



WIND BUSINESS SUPPORT



Version 1
31/01/2023
Author: Ian Fletcher

BEN AKETIL WIND FARM

AVIATION LIGHTING

DESIGN AND CONSULTATION

STUDY REPORT



COMMERCIAL-IN-CONFIDENCE

INTRODUCTION

It is proposed to repower and extend the existing Ben Aketil wind farm on the Isle of Skye, details below. The proposed development was the subject of a scoping submission, ECU reference ECU00004552, with a full planning application anticipated later this year; submitted by Falck Renewables Wind Limited.

An important aspect of the design is the aviation obstruction lighting; both in terms of air safety and of visual impacts. The purpose of this document is to provide information on the proposed development and of the proposed aviation lighting scheme, in order to get feedback from key aviation stakeholders and airspace users. The feedback will be used to amend the lighting design as needed.

Having collected the views of the stakeholders and reviewed the lighting design, a final scheme will be lodged with the UK CAA for their approval, along with all the feedback provided through this consultation process.

Please consider this document as confidential ahead of the full application for consent.

THE PROPOSED WIND FARM

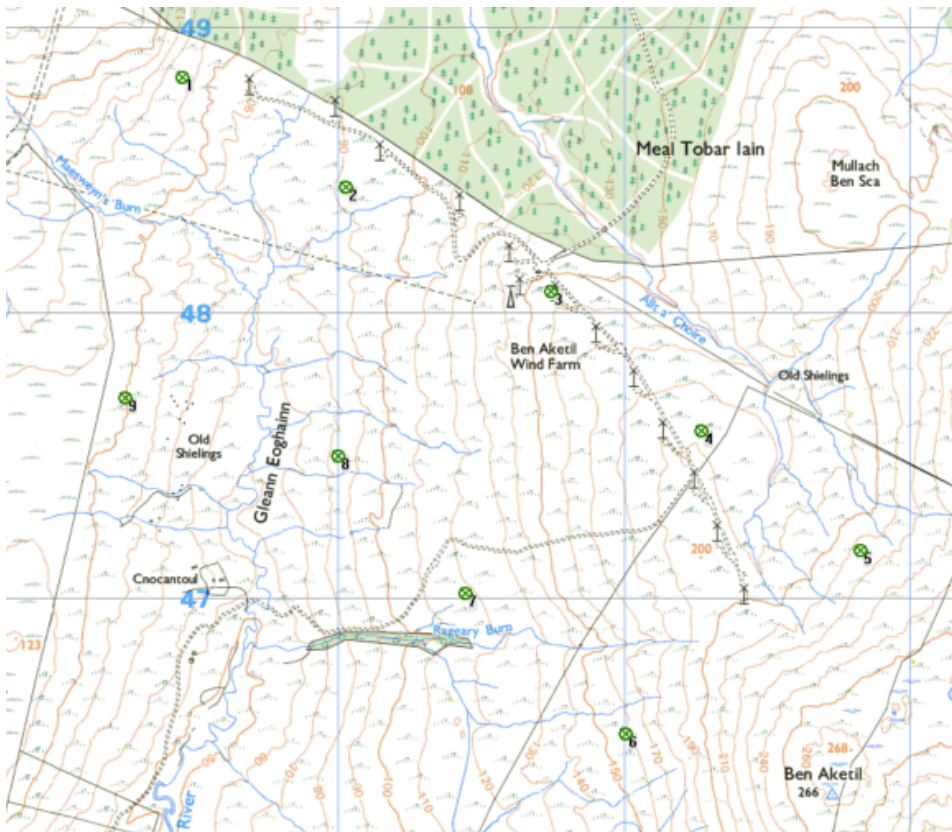
The submission will be for a development comprising 9 turbines, with a tip height of 200m.

The candidate turbines are Siemens Gamesa 6.6-170; details below.

