Department of Energy & Climate Change

Renewable Combined Heat & Power Schemes – Review of Qualification Criteria

Consultation on proposals to amend the calculation of CHP Quality Index for renewable CHP schemes

21 December 2012

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The consultation can be found on DECC's website:
www.decc.gov.uk/en/content/cms/consultations/rev_cri_chp/rev_cri_chp.aspx

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Introduction

Combined Heat & Power (CHP) is an energy conversion concept where both heat and electrical power are supplied from a single process. This offers energy, and hence CO_2 emissions, savings compared to separate generation of heat and electrical power from the same type of fuel. In the UK CHP schemes are eligible for a number of incentives depending on their fuel type, size and the energy savings they deliver. In order to qualify for these incentives CHP schemes must be certified according to the CHP Quality Assurance (CHPQA) programme.

Electrical output from biomass, bioliquid, biogas and waste fuelled CHP schemes is eligible for Renewable Obligation Certificates (ROCs) under the Renewables Obligation. With the exception of biogas, such schemes accredited before 31st March 2015 can be eligible for a higher level of support (a CHP ROC band) under the Renewables Obligation compared to power-only plant using the same fuels. This additional support is provided in acknowledgement of the additional capital costs of CHP plant and the additional energy and CO_2 savings they deliver. To qualify as eligible for this support, schemes must be certified by CHPQA. The relevant certification procedures, including the calculation of the Qualifying Power Output (in MWh) on which plant are eligible for a CHP ROC band, are specified in CHPQA Guidance Note 44.

This consultation seeks views on proposals to revise the qualification criteria for biomass, bioliquid, biogas and waste CHP schemes in the CHPQA standard and Guidance Note 44 to reflect improvements in the efficiency of such schemes since the criteria were first developed. The proposals will affect operators and developers of renewable schemes. Their views, and the views of others, are invited on the proposed revisions.

Contents

General information

Purpose of this consultation

Set out what Government is trying to achieve with the consultation and in particular whose views it is seeking.

Issued: 21 December 2012

Respond by: 22 February 2013

Enquiries to:

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Consultation reference: URN 12D/489 – Renewable Combined Heat & Power Schemes – Review of Qualification Criteria

Territorial extent:
UK. The CHPQA is an administrative scheme which is operated on a UK wide basis. The Renewables Obligation Order 2009 applies to England & Wales only. The Scottish Government and Northern Ireland Executive are responsible for the Renewables Obligation (Scotland) Order 2009 and the Renewables Obligation Order (Northern Ireland) 2009 respectively.

How to respond:
Your response will be most useful if it is framed in direct response to the questions posed, though further comments are also welcome. Supporting evidence for your responses e.g. performance or design data for CHP schemes would be particularly helpful.

Additional copies:
You may make copies of this document without seeking permission. An electronic version can be found at www.decc.gov.uk/en/content/cms/consultations/rev_cri_chp/rev_cri_chp.aspx .

Confidentiality and data protection:
Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

If you want information that you provide to be treated as confidential please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a

request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

We will summarise all responses and place this summary on our website at www.decc.gov.uk/en/content/cms/consultations/. This summary will include a list of names or organisations that responded but not people's personal names, addresses or other contact details.

Quality assurance:
This consultation has been carried out in accordance with the Government's Consultation Principles, which can be found here:
http://www.cabinetoffice.gov.uk/resource-library/consultation-principles-guidance

If you have any complaints about the consultation process (as opposed to comments about the issues which are the subject of the consultation) please address them to:

DECC Consultation Co-ordinator
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Executive Summary

This consultation seeks views on proposed changes to the certification of renewable Combined Heat & Power (CHP) schemes. These proposals are intended to ensure that schemes benefitting from Government support are supplying significant quantities of heat and are delivering the intended energy savings. The proposed changes will affect the eligibility of renewable CHP schemes to be treated as qualifying CHP generating stations for the purposes of the Renewables Obligation and, in particular, the extent to which biomass, bioliquid and waste fuelled schemes are eligible for the higher levels of support available for Good Quality CHP in the Renewables Obligation banding arrangements.

The consultation proposes amending the Quality Index formulae for renewable CHP, used for the purposes of obtaining a CHPQA ROC Eligible certificate, to the following.

	Proposed Quality Index Formulae						
Biogas & Syngas							
≤1MWe	QI =	220	x η_{power}	+	120	x η_{heat}
>1 to ≤25MWe	QI =	195	x η_{power}	+	120	x η_{heat}
>25MWe	QI =	193	x η_{power}	+	120	x η_{heat}
Liquid Biofuels							
≤1MWe	QI =	245	x η_{power}	+	120	x η_{heat}
>1 to ≤25MWe	QI =	191	x η_{power}	+	120	x η_{heat}
>25MWe	QI =	176	x η_{power}	+	120	x η_{heat}
Liquid Biodegradable Waste							
≤1MWe	QI =	245	x η_{power}	+	120	x η_{heat}
>1 to ≤25MWe	QI =	195	x η_{power}	+	120	x η_{heat}
>25MWe	QI =	176	x η_{power}	+	120	x η_{heat}
Solid Waste							
≤1MWe	QI =	362	x η_{power}	+	130	x η_{heat}
>1 to ≤10MWe	QI =	362	x η_{power}	+	130	x η_{heat}
>10 to ≤25MWe	QI =	362	x η_{power}	+	130	x η_{heat}
>25MWe	QI =	338	x η_{power}	+	130	x η_{heat}
Agricultural Biomass							
≤1MWe	QI =	348	x η_{power}	+	130	x η_{heat}
>1 to ≤10MWe	QI =	348	x η_{power}	+	130	x η_{heat}
>10 to ≤25MWe	QI =	348	x η_{power}	+	130	x η_{heat}
>25MWe	QI =	338	x η_{power}	+	130	x η_{heat}
Waste Wood							
≤1MWe	QI =	352	x η_{power}	+	120	x η_{heat}
>1 to ≤10MWe	QI =	316	x η_{power}	+	120	x η_{heat}
>10 to ≤25MWe	QI =	316	x η_{power}	+	120	x η_{heat}
>25MWe	QI =	295	x η_{power}	+	120	x η_{heat}

Wood Fuels								
≤1MWe	QI =	319	x	η_{power}	+	120	x	η_{heat}
>1 to ≤10MWe	QI =	293	x	η_{power}	+	120	x	η_{heat}
>10 to ≤25MWe	QI =	285	x	η_{power}	+	120	x	η_{heat}
>25MWe	QI =	279	x	η_{power}	+	120	x	η_{heat}

The CHPQA Standard specifies different Quality Index formulae for the purposes of determining eligibility for benefits other than ROCs. These formulae are more stringent than those currently used for determining eligibility for ROCs. The above proposed formulae will also be used to update the CHPQA Standard in the cases where the proposed formulae are more stringent than those currently in the Standard (this is the case for ≤25MW schemes only).

