

MiniWind





Small-scale Wind Power – A pre-feasibility study of the potential at Knösö, Karlskrona

This prefeasibility study is a result of the project RURAL-RES. Several sites have been studied and their potential and suitability for establishment of mini wind turbines have been evaluated.

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1 Summary

The site is located on the west side of a peninsula just northeast of Karlskrona. The property is located directly by the sea. In the prevailing wind direction, southwest, there is 500 metres of open water.

The wind conditions are quite good as the property is located at the sea. However there is a line of trees along the shore line causing some turbulence. A 25 metres high tower will probably be required to reach up to good undisturbed wind.

The distance to the closest neighbour is 60 metres and the risk for noise disturbance can not be neglected. Building permit might be an issue due to the risk for noise disturbance.

Suitable size of the turbine is 5.5 kW as its yearly production would be in line with current electricity consumption. No issue with the grid connection is foreseen.

The relatively high tower will result in some extra costs. In order to get an acceptable payback time (10 years) the tower needs to be high enough to avoid wind with a high level of turbulence.

A wind measurement on the selected hub height is strongly recommended in order to get a confirmation of the wind conditions and level of turbulence. A wind measurement would significantly reduce the uncertainty in this project.

2 The site

The selected site is located just east of Karlskrona.



Figure 1. The location

The site is located on the west side of a peninsula. The property is located directly by the sea. In the prevailing wind direction, southwest, there is 500 metres of open water. However there is a line of trees along the shore resulting in some turbulence.

The distance to the closest neighbour is 60 metres, so the selection of turbine and its exact location on the property is critical for avoidance of noise disturbance and shadows.



Figure 2. Detailed map

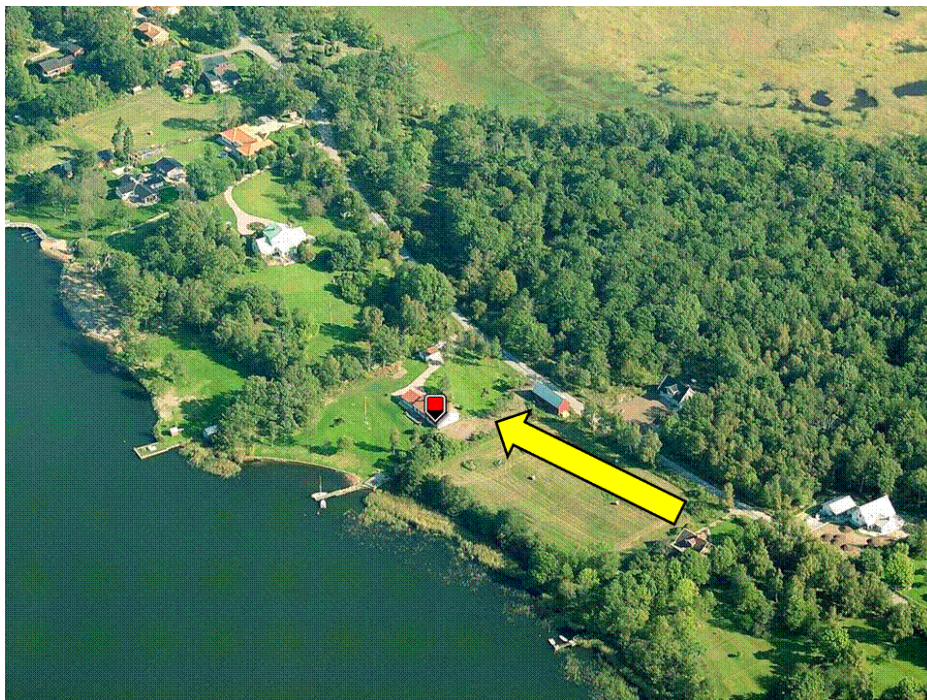


Figure 3. Aerial photo.

3 Wind conditions

The wind map from Uppsala University (1) indicates a yearly average of 7.2 m/s at 49 m and 7.8 m/s at 72 m. This corresponds to the wind gradient in Figure 4 below.

