

**Written evidence from the United Kingdom Without Incineration Network
produced in response to the BEIS consultation on
proposed amendments to the Contracts for Difference scheme**

7th March 2018

Introduction

1. The United Kingdom Without Incineration Network (UKWIN) welcomes this opportunity to contribute to the BEIS consultation on proposed amendments to the Contracts for Difference (CfD) scheme. UKWIN is a network of around 100 member groups, and was founded in 2007 to promote sustainable waste management and public participation in environmental decision-making. Through our work we have been directly involved with more than 100 gasification, pyrolysis and conventional incineration schemes. We have tracked many of these from their initial public announcement to the present day. This wealth of relevant experience provides us with a deep understanding of thermal treatment proposals.
2. In this latest response UKWIN addresses issues associated with mixed (residual) waste. This submission from UKWIN does not focused on issues arising from dedicated biomass or waste wood. We understand that Biofuelwatch, in conjunction with other relevant organisations, is responding with respect to biomass, and we ask that their submission is given proper consideration.
3. Throughout this submission UKWIN uses the terms 'thermal treatment' and 'incineration' to refer to the broad class of technologies that some would refer to as 'Energy from Waste', 'Advanced Thermal Treatment', and 'Advanced Conversion Technology' and which others would refer to as including the treatment of mixed waste by conventional (mass burn) incineration, gasification and/or pyrolysis.
4. By whatever means mixed waste is converted into energy (be it heat, electricity or fuel) that conversion process remains a leakage from the circular economy because it removes resources from the material and biological cycles. Such leakages are undesirable outcomes that should be minimised not subsidised.
5. True innovation comes from not seeing discarded material as waste at all, but rather seeing it as a vital component of the circular economy. For those materials being sent to either landfill or thermal treatment that could have been recycled or composted, the focus should be on investigating the reasons why this material was not recycled, e.g. lack of appropriate sorting, reprocessing and/or composting infrastructure, and on supporting circular economy innovation as appropriate.
6. For those materials that cannot currently be readily recycled, investigation should be undertaken to examine opportunities to redesign products to increase recyclability or undertake efforts to increase product lifespan, etc. Better management of our resources will result not just in better resource productivity but in less waste in general, lowering demand for residual waste treatment capacity and therefore rendering moot the question of what form new capacity should take.
7. CfD and other Government support for thermal treatment constitute an unwelcome and wholly unnecessary distraction from true and much-needed innovation that supports the transition to a low-carbon circular economy.

Consistency with the Government's four principles

8. In February 2014 Defra released Chapter 5 of their Energy from waste: A guide to the debate (also known as 'the EfW Guide'). As noted at Paragraph 218 of that document: "In this Chapter we set out the underlying principles which are driving current Government policy on energy from waste and are likely to remain key considerations for Government and the sector going into the future..."
9. Paragraph 219 goes on to state: "There are four key principles that underpin current thinking on energy from waste and which are expected to remain critical to the development of a sustainable policy into the future:
 - i. Energy from waste must support the management of waste in line with the waste hierarchy.
 - ii. Energy from waste should seek to reduce or mitigate the environmental impacts of waste management and then seek to maximise the benefits of energy generation.
 - iii. Government support for energy from waste should provide value for money and make a cost effective contribution to UK environmental objectives in the context of overall waste management and energy goals.
 - iv. Government will remain technology neutral except where there is a clear market failure preventing a technology competing on a level footing."
10. It appears that the CfD proposals fail to require schemes to be fully consistent with these principles and BEIS appears to make little effort to embed these EfW Guide principles within the various CfD eligibility requirements. It is important that this failing is addressed as part of any continued funding or financial support that would apply to thermal treatment schemes.
11. UKWIN has set out a brief explanation of why the current and the proposed amended CfD rules are inconsistent with the principles. These comments should be read within the context of the entire submission and other documents referred to within the submission. In some cases the proposed CfD amendments have the potential to move us closer to consistency with the principles, but they do not go far enough.
12. UKWIN has set out some suggested improvements later in our submission which would help increase consistency with the principles, however even with the proposed changes a fundamental change to the CfD approach would be required to embody the principles within the eligibility and continued funding requirements.
13. Attention is also drawn to Paragraph 21 of EFRACOM's 'Waste management in England: Fourth Report of Session 2014–15', available from: <https://publications.parliament.uk/pa/cm201415/cmselect/cmenvfru/241/241.pdf> which reads: "Co-ordination and consistency between all Government departments involved with waste policy is essential. Defra's policies and guidance should not be undermined by contradictory messages from other Government departments".
14. This EFRACOM recommendation, emphasising the important of not undermining the waste hierarchy, obviously applies to the CfD scheme.

Principle I: Energy from waste must support the management of waste in line with the waste hierarchy

15. To quote once again from the Government's EfW Guide, Paragraph 226 explains how: "...To be consistent with the first principle this long term role needs to be based on energy from waste that at least constitutes recovery not disposal. This should therefore be a key consideration for both new and existing projects. To be classed as recovery, energy from waste facilities must meet the requirements set out in the waste framework directive, for example through attainment of R1 status".
16. The current and the proposed amended CfD rules fail to make funding contingent on thermal treatment proposals operating as R1 recovery and fail to ensure funded schemes are not competing with recycling/composting.
17. This could result in CfD supporting disposal incinerators (D10) and in other facilities that would be driving waste management down the waste hierarchy.

