

**From:** [McCoy, Laura](#) on behalf of [McCormick, Andrew \(DFE\)](#)  
**To:** [Cousins, Heather](#); [Stewart, Chris \(DFE\)](#); [McMurray, Stephen](#); [McCann, Brendan](#); [Woods, Michael \(DFE\)](#); [Coyne, Terence](#); [Wightman, Stuart](#); [Marten, Lucy](#); [Dukelow, Victor](#); [Smith, Alan](#)  
**Subject:** FW: Follow up correspondence from PAC  
**Date:** 22 December 2016 10:16:18  
**Attachments:** [DECC March 2011 Impact Assessment.pdf](#)  
[NI PAC 21st December.docx](#)  
[image001.png](#)  
[image002.gif](#)

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Dear All

Please see attached correspondence for your information.

Regards,

Laura

## Laura McCoy

Permanent Secretarys Office  
Department for the Economy  
Netherleigh  
Massey Avenue  
Belfast, BT4 2JP  
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[NI Year of Food & Drink 2016](#)

## Please consider the environment - do you really need to print this e-mail?

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**From:** Mark Cockburn [<mailto:mark.cockburn@cepa.co.uk>]  
**Sent:** 21 December 2016 13:45  
**To:** Farrell, Elaine; [pac.committee@niassembly.gov.uk](mailto:pac.committee@niassembly.gov.uk)  
**Cc:** Caldwell, Alison; McCormick, Andrew (DFE); McEvoy, Colette; Sewell, Julie  
**Subject:** RE: Follow up correspondence from PAC

Please see attached in response to Robin Swan's letter of December 12<sup>th</sup>.

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**From:** Farrell, Elaine [<mailto:Elaine.Farrell@niassembly.gov.uk>]  
**Sent:** 12 December 2016 11:03  
**To:** Mark Cockburn <[mark.cockburn@cepa.co.uk](mailto:mark.cockburn@cepa.co.uk)>  
**Cc:** 'Alison Caldwell ([Alison.Caldwell@finance-ni.gov.uk](mailto:Alison.Caldwell@finance-ni.gov.uk))' <[Alison.Caldwell@finance-ni.gov.uk](mailto:Alison.Caldwell@finance-ni.gov.uk)>; 'Andrew.McCormick@economy-ni.gov.uk' <[Andrew.McCormick@economy-ni.gov.uk](mailto:Andrew.McCormick@economy-ni.gov.uk)>; 'Colette McEvoy ([Colette.McEvoy@economy-ni.gov.uk](mailto:Colette.McEvoy@economy-ni.gov.uk))' <[Colette.McEvoy@economy-ni.gov.uk](mailto:Colette.McEvoy@economy-ni.gov.uk)>; [Julie.Sewell@finance-ni.gov.uk](mailto:Julie.Sewell@finance-ni.gov.uk)

**Subject:** Follow up correspondence from PAC

Dear Mark

Please find attached, follow up correspondence from the Chairperson of PAC for you attention.

Kind Regards

Elaine

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**ELAINE FARRELL**

Assistant Clerk  
Public Accounts Committee  
Room 371, Parliament Buildings  
Extension: 21532

work: 028 90521532  
email: [elaine.farrell@niassembly.gov.uk](mailto:elaine.farrell@niassembly.gov.uk)

