Chapter 15

Other Issues

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Other Issues

15.1 Executive Summary

1. This Chapter outlines the potential for effects relating to the Applicant's Earraghail Renewable Energy Development ('the proposed Development') on or from nearby infrastructure, telecommunications and TV, shadow flicker, aviation, climate and carbon balance, air quality, aviation, solar glint and glare, population and human health, risks of disasters and waste management. The findings of these studies are summarised here.

2. **Infrastructure**: This study identifies that there is limited existing infrastructure on the Site which includes an access from the adjacent A83 trunk road and Kintyre Way; access via the existing timber haulage road through the Tarbert Holiday Park, commercial forestry; existing and proposed overhead lines, and a small hydropower scheme on the Abhainn Achachoish.

3. **Telecommunications and TV**: There is no indication as presented by consultees that the proposed Development would interfere with telecommunication links or with television reception transmission which is now served by digital transmitters.

4. **Shadow Flicker**: Shadow flicker guidance indicates that shadow flicker can occur at properties within 10 rotor diameters of wind turbines, located 130 degrees either side of north. A Shadow Flicker assessment confirms that no shadow flicker effects are predicted.

5. **Solar Glint and Glare**: The proposed Development includes for an area of ground mounted solar arrays with a potential generating capacity of around 5 MW. Solar panels have varying reflectivity properties. As a result, solar panels have the potential to produce solar reflection in the form of solar glint (a momentary flash of bright light) and solar glare (a continuous source of bright light). Full details of the glint and glare assessment are included in **Technical Appendix 15.2**, which concludes that no significant effects are predicted.

6. **Climate and Carbon**: The calculations of total carbon dioxide emission savings and payback time for the proposed Development indicates the overall payback period of a development with 13 turbines with an average (expected) installed capacity of around 6 MW each would be approximately 1.8 years, when compared to the fossil fuel mix of electricity generation (see **Section 15.7** below). The payback will be further reduced by the proposed addition of solar arrays, although not included within the Carbon Calculator (which was solely devised for the Scottish Government to monitor onshore wind energy).

7. This means that the proposed Development is expected to take around 22 months to repay the carbon exchange to the atmosphere (the CO_2 debt). Through construction of the proposed Development; the Site would in effect be in a net gain situation following this time period and would contribute to national carbon reduction objectives.

8. **Air Quality**: As the nearest property is within 50 m from the existing Site entrance, effects associated with dust or vehicle emissions are possible, but these potential effects would be managed through good practice construction measures which would form part of the Construction Environmental Management Plan (CEMP) (**Technical Appendix 3.1**).

9. **Aviation and Radar**: Radar modelling shows that all 13 turbines would be in Radar Line of Sight (RLoS) of NATS (En Route) plc's (NERL's) Lowther Hill radar which could result in radar interference. It is considered unlikely that such turbine clutter would have a detrimental impact on NERL's provision of an Air Traffic Service (ATS), however mitigation in the form of alternative radar infill coverage could be used if required. Radar modelling shows that all 13 turbines would likely be detected by the S511 and Terma radars at Glasgow Prestwick Airport (GPA). Although it is not considered that the turbines would have a detrimental impact on GPA's ATS provision, should mitigation be deemed necessary then the Terma radar could be re-optimised to filter out any turbine-induced radar clutter.

10. **Population and Human Health**: Further to the consideration of human health impacts throughout the Environmental Impact Assessment (EIA) Report, it is not expected that there would be any effects from the proposed Development which would have significant effects on population and human health.

11. **Risks of Accidents and Other Disasters**: The vulnerability of the proposed Development to major accidents and natural disasters, such as flooding, sea level rise, or earthquakes, is considered to be low due to its geographical location. In addition, the nature of the proposal and remoteness of the Site means there would be negligible risks on the surrounding environment. Road safety is addressed in **Chapter 12**.

12. **Waste and Environmental Management**: The outline CEMP (**Technical Appendix 3.1**) provides a general overview on how waste and other environmental issues would be managed during the construction phase. The Peat Management Plan (**Technical Appendix 10.2**) also details how excavated peat is controlled, stored, re-used and disposed of during the construction phase of the proposed Development.

13. It is expected that a site-specific waste management plan for the control and disposal of waste generated onsite would be required by condition, should the proposed Development receive consent.

15.2 Introduction

14. This Chapter assesses the potential effects of the construction and operation of the proposed Development on the following issues:

- infrastructure;
- telecommunications;
- television reception;
- shadow flicker;
- solar glint and glare;
- climate and carbon balance;
- air quality;
- aviation;
- population and human health;
- risks of accidents and other disasters; and
- waste and environmental management.

15. A separate Technical Appendix considers the impacts of the proposed Development on Forestry (see **Technical Appendix 15.1).**

15.3 Infrastructure

16. The A83 is the major trunk road serving the Kintyre peninsula between Tarbert, on the eastern shores of the Kintyre Peninsula, and Campbeltown in the south. The A83 provides access to the Site, via an existing timber haulage road that will be upgraded for the proposed Development. There are no public roads on the Site.

17. The Kintyre Way runs through the Site. Within the application boundary, along sections of the Kintyre Way, it is already used as a timber haulage road. There is no public vehicle access along the part of the Kintyre Way within the Site. Sections of the Kintyre Way, where it is already a timber haulage road, will be used for the proposed Development and are shown on **Figure 3.1** of **Chapter 3**. The only exception to this would be for the installation of proposed site enhancements including a bothy (see **Section 3.7.2** of **Chapter 3**).

18. There is an existing 132 kV overhead line operated by Scottish and Southern Electricity Networks (SSEN) that crosses the Site along the route of the existing timber haulage route leading to the Corranbuie land parcel, east of the access off the A83. It is located approximately 3 km from the nearest turbine. Permission has also been granted for a new 275 kV overhead line

to be constructed by Scottish and Southern Electricity Networks (SSEN) between Inveraray and Crossaig that will cross the Site along the route of the existing timber haulage route leading to the Corranbuie forest area[1]. It will be over 3.7 km from the nearest turbine.

19. There is an existing operational "run of river" hydropower project[2] along the Abhainn Achachoish, a river that runs broadly parallel to the existing timber haul road within the Site that leads to the A83. It is operated on behalf of Forestry and Land Scotland (FLS). The penstock (the water pipe leading to the power house for the hydropower project) crosses the existing timber haul road at two locations: NGR NR 8517 6574 and NR 8490 6567. These have been factored into the design of the upgrade to the timber haul road necessary for the proposed Development.

20. The proposed Development's access track commences at the existing junction that is shared with the Tarbert Holiday Park, with a small construction compound also proposed within the holiday park as part of the proposed Development. Consideration of the socio-economic impacts on the holiday park from the proposed Development is included in **Chapter 14**.

21. No Significant effects are predicted on any existing infrastructure as a result of the construction or operation of the proposed Development.

15.4 Telecommunications

22. Wind turbines can potentially cause interference to telecommunication links through reflection and shadowing to electro-magnetically propagated signals including terrestrial fixed microwave links managed by telecommunications operators.

23. Telecommunications operators (Atkins, BT, Ericsson, Joint Radio Company, O2 Telefonica, and Ofcom (Spectrum Licensing)) were invited by the Scottish Government's Energy Consents Unit (ECU) to provide a contribution to inform the Scottish Ministers' scoping opinion, but did not provide a response. In parallel, SPR commissioned assessment of the wireless communication links in the area surrounding the proposed Development. As part of this process, telecommunications operators were consulted. A summary of consultation is provided in **Table 15.1**.

Table 15.1: Summary of Consultation Responses from Telecommunications Stakeholders

Consultee	Summary of Consultation	Comment / Action Taken
Ofcom	Advised that Ofcom no longer checks fixed link positions, instead directing enquiries to the Spectrum Information Portal.	Consultation was undertaken directly with the predominant UK link operators to identify the relevant link infrastructure.
Arqiva	Advised that they have no objection.	No constraints identified.
Atkins	Advised that they have no objection.	No constraints identified.
BT	Advised that no impacts are foreseen.	No constraints identified.
Ericsson (MBNL/EE)	Requested further information. Advised that they have no objection.	No constraints identified.
JRC	Advised the proposal has been cleared (on behalf of a local utility company and Scotia Gas Networks).	No constraints identified.
Airwave	Advised that link information will not be provided due to confidentiality.	Airwave will assess the proposed Development following submission of the application for consent.

