Note on the Spatial Impact of the Proposed Revisions to the Wind Energy Guidelines

Background

This note sets out the results of a high-level analysis of the impacts of the DECLG's proposed revisions to the Wind Energy Guidelines.

Review of Wind Energy Guidelines

In 2006, DECLG issued the Wind Energy Development Guidelines (the 2006 edition was a revised vision of guidelines previously published in 1996). The purpose of these guidelines was to:

1. advise planning authorities on planning for wind energy;
2. ensure a consistency of approach in the identification of suitable locations and the treatment of planning applications throughout the whole country; and
3. assist developers and the wider public in considering the wind energy.

In December, 2013 DECLG began a review of the existing Wind Energy Development Guidelines. The review is taking place in the context of Ireland's targets under Directive 2009/28/EC on the promotion of the use of energy from renewable sources. The review focuses on specific issues, namely:

1. noise;
2. proximity and setback distance; and
3. shadow flicker.

with all other sections of the 2006 guidelines to remain the same. 7,500 submissions were received in response to the public consultation on the draft guidelines. Examination of these submissions indicated that key issues of concern are appropriate noise levels and setback/height.

Renewable Energy Targets

Under the 2009 Renewable Energy Directive, Ireland is legally bound to deliver 16% of its final energy requirements and 10% of its (road and rail) transport energy from renewable sources by 2020. The overall 16% target is to be met by achieving 40% renewable electricity, 12% renewable heat and the legally binding 10% renewable transport by 2020. It is abundantly clear that Ireland must meet steadily increasing targets for renewable electricity production over the next years.

Onshore wind will make the largest contribution to achieving 40% renewable electricity in 2020. Currently there is over 2,200 MW of onshore wind power connected to the Irish grid. The total amount of renewable generation on our system is over 2,600 MW. A total of between 3,500 and 4,000 MW of wind generation is

estimated to be necessary to allow Ireland meet the 40% electricity component of its 2020 renewable energy target. In order to reach a total of between 3,500MW and 4,000 MW of installed capacity by 2020, we need to increase the average rate of build of renewable generation to between 180MW and 280 MW per annum – the current rate of build is about 170 MW per annum.

It is clear that current rates of progress and technology deployment are likely to result in a shortfall in the overall renewable energy target. Analysis by SEAI suggests a one to two percentage point shortfall on the overall renewable energy target. Separate analysis (conducted by Aecom) predicts a four percentage point shortfall on the overall renewable energy target based on the extrapolation of progress to date. There are clear risks pointing to a shortfall at the higher end of the predicted range (four percentage points on the overall renewable energy target). These include the impact of social resistance to the roll-out of grid and windfarms. In the event that Ireland does not meet its 2020 targets, purchasing compliance is estimated to lie in the range of €140m to €600m in 2020 for renewable energy.

In terms of alternatives to onshore wind, it should be noted that it represents the most cost effective deployment of renewable electricity in Ireland. A measure of cost effectiveness is the cost per MWh (termed levellised cost of energy) generated over the course of the projects lifetime, taking into account capital costs, operational costs and the expected energy generation. An EirGrid/Poyry report on low carbon options, published in 2010 quoted the figures below in an Irish context. For further context, figures are also included from a report compiled by the Department of Energy and Climate Change in the UK in 2013.

Table 1

Technology	EirGrid report 2010 - Levellised cost of energy (€/MWh)	DECC report 2013 - Levellised cost of energy (STG£/MWh)
Onshore Wind	70	104-112
Biomass	100	108
Offshore	130	146-159
Tidal	175	
Wave	250	
Large scale Solar PV		158

The UK prices are be higher than the Irish equivalent prices as the yield from a wind generator in Ireland would be greater, and so reduce the cost. REFIT for onshore wind has been found to be a very cost effective tool to support renewables development, as indicated by a report published by the Council of European Energy Regulators earlier this year. This finding of cost effectiveness is aligned with various reports and analyses which have examined the effect of renewables on electricity prices. The ESRI, the Sustainable Energy Authority of Ireland and EirGrid have all undertaken studies and published the results of same.

