

UKWIN's December 2017 critique of 'Cory Riverside Energy: A Carbon Case'

1. UKWIN has undertaken an initial critique of the 'Cory Riverside Energy: A Carbon Case' report to explain some of the errors contained within the report which, when corrected, demonstrates that the greenhouse gas emissions from Cory's Riverside incinerator are in fact significantly higher (between 6.7m and 10.5m tonnes higher over 30 years) than emissions from sending the same waste directly to landfill.
2. Alongside a consideration of the 'Cory Riverside Energy: A Carbon Case' report, UKWIN has drawn on the following relevant source documents:
 - Defra's 'Energy recovery for residual waste: A carbon based modelling approach February 2014' (Defra 2014), as this document is cited by Cory as a source document for their report;
 - BEIS's 'Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal' (last updated March 2017), as this is the most relevant BEIS guidelines as referred to in the Government's Energy from Waste Guide as appropriate for such analysis; and
 - Eunomia's 'The Potential Contribution of Waste Management to a Low Carbon Economy' (Eunomia 2015), as this provides evidence-based best practice guidelines to be used when accounting for the emission of biogenic CO₂ in comparative analysis between incineration and landfill.

Biogenic CO₂ emissions

3. Section 6.3 of the Defra 2014 report, which the Cory report cites as one of its primary data sources, notes that:

"...the model assumes that not all of the biogenic material decomposes in landfill but it is all converted to CO₂ in energy from waste. Landfill therefore acts as a partial carbon sink for the biogenic carbon. This is a potential additional benefit for landfill over energy from waste.

There are two ways to account for this additional effect:

- *[Option 1:] Estimate the amount of biogenic carbon sequestered and include the CO₂ produced from the same amount of carbon in the EfW side of the model (or subtract it from the landfill side)*
 - *[Option 2:] Include all carbon emissions, both biogenic and fossil on both sides of the model"*
4. Cory's carbon analysis fails to account for this additional effect, applying neither Option 1 nor Option 2. UKWIN has used Option 2 for our analysis, but the choice between Options 1 and 2 to account for the difference in biogenic release of CO₂ between landfill and incineration does not affect the conclusion that, in terms of CO₂ emissions, incineration is worse than landfill.

5. Eunomia's 'Low Carbon Economy' report noted that it was essential that biogenic carbon in CO₂ is taken into account. Cory's report fails to follow best practice in this respect.
6. The Eunomia report stated that: *"In comparative assessments between waste management processes, it cannot be considered valid to ignore biogenic CO₂ emissions if the different processes deal with biogenic CO₂ in different ways..."*
7. As such, by ignoring biogenic CO₂ emissions from incineration while failing to adequately credit landfill for sequestration of carbon, Cory has adopted an approach which is not valid and therefore needs correcting to account for the relative net CO₂ impact of incineration compared with landfill.

Offset energy from incineration

8. Defra 2014 states:

"The thermal efficiency of a power-only EfW is defined as power exported to grid / energy content of the waste x 100%" (Para 216)

"Energy (EfW) = mass of waste x calorific value x efficiency" (Para 61)

9. This supports the common sense approach, which is to base the marginal energy generation offset on the electricity exported rather than giving credit for the 'parasitic load' needed to operate the plant.
10. Inexplicably, Cory's carbon report mistakenly uses the gross figure of energy generated, rather than the net figure of energy exported. This error therefore also needs to be corrected.

Carbon intensity of displaced energy source / marginal emissions factor (MEF)

11. A further error in Cory's report is to use an outdated CCGT figure of 0.385 tCO₂/MWh to calculate the carbon intensity of the displaced energy source.
12. UKWIN notes that the highest value in the Defra 2014 range for carbon intensity of displaced energy sources is 0.373 tCO₂/MWh, and that the official BEIS 2011 emissions factor, i.e. the MEF for the first year of operation for the Riverside incinerator, of 0.336 tCO₂/MWh is in fact the correct marginal emissions factor (MEF) to use for these purposes. It should also be noted that were we considering a facility starting operations in 2018 then, due to decarbonisation of the electricity supply, the correct MEF would be 0.280 tCO₂/MWh.
13. As explained at Paragraph 119 of the Defra 2014 document used by Cory: *"...we should use the marginal energy mix which represents the carbon intensity of generating an additional kW of electricity...as renewable energy and nuclear make a greater contribution to the marginal energy mix this will change and the result will be a significant drop in the carbon intensity of the marginal energy mix".*

14. The February 2014 Defra Energy from Waste Guide noted: "When conducting more detailed assessments the energy offset should be calculated in line with DECC guidance using the appropriate marginal energy factor". This is now BEIS guidance, which UKWIN has followed in our Further Corrected Cory Scenario. The Partially Corrected Cory Scenario analysis still uses the outdated 0.385 figure for the purpose of sensitivity analysis.

Proportion of methane captured / Landfill gas capture rate

15. Cory refers to the Defra 2014 document as a primary guidance document, yet Cory uses a 66% landfill gas capture rate in preference to the 75% rate. The 75% rate is based on Government practice and is adopted as the baseline figure in the Defra 2014 document.

16. UKWIN uses the 75% figure for the landfill gas capture rate in our Further Corrected Cory Scenario, whereas the Partially Corrected Cory Scenario analysis uses the 66% figure for the purpose of sensitivity analysis.

