

Loss&Uncertainty - Main result

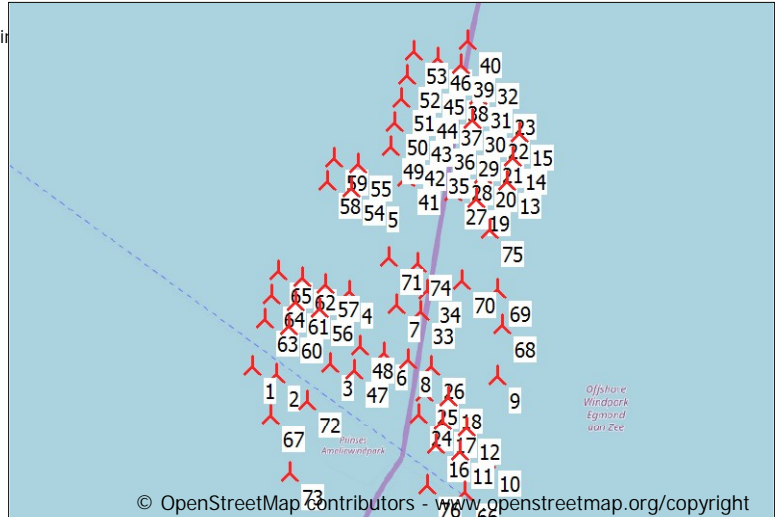
Calculation: HKN 76x SeaTitan HH 125m (met bestaande windparken)

Main data for PARK

PARK calculation 3.1.617: HKN 76x SeaTitan HH 125m (met bestaande windparken)
 Count 76
 Rated power 760,0 MW
 Mean wind speed 9,8 m/s at hub height
 Sensitivity 1,0 %AEP / %Mean Wind Speed
 Expected lifetime 20 Years

RESULTS

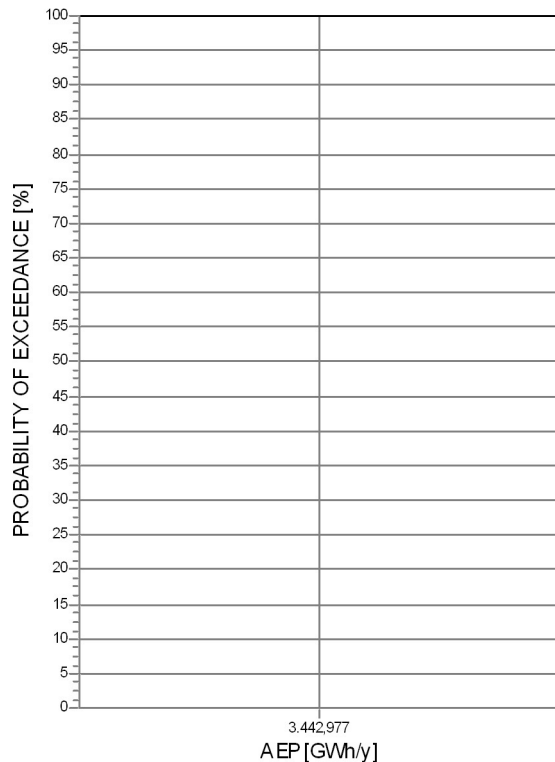
P50
 NET AEP [GWh/y] 3.443,0
 Capacity factor [%] 51,7
 Full load hours [h/y] 4.530



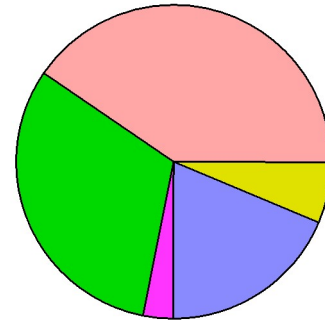
Scale: 400.000

Result details

	P50	Uncertainty	
GROSS AEP *)	4.054,3 GWh/y	0,0 %	0,0 %
Bias correction	0,0 GWh/y	0,0 %	0,0 %
Loss correction	-611,4 GWh/y	-15,1 %	0,0 %
Wake loss		-6,4 %	
Other losses		-9,2 %	
NET AEP	3.443,0 GWh/y	0,0 %	0,0 %