Turbine tip height 200m (worst case), hub height 122.5m, rotor diameter 140-155m

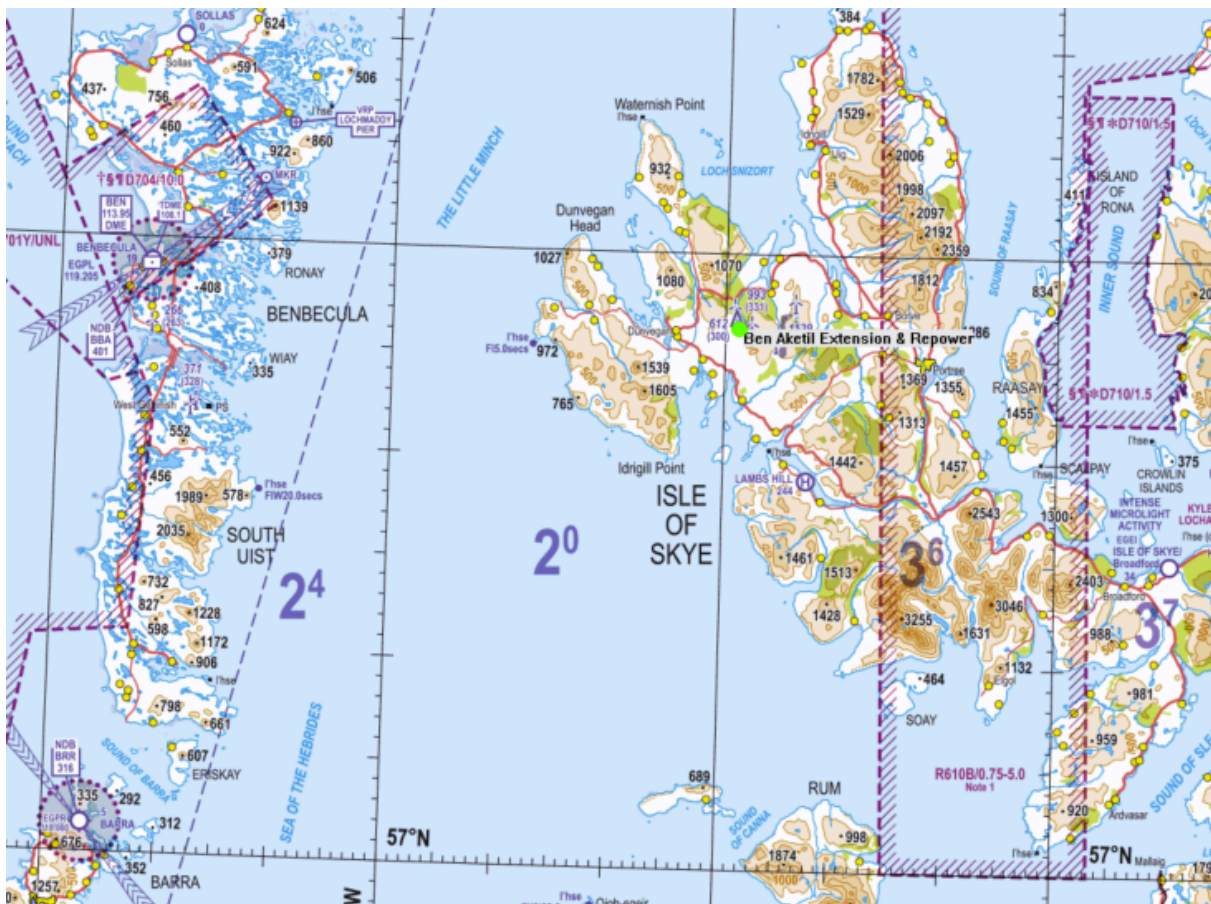
No.	Easting	Northing	NGR	Base Elevation m	Tip Height m	Tip Elevation m AOD	Tip Elevation ft AOD
1	130451	848831	NG 30451 48831	108	200	308	1011
2	131024	848443	NG 31024 48443	91	200	291	955
3	131745	848078	NG 31745 48078	154	200	354	1161
4	132269	847589	NG 32269 47589	184	200	384	1260
5	132826	847171	NG 32826 47171	214	200	414	1358
6	132005	846528	NG 32005 46528	162	200	362	1188
7	131443	847020	NG 31443 47020	118	200	318	1043
8	130999	847503	NG 30999 47503	84	200	284	932
9	130253	847705	NG 30253 47705	97	200	297	974





Turbine location OS 1:25,000; © Crown copyright. All rights reserved. License number 100040585

The map above shows both the locations of the proposed turbines as green circles and the existing turbines to be removed.



Site location on CAA 1:500,000 Aviation chart

LEGISLATION AND GUIDANCE

LEGISLATION

The treatment of land-based obstacles to air navigation is covered by existing legislation. Obstacles located close to licensed aerodromes are covered under Section 47 of the Civil Aviation Act 1982. Government aerodromes are similarly covered under the Town & Country Planning Act (General Permitted Development) Order 2000. Article 219 of the ANO 2009 details the requirement for the lighting of land-based tall structures located outside of the safeguarded areas of licensed and government aerodromes.

Onshore Obstacle Lighting Requirement ICAO regulations (Annex 14 Chapter 6) and article 219 of the ANO 2009 require that structures away from the immediate vicinity of an aerodrome, which have a height of 150 m (492 ft) or more AGL are:

1. Fitted with medium intensity steady red lights* positioned as close as possible to the top of the obstacle, and also equally spaced at intermediate levels, so far as practicable, between the top lights and ground level with an interval not exceeding 52 m;
2. Illuminated at night, visible in all directions and any lighting failure is rectified as soon as is reasonably practicable;

* 'Medium intensity steady red light' means a light that complies with the characteristics described for a medium intensity type C light as specified in Volume 1 (Aerodrome Design and Operations) of Annex 14 (Third edition November 1999) to the Chicago Convention.

POLICY

The CAA issued a Policy Statement in June 2017 called "Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level".

This policy statement highlights and clarifies the requirements set out in the Air Navigation Order, for the lighting of onshore turbines.

Lights should be operated by an acceptable control device (e.g., photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX. The control device should turn the lights off when the illuminance rises to a level of 500 LUX or more.

If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.

In practice the CAA considers every proposed development on a case by case basis, taking into account the specific environment, including the existing developments and lighting as well as the benefits of reduced lighting schemes where light pollution is an issue. Where supported by appropriate studies and consultations the CAA may agree to a variation to the lighting requirements specified in the ANO, under provisions given in the Air Navigation Order (ANO) Article 222 section 6.

