# Sprogø Offshore Wind Farm

Information Memorandum

22 SEPTEMBER 2017

## Disclaimer

## Sund = Ball

### **ESP** Consulting

22 SEPTEMBER 2017

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Michael Selchau Sanggaard Partner +45 6142 6262 michael.sanggaard@esp-consulting.dk ESP Consulting Nordic ApS ("ESP Consulting") has been engaged by A/S Storebælt (the "Owner") as their exclusive financial advisor in connection with the sale (the "Potential Transaction" or the "Transaction") of the assets relating to Sprogø offshore wind farm (the "Asset"). This Information Memorandum (the "Memorandum") has been prepared by ESP Consulting on behalf of the Owner for the sole purpose of assisting interested parties (each a "Party" and collectively the "Parties") in evaluating the Asset.

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## Wind farm background

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Sprogø Offshore Wind Farm ("Sprogø OWF") consists of 7 Vestas V90-3.0 MW wind turbines. The wind turbines are well known in Denmark, due to there proximity to the Storebælt bridge. More than 25 million passengers passed the Storebælt bridge in 2016. This makes the Sprogø OWF a perfect showcase for the Danish wind industry and the green transition of the Danish economy in general.

The wind farm was built by A/S Storebælt in connection with the UN Climate conference, COP15, in 2009 and has delivered its renewable electricity to the grid ever since.

Relative to its age it is in excellent technical condition and has been operated with a proactive operations strategy. This is indicated by its high average historical availability of 97.8 %.

A/S Storebælt is 100 % owned by the Danish State through the holding company Sund & Bælt Holding A/S. The company has recently chosen a strategy to focus more on core activities and therefore want to sell off Sprogø OWF, since this is their only wind farm.

A/S Storebælt will following the sale continue to supply the Storebælt bridge with electricity from renewable sources by buying certified renewable electricity on the market.



## Investment highlights

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#### Highly attractive asset characteristics

- Possibility to invest in one of Denmark's most iconic offshore wind parks and at the same time having potential for a good business case
- Modern, high quality and well maintained wind farm with world class operational track record
  - Vestas V90-3.0 MW wind turbines build on proven technology and world • wide more than 3,000 wind turbines have been installed on- and offshore
  - Concrete gravity foundations, which has low maintenance •
  - Sea cables (both array and export cables) are protected by 1 m burial •
- Its nearshore location relatively close to service harbours enables an efficient operational setup and at the same time it benefits from offshore wind resources
- Ideal wind park for building up offshore expertise and knowledge
- Proven by A/S Storebælt to be an easy asset to own and operate even for a ٠ company with no experience in the energy sector

#### Denmark offshore wind - an attractive asset class

- Attractive infrastructure characteristics with low correlation with other asset classes as profitability is to some extent sheltered from factors that can negatively impact the general economy
- Denmark is one of the most developed offshore wind markets globally. One benefit of this market is a good supporting structure for such an asset including a range of service providers, vessel availability and harbour facilities
- Several market players offer a long-term Power Purchase Agreement ("PPA") and well established markets for sale electricity and Guarantees of Origin\* ("GO's")
- Strong political support to renewable energy in Denmark including subsidies to offshore wind. This wind park is part of the Open Door subsidy scheme. The main part of the subsidy expired in January 2017, but there remains the balancing subsidy part which is valid for a total of 20 years (unitil 2029)
- Long-term upside potential from rising energy prices. There is a broad expectation of upward trend in Danish wholesale electricity prices over the next decade
- Good options for risk management through a wide range of quite liquid products relating to electricity exposure through the financial markets to stabilize cash flows

#### Stable electricity production

Fully operational since December 2009 with Vestas operating and servicing the wind park for the full period

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- Estimated long-term average P50\*\* capacity factor of 36.2 %. The historical average for the whole period has been a bit lower at 34.6 % due to lower than average wind speeds during this period
  - A long-term energy yield estimate
  - Corrected (wind index) historical energy production shows consistent result
- Excellent operational track record with an average historical (turbine) availability of 97.9 % and with the latest full year (2016) at 98.7 %

#### Significant value drivers identified

- Identified potential for reducing operations cost base through negotiating better contracts and/or and reaping possible operational synergies
- Current contracts have an adequate length after closing to secure short-term operations and at the same time give the new owner the possibility to negotiate new contracts that can contribute to a lower cost base
- Possible License Extension\*\*\* at a period with expected attractive market conditions
- Potential to secure attractive mortgage loan financing for up to 60 % of the transaction price

#### High CSR and branding value

- Located beautifully and easily visible more than 25 million passengers passed the Storebælt bridge in 2016
- Estimated P50 annual production of 66.6 GWh corresponding to the annual average electricity consumption for more than 16,000 households
- Receives 1 GO for every 1 MWh produced, totalling an estimated 66,573 certificates per year that can either be used to certify a green energy footprint or sold on the market

Source: A/S Storebælt, ESP Consulting

\* A green certificate

## **Project summary**

Sprogø OWF was constructed in 2008-2009 using competent and experienced contractors. The wind turbines are placed in one string with its closest point to Sprogø measuring only 635 m. The wind turbines are placed on concrete gravity foundations which are on 6 - 18 m depth in Storebælt. There is easy access by sea from both the harbours in Korsør and Nyborg.

A/S Storebælt gained the Power Production License\* to use the wind for electricity power production and deliver it to the grid from Sprogø OWF from DEA on 21 October 2009. The license is valid for 25 years from date of wind park commissioning (4 December 2009) and includes a Possible License Extension\*.

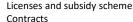
Electricity is exported via the grid on Sprogø to the price area DK1 (Denmark West).

The wind farm has a total capacity of 21.0 MW and in the period 2010-2016 it had an average historical availability of 97.9 % corresponding to an annual average of 3,099 full load hours ("FLH")\*\*\*.

General information	
Wind turbines	7 Vestas V90 3.0 MW
Foundations	Concrete gravity
Total generating capacity	21.0 MW
First power	October 2009
Fully commissioned	December 2009
License to produce, from	October 2009
License validity*	25 years + Possible License Extension
Distance to shore	635 – 1,500 m
Sea depth	6 – 18 m
Grid connection	Sprogø
Price area	DK1, Denmark West
Subsidy scheme	Open Door**
Technical information	
Hub height above sea level	70 m
Tip clearance	25 m
Rotor diameter	90 m
Revolutions per minute	8.6 - 18.4
Weight per turbine	219 mt
Total weight incl. foundations	1,604 – 1,879 mt
Production summary	
Production delivered to grid, Oct2009 – Dec2016	456.1 GWh
Average availability	97.9 %
Historical annual avg. FLH***	3,099

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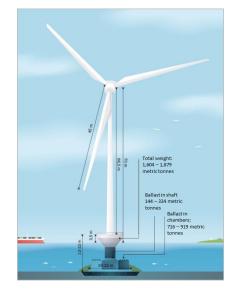
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#### **Contractors construction phase**

COWI
Vestas
Niras (design), Aarsleff & Blifinger Berger JV (contractor)
NKT Cables A/S (supply), Peter Madsen A/S & Svensk Sjöentreprenad AB (installation)
SK Forsyning, SEAS-NVE
ÅF Hansen & Henneberg (design)
Environmental Management Consultants



## Asset scope and transaction structure

ESP Consulting offers the asset to the market on the behalf of the original developer and owner, A/S Storebælt, a subsidiary of the stateowned Sund og Bælt Holding A/S.

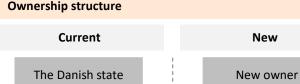
The asset scope includes the 7 wind turbines, associated foundations as well as cables to the point of grid connection in the Disconnector Station at Sprogø.

The wind farm will be sold as a complete handover of the asset.

See the document "Sales process and heads of terms" for further relevant information regarding the transaction.

#### Asset scope\*

- 7 Vestas V90-3.0 MW wind turbines
- 7 concrete gravity foundations and all machinery and equipment placed on these
- 7 DAVIT cranes (500 kg lifting capacity), one placed on each foundation
- 6 Array cables connecting the 7 wind turbines. Total length of the cables is c. 3.3 km
- 2 10 kV export sea-cables, connecting the wind farm to the Disconnector Station on Sprogø. Total length of the cables is c. 1.3 km
- SCADA system
- Standard key system for tower doors



**Project summary** 

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100 % Sund og Bælt Holding A/S 100 %

100 %

A/S Storebælt

Sprogø OWF

(Asset)

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Asset transfer to balance sheet of the new owner

#### Location



Location: North of Sprogø, Denmark

#### WGS84 coordinates of wind turbines:

WTG1: 10 58.8660/55 20.7800 WTG2: 10 58.4519/55 20.7272 WTG3: 10 58.0367/55 20.6744 WTG4 10 57.6215/55 20.6221 WTG5: 10 57.2064/55 20.5693 WTG6: 10 56.7903/55 20.5164 WTG7: 10 56.3750/55 20.4635



100 %

**Storebælt** 

Sund = Bælt

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New

Sprogø OWF

(Asset)

## Sales process and milestones

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	Round 1: N bio	• >>	Round 2: Du and bind	• · · · · · · · · · · · · · · · · · · ·	Round	3: Final binding and c	g bids, contra losing	ct signing	New	owner
	2	2017					2018			
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
	nent of sale nvitation to rocedure Written f	<ul> <li>22 November Deadlin non-bindin</li> <li>4 December</li> <li>5 eedback on nor</li> <li>5 bids. Data roor</li> <li>oper</li> </ul>	e for ng bids er n- Writte n	<ul> <li>26 January 12</li> <li>Deadline</li> <li>binding binding binding binding bids</li> </ul>	for bids <i>12 Febr</i> Deadlin	nding bids. Data			1 June Closing and t asset owners operational a responsibiliti	hip and all Ind financia

## V90-3.0 MW wind turbine

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Vestas is a global leader in sustainable energy solutions and is the largest producer of wind turbines in the world.