The consultation also proposes making the following changes;

- A safeguard provision to ensure that all renewable CHP schemes meeting specified minimum heat efficiency, overall efficiency and primary energy saving criteria are guaranteed a Quality Index of 100.

- Grandfathering of the new Quality Index formulae for the lifetime of support for schemes under the Renewables Obligation and Renewable Heat Incentive. The Quality Index of each scheme will continue to be assessed annually (using the new grandfathered formulae) based on their performance in year.

- Revisions to the fuel type categorisation of renewable CHP schemes.

- Lowering the required Quality Index for schemes which supply heat primarily through a District Heat Network to a Quality Index of 95 for the first 5 years of operation, to support the evolution of such networks.

It is proposed that the revised arrangements will be applied to all new and existing renewable CHP schemes from 1st January 2014.

Catalogue of consultation questions

Consultation Question 1
Do you agree with the proposed coefficients in the revised Quality Index formulae for renewable CHP? Please provide evidence to support your response.

Consultation Question 2
Do you agree with the proposed safeguard provision? Please provide a justification for your answer.

Consultation Question 3
Do you agree with the proposed approach on grandfathering? Please provide a justification for your response and data in support of this or any alternative proposed approach.

Consultation Question 4
Do you agree with the proposed fuel categorisation? Please provide data on the efficiency of schemes fuelled with particular fuel types in support of any alternative categorisation.

Consultation Question 5
Do you agree with the proposed approach on District Heat Networks? Please provide a justification for your response and data in support of this or any alternative proposed approach.

Main document

1. Renewable Combined Heat & Power in the UK

1.1 As at October 2012 there are 45 CHP schemes certified under the CHP Quality Assurance (CHPQA) programme and operating in the UK which burn non-gaseous renewable fuels (solid biomass, bioliquids and waste)[1]. The majority of these are bioliquid fuelled schemes of less than 1MW electrical capacity, but the bulk of capacity consists of a smaller number of solid biomass and waste fuelled schemes with larger electrical capacity. In addition to the existing schemes there are 23 proposed schemes which have already applied for CHPQA certification and a number of other schemes in development, although it is uncertain how many of these will be constructed. These schemes cover a range of technologies, capacities, fuels and serve a number of different types of heat load. Many schemes utilise both renewable fuels and conventional fossil fuels, either via co-firing or via flexibility to switch between fuels depending on availability.

1.2 In broad terms there are three fuel types solid biomass (including organic waste), bioliquids (including liquid waste) and biogas. For the purposes of CHPQA certification fuel types are currently broken down further as follows. This categorisation is intended to group fuels according to the efficiency of the technology used to combust and extract energy from them. The current categories and types and sources of fuel for renewable CHP are as follows:

- Solid waste –The organic fraction of municipal solid waste, industrial waste, clinical waste, refuse derived and solid recovered fuels. Recycled wood from construction waste. Also organic waste material such as manure, chicken litter, food waste.
- Agricultural Biomass – perennial energy crops such as miscanthus grass and short rotation coppice willow. By-products and residues from forest management, such as branches and small roundwood and undried wood chips.
- Wood Fuels– commercial grade wood fuels such as pellets, dry wood chips. Untreated wood waste wood from the timber, furniture and other wood product industries.
- Liquid biofuels – virgin vegetable oils and liquid fuels manufactured from organic matter such as Fatty Acid Methyl Esters, Hydrogenated Vegetable Oil, BioDiMethyl Ether, Biomass To Liquid, Biomethanol, Bioethanol, Biobutanol, BioEthyl Tertiary Butyl Ether, BioMethyl Tertiary Butyl Ether
- Liquid wastes – organic waste liquids from domestic and industrial activity such as used cooking oil, tallow.
- Biogas – sewage gas, landfill gas, biogas from anaerobic digestion.
- Syngas –synthesis gas from gasification of organic waste.

1.3 The main technologies utilised are reciprocating engines for smaller bioliquid and biogas fuelled schemes and conventional boiler and steam turbine technologies for solid biomass fuelled schemes.

[1] There are also 62 biogas schemes, of which 52 are at Sewage treatment works (STWs) and the rest are either Anaerobic Digestion or biomass gasification.

1.4 Renewable CHP schemes provide heat for a range of purposes including space and water heating in buildings, district heating and heat for a variety of industrial processes in chemicals, paper & pulp, food & drink, and sewage treatment sectors in particular.

1.5 Due to its high energy conversion efficiency, CHP is identified by the UK Bioenergy Strategy as one of the priority routes for the use of biomass. This is recognised in the Renewables Obligation by the eligibility of certain renewable CHP schemes, accredited prior to 31st March 2015, for additional Renewable Obligation Certificates (ROCs) per MWh of electrical output (CHP ROC bands). The introduction of the Renewable Heat Incentive (RHI) provided an opportunity for renewable CHP to be more directly rewarded for its useful heat output, thus from 1st April 2015 new renewable CHP schemes certified by CHPQA will no longer be eligible for the CHP ROC bands. Instead it is proposed that they would receive ROCs for their electrical output at the standard level for renewable power generation plus a specific RHI tariff on their heat output[2]. New renewable CHP schemes accredited in the period between 1st April 2013 and 31st March 2015 will be able to choose between the CHP ROC bands or the RHI tariff[3]. The support mechanism chosen will apply for the lifetime of support for the plant i.e. plant are not able to change their choice of support mechanism during their operation.

[2] http://www.decc.gov.uk/en/content/cms/consultations/rhi_exp_nondom/rhi_exp_nondom.aspx

[3] The option of choosing the RHI tariff is dependent upon the tariff being confirmed and the scheme meeting the relevant eligibility criteria for that tariff.

