Inch Cape Offshore Wind Farm

New Energy for Scotland

Offshore Environmental Statement:

VOLUME 2H

Appendix 20B: Aviation and Lighting Requirements

REPSOL edp renewables

Osprey
Consulting Services Ltd

Appendix 20B Aviation Lighting Requirements

Ref: 7449/003 Issue 1

Date: 15th May 2013

Osprey Consulting Services Ltd, The Forge, Bentley Business Park, Bentley, Hampshire. GU10 5HY

Tel: 01420 520200 Fax: 01420 520649 Email: enquiries@ospreycsl.co.uk

Document Details

Document Title	Appendix 20B Aviation Lighting Requirements
Document Ref	7449/003
Issue	Issue 1
Date	15th May 2013

Amendment Record

Issue	Amendment	Date
Draft A	Document Creation	7th September 2012
Issue 1	Final Document	15th May 2013

Approvals

Approval Level	Authority	Name	Signature
Author	Osprey CSL	Stewart Heald	
Internal Approval	Osprey CSL	R A Hinchcliffe	
Client 1 Approval	Repsol	Esther Villoria	
Client 2 Approval	Repsol	Clare Lavelle	

MANAGEMENT SUMMARY

Inch Cape Offshore Limited (ICOL) are developing a Wind Farm and associated Offshore Transmission Works (OfTW). The project location can be seen in figure 7.1 and for assessment purposes is considered as two discrete locations, the Development Area and the Offshore Export Cable Corridor. A description of the Project can be found in Chapter 7: Description of Development.

This report considers the aviation stakeholders, their operational and legal requirements, associated regulatory policy and guidance in order to identify potential lighting scheme solutions for the operational phase of the Wind Farm. The detailed scheme will be agreed in consultation with the Civil Aviation Authority (CAA) prior to construction.

A scheme covering the construction phase will be agreed separately once the construction plan is finalised. This is discussed briefly later in the report.

The principles discussed for construction also apply to decommissioning, and will be considered at the appropriate time.

The lighting requirement of the Project was considered against the following stakeholders:

- MOD - The MOD have requested low intensity red lights to WTGs in the Development Area.
- CAA – The CAA will be required to approve the aviation lighting scheme prior to construction and will consider guidance from MOD, National Air Traffic Services (NATS) and the maritime community.
- NATS – NATS is responsible for the safeguarding of its infrastructure, ensuring system integrity and performance in the provision of the air traffic service (ATS). No safeguarding objection was received from NATS concerning the Wind Farm. As such it is unlikely that they will provide any specific comments regarding the Project lighting scheme.
- Search and Rescue (SAR) - SAR flying units are important stakeholders as the requirement to demonstrate an effective and safe capability to mount airborne rescue from within an offshore wind farm has been recognised. Associated trials have been conducted and much of the guidance published is incorporated in this report. The MOD, CAA and Maritime Coastguard Agency (MCA) will want to ensure that SAR interests are accommodated.

Shipping and Navigation interests are currently in consultation with the offshore wind industry and aviation stakeholders regarding WTG aviation lighting. There are concerns that the mandated steady red aviation light, when displayed below the horizontal plane, could be mistaken for maritime lighting (e.g. the port light on a vessel). This could present a risk to maritime surface vessels. Consultation is on-going to find a solution to address the concerns of maritime users. However the CAA policy statement (November 2012) [Reference 1] advises developers to adhere to Article 220 [Part 28] (CAP 393, 2012 [Reference 2]).

TABLE OF CONTENTS

20B.1 INTRODUCTION

20B.1.1 General

Inch Cape Offshore Limited (ICOL) are developing the Inch Cape Offshore Wind Farm and associated Offshore Transmission Works (OfTW). The Project Development Area can be seen in figure 7.1 and for assessment purposes is considered as two discrete locations, the Development Area and the Offshore Export Cable Corridor. A description of the Project can be found in Chapter 7: Description of Development.

This report considers the aviation stakeholders, their operational and legal requirements, associated regulatory policy and guidance in order to identify potential lighting scheme solutions for the operational phase of the Wind Farm. The detailed scheme will be agreed in consultation with the Civil Aviation Authority (CAA) prior to construction.

A scheme covering the construction phase will be agreed separately once the construction plan is finalised. This is discussed briefly later in the report.

The principles discussed for construction also apply to decommissioning, and will be considered at the appropriate time.

