Agence Française de Sécurité Sanitaire de l'Environnement et du Travail

CONTEXT AND OPINION RELATED TO THE HEALTH EFFECTS OF NOISE GENERATED BY WIND TURBINES

Afsset reference number 2006–005

This document summarizes working group research and presents Afsset's opinion.

Presentation of the Issue

On June 27, 2006, Afsset was mandated by the ministries responsible for health and the environment to conduct a critical analysis of the report issued by the Académie nationale de medicine[1] [national academy of medicine] evaluating the effects of wind turbine operation on human health. The report advocates the use of a minimum 1,500-metre site distance for 2.5 MW wind turbines or more, as well as the use of the Règlementation des Installations Classées pour la Protection de l'Environnement (ICPE) [installations classified for environmental protection regulations] for certain installations.

Scientific Context

At the end of 2006, more than 72,000 MW of wind-generated electricity was operational worldwide. Global growth in this field has occurred at a rate of more than 24% per year for the past five years. In Europe, after the UK, France had the second largest wind resources. For the only metropolitan area, 2,700 MW of power was available by the end of 2007.

France has approximately 250 wind farms and 2,000 wind turbines; 20 of the 22 regions have wind farms. The Centre and Languedoc regions lead with 315 and 281 MW respectively. Next are the regions of Bretagne (257 MW), Picardie, Champagne-Ardenne and Lorraine (more than 150 MW each). The sector continues to develop rapidly.

The average unit power of installed wind turbines has been growing very rapidly for several years. The current standard apparatus delivers two megawatts of power (windmill with an 80-metre diameter rotor mounted on a tower 70 to 100 metres high). Impending installations range from 2.5 to as much as 3 MW. The trend is toward wind farms with fewer, stronger windmills: the largest will soon reach 5 MW.

Despite the increasing interest in renewable energy, the public is questioning potential environmental and health effects that may follow windmill implementation. In particular, many residents adjacent to future installations are advancing the issue of windmill-generated noise to reject installation of new farms.

[1] "Retentissement du fonctionnement des éoliennes sur la santé de l'homme" [The effects of wind turbine operation on human health], March 14, 2006.

Organization of Expertise

Afsset presented the "Evaluation des risques liées aux agents physiques, nouvelles technologies et grands aménagements" [assessment of risks associated with physical agents, new technology and large installations] to the Comité d'Experts Spécialisés (CES) [committee of expert specialists], which mandated a working group on the health effects noise generated by wind turbine; the group consisted of experts, all CES members, to complete the expert research. The CES endorsed the prerequisite analysis of the document and issued a statement on its admissibility during its session held on October 24, 2006.

The expert research was conducted and the report drafted by the working group. It should be noted here that, since the ministries request to Afsset by was not for a health risk assessment; thus the CES did not need to make a submission to the Courts.

This expert research arose from a group of experts with complementary skills. It was conducted in compliance with the standard NF X 50-110 "qualité en expertise" [quality of expertise].

Description of the Method

In order to become familiar with their position, the group sent a list of questions many professionals in the wind power sector (builders, developers and wind farm managers). However, these professionals did not wish to respond individually and directly to Afsset. As a result, we asked the Syndicat des energies renouvelables (SER) [renewable energies association] to have the professionals answer our questions and to centralize the answers. The SER provided the working group with its position, and overall answers to the questions asked.

Since those involved in the industry responded through SER, it was not possible to compare the analyzes of the various stakeholders in this file (builders, developers . . .) with respect to their consideration of the noise problem. The few responses received by the association were included in this report.

Among other things, in May 2007, SER organized a working group visit to two wind farms that had been recently installed in the department of Eure-et-Loir.

The Agence de l'Environnement et de la Maîtrise de l'Energie (Ademe) [environment and energy agency] was asked to contribute to this report through the delivery of services in compliance with the terms of the submission. The Ademe contributed a great deal of information to the working group, essentially related to:

- the development of the wind energy file: status and perspectives;
- the regulations applicable to wind turbines with respect to noise levels;
- assessment of noise generated by wind turbines;
- sound levels measured in neighbouring areas; and
- the results of a questionnaire survey administered to DDASS.

