



Mullbergs Vind

Ett samarbete mellan Skanska och Jämtkraft

Renewable energy for 50,000 households

The wind is an endless resource. The energy that tousles the hair on your head and which rustles the leaves and treetops – we transform this into electricity that you can use to cook dinner, watch the television or charge your car. Four metres per second is all it takes for the wind turbines on Mullberget to start producing electricity; full production is reached at ten metres per second. In a normal year, the average wind speed in the wind farm is seven metres per second. In total, Mullberg Wind Farm has 26 turbines that can provide electricity for around 50,000 households every year for the next 25 years. Each wind turbine is 179 metres tall and weighs almost 600 tonnes.

Wind power is one of the future's sustainable power sources, and with more renewable electricity we create the right conditions for phasing out fossil fuels in Sweden, Europe and the rest of the world. Social and environmental sustainability has been at the heart of work on Mullberg Wind Farm. Our vision has been that its construction will have the least possible environmental impact. Naturally, a major project such as Mullberg Wind Farm makes a mark in the landscape, but in order to minimise this impact, the site has been classed as a “green

workplace” in accordance with Skanska's ISO 14001 certification.

This means, for example, that there are limits on the emission levels of the machinery, and for power consumption, chemical use and waste management. The design of the wind turbines and their foundations has also been adapted to minimise emissions and material use. The towers were built on site by bolting their walls together and assembling them into sections that were then lifted onto each other.

Filling the foundations with sand instead of concrete meant that the amount of rebar and concrete was reduced, leading to 30 per cent lower carbon emissions.

The wind farm not only provides renewable power, it also brings optimism to the local area. An agreement with the community organisation in Rätan means that local funding will be paid and distributed to projects that benefit the area. A first instalment was provided when the towers were raised and the area will also benefit from an annual percentage of the returns on the farm's revenue. In addition to this, the project also compensates landowners and Tässäsen Sami village.



Big, tall and half a million bolts

All the foundations on which the wind turbines are built are anchored to the bedrock using ten encased cables, each of which is tensioned to a total of 3,500 tonnes in order to withstand the stresses on the wind turbine. Only 129 cubic metres of concrete has been used for each foundation.

The towers are 122.5 metres tall and are made up of ten sections that are bolted together using 18,500 bolts. The nacelle and rotor blades are at the top. They have a diameter of 113 metres and are most efficient when their speed is around six times that of the wind, so when the wind speed is ten metres per second, the tips of the blades are moving at 60 metres per second.

The total height of each wind turbine is 179 metres and they can generate three megawatts (MW) of power. The weight of the nacelle and rotor is 140 tonnes and the tower weighs 450 tonnes. The blades are fitted with a de-icing system, using integral carbon-fibre mats that are heated to avoid ice accumulation and ice throw.



From idea to wind farm in just a few years

2009

Eolus Vind conducts a pilot study for wind power in the area.

2010

Permit application submitted.

The wind farm's environmental permit is granted.

2011

Jämtkraft and Mullbergs Vind given the design work begins in crane sites are and a switchgear foundations for designed and c





2012

Skanska acquire the project; Jemtska AB is founded. Jemtska is signed and build contract and in the autumn. Roads and foundations are cleared, cables dug down, near building constructed. The casting for the 26 wind turbines are begins.

Ground preparation and the casting for the foundations are finished in early autumn. The first towers are assembled and raised.

2013

2014

The final rotor blades are lifted into place in the spring. The wind park is finished and officially opened late in the summer. It is estimated that the wind farm will produce renewable power for 50,000 households for 25 years.





Local power

Mullberg Wind Farm doesn't just generate electricity, it is also a local driving force. We have been keen to involve businesses and people who live in and around our wind farm throughout the construction process. One of our stated aims has been to hire local contractors. When summarising its construction, we can state that more than 50 per cent of the contractors are located in the county of Jämtland and that we have worked with local organisations, schools, restaurants and shops.

Mullbergs Vind AB has signed a local funding agreement with Rätan's community organisation, so the wind farm will continue to contribute to good local development. The first payment was made when the towers were raised and the area will receive

percentage returns from the wind farm's revenue. The money can be freely allocated to projects that benefit the local area. In addition to this funding, the project also compensates landowners and Tås-såsen Sami village.

During the construction period we have organised a number of study visits to the wind farm, as well as events in Rätan, giving many people the opportunity to come into contact with the project and with wind power. We have also worked with the school in Rätan as part of the project. The pupils have named the 26 wind turbines and each one has a drawing that was drawn in association with its naming.

