Abstract

An issue crippling small to medium wind turbine deployment is the cost of technical studies, which are required to ensure legal, safe and profitable installations. These costs represent a significant amount of the total investment, and curtail the already limited profitability of small wind projects. It is therefore relevant to define siting guidelines and resource assessment methodologies, which enable potential consumers to properly screen their site and estimate feasibility while avoiding the additional costs.

Objectives

1- Setting up guidelines for optimal siting of wind turbines with regard to technical constraints and obstacles;
2- Setting up guidelines for small wind turbines selection. Criteria include: certification of turbine types and availability of test results, availability and experience of local installers, maintenance contracts;
3- Assessing wind resources at small to medium wind turbines hub height (15 to 60m), based on available wind data and speed or energy correction factors accounting for the presence of obstacles for 4 case studies. Comparison to the values from the ‘Windplan Vlaanderen’ database and to the actual yields of existing installations;
4- Assessing the financial profitability of these installations, and generalize findings to the Flanders territory.

Methods

A literature study on the siting recommendations with regards to obstacles was carried out, and information regarding distances to achieve from technical constraints in Flanders were gathered.

An inventory of the small and medium wind turbines certified upon relevant quality standards and available on the Belgian market from reliable providers was done. For all 4 sites, a constraints and obstacles mapping was done. Best siting locations were identified. Energy yield assessments were carried out using the WASp model and data from the European Wind Atlas. These results were compared to actual yield figures, as well as the results obtained using data from neighboring meteorological stations and from the ‘WindPlan Vlaanderen’ database.

Financial analysis were done, taking into account the Flemish regulatory framework for farmers, green energy legislation, and electricity bills of the farmers.

Results

The literature study revealed a consensus on the distance to achieve from obstacles of 20 times the height of obstacles, unless the wind turbine rotor can be above twice their height.

Only 4 small wind turbine types available on the belgian market could be envisaged for the study with regards to the selected quality criteria.

For small wind turbines, It was not possible to achieve the recommended distances from obstacles on any of the sites, although these agricultural sites presented significant available areas. The best siting locations for small wind turbines were still identified, and a minimal distance to obstacles of 8 times the height of the surrounding obstacles could be achieved.

Appropriate siting locations for medium wind turbines were identified on only 3 out of the 4 sites, due to technical constraints.

The relevance of using WASp and data from the European Wind Atlas was evaluated by comparing results to actual production figures from the Schondijke test site, where obstacles are blocking the wind in the main wind direction and are located at a similar distance as is achieved on the 4 sites. The difference was only 4.5%, which demonstrates that WASP could provide accurate results.

On the 4 test sites, the impact of obstacles on the energy yield was:
- 11 to 32% for small wind turbines
- 1 to 4% for medium wind turbines

Conclusions

- Obstacles have a large impact on the yield of small wind turbines even if these are located as far as possible, while their impact is not significant for medium wind turbines.
- On many sites of Flanders, even in rural settings, it may not be possible to install medium wind turbines due to technical constraints.
- Using WASp and data from the European Wind Atlas provides reliable yield estimates for small to medium wind turbines in rural areas of Flanders, provided that the turbines are correctly sited, as far as possible from obstacles.
- Using data from the ‘WindPlan Vlaanderen’ provides useful first estimates for medium wind turbines although this database should be updated, while the reliability of the yield results obtained using data from neighboring meteorological stations is low.
- Profitability of medium wind installations can be achieved by farmers in most of rural areas in Flanders. Profitability of small wind installations can be achieved by farmers in open rural sites of Flanders located relatively close to the North Sea.
- In Flanders, the profitability of a small to medium wind installations is largely dependant on the accounting system selected by the farmer.

References

1. VUB – Windplan Vlaanderen
2. Windmakers project full report (dutch):
   http://www.onepedia.be/nl/windmakers/windturbines