[1] Information on the route and wider project can be accessed from SSEN's website: https://www.ssen-transmission.co.uk/projects/inveraray-crossaig/ [accessed August 2021]
[2] Information on the hydro power scheme is available from the Argyll and Bute Council planning website at the following location (Ref: 15/02435/PP): https://publicaccess.argyll-bute.gov.uk/online-applications/caseDetails.do?caseType=Application&keyVal=NU1YMLCH0CM00 [accessed August 2021]

Consultee	Summary of Consultation	Comment / Action Taken
Vodafone	Provided details of the nearest link path. Advised all other links are more than 3 km away.	All proposed turbines lie significantly outside the exclusion zone and no impacts are predicted.

24. From the consultation responses received, it is apparent that there is no indication that the proposed Development would interfere with telecommunications links.

15.4.1 Television reception

25. Wind turbines have the potential to adversely affect analogue television reception through either physical blocking of the transmitted signal or, more commonly, by introducing multi-path interference where some of the signal is reflected through different routes. However, the proposed Development is located in an area now served by a digital transmitter. Therefore, television reception is unlikely to be affected by the proposed Development as digital signals are rarely affected. In the unlikely event that television signals are affected by the proposed Development, reasonable mitigation measures would be considered by SPR.

15.5 Shadow Flicker

26. Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind the rotors of a wind turbine and casts a shadow over neighbouring properties. As the blades rotate, the shadow flicks on and off, an effect known as shadow flicker. The effect can only occur inside buildings, where the flicker appears through a window opening.

27. The likelihood and duration of the effect depends upon:

- direction and aspect of the property relative to the turbine(s): in the UK, only properties within 130 degrees either side of north, relative to the turbines, can be affected, as turbines do not cast long shadows on their southern side;
- distance from turbine(s): the further the building is from the turbine, the less pronounced the effect would be, given the shadow fades with distance. Flicker effects are known to be strongest and most likely to have the potential to cause significant effects within ten rotor diameters of a turbine (refer to **Technical Appendix 4.1**for further detail);
- turbine height and rotor diameter;
- topography between the turbine and receptor;
- time of year and day;
- wind direction and orientation of the turbine blades in relation to the receptor; and
- weather conditions (i.e. cloudy days reduce the likelihood of effects occurring).

28. If significant effects due to shadow flicker cannot be avoided through embedded mitigation, then technical mitigation solutions are available, such as temporarily shutting down those turbines(s) which cause the effect during specific intervals where certain contributory conditions occur.

29. Shadow flicker effects are only considered during the operational phase of a wind turbine development.

15.5.1 Legislation, Policy and Guidance

Legislation

30. There is no legislation that deals directly with shadow flicker. There is no formal limit on the amount of shadow flicker that is considered acceptable within the UK.

Policy

31. **Chapter 4** of the EIA Report sets out the planning policy framework that is relevant to the EIA. At a national level, of particular relevance is Paragraph 163 of Scottish Planning Policy (SPP) 2014. This identifies that schemes should take account of various considerations, including the impact of a proposed scheme on communities or individual dwellings in terms of visual impact, residential amenity, shadow flicker and noise.

32. For Argyll and Bute, Policy LDP 6 – Supporting the Sustainable Growth of Renewables states that applications for wind turbine developments will be assessed against criteria including noise and shadow flicker.

Guidance

33. Planning guidance in the UK requires developers to investigate the impact of shadow flicker. This guidance does not specify how to assess the impact, or how to assess the significance of the impact. In Scotland current guidance is available in the 'Onshore Wind Turbines: Planning Advice' document (last updated May 2014).

15.5.2 Methodology

34. As noted in **Chapter 2**, the location of the proposed turbines has been carefully considered with respect to distance from residential properties.

35. An assessment has been carried out to identify whether shadow flicker would be likely to occur at properties neighbouring, and if so the predicted times of year, and the time and duration of these potential effects.

36. Shadow flicker is calculated based on the worst-case condition assuming the sun is always shining. There are no screening features such as trees, no accounting for periods of turbine shut down and also the wind is always blowing at sufficient velocity to spin the blades and in a direction which results in the blades being perpendicular to the property (maximum shadow flicker or worst-case).

15.5.3 Consultation

37. Consultation was undertaken with a range of consultees, as outlined in **Chapter 6**. Argyll and Bute Council's Scoping response (dated 25th June 2020) requested that the proposed Development be assessed for any impacts on communities and individual dwellings, including visual impact, residential amenity, noise and shadow flicker.

Study Area

38. In line with the best practice guidance, a Study Area based on a distance of 10 rotor diameters from the proposed candidate wind turbines is normally employed to determine the zone of potential shadow flicker incidence. The candidate wind turbines for the proposed Development would have a rotor diameter of around 150 m; this gives a Study Area of 1,500 m from the turbines. In addition to this, a further 50 m area was added to the 10 rotor diameter distance in order to account for micrositing, should the proposed Development receive consent.

39. The maximum Study Area for the proposed Development was mapped using GIS software. This was then refined to include only the areas within 130 degrees of north of proposed wind turbine locations. Properties within 10 rotor diameters (1,500 m) plus 50 m for the reasons outlined above (1,550 m) and the 130° area were identified from OS AddressBase data. No properties were identified within this area.

15.5.4 Predicted Effects

40. Based on the fact that no residential receptors lie within the Study Area in which shadow flicker might be experienced, no shadow flicker effects are predicted.

15.5.5 Mitigation

41. No mitigation is currently required for the operational phase of the proposed Development as no shadow flicker effects are predicted to occur.

15.6 Solar Glint and Glare

15.6.1 Introduction

42. An element of the proposed Development is a proposed area of ground mounted solar arrays with a potential generating capacity of around 5 MW (see **Chapter 3** and **Figure 3.1**).

43. Solar panels have varying reflectivity properties; however, no solar panel absorbs 100 % of incoming light. As a result, solar panels have the potential to produce solar reflection in the form of solar glint (a momentary flash of bright light) and solar

glare (a continuous source of bright light). Solar glint will be witnessed by moderate to fast-moving receptors whilst solar glare will be encountered by static or slow-moving receptors with respect to a solar farm.

44. Guidance states that common receptors of solar glint and glare effects are residents, road users, railway users and aviation operations. To address these concerns, SPR commissioned a technical report to assess the potential for solar glint and glare impacts arising from the proposed Development. This is included as **Technical Appendix 15.2**.

15.6.2 Methodology

45. The glint and glare assessment methodology adopted has been derived from the information provided through consultation with stakeholders and by reviewing the available guidance and studies. The methodology for a solar glint and glare assessments is as follows:

- identify receptors in the area surrounding the area of search for solar development within the Site;
- consider direct solar reflections from the proposed solar development towards the identified receptors by undertaking geometric calculations;
- consider the visibility of the panels from the receptor's location. If the panels are not visible from the receptor then no reflection can occur;
- for those receptors where there is visibility of panels, based on the results of the geometric calculations, determine whether a reflection can occur, and if so, at what time it will occur;
- consider both the solar reflection from the solar development and the location of the direct sunlight with respect to the receptor's position;
- consider the solar reflection with respect to the published studies and guidance - including intensity calculations where appropriate; and
- determine whether a significant adverse effect is expected.

15.6.3 Study Areas

46. Two Study Areas have been identified in relation to glint and glare impacts, covering ground-based receptors and aviation receptors respectively. These are identified in **Appendix 15.2**.

15.6.4 Ground-based receptors

47. There is no formal guidance with regard to the maximum distance at which solar glint and glare should be assessed. From a technical perspective, there is no maximum distance for potential reflections. The significance of a reflection however decreases with distance because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes as the separation distance increases. Terrain and shielding by vegetation or the urban environment are also more likely to obstruct an observer's view at longer distances. Details of the approach adopted are included in **Appendix 15.2**.

48. The above parameters and extensive experience over a significant number of glint and glare assessments undertaken, shows that a 1 km buffer from the area of search for solar development (see **Figure 3.1**) is considered appropriate for glint and glare effects on ground-based receptors.

