

# *Network Innovation Competition Full Submission*

## *Supplementary Answer Form*

Tick if this answer is Confidential: ☐

Tick if this answer has been provided verbally: ☐

Project code:	NGGDGN01	Question Number	18																												
Question date	5/9/13	Answer date	9/9/13																												
Submission section question relates to	2.1																														
Topic	Aims and Objectives																														
Question	Please provide a comparison of the costs and CO2 impact of using imported biomass for Drax-electricity-heat pumps rather than gasification-bio-SNG-gas central heating.																														
Notes on question																															
Answer	<p>Bio-SNG offers appreciable carbon dioxide and cost savings compared with other routes, as summarised in the table below</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th></th> <th colspan="3">Actual Carbon Dioxide emissions CO<sub>2e</sub></th> <th colspan="3">£Attributed Cost</th> </tr> <tr> <th></th> <th>General per MWhr (kg CO<sub>2e</sub>)</th> <th>Household pa (kg CO<sub>2e</sub> pa)</th> <th>For 100 TWh pa BioSNG (te CO<sub>2e</sub> pa)</th> <th>General per MWhr £</th> <th>Household pa £pa</th> <th>For 100 TWh pa BioSNG £Bill pa</th> </tr> </thead> <tbody> <tr> <td><b>BioSNG</b></td> <td>-68 to 83</td> <td>-870 to 1,062</td> <td>-6,800,000 to 8,300,000</td> <td>£79</td> <td>£1,016</td> <td>£7.9 Billion</td> </tr> <tr> <td><b>Bio-electricity to heat pump</b></td> <td>100</td> <td>1,280</td> <td>10,000,000</td> <td>£92 to £207 plus network costs</td> <td>£1,177 to £2,649 plus network costs</td> <td>£9.2 to £20.7 Billion plus network costs (£37Billion by 2050)</td> </tr> </tbody> </table> <p>This is explained in more detail:</p> <p><b><u>Greenhouse Gas Comparison</u></b></p> <p><b>Drax-electricity-heat-pump solution:</b> Government recommendations, following recent NNFFC data for biomass sustainability<sup>1</sup> suggests that by 2020, biomass conversions must comply with a standard of</p>				Actual Carbon Dioxide emissions CO <sub>2e</sub>			£Attributed Cost				General per MWhr (kg CO <sub>2e</sub> )	Household pa (kg CO <sub>2e</sub> pa)	For 100 TWh pa BioSNG (te CO <sub>2e</sub> pa)	General per MWhr £	Household pa £pa	For 100 TWh pa BioSNG £Bill pa	<b>BioSNG</b>	-68 to 83	-870 to 1,062	-6,800,000 to 8,300,000	£79	£1,016	£7.9 Billion	<b>Bio-electricity to heat pump</b>	100	1,280	10,000,000	£92 to £207 plus network costs	£1,177 to £2,649 plus network costs	£9.2 to £20.7 Billion plus network costs (£37Billion by 2050)
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240kgCO<sub>2e</sub>/MWhr electricity. Were this to deliver heat by resistive heating, after distribution losses of 5%, this is 250kgCO<sub>2e</sub> /MWhr, ie the same as natural gas, that is no saving. Where heat pumps are used the net carbon footprint is **100kgCO<sub>2e</sub> /MWhr** (based on a COP of 2.5).

**Bio-SNG via Gasification.** The data presented in the application for Bio-SNG shows a net delivered footprint of **-68 (minus) up to 83 kgCO<sub>2e</sub> /MWhr**, depending on the methodology used to calculate the assessment (BEAT2 vs RED), assuming a condensing gas boiler. This assessment was undertaken by NNFCC for the Bio-SNG project and is based on waste derived feedstocks (it should be noted that a facility like Drax would not be technically capable of benefiting from operating on waste derived feedstocks). The Bio-SNG NNFCC report also considered pure biomass feedstock for Bio-SNG production, and suggested a footprint of around 40 kgCO<sub>2e</sub> /MWhr for imported feedstocks by both methodologies (Noting that the assumption set for that work regarding primary biomass footprint may not have been exactly the same as for the more recent work undertaken for DECC)

To compare this with typical household usage (based on 12.8MWhr pa of delivered heat after an 80% boiler), the BioSNG route equates to **a saving of between 218kg to 2,150 kg CO<sub>2e</sub> per annum** compared with bio-electricity to heat pumps.

At a national level, adoption of 100TWh pa of Bio-SNG compared with the bio-electricity to heat pump route would **save between 1.7 and 16.8 million te CO<sub>2e</sub> per annum**.

In summary the carbon footprint for BioSNG appears to be appreciably lower than that for the alternative route.

#### **Cost comparison**

This uses the incentive tariffs as being representative of the costs of delivering heat by both solutions over and above heat by conventional fossil fuels. This doesn't include the network costs of electrification (distribution upgrading and increased generation capacity), which are considered separately.

**Drax-electricity-heat-pump solution:** The costs comprise the incentive required for the primary renewable electricity generation AND the incentive required to install a heat pump. Assuming £45/MWhr for the electricity, this equates to £19/MWhr for the electricity component after 5% distribution losses and when utilising a heat pump with a COP of 2.5. RHI support for heat pumps varies between £73-£188/MWhr depending on whether it is air source or ground source. This equates to **£92-207/MWhr** of delivered heat. In addition a drive towards using electricity for heat would also require significant upgrading of national generation, and distribution infrastructure.

**Bio-SNG via Gasification.** At the current support levels the Bio-SNG solution requires only **£79/MWhr** of delivered heat (accounting for boiler efficiency at 90% and gas line losses of 0.6%). There are NO additional infrastructural costs required since this uses existing infrastructure.

To compare this with typical household usage (based on 12.8MWhr pa of delivered heat after an 80% boiler), the BioSNG route equates to a **saving**

	<p><b>of between £161 and £1,633 per annum, excluding network costs.</b></p> <p>The BioSNG route also removes customer demand-side changes of appliance and heating system.</p> <p>At a national level, adoption of 100TWh pa of Bio-SNG compared with the bio-electricity to heat pump route would save between <b>£1.3 and £12.8 Billion per annum</b> in addition to the network cost savings. The RESOM suggests that by 2050 the cost of this is <b>£37 Billion</b>.</p> <p>In summary the cost per unit of heat delivered is appreciably lower for the BioSNG route compared with the Drax-Electricity-heat-pump route.</p> <p><i><sup>1</sup> NNFCC Report Title: RO Sustainability Standards, Project Number: DC13-08, March 2013, A report for DECC</i></p>
Attachments	
Verbal Clarifications (Consultants )	