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Small-scale Wind Power – A feasibility study of the potential at Johannesberg, Lösen, Karlskrona

This feasibility 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

This site is located northeast of Karlskrona. The wind conditions are fairly good as the distance to the sea is less than 5 km and the site is located on a height. The surroundings consist of low to medium high forest and a tower height of 35 metres will be required in order to reach the required 5.5 m/s average wind speed.

The distance to neighbours is well over what's required in order to avoid noise disturbance or shadows.

Suitable size of the turbine is 10–15 kW as its yearly production would be in line with current electricity consumption. The grid connection at this site has limited capacity. The main fuses are today 20 A. An increase of the fuses will not be possible unless without reinforcements on the grid. The 20 A fuses limit the turbine size to 13 kW.

The high tower will result in extra cost resulting in a payback time of 13–15 years. The high tower also makes it difficult to find a location on the property where the distance to the living house is longer than the total turbine height.

After discussion with the owner we have concluded not to proceed with a feasibility study for this location. The risk for long payback time is too high and a 35 m tower close to the living house is not acceptable for the owner.

2 The site

The selected site is located northeast of Karlskrona.

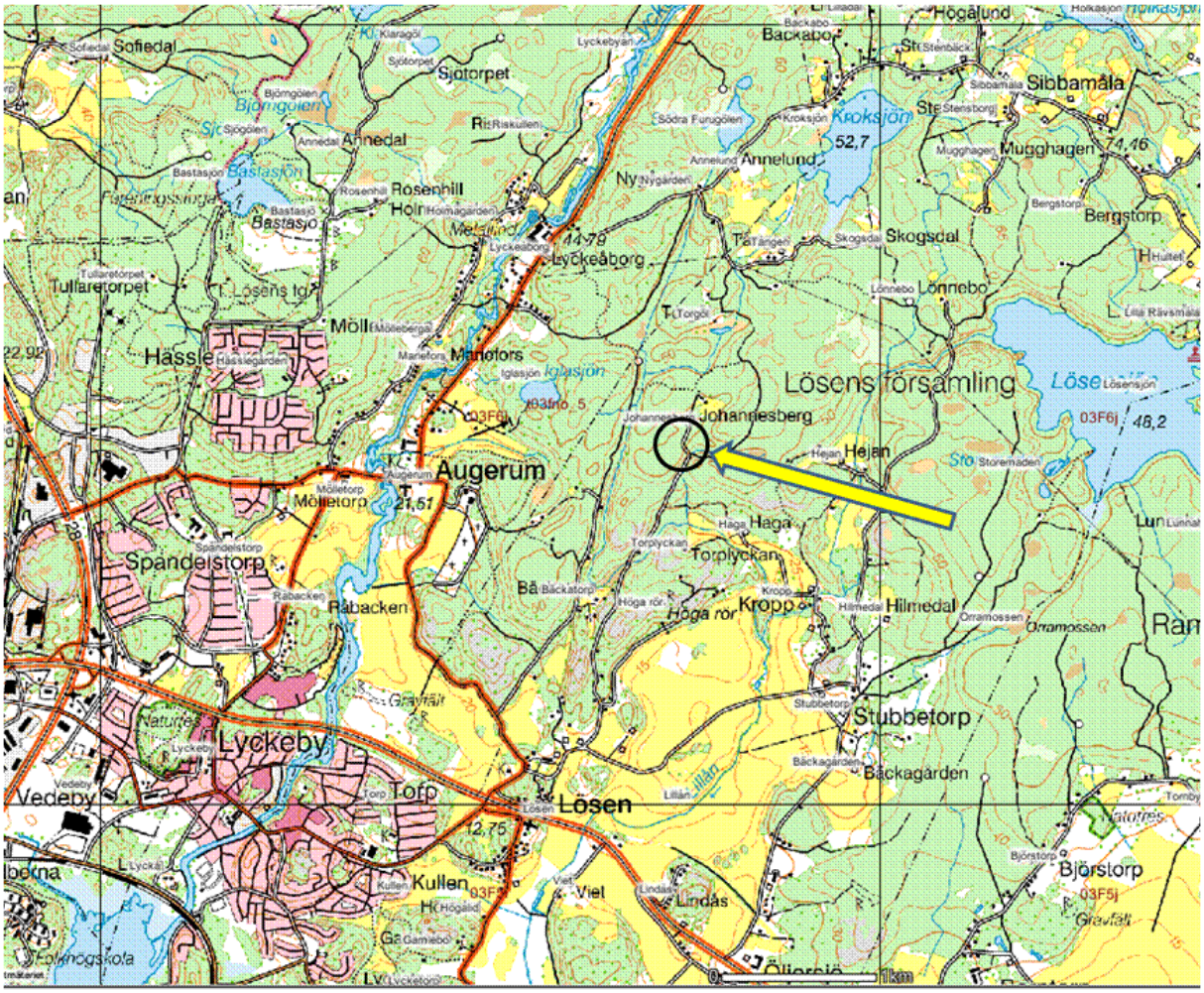

Figure 1. The location

The owner is evaluating different alternatives to reduce the energy costs. One alternative could be to install a small wind turbine.

