

GUIDANCE NOTE 26

DETERMINATION OF CHP QUALIFYING POWER OUTPUT

QUALIFYING POWER OUTPUT (CHP_{QPO})

GN26.1

A Scheme must achieve a minimum (threshold) QI of 100 (or 95 for a new CHP Scheme during its initial period of operation) for all of its power outputs to be considered an output of Good Quality CHP.

- Refer to GN10 for guidance on QI Criterion.

GN26.2

Schemes that fail to achieve the QI Threshold must calculate CHP Qualifying Power Output (CHP_{QPO}). For Schemes with a QI below the relevant threshold the CHP_{QPO} is annual power generation from a CHP Scheme that would have achieved the relevant QI Threshold of 100 or 95 given the actual annual heat supply. The balance of power is not considered to be generated in Good Quality CHP.

CALCULATING QUALIFYING POWER OUTPUT

GN26.3

The procedure for calculating CHP_{QPO} differs depending on whether the CHP Scheme includes condensing steam turbine(s). These may be either fully condensing or partially condensing (i.e. pass-out) steam turbines.

GN26.4

For CHP Schemes without condensing steam turbines, the basic assumption of the calculation is that for a given fuel input the power output, and hence the Power Efficiency, is fixed. In such cases the only way to improve the QI is to increase the useful heat outputs and hence the Heat-to-Power ratio. The calculation determines the Heat-to-Power ratio that would be necessary to achieve the threshold QI and the CHP_{QPO} is the scaled back power output based on the actual annual heat output and this Equivalent Heat-to-Power ratio.

GN26.5

To determine the CHP_{QPO} where a CHP Scheme **does not** include a condensing steam turbine, the calculation is as follows:

Step 1 Calculate the new Heat Efficiency required to achieve the threshold (QI_{th}):

$$\text{New } \eta_{\text{Heat}} = (QI_{\text{th}} - (X \times \eta_{\text{Power}})) / Y$$

Where:

η_{Power} = Power Efficiency

η_{Heat} = Heat Efficiency

Step 2 Calculate the Equivalent Heat-to-Power ratio.

$$\text{Equivalent Heat-to-Power ratio} = \text{New } \eta_{\text{Heat}} / \eta_{\text{Power}}$$

Step 3 Calculate the Qualifying Power Output

$$\text{CHP}_{\text{QPO}} = \text{CHP}_{\text{QHO}} / \text{Equivalent Heat-to-Power ratio}$$

Where any component of the heat outputs from a Scheme has an uncertainty in excess of the acceptable level of uncertainty that is deemed ‘best practice’ as set out in GN13.10, the CHP_{QHO} must be multiplied by the overall adjustment factor FOH for the purpose of deriving the CHP_{QPO} . FOH must be derived as set out in GN19. In such cases CHP_{QPO} becomes:

$$\text{CHP}_{\text{QPO}} = \text{CHP}_{\text{QHO}} \times \text{FOH} / \text{Equivalent Heat-to-Power ratio}$$

GN26.6

For CHP Schemes that include either fully or partially condensing (pass-out) steam turbine(s), the overall logic is identical but the calculation takes account of the fact that there is flexibility to increase the output Heat-to-Power ratio, and hence the QI, for a given fuel input. This may be achieved by reducing the steam flow to the condensing section of the steam turbine and instead supplying this steam as a heat output. As the heat output increases, the power generated reduces and for CHPQA this trade-off is represented by the introduction of a factor called the Z ratio. GN28 provides details of Z ratio. As for other CHP Schemes, the Heat-to-Power ratio that would be necessary to achieve the QI Threshold is determined and the CHP_{QPO} is the scaled back power output based on the actual heat inputs and this Equivalent Heat-to-Power ratio.

GN26.7

To determine the CHP_{QPO} where a CHP Scheme includes a condensing steam turbine, the calculation is as follows:

Step 1 Determine the Z ratio for the CHP Scheme (refer to GN28).

Step 2 Calculate the new Heat Efficiency required to achieve the QI Threshold.

$$\text{Change in } \eta_{\text{Heat}} = \text{Change in QI} / (Y - (X / Z \text{ ratio}))$$

$$\text{New } \eta_{\text{Heat}} = \text{Change in } \eta_{\text{Heat}} + \eta_{\text{Heat}}$$

Step 3 Calculate the new Power Efficiency required to achieve QI=100.

$$\text{Change in } \eta_{\text{Power}} = \text{Change in } \eta_{\text{Heat}} / Z \text{ ratio}$$

$$\text{New } \eta_{\text{Power}} = \eta_{\text{Power}} - \text{Change in } \eta_{\text{Power}}$$

Step 4 Calculate Equivalent Heat-to-Power ratio.

$$\text{Equivalent Heat-to-Power ratio} = \text{New } \eta_{\text{Heat}} / \text{New } \eta_{\text{Power}}$$

Step 5 Calculate the Qualifying Power Output.

$$\text{CHP}_{\text{QPO}} = \text{CHP}_{\text{QHO}} / \text{Equivalent Heat-to-Power ratio}$$

Where any component of the heat outputs from a Scheme has an uncertainty in excess of the acceptable level of uncertainty that is deemed ‘best practice’ as set out in GN16.10 - GN16.13, the CHP_{QHO} must be multiplied by the overall adjustment factor FOH for the purpose of deriving the CHP_{QPO} . FOH must be derived as set out in GN19. In such cases CHP_{QPO} becomes:

$$\text{CHP}_{\text{QPO}} = \text{CHP}_{\text{QHO}} \times \text{FOH} / \text{Equivalent Heat-to-Power ratio}$$