



Phenix Energy

Renewable Energy Feasibility Study (Wind)

LOCHGELLY HIGH SCHOOL

JUNE 2013

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Date Of Issue	Jun-13
Version	Master Copy : Ver 1
Distribution List	[REDACTED] - Fife Council [REDACTED] - Gardner & Theobald Phenix Energy - Project Master File

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Project Overview

The UK government have incentivised the uptake of renewable energy by various means including Renewable Obligation Certificates (ROCs), the Feed in Tariff (FiTs) and the Carbon Reduction Commitment. There is also potential for sales of energy, in addition to savings resulting from use of the energy generated on-site. Fife Council wishes to maximise the benefits of renewable energy across its estate, by taking forward projects of all sizes, wherever practicable and financially viable.

All Renewable Energy projects have implications for the environment and have wider socio-economic impacts. Fife Council aims to take forward environmentally sound developments that maximise wider benefit to Fife, and minimise risk to the Council and people of Fife.

With this in mind Fife Council has developed a clearly defined Renewable Energy Strategy which aims to;

- Reduce carbon emissions in line with Fife Council's targets and contribute to the national targets on carbon emission reduction,
- Develop renewable generation in line with Fife Council's targets and contribute to the national targets on renewable heat and power
- Reduce energy costs incurred by Fife Council across its Estate
- Reduce carbon costs (CRC) incurred by Fife Council
- Create wider socio-economic benefits for Fife

As part of this Renewable Energy Strategy, Fife Council have identified an initial group of 50 sites for review and assessment as to their suitability for inclusion in their proposed programme of wind turbine installations within the curtilage of properties and land within the Fife Council Estate. The target figure is for 20 of the initial group of sites reviewed, to be taken forward and the proposal is that these turbines would then be utilised to reduce and off-set on site electricity costs by means of connection into the existing power network. Alternatively the wind turbine may be connected to the local electricity network directly and the power generated would then be sold back to Scottish Power/SSE by means of a Power Purchase Agreement (PPA). This would produce an income stream for Fife Council through the Feed In Tariff Scheme (FiTs). As part of this scheme there will also be a significant reduction of Fife Council's carbon footprint

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Methodology & Approach

Fife Council provided a list of 50 sites from within their Estate that they felt may be suitable for development involving Renewable Energy and in particular the installation of a free standing wind turbine.

The proposed sites were divided up and allocated to the Phenix Project Team Members (PTM) and the detailed feasibility was then prepared using the following methodology and process.

Each site was allocated and passed to 2 separate PTMs. Stage 1 of the process involved one PTM carrying out a desk-top analysis and review of the site and the other PTM carrying out a site visit to walk the site and record site information and take photographs. These reviews were carried out independently of each other. The PTM's then reversed roles and carried out the opposite study to the one they first completed, again this was completed independently of each other. The benefit of this, is that we get a complete review and picture of each of the sites from the perspective of two independent PTM's and we also get a second site check on the micro site wind/weather conditions.

This also includes liaison with external agencies such as Local Planning Authorities, DNO's, SEPA, etc..

When all the information has been collated the detailed feasibility is then built up and produced by the 2 PTM's working as a team to review the information sets gathered. This allows any anomalies or information issues to be worked through before the report draft is completed. Upon completion the report is then reviewed by the Technical Director and discussed with the PTM's responsible for producing it. The final draft is then reviewed by the Managing Director and signed off before issue to the Client/Commissioning Party.