2. Renewable Obligation Certificate Banding for Combined Heat & Power

2.1 The Government's response[4] to the Renewable Obligation Banding Review sets out decisions on the level of support under the Renewables Obligation for electricity generation technologies in England and Wales[5] between 1st April 2013 and 31st April 2017, when the Renewables Obligation is planned to close to new capacity. The levels of ROC support for the various types renewable CHP scheme are summarised in the following paragraphs[6].

2.2 Good Quality Energy from Waste CHP is eligible for 1 ROC per MWh of electrical output from renewable material. This compares with no ROC support for power-only Energy from Waste plant. Unlike other forms of CHP, new Energy from Waste schemes accrediting up until 31st March 2017 will remain eligible for this rate of support.

2.3 Good Quality biomass CHP (including dedicated biomass, bioliquids, co-firing, conversions from fossil fuel plant, energy crop co-firing and enhanced co-firing) will be eligible for an additional 0.5 ROC per MWh of electrical output compared to power-only plant of the same category. These CHP ROC bands will be available for plant accrediting up until 31st March 2015, provided they have not opted to receive the RHI tariff on heat output instead.

2.4 CHP fuelled with biogas from anaerobic digestion, synthesis gas or pyrolysis oil is eligible for 2 ROCs per MWh of electrical output. This is identical to the level of support for power-only plant using these fuels/technologies, on the grounds that this plant is already eligible for the maximum level of support allowed for any form of renewable generation under the Renewables Obligation.

2.5 Although power-only plant fuelled by landfill gas or sewage sludge are only eligible for lower levels of support there is no CHP ROC band provided for these fuels under the Renewables Obligation due to lack of evidence to support this.

2.6 Where schemes use multiple renewable fuels the output on which they are eligible for the various ROC bands is determined in proportion to the energy content of each input fuel type.

2.7 As indicated in paragraphs 2.2 and 2.3 waste, biomass and bioliquid CHP schemes are eligible for a higher level of support under the Renewables Obligation compared to power-only plant, provided that some or all of their electrical output is certified as Good Quality under the CHPQA programme. Despite the fact that other renewable CHP fuel/technology

[4] http://www.decc.gov.uk/assets/decc/11/consultation/ro-banding/5936-renewables-obligation-consultation-the-government.pdf

[5] For information on support arrangements in Scotland contact Neal Rafferty, neal.rafferty@scotland.gsi.gov.uk, 0300 244 1227.

[6] These decisions are subject to State Aid clearance and Parliamentary approval.

types are not eligible for increased ROC support relative to power-only plant they may still seek certification as Good Quality CHP under the CHPQA programme in order to claim other benefits such as Enhanced Capital Allowances and preferential Business Rates[7].

2.8 The Northern Ireland Renewables Obligation (NIRO) operates alongside the Renewables Obligation and Renewables Obligation Scotland. The NIRO differs from the other Renewables Obligations in the setting of different banding levels for certain technologies (excluding renewable CHP) in the absence of a small scale Feed-In Tariff. In addition, the NIRO currently has an end date of 2033, but this will shortly be extended to 2037 to align with the other two Renewable Obligations. Northern Ireland has also recently consulted on introducing a six month grace period to 30 September 2015 in relation to the 0.5 ROC uplift for CHP projects seeking accreditation under the NIRO. This is to take account of the current absence of an RHI tariff for biomass above 1MW.

3. Combined Heat & Power Quality Index & Reasons for Review

3.1 The current Quality Index (QI) for CHP schemes is defined as a function of their heat efficiency (the heat load as a proportion of fuel input energy) and power efficiency (the electrical energy output as a proportion of fuel input energy)[8]. The QI is one of two criteria used for determining the extent to which a CHP qualifies as Good Quality (the other is power efficiency).

$$QI = X\eta_{power} + Y\eta_{heat}$$

where η_{power} = power efficiency
η_{heat} = heat efficiency

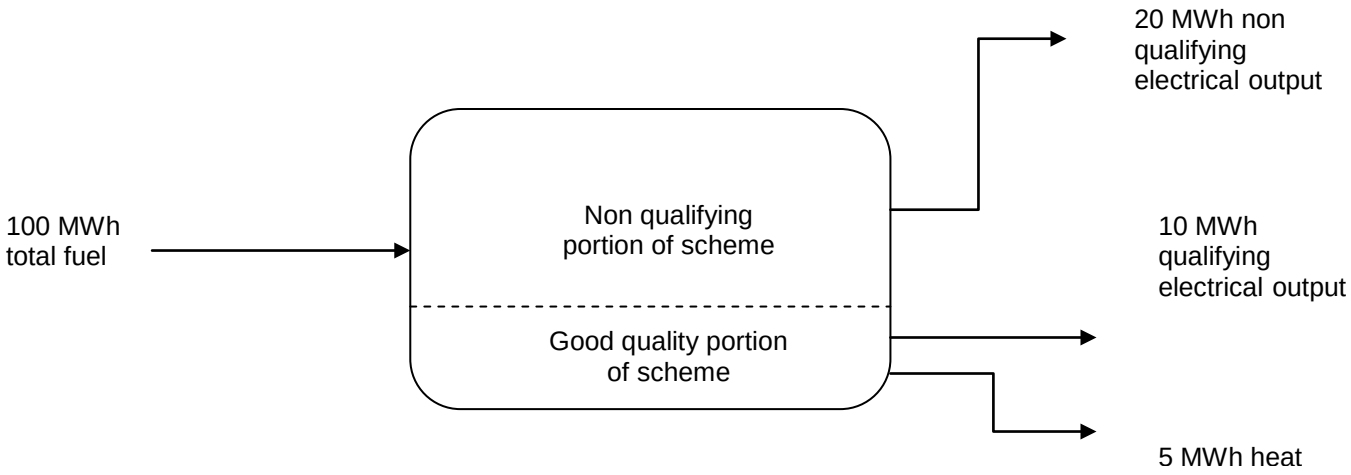
3.2 The coefficients X and Y are defined according to the electrical capacity and fuel/technology type of the scheme. The coefficient values for the purpose of obtaining ROCs under the CHP ROC bands are given in CHPQA Guidance Note 44 (for Solid Waste, Agricultural Biomass, Wood Fuel and Syngas fuelled schemes) and the CHPQA Standard (for Biogas, Liquid Biofuels and Liquid Waste fuelled schemes). For the purposes of calculating QI for CHP ROC band eligibility, Guidance Note 44 takes precedence over the CHPQA Standard.

