



**Foel Fach Wind Farm Limited.**

# **Foel Fach Wind Farm – Environmental Statement Volume III**

Appendix 9.14: Preliminary Report on the Visibility of Aviation  
Lights at Foel Fach

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Energy for  
generations



# Preliminary Report on the Visibility of Aviation Lights at Foel Fach

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- 1.1 Foel Fach is a proposed wind farm which will carry 4 aviation warning lights at turbine hub level. These will operate at nominal 200 candela emission in good weather, and 2000 candela when the meteorological visibility is less than 5km.
- 1.2 There are several factors that affect how visible aviation warning lights are to a distant observer. The 200 candela brightness is only seen when the lights are viewed at or slightly above the horizontal. When the lights are seen from below (negative elevation angles) the lights appear fainter. The exact decrease depends on the model of light fitted, but we might expect that for a location such as viewpoint 4 (on the edge of Y Bala), which views the lights at approximately -4 degrees, the actual brightness of the light seen is less than 20 candelas. The other major effect is simply distance. To the observer the apparent brightness they see diminishes at least as fast as  $1/\text{distance}^2$ . The other two major factors are the atmosphere, which even in clear conditions can absorb and scatter light before it reaches the observer, and the presence of any other man made lighting along the same line of sight, whether foreground such as houses, cars, streetlights, or more distant such as the scattered light from more distant urban areas. The latter can be tested using satellite data.
- 1.3 The figure shows a preliminary analysis of the night-time lighting present in the area. The most obvious effect is that when looking at Foel Fach from the west through south, there will be a distant glow that backgrounds the aviation lights. This will considerably impact people's ability to see the aviation lights simply due to the properties of night time vision in the human eye.
- 1.4 Partial weather data from Met Office automated weather stations suggest the area as whole experiences quite variable conditions. The night-time visibility in winter nights varies from median values between 8 and 18km for the three appropriate recording sites nearest to the wind farm, with a significant fraction below 5km visibility. However a large fraction of the latter records have a cloud base height

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<sup>1</sup> Dr Stuart Lumsden is an Associate Professor at the University of Leeds. He worked for the professional optical observatory based near Coonabarabran, NSW, the (then) Anglo-Australian Observatory for 6 years, and is familiar with issues related to light pollution, and the propagation of light. He has acted as an expert on such matters for wind farm developments in Scotland over the past 12 years, with particular regard recently to visible red aviation lighting for the turbines exceeding 150 m at developments across Scotland, including the public inquiries for Crystal Rig IV, and Clash Gour, and the hearing session at Scoop Hill near the Dark Sky Community at Moffat, and provided advice related to the recently consented Craiginmoddie development adjacent to the Galloway Dark Sky Park. He was a member of the Scottish Government Aviation Lighting Guidance Working Group.

below the level of the turbine lights, so they effectively will not be seen from below in such conditions (when they switch up to 2000 candela).

1.5 Even when the visibility is greater than 5km, it is still often limited. The effect this is to considerably reduce the apparent brightness of the 200 candela lights to distant observers. For example, an observer at 10km distance from the lights in 15km visibility sees only 20% of the intensity they would see if the visibility was perfect (infinite distance) due to the atmospheric attenuation alone. This highlights the importance of considering the effect of the atmosphere rather than just the candela emitted in the direction of the observer.

1.6 Many of the viewpoints which see the lights near their brightest horizontal emission are actually peaks in the National Park, perhaps with relatively few visitors at night (eg viewpoints 7 and 12). A more typical elevated location where viewers will be present at night is viewpoint 9, which will see the lights at source below 100 candela. Provisional modelling of the atmospheric attenuation present suggests that the lights will appear about as bright as a bright star from that location, albeit red in colour rather than the typical white of stars. Similar brightness is expected for several of the nearer (accessible) viewpoints, but probably no brighter than this.

1.7 Further analysis will be required to estimate the effect of the lights on all viewpoints, and for typical weather conditions, but on this preliminary analysis it can be concluded that where night-time viewers are likely to be present, the lights will appear no brighter than the brightest stars

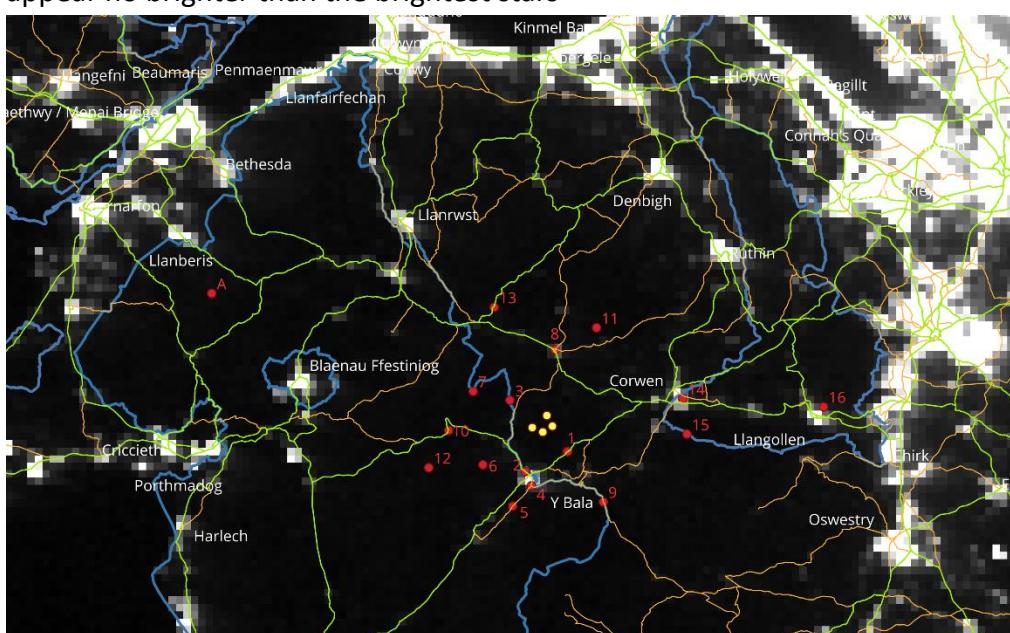


Figure 1: Night-time satellite image of the region around Foel Fach. The 4 lit turbines are indicated by yellow dots, the viewpoints by red dots, and major and minor roads highlighted in green. The boundaries of the National Park and the AONB are shown in blue. Anyone viewing Foel Fach whilst looking towards the built up areas around Merseyside, or even the north coast of Wales, will see the light pollution from those areas along the horizon as well unless well shielded (ie valley bottoms).