Sunrise Renewables (Barry) Ltd
Renewable Power Plant at David Davies Road, Barry ("Project")
Waste Disposal Status of the Project

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1. Waste Framework Directive

1.1 Is the Waste Hierarchy even relevant? The most important point to understand is that the Project is a renewable power plant using syngas derived from the gasification of waste wood biomass as its fuel.

It is not a waste incineration installation and is not therefore regulated by the Waste Framework Directive[1] ("**WFD**").

As such, it is not necessary to perform the 'R1 Energy Efficiency Calculation' for the purposes of determining whether or not it is a "waste disposal facility" for the incineration of hazardous or non-hazardous waste under Schedule 1 of The Environmental Permitting (England and Wales) Regulations 2010[2] ("**EPR**").

1.2 EU Authority. This is clear from the European Union's own guidance on the WFD[3] which states in its very first sentence:

> *"These guidelines are destined to provide legal certainty and a level playing field in the application of the energy efficiency thresholds for municipal waste incinerators in Annex II of Directive 2008/98/EC on waste (Waste Framework Directive - WFD)."*

The Annex II cited includes example R1 (which is where the "R1 Energy Efficiency Calculation" nomenclature derives from):

> *"R1 - Use principally as a fuel or other means to generate energy [which] includes incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal to or above:*
> *— 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,*
> *— 0.65 for installations permitted after 31 December 2008,*
> *using the [R1 Energy Efficiency Calculation formula]"*

1.3 Natural Resource Wales Guidance. This is recognised by Natural Resource Wales in its own guidance[4] on the application of the WFD under the EPR in Wales:

> *"The Directive allows municipal waste incinerators to be classified as recovery operations provided they achieve a defined threshold of energy efficiency. This has been introduced to:*
> - *promote the use of waste in energy efficient municipal waste incinerators*
> - *encourage innovation in waste incineration*
>
> *Whether or not the energy efficiency threshold is achieved is worked out by using the R1 Energy Efficiency formula included in the Directive."*

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[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF
[2] http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents
[3] http://ec.europa.eu/environment/waste/framework/pdf/guidance.pdf
[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/361544/LIT_5754.pdf

1.4 Environment Agency Guidance. Natural Resource Wales' guidance incorporates the Environment Agency's guidelines[5] on "How incinerators can be classified as energy recovery", which state under how to "Qualify as an R1 recovery operation":

> *"The incinerator must be:*
> *• regulated by the Environment Agency*
> *• dedicated to municipal waste (MWI) or automotive shredder residues (ASR)*
> *This approach applies only to incineration plant as defined by the [EPR]"*

It is therefore clear: the Waste Framework Directive applies to incinerators which are dedicated to processing municipal waste and municipal waste-derived products (such as RDF). It does not apply to biomass power plants using waste wood.

2. The Environmental Permitting (England and Wales) Regulations

2.1 WFD application in Wales. A review of the detailed legislation applicable in Wales (being the EPR) and what is to be considered an 'incineration plant' supports the conclusion under Section 1 above:

2.2 Waste Incineration Installations. A "Waste Incineration Installation" is defined in EPR Schedule 13:

> ***2.*** *(1) In this Schedule, "**waste incineration installation**" means that part of an installation or Part A mobile plant in which any of the following activities is carried on—*
>
> *(a) the incineration of waste falling within the following provisions of Section 5.1 of Part 2 of Schedule 1—*
>
> *(i) paragraphs (a) to (c) of Part A(1), or*
>
> *(ii) paragraph (a) or (b) of Part A(2); or*
>
> *(b) any other activity falling within Part 2 of Schedule 1 which is carried on in a co-incineration plant (as that term is defined in Section 5.1 of Part 2 of Schedule 1).*

Since the Project only uses a single fuel-type, it would not in any event be a co-incinerator for the purposes of (b).

