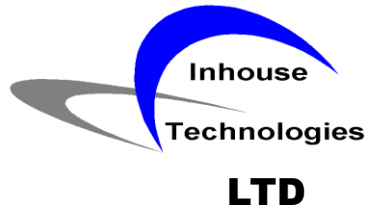


APPENDIX K.1
TELECOMMUNICATIONS AND AVIATION
IMPACT STUDY



Wind farm developments at Grousemount

For ESB Wind Farm Development Ltd

Title:

Telecommunications and Aviation Impact study

Project No. 15002

Report No. 15004

Version 1.1

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1 INTRODUCTION

The ESB is in the process of developing a wind farm in County Kerry. The location is at;

1. Grousemount townland near Kilgarvin village.

This wind farm has been created by the integration of two earlier approved wind farms into a single wind farm. These wind farms had approved planning permissions obtained in two earlier phases and the purpose of this assignment was to refresh the data already obtained during the earlier planning application phases and to investigate if anything might have changed with possible stakeholders since earlier planning was approved. It is now planned by ESBi to go for renewed planning of this single larger wind farm with An Bord Planala. The new application will integrate 38 Turbines into a single wind farm

1.1 SELECTION OF INHOUSE TECHNOLOGIES LTD

ESBi contacted Inhouse Technologies (IHT) Ltd in order to provide assistance in relation to this project. IHT had tendered to the ESB in the past to provide assistance in the areas of Telecommunications and Television interference mitigation during wind farm development and operation. As a result of this tender process, ESBi was aware of IHT's capability and experience.

1.2 SCOPE OF WORKS

The agreed scope of the works undertaken was to provide a desktop assessment of possible interference impacts on Telecommunications infrastructure and any radar infrastructure found in the vicinity of the windfarm. The work was also hoped to identify and predict any impacts on existing systems and if found, to propose possible mitigation measures. This work has required liaison with Telecommunication operators and other stakeholders.

2 EXECUTIVE SUMMARY

A total of approximately 46 companies were contacted during this process. Of those that have responded to date most have positive views about the development and only two companies have yet to respond properly.

One of the two companies is called Towercom. This company has not ever responded to any requests from Inhouse Technologies for engagement, except to state that they would respond in due course. The company is only a site provider for 3rd parties and does not operate any networks of it's own.

The 2nd company that has yet to respond is a rural broadband operator called Maints Broadband. The owner is Mr Paul Humphreys and it is based in Kilmallock Co Limerick. According to the company website it only operates in Limerick county and a small part of county Clare, so it can be assumed that there will be no interference from the development.

No company has expressed any serious concerns about the developments. It has been a very successful consultation process. This is because the area is rather unpopulated, remote and does not have a lot of existing telecommunications infrastructure.

There are already some operational wind farms in the locality and IHT Ltd has undertaken many remedial works for operators in the past to overcome interference issues in relation to Television reception interference.

It is anticipated that some television interference may result to domestic television reception but RTE Network have only requested that a protocol be signed in advance. Kerry Fire brigade have requested that ESBi provide generic advice on how first responders should respond to a fire in a wind turbine. The Irish Aviation Authority and the Air corps have requested that suitable illumination is provided on the structures along with adequate notice of a minimum of 30 days is given before the erection of any turbines.

3 PURPOSE OF THIS DOCUMENT

The purpose of this document is to detail the activities performed as per the scope of works and to provide the ESB with a baseline document with which further development works and liaison can be based, if required.

3.1 HISTORY OF DOCUMENT

This is the first draft of this document. It is anticipated that further work by the ESB and its stakeholders may update and modify the information contained within this document. The subsequent work to be undertaken is expected to be informed by the results of the work undertaken during this assignment and the information detailed in this document.

4 WINDFARM DETAILS

The windfarm under development is located in County Kerry, it is detailed in the following sections.

4.1 GROUSEMOUNT SITE CO-ORDINATES

This large windfarm is called ‘Grousemount’ wind farm and it is to be located in South Kerry near to the village of Kilgarvin. It is to be located close to some existing wind farm developments. It is a scarcely populated area and the land surrounding the wind farm is considered to be rural, remote and free from infrastructure that might be affected by the planned developments.

The co-ordinates that were given to IHT Ltd for the 38 turbines that are to be sited on the wind farm are as follows.

