Introduction

Quality Assurance for Combined Heat & Power
Form F3 - Self Assessment of Proposed New and Upgraded CHP Schemes

NOTES:

- This Form F3 is intended for the Self-Assessment of proposed new or upgraded CHP Schemes based on the final Scheme design and anticipated operating conditions.
- Forms F2 and F4 must be submitted for existing Schemes in Initial or Annual Operation.
- This Form must be accompanied by a series of attachments as listed in "F3-Comments - Additional Comments" and described under the various Sections to which they refer.
- Guidance Note GN3 has been written to help you complete this Form.
- The most up-to-date version of the CHPQA Standard and Guidance Notes must be used, these can be found on the CHPQA web site (https://www.gov.uk/guidance/combined-heat-power-quality-assurance-programme).
- CHPQA Certificates resulting from CHPQA Validation of your Self-Assessment are valid until 31 December of the year of issue. [This applies to all existing, upgraded and new Schemes]
- Information provided on this Form will be stored electronically and treated in the strictest commercial confidence. Only the Government or its agents will use it, for the sole purpose of the CHPQA programme including collection and collation of national statistics.

CONTENT OF FORM F3:

Part 1 Scheme Identification and Site Information

Part 2 Detailed Description of Proposed Scheme/Upgrade

Part 3 Scheme Performance for CHPQA

Part 4 Criteria for Good Quality CHP

Part 5 Calculation of CHP_{QPC}

Part 6 Schemes Approaching Initial Operation

Part 7 Calculation of CHP_{QPO} (Initial Operation)

Part 8 Exports of Electricity and Heat

Part 9 Using CHPQA to Claim ROCs or for the purpose of qualifying for CfDs

Part 10 ROCs/CfDs CHP_{QPO} calculation (Annual Operation)

Part 11 Secretary of State (CHP) Exemption Certificate Application

Part 12 Declaration and Attachments

The CHPQA programme is carried out on behalf of the Department of Energy and Climate Change, the National Assembly for Wales, and the Northern Ireland Department of Enterprise, Trade and Investment.

Scheme Identification

Part 1: Scheme Identification & Site Information

Site Name:	Rivenhall
Site reference:	6751
Scheme reference:	A
Company name:	Fichtner Consulting Engineers Ltd

Q1 : Economic Sector

Which sector best describes the site on which your Scheme is located.

Paper, publishing and printing

e.g. Iron & Steel. See GN12.1 for list.

Q2 : Basic Information

This information is required to set out the background and context of the proposed new or upgraded Scheme and to indicate its current state of development.

Site/consumer non-production hours (hours/year):	192
Site/consumer production hours (hours/year):	8400
Site/consumer total operating hours (hours/year):	8568
Does this site have existing CHP Schemes:	No
If YES - Reason for F3 if the site already has a scheme:	
If YES - Existing CHP sheme registered:	No

If YES - What is the Scheme reference number(s):	
What are the overall objectives of the proposed Scheme/upgrade? (e.g. to better meet existing/increased site heat/power demand.). Please include details and relevant attachments on the proposed utilisation and use of heat.:	To produce renewable electricity and heat for use at the adjacent Market De-Inked Pulp Plant ('Pulp Plant') and other waste treatment processes. Power not used on site will be exported to the Grid. The developer, Gent Fairhead and Co. Limited has been allocated a Contract for Difference (CfD) for an Energy-from-Waste (EfW) scheme with CHP.
Provide a general description of the proposed Scheme (e.g. ownership, operation and maintenance arrangements, normal running hours, typical operation, and uses of heat and power outputs). (If there is insufficient space opposite, please provide the description as an Attachment).:	See Attachment 9 - General Description of the scheme. The site is expected to operate for 8,568 hours per year with an equivalent, full load availability of at least 8,000 hours per year for the CHP Plant and approximately 8,400 hours for the MDIP Plant
What is the state of development of the proposed Scheme? (e.g. specification / tendering / procurement / installation / commissioning):	Pre-contract design has been carried out by the selected contractors for the CHP Plant (Hitachi Zosen Inova AG), MDIP Plant (Voith GmbH) and WWTP (Coffey Northumbrian Ltd). Financial close is targeted for May 2016.