3.3 The value of these X and Y coefficients was derived in order to ensure that only schemes which deliver a primary energy saving of 10% relative to separate generation of electricity and heat (using EU reference values) can achieve a QI of 100. The coefficients are also designed to ensure that schemes above 25MW electrical capacity must have an overall efficiency of at least 35% in order to achieve a QI of 100 and thus fully qualify as Good Quality CHP on the whole of their output.

[7] Further information on the support for which CHPQA certified schemes are eligible is available at http://chp.decc.gov.uk/cms/chp-incentives/

[8] NB All efficiencies used in CHPQA calculations and referred to in this document are calculated on the basis of the Gross Calorific Value of the fuel.

3.4 In the event that a scheme has a Quality Index of less than 100 its electrical output is scaled back by dividing the heat load by the (increased) heat to power ratio at which the scheme would achieve a Quality Index of 100. This scaled back electrical output is the "Qualifying Power Output" on which a renewable CHP scheme would be eligible for ROCs. This is illustrated in the examples shown in Figures 1 and 2 below, based on the current QI formulae for a <1MWe liquid biofuel scheme and a 1-25MW wood fuelled plant respectively.



Overall Scheme Performance: Power efficiency = 30%
Heat efficiency = 5%

$$QI = 275\eta_{power} + 120\eta_{heat}$$

$$QI = 275 \times 0.30 + 120 \times 0.05$$

$$QI = 88.5$$

Good Quality Portion: Power efficiency = 30%
New Heat efficiency = 15%

$$QI = 275\eta_{power} + 120\eta_{heat}$$

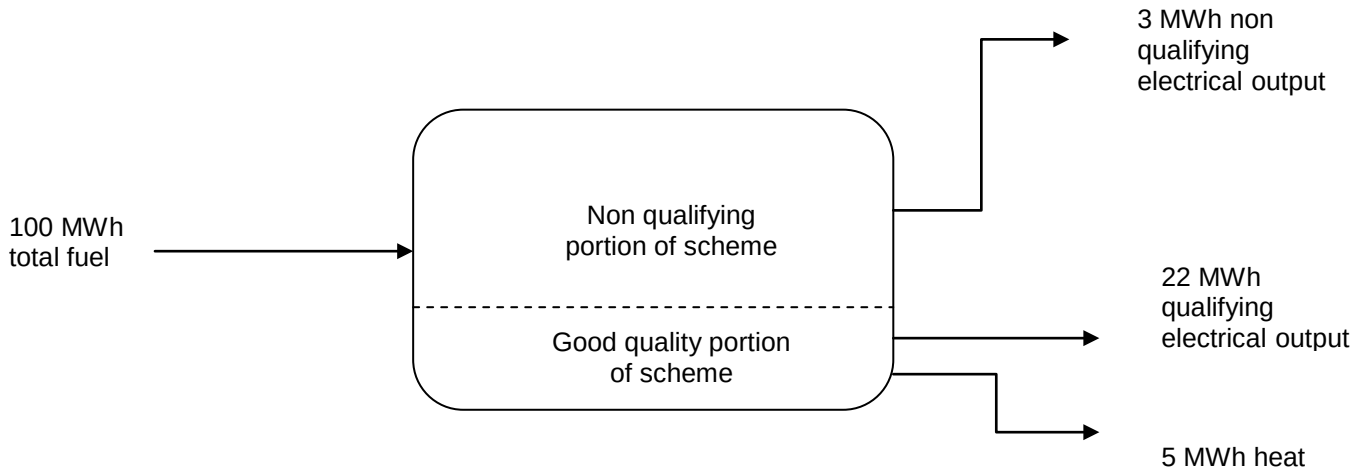
$$QI = 275 \times 0.3 + 120 \times 0.15$$

$$QI = 100$$

$$NewH : P = 0.15 / 0.3 = 0.5$$

$$QPO = 5 / 0.5 = 10MWh$$

Figure 1. Illustrative example of scale back of power output for a <1MWe bio-liquid scheme (all figures approximate)



Overall Scheme Performance: Power efficiency = 25%
Heat efficiency = 5%

$$QI = 315\eta_{power} + 120\eta_{heat}$$
$$QI = 315 \times 0.25 + 120 \times 0.05$$
$$QI = 85$$

Good Quality Portion: New Power efficiency = 20%
New Heat efficiency = 31%

$$QI = 315\eta_{power} + 120\eta_{heat}$$
$$QI = 315 \times 0.20 + 120 \times 0.31$$
$$QI = 100$$
$$NewH:P = 0.31/0.2 = 1.55$$
$$QPO = 5/1.55 = 3MWh$$

Figure 2. Illustrative example of scale back of power output for a 1-25MWe biomass steam turbine scheme (all figures approximate)

3.5 Unfortunately experience since November 2008, when the current QI formulae in Guidance Note 44 were published, shows that the maximum potential heat and electrical power efficiencies assumed in deriving the formulae were underestimated. This results in some schemes being able to fully qualify as Good Quality CHP despite not meeting the requirement of at least a 10%[9] primary energy saving. Some schemes with a high power efficiency are able to fully qualify despite having only a minimal heat load. Figures 3 and 4 show the QI of all existing and proposed UK CHP schemes which have been CHPQA certified, schemes in the shaded areas are fully qualified despite delivering less than 10% primary energy saving or less than 10% heat efficiency. Schemes with less than 10% heat efficiency are neither delivering the additional benefits expected of CHP operation nor are they likely to be incurring the full capital and operating costs associated with operating as a CHP plant with a more significant heat load.

[9] Schemes below 1MW electrical capacity are simply required to deliver an energy saving (i.e. >0%) by the Directives.

Figure 3. Current QI of all existing and proposed CHPQA certified schemes v Heat Efficiency

Figure 4. Current QI of all existing and proposed CHPQA certified schemes v Primary Energy Saving

3.6 It is therefore necessary to review the existing QI formulae used for determining eligibility for the CHP ROC bands in order to ensure that only schemes with a significant heat load and which meet primary energy saving requirements fully qualify and are eligible for the CHP ROC bands on their full electrical output.

4. Review Methodology & Assumptions

4.1 DECC tasked Ricardo-AEA Ltd with developing revised QI formulae for renewable CHP schemes. The objective of the analysis was to ensure that existing and proposed renewable CHP schemes must meet the following criteria in order to achieve a QI of 100 and therefore fully qualify as Good Quality CHP.

i. The minimum primary energy saving requirement of 10% (0% for schemes <1MW electrical capacity).

ii. A new requirement for a minimum heat efficiency of 10%.

iii. An overall efficiency of at least 35% for schemes >25MW electrical capacity.