Turbine Number	Easting	Northing
T1	109189	71529
T2	109300	71288
T3	109376	71059
T4	109579	70678
T5	109854	70412
T6	110185	70185
T7	110118	69859
T8	108890	69885
T9	108740	69490
T10	109135	69646
T11	108826	69177
T12	109260	69277
T13	109681	69339
T14	109369	68869
T15	109085	68473
T16	107401	68648
T17	107175	68910
T18	107569	69000
T19	107308	69222
T20	107640	70242
T21	108023	70441
T22	107514	70561
T23	107140	70585
T24	106731	70587
T25	107807	72252
T26	107274	72007
T27	107636	71944
T28	107394	71660
T29	107036	71726
T30	106721	71543
T31	106415	71225
T32	105934	71133
T33	106126	71455
T34	106397	71709
T35	106693	71926
T36	107598	72368
T37	107247	72274
T38	106985	72302

Table 1: Grousemount site Wind Turbine details

4.2 TECHNICAL DETAILS OF GROUSEMOUNT TURBINES

The details of the Turbines to be used on this site are given in Table 2 as follows;

Grousemount – WTG 1-38	
Technical Information	
Tip Height	126 m
Hub Height	70 m
Blade length	56 m

Table 2: Turbine details

5 STAKEHOLDERS IDENTIFIED

Using experience gained working on similar projects, then by searching public databases and finally by interviewing stakeholders on the telephone and via email, approximately 46 possible stakeholders were identified. These stakeholders included the main wireless operators in Ireland such as broadcasters and also cellular network operators as well as aviation operators and airports. It also included new Internet market entrants operating wireless based broadband services and wireless internet service providers (WISP). Some of the leads that were generated during the project later proved to be worthless because the stakeholder identified had not taken up licences for the operation of services within the area nearby the windfarms. IHT has grouped the stakeholders into 5 categories to highlight the different types of users that might be expected to be adversely affected by the Windfarms. These are detailed below.

5.1 AVIATION OPERATORS

Most of the impacts that could be expected to the networks operated by the following stakeholders involve lighting issues, accidental encroachment into the site by 3rd parties, navigation hazards for airplanes and also possibly infringement into existing telecommunication links or radar networks. The companies listed in table 3 below were contacted and some placed requests for suitable illumination of the turbine structures, whilst some others stated that they do not expect any interference issues to arise.

No	<i>Company name</i>
1	Irish Aviation Authority
2	Department of defence
3	Cork
4	Kerry airport
5	Shannon airport

Table 3: Aviation operators

5.2 BROADCASTERS

Traditionally Wind Farms caused major impacts to Television networks and to the reception of analogue Television in areas of existing poor TV signal levels. This location has had major problems due to interference from previous Wind farm developments. With the move to the digital ‘Saorview’ TV system and the move away from Microwave Multipoint Distribution Systems (MMDS) for wireless TV provision, this is becoming far less of a problem. However, it should be expected that some domestic Television reception interference will be caused.

There are some FM radio services that are broadcast locally. These rarely if ever report any interference issues from wind farms. No FM radio interference is expected.

The following stakeholders in table 4 below were contacted and no issues were identified from the respondents. One stakeholder (Kerry Radio) reserved the right to contact the ESB to correct any issue, should it arise. RTE Network Ltd (2rn) requested that ESBi sign a standard protocol with them. UPC provided a map as shown in figure 1 below.

No	<i>Company name</i>
1	UPC
2	TG4
3	BAI
4	Kerry Radio
5	RTENL (2rn)