49. Potential receptors within the 1 km buffer are identified based on mapping and aerial photography of the region. The initial judgement is made based on high-level consideration of aerial photography and mapping i.e. receptors are excluded if it is clear from the outset that no visibility would be possible. A more detailed assessment is made if the modelling reveals a reflection would be geometrically possible.

15.6.5 Aviation receptors

50. There is no formal buffer distance within which aviation effects must be modelled. However, in practice, concerns are most often raised for developments within 10 km of a licensed airport. Requests for modelling at ranges of 10 - 20 km are far less common. Assessment of aviation effects for developments over 20 km from a licensed airfield is a very unusual requirement. For this reason, a 10 km buffer around the area of search for solar development has been used as the basis of assessment.

15.6.6 Predicted Effects

51. Assessment of potential effects on ground-based receptors (roads and dwellings) and aviation receptors are provided below. Further details are provided in **Technical Appendix 15.2.**

Roads

52. All roads within the 1 km buffer for consideration of glint and glare effects are timber haulage roads that are not open to the public. Assessment is not recommended for local roads, where traffic volumes and/or speeds are likely to be relatively low. Any solar reflections from the area of search for solar development that are experienced by a road user along a local road would be considered a low level of effect and not significant, in the worst case in accordance with the guidance presented in Appendix D of **Technical Appendix 15.2**.

53. Furthermore, a review of the available imagery indicates that the nearest significant road infrastructure in the form of the B1001 and the A83 (located approximately 5.3 km and 8 km respectively from the area of search for solar) are significantly screened by the intervening terrain.

54. Overall, no significant effects upon road users are predicted and therefore no mitigation is required.

Residential receptors

55. No dwellings were identified within the 1 km buffer for consideration of glint and glare effects.

56. Furthermore, a review of the available imagery indicates that the nearest identified dwellings, located at least 2.7 km from the area of search for solar development, are significantly screened by the intervening terrain.

57. Overall, no significant effects upon dwellings are predicted.

Aviation

58. The high-level assessment of aviation receptors identified in the glint and glare study in **Appendix 15.2** identified three potential receptors within the Study Area.

Bute Airfield

59. For the approach to runway threshold 09, its orientation is such that any predicted solar reflections arising from the proposed Development will be outside of the pilot's main field of view (50 degrees either side of the approach bearing) and would therefore not be considered significant in accordance with the associated guidance (**Appendix 15.2**).

60. For the approach to runway threshold 27, the proposed development will be within a pilot's main field of view. However, it can be safely presumed that any predicted solar reflections would have a 'low potential for temporary after image' in the worst case, which is acceptable under the associated guidance.

61. Overall, no significant effects on aviation activity associated with Bute Airfield are predicted.

Gigha Airfield

62. For the approach to runway threshold 07, the proposed development will be within a pilot's main field of view. However, it can be safely presumed that any predicted solar reflections would have a 'low potential for temporary after image' in the worst case, which is acceptable under the associated guidance (Appendix D).

63. For the approach to runway threshold 25, its orientation is such that any predicted solar reflections will be outside of the pilot's main field of view and would therefore not be considered significant in accordance with the associated guidance.

64. Overall, no significant effects on aviation activity associated with Gigha Airfield are predicted.

Campbeltown Airport

65. For the approach to runway threshold 11 and 29, the orientations are such that any predicted solar reflections will be outside of the pilot's main field of and would therefore not be considered significant in accordance with the associated guidance.

66. For the ATC Tower, it is expected that at 46 km any views of the area of search for solar within the Site would be significantly screened by the intervening terrain.

67. Overall, no significant impact on aviation activity associated with Campbeltown Airport is predicted and no further detailed assessment is recommended.

15.6.7 Mitigation

68. Given that no significant effects are predicted, no mitigation is proposed.

15.7 Climate and Carbon Balance

15.7.1 Introduction

69. In addition to the value renewable energy developments provide in terms of the electricity they produce, the Scottish Government considers wind turbines, and other renewable and supporting technologies such as solar panels and battery energy storage systems (BESS), as an important mechanism for the reduction of carbon dioxide (CO_2), and other greenhouse gas (GHG) emissions, into the atmosphere. This offers a sustainable alternative to emissions-intensive electricity generated from fossil fuels.

70. Renewable energy developments achieve emissions savings by reducing the consumption of fossil fuel generated mains electricity. However, during their manufacture, construction and decommissioning, wind turbine and solar PV infrastructure can themselves result in the emissions of CO_2 gas, particularly in such instances as where natural carbon stores such as forestry and/or peat are present and potentially impacted upon by the development.

71. For this reason, this Section provides an approximation of the CO_2 emissions associated with the manufacture and construction and decommission of the onshore wind element of the proposed Development. It further provides an estimate of the contribution which this element of the proposed Development would make towards the reduction of emissions which would otherwise be produced by fossil fuel power generation. This provides an indication of the whole-life carbon balance of the onshore wind portion of the proposed Development, together with an understanding of its emissions payback period. Once emissions resulting from the manufacture construction and decommission of the onshore wind element of the proposed Development have been paid back (offset), then each subsequent unit of wind generated electricity would displace a unit of conventionally generated electricity, thereby contributing to the overall reduction in emissions into the atmosphere.

72. Note that in the calculation of emissions associated with the proposed Development, the majority of associated infrastructure is taken into account. The exceptions to this rule include the solar panels and the BESS located onsite (for which no peat would be excavated), and the subsequent generation of electricity from the former. With this in mind, it may be deduced that the results of the below outlined assessment are highly conservative in that the full (positive) extent of renewable electricity generated by the proposed Development is not taken into account; only that of the onshore wind element.

15.7.2 Carbon and Peatland

73. Renewable energy developments in upland areas are often sited on areas of peatland which hold stocks of poorly protected carbon. If disturbed, these stocks have the potential to release carbon into the atmosphere in the form of CO_2.

74. Scotland hosts the majority of peat soils in the UK. Therefore, it has a responsibility to maintain and enhance the quality and stability of its peat soils; partly by ensuring that developments do not cause a significant loss of these carbon reservoirs. Part of the proposed Development is sited on peaty soils which has been negatively impacted by extensive commercial forestry planting thereby limiting their capacity to sequester and store carbon. Specifically, the peat located on the proposed site is not considered pristine as a result of its disturbance due to planting and harvesting activities, which are likely to have resulted in the release of CO_2 into the atmosphere and the limitation of their ability to sequester carbon.

75. The carbon balance assessment considers the implications of any part of the proposed Development which could lead to the release of CO_2 due to the disturbance of peat.

76. The disturbance of peat has been considered during the design process which has avoided areas of deep peat. The design process is described in **Chapter 3** whilst specific details relating to peat depth are included in the Peat Slide Risk Assessment, in **Technical Appendix 10.1**.

Characteristics of Peatland

77. The loss of carbon from the carbon fixing (sequestering) potential of vegetation on peatland is small but is calculated for the area from which peat is removed and the area affected by drainage. The carbon stored in the peat itself represents a much larger potential source of carbon loss.

78. When flooded, peat soils emit less CO_2 but more methane (CH_4) than when drained. In flooded soils, CO_2 emissions are usually exceeded by plant fixation (sequestration), so the net exchange of carbon within the atmosphere is negative and soil stocks increase. When soils are aerated, CO_2 emissions usually exceed plant fixation, so the net exchange of carbon within the atmosphere is positive.

79. To calculate the CO_2 emissions attributable to the removal or drainage of the peat, emissions occurring if the soil had remained *in situ* and undrained are subtracted from the emissions occurring after removal or drainage.

80. The indirect loss of CO_2 fixation by plants originally on the surface of the site but eliminated by construction activities, including the destruction of active bog plants and felling, is calculated using site-specific data collected as part of the EIA process and based upon blanket bog. Further information on peat is provided in **Chapter 10**, with information on habitats in **Chapter 8**.