GUIDANCE

In respect of an Aircraft Detection Lighting System, the Department for Transport published guidance on 26 October 2021 stating that "the Department for Transport and the Civil Aviation Authority will convene a task force...to develop and publish electronic conspicuity (EC) specifications to enable interoperability between airspace users. The adoption of EC specifications will not be mandated UK-wide. However, compliance with the established EC specifications will be required in mandatory airspace to ensure interoperability between airspace users." While you note that the most promising direction for ADLS is a system that exploits electronic conspicuity as a



means to trigger obstacle lighting, we are aware of certain developers who are keen to use ADLS with active detection from the ground as well as the need to better understand aviation operations and equipage levels at night in the airspace over the Scottish mainland. We will consider what additional activity is required for this and keep the wind industry advised accordingly.

<https://www.gov.uk/government/publications/electronic-conspicuity-specifications/electronic-conspicuity-specifications-enabling-interoperability-between-airspace-users>

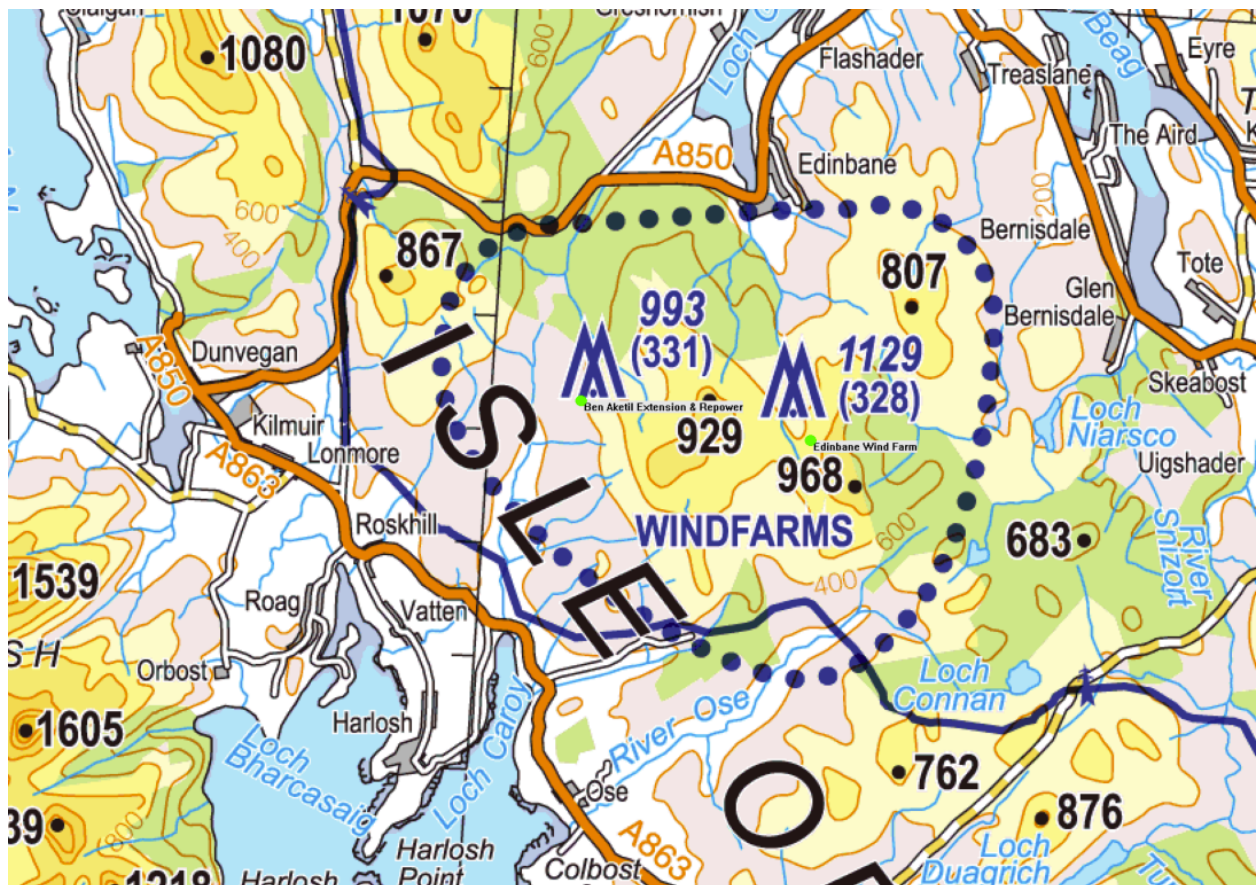
DESIGN CONSIDERATIONS

AIRSPACE ENVIRONMENT

The site lies underneath class G airspace, distant from lower airspace ATS routes. It is remote from aerodromes, with the nearest commercial airport over 50km to the west at Benbecula. There is an unlicensed aerodrome on Skye itself, over 40km to the south-west of the site. Primary routing for commercial flights to Benbecula and Lewis, connecting with the Scottish Terminal Area and northern Scotland, are via the class E routes L602 and Y906 respectively. This vectors aircraft away from the site.