Table 4: Broadcast stakeholders

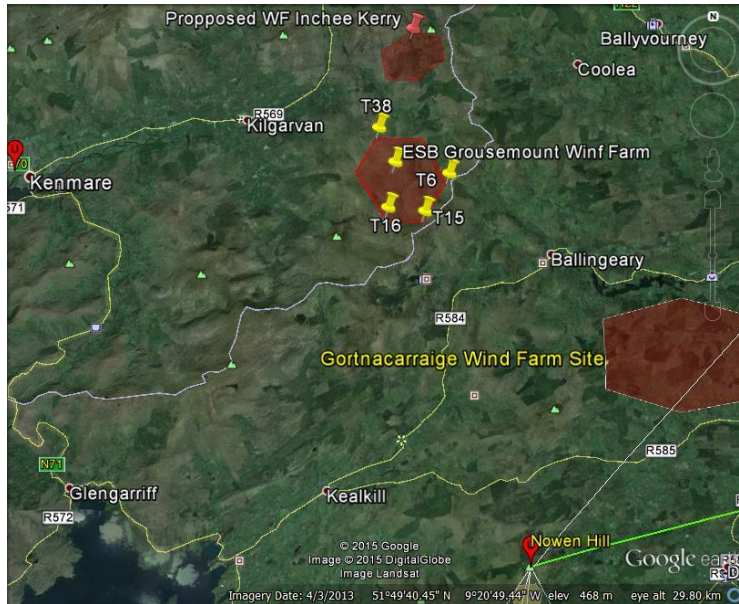


Figure 1 - UPC links and Grousemount

5.3 TELECOMMUNICATION OPERATORS

This is an important grouping as this group contains stakeholders that are very sensitive to wind farm developments. These stakeholders are highly aware of any possible impacts and often have the required tools to analyse the wind farms. The stakeholders that were contacted in table 5 below have the best ability to provide accurate analysis of the possible impacts of the planned wind turbines. None of the companies contacted stated that they had any concerns about the development. An Garda Siochana responded to state that they would allow Tetra Ireland respond for them. Tetra Ireland responded to say they had no issues.

No	Company name
1	Eircom
2	Airspeed
3	Netshare Ireland/Vodafone
4	IMAGINE
5	BT
6	THREE (H3G)
7	Garda Siochana
8	ESB Telecoms
9	MOSAIC (02 & Three)
10	TOWERCOM
11	Meteor (MOSAIC)

Table 5: Telecommunication operators

5.4 BROADBAND OPERATORS

This is a new group of Telecommunication stakeholders that has emerged within the last few years. These companies often provide wireless based (Wi-Fi) Internet and broadband services to end customers in rural and remote areas of Ireland that are not yet served by the main telecommunications operators. Some also operate limited microwave links carrying trunk broadband into their Wi-Fi broadcast cells. Most of these operators do not have the ability to do any internal analysis of the impacts of the developments. They represent a potentially latent threat to the developments due to the highly political nature of their expected responses to any reported interference. Table 6 below details the stakeholders contacted. Nearly all responded to state that they have no issue with the development. One company Mains Broadband has not yet responded.

No	<i>Company name</i>
1	Xpresnet
2	Digiweb
3	Centrecom
4	Mains broadband
5	EOBO Ltd (Bbnet)
6	Ripplecom
7	Rural Broadband
8	Celtic Broadband
9	Kerrybroadband
10	Invertec broadband
11	Kingdom broadband
12	Kernet
13	SCC Broadband
14	Sbb.ie
15	Airwave internet
16	Cork community broadband
17	Digitalforge
18	Fastrack broadband
19	Munster broadband
20	Munster wireless
21	Rapid Broadband

Table 6: Wi-Fi providers

5.5 OTHER USERS

These stakeholders include those that operate VHF radio, microwave links and those that use the national TETRA digital radio system. All of the stakeholders listed in table 7 below responded to state that they have no issue with the planned developments. These stakeholders typically tend to outsource all network operations to 3rd party service providers such as Sigma and Tetra Ireland and generally have no capability to analyse wind farm impacts. Kerry Fire Brigade responded and requested that ESBi provide them with advice and instructions on how first responders should attempt to deal with a fire located in a wind turbine. It raises issues in relation to safety from high voltage power lines contained within a confined and elevated space.

No	<i>Company name</i>
1	Tetra Ireland
2	Sigma
3	National Ambulance Service
4	Kerry Fire Brigade

Table 7: Other users

6 RESPONSES FROM STAKEHOLDERS

To summarize the responses from the companies and individuals canvassed, approximately 47 stakeholders were identified and canvassed for feedback via email, telephone and in some cases where no response was forthcoming but deemed required, also by letter.

The stakeholders can be categorised into two categories. The main category is those that have no concerns and have responded to confirm this. The 2nd is those that have not yet responded.

6.1 STAKEHOLDERS WITH NO ISSUE

This is by far the largest group of stakeholders with 44 companies to date now having responded positively to the consultation that they have no issue. Please refer to table 8 below.

1	Irish Aviation Authority
2	Department of defence
3	Cork
4	Kerry airport
5	Shannon airport
6	UPC
7	TG4
8	BAI
9	Kerry Radio
10	RTENL (2rn)
11	Eircom
12	Airspeed
13	Netshare Ireland/Vodafone
14	IMAGINE
15	BT
16	THREE (H3G)
17	Garda Siochana
18	ESB Telecoms
19	MOSAIC (02 & Three)
20	Meteor (MOSAIC)
21	Xpresnet
22	Digiweb
23	Centrecom
24	EOBO Ltd (Bbnet)
25	Ripplecom
26	Rural Broadband
27	Celtic Broadband
28	Kerrybroadband
29	Invertec broadband
30	Kingdom broadband
31	Kernet
32	SCC Broadband
33	Sbb.ie
34	Airwave internet
35	Cork community broadband
36	Digitalforge
37	Fastrack broadband
38	Munster broadband
39	Munster wireless
40	Rapid Broadband
41	Tetra Ireland
42	Sigma
43	National Ambulance Service
44	Kerry Fire Brigade

Table 8: Respondents with no issue

ESB telecoms provided a map showing the turbines and their nearest microwave link circuits. This map below in figure 2 shows that the development is well away from any existing ESB telecommunication paths.