Principle II: Energy from waste should seek to reduce or mitigate the environmental impacts of waste management and then seek to maximise the benefits of energy generation

18. The current and the proposed amended CfD rules fail to ensure that proposals would not give rise to unacceptable environmental impacts that are demonstrably worse than conventional waste incineration.
19. The current and the proposed amended CfD rules also fail to ensure that proposed facilities maximise the benefits of energy generation, i.e. they fail to ensure that to be eligible for CfD support thermal treatment facilities must operate at the highest levels of efficiency.

Principle III: Government support for energy from waste should provide value for money and make a cost effective contribution to UK environmental objectives in the context of overall waste management and energy goals

20. The current and the proposed amended CfD rules fail to ensure that thermal treatment facilities eligible for CfD support are consistent with Government objectives for decarbonising the energy supply and for managing waste/resources in a sustainable manner.

Principle IV: Government will remain technology neutral except where there is a clear market failure preventing a technology competing on a level footing

21. No compelling case has been made to support the notion that gasification and pyrolysis are deserving of financial support, especially when some proposals (e.g. 'close-coupled gasification') appear to be functionally equivalent to conventional mixed waste incineration.

General comments

22. In December 2016 UKWIN provided a response to BEIS' call for evidence on fuelled and geothermal technologies in the CfD scheme, available at: http://ukwin.org.uk/files/pdf/December_2016_UKWIN_CfD_Submission.pdf
23. This previous submission set out a strong case for excluding incineration, gasification and pyrolysis from all forms of Government subsidy and financial support, including CfD. The arguments we made in 2016 remain valid, and indeed can be said to have only strengthened as time has passed.
24. Further evidence to support the discontinuation of subsidies and other support mechanisms for all forms of thermal treatment including ACT is set out in Annex A (below).
25. In December 2017 the Government published 'From waste to resource productivity'. The introduction to this report states that: "We need to change from a mindset of managing waste to one of increasing resource productivity".
26. Thermal treatment, including by so-called Advanced Conversion Technology ('ACT') or by other means, is at odds with efforts to promote resource conservation, resource productivity, the circular economy, and carbon reduction.
27. To be sustainable, the carbon reduction imperative has to be fully achievable for, and clearly demonstrated by, any scheme that would benefit from CfD. In relation to CfD schemes involving thermal treatment this does not appear to be the case.
28. Based on our analysis of many waste incineration and so-called 'ACT' schemes, we conclude, and can demonstrate, that electricity generated by waste gasification (close coupled or not) and steam turbines cannot achieve carbon reduction as compared to CCGT generation and, in carbon terms, performs worse than landfill.
29. Furthermore, UKWIN notes that while landfilling is taxed to reflect (internalise) the external environmental costs of the greenhouse gas (GHG) emissions it causes, waste incineration / 'ACT' schemes are not.
30. The failure to internalise such externalities in relation to the thermal treatment of waste is recognised by Defra as a market failure, for example in their Economics of Waste and Waste Policy document (released in 2011).
31. It is completely unacceptable for a technology to be subsidised for its disputed potential benefits whilst it is not being penalised (e.g. charged through an incineration tax or similar) for its acknowledged environmental harms.
32. UKWIN feels compelled to point out, and to reiterate, that whilst for some assessment purposes the Government assumes that bioenergy has zero GHG emissions, the thermal treatment of waste through incineration or ACT results in significant quantities of fossil CO₂ being released into the atmosphere.
33. Additionally, with ACT and conventional incineration, a significant proportion of biogenic CO₂ is emitted, and the release of these GHGs could have been avoided if the feedstock had been biostabilised prior to landfill, composted, or recycled.

34. Government subsidies for various forms of thermal treatment, including ACT, are harming the top tiers of the waste hierarchy (i.e. reduction, reuse, recycling and composting including anaerobic digestion) and this unintended consequence should be taken into account when considering whether or not to continue subsidising various forms of incineration. For details of how incineration is harming recycling, see: http://ukwin.org.uk/btb/BtB_Incineration_Harms_Recycling.pdf
35. UKWIN believes that the widespread scepticism about the efficiency of ACT is merited. It would be absurd to grant future CfD support to forms of thermal treatment that are less efficient than conventional waste incineration.
36. In addition to incineration, including gasification and pyrolysis, being less efficient than CCGT and having higher carbon intensity than CCGT, these thermal treatment technologies are also less 'dispatchable' than CCGT.
37. We do not believe that conventional energy from residual waste plants, nor those dignified as ACT, can offer rapid response electricity to grid standby capability in the ways that CCGT can, nor do these technologies offer, given the requirement for carbon reduction, an acceptable 'base load' capability, nor can they fulfil the innovation credentials that we believe BEIS should be insisting upon.
38. Nor do we believe that incineration can compete with natural gas for heat supplies unless supported by high gate fees, and even if it can compete, incineration itself still requires natural gas back up for both stand-by purposes and for start ups after both planned (maintenance) and unplanned shutdown periods.
39. Moreover, the availability of residual waste at the volumes to which we have become accustomed depends on current unsustainable levels of plastic and other combustible packaging waste, and BEIS should be looking to support innovations that help remove such resources from the residual waste stream (e.g. via waste reduction, sorting, recycling, reprocessing, etc.) rather than looking to support technologies that rely on destroying these potentially valuable resources.
40. BEIS must not assume that we need to incentivise innovation in energy from waste based on the false premise that we will inevitably have waste in large volumes requiring disposal. We do not accept that premise and, increasingly, the Government, MPs and others are not accepting it either, e.g. Axion Polymers argue that storage of waste plastic for recycling in the future, if necessary in landfill, is a better option than incineration (including ACT). Axion's suggested approach would be entirely consistent with the recent comments made to the Environment, Food and Rural Affairs Committee (EFRACOM) by Professor Ian Boyd, Defra's Chief Scientific Adviser. See: <http://ukwin.org.uk/2018/02/01/chief-defra-scientist-says-incineration-extinguishes-innovation/>
41. Whilst the Government might refer to gasification and pyrolysis as 'Advanced' Conversion Technology, it should not be taken as a given that the technology provides any actual 'advances' on anything. Gasification and pyrolysis may be more complicated than conventional incineration but they have not been shown to be an improvement in terms of thermal efficiency, reliability, pollution or carbon intensity.

