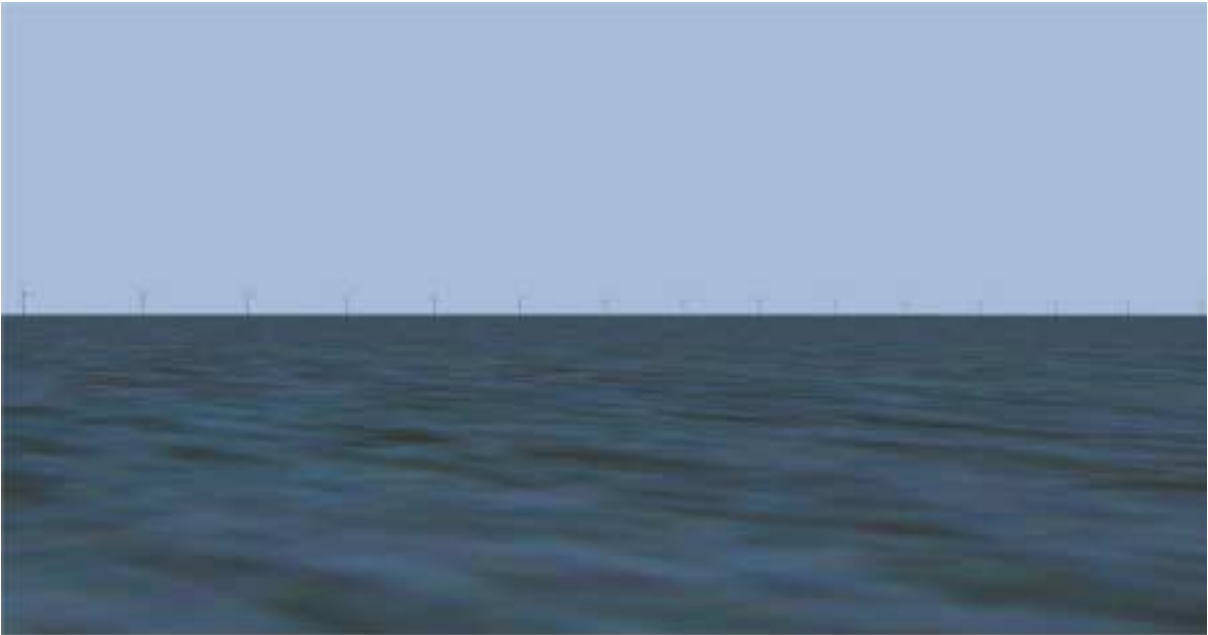


YORKSHIRE FORELAND, UK, 52.5 MW (15 x 3.5 MW)



Photomontage showing the visibility from coastline at Easington based on standard 45 mm focal length camera. Photo point is shown on map with green lines.



Project description

The proposed project is 4.5 km offshore outside Kilnsea, Humberside, around 18 km east of Grimsby. The project consists of a bow with 15 3,5 MW WTGs which makes 52,5 MW in all. Each WTG is assumed with a hub height of 95 m and a rotor diameter of 100 m. Some very rough preliminary calculations show that around 800 GWh could be produced annual. The proposed layout has 600 m spacing (6 rotor diameters) – the circle bow has 10 km radius. Grid connections are assumed obtained with one or more direct 30 kV lines to Grimsby. The foundation type is assumed to be monopole at a water dept less than 20 m.

The project description and the calculations performed are of initial nature and must be further consolidated.



