Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

# Certification Process for High Efficiency CHP
# Decision Paper

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Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

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## CER – Information Page

**Abstract:**

This paper sets out the CER's process regarding certifying high efficiency CHP in accordance with the Electricity Regulation Act, 1999, as amended.

**Target Audience:**

Operators of CHP generators and interested parties

**Related Documents:**

- S.I. No. 499 of 2009
- S.I. No. 299 of 2009
- S.I. No. 298 of 2009
- Decision 2008/952/EC
- Decision 2007/74/EC
- Energy (Miscellaneous Provisions) Act, 2006
- Directive 2004/8/EC
- CER/11/189: Consultation on Certification Process for High Efficiency CHP
- 2011-877-EU : Efficiency reference values in cogeneration
- 2004/22/EC Measuring Instruments Directive

## Executive Summary

The CER has been appointed under the relevant legislation to certify high efficiency CHP ("HE CHP"). Accordingly the CER is now putting in place a standardised process for applications from generators to be assessed for certification as HE CHP. This process involves the review and assessment of applications from existing plants and new plants that have not been certified previously. There will also be ongoing periodic reporting for plants which have been certified and an appropriate auditing regime to ensure the robustness of the certification process.

The certification process is designed to ensure that the plant meets the high efficiency criteria set out in legislation. HE CHP is defined on the basis of primary energy savings (PES).

If the overall efficiency exceeds a defined level of 75% or 80% for 'Combined cycle gas turbines with heat recovery' and 'Steam condensing extraction turbines-based plants' then all of the electricity from the plant is taken into account in the PES calculation. Where this defined level is not met the share of electricity deemed to be produced by the CHP plant for the purpose of the PES calculation is calculated on the basis of the power to heat ratio.

The focus of the EU Directive[1] is to establish a common methodology for the evaluation of CHP as HE CHP based on an economically justifiable demand for heat – i.e. useful heat. Whether or not the heat produced by the unit can be defined as useful heat is a key consideration in the certification process. Therefore, applicants are required to provide details of heat demands and to provide evidence of their economic justification in accordance with this decision.

The CER has concluded that all economically justifiable heat will be considered useful heat ("Approach 1" in the Consultation Paper).

Applicants requesting certification will be processed on request and certified based on available data (actual or projected data). Subsequent to the initial certification all HE CHP units will report annually to the CER setting out whether they have met the high efficiency standards and including key defined parameters based on operational data (where available) for a twelve month period from the date of receipt of certification.

[1] Directive 2004//8/EC on the promotion of cogeneration based on a useful heat demand

Generators who, having been certified, subsequently fail to meet the criteria will be notified they are no longer certified as HE CHP. Such a generator may apply for certification again and will be considered HE CHP once again if the criteria are met based on the operational data[2].

Audits will be carried out, with the selection of the generators to be audited varying from year to year. Large generators will be audited more frequently with smaller generators being randomly selected. Some generators will be specifically selected to verify anomalous, inconsistent or noteworthy applications and/or submissions. Certification may be revoked should material discrepancies be found between a generator's application and the results of the audit.

Applicants will be required to provide:

- details of plant specification;
- demonstration of useful heat demand and that this demand is economically justifiable;
- details of measurement and metering arrangements;
- operational data for twelve months reporting period; and
- calculated parameters.

The reliability and quality of operational data measurements are essential to establishing a robust and non-discriminatory HE CHP certification scheme. The measurement methods used must therefore conform to transparent and objective accuracy and reliability criteria. Details of certification, calibration and accuracy of measurement methods must be provided and must be appropriate to the scale, technology, and type of project involved.

Calculations of efficiency and other key operational parameters are carried out according to methods prescribed in the Act, the Directive and supporting documentation. The principal calculations are:

- electrical, thermal and overall efficiency (all on a NCV[3] basis);
- power to heat ratio;
- electricity from HE CHP; and
- the primary energy savings.

[2] The reporting period shall align with the initial date of receipt of certification unless otherwise agreed by CER.
[3] NCV: Net Calorific Value

Applicants will be required to submit all relevant information to substantiate and support their application and to demonstrate qualification as HE CHP. The CER may require additional information from the applicant in order to certify that the plant produces HE CHP and to validate the necessary calculations in that regard.

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# 1 Introduction

This paper outlines the Commission for Energy Regulation's decision regarding the process for the certification of High Efficiency CHP (HE CHP)**.** This is further to the publication of a consultation on this matter in 2011 (CER/11/189).[4]

Interested readers should refer to that paper where the background to this issue is set out.

[4] Certification Process for High Efficiency Combined Heat and Power, Consultation Paper CER/11/189, http://www.cer.ie/GetAttachment.aspx?id=79e9bd89-c53c-4aa7-bf8c-97237d368e89

## 2 Overview of Key Responses

Twenty one responses were received to the consultation paper. The non-confidential respondents were as follows. All responses not marked confidential are published:

Mc Donnell Farms Biogas Ltd
SEAI
Edina Ltd
Mayo Renewable Power Ltd
Dalkia Ltd
MEGA
CES Energy Ltd
Biotricity Ltd
Bord na Móna
Byrne Ó Cléirigh Consulting
Cré
Greenstar
IRBEA
HDS Ltd
Shannon LNG
Stream Bio Energy
IBEC CHP Ireland
Aughinish Alumina Ltd
Fingleton White & Co. Ltd
2 confidential responses

The main points made by respondents are summarised below. Responses to these key points are also provided except where they raised specific substantive issues that are addressed elsewhere in this decision paper.

### 2.1 Administration

Most respondents who commented on this matter requested that the CER keep the overall certification process simple, transparent, and inexpensive to all stakeholders. Most respondents commented that whatever procedures are adopted by the CER these should result in the minimum amount of regulatory burden and regulatory risk as is possible.

A number of respondents urged the use of some form of minimum size level for HE CHP assessment/certification, citing the examples of CER's reduced requirements for licensing and authorising of generation plant. It was also suggested that the administrative procedures could be classified along the lines of CER/09/099, reflecting the technology type, its stage of development and its scale.

***CER Response:*** *The CER acknowledges the need to keep the administration of the certification regime as straightforward and accessible as possible, while at the same time being robust, credible and meeting the requirements of the legislation.*

### 2.2 Useful Heat: Approach 1 vs. Approach 2

Respondents who commented on this matter were mostly in favour of Approach 1 in the consultation paper[5].

In general respondents considered that the recycling of heat back into the CHP process is an efficient and productive use of heat and should be encouraged. A respondent noted it does not consider there is any text in Decision 2008/952/EC that supports the notion that the EU Commission has taken or supports a position that any "recycled heat", including "re-cycled heat" used to "process fuel" that is then consumed by the HE CHP unit should under all circumstances be denied a classification as useful heat. Another respondent expressed the view that the use of CHP fuel to dry fuel for the CHP should only be considered as meeting the requirement of 'useful heat' for projects where the fuel is a cast off product from wood production e.g. sawmill with low-grade residues.