42. Indeed, in many respects gasification and pyrolysis should be considered a significant step backwards compared to conventional incineration, which is especially disappointing considering the legion of problems quite reasonably associated with traditional incineration options.
43. The Government should not be promoting as innovative that which is at best merely 'novel', nor should they be rewarding companies for rebranding facilities that are functionally equivalent to the old in the guise of the new. Furthermore, Government should not be promoting new technologies that are environmentally unsustainable or systemically undesirable.
44. We cannot understand why the Government, in the CfD consultation document, appears to be proposing GHG limits for biomass-fuelled technologies but not also for mixed waste-fuelled technologies.
45. Footnote 26 of the CfD Consultation Document states: "Consistent with the UK Greenhouse Gas Inventory methodology, nuclear and renewables (including bioenergy) are assumed to have zero carbon dioxide emissions".
46. Ignoring biogenic carbon when assessing the impact of thermal treatment is not consistent with the GHG Inventory methodology for the reasons given in 'The Potential Contribution of Waste Management to a Low Carbon Economy' (Eunomia 2015).
47. However, even with this 'zero rating', if the Government is to consider awarding CfDs for the benefits from the biogenic portion of mixed wastes, the carbon emissions from the fossil proportion must not be ignored.
48. The claimed CO₂e reduction benefits from the biogenic proportion are almost certain to be more than cancelled out by the negative effects of the fossil proportion.
49. For a proposed technology to be eligible for CfD BEIS must ensure that it is at least capable of achieving a clear carbon reduction as compared to the long-run generation-based marginal emissions factor set out in BEIS guidance (see below).

Comments on the consultation document's proposed criteria for ACTs in the CfD scheme

50. As per UKWIN's comments set out above, we would have expected to see carbon criteria proposed for ACT.
51. This omission in the Government's draft proposals is both disappointing and counter-productive when it comes to meeting the Government's carbon reduction objectives and associated legal obligations.
52. We consider that Approaches 1, 2 and 3, as set out at Paragraph 89 of the consultation document, provide for comparison of carbon performance, which appears to apply to biomass and which includes no equivalent comparator for mixed waste-fed ACT installations. This omission of ACT is quite unacceptable.

53. If part of the function of the CfD scheme is to support an improvement on the status quo, e.g. in relation to climate change impacts, then it is entirely justified to expect proposals benefiting from CfD support are markedly superior to conventional alternatives. It would be counter-productive for the CfD scheme to be used to support proposals that are no better, or that are even worse, than conventional, status quo, alternatives. As such, it is essential that any thermal treatment schemes benefitting from CfD support be required to demonstrate consistency with ambitious GHG criteria.
54. In addition to any of the criteria that the Government intend to apply (based on actual or projected average grid emissions), all CfD proposals should be required to demonstrate that they would produce electricity that would have a significantly lower carbon intensity than the long-run marginal emissions factor for their anticipated year of commissioning.
55. That is to say, a requirement should be put in place that follows Government guidance which advocates the use of BEIS' long-run generation-based marginal emissions factor for calculating the generation capacity that would be displaced by new capacity.
56. Or, to be more technical, a CfD proposal would need to demonstrate superiority when compared to a counterfactual with a carbon intensity at least as low as that set out in Table 1: Electricity emissions factors to 2100, kgCO₂e/kWh, Column F (i.e. the 'generation-based long-run marginal' column), of the BEIS 'Data tables 1 to 19: supporting the toolkit and the guidance'.
57. By way of illustration, based on the December 2017 version of the BEIS data tables, the anticipated carbon intensity of the counterfactual for 2025 is 0.205 kgCO₂e/kWh, and the 15-year Column F average for 2025 - 2039 is 0.112 kgCO₂e/kWh.
58. In relation to Criterion 1 (Efficiency of the gasification or liquefaction process), we ask BEIS for confirmation that by 'conversion efficiency' the Government means 'cold gas efficiency'.
59. In relation to Paragraph 36 of the consultation document, the Government appears to have got their arithmetic wrong. For an overall plant efficiency of 35%, given a conversion efficiency of 60%, it would be necessary for the efficiency of the process converting the syngas / synliquid to power to be almost 60%.

Response to consultation question 8

60. UKWIN does not accept 60% is an acceptable minimum level. It implies the loss of 40% of the energy in the feedstock. If there is to be any CfD support for ACT, the minimum acceptable level of conversion efficiency should be at least 85%.

