

Our Case Number: ABP-319866-24



An
Bord
Pleanála

Donnacha Gallagher
19 Kellys Bay Heights
Skerries
K34 TY01

Date: 14 August 2024

Re: Proposed development known as North Irish Sea Array ("NISA") Offshore Wind Farm
Located off the coast of Counties Dublin, Meath and Louth (www.northirishsearraysid.ie)

Dear Sir / Madam,

An Bord Pleanála has received your recent submission and fee in relation to the above-mentioned proposed development and will take it into consideration in its determination of the matter. Please accept this letter as a receipt for the fee of €50 that you have paid.

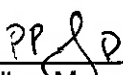
The Board will revert to you in due course with regard to the matter.

Please be advised that copies of all submissions/observations received in relation to the application will be made available for public inspection at the offices of Dublin City, Fingal, Meath and Louth |County Councils and at the offices of An Bord Pleanála when they have been processed by the Board.

More detailed information in relation to marine infrastructure development can be viewed on the Board's website: www.pleanala.ie.

If you have any queries in the meantime, please contact the undersigned officer of the Board or email marine@pleanala.ie quoting the above mentioned An Bord Pleanála reference number in any correspondence with the Board.

Yours faithfully,



Ellen Moss
Executive Officer
Direct Line: 01-8737285

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Bord Pleanála

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Re: North Irish Sea Array Offshore Windfarm OA29N.319866

AN BORD PLEANÁLA	
LDG-	<u>073883-24</u>
ABP-	
09 AUG 2024	
Fee: €	<u>50</u> type: <u>Check</u>
Time:	<u>15.20</u> By: <u>Lund</u>

I am making an observation opposing the specific location of the NISA wind farm. I believe it would adversely impact the visual amenity of Skerries where I live. Instead of the current proposal, I would propose to move this 5km further out which would bring the visual impact down to a more moderate level. I enclose a cheque for 50 euros. I ask for an oral hearing.

Introduction

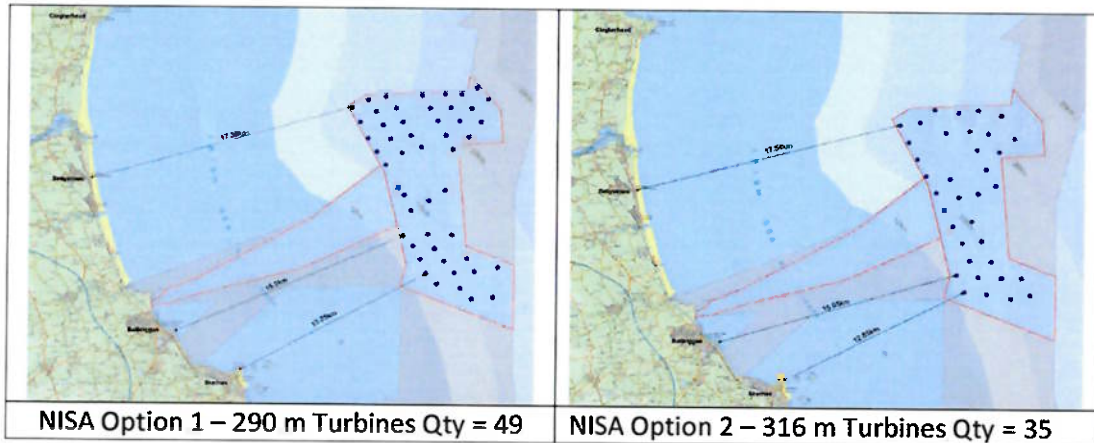
I am a mechanical design engineer and have over 20 years' experience in equipment design. I studied a masters in renewable energy systems (2010) and management of clean technologies (2022). I believe offshore wind energy is an essential part of Ireland future energy and the current group of projects will be a once in a generation event. It is essential that they are implemented in the right way.

I have researched the area of offshore wind farm visual impact and aesthetics through a self-funded Masters project in DCU (2022). This involved the investigation of the published literature, development of trigonometric models and analysis, visits to the UK (England, Scotland and Wales) to see a range of offshore wind farms, comparison of the Irish offshore wind farm proposals, and a bathymetric study of water depths.

An essential area for guidance for visual impact is around height to distance ratios and field of view angles. Personally I think that a height to distance ratio of 2:100 and field of view angle of 50 degrees (such as Clacton, Essex) is the limit before the wind farm begins to look imposing. (Going above 60 degrees spans into the peripheral vision starts to feel imposing). And this type of development suits seaside towns with attractions, marinas, busy promenades, etc. In a rural and scenic location, a smaller viewing angle work better, e.g. 30 degrees, so people can see more of the horizon. And smaller height, e.g. 1.5 which is found in Easington, Humberside. These were places where I was really impressed with the aesthetics.

Nisa Wind Farm – Current Proposal Assessment

The Current NISA wind farm is shown in the maps below for 2 options for 35 and 49 turbines. The maps have distances and viewing points at 4 locations. I copied these maps into a CAD program and calculated distances and angles accurately. Objective parameters for height to distance, apparent height to distance, and a visual impact score were calculated.