2.2 Incineration Plants. In respect of (a) above, this refers to EPR Schedule 1, Part 2, Section 5.1 the relevant parts of which read as follows:

> *Part A(1) (c) The incineration of non-hazardous waste **in an incineration plant** with a capacity of 1 tonne or more per hour.*
>
> *"**incineration plant**" means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated, including—*
>
> *(a) the incineration by oxidation of waste; and*
> *(b) other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substances resulting from the treatment are subsequently incinerated.*
> *This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pre-treatment facilities, waste-fuel and air-supply systems, boiler, facilities*

[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/361544/LIT_5754.pdf

for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations, recording and monitoring incineration conditions, ***but does not cover incineration in an excluded plant****;*

*"****excluded plant****" means—*

…

(iv) ***wood waste*** *with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coating,* ***and which includes in particular such wood waste originating from construction and demolition waste****,*

…

2.3 Processed Wood: The Project is solely processing waste wood from Grades A to C below (Waste Recycling Association definitions) and does not include halogenated organic compounds or heavy metals:

Grade A: "Clean" recycled wood – material produced from pallets and secondary manufacture etc and suitable for producing animal bedding and mulches.

Grade B: Industrial feedstock grade – including grade A material plus construction and demolition waste, this is suitable for making panel board.

Grade C: Fuel grade – this is made from all of the above material plus that from municipal collections and civic amenity sites and can be used for biomass fuel.

2.4 Excluded Plant: As an '*Excluded Plant*' under EPR Schedule 1, the Project is not within the definition of a '*Waste Incineration Installation*' and is therefore outside of the WFD.

The "R1 Energy Efficiency Calculation" is a provision having its origins in the WFD and is a means by which to determine whether a waste incineration installation exceeds the energy recovery threshold required in order for it to be considered as a recovery operation for the purposes of the Waste Hierarchy. However, this is not relevant for the Project for the reasons mentioned.

3. Hypothetical R1 Energy Efficiency Calculation

3.1 Hypothetical Scenario: Even though the Project falls outside the WFD/EPR provisions relating to incineration (so that the R1 Energy Efficiency Calculation is not relevant), it would in any case comfortably exceed the 0.65 R1 threshold. This is the threshold above which energy recovery from a municipal waste incineration plant is considered sufficiently high for it not to be considered a 'waste disposal facility' under Schedule 1 of the EIA Regulations. This section 3 therefore considers a hypothetical scenario in which the Project falls to be considered under the EPR.

3.2 Feedstock Specification: For the purposes of the Project, the following common parameters for the supply of Waste Wood have been specified by the manufacturer of the boiler:

Parameter	Unit	Acceptance Range		Design Value
		Minimum	Maximum	
Higher heating value (HHV), d.b	MJ/kg	18.6		19.599
Lower heating value (LHV), a.r.	MJ/kg	11	16	14.275
Moisture Content	wt-%	5.00%	30.00%	20.00%

d.b = dry basis; a.r. = "as received"

This can be compared with the laboratory results from a representative test of a waste wood sample – each sample will vary a little but the heating values are closely aligned with the specification above.

Date Sampled: 20 August 2014
Date Received: 20 August 2014
Test Date: 21 August to 10 September 2014
Date Reported: 11 September 2014

			Results Basis		
Method Reference		Units	**As Received ***	**As Analysed**	**Dry ***
SP20	Total Moisture	%	17.0	-	-
CA2	Analysis Moisture	%	-	3.3	-
CA 3	Ash	%	1.6	1.9	2.0
CA 6	Volatile Matter	%	66.4	77.4	80.0
CA31	Total Sulphur	%	0.03	0.04	0.04
**	Chlorine	%	0.09	0.11	0.11
CA9	Carbon	%	38.80	45.21	46.75
CA9	Hydrogen	%	4.82	5.62	5.81
CA9	Nitrogen	%	2.55	2.97	3.07
CA11	Gross Calorific Value	kJ/kg	16265	18950	19597
*	Net Calorific Value	kJ/kg	14797	-	-
CA 32	Biomass (dissolution) by energy	%		97.6	

The above data is relevant to determining the energy content of the waste wood used in the R1 Energy Efficiency Calculation below.

3.3 R1 Principles: Were the WFD to apply to the Project then in order to be classed as an R1 operation (use principally as a fuel or other means to generate energy) the process would have to meet the following criteria:

- The combustion of waste must generate more energy than the consumption of energy by the process itself;
- The greater part of the waste must be consumed during the operation;
- The greater amount of the energy generated must be recovered and used (either as heat or electricity);
- The waste must replace the use of a source of primary energy

3.4 R1 Energy Efficiency Formula: The WFD specifies that incineration facilities dedicated to the processing of municipal solid waste can be classified as R1 only where their energy efficiency is equal to or above 0.65 (for installations permitted after 31st December 2008). The formula used to calculate this value of energy efficiency is:

Energy efficiency = (Ep - (Ef + Ei))/(0,97 × (Ew + Ef))
In which:
Ep means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/year)
Ef means annual energy input to the system from fuels contributing to the production of steam (GJ/year)
Ew means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)

Ei means annual energy imported excluding Ew and Ef (GJ/year) 0.97 is a factor accounting for energy losses due to bottom ash and radiation.

