

 Total Broadband Solutions	Procedure: 001	Rev: 1.0
Title: Ballysallagh Solar Farm EMF/EMC Assessment	Approved: KH	Date: 25/06/24

Report

Ballysallagh Solar Farm EMF/EMC Impact Assessment Report

This document was prepared for Ballysallagh Solar Farm (Cork County Council Ref: 24/05630) and is submitted for information purposes.

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Executive Summary

This EMF/EMC Assessment Statement has been prepared by Ai Bridges Ltd on behalf of Ballysallagh Solar Farm Limited. It is prepared as part of a planning application to Cork County Council to obtain permission for the proposed solar farm at Ballysallagh, Co Cork. The purpose of this study is to:

- i) Assess the potential impact of the proposed development due to EMF (Electromagnetic Fields).
- ii) Assess the potential impact of the proposed development due to EMC (Electromagnetic Compatibility).

For the EMF assessment, International Guidelines and Standard were used to assess the potential impact of EMF on human health. The guidelines indicate that the EMF levels that would be emitted from the inverter/transformer stations and underground interconnector cabling associated with the solar farm, as well as the substation and underground grid connection cable, would be well below recommended levels. Table 1 below provided a summary of expected EMF impacts due to the proposed solar farm at Ballysallagh.

Assessment	Summary	Impact of Proposed Development
EMF	EMF levels from the inverter/transformer stations and underground interconnector cabling associated with the solar farm, as well as the substation and underground grid connection, would be well below recommended levels which is the level at which radiation is potentially harmful to humans as published in the ICNIRP guidelines.	No issues.

Table 1. Summary EMF Impacts

For the EMC assessment, a desktop survey was carried out to identify the telecom infrastructure in the vicinity of the proposed development. The desktop survey results found that there are two Telecom Mast-sites within 3 km of the proposed development site. Analysis indicates that electro-magnetic emissions due to the proposed development will dissipate rapidly and as the telecoms mast-site is sufficiently far from the proposed development there will be no EMC impacts.

Consultations with the telecom operators who have network infrastructure at the mast-site were also undertaken to determine if they have any concerns regarding EMC. The responses received from the telecom operators can be found in Section 3.1.1 of this report. None of the operators have raised any concerns regarding EMC due to the proposed development. Table 2 below provided a summary of expected EMC impacts due to the proposed development.

Assessment	Summary	Impact of Proposed Development
EMC	The EMF signals due to the proposed development would be very low and would be negligible at the telecoms mast-sites at Corbally North and Lisgoold. The relevant telecom operators with network equipment at the mast-sites at Corbally North and Lisgoold have been notified of the proposed development and no issues have been raised regarding EMC.	No issues.

Table 2. Summary of EMC Impacts.

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Section 1 - Solar Farm Site Information

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1. Introduction

In this section a brief summary of the proposed development site is provided. Details regarding the site's geographic location and the nearest Telecom Operator Mast-sites are presented.

1.1 Solar Farm Site Information

Ballysallagh Solar Farm Limited intend to apply for a 10 Year Planning Permission for a solar farm with a total area of circa 179 hectares in the townlands of Ballysallagh, Dundullerick East, Dundullerick West and Rathcobane in County Cork. The working title for the project is "Ballysallagh Solar Farm".

The solar farm will consist of solar panels on ground mounted frames, 25 no. single storey electrical inverter/transformer stations, 3 no. single storey spare parts containers, 3 no. Ring Main Units, 7 no. weather stations, underground electrical ducting and cabling within the development site, private lands and within the L7691 and L7692 public roads to connect solar farm field parcels, security fencing, CCTV, access tracks, 7 no. stream/drain deck crossings, temporary construction compounds, landscaping and all associated ancillary development and drainage works.

The operational lifespan of the solar farm will be 40 years and planning permission is requested for this duration. The proposed solar farm site is approximately 15km northeast of Cork City and is shown below in Figure1.