A number of respondents made the point that the AD process fundamentally requires heat, it cannot occur in the absence of heat. Therefore, heat re-cycled into an AD plant should be considered useful heat.

Some respondents were in favour of Approach 2 in the consultation paper. One respondent considered that heat used in the preparation of CHP boiler feed water or the preparation of CHP fuel should be netted against the total heat export of the plant. This would be similar to the in-house power load of the CHP plant being netted against the total power generated.

[5] Please refer to section 3.3 of CER/11/189.

A respondent considered Approach 2 is reasonable given the intent of the Directive but it is restrictive in the sense the respondent considers it offers no latitude to the development and roll-out time which will be necessary to establish the entire supply chain and heat take-off requirement. It was noted that conventional fuel would not be used to dry out wet biomass fuel typically as it would be economically unviable, therefore use of CHP heat to dry wet fuel would not be a PES, unless the generator can prove that it is from an economic market value perspective.

***CER Response:*** *The CER recognises that the question of treatment of useful heat is pivotal when certifying HECHP and carrying out associated calculations. The CER's decision regarding this issue is set out in section 3 below where the reasoning for this decision is provided.*

### 2.3 Useful Heat – 'Market Conditions'

A number of respondents noted that they do not consider 'at market conditions' to necessarily mean in the absence of support, such as REFIT. A respondent considers that 'at market conditions' here should allow for the fact that support under the REFIT scheme is in fact 'at market conditions' for a biomass plant as this is what is needed to bring such a plant to market. Another respondent also sought clarity on this matter, including whether 'at market conditions' excluded non-financial support/subsidy.

***CER Response:*** *The question of interpretation of 'market conditions' is addressed in section 3.1 of this document.*

### 2.4 Alternative to CHP Information Requested by the CER

One respondent noted that the CER is concerning itself solely with the economically justifiable element of the assessment and that this may result in a shapshot view which does not measure the entire benefits of a project. In this context a number of respondents proposed that the CER should consider the external economic benefits of a project. The respondent also urged the CER to take a broad view of the merits of each individual project.

It was also noted that planning laws may already consider whether a project is viable in economic and environmental terms and where such a consent is issued, perhaps the CER should consider this as a measure of meeting that 'economically justified' test. Along similar lines, another respondent suggested that a business plan for projects should not be necessary as the lending institution due diligence process will ensure that a project is viable. The respondent suggested that a letter of intent from the promoter should suffice in this respect particularly for micro and small scale projects. Another respondent emphasised the importance of ensuring that HE-CHP certification does not become another barrier to development of AD project.

A respondent noted it should further be recognised that CHP plants may be located in remote areas such as landfills, industrial sites or may be local to fuel sources where a 'traditional' user of heat may not exist. Adopting a reasonable and practical approach to the use of heat from remote CHP units will lead to the development of new and appropriate end use for such heat.

A number of respondents noted that the plant operator may have a close relationship with the principle heat user. For instance it may be necessary for financing reasons that the principle heat user become a shareholder in the CHP plant to secure the off take. It must also be noted that trade between neighbouring companies is very common and can be a necessary part of maintaining competitiveness. Some respondents noted that CHP and certain types of heat loads do not exist independently of one another. For example, there is a symbiotic relationship between district heating infrastructure and CHP systems i.e. one could not function and operate without the other. It was requested that the definition of 'commercial interest' in this context be considered further.

***CER Response:*** *The CER notes that in certifying HECHP and carrying out associated calculations, it can only consider matters that are set out in the legislation which applies. Therefore, the CER cannot consider wider issues regarding the costs/benefits of HECHP.*

*Regarding the question of relying on planning decisions, the CER is of the view that it must carry out an assessment of useful heat in the context of the legal definitions relating to this matter and notes that the requirement here is in relation to 'economically justifiable demand' which is defined as that which 'does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration'. Therefore an assessment is required of the useful demand where this is satisfied by a process other than cogeneration. Where parties are developing/have developed CHP plants, planning authorities make decisions regarding the CHP plant and not another means of satisfying the demand for heat. Similarly, where a lending institution carries out due diligence on a proposed project this will be in relation to the CHP project and not the alternative means of satisfying the demand for heat.*

*The timing of initial certification is driven by the applicant. Subsequent review and calculation of the PES is carried out on an annual basis in accordance with requirements under Section 6 of the Energy (Miscellaneous Provisions) Act 2006 which defines 'high efficiency combined heat and power'.*

*For CHP plants supplying heat at market conditions to independent commercial entities with no commercial interest in the CHP plant, the demonstration of an economically justified useful heat demand is more straightforward. Where there is a shared commercial interest the heat demand must be demonstrated to be economically justified in the normal manner as set out in Section 3. This is intended to ease the application process and requirements for CHP plants associated with district heating schemes.*

### 2.5 Assessing Useful Heat – Anaerobic Digestion

A number of respondents made the point that the AD process fundamentally requires heat, as it cannot occur in the absence of heat. It was noted that heat re-cycled into an AD plant should be considered useful heat and as AD requires the heat by definition, AD plant should be considered useful heat automatically.

***CER Response:***

*For anaerobic digestion the heat demand must be demonstrated to be economically justified in the normal manner as set out in Section 3.*

### 2.6 Data Measurement and Metering

Respondents considered that the type of metering/measurement of information required under the CER's certification process must be appropriate to the type and scale of the project and not prove to be too onerous from a financial perspective. A number of respondents requested that CER should allow reverse calculation of fuel contributed based on a certified mix (from commissioning) or using conversion efficiencies of the plant. One respondent suggested that the original commissioning report should be sufficient for Micro and Small plants and another respondent suggested that fuel input should be calculated based on a reverse calculation for all plant less than 2 MW.

It was noted that the requirement to measure feedstock is not widely practical for an AD plant, as the quality and the consistency of the feed material can vary widely. It would also be cost prohibitive, particularly for micro and small scale plants. It was suggested that for an AD operator that a reasonable approximation of the figures may be appropriate where certainty is impractical or too costly.

A respondent noted any metering required should be as supplied with the plant equipment, i.e. ESB Meter. Also there should not be any test equipment required for the annual review. The original commissioning reports should be sufficient for micro and small plants. The accuracy requirements of the equipment for such plants should also not have to be more accurate than +/- 2%.

***CER Response:*** *The CER's decisions regarding data measurement and metering are set out in section 5.3 of this document.*

### 2.7 Certification/Re-Certification and Auditing

A respondent suggested that holders of HE CHP certificates should present their own audit data to the CER and only in a case where the CER elects to carry out an audit or request further information that there is further interaction. One respondent suggested a 90 day period within which the HE CHP certificate holder would have time to correct any error a CER audit of the process uncovers. A number of respondents noted that there should be an option for lodgement of further information subsequent to the initial application, particularly if something was omitted or clarification sought by the CER.

One respondent suggested that the certification process extend over a two to three year period and does not consider that failure to meet the required standard set in a certification should result in automatic loss of the HE CHP certificate.

In general respondents who commented on this matter noted the financial and operating risk that automatic loss of certification holds for parties.

