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HOLLANDSE KUST (NOORD) LEVELISED COST OF ENERGY BASELINE AND SCENARIOS

HOLLANDSE KUST (NOORD) LEVELISED COST OF ENERGY BASELINE AND SCENARIOS

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Summary

For the Hollandse Kust (noord) offshore wind farm zone, the Ministry of Economic Affairs and Climate Policy is currently making key decisions regarding the site definition. An Innovative Area is being considered, as are different buffers from the offshore platform Q4C, leaving more space between Hollandse Kust (zuid) and (noord) and limited use of the 10-12 NM zone.

To provide additional insight into the cost reduction potential of different measures, RVO.nl has commissioned Ecofys to perform comparisons between a baseline concept and various different scenarios. The Ministry of Economic Affairs and Climate Policy defined five scenarios, which are compared to an agreed Baseline, with relative differences presented for discussion purposes. The comparisons are based on relative differences in Levelised Cost of Energy (LCOE) calculations between scenarios. The LCOE calculations were performed with the Ecofys Offshore Wind Cost Model with input data from Ecofys and RVO.nl.

The five investigated options could individually lead to increases in overall LCOE of 0.4 to 4.8%, as shown in Table 1. Note that the precision shown in these results does not reflect the level of uncertainty.

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Table 1 – Differences in calculated costs and LCOE for each Alternative Scenario, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4C	Alternative 4D
Summary	Include space for an Innovative Area	Safety buffer of 5 nm around platform Q4c	Remove north-east corner to increase helicopter accessibility to Q4c	Leaving more space between Hollandse Kust (zuid) and (noord), and use the 10-12 NM zone sparingly. - 4C is smaller site than 4D	
Total DEVEX	0%	0%	0%	0%	0%
Total CAPEX	**-7.3%**	**+0.1%**	**+0.1%**	**-1.6%**	**-0.7%**
Total Annual OPEX	**-4.0%**	0%	0%	0%	0%
Decommissioning	**-6.1%**	0%	**+ 0.2%**	**-2.1%**	**-1.2%**
LCOE Developer	**+1.3%**	**+1.2%**	**+0.4%**	**+4.6%**	**+3.0%**
- Contributing factors	• Lower yield • Slightly lower wake losses Higher O&M costs • Increased number of cable crossings,	• Increased wake losses: lower yield • Increased number of cable crossings	• Increased wake losses: lower yield • Increased number of cable crossings	• Smaller number of cable crossings and shorter array cable lengths • More than offset by the decrease in yield due to higher wake losses* • 4C has higher CAPEX reductions than 4D, but more wake losses	
LCOE Tennet	0%	**+1.2%**	**+0.4%**	**+5.9%**	**+3.6%**
- Contributing factors	• Assumed same as base case	• Increased wake losses: lower yield	• Increased wake losses: lower yield	• Increased wake losses: lower yield	
LCOE Overall	**+1.1%**	**+1.2%**	**+0.4%**	**+4.8%**	**+3.1%**

* The calculated losses are still within the same range as similar offshore wind farms, including layouts analysed for Hollandse Kust (zuid), based on similar but not identical turbines and assumptions. In: Ecofys, 20 June 2016, 'Hollandse Kust Zuid Levelised Cost of Energy Baseline and Scenarios', ref: WIENL16053

Table of contents

1 Introduction **1**

1.1 Goal of the study 1

1.2 Approach 1

1.3 Explanatory note 2

2 Baseline Scenario **3**

2.1 Design Assumptions 3

2.2 Site Design 4

3 Alternative 1 **6**

4 Alternative 2 **10**

5 Alternative 3 **14**

6 Alternative 4C and 4D **18**

7 Comparison of Alternatives **24**

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1 Introduction

1.1 Goal of the study

In September 2014, the Minister of Economic Affairs decided on the "Routekaart" for offshore wind in the Netherlands, where a total of 3.5 GW of offshore wind energy will be realised before 2023, by developing 5 large concentrated wind areas (of 700 MW each).

For the Hollandse Kust (noord) offshore wind zone, the Ministry of Economic Affairs and Climate Policy is currently making key decisions regarding the site definition. An Innovative Area is being considered, as are different buffers from the offshore platform Q4C, and leaving more space between Hollandse Kust (zuid) and (noord).

To provide additional insight into the cost reduction potential of different measures, RVO.nl has commissioned Ecofys to perform comparisons between a baseline concept and various different scenarios. The comparisons are based on relative differences in Levelised Cost of Energy (LCOE) calculations between scenarios. The LCOE calculations were performed with the Ecofys Offshore Wind Cost Model with input data from Ecofys and RVO.nl.

1.2 Approach

This report summarises the evaluation of four alternative scenarios, according to the following approach:

1. **Design Baseline Case**
   Ecofys evaluated the wind resource of the zone and provide a baseline layout for yield calculations and cost estimation. This allowed the calculation of a Baseline LCOE. The Baseline Scenario is described in Chapter 2.
2. **Evaluate New Scenarios**
   a. **Create wind farm layouts and provide yield and wake assessments**
      For each new scenario, Ecofys designed corresponding wind farm layouts, based on the scenario definitions from the Ministry of Economic Affairs and Climate Policy and using best-practice principles.
   b. **Provide cost price analysis for comparison of different offshore wind farm layouts**
      For each new layout, Ecofys calculated the corresponding costs, in order to determine the Scenario LCOE. The relative difference compared to the Baseline LCOE allows for easy comparison between scenarios.

The five alternative scenarios were defined by the Ministry of Economic Affairs and Climate Policy. A brief description is provided in Table 2, with further details of the scenarios and results in Chapters 3 to 6. The scenarios are compared together in Chapter 7.