4.2 Ricardo-AEA Ltd used the limiting case assumptions in Table 1 below to develop revised coefficients, which were refined by iteration and testing using heat efficiency, power efficiency, primary energy saving and overall efficiency data for all CHPQA certified schemes. Assumptions on the maximum potential efficiency of different technologies were based on performance data from existing renewable CHP schemes and proposed schemes certified on the basis of design data.

Fuel Type	Electrical Capacity (MW)	Prime Mover Technology	Minimum Electrical Efficiency (% GCV)	Maximum Electrical Efficiency (% GCV)	Maximum Total Efficiency (% GCV)	Risk
Biogas	**≤1MW**	Reciprocating engine	-	40%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	80%	Fully qualifying without 10% Primary Energy Saving
	>1MW	Reciprocating engine	-	45%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	80%	Fully qualifying without 10% PES
Liquid Biofuels	**≤1MW**	Reciprocating engine	-	36%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	85%	Fully qualifying without 10% PES
	>1MW	Reciprocating engine	-	45%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	85%	Fully qualifying without 10% PES
Liquid Biodegradable Waste	**≤1MW**	Reciprocating engine	-	36%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	80%	Fully qualifying without 10% PES
	>1MW	Reciprocating engine	-	45%	-	Fully qualifying without 10% Heat efficiency
		Gas turbine	20%	-	80%	Fully qualifying without 10% PES
Solid Waste	**≤1MW**	Biomass Air Turbines or Steam Turbines	-	24%	-	Fully qualifying without 10% Heat efficiency
		Organic Rankine Cycle or Steam Turbine	10%	-	80%	Fully qualifying without 10% PES
	>1MW to ≤25MW	Condensing Steam Turbine	-	26%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbine	10%	-	80%	Fully qualifying without 10% PES
	>25MW	Condensing Steam Turbine	-	28%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbine	10%	-	80%	Fully qualifying without 10% PES
Agricultural Biomass	**≤1MW**	Biomass Air Turbines or Steam Turbines	-	25%	-	Fully qualifying without 10% Heat efficiency
		Organic Rankine Cycle or Steam engines	10%	-	80%	Fully qualifying without 10% PES
	>1MW to ≤25MW	Condensing Steam Turbine	-	27%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbine	10%	-	80%	Fully qualifying without 10% PES
	>25MW	Condensing Steam Turbine	-	28%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbine	10%	-	80%	Fully qualifying without 10% PES
Waste Wood	**≤1MW**	Biomass Air Turbines	-	25%	-	Fully qualifying without 10% Heat efficiency
		Organic Rankine Cycle or Steam engines	10%	-	80%	Fully qualifying without 10% PES
	>1MW to ≤25MW	Condensing Steam Turbines	-	30%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbines	10%	-	80%	Fully qualifying without 10% PES
	>25MW	Condensing Steam Turbines	-	32%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbines	10%	-	80%	Fully qualifying without 10% PES
Wood fuels	**• 1MW**	Biomass Air Turbines	-	25%	-	Fully qualifying without 10% Heat efficiency
		Organic Rankine Cycle or Steam engines	10%	-	85%	Fully qualifying without 10% PES
	>1MW to ≤25MW	Condensing Steam Turbines	-	31%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbines	10%	-	85%	Fully qualifying without 10% PES
	>25MW	Condensing Steam Turbines	-	33%	-	Fully qualifying without 10% Heat efficiency
		Back Pressure Steam Turbines	10%	-	85%	Fully qualifying without 10% PES

Table 1. Quality Index Review – Limiting Case Input Assumptions

5. Current & Proposed Quality Index Formulae

5.1 The resulting proposed coefficients are shown in Table 2 below alongside the existing values from Guidance Note 44 (or the CHPQA Standard where the fuel category is not included in the Guidance Note). Note that in some cases, to better reflect technological capability, fuel categories have been modified. This is discussed in more detail in section 8 below.

5.2 The formulae are listed here according to fuel type for ease of comparison with existing formulae. However, the primary focus of the categorisation is to group schemes with similar technology and efficiencies together. A simple fuel type descriptor cannot fully capture the detail of this categorisation and it is proposed that, when published in a revised Guidance Note 44 and CHPQA standard, the categories simply be coded alphabetically with a more detailed list of the fuels included separately. The categorisation of fuels into the different types is discussed in more detail in section 8 below.

	Current QI Formulae	Proposed QI Formulae
Biogas & Syngas		
≤1MWe	QI = 285 x η_{power} + 120 x η_{heat}	QI = 220 x η_{power} + 120 x η_{heat}
>1 to ≤25MWe	QI = 251 x η_{power} + 120 x η_{heat}	QI = 195 x η_{power} + 120 x η_{heat}
>25MWe	QI = 193 x η_{power} + 120 x η_{heat}	QI = 193 x η_{power} + 120 x η_{heat}
Liquid Biofuels		
≤1MWe	QI = 275 x η_{power} + 120 x η_{heat}	QI = 245 x η_{power} + 120 x η_{heat}
>1 to ≤25MWe	QI = 191 x η_{power} + 120 x η_{heat}	QI = 191 x η_{power} + 120 x η_{heat}
>25MWe	QI = 176 x η_{power} + 120 x η_{heat}	QI = 176 x η_{power} + 120 x η_{heat}
Liquid Biodegradable Waste		
≤1MWe	QI = 275 x η_{power} + 120 x η_{heat}	QI = 245 x η_{power} + 120 x η_{heat}
>1 to ≤25MWe	QI = 260 x η_{power} + 120 x η_{heat}	QI = 195 x η_{power} + 120 x η_{heat}
>25MWe	QI = 176 x η_{power} + 120 x η_{heat}	QI = 176 x η_{power} + 120 x η_{heat}
Solid Waste		
≤1MWe	QI = 370 x η_{power} + 140 x η_{heat}	QI = 362 x η_{power} + 130 x η_{heat}
>1 to ≤10MWe	QI = 370 x η_{power} + 140 x η_{heat}	QI = 362 x η_{power} + 130 x η_{heat}
>10 to ≤25MWe	QI = 370 x η_{power} + 140 x η_{heat}	QI = 362 x η_{power} + 130 x η_{heat}
>25MWe	QI = 364 x η_{power} + 140 x η_{heat}	QI = 338 x η_{power} + 130 x η_{heat}
Agricultural Biomass		
≤1MWe	QI = 370 x η_{power} + 130 x η_{heat}	QI = 348 x η_{power} + 130 x η_{heat}
>1 to ≤10MWe	QI = 370 x η_{power} + 130 x η_{heat}	QI = 348 x η_{power} + 130 x η_{heat}
>10 to ≤25MWe	QI = 370 x η_{power} + 130 x η_{heat}	QI = 348 x η_{power} + 130 x η_{heat}
>25MWe	QI = 338 x η_{power} + 130 x η_{heat}	QI = 338 x η_{power} + 130 x η_{heat}
Waste Wood		
≤1MWe	previously treated as Solid Waste	QI = 352 x η_{power} + 120 x η_{heat}
>1 to ≤10MWe		QI = 316 x η_{power} + 120 x η_{heat}
>10 to ≤25MWe		QI = 316 x η_{power} + 120 x η_{heat}
>25MWe		QI = 295 x η_{power} + 120 x η_{heat}
Wood Fuels		
≤1MWe	QI = 329 x η_{power} + 120 x η_{heat}	QI = 319 x η_{power} + 120 x η_{heat}
>1 to ≤10MWe	QI = 315 x η_{power} + 120 x η_{heat}	QI = 293 x η_{power} + 120 x η_{heat}
>10 to ≤25MWe	QI = 315 x η_{power} + 120 x η_{heat}	QI = 285 x η_{power} + 120 x η_{heat}
>25MWe	QI = 315 x η_{power} + 120 x η_{heat}	QI = 279 x η_{power} + 120 x η_{heat}