The house is surrounded by forest of different height. The distance to the sea is less than 5 km and the property is located on a height. The distance to closest neighbour is several 100 metres, i.e. a small wind turbine should not disturb any neighbour.

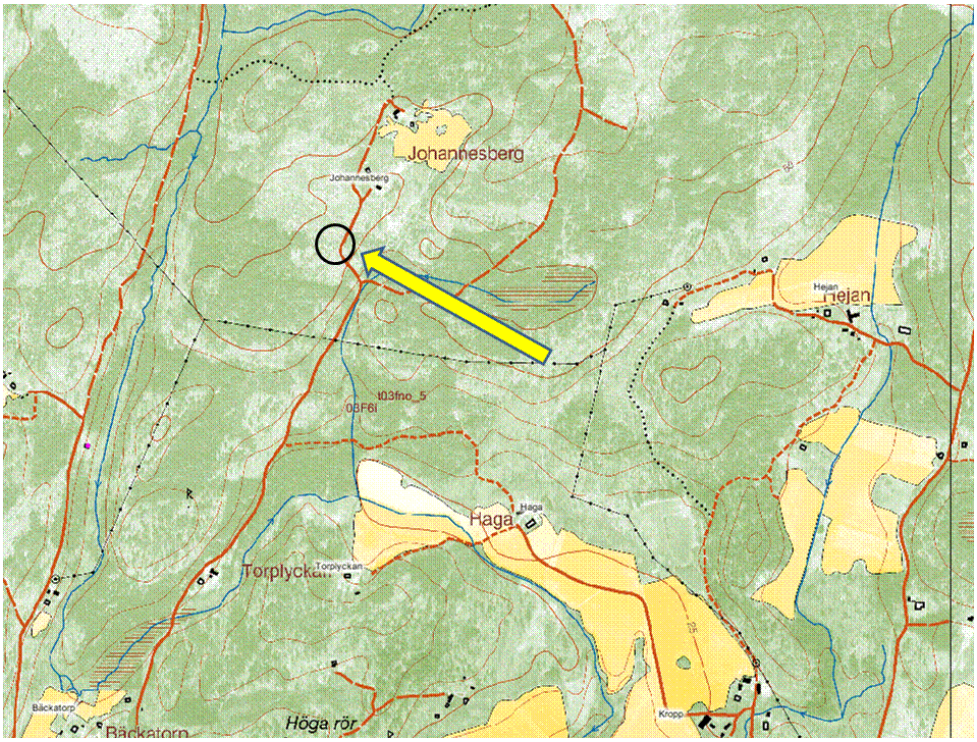

Figure 2. Detailed map

Figure 3. Aerial photo.

3 Wind conditions

The wind map from Uppsala University (1) indicates a yearly average wind speed of 6.2 m/s at 49 m and 7.1 m/s at 72 m. This corresponds to the wind gradient in Figure 4 below.

