

11 Shadow Flicker & Reflected Light

Shadow Flicker Assessment

Background Information

- 11.1 In sunny conditions, any shadow cast by a wind turbine will mirror the movement of the rotor. When the sun is high, any shadows will be confined to the wind farm area but when the sun sinks to a lower azimuth moving shadows can be cast further afield and potentially over adjacent properties. Shadow flicker is generally not a disturbance in the open as light outdoors is reflected from all directions. The possibility of disturbance is greater for occupants of buildings when the moving shadow is cast over an open door or window; since the light source is more directional.
- 11.2 Whether shadow flicker is a disturbance depends upon the observer's distance from the turbine, the direction of the dwelling and the orientation of its windows and doors from the wind farm, the frequency of the flicker and the duration of the effect, either on any one occasion or averaged over a year.
- 11.3 In any event and irrespective of distance from the turbines, the flickering frequency will depend upon the rate of rotation and the number of blades. It has been recommended (Clarke, 1991) that the critical frequency should not be above 2.5 Hz, which for a three-bladed turbine is equivalent to a rotational speed of 50 rpm. The proposed turbines at Upper Ogmore Wind Farm would rotate at a maximum of approximately 16 rpm, well below this threshold.

Reflected Light

- 11.4 A related visual effect to shadow flicker is that of reflected light. Theoretically, should light be reflected off a rotating turbine blade onto an observer then a stroboscopic effect would be experienced. In practice a number of factors limit the severity of the phenomenon and there are no known reports of reflected light being a significant problem at wind farms.
- 11.5 A limiting factor is that wind turbines have a semi-matt surface finish which means that they do not reflect light as strongly as materials such as glass or polished vehicle bodies.
- 11.6 Secondly, due to the convex surfaces found on a turbine, light will generally be reflected in a divergent manner.
- 11.7 Thirdly, as with shadow flicker, certain weather conditions and solar positions are required before an observer would experience the phenomenon.

- 11.8 It is therefore concluded that Upper Ogmere Wind Farm will not cause a material reduction to amenity owing to reflected light.

Policy and Guidance

- 11.9 There is no guidance on shadow flicker in Welsh planning policy. However, the Update to Shadow Flicker Evidence Base (2011), published by the then Department for Energy and Climate Change (DECC), states that assessing shadow flicker effects within ten times the rotor diameter of wind turbines has been widely accepted across different European countries, and is deemed to be an appropriate area.

Methodology

- 11.10 In accordance with the aforementioned DECC report, the starting point for analysis would be performing analysis on all occupied houses within ten rotor diameters of any proposed wind turbine.
- 11.11 This shadow flicker assessment is based on turbines with a 105m rotor diameter and the planning application includes a 50m micro-siting distance for infrastructure. As such, this 50m distance is added to the ten-rotor diameter 1050m distance to give a total distance of 1100m from any turbine.
- 11.12 Analysis should be undertaken for shadow flicker at all properties within 1100m from any wind turbine.
- 11.13 There are no inhabited houses within 1100m of any of the proposed turbines.

Results

- 11.14 With due reference to the DECC report, and an allowance for 50m micro-siting, there are no inhabited houses within 1100m of any wind turbine and thus no flicker is predicted.
- 11.15 It is therefore concluded that Upper Ogmere Wind Farm will not cause a material reduction to residential amenity owing to shadow flicker.

Mitigation

- 11.16 Mitigation measures can be incorporated into the operation of the Wind Farm to reduce the instance of shadow flicker. Mitigation measures range from planting tree belts between the affected dwelling and the responsible turbine(s), installing blinds at the affected dwellings or shutting down individual turbines during periods when shadow flicker could theoretically occur.
- 11.17 As there are no properties within 1100m, mitigation is not expected to be required.

References

[1] Clarke A.D (1991), A case of shadow flicker/flushing: assessment and solution, Open University, Milton Keynes

[2] Brinckeroff, Parsons (2011) 'Update of UK Shadow Flicker Evidence Base', Department of Energy and Climate Change, UK Government