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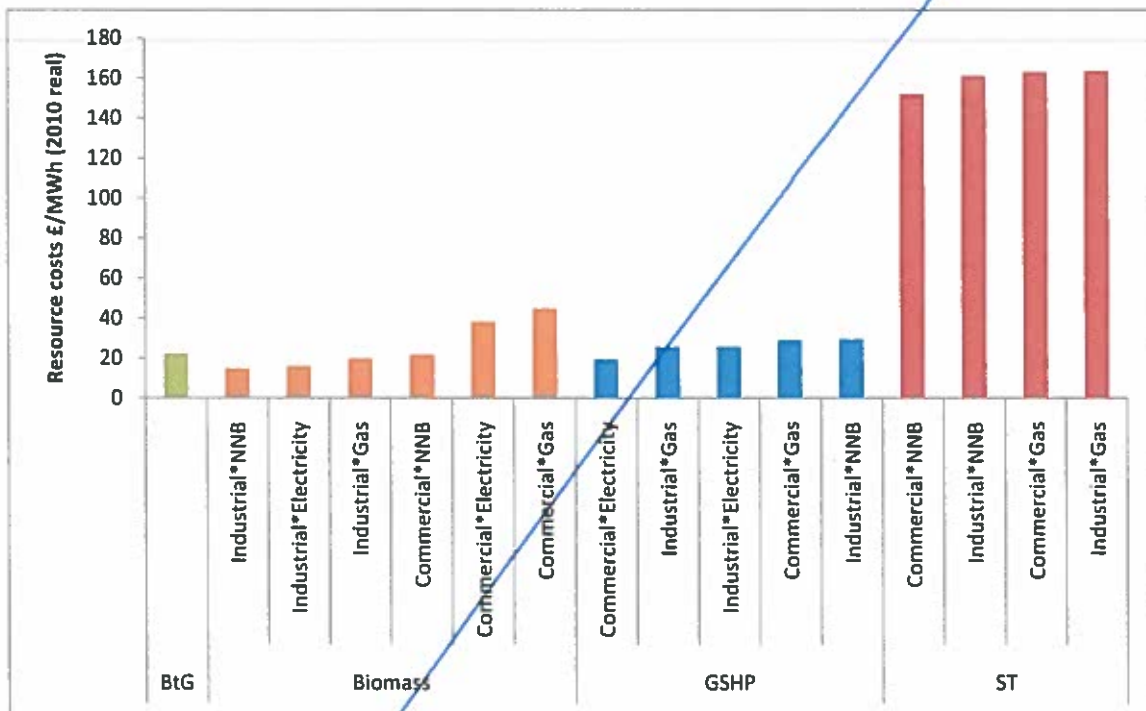
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- **Biomethane to grid:** Analysis undertaken by SKM-Enviros provided a series of cost and uptake potential data for biomethane injection to the grid plants under different feedstock assumptions. Based on this data the RHI tariffs were set at a level that based on the analysis allowed the all of the potential TWh from waste injection plants to come forward while also incentivising some of the larger and more costs effective plants that could be using different feedstocks, such as energy crops. (see Annex 5 for details on the assumptions used).

**Chart 1: Resource costs per MWh in 2020 of key renewable heat technologies<sup>13</sup>**



Note: All the above costs are depended on underlying assumptions on the costs and efficiencies of the technology. BtG stands for Biomethane to Grid

21. Details of the reference installations selected for each tariff category under the final proposals are presented in Annex 3. An example of the calculation is provided in Annex 4.

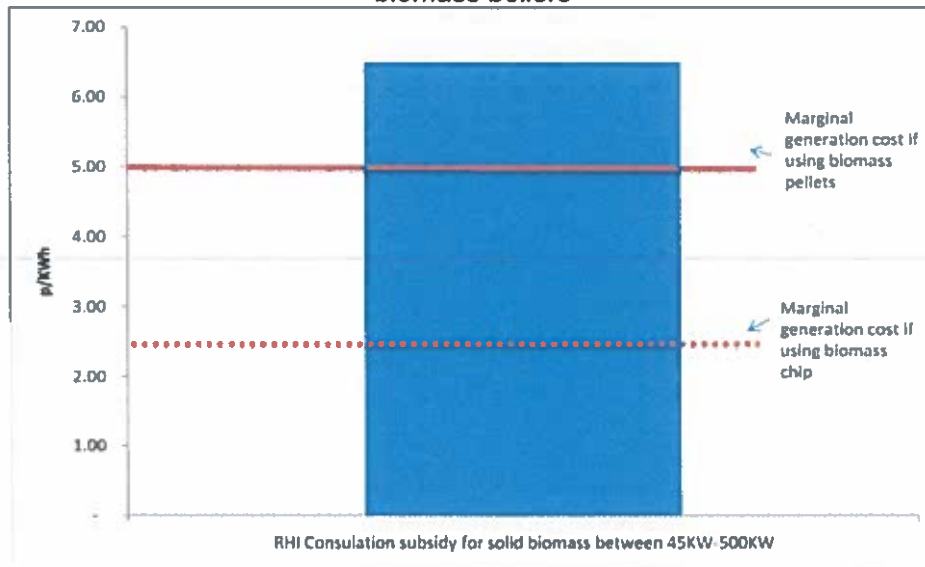
### **Tiered biomass tariff**

22. In addition to the above changes a further modification was undertaken to address the inherent risk of over generation of heat that arose from the structure of the RHI tariffs as set out in the February consultation. As noted in the policy document payments for non-domestic installations will be calculated on the basis of metered output. This reflects the complexity of building occupancy and usage which makes it very difficult to derive a standard deeming methodology across the non-domestic sector. However this means that when installations have the opportunity to receive a tariff that exceeds their marginal costs of generating an extra unit of output the use of metering creates the perverse incentive to over generate heat.
23. An example of this is presented in the graph below which compares the RHI consultation tariff for the 45KW-200KW segment with the marginal costs of generating a unit of heat through biomass pellets and chip<sup>14</sup>.