Facts on layout proposal and estimated investment costs

WTG size layout specification and price

Total installed power	52.5MW		Distance in RD	
Number of rows	1		x	x
WTGs per row)*	15		600	6.0
Number of WTGs	15		Hub height	RD (m)
Size of WTG	3.5	MW	95	100
Price information in this case are very rough estimates				
Price for WTGs, installed (k€)	44,625	850	€/kW	

Foundation, specification and cost estimate: **52.5 MW**

Type of foundation	Monopile								
Number of foundations:	15								
Water debt (m)	20	RD	HH						
WTG-size (MW, rotor diameter, hub height)	3.5		100	95	Debt#1	Debt#2	Debt#3	Debt#4	Debt#5
Ice risk (yes/no)	No								
100 year max wind gust (m/s)	?								
100 year max wave height (m)	?								
Tidal difference (m)	?								
	For all k€	k€ per pcs.	€/kW	Per foundation, debt dependent					
Fixed price, design cost,									
Fixed price, building/shipping facilities									
Fixed ground prepare cost									
Variable ground prepare cost									
Variable, building cost									
Installation cost									
SUM	23,625	1575	450						

Figure 1 Foundation costs are very roughly estimates while no detailed data on water, weather and sea bottom conditions are available so far.

Grid connection:

	Number or length (m)	Voltage(kV)	mm²	Material	Lines/cable	Prices k€		Per unit or	
						For all	per meter, €	€/kW	
Off shore									
Sea cable, from wind farm to shore	36000	30	300	CU	Cable	3,600	100	69	
In row cables	0	30	300	CU	Cable	-	100	-	
Rows to collect point cables	8400	30	300	CU	Cable	840	100	16	
Cable roll out/Wash down, variable	26400					1,320	50	25	
Cable roll out/wash down, fixed cost						200	200,000	4	
Total number of WTG connectors	15					375	25,000	7	
Off shore HV station	0					-		-	
Connection (electrical work)									
Other fixed costs						300	300,000	6	
Other variable costs									
On shore									
From shore to HV-grid									
HV station (if needed)									
Connection (electrical work)									
Compensation (reactive power)									
Other fixed costs						500	500,000	10	
Other variable costs									
Total						7,135		136	

Figure 2 In this calculation 2 parallel 30 kV cables are assumed to Grimsby. Needs detailed analyses.

Total budget for 52.5 MW wind farm

	k€	€ per kW	Percent
WTGs	44,625	850	50%
Foundation	23,625	450	26%
Grid connection	7,135	136	8%
Planning and permissioning	7,180	137	8%
Organisation, management	2,692	51	3%
Miscellaneous (e.g. risk)	4,487	85	5%
TOTAL	89,744	1,709	100%

Note: Cost estimates are based on rough scaling of mainly experience from Danish offshore projects.

Expected energy production, and PPA

The energy calculation based on wind data from nearest EU-Windatlas data at Waddington (which might be quite uncertain) is performed. The WAsP calculation model is used from the WindPRO software tool, where the whole project is modeled. The onshore surface roughness towards west has been taken into consideration in the calculation that shows 226 GWh/year. From this uncertainty, grid losses and availability losses shall be withdrawn – probably around 20% at present stage, which makes 181 GWh.

