MEMO

Subject: Wake effects of three modified versions of TNW variant 2
Date: 28 November 2018

Introduction

BLIX Consultancy & partners recently performed a study to investigate the Levelized Cost of Energy (LCoE) of different variants for the wind farm site boundaries of the roadmap 2030 areas (BLIX, 2018). On the 4th of October 2018, RVO requested BLIX to investigate the wake effects for three modified versions of Ten Noorden van de Waddeneilanden (TNW) variant 2. This memo describes the results.

Layouts

The new variants are adapted versions of TNW variant 2 (see Figure 1):

1. Variant 2.1: triangular area at east side excluded, turbines included on the west side;
2. Variant 2.2: shift of eastern boundary to the west with 1.2 km, turbines included on the west side;
3. Variant 2.3: shift of eastern boundary to the west with 2.4 km, turbines included on the west side.

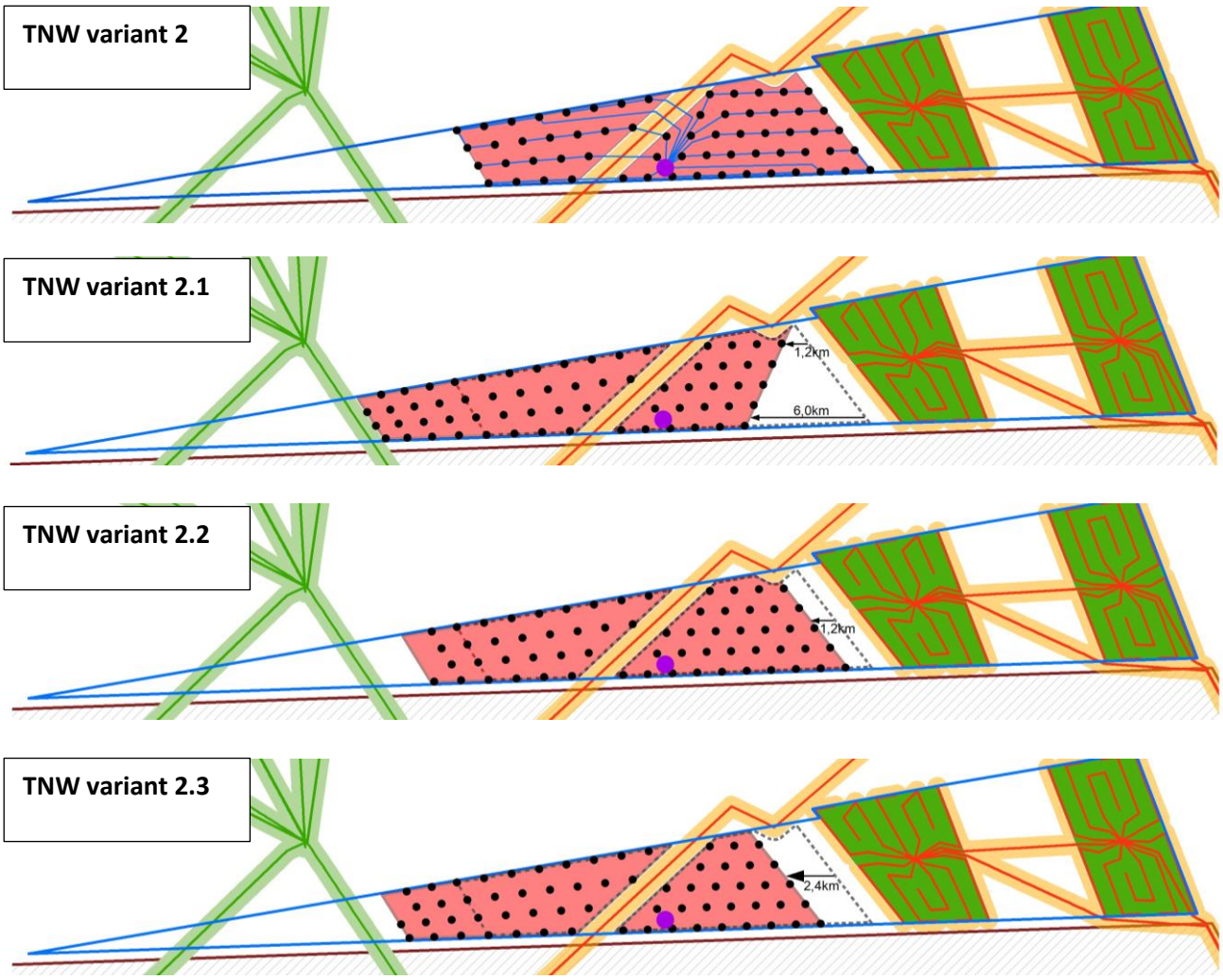

Figure 1: wind farm layout of TNW var 2, 2.1, 2.2 and 2.3

MEMO

Results

The wake effects for TNW and the existing Gemini offshore wind farm are shown in Table 1.

Table 1: wake effects of new alternatives for TNW

Variant	Standalone	TNW var 2	TNW var 2.1	TNW var 2.2	TNW var 2.3
Wake effects [%] at Gemini	13.4%	14.7%	13.8%	14.3%	14.0%
Difference [%]* at Gemini		0.0%	-0.9%	-0.4%	-0.7%
Wake effects [%] at TNW		10.8%	10.3%	10.4%	10.3%
Difference [%]* at TNW		0.0%	-0.5%	-0.4%	-0.5%

* The wake effect differences are expressed in percentage points

Compared to variant 2, the variants have the following impact on the wake effects at Gemini:

- Variant 2.1: 0.9% reduction of wake effects at Gemini offshore wind farm
- Variant 2.2: 0.4% reduction of wake effects at Gemini offshore wind farm
- Variant 2.3: 0.7% reduction of wake effects at Gemini offshore wind farm

Compared to variant 2, the new variants have the following impact on the yield at TNW:

- Variant 2.1: 0.5% reduction of wake effects at TNW
- Variant 2.2: 0.4% reduction of wake effects at TNW
- Variant 2.3: 0.5% reduction of wake effects at TNW

Conclusions

- Compared to variant 2, variant 2.1 and 2.3 cause a significant reduction of wake effects at Gemini offshore wind farm. Variant 2.2 causes a moderate reduction of the wake effects at Gemini offshore wind farm compared to variant 2.
- For all variants (2.1, 2.2 and 2.3) the yield at TNW is larger than for variant 2. Turbines placed in the western section are less prone to wake effects.
- Therefore, overall, variants 2.1 and 2.3 are most favourable for Gemini and TNW.

References

BLIX & partners (2018). Study into Levelized Cost of Energy of variants for wind farm site boundaries of Hollandse Kust (west), Ten Noorden van de Waddeneilanden and IJmuiden Ver. Final – V3.0. Dated 30 October 2018.