20B.1.2 Background

Guidance for aviation marking and lighting requirements is found in the following publications:

- Civil Aviation Publication (CAP) 764 CAA Policy and Guidelines on Wind Turbines [Reference 3];
- Article 220 of the Air Navigation Order (ANO, CAP 393) 2012 – amendment 1/2012 [Reference 2];
- Maritime and Coastguard Agency (MCA) Marine Guidance Note MGN 371;
- MCA Marine Guidance Note MGN 372;
- CAA Policy Statement: Guidance on actions in the event of the failure of aviation warning lights, 27 April 2012 [Reference 4];
- DAP Policy Statement: The Lighting and Marking of Wind Turbine Generators and Meteorological Masts in United Kingdom Territorial Waters, dated 22 November 2012 [Reference 1]; and
- CAP 437 Standards for Offshore Helicopter Landing Areas [Reference 5].

Government Legislation [Reference 2] requires that offshore Wind Turbines Generators (WTGs) 60 metres (m) or more above the level of the sea at the Highest Astronomical Tide (HAT) are fitted with Aviation Warning Lights. This is to assist the identification of a wind farm as a potentially hazardous area to low flying aircraft, and hence enable aircraft commanders to take early avoiding action if necessary. Normally these would be steady red lights; however, recent experience with some large offshore wind farms has raised concerns from the maritime community regarding the potential for confusion with marine lights.

RenewableUK have stated in a recent aviation update [Reference 6] that a change to the characteristics of Aviation Warning Lighting on offshore WTGs has been tested. This change was to minimise confusion between marine and aviation lights and, following assessment, marine and aviation stakeholders agreed that the new characteristic was satisfactory. The CAA have issued an update to their policy statement on the lighting of offshore WTGs to state that; if a developer can make a case, that is likely to receive CAA approval for the use of a flashing red Morse Code letter 'W' to resolve potential issues for the maritime community. The lighting characteristics are laid down in CAP 393, the ANO [Reference 2] and further clarified in CAA Policy and will be taken into account during the consenting and design phases of the Wind Farm.

The MOD commonly requests the use of infrared (IR) lights for onshore wind farms (although not usually in addition to medium intensity red lights). MOD has produced a specification for such lights: MOD reference WITT/605/LFOPS, MOD Specification for IR and Low Intensity Red Vertical Obstruction Lighting, dated 17 December 2010 [Reference 7]. It is not anticipated that infrared lighting will be required for the Project as the MOD have not made any requests in their responses to ICOL when stating their lighting requirements [Reference 8].

20B.2 WIND TURBINE MARKING

20B.2.1 Overview

Legislation [Reference 2] requires the fitting of obstacle lighting, primarily for night time use, on offshore WTGs with a height of 60 m or more above HAT. Whilst Article 220 of ANO (2009) [Part 28] refers, CAA CAP 764 *CAA Policy and Guidelines on Wind Turbines* [Reference 3] states that offshore WTGs of 60 m and higher are required to be fitted with aviation obstruction lighting as follows:

- Where four or more WTG are located together in the same group, with the permission of the CAA only those on the periphery of the group need to be fitted with medium intensity obstruction lighting; and
- For WTGs that are lit with medium intensity lighting at least one steady red light must be positioned as close as possible to the top of the fixed structure; and
- The downward spread of light is restricted as far as possible to minimise any potential confusion with maritime lighting whilst maintaining flight safety.

Shipping and Navigation interests are currently in consultation with the offshore wind industry and aviation stakeholders regarding WTG aviation lighting. There are concerns that the mandated steady red aviation light, when displayed below the horizontal plane, could be mistaken for maritime lighting (e.g. the port light on a vessel). This could present a risk to maritime surface vessels. CAA policy statement (November 2012) [Reference 1] advises developers to adhere to Article 220 [Part 28] (CAP 393, 2012 [Reference 2]). Furthermore, Reference 1 states that work has been undertaken to develop an aviation warning lighting standard where, from the nature of the lighting, it will be apparent to mariners that the aviation lighting is clearly distinguishable from maritime lighting. Where it is evident that the default aviation lighting standard detailed in Article 220 [Reference 2] may generate issues for the maritime community a developer can make a case, that is likely to receive CAA approval, for the use of a flashing red Morse Code Letter 'W' to resolve potential issues to the maritime community. If flashing lighting is deemed appropriate, the flash sequence on each WTG within the same wind farm development would be required to be synchronised (i.e. all lights flashing at the same time).

20B.2.2 Helicopter Winching Operations

CAP 437 *Standards for Offshore Helicopter Landing Areas* [Reference 5] provides guidance on lighting requirements for helicopter winching operations onto offshore WTGs.

The requirements consist of 16 – 60 candela steady green lights to indicate to a pilot when it is safe to operate, that the WTG nacelle and rotor are locked in a safe position.