Sprogø OWF consists of 7 Vestas V90-3.0 MW wind turbines. The V90-3.0 MW was introduced to the market in 2003 and is both reliable and cost efficient. By June 2017 Vestas had sold 3,146 units of the V90-3.0 MW worldwide on both on- and offshore sites.

The V90-3.0 MW operates in windspeeds from 3.5 m/s up to 25 m/s and are very well suited for the wind conditions at Sprogø OWF.

The turbine features control of reactive power capability which stabilizes the frequency and the voltage to the grid. The V90-3.0 MW is also able to support the grid according to various applicable grid requirements.

#### Vestas

Vestas is a global leader in sustainable energy solutions and is the largest producer of wind turbines in the world. The corporation operates in 76 countries and employs more than 21,000 people. As of 2017 the total installed capacity reached 85 GW.

Vestas has successfully provided many clients in Denmark with their services.

In 2014 Vestas separated their offshore wind business into a 50/50 joint venture with Mitsubishi Heavy Industries ("MHI"). The joint venture, MHI Vestas, has headquarters in Aarhus (Denmark).

#### V90-3.0 MW specifications

Specification	Data
Rotor diameter	90 m
Swept area	6,362 m <sup>2</sup>
Rated power	3.0 MW
Cut-in wind speed	3.5 m/s
Rated wind speed	15 m/s
Cut-out wind speed	25 m/s
Re-cut in wind speed	20 m/s
Wind class	IEC IA and IEC IIA
Operating temperature	- 20° C to 40° C
Gearbox	2 planetary stages and 1 helical stage
Power regulation	Pitch regulated with variable speed

#### Supporting programmes

An important program in Vestas is the Active Output Management (AOM) that secures delivery of services and maintaining the performance of the wind turbines to the best of its capabilities after they have been installed.

To improve the business performance of their clients, Vestas provides their unique Supervisory Control And Data Acquisition (SCADA) which is a analytical tool that helps to maximize production and minimize downtime.

#### Offshore wind farms with V90-3.0 MW

Wind farm	Country	WTGs	Capacity MW	Commissioned
Thanet	UK	100	300	2010
Northwind	Belgium	72	216	2014
Robin Rigg	UK	60	180	2010
Belwind	Belgium	55	165	2010
Egmond a.z	Netherlands	36	108	2008
Kentish Flats	UK	30	90	2005
Barrow	UK	30	90	2006

## Gravity based foundations

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Sprogø OWF's 7 wind turbines are placed on 7 gravity based foundations ("GBF").

The near shore location and shallow water depth at Sprogø OWF are well suited for GBF's, and the GBF's have proven to be a stable, reliable and low cost solution.

Niras was lead technical advisor to A/S Storebælt in designing and planning of the foundations for Sprogø OWF.

The foundations were supplied and installed by a joint venture between Bilfinger Berger and Aarsleff, where the JV was responsible for both construction and installation of the GBF's.

There has been limited service costs relating to the foundations since start of operation.

The only significant expense was for some accelerometer measurements in 2011-2012 on the foundation for WTG7 to test its stability. This turbine is placed on relatively high sea depth giving rise to higher vibrations. The conclusion of the tests were, that the vibration level was normal.

#### Niras (design)

Niras has provided consultancy services within the field of wind energy for more than 25 years. They have wide-ranging expertise and experience as leading technical advisers to offshore foundations through construction of offshore wind farms – both in Denmark and abroad.

#### **Bilfinger Berger\***

Bilfinger Berger had a leading market position in the construction of offshore wind farms in the North and Baltic Seas. In conjunction with Per Aarsleff, the Company has constructed foundations for the large-scale Danish wind farms, Horns Rev 2 and Rødsand 2.

In August 2016 Bilfinger Berger sold off its offshore foundation manufacturing activities to the VTC Group Munich, and its installation activities to the Dutch Van Oord Group.

#### Aarsleff

been a driver of development over the past ten years.

The company completed their first offshore wind farm in 2003, and since then, carried out as many as 500 wind turbine foundations in steel and concrete.

## Aarsleff is among the world's leading companies within installation of foundations for offshore wind farms and have

Source: ESP Consulting, Niras A/S webpage, Bilfinger webpage, Aarsleff A/S webpage, Carbon Trust webpage, MPA webpage \* Now Bilfinger SE

#### **Gravity based foundations**

Gravity based foundations are concrete shells that are placed on the sea bed and then ballasted. GBF's provide the robustness and performance required to meet the engineering demands placed on foundation solutions. As such it represents a simple and effective foundation solution for offshore wind farms and has been widely used in especially coastal areas in Northern Europe.

With a proven long term performance of concrete structures and over 300 installed concrete offshore wind foundations across the world, this foundation is extremely durable and provides a solution which is both economic to build and delivers considerably reduced maintenance over the life of the structure.

#### Offshore wind farms with GBF's

Country	Project	Number of foundations
Denmark	Tunø Knob	10
Denmark	Middelgrunden	20
Denmark	Rødsand 1	72
Denmark	Avedøre Holme	3
Denmark	Sprogø	7
Denmark	Rødsand 2	90
Sweden	Lillgrund	48
Sweden	Kårehamn	16
Germany	Arkona-Becken Südost	1
Belgium	Thronton Bank	6
France	Fecamp	1

## Wind ressources

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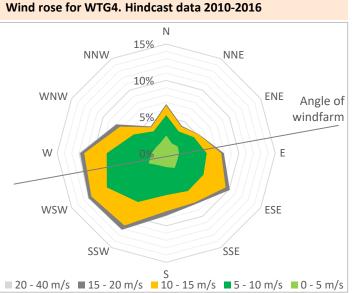
Sprogø OWF is placed just off the northern coast of Sprogø with excellent wind resources and still on relative shallow water.

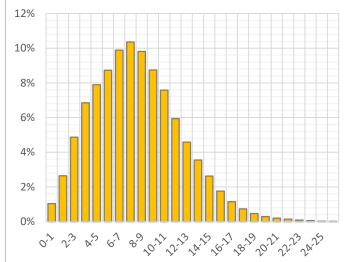
The long-term average mean wind speed for Sprogø OWF at 70 meters above sea level has been estimated to 8.1 m/s in the long-term energy yield assessment.

In the period from 7 November 2009 to 14 September 2017 the average mean wind speed has been 7.9 m/s, measured 70 meters above sea level in WTG4.

This reflects, that the wind index for this period has been 2 pp. below 100, indicating that on average slightly more wind can be expected in the future.

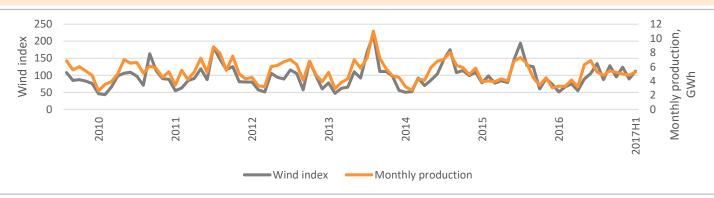
The prevailing wind direction is WSW to SSW.





Weibull distribution for WTG4. Hindcast data 2010-2016





Source: A/S Storebælt, SCADA system, ESP Consulting analysis

## Production forecast and history

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A long-term energy yield assessment was done by Vestas with an estimated annual net production of 66.6 GWh.

In the period 2010- 2016, Sprogø OWF has annually produced an average of 65.1 GWh\*. The production has therefore been slightly below forecasted production. The main reason for this is that the wind index has been lower than 100 (normalized level) for this period. The historical energy production corrected via linear scaling to index 100 gives 66.5 GWh, which is consistent with the long-term forecast.

The production data includes 9.7 GWh foregone production, due to intentional stop of the wind turbines from ancillary services (down regulation) in 2015 and 2016. These intentional stops are driven by imbalances in the Danish or German electricity system where the Transmission System Operator ("TSO") requests and pays electricity producers to counterbalance the imbalances.

A/S Storebælt is looking into the possibility to have the existing long-term yield energy assessment verified by an independent third party vendor during the sales process.

#### Production forecast

The following table sums up a long-term wind resource and energy yield assessment performed in October 2008:

#### Long-term wind energy yield assessment

Models	WindPRO (EMD International)
Wind data	Meteorological data
Wind model	Weibull distribution
Avg. wind speed	8.1 m/s
Wind energy	5.2 kWh/m2
Hub height	70 m
Net production*	66,572.9 MWh
Park capacity factor	36.2 %

The following table compares the long-term forecast with historical production. Apart from the actual production averages, a corrected version (to wind index 100) is also calculated:

		Turbine	Net produc-	Capacity
Estimate name	Wind index	availability	tion (MWh)	factor
Long-term	100,0	-	66.573	36,2%
Historical	95,8	97,9%	65.069	34,6%
Historical, corrected	100,0	97,9%	67.922	36,9%

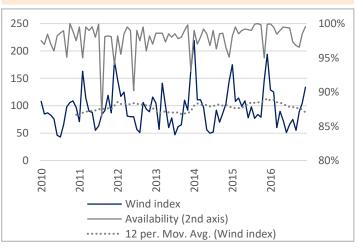
For the financial forecasts in this Memorandum, the long-term estimate is used.

#### Production history, 2010 - 2016

The average annual historical production in the period 2010-2016 has been 65.1 GWh\*. Corrected to wind index 100 this corresponds to 67.9 GWh.