Theory

$$\text{Curvature Drop} = D = (2R - (4R^2 - 4L^2)^{0.5}) / (2 \times 1000)$$

$$\text{Apparent Height} = \text{Turbine Height} - \text{Earth Curvature Drop for Observer Height} = aH = H - D + P$$

$$P = \text{Observer Height}$$

$$\text{Apparent Height to Distance Ratio} = aH:D = aH / D$$

$$\text{VIS} = \text{Visual Impact Score} = (\text{Angle} / 120) \times (aH:D / 5) \times 1000 \quad (\text{Author's scoring system})$$

For ease of discussion and presenting of results the aH:D is multiplied by 100 so for example aH:D = 2:100 equals 2.0.

Current Proposal – Results

Findings for the current wind farm layout are shown in the table below.

Location	Label	No. Turbines	Distance (km)	Height (m)	H:D Ratio (x100)	Apparent aH:D Ratio	Combined Angle (degs)	Visual Impact Score	Subjective Comment / Initial Impression from Photomontage
Clogherhead (N35)	CLN35	35	17.9	316	1.77	1.66	26.3	0.73	Most pleasing of all photomontages due to angle under 30 degrees
Clogherhead (N49)	CLN49	49	17.5	290	1.65	1.55	28.0	0.72	
Laytown (N35)	LAN35	35	17.6	316	1.79	1.69	34	0.96	Turbines look well with nice scenery. The taller more spaced turbines look slightly better.
Laytown (N49)	LAN49	49	17.4	290	1.67	1.56	36.44	0.95	
Balbriggan (N35)	BAN35	35	16.0	316	1.98	1.89	42.8	1.35	Turbines overlap harbour wall in photomontage. Smaller turbines look slightly better with harbour wall.
Balbriggan (N49)	BAN49	49	15.9	290	1.82	1.74	46.2	1.34	
Skerries (N35)	SKN35	35	12.9	316	2.46	2.40	47.7	1.91	Height is dominant with aH:D over 2.0
Skerries (N49)	SKN49	49	13.5	290	2.14	2.08	51.7	1.79	

NISA Photomontages Assessment



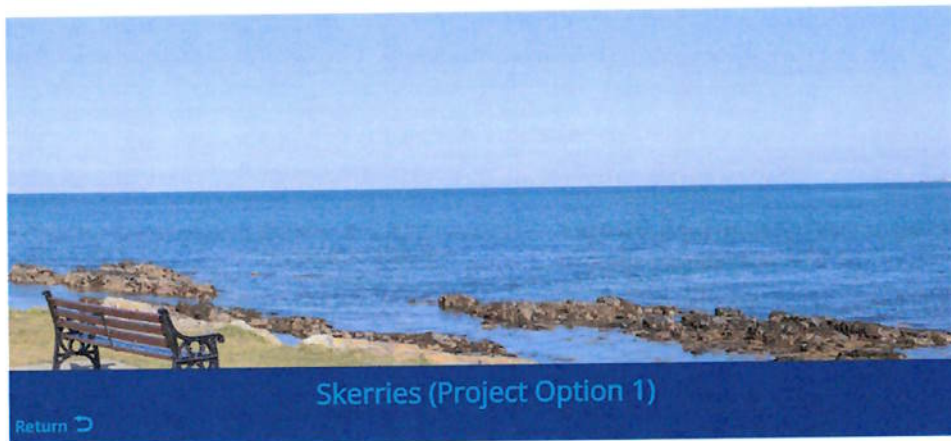
When viewed properly on a computer screen using the recommended settings, the photomontage for Clogherhead for both options is pleasing due to the angle being under 30 degrees. The wind farm is framed with nice scenery on either side. The aH:D is approximately 1.7 which is slightly over the value of 1.5 which would be more pleasing.



For the photomontage at Laytown, the taller more spaced out turbines look better with more permeability to see through between the turbines. The turbines seem to compliment the nice scenery on each side. The aH:D is approximately 1.7 which is slightly over the value of 1.5 which would be more pleasing.



The photomontage for Balbriggan is dominated by the lighthouse and harbour wall. The smaller turbines at $aH:D=1.7$ are slightly more pleasing and blend in better with the harbour wall. This is slightly over the value of 1.5 which would be more pleasing.



