in Texas in combination with the solar resource. Since the wind and the sun produce energy at different times of day, just swapping out the single solar VPPA for a combined solar and wind VPPA can make a big difference. As shown in Figure 3, this approach can help the customer increase their green score from 62% to over 80%.

In PJM, onshore wind power and solar power is not as abundant as in ERCOT, making sustainability a more difficult problem for corporate buyers. However, suppliers like Ørsted –which is bringing the nation's first offshore wind facilities online and working to drive down the cost of energy storage –

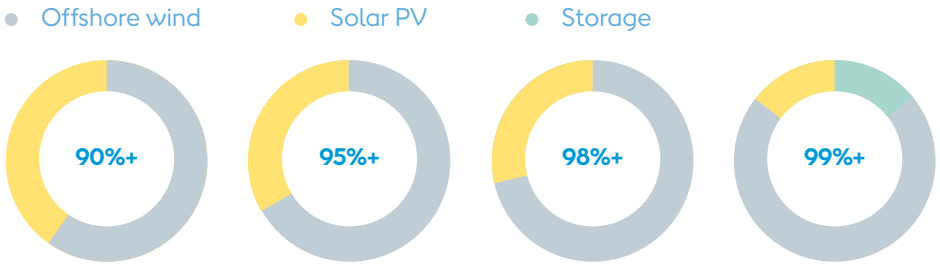
"Although offshore wind power on the East Coast is more expensive per MWh than Texas wind, it also has a more constant production profile and higher overall capacity factor, both qualities that are advantageous to the 24/7 customer."

FIGURE 4

Cost to achieve 100% renewable energy 24/7

As U.S. customers strive towards higher sustainability, they should incorporate offshore wind and storage into their VPPA contracts. Reaching the highest levels of green energy consumption, however, can be expensive: to increase the Green Score from 90% to 91% entails a 5% increase in cost, while increasing from 98% to 99% entails a 20% increase in cost.

PJM customer with the technology mix that would most economically achieve a certain green consumption percentage



Cost increase:
90% → 95% green = +30% cost
95% → 98% green = +20% cost
98% → 99% green = +20% cost

Muscle Shoals, Colbert County, Alabama

are able to offer cost-effective solutions. Although offshore wind power on the East Coast is more expensive per MWh than Texas wind, it also has a more constant production profile and higher overall capacity factor – both of which are attractive qualities to the 24/7 customer. In addition to mixing offshore wind and solar, incorporating energy storage is necessary to achieve the highest sustainability levels. Figure 4 shows the technology mix that a customer in PJM would use to most economically achieve a certain green consumption percentage.

Achieving a genuine 24/7 load-following product is a complex and challenging endeavor. For a corporate customer to embark on this journey, they will need to partner with an organization that has the capabilities both to deliver complex renewable energy projects as well as to coordinate, manage, and schedule those resources in the market.

In Ørsted's North Western European markets, solar PV does not have the same capacity factors as ERCOT or PJM so Ørsted would build a 24/7 product around an offtake from offshore wind which can provide at least 50% Green Score and on top of this Ørsted would look to add solar PV and storage to further increase the Green Score.

Definitions

A Virtual Power Purchase Agreement (VPPA) is a contract between a corporate buyer and project owner. It is a financial transaction: a corporate buyer does not own the physical electrons generated by the project. The VPPA exchanges a fixed cash flow for a price-dependent cash flow and renewable energy certificates (RECs). Because the VPPA is financial, the buyer still needs to meet its electricity load through their local utility or retail electric provider.

Green Score as defined by this paper is the percentage of carbon free electricity that the buyer is contracting to meet their sustainability initiatives. If a buyer has a 100% Green Score, that would mean that 100% of their load is being met with carbon free energy 100% of the time. Whereas a Green Score of 50% would mean that the buyer is only receiving carbon free energy coincident with 50% of their load.

Scope 1 emissions covers direct emissions from owned or controlled sources.

Scope 2 emissions covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.

Scope 3 emissions includes all other indirect emissions that occur in a company's value chain.

Ørsted – A global renewable energy major

Ørsted, a company that in only 10 years has transformed from one of the world's most carbon-intensive utilities to one of the world's most sustainable energy companies, as recognized by the 2020 Corporate Knights Global 100 Ranking, knows firsthand the challenges to achieving sustainability goals and handing those challenges.

Beyond our own transformation, we have helped numerous corporations on their journey to carbon neutrality. Ørsted has key capabilities that set us apart from other energy companies and provide us the platform to work with corporations interested in achieving their energy and sustainability goals.

Green Transformation

In Ørsted, our vision is to create a world that runs entirely on green energy. We have transformed from a fossil-fuel based energy company to a green energy company in a little more than a decade by investing significantly in renewables. We invested over $30 Billion USD between 2010-2019, and are investing over $55 Billion USD) exclusively in green energy thru 2027. Our carbon emissions have reduced 87% since 2006, and the share of green energy in our energy generation has risen to 90% by the end of 2020. As an organization driven by sustainability, we have been on our own green transformation, so deeply understand the challenges and opportunities that come along with that.

Market Footprint

As a global company with renewable energy assets across North America, Europe, and Asia, we can help corporate customers meet their global needs. We work with organizations to identify the best path to achieving their goals within the United States and beyond, helping them to optimize their energy procurement.