81. Emissions due to the indirect, long-term liberation of CO_2 from carbon stored in peat due to drying and oxidation processes caused by on-site construction can also be calculated from site-specific data for the proposed Development. The resultant figure is a reasonable worst-case scenario, as peat would be reused onsite to minimise carbon losses for restoration of the proposed Development, and for habitat restoration including ditch blocking. See the Outline Habitat Management Plan (**Technical Appendix 8.5**) for further information.

15.7.3 Turbine Manufacture

82. Emissions arising from the fabrication of the turbines and associated components of the proposed Development are based on the full life analysis of a typical turbine and include CO_2 emissions resulting from transportation, erection, operation, dismantling and removal of turbines and foundations and transmission grid connection equipment from the existing electricity grid system.

83. With respect to the turbines, emissions from material production are the dominant source of CO_2. Emissions arising from the construction (including transportation of components, quarrying, building foundations, access tracks and hard standing) and decommissioning are also included in the calculations. This assessment has used Nayak et al. (2008) default values for 'turbine life' emissions, calculated with respect to installed capacity.

84. A number of technical papers (detailed in Nayak et al., 2008) have reported a wide range of windfarm emissions values; these being between six and 34 tCO_2 GWh-1. From these, additional CO_2 payback time can be calculated and compared due to production, transportation, erection and operation of the proposed Development.

85. These values are significant, so it is important that they are considered in relation to calculating the CO_2 payback period of the proposed Development. However, it should be noted that this may still compare very favourably with the lifecycle analysis of other means of non-fossil fuel-based power generation, such as nuclear, particularly when the full energy costs of construction, operation, maintenance and decommissioning, uranium mining and transportation as well as long-term waste management are taken into account.

15.7.4 Characteristics of Forestry

86. The presence of extensive areas of forestry on, and/or in the vicinity of, an onshore wind development has the potential to significantly reduce its wind energy yield. For this reason, best practice has been to clear existing forestry from the surrounding area prior to the construction of the development. This practice often leaves open ground in its stead thus resulting in a loss in the CO_2 sequestration potential of the land.

87. The amount of carbon released into the atmosphere as a result of felling is dependent upon the type of tree being felled, the age of the crop, the use of the timber and how quickly the stored carbon is released into the atmosphere. Cannell (1999, in Nayak et al., 2008) provides estimates for the amounts of carbon sequestered by fast-growing trees (such as poplar), medium (such as Sitka spruce) and slow-growth (such as beech) trees, as outlined in **Table 15.2**.

Table 15.2: Carbon Sequestration Potential of Fast, Medium and Slow-Growing Tree Species (Cannel, 1999)

	Poplar	Sitka	Beech
Yield Class (m^3 ha ^{1} yr ^{1})	12	16	6
Carbon sequestered, G forest (tCO_2 ha^{-1} yr^{-1})	26.8	13.2	8.8
Crop rotation, t forest (years)	26	55	92
CO_2 sequestered per crop rotation (tCO_2 ha^{-1})	694.66	724.68	808.86

88. The area of forestry to be felled, coupled with average carbon sequestered per year and the lifetime of the proposed Development, is used to determine the potential loss of CO_2 due to forestry clearance.

15.7.5 Scope and Methodology

89. The assessment of the carbon balance of the proposed Development is based upon a detailed baseline description of the proposed Development and its location. All calculations are premised upon site-specific data, where available. Where site-specific data is not available, national/regional information has been used (e.g., from the Met Office and the Department for Business, Energy and Industrial Strategy etc.).

90. The methodology used to calculate CO_2 emissions which would result from the proposed Development is based upon 'Calculating Carbon Savings from Windfarms on Scottish Peatlands – A New Approach' (Nayak et al., 2008 and 2010, Smith et al., 2011). These documents are incorporated into the latest version (V1.6.1) of the Scottish Government's Carbon Calculator Tool. This tool enables carbon losses and carbon savings to be quantified across the project lifecycle stages (construction, operation and decommissioning/site restoration), and these losses and savings are combined to establish the overall (net) carbon effect of the proposed Development, as well as its 'carbon payback period'.

91. Since the proposed Development is seeking consent for 40 years of operational lifetime, an operational lifespan of 40 years has been assumed within the Carbon Calculator – **Technical Appendix 15.4**.

15.7.6 Consultation Undertaken

92. Consultation was undertaken in relation to potential climate change mitigation issues through the EIA Scoping process as summarised below. Two responses were received in relation to the climate change mitigation section of the EIA scoping report which was issued to consultees on the 1st May 2020.

Argyll and Bute Council (A&BC)

93. Argyll and Bute Council noted that; *"whilst by its very nature, the proposed development will reduce demand for fossil fuel electricity generation and thus [provide] a benefit to the Scottish Government's targets, further consideration of the proposed development in terms of climate change mitigation and adaptation will be given in the EIA, in accordance with best practice. It is noted that a carbon balance calculation will be undertaken and that an assessment of the effects of the proposed development of receptors to adapt to future climatic conditions will also form part of the climate change assessment. During the design process, the wind turbines will be sited to avoid areas of deep peat as far as practicable and measures to minimise disturbance to peat especially during excavation will be considered. To minimise peat disturbance during construction and decommissioning Best Practicable Measures will also be considered that will be provided as part of the Construction Environmental Management Plan."*.

94. An assessment of the vulnerability of the proposed Development to climate change was scoped out of the EIA. However, on this subject, A&BC acknowledged that; *"none of the following climate trends could affect the proposed with the exception of increased windstorms: increased temperature; changes in the frequency, intensity and distribution of rainfall events (e.g. an increase in the contribution to winter rainfall from heavy precipitation events and decreases in summer rainfall); and increased windstorms; and sea level risk. Braking mechanisms installed on turbines allow them to be operated only under specific wind speeds and should severe windstorms be experienced, then the turbines would be shut down. In addition, given*

the elevated location of the project area, flooding will not pose a significant risk to the operation of the wind farm nor will the construction of the proposed development contribute to flooding elsewhere. Therefore, it is considered unlikely that significant effects will arise as a result of the proposed Development, and this topic can be scoped out of the further assessment. The Council is satisfied with this approach".

95. These comments were emulated by the Scottish Government's Energy Consents Unit also.

RSPB

96. RSPB notes that; *"carbon calculations for the proposal should be based on the latest version of the Scottish Government's carbon calculator and should clearly show the carbon payback period of the proposed scheme"*.

15.7.7 Statutory and Planning Context

National Context

97. In addition to the statutory instruments outlined in detail in **Chapter 4**, the Scottish Planning Policy and NatureScot guidance is also relevant to climate change mitigation.

Scottish Planning Policy (SPP)

98. The Scottish Planning Policy (SPP) sets out how the Climate Change (Scotland) Act 2009 should be delivered on the ground. The SPP states that "by seizing opportunities to encourage mitigation and adaptation measures, planning can support the transformational change required to meet emission reduction targets and influence climate change" (para 19, SPP, 2014).

99. The SPP states (para 205) that, where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of carbon into the atmosphere. Developments should aim to minimise this release.

NatureScot, Good Practice During Wind Farm Construction

100. The Scottish Natural Heritage (SNH), now Nature Scot, Good Practice During Wind Farm Construction guidance recognises that one of the key aims of wind farm development is to reduce carbon emissions, but that windfarm developments, through the materials used, during the construction processes employed and the potential emissions from disturbed soils and habitats, do result in carbon emissions.

101. The guidance recognises that, in some circumstances, the carbon payback of wind farm developments could be significantly affected by the construction methods used and the degree of restoration of the Site. The guidance therefore seeks to ensure that good practice is adopted to reduce the carbon emissions associated with windfarm development.

102. The good practice approach to development on peat and carbon savings recommended by this guidance can be summarised as follows:

- conduct a detailed peat survey;
- where possible, position the site infrastructure in areas of shallower peat or design an appropriate engineering solution to avoid and/or minimise excavation of peat (for example floating roads and piling solutions);
- minimise the detriment to peat if excavation cannot be fully avoided;
- avoid or reduce peat displacement from the development of borrow pits;
- excavations should be prevented from drying out or desiccating as far as possible. Consideration should also be given to spraying with water;
- if stockpiling peat, assess the potential loading effects for peat slide risk;
- the peat should be restored as soon as possible after disturbance;
- consider cable trenching operations and timings;
- floating roads should be used in areas of deeper peat;
- minimise plant movements and haul distances in relation to any earthworks activities including peat management; and
- developers should take ancillary opportunities to improve habitats.