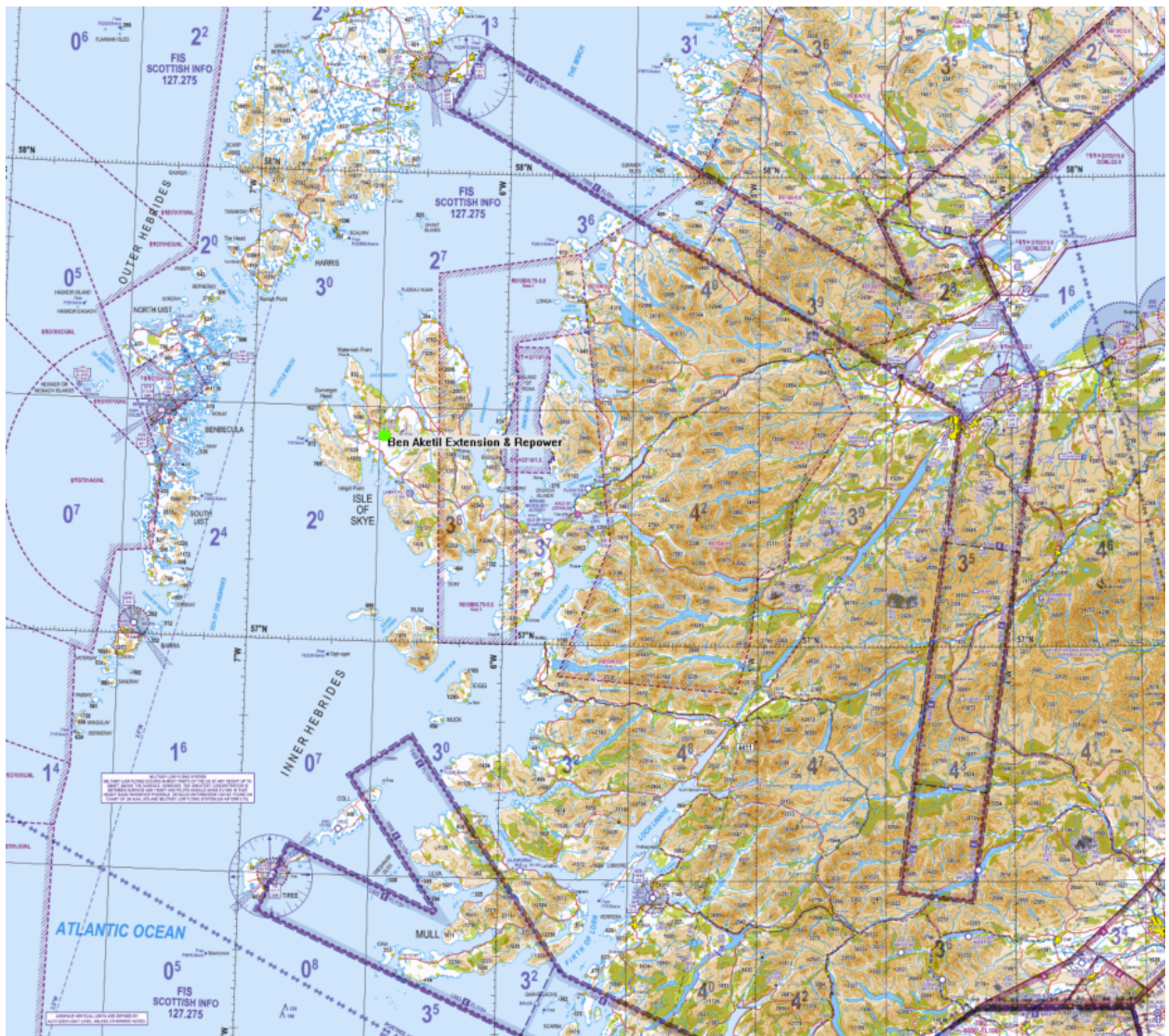
There will be some GA traffic, unlikely to operate in conditions of low light or poor visibility. Police, ambulance and Search and Rescue helicopters will occasionally operate in the area.

The site is located 11.4km (6.1nm) west of the edge of the Highlands Restricted Area R610B; which was established in the interests of flight safety to enable military pilots to train at low-level in all weather conditions including Instrument Meteorological Conditions (IMC).



Local area on CAA VFR 1:25,000 chart

The most elevated turbine tip is 1358ft for T5, significantly more elevation than all current obstacles.