When do you expect to:	State month and year for each phase:	
(a) start construction:	06/2016	(MM/YYYY)
(b) start commissioning:	10/2018	(MM/YYYY)
(c) start Initial Operation (if known, see GN10.17):	06/2019	(MM/YYYY)
(d) date of first firing:	10/05/2019	(DD/MM/YYYY)
Scheme Technology Type (main prime mover):	Pass-out condensing steam turbine	

Q3 : Site/Consumer Energy Demands

Period 1 (e.g. Winter, production campaign period 1, etc.):

Period description: Winter

Period: OCT - MAY Months: (e.g. Oct-Apr)

Heat/Steam demand:

Base:	25434	kWth * for	3557	hours
Peak:	28143	kWth * for	202	hours
Average:	25380	kWth * for	5741	hours

Electricity demand:

Base:	13500	kWe for	1	hours
Peak:	13500	kWe for	1	hours
Average:	13500	kWe for	5741	hours

Period 2 (e.g. Summer, production campaign period 2, etc.):

Period description: Summer

Period: JUN - SEP Months: (e.g. May-Sep)

Heat/Steam demand:

Base:	14378	kWth * for	458	hours
Peak:	18376	kWth * for	2243	hours
Average:	17008	kWth * for	2827	hours

Electricity demand:

Base:	1	kWe for	1	hours
Peak:	1	kWe for	1	hours
Average:	13500	kWe for	2827	hours

Predicted Future Annual Loads:

Period description: Long Term Operation

Heat/Steam demand:

Base:	14378	kWth * for	458	hours per annum
Peak:	28143	kWth * for	202	hours per annum
Average:	22617	kWth * for	8568	hours per annum

Electricity demand:

Base:	1	kWe for	1	hours per annum
Peak:	1	kWe for	1	hours per annum
Average:	13500	kWe for	8568	hours per annum

* On a separate, numbered attachment show the calculation of heat demands kWth from the basic data (e.g. steam flow, pressure, temperature and specific enthalpy)

Q4 : Scheme Equipment Details

Part 2: Detailed Description of Proposed Scheme/Upgrade

Identify each plant item on your CHP Scheme Line Diagram (to be included as Attachment 1) and, in the table in Section 4 below, by tag number using the notation in Guidance Note GN12.3.

Use the table on the following page to itemise all items of plant, e.g. prime movers, boilers, duct burners, etc, within your CHP Scheme boundary. Include any mechanical power generation plant but express the capacity in terms of electrical power equivalent (mechanical power x 1.05, see GN15.4) and mark with an asterisk.

Tag no.	Tag prefix	State	Manufacturer	Model / type	Design Capacity (referenced to ISO conditions) Heat kW	Power kWe
1	fired Boiler	Existing	Hitachi Zosen Inova	SRF/RDF-fired steam boiler	92000	0
2	fired Boiler	Existing	Hitachi Zosen Inova	SRF/RDF-fired steam boiler	92000	0
1	steam turbine/engine	Existing	Not finalised yet	Pass-out condensing stean	0	49950

Total Power Capacity (as electrical output) = CHP_{TPC} 49950 We

Q5-1 : Projected Scheme Performance Details

Summarise the CHP process design and 3 anticipated operating cases in the table below. This information must be supported by Energy Flow Diagrams for each of the 4 cases (showing heat and material flows, Attachments 2 to 5), Site and Scheme Annual and Daily Heat Profiles (Attachments 6 and 7) and Load Duration Curves (Attachment 8). See GN12.4 and GN12.5.

If the site has existing CHP within the same Scheme boundary as the proposed plant, provide information for the complete Scheme.

Stream no.	Type	Description	Fuel Type	Unit	Projected average annual loads: First year of Operation*	Projected average annual loads: Long Term Annual Operation	MaxHeat under Long Term AO (see GN10.14)
		Scheme operating hours per year		hours	4958	8568	1026
1	Energy input	Biological Solid Wastes	Solid recovered fuels	kW	85852.4	95064.8	106393.2
2	Energy input	Biological Solid Wastes	Paper sludge	kW	0	326.8	326.8
3	Energy input	Oil	Fuel oil	kW	353.2	345.1	0
4	Energy input	Biological Solid Wastes	Solid recovered fuels	kW	85852.4	95064.8	106393.2
5	Energy input	Biological Solid Wastes	Paper sludge	kW	0	326.8	326.8
6	Energy input	Oil	Fuel oil	kW	353.2	345.1	0
7	Power output	ST1 power generated		kW	40280.6	44756.2	49133
8	Heat output	Hot water to space heating		kW	0	4449.3	8754.9
9	Heat output	LP steam to process		kW	4478.6	8528.4	9542.1
10	Heat output	MP steam to process		kW	0	9639.4	10091.7

* First year of operation is the period from the start of Initial Operation to the end of the first calendar year during which the plant starts operating as a CHP. For example, if you anticipate entering Initial Operation inat the beginning of May, then the scheme operating hours for the first year of operation is from May until the end of December that year, and projected annual performance should be based on these eight months.