15.7.8 Local Context

Argyll and Bute Local Development Plan

103. In its Local Development Plan, Argyll and Bute Council acknowledges that a key challenge that it faces is being able to mitigate and adapt to the growing impacts of climate change in an affordable way at a local level. As such, it seeks to

address the impacts of climate change in everything it does. Accordingly, Policy LDP6 (Supporting the Sustainable Growth of Renewables) sets out that the council will support renewable energy developments where they are consistent with the principles of sustainable development. With this in mind, the policy goes on to state that all applications for wind turbine developments will be assessed against impacts upon carbon rich soils, using the [Scottish Government] carbon calculator. In keeping with this sentiment, Policy LDP 10 (Maximising our Resources and Reducing Our Consumption) states that the council will support all development proposals that seek to maximise our resources and reduce consumption where these accord with the avoidance of disturbance of carbon rich soils.

Argyll and Bute Local Development Plan – Supplementary Guidance

In its Supplementary Guidance, Argyle and Bute Council acknowledges the value of protecting soil and peat resources. In doing so, it states that "Argyll and Bute Council will only support development where appropriate measures are taken to maintain soil resources and functions to an extent that is considered relevant and proportionate to the scale of the development". This is because peat "is a major carbon store; a healthy peat bog absorbs and stores carbon, but an unhealthy and drying-out bog releases carbon, adding to carbon dioxide in the atmosphere and contributing greatly to climate change".

Existing Environment

104. The baseline conditions in relation to potential climate change impacts from the proposed Development include existing carbon stored in the Site (such as peat and forestry) that could be impacted by the proposed Development resulting in CO_2 and other GHG emissions.

105. The Site is predominantly comprised of forestry, being dominated by the Corranbuie Forest (1,065 ha) and the Skipness Forest (1,165 ha) to the south. Open moorland is situated within the central area of the Site.

106. The topography of the Site is variable and undulating and is dictated by five small hills within the forested areas: Cnoc nan Caorach (254 m AOD), Cruach Bhreac (351 m), Cruach na Machrach (346 m), Guallan Mhor (303 m) and Meall Donn (276 m). Between the hills, the land is generally below 14% slope, with the exception of some land in the north Corranbuie parcel and throughout the southwest of the Skipness parcel. Semi-natural broadleaved woodland is present in several small pockets along the northern and northeastern boundaries of the Site. These are predominantly sessile oak, with smaller amounts of hazel, downy birch and willow. The majority of these areas are listed in the ancient woodland inventory.

15.7.9 Predicted impacts

Peat

107. In the open moorland area, peat is found in the form of upland blanket peat. Some erosion features were noted in this area in the form of peat hagging where excavation works had been carried out for the access road. Within the southern part of the Site, inside Skipness Forest, peat development has been disrupted by the commercial forestry operations and is no longer in near-natural condition. The area would formerly have consisted of a patchwork of peaty soils, shallow peat and deeper peat reflecting the underlying topography. Extensive drainage ditches have been excavated, partially draining much of the area.

108. Where recent harvesting and replanting has been carried out, the shallow soils have been extensively disturbed. Peat which would have been present at the surface overlying shallow weathered bedrock is now present as a mixture of structureless peat and pieces of bedrock of various sizes. Additional drainage ditches have been installed and currently provide significant drainage to these areas.

109. Peat depth surveys were undertaken in March and May 2020 across the application boundary area and in April 2021 for areas of proposed infrastructure. The peat depth survey and reconnaissance survey both confirm that peat is present in the area but is patchy and irregular in its distribution across the Study Area. The peat survey also confirmed that within the Study Area, peatland has been significantly modified for commercial forestry with extensive drainage system modifications present in many areas.

110. Much of the recorded peat is relatively shallow (<1.5 m), although some areas of deep peat (>1.5 m) are present. Areas of deep peat are patchy in distribution across the Study Area and usually form small basins between hill crests, around the headwater areas of some watercourses. Two main areas of deep peat were found north of Turbine 9 and west of Loch na Machrach Mòire. There are also small areas of deep peat north of Turbine 7, west of Turbine 15, north-east of Turbine 13 and south of Turbine 19. Areas of very deep peat (>2.5 m) were infrequent within the Study Area; a notable area of very deep was located northeast of Turbine 9. More details of peat depth and peat depth variation are provided in **Technical Appendix 10.1**. An overview map of the peat depth distribution within the Study Area is provided in **Figure 10.4**.

Forestry

111. Corranbuie Forest and Skipness Forest are owned and managed by Forestry and Land Scotland (FLS). The forests comprise two adjoining woodland areas partially separated by an area of open moorland. Corranbuie Forest extends to 1065 ha and Skipness Forest extends to 1165 ha. The eastern coastal fringes are dominated by Atlantic oakwoods designated as the Tarbert to Skipness Coast SSSI and Tarbert Woods SAC. The northern part of Corranbuie backs onto Tarbert village, with an important recreational area, legacy of the Millennium Forest for Scotland Trust project and Corranbuie Oakwood. The Kintyre Way runs through both woodlands. Much of Corranbuie is a diverse matrix of conifers and open space. Skipness has more productive plantations, but also a significant area of windblow to clear.

112. The primary objectives for the Land Management Plan are commercial conifer timber production including clearance of a significant area of windblow in Skipness; construction of new forest roads to access the forest for harvesting; enhancement and protection of designated sites; and certification under the UK Woodland Assurance Scheme. Further information on the approach to forestry for the proposed Development is provided in **Appendix 15.1**.

Predicted impacts

113. The proposed Development comprises 13 three-bladed horizontal axis wind turbines up to 180 m tip height, with a rated output of around 6 megawatts (MW) and ground mounted solar arrays of around 5 MW, with a combined installed generation capacity of around 78 MW, producing a combined output of between 230-280 GWh of renewable electricity annually. Around 25 MW (approximately 1/3 turbine capacity) of energy storage, in the form of a battery energy storage system (BESS), would also be installed to store energy and so provide flexible balance of energy and the delivery of the full potential of energy to meet the demands of the National Grid.

114. The results of the carbon balance assessment carried out for the proposed Development are presented below for each project stage.

15.7.10 Construction and Decommissioning

115. **Table 15.3** presents the results of the carbon balance assessment (in tonnes of carbon dioxide equivalent: tCO_2e) for the manufacture, construction and decommissioning stages of the proposed Development. Any post-decommissioning site-restoration and enhancement work, such as the blocking of drainage ditches to promote re-wetting or tree-planting will be agreed with NatureScot in due course (see **Appendix 8.5** Outline Habitat Management Plan). These kinds of activities have the potential for significant carbon savings by promoting the growth of natural carbon stores such as forestry and peat.

Table 15.3: Sources of GHG Emissions and Savings

Source of GHG Emissions/Savings	GHG Emissions (tCO_2e)
Construction	
Losses due to turbine manufacture, construction and decommissioning	68,164
Losses due to back-up power generation	59,445
Losses due to reduced carbon fixing potential	1,415
Losses from of soil organic matter	46,800
Losses due to Dissolved Oxygen Content and Portable Oxygen Content	214
Losses due to forestry felling	58,556
Total	**234,593**

116. **Table 15.3** shows total GHG emissions of 234,593 tCO_2e are predicted from the manufacture, construction and decommissioning of the proposed Development.

117. SPR is committed to undertaking compensatory planting (see **Appendix 15.1**) as required under the Forestry Commission Scotland Control of Woodland Removal Policy (2009) in order to achieve no net loss of forestry. The location and type of planting will be agreed with NatureScot and Scottish Forestry in due course. For the purpose of this assessment, it has been assumed that compensatory planting will be equal to the felling that will take place.

118. The project is also committed to undertaking post-construction habitat restoration and enhancement work (see **Appendix 8.5**. Minimum, maximum and expected areas have been identified and calculated (see **Appendix 8.5**) and included in the Carbon Calculator in **Appendix 15.4**).

119. **Table 15.4** shows the total CO_2 gains acquired due to the improvement of the Site (tCO_2e). These are predicted to equate to approximately 115,440 tCO_2e.