1.Site Details

Lochgelly High School
Station Road
Lochgelly
KY5 8LZ



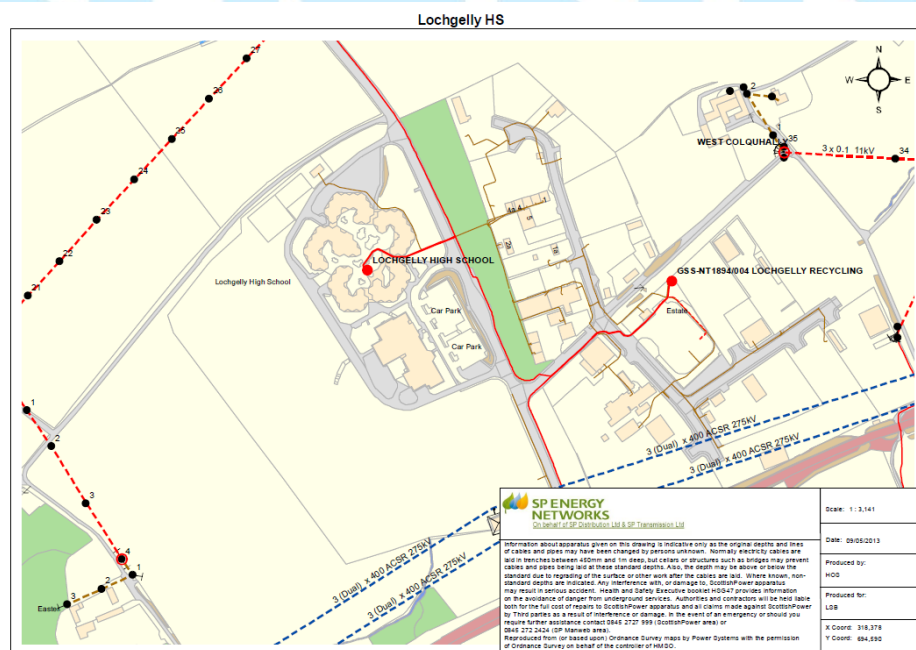
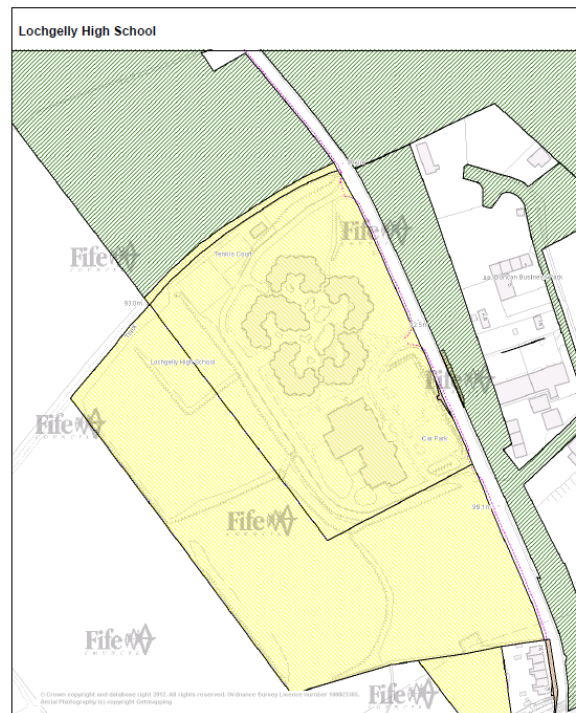


a. Possible turbine location, trees to be removed

The High School is located on the outskirts of Lochgelly and lies 100m above sea level. The School is bounded by open farmland to the North, West and South. The Eastern boundary faces onto industrial units and builders merchant.

The Western elevations and playing fields are bound by open grass/farm land and it is here that may be suitable for the siting of a wind turbine in the top corner as shown on the map. This area is lined with mature trees that will need to be removed if the project is to proceed.





The condition of the existing electrical installation within the school is unfounded at this time and may require some alterations/upgrading to accommodate any turbine installation. Kelty Primary Sub-Station is located 2.7 km to the West of the site.

Locally there is a 3 phase underground electricity cable to the East of the site located within the footpath of Station Road. A formal application will need to be made to Scottish Power to ascertain if there is sufficient capacity within the existing network to facilitate an embedded generation connection. From our discussions with Scottish Power there are no diversions or reinforcement works anticipated at this time although this would be clarified as part of any formal application.

2. Wind Resource

The prevailing wind on the site comes predominantly from the West, South West approximately 60% of the year. The remainder of the time sees it fluctuating through various directions. The wind speed recorded on the DECC website for the 1km grid Square that the school sits in is **6.2 m/s @25m**.

The local landscape is undulating and free from any major structures or buildings of a size that would impact on the wind-flow in relation to any proposed wind turbine. There is mature vegetation/planting and trees that border the playing fields and these will need to be removed if the project is to proceed.