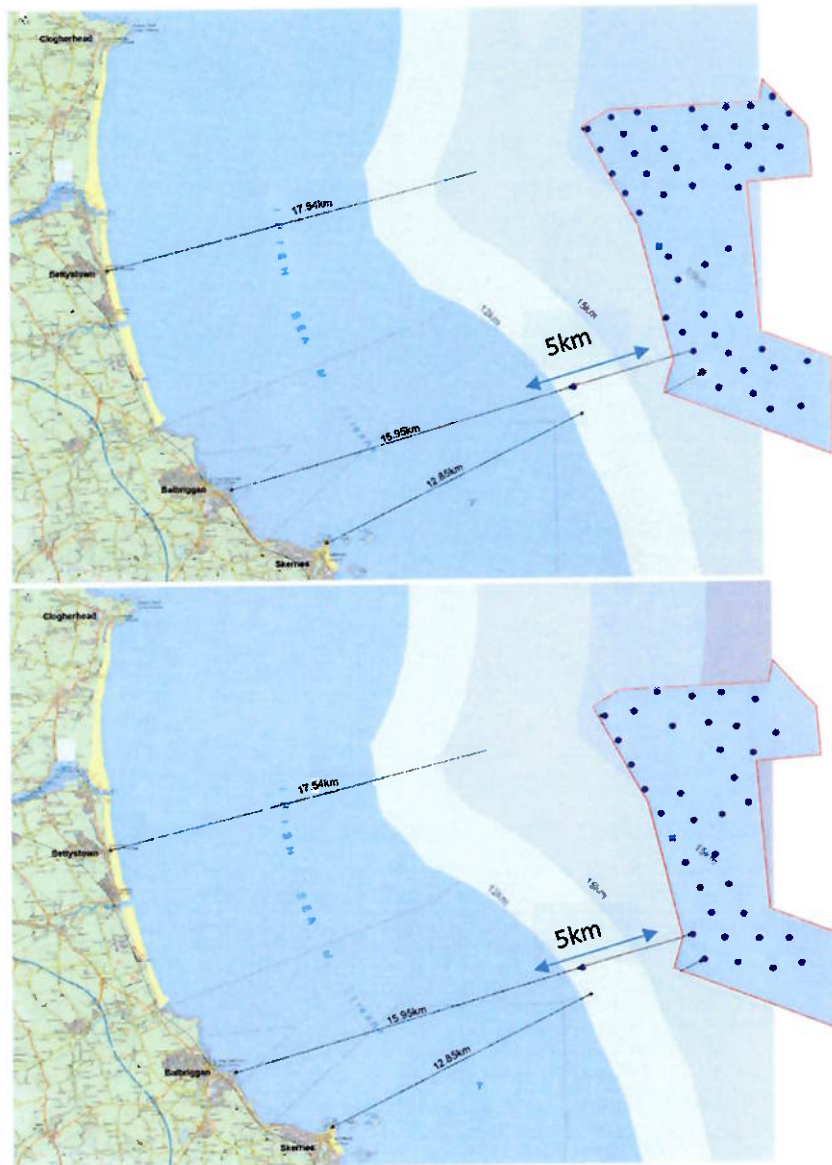
The photomontage for Skerries looks better with the smaller turbines. The smaller turbines $aH:D$ is approximately 2.1 which is just about the limit before the turbines look imposing. The larger turbines $aH:D$ of 2:4 would look very dominant and probably look out of place.

The visual impact is heightened at Skerries which is a headland and is therefore the closest point to the wind farm at 12.9 km. In comparison, Balbriggan at 15.9 km is 3km further away because of its location in the large bay between the Skerries and Clogherhead headlands.

Skerries is a unique scenic coastal town on the east coast and a very pleasant location for day trips for the general Dublin population. The proposed wind farm is off to one side and scenic views without turbines would still be possible by looking backwards from the headland over the south strand and north harbour. However, the turbines are within the view, although not in line of the Mourne mountains and so would be notable and impact the character of the area. The $aH:D$ of approximately 2.1 would be improved if reduced to 1.5. Also, the angle of 52 degrees is within peripheral vision and acceptable. This could be improved if reduced slightly.

Nisa Wind Farm – Alternative Proposal & Assessment

My alternative NISA wind farm is shown in Figure 2 for 2 options for 35 and 49 turbines. This moves out the wind farm by a further 5km from Balbriggan shown by the marked dimension. The shape is kept the same as the current proposal.



Alternative NISA Option 1 – 290 m Turbines Qty = 49 ; (b) Alternative NISA Option 2 – 316 m Turbines Qty = 35. Moved out by 5km from Balbriggan.

Alternative Proposal - Results

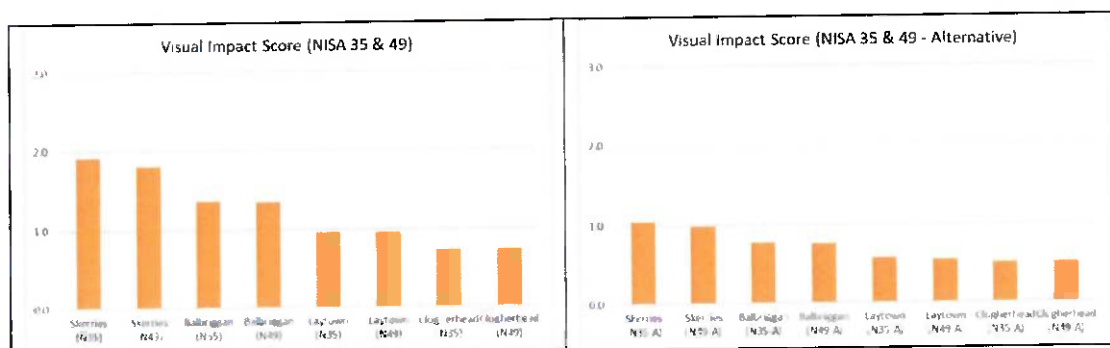
Findings for the alternative wind farm layout are shown in the table below. This is more easily interpreted by studying the bar graphs below.