Table 15.4: Total CO_2 Gains Acquired Due to Improvement of the Site

Improvement	GHG Emissions (tCO_2e)
Change in emissions due to improvement of degraded bogs	0
Change in emissions due to improvement of felled forestry	-49,429
Change in emissions due to restoration of peat from borrow pits	-108
Change in emissions due to removal of drainage from foundations and hardstanding	-262
Total change in emissions due to improvements	**-49,798**

Operation

120. The operational stage of the proposed Development has the greatest potential for emissions savings, and therefore beneficial climate change impacts. At this stage, GHG emissions from construction activities have ceased and the operation of the turbines would generate zero-carbon electricity for the remainder of their lifespan.

Table 15.5 presents the annual emissions savings that are predicted for the proposed Development, as measured against the fossil fuel mix of the grid electricity having consideration for the capacity factors (load factors) proposed by Scottish Power of 35% (minimum 30%, maximum 40%). It is expected that the proposed Development would exceed these capacity factors and therefore, GHG savings would be greater than those presented in **Table 15.5** and the Carbon payback period would be sooner.

Table 15.5: Annual Emissions Savings Against Fossil Fuel Electricity Generation Mix

Source of GHG savings	GHG savings (tCO_2e/year)		
Capacity Factor	**30%**	**35%**	**40%**
Onshore wind generation operation	89,168	104,029	118,891
Total CO_2 savings per year	**89,168**	**104,029**	**118,891**

Emissions Payback Period

121. Dividing the net GHG emissions predicted for the manufacture, construction and decommissioning stages (taking into account CO_2 gains from site improvement: 184,795 tCO_2e) by the predicted annual carbon savings from windfarm operation (104,029 tCO_2e) gives a predicted emissions payback of 1.8 years. Therefore, net GHG emissions from the construction and decommissioning are predicted to be offset by emissions savings from the construction of the proposed Development's within 1.8 years of it becoming operational (**Table 15.6**).

Table 15.6: Carbon Payback Period of the proposed Development, Assuming Fossil Fuel Electricity Mix, for a Range of Capacity Factors

Capacity factor	30%	35%	40%
Carbon payback time (years)	2.1	1.8	1.6

Net GHG Effect

122. Since the proposed Development is seeking consent for 40 years, an operational lifespan of 40 years has been assumed within the Carbon Calculator – **Technical Appendix 15.4**. Thus, the total CO_2 emissions savings over the assumed lifetime of the project (excluding the contribution made by the ground mounted solar arrays) is expected to be circa 3,976,365 tCO_2e (104,029 tCO_2e over 40 years, minus net emissions from manufacture, construction, and decommissioning).

15.8 Air Quality

123. Construction activities can result in short-term temporary effects from dust if unmanaged. This can result in nuisance effects, such as soiling of buildings and, if present over a long period of time, can affect human health. As the nearest property is adjacent to the application boundary and the existing access to the Site, effects associated with dust or vehicle emissions are considered to be likely. Mitigation measures as part of the outline CEMP (**Technical Appendix 3.1**) would be implemented based on good construction practice to reduce the potential for dust emissions.

124. Experience of construction on similar sites suggests that the mitigation approaches are sufficient to avoid any significant effects.

125. Some of the standard mitigation measures implemented on site may include, but will not be limited to, the following:

- adherence to the speed limit on site in order to reduce the dust generated from transport on site roads;
- water bowsers – spraying with water to dampen dust down;
- road sweepers – remove silt from the road surface to reduce the potential for dust on public roads, if required;
- materials with the potential to produce dust to be stored so as to prevent dust generation e.g. materials stored out of the wind and covered; and
- transport of dust generating material to be covered.

15.9 Aviation and Radar

15.9.1 Introduction

126. The potential impacts of wind turbines on aviation interests have been widely publicised and are outlined below:

- physical obstruction: turbines can present a physical obstruction at, or close to, an aerodrome or other aviation activity site; and
- Radar / Air Traffic Services: turbines can produce spurious / false returns known as “clutter”, particularly from primary surveillance radar (PSR). Turbine clutter appearing on a radar display can affect the safe and efficient provision of air traffic services (ATS) as it can mask unidentified aircraft from the air traffic controller and / or prevent them from accurately identifying aircraft under their control and / or cause the track of the aircraft under control to be incorrectly reported. In some cases, radar reflections from the turbines can affect the performance of the radar itself.

127. This Section provides an assessment of the potential impacts the proposed Development may have on aviation within the area. This assessment has included a review of the location, technical characteristics and operational activities of aviation interests and operations in the vicinity of the Site, along with an examination of how they may be affected by the proposed wind turbines.

15.9.2 Approach

128. The effects of the proposed Development have been assessed by modelling whether any of the wind turbines would be in the line of sight of any aviation radar facilities, and whether the Site is in an area of operational importance to those radars. Evaluation of these effects also considered the response of radar operators to pre-application consultation. Full details of the assessment methodology and modelling are provided in **Technical Appendix 15.3**.

15.9.3 Legislation, Policy and Guidelines

129. The following guidance and industry standards on the potential effects of wind turbines on aviation have been considered in the assessment:

- Scottish Government Onshore Wind Policy Statement, December 2017;
- Civil Aviation Authority (CAA), CAP 168: Licensing of Aerodromes, March 2019;
- CAA, CAP 2038A00: Air Navigation Order 2016, January 2021;
- CAA, CAP 670: Air Traffic Services Safety Requirements, Part B, Section 4, June 2019;
- CAA, CAP 738: Safeguarding of Aerodromes, October 2020;
- CAA, CAP 764: CAA Policy and Guidelines on Wind Turbines, February 2016;
- CAA, Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level, June 2017;
- NATS wind farm self-assessment maps available on the NATS website; and
- Planning Circular 2 2003: Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas) (Scotland) Direction 2003, January 2003.

130. Guidance establishes that if a development is within potential line of sight of an air defence, aerodrome or en-route radar, then an assessment of the effects is likely to be required. However, paragraph 1.21 of CAP764 states that for an Air Navigation Service Provider's (ANSP) objection to a windfarm to be well founded, and thus necessitate the provision of mitigation, both the following must first be established:

a) there must be an impact of the ANSP's Communications, Navigation and Surveillance (CNS) infrastructure: and
b) that CNS impact must have a detrimental impact on the Air Traffic Service (ATS) provided by the ANSP

131. Further consultation is also required if turbines are planned within:

- 30 kilometres (km) of an airfield with a surveillance radar;
- 17 km of a non-radar licensed aerodrome with a runway of more than 1,100 metres (m);
- 5 km of a non-radar licensed aerodrome with a runway of less than 1,100 m;
- 4 km of an unlicensed aerodrome with a runway of more than 800 m;
- 3 km of an unlicensed aerodrome with a runway of less than 800 m; and
- 3 km of any other unlicensed aviation land use.

132. Notwithstanding these CAA recommended distances, the British Gliding Association (BGA) requests that relevant gliding sites and the BGA are consulted where developments are proposed within 10 km of any charted glider launch site.

133. The proposed turbine height of up to 180 m to blade tip, requires aviation lighting to be installed under Article 222 of the Air Navigation Order (ANO) 2016. This requires medium intensity ‘steady’ red aviation lights, rated at 2,000 candela, to be fitted at nacelle level. In addition, the CAA requires low intensity lights to be fitted at the intermediate level on the turbine tower (CAA Policy Statement, 2017). The intermediate tower lights would be 32 candela.

134. The CAA Policy Statement also states that *“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.”* This allows minimum intensities to be dimmed to 10% of their values

if meteorological conditions permit (i.e. the 2,000 candela minimum intensity can be dimmed to 200 candela, if visibility is greater than 5 km).

135. The CAA is also in the process of preparing a new policy statement on En-Route Aviation Detection Systems for Wind Turbine Obstruction Lighting Operation for industry consultation. SPR, as a member of RenewableUK's Aviation Working Group, has had the opportunity to review and comment on the CAA's draft proposals. The CAA's policy is still under development, drawing on similar policies in North America and continental Europe. It is anticipated that the guidance will be finalised and released during 2022. The draft guidance currently envisages allowing aviation lights only to be illuminated when an aircraft is within a volume bounded by 4 km (horizontal distance) from the perimeter group of turbines and between 150 m above ground level of the lowest turbine and 300 m above the highest turbine tip of the Site. An aircraft's presence in this volume would be detected by a surveillance (radar) system.