Trading Capabilities

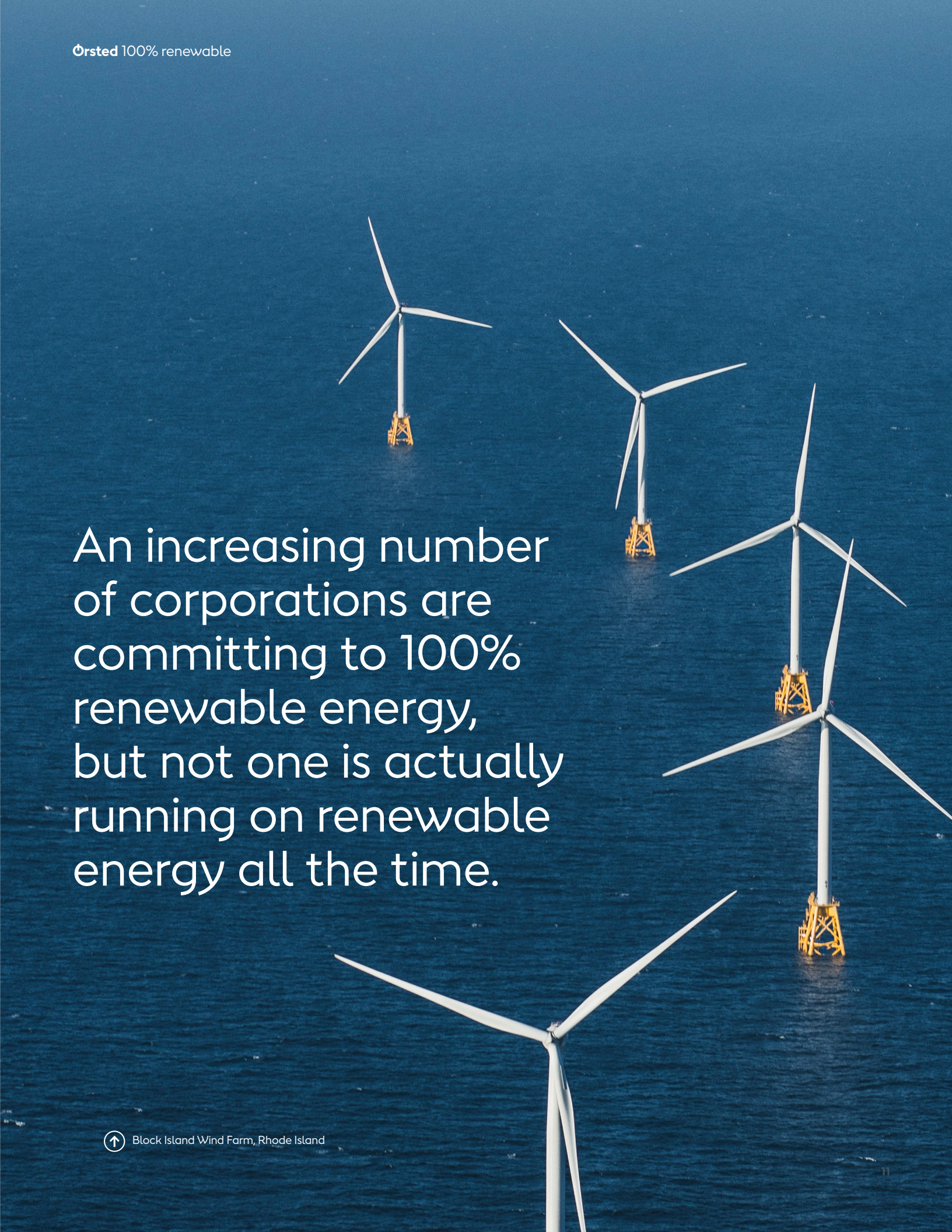
In the United States and Europe, Ørsted has a variety of trading solutions that provide large energy users with a 'one stop shop' for trading and risk management services. We can leverage these capabilities along with our robust platform of assets to structure products that provide customers a custom solution for their energy needs.

Deep renewable technology experience

Across our platform, Ørsted has over three decades of experience in developing, constructing and owning renewable energy facilities . Ørsted's renewable energy expertise is across multiple technology spheres including offshore and onshore wind , solar, energy storage, bioenergy plants, and provides energy products to its customers making it a one-stop shop.

Hydrogen and Power-to X expertise

In an effort meet increasing decarbonization goals, Ørsted has established a dedicated green hydrogen and power-to-x team, announcing numerous projects in the past 24 months, including the Green Fuels for Denmark project, the Westkuste 100, and the Gigastack project. This technology expansion reflects our understanding of changing customer needs and our commitment to providing all relevant technologies to meet tomorrow's decarbonization challenges.



An increasing number of corporations are committing to 100% renewable energy, but not one is actually running on renewable energy all the time.

Block Island Wind Farm, Rhode Island

Ørsted
Love your home

About Ørsted

The Ørsted vision is a world that runs entirely on green energy. Ørsted develops, constructs, and operates offshore and onshore wind farms, solar farms, energy storage facilities, and bioenergy plants, and provides energy products to its customers. Ørsted ranks as the world's most sustainable energy company in Corporate Knights' 2021 index of the Global 100 most sustainable corporations in the world and is recognised on the CDP Climate Change A List as a global leader on climate action. Headquartered in Denmark, Ørsted employs 6,472 people. Ørsted's shares are listed on Nasdaq Copenhagen (Orsted). In 2020, the group's revenue was DKK 52.6 billion (EUR 7.1 billion). Visit orsted.com or follow us on Facebook, LinkedIn, Instagram, and Twitter.

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