

Summary

The government is working on the roll-out of large wind farms at sea from 10 NM (18.5km) offshore. In some coastal towns residents are concerned about the visibility of the wind farms from the shore. By default, the wind turbines are delivered in white tones. ROM3D's desk study showed there are opportunities to camouflage wind turbines through different colouring and the application of patterns. RVO.nl wanted to investigate whether visibility is actually reduced.

RVO.nl has developed three scale models of an 8 MW turbine, with one turbine in standard white colour and the other two with different colours and patterns. By means of experimental research with a test group and test setup, research bureau Motivaction has given RVO.nl a first insight into differences in experience with these scale models, simulating the situation of the turbines being located a longer distance from the coast. Based on this, it may be possible for a follow-up investigation to gain more assurance about differences in experience.

The research answers the following key questions:

- To what extent are the two scale models of camouflaged wind turbines less or more visible to the test group compared to a scale model of a standard white wind turbine?
- Which type of turbine would people prefer to see in the North Sea?
- Which factors affect the visibility?

Conclusions

The visibility of the three scale models

- In the test setup, as tested on three different days, the grey turbine was considered the least visible on average, followed by the black and white turbine and, by just a fraction more, the white one. The black and white model ranks in the middle position in terms of perceived (in)visibility as experienced by the test group.
- Looking at the estimated distance (based on the median) - as an indicator of visibility - the grey turbine was generally perceived to be a fraction closer and in this sense the most visible. The distance of the black and white turbine and white turbine were estimated equally. But these differences are negligible.

Factors affecting visibility

- The average results obtained on the three test days cannot be generalised to a larger target group. We can clearly see that if weather conditions were sunny during the three test days, the grey turbine was perceived as the least visible and the white turbine the most visible. In cloudy circumstances it was the exact opposite. This means the visibility of the wind turbines depends on weather conditions.
- To filter out these "random" influences, advanced multivariate analyses were conducted, taking into account various possible impacts on visibility, including weather conditions, attitudes of beach visitors to offshore windmills and socio-demographic aspects such as education, age and gender. Because of the small sample ($n = 45$), it is difficult to make solid statements about the effect of weather conditions.

Two of the most likely effects are as follows:

- The scale model of the grey turbine is perceived as more visible than the white turbine in overcast conditions.
- The scale model of the black-and-white turbine is perceived as more visible than the white turbine in heavily overcast conditions. The effects on the visibility of the grey and black and white turbine in sunny weather were unfortunately unambiguous to make solid conclusions.

Preferences for placing wind turbines in the North Sea

- Nearly half of the test panel prefers the use of white turbines in the North Sea (49%). The second choice is the grey turbine (38%) and finally the black and white turbine (11%). A single person (2%) could not make a choice. On the basis of open interviews, it appears the test panel, when giving their preference, sometimes consciously choose offshore windmills with high visibility. Considerations playing a role here are: it is more trustworthy, safer for swimmers and for air and sea traffic, and one person considers it more beautiful and something to be proud of.
- On the other hand, relatively many of the test panel prefer the white turbines the least (44%). This also applies to the grey turbine (42%).
- The black and white turbine ranks in the middle position: only a few would prefer them most (11%) and also prefer them least (9%).
- If we take into account weather conditions, it appears that in sunny weather the test panel prefers the grey turbine the most and the white turbine the least. In overcast conditions it is the exact opposite.
- Because there is no large and representative sample, these insights and conclusions cannot be generalised to the entire population.