It should be noted that while bioenergy can be further developed, the available domestic resource is very limited and its expansion would take many years and many thousands of hectares. Analysis has also shown that using biomass to

generate electricity would divert limited supplies from the heat and transport sectors, compromising the meeting of targets in those sectors. Additional onshore wind would be required to make up this shortfall. It should also be noted that using biomass to generate electricity is a very inefficient use of a scarce resource, if the associated heat output is not captured for an economically useful purpose.

Modelling Exercise and Findings

DECLG's May 2015 proposed revisions to the Wind Energy Guidelines set an absolute 40dB noise limit, aligning with previous modelling exercises. In addition, various land cover classes were identified by DECLG, which are to be subject to a variety of setback and height limits. The Geological Survey of Ireland defined the land cover classification and setback limits, which they produced as Environmental Systems Research Institute shape files for each class as described in Table 2 below. The data was converted to single part polygons and to be used within the Irish Transverse Mercator coordinates system. Simple codes were assigned to each class to make more convenient referencing within the geographic information system (GIS) model.

Table 2 Land Cover Classes

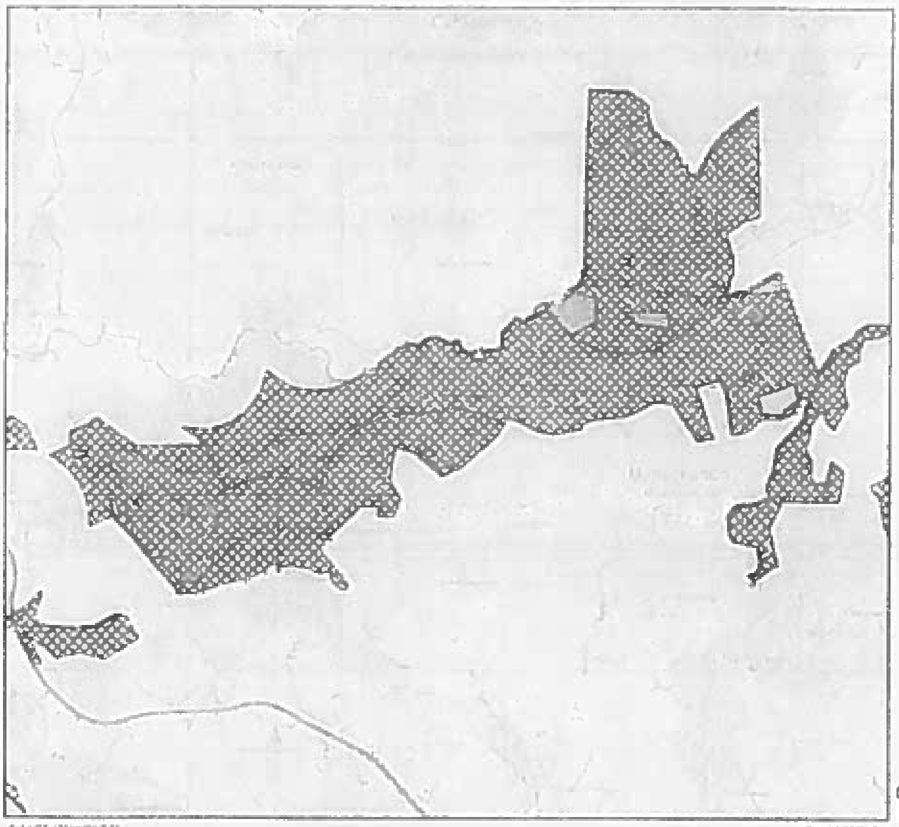
Code	Land Cover Class
mm1	Mountain Moorland and hills above 150m
mm2	Mountain Moorland and hills below 150m
tm	Transitional marginal land
ff	Flat farm land
fp	Flat peat land
tv	Urban (Town/Villages)
in	Industrial
lk	Lakeside
co	Coastal

A GIS model was then built using the additional setback parameters set out in the table contained within the DECLG Wind Guidance Draft Memorandum for Government (29/04/2015). Below is an indicative workflow of the GIS model.