3. Noise Factors & Receptors

The school itself sits on the edge of Lochgelly amongst some industrial units and as such there may be significant levels of background noise from traffic or noise of an industrial nature that could be used within any mitigation formula in relation to noise and the required separation distance to the closest receptors.

The closest receptors to the proposed turbine site are 134m away. This will restrict the type and size of turbine suitable for installation on this site.



4. Shadow Flicker

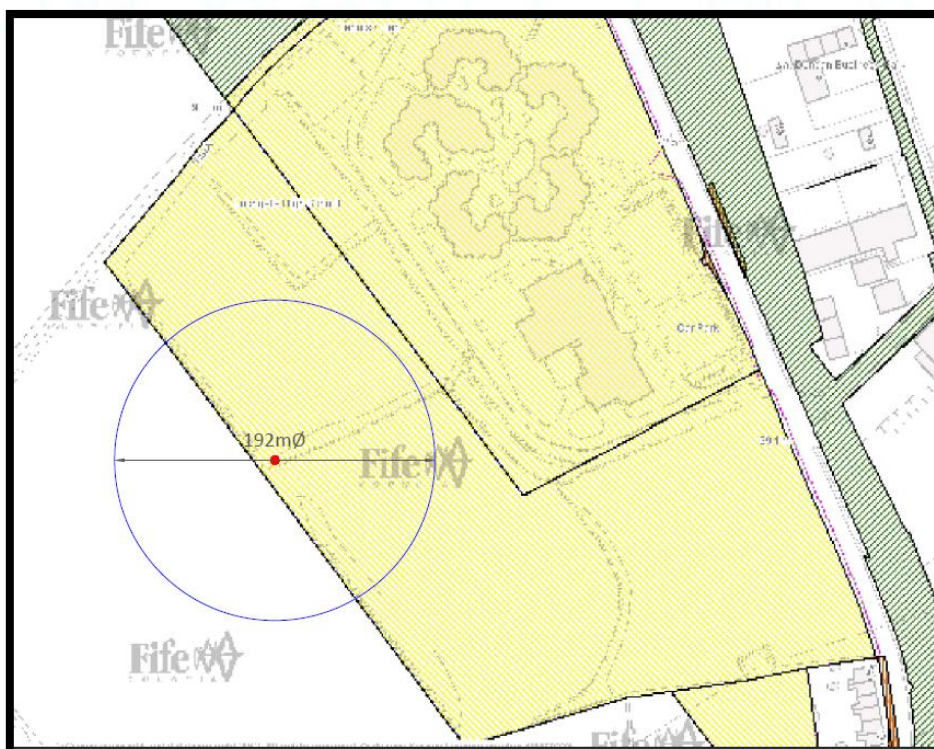
The term “shadow flicker” refers to the flickering effect caused when rotating wind turbine blades periodically cast shadows over neighbouring properties as they turn, through constrained openings such as windows. The magnitude of the shadow flicker varies both spatially and temporally and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed, direction, cloudiness, and position of the turbine to a sensitive receptor.

Planning guidance in the UK (Companion Guide to PPS22, PAN45, Best Practice Guidance to PPS18 and the Welsh Planning Guidelines) requires developers to investigate the impact of shadow flicker, but does not specify methodologies.

The three key computer models used by the industry are WindPro, WindFarm and Windfarmer. It has been shown that the outputs of these packages do not have significant differences between them. All computer model assessment methods use a “worst case scenario” approach and don’t consider realistic factors such as wind speed and cloud cover which can reduce the duration of the shadow flicker impact.

On health effects and nuisance of the shadow flicker effect, it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health. Mitigation measures which have been employed to operational wind farms such as turbine shut down strategies, have proved very successful, to the extent that shadow flicker cannot be considered to be a major issue in the UK.

Only dwellings within 130 degrees either side of north relative to a turbine can be affected and the shadow can be experienced only within 10 rotor diameters of the wind farm. Shadow flicker is more likely to be relevant when considering potential effects on residential amenity than on health effects.