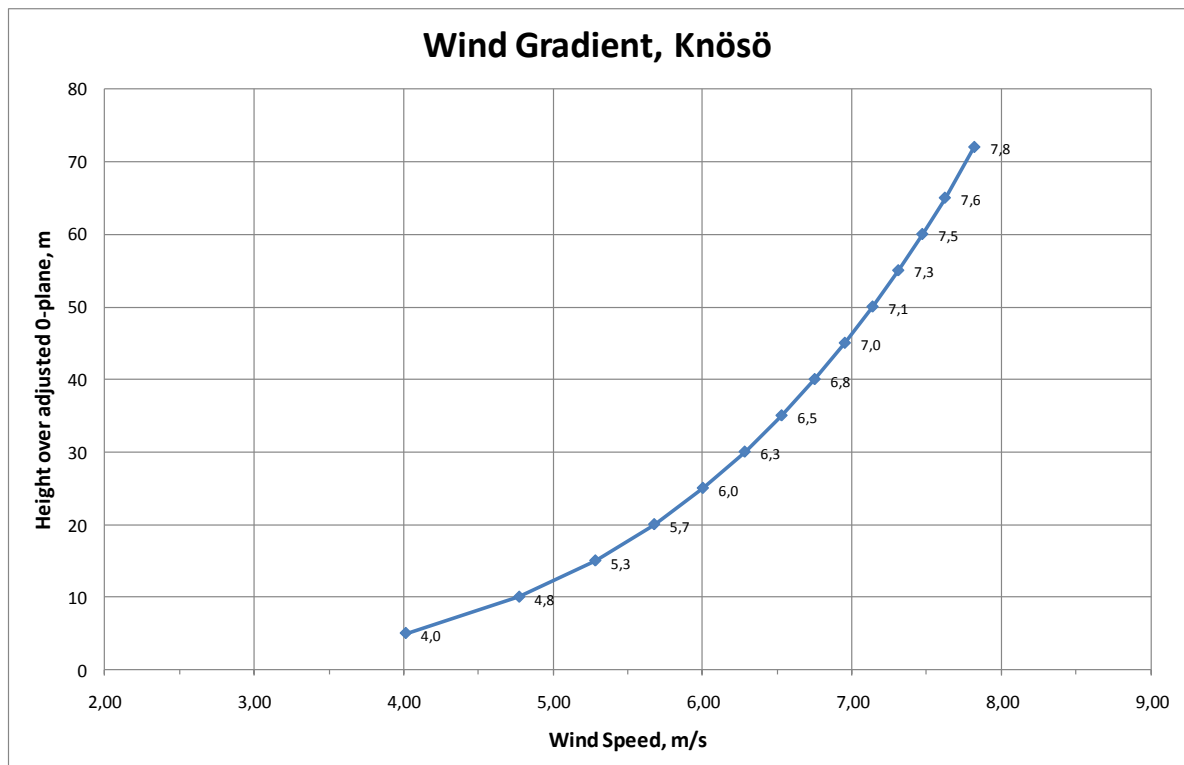


Figure 4. The wind gradient for Låganäs, Knösö, Karlskrona

The wind conditions are quite good as the site is located close to the sea. However the line of trees along the shore line will disturb the wind. The trees are of 10 metres height and the wind will be disturbed in up to 20 metres leeward behind the trees. The wind gradient in Figure 4 indicates that an 18 m tower would be enough to reach 5.5 m/s as average wind speed. That is the level where investments in small-scale wind turbines get an acceptable (10 years) payback time in Sweden today. Due to the turbulence created by the line of trees a higher tower would be preferred. A tower of 25 m would probably be enough for reaching up to undisturbed wind.

4 Where to place the wind turbine?

The best location would be west of the house close to the shore line. This would give the best wind, but the tower and turbine would dominate the view from the patio at the house and is not accepted by the owner. Minimum impact for the owner would be a location southeast of the living house. In the south there is an open field but the line of trees along the shore will create some turbulence in winds from southwest and a quite high tower will be required.

With a high tower in this location the distance to the living house would be less than the total height of the turbine. There are no regulations against placing a small turbine close to a living house but it can result in higher insurance costs. The distance to the closest neighbour will with this location be 60 metres and the risk for noise disturbance and shadows might make it difficult to get building permit for the wind turbine.

5 Connection to the grid

The grid has quite a good quality and will probably not limit the turbine size.

6 Economy

The owner today has a yearly consumption of 12 000 kWh. A 5–7 kW turbine would be suitable as it has the potential to produce the same amount of energy.

As mentioned earlier, the hub height should preferably be 25 m. As the turbines will be quite small, the cost for a 25 m tower will be a relatively high part of the total cost, i.e. the payback time might be longer than the preferred 10 years. The estimated payback time for a 5.5 kW turbine on a 25 m tower at this location is 12 years.

Selecting a larger turbine could be an option but the risk for noise disturbance at the neighbours' houses will probably make it impossible to get building permit for a larger turbine.

Due to the uncertainty regarding the level of turbulence a wind measurement is strongly recommended to evaluate the level of turbulence on the selected hub height. The measurement period of 1–2 months would be enough to determine the level of turbulence.

7 Impact analysis

Reduction of greenhouse gases	YES	A production of 11 MWh can reduce the CO ₂ emission with 9300 kg/year
Acceptable visual impact on the landscape	YES/NO	YES; A 5.5 kW turbine is quite small and will not dominate the landscape. NO; The turbine will be visible from the road and the bridge 500 m west of the property and could by some people be perceived as a visual impact on the landscape.
Acceptable environmental impact for neighbours	YES/NO	The distance will be 60 m to the closest neighbour and the risk for noise disturbance can't be neglected. YES; A turbine with low noise level must be selected. NO; Building permit might be an issue as the distance to the neighbour is quite short.
Acceptable environmental impact for owner	YES	With the location southeast of the house the disturbance will probably be acceptable in the garden facing the sea.
Good economical investment for the owner	YES?	The payback time is very dependent on the wind conditions. The level of turbulence is difficult to estimate. A wind measurement at the selected hub height is strongly recommended.
Potential as good example of small-scale wind power for the general public and the society	YES	An example of how a private house owner can produce renewable energy covering his own consumption.
Potential for valuable experiences	YES	This installation will be a good verification of how the turbulence from the tree line will impact the energy production at the selected hub height.

8 References

1. Uppsala University, Wind resource mapping of Sweden using the MIUU model.
<http://www.energimyndigheten.se/Global/Om%20oss/Vindkraft/Wind3.PDF>
(December 2010)

