

MiniWind



Small-scale Wind Power – A pre-feasibility study of the potential at Bredavik, Sturkö, 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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Energy Agency for Southeast Sweden

Lennart Tyrberg

Wind power expert



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Contents

1	SUMMARY.....	5
2	THE SITE	6
3	WIND CONDITIONS.....	8
4	WHERE TO PLACE THE TURBINE?	9
5	CONNECTION TO THE GRID	9
6	ECONOMY	9
7	IMPACT ANALYSIS	10
8	REFERENCES	11

1 Summary

This site is located on an island south of Karlskrona. The wind condition is very good as the site is located on an island and the distance to the sea is only 700 m. The landscape in the prevailing wind direction is open farmland, i.e. the wind containing the most energy will be fairly undisturbed.

The distance to the closest neighbours is 100 metres and should be enough to avoid noise disturbance or shadows.

Suitable size of the turbine is 15 kW as its yearly production would be in line with current electricity consumption. A tower height of 25 metres is recommended. It will, with some margin, secure a good energy production.

The grid capacity on the island is good and no issues with the grid connection are foreseen.

An investment in a small-scale wind turbine at this site will probably be a good investment for the owner. The payback time is estimated to 7–8 years, which is quite a short payback time for Swedish conditions.

2 The site

The studied site is located on an island south of Karlskrona.



Figure 1. The location

The site is a former farm. Only the living house is used today. In the prevailing wind direction, southwest, the surroundings consists of farmland. In south the distance to the sea is 700 metres.

The distance to the closest neighbour is 100 metres i.e. a small wind turbine would probably not disturb any neighbours.