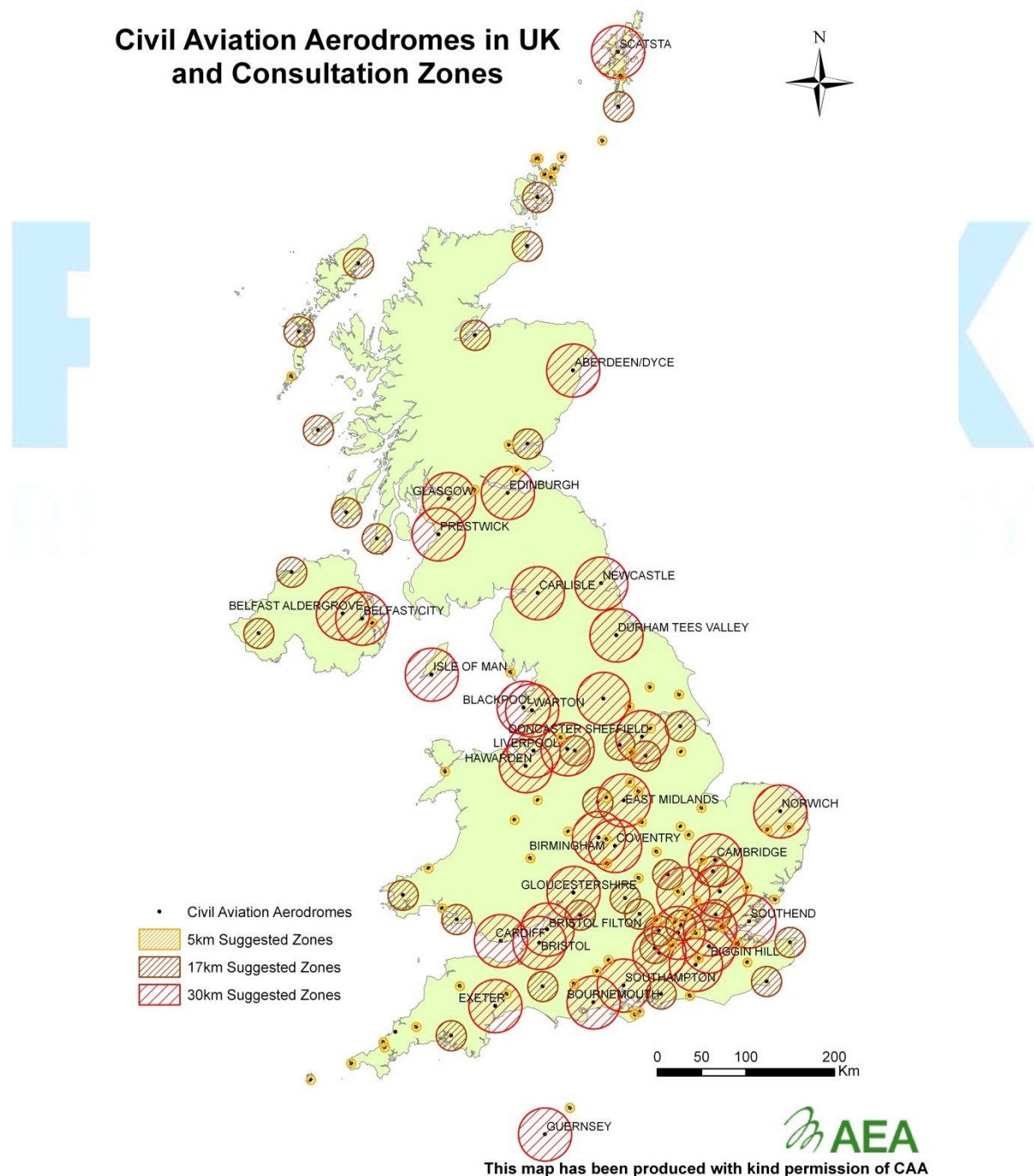


5. Aviation & Radar

Wind energy projects are required to consult with and take cognizance of commercial airports and private airfields whose safe operation could be compromised by the installation of a wind turbine. The Civil Aviation Authority (CAA) have consultation guide-lines in place in relation to their airports throughout the UK.