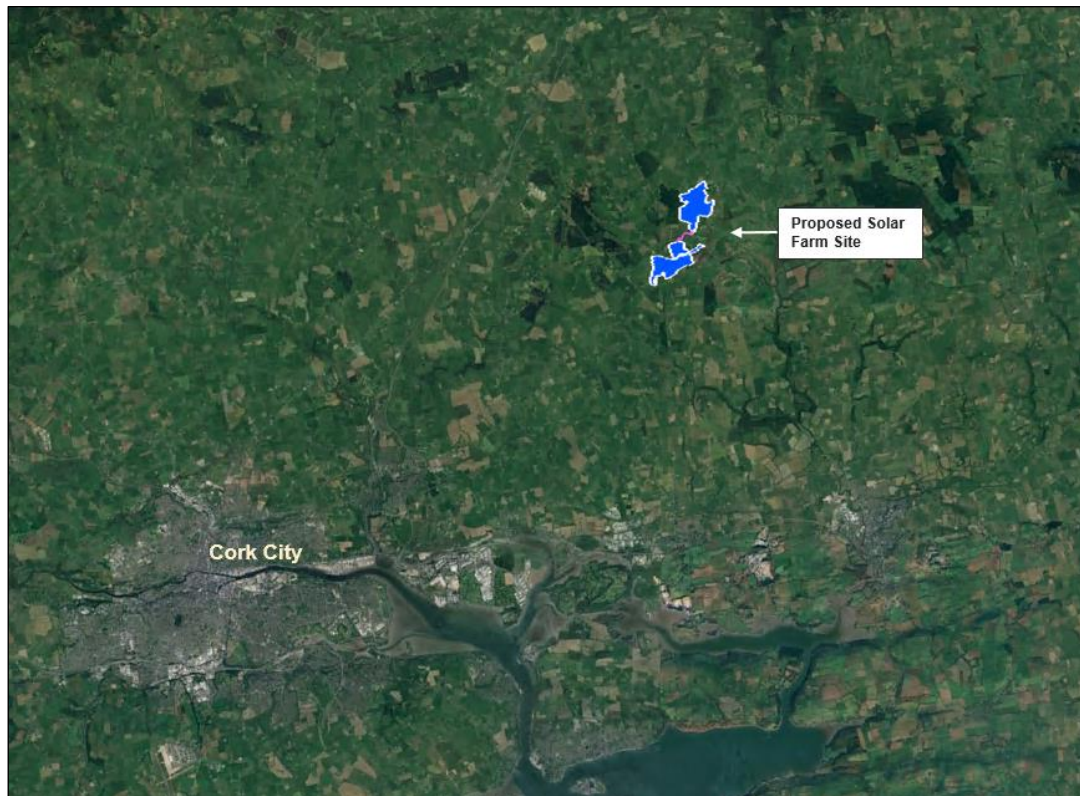


Figure 1. Location of proposed Solar Farm

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The solar farm will connect to the existing Knockraha 220kV substation by means of a proposed substation and associated underground cable. The grid connection for the solar farm, including the substation, will be the subject of a separate 'Strategic Infrastructure Development' (SID) application to An Bord Pleanála.

The substation will be based on EirGrid design specifications. The substation compound will consist of EirGrid and IPP Control Room buildings, High Voltage (HV) electrical equipment and associated infrastructure including palisade fences and concrete post and rail fences. The installation of HV electrical equipment will include a 33kV Transformer with associated equipment along with:

- Cable Sealing End (CSE);
- Surge Arrestor (SA);
- Earth Disconnect (DA, DB, DL, DT);
- Current /Voltage Transformer (CT/VT);
- House Transformer (HoT);
- Circuit Breaker (CB);
- Lightning Masts (LM);
- Back-Up Diesel Generator;
- Harmonic filters if required by EirGrid;
- Capacitor Bank if required by EirGrid;
- Fire/Blast Wall;
- Telecoms Pole;
- Underground cable trench for the grid connection to the existing Knockraha 220kV substation comprising of 3 no. power ducts, 2 no. telecom ducts and 1 no. earth continuity ducts.

The Technical Specification of the inverter/transformer to be used at the proposed development is shown below in Figure 2.

Type designation	SG6250HV-MV	SG6800HV-MV
Input (DC)		
Max. PV input voltage		1500 V
Min. PV input voltage / Startup input voltage		875 V / 915 V
MPP voltage range		875 – 1300 V
No. of independent MPP inputs		4
No. of DC inputs	32 / 36 / 44 / 48 / 56 (Max. 48 for floating system)	
Max. PV input current	2 * 3997 A	
Max. DC short-circuit current	2 * 10000 A	
PV array configuration	Negative grounding or floating	
Output (AC)		
AC output power	2 * 3125 kVA @ 50 °C, 2 * 3437 kVA @ 45 °C	2 * 3437 kVA @ 45 °C
Max. inverter output current		2 * 3308 A
AC voltage range		20 kV – 35 kV
Nominal grid frequency / Grid frequency range		50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
Harmonic (THD)		< 3 % (at nominal power)
Power factor at nominal power / Adjustable power factor		> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / AC connection		3 / 3-PE

Figure 2. Inverter/Transformer Technical Specification

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There are 3 no. separate parcels of land within the proposed solar farm. Inverter/transformer stations located in each parcel will be connected to the proposed substation via 33kV underground AC electrical interconnections (hereafter referred to as 33kV UGC Interconnectors). These are to be placed on private lands and within the public road network, with 4 no. separate Interconnectors. The number of ducts and cables, and therefore the trench width, will vary depending on the section of the 33kV UGC Interconnector.

The substation is expected to be a 220kV AIS tail-fed electricity substation, with 33kV customer compound. The substation will consist of the EirGrid and Independent Power Producers (IPP) control room buildings, a transformer, security fencing, security lighting, drainage infrastructure, temporary construction compound and high voltage electrical equipment.

An underground grid connection cable is proposed to connect the proposed substation into the existing Knockraha 220kV substation. The grid connection is expected to be 220kV depending on the final design configuration of the substation.

It should be noted that details regarding the substation and grid connection is included for information purposes only and does not form part of the development for which planning permission is sought from Cork County Council.