Note: Please provide an Attachment evidence of anticipated initial and future loads (e.g. 5-year business plan to support future loads):

Q5-2 : Projected Scheme Performance Details

Total Energy Inputs:

Initial Operation: 172411.2 kW

Long Term Annual Operation: 191473.4 kW

MaxHeat under Long Term AO: 213440 kW

Total Power Outputs:

Initial Operation: 40280.6 kW

Long Term Annual Operation: 44756.2 kW

MaxHeat under Long Term AO: 49133 kW

Total Heat Outputs:

Initial Operation: 4478.6 kW

Long Term Annual Operation: 22617.1 kW

MaxHeat under Long Term AO: 28388.7 kW

Q6 : Scheme Monitoring Arrangements

See GN12, 13, 14, 15, 16, 17, 18, 20 & 22.

Use this table to list all existing and proposed metering arrangements (including the meters by which you are billed) for your Scheme inputs and outputs. See GN12.7.

Stream numbers should be as identified on your Scheme Line Diagram at Attachment 1. The table should detail the anticipated uncertainty values for all existing and proposed metering arrangements. See GN13.10 to GN13.13.

Attach details of any indirect methods used to derive unmetered inputs or outputs as a numbered Attachment (include below the monitoring upon which these rely). (See Guidance Notes GN20 to GN22).

Type	Stream number	Input or Output	Description	Uncertainty %
Energy input	3	Calculated	Oil	2
Energy input	4	Calculated	Biological Solid Wastes	2
Energy input	5	Calculated	Biological Solid Wastes	2
Energy input	6	Calculated	Oil	2
Energy input	1	Calculated	Biological Solid Wastes	2
Energy input	2	Calculated	Biological Solid Wastes	2
Power output	7	Calculated	ST1 power generated	0.5
Heat output	8	Calculated	Hot water to space heating network	0
Heat output	9	Calculated	LP steam to process	0
Heat output	10	Calculated	MP steam to process	0

Q7 : Projected Annual Demand and MaxHeat Operation

Part 3: Scheme Performance for CHPQA

Important: Where future heat demand is greater than present site demands, please attach evidence as a numbered Attachment of when future loads will come on stream. See GN3. (Part 3, section 7)

	Projected average annual loads (from section 5)		MaxHeat under LTAO	Units
	Initial Operation (IO)	Long Term Annual Operation (LTAO)		
Energy inputs (GCV basis)	172.4112	191.4734	213.44	MW
Heat outputs	4.4786	22.6171	28.3887	MWth
Power outputs	40.2806	44.7562	49.133	MWe
Heat efficiency (η_{heat})	2.6	11.81	13.3	%
Power efficiency (η_{power})	23.36	23.37	23.02	%

Q8 : QI Definition

The QI definitions in Table 1 of Issue 5 of the Standard should be used for the 2016 certification of new and existing schemes.

Use the table below to enter the appropriate QI definition for your Scheme. If your Scheme uses a mixture of fuels you must calculate a weighted average QI definition.

Please refer to Issue 5 of the CHPQA Standard if further clarification is required.