In Fife this will mean reviewing the potential turbine site in relation to Fife Airport, Perth Airport, Dundee Airport and Edinburgh Airport. There is also a radar station installed near Kincardine which provides additional primary radar functions for Glasgow International Airport.

The MOD are regarded as a Statutory Consultee and specifically in relation to Fife, the operations base at RAF Leuchars will require consideration when selecting a turbine appropriate for this site.



6. Transport & Access

The road network in the direct vicinity of the depot consists of a standard size and layout.

Overall the access to the site is not a concern.



- b. Access to the School via B920 and onto one-way system that loops behind the school

7. Potential Wind Turbines

	KW6	C&F 20	Endurance E3120	NP100	ACSA A27	EWT 54 / 52 - 500kW
4.0 m/s	4,628 kWh	24,670 kWh	62,500 kWh	77,000 kWh	492500	N/A
5.0 m/s	8,949 kWh	43,799 kWh	114,900 kWh	146,000 kWh	16,6 kW h	N/A
5.5 m/s	11,415 kWh	53,637kWh	142,200 kWh	182,000 kWh	N/A	1391000 kWh
6.0 m/s	13,881 kWh	63,475 kWh	168,900 kWh	222,000 kWh	411,000 kWh	1,634,000 kWh
6.5 m/s	16,329 kWh	72,056 kWh	194,300 kWh	258,000 kWh	492,500 kWh	1,864,000 kWh
7.0 m/s	18,776 kWh	80,638 kWh	217,700 kWh	297,000 kWh	575,000 kWh	2,076,000 kWh
7.5 m/s	21,002 kWh	87,108 kWh	238,800 kWh	334,000 kWh	655,000 kWh	2,269,000 kWh
8.0 m/s	23,228 kWh	93,578 kWh	260,000 kWh	367,000 kWh	734,000 kWh	2,431,714 kWh
8.5 m/s	25,120 kWh	N/A	N/A	401,000 kWh	803,114 kWh	2,561,575 kWh
Cost Comparison	£35,000 (fully installed)	£110,000 (fully installed)	£275,000 (fully installed - 25k extra for larger tower)	£350,000 (fully installed)	£640,000 (fully installed)	£1,600,000 (fully installed)

8. Site Summary and Turbine Recommendation

	PASS	FAIL	MITIGATE
SECTION 1 (CRITICAL)			
Location	X		
Wind Speed	X		
Separation Distance			X
Grid			X
Transport/Access	X		
SECTION 2			
Aviation/Radar	X		
Ecology	X		
Noise/Shadow			X

Based on the fore-going review of this site we would recommend moving this site forward for initial pre-screening by the local planning authority. Based on the site conditions the turbine best suited to this site would be an **E3120**.

Financials



9.Financials

Lochgelly High School currently uses 852,311 Kw of electricity per annum which produces approximately 7670 tonnes of CO2 per annum. Assuming a unit cost of 0.15 per kw, the average electricity bill per annum for the centre is in the region of £127,846.00 excluding ancillary charges and the like.

Turbine Type	Rated Output	Wind Speed	Supply & Install Cost (exc. Grid)	kWh's P.A	FIT Rate (post Oct)	FIT Rate (post April 2014)	Export Tariff	Year 1 Income	Payback (years)	20 Year Income (Overall)
E3120	80kW	6.0m/s	£275,000	168,900	0.2165	0.2	0.03	£41,634	6.6	£557,677.00