Table 2 – Overview of Alternative Scenarios

Alternative	Summary
Alternative 1	Include space for an Innovative Area
Alternative 2	Safety buffer of 5 nm around platform Q4c
Alternative 3	Remove north-east corner to increase helicopter accessibility to Q4c
Alternative 4C	Leaving more space between Hollandse Kust (zuid) and (noord), and use the 10-12 NM zone sparingly. - 4C is smaller site than 4D
Alternative 4D	

1.3 Explanatory note

LCOE is defined as the long-term constant offtake price required during the operational phase of the project, to achieve a required equity hurdle rate, for all phases of the project (development, construction, operation, and decommissioning), resulting in a zero value for the net present value of the cash flow. This implies that a 1% LCOE increase is equal to a 1% increase in the required offtake price during the operational phase.

2 Baseline Scenario

2.1 Design Assumptions

The primary design assumptions for the Baseline and Alternative Scenarios are shown in Table 3, as agreed with RVO.nl. The primary settings of the Ecofys Offshore Cost Model were confirmed with RVO.nl, although the details are not presented here since the model remains confidential.

Table 3 – Key Assumptions for Site Design

Parameter	Input
Wind farm size	700 MW
OHVS	1 x 700 MW offshore substations Location to be defined by TenneT
Wind turbine type	Representative 9 MW (180 m rotor)
Wind turbine spacing	10D (rotor diameters) downwind, 8D crosswind (approx.)
Wind turbine power curve	Estimated based on rotor diameter and rated capacity
Water depths	16.5-25.3 m RWS bathymetry dataset 2010
Foundations	Monopiles
Export cable	Export cable route defined by TenneT 220 kV cables
Infield cable voltage	66 kV
Nearest port	Ijmuiden
Weather downtime	33%
Soil conditions	Primarily sand (piling is possible)
Wind speeds	9.6 m/s at 118 m hub height
Yield	Wake losses: calculated using NO Jensen model, with correction for deep-array effects Electrical losses: calculated for infield and export cables, OHVS and onshore converter station Other losses: estimated
Debt/equity	Developer WACC = 3.8% TenneT WACC = 3.3% Project lifetime = 25 years
All other inputs	Standard Ecofys Offshore Cost Model settings

2.2 Site Design

To form the basis for comparison, Ecofys designed a baseline layout for the Hollandse Kust Zuid zone, as shown in Figure 1. The site-specific inputs for the baseline layout are presented in Table 4.

Table 4 – Site-specific Inputs for Baseline Layouts

	Baseline Hollandse Kust (noord) zone
Wind turbine rated capacity [MW]	9.0
Number of wind turbines	78
Wind farm rated capacity [MW]	702
Average water depth [m]	22.7
Distance to port (Ijmuiden) [km]	25
Export cable length offshore [km]	35
Export cable length onshore [km]	8
Number of cable crossings - export cable [-]	7
Export cable voltage [kV]	220
Array cable length [km]	173.2
Array cable voltage [kV]	66
Number of cable crossings - array cables [-]	33
Average annual wind speed at 118 m [m/s]	9.6
Wake losses [%]	8.2%
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%
Array cable losses [%]	0.5%
E-infra losses [%]	1.2%
Net annual yield [GWh]	2,895

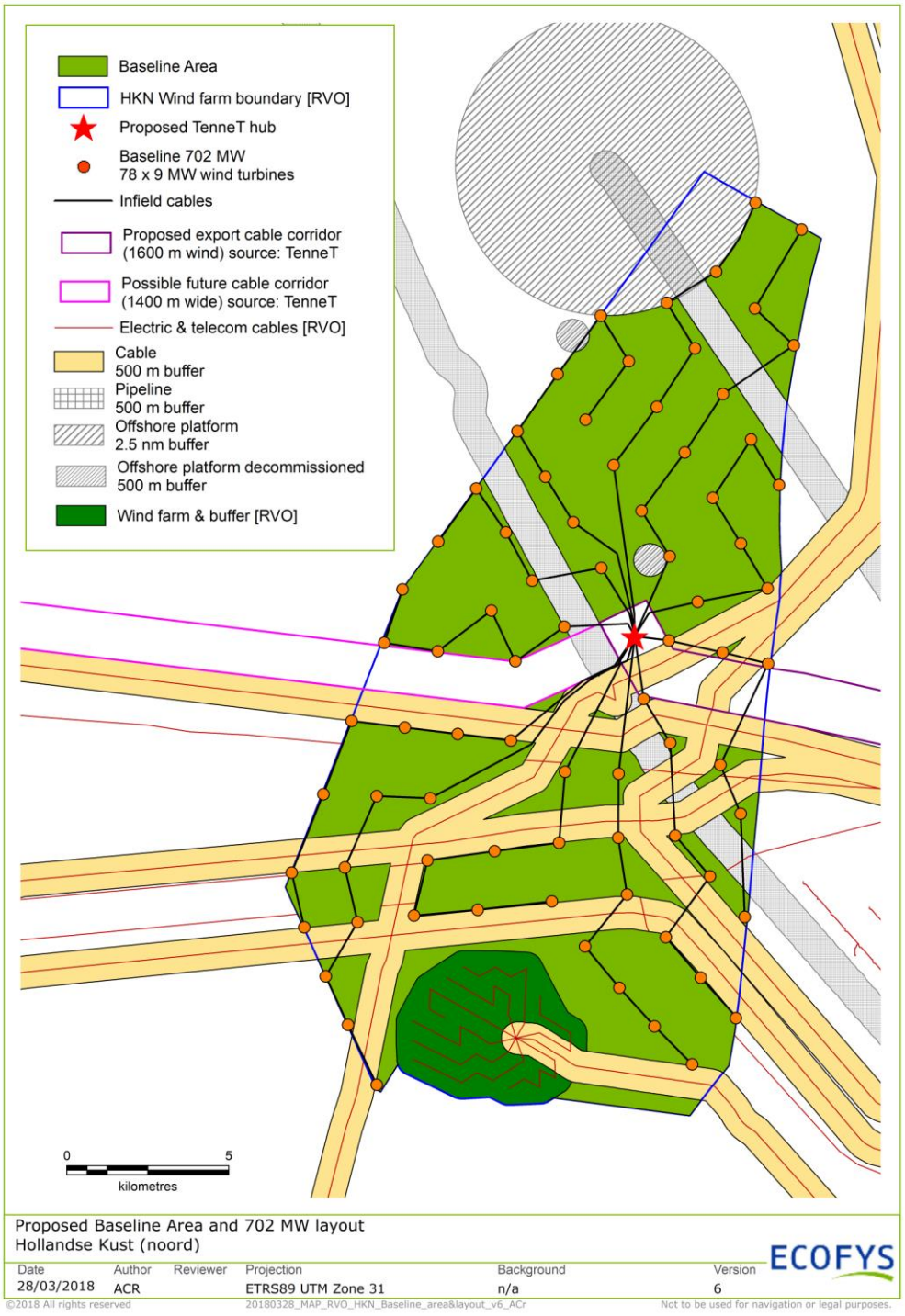

Figure 1 – Baseline layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

3 Alternative 1

This section presents the key results from “Alternative 1”, based on the following scenario description from RVO.nl:

> *Reduce the available area to allow for an Innovative Area reserved for 4 x 12 MW wind turbines. The wind farm capacity is reduced to 648 MW.*

The layout and infield cable layouts were modified according to the scenario description, as shown in Figure 2.

The relative changes in LCOE due to changes for this scenario are shown in Table 5.

The LCOE for the grid operator is assumed to be same as in the base case: the costs are equal, while the yield as seen by the grid operator (which directly influences the LCOE) is uncertain due to the unknown yield of the turbines on the innovations plot.

The LCOE for the developer is slightly (1.3%) higher. One factor causing this higher LCOE is the relatively higher O&M costs which is caused by the reduced advantage of economies of scale. Another factor is the increase of the number of cable crossing, which increases the CAPEX. Finally, the development cost will not be significantly reduced, while the yield of the parks is lower. These factors have been offset slightly by the slightly lower wake losses.

The relative differences in site designs and costs are shown in bold in Table 6 and Table 7.

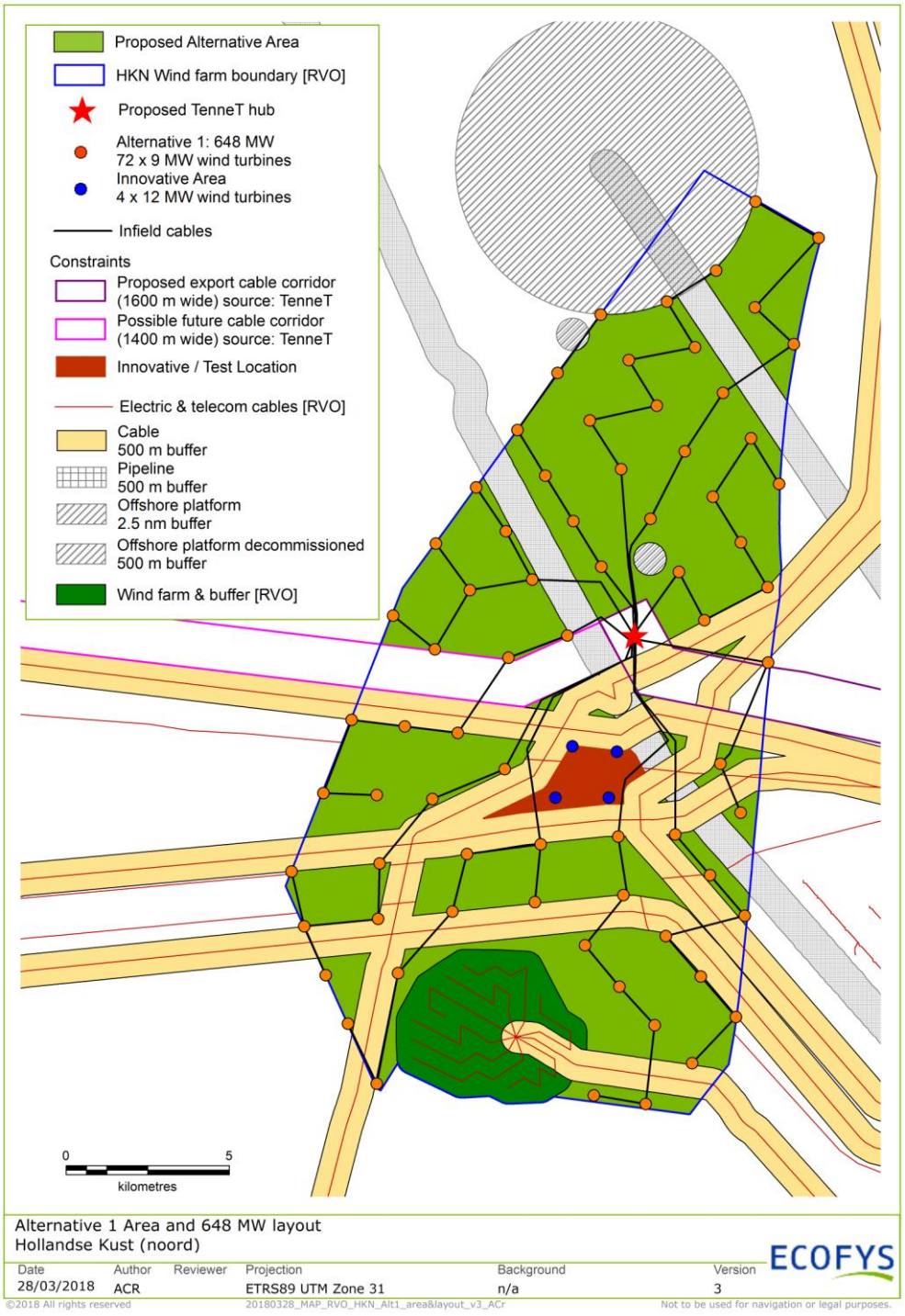

Figure 2 – Alternative 1 layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

Table 5 – Changes in LCOE for Alternative 1 including explanations

Result	Impacts on LCOE	Cause
Zone - Developer	Increase of +1.3%	Reduction in yield is proportionally greater than reduction in costs. This is due several factors: the relatively higher O&M costs (caused by the reduced advantage of economies of scale) and similar development costs for less capacity.
Zone – TenneT	No change	The yield as seen by the grid operator (which directly influences the LCOE) is uncertain due to the unknown yield of the turbines on the innovations plot. Therefore, the value for Alternative 1 is assumed to be the same as for the Baseline scenario.
Zone - Overall	Increase of +1.1%	See above