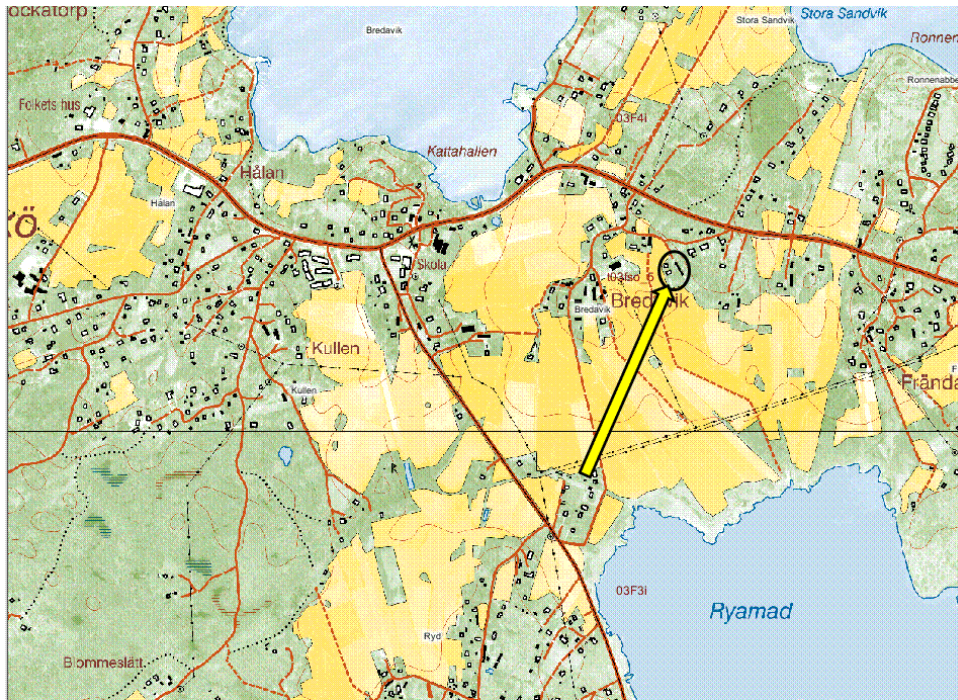


Figure 2. Detailed map

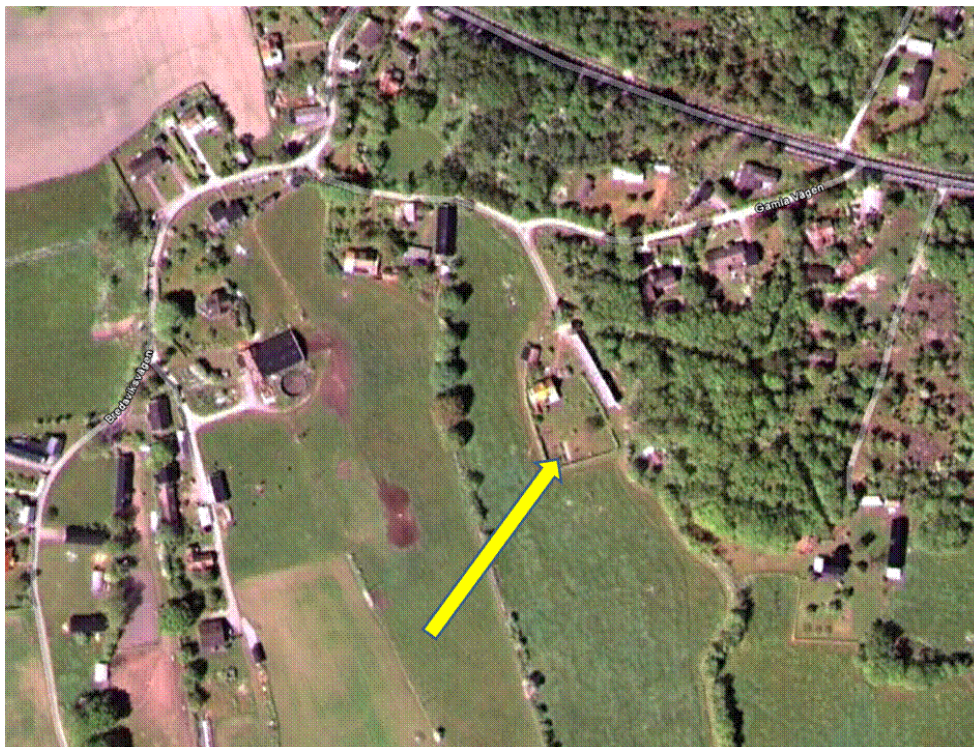


Figure 3. Aerial photo

3 Wind conditions

The wind map from Uppsala University (1) indicates a yearly average of 7.4 m/s at 49 m and 8.1 m/s at 72 m. This corresponds to the wind gradient in Figure 4 below.