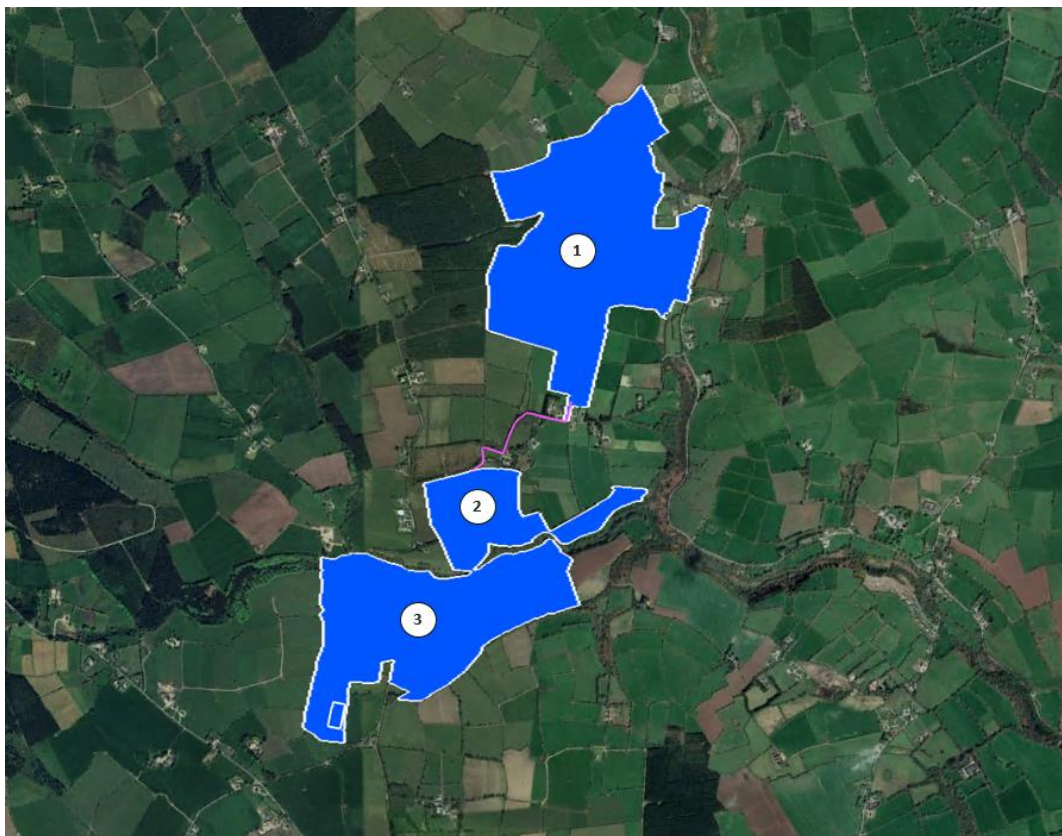


Figure 3. Solar Farm Layout and Parcel Locations

As previously stated, it is proposed that an underground grid connection cable will connect the proposed substation into the existing Knockraha 220/110kV substation. This grid connection will be subject to a separate SID application to An Bord Pleanála. A proposed UG cable route is shown below in Figure 4.

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A decision on the final grid connection route will be made in advance of the future SID application to An Bord Pleanála. Irrespective of the final voltage (220kV or 110kV) of the proposed substation and grid connection, which will be subject to a future Strategic Infrastructure Development (SID) application to An Bord Pleanála, the finding of this report remain unchanged.