Table 6 – Site-specific Inputs (differences from Baseline are highlighted in bold)

	Baseline Hollandse Kust (noord) zone	Alternative 1 Hollandse Kust (noord) zone
Wind turbine rated capacity [MW]	9.0	9.0
Number of wind turbines	78	**72**
Wind farm rated capacity [MW]	702	**648**
Average water depth [m]	22.7	**22.5**
Distance to port (Ijmuiden) [km]	25	25
Export cable length offshore [km]	35	35
Export cable length onshore [km]	8	8
Number of cable crossings - export cable [-]	7	7
Export cable voltage [kV]	220	220
Array cable length [km]	173.2	**169.5**
Array cable voltage [kV]	66	66
Number of cable crossings - array cables [-]	33	**30**
Average annual wind speed at 107 m [m/s]	9.6	9.6
Wake losses [%]	8.2%	**8.0%**
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%	5.5%
Array cable losses [%]	0.5%	0.5%
E-infra losses [%]	1.2%	1.2%
Net annual yield [GWh]	2,895	**2,674**

Table 7 – Difference in calculated costs, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 1 - Hollandse Kust (noord) zone
Baseline scenario for comparison	Baseline Hollandse Kust (noord) zone
Total DEVEX	0%
Total CAPEX	**-7.3%**
Total Annual OPEX	**-4.0%**
Decommissioning	**-6.1%**
LCOE Developer	**+1.3%**
LCOE TenneT	0%
LCOE Overall	**+1.1%**

4 Alternative 2

This section presents the key results from “Alternative 2”, based on the following scenario description from RVO.nl:

> *Reduce the available area to allow for a safety buffer of 5 nm around platform Q4c (increased from 2.5 nm in Baseline).*

The layout and infield cable layouts were modified according to the scenario description, as shown in Figure 2.

The relative changes in LCOE due to changes for this scenario are shown in Table 8.

The LCOE for the grid operator increased slightly due to the lower yield. There is a slight overall increase in LCOE for the developer, due to more cable crossings and a lower yield.

The relative differences in site designs and costs are shown in bold in Table 9 and Table 10.

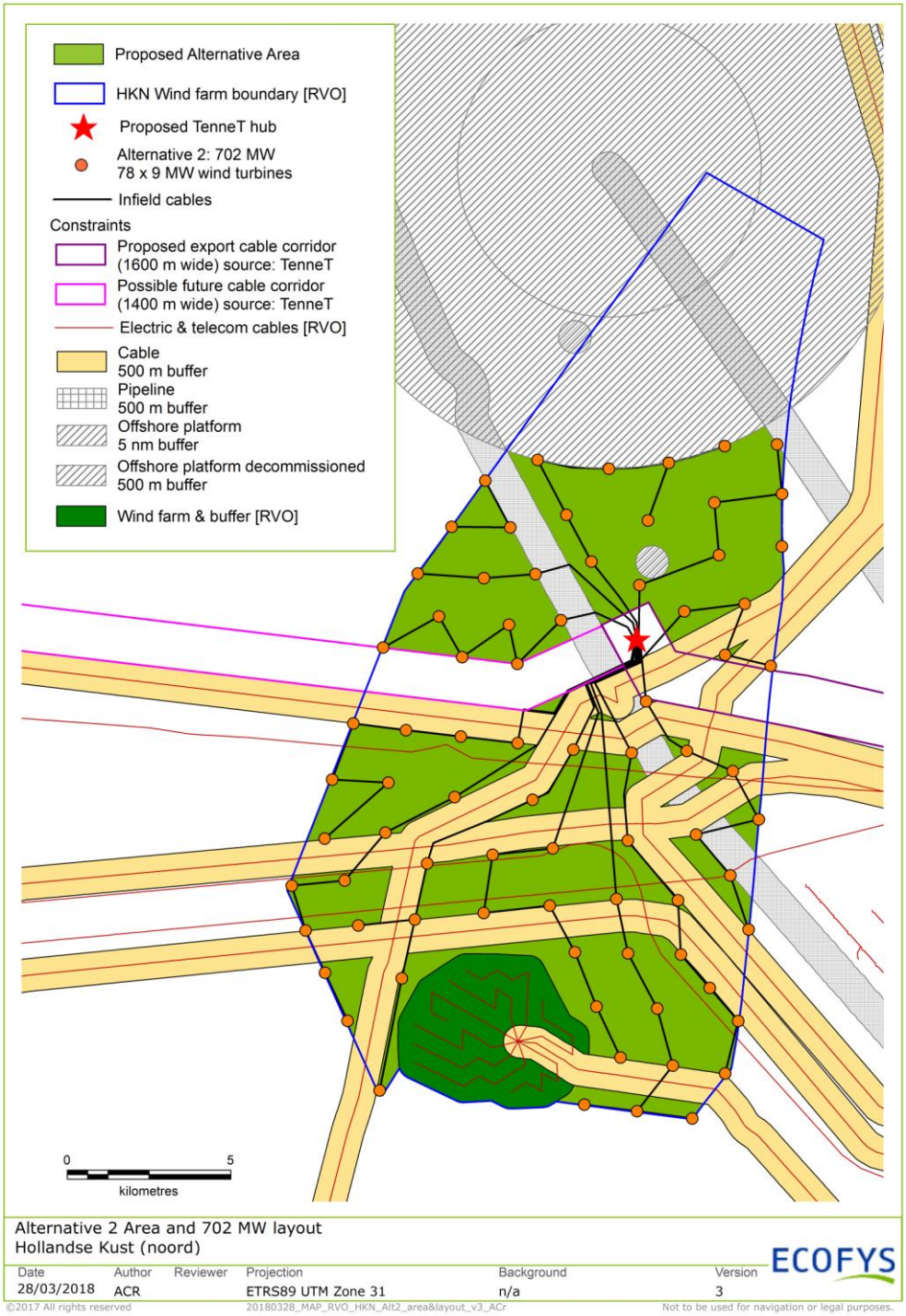

Figure 3 – Alternative 2 layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