Fuel type	Fraction Fn	Factors		Weighted Factors	
		Xn	Yn	Fn x Xn	Fn x Yn
Natural Gas		186	115		
Coal		176	115		
Oil	0.0036	176	115	0.63	0.41
Fuel Cells		180	120		
Biogas		193	120		
Syngas		193	120		
Liquid Biofuels		176	120		
Renewable Liquid Waste		176	120		
Biological Solid Wastes	0.9964	220	120	219.21	119.57
Agricultural Biomass		220	120		
Waste Woods		220	120		
Wood Fuels		220	120		
By-product Gases		193	120		
Waste gases or waste heat		193	120		
Non-Renewable Liquid Waste		176	120		
Sum	**1**			**219.84**	**119.98**

Q9 : Quality Index (Projected Annual and MaxHeat Operation)

	X	x	Power Efficiency	+	Y	x	Heat Efficiency	=	QI
Initial Operation (IO)	219.84	x	23.36 %	+	119.98	x	2.60 %	=	54.47

Long Term Annual Operation (LTAO)	219.84	x	23.37 %	+	119.98	x	11.81 %	= 65.55
MaxHeat under LTAO	219.84	x	23.02 %	+	119.98	x	13.30 %	= 66.57

Q10 : Scheme Performance Indicators

Part 4: Criteria for Good Quality CHPA

Scheme Power Efficiency under Long Term Annual Operation (from Section 7): 23.37 %

Scheme QI under Long Term Annual Operation (from Section 9): 65.55

Scheme QI at MaxHeat under Long Term Annual Operation (from Section 9): 66.57

Q11-1 : Selected Threshold Criteria

With reference to the Threshold Criteria for Good Quality CHP set out in the CHPQA Standard, (Section 4 - Interpretation) and in GN42.16, select the Threshold Criteria you wish your Scheme to be assessed against.

QI threshold:	105	(a) under Long Term Annual Operation OR if not (b) at MaxHeat under LTAO
Power Efficiency threshold:	20 %	under Long Term Annual Operation

Q11-2 : Selected Threshold Criteria

The scheme **did not** meet the QI threshold.

Q11-3 : Selected Threshold Criteria

The scheme **did not** meet the QI Threshold of 105 under MaxHeat conditions.

Q12-1 : CHP Qualifying Power Capacity

Part 5: Calculation of CHP_{QPC}

IMPORTANT: CHP_{QPC} calculation is based on projections of fuel use (GCV), power generation and heat supply, all in MW, based on anticipated maximum heat output under normal operating conditions (MaxHeat conditions). See GN27.

Does your Scheme have a condensing steam turbine ?: Yes

Q13-1 : CHP Qualifying Power Capacity with Condensing Steam turbine

From Table GN28-1 in Guidance Note GN28, select the most appropriate Z ratio for your Scheme. Complete the statement below:

Step 1 Define Z ratio for the CHP Scheme:

Steam export pressure: 6 bar(a);

ST size: 49.95 MWe;

Z ratio: 5.56

Q13-2 : CHP Qualifying Power Capacity with Condensing Steam turbine

Step 2 Calculate the Heat Efficiency required to achieve the Threshold $QI_{MaxHeat}$ of 105:

Change η_{HEAT} = 100 x (Change QI) / (Y - (X / Z ratio))

= 100 x (105 - 66.57) / (119.98 - (219.84 / 5.56))

Change η_{HEAT} = 47.77 %

New η_{HEAT} = Change η_{HEAT} + η_{HEAT}

= 47.77 % + 13.30 %

New η_{HEAT} = 61.07 %

Step 3 Determine the corresponding change in power efficiency:

Change η_{POWER} = Change η_{HEAT} / Z ratio

= 47.77 % / 5.56

Change η_{POWER} = 8.59 %

New η_{POWER} = η_{POWER} - Change in η_{POWER}

= 23.02 % - 8.59 %

New η_{POWER} = 14.43 %

Step 4 Determine the equivalent Heat to Power ratio:

Equivalent Heat to Power ratio = New η_{HEAT} / New η_{POWER}

= 61.07 % / 14.43 %

Equivalent Heat to Power ratio = 4.2322

Step 5 Determine the Qualifying Power Capacity = CHP_{QPC}:

CHP_{QPC} = Predicted MaxHeat to be supplied / Equivalent Heat-to-Power ratio

= 28.3887 / 4.2322

Q14 : Initial Operation

Part 6: Schemes Approaching Initial Operation

Do you expect your Scheme to become operational in the current calendar year: No

Q15 : Initial Annual Energy Inputs and Outputs

	Average annual loads (MW)	x	Annual operating hours	Annual MWh	
Energy inputs	172.411	x	4958	854813.74	= CHP_{TFI}
Heat Outputs	4.479	x	4958	22206.88	= CHP_{QHO}
Power Outputs	40.281	x	4958	199713.2	= CHP_{TPO}

Q16 : Good Quality Criteria for Initial Operation

	Initial Operation	Threshold Criteria	
Power Efficiency under Initial Operation	23.36	20	%
QI under Initial Operation	54.47	95	

Q17 : Qualifying Fuel Input CHP_{QFI} (Initial Operation)

Power Efficiency ≥ threshold (20%) therefore: CHP_{QFI} = CHP_{TFI} = **854813.74** MWh

Q18 : Qualifying Power Output CHP_{QPO} (Initial Operation)

QI < threshold (95%) therefore: CHP_{QPO} must be calculated.