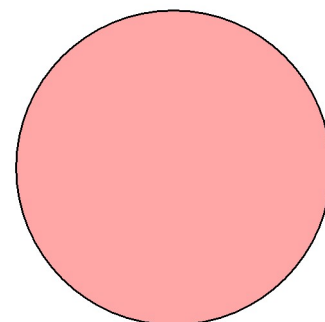


Loss: 15,1 %



1. Wake effects	6,4 %	2. Availability	5,0 %
3. Turbine performance	0,5 %	4. Electrical	3,0 %
5. Environmental	1,0 %	6. Curtailment	0,0 %
7. Other	0,0 %		

Uncertainty: 0,0 %



A. Wind data	0,0 %	B. Wind model	0,0 %
C. Power conversion	0,0 %	D. BIAS	0,0 %
E. LOSS	0,0 %		

*) Calculated Annual Energy Production before any bias or loss corrections
 Assumptions: Uncertainty and percentiles (PXX values) are calculated for the expected lifetime

Loss&Uncertainty - Assumptions and results

Calculation: HKN 76x SeaTitan HH 125m (met bestaande windparken)

ASSUMPTIONS

LOSS	Method *)	Loss [%]	Loss [GWh/y]	Std dev**) [%]	Comment
1. Wake effects					
Wake effects, all WTGs	Calculation	6,4	261,5	0,0	
2. Availability					
Turbine availability	Estimate	5,0	202,7	0,0	
3. Turbine performance					
High wind hysteresis	Estimate	0,5	20,3	0,0	
4. Electrical					
Electrical losses	Estimate	3,0	121,6	0,0	
5. Environmental					
Performance degradation not due to icing	Estimate	0,5	20,3	0,0	
Performance degradation due to icing	Estimate	0,5	20,3	0,0	
6. Curtailment					No input
7. Other					No input
LOSS, total		15,1	611,4	0,0	

UNCERTAINTY	Method *)	Std dev, wind speed [%]	Std dev, AEP [%]	Comment
A. Wind data				
Wind measurement/Wind data				
Long term correction				
Year-to-year variability				
Future climate				
Other wind related				
B. Wind model				
Vertical extrapolation				
Horizontal extrapolation				
Other wind model related				
C. Power conversion				
Power curve uncertainty				
Metering uncertainty				
Other AEP related uncertainties				
D. BIAS, total uncertainty			0,0	
E. LOSS, total uncertainty			0,0	
UNCERTAINTY, total (1y average)			0,0	
UNCERTAINTY, total (20y average)			0,0	

VARIABILITY

Years	Variability (std dev) [%]	Total std dev [%]
1	0,00	0,0
5	0,00	0,0
10	0,00	0,0
20	0,00	0,0

RESULTS

AEP versus exceedance level / time horizon

PXX [%]	1 y [MWh/y]	5 y [MWh/y]	10 y [MWh/y]	20 y [MWh/y]
50	3.442.977	3.442.977	3.442.977	3.442.977
75	3.442.977	3.442.977	3.442.977	3.442.977
84	3.442.977	3.442.977	3.442.977	3.442.977
90	3.442.977	3.442.977	3.442.977	3.442.977
95	3.442.977	3.442.977	3.442.977	3.442.977

*) Calculation means that a calculation method available in the windPRO software is used. This still typically involve a user judgement and user data where the quality of those decides the accuracy. If calculation method is used, the values will often be different from turbine to turbine, here the average is shown, but at page "WTG results" the individual turbine results are shown.