Table 8 – Changes in LCOE for Alternative 2 including explanations

Result	Impacts on LCOE	Cause
Zone - Developer	Increase of +1.2%	Lower yield due to higher wake losses; slightly higher CAPEX costs due to extra cable crossings.
Zone – TenneT	Increase of +1.2%	The LCOE has increased due to a lower yield.
Zone - Overall	Increase of +1.2%	See above

Table 9 – Site-specific Inputs (differences from Baseline are highlighted in bold)

	Baseline Hollandse Kust (noord) zone	Alternative 2 Hollandse Kust (noord) zone
Wind turbine rated capacity [MW]	9.0	9.0
Number of wind turbines	78	78
Wind farm rated capacity [MW]	702	702
Average water depth [m]	22.7	**22.5**
Distance to port (Ijmuiden) [km]	25	25
Export cable length offshore [km]	35	35
Export cable length onshore [km]	8	8
Number of cable crossings - export cable [-]	7	7
Export cable voltage [kV]	220	220
Array cable length [km]	173.2	**175**
Array cable voltage [kV]	66	66
Number of cable crossings - array cables [-]	33	**37**
Average annual wind speed at 107 m [m/s]	9.6	9.6
Wake losses [%]	8.2%	**9.2%**
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%	5.5%
Array cable losses [%]	0.5%	0.5%
E-infra losses [%]	1.2%	1.2%
Net annual yield [GWh]	2,895	**2,862**

Table 10 – Difference in calculated costs, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 2 - Hollandse Kust (noord) zone
Baseline scenario for comparison	Baseline Hollandse Kust (noord) zone
Total DEVEX	0%
Total CAPEX	**+0.1%**
Total Annual OPEX	0%
Decommissioning	0%
LCOE Developer	**+1.2%**
LCOE TenneT	**+1.2%**
LCOE Overall	**+1.2%**

5 Alternative 3

This section presents the key results from “Alternative 3”, based on the following scenario description from RVO.nl:

> *Reduce the available area in the north-east corner of the site, to increase helicopter accessibility to platform Q4C.*

The layout and infield cable layouts were modified according to the scenario description, as shown in Figure 4.

The relative changes in LCOE due to changes for this scenario are shown in Table 11.

The LCOE for the developer is slightly (0.4%) higher. The primary factor causing this higher LCOE is an increase in wake losses. This layout also has a slightly higher CAPEX due to changes to the infield cable layout since there are more turbines in the southern part of the site.

The relative differences in site designs and costs are shown in bold in Table 12 and Table 13.

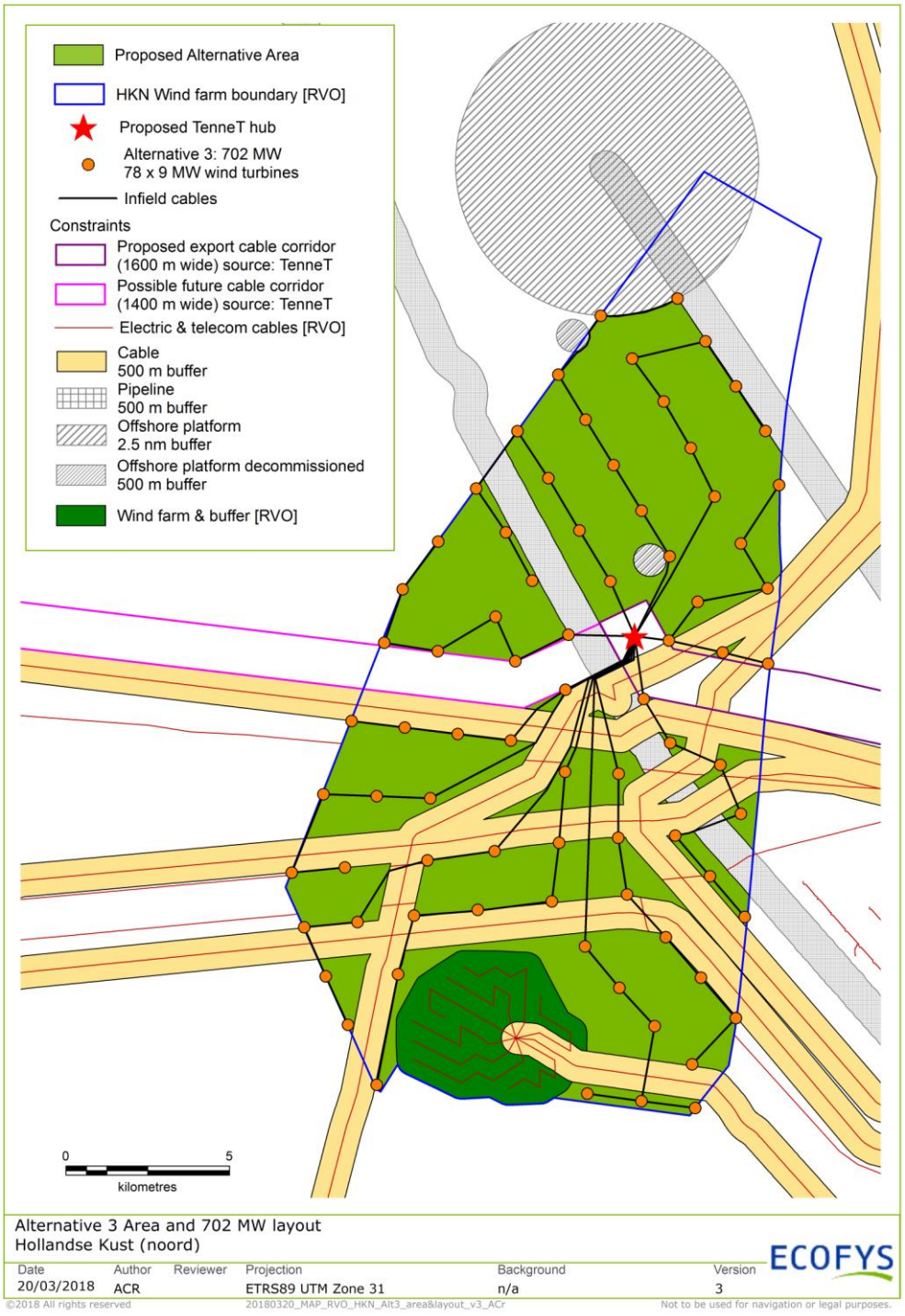

Figure 4 – Alternative 3 layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

