Deutsche WindGuard

Onshore Wind Energy Cost Situation
International Comparison
Summary

On behalf of:

BWE Bundesverband WindEnergie

VDMA Power Systems

Deutsche WindGuard GmbH - Oldenburger Straße 65 - 26316 Varel - Germany
+49 (0) 4451/95150 - info@windguard.de - www.windguard.de

Editin g: Silke Lüers
Cornelia von Zengen
Dr Knud Rehfeldt

Translation: VDMA Power Systems

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Deutsche WindGuard GmbH

Berliner Straße 65

26316 Varel, Germany

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Summary

An examination of the onshore wind energy cost situation shows that, in comparison to other countries, Germany comes out mid-level. However, it is not just the costs but also the system technology used in the comparison countries (the USA, the UK and Denmark in this case) that needs to be evaluated. Wind energy systems (WES) in Germany feature large hub heights and very large rotor diameters in relation to system performance, particularly in regions where wind levels are comparatively low. The comparison of the system technology also shows that the latest system technology available on the market is always used in Germany, i.e. the most powerful WES. This shows that the willingness to embrace innovation in Germany is extremely high by international comparison.

While locations with significantly higher average wind speeds are used for wind energy in most of the countries under investigation, Germany also tends to use less wind-intensive locations due to the shortage of highly wind-intensive locations. In order to improve the very low capacity factor of the power plant fleet in Germany compared to other countries, the location-specific system design with the above-mentioned characteristics regarding hub height and rotor diameter involves increased main investment costs.

1.1. Main investment costs

Germany is average in terms of main investment costs. For example, the costs for WESs in the USA and China are much lower than in Germany. These countries benefit from economies of scale thanks to the large number of new systems installed every year. In countries such as Austria, Switzerland or even Japan, i.e. countries that tend to have lower annual installation rates, the main investment costs are well above the level in Germany. In addition, labour costs for manufacturing WESs are lower in countries like China than they are in Germany. Furthermore, a comparison of system technology between the USA and Germany, for example, shows that systems with both a higher power as well as much larger hub heights have been installed on average in Germany. This newer system configuration, which has been adapted to suit German wind conditions, explains the higher main investment costs, since the higher hub heights and larger rotor diameters result in higher costs due to, among other things, the increased consumption of materials.

1.2. Additional investment costs

When comparing additional investment costs in Germany with the typical additional investment cost distribution calculated by EWEA, it emerges that the share in the overall investment costs is within the average range, but that the distribution of the individual cost groups differs in some cases [EWEA 2009]. For example, the costs of the foundations are below-average in Germany, but the planning costs are much higher than the European average [DWG 2013b].In Germany, the additional investment costs vary over quite a considerable range. This is due to the differences in planning and approval costs from project to project, for example. However, such location-specific differences also arise in other countries, as the example of the UK shows.

1.3. Overall investment costs

In Germany, the overall investment costs for onshore wind energy projects are also within the average range compared to other countries. It can be seen that countries such as China and India, which tend to have relatively low WES costs, also have very low overall investment costs compared to Germany.

The situation in the USA is very different. Although WES costs in the USA are much lower than in Germany, the overall investment costs are comparable to those in Germany. This shows that the additional investment costs in the USA must be comparatively high. By contrast, in countries such as Australia, Japan, Ireland, Switzerland and even Italy and Sweden, the overall investment costs are much higher than the German level.

1.4. Operating costs

Operating costs vary greatly from country to country. They amount to around $10/MWh in the USA, but are more than four times higher than this in Switzerland at over $45/MWh. On the one hand, the reasons for this are due to the framework conditions. On the other hand, it is also noticeable that countries with a particularly large number of wind-intensive locations can operate wind farms particularly cost-effectively. In the USA there have been considerable cost reductions since the 1980s. The currently very low operating costs can also be attributed to the high capacity factor. In addition, economies of scale come into play, particularly in terms of the operating costs. If it is possible to construct very large wind farms, as is the case in the USA for

example, this leads to a considerable reduction in operating costs. In Germany, operating costs are in the upper middle range, although they vary from location to location due to various cost elements that depend on the capacity factor.