Location	Label	No. Turbines	Distance (km)	Height (m)	H:D Ratio (x100)	Apparent aH:D Ratio	Combined Angle (deg)	Visual Impact Score	Subjective Comment / Initial Impression from Photomontage
Clogherhead (N35-A)	CLN35A	35	22.1	316	1.43	1.28	23.6	0.50	Most pleasing of all photomontages due to angle under 30 degrees
Clogherhead (N49-A)	CLN49A	49	21.6	290	1.34	1.20	25.02	0.50	
Laytown (N35-A)	LAN35A	35	22.6	316	1.40	1.25	27.26	0.57	Turbines look well with nice scenery. The taller more spaced turbines look slightly better.
Laytown (N49-A)	LAN49A	49	22.5	290	1.29	1.14	28.68	0.54	
Balbriggan (N35-A)	BAN35A	35	21.0	316	1.51	1.37	33.69	0.77	Turbines overlap harbour wall in photomontage. Smaller turbines look slightly better with harbour wall.
Balbriggan (N49-A)	BAN49A	49	20.9	290	1.39	1.25	36.1	0.75	
Skerries (N35-A)	SKN35A	35	17.8	316	1.77	1.67	37.5	1.04	Height is more pleasing with aH:D between 1.5 to 1.7
Skerries (N49-A)	SKN49A	35	18.5	290	1.57	1.45	40.54	0.98	

Adding 5km to the distance, brings all distances to shore to 21km or greater except for at Skerries which is approximately 18km. Achieving a greater distance at Skerries is difficult as this is a headland which points out of the mainland. The 22km foreshore distance is favoured by environmental groups.

(i) VIS Visual Impact Score

The VIS visual impact score combines angles and heights into one number. The is useful to show at a glance the approximate overall ranking of wind farms. It is interesting to see how by using this method that making a relatively small change of moving out the turbines by 5km reduces the VIS score by nearly half at Skerries from 1.9 down to 1.0. By the author's assessment, a score between 0.5 and 1.0 is moderate.

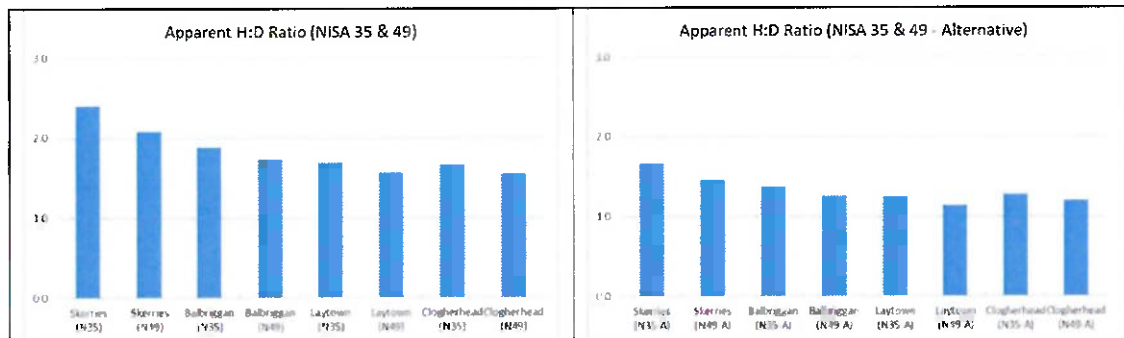


Comparison of Visual Impact Scores (a) NISA Current (b) NISA Alternative

(i) Apparent Height to Distance Ratio (aH:D)

The height to distance ratio is a favoured metric for offshore wind farm analysis. Here the apparent height to distance ratio is used which allows for the earth curvature and become more noticeable around 20km where the curvature drop is 31 meters and increases significantly after this.