136. Calculations estimate that the upper boundary of the volume which would require aviation obstacle lighting to be activated for the proposed Development would be a maximum of 2,700 feet above mean sea level (amsl). The aviation lighting would not be activated when commercial airlines pass over the Site as such aircraft ordinarily operate in Controlled Airspace (CAS) which extends upwards from approximately 19,500 feet amsl over the Site.

15.9.4 Baseline

137. The Site is approximately 58 km (measured to the nearest area of the proposed turbines) north west of Glasgow Prestwick Airport (GPA) and 57 km west of Glasgow Airport, the two major radar-equipped airports in the west of Scotland.

138. There are two PSR facilities at GPA: a Marconi S511 radar used for planning purposes, and a Terma Scanter 4002 radar used for approach control. Initial assessments have established that the proposed turbines would be within radar line of sight (RLoS) of both these PSRs.

139. Glasgow Airport also maintains two PSRs: a NASR-10 and a Terma Scanter 4002. Initial assessments have established that the proposed turbines would not be within RLoS of these radars.

140. The closest NATS (En Route) plc (NERL) operated radars to the Site are at Lowther Hill and Tiree. Lowther Hill PSR is located approximately 110 km southeast of the Site while Tiree PSR lies 119 km north west. Initial assessments have established that the proposed turbines would be in RLoS of Lowther Hill PSR.

141. The closest non-radar licensed aerodrome to the Site is Campbeltown Airport, approximately 40 km to the southwest. No other licensed or unlicensed aerodromes are within close proximity of the Site.

142. The Site is situated within Class G (uncontrolled) airspace which extends from the ground to Flight Level (FL) 195 (approximately 19,500 ft amsl). In uncontrolled airspace the responsibility to see and avoid other traffic and obstacles rests with the pilots in command of civilian and military aircraft – any ATS provided is essentially advisory. Above FL 195 the airspace is Class C controlled airspace. The elevation of the highest proposed turbine would extend to less than 1,700 ft amsl, and as such would not penetrate any controlled airspace. The Site is laterally clear of any of the airspace structures that are in the vicinity. The Site is within the Glasgow Airport Air traffic Control Surveillance Minimum Altitude Chart, however, as the obstacles on the Isle of Arran are far higher, the chart would not require updating.

143. All of the proposed turbines would lie within a Ministry of Defence (MOD) "blue" low flying consultation zone. A "blue" zone is classed by the MOD as a low priority military low flying area that is less likely to raise concerns.

15.9.5 Consultation

144. The relevant aviation stakeholders were consulted regarding the potential effects of the proposed Development as part of the Scoping process. A summary of consultation is provided in Error! Reference source not found.**5.7**.

Table 15.7: Consultation Responses

Consultee	Summary of Consultation	Comment / Action Taken
Ministry of Defence / Defence Infrastructure Organisation (DIO)	Email dated 27/05/2020: The MOD has no concerns to the proposal. The MOD will request that the development should be fitted with MOD accredited aviation safety lighting in accordance with ANO 2016. DIO Safeguarding wishes to be consulted and notified of the progression of planning applications and submissions relating to this proposal to verify that it will not adversely affect defence interests. It is noted that the proposal will involve temporary and permanent anemometry masts. No details are available at this stage but the MOD would like to review the details once any planning application is submitted. If planning permission is granted, we would like to be advised of the following prior to commencement of construction: • the date construction starts and ends; • the maximum height of construction equipment; • the latitude and longitude of every turbine. This information is vital as it will be plotted on flying charts to make sure that military aircraft avoid this area. If the application is altered in any way we must be consulted again as even the slightest change could unacceptably affect us.	Appropriate MOD accredited lighting in accordance with CAA requirements would be fitted to the turbines as part of the proposed Development. SPR would consult with MOD/DIO prior to the commencement of construction so that details of the scheme can be provided.
Glasgow Prestwick Airport	Email dated 25/06/2020: This development is in an area where GPA ATC (Air Traffic Control) regularly hand military aircraft over to military controllers (and vice versa) in particular during the regular military exercises that GPA contribute to an annual basis – and such any radar clutter resulting from these proposed turbines of Earraghail Windfarm would require to be mitigated appropriately to minimise any impact to the safe handover of traffic between ATC Units. Initial LOS (line of sight) analysis by ourselves intimates that these turbines may be visible to GPA primary radars – and we trust the Aviation Section of the detailed EIA will explore this in full and report accordingly.	Initial modelling of the S511 and Terma PSRs at GPA showed that all 13 of the proposed turbines would be in RLoS of these radars. It can be assumed that both the S511 and Terma PSRs would also detect all 13 turbines.
NATS Safeguarding	Email dated 25/06/2020: The proposed development has been examined by our technical safeguarding teams and conflicts with our safeguarding criteria.	Initial modelling of the closest NERL PSRs showed that all 13 turbines would be in RLoS of Lowther Hill PSR. It can be assumed that Lowther Hill PSR would detect all 13 turbines.

Consultee	Summary of Consultation	Comment / Action Taken
NATS Technical and Operational Assessment (TOPA) for Earraghail Renewable Energy Development SG29685 Issue 1 June 2020	Accordingly, NATS (En Route) plc objects to the proposal. The terrain screening available will not adequately attenuate the signal from Lowther Hill radar, and therefore the development is likely to cause false primary plots to be generated. A reduction in the radar's probability of detection, for real aircraft, is also anticipated. The anticipated impact is deemed to be acceptable by NATS Engineering, but unacceptable to NATS Prestwick Centre ATC.	

15.9.6 Assessment of Effects

145. Modelling of the S511 and Terma PSRs at GPA showed that all 13 of the proposed turbines would be in RLoS of these radars. It can be assumed that both the S511 and Terma PSRs would also detect all 13 turbines.

146. Modelling of NERL's Lowther Hill PSR confirmed the finding of the NATS TOPA that all 13 proposed turbines would be in RLoS and likely to be detected.

147. As stated in 2012 by GPA in a response to the planning application for the nearby Freasdail Wind Farm, the proposed Development is in an area on the edge of GPA's Radar Consultation Zone and, in an area 'rarely used' by the airport for vectoring aircraft. Any clutter associated with the proposed Development would therefore be unlikely to have a negative impact on GPA's ability to provide an ATS.

148. The airspace immediately above the Site is uncontrolled airspace extending to FL 195 with controlled airspace above this level. NERL does not provide surveillance-based services in uncontrolled airspace and above FL 195 utilises only Secondary Surveillance Radar. Any PSR returns, including clutter associated with turbines, would not be displayed to controllers and hence would not impact upon the provision of an ATS.

149. Full details of the radar modelling and airspace analysis for both GPA and NERL are contained within **Technical Appendix 15.3**.

15.9.7 Mitigation and Conclusion

150. Mitigation should only be required where radar clutter generated by the proposed Development's turbines has a detrimental impact on the ATS provided in the airspace in the vicinity of the Site.

151. Although it is not considered that the turbines would have a detrimental impact on GPA's ATS, should mitigation be deemed necessary then the Terma PSR could be re-optimised to filter out any turbine-induced radar clutter.

152. Again, although it is not considered that clutter associated with Lowther Hill PSR would have an impact on NERL's ATS, there would be mitigation options available. Infill radar feeds could be used from PSRs that are integrated into NERL's Multi-Radar Tracking infrastructure, including Tiree PSR (minimum infill coverage of 3,500 ft amsl), Cumbernauld PSR (minimum infill coverage of 4.000 ft amsl) and the two Glasgow Airport PSRs (minimum infill coverage of 6,000 ft amsl).

153. Lowther Hill PSR is expected to be replaced by a more advanced radar facility with in-built capability for mitigating the impact of turbines by the end of 2021. The NATS press release announcing the replacement radar can be accessed online using the following link: https://www.nats.aero/news/advanced-new-radar-at-lowther-hill-to-enable-more-wind-energy-generation/. At the present time the full mitigation capabilities of this radar are not known.