Year	Average availiability*	Production to grid GWh	Down regulation GWh	Potential production GWh	Average capacity factor Pct.
2010	97.8%	63.7		63.7	34.6%
2011	97.1%	66.4		66.4	36.1%
2012	97.3%	67.1		67.1	36.5%
2013	98.0%	62.2		62.2	33.8%
2014	97.7%	67.1		67.1	36.5%
2015	98.9%	65.0	6.2	71.2	38.7%
2016	98.7%	55.1	2.7	57.8	31.4%
Yearly average	97.9%	63.8		65.1	35.37%

#### Historical wind index and tech. availability, 2010 - 2016



## Technical availability

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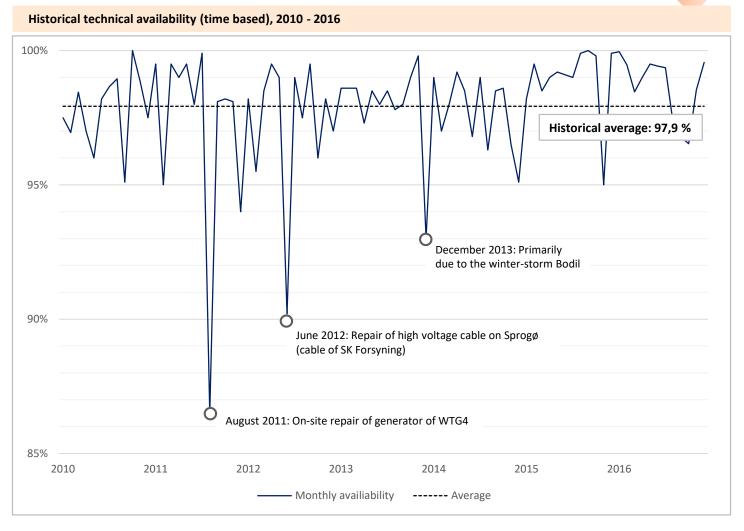
Sprogø OWF has a historical average availability of 97.9 % (time based) in the period 2010-2016. The latest full year (2016) figure was as high as 98.7 %.

Sprogø OWF was during the Vestas Offshore Customer Service Days 2013 highlighted as having *the* highest availability among all wind parks worldwide that uses Vestas wind turbines.

Only 3 specific incidents have during almost 7 years of operation led to relative low monthly availability, namely:

- August 2011: The generator in WTG4 needed repair on-site
- June 2012: The high voltage cable on Sprogø was repaired leading to a stop of the WTG's (cable of SK Forsyning)
- December 2013: A strong winter-storm, Bodil, passed over Denmark leading to stops and reduced availability

The data shows that WTG failures and repairs have only reduced availability significantly on one occasion, the August 2011 on-site repair of the generator in WTG4.



## **Power prices**

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Sprogø OWF benefitted from relative high spot power prices in the years 2010 and 2011, followed by a rather sharp decline in power prices lasting up until Q2 2015.

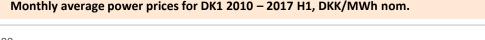
Since then the spot power prices in DK1 have been increasing from an all time low of 100 DKK/MWh up to the current level between 200 and 250 DKK/MWh.

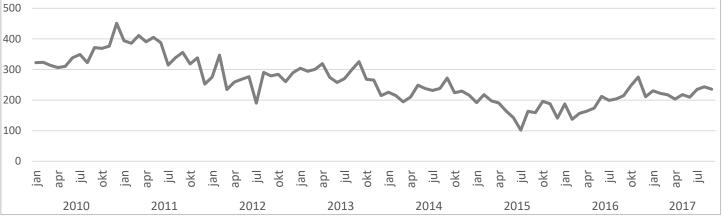
The Danish Energy Agency ("DEA") publishes their power price forecasts on a regular basis based on their central estimates of fuel and carbon prices, power demand and development of renewable and fossil generation capacities.

The central estimate from DEA estimates that the spot power price for DK1 will increase to 349 DKK/MWh nom. in 2025 and to 457 DKK/MWh nom. in 2030.

Such an increase in spot power prices will increase revenue and profit of the wind park significantly from the current levels.

Power prices are assumed constant in real prices from 2030 onwards.





#### Power price forecast for DK1 2017H2 – 2030, DKK/MWh nom.

	Power price forecast	Power price estimate	Wind downlift***	Sprogø OWF wind adjusted power price forecast
2017H2	240	Futures*	10%	216
2018	216	Futures	11%	193
2019	213	Futures	11%	189
2020	214	Futures	12%	188
2021	249	DEA**	12%	219
2022	269	DEA	13%	235
2023	294	DEA	13%	256
2024	308	DEA	13%	267
2025	349	DEA	14%	302
2030	457	DEA	15%	388

Source: Nordpool, Nasdaq, Energinet.dk, Energistyrelsen

\* Nasdaq ENOYR power futures + system to DK1 CFD. Retrieved 21 September 2017

\*\* DEA, Basisfremskrivning 2017, spotpris DK1

\*\*\* DEA, Basisfremskrivning 2017, DK1 offshore wind downlift estimate

## Power price forecast benchmarking

Project summary Asset description Production and availability <b>Power prices</b> Operational setup Licenses and subsidy scheme	Storebælt Sund≋BæM ESP Consulting
Contracts Value creation opportunities	22 SEPTEMBER 2017

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#### The cash flow forecast in this Memorandum is based on DEA's central power price forecast.

DEA publishes power price forecasts on an annual basis as part of their yearly energy- and climate projection report.

Due to future power prices high importance to the future cash flow of Sprogø OWF, ESP Consulting have benchmarked DEA power price forecast with a number of forecasts from other sources.

The benchmark illustrates that all the forecasts expect increasing power prices in the coming decade(s), though with a relative lower increase from 2030 onwards. Also, DEA's central power price forecast represents one of the more conservative (low) forecasts.

The reason behind this is two-fold. Firstly, there is currently an excess power generation capacity in Northen Europe. This situation is expected to be turned around in the period from 2020 to 2030, so instead the market will be characterized by a more scarce generation capacity. Secondly, the price on fossil fuels and CO<sub>2</sub>-emission allowances are currently low, with many markets analysts expecting increasing prices in the next two decades.

#### Power price forecasting

Power price forecasting is a central field of energy economics. Forecasting is a data rich task, typical done by specialist using detailed mathematical modelling of the energy system combined with short- and long term estimates of fuel prices, technology prices, power demand etc.

A price forecast typical includes a

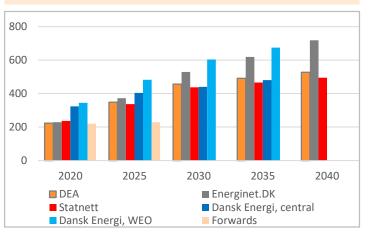
- Short to medium term: Where spot power prices are forecasted based on the future market
- Medium to long term: Where power prices are forecasted ٠ to transition into the long run prices
- Long term: Where power prices are forecasted in accordance with fundamentals, i.e. long run costs of energy

#### Forecast stakeholders

Power price forecasts are a central input to a number of different stakeholders, including both owners of renewable and conventional generation assets, energy system planners, policy makers and traders. Parties with either an economical or political stake in the future power price can choose to do their own power price forecasting, use public available forecasts from third parties or acquire a customized forecast from specialist vendors.

Good power price forecasts has high value for all stakeholders and due to this a number of public and private agencies publish detailed power price forecasts on a regular basis.

#### Power price forecasts, DK1 (Denmark West)\*, DKK nom.



Forecast	Scenario	Forecast from	Forecast to
Energinet.DK	-	2017	2040
Statnett	-	2016	2040
Dansk Energi	Central	2017	2035
Dansk Energi	WEO	2017	2035
DEA	-	2017	2030
Futures	-	-	2025

"Central" refers to Dansk Energi's central power price scenario from their 2017 forecast. "WEO" refers to the forecast based on fuel and CO2-prices as projected in the World Energy Outlook. "Forwards" are current power future contracts on Nasdaq.

## **Operational setup**

The operation and maintenance ("O&M") have been performed by the turbine producer itself, Vestas/MHI Vestas, since the start of operation. This has ensured continuity and a high quality of services. The current contract expires on 18 March 2018, but A/S Storebælt is looking into the opportunities to extend the agreement until 31 December 2018 and assign the agreement to the buyer. This would leave the new owner enough time to take over the operation themselves or find a third party operator.

The current O&M contract includes scheduled and unscheduled services (excl. spare parts and any jack-up vessel for the latter) and 24/7 remote monitoring. From 19 March 2018 MHI Vestas are expected to supply all technicians. A/S Storebælt is responsible for supplying a crew vessel, which is in place through a contract with Dansk Offshore Transport.

Sprogø harbour currently acts as service harbour and will continue to do so until expiry of the current MHI Vestas O&M contract (including the extension period). Hereafter the wind park needs to be serviced from another harbour, where Korsør or Nyborg are relevant options.

#### O&M history

Vestas have since the start of operation been responsible for O&M. For the first 5 years through the Service and Warranty Agreement ("SWA"), which expired 18 March 2015.

Towards the end of the SWA period, A/S Storebælt held a competitive tender for these services, that MHI Vestas won. This new agreement expires on 18 March 2018, but has an option for an extension. A/S Storebælt is looking into the opportunities to extend the agreement until 31 December 2018 and assign the agreement to the buyer. Further information will be provided well in advance of the deadline for submitting the Round 1 bid.

This would leave time for the new owner to either prepare to take over operations themselves or find a third party operator.

#### Harbour access

The wind park has used Sprogø harbour (distance c. 4.5 km) as service harbour from beginning of operation. This setup will continue until expiry of the current MHI Vestas O&M contract (including the extension period). A new owner will have access to the Sprogø harbour in this period.

Hereafter the wind park needs to be serviced from another harbour. Relevant options are Korsør (distance c. 11.0 km) or Nyborg (distance c. 14.6 km). Both harbours have adequate infrastructure as service harbour.