For SAR operations, the MCA advise that provided that the WTGs are lit in accordance with Article 220 [Part 28] (CAP 393, 2012 [Reference 2]) or with winch lighting, then there is no additional lighting requirement. However, the MCA has requested that "all lights should be under the control of the wind farm control

centre or, out of hours, a person who has rapid access to control of the wind farm lighting and WTG so that they can be switched off/on as required by the emergency situation" [Reference 1].

20B.2.3 Military Low Flying

MOD have concerns with regard to military low flying which is conducted at heights that directly conflict with WTGs. Although outside of the UK Low Flying System (UKLFS), occasional military low flying may take place in the vicinity of the Development Area. This low flying is usually conducted with the aid of Night Vision Goggles (NVGs) or by utilising the Forward Looking Infra-red Radar (FLIR) fitted to some aircraft in the MOD inventory. The MOD have conducted trials to determine the suitability of NVG compatible infra-red (IR) obstruction lighting which are invisible to the naked eye. The trials have been successful.

If IR lighting is requested, in some instances a combination of IR and red lighting may be required to denote the extremities of the Wind Farm and OfTW. However, it is not anticipated that infrared lighting will be required for the Project as the MOD have not made any requests in their responses to ICOL when stating their lighting requirements [Reference 8]. The MoD has requested that that all WTGs be fitted with 200 candela omni-directional red lighting at the highest practicable point.

20B.2.4 Failure of Aviation Lighting

The CAA Directorate of Airspace Policy (DAP) issued a policy statement dated 27 April 2012 [Reference 4] which gave guidance on actions in the event of failure of aviation lighting on offshore wind farms. During operation of the Wind Farm there may be occasions when one or more lights cease to operate. Although it is incumbent upon the operator of the wind farm to rectify the situation as soon as practicable, there may be occasions when it is not possible to complete a repair in a timely manner, and these would require notification.

The ANO [Reference 2] states that "*in the event of the failure of any light which is required by this article to be displayed by night the person in charge of a wind turbine generator must repair or replace the light as soon as reasonably practicable*."

It is anticipated that in the case of an offshore wind farm there may be occasions when meteorological or sea conditions prohibit the safe transport of staff for repair tasks. Also given the nature of the interconnections within a wind farm, there may be fault conditions which are wider and would take longer to diagnose or repair. In such cases international standards and recommended practices require the issue of a Notice to Airmen (NOTAM).

The CAA's DAP considers the operator of an offshore wind farm as an appropriate person for the request of a NOTAM relating to the lighting of their wind farm. Should the anticipated outage be greater than 36 hours then the operator shall request a NOTAM to be issued by informing the NOTAM section (operating 24 hours) of the UK Aeronautical Information Service (AIS).

20B.2.5 Construction Phase

The Inch Cape Wind Farm is likely to be built in phases, with different 'sectors' of WTGs becoming operational in each phase. The actual construction plan is not currently finalised, but a separate lighting plan should be approved by the CAA for this phase.

Depending on the timeframe for construction, the WTGs on the periphery of each sector should be fitted with medium intensity lights (it is unlikely that lights will need to be fitted to the interior WTG in each sector). Ideally, these WTGs would be those to be lit when the whole Wind Farm is operational. Furthermore, construction will necessitate the use of tall plant, perhaps taller than the WTG. A lighting plan for such plant – as well as for partially completed WTG – will also be agreed with the CAA as part of the construction plan.

20B.3 CONCLUSIONS

As per the assessment in Chapter 20: Military and Civil Aviation the MOD and the CAA are the most significant aviation stakeholders representing interests in lighting or marking schemes of the Project.

CAP 437 [Reference 5], Chapter 10, Paragraph 2 and sub-paragraphs detail guidance for the marking scheme on the top of the nacelle to support helicopter operations.

The following table summarises the lighting requirements for the Wind Farm and OfTW to satisfy Article 220 [Part 28] of the Air Navigation Order [Reference 2].

Type of Light	Brightness	Proposed Lighting Scheme
Red (Medium Intensity)	2,000 candela	Positioned as close as possible to the top of the fixed structure: Routinely, for the purpose of Article 220 [Part 28], the CAA will require that those WTG on the periphery of the Wind Farm need to be equipped with aviation warning lighting and such lighting where achievable shall be spaced at longitudinal intervals not exceeding 900 metres.
Green (Low Intensity)	16-60 candela	Located on the nacelle within the pilot's field of view, this is capable of being operated remotely and from the platform itself or within the nacelle. A steady green light is displayed to indicate to the pilot that the WTG blades and nacelle are secure and it is safe to operate. A flashing green light is displayed to indicate that the WTG is in a state of preparation to accept hoist operations or, when displayed during hoist operations, that parameters are moving out of limits. When the light is extinguished this indicates to the operator that it is not safe to conduct helicopter hoist operations.

