DECC RESEARCH INTO A PENALTY SCHEME FOR AM

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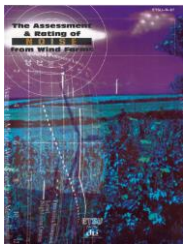
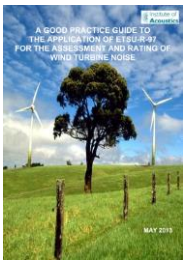
1 INTRODUCTION

Policy responsibility for the management of noise from onshore wind turbines lies with the Department of Energy and Climate Change (DECC), and has been subjected to increased scrutiny in recent years. The Department for Trade and Industry published the ETSU-R-97 guidelines on how to assess wind turbine noise in 1996. These guidelines were first adopted in Planning Policy Guidance 22, then Planning Policy Statement 22, and are currently endorsed in the Noise Policy Statement for Renewable Energy Infrastructure (EN-3).



In 2010 following growing public concern on how wind farm noise assessments were undertaken, DECC commissioned a review of how ETSU-R-97 was applied, which concluded that it was necessary to provide clearer guidance on the assessment methodology. DECC invited the Institute of Acoustics (IOA) to produce a Good Practice Guide (GPG) for the assessment of wind turbine noise, which was subsequently published in May 2013. The IOA's remit related specifically to the technical elements of the assessment process only; they did not review or consider any of the limits, which are a matter of Government policy.



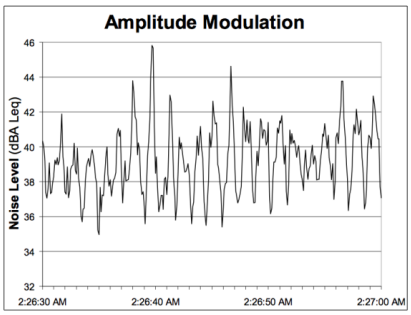
One aspect that the IOA GPG was not able to provide guidance on at the time (due to a lack of available evidence) was a particular acoustic feature of wind turbine noise known as amplitude modulation (AM). It is well established that the aerodynamic noise from a wind turbine is made up of periodic noises from each of the blades, and this is a normal characteristic that was recognised in ETSU-R-97. However, more recent investigations at a number of sites have revealed instances where modulation depth increases and frequency content changes in the turbine noise have led to an adverse subjective response.

Increased awareness of amplitude modulation has led to a number of research projects to look at causal mechanisms for AM and the subjective response when it occurs. One such project was funded by RenewableUK (RUK), which reported in December 2013 with the latest research on what the likely cause of the AM was (most likely when one of three blades goes into 'stall') and what might to done to prevent the condition occurring. They also undertook some laboratory trials to look at the dose-response for AM to try to establish the appropriate penalty level. RUK also published a draft planning condition based on the research, but the IOA has cautioned against its use due to a lack of an agreed definition for AM, a lack of testing of the proposed metric, and a lack of evidence for a suitable penalty level.

2 AM DEFINITION AND METRIC

Following the model adopted for the production of the GPG, the IOA set up an AM Working Group (AMWG), which released a consultation document earlier in 2015 on a definition and metric for AM, based on up to date evidence. This document proposed three methods of assessment, which broadly speaking are based on a time domain method, a frequency domain method, and a hybrid method combining the two. Following the consultation feedback, the IOA will narrow down the choice of metric to one preferred option.

In order to provide an adequate control for what would be considered to be an unacceptable level of AM, DECC needs a penalty system, and this is not an output of the IOA AMWG work. People react to noise in different ways, and for that reason, policy decisions on thresholds in environmental noise tend to be taken from dose-response studies where exposure levels are rated against the percentage of people (highly) annoyed by the exposure. As DECC want the threshold to be linked to Government policy and the available evidence is in the form of dose-response studies it is likely that the penalty for AM would be derived in a similar fashion.



The aim of the project is defined as:

- To review the evidence on the effects of, and response to, AM in relation to wind turbines, including but not limited to the research commissioned and published by RenewableUK in December 2013.
- To work closely with the Institute of Acoustics' AM Working Group, who are expected to recommend a preferred metric and methodology for quantifying and assessing the level of AM in a sample of wind turbine noise data.
- To review the robustness of relevant dose-response relationships, including the one developed by the University of Salford as part of the RenewableUK study, on which the correction (or penalty) for amplitude modulation proposed as part of its template planning condition is based.
- To consider how, in a policy context, the level(s) of AM in a sample of noise data should be interpreted, in particular determining at what point it causes a significant adverse impact.
- To recommend how excessive AM might be controlled through the use of an appropriate planning condition, which includes a penalty scheme.
- To consider the engineering/cost trade-offs of possible mitigation measures.