Response to consultation question 9

61. Continuous monitoring of C12 and C14 is desirable. However, we note that there can be significant differences between the proportion of feedstock that is biogenic and the proportion of energy that is generated through burning biogenic material due to differences in calorific value (CV) between biogenic and non-biogenic feedstocks (e.g. when mixing low-CV food waste with high-CV plastics).

Response to consultation question 10

62. We assume that this question should in fact read: "...the efficient generation of electricity **from** ACT..."
63. Government policy is clear, e.g. as described in Paragraphs 22 and 211 of the 2011 Waste Review, and at Paragraph 59 of the EfW Guide: "Government's aim is to get the most energy out of residual waste, rather than to get the most waste into energy recovery".
64. It is therefore completely unacceptable for any Government support to be directed towards any facility that would be worse than, or little better than, conventional waste incineration in relation to efficiency and to carbon intensity.
65. If there are to be subsidies for thermal treatment then we believe that options using syngas to fuel an internal combustion engine should be required to achieve at least 50% efficiency. We note that 50% efficiency, at an 85% conversion to syngas / synliquid efficiency, provides for an overall efficiency of just 42.5%.

Response to consultation question 11

66. The maximum level of incombustibles in syngas or synliquid should reflect the requirements of end users without compromising environmental protection.
67. There is no point subsidising the development of a technology if there is no viable end market for that technology's outputs.

Response to consultation question 12

68. The maximum level for incombustible material, proposed to be 20%, should reflect the end users' requirements without compromising environmental protection.
69. Attention should be paid to the composition as well as to the proportion of incombustible material, as it is possible that even relatively small proportions of impurities in the syngas could make a large difference.
70. The nature of impurities introduced as part of the syngas process may differ significantly from those in more conventional gas sources and this needs to be carefully considered.

Response to consultation question 13

71. We consider it unlikely that end users will accept any water at all but, again, the limit should reflect the requirements of end users without compromising the interests of environmental protection.
72. Due to the heterogenous nature of the feedstock a rigorous testing regime may be required to provide any level of certainty regarding the quality of the feedstock and the absence of unwanted impurities.

Response to consultation question 15

73. As stated above we do not believe there should be any CfD support for any form of thermal treatment, but if there are to be subsidies then we believe that ACT plants should be expected to meet the requirements of both Options A and B.

74. Excluding 'close-coupled' gasification and others forms of ACT that are difficult to distinguish from conventional incineration would better align CfD support with the development of ACT as a distinct technology that may produce some form of transport fuel.
75. UKWIN is alarmed by the suggestion that Generators will be able to self-declare that their facility meets the requirements at eligibility stage because there are financial incentives for them to err on the side of assuming eligibility, e.g. because they may be able to secure other investment funding on the basis of being of purporting to be eligible for CfD support.
76. It might be helpful if those promoting CfD schemes were required to agree to an undertaking that wherever they cite potential CfD funding (e.g. to prospective investors or local authorities) they also state that such CfD funding is contingent on technological eligibility that had yet to be demonstrated to the relevant regulator. This would help ensure that investors and other decision-makers would be more fully aware of the need to make their own determination of CfD eligibility.
77. Such an arrangement would help promote technologies coming forward that are more likely to be eligible, whilst discouraging those who might be tempted to draw on the credibility of the CfD scheme to secure investment and other support, e.g. planning permission, in circumstances where the would-be Generator is not confident that their proposal would actually meet CfD eligibility criteria.

Response to consultation question 16

78. Electricity generation by internal combustion engine together with waste heat conversion via the Organic Rankine Cycle may offer a possible option, although a high level of syngas clean up / quality would be essential.
79. Note however that the efficiency of an internal combustion engine running on syngas could mean that, without a very high level of cold gas efficiency, the overall process, even with significant improvements, would fail to achieve any degree of carbon reduction, and therefore should not be rewarded with Government support.

Response to consultation question 17

80. UKWIN does not consider that a close coupled combustion configuration can be considered 'advanced'.
81. We understand that close coupled gasification configurations are incapable of achieving carbon reduction objectives and therefore close coupled gasification should not qualify for CfD support.

Response to consultation question 18

82. Testing should be carried out at least weekly.
83. UKWIN favours a continuous monitoring process option.

Response to consultation question 19

84. UKWIN supports the proposal to terminate any CfD contracts for ACT where there is a significant period of non-compliance.

85. Similarly, in order to encourage CfD-supported ACT facilities to operate to a reasonable standard, UKWIN would support the termination of ACT contracts where there are repeated or serious environmental permit breaches; or where a facility fails to achieve or maintain R1 status (and thus is operating as a disposal facility); or where a facility is causing a statutory nuisance.
86. There is a real danger that those seeking to operate an ACT facility will use the fact that their scheme has secured CfD support to justify a proposal that would otherwise be refused planning permission or denied investment due to poor environmental performance.
87. It is therefore necessary to ensure that robust measures are in place to promote higher levels of environmental performance for CfD-supported schemes.

Response to consultation question 20

88. UKWIN notes the CfD consultation document states: "The government considers that renewable CHP schemes of all sizes are capable of achieving a 70% Net Calorific Value (NCV) of overall efficiency, provided an appropriate heat off-taker is in place".
89. It is essential that heat off-take users are in fact in place, and that contractual arrangements are completed, before CfD support is signed off.
90. Additionally, account should be made of the seasonal variations in relation to heat load requirements.
91. There is no point subsidising the generation of heat that is either surplus to requirements or that is simply not used.

