NOISE IMPACT - WIND FARMS IN QUEBEC

Martin Meunier, ing., M.Ing. [*1] **and Jacques Savard, M.Sc.** [†2]
[1] Chargé de projet, SNC-Lavalin inc., Environnement et Eau, Longueuil, Québec, Canada.
[2]Directeur, groupe acoustique, SNC-Lavalin inc., Environnement et Eau, Longueuil, Québec, Canada.

Résumé

La filiale éolienne de la production énergétique au Québec, a été créée véritablement à la fin des années 90, avec la mise en service du parc Le Nordais dans la région de la Gaspésie. Au fil des différents appels d'offre lancés par Hydro-Québec, société d'État chargée de la fourniture d'énergie, la production éolienne a augmenté graduellement pour atteindre une capacité installée de près de 2900 MW. Au Québec, les projets industriels, desquels font partie les pars éoliens, doivent selon certains paramètres, faire l'objet d'études d'impact et d'audiences publiques. Malgré que cette forme de production d'énergie soit qualifiée de verte, les projets éoliens ont rencontré de l'opposition fondée notamment sur le bruit, ayant mené à l'abandon de certains des projets. Des membres du personnel du groupe acoustique et vibration de SNC-Lavalin inc., ont été impliqués depuis le tout début de cette filiale énergétique et ont su développer une expertise unique au Québec, au niveau de la caractérisation de la situation initiale, la modélisation, la vulgarisation des aspects techniques lors des audiences publiques, la surveillance lors des travaux de construction et finalement, lors du suivi en phase d'exploitation.

Mots clefs : bruit, infrason, syndrome éolien, parc éolien

Abstract

The wind energy branch of power production in Quebec was truly created at the end of the 1990's, with the commissioning of the Le Nordais wind farm in the Gaspésie region of Quebec. Throughout various tenders issued by Hydro-Québec, the Crown corporation responsible for the supply of energy, wind generation has increased gradually to reach an installed capacity of nearly 2,900 MW. In Quebec, industrial projects (including wind farms) must be the subject of impact assessments and public hearings, according to certain parameters. Although this is a green form of energy production, wind farm projects have met with opposition on the basis of noise, which has lead to the abandonment of some projects. The noise and vibration personnel at SNC-Lavalin Inc. have been involved in the Quebec's wind energy branch since its beginnings and have developed a unique expertise in Quebec in terms of their ability to characterize a wind farm's initial situation, perform noise modeling, popularize technical aspects of the project at public hearings, to monitor during construction, and finally to monitor during the operational phase.

Keywords: noise, infrasound, wind turbine syndrome, wind farm

1 Introduction

Most of the energy produced in the province of Quebec (Canada) comes from renewable sources. Among these renewable sources, wind energy started to become more prominent in the late 1990's, with the project *Énergie Le Nordais* [1]. Now there are more than 30 wind farms in Quebec either in operation or in development.

Wind farms are generally seen as a good sustainable way to produce energy. However, their construction and operation are not without some alleged impact on the environment, including the impacts of noise and vibration.

SNC-Lavalin Inc. and its staff has been a key player in noise impact assessments for the majority of wind farms in operation in Quebec, since the first project.

[*] martin.meunier@snclavalin.com
[†] jacques.savard@snclavalin.com

2 Noise impact assessment overview

Industrial projects in Quebec which have the potential to emit contaminants into the environment must go through a process of assessment and verification of their impacts, including noise. Furthermore, if reasonably requested by a person, a group or a municipality, the minister of the environment asks for public hearings to be held with regards to the project's potential environmental impacts.

The most stringent provincial noise criteria in Quebec (during nighttime and in low density of occupation lands), is 40 dBA $L_{\mathrm{Aeq}1hr}$, with corrective terms added if applicable. [2]

The following paragraphs give an overview of the history of noise impact assessments for wind farms in Quebec.

For the first wind farm project (Le Nordais), no comprehensive noise modeling was performed at the impact assessment stage. Wind turbines were presented to be noise

emitters only in windy conditions, and that noise produced by the wind itself would mask the noise from the turbines. Despite this indication, it was required for the developer to implement a noise survey to determine, among other things, the presence of infrasound.

For a later project in early 2000 (Murdocville), a noise model was prepared during the environmental impact assessment stage, using the dominant wind direction and average wind speeds over the year as inputs. It must be mentioned that the ministry of Environment in Quebec does not give any specific directives regarding the noise modeling, and is still the case at the time of this writing.

For the next project (in the Gaspesie region), a more general approach was used. Site-specific considerations for wind speed and direction were discarded and the ISO 9613-2 methodology was adopted (e.g. all receivers are downwind from all wind turbines). The presence of wooded areas was also taken into account, and the parameter G for the ground effect was assumed to be 1 (soft and sound absorbing).

Following this project, SNC-Lavalin conducted a comprehensive noise survey, including long term noise measurements both inside and outside dwellings in proximity to a wind farm, along with long term ground vibration measurements both at a dwelling and at the nearest wind turbine.

This survey shows that apprehension expressed by some inhabitants regarding vibrations produced by wind turbines were not correlated with actual quantitative onsite vibration measurements. It also provided the opportunity to better establish which parameters are most important for a noise model for wind farms.

All noise models produced for subsequent projects conducted by SNC-Lavalin Inc. have taken into account these adjustments. A more accurate prediction of anticipated noise levels due to wind farms allows developers to better determine their wind turbine layouts and reduce possible issues regarding noise criteria and complaints.

3 Noise surveys during the operational phase

The ministry of environment in Quebec asks for noise surveys on all wind farm projects for the 1st, 5th, 10th and 15th year after commissioning. This is not a general request from the ministry for all types of industrial projects. For the primary projects, only short term measurements (1 hour) were taken when the wind turbines were considered to be at full power. It was quickly observed that it was very difficult to use weather forecasts to determine when the turbine production rate would be at 100%, and thus when to perform the survey. A 24 hour sampling was then adopted, which was further increased to 2 weeks.

To get the most out of the measurements, recent surveys include portable weather stations, special wind screens on the microphones, and digital audio recorders (if not already included in the sound level meter). In some remote locations, standalone stations which are remotely accessible and have been developed by SNC-Lavalin Inc., were used.

4 Public Hearings

SNC-Lavalin inc. has participated in a great number of public hearings over the years on wind farm projects.

The main concerns raised by the public were on the noise level itself (e.g. misunderstanding of the difference between sound power level and sound pressure level, which occurs both among the public as well as some ministry representatives), the dose effect curve specific for wind farms (as preliminarily determined in a Swedish study[3]), infrasound and its numerous alleged effects on the health of humans and farm animals, and the misleading statement that wind turbines are always masked by the wind.

The social acceptability of projects is also an issue, given the fact that some aspects of wind farm energy in Quebec are not well perceived by the public (subsidies, energy surplus, visual impact, private interest vs. public).

5 Conclusion

The wind farm industry has evolved since its first project in Quebec, on many aspects including noise impact assessment and measurements.

SNC-Lavalin inc. has been a key player in this evolution, and is involved in many other areas of acoustics related to transportation, construction, architecture, and industry.

References

[1] Ministère de l'Énergie et des Ressources naturelles du Québec, Windfarms Projects in Québec (in French), http://www.mern.gouv.qc.ca/energie/eolien/eolien-projets.jsp (Last viewed March 31, 2015).

[2] Note d'instructions 98-01 sur le bruit, ministère de Développement durable, de l'Environnement et de la Lutte sur les changements climatiques, 9 juin 2006

[3] Eja Pedersen, Human response to wind turbine – perception, annoyance and moderating factors, 2007