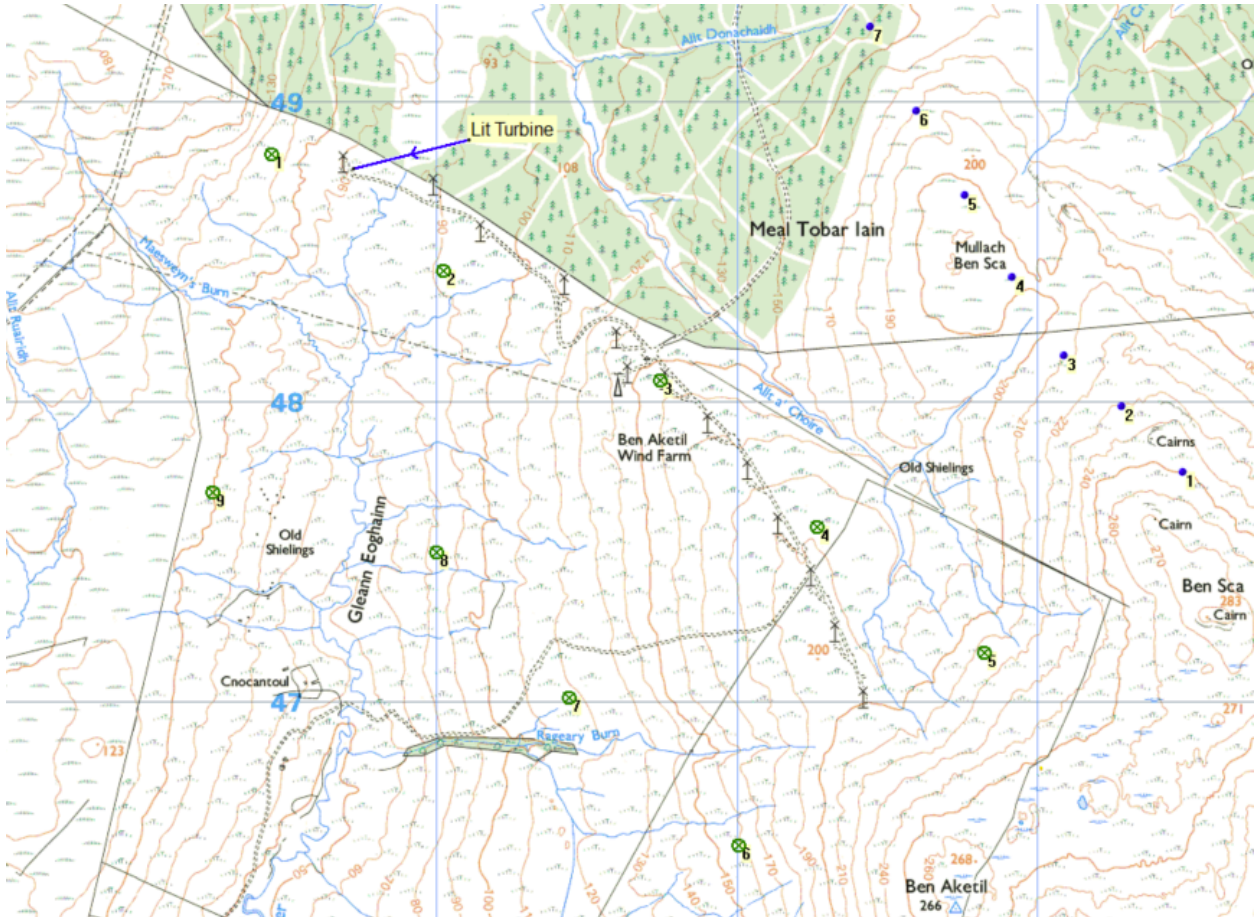


Site location in wider area, shown on CAA 1:500,000 VFR chart

LIGHTING ENVIRONMENT

One of the operational Ben Aketil turbines has a visible spectrum aviation obstacle light.

Turbine 11, the least elevated turbine, is fitted with a an MB20 W red light, with intensity settings of 20cd/60cd/130cd/170cd. This turbine will be removed. The most elevated turbine of the operational wind farm is the farthest south.



Turbine locations on OS 1:25,000; © Crown copyright. All rights reserved. License number 100040585

The map above shows the lit operational turbine, the proposed repowering and extension turbines as green circles and the consented Ben Sca turbines as blue dots. The Ben Sca turbines have a tip height of 135m and are unlit. The most elevated tip on the Ben Sca development will be on T1 at 385m or 1263ft.

The site is remote from major light sources.

LIGHT POLLUTION / DARK SKIES

The area has no major conurbations and the background light levels will be very low.

The Highland Council provided the following 'pre-application advice for major developments' on the topic of Aviation Lighting.

Turbines of a height of 150m or greater currently require aviation lighting. Any lighting strategy for the site must be prepared in agreement with CAA/HIAL. Turbine lighting at this location would be of concern and require careful assessment of likely effects and consideration should therefore be given to limiting light pollution associated with the development. If visible aviation lighting is proposed, an assessment of its impact on the nightscape must be submitted at the application submission stage, including hours of darkness - noting that these hours will include not only night-time but also some periods when receptors may still be going about their daytime activities. Your assessment should include visualisations at a range of viewpoints to be agreed with the Council and NatureScot.

NatureScot would encourage the applicant to explore all available forms of lighting mitigation and, in particular, to seriously consider the potential for proximity activated lighting. It is our understanding that this proximity activated lighting technology could potentially be a very effective solution to lighting related impacts and would likely mean that turbines lights would be switched off for over 98% of the time. Discussion of case-specific permissibility issues for proximity activated lighting should be taken forward with the Civil Aviation Authority (CAA) (contact Andy.Wells@caa.co.uk). NatureScot would welcome further discussion on the scope of the lighting assessment methodology with the applicant.

LIGHTING REQUIREMENT

The turbines proposed have ground to tip heights of up to 200m. Because they are over 150m tall, there is a statutory requirement for en-route aeronautical obstacle lighting, under the Air Navigation Order (ANO) Article 219 .

MOD requirement

In the DIO scoping response dated 08 September 22, their reference DIO10055997, the MOD requested that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction.