Current usage per annum	852,311 kw
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Current utility cost per annum	£127,846.00
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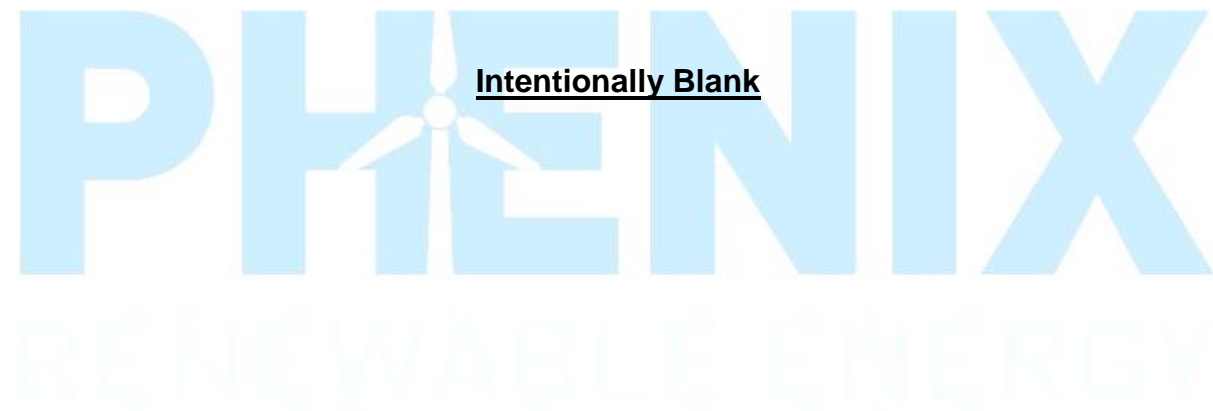
Current CO2 level	7670 tonnes
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Projected Operation & Maintenance

Projected annual generation value	£41,634
Projected annual maintenance cost	£2900
Projected annual insurance cost	£966
Projected net re-distribution value	£37,768

NB1.Current usage is based on 4 year average

NB2.Current utility cost based on 0.15p per unit



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In terms of **FINANCIAL RISK**, at this stage all figures used within this document are based on the current Feed- In- Tariff rates detailed below, which are applicable until April 2014 as it currently stands. These rates can be seen from the tables below as well as the current digression time-table which shows the dates for proposed review and reductions, assuming the appropriate levels of capacity have been achieved.

ofgem E-Serve

Feed-in Tariff Payment Rate Table for Non-Photovoltaic Eligible Installations for FIT Year 4 (1 April 2013 to 31 March 2014)

1. The FIT tariff rate for an Accredited FIT Installation of a description specified in the first column of the tables below and with a Tariff Date specified in the second column is the applicable rate specified in the corresponding entry in the third column.
2. The rates below have been adjusted by the annual RPI rate (as at December 2012) of 3.1 percent. All tariff rates are pence per kilowatt hour at 2013/14 values.
3. In Tables 2 and 4, the Conditional Date referred to in the entries in the second column for certain descriptions of installations refers to 15 March 2013.
4. In Tables 2 and 3, the largest capacity bands have been adjusted in line with the level of support under the Renewables Obligation for the 2013/14 period, and adjusted by RPI.

Table 1: Anaerobic Digestion

Description	Period in which Tariff Date falls	Tariff (p/kWh)
Anaerobic digestion with total installed capacity of 250kW or less	1 April 2010 to 29 September 2011	13.09
	30 September 2011 to 31 March 2014	15.16
Anaerobic digestion with total installed capacity greater than 250kW but not exceeding 500kW	1 April 2010 to 29 September 2011	13.09
	30 September 2011 to 31 March 2014	14.02
Anaerobic digestion with total installed capacity greater than 500kW	1 April 2010 to 30 November 2012	10.21
	1 December 2012 to 31 March 2014	9.24

Table 2: Hydro

Description	Period in which Tariff Date falls	Tariff (p/kWh)
Hydro generating station with total installed capacity of 15kW or less	1 April 2010 to 30 November 2012	22.58
	1 December 2012 to 31 March 2014	21.65
Hydro generating station with total installed capacity greater than 15kW but not exceeding 100kW	1 April 2010 to 31 March 2014	20.21
Hydro generating station with total installed capacity greater than 100kW but not exceeding 500kW	before the Conditional Date	12.48
	on or after the Conditional Date	15.98
Hydro generating station with total installed capacity greater than 500kW but not exceeding 2MW	1 April 2010 to 31 March 2014	12.48
Hydro generating station with total installed capacity greater than 2MW	1 April 2010 to 30 November 2012	5.05
	1 December 2012 to 31 March 2013	4.62
	1 April 2013 to 31 March 2014	3.23