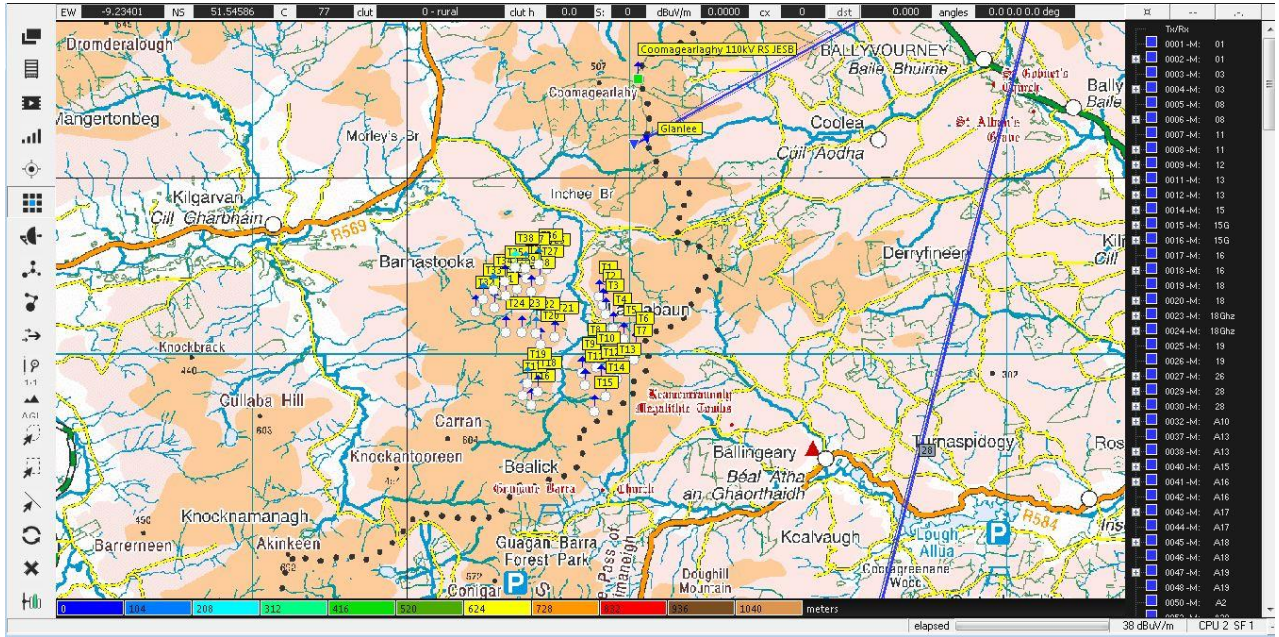


Figure 2 - ESB Telecoms microwave network and Grousemount – no interference

6.2 RESPONSES NOT YET FULLY CONCLUSIVE

The two companies listed below in table 9 have either ignored the consultation or stated that they are working on the issue and will reply. Respondent number 1 – Towercom is a large site operator but seems disinterested in the issue and has failed to engage despite acknowledging the consultation. The other company Maints Broadband has not responded at all but a map of their network was available from their website which clearly shows in figure 3 below that their network is well away from this development in another county and will not be interfered with.