***CER Response:*** *The CER is conscious of the need to avoid creation of unnecessary regulatory risk. Initial certification necessitates examination of 'useful heat' and of the calculation of associated outcomes such as the PES. This matter is further addressed in section 7 below. The PES will be calculated on an annual basis in accordance with section 6 of the Miscellaneous (Energy Provisions) At 2006. Here, HECHP parties will submit calculations and supporting information annually for CER review and approval.*

### 2.8 Guarantees of Origin

It was requested that the CER clarify to what extent the proposed certification process meets Ireland's requirements under Article 5 of Directive 2004/8/EC. It was requested that with the development of a HE CHP certification process it will need to be clarified if all biomass CHP facilities will still be automatically eligible for the GO scheme.

***CER Response:*** *The CER has no role in the provision of guarantees of origin in relation to high efficiency CHP. This is clear from Regulation 14 of Statutory Instrument Number 147 of 2011 in this regard.*[6]

[6] http://www.irishstatutebook.ie/pdf/2011/en.si.2011.0147.pdf

## 3 Useful Heat

There are two principal areas that the CER considers must be addressed when processing an application for certification as HE CHP. This first of these, the question of what qualifies as 'useful heat' is outlined in this section. The second, which involves an examination of the technical data provided by the applicant and requirements around same is outlined in sections 4 and 5.

In order for the CER to certify that a given heat load is useful heat within the definition of the Directive and relevant Irish legislation, the CER must be satisfied that the heating/cooling demand does not exceed that which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration. This requires an assessment by the CER of information provided by the applicant. The onus is on the applicant to prove to the CER that the heat is useful heat.

In the consultation paper the CER outlined two alternative potential approaches regarding the classification of useful heat. Under Approach 1 all economically justifiable heat is considered useful heat whereas under Approach 2 heat that is recycled back into the CHP unit is not considered useful heat. The CER has considered all responses to the consultation and has decided to adopt Approach 1 with regard to the classification of useful heat.

In summary the CER agrees with the view expressed by a number of respondents that there is no specific text in the Directive that heat used to process fuel/or which is 'recycled' in some form back into the CHP generator should under all circumstances be denied assessment as useful heat. Heat loads specifically noted in either the Directive or in EU Decision 2008/952/EC as those that should not be considered as useful heat are clearly not eligible for assessment as useful heat. Therefore all heat loads, other than those referred to immediately above, that are shown to be economically justified in accordance with this decision are considered 'useful heat'. The CER considers that to preclude applicants from presenting their position and supporting information as to why they consider that recycled heat meets the definition of 'useful heat' and associated requirements in that regard could be considered an overly restrictive interpretation of the Directive. There is a strong argument that an interpretation that precluded this would discriminate against co-located plant as argued by one respondent.

The CER notes in passing that Approach 1 is akin to the approach that is taken in the UK to this issue.

### 3.1 Required Information for Assessing Useful Heat

The CER considers that useful heat is heat (or cooling) that exists or would exist in the absence of a CHP plant and which would otherwise be met by other energy generation processes at market conditions. The intention of the Directive is that a bona fide need for heat generation is displaced by the more efficient HE CHP process. The CER therefore considers it necessary and appropriate that applicants must be able to demonstrate that the heat demand is indeed useful heat and would otherwise be satisfied at market conditions by energy generation processes other than cogeneration.

The CER acknowledged in the consultation that the assessment of 'useful heat' has the potential to be a difficult and detailed task. The approach set out below is one that seeks to meet the requirements of the legislation in an appropriate manner, allowing for an appropriate level of assessment by the CER whilst seeking to provide applicants with sufficient guidance as to the nature of the information that is required.

In order for a plant to qualify as HE CHP, the CER must complete an assessment of an objective nature that a useful heat load does/will exist. The test that is required is that the heat demand is 'economically justifiable' as defined in legislation. The CER has no wish to 'over regulate' but it cannot ignore its statutory duties. The approach outlined below is considered reasonable and proportionate. It also entails a certain level of case-by-case assessment. The CER considers that it must put in place a framework that will enable it:

- to assess where relevant the required information (capital costs/ operating costs/input assumptions) relating to the alternative[7] (to CHP) heat generation process presented by the applicant at market conditions;
- to be satisfied that the heat demand is economically justifiable at market conditions in the absence of CHP, and;
- to obtain general information regarding the CHP unit that is or is proposed to be installed.

Having considered the responses to the consultation the CER acknowledges that the term '*at market conditions*' doesn't necessarily exclude direct support or subsidy for the alternative to CHP under an approved scheme, in the absence of the CHP project. For clarity, supports for CHP/ HECHP are excluded here.

[7] Please note that more than one alternative can be provided here.

As a result of the necessary case-by-case nature of the assessment, the CER may request information which is additional to that below.

### *3.1.1 Information regarding the CHP Plant*

A process flow diagram or piping schematic indicating the CHP plant and the heat loads claimed as useful heat demands should be provided. This should include any other heat supply (e.g. boilers), an indication of the boundary around the CHP plant, supply to useful heat end uses and location of heat metering. Where heat is provided by extraction steam the process flow diagram should indicate points of extraction and pressure and temperature. A description of the annual heat profile, daily heat profile, the heat load duration curve and the sizing of the CHP plant relative to these should be provided.

### *3.1.2 Information Regarding the Alternative to CHP*

#### *A: Existing Heat Demands served by other than CHP*

For cases where the heat demand is already being served by means other than CHP, applicants should submit information regarding the current means by which the heat demand is being served. Evidence should be provided to the CER that the heat load exists and that the heat load is being met by a heat generation process as part of an economically justifiable business at market conditions. Once this is demonstrated in such cases, a useful heat load exists.

Where a business is, at the time of its application for certification, meeting its heat load with CHP, the CER assessment of the alternative (to CHP) outlined below is required to identify that the heat load is required and economically justifiable at market conditions independent of CHP.

#### *B: Other Heat Demands*

Where the heat demand identified is either not yet in existence or is being served by CHP an assessment of the business (using the hypothetical alternative to CHP) is needed to show that the heat load is required and economically justifiable.

A techno-economic feasibility study providing a high level overview of the business that will use the heat should be provided. This should include key high level information on the type of business involved, capital costs, operating costs, market revenues and rate(s) of return for the business that will be using the heat demand at relevant market conditions. An overview of the technical aspects of the business should also be provided. This is an overview for the CER's information of the business which will use the heat demand, not an overview of the heat demand itself. The CER reserves the right to request further information in this regard if it deems necessary.

In addition, a net present value (NPV) calculation should be provided for the business that will use the heat. An Internal Rate of Return (IRR) should also be calculated for the business over a 15 year term. Here, a positive NPV coupled with an IRR that is at least equal to the prevailing Weighted Average Cost of Capital (WACC) employed by the CER in relation the regulated electricity network[8] must be shown in order for the 'economically justifiable demand' criteria to be met.