Table 11 – Changes in LCOE for Alternative 3 including explanations

Result	Impacts on LCOE	Cause
Zone - Developer	Increase of +0.4%	Slightly lower yield due to slightly higher wake losses; slightly higher CAPEX costs due to extra cable crossings and slightly longer array cable length. Average water depth slightly decreases.
Zone – TenneT	Increase of +0.4%	Slightly lower yield due to slightly higher wake losses.
Zone - Overall	Increase of +0.4%	See above

Table 12 – Site-specific Inputs (differences from Baseline are highlighted in bold)

	Baseline Hollandse Kust (noord) zone	Alternative 3 Hollandse Kust (noord) zone
Wind turbine rated capacity [MW]	9.0	9.0
Number of wind turbines	78	78
Wind farm rated capacity [MW]	702	702
Average water depth [m]	22.7	**22.6**
Distance to port (Ijmuiden) [km]	25	25
Export cable length offshore [km]	35	35
Export cable length onshore [km]	8	8
Number of cable crossings - export cable [-]	7	7
Export cable voltage [kV]	220	220
Array cable length [km]	173.2	**176.2**
Array cable voltage [kV]	66	66
Number of cable crossings - array cables [-]	33	**36**
Average annual wind speed at 107 m [m/s]	9.6	9.6
Wake losses [%]	8.2%	**8.4%**
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%	5.5%
Array cable losses [%]	0.5%	0.5%
E-infra losses [%]	1.2%	1.2%
Net annual yield [GWh]	2,895	**2,885**

Table 13 – Difference in calculated costs, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 3 Hollandse Kust (noord) zone
Baseline scenario for comparison	Baseline Hollandse Kust (noord) zone
Total DEVEX	0%
Total CAPEX	**+0.1%**
Total Annual OPEX	0%
Decommissioning	**+ 0.2%**
LCOE Developer	**+0.4%**
LCOE TenneT	**+0.4%**
LCOE Overall	**+0.4%**

6 Alternative 4C and 4D

This section presents the key results from “Alternative 4”, based on the following scenario description from RVO.nl:

> *Different iterations of reductions to the available area in the south, to evaluate the influence of leaving more space between Hollandse Kust (zuid) and (noord), and to use the 10-12 NM zone sparingly.*

Five scenarios were considered initially, with different turbine and infield cable layouts, modified according to the scenario description. Two scenarios were selected, together with RVO.nl, for further cost modelling. The layouts are shown in Figure 5 and Figure 6.

The wake losses for both scenarios are significantly higher than the Baseline. The calculated losses are still within the same range as similar offshore wind farms, including layouts analysed for Hollandse Kust (zuid)[*] (based on similar but not identical turbines and assumptions).

The relative changes in LCOE due to changes for this scenario are shown in Table 14 and Table 15.

The LCOE for the developer are higher for both alternatives (4.6% and 3.0%). There is a notable reduction in CAPEX due to a smaller number of cable crossings and shorter array cable length. But in both alternatives, the CAPEX reduction is more than offset by the decrease in yield due to higher wake losses. Alternative 4C has higher CAPEX reductions than 4D, but also more wake losses, resulting in a higher LCOE.

The relative differences in site designs and costs are shown in bold in Table 16 and Table 17.

[*] Ecofys, 20 June 2016, ‘Hollandse Kust Zuid Levelised Cost of Energy Baseline and Scenarios’, ref: WIENL16053