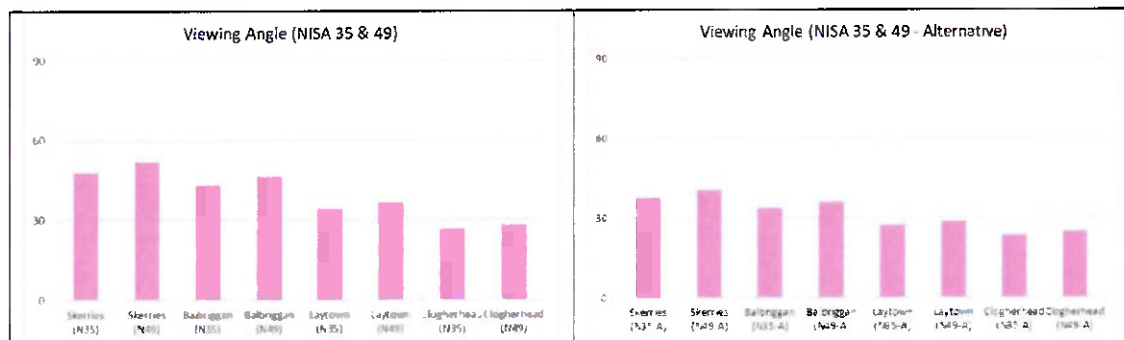
For Skerries the aH:D drops from 2.4 to 1.8 for the N35 option and 2.1 to 1.5 for the N49 option. A value greater than 2.0 starts to become imposing and 2.4 would look out of place for Skerries.



Comparison of Apparent Height to Distance (a) NISA Current (b) NISA Alternative

(ii) Viewing Angle

The viewing angle is a maximum of 52 degrees at Skerries for the N49 option, which is well within peripheral vision limit of 60 degrees. This can be improved down to a more aesthetic 38 degrees for the N35 option alternative wind farm.



Comparison of Viewing Angle (a) NISA Current (b) NISA Alternative

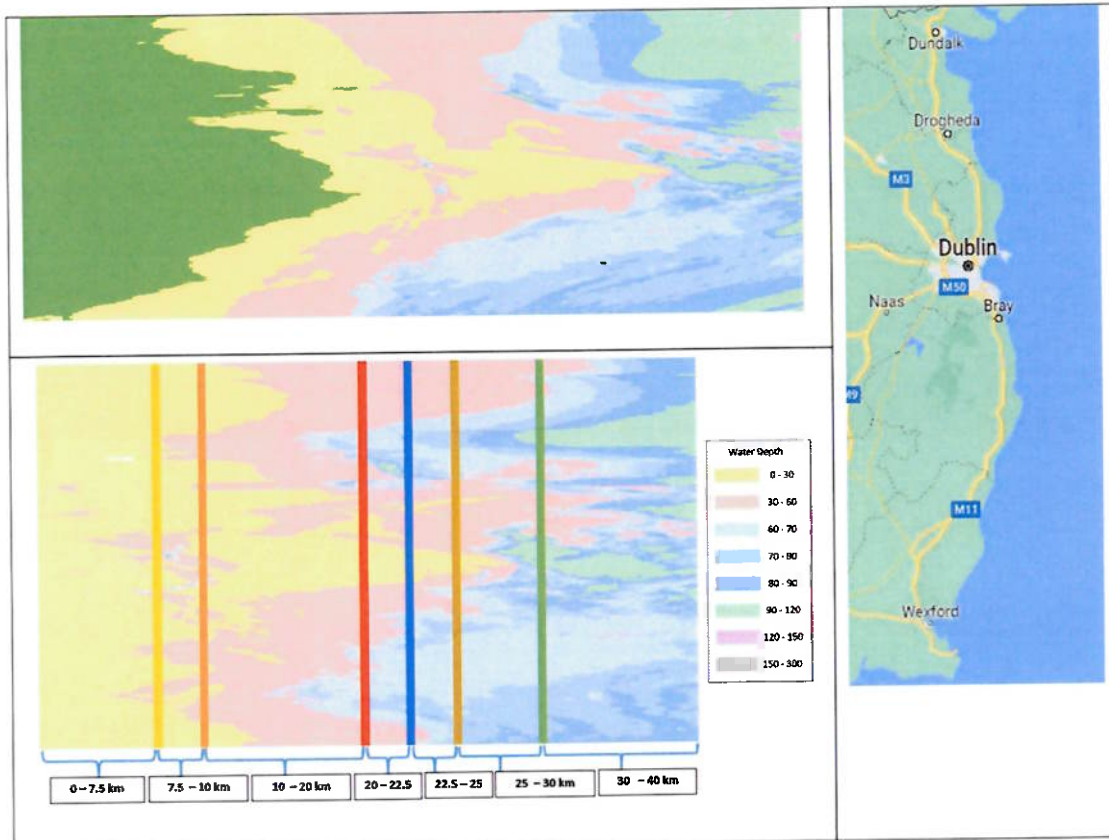
Considering the 2 alternative layouts in Skerries, N35 and N49, there is a trade-off compromise between height and angle. However, when combined the calculated VIS scores for both score around the same at 1.0.

The N35 option would probably better suit the wind farm developer to have a smaller number of installations which might influence the final decision.