The CER considers that the above techno economic feasibility study coupled with the NPV and IRR calculations, is necessary to ensure that the case being presented is plausible and that bona fide heat loads as intended under the Directive are at issue. These requirements, based on commonly used tools for project assessment, are intended to act as an 'economic sanity check' in that regard. The CER wishes to ensure that the economic justification presented using the alternative heat generation process is reasonable and premised on assumptions at market conditions. Where there are clear, comparable examples of similar businesses using heat generation processes which are analogous to that which would serve the demand in the absence of CHP, examples of same should be provided where possible.

Therefore the CER requires the following information in respect of the heat demand be provided:

- a catalogue of heat loads claimed as useful heat, which should include the following;
  - *For industrial processes* (i.e. heat demands other than space heating/cooling and hot water):
    - the annual volume of production of products whose production process uses the heat;
    - the exact consumption of heat in the various stages of that production process and temperature at which heat is required;
    - reference to industry standards detailing benchmark or normal heat demands (e.g. BAT Reference Notes[9]);

[8] Please see CER/10/206 for the current WACC as determined by the CER.
[9] BAT reference notes for a range of industrial processes are available - http://eippcb.jrc.es/reference/

- details on historic heat demands and fuel and heat supply for existing processes; and
- where the useful heat is used in conjunction with an absorption chiller to provide a cooling load, the above information should be provided for the cooling load together with details of the absorption chiller (rated capacity, output, range of operating temperatures).

➢ *For commercial applications* (i.e. supplying space heating/cooling and hot water):

- nature and use of premises (e.g. hotel, office, retail etc);
- floor area, year of construction;
- reference to benchmark data on typical heat loads (e.g. CIBSE Guide F); and
- where the useful heat is used in conjunction with an absorption chiller to provide a cooling load, the above information should be provided for the cooling load together with details of the absorption chiller (rated capacity, output, range of operating temperatures).

➢ *For district heating applications*:

- nature of end uses;
- method of metering and billing of end users. Details of heat metering system and data collection system used;
- demonstration that the cost of heat supplied is comparable to the cost of heat provided by alternative fuels or processes at market conditions;
- state whether the CHP plant operator has or shares a commercial interest with any of the heat customers or procures goods or services from any of the heat customers, and;
- for existing systems records of total heat delivered to the district heating scheme and billing to end users.

- quantify the heat loads in the entire process, and provide confirmation that the heat demand intended to be met by the CHP process does not exceed the demand outlined for the alternative heat generation process;
- where relevant, costings at market conditions for the alternative heat generation process, including relevant capital costs for the unit, annualised capital costs, rates of return and operating costs. The basis for all costings should be provided;
- where relevant the quantity and cost of fuel to supply the useful heat demand at relevant market conditions[10]; and
- where there is more than one economically justifiable alternative, information on such additional alternatives may be provided.

[10]The value of the processed fuel should be comprehensively established indicating the current market in terms of market size and average price. References to price indices, market studies or other objective information on markets and prices should be included.

Where the useful heat demand claimed relates to the processing of fuel, including where a proportion of which is used/proposed to be used in the CHP plant, the following must be provided where relevant for the alternative (to CHP) heat generation process:

- quantify the amount of fuel produced or treated by the process which would not be re-used/recycled into the CHP and the heat demand associated with processing fuel that is not re-used/recycled;
- added value of fuel generated or treated by the process for the above use at market conditions and the basis for this added value;
- quantify the amount of fuel produced or treated by the process which is intended to re-used/recycled into the CHP plant and the heat demand associated with processing fuel that is re-used/recycled, and outline the added value of fuel generated or treated by the process at market conditions which is being put to a comparable use and the basis for this added value;
- avoided cost of disposal of feedstock (including processing requirements) or value of feedstock at market conditions as appropriate; and
- detail the counterfactual route for use, processing, or disposal of the feedstock (e.g. landfilling, land spreading) and associated costs or revenues and the basis for these costs/revenues;
- where there is more than one economically justifiable alternative, such additional alternatives may be demonstrated.

### 3.2 Useful Heat – Anaerobic Digestion

Anaerobic Digestion will be assessed, as outlined above in this section, in the same manner as other processes with a heat demand. The CER must be convinced that the heating demand does not exceed that which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration. In the case of anaerobic digestion, demonstration of an economically justifiable heat demand may include avoided waste disposal costs and regulatory requirements for heat treatment of wastes.

Information provided by all applicants will be assessed by the CER. The onus is on the applicant to prove to the CER that the heat is economically justifiable heat.

# 4 Calculation Methodology

## 4.1 Introduction

This section deals with the calculation methodology based around the principles of determining primary energy savings (PES), the power to heat ratio and determination of electricity from HE CHP as laid out in the Act, the Directive and associated decisions.

The calculation methodology will derive the following calculated parameters:

- Power to heat ratio;
- Primary energy savings (PES);
- Determination of HE CHP electricity as per Schedule 3 of the Act.;
- Electrical efficiency;
- Heat efficiency; and,
- Overall efficiency.

The certification and reporting processes for HE CHP is designed to collect robust and reliable operational data and information required to calculate efficiency and other key indicators of HE CHP plant operation. These processes will address the requirements for certification and the CER's obligations as provided for in Irish legislation.

In the first instance, applicants will have to demonstrate to the CER that the heat demand is 'useful heat', as defined in Directive 2004/8/EC and outlined in section 3.above.

The calculation methodology and the technical parameters determining qualification as HE CHP are based on those defined in legislation. Qualification or otherwise is determined primarily on the basis of overall efficiency and Primary Energy Savings.

## 4.2 Definition of High Efficiency CHP (HE CHP)

The Act defines HE CHP as follows:

> 'high efficiency combined heat and power' means combined heat and power production which on an annual basis—
>
> > (*a*) in the case of small scale combined heat and power and micro-combined heat and power, achieves primary energy savings calculated in accordance with paragraphs 3 and 4 of Schedule 3, and

(*b*) in the case of all other combined heat and power, achieves primary energy savings calculated in accordance with paragraphs 3 and 4 of Schedule 3 of at least 10 per cent compared with the references for separate production of heat and electricity;

HE CHP is defined on the basis of primary energy savings (PES). If the overall efficiency exceeds a defined level of 75%, or 80% for 'Combined cycle gas turbines with heat recovery' and for 'Steam condensing extraction turbines-based plants', then all of the electricity from the plant is taken into account in the PES calculation. Where this defined level is not met the share of electricity deemed to be produced by the CHP plant for the purpose of the PES calculation is calculated on the basis of the power to heat ratio.

PES is a function of the heat efficiency and the electrical efficiency of the process relative to the reference values[11] for separate heat and electricity production. Key to this equation is the amount of heat that can be defined as 'useful heat'. The following section discusses each component of the calculation and parameters in detail.

### 4.3 Overall Efficiency

Overall efficiency is calculated as the ratio of energy outputs (electricity, mechanical energy and useful heat) to fuel input, both measured over the same defined reporting period.

$$Overall\ Efficiency = \frac{Electricity + Mechanical\ Energy + Useful\ Heat}{Fuel\ Input}$$

[11] Refer to relevant European Commission decision for the EU harmonised efficiency reference values which apply. This is currently 2011/877/EU.