Criteria for Quality of Expertise

To be included in this report, the scientific research must have been published in an international journal following the opinion of a scientific reading committee, even though these journals are not of equal quality. Bibliographic research was conducted by consulting the bibliography of international reports on the subject and by consulting bibliographic databases usually used by researchers. The reports of significant research or summary reports that had been made public were also analyzed. Unpublished communications from conventions and colloquia were not considered.

Each article was reviewed on the basis of quality criteria in the relevant field of expertise. For example, the epidemiological quality criteria were based on the representativity of the subjects studied, bias control, quality of data collection, selection of exposure indicators and consideration of conflicting factors, the quality of the statistical analyses and the robustness of the research (depending specifically on the number of subjects included in the research).

Each expert was responsible for writing a contribution in his or her field of expertise. Certain portions were a cooperative effort of several experts. The texts were submitted to the entire group for review. The conclusions and proposals were written collectively by the working group. Conclusions were based on the weight of evidence including the scientific quality of the research, replicability, research consistency, etc.

When an expert believed it was necessary to consult an external individual recognized for his or her skill, the potential inclusion of the information provided was at the discretion of the expert. Such information was not explicitly mentioned in the report. Two scientific revisers external to the working group were asked to re-read and comment on the various phases of report development.

Conclusions and Recommendations of the Group Expertise

Conclusions

It appears that the noise emitted by windmills is not sufficient to result in direct health consequences as far as auditory effects are concerned. As is exposure outdoors, this noise may, depending on the circumstances, give rise to some discomfort that may at times be exacerbated by factors other than sound, thus influencing the acceptance of windmills (for example, aesthetics or landscaping). A variety of additional auditory effects, while difficult to quantify or to attribute unequivocally to a single noise source, may be associated with this type of exposure (stress or sleep disturbance, for example). Inside homes, with the windows closed, no environmental nuisances were noted, or consequences were unlikely in light of the noise measured.

A review of the data on noise measured in proximity to windmills, sound propagation simulations and field surveys demonstrates that permanent definition of a minimum

1,500 m installation distance from homes, even when limited to windmills of more than 2.5 MW, does not reflect the reality exposure to noise and does not seem relevant.

It would seem wise to recommend systematic local studies prior to each decision. For this purpose, we currently have opportunities available for careful research and simulations which, by including a certain number of physical characteristics (meteorology, ground effect, etc.), would ensure compliance with the regulations and respect for the environment of near or distant adjacent residents, prior to the implementation of a wind farm. Seeking local consensus and solutions that are both socially acceptable and economically viable makes it possible to anticipate providing items from the environmental impact research systematically available to affected parties, in accordance with the terms and conditions of applying the ambient noise decree.

When considering the inclusion of windmills as part of ICPE application, it is appropriate to emphasize that application of this regulation in its strictest sense would make it difficult to comply with sound levels at the periphery of industrial properties. This could lead to an inconsistency that could lay insurmountable acoustic limitations at the foot of each windmill in a farm. These texts should therefore be specifically tailored to windmills.

It would be more appropriate to continue assessing the sound impact of windmills based on *emergences*[2], sound exceeding ambient sound levels in accordance with the methodology that is already well known to neighbouring residents.

Recommendations

The working group recommends implementation of specifications from the [environmental] impact study including careful modeling of the acoustic impact. Emergence calculations conducted during this research make it possible to assess potential indirect health effects prior to wind farm installation, in addition to enabling the mandatory administrative audit of this acoustic research.

More specifically:

- Define a research perimeter: indicate all zones likely to be affected by windmill noise, including those that are not inhabited;
- Quantify the levels and duration of the impact on the affected areas as a function of anticipated meteorological conditions over the year;
- Indicate measures taken by the wind farm operator in case the authorized *emergence* [level] is exceeded;
- At city hall, provide maps of the areas affected by a wind farm site; and
- For impact studies of other projects, impose inclusion of the potential effect of an existing wind farm on areas affected by the projected wind farm.

[2] Emergence refers to the mathematical difference between ambient and residual noise levels.

In addition, the method for reviewing the effects of sound levels on the environment, based on *emergences* between the residual and ambient levels, seems to comprise all difficulties advanced by windmill developers.

The desire for regulatory simplicity should also lead to a commitment to efforts to clarify nuisance criteria. Such a result can be accomplished by increasing knowledge regarding noise-related discomfort criteria.

The Chair of the working group, Michel Rumeau, accepted the group expertise report during its session on October 22, 2007 and notified Afsset management of this adoption.