<sup>13</sup> Chart 1 shows an illustration of the costs effectiveness of renewable heat technologies based on the revised technical data in terms of the expected resource cost to society of each TWh of heat generated in 2020 (i.e. not including any transfers or subsidies that may arise out of a particular policy regime). The cost effectiveness is sub-divided by sector (industrial and commercial) and fossil fuel displaced (gas, electricity and “non-net bound” (NNB) fuels such as heating oil and coal).

<sup>14</sup> This assumes 2010 costs based on analysis undertaken by AEA and set out in detail in the accompanying analytical annex.

**Chart 2: Perverse incentive to over generate:**  
RHI consultation subsidy vs marginal generation cost from woodchip and pellets for 45KW-500KW biomass boilers



24. This perverse incentive is expected to be significant for non-domestic biomass space heating installations that are less than 1MWth and which could face heat generation costs below the RHI consultation support levels (originally set 6.5p/MWh for installations between 45kW-500KW).
25. On the other hand we think that this perverse incentive presents less of a problem in the following areas:
- Large (>1MW) biomass plants (process heating): Although venting heat in that segment could be attractive if generators have access to cheap or free fuel, our analysis suggests that at the proposed tariff levels of 2.6p/KWh these installations would have little incentive to over generate (as shows in the graph above). However we will keep this area under review and propose changes to the tariff structure under future RHI reviews if required.
  - Solar thermal: The amount of generation is limited by the sun rather than the operator of the installation and we expect solar thermal equipment to be able to have a limited generation capability (about 50% of hot water requirements over a year);
  - Biomethane injection: Support for biomethane injection is related to the amount of generation that the plant produces and injects to the grid, not to a specific heat load. Therefore additional generation/ injection that goes directly into the gas grid will always be useful so should be encouraged;
  - Heat pumps: depending on the future electricity price and the efficiency of the heat pump, the RHI non-domestic heat pump tariff payments could be higher than the cost of the electricity needed to generate the heat. As Table 4 below shows this is expected to be more of an issue in the 0-100KW segment (for example if in this segment a heat pump has a coefficient of performance of 300% the marginal costs of generating an extra unit of heat will be 3.5p/KW against an RHI tariff of 4.3p/KWh).

**Table 4: Illustration of perverse incentive to overgenerate for non-domestic GSHPs**

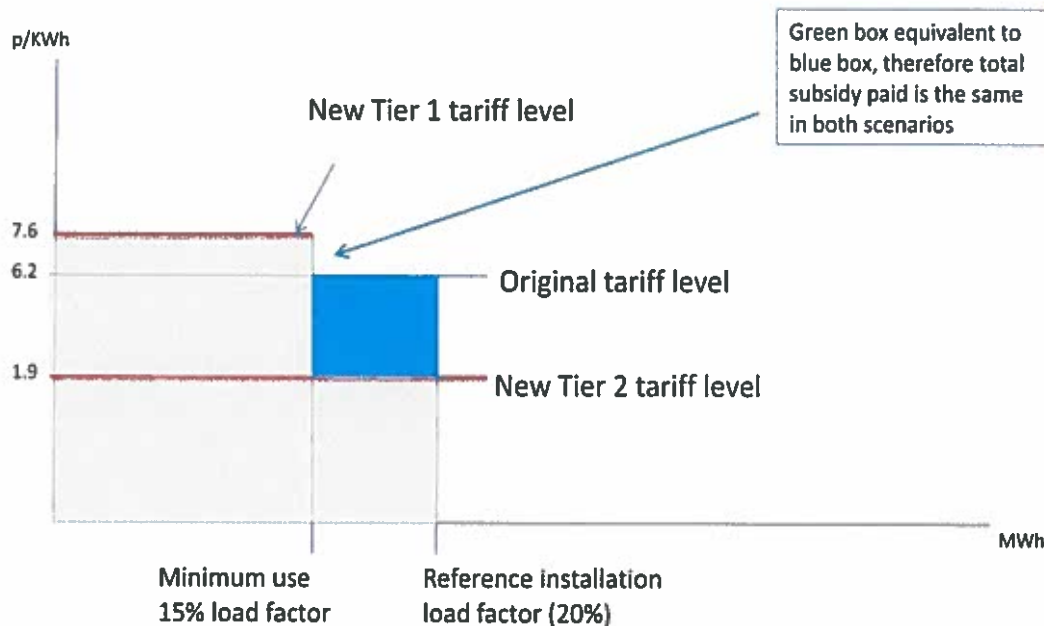
	RHI tariff (p/KWh)	Cost of electrical input under central electricity cost assumption (p/KWh)		
		If 350% COP*	If 300% COP	If 250% COP
0-100KW	4.3	3.0	3.5	4.2
100KW+	3.0	3.0	3.5	4.2

