SHADOW FLICKER SCHEME OF PROTOCOL

FAZAKERLEY WWTW

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose of the Report

This Report has been prepared by Arcus Consultancy Services Ltd ('Arcus') on behalf of United Utilities in relation to the development of the Fazakerley Waste Water Treatment Works Wind Turbine (Application Reference No. 14F/1296), consented by Liverpool City Council in December 2014.

This report presents a proposed scheme of protocol to shadow flicker effects in response to planning condition number 14 set out in the decision notice which states:

"Prior to the First Export Date, a scheme setting out a protocol for the assessment of shadow flicker in the event of a complaint being received, including the remedial measures to be taken, shall be submitted to and approved in writing by the Local Planning Authority. Operation of the wind turbine shall be in accordance with the approved protocol."

This report contains the following sections:

- Shadow Flicker Background
- Discussion of Predicted Shadow Flicker Effects
- Mitigation Measures

2 SHADOW FLICKER BACKGROUND

Shadow flicker is an effect that can occur when the shadow of a moving wind turbine blade passes over a small opening (such as window), briefly reducing the intensity of light within the room, and causing a flickering to be perceived.

The likelihood and the duration of this occurring depends upon certain combinations of relative sun, turbine and window locations, turbine orientation, times of day, days of the year and weather conditions.

The flickering may have the potential to cause disturbance and annoyance to residents if it affects occupied rooms of a house.

The frequencies of flicker caused by modern wind turbines (less than 1 Hertz (Hz))[1,2] are well below the frequencies known to trigger effects in individuals susceptible to epilepsy. The Epilepsy Action website[3] states that "Most people with photosensitive epilepsy are sensitive to 16-25 Hz. Some people may be sensitive to rates as low as 3 Hz and as high as 60 Hz." There is no evidence that wind turbines can trigger seizures.

Therefore, any potential shadow flicker effects from the Development are purely an effect on residential amenity, rather than having the potential to affect the health or well-being of residents.

No formal guidance is available regarding what levels of shadow flicker may be considered acceptable in the UK. However, Best Practice Guidance to Planning Policy Statement (PPS18)[4] Renewable Energy published by the Department of the Environment, Northern Ireland, (2009) (which relies on a survey undertaken by Predac, a European

[1] Epilepsy Action (2010), Other Possible Epilepsy Triggers [online]. Available at: https://www.epilepsy.org.uk/info/photosensitive-epilepsy [Accessed on 24/07/2015]
[2] Department of Communities and Local Government (DCLG) (2004) Planning for Renewable Energy: A Companion Guide to PPS22, pp. 17 [online]. Available at http://planningguidance.planningportal.gov.uk/blog/guidance/renewable-and-low-carbon-energy/particular-planning-considerations-for-hydropower-active-solar-technology-solar-farms-and-wind-turbines/#paragraph_020 [Accessed on 24/07/2015]
[3] Epilepsy Action (2010), Photo-sensitive Epilepsy [online]. Available at: http://www.epilepsy.org.uk/info/photo.html [Accessed on 24/07/2015]
[4] Department of The Environment, Northern Ireland (2009) Best Practice Guidance to Planning Policy Statement 18 'Renewables Energy' Available online at:
http://www.planningni.gov.uk/index/policy/policy_publications/planning_statements/planning_policy_statement_18__renewable_energy__best_practice_guidance.pdf [Accessed on 24/07/2015]

Union sponsored organisation that promotes best practice in energy use and supply) states that:

"It is recommended that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes per day."

3 DISCUSSION OF PREDICTED SHADOW FLICKER

In line with the Condition number 14 if a complaint is received regarding potential shadow flicker effects as a result of the operation of the wind turbine an assessment will be undertaken to assess the level of effect, if any, and identify remedial measures that can be applied to remove the effect.

The assessment would be completed using a specialist computer software package[5] and site survey. It should be noted that computer modelling is considered to be conservative and likely to over predict the level of effect, as the screening effects provided by trees or other buildings are not usually taken into account. The degree of effects will depend on the precise location of such screening, which may change over time as vegetation grows or is cut down and in addition, atmospheric conditions will further reduce the actual effects arising.

It is also noteworthy that in 2010 the Department of Energy and Climate Change commissioned Parsons Brinckerhoff to review international guidance on shadow flicker.[6] The report published in April 2011 identified that while the approach across Europe varies, a key finding of the study was that in the UK there have not been extensive issues with shadow flicker, and the results of a questionnaire survey to the industry and planning authorities yielded few complaints. Furthermore, the report also identified that mitigation measures adopted by developers, which mostly include turbine shut down at particular times, have been successful.

4 MITIGATION MEASURES

United Utilities are committed to avoiding unacceptable impacts on residential amenity as a result of operating the wind turbine. The approach set out below is intended to identify solutions that may be able to provide effective mitigation whilst minimising loss of generation of renewable energy from the turbine in the event that a shadow flicker effect is found to occur. The emphasis would be on identifying an acceptable solution through dialogue with affected residents.

In the event that complaints of shadow flicker from the wind turbine are received by United Utilities or the Local Planning Authority, an investigation will be undertaken at the expense of United Utilities to confirm the occurrence at the property is caused by the operation of the wind turbine. Mitigation measures would then be implemented in order to prevent shadow flicker from occurring or to reduce its intensity to an acceptable level.

In the first instance, discussion with the residents at the affected property would be carried out to explain the effect and discuss their experience of it, consider possible mitigation measures including implementation of screening planting or installation of blinds at the affected receptor to minimise or reduce the intensity of the effects.

However, if these simple measures are not agreed with the residents to be effective, the turbine management system can be pre-programmed to specific times when the turbine should be shut down to prevent shadow flicker from occurring. Further investigation and detailed survey of the affected property would then be carried out and re-modelled using the computer software based on the exact property dimensions, window locations,

[5] ReSoft Windfarm version 4.1.2.7

[6] Department of Energy and Climate Change – Shadow Flicker Evidence Base April 2011 online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf [accessed on 24/07/15]

screening, etc. This will provide a detailed list of times and dates when there is potential for individual shadow flicker events to occur. The turbine would then be pre-programmed to shut down at the times when flicker is predicted to occur, thereby preventing shadow flicker from recurring.

Following the implementation of mitigation, residents would be encouraged to report an accurate and precise record of any times when flicker is occurring to an unacceptable level. From this information, shut down times could be altered and/or applied reactively with working knowledge of actual effects which occur in practice in addition to the theoretical knowledge provided by the computer software.

This approach, however, does have the disadvantage of potentially shutting the turbine down at times when it is not necessary to do so, such as occasions when shadow flicker is predicted but would not occur in practice due to turbine orientation (in response to wind direction), cloud cover or sunlight intensity.

If at this point, it is found there are repeated occurrences of unnecessary loss of renewable electricity generation as a result of the turbine shut-down times, a control system could be installed, at the expense of United Utilities, as part of the wider turbine control system to calculate, in real time, whether shadow flicker may affect the property. This is based on surveyed details for the property and wind turbine, and the intensity of sunlight, as measured by a device attached to the turbine tower. When the control system calculates that the sunlight is bright enough to cast a shadow of appropriate size and strength, and that the turbine is orientated in such a way that shadow will fall on that property, it would then automatically shut the turbine down, re-starting it when the shadow has moved away from the property. This would prevent shadow flicker from occurring only at times when it would actually occur in practice whilst avoiding unnecessary loss of renewable electricity generation.