15.10 Population and Human Health

154. **Chapter 7**, **Chapter 10**, **Chapter 12**, **Chapter 13** and **Chapter 14** of this EIAR, contain assessments which relate to the health and wellbeing of the local population. These Chapters assess the potential effects of the proposed Development, both positive and negative, provide an analysis of the significance of these effects and also put forward measures to mitigate against negative effects on people and their health.

155. **Chapter 16** provides an overview of the mitigation put forward as part of these assessments in order to reduce any negative effects of the proposed Development to an acceptable level.

156. Further to the topics covered in **Chapters 7 to 15**, it is not expected that there will be any other effects from the proposed Development which would have significant effects on population and human health.

15.11 Risk of Accidents and Other Disasters

15.11.1 Introduction

157. The vulnerability of the proposed Development to major accidents and natural disasters, such as flooding, sea level rise, or earthquakes, is considered to be low due to its geographical location and the fact that its purpose is to ameliorate some of these issues.

158. In addition, the nature of the proposals and remoteness of the Site means there would be negligible risks on the factors identified by the EIA Regulations. For example:

- population and human health – the Site is remote with no permanent residents on the Site, and a low population density surrounding it. The required safety clearances around turbines have been a key consideration throughout the design process;
- biodiversity – receptors and resources would be unaffected as there would be little risk of polluting substances released or loss of habitat in a turbine failure scenario (highly unlikely);
- land, soil, water, air and climate – there would be little risk of polluting substances released or loss of habitat in a turbine failure scenario (highly unlikely); and
- material assets, cultural heritage and the landscape – there would be no adverse effects on these features in a turbine failure scenario (highly unlikely).

15.11.2 Public Safety and Access

159. The RenewableUK Onshore Wind Health and Safety Guidelines (2015) note that wind turbine development and operation can give rise to a range of risks to public safety including:

- traffic (especially lorries during construction, and abnormal loads for the transport of wind turbine components; including beyond the application boundary);
- construction site hazards (particularly to any people entering the Site without the knowledge or consent of the site management);
- effects of catastrophic wind turbine failures, which may on rare occasions result in blade throw, tower topple or fire; and
- ice throw, if the wind turbine is operated with ice build-up on the blades.

160. The RenewableUK guidance (2015) states that "*Developers should ensure that risks to public safety are considered and managed effectively over the project lifecycle, and should be prepared to share their plans for managing these risks with stakeholders and regulators; effective engagement can both build trust, and help to reduce the level of public safety risk by taking account of local knowledge*."

161. Site security and access during the construction period would be governed under Health and Safety at Work Act 1974 and associated legislation. There would be no public access to the Site during construction. However, the Land Reform (Scotland) Act (2003) which came into effect in February 2005 establishes statutory rights of responsible access on and over most land. The legislation offers a general framework of responsible conduct for both those exercising rights of access and for landowners..

162. During construction, some restrictions on use of the public paths running through the proposed Development may be required for public safety. A temporary diversionary route for the Kintyre Way would be considered to divert users away from construction activities where required.

163. Once the construction period and commissioning of the proposed Development is complete, no special restrictions on access are anticipated.

164. Informal recreational access within the Site, which is being promoted by the proposed Development, would benefit from the presence of the proposed Development by providing a feature of interest and enhancing access through site infrastructure. Appropriate warning signs would be installed concerning restricted areas such as the substation compound, transformers, switchgear and metering systems. All onsite electrical cables would be buried underground with relevant signage.

15.11.3 Traffic

165. Accident data for the roads local to the Site (A83 between the Site and Campbeltown Harbour to the south and north to Lochgilphead) has been reviewed and is presented **in Chapter 12**. An assessment of the potential effects on road safety has been undertaken. In summary, the proposed Development would create an increase to HGV traffic levels within the Study Area, but these levels would remain well within the design capacity of the local road network Study Area

15.11.4 Construction

166. With regard to risks and accidents during the construction phase, the construction works for the proposed Development would be undertaken in accordance with primary health and safety legislation, including the Health and Safety at Work Act 1974 and the Construction (Design and Management) (CDM) Regulations 2015 which will include a requirement to produce emergency procedures in a Construction Phase (Health & Safety) Plan in accordance with the Regulations.

167. Nonetheless, the risk of accidents and other disasters is covered where relevant in individual topic Chapters, for instance, the potential for environmental incidents and accidents such as spillages are considered in **Chapter 8, Chapter 9** and **Chapter 10**. Flood risk is also assessed in **Chapter 10**.

15.11.5 Extreme weather

168. As far as the risk of turbine failure during high winds is concerned, the turbines would cut-out and automatically stop as a safety precaution in wind speeds over 25 m/s. The solar mounting panels would also be designed to with stand high winds. Failure of the solar panel arrays during high winds, whilst not expected, would be unlikely to result in any significant environmental effects. The BESS would also be designed to withstand high winds and adverse weather conditions and would be fully bunded to prevent any spillage or leakage of battery fluids.

169. Wind turbines can be susceptible to lightning strike due to their height and appropriate measures are taken into account in the design of turbines to conduct lightning strikes down to earth and minimise the risk of damage to turbines. However, occasionally lightning can strike and damage a wind turbine blade. Modern wind turbine blades are manufactured from a glass-fibre or wood-epoxy composite in a mould, such that the reinforcement runs predominantly along the length of the blade. This means that blades are designed to stay attached to the turbine and in all cases turbines will automatically shut down if damaged by lightning. Solar panels can also be susceptible to lightning strikes and they would be installed with lightning protection systems to reduce risks of lightning damage or arcing.

170. Ice build-up on blade surfaces occurs in cold weather conditions. Wind turbines can continue to operate with a very thin accumulation of snow or ice, but will shut down automatically as soon as there is a sufficient build up to cause aerodynamic or physical imbalance of the rotor assembly. Potential icing conditions affecting turbines can be expected two to seven days per year (light icing) in Scotland (Tammelin et. al, 2000), which is a low probability of occurring.

171. Modern wind turbines, such as those being considered for the proposed Development, are typically equipped with an ice detection system which works on a power curve analysis method. Ice build-up negatively affects the aerodynamic properties

of the blade and thus impacts energy production performance, which can be remotely detected. When certain criteria are fulfilled, the turbine can be automatically shut down, thus limiting the risk of ice-throw.

172. There are monitoring systems and protocols in place to ensure that turbines that have been stationary during iceing conditions are restarted in a controlled manner to ensure public safety. The highest risk of ice throw occurs when the turbines are restarted.

173. In addition, the proposed turbines are not located close to any buildings or public roads. The Kintyre Way is the closest public access to the turbines. The risk to public safety is therefore considered to be very low due to the few likely occurrences of these conditions, along with the remote natures of the Site.

15.11.6 Seismic activity

174. No fault lines are present on or in the immediate vicinity of the Site, and there are no records of any earthquakes occurring in the vicinity of the Site since 1927 (BGS GeoIndex, viewed 10/08/2021). Earthquakes in Scotland are typically no greater than 3 on the Richter Scale and, therefore, minor and unlikely to cause significant damage to buildings and infrastructure.

175. It is very unlikely that an earthquake would occur on the vicinity of the Site resulting in any damage to the proposed Development. Should a wind turbine or solar array be damaged, the risk to public safety is considered to be negligible due to the remote location and careful design layout of the infrastructure.

15.12 Waste and Environmental Management

176. **Chapters 7 to 14** put forward suggestions on how to mitigate any negative impacts from the proposed Development with regards to waste and environmental management. These are summarised in **Chapter 16**.

177. The outline CEMP (**Technical Appendix 3.1**) provides a general overview on how waste and other environmental issues would be managed during the construction phase. The Peat Management Plan (**Technical Appendix 10.2**) also details how excavated peat is controlled, stored, re-used and disposed of during the construction phase of the proposed Development.

178. The forestry appendix (**Technical Appendix 15.1**) also provides information relating to the reuse and disposal of forestry wastes associated with felling required for the proposed Development.

It is expected that a site-specific waste management plan for the control and disposal of waste generated onsite would be required by condition, should the Proposed Development receive consent.

15.13 References

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