Response to consultation question 23

92. It should be noted that raising minimum heating efficiency will impact on electrical efficiency. In the final analysis the question to be answered is: what combination will offer the best carbon reduction result in the long-term?
93. The Government needs to consider whether to prioritise the delivery of electricity at the expense of heat, but the requirement for 'ACTs' to deliver syngas / synliquid rather than steam (Option 3B: require the syngas or synliquid be used in an internal combustion engine, turbine or a fuel cell) could be used to ensure this.

Response to consultation question 26

94. In relation to ensuring that this new criterion delivers a significant carbon saving, UKWIN does not understand why this section applies to biomass installations only.
95. The Government should apply the consideration set out at Paragraph 87 to energy from mixed waste in addition to energy from biomass.
96. We appreciate that the biomass criteria will not always be appropriate to mixed waste installations but consider that, for the purposes of assessing the carbon reduction performance of electricity generation based on a mixed waste feedstock, criteria must be set and applied.

Response to consultation question 30

97. UKWIN agrees with the Government's approach as regards the definitions.

98. As regards the variable nature of parasitic loads and electrical losses, the nature and sizes of individual loads should be confirmed before a CfD is signed off.

99. We would not disagree that the parasitic loads and electrical losses are as defined and that they should be deducted when determining the Installed Capacity.

100. As regards unintended consequences, the actual net output capacity will be marginally greater than the nominal capacity since the parasitic load will not always be at its maximum.

101. Start-up and support fuels must be fully accounted for in any carbon analysis.

Response to consultation question 31

102. UKWIN is concerned that the proposed amendment could give rise to circumstances where facilities that would not be granted CfD support could be supported by CfD in situations where one scheme is amended to be replaced with an inferior scheme.

103. As such it is important that any proposed amendment to an eligible scheme be required to demonstrate a net positive environmental impact when compared with the scheme being amended, and to show that the amended scheme meets all of the criteria that would be applied for initial CfD eligibility.

Annex A

Further evidence to support the discontinuation of subsidies for all forms of expensive residual waste treatment, including conventional incineration and ATT/ACT

- a. Government support, whether it be financial or otherwise, should focus closely on solutions that reduce the demand for expensive and carbon-intensive infrastructure without assuming the inevitability of maintaining current or increased volumes of residual, combustible, non-recyclable, waste. This means that neither ACT nor conventional incineration should be eligible for Government support, including CfD.
- b. Waste incinerators are very expensive to build, meaning they come with significant opportunity costs.¹ When one examines the impact of a more circular economy alongside the residual waste treatment infrastructure that is currently operational or under construction it becomes clear that the conclusion to be drawn is that there will be no need for any further expensive new residual waste infrastructure such as incineration, sometimes called 'energy from waste', and this includes new ACT plant and new CHP incinerators.²
- c. Additional incineration capacity is not needed, does not merit being supported or underwritten by the public purse, and should be actively avoided. There is a genuine risk that exacerbating incineration overcapacity could further undermine efforts to deliver much-needed infrastructure relating to the higher tiers of the waste hierarchy, i.e. incineration acts as a barrier to a more circular economy and to CO₂ emission reductions associated with the circular economy.³
- d. There is therefore an imperative for BEIS to support measures to prevent the construction of new waste incineration capacity and to limit the use of existing incinerators to treating only 'genuinely residual' waste, e.g. through pre-sorting requirements, an incineration tax, and measures to improve source separation for households and businesses.⁴ Restricting incinerator feedstock to only genuinely residual material would free-up treatment capacity at existing incinerators, making it clear that even the most innovative new residual waste treatment facilities are surplus to requirements.
- e. BEIS has confirmed that the UK's CO₂e emissions associated with fossil carbon from EfW in 2015 amounted to 3.3 million tonnes⁵, as reported under the 'Energy sector'

¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221036/pb13889-incineration-municipal-waste.pdf stated in 2013 that incinerators cost £145m-£200m to build, but ENDS reported in 2017 that costs had increased and are likely to increase further -

<https://www.endswasteandbioenergy.com/article/1425234/brexit-pushing-efw-plant-build-costs>

² See http://ukwin.org.uk/btb/BtB_Incineration_Overcapacity.pdf and <http://www.eunomia.co.uk/reports-tools/residual-waste-infrastructure-review-12th-issue/> and <http://tolvik.com/wp-content/uploads/UK-EfW-Statistics-2016-report-Tolvik-June-2017.pdf>

³ See http://ukwin.org.uk/btb/BtB_Incineration_Overcapacity.pdf and http://ukwin.org.uk/btb/BtB_How_to_Increase_Recycling.pdf and <https://www.gov.uk/government/publications/from-waste-to-resource-productivity-food-waste> and http://ukwin.org.uk/files/pdf/July_2017_UKWIN_London_Assembly_Waste_Management_Submission.pdf

⁴ See <http://ukwin.org.uk/2016/11/17/ukwin-welcomes-eac-treasury-report-and-calls-for-residual-waste-tax/> and <http://ukwin.org.uk/2014/09/12/circular-economy-report-calls-for-incineration-tax-consideration/>

⁵ <http://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2017-11-22/115103/>

category, but even the 3.3 million tonne CO₂e figure does not include the significant quantity of CO₂e emitted by EfW plants attributed to the burning of biogenic material (such as food waste, wood, paper and cardboard).