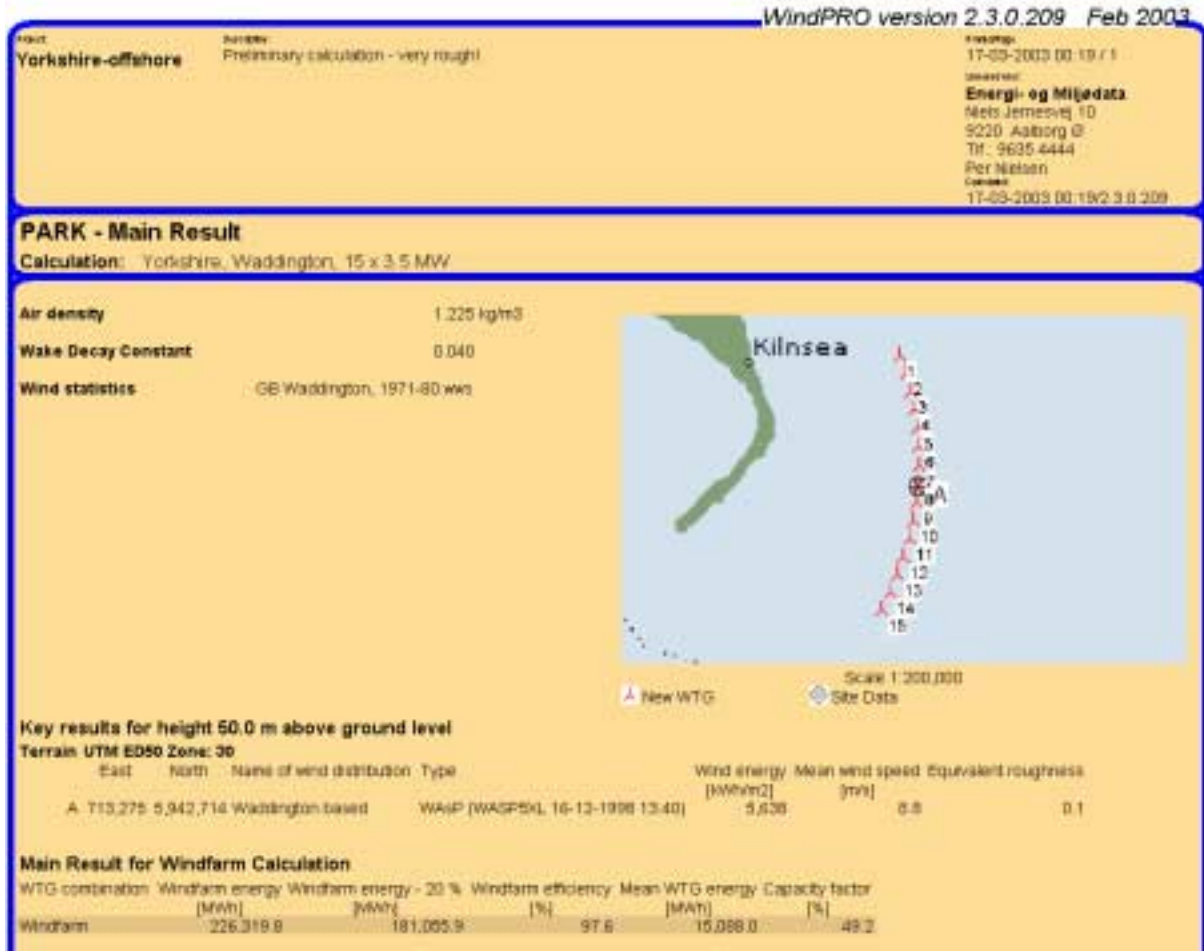


Figure 3 The energy calculation printout from WindPRO software.

Knowledge from existing onshore wind farms near site combined with the Horns Rev (first large Offshore project in North Sea in DK installed end 2002) experience that now start to come, a more certain estimate can be made with relative limited effort. Installation of wind measurement mast at site would be preferable.

UK-WTG electricity price	£/MWh		€/kWh		Average	Comment
	min	max	min	max		
Brown electricity price	12	18	0.019	0.029	0.024	Inflated
Climate Change Levy		4.3	0.000	0.007	0.003	limited to 12000 full load hour
Ren. Obl. Cert. (ROC)	30	50	0.048	0.081	0.065	non inflated, very uncertain
Local prod. benefit		1.5	0.000	0.002	0.001	Inflated
Total	42	73.8	0.068	0.119	0.094	

Figure 4 The price paid per kWh and especially the development is uncertain. To minimize the risk, it could be an option to make long-term contracts, especially for the ROC's. The CCL is only included the first 12000 full load hours, simply due to lack of knowledge of future expectations.

Operation costs and economic feasibility

Based on onshore experience following figures have been used in the calculations:

Operation cost	onshore	offshore estimate
Insurance	5 €/kW/y	10 €/kW/y
Service and maintenance	10 €/kW/y	18 €/kW/y
Adm. and management	3 €/kW/y	5 €/kW/y
SUM/year	18 €/kW/y	33 €/kW/y
Per WTG:		1.0 €/kWh/y
Decommissioning	50 k€/WTG	0.7 €/kW/y

Figure 5 Operation cost used in calculation. The resulting 1 €/kWh match well the DK utilities expectations for the calculated DK projects. The decommissioning costs is set relative low, but there should be good reasons to believe in that instead of decommissioning, repowering would be more likely. Additionally 2% of total income is added for rent to Crown Estate.