- Project summary Asset description Production and availability Power prices
  - **ESP** Consulting
- Licenses and subsidy scheme Contracts

**Operational setup** 

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#### Current O&M contract scope

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Main services:

- Scheduled services
- Unscheduled services (excl. any spare part and vessel)
- 24/7 remote monitoring, surveillance and supervision using the SCADA system
- Reporting incl. quarterly reports

#### Main warranties:

- Services Defect Warranty
- Warranty for MHI Vestas delivered spare parts

#### Features:

- A/S Storebælt supplies crew vessel\*
- Sprogø harbour used as service harbour
- A/S Storebælt has a Representative with certain duties (Asset Manager type role)

The following features are only valid until 18 March 2018:

• A/S Storebælt is required to provide 1 technician

License over	view		<ol> <li>Project summary</li> <li>Asset description</li> <li>Production and availability</li> <li>Power prices</li> <li>Operational setup</li> <li>Licenses and subsidy scheme</li> <li>Contracts</li> <li>Value creation opportunities</li> <li>Financials</li> <li>Appendix</li> </ol>	Storebælt Sund & Back ESP Consulting 22 SEPTEMBER 2017
3 licenses have been relevant for Sprogø OWF of which 2 are still relevant, namely the	Licenses for offshore wind energy in Denmark	Description		ed action for les process
Construction License (in Danish: Etableringstilladelsen") and the Power Production License (in Danish "Elproduktionstilladelsen"). The latter is a license to use the wind for electricity power production and deliver it to the grid.	Pre-investigation License (in Danish: "Forunder- søgelsestilladelse")	<ul> <li>Relevant for parks outside tenders</li> <li>Gives permission to perform physical site investigations including EIA*, geotechnical and geophysical surveys</li> </ul>	<ul> <li>License granted on 1</li> <li>July 2008</li> <li>License no longer relevant</li> </ul>	None
The sale and following transfer of Sprogø OWF is conditional on consent from DEA regarding the transfer of the 2 licenses Construction License and the Power Production License to the new owner.	<b>Construction License</b> (in Danish: "Etableringstilladelse")	<ul> <li>License to construct the wind park</li> <li>Requires that the report coming out of the pre-investigation surveys and EIA is approved</li> <li>Sets requirements both for the activities of construction, operation and decommissioning</li> </ul>	December 2008 f • Some requirements t	Needs approval from DEA to be rransferred to the new owner
	Power Production License (Danish: "Elproduktions- tilladelsen")	<ul> <li>License to use the wind for production of electricity, which is a requirement for production to the grid</li> <li>Requirements described in the Construction License</li> <li>Complements the Construction License</li> <li>Conditions to be met at first power</li> </ul>	October 2009 f • Valid 25 years until 3 t	Needs approval from DEA to be ransferred to the new owner
	<b>Production License</b> (in Danish: "Produktionsbevilling")	<ul> <li>Not specific to wind energy</li> <li>License necessary for all electricity producing units above 25 MW capacity in Denmark</li> </ul>	<ul> <li>Not relevant since &lt; 25</li> <li>MW capacity</li> </ul>	None

## **Power Production License**

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The Power Production License (in Danish "Elproduktonstilladelsen") for Sprogø OWF was granted to Sund og Bælt Holding A/S (on behalf of A/S Storebælt) by DEA on 21 October 2009.

A change of ownership of the wind farm means that the Power Production License needs to be transferred to a new owner. Before this can take place, the transfer needs to be approved in writing by DEA. The requirements for such an approval are generally that the new owner proves capable of taking on the financial and operational obligations as set out in the license.

#### License background

The Power Production License to use the wind for electricity power production and deliver it to the grid for Sprogø OWF was given to Sund og Bælt Holding A/S (on behalf of A/S Storebælt) by DEA on 21 October 2009. License was given in accordance with §29 in the Danish law on renewable energy "Lov om fremme af vedvarende energi".

#### License description

The license is valid for 25 years from date of final commissioning of the wind farm (4 December 2009). Concerning license extension see the description to the right.

The license holder is obliged to report annually to DEA about technical conditions of the wind farm. In addition, the license holder is obliged to decommission the wind farm, should DEA require this due to any of the following conditions:

- Expiration of license
- The wind farm is not properly maintained or broken to an extent of destruction
- The wind farm ceases to function as a windfarm
- Terms and obligations as stated in the license are not being met

As a 100 % state-owned company, the current owner A/S Storebælt is exempt from providing collateral for decommissioning of the wind farm. However, DEA can require the new owner to provide collateral for costs of decommissioning of the wind farm.

#### **Possible License Extension**

The term "Possible License Extension" refers to the license opportunity to renegotiate the terms of continued operation of the existing asset after expiry of the 25 years.

A/S Storebælt is in dialogue with DEA concerning how to interpret this opportunity with respect to e.g. conditions for an extension and possible duration.

#### License transfer

The current license holder, Sund og Bælt Holding A/S (on behalf of A/S Storebælt), cannot transfer the rights of the license to a third party without written consent from DEA. The DEA can only refuse to give such consent based on objective reasons. As such any bidder fulfilling reasonable objective qualifications to take over the license can expect to be granted the license.

## Open Door subsidy scheme

1. Project summary Storebælt Asset description 2. Sund = Rs Production and availability Power prices 5 Operational setup **ESP** Consulting Licenses and subsidy scheme Contracts 22 SEPTEMBER 2017 8. Value creation opportunities Financials 9. 10. Appendix

Denmark has pioneered the offshore wind industry through decades of a stable and positive regulatory environment towards offshore wind. Many offshore wind parks already exist and significant new capacity is planned in the future.

Several subsidy schemes exist for offshore wind in Denmark. Sprogø OWF is covered by rules known as Open Door scheme ("Åben Dør ordningen"\*), which consists of 2 subsidy elements:

- 1. A 250 DKK/MWh price premium for the first 22,000 full load hours ("FLH")
- A balancing subsidy of currently\*\* 13 DKK/MWh for the production for 20 years (until 2029)

Element no. 1. expired in January 2017.

#### History of offshore wind in Denmark

Denmark has a long tradition with offshore wind parks starting with the world's first offshore wind park, Vindeby, in 1991.

The regulatory environment has been stable and positive towards the pioneering and continuous development of offshore wind capacity. This has primarily been achieved by offering different subsidy schemes over the years to support the development of the industry towards becoming competitive with traditional fossil fuel power plant technologies.

Below is a map of current offshore wind parks. In addition to these a number of other wind parks are under development or construction including Vesterhav Nord, & Syd, Kriegers Flak, Jammerland Bugt and Mejl Flak.



#### **Open Door scheme**

The wind park is covered by rules known as Open Door scheme ("Åben Dør ordningen"), regarding subsidy for wind farms. The subsidy is regulated by §36 in the law "Lov om fremme af vedvarende energi".

The subsidy scheme consists of 2 subsidy elements:

- 1. A 250 DKK/MWh price premium for the first 22,000 FLH
- 2. A balancing subsidy of currently\*\* 13 DKK/MWh for the production for 20 years (until 2029)

The subsidy rates are not price indexed.

The 22,000 FLH mark was reached on Sprogø OWF in January 2017, so element no. 1 has expired

Other offshore wind parks on Open Door scheme:

- Vindeby (1991)
- Tunø Knob (1995)
- Middelgrunden (2000)
- Rønland (2003)
- Samsø (2003)
- Frederikshavn (2003)
- Avedøre Holme (2009/10)

Source: A/S Storebælt, DEA

## Current contracts

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A/S Storebælt currently holds 5 contracts with vendors in relation to the ownership and operation of Sprogø OWF.

The service agreement with MHI Vestas expires on 18 March 2018, but has an option for an extension. A/S Storebælt is looking into the opportunities to extend the agreement until 31 December 2018 and assign the agreement to the new owner. Further information will be provided well in advance of the deadline for submitting the Round 1 bid.

The service crew vessel contract with DOT continues until 31 December 2018 and will be transferred to the new owner at closing.

The power sales and ancillary services contract with Vindenergi Danmark will be terminated with effect from 1 June 2018. However, the new owner may request to extend and take over the contract from 1 June 2018. Such a request should be notified A/S Storebælt no later than 22 March 2018.

The insurance contract with IF Skadeservice will automatically terminate by a change of ownership event. As such the contract will terminate at closing on 1 June 2018. The new owner needs to negotiate a new contract.

The framework contract describing ownership and onshore grid operations on Sprogø needs an addendum that replaces A/S Storebælt with the new owner with respect to the power supply installations concerning Sprogø OWF while other rights and obligations of the parties remain unchanged.