Q19 : CHP Qualifying Power Output

Part 7: Calculation of CHP_{QPO} (Initial Operation)

- If a CHP Scheme achieves a QI less than the Threshold, the CHP_{QPO} is calculated. The CHP_{QPO} is the proportion of the power generated that qualifies as an output from 'Good Quality' CHP. See GN26 , GN27 and GN28.
- CHP_{QPO} calculation is based on fuels used, power generated and heat supplied in MWh based on initial annual operation from Part 6.

Does your Scheme have a condensing steam turbine ?: Yes

Q21-1 : CHP Qualifying Power Output with Condensing Steam turbine

From Table GN28-1 in Guidance Note GN28, select the most appropriate Z ratio for your Scheme. Complete the statement below:

Step 1 Define Z ratio for the CHP Scheme:

Steam export pressure: 6 bar(a);

ST size: 49.95 MWe;

Z ratio: 5.56

Q21-2 : CHP Qualifying Power Output with Condensing Steam turbine

Step 2 Calculate Heat Efficiency required to achieve the Threshold QI value:

Change η_{HEAT} = 100 x (Change QI) / (Y - (X / Z ratio))

= 100 x (95 - 54.47) / (119.98 - (219.84 / 5.56))

Change η_{HEAT} = 50.39 %

New η_{HEAT} = Change η_{HEAT} + η_{HEAT}

= 50.39 % + 2.60 %

New η_{HEAT} = 52.99 %

Step 3 Determine the corresponding change in power efficiency:

Change η_{POWER} = Change η_{HEAT} / Z ratio

= 50.39 % / 5.56

Change η_{POWER} = 9.06 %

New η_{POWER} = η_{POWER} - Change in η_{POWER}

= 23.36 % - 9.06 %

New η_{POWER} = 14.30 %

Step 4 Determine the equivalent Heat to Power ratio:

Equivalent Heat to Power ratio = New η_{HEAT} / New η_{POWER}

= 52.99 % / 14.30 %

Equivalent Heat to Power ratio = 3.7056

Step 5 Calculate the Qualifying Power Output = CHP_{QPO}:

CHP_{QPO} = CHP_{QHO} / Equivalent Heat-to-Power ratio

= 22206.88 / 3.7056

CHP_{QPO} = 5992.789 MWh

Q22-1 : Electricity and Heat Customers

Part 8: Export of Electricity and Heat

Does your Scheme export Electricity (See GN15.10 to GN15.14): Yes

Does your CHP Scheme export Heat (See GN16.5 - GN16.7): Yes

Q22-2 : Electricity and Heat Customers

The details of non-residential heat customers including the amount of heat supplied to these customers is necessary for CHPQA Certification.

The details of non-residential electricity customers including the amount of electricity supplied to these customers is not necessary for CHPQA Certification, but can be required by the Secretary of State under the Electricity Act 1989 (S98). See GN15.12.

Organisation name:	GFC Rivenhall Pulp
Sector (see GN12.1):	Paper, publishing and printing
Contact name:	Thomas Fairhead
Position held:	Director
Email address:	Fairhead@gent-fairhead.demon.co.ul
Address:	Court of Noke
Town:	Pembridge
County:	Herefordshire
Postcode:	HR6 9HW
Telephone number:	020 7603 7055
Annual electricity supplied (MWh):	113400
Annual net heat supplied (MWh):	155411

For electricity sales, is this company (tick where appropriate):

- (●) Part of the same qualifying group?
- ( ) Not part of the same qualifying group?
- ( ) An electricity supplier?