Assumptions and Outputs for the GIS Model

- The maximum setback distances given in the memorandum (ranging from 600m to 875m) and turbine heights (ranging from 100m to 170m) were assumed in the model. This reflects the trend toward larger turbines across the industry. It also maximises the potential of the land area under the proposed limits.
- The spatial extent (scale) constraint is assumed to apply to the maximum scale of each individual proposed development within a given area. As such, it does not influence the calculation of areas within this analysis.
- The results from the new constraints scenario are shown in Table 3 in column "Area available (km^2) matching minimum wind speed". This is highlighted in yellow for clarity. It should be highlighted that this constitutes the available area ***before*** the 40dB limit is applied.
- The results for the 40dB from the earlier modelling were then intersected with the results from the above model for the relevant turbine height.
- In each case, the 'output' areas are those areas open for development after the application of the 40dB and new setback constraints.
- The intersection or areas which remain following the application of both the 40dB criteria and the new setback constraints model are given in column "Remaining area following application of 40dB limit" in Table 3.
- The capacity and output potential given in the Table 3 were calculated on the remaining area following application of all proposed constraints.

The map below shows typical results from the two GIS models.



Sample Map showing resutls from the GIS Models

Table 3 – Details of the land cover classes (Memorandum dated 29/04/2015) and the model calculation

Location		Spatial extent (scale)		Height		Matching Minimum Wind Speed at Tip Height (m/s)	Setback from sensitive properties (residences, schools)	Area available (sq. km) matching minimum wind speed	Remaining Area (sq. km) following application of 40dB limit	Percent of ROI land Area	Capacity available (MW)	Assumed Capacity Factor for Tip Heights	Capacity Output Potential (GWh)
		Existing guidelines	New	Existing guidelines	New		New						
Mountain, moorland and hills	> 150m	Tend towards large	30 turbines maximum	Any height	150m	7.75	Min 500m, multiplier of 5 (750m max)	293	128.01	0.18%	1,280.1	33.33%	3,176.89
	< 150m	Tend towards small	20	Medium	125m	8	Min 500m, multiplier of 6 (750m max)	20	10.46	0.01%	104.6	30.00%	233.66
Transitional marginal land	Ridges and hilltops preferred	Tend towards small	10	Medium and short	125m	8	Min 500m, multiplier of 7 (875m max)	0.3	0.10	0.00%	1.0	30.00%	2.23
Flat farm land		Tend towards small	10	Medium	125m	8	Min 500m, multiplier of 7 (875m max)	70.8	0.43	0.00%	4.3	30.00%	9.61
Flat peat land		Large	50 turbines maximum	Tall	170m	7.75	Min 500m, multiplier of 5 (850m max)	8.2	3.66	0.01%	36.6	33.33%	90.83
Urban and industrial	Urban town and villages	Tend towards small	2	Short	100m	8	Min 1km from town and villages	0	0.00	0.00%	0.0	30.00%	0.00
	Industrial	Tend towards small	1 off-turbine	Short	100m	8	Min 600m	0	0.00	0.00%	0.0	30.00%	0.00
Lakeside		Tend towards small	10	-	100m	8	Min 500m, multiplier of 8 (800m max)	0	0.00	0.00%	0.0	30.00%	0.00
Coastal	Set back from water	Tend towards small	10	Tall may be acceptable	100m	8	Min 500m, multiplier of 8 (800m max)	67	4.44	0.01%	44.4	30.00%	99.18
								399.08	147.10		1,471.0		3,612.4

Republic of Ireland Land Area (km²)	70,273
Capacity Intensity (MW per km²)	10
Losses	15%
Hours in the Year	8,760

The results in Table 3 indicate an available capacity of 1,471MW. However, this needs to be further adjusted for the following reasons:

- The model, by its nature, cannot take account of site-specific engineering and other technical constraints, including site specific wind quality. It is probable that a proportion of the available land, and capacity indicated, would prove not to be technically or economically viable due to site specific constraints.