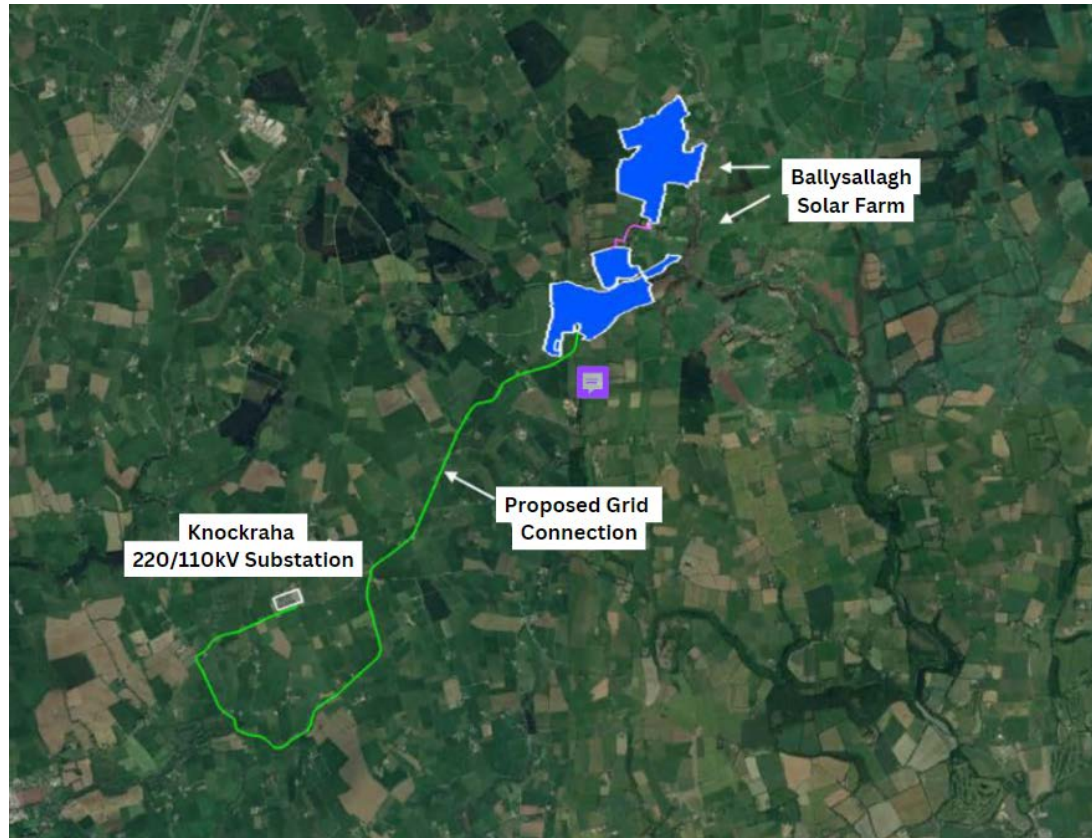


Figure 4. Grid Connection Route

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Section 2 - EMF (Electromagnetic Fields) Impact Assessment

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2. EMF (Electromagnetic Fields)

The Environmental Protection Agency describes Electro-magnetic fields (EMF) as follows:

Electromagnetic fields (EMF) together with optical radiation, which includes infrared, visible light, and ultraviolet radiation, collectively make up the non-ionising radiation (NIR) spectrum. This type of radiation does not have enough energy to break up (ionise) atoms or molecules. It is therefore different to ionising radiation, such as X-rays or radioactive sources, which can break up molecules and is known to cause damage to human cells.

EMF are generated by everyday items such as mobile phones and electrical appliances. EMF are intentionally produced and used to transmit information wirelessly over great distances or to heat things such as food. So, we use EMF every time we listen to the radio, watch television, warm up food in a microwave oven or use our mobile phone. EMF are also generated when electricity is produced (e.g. power plants) and distributed (e.g. power lines), and whenever we use an electric appliance at home or in work.

EMF sources also occur in nature and include the earth's magnetic field, which causes compasses to point north, or the electric fields produced in the atmosphere during lightning storms. EMF are also emitted by the sun, and even by our own bodies.

The Electromagnet Spectrum is illustrated in below Figure 5.

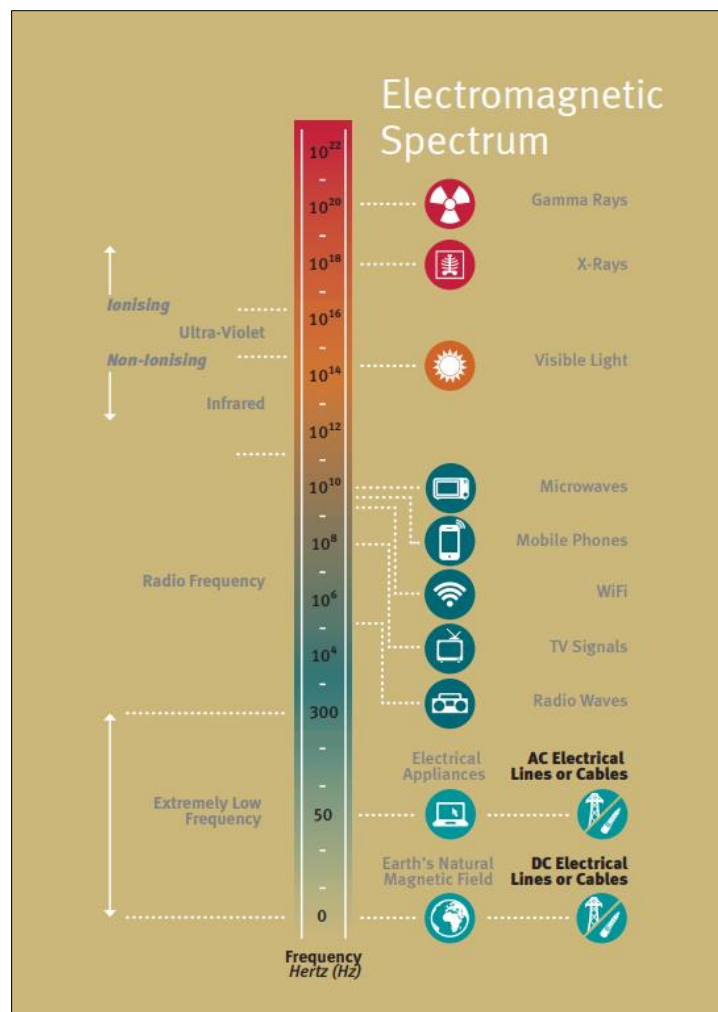


Figure 5. Electromagnetic Spectrum

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2.1 Impacts of EMF

High levels of EMF exposure can be harmful to human health and the Irish government's policy in relation to EMF public exposure is to comply with the 1998 International Commission on Non-Ionising Radiation Protection (ICNIRP) guidelines. Electromagnetic fields are measured using units of microtesla (μT) and the public limit advised by the ICNIRP 1998 guidelines is 100 μT .