- f. Based on an assumption, as used by Defra, that half of all direct emissions from incinerators derive from biogenic sources, it would be reasonable to estimate the direct emissions from incineration to have been around 6.6 million tonnes of CO₂e in 2015.
- g. As the quantity of waste incinerated has increased since 2015 it is therefore reasonable to assume that the current figure for CO₂e emitted directly through incineration is well above 8 million tonnes.
- h. As noted in the evidence-based recommendations of Eunomia's 2015 report entitled 'The Potential Contribution of Waste Management to a Low Carbon Economy': "All lifecycle studies engaged in comparative assessments of waste treatments should incorporate CO₂ emissions from non-fossil sources in their comparative assessment" and: "Recognising the uncertainty associated with the way in which emissions from the AFOLU (agriculture, forestry and other land use) Sector are accounted for, inventories should include emissions of biogenic CO₂ from incineration (and biomass power plants) until such time as the accounting methods have across countries been assessed in terms of the adequacy of the treatment of this matter".⁶
- i. Eunomia's report also explains 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..."
- j. The 'discounting' of biogenic carbon emissions is not only inconsistent with IPCC guidelines but ignores the fact that avoided – or captured – biogenic carbon emissions contribute to an overall reduction, or at least a reduced increase, in carbon levels in the atmosphere. The need to account correctly for carbon emissions from waste processes applies equally to landfill.
- k. The issue of properly accounting for biogenic carbon sequestration is also covered in Defra's 'Energy recovery for residual waste: A carbon based modelling approach' report which states: "...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".⁷
- l. Another relevant issue highlighted in the Defra carbon based modelling document is that: "...[for assessments of CO₂ offset from energy generation] 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".

⁶ <https://zerowasteurope.eu/downloads/the-potential-contribution-of-waste-management-to-a-low-carbon-economy/>

⁷ <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=19019>

- m. Defra's February 2014 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".
- n. Taking this into account, electricity generated by waste incinerators (including gasification and pyrolysis) is becoming increasingly worse in climate change terms (relative to the increasingly decarbonised energy supply), and incineration's adverse climate change impact needs to be taken into account in relation to planning future infrastructure.⁸
- o. Energy generated through the incineration (including gasification and pyrolysis) of waste is both high carbon and unsustainable. Electricity produced through incineration has a higher carbon intensity than the conventional use of fossil fuels (including Combined Cycle Gas Turbines), and is significantly higher than the level most people would consider to constitute 'low carbon'. The high carbon intensity of energy produced via EfW is considered in more detail below.
- p. Waste incineration is known to exacerbate climate change by releasing more than one tonne of CO₂ for every tonne of waste burned⁹, meaning that a single incineration facility can be emitting hundreds of thousands of tonnes of CO₂ each and every year of operation. As a typical waste incinerator can last for 30 years or more, incinerators are responsible for a significant adverse GHG legacy.
- q. By the year 2050, energy produced by waste incinerators could be more than ten times the average carbon intensity of the decarbonised electricity grid, making incineration a significant barrier to long-term decarbonisation of the power supply and making incineration an unnecessary obstacle to a low-carbon economy.¹⁰
- r. As the Government's National Policy Statement for Renewable Energy Infrastructure (EN-3) states: "CO₂ emissions may be a significant adverse impact of biomass / waste combustion plant".
- s. Electricity generation efficiency is inevitably low because of steam cycle limitations at the temperatures considered practicable in EfW incineration plants. This means that CO₂e per unit of power delivered is relatively high and will inevitably exceed that of the grid source it is deemed to replace.
- t. The European Environment Agency's (EEA's) diagram of the circular economy clearly shows that incineration is a leakage from the circular economy to be 'minimised'¹¹.
- u. As a report from the EEA put it: "One of the central pillars of a circular economy is feeding materials back into the economy and avoiding waste being sent to landfill or

⁸ <https://www.gov.uk/government/publications/energy-from-waste-a-guide-to-the-debate>

⁹ According to page 5 of the Environment Agency's "Pollution inventory reporting – incineration activities guidance note Environmental Permitting (England and Wales) Regulations 2010 Regulation 60(1)", Version 4 December 2012 available from:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296988/LIT_7757_9e97eb.pdf

"Between 0.7 and 1.7 tonnes of CO₂ is generated per tonne of MSW [Municipal Solid Waste] combusted".

¹⁰ <http://www.zerowasteurope.eu/downloads/the-potential-contribution-of-waste-management-to-a-low-carbon-economy/>

¹¹ <http://www.eea.europa.eu/media/infographics/circular-economy/view>

incinerated, thereby capturing the value of the materials as far as possible and reducing losses".¹²