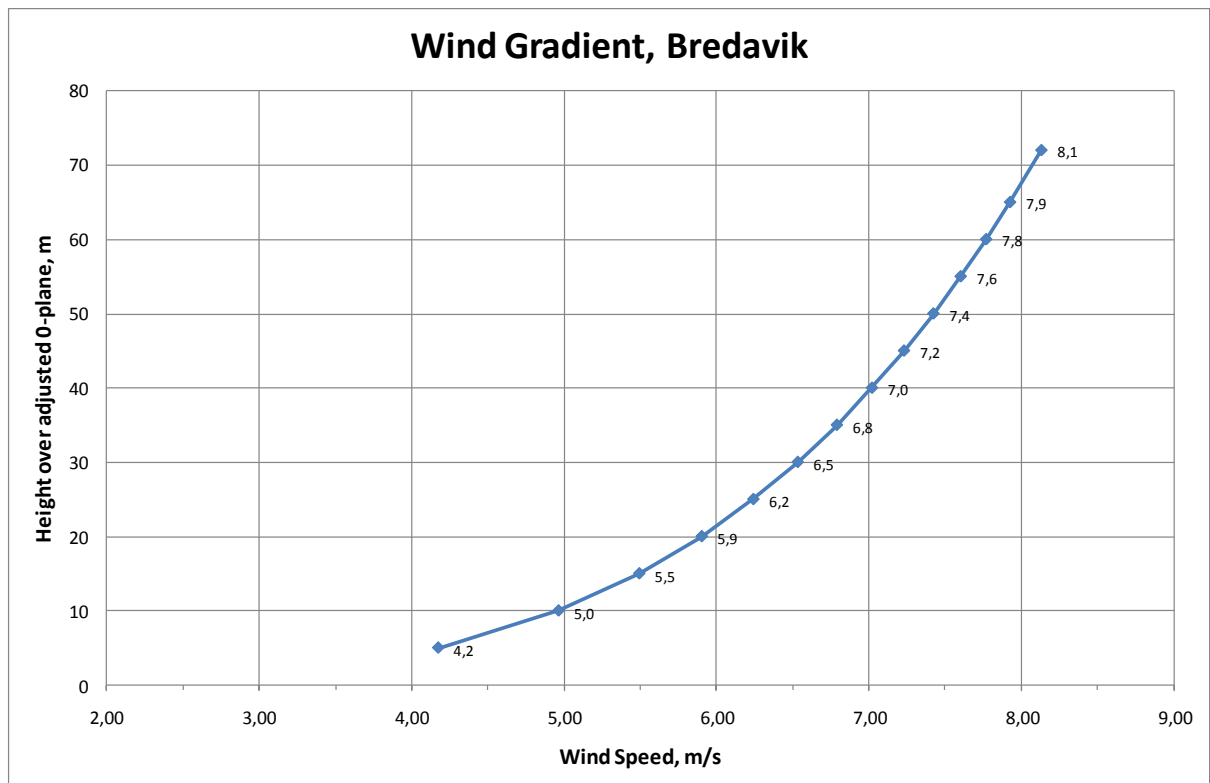


Figure 4. The wind gradient for Bredavik, Sturkö, Karlskrona

The wind conditions are very good as the site is located on an island close to the sea. We also have an open landscape in the prevailing wind direction i.e. the most common wind will have low level of turbulence and high energy. The wind gradient in Figure 4 indicates that a 15 m tower would be enough to reach the average wind speed 5.5 m/s. This is the level where investments in small-scale wind turbines get an acceptable (10 years) payback time in Sweden today. But preferably a higher tower could be installed, for example 25 m. This would give an average wind speed of 6.2 m/s and result in a very good energy production. With a 25 metres high tower the payback time would be reduced to 7–8 years.

4 Where to place the turbine?

The obvious location for the wind turbine is in the south-west corner of the property as indicated in Figure 3. Winds from south-west will reach the turbine with a minimum of disturbances. This would also give a distance to the owners living house of 35 metres which is more than the total height of the turbine if the hub height of 25 m is selected. The distance to the closest neighbour would be 100 metres and enough to avoid disturbing noise. A temporary road can easily be arranged for transportation and installation of the turbine.

5 Connection to the grid

The grid on the Sturkö island has quite a good quality and is not foreseen putting any limitation on the turbine's size.

6 Economy

The owner today has a yearly consumption of 25 000–30 000 kWh. A 15 kW turbine on a 25 m high tower would probably be a good choice. It has the potential of a production well covering the owner's need for electricity. Any surplus will be feed into the grid and can be sold.

As mentioned earlier, a hub height of 25 m is suggested. With this height an average wind speed of 6.2 m/s is expected resulting in a very good production, and a payback time of 7–8 years is a realistic expectation.

Selecting a larger turbine could be an option but would not significantly shorten the payback time. Production reducing the need for buying electricity is worth 1.50 Swedish kronor/kWh (0.14 euro¹) while production sold only is worth 0.75 Swedish kronor/kWh (0.07 euro). As we don't have a system of feed in tariffs the best payback time is reached if most of the production can be used to reduce the need of buying electrical energy from the grid.

¹ Exchange rate from 25 November 2010.

7 Impact analysis

Reduction of greenhouse gases	YES	A production of 30 MWh can reduce the CO ₂ emission with 25 000 kg/year
Acceptable visual impact on the landscape	YES	A turbine of this size will probably not give a significant disturbance of the landscape picture. There are many summerhouses on the island and we know from experience that this group of house owners often protests to wind turbines. Good and early information is the best way to manage this risk for opposition.
Acceptable environmental impact for neighbours	YES	The distance is 100 m or more i.e. noise disturbance or shadows will probably not occur. The closest neighbour will have some trees between his house and the turbine.
Acceptable environmental impact for owner	YES	With the proposed location of the turbine the distance to the living house will be more than the total height of the turbine. Outside the house, in the garden, some noise disturbance might occur but the owner has the option to stop the turbine if the noise level becomes unacceptable.
Good economical investment for the owner	YES	The good wind conditions and the open landscape in the prevailing wind direction give a high potential for a good production. The payback time is estimated to 7–8 years. With a turbine lifetime of 20 years it has the potential to be a good investment for the owner.
Potential as good example of small-scale wind power for the general public and the society	YES	This site has the potential of being a good investment for the owner i.e. a good example that small-scale wind power can be profitable. Many people visit the island especially during summer and the turbine will be seen by many persons. Two 800 kW turbines are already installed on the island. In comparison to them this turbine will be perceived as less disturbing and hopefully creates a more positive attitude to the small wind turbines.
Potential for valuable experiences	YES	This is a windy location and it will put the installed turbine to a quite tough test. The turbine that can prove itself on this site will have a very good reference.

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)