\*COP stands for Coefficient of Performance

- However, even if tariffs are higher than electricity costs, generators are unlikely to have sufficient information on the coefficient of performance (COP) at each point in time to exploit this opportunity. Therefore although the risk of perverse incentive could exist in that category it is not considered as acute as for the medium biomass segments. Although no change in the tariff structure is proposed we will monitor this area and if required propose changes in future reviews.

26. In order to address the problem for biomass heat generators in the below 1MW segment the final proposals of the RHI include a 2 part biomass tariff (or tiered tariff). The tiered tariff is split into a Tier 1 higher tariff available for the first 1,300KWh of heat<sup>15</sup> (aiming to cover mainly the capital costs repayment) and a tier 2 lower tariff applicable upon reaching the maximum of the Tier 1 tariff (aiming to cover the fuel costs of the installation). The Tier 2 tariff (at 1.9p/KWh) has been set in a way that removes the perverse incentive to over generate and vent heat for that segment while based on our evidence on gas and biomass prices also provides generators with sufficient support to cover the net cost of the renewable fuel (in line with the principle of the RHI).
27. Chart 3 below shows an example of how the tiered tariff has been calculated for the reference installation in the below 200KW biomass segment.

**Chart 3: Calculation of tiered tariff for below 200KW biomass segment**



28. In addition to the elimination of the perverse incentive the two tiered tariff also provides the additional advantage of eliminating rents for installations that have higher heat requirements than the reference installation and face lower costs (this is achieved as the installations receive a lower ongoing fuel costs tariff (tier 2) to cover their higher operational time instead of the previously proposed high single tariff which aimed to also cover capital costs)

### **Additional changes**

29. Finally modelling projections were also adjusted to reflect stakeholder feedback on the tariff boundaries and DECC's phased approach on the implementation of the scheme (see policy document for more details). These included in particular:
- **Rebanding of GSHP and biomass boilers:** Reflecting stakeholder feedback the size boundaries between the bands for GSHP, biomass boilers and solar thermal have been

<sup>15</sup> Based on a minimum heat load factor of 15%.

Robin Swann  
Chairperson  
Public Accounts Committee  
Room 371  
Parliament Buildings  
Ballymiscaw  
Belfast  
BT4 3XX

22 December 2016

Dear Robin,

**Public Accounts Committee Evidence Session**

Please find below responses to your additional questions.

**In your evidence you said that your Engineers advised that it would be representative for tariffs to be calculated based on a 50 kw boiler which was being used for 17% of the time. Can you provide any evidence to show where this advice came from?**

*Please see email from Mahmoud Abu-ebid of Ricardo (AEA), the lead engineer, in response to a data request from Dr Andrew McCormick which sets out why they provided the input assumptions on the 50kW boiler and 17% load factor.*

**From:** Abu-ebid, Mahmoud [mailto:Mahmoud.Abu-ebid@ricardo.com]

**Sent:** 04 November 2016 15:33

**To:** Mark Cockburn <mark.cockburn@cepa.co.uk>; Haydock, Heather <Heather.Haydock@ricardo.com>

**Subject:** RE: Non-Domestic Renewable Heat Incentive

Dear Mark,

From Andrew McCormick's letter of 26 October to you, there appear to be two issues on which you are seeking details of the underlying rationale:

1. The assumption of a 17% load factor
2. The use of a 50kW boiler size as being representative for the 20-100 kW tariff band

Unfortunately, Oliver Edberg and Nick Barker are no longer with Ricardo and so we have had to go back over internal communications, spreadsheets and reports to determine how the assumptions were developed.