Contract	Vendor/counterparty	Description	Status sales process
Service agreement	• MHI Vestas	<ul> <li>Wind turbine service contract. See slide 16 regarding scope</li> </ul>	• Expires 18 March 2018, currently negotiating with the goal to extend to 31 December 2018 and the possibility to assign the agreement to the new owner
Service crew vessel	<ul> <li>Dansk Offshore Transport ("DOT")</li> </ul>	<ul> <li>Crew vessel transport</li> <li>Vessel type: Pilot boat</li> <li>Response time 2.5 hours</li> </ul>	<ul> <li>Expires 31 December 2018</li> <li>Contract will be transferred to new owner</li> <li>Termination notice 1 month</li> </ul>
Power sales and ancillary services	Vindenergi Danmark	<ul> <li>Services include:</li> <li>Sale of power</li> <li>Sale of GO's</li> <li>Sale of ancillary services, e.g. down (and up-) regulation</li> <li>Balancing</li> </ul>	<ul> <li>Will be terminated with effect from 1 June 2018</li> <li>The new owner may continue the contract from 1 June 2018</li> </ul>
Insurance	IF Skadeforsikring	<ul> <li>Coverage:</li> <li>All Risks Damage incl Machinery Breakdown</li> <li>All Risks Business Interruption incl. Machinery</li> </ul>	<ul> <li>Automatic termination triggered by change of ownership (1 June 2018)</li> <li>The new owner needs to negotiate a new contract from 1 June 2018</li> </ul>
Framework contract for grid on Sprogø	<ul> <li>A/S Storebælt</li> <li>Fynsnet A.M.B.A</li> <li>SK Elnet A/S</li> <li>Nyborg Elnet A/S</li> <li>SEAS-NVE Transmission A/S</li> </ul>	<ul> <li>Describes ownership and onshore grid operations between the various owners and operators of Sprogø grid infrastructure</li> </ul>	<ul> <li>Sale conditional on an addendum that replaces A/S Storebælt with the new owner</li> </ul>

Source: A/S Storebælt

C	201	nt	ra	cts	; ti	ime	ili	ine	5										1. 2. 3. 4. 5. 6. <b>7.</b> 8. 9. 10.	Asset of Produc Power Opera Licens <b>Contra</b>	r prices ational s ses and acts creatio cials	ption and av s setup d subs	n availabili	neme	Su. ESP	nd≋ Con	Back sulting BER 2017
	Round 1: Non-binding bidsRound 2: Due diligence and binding bidsRound 3: Final binding bids, contract signing and closing						-																				
S	A/S Storebælt as owner														Nev	w own	ier										
roces		2	2017						1	20	018								2019				2	2028			34/2039
Sales process	Sep	Oct	Nov	Dec	Jan	Feb M	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	N	Aar A	Apr	Ĺ	Jan	Dec		Jan	Dec
	ය 28 February Contract signing					1 June Closing																-	December od. license				
Service Contract	мні	Vestas						MHI Ve	estas – e	expected	d exten	ision						New owner takes over service themselves or negotiates new service contract with third party supplier									
Crew vessel	Dansk	د Offshر	ore Tran	nsport													does	Depends on scope of service contract. If the new service contract does not include crew vessel services, then the new owner negotiates new contract with DOT or another third party supplier									
Insurance	IF For	rsikring								Nev	v owner	r negot	tiates n <sup>,</sup>	ew contr	act		_:										
Power sales etc.	Vinde	energi [	Danmark	k							w owner h other 1				/er sales	s themse	elves, triggers option to continue contract or negotiates new contract										
Grid	Fram	ework (	contract	t for onsł	nore gric	d on Sprog	ø		lendum nade	Agr	Agreement will continue but the sale is conditional on an addendum that replaces A/S Storebælt with the new owner						owner										

# Wind farm lifetime extension opportunity

1. Project summary Storebælt Asset description Sund = Bælt Production and availability Power prices **ESP** Consulting 5. Operational setup Licenses and subsidy scheme 6. 7. Contracts Value creation opportunities 22 SEPTEMBER 2017 8. Financials 9. 10. Appendix

A lifetime extension first of all requires that the Power Production License can be extended. The prospects for this are captured by the term Possible License Extension.

Based on the successful license extension with a period of 5 years for Vindeby wind farm and general market intelligence, we believe this extension duration could also be given to other wind farms. This is used as a baseline for considering the financial effects of the opportunity.

Regarding the technical lifetime of the asset both general market intelligence as well as Sprogø OWF specific factors suggest that 30 years could be possible.

Our financial model shows a significant positive value relating to a lifetime extension of 5 years.

A/S Storebælt is in dialogue with DEA concerning how to interpret this opportunity with respect to e.g. conditions for an extension and possible duration. Any new information will be made available online on the website or in the data room.

A/S Storebælt takes no responsibility for whether this opportunity is achieved by a new owner.

#### License extension

Increasing the wind farm lifetime first of all requires that the Power Production License can be extended. The prospects for this are captured by the term Possible License Extension and explained on slide 18.

The world's first offshore wind park Vindeby, which was constructed in 1991, originally had a Power Production License of 20 years. It applied for a license extension and was granted extra 5 years. The park was finally decommissioned in the beginning of 2017.

Based on the successful license extension with a period of 5 years for Vindeby and general market intelligence, we believe this extension duration could also be given to other wind farms. This is used as a baseline for considering the financial effects of the opportunity.

#### **Technical lifetime**

Several major players in the market expect a technical lifetime of a wind park to be 30 years, e.g. DONG Energy bid in the latest German offshore wind CfD auction was based on an assumption of 30 years park lifetime.

The technical lifetime can be shortened if the wind park is operated and maintained poorly. However, Sprogø OWF has always been operated up to the highest standards.

Also note that on average Sprogø OWF is not "run as hard" compared to many other offshore parks. This can be seen from its lower capacity factor (historical averages) of 34.6 % compared to e.g. Anholt at 48.7 %, Horns Rev 1 at 42.3 % and Horns Rev 2 at 47.7 %.

#### **Economic lifetime**

The financial model used in this document shows that a lifetime extension of 5 years yields a significant positive value.

## O&M cost benchmarking

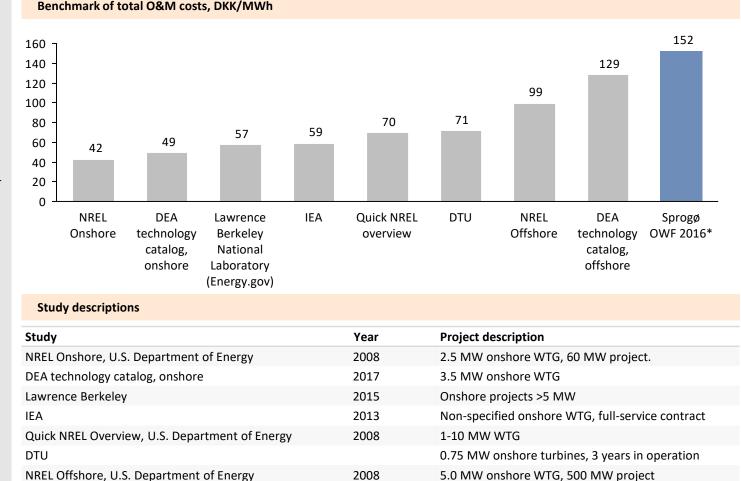
1. Project summary Storebælt 2. Asset description Sund = Balt 3. Production and availability 4. Power prices 5. Operational setup ESP Consulting Licenses and subsidy scheme 6. Contracts 7. Value creation opportunities 22 SEPTEMBER 2017 8. Financials 9. 10. Appendix

A benchmarking analysis of Sprogø OWF's O&M costs compared with a set of studies on costs of operating wind farms, shows that current O&M costs for Sprogø OWF are relatively high.

This is partly due to the logistic setup and a high cost of WTG services, since this cost element takes up a very high share of total O&M costs for Sprogø OWF.

DEA estimates O&M costs to 129 DKK/MWh for offshore wind farms, based on an average of DONG's offshore windfarm in 2016, interviews with the industry and analysis of bid prices.

Based on identified optimizations and upsides we assess that a new owner could bring O&M costs to 120 DKK/MWh or below.



2017

8.0 MW offshore WTG

Source: A/S Storebælt, ESP Consulting analysis

\* Calculated as 2016 costs divided by 2010 – 2016 historical average (potential) production

DEA technology catalog, offshore

## **O&M** cost base optimization

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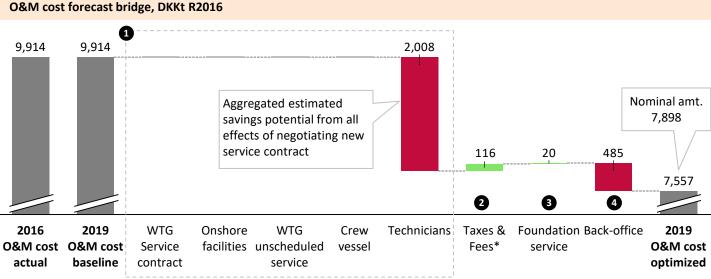
Our analysis show there is potential for a new owner to optimize the operational setup for the wind farm and at the same time reduce O&M costs. The current WTG Service contract expires 18 March 2018, but A/S Storebælt are currently negotiating with the goal to extend it to 31 December 2018. The main lever to reduce the O&M costs is to negotiate better terms in a new contract. A second large lever is to save costs on internal admin resources.

The O&M cost base optimization has been made based on a few structural changes to the operational setup. First of all it is assumed that the new WTG Service contract cost item will be inclusive of unscheduled service as well as all technicians. Secondly the response time for unscheduled events is increased from 2.5 hours to 20 hours.

The forecasted cost of the new WTG Service contract in this document is based on relevant benchmarks.

Further identified synergies that can be reaped (not quantified):

- Further reduced WTG service cost if the new owner has internal service capabilities
- Reduction in trading costs if new owner has internal trading desk/capabilities



- All of these effects stem from negotiation of **A** a new service contract with the following changes:
  - WTG Service contract scope changes to full service (incl. unscheduled maintenance and all crew). Price based on benchmarks
  - Change of harbour to Korsør or Nyborg and need for storage area
  - Unscheduled service cost reduced to 0 since included in Service contract
  - Crew vessel response time assumed • raised from 2.5 to 20 hours with availability still expected above 97 %

- Technicians all included in Service contract
- 2 The forecast is based on the long-term energy yield assessment of 66.6 GWh, which is slightly higher than historical production due to lower wind index. Therefore the expected feex are higher, since they are production based
- 8 For foundation service we have assumed costs corresponding to the average realized cost for scheduled service. It is slightly higher than the 2016 baseline
- For administrative resources the requirement (4) is assumed to be 15 % of an asset manager and 15 % of a finance controller. This brings down the cost significantly compared to the baseline

Source: A/S Storebælt, ESP Consulting analysis

\* Taxes & Fees prices assumed constant. Cost increase due to expected higher production based on average wind year

# Certified V90-3.0MW service providers

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In relation to negotiating a new service contract, there are – apart from the current O&M service provider MHI Vestas –a number of other service providers that are certified by DEA to service the V90-3.0 MW wind turbines in Denmark.