Solar farms can emit low levels of EMF from inverter/transformer stations and underground interconnector cabling as well as from on-site substations and any associated grid connection cabling; however, the levels of EMF emitted are substantially lower than the basic restriction level which is the level at which radiation is potentially harmful to humans. Figure 6 below shows a comparison of AC electric fields from common sources.

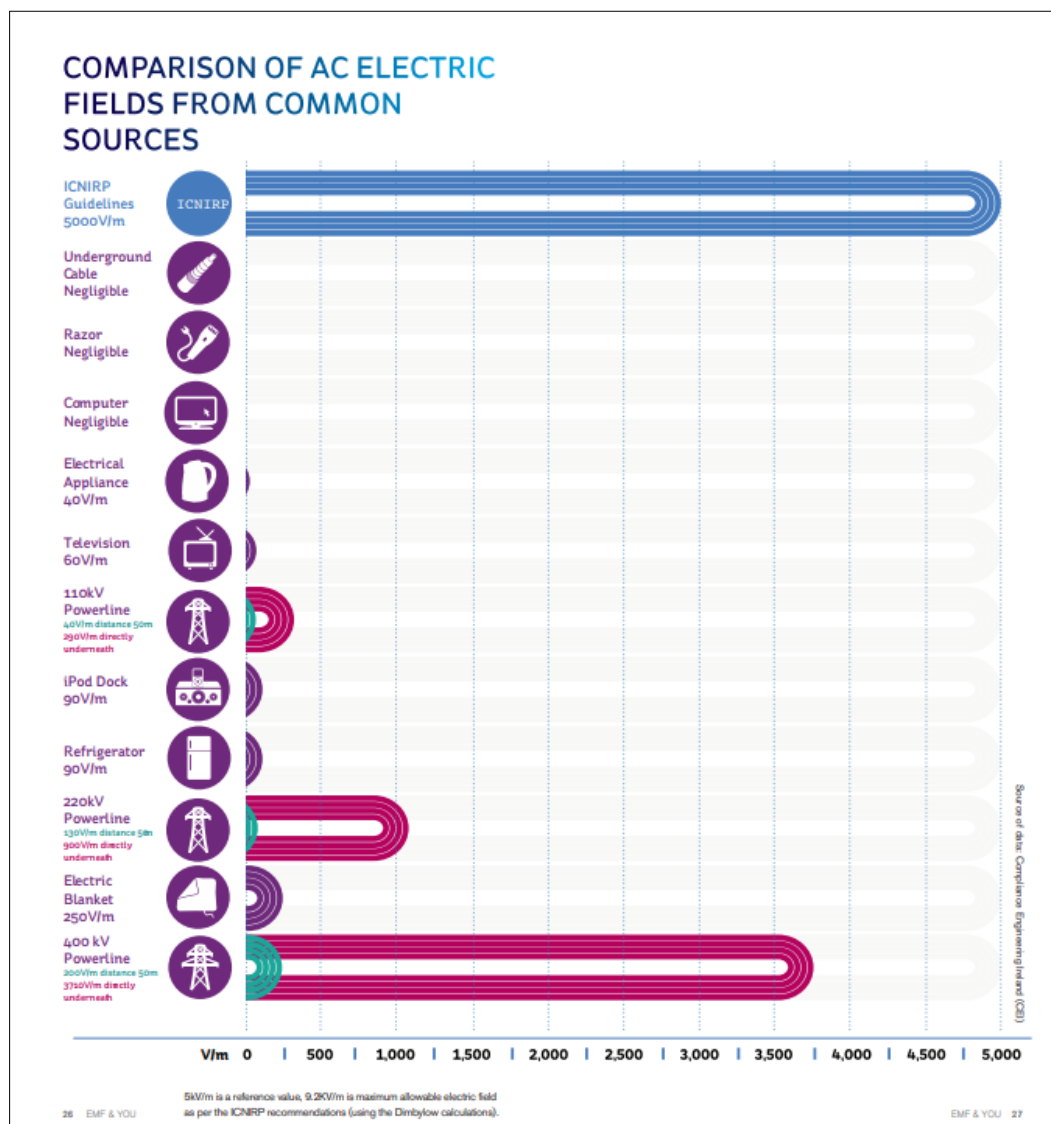


Figure 6. Comparison of AC electric fields from common Sources *

* Image from ESB Document "EMF & You"

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EMF strength decreases with distance relatively quickly. This is illustrated in Figure 7 below which shows how exposure to EMF decreases with distance.

As shown below, when directly on top of a 110 kV cable the magnetic field is 2.32 μ T. When directly on top of a 220 kV cable the magnetic field is 26.01 μ T. Both of these levels are well below the 100 μ T public limit.

As the highest cable voltages at the proposed development (including grid connection) are 110/220 kV, the EMF levels will be considerably lower than the ICNIRP recommendation of 100 μ T. EMF levels at the transformer are also expected to be considerably lower than the ICNIRP recommendation of 100 μ T.

The nearest residence to the proposed substation is over 150 meters away and any EMF signals from the solar farm will be negligible and any inverter/transformer emissions or associated EMF signals will have negligible impact on residences that are located outside the development boundary. Any emissions from the inverters would dissipate rapidly within the development site boundary which would be considerably lower than the ICNIRP recommendation of 100 μ T.