If the overall efficiency is above the levels set in Annex II of the Directive all the measured electrical and useful heat output is taken into account when calculating the PES and determining qualification and HE CHP. The levels are:

- 80% for 'Combined cycle gas turbines with heat recovery' and 'Steam condensing extraction turbines-based plants', and
- 75% for the other types of CHP units,

If the overall efficiency does not meet the above criteria, the CHP and the non-CHP electricity outputs will have to be determined on the basis of the power to heat ratio. It should be noted that the power to heat ratio will be calculated in every case but the output of the calculation will only be used where the overall efficiency is less than the above levels.

### 4.4 Power to Heat Ratio

The actual power to heat ratio is determined based on the measured actual heat and electricity outputs when the plant is operating in 'full CHP mode' i.e. when the useful heat output is maximised. The power to heat ratio is based on measured data over the certification period. The plant operator shall measure and record the electricity and useful heat outputs during periods of operation with no heat rejection and with maximum heat output. A test report detailing the test process and measurements should be provided as an attachment to the application form. The actual power to heat ratio ($C_{actual}$) is then determined as:

$$Actual\ Power\ to\ Heat\ Ratio\ (C_{Actual}) = \frac{Electricity\ Output\ measured\ in\ HECHP\ Mode}{Useful\ Heat\ measured\ in\ HECHP\ Mode}$$

For CHP plant with no dump load facility and without the capacity to operate in condensing mode or otherwise alter the power to heat ratio, the actual power to heat ratio will be the ratio of annual electricity generated to useful heat. CHP plant which seeks certification on the basis of design data prior to operation should submit the design power to heat ratio ($C_{design}$) in full CHP mode.

The electricity from high efficiency CHP is then:

$$E_{CHP} = C_{Actual} \times H_{CHP}$$

Where:

- $E_{CHP}$ is the amount of electricity form cogeneration
- $C_{actual}$ is the power to heat ratio
- $H_{CHP}$ is the amount of useful heat from cogeneration (calculated for this purpose as total heat production minus any heat produced in separate boilers or by live steam extraction from the steam generator before the turbine.

If the actual power to heat ratio of the cogeneration unit is not known, the plant operator can use the default power to heat ratio, as specified in Annex II of the Directive to calculate CHP electricity. In that case however, the operator must submit the reasons for not having a known actual power to heat ratio, the period for which data are lacking and the measures taken to remedy the situation.

### 4.5 Non-CHP Fuel

In order to calculate the PES for the CHP electricity, the non-CHP fuel must be calculated and deducted from the total fuel to determine the 'fuel input used to produce the sum of useful heat output and electricity from CHP'.

This is calculated as the amount of non-CHP electricity divided by 'the plant specific efficiency value for electricity production'.

The means of calculating the 'the plant specific efficiency value for electricity production' is not prescribed in the guidelines on the implementation of Annex II (2008/952/EC). However, the approach taken in the DG TREN report[12] published in 2007 is to calculate the efficiency on the basis of production at maximum electrical output, and is consistent with 2008/952/EC. Accordingly, that is:

$$Efficiency\ Electricity\ Production = \frac{Electricity\ output\ (\ electricity\ generation\ mode)}{Fuel\ input\ (electricity\ generation\ mode)}$$

For CHP plants without power loss[13] the plant specific efficiency for electricity generation is the same as the electrical efficiency. For CHP plant with power loss and for which the electrical efficiency varies according to the heat generation, the plant specific efficiency for electricity production should be determined by operation of the plant at maximum electrical output or by the determination of the power loss coefficient. A test report detailing the measurements and calculations determining the plant specific efficiency for electricity production should be provided as an attachment to the application. Although it is considered unlikely to arise, small scale plants with power loss may determine the plant specific efficiency for electricity production based on generic performance data provided by the manufacturer.

The non-CHP fuel is then:

$$non-CHP\ Fuel = \frac{E_{total} - E_{CHP}}{Efficiency\ for\ Electricity\ Production}$$

[12]Guidelines for Implementation of theCHP Directive 2004/8/EC: Guidelines for implementation of Annex II and Annex III - March 2007

[13]The term 'power loss' relates to the relationship between the reduction in electrical power output as heat output is increased in certain types of CHP (for example steam condensing-extraction turbines) and is used with the same meaning as in the DG TREN Guidelines for Implementation of the CHP Directive of March 2007. CHP plants with power loss are required to provide a test report establishing the efficiency at maximum electrical output, the efficiency at maximum heat output and the power loss coefficient. These parameters are necessary for the calculation of electricity production from high efficiency CHP and primary energy savings as detailed in the consultation document and the legislation.

### 4.6 Primary Energy Savings (PES)

As noted above the essence of the determination of HE CHP is PES. This is determined according to the following formula.

$$PES = \left( 1 - \frac{1}{\frac{CHPH\eta}{refH\eta} + \frac{CHPE\eta}{refE\eta}} \right) \times 100$$

Where:

CHPHη Is the heat efficiency of the combined heat and power defined as annual useful heat output divided by the fuel input used to produce the sum of useful heat output and electricity production from combined heat and power.

refHη Is the efficiency reference value for separate heat production

CHPEη is the electrical efficiency of the combined heat and power, defined as annual electricity production from combined heat and power divided by the fuel input used to produce the sum of useful heat output and electricity production from combined heat and power.

refEη Is the efficiency reference value for separate electricity production

The reference values for the separate production of electricity and heat should be taken from the Commission Decision establishing harmonised efficiency reference values for separate production of electricity and heat (20011/887/EU) with the application of appropriate correction factors contained therein. Climate adjustments therein are based on annual average temperatures.[14]

The electricity generated from the plant shall be deemed to be from HE CHP if the PES exceeds the prescribed levels:

- For CHP with a capacity < 1 MWe, PES > 0
- For CHP with a capacity ≥ 1 MWe, PES ≥ 10%

[14] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:343:0091:0096:EN:PDF

### *4.6.1 Calculation Methodology Flowchart*

The calculation methodology is summarised in Figure 1 below.