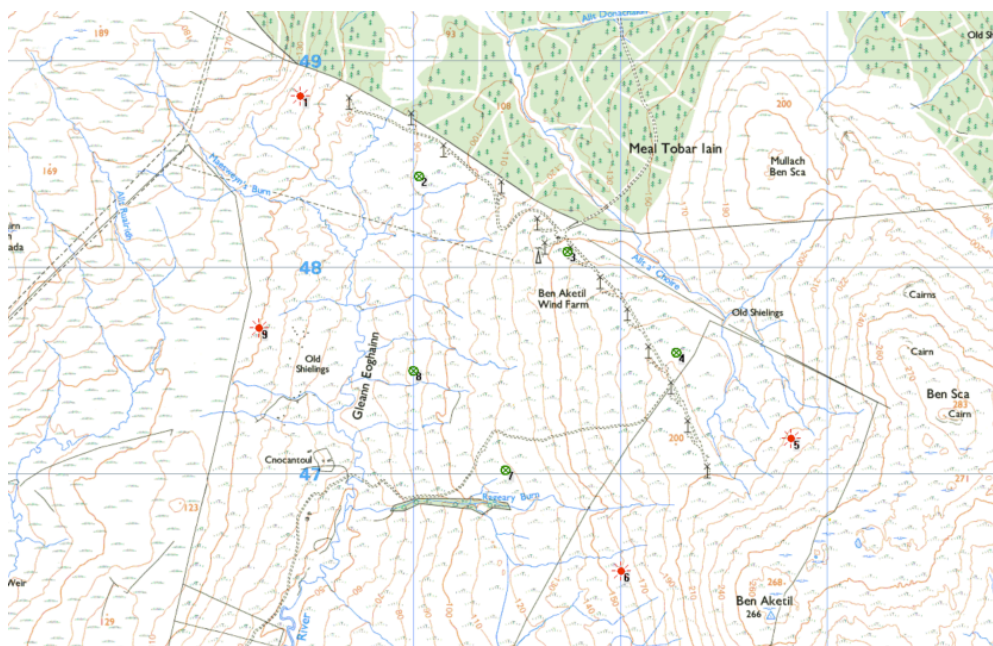
As a minimum the MOD would require that the development be fitted with MOD accredited aviation safety lighting in accordance with the Air Navigation Order 2016.

THE PROPOSED LIGHTING SCHEME

There is a statutory requirement to light the wind farm because the turbines are over 150m tall. However, because of the nature of the area, light pollution from aviation obstacle lighting is of concern. In balancing these two requirements it is considered appropriate to use a reduced lighting scheme, with not all turbines being lit. This can be acceptable where the night time use of the airspace is only very rarely low flying VFR (Visual Flight Rules) traffic with no NVGs (Night Vision Goggles).

In consideration of the combination of the legislation and the local design considerations, it is proposed to use a cardinal lighting scheme. This requires visible spectrum obstacle lights on the turbines that define the geographical footprint of the wind farm.

In this case, the proposal is for 4 turbines to have nacelle mounted, medium intensity, visible spectrum, steady red obstacle lights, specifically turbines 1, 5, 6 and 9; illustrated on the map below. The lights to operate from dusk until dawn. This will include the most elevated turbine, i.e. the turbine having the most elevated turbine tip, T5.



Proposed Lit Turbines – 1,5,6,9

EXPLANATORY NOTES

Turbine 5 has the most elevated tip and hence should be lit.

Turbines 1, 5, 6 and 9 define the principal corners.

All remaining turbines are within the rectangle defined by the corner turbines identified above.

Turbines listed in decreasing tip elevation order

T_NO	Base elevation m	Blade Tip Height m	Tip Elevation m	Tip Elevation ft
5	214	200	414	1358
4	184	200	384	1260
6	162	200	362	1188
3	154	200	354	1161
7	118	200	318	1043
1	108	200	308	1011
9	97	200	297	974
2	91	200	291	955
8	84	200	284	932

The turbines with red text are proposed to be lit.

LIGHTING SPECIFICATION

Visible spectrum obstacle lighting must consist of one medium intensity (2000 candela) steady red light, mounted on the top of the nacelle, and a second alternative 2000 candela red light provided in case of failure of the operating light. No intermediate level lights to be fitted on the turbine towers.

Visible lights can be dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5km in all directions.

Summary of lighting specification:

- Medium intensity steady red (2000 candela) lights on the nacelles of turbines 1, 5, 6 and 9 (4 in total);
- a second 2000 candela light on the nacelles of the above turbines to act as alternatives in the event of a failure of the main light;
- the lights on these turbines to be capable of being dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5km;

Note on ADLS

The UK CAA, together with the UK Wind Sector is exploring the future use of Aircraft Detection Lighting Systems (ADLS). The most promising direction widely considered to be a system that exploits electronic conspicuity as a means to trigger obstacle lighting. Such systems are unable to be used within the current regulatory environment, with changes offering the potential alongside UK airspace modernisation. Whilst this proposal is unable to specify ADLS within the coming submission, the time-scale to implementation may allow for the use of ADLS and this would be welcomed. The lighting scheme must have CAA approval prior to implementation.



CONSULTATIONS

The following consultees are considered to be relevant to this location.

Consultee	Reason
Highlands and Islands Airports Limited (HIAL)	As the owners and operators of Benbecula Airport and with knowledge of night time VFR airspace activity
MOD	As potential operators in the area; Low Flying Area 14, an area within which fixed wing aircraft may operate as low as 250 feet above ground level to conduct low level flight training.
Police Scotland	Use of helicopters, flying low on visual flight rules
Scottish Air Ambulance	Use of helicopters, flying low on visual flight rules

Following feedback from the above consultees, the lighting design will be reviewed. The design evolution and a final design will be proposed to the CAA for their consideration and approval. The views expressed by the consultees will be shared with the CAA.

CONSULTEE RESPONSES

The following tables lists the consultees and their responses to the proposed lighting scheme. The full responses are included as an appendix.