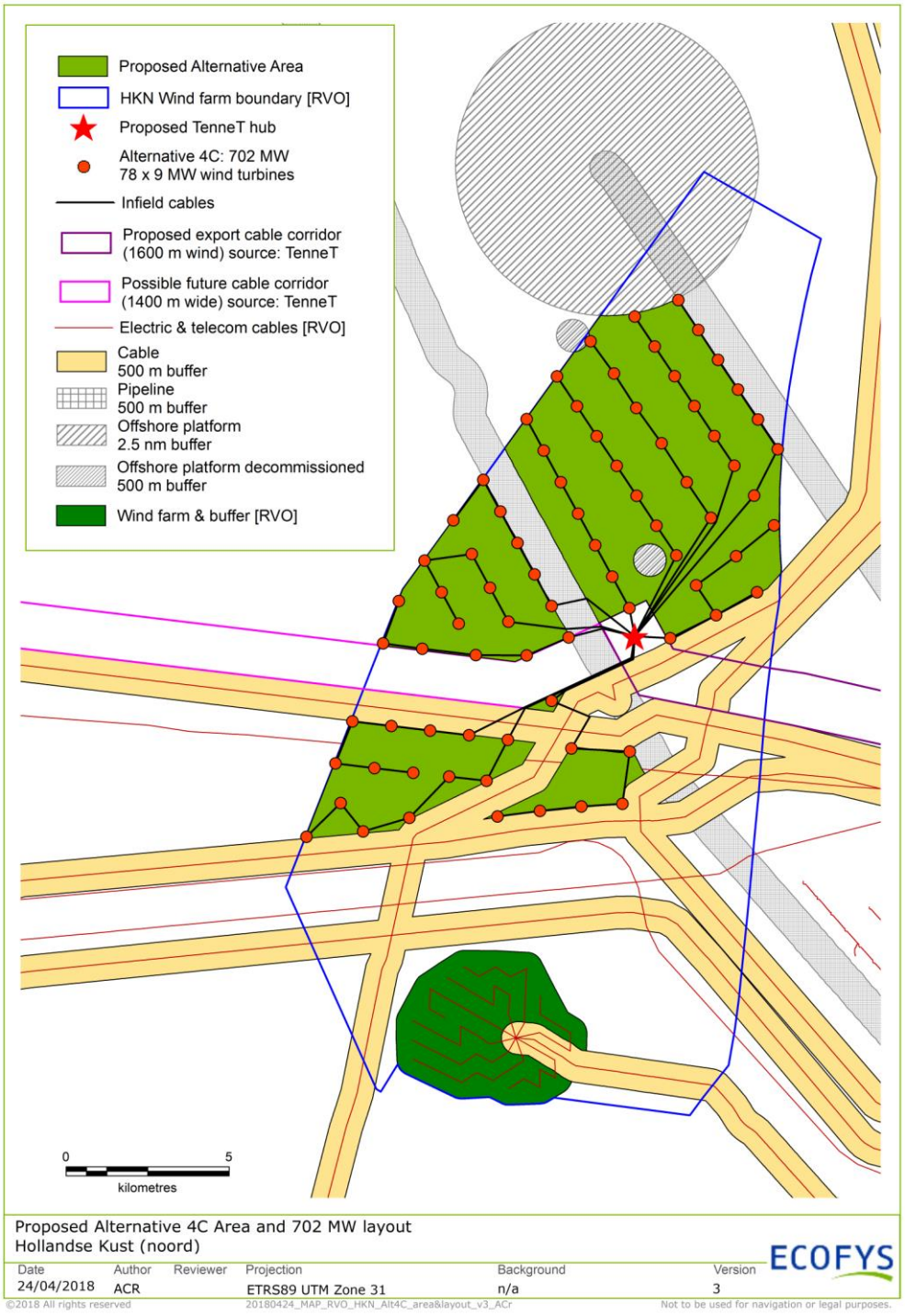

Figure 5 – Alternative 4C layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

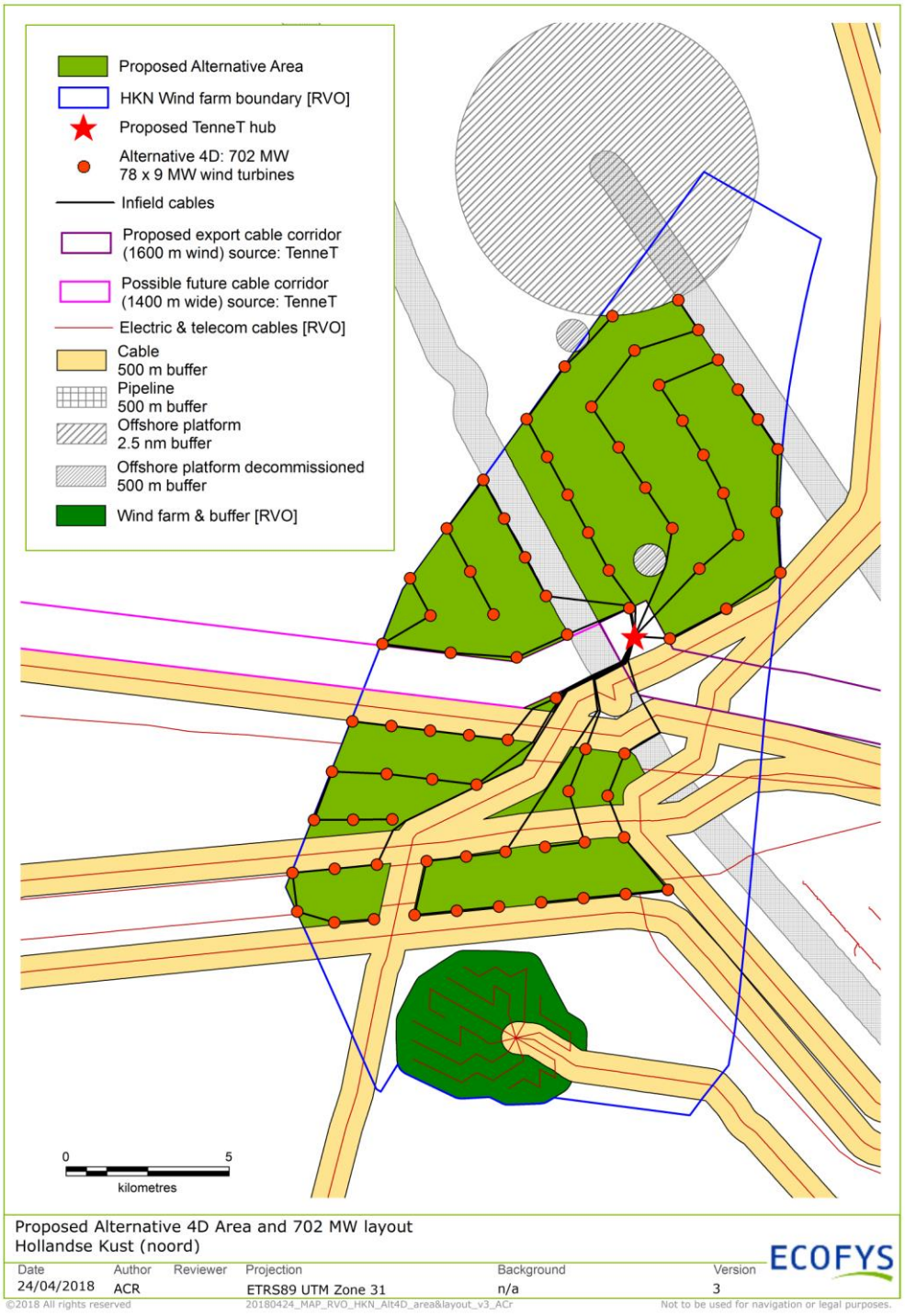

Figure 6 – Alternative 4D layout for Hollandse Kust (noord) zone (boundaries defined by RVO.nl and Ecofys; layouts designed by Ecofys)