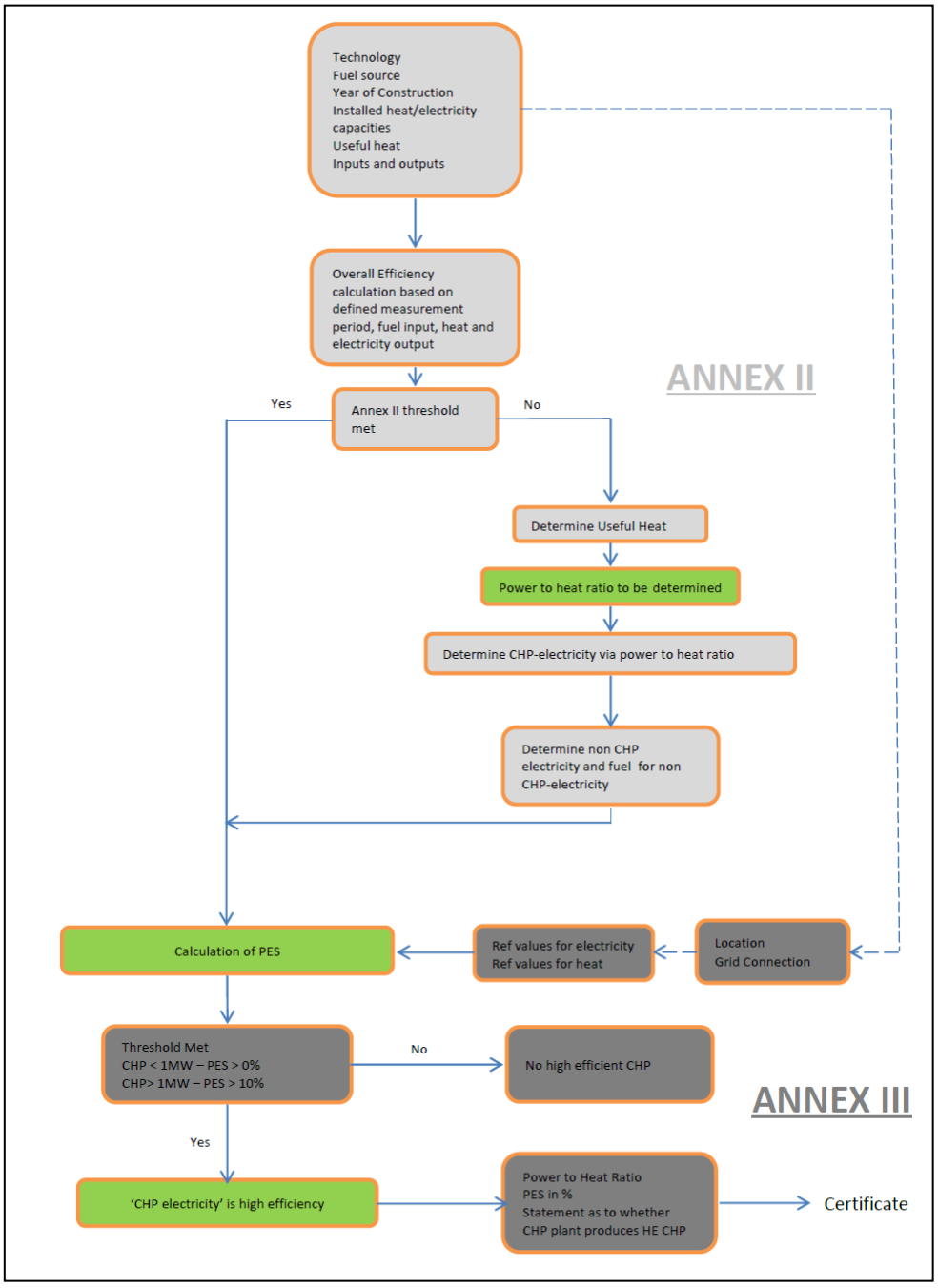


**Figure 1 – The Calculation Methodology[15]**

[15] Note that references to Annex II and Annex III in Figure 1 relate to the annexes in the Directive.

### *4.6.2 Worked Examples*

Worked examples of potential qualifying HE CHP installations are provided in Table 2 following with full details in Appendix D.

| Plant | 1<br>ICE | 2<br>GT | 3<br>CCGT | 4<br>Biomass CHP | 5<br>WTE |
|---|---|---|---|---|---|
| **Design Specification** | | | | | |
| Rated Electrical Output | 900 kW | 15 MW | 270 MW | 5 MW | 20 MW |
| Rated Heat Output | 1,000 kW | 24 MW | 280 MW | 3 MW | 15 MW |
| **Operational Data** | | | | | |
| Annual Electricity Generation (MWh/yr) | 4,500 | 117,000 | 1,574,000 | 24,000 | 100,000 |
| Annual Useful Heat(MWh/yr) | 5,200 | 188,000 | 1,488,000 | 14,400 | 90,000 |
| Power to Heat Ratio | 0.86 | 0.55 | 0.9 | 0.6 | 0.83 |
| **Calculated Parameters** | | | | | |
| Overall Efficiency | 75% | 73% | 71% | 35% | 39.6% |
| High Efficiency CHP Electricity | 4,500 | 103,400 | 1,339,200 | 8,640 | 75,000 |
| % of Total Electrical Output | 100% | 88% | 85% | 36% | 75% |
| PES | 14% | 12% | 15% | 12% | 10% |

**Table 2 – Examples of HE CHP**

The examples provided are as follows:

1. Internal combustion engine operating primarily in ‘high efficiency CHP’ mode (for example on large commercial or small industrial site)

2. Gas turbine operating primarily in ‘high efficiency CHP’ mode (for example on large industrial site)

3. Combined cycle gas turbine operating primarily in ‘high efficiency CHP’ mode (for example on large, energy intensive industrial site)

4. Biomass CHP plant operating on an industrial site or adjacent to a significant heat load

5. Waste to energy plant adjacent to a significant heat load or district heating scheme)

It is notable that in only one case, that of the internal combustion engine, does the CHP plant meet the efficiency criteria of 75% / 80% for electricity production from HE CHP specified in the CHP Directive and Schedule 3 of the Electricity Act 1999. In all other cases the electricity from high efficiency CHP must be calculated and the PES calculated on the basis of fuel used for HE CHP production. These examples are for illustrative purposes.

# 5 Calculation Methodology Information Requirements

## 5.1 Introduction

The information requirements for an application for certification as HE CHP and associated reporting vary depending on the scale and nature of the CHP plant and the type and nature of the useful heat load. This section deals with the information requirements for the certification of the plant as HE CHP based on the calculation methodology outlined in section 4.

The Directive specifies the following three scales of CHP plant:

- Large scale: ≥ 1 $MW_e$
- Small scale: ≥ 50 $kW_e$ and < 1 $MW_e$
- Micro scale: < 50 $kW_e$

Certification of both small scale and large scale CHP must be based on actual operational data taken from measured inputs and outputs collected over the reporting period. For new plants for which operational data is not available, certification can be based on expected operational values.

The Directive provides that PES and electricity generation from micro-CHP may be calculated on the basis of certified data. Certified performance data should be according to an appropriate test standard and certified by an appropriately accredited test facility.

For CHP plants that are capable of dumping heat, operating in condensing power generation mode or otherwise altering the power to heat ratio, additional information on operating parameters when operating in HE CHP mode and at maximum electrical output must be provided. This will enable the calculation of the 'actual power to heat ratio' and the plant specific electrical efficiency.

HE CHP plants will typically be certified on the basis of operational data for a twelve month period . CHP plants that have been in operation for less than twelve months , or for which twelve month's operational data is not available, may be certified on the basis of design data and available operational data. Where twelve months' operational data are not available reasons for the lack of data should be provided and actions to ensure the future availability of data should be detailed. The CER may request that an applicant re-submit an application that does not include all the requested information.