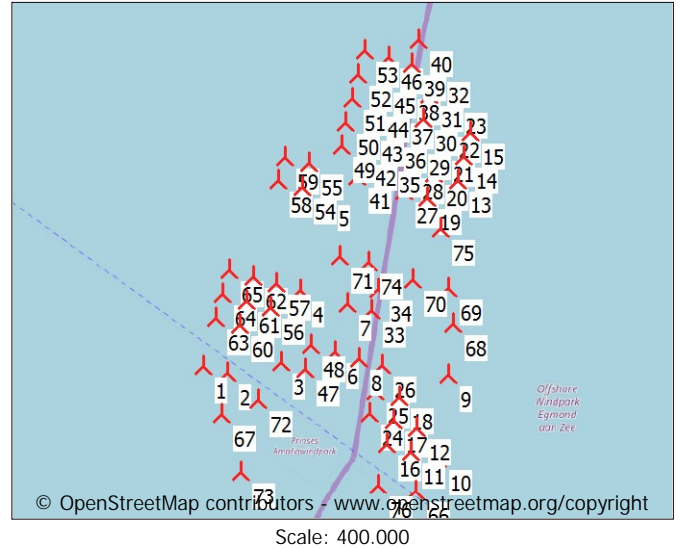
**) For totals the std dev refers to the full AEP, otherwise std dev refers to the bias or loss component which is a fraction of the total AEP.

Loss&Uncertainty - WTG results

Calculation: HKN 76x SeaTitan HH 125m (met bestaande windparken)

Main data for PARK

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 Rated power 760,0 MW
 Mean wind speed 9,8 m/s at hub height
 Sensitivity 1,0 %AEP / %Mean Wind Speed
 Expected lifetime 20 Years



Expected AEP per WTG including bias, loss and uncertainty evaluation

Description	Calculated GROSS*) [MWh/y]	Bias [%]	Loss [%]	20 years averaging	
				Unc. [%]	P50 [MWh/y]
Layer: 11 extra Sea Titans					
66 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (271)	53.421,3	0,0	12,2	0,0	46.897,7
67 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (273)	53.281,7	0,0	12,3	0,0	46.714,8
68 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (275)	53.436,5	0,0	13,1	0,0	46.425,5
69 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (276)	53.424,4	0,0	13,3	0,0	46.314,3
70 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (277)	53.388,5	0,0	14,3	0,0	45.770,9
71 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (278)	53.325,4	0,0	14,4	0,0	45.630,3
72 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (282)	53.293,5	0,0	13,9	0,0	45.902,1
73 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (284)	53.292,1	0,0	11,6	0,0	47.102,1
74 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (285)	53.348,8	0,0	14,7	0,0	45.486,7
75 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (286)	53.407,0	0,0	13,6	0,0	46.148,3
76 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (287)	53.381,9	0,0	12,7	0,0	46.621,2
Layer: Sea Titan 65 turbines					
1 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (190)	53.272,7	0,0	12,2	0,0	46.784,5
2 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (192)	53.280,4	0,0	13,3	0,0	46.202,2
3 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (197)	53.304,7	0,0	14,9	0,0	45.345,9
4 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (198)	53.311,4	0,0	14,9	0,0	45.368,2
5 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (199)	53.317,0	0,0	14,6	0,0	45.553,4
6 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (203)	53.333,7	0,0	15,5	0,0	45.084,7
7 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (204)	53.341,0	0,0	14,9	0,0	45.386,2
8 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (206)	53.350,9	0,0	15,2	0,0	45.252,9
9 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (214)	53.432,5	0,0	13,5	0,0	46.239,8
10 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (215)	53.438,6	0,0	13,0	0,0	46.468,1
11 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (213.1)	53.407,5	0,0	14,5	0,0	45.654,0
12 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (213.2)	53.413,6	0,0	15,0	0,0	45.398,8
13 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (212.1)	53.419,5	0,0	15,2	0,0	45.295,4
14 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (212.2)	53.415,8	0,0	15,6	0,0	45.069,5
15 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (212.3)	53.418,0	0,0	14,9	0,0	45.446,1
16 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (211.1)	53.388,1	0,0	14,7	0,0	45.528,0
17 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (211.2)	53.384,9	0,0	15,9	0,0	44.915,7
18 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (211.3)	53.387,5	0,0	15,4	0,0	45.169,6
19 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (210.1)	53.391,6	0,0	15,5	0,0	45.113,5
20 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (210.2)	53.387,8	0,0	16,9	0,0	44.343,5
21 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (210.3)	53.392,6	0,0	17,4	0,0	44.128,1
22 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (210.4)	53.394,3	0,0	16,9	0,0	44.356,2
23 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (210.5)	53.386,5	0,0	15,4	0,0	45.155,8
24 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (209.1)	53.369,0	0,0	15,4	0,0	45.125,5
25 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (209.2)	53.365,1	0,0	15,9	0,0	44.864,0
26 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (209.3)	53.371,3	0,0	15,0	0,0	45.373,4

To be continued on next page...