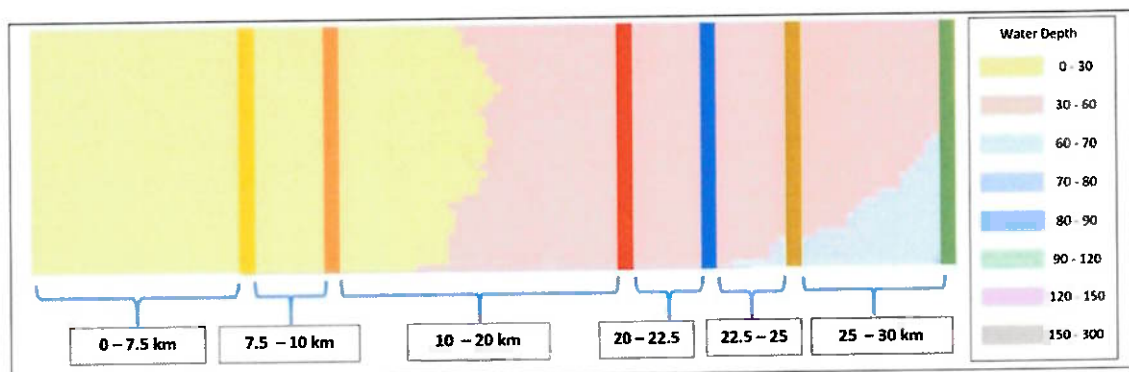
Water Depth Analysis

A bathymetry water depth analysis is important as this constraint impacts the location of offshore wind farms. With current technology, fixed offshore platforms are limited to approximately 60m water depth. Beyond this depth floating platforms need consideration.

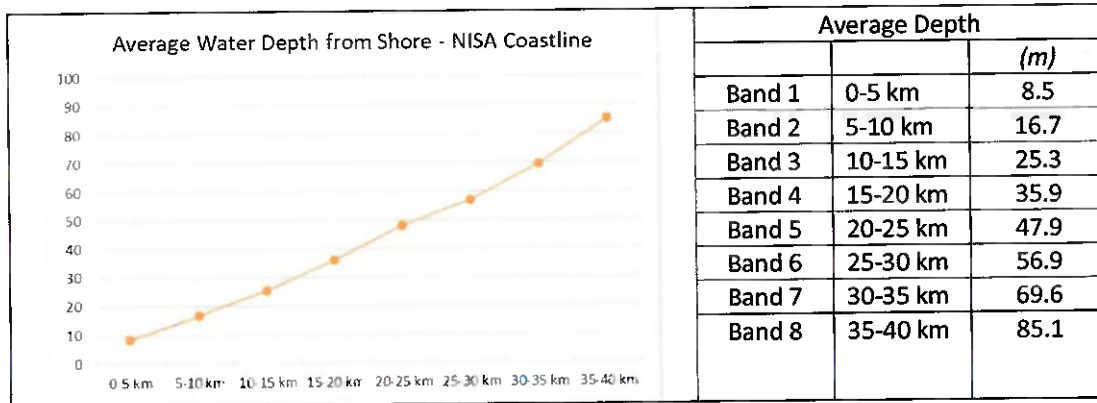
Data is shown below for the Irish East coast from Dunany point, Co. Louth to Ravens Point Co. Wexford. The region in the north east where NISA is located has a more favourable water depth than other regions along the east coast.



Data from GEBCO website analysed for east coast of Ireland. (a) With coastline (b) Coastline removed from left in east/west direction



Data from GEBCO website analysed for NISA location from Bremore Point, Co. Dublin to Termonfeckin, Co. Louth



Average Water Depth from Shore from Bremore Point, Co. Dublin to Termonfeckin, Co. Louth

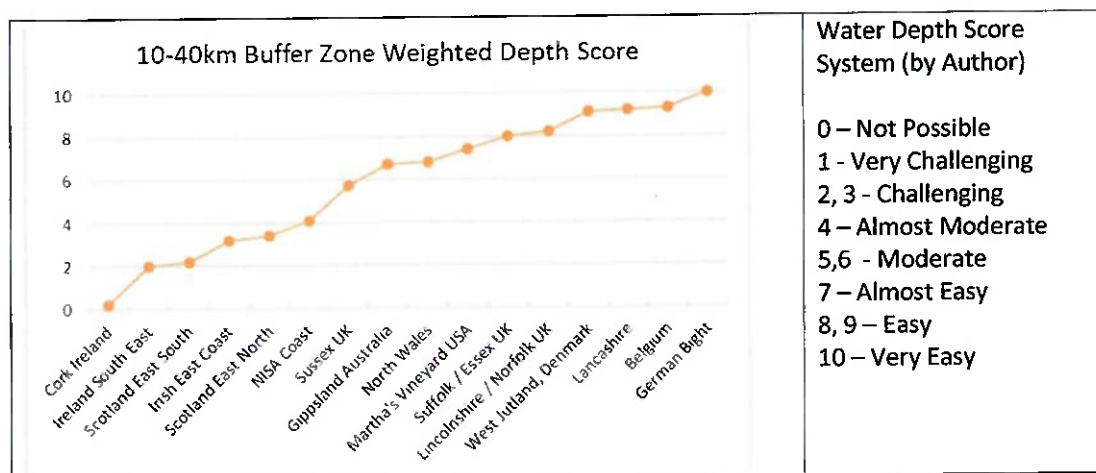
The bathymetric data looks promising for keeping the turbines within 60 meter water depths in the region of interest which is 20-25km from shore. There is approximately a 12m average depth difference by moving the turbines a further 5km distance from shore, i.e. from 35.9 to 47.9 meters.