In addition to these there are also a number of other service providers that are certified for the V90-2.0 MW wind turbine:

- Ven-to-APS
- Wind Estate A/S
- Connected Wind Services Denmark
- Deutsche Windtechnik Service GmbH & Co KG
- Windtech A/S
- Concept Wind Service ApS

Certified v30-5.0MN	V service providers*	
	Description	Organization in DK
MHI Vestas	<ul> <li>Joint offshore venture between Vestas and MHI since 2014</li> <li>Offers a range of O&amp;M service deals</li> </ul>	Offices in Aarhus, Denmark
KK Windsolutions	<ul> <li>Danish company , that has been in the wind business since 1978</li> <li>Operates world wide</li> </ul>	<ul><li>Headquarter in Ikast, Denmark</li><li>Close to 1000 employees</li></ul>
Total Wind	<ul> <li>Started in 2003</li> <li>Works with installation and service of windmills</li> </ul>	<ul><li>Has service offices in Denmark</li><li>Has 670 employees</li></ul>
Øer A/S	<ul> <li>Founded in 1963 and has been doing offshore wind since 2005</li> <li>Provides single services and package solutions</li> </ul>	<ul> <li>Headquarter in Aarhus, Denmark</li> <li>Employs 120 technicians working on wind</li> </ul>
PMT ApS PMT	Opened in 2010 with focusing solely on service of windmills	<ul> <li>Headquarter in Skælskør, Denmark</li> <li>Services in Denmark and Sweden</li> </ul>
ALL NRG	<ul> <li>20 years of wind power experience</li> <li>Worked on more than 90 % of worlds wind turbines</li> </ul>	Five offices for support in Denmark
Danish Blade	Blade services, repairs, inspections and advisory	Headquarters in Denmark
Wind Estate	<ul> <li>Wind farm owner and operator</li> <li>Own service function</li> </ul>	<ul> <li>300 operating WTG's in Denmark</li> <li>200 MW WTG's operating in Denmark</li> </ul>

Source: Energistyrelsen, company webpages

\* With valid certificate for Vestas V90-3.0MW services as per 22 September 2017. DWP Solution is listed as certified Vestas WTG's, but certificate list not available on http://www.vindmoellegodkendelse.dk/service/servicefirmaer/

## Mortgage loan financing opportunity

Existing mortgage loan



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#### A/S Storebælt has financed the wind farm through a mortgage loan in Realkredit Danmark. The mortgage loan is a non-callable floating rate bond with semiannual refixing, and the interest rate is fixed with a margin of 0.25 % to 6-month CIBOR with a current interest rate as per 1 July 2017 of 0.16 % (including margin) and a contribution margin to Realkredit Danmark of 0.45 %. The maturity date of the underlying loan is 31 March 2030.

A/S Storebælt will by default redeem this mortgage loan and arrange the release of the pledged security in the wind turbines no later than the day of closing.

However, the mortgage loan up to a value of 60 % of the transaction price can be transferred to the new owner. The new owner must exercise this option no later than 22 March 2018 if they want to transfer the mortgage. If the new owner chooses to exercise this option, then the transfer of the mortgage will have effect from closing. A requirement to exercise this option is a credit approval from Realkredit Danmark.

The buyer can alternatively choose to transfer the mortgage to a mortgage loan in a different financial institution. The same deadline and conditions apply in this case.

Any remaining financing in addition to the loan transferred to the new owner will be redeemed.

In both cases the new owner can save stamp duty of 1.5 % of the loan value from transferring the mortgage.

Existing mortgage loan	
Loan information	
Principal	198,591,000.00 DKK
Loan type	RD Cibor6
Repayment	Annuity
Loan term	16 years
Annual payments	4
Issue date	31 March 2014
Nominal interest rate p.a.	Variable Cibor6 + 0.25 %
Refixing	Semi-annual, 0.16 % (1 July 2017)
Fund code	DK0009298325
Contribution margin*	0.45 % (1 July 2015)

#### New owner financing opportunities

The new owner has the opportunity to transfer the mortgage loan up to a value of 60 % of the transaction price. If the new owner chooses to exercise this option, then the transfer of the mortgage will have effect from closing. A requirement to exercise this option is a credit approval from Realkredit Danmark. The new owner must exercise this option no later than 22 March 2018.

The buyer can alternatively choose to transfer the mortgage to a mortgage loan in a different financial institution. The same deadline and conditions apply in this case.

Any remaining financing in addition to the loan transferred to the new owner will be redeemed.

Source: A/S Storebælt

\* Contribution margin calculation: Annual percentage of outstanding debt. Minimum annual contribution 2,000 DKK

\*\* No forecast for Cibor6 published

## **Revenue** elements

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The total revenue stems from a number of cash flow streams. Historically there have been the following revenue streams:

- 1. Spot market
- 2. Open Door subsidy premium (250 DKK/MWh)
- Balancing subsidy 3.
- GO certificates 4.
- Ancillary services 5.

The Open Door subsidy scheme of 250 DKK/MWh expired in January 2017. It was valid for the first 22,000 FLH, which was reached at this time.

The balancing subsidy of 13 DKK/MWh\* will continue for 20 years (until 2029).

The ancillary services have been offered as a service/product through a contract since 2015. For Sprogø OWF it mainly consists of down regulation in hours where there is excess power. This gives a premium to the spot in those hours and it saves on the mechanical parts of the turbine.

Revenue	stream o	description
---------	----------	-------------

	Description	Volume	Rate	Period
Spot market	<ul> <li>Sale of electricity in the spot market (day ahead and intraday markets)</li> <li>Minimum price compensation 2012-2014</li> </ul>	MWh park electricity production	Power market price. See slide 14-15	Park lifetime
Open Door subsidy premium 25 øre/kWh)	<ul> <li>Subsidy price premium paid for first 22,000 FLH</li> </ul>	MWh park electricity production	250 DKK/MWh	First 22,000 FLH (expired in January 2017)
alancing subsidy	<ul> <li>Subsidy paid to compensate producer for balancing costs</li> </ul>	MWh park electricity production	13 DKK/MWh*	20 years (until 2029)
iO certificates	<ul> <li>Sale of GO's (green certificates)</li> </ul>	1 certificate per 1 MWh park electricity production	Market price of certificates	Park lifetime
Ancillary services	<ul> <li>Sale of ancillary services associated with down- (and sometimes up-) regulation of the park power production relative to planned production</li> </ul>	Down regulation power MWh requested by Energinet.dk relative to submitted planned production Max: Planned volume	Consists of: Market price + compensation for regulating power 30 DKK/MWh OR special compensation 100 DKK/MWh**	Park lifetime. When requested by Energinet.dk

Source: ESP Consulting analysis

\* At start of operations the rate was 23 DKK/MWh. It was changed with effect from 1/1/2016 to 18 DKK/MWh. It was further changed with effect from 27/12/2016 to 13 DKK/MWh

\*\* If the down regulation request is due to DK domestic reasons, then the service is categorized as down regulation at rate 30 DKK/MWh. If it is caused by foreign effects it is special regulation at rate 100 DKK/MWh

# O&M cost elements (1/2)

**O&M** cost element description

The total O&M costs stem from a number of activities and cash flow streams:

- 1. WTG
- 2. Foundation and cranes
- 3. Transmission assets and systems
- 4. Technical resources
- 5. Administration & back-office
- 6. Environmental & safety related costs
- 7. Logistics
- 8. Onshore facilities
- 9. Insurance
- 10. Taxes & Fees
- 11. Other

It is estimated that significant cost reductions can be made by a new owner to the current baseline O&M costs. Especially with possible synergies and economies of scale benefits through e.g. existing ownership of wind parks in the same geographic area and already active service setup. Each cost element has been described and qualitatively assessed for estimated savings potential.

		Description	Estimated savings potential*
TG	Scheduled service	Scheduled WTG services     included in service contract	
	Unscheduled service	Unscheduled service fees, spa parts and equipment	re U
	Jack-up requirements	Jack-up requirements and jack     up vessels	-
	TWG own power consumption	WTG and foundations own     power consumption	$\bigcirc$
oundation d cranes	Scheduled services	Scheduled services for foundation and Davit cranes	$\bigcirc$
	Unscheduled service	Unscheduled services for foundation and Davit cranes	$\bigcirc$
ansmission sets and	Scheduled services	Scheduled services for transmission assets and syster	ns
stems	Unscheduled service	Unscheduled services for transmission assets and system	ns

# O&M cost elements (2/2)



O&M cost ele	ment description			O&M cost ele	ment description		
		Es Description	stimated savings potential*			Description	Estimated savings potential*
Technical resources	Technicians	Inhouse WTG service technici- ans and asset management staff		Onshore facilities	Facilities	Storage room and offices	$\bigcirc$
	Tools	Tools for WTG services	$\bigcirc$	Insurance		Property damage and business interruptions insurance, incl. machinery break-down	
Admin and back-office		Management fees and HQ costs		Taxes & Fees	Trading costs	Power sales and ancillary service trading fees	$\bigcirc$
Environmen- tal & safety	Environmental related costs	Environmental related costs	$\bigcirc$		Balancing costs	Power imbalances costs	$\bigcirc$
related costs	Safety related costs	Safety related costs, i.e. safety gear etc.	$\bigcirc$		TSO feed-in fee	Danish TSO, Energinet.DK, feec in fee	J-
Logistics	Crew vessels	Charter of crew vessel					
	Fuel costs	Fuel costs for crew vessels	$\bigcirc$				

## **Historical revenue**

- Project summary Asset description
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The annual revenue in the period 2010-2016 has been in the range 25 – 42 DKKm. By far the largest revenue elements have been the spot market and the Open Door subsidy premium.

The main drivers behind the decline in revenue have been a decline in the offtake spot market price, a low wind year in 2016 and reduction in the balancing subsidy rate.