Loss&Uncertainty - WTG results

Calculation: HKN 76x SeaTitan HH 125m (met bestaande windparken)

...continued from previous page

Description	Calculated GROSS*) [MWh/y]	Bias [%]	Loss [%]	20 years averaging	
				Unc. [%]	P50 [MWh/y]
27 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.1)	53.368,3	0,0	16,0	0,0	44.843,4
28 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.2)	53.364,9	0,0	17,2	0,0	44.171,1
29 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.3)	53.369,6	0,0	17,9	0,0	43.821,7
30 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.4)	53.365,5	0,0	17,7	0,0	43.930,7
31 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.5)	53.370,6	0,0	16,9	0,0	44.335,4
32 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (208.6)	53.369,6	0,0	14,9	0,0	45.400,8
33 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (207.1)	53.356,9	0,0	15,1	0,0	45.279,8
34 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (207.2)	53.360,4	0,0	15,6	0,0	45.024,3
35 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.1)	53.348,5	0,0	17,5	0,0	44.014,8
36 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.2)	53.347,7	0,0	18,0	0,0	43.733,1
37 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.3)	53.350,0	0,0	17,7	0,0	43.898,7
38 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.4)	53.349,6	0,0	17,0	0,0	44.264,3
39 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.5)	53.348,4	0,0	15,7	0,0	44.952,1
40 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (205.6)	53.345,4	0,0	13,3	0,0	46.249,5
41 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.1)	53.327,0	0,0	16,0	0,0	44.791,8
42 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.2)	53.329,5	0,0	17,3	0,0	44.127,0
43 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.3)	53.330,8	0,0	17,7	0,0	43.917,5
44 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.4)	53.328,1	0,0	17,3	0,0	44.126,8
45 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.5)	53.333,3	0,0	16,7	0,0	44.437,8
46 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (202.6)	53.327,3	0,0	15,0	0,0	45.325,2
47 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (201.1)	53.317,4	0,0	15,5	0,0	45.036,0
48 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (201.2)	53.321,4	0,0	15,5	0,0	45.040,0
49 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (200.1)	53.316,3	0,0	15,8	0,0	44.893,8
50 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (200.2)	53.316,7	0,0	15,5	0,0	45.042,5
51 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (200.3)	53.315,9	0,0	15,1	0,0	45.239,4
52 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (200.4)	53.309,3	0,0	14,5	0,0	45.601,9
53 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (200.5)	53.312,3	0,0	13,0	0,0	46.378,2
54 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (196.1)	53.299,6	0,0	14,8	0,0	45.409,0
55 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (196.2)	53.300,4	0,0	14,9	0,0	45.359,1
56 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (195.1)	53.297,2	0,0	15,5	0,0	45.033,5
57 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (195.2)	53.298,8	0,0	15,4	0,0	45.092,8
58 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (194.1)	53.289,0	0,0	13,4	0,0	46.151,2
59 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (194.2)	53.291,8	0,0	13,3	0,0	46.202,9
60 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (193.1)	53.281,7	0,0	14,4	0,0	45.594,8
61 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (193.2)	53.287,2	0,0	15,7	0,0	44.895,3
62 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (193.3)	53.286,1	0,0	14,9	0,0	45.358,8
63 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (191.1)	53.274,6	0,0	13,3	0,0	46.184,2
64 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (191.2)	53.276,7	0,0	14,0	0,0	45.830,9
65 AMSC (Pondera) SeaTitan 10MW 10000 190.0 !O! hub: 125,0 m (TOT: 220,0 m) (191.3)	53.273,9	0,0	13,0	0,0	46.349,6
PARK	4.054.334,8	0,0	15,1	0,0	3.442.977,2