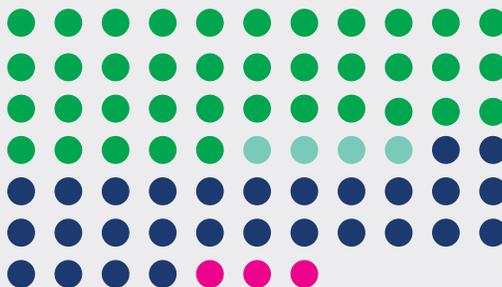


Project stakeholders

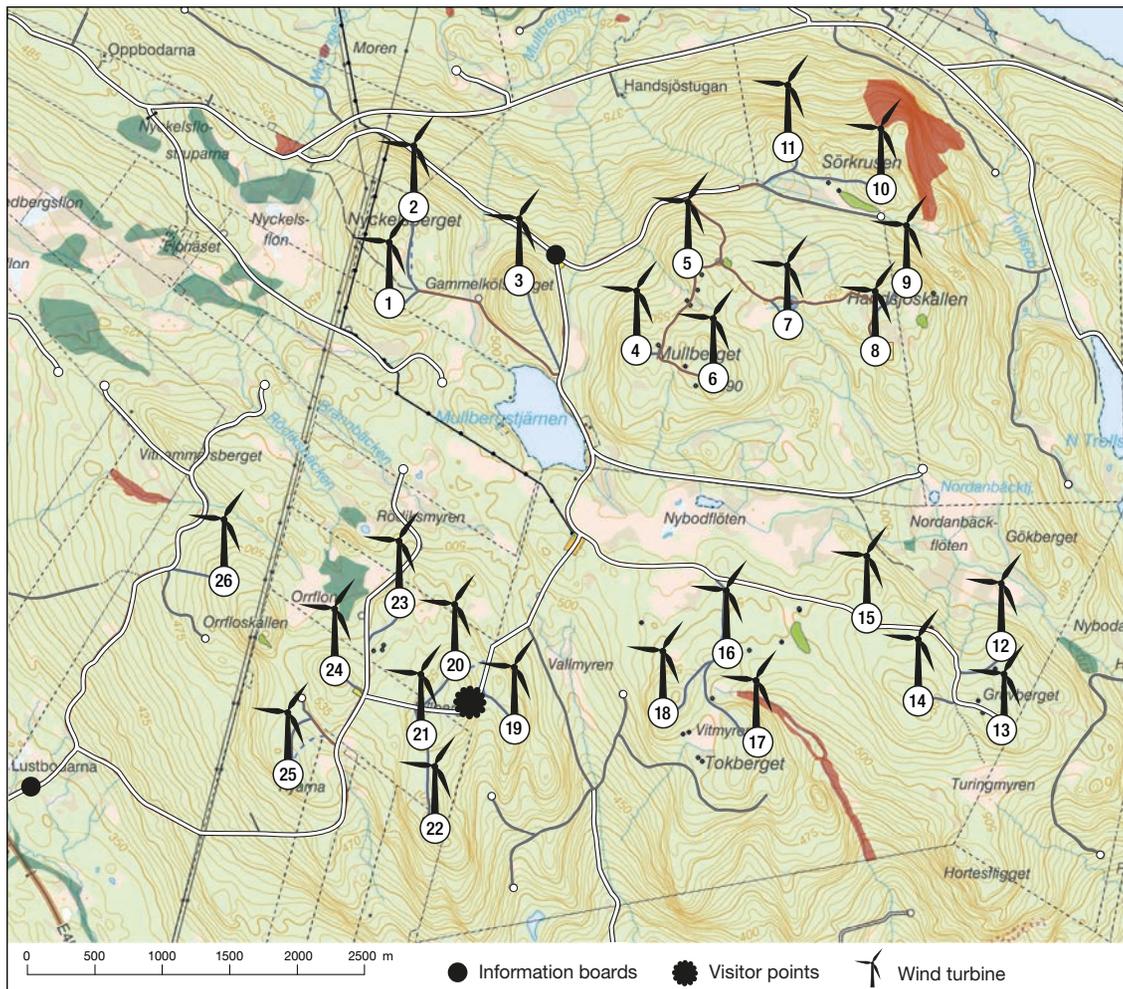
Mullbergs Vind AB is equally and jointly owned by Jämtkraft and Skanska. The project has entailed cooperation on development, financing, construction and operation. Skanska's contributions include development, investments and building and planning expertise. Jämtkraft contributes expertise in power production, electricity trading and grid services.

Jemtska, which is owned by Jämtkraft and Skanska Sverige, has coordinated the construction and been the primary contractor for the wind farm's infrastructure. They have hired subcontractors from Jämtland, Västernorrland, the rest of Sweden and internationally. Out of the 73 subcontractors, 38 are from Jämtland and four from Västernorrland. Siemens supplied and assembled the 26 wind turbines.

Many local contractors



- Companies from Jämtland
- Companies from Västernorrland
- Companies from the rest of Sweden
- International companies



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|----------------|---------------|----------------|-------------|
| 1. Åskar | 8. Rainfall | 15. Snöstjärna | 22. Dunster |
| 2. Suenami | 9. Weather | 16. Regnbåge | 23. Dimma |
| 3. Vindstjärna | 10. Disa | 17. Dunder | 24. Ivar |
| 4. Snöfall | 11. Duggregn | 18. Tornado | 25. Storm |
| 5. Harrycane | 12. Vinter | 19. Norrsken | 26. Oväder |
| 6. Cycklona | 13. Snöflinga | 20. Virvelvind | |
| 7. Dagmar | 14. Blixten | 21. Månsten | |

The wind turbines were named by pupils at Råtan school.

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