In January 2017 the Open Door subsidy premium expired, so going forward this element will not contribute further.

In 2015 A/S Storebælt entered agreement with Vindnergi Danmark on the sale of ancillary services in 2015. Since then there has been an annual revenue of approximately 1.2 DKKm from ancillary services.

#### Historical revenue 2010 – 2017H1

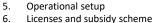
Annual revenue	-							2017
DKKt nom.	2010	2011	2012	2013	2014	2015	2016	H1
Spot market	20,336	23,327	17,033	16,889	14,578	10,611	9,400	6,363
Open Door subsidy premium	15,937	16,608	16,765	15,556	16,779	16,243	13,779	1,183
Balancing subsidy	1,466	1,528	1,542	1,431	1,544	1,494	992	396
GO certificates*	105	169	172	156	314	390	228	155
Ancillary services**	-	-	-	-	-	1,494	909	601
Total	37,844	41,632	35,512	34,031	33,215	30,232	25,308	8,697

Annual revenue volumes and avg. prices								2017
MWh	2010	2011	2012	2013	2014	2015	2016	H1
Spot market	63,746	66,432	67,060	62,224	67,114	64,971	55,114	30,460
Open Door subsidy premium	63,746	66,432	67,060	62,224	67,114	64,971	55,114	4,731
Balancing subsidy	63,746	66,432	67,060	62,224	67,114	64,971	55,114	30,460
GO certificates	53,821	56,507	57,289	51,879	57,116	54,922	45,649	25,497
Ancillary services	-	-	-	-	-	6,205	2,695	2,225
Average prices , DKKt nom./MWh								
Spot market	319	351	254	271	217	163	171	209
Open Door subsidy premium (250 DKK/MWh)	250	250	250	250	250	250	250	250
Balancing subsidy	23	23	23	23	23	23	18	13
GO certificates	2	3	3	3	5	7	5	6
Ancillary services, Gross	-	-	-		-	241	337	270
Ancillary services, premium	-	-	-	-	-	77	167	61

## Historical O&M costs

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The operation and maintenance of Sprogø OWF are handled by a mixed team of MHI Vestas and inhouse A/S Storebælt service crew. A/S Storebælt employs 2 technicians (parttime) for WTG services on top of the MHI Vestas services contract.

Offshore crew transport is carried out by Dansk Offshore Transport A/S.

In the period up to March 2015 the service contract with Vestas included an availability guarantee, For the service contract following the 5 year SWA period, the availability guarantee was dropped, leading to a lower price.

As a result the total O&M costs has been reduced in 2015 and 2016 compared to previous years.

#### Historical O&M costs 2010 – 2017H1

Annual costs								2017
DKKt nom.	2010	2011	2012	2013	2014	2015	2016	H1
WTG*	7,601	8,107	8,169	8,580	8,346	4,972	5,055	2,443
Foundation and cranes	-	204	499	47	40	98	36	-
Scheduled service	-	-	-	-	-	-	-	-
Unscheduled service	-	188	404	11	-	58	-	-
Cranes	-	16	95	36	40	40	36	-
Transmisssion assets and systems	-	-	-	-	-	-	-	-
Scheduled service	-	-	-	-	-	-	-	-
Unscheduled service	-	-	-	-	-	-	-	-
Technicial resources	1,220	1,077	1,172	1,220	1,152	1,278	1,541	767
Technicians**	1,141	1,077	1,160	1,192	1,145	1,276	1,528	764
Tools	79	1	12	28	7	2	13	3
Administration & back-office	228	521	519	465	421	345	686	258
Back office support	228	521	519	465	421	345	686	258
Environmental and safety related costs	4	31	34	93	-	2	-	-
Environmental related costs	-	31	-	-	-	2	-	-
Safety related costs	4	-	34	93	-	-	-	-
Logistics	1,436	1,177	1,272	1,308	1,308	1,282	1,268	595
Crew Vessels	1,436	1,177	1,272	1,308	1,223	1,246	1,241	579
Fuel costs	-	-	-	-	86	35	27	16
Onshore facilities	32	121	10	18	-	-	1	-
Facilities	32	121	10	18	-	-	1	-
Insurance	417	448	448	450	453	453	453	227
Property damage and liability insurance	417	448	448	450	453	453	453	227
Taxes & Fees	2,069	1,169	1,301	1,217	1,178	1,003	874	460
Balancing costs	1,686	837	907	869	802	575	382	260
TSO Feed-in fee	255	199	260	223	241	298	382	140
Trading costs	127	133	134	124	134	130	110	61
Total	13,006	12,854	13,424	13,398	12,898	9,433	9,914	4,749

#### Source: A/S Storebælt

\* Including scheduled and unscheduled services, jackup requirements and own power consumption

\*\* Including A/S Storebælt inhouse technicians and asset management

## **Decommissioning costs**

The decommissioning obligation is described in the Power Production License. The key principle is that the area has to be reestablished to the state it had prior to construction of the wind park.

This per default means that the following equipment needs to be dismantled, removed from site and disposed:

- Wind turbines
- Foundations
- Scour protection
- Array cables
- Export sea-cables

There is a lack of empirical data, so two types of models have been used to forecast the costs: A top-down and a bottom-up model. They both come up with very similar results as can be seen to the right. The average cost is 19.7 DKKm (R2034).

For a 5 year lifetime extension, the estimated cost (adjusted for inflation) is 21.8 DKKm (R2039).

All forecast numbers contain a certain amount of risk

#### **Decommissioning obligation**

Extract from the Power Production License:

- The license holder is bound to pay for any re-establishing and decommissioning of the area when the concession ends or the plant is shut down
- DEA can set the time frame and conduction plan for such reestablishments
- New owners are required to provide necessary security for future decommissioning of the plant
- A plan for decommissioning needs to be send to DEA at least two years before shut down of the plant or the end of the concession
- The decommission plan shall include a plan for the removal of the plants. Further, the decommission plan shall include a report of the environmental and security related consequences and a time frame for decommission. DEA can provide certain demands for the decommissioning, and it is to be expected that the best available technology and best environmental praxis will be required
- The license does not relief the license holder of any legal responsibilities regarding the plant's presence and does not provide guarantee of the proposed constructions safety or stability

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#### **Decommissioning cost forecast**

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Method A: Top-down

Method B: Bottom-up

- Given lack of empirical data the majority of companies use a top-down cost estimation
- Based on experience from a wide range of energy companies the cost is typically estimated as 2-5 % of CAPEX, adjusted to price level of year of decommissioning
- Project specific characteristics determine where to be in the range
- CAPEX: 400 DKKm (2009)
- Estimate: 3 % x CAPEX = 12.0 DKKm (R2009)

Parameter			
Estimate baseline	DKKm	R2009	12.00
Estimate year 2034	DKKm	R2034	19.69
Estimate year 2039 extension	DKKm	R2039	21.74

- Model based on research paper "Modelling the decommissioning cost of offshore wind development on the US Outer Continental Shelf", Mark J. Kaiser, Brian Snyder
- Model recalibrated as best as possible to the site characteristics for Sprogø OWF, primarily various distance parameters. Assumed monopiles instead of GBF
- The estimate includes activities of turbine removal, foundation removal, cable removal, scour protection removal, site clearance
- The cheapest logistical solution has been chosen for each activity
- Estimate: 12.8 DKKm (R2012)

Parameter			
Estimate baseline	DKKm	R2012	12.78
Estimate year 2034	DKKm	R2034	19.75
Estimate year 2039 prolongation	DKKm	R2039	21.81
			~ ~

Note: This is a simple cash flow model, which doesn't take into account all cash effects such as tax and working capital.

Source: A/S Storebælt, Mark J. Kaiser, ESP Consulting analysis

<sup>\*</sup> Decommissioning costs occurring after end of operations in either December 2034 or December 2039

## Forecasted volume and prices

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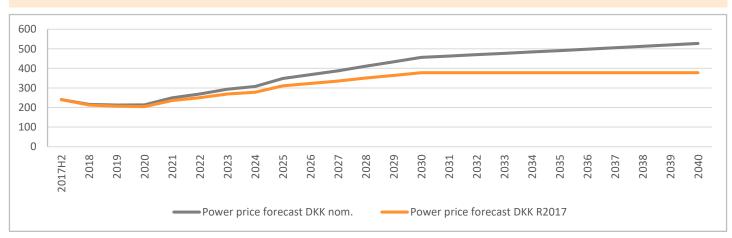
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#### Forecasted production volumes and avg. prices 2018M6 – 2039M11 with optimized setup and lifetime extension to 2039M11

Annual volumes MWh	2018 M6-M12	2019	2020	2021 - 2025	2026 - 2030	2031 - 2033	2034 M1-M11	2018M6 - 2034M11	2034M12 - 2039M11	2018M6 - 2039M11
Spot market	33,892	62,123	62,123	310,615	310,615	186,369	56,946	1,022,683	310,615	1,333,298
Open Door subsidy premium	-	-	-	-	-	-	-	-	-	-
Balancing subsidy	33,892	62,123	62,123	310,615	186,369	-	-	655,122	-	655,122
GO certificates	33,892	62,123	62,123	310,615	310,615	186,369	56,946	1,022,683	310,615	1,333,298
Ancillary services*	2,428	4,450	4,450	22,250	22,250	13,350	4,079	73,257	22,621	95,878
Average prices	2018	2010	2020	2021 -	2026 -	2031 -	2034	2018M6 -	2034M12 -	2018M6 -
DKK/MWh nom.	M6-M12	2019	2020	2025	2030	2033	M1-M11	2034M11	2039M11	2039M11
Spot market	193	189	188	256	352	399	411	310	429	337
Open Door subsidy premium	-	-	-	-	-	-	-	-	-	-
Balancing subsidy	13	13	13	13	13	-	-	13	-	13
GO certificates	6	6	6	7	7	8	8	7	8	7
Ancillary services*	318	311	310	378	474	522	533	432	551	460

#### Spot power price forecast 2017H - 2040



The estimated long-term annual wind energy yield for Sprogø OWF is 66,573 MWh.