Table 2. Current & proposed QI Formulae

Consultation Question 1

Do you agree with the proposed coefficients in the revised Quality Index formulae for renewable CHP? Please provide evidence to support your response.

5.3 The QI approach is the established approach to CHP certification in the UK. It incorporates a well understood scale-back mechanism for partially qualified plant, which is valued by stakeholders. However, on its own the QI approach cannot perfectly ensure that all schemes which meet the proposed criteria described in 4.1 achieve a QI of 100, whilst simultaneously ensuring that no schemes which do not meet the criteria achieve a QI of 100. The above formulae have been developed to minimise the risk of schemes which do not meet the criteria from achieving a QI of 100. However, one or two schemes which do meet the criteria fail to achieve a QI of 100 under these formulae. To avoid this outcome it is proposed to introduce a safeguard provision that will guarantee a QI of 100 if all of the relevant criteria are met, regardless of the results from the formulae. Thus provided the following conditions are met a scheme will be awarded a QI of at least 100;

- Schemes over 25MW electrical capacity: heat efficiency $\geq$ 10%, overall efficiency $\geq$ 35%, primary energy saving $\geq$ 10%
- Schemes of 1-25MW electrical capacity: heat efficiency $\geq$ 10%, primary energy saving $\geq$ 10%
- Schemes below 1MW electrical capacity: heat efficiency $\geq$10%, primary energy saving >0%

Consultation Question 2

Do you agree with the proposed safeguard provision? Please provide a justification for your answer.

6. Impact of Proposed Quality Index Formulae

6.1 The results of applying the proposed QI formulae (and safeguard provision) to existing and proposed schemes which have been CHPQA certified are shown in Figures 5 and 6 below. It can be seen that the formulae are successful in ensuring that schemes need a heat efficiency of 10% and a primary energy saving of 10% to achieve a QI of 100 or higher. A number of schemes do not meet a QI of 100 despite having a heat efficiency in excess of 10%, these are schemes whose primary energy saving, according to EU formulae, are less than 10%. There are also one or two schemes which do not achieve a QI of 100 despite primary energy savings in excess of 10%. These are schemes that have less than 10% heat efficiency.