- v. There is a significant difference between residual waste and 'genuinely residual waste'. South Gloucestershire Council commissioned analysis into their residual waste, which found:
 - w. *"A total of 52 percent of the contents of the average black bin could have been recycled in 2014-15 through the existing kerbside recycling service.*
 - x. *"A further 10.1 percent could have been recycled through the Sort It recycling centres.*
 - y. *"In 2014-15 the council spent over £3m disposing of this recyclable material in the residual waste stream. The majority of this was processed into material used for energy production".¹³*
 - z. The aforementioned recyclability survey is based on what could have been recycled at the time. As we move towards the circular economy the recyclability of products will increase and technologies to sort, recycle and reprocess a wider range of materials will improve.
- aa. It should also be noted that despite the significant CO2 emissions associated with waste incineration, such facilities are not included in the EU Emissions Trading Scheme, and as has been acknowledged by Defra, the cost to society of the release of CO2 from incineration is not reflected in the price of treatment.¹⁴
- bb. The plastic element of the feedstock is comprised almost entirely of packaging material. Incineration relies on such packaging material for feedstock. This, in itself, goes far to demonstrate the extent to which incinerators demand recyclable, high carbon, materials, thereby limiting opportunities for plastics recycling.
- cc. Resource Minister Thérèse Coffey has said: "My hon. Friend the Member for Rugby referred to energy from waste. I caution against some of what he said. In environmental terms, it is generally better to bury plastic than to burn it".¹⁵
- dd. Defra's aforementioned Energy from Waste Guide explains how: "Fossil based residual wastes, e.g. plastics and synthetic rubbers that cannot be recycled, do not decompose in the same way as biogenic material in landfill. For these waste streams conventional energy from waste will almost always deliver a negative carbon balance compared to landfill".
- ee. The Science Advisory Council's Waste Sub-group noted that: "...Although landfilling tends to be regarded as inherently bad and to be avoided, there is evidence that in some instances...landfill may be the least environmentally, economically or technically unsuitable option. Landfill can also be a way of storing materials that have

¹² <http://www.eea.europa.eu/publications/circular-economy-in-europe>

¹³ <http://edocs.southglos.gov.uk/wastestrategyevidence/pages/waste-composition-kerbside/>

¹⁴ <https://www.gov.uk/government/publications/the-economics-of-waste-and-waste-policy>

¹⁵ <https://hansard.parliament.uk/commons/2017-01-23/debates/590623BD-398C-4586-A693-FCC1DB5EA444/Non-RecyclableAndNon-CompostablePackaging>

a potential future value, and other countries already recognise the value of landfill mining".¹⁶

- ff. Such sentiments setting out the environmental case for avoiding the incineration of plastics are consistent with what has recently been stated by Axion Polymers and, significantly, Defra's own Chief Scientific Adviser.
- gg. Defra's Professor Ian Boyd, appeared before the Environment, Food and Rural Affairs Committee (EFRACOM) on the 31st of January 2018. We have produced our own transcript of what he stated based on the recording available from: <http://www.parliamentlive.tv/Event/Index/9c6b4590-5882-4464-a945-29783d4af339>
- hh. Professor Boyd was one of the principal authors of the recently-published 'From Waste to Resource Productivity' report which emphasised the importance of moving away from incineration and landfill and towards more efficient and sustainable uses of resources.
- ii. This report will provide an important part of the evidence base for the Government's forthcoming Resources and Waste Strategy, due to be released in the second half of 2018.
- jj. Prof. Boyd explained how: "If there is one way of extinguishing the value of the materials fast, it's to stick it in an incinerator and burn it. Now it may give you energy at the end of the day, but actually some of those materials, even if they are plastics, with a little bit of ingenuity, can be given more positive value. And one of the things that worries me is that we are taking these materials, we're putting them in incinerators, we're losing them forever, and actually we're creating carbon dioxide out of them as well, which is not a great thing, when in fact we could be long-term storing them until we have the innovative technologies to re-use them and to turn them into something that is more positively valued. And this brings me to a more general point about landfill...landfill is actually a very low marginal-cost method for storing materials – highly resistant materials such as plastics and metals – for a long period of time. If we cannot extract the value from them now, so one caveat I would put around the current direction of travel on landfill, is that we shouldn't lose sight of the fact that in a few decades time, or maybe a bit longer, we might be mining our landfill sites for the resources they contain, and rather than put some of those resources into incinerators and just lose them forever we might want to think differently about the landfill sites."
- kk. Boyd later stated: "I think that incineration, and this is a personal view, I think incineration is not a good direction to go in. I think that if you are investing many tens of millions, hundreds of millions, in urban waste incineration plants – and those plants are going to have a 30 to 40 year lifespan – you have to have the waste streams to keep them supplied. Now that is the market pull on waste, so it encourages the production of waste, it encourages the production of residual waste, it encourages people to think that we can throw what could be potentially valuable materials if we were to think about them innovatively into a furnace and burn them."

¹⁶ <http://webarchive.nationalarchives.gov.uk/20130702173345/http://www.defra.gov.uk/sac/files/sac-waste-subgroup-finalreport-june-20111.pdf>

- II. Fossil CO₂e emitted per unit of energy exported was calculated for the Bilsthorpe Energy Centre planning inquiry, which focussed on a proposed gasification-type incineration facility (also described as 'Advanced Thermal Treatment').