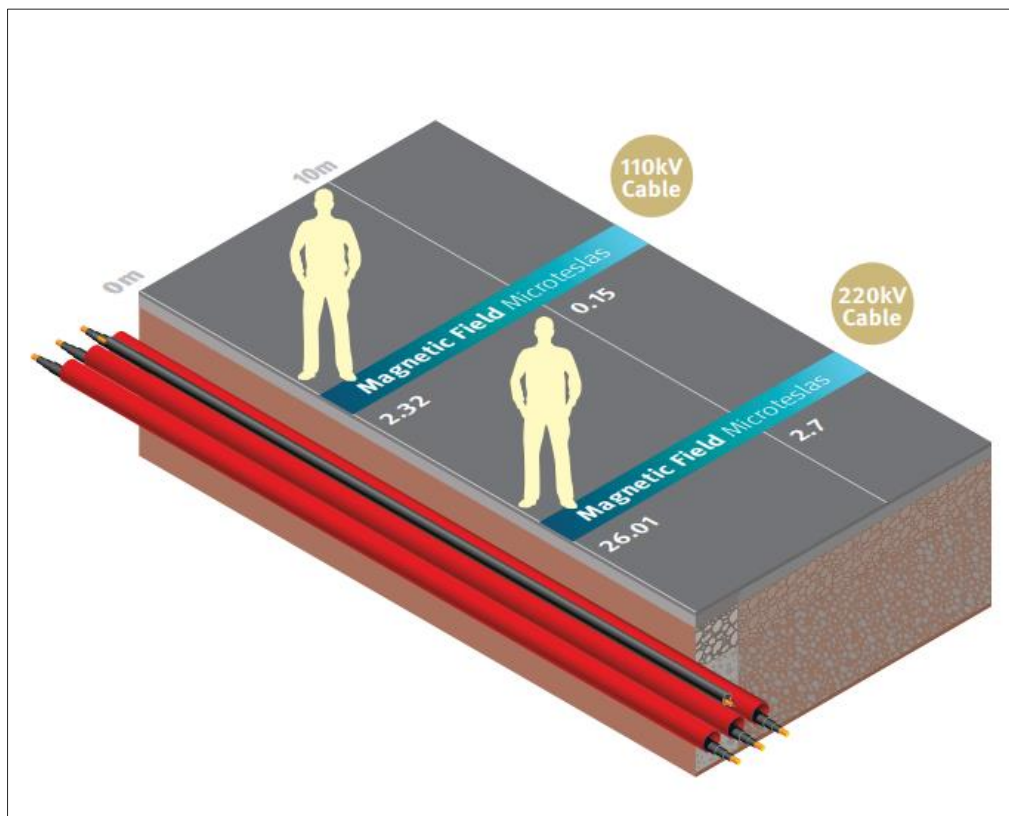


Figure 7. Magnetic Field Levels*

* Image from Eirgrid Document "The Electricity Grid and Your Health"

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Section 3 - EMC (Electromagnetic Compatibility) Impact Assessment

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3. EMC (Electromagnetic Compatibility)

EMC concerns the ability of electrical / electronic systems and devices to function properly when in close proximity to each other.

3.1 Impacts of EMC

High levels of Electromagnetic Fields can cause Electro-Magnetic Interference (EMI) to electrical devices and telecommunications systems. A desktop survey was carried out to identify the nearest telecommunications infrastructure to the proposed development site. The results of the desktop survey found that there are two Telecommunications mast-sites within 3 km of the proposed solar farm site boundary. The telecom mast-site is shown below in Figure 8.

Using the ComReg database of telecom operators, the following operators were found to have network infrastructure at this mast-site: Eir, Imagine Broadband, Three Ireland and Vodafone Ireland. Field Surveys of these mast-site were also carried out, the results of which are presented in Appendix B of this report.