**17% load factor**

For the 2011 report, the total heat consumption for each sector in NI was calculated based on the 2010 AECOM report 'Assessment of the Potential Development of Renewable Heat in Northern

Ireland: Final Report', Table 7 together with IDBR and public building stock data obtained from the Northern Ireland Statistics and Research Agency. We defined the smallest 98% of service sector buildings as being 'small' and estimated an average heat consumption for small service sector buildings of 29,961 kWh/yr. The load factor depends on the size of boiler assumed, but from our experience of biomass boilers we knew that a load factor of around 20% was typical. This is also in line with the typical number of hours during the year when heating is needed in commercial and administrative types of building. The smallest common standard boiler size required to give a load factor at around 20% for the annual heat consumption of 29,961 kWh/yr is 20kW, giving a load factor of 17%.

### 50 kW boiler size

Following the consultation, feedback on the split of tariff bands at 45kW set out in the 2011 report, we reviewed the assumed average boiler sizing and increased it to 50kW for the proposed 20 to 100 kW band. As explained in the footnote under Table 3.1 in the 2012 report, we concluded that 20kWt was too small for a typical 'small' biomass boiler application in non-domestic properties. At this scale we saw no reason to adjust the load factor, so the 17% was maintained for a building with a higher annual heat consumption in proportion with the increase in assumed boiler size.

I hope this provides a clear picture of the rationale we followed at the time.

Best regards

Mahmoud

**From:** Mark Cockburn [<mailto:mark.cockburn@cepa.co.uk>]

**Sent:** 27 October 2016 14:50

**To:** Abu-ebid, Mahmoud <[Mahmoud.Abu-ebid@ricardo.com](mailto:Mahmoud.Abu-ebid@ricardo.com)>; Haydock, Heather <[Heather.Haydock@ricardo.com](mailto:Heather.Haydock@ricardo.com)>

**Subject:** FW: Non-Domestic Renewable Heat Incentive

Dear Mahmoud and Heather

Please see attached the letter I received yesterday. Amongst the questions they raise a couple are engineering related, for instance on why 50kw was chosen as the reference boiler. I'd be grateful if you could take a look. I'm trying to get back with the information by Nov 4<sup>th</sup>.

Thanks

Mark

**From:** McCoy, Laura [<mailto:Laura.McCoy@economy-ni.gov.uk>] **On Behalf Of** McCormick, Andrew (DFE)

**Sent:** 26 October 2016 11:16

**To:** Mark Cockburn <[mark.cockburn@cepa.co.uk](mailto:mark.cockburn@cepa.co.uk)>

**Cc:** Cousins, Heather <[Heather.Cousins@economy-ni.gov.uk](mailto:Heather.Cousins@economy-ni.gov.uk)>; Dukelow, Victor <[Victor.Dukelow@economy-ni.gov.uk](mailto:Victor.Dukelow@economy-ni.gov.uk)>; McCann, Brendan <[Brendan.McCann@economy-ni.gov.uk](mailto:Brendan.McCann@economy-ni.gov.uk)>; Woods, Michael (DFE) <[Michael.Woods@economy-ni.gov.uk](mailto:Michael.Woods@economy-ni.gov.uk)>; Stewart, Chris (DFE) <[Chris.Stewart@economy-ni.gov.uk](mailto:Chris.Stewart@economy-ni.gov.uk)>; Wightman, Stuart <[Stuart.Wightman@economy-ni.gov.uk](mailto:Stuart.Wightman@economy-ni.gov.uk)>; Marten, Lucy <[Lucy.Marten@economy-ni.gov.uk](mailto:Lucy.Marten@economy-ni.gov.uk)>; Murphy, Shane <[Shane.Murphy@economy-ni.gov.uk](mailto:Shane.Murphy@economy-ni.gov.uk)>; Smith, Alan <[Alan.Smith@economy-ni.gov.uk](mailto:Alan.Smith@economy-ni.gov.uk)>  
**Subject:** Non-Domestic Renewable Heat Incentive

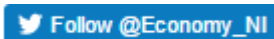
Mark

Please see attached correspondence from Andrew McCormick.