Note that this 'Aviation Lighting Design and Consultation' document, was presented to the aviation consultees in eliciting their responses. The only sections added are those of this section 'Consultee Responses' and below. These sections being added after the responses were received, in order to present a complete study to the CAA for their consideration.

Consultee	Response
MOD	No response to lighting consultation. The scoping response stated "As a minimum the MOD would require that the development be fitted with MOD accredited aviation safety lighting in accordance with the Air Navigation Order 2016."
Police Scotland	I have no concerns and don't envisage any impact to Babcock police operations.
Scottish Air Ambulance	The proposal to use a visible spectrum cardinal lighting scheme, with all of the turbines falling within this area, as well as the most elevated turbine being lit, would be acceptable from a Babcock air ambulance perspective.
HIAL	I can confirm that we approve Ben Aketil's Aviation Obstruction Lighting plan.

DESIGN AMENDMENTS AS A RESULT OF CONSULTEE FEEDBACK

No amendments are required.

It is proposed to use a timer to trigger the night time lighting, rather than a flux meter.

The switching on and off of lights would be controlled by a timer 30 minutes before sunset until 30 minutes after sunrise, and not by photocells or similar that respond to particular light levels, thereby not incurring effects in the daytime.



APPENDIX A – CONSULTEE RESPONSES



SAS

From: Winn, Peter [mailto:Peter.Winn@babcockinternational.com]
Sent: 10 January 2023 16:06
To: Ian Fletcher
Cc: Young, Dave; Thomson, Nigel
Subject: Re: CAUTION: External email - FW: Ben Aketil Aviation Obstruction Lighting Consultation

Afternoon Ian,

I hope you're well?

You're right I have taken over from Adam as Babcock managing pilot for Scotland for the Scottish Charity Air Ambulance contract. I'll only be able to comment on acceptability for our operations and not SAS as a whole. The aircraft we operate on this contract do not use NVIS or conduct ad hoc night operations to ground level. Gama also provide helicopters in support of Scottish Ambulance Service which do use NVIS and do undertake night operations down to ground level, so they should also be informed.

Dave Young will still need to be informed and consulted on any windfarm lighting changes as he represents the Scottish Police aviation interests, which do operate at low level at night using NVIS.

With regards to the Skye, Ben Aketil Obstruction Lighting consultation.

The proposal to use a visible spectrum cardinal lighting scheme, with all of the turbines falling within this area, as well as the most elevated turbine being lit, **would be acceptable** from a Babcock air ambulance perspective.

Kindest regards

Pete

Peter Winn BSc | Pilot : Aberdeen
UK Aviation | Aviation
Babcock International Group
Farburn Terrace | Aberdeen Airport East | Dyce | Aberdeen | AB21 7DT
Tel: +447855 124 896 | Peter.Winn@babcockinternational.com
www.babcockinternational.com

SCOTTISH POLICE

From: Young, Dave [mailto:Dave.Young@babcockinternational.com]
Sent: 12 January 2023 11:25
To: Ian Fletcher; Winn, Peter
Cc: Thomson, Nigel
Subject: Re: CAUTION: External email - Ben Aketil Aviation Obstruction Lighting Consultation

Hello Ian,

Thanks for taking the time to consult with us regarding the potential impact to our operations.

I have no concerns and don't envisage any impact to Babcock police operations.

Adam has now retired and his successor is Capt. Pete Winn who will be looking after our HEMS/ Air Ambulance operations from now on. I have cc'd Pete in to this reply for his consideration and comment. Nigel Thomson cc'd in for visibility as Chief Pilot for Babcock Onshore.

If I can be of any more help in the future, please don't hesitate to contact me.

Kind regards,

Dave

Dave Young FRAeS
Unit Chief Pilot Police Scotland
UK Aviation | Aviation
Babcock International Group
Babcock Onshore | Clyde Heliport | 16 Linthouse Road | Govan | Glasgow | G51 4BZ
Telephone: 0141 226 4261 | Mobile: 07903 689858
Dave.Young@babcockinternational.com
www.babcockinternational.com



MOD – SCOPING RESPONSE**Physical Obstruction**

In this case the development falls within Low Flying Area 14, an area within which fixed wing aircraft may operate as low as 250 feet or 76.2 metres above ground level to conduct low level flight training. The addition of turbines in this location has the potential to introduce a physical obstruction to low flying aircraft operating in the area.

To address this impact, and given the location and scale of the development, the MOD require conditions are added to any consent issued requiring that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction. Suggested condition wordings are set out in Appendix A.

As a minimum the MOD would require that the development be fitted with MOD accredited aviation safety lighting in accordance with the Air Navigation Order 2016.

Summary

Subject to the two conditions requested above and provided in Appendix A, the MOD has no objections to the development.

The MOD must emphasise that the advice provided within this letter is in response to the information detailed above in the document titled consultation dated August 2022. Any variation of the parameters (which include the location, dimensions, form, and finishing materials) detailed may significantly alter how the development relates to MOD safeguarding requirements and cause adverse impacts to safeguarded defence assets or capabilities. In the event that any amendment, whether considered material or not by the determining authority, is submitted for approval, the MOD should be consulted and provided with adequate time to carry out assessments and provide a formal response.

I hope this adequately explains our position on the matter. If you require further information or would like to discuss this matter further, please do not hesitate to contact me.