- mm. At the Bilsthorpe planning inquiry an expert witness for the applicant confirmed that if carbon intensity were calculated by dividing the direct fossil GHG emissions from the proposed Bilsthorpe gasification facility by the power exported that, based on the expert's own 'average' scenario and his choice of marginal emissions factor, the electricity that would be exported by the facility would have a fossil carbon intensity of **903g CO₂e/KWh**, implying an even higher total carbon intensity when taking biogenic carbon emissions into account.¹⁷
- nn. Such 'high carbon' facilities should certainly not receive Government financial support such as CfD funding.
- oo. It should be noted that, based on their existing poor track record, gasification and pyrolysis plants can generally be expected to display a significantly lower availability when compared with conventional incinerators, not least because gasification / pyrolysis plants struggle to export any electricity.¹⁸
- pp. The publicly available information about the technology to date suggests that gasification and pyrolysis constitute some of the riskiest technologies in the waste industry. If the goal is to invest in better waste management then UKWIN's view is that there are far better technologies in which to invest.
- qq. Further technical information about why gasification is unsuitable for treating a mixed waste feedstock is set out in UKWIN's submission to the 2016 BEIS' call for evidence on fuelled and geothermal technologies in the Contracts for Difference scheme, see: http://ukwin.org.uk/files/pdf/December_2016_UKWIN_CfD_Submission.pdf
- rr. The information released on gasification to date appears to indicate that residual waste is not a suitable source of quality gas for conversion into hydrogen or methane. The syngas produced via gasification and pyrolysis appears to contain very large quantities of tar.
- ss. Based on the experience of Air Products Tees Valley facility tarring is a significant issue. UKWIN notes, for example, the submission entitled 'Review of heat recovery options for Tees Valley 2, Pre operational condition PO 2' made to the Environment Agency on behalf of Air Products, which includes the following:

"Heat recovery at the cooling quench stage was initially considered, to improve energy efficiency, but was discounted due to concerns over the slagging, tars, and re-combination of organic molecules into complex organics. Previous experience with IGCC plants employing syngas coolers has shown this to be point of poor reliability. Downtime and maintenance increases due to fouling and erosion. Slag deposition on the upstream surfaces and on the cool tube sheet can flake off and plug the heat exchanger flow paths. Solids accumulation at the tube sheet can also cause tube plugging and high differential pressures. As plugging of some tubes occurs, the velocity of the solids-laden gas through the remaining open tubes can become high enough to cause erosion."

¹⁷ <http://www.nottinghamshire.gov.uk/media/110334/document-ip25-ukwin-carbon-intensity-spreadsheet-30-oct-2015.pdf>

¹⁸ <http://ukwin.org.uk/fail>

"In addition, any tars which may have formed in the gasification process can deposit on the cooler surfaces and foul the heat transfer surface and the cooler surfaces can also provide location where dioxins or furans can form." ¹⁹

- tt. High profile gasification and pyrolysis failures in Tees Valley and elsewhere indicate that attempts to devise a continuous flow system based around gasification and/or pyrolysis appear to have foundered because of difficulties in ensuring the exclusion of air alongside other factors.
- uu. Fundamental issues with using mixed waste as a feedstock for gasification and pyrolysis include the relatively uncontrolled source of feedstock meaning that it contains both undesirable elements within the feedstock and an undesirable variation in composition, which means that one can neither reliably predict nor control how the feedstock will behave when gasified or pyrolysed.²⁰
- vv. As noted in Defra's EfW Guide, using ACT to produce transport fuel is "technically difficult, relatively unproven at commercial scale, and some of the generated energy is used to power the process, reducing the overall benefits".
- ww. In our estimation, the environmental impact associated with producing the syngas would far outweigh any gains from using the syngas as a substitute fuel. Using gasification and pyrolysis to convert mixed waste into transport fuels appears to be neither environmentally desirable nor technically feasible.
- xx. The high energy requirements of preparing waste for gasification ('bio-drying' and processing to regularise the size, moisture content, oxygen content, etc of the feedstock), the high energy requirements of syngas cleaning, and the need for significant quantities of fossil-based start-up and support fuels for gasification mean that, even if gasification could be made to work, using gasification to produce to produce electricity, heat or transport fuels would increase overall CO₂ emissions.
- yy. It is important to ensure that the fiscal and regulatory framework is changed to better promote recycling over incineration, and to address issues relating to 'lock-in' and externalities.
- zz. Reducing the 'pull' to incineration supports the reduction in overall residual waste in the medium and long term and provides greater confidence for investment in the top tiers of the waste hierarchy.
- aaa. As such, even if there are to be CfD subsidies for ACT then these should not be put in place prior to existing issues with residual waste treatment competing with recycling being fully addressed.
- bbb. 1. By whatever means mixed waste is converted into energy (be it heat, electricity or fuel) that conversion process remains a leakage from the circular economy because it removes resources from the material and biological cycles.
- ccc. Such leakages are undesirable outcomes that should be minimised not subsidised.

¹⁹ https://www.whatdotheyknow.com/request/correspondence_re_tees_valley_re

²⁰ <http://resource.co/article/advanced-conversion-technologies-heated-debate-11503>

- ddd. True innovation comes from not seeing discarded material as waste at all, but rather seeing it as a vital component of the circular economy. For those materials being sent to either landfill or thermal treatment that could have been recycled or composted, the focus should be on investigating the reasons why this material was not recycled, e.g. lack of appropriate sorting, reprocessing and/or composting infrastructure, and on supporting circular economy innovation as appropriate.
- eee. For those materials that cannot currently be readily recycled, investigation should be undertaken to examine opportunities to redesign products to increase recyclability or undertake efforts to increase product lifespan, etc. Better management of our resources will result not just in better resource productivity but in less waste in general, lowering demand for residual waste treatment capacity and therefore rendering moot the question of what form new capacity should take.
- fff. In conclusion, CfD and other Government support for thermal treatment constitute an unwelcome and wholly unnecessary distraction from true and much-needed innovation that supports the transition to a low-carbon circular economy.