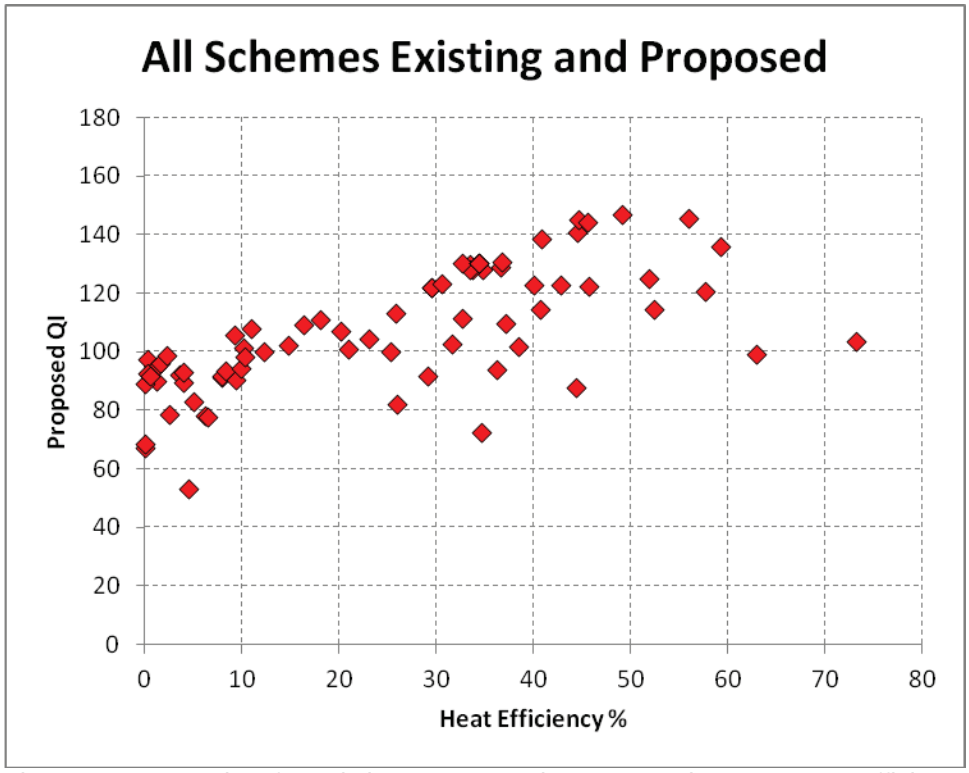


Figure 5. Proposed QI for existing & proposed UK CHP schemes v Heat efficiency

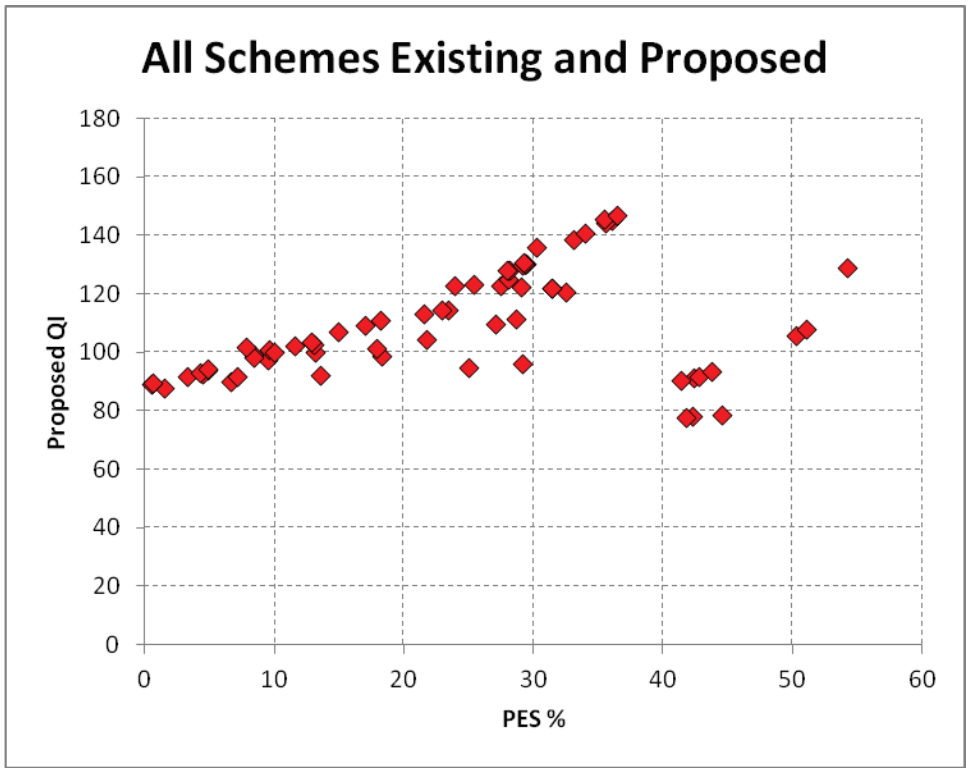


Figure 6. Proposed QI for existing & proposed UK CHP schemes v Primary energy saving

6.2 Table 3 below gives a summary of impacts on existing and proposed CHPQA certified schemes. It provides data on the number of schemes which would experience a reduction in the level of support for which they are eligible under the proposed formulae, the average percentage reduction in ROCs for these schemes and the reduced “Qualifying” Power Output (QPO) across all schemes. Where schemes use more than one renewable fuel they are listed according to the main fuel used.

	Solid Biomass Schemes	Bioliquid Schemes	Biogas Schemes
Existing schemes			
No of schemes	12	33	62
No of schemes with reduced support	6	13	0
Average % reduction in ROCs for affected schemes	9%	16%	NA
Current total QPO (MWh)	763,942	18,927	795,944
Total QPO with revised QI formulae (MWh)	564,352	7,230	770,624
Proposed schemes			
No of schemes	20	10	14
No of schemes with reduced support	9	0	0
Average % reduction in ROCs for affected schemes	18%	0%	0%
Current total QPO (MWh)	3,702,413	6,586	100,712
Total QPO with revised QI formulae (MWh)	2,175,180	6,586	97,297

Table 3. Summary of Impacts of Revised QI Formulae on ROC eligibility and QPO

7. Grandfathering of CHP Quality Index Formulae

7.1 CHPQA certification criteria have not previously been grandfathered. The reasons which necessitated this consultation show that this approach has been justified to date, as the current QI formulae are not in all cases delivering the primary energy saving requirements and need to be amended. However, the lack of grandfathering may be a potential risk to securing investment in new renewable CHP capacity.

7.2 The Department is keen to see additional renewable CHP capacity brought forward in line with the Bioenergy Strategy. When the current QI formulae were set in 2008 there was only limited experience of the performance of renewable CHP schemes. Now that more experience of the performance of renewable CHP schemes is available we can be more confident that the revised formulae proposed will ensure that the required primary energy savings criteria are met and ensure that only schemes with a significant heat load fully qualify. The proposed introduction of a specific heat tariff will also help ensure this for schemes accrediting from 1st April 2015 by directly incentivising higher heat efficiencies.

7.3 We therefore propose that once a scheme has been certified in accordance with the revised QI formulae the same QI formulae should be applied for the remaining lifetime of support for the plant. This is subject to any change that may be necessitated by EU legislation. This only grandfathers the formulae used, the actual QI of a scheme will continue to be assessed annually based on actual performance each year.

Consultation Question 3

Do you agree with the proposed approach on grandfathering? Please provide a justification for your response and data in support of this or any alternative proposed approach.

8. Categorisation of Fuels

8.1 As discussed in section 5 the categorisation of schemes for the purposes of QI formulae is intended to group schemes with similar maximum potential efficiencies. Maximum potential efficiency is dictated by a combination of the prime mover technology and fuel properties e.g. moisture content, level of contaminants which could give rise to corrosion risks etc. With this in mind the fuels types which will be considered to be within each of the categories listed in Table 2 in section 5 are shown in Table 4 below.

QI Category	Fuels included
Biogas & Syngas	Gas produced by anaerobic digestion of biological material, Sewage gas, Landfill gas, Synthesis gas from gasification of biological material
Liquid Biofuels	Fatty Acid Methyl Esters, Bio DiMethyl Ether, Biomass To Liquid fuels, Virgin vegetable oil, Biomethanol, Bioethanol, Biobutanol, Bio Methyl Tertiary Butyl Ether, Bio Ethyl Tertiary Butyl Ether, Pyrolysis oil from pyrolysis of biological material
Liquid Waste	Tallow, Used cooking oil
Solid Waste	The biological fraction of; Municipal solid waste, Industrial waste, Clinical waste, Refuse derived fuel, Solid recovered fuel, Poultry litter, Sewage sludge, Paper sludge
Agricultural Biomass	Logs, Roundwood, Energy crops, Agricultural residues, Prunings, Milling residues, Arboricultural & Forestry residues, Distillers grain
Waste Wood	Contaminated waste wood (grades B-D of PAS 111)
Wood Fuels	Wood pellets, Dry wood chips, Straw, Bagasse, Nut shells, Husks and Cobs, Visibly clean waste wood (grade A of PAS 111)

Table 4. Fuel categorisation

8.2 As noted in section 5 the simple fuel category descriptions used here cannot fully capture the list of fuels included in each category. For this reason it is proposed to re-name the categories in the Guidance Notes and CHPQA Standard using alphabetical characters.