Description	Period in which Tariff Date falls	Tariff (p/kWh)
Wind with total installed capacity of 1.5kW or less	1 April 2010 to 31 March 2012	39.07
	1 April 2012 to 30 November 2012	36.91
	1 December 2012 to 31 March 2014	21.65
Wind with total installed capacity greater than 1.5kW but not exceeding 15kW	1 April 2010 to 31 March 2012	30.21
	1 April 2012 to 30 November 2012	28.87
	1 December 2012 to 31 March 2014	21.65
Wind with total installed capacity greater than 15kW but not exceeding 100kW	1 April 2010 to 31 March 2012	27.32
	1 April 2012 to 30 November 2012	26.19
	1 December 2012 to 31 March 2014	21.65
Wind with total installed capacity greater than 100kW but not exceeding 500kW	1 April 2010 to 30 November 2012	21.24
	1 December 2012 to 31 March 2014	18.04
Wind with total installed capacity greater than 500kW but not exceeding 1.5MW	1 April 2010 to 30 November 2012	10.72
	1 December 2012 to 31 March 2014	9.79
Wind with total installed capacity greater than 1.5MW	1 April 2010 to 30 November 2012	5.05
	1 December 2012 to 31 March 2013	4.62
	1 April 2013 to 31 March 2014	4.15

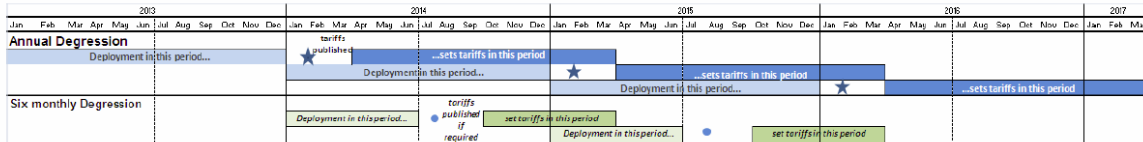
As soon as any wind turbine project has been through the Preliminary Accreditation Process with OFGEM then the rates and revenue stream prevailing at the time of accreditation are guaranteed for 20 years from the date of commissioning.

At this point the risk to the revenue stream lies with any issues (they may be funding or construction issues) that prevent the project being realized and completed within the time constraints laid down within the Preliminary Accreditation.

Degression Process for Wind, Anaerobic Digestion and Hydro

Annual Degression

- The degression process for wind, anaerobic digestion and hydro starts in 2014
- New tariffs take effect annually from 1 April 2014, and are based on deployment in the preceding calendar year as described in upper part of the diagram below.



Six monthly Degression

- Six monthly degression only occurs if installed capacity has reached the expected annual level (as forecast by modelling) in the first half of the calendar year.
- If six monthly degression is prompted, new tariffs will be published by 1 Aug to take effect from 1 October (not April)
- Deployment includes capacity registered for preliminary accreditation in the period.



Preliminary Accreditation Process

- Once accredited, installations eligible for preliminary accreditation between 1 April and 30 November each year will receive the tariff that they would have received if they had accredited at the time they applied for preliminary accreditation.
- Tariff guarantees apply for a fixed point from application - (i) six months for solar PV, (ii) one year for AD and wind, (iii) two years for hydro. Example 1 below demonstrates this scenario for each technology

Example 1

	2012		2013												2014												2015											
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar PV																																						
AD / Wind																																						
Hydro																																						

- Installations granted preliminary accreditation with an effective date in the period 1 Jan – 31 March each year will be eligible for the tariff that applies the following April
- This is to reduce the likelihood of a rush to "pre-book" a previous year's tariff in the early part of a year
- Example 2 demonstrates this scenario for each technology

Example 2

	2012		2013												2014												2015					
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Solar PV																																
AD / Wind																																
Hydro																																

10. References

DECC – Department for Energy & Climate Change

ETSU- R97 – Noise Guidelines

Fife Council Wind Energy – Supplementary Planning Guidelines

CAA – Civil Aviation Authority

MOD – Ministry Of Defence

Parsons Brinkerhoff for DECC

SPP6 – Scottish Planning Policy

Fife Council Local Development Plan

SNH – Scottish Natural Heritage

OFGEM

Scottish Power

Wind Finder