Further information about the effects of wind turbines on MOD interests can be obtained from the following websites:

MOD: <https://www.gov.uk/government/publications/wind-farms-ministry-of-defence-safeguarding>

Yours sincerely,

Jill Roberts



DIO Safeguarding

Condition - Aviation Lighting

Prior to commencing construction of any wind turbine generators, or deploying any construction equipment or temporal structure(s) 50 metres or more in height (above ground level) the undertaker must submit an aviation lighting scheme for the approval of the Scottish Government Energy Consent Unit in conjunction with the Ministry of Defence defining how the development will be lit throughout its life to maintain civil and military aviation safety requirements as determined necessary for aviation safety by the Ministry of Defence.

This should set out:

- a) details of any construction equipment and temporal structures with a total height of 50 metres or greater (above ground level) that will be deployed during the construction of wind turbine generators and details of any aviation warning lighting that they will be fitted with; and
- b) the locations and heights of all wind turbine generators and any anemometry mast featured in the development identifying those that will be fitted with aviation warning lighting identifying the position of the lights on the wind turbine generators; the type(s) of lights that will be fitted and the performance specification(s) of the lighting type(s) to be used.

Thereafter, the undertaker must exhibit such lights as detailed in the approved aviation lighting scheme. The lighting installed will remain operational for the lifetime of the development.

Reason for condition.

To maintain aviation safety.

HIAL

From: Safeguarding [mailto:Safeguarding@hial.co.uk]
Sent: 12 January 2023 16:00
To: Ian Fletcher
Subject: RE: Ben Aketil Aviation Obstruction Lightign Consultation

Hi Ian,

Thank you for sending this through. I can confirm that we approve Ben Aketil's Aviation Obstruction Lighting plan.

Kind regards,

Nyree

Nyree Millar-Bell

Aerodrome Safeguarding and Operational Support Officer
Highlands and Islands Airports Limited

✉ NBell@hial.co.uk 🌐 Visit our Website at www.hial.co.uk





Defence Infrastructure Organisation

Kaye Noble
Safeguarding Manager
Ministry of Defence
Safeguarding Department
St George's House
DIO Headquarters
DMS Whittington
Lichfield
Staffordshire
WS14 9PY

Telephone [MOD]: 07815487744

E-mail: Kaye.noble106@mod.gov.uk

Your Reference:

Our Reference: DIO 10055997

Ian Fletcher
Wind Business Support
Odstone
Westcot Lane
Wantage
OX12 9PZ

By email only

02 March 2023

Dear Ian,

Application reference:

Site Name:

Proposal:

Site address:

Thank you for consulting the Ministry of Defence (MOD) in relation to the Lighting Proposal through your communication dated 10th January 2023.

The Defence Infrastructure Organisation (DIO) Safeguarding Team represents the MOD as a consultee in UK planning and energy consenting systems to ensure that development does not compromise or degrade the operation of defence sites such as aerodromes, explosives storage sites, air weapon ranges, and technical sites or training resources such as the Military Low Flying System.

I am writing to advise you that the MOD has concerns with the proposal.

The proposal concerns a development of 9 turbines with maximum blade tip heights of 200.00 metres above ground level. The proposed development has been assessed using the location data (Grid References) below provided in the document "Aviation Lighting" dated 3rd January 2023.

Turbine no.	Easting	Northing
1	130451	848831
2	131024	848443
3	131745	848078
4	132269	847589
5	132826	847171

6	132005	846528
7	131443	847020
8	130999	847503
9	130253	847705

The principal safeguarding concerns of the MOD with respect to this development of wind turbines relates to their potential to create a physical obstruction to air traffic movements.

Physical Obstruction

In this case the development falls within Low Flying Area 14 (LFA 14), an area within which fixed wing aircraft may operate as low as 250 feet or 76.2 metres above ground level to conduct low level flight training. The addition of turbines in this location has the potential to introduce a physical obstruction to low flying aircraft operating in the area.

To address the impact up on low flying given the location and scale of the development, the MOD would require that conditions are added to any consent issued requiring that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction.

The MOD acknowledge engagement held with the developer's aviation consultant and can confirm that the lighting proposal submitted for review has been deemed acceptable. It is noted that this lighting brief submitted for review only provides details of lighting for the completed development and does not cover construction equipment and temporal structures.

Summary

The MOD has concerns with this development of wind turbines due to their potential to create a physical obstruction to air traffic movements.

The MOD must emphasise that the advice provided within this letter is in response to the data and information detailed in the developer's document titled "Aviation Lighting Design and Consultation" dated 3rd January 2023. Any variation of the parameters (which include the location, dimensions, form, and finishing materials) detailed may significantly alter how the development relates to MOD safeguarding requirements and cause adverse impacts to safeguarded defence assets or capabilities. In the event that any amendment, whether considered material or not by the determining authority, is submitted for approval, the MOD should be consulted and provided with adequate time to carry out assessments and provide a formal response.

I hope this adequately explains our position on the matter. If you require further information or would like to discuss this matter further, please do not hesitate to contact me.

Further information about the effects of wind turbines on MOD interests can be obtained from the following websites:

MOD: <https://www.gov.uk/government/publications/wind-farms-ministry-of-defence-safeguarding>

Yours sincerely

K Noble

Kaye Noble

Assistant Safeguarding Manager
DIO Safeguarding