This formula shall be applied in accordance with the reference document on Best Available Techniques for waste incineration.

In the case of the Project, we have run three R1 scenarios detailed in the Appendix to this paper and the results are as follows:

Scenario	**Explanation**	**R1 Calculation**
Scenario A	This is the mode of operation with the Project operating at the minimum guaranteed output according to the Contractor (9.26MW)	0.73
Scenario B	This is the expected mode of operation (10MW) with the installed boiler operating at minimum guaranteed steam load	0.74
Scenario C	This is the expected mode of operation (10MW) with the installed boiler operating at expected steam load	0.78

For the purposes of previous information provided, we have used the most conservative Scenario A to demonstrate that were the Project to come within the WFD/EPR regime, it would in any case comfortably exceed the 0.65 threshold level.

Sunrise Renewables (Barry) Ltd

July 2015

APPENDIX: DETAILED R1 ENERGY EFFICIENCY CALCULATION

	Type of energy	Scenario A energy Ex [MWh]	Scenario B energy Ex [MWh]	Scenario C energy Ex [MWh]
1.1	amount of incinerated waste (without 1.2 and 1.3)	321,726	337,813	321,840
1.2	e.g amount of incinerated sewage sludge	0	0	0
1.3	e.g. amount used activated carbon incinerated	0	0	0
1	**Ew: energy input to the system by waste**	**321,726**	**337,813**	**321,840**
2.1	Ef 1: amount of light fuel oil for start up (after connection with the steam grid)	0	0	0
2.2	Ef 2: amount of light fuel oil for keeping the incineration temperature	0	0	0
2.3	Ef 3: amount of natural gas for start up and keeping incineration temperature	0	0	0
2	**S Ef: energy input by imported energy with steam production**	**0**	**0**	**0**
3.1	Ei 1: amount of light fuel oil for start up/shut down (no connection with the steam grid)	350	350	350
3.2	Ei 2: e.g. natural gas for heating up of flue gas temperature for SCR and start up/shut down	0	0	0
3.3	Ei 3: imported electricity (multiplied with the equivalence factor 2.6)	0	0	0
3.4	Ei 4: imported heat (multiplied with the equivalence factor 1.1)	0	0	0
3	**S Ei: energy input by imported energy without steam production**	**350**	**350**	**350**
4.1	Epel internal used: electricity produced and internally used for the incineration process	10,400	10,920	10,920
4.2	Epel exported: electricity delivered to a third party	74,080	80,000	80,000
4	**S Epel produced = Epel internal used + Epel exported**	**84,480**	**90,920**	**90,920**
5.1	Epheat exp.1: steam delivered to a third party without backflow as condensate	0	0	0
5.2	Epheat exp.2: district heat delivered to a third party with backflow as condensate (hot water)	0	0	0
5	**S Epheat exported = Epheat exp.1 + Epheat exp.2**	**0**	**0**	**0**
6.1	Epheat int.used1: for steam driven turbo pumps for boiler water, backflow as steam	0	0	0
6.2	Epheat int.used2: for heating up of flue gas with steam, backflow as condensate	0	0	0
6.3	Epheat int.used4: for concentration of liquid APC residues with steam, backflow as condensate	0	0	0
6.4	Epheat int.used5: for soot blowing without backflow as steam or condensate	6,484	6,484	6,484
6.5	Epheat int.used7: for heating purposes of buildings/instruments/silos, backflow as condensate	0	0	0
6.6	Epheat int.used8: for deaeration - demineralization with condensate as water input	0	0	0
6.7	Epheat int.used9: for NH4OH (water) injection without backflow as steam or condensate	0	0	0
6	**S Epheat int.used = S Epheat int.used1-9**	**6,484**	**6,484**	**6,484**
	R1 = (Ep - (Ef + Ei)) / (0.97 * (Ew + Ef))	**0.73**	**0.74**	**0.78**
	Ep = 2.6*(S Epel int.used+S Epel exported) + 1.1*(S Epheat int.used+S Epheat exported)	**226,780**	**243,524**	**243,524**