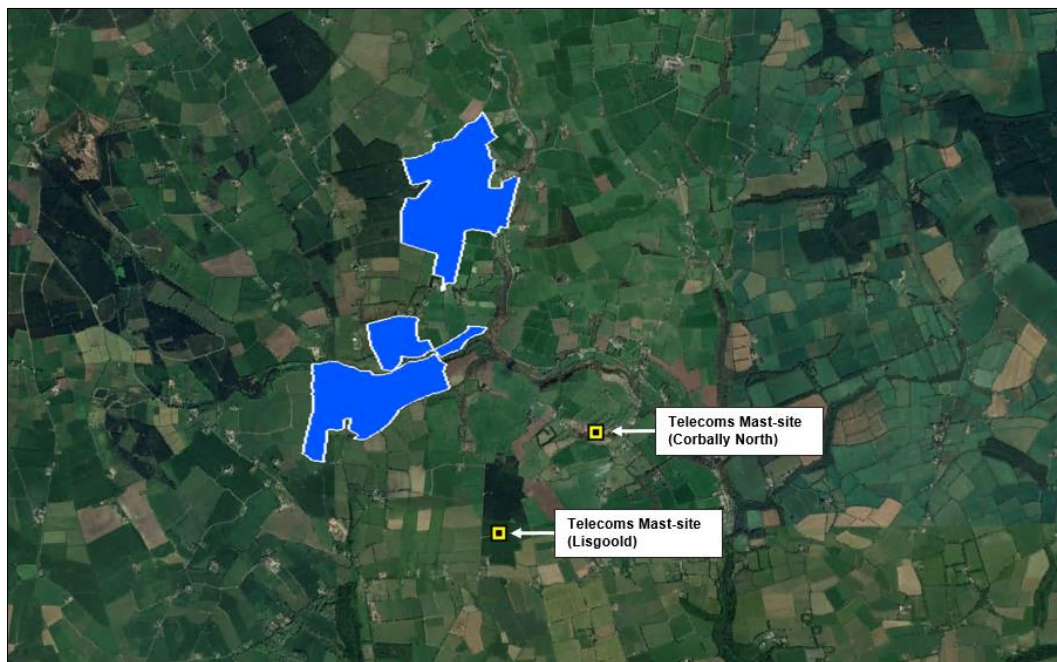


Figure 8. Telecoms Mast-Site within 3 km of the proposed development site

Telecoms Mast ID	Distance from Solar Farm Site	Telecom Operator(s) with infrastructure at mast-site
Corbally North	1.4 km	Vodafone
Lisgoold	1.4 km	Eir, Imagine Broadband & Three Ireland

Table 3. Telecom Mast-site within 3 km of the proposed development site

As outlined in Section 2.1 of this report, the level of EMF from the proposed development will be very low and no impacts are expected on the telecom operator networks at Corbally North and Lisgoold; however, consultations were carried out with the relevant operators. The consultation process is outlined in Section 3.1.1 that follows.

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3.1.1 Telecom Operator Consultations

Consultations beginning in May 2024 were undertaken with the relevant telecom network operators at the Corbally North and Lisgoold mast-sites. The operators were requested to raise any concerns they may have regarding EMC impacts to their networks due to the proposed solar farm development.

Table 4 lists the Telecom Operators contacted, and the issues raised by the operators. The responses received from the Telecom Operators are provided in Section 3.1.1.1 to Section 3.1.1.4.

ID	Operator	Response Received (Yes/No)	Issues raised by Operator \ Observations.
1	Eir	Yes	No EMC issues raised by Eir.
2	Imagine Broadband	Yes	No EMC issues raised by Eir.
2	Three Ireland	Yes	No EMC issues raised by Three Ireland.
3	Vodafone	Yes	No EMC issues raised by Vodafone.

Table 4. Telecom Operators Consulted

3.1.1.1 Eir Response to Consultations

Eir have raised no concerns regarding the proposed development. The Eir response to consultations is provided below:

"We have no transmission links within the proposed area .. and it has no risk to the network for Eir Mobile or the Eir fixed network."

3.1.1.2 Imagine Broadband Response to Consultations

Imagine Broadband have raised no concerns regarding the proposed development. The Imagine Broadband response to consultations is provided below:

*"At present Imagine have no microwave links affected by this development.
Your mail has been forwarded to our radio planning department. They will respond directly if they have any concerns."*

3.1.1.3 Three Ireland Response to Consultations

Three Ireland have raised no concerns regarding the proposed development. The Three Ireland response to consultations is provided below:

"We don't have any concerns in relation to EMC."

3.1.1.4 Vodafone Response to Consultations

Vodafone have raised no concerns regarding the proposed development. The Vodafone response to consultations is provided below:

"Vodafone does not have any transmission in the proposed area. See screenshot below."

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Section 4 - Conclusions

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4. Conclusions

From the findings made in this report the following conclusions have been made:

- The EMF impacts due the proposed development are shown below in Table 5.

Assessment	Summary	Impact of Proposed Development
EMF	EMF levels from the inverter/transformer stations and underground interconnector cabling associated with the solar farm, as well as the substation and underground grid connection, would be significantly lower than the basic restriction level which is the level at which radiation is potentially harmful to humans as published in the ICNRIP guidelines.	No issues.

Table 5. EMF Impacts due to proposed development.

- The EMC impacts due the proposed development are shown below in Table 6.

Assessment	Summary	Impact of Proposed Development
EMC	The EMF signals due to the proposed solar farm would be very low and would be negligible at the telecoms mast-sites at Corbally North and Lisgoold. The relevant telecom operators with network equipment at Corbally North and Lisgoold have been notified of the proposed solar farm development and no issues have been raised regarding EMC.	No issues.

Table 6. EMC Impacts due to proposed development.

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APPENDIX A – References

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Appendix A – References

The following standards, guidelines and documents were referenced in this report.