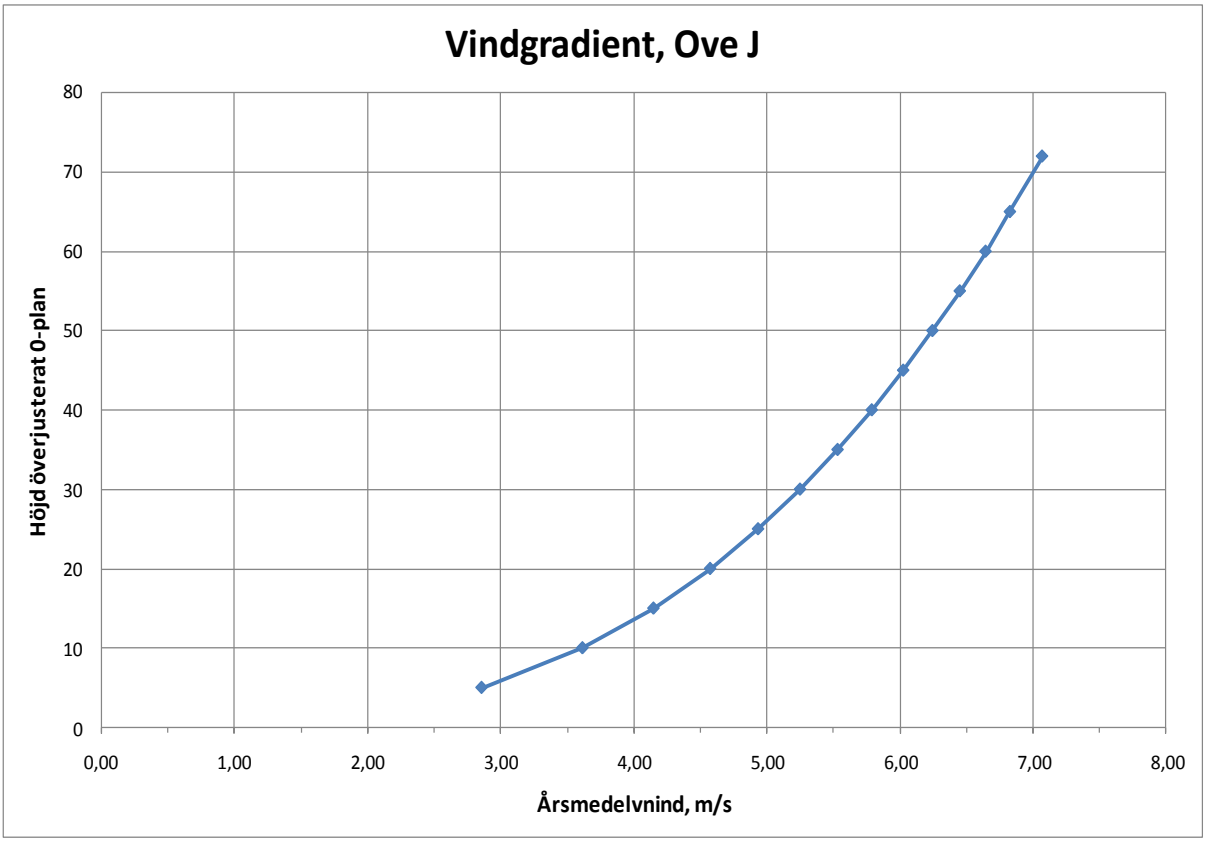

Figure 4. The wind gradient for Lösen, Karlskrona

As the surroundings have a quite high roughness class a relatively high tower will be needed. A tower with the height 35 m will be needed to reach wind speed 5.5 m/s. The average wind speed is okay but the surrounding forest might cause a high degree of turbulence. Unless a very high tower is selected there is a large risk for disturbances in the energy production due to turbulence.

4 Where to place the wind turbine?

The best location for the wind turbine is probably south of the owner's house, close to the garage. The place can be reached from the road with a truck or mobile crane. The turbine will be placed close to the border of the property but still the distance to the living house will be less than the height of the tower.

Preferably the distance between the turbine and a living house should be longer than the total height of the wind turbine.

5 Connection to the grid

The connection to the grid puts with high probability a limit on how large turbine that can be installed. The owner has observed fluctuation in voltage. The distance to closest transformer is >400 m. The main fuses are today 20 A and can probably not be increased, i.e. the turbine size will be limited to 13 kW.

6 Economy

The owner toady has a yearly consumption of 20 000–25 000 kWh. A 10–15 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 35 m or higher to reach an average wind speed of 5.5 m/s, i.e. the limit where small-scale wind turbines get economically feasible in Sweden today. For a 10 kW turbine the cost for the 35 m tower will represent a quite high degree of the total investment and will have a negative impact on the payback time.

Selecting a larger turbine could have been an option but the weak connection to the grid puts a limit on the size of turbine we can select.

7 Impact analysis

Reduction of greenhouse gases	YES	A production of 20 MWh can reduce the CO_2 emission with 17 000 kg/year
Acceptable visual impact on the landscape	YES	The site is surrounded by forest. The turbine will not be visible unless you are very close.
Acceptable environmental impact for neighbours	YES	The distance is >200 m i.e. now noise disturbance or shadows will occur. The turbine will hardly be visible due to the surrounding forest.
Acceptable environmental impact for owner	NO	The high tower can't be located long enough from the living house and it will dominate the garden. Disturbing noise will probably be an issue in the garden.
Good economical investment for the owner	NO	The high tower results in an unacceptably long payback time
Potential as good example of small-scale wind power for the general public and the society	YES/NO	YES; an example of how a private house owner can produce renewable energy covering his own consumption. NO; it will probably not be a good investment for the owner and can in the worst case be used as an argument against small-scale wind power. Few people will spontaneously pass and see the turbine.
Potential for valuable experiences	YES	Large-scale wind power turbines today are built in forests. Experiences from this installation would show if also small-scale turbines can be built with surroundings dominated by forests.

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)