- The model cannot take account of site specific environmental value or habitats, nor can it assume cumulative or in combination effects of wind being concentrated into a significantly reduced national land bank. It is probable that a proportion of the available land and capacity indicated would not be successful within a planning process, given these local factors.

- The model cannot take into account the ability or likelihood of each of the parcels of potential land for wind development being able to access appropriate grid connection for the potential capacity at the site.

- In addition, it is likely that there will be some distance between individual developments (to account for cumulative and in combination effects). This may be applied intuitively by both developers and/or planning authorities, but will in any event further reduce the effective land area likely to be ultimately developed for wind from that considered initially available for development.

Given the above, SEAI have used their planning database to indicate the likely capacity that would be delivered form the theoretical 'available land area' through to an operational asset. This has been estimated at less than 20%.

Thus, on the basis of the scenario generated from SEAI planning data, it may be assumed that of the MW capacity indicated in the Table 3 above, some 20% of that capacity may ultimately be delivered.

The associated results are presented in Table 4 below:

Table 4 – Details of the land cover classes (Memorandum dated 29/04/2015) and the model calculation (20% of capacity delivered)

Location		Spatial extent (scale)		Height		Matching Minimum Wind Speed at Tip Height (m/s)	Setback from sensitive properties (residences, schools)	Area available (sq. km) matching minimum wind speed	Remaining Area (sq. km) following application of 40dB limit	Percent of ROI land Area	Capacity available (MW)	Assumed Capacity Factor for Tip Heights	Capacity Output Potential (GWh)
		Existing guidelines	New	Existing guidelines	New		New						
Mountain, moorland and hills	> 150m	Tend towards large	30 turbines maximum	Any height	150m	7.75	Min 500m, multiplier of 5 (750m max)	293	128.01	0.18%	256.02	33.33%	635.378
	< 150m	Tend towards small	20	Medium	125m	8	Min 500m, multiplier of 6 (750m max)	20	10.46	0.01%	20.92	30.00%	46.732
Transitional marginal land	Ridges and hilltops preferred	Tend towards small	10	Medium and short	125m	8	Min 500m, multiplier of 7 (875m max)	0.3	0.10	0.00%	0.2	30.00%	0.446
Flat farm land		Tend towards small	10	Medium	125m	8	Min 500m, multiplier of 7 (875m max)	70.8	0.43	0.00%	0.86	30.00%	1.992
Flat peat land		Large	50 turbines maximum	Tall	170m	7.75	Min 500m, multiplier of 5 (850m max)	8.2	3.66	0.01%	7.32	33.33%	18.166
Urban and industrial	Urban town and villages	Tend towards small	2	Short	100m	8	Min 1km from town and villages	0	0.00	0.00%	0.0	30.00%	0.00
	Industrial	Tend towards small	1 off-turbine	Short	100m	8	Min 600m	0	0.00	0.00%	0.0	30.00%	0.00
Lakeside		Tend towards small	10	-	100m	8	Min 500m, multiplier of 8 (800m max)	0	0.00	0.00%	0.0	30.00%	0.00
Coastal	Set back from water	Tend towards small	10	Tall may be acceptable	100m	8	Min 500m, multiplier of 8 (800m max)	6.7	4.44	0.01%	8.88	30.00%	19.836
								399.08	147.10		294.2		722.5

Republic of Ireland Land Area (km²)	70,273
Capacity Intensity (MW per km²)	10
Losses	15%
Hours in the Year	8,760

Overall Conclusions

DECLG's proposed revisions to the Wind Energy Guidelines would allow for an overall capacity of 294MW of onshore wind. This is well below the 3,500MW to 4,000MW of renewable electricity required to meet Ireland's 40% 2020 ambition, with compliance costs of up to €600m in 2020. In addition, the proposed guidelines would effectively eliminate onshore wind development in Ireland over time. This would have a detrimental and extremely costly impact on our capacity to decarbonise our energy system by 2050.