International Comparison

Information from my MSc project compares the water depth score (WDS) under 60m out to 40km distance from shore. The NISA coastline compares favourably to other locations around the world. This would probably be better again for depths up to 30km from shore, but this analysis is not carried out in my project. Note that Scotland has a more challenging water depth score and is developing large offshore wind farm projects over 20km from shore.

$$\text{Water Depth Score} = \frac{2 * (\text{Depth \% 0-30m}) + (\text{Depth \% 30-60m}) \times 10}{2 * (\text{Depth \% 0-30m}) + (\text{Depth \% 30-60m}) + (\text{Depth \% >60m})}$$

from 10 km to 40 km



References

The methods for this analysis can be found in my MSc thesis

https://drive.google.com/drive/folders/1X_jTlfbSP5IYiGBXH2Zctkfv6C7SwiA

MSc Project - Visits to North Wales, England & Scotland – objective & subjective data

Location	Label	No. Turbines	Distance	Height	H:D Ratio (x100)	Apparent aH:D Ratio	Combined Angle	Visual Impact Score	Researcher's Subjective Comment / Initial Impression
Very Large Impact	Very Noticeable & Imposing- Can fit Landscape Depending on Surroundings					Visual Impact Score Above 2.0			
Blackdog Beach, Scotland	BLKB	11	3.0	202.5	6.75	6.75	63.9	7.2	Extremely large & close-aesthetics mitigated due to beach
Great Yarmouth, Norfolk	GY	30	2.8	108	3.86	3.86	73.2	4.7	Very noticeable - fits into coastal resort setting
Holylake, Liverpool	HO	222	7.5	187	2.49	2.49	87.8	3.6	Noticeably spread out – unkempt foreshore
Skegness, Lincolnshire	SK	54	5.7	133.5	2.35	2.35	85.6	3.4	Very noticeable - fits into coastal resort setting
Worthing Proposed	WP	216	14.0	300	2.14	2.08	99.4	3.4	Currently in planning
Brighton Proposed	BP	216	14.4	300	2.08	2.01	72.7	2.4	Currently in planning
Rhyl, Wales	RH	215	13.8	151.5	1.52	1.43	92.1	2.2	Noticeably spread out – moderate height
Large Impact	Limit Before Starts to Dominate View					Visual Impact Score Between 1.0 to 2.0			
Withernsea, Humberside	WI	108	8.5	179	2.11	2.11	57.5	2.0	Noticeable - further away wind farm more optimum
Clacton on Sea, Suffolk	CL	48	6.8	130	1.92	1.92	51	1.6	Noticeable - fits into coastal resort setting
Aberdeen Beach, Scotland	ABNB	16	5.5	202.5	3.67	3.67	26.3	1.6	Very noticeable – aesthetics mitigated due to beach
Moderate Impact	Noticeable – Not too Imposing					Visual Impact Score Between 0.5 to 1.0			
Llandudno, Wales	LL	185	10.4	151.5	1.45	1.43	41.7	1.0	Moderate - height Looked 20% of Headland
Whaligoe, Scotland	WHGO	84	14.9	178	1.19	1.12	53.6	1.0	Noticeable but small and faint on day
Crosby, Liverpool	CR	57	9.8	187	1.92	1.90	26.2	0.8	Very noticeable but small angle – aesthetics mitigated due to beach
Easington, Humberside	EA	73	9.4	136	1.44	1.43	33	0.8	Noticeable but small angle – aesthetics mitigated due to beach
Sutton on Sea, Lincolnshire	SU	235	17.6	133.5	0.76	0.65	69.8	0.8	Low to moderate - aesthetic to one side
Craighead, Scotland	CRHD	54	15.1	208	1.37	1.30	37.4	0.8	Not Installed Yet
Worthing, Sussex	WO	116	14.0	136	0.97	0.90	44	0.7	Low to moderate - not imposing
Brighton, Sussex	BR	116	14.4	136	0.94	0.87	33.7	0.5	Low to moderate – fits coastal resort setting

Note : Category names from White Consultants (2020). Categories in left column by Author based on turbine height to distance and horizontal angle only. This does not include sensitivity of receptor which is field of expertise of landscape architects and designers. Visual Impact Score= (Angle / 120) x (aH:D / 5) x 10)