Most of the production is expected to be sold on the spot market. However, going forward it is expected that Sprogø OWF can continue to create value also from ancillary services. The volumes sold as ancillary services in the forecast is based on the historical average for 2015 / 2016, with the remaining production to be sold at the spot market.

Sprogø OWF is no longer entitled to the Open Door subsidy premium. As such, the primary revenue will come from the sale of power on the spot market. Spot power prices are forecasted based on current futures and DEA.

However, Sprogø OWF will continue to receive the balancing subsidy until 2029.

The prices on ancillary services are assumed constant (in real prices) in the remaining lifetime of Sprogø OWF.

Source: Nasdaq, DEA and ESP Consulting

\* Ancillary services for Sprogø OWF has primarily come and are expected to come from sale of down-regulation on the intraday market

## Cash flow forecast

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Future revenue will primarily come from the spot market. Spot power prices today are relative low, but there has nonetheless been an increasing trend since summer 2015. The forecasted spot market revenue is based on estimated volumes using the long-term energy vield estimate.

Spot market prices are forecasted by using forward prices in the period from 2017H2 to 2020. In the period from 2021 to 2039 the forecasted spot market revenue is based on DEA's 2017 central spot power price- and downlift forecast

In this forecast, the Increasing power prices will lead to significant higher revenue and reduced costs in an optimized setup leads to a significantly increased net cash flow.

The total estimated undiscounted net cash flow from 2018M6 to 2034M11 is forecasted to 200 DKKm. If production is prolonged to December 2039 following DEA's approval, the forecasted extra undiscounted net cash flow is 86 DKKm. Thus the total net cash flows for the full period is 258 DKKm.

The forecasts will at a later stage be released on the webpage in an Excel-file.

		•	•							
Forecasted revenue	2018	2019	2020	2021 -	2026 -	2031 -	2034	2018M6 -	2034M12 -	2018M6 -
DKKt nom.	M6-M12	2019	2020	2025	2030	2033	M1-M11	2034M11	2039M11	2039M11
Spot market	6,532	11,729	11,673	79,452	109,333	74,453	23,417	316,590	133,274	449,864
Open door subsidy premium				-	-		-	-	-	
Balancing subsidy	441	808	808	4,038	2,423		-	8,517	-	8,51
GO certificates	208	388	393	2,054	2,208	1,404	441	7,096	2,513	9,60
Ancillary services	773	1,383	1,379	8,407	10,548	6,963	2,175	31,629	12,472	44,10
Total	7,954	14,307	14,253	93,951	124,511	82,820	26,034	363,831	148,259	512,090
Forecasted costs	2018	2010	2020	2021 -	2026 -	2031 -	2034	2018M6 -	2034M12 -	2018M6 -
DKKt nom.	M6-M12	2019	2020	2025	2030	2033	M1-M11	2034M11	2039M11	2039M11
WTG	-3,606	-5,408	-5,598	-31,229	-37,396	-25,882	-8,521	-117,639	-51,700	-169,33
Foundation and second										

Cash flow forecast 2018M6 – 2039M11 with optimized setup and lifetime extension to 2039M11

DKKt nom.	M6-M12	2019	2020	2025	2030	2033	M1-M11	2034M11	2039M11	2039M11
WTG	-3,606	-5,408	-5,598	-31,229	-37,396	-25,882	-8,521	-117,639	-51,700	-169,339
Foundation and cranes	-51	-61	-62	-323	-347	-221	-69	-1,133	-395	-1,528
Transmisssion assets and systems	-	-	-	-	-	-	-		-	-
Technicial resources	-8	-	-	-	-	-	-	-8	-	-8
Administration & back-office	-123	-210	-215	-1,144	-1,273	-832	-265	-4,062	-1,538	-5,600
Environmental and safety related costs	-	-	-	-	-	-	-	-	-	-
Logistics	-761	-698	-708	-3,701	-3,979	-2,529	-796	-13,173	-4,528	-17,700
Onshore facilities	-2	-15	-15	-81	-87	-55	-17	-273	-99	-371
Insurance	-272	-473	-480	-2,507	-2,696	-1,714	-539	-8,681	-3,068	-11,749
Taxes & Fees	-558	-1,033	-1,049	-5,477	-5,888	-3,743	-1,177	-18,926	-6,701	-25,627
Decomommisioning*	-	-	-	-	-	-	-	-	-21,800	-21,800
Total	-5,380	-7,899	-8,127	-44,461	-51,666	-34,976	-11,385	-163,894	-89,828	-253,722

Forecasted EBITDA	2018	2010	2020	2021 -	2026 -	2031 -	2034	2018M6 -	2034M12 -	2018M6 -
DKKt nom.	M6-M12	2019	2020	2025	2030	2033	M1-M11	2034M11	2039M11	2039M11
EBITDA	2,574	6,409	6,127	49,489	72,846	47,844	14,649	199,937	58,430	258,368

Note: This is a simple cash flow model, which doesn't take into account all cash effects such as tax and working capital.

Source: Nasdag, DEA and ESP Consulting analysis

<sup>\*</sup> Decommissioning costs occurring after end of operation. Forecasted decommissioning in 2039

## Appendix



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## Asset scope

## Aerial overview of asset location

The aerial overview shows the assets in scope, which include all hardware up to the point where the export sea-cables enter the Sprogø **Disconnector Station.** 

The export sea-cables are both connected to WTG3.

The rest of the grid assets including the Disconnector Station, various land cables and Sprogø Teknikbygning are mainly owned by SK Elnet and SEAS-NVE.

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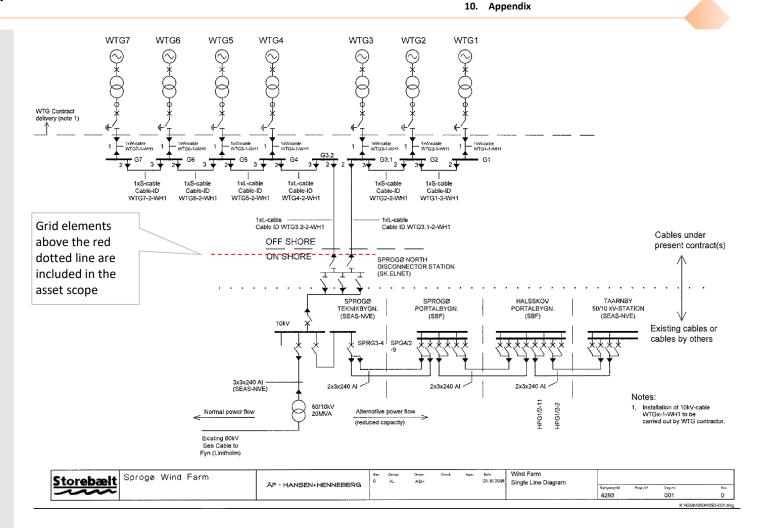
## Asset scope

## Single Line Diagram

The Single Line Diagram shows the hardware including interconnectors from the wind park and to the main grid. It also includes specification of who owns what equipment in parenthesis.

The normal power flow goes towards Fynen to price area DK1 (Denmark West) via a 60 kV cable.

There is an alternative power flow towards Sealand with reduced capacity.



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Term	Description	Term	Description
"Aarsleff"	Per Aarsleff A/S	"MW"	Megawatt
"Asset"	See slide 7	"MWh"	Megawatt hour
"Buyer"	The party that satisfy any regulatory	"m/s"	Meters per second
	requirements and makes the highest bid	"Niras"	Niras A/S
<i>и</i> п	in the final bidding round	"N/A"	Not applicable
"c."	Approximately	"Open Door scheme"	Åben Dør ordningen
"CAPEX"	Capital Expenditure	"Owner"	A/S Storebælt
"CfD"	Contracts for Difference	"O&M"	Operations & Maintenance
"Construction License"	In Danish: "Etableringstilladdelse"	"Potential Transaction"	Potential sale of the Asset
"DEA"	Danish Energy Agency, in Danish: "Energistyrelsen"	"Possible License Extension"	The license opportunity to renegotiate the terms of continued operation of the
"DKK/MWh"	Danish Krone per megawatt hour		existing asset, see slide 18
"DK1"	Price area DK1 (Denmark West)	"Power Production License"	In Danish "Elproduktionstilladelse"
"DOT"	Dansk Offshore Transport ApS	"PPA"	Power Purchase Agreement
"EIA"	Environmental Impact Assessment	"рр."	Percentage points
"Energistyrelsen"	Danish Energy Agency	"Pre-investigation License"	In Danish: "Forundersøgelsestilladelse"
"ESP Consulting"	ESP Consulting Nordic ApS	"Production License"	In Danish: "Produktionsbevilling"
"FLH"	Full Load Hours	"R2016"	Real 2016 prices
"FTE"	Full Time Equivalent	"Sprogø OWF"	Sprogø Offshore Wind Farm
"GBF"	Gravity Based Foundation	"SWA"	Service and Warranty Agreement
"GO"	Guarantee of Origin (green certificate)	"Transaction"	Sale of the Asset
"GWh"	Gigawatt hour	"TSO"	Transmission System Operator
"kWh/m²"	Kilowatt hour per square meter	"Vestas"	Vestas Wind Systems A/S
"m"	Meters	"WTG"	Wind turbine generator
"Memorandum"	Information Memorandum	"Øre/kWh"	Øre per kilowatt hour
"MHI"	Mitsubishi Heavy Industries		
"MHI Vestas"	Joint venture between Mitsubishi Heavy Industries and Vesters Wind Systems A/S		

relating to offshore wind activities