Organisation name:	electricty supplier (not yet selected)
Sector (see GN12.1):	Power generation
Contact name:	-
Position held:	-
Email address:	AA@AA.AAA
Address:	-
	-
Town:	-
County:	-
Postcode:	-
Telephone number:	
Annual electricity supplied (MWh):	224826
Annual net heat supplied (MWh):	0

For electricity sales, is this company (tick where appropriate):

- ( ) Part of the same qualifying group?
- ( ) Not part of the same qualifying group?
- (●) An electricity supplier?

Q23 : Using CHPQA to claim ROCs or CfD

Part 9: Using CHPQA to Claim Renewable Obligation Certificates or Qualify for Contracts for Difference Support

STATEMENT OF INTENTION TO USE CHPQA TO CLAIM ROCS OR QUALIFY FOR CFD

If a scheme uses renewable fuels and you wish to use CHPQA to claim ROCs or qualify for Contracts for Difference Support, you will need to obtain a GN44 CHPQA certificate.

If you wish to use CHPQA to claim ROCs or qualify for Contracts for Difference Support please select from the dropdown below, if not then please select 'No' and go straight to the end of the submission.

Claim for: CfD

Q24-1 : ROCs and CFD QI Definitions

The QI formulae in Table 2 of GN44 (v4 and v5) apply from 1st January 2014/

- For CHP 'ROC eligible' certification use QI formulae in GN44 (V4)
- For CHP 'CfD qualification' certification use QI formulae in GN44 (V5)

However the earlir Guidance Note 44's QI formulae and associated fuel categories will continue to apply to all schemes for the purpose of claiming ROCs onl, that were in operation or that can demonstrate they reached financial close, prior to 26 July 2012. These earlier QI formulae are reproduced in Table 3 of GN44 (v4).

See GN44(v4-ROCs and v5-CfD) for further clarification.

If your Scheme uses a mixture of fuels you must calculate a weighted average QI definition using fuel fractions calculated in Part 3 section 8.

Fuel type	Fraction Fn	Factors		Weighted Factors	
		Xn	Yn	Fn x Xn	Fn x Yn
Natural Gas		186	115		
Coal		176	115		
Oil	0.0036	176	115	0.63	0.41
Fuel Cells		180	120		
Biogas		193	120		
Syngas		193	120		
Liquid Biofuels		176	120		
Renewable Liquid Waste		176	120		
Biological Solid Wastes	0.9964	350	130	348.74	129.53
Agricultural Biomass		338	130		
Waste Woods		318	120		
Wood Fuels		279	120		
By-product Gases		193	120		
Waste gases or waste heat		193	120		
Non-Renewable Liquid Waste		176	120		
Sum	**1**			**349.37**	**129.94**

Q24-2 : ROCs Quality Index (Projected Annual and MaxHeat Operation)

	X	x	Power Efficiency	+	Y	x	Heat Efficiency	=	QI
Initial Operation (IO)	349.37	x	23.36 %	+	129.94	x	2.60 %	=	84.99
Long Term Annual Operation (LTAO)	349.37	x	23.37 %	+	129.94	x	11.81 %	=	96.99
MaxHeat under LTAO	349.37	x	23.02 %	+	129.94	x	13.30 %	=	97.71

Q25-1 : ROCs and CFD Selected Threshold Criteria

CHP Schemes wishing to claim ROCs or qualify for CfD support will be validated against a QI Threshold of 100 under Normal Operating Conditions. For ROC and CfD eligibility, a CHP Scheme is not required to meet any power efficiency threshold.

QI threshold: 100 under Annual Operation

Power Efficiency threshold: 20 % under Annual Operation

Note: The Self-Assessment for long term operating conditions (i.e. normal operation) should be based on the expected whole year energy utilisation averaged over the Scheme's annual operating hours (see GN3). The only exception is that Residential Community Heating Schemes can be Self-Assessed over a seven-month Heating Season, subject to meeting the conditions set out in GN30.

Q25-2 : ROCs and CFD Initial Annual Energy Inputs and Outputs

The scheme **did not** meet the QI threshold.

Q25-3 : ROCs and CFD Initial Annual Energy Inputs and Outputs

The scheme **did not** meet the QI Threshold of 105 under MaxHeat conditions.