Location	Label	No. Turbines	Distance	Height	H:D Ratio (x100)	Apparent aH:D Ratio	Combined Angle	Visual Impact Score	Researcher's Subjective Comment / Initial Impression
Small Impact	Perceptible - Hardly Noticeable					Visual Impact Score Under 0.5			
Southend on Sea - East	SS	220	17.7	115	0.65	0.54	29.1	0.3	Small size - not imposing
Hunstanton, Norfolk	HU	54	19.5	133.5	0.69	0.56	19.5	0.2	Night time lights in distance looked aesthetic
Gourdon, Scotland	GODN	119	29.8	210	0.70	0.49	19.1	0.2	Minimal impact
Stonehaven, Scotland	STHN	5	19.7	210	1.07	0.94	9.7	0.2	Minimal impact – fits coastal surroundings
Aldeburgh, Suffolk	AL	140	29.6	133.5	0.45	0.24	33.5	0.1	Barely Visible
Montrose, Scotland	MNTS	114	32.5	210	0.65	0.41	12.2	0.1	Being installed - barely visible
Dunnottar Castle, Scotland	DUCA	5	19.6	210	1.07	0.95	9.3	0.1	Low impact – mixture of heritage with new technology
Peterhead, Scotland	PEHD	5	24.4	178	0.73	0.56	5.4	0.1	Small & difficult to see
Lowestoft, Suffolk	LO	102	53.2	205	0.39	0.00	21	0.0	Not visible – should be excluded as turbines more than 50km distance away

Note : Category names from White Consultants (2020). Categories in left column by Author based on turbine height to distance and horizontal angle only. This does not include sensitivity of receptor which is field of expertise of landscape architects and designers. Visual Impact Score= (Angle / 120) x (aH:D / 5) x 10)

Visual Impact Constraints Around Offshore Wind

Open Education Unit

Researcher: Donnacha Gallagher

MSc in Management of Clean Technologies

Self Funded Research

Introduction

Irish offshore wind proposals are going through planning process. This requires public

consultations as part of EU directives, and

Seascope Visual Impact Assessments (SVIA's)

Main hypothesis of MSc research is that the key to understanding visual impact when viewed as design constraint analysis.

Methods

Literature Review

- Planning processes in EU, UK and Ireland
- (SVIA) methodology
- Public opinions to offshore wind farms
- Human responses to visual impact
- Key technical parameters

Assessment Methodology

Find objective scoring method for visual impact based on height to distance ratio (H:D ratio), apparent height with earth curvature (aH:D ratio) & combined angle

Offshore Windfarm Site Visits

For UK visit existing offshore wind

farms, using published data calculate visual impact score & compare with subjective assessment at 26 points

Comparison with Irish Proposals

For Ireland, calculate score & estimate visual impact at 21 viewing points

Expert Survey

- “Does Ireland have adequate guidance for the assessment of visual impacts of offshore wind developments?”
- Development of survey through DCU ethics application with 7 expert participants interviewed

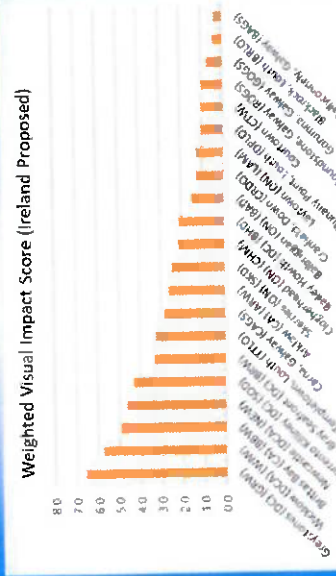
Results

Arbitrary method developed after windfarm visits to combine angle and aH:D into one score

$$\text{Visual Impact Score} = (\text{Angle} / 120) \times (\text{aH:D} / 5) \times 10$$

Visual Impact Score	Comment / Initial Impression
Above 2.0	Starts to dominate view but can fit landscape depending on surroundings and mitigation
Above 1.0	Noticeable but can fit landscape depending on surroundings and mitigation
Between 1.0 and 0.5	Moderate and can be aesthetic
Below 0.5	Minimal

Irish Proposals



- 9 viewing points over a score of 2.5 in 2 distinctive categories
- Close to shore but mitigated by smaller angles, e.g. in Louth and Galway
- Larger angles due to multiple proposals
- cumulative impact, e.g. in Wicklow
- No detailed plans for Wicklow which might mitigate angle. Note scoring system does not include permeability / turbine density.

Conclusions

- Ireland is very insecure energy location and needs offshore wind. The visual impact issue must be put into a wider perspective on energy security.
- Designers and planners will develop the best layout and methods to mitigate visual impact.
- Parametric analysis helps to quickly assess level of visual impact of offshore wind farms. This does not take into account sensitivity of receptor which needs a full SVIA.
- A variety of wind farms within the UK with similar seascapes to Ireland can help form opinions.

Reflections

- **Ideas that altered during project**
 - A lot more positive about offshore wind after seeing UK wind farms, bigger & less impactful than onshore
 - Initially thought about buffer zones from shore, e.g. 20km, changed to thinking more about aesthetic turbine layouts.
 - Changed from public survey to expert survey.
- **Suggestions for Future Research**
 - Public surveys on basis of accepting wind farms going to be a feature in future seascapes, e.g. what might be limit before imposing
 - Visual impact aesthetics vs. perceptions and their physiological responses in the brain
 - Marine spatial plans (MSP's) in other countries