MEMO TABLE WIND SCENARIOS 15_6_2015

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

Absolute Noise Limit 40 dB

Location		Spatial extent (scale)		Height		Matching Minimum Wind Speed at Tip Height (m/s)	Setback from sensitive properties (residences, schools)	Area available (km^2) matching minimum wind speed	Remaining Area (km^2) following application of 40dB limit and LA Wind Strategy "NO GO" zones	Percent of ROI land Area	Capacity available (MW)	Assumed Capacity Factor for Tip Heights	Capacity Output Potential (GWh)
		Exsiting guidelines	New	Exsiting 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)	435.82	156.88	0.22%	1,568.80	33.33%	3,893.37
	< 150m	Tend towards small	20	Medium	125m	8	Min 500m, multiplier of 6 (750m max)	0	0.00	0.00%	0.00	30.00%	0.00
Transitional marginal land	Ridges and hilltops prefered	Tend towards small	10	Medium and short	125m	8	Min 500m, multiplier of 7 (875m max)	0.28	0.00	0.00%	0.00	30.00%	0.00
Flat farm land		Tend towards small	10	Medium	125m	8	Min 500m, multiplier of 7 (875m max)	80.89	0.00	0.00%	0.00	30.00%	0.00
Flat peat land		Large	50 turbines maximum	Tall	170m	7.75	Min 500m, multiplier of 5 (850m max)	214.65	87.62	0.12%	876.20	33.33%	2,174.51
Urban/Industrial	Urban town & villages	Tend towards small	2	Short	100m	8	Min 1km from town & villages	0	0.00	0.00%	0.00	30.00%	0.00
	Industrial	Tend towards small	1 off-turbine	Short	100m	8	Min 600m	0	0.00	0.00%	0.00	30.00%	0.00
Lakeside		Tend towards small	10	-	100m	8	Min 500m, multiplier of 8 (800m max)	0	0.00	0.00%	0.00	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)	0	0.00	0.00%	0.00	30.00%	0.00
								731.64	244.50		2,445.00		6,067.88

Republic of Ireland Land Area (km^2)	70,273
Capacity Intensity (MW per km^2)	10
Losses	15%
Hours in the Year	8,760

NOTES:

1. Excluded area wihtin 500m buffer from lakes greater than $4km^2$.
2. New (NPWS) Annex 1 mapping used as exclusion.
3. Tip height buffer from SACs & SPAs added to the exclusion areas.
4. Remove local authority red zones (LA Wind Strategies) from areas for development.
5. Removed polygons that can only take one turbine.
6. Allowed development in PNHAs.

Table 4 - Details of the land cover classes (Memorandum dated 29/04/2015) and the model calculation (16% of capacity delivered)

Absolute Noise Limit 40 dB

Location		Spatial extent (scale)		Height		Matching Minimum Wind Speed at Tip Height (m/s)	Setback from sensitive properties (residences, schools)	Area available (km²) matching minimum wind speed	Remaining Area (km²) following application of 40dB limit	Percent of ROI land Area	Capacity available (MW)	Assumed Capacity Factor for Tip Heights	Capacity Output Potential (GWh)
		Exsiting guidelines	New	Exsiting 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)	435.82	156.88	0.22%	251.01	33.33%	622.94
	< 150m	Tend towards small	20	Medium	125m	8	Min 500m, multiplier of 6 (750m max)	0	0.00	0.00%	0.00	30.00%	0.00
Transitional marginal land	Ridges and hilltops prefered	Tend towards small	10	Medium and short	125m	8	Min 500m, multiplier of 7 (875m max)	0.28	0.00	0.00%	0.00	30.00%	0.00
Flat farm land		Tend towards small	10	Medium	125m	8	Min 500m, multiplier of 7 (875m max)	80.89	0.00	0.00%	0.00	30.00%	0.00
Flat peat land		Large	50 turbines maximum	Tall	170m	7.75	Min 500m, multiplier of 5 (850m max)	214.65	87.62	0.12%	140.19	33.33%	347.92
Urban/ Industrial	Urban town & villages	Tend towards small	2	Short	100m	8	Min 1km from town & villages	0	0.00	0.00%	0.00	30.00%	0.00
	Industrial	Tend towards small	1 off-turbine	Short	100m	8	Min 600m	0	0.00	0.00%	0.00	30.00%	0.00
Lakeside		Tend towards small	10	-	100m	8	Min 500m, multiplier of 8 (800m max)	0	0.00	0.00%	0.00	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)	0	0.00	0.00%	0.00	30.00%	0.00
								731.64	244.50		391.20		970.86

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

NOTES:

1. Excluded area wihtin 500m buffer from lakes greater than 4km².
2. New (NPWS) Annex 1 mapping used as exclusion.
3. Tip height buffer from SACs & SPAs added to the exclusion areas.
4. Remove local authority red zones (LA Wind Strategies) from areas for development.
5. Removed polygons that can only take one turbine.
6. Allowed development in PNHAs.