Table 14 – Changes in LCOE for Alternative 4C including explanations

Result	Impacts on LCOE	Cause
Zone - Developer	Increase of 4.6%	The CAPEX is reduced due to a lower number of cable crossings and less array cable length, but this is more than offset by the decrease in yield to due increased wake losses and slight increase in average water depth.
Zone – TenneT	Increase of 5.9%	The LCOE is increased due to the lower yield
Zone - Overall	Increase of 4.8%	See above

Table 15 – Changes in LCOE for Alternative 4D including explanations

Result	Impacts on LCOE	Cause
Zone - Developer	Increase of 3.0%	The CAPEX is reduced due to a lower number of cable crossings and less array cable length, but this is more than offset by the decrease in yield due to increased wake losses and slight increase in average water depth.
Zone – TenneT	Increase of 3.6%	The LCOE is increased due to the lower yield
Zone - Overall	Increase of 3.1%	See above

Table 16 – Site-specific Inputs (differences from Baseline are highlighted in bold)

	Baseline Hollandse Kust (noord) zone	Alternative 4C Hollandse Kust (noord) zone	Alternative 4D Hollandse Kust (noord) zone
Wind turbine rated capacity [MW]	9.0	9.0	9.0
Number of wind turbines	78	78	78
Wind farm rated capacity [MW]	702	702	702
Average water depth [m]	22.7	**23.1**	**23.1**
Distance to port (Ijmuiden) [km]	25	25	25
Export cable length offshore [km]	35	35	35
Export cable length onshore [km]	8	8	8
Number of cable crossings - export cable [-]	7	7	7
Export cable voltage [kV]	220	220	220
Array cable length [km]	173.2	**129.2**	**151.0**
Array cable voltage [kV]	66	66	66
Number of cable crossings - array cables [-]	33	**10**	**21**
Average annual wind speed at 107 m [m/s]	9.6	9.6	9.6
Wake losses [%]	8.2%	**13.2%**	**11.3%**
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%	5.5%	5.5%
Array cable losses [%]	0.5%	0.5%	0.5%
E-infra losses [%]	1.2%	1.2%	1.2%
Net annual yield [GWh]	2,895	**2,734**	**2,794**

Table 17 – Difference in calculated costs, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 4C Hollandse Kust (noord) zone	Alternative 4D Hollandse Kust (noord) zone
Baseline scenario for comparison	Baseline Hollandse Kust (noord) zone	Baseline Hollandse Kust (noord) zone
Total DEVEX	0%	0%
Total CAPEX	**-1.6%**	**-0.7%**
Total Annual OPEX	0%	0%
Decommissioning	**-2.1%**	**-1.2%**
LCOE Developer	**+4.6%**	**+3.0%**
LCOE TenneT	**+5.9%**	**+3.6%**
LCOE Overall	**+4.8%**	**+3.1%**

7 Comparison of Alternatives

The five alternative scenarios are directly comparable in Table 18, in terms of differences infrastructure and yields. In Table 19, the resulting differences in costs and LCOE are shown. The differences relative to the Baseline Scenario are highlighted in bold.

Table 18 – Comparison of Site-specific Inputs for each Alternative Scenario (differences from Baseline are highlighted in bold)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4C	Alternative 4D
Summary	Include space for an Innovative Area	Safety buffer of 5 nm around platform Q4c	Remove north-east corner to increase helicopter accessibility to platform Q4C	Leaving more space between Hollandse Kust (zuid) and (noord) - 4C is smaller site than 4D	
Wind turbine rated capacity [MW]	9.0	9.0	9.0	9.0	9.0
Number of wind turbines	**72**	78	78	78	78
Wind farm rated capacity [MW]	**648**	702	702	702	702
Average water depth [m]	**22.5**	**22.5**	**22.6**	**23.1**	**23.1**
Distance to port (Ijmuiden) [km]	25	25	25	25	25
Export cable length offshore [km]	35	35	35	35	35
Export cable length onshore [km]	8	8	8	8	8
Number of cable crossings - export cable [-]	7	7	7	7	7
Export cable voltage [kV]	220	220	220	220	220
Array cable length [km]	**169.5**	**175**	**176.2**	**129.2**	**151.0**
Array cable voltage [kV]	66	66	66	66	66
Number of cable crossings - array cables [-]	**30**	**37**	**36**	**10**	**21**
Average annual wind speed at 107 m [m/s]	9.6	9.6	9.6	9.6	9.6
Wake losses [%]	**8.0%**	**9.2%**	**8.4%**	**13.2%**	**11.3%**
Other turbine losses: non-availability, turbine transformer losses, blade degradation and hysteresis [%]	5.5%	5.5%	5.5%	5.5%	5.5%
Array cable losses [%]	0.5%	0.5%	0.5%	0.5%	0.5%
E-infra losses [%]	1.2%	1.2%	1.2%	1.2%	1.2%
Net annual yield [GWh]	**2,674**	**2,862**	**2,885**	**2,734**	**2,794**

Table 19 – Differences in calculated costs for each alternative scenario, relative to Baseline (reductions are highlighted in green, increases are highlighted in red)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4C	Alternative 4D
Summary	Include space for an Innovative Area	Safety buffer of 5 nm around platform Q4c	Remove north-east corner to increase helicopter accessibility to platform Q4C	Leaving more space between Hollandse Kust (zuid) and (noord) - 4C is smaller site than 4D	
Total DEVEX	0%	0%	0%	0%	0%
Total CAPEX	**-7.3%**	**+0.1%**	**+0.1%**	**-1.6%**	**-0.7%**
Total Annual OPEX	**-4.0%**	0%	0%	0%	0%
Decommissioning	**-6.1%**	0%	**+ 0.2%**	**-2.1%**	**-1.2%**
LCOE Developer	**+1.3%**	**+1.2%**	**+0.4%**	**+4.6%**	**+3.0%**
LCOE Tennet	0%	**+1.2%**	**+0.4%**	**+5.9%**	**+3.6%**
LCOE Overall	**+1.1%**	**+1.2%**	**+0.4%**	**+4.8%**	**+3.1%**

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