Regards,

**Laura McCoy**

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**When you calculated the suggested tariffs did you do any sensitivity analysis to look at what returns might be if a boiler at the high end of your range (99kw) was used or more hours were actually used. If you had done these calculations might it have led you to identify the need for tiering?**

We are unclear whether this question relates to the 2011 report or to the 2012 Addendum: we therefore address the question in both contexts.

## *2012 Addendum*

We have previously set out that no sensitivity analysis was performed as part of the questions addressed in the 2012 Addendum. Also as previously explained and demonstrated to you in the email correspondence, this was a limited exercise in which we responded to specific questions; it was not a re-run of the work we did in the 2011 report.

Sensitivity analysis would, however, not have been required to demonstrate that tiering should have been applied: *the fact that the tariff was in excess of variable costs would have been sufficient alone.* Establishing the tiers is a mechanical exercise which does not necessarily need a model. For convenience, the relevant section of DECC's March 2011 Non Domestic RHI Impact Assessment is attached to this letter.

## *2011 Report*

This is what we followed in 2011 and explains where tiering should be applied – that is, where the tariff is above variable costs – and how it is calculated.

It is, of course, possible to calculate what a 99kW boiler would have received given the initial banding and tariff assumptions set out in the 2011 report. Under these proposals a 99kW boiler would have fallen into the 45kW+ banding. Thus, if it had been run at a 100% load factor at 1.3p per kWh this would have been calculated as: 99 (boiler capacity) X 8760 (annual available hours) X 1.3p (relevant tariff) which equals £11,274 per annum. By means of comparison this would have been equivalent to:

- 48% of the £23,377 received by a top of the small GB band 199kW boiler operating at the 15% tiering threshold, given an 8.94p per kWh (used up to the degeneration reduction in May 2014); or
- £12,505 which is the maximum that can be earned by a 99kW boiler operating under the two tier structure (with 400,000 kWh cap) introduced into Northern Ireland in November 2015.

**In your evidence to the Committee you said that the marginal cost of fuel for the wood pellet boilers was 5.2pence per kwh. Your own figures in table 3.3 page 13 of your addendum in February 2013 show the cost per kwh of wood pellets for a small/medium commercial operation to be 3.37 pence. Please can you explain the difference in cost between the 3.37 pence per kwh and the 5.2 pence you quoted?**

In the February 2012 Addendum biomass prices were re-checked by AEA to ascertain whether biomass prices in Northern Ireland were higher than initially assumed in the 2011 report. This was in response to claims made by consultation respondents who were seeking a higher tariff rate. The evidence AEA collected suggested that pellets prices in Northern Ireland were not higher than those included in the 2011 report. As set out in the 2012 Addendum, as a result of this the initial central scenario of 4.39p was kept. In other words, no changes were made to the initial biomass cost assumptions.

The original base prices for biomass pellets in the 2011 report came from AEA who based this on their 2011 study of biomass availability in the UK (see page 124 of the 2011 report for an explanation). As this sets out, there is no one price for biomass – it can vary according to whether it is bagged or provided in bulk and according to its quality.

4.39p is an input price which does not take account of the efficiency of the boiler. AEA – as our engineers – advised that the 50kW reference boiler had an efficiency of 85%. Thus, to take efficiency of less than 100% into account, it is necessary to gross up the 4.39p to adjust for the lost efficiency in the process of generating a given volume of heat.<sup>1</sup> This produces a figure of 5.16p (rounded up to 5.2p).<sup>2</sup>

Of course, if other variable costs such as those listed in the table included in your letter to us are added this would increase variable costs further bringing them closer to the 5.9p /kWh tariff. We understand that over time this gap has widened as biomass costs appear to have fallen while the tariff has increased in line with Retail Price Inflation.

*Yours sincerely,*

*Mark Cockburn  
Managing Director  
Cambridge Economic Policy Associates Ltd (CEPA)*

<sup>1</sup> 4.39p/0.85

<sup>2</sup> It is not clear that the values presented in your letter to us showing figures provided by DETI to the NIAO, that the 3.36p/kWh pellet cost has been grossed up to take account of the 92% efficiency factor assumed. If lost efficiency is not accounted for it leads to an underestimation of the full fuel cost given the difference between the respective unit costs of what is put in and what comes out as heat generated.