Reference 1 states that work has been undertaken to develop an aviation warning lighting standard where, from the nature of the lighting, it will be apparent to mariners that the aviation lighting is clearly distinguishable from maritime lighting. Where it is evident that the default aviation lighting standard detailed in Article 220 [Reference 2] may generate issues for the maritime community a developer can make a case, that is likely to receive CAA approval, for the use of a flashing red Morse Code Letter 'W' to resolve potential issues to the maritime community.

It is not anticipated that low intensity IR lights may be requested in addition by the MOD). The MoD has requested that that all WTGs be fitted with 200 candela omni-directional red lighting at the highest practicable point.

The construction phase will require development of a lighting scheme which will be approved by the CAA.

REFERENCES

Ref	Title	Origin
1	CAA DAP Policy Statement: The lighting and marking of wind turbine generators and meteorological masts in the UK Territorial Waters 22 November 2012	CAA
2	CAP 393: Air Navigation: The Order and the Regulations April 2012, incorporating amendments to 1/2012 http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=226	CAA
3	CAA Policy and Guidelines on Wind Turbines CAP764 Version 4 Amendment 2012/01, January 2012 http://www.caa.co.uk/docs/33/Cap764.pdf	CAA
4	CAA DAP Policy Statement: Guidance on actions in the event of the failure of aviation warning lights on offshore wind turbines. 27 April 12	CAA
5	CAA Standards for Offshore Helicopter Landing CAP 437 February 2013 http://www.caa.co.uk/docs/33/CAP437RFS.pdf	CAA
6	RenewableUK Aviation Update: Email 01 August 2012	RenewableUK
7	MOD Specification for IR and Low Intensity Red Vertical Obstruction Lighting dated 17 December 2010. Ref: WITT/605/LFOPS http://www.bwea.com/pdf/aviation/MOD_Spec_IR_Low%20Intensity_Red_Vertical_Obstruction_Lighting.pdf	MOD
8	E-mail from Senior Safeguarding Officer, Defence Infrastructure Organisation to ICOL.	MoD DIO

Ref	Title	Origin
	12th February 2013 and 19th February 2013	

ANNEX 20B.1 – Article 220 of the Air Navigation Order 2012

Lighting of wind turbine generators in United Kingdom territorial waters

220 (1) Subject to paragraph (10), this article applies to any wind turbine generator:

(a) the height of which is 60 metres or more above the level of the sea at the highest astronomical tide; and

(b) which is situated in waters within or adjacent to the United Kingdom up to the seaward limits of the territorial sea.

(2) Subject to paragraph (3) the person in charge of a wind turbine generator must ensure that it is fitted with at least one medium intensity steady red light positioned as close as reasonably practicable to the top of the fixed structure.

(3) If four or more wind turbine generators are located together in the same group, with the permission of the CAA only those on the periphery of the group need be fitted with a light in accordance with paragraph (2).

(4) Subject to paragraph (5), the light or lights required by paragraph (2) must be so fitted as to show when displayed in all directions without interruption.

(5) When displayed:

(a) the angle of the plane of the beam of peak intensity emitted by the light must be elevated to between three and four degrees above the horizontal plane;

(b) not more than 45% or less than 20% of the minimum peak intensity specified for a light of this type is to be visible at the horizontal plane;

(c) not more than 10% of the minimum peak intensity specified for a light of this type is to be visible at a depression of 1.5 degrees or more below the horizontal plane.

(6) Subject to paragraph (7), the person in charge of a wind turbine generator must ensure that by night, any light required to be fitted by this article is displayed.

(7) In the event of the failure of any light which is required by this article to be displayed by night the person in charge of a wind turbine generator must repair or replace the light as soon as reasonably practicable.

(8) If visibility in all directions from every wind turbine generator in a group is more than 5 km the light intensity for any light required by this article to be fitted to any generator in the group and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.

(9) In any particular case the CAA may direct that a wind turbine generator must be fitted with and display such additional lights in such positions and at such times as it may specify.

(10) This article does not apply to any wind turbine generator for which the CAA has granted permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

(11) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.

(12) In this article:

(a) 'wind turbine generator' is a generating station which is wholly or mainly driven by wind;

(b) the height of a wind turbine generator is the height of the fixed structure or if greater the maximum vertical extent of any blade attached to that structure; and

(c) a wind turbine generator is in the same group as another wind turbine generator if the same person is in charge of both and:

(i) it is within 2 km of that other wind turbine generator; or

(ii) it is within 2 km of a wind turbine generator which is in the same group as that other wind turbine generator.