RPS REPORT ITERATION 6 – 14TH JUNE 2015

Gerald McTiernan

From:	Jim Gannon <Jim.Gannon@rpsgroup.com>
Sent:	19 June 2015 16:00
To:	Brian Carroll .T (Renewable Energy); Niall Cussen - (DECLG)
Cc:	McCann John (John.McCann@seai.ie); Sarah Corcoran; Cotter Eimear; Saeed Khan; Robert Ovington - (DECLG)
Subject:	Setback Modelling Exercise
Attachments:	Note on Setback Modelling Exercise.docx; Memo Table Wind Scenarios 19_06_2015 _500sqkm Lakes R03.pdf

All,

Please see attached the results of our collective discussion and subsequent modelling this morning. Attached is the modelled results in tabular format. We also attach an overall note on the setback modelling exercise which includes as a final exercise the consideration of overlap between the existing operational portfolio of wind turbines and the modelled output.

We can confirm that no technical questions remain unanswered or unaddressed within the modelling exercise.

Mapped output will be provided at the meeting.

Kind Regards,
Jim Gannon & Rob Ovington

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

Absolute Noise Limit 45 dB

Location		Spatial extent (scale)		Height		Setback from sensitive properties (residences, schools)	Remaining Area (km²) following application of 45dB limit, removal of areas with mean wind speed bellow minimum threshold, and exclusion of agreed no-go areas	Percent of ROI land Area	Capacity available (MW)	Assumed % delivery rate	Assumed MW delivered
		Exsiting guidelines	New	Exsiting guidelines	New	New					
Mountain Moorland and hills	> 150m	Tend towards large	30 turbines maximum	Any height	150m	Min 500m, multiplier of 5 (750m max)	287.85	0.41%	2,878.50	15.00%	431.78
	< 150m	Tend towards small	20	Medium	125m	Min 500m, multiplier of 6 (750m max)	47.67	0.07%	476.70	15.00%	71.51
Transitional marginal land	Ridges and hilltops prefered	Tend towards small	10	Medium and short	125m	Min 500m, multiplier of 7 (875m max)	0.33	0.00%	3.30	15.00%	0.50
Flat farm land		Tend towards small	10	Medium	125m	Min 500m, multiplier of 7 (875m max)	58.69	0.08%	586.90	15.00%	88.04
Flat peat land		Large	50 turbines maximum	Tall	170m	Min 500m, multiplier of 5 (850m max)	182.67	0.26%	1,826.70	30.00%	548.01
Urban/Industrial	Urban town & villages	Tend towards small	2	Short	100m	Min 1km from town & villages	0.00	0.00%	0.00	15.00%	0.00
	Industrial	Tend towards small	1 off-turbine	Short	100m	Min 600m	0.00	0.00%	0.00	15.00%	0.00
Lakeside		Tend towards small	10	-	100m	Min 500m, multiplier of 8 (800m max) to apply only to inland lakes with a surface area >5km²	0.00	0.00%	0.00	15.00%	0.00
Coastal	Set back from water	Tend towards small	10	Tall may be acceptable	100m	Min 500m, multiplier of 8 (800m max)	0.00	0.00%	0.00	15.00%	0.00
							577.21		5,772.10		1,139.82

Republic of Ireland Land Area (km²)	70,273
Capacity Intensity (MW per km²)	10

Meeting Note

Clarification Requests and Responses

No-Go Areas

The following areas represent the agreed list of exclusion zones deemed not available for wind development:

Dataset	Buffer
Special Areas of Conservation (SAC's)	150m Buffer
Special Protection Areas (SPA's)	150m Buffer
Natural Heritage Areas	150m Buffer
Proposed Natural Heritage Areas	150m Buffer
National Parks	
Ramsar Sites	
Lakes and Reservoirs above 5km^2	500m Buffer
Other Lakes and Reservoirs	100m Buffer
Freshwater Pearl Mussel Catchments (designated under si296 only)	
Annex I Habitats (Dataset From NPWS)	
Settlements and Built-up Areas (CSO)	
Zoned Land (Myplan.ie Data)	
Airports/Aerodromes (1km buffer applied for study)	
Military Lands	
Slopes Greater than 10 Degrees (17.6%)	
Sites which can only accommodate one turbine or lower.	
Areas identified by Local Authorities as Not Suitable for Development / No Go	

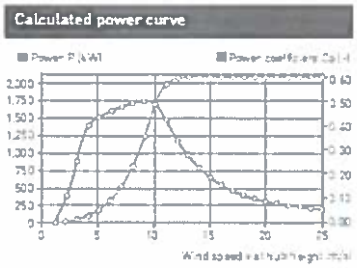
The buffers to the no-go areas defined above represent a nominal 'construction' distance to protected habitats. They do not consider, for example, the reason for designation or the range of protected species activity outside those habitat boundaries (e.g. Hen Harrier).