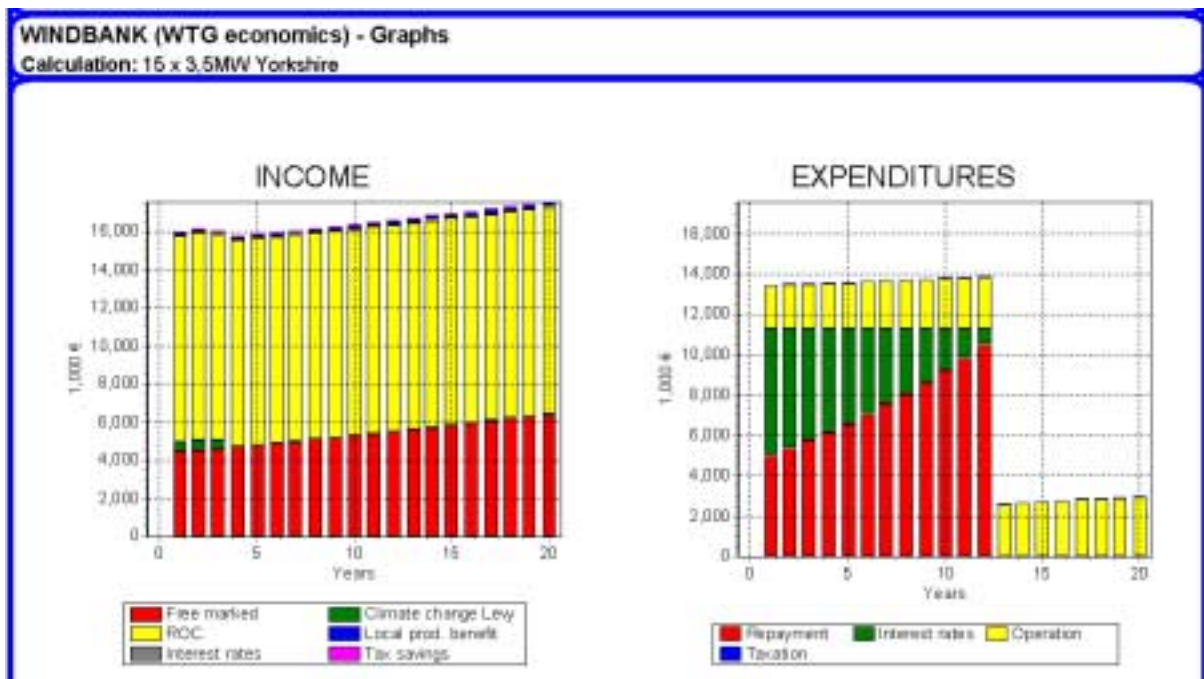


Figure 6 With the above estimated price development a payback time of 9.6 years will be expected. Tax calculations is not included, but these will typically have a positive influence on the pay back time due to tax credits from loans.

RATIOS

	€/	/kW	/m ²	/MWh
Preliminary expenses	€	1,709	-	496
O/M costs	average €/years	39	-	11
Energy production	kWh/Years	3,449	-	-

Minimum life span for redemption of loan	9.6 Years
Simple pay back time	7.1 Years
Net present value for share	538 €
Net present value in % of investment	108.5 %
Production price at calculation interest 6.0%	0.06 €/kWh

Figure 7 One share is here 1000 kWh/year, an investment of 496€

Infrastructure, environmental aspects etc. needs investigations.