Q27-1 : CHP Qualifying Power Output with Condensing Steam turbine

Part 10: ROCs and CfD CHP_{QPO} calculation (Annual Operation)

NOTES:

- **If a CHP Scheme achieves a QI less than the Threshold, the CHP_{QPO} is calculated. The CHP_{QPO} is the proportion of the power generated that qualifies as an output from 'Good Quality' CHP. See GN26 & GN28.**
- **CHP_{QPO} calculation is based on fuels used, power generated and heat supplied in MWh based on annual data submitted in Part 2. See GN26.**

From Table GN28-1 in Guidance Note GN28, select the most appropriate Z ratio for your Scheme. Complete the statement below:

Step 1 Define Z ratio for the CHP Scheme:

Steam export pressure: 6 bar(a);

ST size: 49.95 MWe;

Z ratio: 5.56

Q27-2 : CHP Qualifying Power Output with Condensing Steam turbine

Step 2 Calculate the Heat Efficiency required to achieve the Threshold QI of 100:

Change η_{HEAT} = 100 x (Change QI) / (Y - (X / Z ratio))

= 100 x (100 - 96.99) / (129.94 - (349.37 / 5.56))

Change η_{HEAT} = 4.49 %

New η_{HEAT} = Change η_{HEAT} + η_{HEAT}

= 4.49 % + 11.81 %

New η_{HEAT} = 16.30 %

Step 3 Determine the corresponding change in power efficiency:

Change η_{POWER} = Change η_{HEAT} / Z ratio

= 4.49 % / 5.56

Change η_{POWER} = 0.81 %

New η_{POWER} = η_{POWER} - Change in η_{POWER}

= 23.37 % - 0.81 %

New η_{POWER} = 22.56 %

Step 4 Determine the equivalent Heat to Power ratio:

Equivalent Heat to Power ratio = New η_{HEAT} / New η_{POWER}

= 16.30 % / 22.56 %

Equivalent Heat to Power ratio = 0.7225

Step 5 Calculate the Qualifying Power Output = CHP_{QPO}:

CHP_{QPO} = CHP_{QHO} / Equivalent Heat-to-Power ratio

= 193783.3128 / 0.7225

CHP_{QPO} = 268212.198 MWh

Q28 : Secretary of State Exemption Certificate

This section must be completed in order to obtain your Secretary of State (CHP) Exemption Certificate.

Please choose one of the options below:

- ( ) 1. A Secretary of State (CHP) Exemption Certificate is not required for this CHP Scheme.
- ( ) 2. Please maintain the validity of the Secretary of State (CHP) Exemption Certificate for this CHP Scheme.
- (•) 3. Please send me the Secretary of State (CHP) Exemption Certificate for this CHP Scheme.
- ( ) 4. Please vary the Secretary of State (CHP) Exemption Certificate for this CHP Scheme.
  It was previously certified as being partly exempt and now subsequently satisfies the conditions for full exemption, or
- ( ) 5. Please vary the Secretary of State (CHP) Exemption Certificate for this CHP Scheme.
  Its efficiency percentage now falls below or rises above the prescribed threshold efficiency percentage.

Your SoS certificate will be sent to you via email. Please supply the email address and contact details below for the nominated individual who you wish to receive your SoS certificate.

Supply email address of nominated individual : fairhead@gent-fairhead.demon.co.uk

Title: Mr. Forname: Thomas Surname: Fairhead

Address: Cort of Noke

Pembridge

Herefordshire

Post code: HR6 9HW

Q29 : Declaration

- I confirm that I am the nominated Responsible Person for the operation of the Scheme described in part 2 of this form.
- I confirm that I have supplied all necessary information as required by the CHPQA Administrator, based on the CHP Scheme described in this form and that all information provided in this form is correct and conforms to the requirements set out in the CHPQA Standard.
- I undertake to inform the CHPQA Administrator should any of the above details change.

I require a Certificate of Energy Efficiency* in accordance with Section 45B of the Capital Allowances Act 2001: Yes

* If a Certificate of Energy Efficiency is required, you must provide a list of identified potential electricity customers and complete Section 21.

Name:
MR. NICK CLARIDGE

Position:
PRINCIPAL CONSULTANT/OWNER'S ENGINEER

Date: 04/02/2016

Tick box to confirm: ☑

Q30 : Additional Comments

If you would like to include any additional comments/details for clarification of your submission, please provide these details below:

The Z-factor of 5.56 is calculated using energy-weighted calculation for annual performance and the Z-factors in GN28 for bleed pressure at the turbine of 13, 6 and 2 bara with corresponding Z-factors of 6.66, 5.25 and 4.44 respectively.