Wind Data

In previous tables and discussion there has been reference to wind speed. The two key points relating to wind speed have regard to the height at which it is measured and also a minimum threshold wind speed:

- Wind speed extracted from the wind atlas is the mean wind speed at a given height. The wind speed at the hub height of a turbine dictates projected wind output. For example, a hub height of 100m can be typical for a turbine of tip-height approx. 160m – and wind speed at a hub height of 100m would be used to determine viability at this tip height.
- The minimum threshold referred to is the minimum mean wind speed at which a turbine of a given tip-height is deemed viable.

N.B. Although wind turbines will 'cut-in' or begin turning at lower wind speeds, in some extreme cases as low as 2.5m/s, the minimum mean wind threshold at which a site would be viable is in fact higher. As an illustration of the point, please refer to the table below extracted from an Enercon E-82 Turbine Sales Brochure. These show turbine power output at a particular wind speed, under ideal conditions anticipated by a manufacturer. The Power (P) should be considered against the capacity of the turbine of 2,000 kW.



Wind (m/s)	Power P (kW)	Power-coefficient Cp (-)
1	0.0	0.00
2	3.0	0.12
3	25.0	0.29
4	82.0	0.40
5	174.0	0.43
6	321.0	0.46
7	532.0	0.48
8	815.0	0.49
9	1,150.0	0.50
10	1,580.0	0.49
11	1,810.0	0.42
12	1,950.0	0.35
13	2,050.0	0.29
14	2,050.0	0.23

NB – for the purposes of the modelling exercise, a standard 100m hub height has been assumed across land area classifications. This will have resulted in an over-estimation of the model output from areas where a tip-height lower than 150m has been specified in the memorandum.

Use of CORINE Data

The starting area for the matrix is based on the CORINE land use classification. There is a lack of accuracy within the CORINE dataset and due to the alignment of the proposed memorandum land classification areas to CORINE Dataset's own land classification. It is agreed that although this would result in certain exceptions where some small areas will be mis-represented, it is acknowledged collectively that this will have no net impact.

Mapping Exercise

Three Maps accompany the exercise:

1. A map representing the remaining land area deemed available for development after all agreed no-go areas are extracted.
2. A map showing two distinct classifications:
    a. Mean Wind Speed at 100m above the minimum threshold of 7.5m/s
    b. Mean Wind Speed at 100m below the minimum threshold of 7.5m/s

3. A map representing the remaining land deemed available for development after the no-go areas and areas deemed non-viable due to wind speed.
4. The results of map 3, superimposed over the Bord na Mona landholdings.

Delivery Rates

In previous model iterations, historic data resulted in the generation by SEAI of a presumed 16% 'delivery rate' of wind capacity in the areas deemed available for development by the model.

The following delivery factors are now proposed as an agreed position:

- A 30% delivery rate will be assumed for the Flat Peatlands land classification area given that they are largely in single ownership and on the assumption that there would be an explicit national planning policy position favouring the delivery of wind within Flat Peatlands areas and the supporting infrastructure that would be required to connect this to the national grid.
- A 15% delivery rate will be assumed for all other land classification areas.

Additional Exercise

A subsequent exercise has been conducted which considers any overlap between the existing operational fleet of wind turbines in Ireland and the areas resulting from the model which remain available for wind development, within the framework set by the proposed memorandum.

The data from which existing turbine locations are drawn represents approximately 75% of existing turbines and was generated by the SEAI from satellite imagery, in the absence of a dataset of detailed turbine positions from planning authorities or other sources. This 75% is assumed to be representative of the existing operating fleet of wind farms and the results from the exercise on this 75% have been extrapolated to 100% to represent the existing capacity of 2,280MW.

This will illustrate two aspects of the model:

1. The extent of the existing operational wind portfolio that is accounted for within the areas deemed available for development by the modelling exercise.

2. The extent of the existing operational wind portfolio that could not be developed should the memorandum be adopted.

For this exercise, a very broad approximation of capacity per turbine has had to be assumed. It is approximated that there is 2,280MW of installed capacity in the Republic of Ireland (IWEA Website). SEAI has estimated that there are approximately 1,470 turbines representing this capacity. Given these broad estimations, we assume for this exercise that each turbine represents approximately 1.55MW of installed capacity.

The results of the above are that:

1. Approximately 299MW of the existing wind farm portfolio is accounted for in the final result of the model.
2. Approximately 1,980MW of the existing wind farm portfolio could not be developed should the memorandum be adopted.