CHP plants that are not yet installed or operational may be certified as HE CHP on the basis of design data. This in no way guarantees that future evaluations, based on operational data, will result in continued certification.

### 5.2 CHP Plant Design

The following information is required for all applicants:

- description of the CHP plant;
- primary fuel source (and secondary source where applicable);
- prime mover type, make, model and rating;
- heat loads and demonstration of economically justified useful heat demand;
- schematic diagram of CHP indicating boundaries as per Annex II of the2008/952/EC and location of meters and measurement devices; and
- specification of measurements and recording provisions including quality of meters and calibration certificates.

### 5.3 Operational Data and Measurement

The reliability and quality of operational data measurements are essential to establishing a robust and non-discriminatory HE CHP certification scheme. The measurement methods used must therefore conform to transparent and objective accuracy and reliability criteria.

While it is required that certification is carried out on the basis of actual measured data (2008/952/EC – Article 5.3), it is recognised that measurements and metering arrangements should be appropriate to the scale, complexity and type of CHP installations. For CHP plant using wastes, residues or other fuel inputs with varying quality and NCV, and particularly small scale CHP using these fuels, the particular complexity of measuring fuel input is recognised.

Large scale CHP is expected to have accurate and reliable metering of fuel usage and electricity and heat generation and applications can be based on actual metered data. It is expected that metering should be of a defined accuracy and resolution according to relevant standards and that calibration certificates or type approval certificates can be made available.

Small scale CHP is required to be provided with metering. However it is possible that this metering may be less comprehensive than that installed in large scale CHP. Although the Directive and associated decisions do not specify required accuracy for meters, it is considered that all meters and measurement devices should be calibrated, tested and capable of measuring to a reasonable level of accuracy. Applicants should provide details of the testing and calibration of metering including manufacturer's specification and other available information.

Operational Measurements required as per Part IIa of the application form are:

- Fuel input on a net calorific value (NCV) basis. Natural gas NCV should be reported as a weighted average of the gas NCV reported by Bord Gáis Networks or an approved natural gas undertaking. Oil and LPG NCVs should be on the basis of supplier's information.

  Fuel input for fuels of varying quality, composition and moisture content may be measured indirectly by determining the energy balance for the plant. For large scale plant this shall include a determination of combustion efficiency based on flue gas analysis. The indirect measurement should be correlated to measurement of fuel input by mass or volume and by NCV.

  Where an operator seeks certification on the basis of indirectly measured fuel input, details of the proposed measurement regime should be provided.

  In general, for small scale plant with a fixed electrical conversion efficiency using a fuel of varying quality (e.g. an internal combustion engine fuelled by biogas), the fuel input may be calculated primarily on the basis of electrical output and engine efficiency.

- Electricity generation measured at the generator terminals both over the reporting period and over the period(s) of operation in HE CHP mode, where applicable.

  For small scale plant directly connected to the electricity network, that is where the only loads are parasitic loads associated with the CHP, the electricity generation may be measured by adjusting the net metered output for parasitic loads if deemed acceptable by the CER. The acceptability will be assessed on a case by case basis according to the accuracy and reliability of the adjusted measurement, the scale of the plant and the cost of additional metering at the generator terminals.

- Useful heat output measured as indicated on the process flow and piping diagram both over the reporting period and over the period(s) of operation in HE CHP mode, where applicable.

  For steam boilers with condensate return, the heat content of the condensate returned must be deducted from the useful heat output. Applicants shall specify the method used to determine the rate of condensate return and record the energy content of returned condensate. For small scale CHP plants the condensate return may be estimated rather than measured.

In general measuring instruments should comply with the provisions of the Measuring Instruments Directive 2004/22/EC ("MID") and the detailed requirements for meter types specified in Annex MI of the Directive. Relevant provisions are outlined in Table 1.

| **Measuring Instrument** | **Relevant Annex to MID** |
|---|---|
| Gas meters | Annex MI-002 |
| Active electrical energy meters | Annex MI-003 |
| Heat meters | Annex MI-004 |
| Measurement of quantities of liquids other than water | Annex MI-005 |
| Exhaust gas analysers | Annex MI-010 |

**Table 1 –Summary of Relevant Measurement Specification in the MID**

The applicant should detail the make and model of the relevant meter identified, specify the class to which the meter conforms and provide relevant supporting documentation (e.g. calibration certificates, type approval certification, manufacturer's specification). Where the measurement does not conform to the relevant provisions of the MID, the plant operator shall detail relevant standards (IS, EN or ISO) to which the measurement conforms and detail the class where applicable.

For measurement of inputs and outputs not covered by the MID, the following requirements apply.

- Steam meters should have an accuracy of ± 2% of measured flow. While there is a range of methods of measuring steam flow, it is expected that the most common are differential pressure meters (orifice plate, venturi and nozzle). Meters of this type should conform to ISO 5167. Where meters of other types are used, details of meter accuracy and standards to which the meter conforms should be provided. Manufacturer's data sheets should be provided and calibration certificates should be available if requested.

- Solid fuels should be measured by scales or belt weighing machines and measurements of continuous input by mass should be correlated with delivery records.

The fuel should be analysed for calorific value by external accredited laboratories at appropriate intervals. The moisture content should be analysed for representative samples. This analysis may be carried out internally but should be validated by external analysis by an accredited laboratory at appropriate intervals. It is expected that this would be carried out as a matter of routine operations management and operators applying for certification should provide details of the proposed fuel sampling and analysis regime.

For small scale plant, that is plant with a capacity of less than 1 $MW_e$, fuel input may be calculated indirectly from plant efficiency provided this is correlated with delivery records and NCV data.

- For gaseous alternative fuels (e.g. biogas), samples should be taken for external analysis by an accredited laboratory at appropriate intervals. Continuous gas analysis may also be carried out and the calorific value determined according to the composition of the gas.

  For large scale plant measuring energy input using indirect measurement, the energy input should be correlated with measured fuel input by volume and NCV.

- Liquid or other alternative fuels not conforming to a relevant standard should be sampled and analysed for NCV at appropriate intervals.

### 5.4 Performance Indicators

Applicants are required to calculate the principal performance parameters following. Spreadsheet calculation templates are published alongside this decision paper. The performance parameters required are:

- Electrical efficiency, thermal efficiency and overall efficiency
- Actual power to heat ratio
- Electricity from HE CHP
- Primary energy savings (PES)

# 6 Application Process and Annual Reporting

## 6.1 Applications for Certification

Parties applying for certification must submit a completed application form and provide relevant supporting documentation to the CER for review and evaluation. This includes information regarding 'useful heat' as set out in this decision paper. The timing of submission of applications for certification is a matter for parties themselves. Applications can be made on the basis of forecast operation/data for an annual period for plants not yet built or on the basis of ex-post operational data for an annual period for existing plants. Evaluations may require meetings with applicants and site visits. The application form is set out in Appendix B.