- ComReg Document 08/51R2, Programme of Measurement of Non-Ionising Radiation Emissions
- International Commission on Non-Ionising Radiation Protection ‘Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300GHz)’. Health Physics 74 (4): 494-522; 1998.
- EU Council ‘Recommendation on the limitation of exposure of the general public to electromagnetic fields’ (0Hz to 300GHz) 1999/519/EC.
- ICNIRP ‘Guidelines for limiting exposure to time varying electric and magnetic fields (1Hz–100kHz) Health Physics’ 99(6):818-836; 2010.
- Directive of the European Parliament and of the Council on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) 2013/35/EU.
- Eirgrid Document: XDS-GFS-00-001-R4 Functional Specification 110/220/400 kV Substation General Requirements
- Eirgrid Document: “*The Electricity Grid and your Health*”
- ESB Document: “*EMF & You*”
- EPA <https://www.epa.ie/environment-and-you/radiation/emf/what-is-emf/>
- EPA <https://www.epa.ie/environment-and-you/radiation/emf/emf-and-your-health/>

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APPENDIX B – Telecoms Mast-Site Field Survey Findings

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Appendix B – Mast-Site Field Survey Findings

The telecom mast-sites surveyed for this EMF/EMC Study are shown relative to the proposed solar farm site in the figure below.

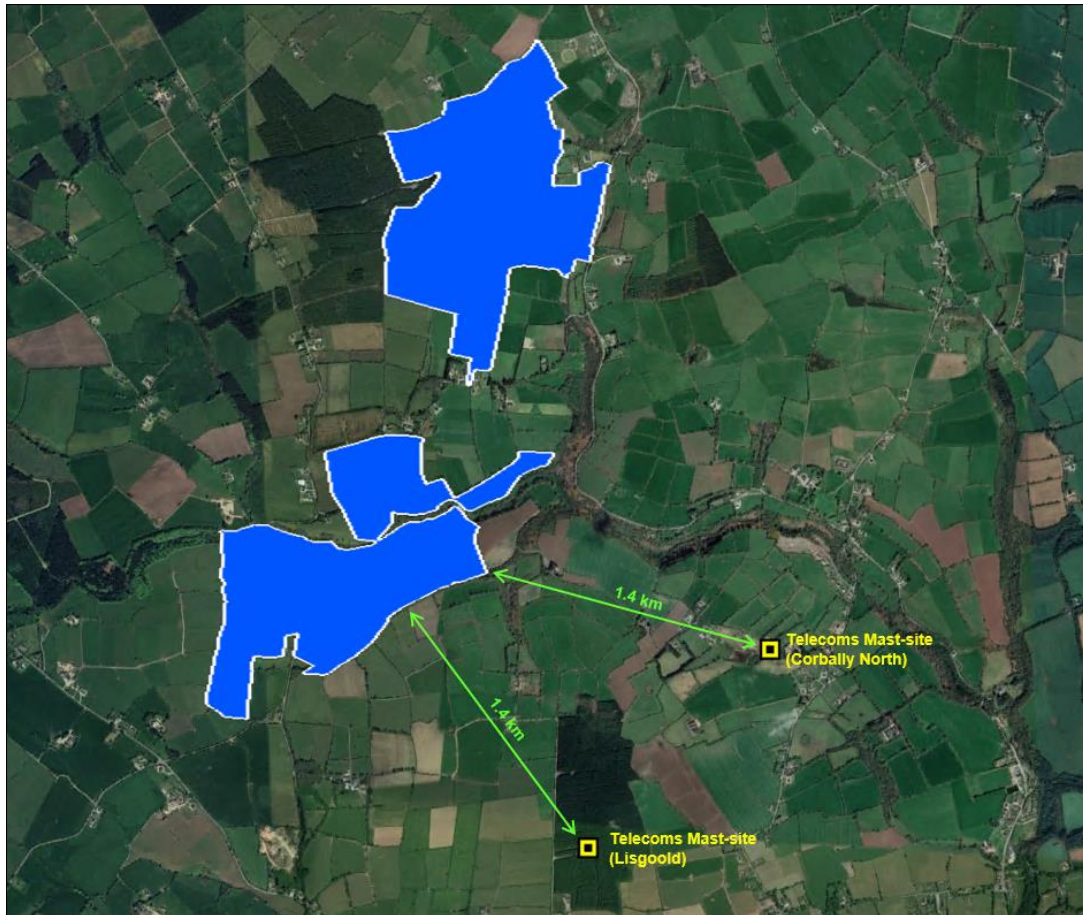


Figure 9. Telecom Mast-Site(s) shown relative to proposed solar farm.

The findings from the field surveys of each of the mast-sites are presented below.

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Mast-Site A (Corbally North)

Telecommunications Mast-Site A is located in the townland of Corbally North, Co Cork and is approximately 1.4 km east of the proposed development site.

A photo of the mast structure at this location is shown in the figure below. The Telecom Operators who have telecommunications equipment at this mast-site are listed in Table 7.



Figure 10. Mast-Site A

Mast ID	Telecom Operators
Mast A	Vodafone

Table 7. Field Survey Summary – Mast-Site A

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Mast-Site B (Lisgoold)

Telecommunications Mast-Site B is located in the townland of Lisgoold, Co Cork and is approximately 1.4 km south of the proposed development site.

A photo of the mast structure at this location is shown in the figure below. The Telecom Operators who have telecommunications equipment at this mast-site are listed in Table 8.



Figure 11. Mast-Site B

Mast ID	Telecom Operators
Mast B	Eir, Imagine Broadband, Three Ireland

Table 8. Field Survey Summary – Mast-Site B

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