1	TOWERCOM
2	Maints Broadband

Table 9: No conclusive response

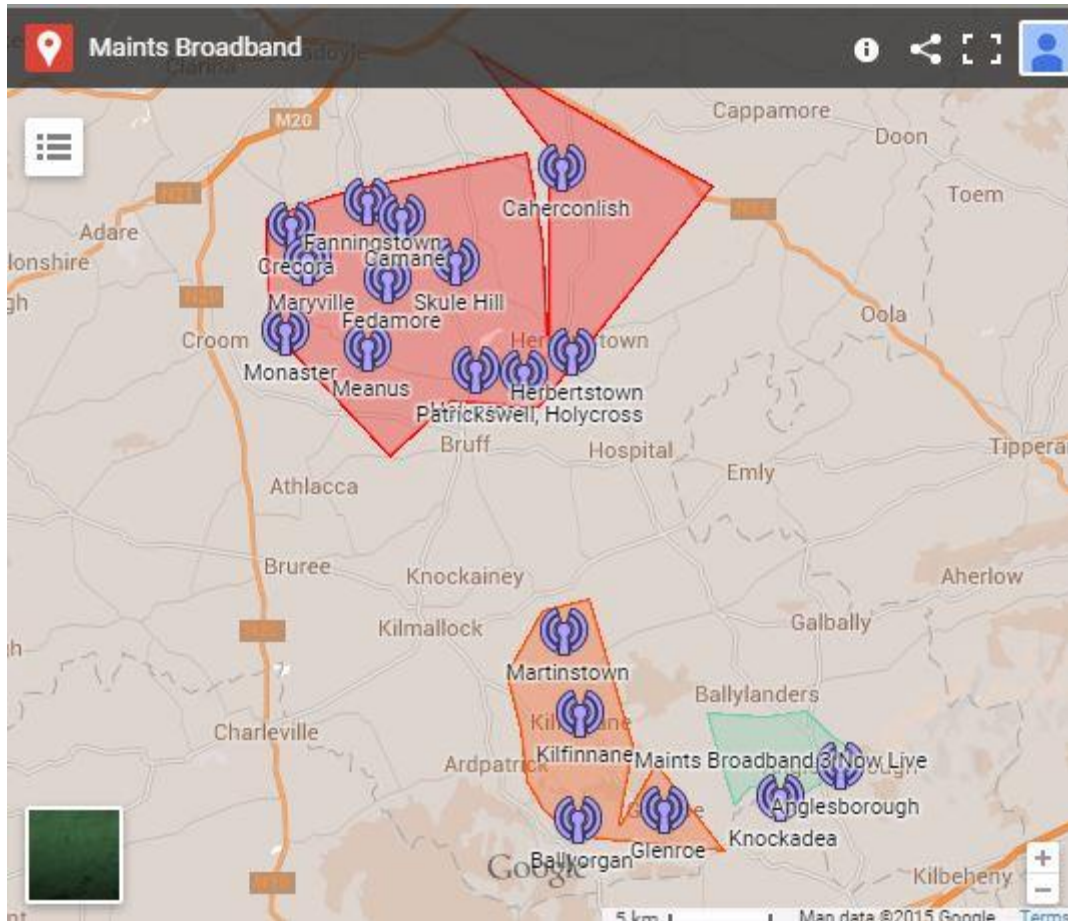


Figure 3 - Coverage map of the Maints broadband network

7 PROBLEMS IDENTIFIED

No problems were identified during this consultation process.

8 MITIGATION MEASURES

No mitigation measures need to be considered at this stage.

9 NAVIGATION REQUIREMENTS

There are Turbine lighting conditions that were expressed by the Irish Aviation Authority and the Air Corps. These may already have been captured during the planning application phases. They are detailed now for consideration.

9.1 THE IRISH AVIATION AUTHORITY (IAA)

The IAA have no objection to the developments but have requested that the following items be implemented.

1. An agreed scheme of aviation obstacle warning lighting for the wind turbines. The Irish Aviation authority needs to be involved in this selection.
2. Coordinates and elevation details of the built turbines should be supplied to the Irish Aviation Authority for charting purposes.

3. The Irish Aviation Authority should be notified at least 30 days prior to the erection of the development.

9.2 AIR CORPS

The Department of Defence have responded to state that the Air Corps have requested that;

4. Turbines delineating corners of the wind farm should be illuminated by high intensity obstacle lighting.
5. Obstruction lighting elsewhere in a wind farm will be of a pattern that will allow the hazard be identified and avoided by aircraft in flight.
6. Obstruction lights used should be incandescent or of a type visible to Night Vision Equipment. Obstruction lighting fitted to obstacles must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum specifically at or near 850 nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.

10 CONCLUSIONS

There are no telecommunication or radar interference issues that have been identified at this wind farm for any stakeholder.

Careful attention is required to the lighting of the turbines. There are a number of interested parties including the Air Corps and the Irish Aviation Authority.

11 NEXT STEPS

ESBi Wind development team are advised to engage with the two identified stakeholders that have yet to respond in order to conclude the consultation.

- RTE Network Ltd require that a standard protocol is signed.
- Kerry Fire Brigade require some advice on the best practice for dealing with fires within wind turbines.
- The Irish aviation authority and the air corps require proper illumination of the wind farm and adequate notice before any turbine is erected to allow for charting of the hazard.

12 END OF DOCUMENT

If you require further assistance on any matter or clarification, please do not hesitate to contact me at any time.

Seamus O Leary
Chartered Engineer

Date: 10th July 2015