Consultation Question 4

Do you agree with the proposed fuel categorisation? Please provide data on the efficiency of schemes fuelled with particular fuel types in support of any alternative categorisation.

9. District Heat Networks

9.1 *The Future of Heating: A strategic framework for low carbon heat in the UK*[10] identifies heat networks supplied by low or zero carbon heat sources as having a key role to play in decarbonising heating in buildings in areas of dense heat demand. *The Future of Heating* also indicates that District Heat Networks generally start small and expand over time. We are aware of one existing and four proposed schemes which supply heat loads through District Heat Networks or are configured to do so, but would only be partially qualified under the proposed revisions to the QI formulae.

9.2 Under current CHPQA arrangements a reduced QI threshold of 95 applies for a period of initial operation of a scheme. This period is 1 year in general, but 2 years in respect of District Heating in order to provide time, both for teething problems with the CHP scheme to be ironed out, and for District Heat loads to be built up.

9.3 In view of the important role that District Heat Networks can play in decarbonising heat in areas of dense heat demand by supplying heat from renewable sources, and the adverse impact that the proposed formulae might otherwise have on the establishment of these networks, we propose that a reduced QI threshold of 95 apply for a period of 5 years in respect of schemes which supply heat primarily through District Heat Networks serving commercial, public and/or residential buildings. A business plan showing District Heating development will be required at the time of initial certification.

Consultation Question 5

Do you agree with the proposed approach on District Heat Networks? Please provide a justification for your response and data in support of this or any alternative proposed approach.

[10] http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/heat/4805-future-heating-strategic-framework.pdf

10. Amendments to the CHPQA Standard

10.1 The CHPQA Standard defines QI formulae for the certification of CHP schemes for eligibility for other forms of support than ROCs e.g. Enhanced Capital Allowances, preferential Business Rates etc. The Quality Index formulae used for this purpose are, in general, more stringent than those used in Guidance Note 44 for obtaining a CHPQA ROC Eligible Certificate, although in the case of some fuel types/scheme sizes, the formulae in the CHPQA Standard are used for both the general CHPQA certificate and the ROC Eligible Certificate.

10.2 The proposed formulae in section 5 for schemes of 25MW electrical capacity or less are more stringent than the current formulae in the CHPQA Standard. It is therefore proposed that the new formulae for these schemes be copied across into the CHPQA Standard also. For schemes with installed electrical capacities above 25 MW no change to the formulae in the CHPQA Standard is proposed. This approach reflects the fact that the tighter formulae for ≤25MW schemes are required to ensure that the minimum primary energy saving and heat efficiency criteria are met. The resulting formulae for renewable CHP schemes in the revised CHPQA standard would therefore be as shown in Table 5 below.

	Proposed QI Formulae for CHPQA Standard						
Biogas & Syngas							
≤1MWe	QI =	220	x η_{power}	+	120	x η_{heat}	
>1 to ≤25MWe	QI =	195	x η_{power}	+	120	x η_{heat}	
>25MWe	QI =	193	x η_{power}	+	120	x η_{heat}	
Liquid Biofuels							
≤1MWe	QI =	245	x η_{power}	+	120	x η_{heat}	
>1 to ≤25MWe	QI =	191	x η_{power}	+	120	x η_{heat}	
>25MWe	QI =	176	x η_{power}	+	120	x η_{heat}	
Liquid Biodegradable Waste							
≤1MWe	QI =	245	x η_{power}	+	120	x η_{heat}	
>1 to ≤25MWe	QI =	195	x η_{power}	+	120	x η_{heat}	
>25MWe	QI =	176	x η_{power}	+	120	x η_{heat}	
Solid Waste							
≤1MWe	QI =	362	x η_{power}	+	130	x η_{heat}	
>1 to ≤10MWe	QI =	362	x η_{power}	+	130	x η_{heat}	
>10 to ≤25MWe	QI =	362	x η_{power}	+	130	x η_{heat}	
>25MWe	QI =	220	x η_{power}	+	120	x η_{heat}	
Agricultural Biomass							
≤1MWe	QI =	348	x η_{power}	+	130	x η_{heat}	
>1 to ≤10MWe	QI =	348	x η_{power}	+	130	x η_{heat}	
>10 to ≤25MWe	QI =	348	x η_{power}	+	130	x η_{heat}	
>25MWe	QI =	220	x η_{power}	+	120	x η_{heat}	
Waste Wood							
≤1MWe	QI =	352	x η_{power}	+	120	x η_{heat}	
>1 to ≤10MWe	QI =	316	x η_{power}	+	120	x η_{heat}	
>10 to ≤25MWe	QI =	316	x η_{power}	+	120	x η_{heat}	
>25MWe	QI =	220	x η_{power}	+	120	x η_{heat}	

Wood Fuels								
≤1MWe	QI =	319	x	η_{power}	+	120	x	η_{heat}
>1 to ≤10MWe	QI =	293	x	η_{power}	+	120	x	η_{heat}
>10 to ≤25MWe	QI =	285	x	η_{power}	+	120	x	η_{heat}
>25MWe	QI =	220	x	η_{power}	+	120	x	η_{heat}

Table 5. Proposed QI formulae for updating CHPQA Standard

11.Next Steps

11.1 Following conclusion of the consultation and a Government response, the intention is to issue a revised version of Guidance Note 44 and the CHPQA Standard. It is envisaged that these would be applied for CHPQA certifications from 1st January 2014 to avoid complications with applying revised criteria partway through the 2013 certification year. Amendments to the Renewables Obligation Order 2009 will be required to reference the revised Guidance Note 44 for the purposes of determining whether a generating station is a qualifying CHP generating station (these are stations which have been certified under CHPQA, and only these stations are eligible for support under the CHP ROC bands). The amended reference will be included in the package of Renewables Obligation amendments scheduled to be made in October 2013.

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