1.5. International comparison of capacity factors

The countries covered by this study differ considerably in terms of their wind potential. This, in turn, has a strong impact on electricity production costs. In light of this, the study deals solely with the different cost groups and not with the electricity production costs. However, since the analysis of operating costs is usually based on $/MWh figures, the wind potential of the locations covered by the study plays a key role here. For this reason, an analysis was performed of the capacity factors that can be achieved at representative locations in the countries in the investigation. A sample wind energy system (Vestas V80 2WM with a hub height of 78 m) was used here to work out the gross capacity factors in each case, without taking into consideration losses due to wind farm efficiency, grid and technical availabilities etc. A comparison of the results is shown in Figure 1-1.

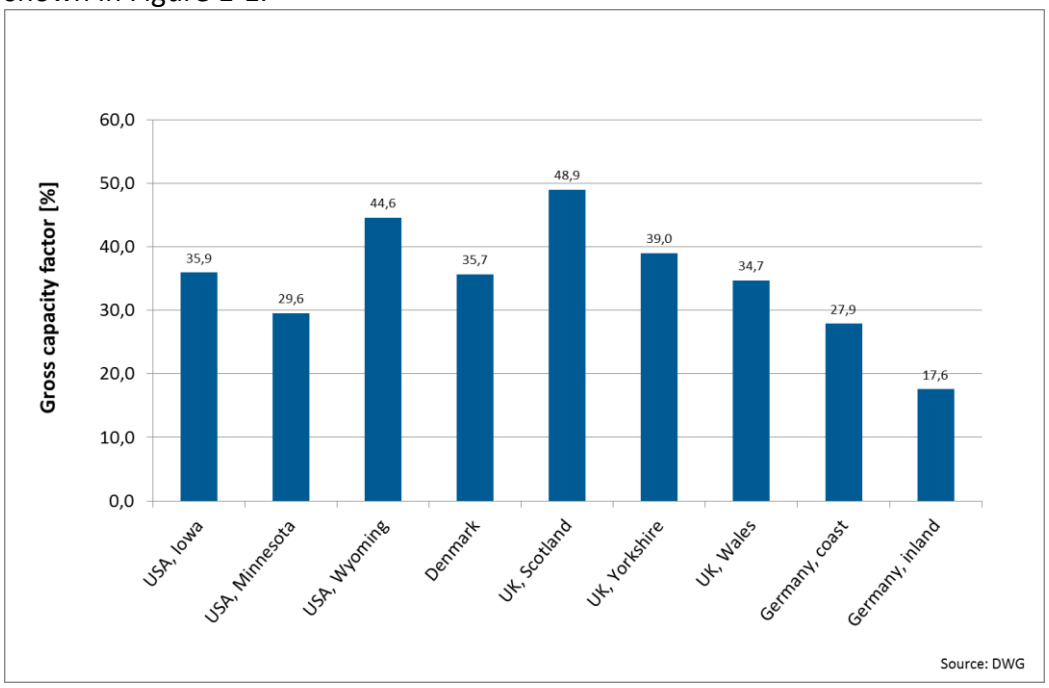

Figure 1-1: Capacity factor [%] of a Vestas V80 2MW system with a hub height of 78 m at different sample locations (gross values without grid losses, wind farm efficiency, technical availability etc.)

As the graphic shows, Germany has the lowest wind potential in an international comparison. While gross capacity factors of well above 40% are reached in good locations in Scotland (UK) or Wyoming (USA), with the system technology used in the example only a gross capacity factor of 27.9% can be

attained in Germany, even on the coast. The sample location inland lags well and truly behind other countries with a gross capacity factor of 17.6%. So that wind power can still be used efficiently in Germany, specially developed, advanced turbine technology must be used. Typically, this technology has particularly high hub heights and large rotor diameters. This makes Germany a pioneer in technology on the one hand, yet results in higher investment costs on the other. Despite this cost disadvantage, Germany is absolutely mid-level in comparison to other countries. This shows that the use of wind energy in Germany is very cost efficient, despite the lower wind potential and the resulting higher investment costs.

List of abbreviations

EWEA	European Wind Energy Association
MW	Megawatt
MWh	Megawatt hours
WES	Wind energy system

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