3 METHODOLOGY

The project work is split into two Phases, involving the following steps:

Phase 1

❖ Compile a list of relevant research and evidence (consulting relevant Stakeholders)
❖ Propose an approach and methodology
❖ Define evidence needs
❖ Prepare a detailed work plan
❖ Submit a summary of the above activities for approval

Phase 2

❖ Obtain copies of all relevant evidence, including the RUK work
❖ Critically review the robustness of the relevant studies into the subjective response to AM, and any penalty schemes

- Critically review the RUK proposed planning condition in the context of ETSU-R-97 and the six tests in the National Planning Policy Framework (NPPF)
- Summarise (for a non-technical audience) main findings of the review of evidence
- Recommend an appropriate penalty scheme (or alternative) for use in a planning condition, compatible with the IOA AM Working Group's preferred metric
- Prepare a draft report summarising the main findings and setting out clear recommendations, in a form suitable for publication by DECC
- Amend the report in light of peer review comments, and produce a final report
- Present the main findings and recommendations

Comment [LM1]: Circular 11/95 cancelled with the exception of Appendix A https://www.gov.uk/government/publications/the-use-of-conditions-in-planning-permissions-circular-11-1995

3.1 Phase 1

The first task for the team will be a one day workshop which will involve a brainstorming session on the review criteria for the AM metric, and the existing dose-response studies, and to define the evidence needs for the project. The Chair of the IOA AMWG will be invited to give an initial briefing to the team on the consultation and the three proposed AM metrics, and the considerations made so far by the AMWG on how the metric would interact with the existing dose-response studies.

Following the workshop, the project team will contact other interested Stakeholders by email and phone to explain the nature of the project, and to seek collaboration and knowledge transfer. Stakeholders include the research teams who have undertaken dose response studies on AM (the University of Salford, a team led by Tachibana in Japan and that of the work by Lee, Ioannidou and Seong).

Following the Stakeholder interactions and searches using suitable publication databases, a complete list of the relevant research and evidence will be produced for review by DECC. The output from Phase 1 will be a report prescribing the approach to the review and the proposed assessment criteria, along with the complete list of research to be reviewed. It is anticipated that the IOA AMWG will have arrived at their preferred metric (following assessment of the consultation responses) by the end of Phase 1, enabling Phase 2 to proceed with a single AM metric.

3.2 Phase 2

Phase 2 will involve an in-depth review of the available AM dose-response studies, with particular emphasis on the RUK research. The review will look at the following aspects (this list is not exhaustive):

- Method of data collection (with regards to GSR Ethical principles)
- Sample size
- AM metric used
- Objective assessment of health effects to AM stimuli
- Laboratory vs. field trials
- Data analysis
- Objective assessment of the outcome (the relationship between dose and response)
- Level of peer review

Specifically with AM, there are a number of elements which could affect the 'dose'. The penalty scheme will need to consider:

- the metric that will define the modulation depth and frequency of occurrence over a time period (to be determined);
- the level of AM before it becomes unacceptable;
- how often any identified periods of AM have to occur within the assessment period; and
- whether there are other significant factors that need to be taken account of – these will be identified during the Phase 1 work.

It is expected that a number of queries may arise out of the reviews, and the project team will contact the study authors for their responses. Responses received will be included in the final report. Following the reviews, conclusions will be made on how robust the studies are, the limitations of the study results, and whether sufficient information exists on which to propose a suitable penalty scheme.

The RUK proposed planning condition will then be reviewed in conjunction with any more recent conditions to control AM (such as the 'final Denbrook' condition), the IOA preferred metric, and the outcome of the research reviews. The condition will be compared with ETSU-R-97 and to the six tests in the NPPF of being:

1. necessary;
2. relevant to planning and;
3. to the development to be permitted;
4. enforceable;
5. precise and;
6. reasonable in all other respects.

A penalty scheme will be proposed based on the robustness of the available evidence. Where no clear evidence is found for the onset of significant effects, a range of values will be proposed, highlighting the potential impacts of the decision within the range, and linking the range to current Government policy.

It may be possible to define the AM penalty range in terms of the effect levels defined in the Noise Policy Statement for England for the:

- No Observed Effect Level (NOEL)
- Lowest Observed Adverse Effect Level (LOAEL)
- Significant Observed Adverse Effect level (SOAEL)

The final task is to consider the engineering/cost trade-offs of possible mitigation measures. The last work package in the RUK study is an investigation on the likely cause of AM, and the suggested methods of mitigation. These include pitch control on the blades, reprogramming the power curve of the turbine to avoid stall conditions, and ultimately curtailment of the turbine completely in the wind conditions where it occurs. Whilst typical mitigation measures will be discussed, the results will vary from one site to the next, due to different turbine models and different wind regimes.

The final report will be provided in draft including:

- an executive summary (suitable for a non-technical audience);
- the results of the review;
- the robustness of the available AM dose-response evidence;
- the limitations of the available evidence;
- an updated planning condition incorporating the IOA AM metric; and
- recommendations on the appropriate penalty scheme, and the range for a suitable threshold, linked where possible to Government policy.

4 PROJECT TIMELINES

The results of Phase 1 are expected to be available to be delivered at the IOA Conference in Harrogate. Phase 2 is expected to be completed by spring 2016.

5 EVIDENCE COLLECTION

As stated above, Phase 1 of the project is to identify all relevant papers for review. Input from delegates is welcomed to ensure that no evidence is missed. The author of the paper can be contacted using the details on the paper abstract.