Table 1: Scenario Outline

	Defra 2014 Baseline Scenario	Cory Choice	Partially Corrected Cory Scenario	Further Corrected Cory Scenario
Biogenic CO2 emissions	Considered in Section 6.3 of Defra 2014	Not accounted for by Cory	Follows Defra 2014 Option 2	Follows Defra 2014 Option 2
Offset energy from incineration	Considered at paragraph 61 and 216	Use total power generated	Total power generated	Total power exported
Carbon intensity of displaced energy source / marginal emissions factor (MEF)	0.373 (Highest value of Defra 2014 range)	0.385 (Higher than all of the Defra 2014 range)	0.385 (Cory figure)	0.336 (BEIS 2011 emissions factor ¹ ; within Defra 2014 range)
Proportion of methane captured / Landfill gas capture rate	75% (Based on Government practice)	66% (Lower than Defra Baseline Scenario)	66% (Cory figure)	75% (Defra 2014 Baseline Figure)

¹ Latest BEIS figure for 2011 generation-based electricity emissions factor as per Table 1 of the Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - last updated 15 March 2017; within Defra 2014 range and used per guidance in Defra's Guide to Energy from Waste

17. When comparing the greenhouse gas emissions from the Riverside incinerator with sending the same waste to landfill we can see, from the tables below, that even taking account of the benefits in carbon saved by using transport by water instead of road, Cory's incinerator still emits significantly more CO₂e than sending the same waste to landfill.
18. Based on the assumptions in the Cory and Defra reports and by BEIS, over a 30 year period sending the waste to the Riverside incinerator would result in between 6.7 million and 10.5 million tonnes of CO₂e being released compared to sending that same waste directly to landfill. This means the Riverside facility is exacerbating climate change and should be considered a 'high carbon' facility.

Table 2: Partially Corrected Cory Central Scenario (tCO₂e)

	Transfer stations	Transport	Process	Displaced electricity emissions	Total tCO ₂ e
Cory Riverside Energy	4,160	5,163	693,137 [a]	-221,979	480,481
UK Landfill		18,642	260,111	-24,530	254,223
Net Carbon saving (CO₂e) per year	-4,160	13,478	-433,026	130,470	-226,258
Net Carbon saving (tCO₂e) over 30 years					-6,787,740

Notes:

(Grey Cell) = Figure directly from Cory Table 11

[a] 693,137 = 700,138 tonnes of waste (Cory page Table 9) x 27% total carbon percentage (Cory Table 9) x 44/12 Carbon to CO₂ (Cory Table 5) [Calculates total CO₂ - Correcting for Cory having used just fossil-based CO₂ and failing to account for the biogenic carbon emitted]

Table 3: Further Corrected Cory Central Scenario (tCO₂e)

	Transfer stations	Transport	Process	Displaced electricity emissions	Total tCO ₂ e
Cory Riverside Energy	4,160	5,163	693,137 [a]	-173,096 [b]	529,364
UK Landfill		18,642	183,608 [c]	-24,328 [d]	177,922
Net Carbon saving (CO₂e) per year	-4,160	13,478	-509,529	130,470	-351,442
Net Carbon saving (tCO₂e) over 30 years					-10,543,267

[a] 693,137 = Corrected as per Table 2 notes above

[b] -173,096 = 515,166 MWh exported (Cory Table 6) x 0.336 MEF (BEIS long-run generation-based marginal emissions factor 2011) [Corrected to account parasitic load]

[c] 183,608 = 75% landfill gas capture based on Cory Table 9 methodology [Corrected to take account of Government use of 75% landfill gas capture, and not Cory's figure of 66%]

[d] -24,328 = 72,404 MWh (adjusted from Cory Table 10 to account for 75% methane capture) x 0.336 MEF (BEIS long-run generation-based marginal emissions factor 2011) [Corrected to take account of BEIS MEF for 2011 and Government 75% landfill capture]

CO2 benefits of alternative waste treatment methods

19. The above analysis is only comparing the waste incinerator at Riverside with sending waste directly to landfill. In reality, the waste could be sent to MBT prior to landfill, which would result in a high degree of bio-stabilisation that would significantly reduce the methane released from landfill and this would therefore further improve the position of landfill compared with incineration.
20. Furthermore, the composition analysis provided by Cory indicates that a significant proportion of the waste could potentially be separately collected for recycling or composting.
21. Table 4 of the Cory report indicates that much of the material used as feedstock by the Riverside incinerator in 2015 could have been recycled or composted. For example:
- About 28% of the feedstock (by weight) was paper and card
 - About 26% was putrescible (compostable material)
 - Just over 16% was plastic film or dense plastic
 - More than 7% was either glass or metal
 - About 3.5% was textiles
22. Based on the Scottish Government's Zero Waste Scotland Carbon Metric, recycling just 50% of the plastic used as feedstock for the Riverside incinerator in 2015 would have resulted in a carbon saving of 53,291 tonnes of CO₂e per year, and recycling 50% of the paper and card would result in carbon savings of 30,718 tonnes of CO₂e per year.
23. For other materials there are also significant carbon savings that could have been made had the focus been on recycling and composting rather than incineration. Even greater carbon savings could have been achieved if there had been a greater focus on waste minimisation.