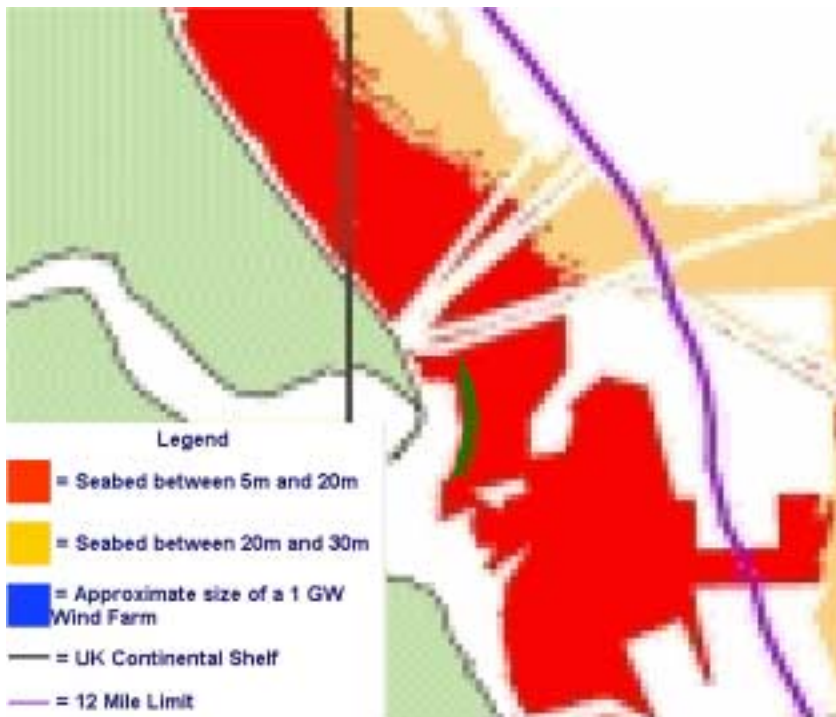
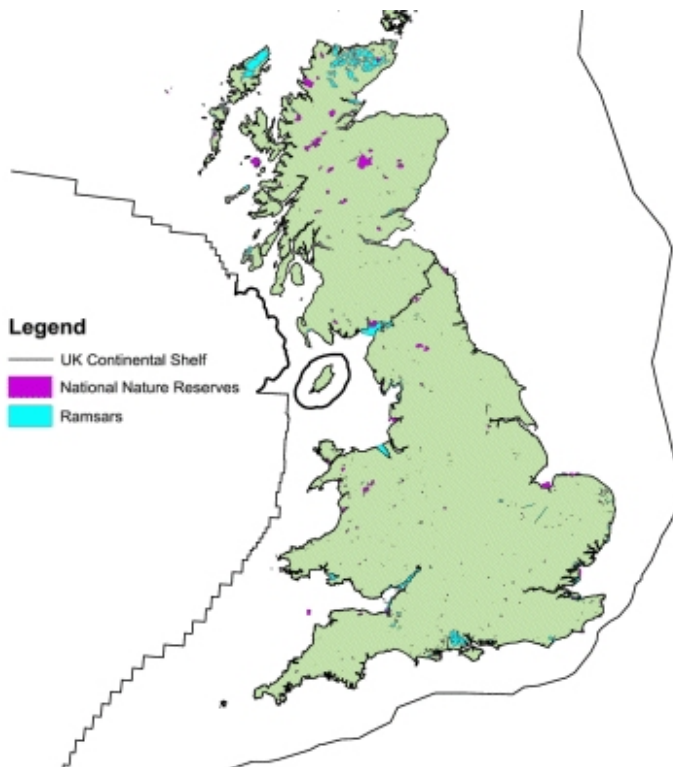


Figure 8 The wind farm shown on top of the map from dti's WindBase. This show that the site is within the 5-20 m water dept and that it does not conflict with major traffic routes.



The Ramsars and Natural nature reserves indicate no problems for this specific site. There will be a 30-month investigation and documentation phase in order to achieve a building permission, where the Environmental Impact Assessment will be a major part.

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