The processing of initial applications will involve checking for completeness in the first instance, reviewing the information provided in respect of useful heat loads, the heat load profile, and also examining the quality of the supporting documentation (for example, assessing the adequacy and appropriateness of metering and measurement). The operational data, where necessary to submit, will be checked for anomalies (e.g. large variations in efficiency) and the efficiency calculations submitted checked for accuracy. The CER will request outstanding information from applicants where necessary.

The submission should be made in electronic form and information that cannot be submitted electronically may be submitted in hard copy. Note that a signed original application form must be submitted in hard copy. Once the evaluation is complete the applicant will be issued with a certificate or will be informed in writing of the reasons why the application was unsuccessful.

Where certification is issued pre construction of the plant, it may be necessary to review this certification closer to the commissioning date for the plant if matters such as the plant design or the use of heat change from that submitted. The onus is on parties to alter the CER of such changes in such cases.

Where a certificate is issued, this certification will remain in force until such time as the CER revokes it due to failure to meet requirements regarding HECHP under the annual reporting process (see below). Where certification is revoked, parties may reapply for certification for the next annual period of operation.

### 6.2 Certification

The certificate issued to successful applicants will state that the plant in question has been certified by the CER as high efficiency CHP from the date of issue of the certificate. It will also refer to annual reporting requirements. Please see the sample certificate set out in Appendix F

### 6.3 Annual Reporting

Where a certificate has been received, the onus is on parties to submit annually reports to the CER within two calendar month of the anniversary of the date of issue of their certificate. These reports will be based on independently audited information regarding the operation of the plant for an annual period commencing on the anniversary of the date of issue of their certificate.

The template set out in Appendix C should be completed. Here, based on audited actual operational data, parties must calculate and provide the parameters set out in section 4 of this paper, namely, the electrical, thermal and overall efficiency, the actual power to heat ratio, the electricity from HECHP and the PES. Parties must sign the declaration set out in that Appendix confirming that key parameters submitted in the context of their application for certification under 7.1 have not changed including the plant design, useful heat load type and measurement arrangements.

### 6.4 Review of Useful Heat

Once certified, the CER reserves the right to review the certification of a heat load for a plant as useful heat within the meaning set out in the Directive, the relevant Irish legislation and this Decision Paper. The CER considers this may be appropriate, for example, if the heat load serves a significantly different purpose from that certified as useful heat by the CER, or if the business to which the heat load is attached materially changes from that used to certify the heat load as useful heat.

### 6.5 Implementation Post Decision Paper

Complete applications received will be processed on a first come first served basis. Given the potential for varying degrees of complexity and novelty, this does not necessarily mean the first completed application received will necessarily be the first application to be certified. This approach avoids the potential for more complex applications to unnecessarily hold up others. The same approach will apply to review of annual reports where relevant.

## 7 Auditing Regime

The CER reserves the right to conduct independent audits of certified plants from time to time. All operators of certified plants must facilitate the audit process and sign a declaration to that effect.[16] Audits will ensure that the CHP plant is designed, metered, operates and performs as per the details provided in the application and that the plant meets the criteria for qualification as HE CHP on an ongoing basis.

The auditing regime will be appropriate to the scale of CHP plants certified as HE CHP and will include auditing as follows:

- large scale plants certified as HE CHP will be audited from time to time on the basis of random sampling;
- auditing of selected certified HE CHP plants triggered by anomalies in performance data submitted or other matters brought to the attention of the CER that it is deemed merit the carrying out of an audit; and,
- newly commissioned HE CHP plants will be specifically selected for audit.

Audits will typically involve a site-based evaluation of a registered HE CHP plant but may include any activity or requests for information to confirm the validity of applications for registration and performance data submitted. The CER may require spot audits and this may necessitate site visits by the CER and/or its agents.

A site-based audit will include:

- Confirmation of plant design - name plate make, model and rating of all components.
- Review of commissioning records and performance parameters measured during commissioning.
- Review of metering arrangements, location of meters and name plate make and model of meter where available. Documentation including meter calibration certificates will be inspected. Record of all meter readings from meters.

[16] Please refer to the application forms in the Appendices to this document.

- Confirmation of useful heat demand (i.e. identification of the demand that boilers would otherwise have provided), confirmation that the demand exists independently of the CHP plant and is not being in some way wasted. This will not necessarily relate to the date the audit is conducted but is a verification that for the periods the plant has been certified as having a useful heat load, that the heat load exists at the site, as disclosed to the CER in the relevant application(s and in ongoing reporting to the CER.

- Inspection of piping arrangements and distribution of heat to 'useful heat' loads and validation of schematic and 'as built' pipe work drawing.

- Inspection of data acquisition and recording arrangements and verification against meter readings where possible.

- Record of operational data (from meters and from data acquisition system) during period of audit

    - Fuel input at intervals (e.g. 30 min)

    - Electricity generation

    - 'CHP heat' output and any 'non-CHP heat' output

- Calculation of performance parameters on the basis of total meter readings and meter readings recorded during the period of the audit. Investigation and comment on any discrepancies between data submitted to the CER and observed data and performance.

- Identification of factors that may affect CHP efficiency (e.g. lower than design heat loads).

Where small inaccuracies are found at a site relative to the information provided to the CER for HE CHP certification and where these inaccuracies are not considered material the CER may request that such inaccuracies are addressed in time for the next annual HE CHP certification and that the relevant party confirm same in the relevant annual report to the CER.

The CER considers it appropriate that where there are material inaccuracies found at a site relative to the information provided to the CER for the purposes of HE CHP certification (substantially different type of useful heat load to that submitted to the CER for HE CHP certification, no useful heat load where CER was informed there was, inadequate metering arrangements etc), this may result in revocation of the HE CHP certificate.

# 8 Conclusion

The CER has been appointed under the relevant legislation to certify high efficiency CHP ("HE CHP"). Accordingly the CER now puts in place a standardised process for applications from generators to be certified as HE CHP and for ongoing reporting in that context. This process involves application for existing and new plants that have not been certified previously, annual reporting of those plants previously certified and an auditing mechanism to ensure the robustness of the certification and reporting processes.

Applicants for certification as HE CHP will be required to:

- Demonstrate that the heat load is useful heat within the meaning of the Directive, Irish legislation and the proposed required criteria set out in this paper;
- complete and submit the relevant application forms and provide the required operational and supporting data;
- maintain operational records and where appropriate install metering and measurement systems where necessary;
- provide full access to operational data; and
- provide access and facilitate inspection of plant and records by auditors appointed by the CER.

The calculation methodology is based around the principles of determining PES, the power to heat ratio and determination of electricity from HE CHP as laid out in the Act, the Directive and associated decisions. The principal results of the calculation methodology will be:

- Power to Heat Ratio
- Primary energy savings (PES)
- Determination of HE CHP electricity as per Schedule 3 of the Act.

The calculation methodology will also derive the following calculated parameters:

- electrical efficiency;
- heat efficiency;
- overall efficiency;

In addition to application for certification, parties must submit periodic reports based on audited information to the CER as set out in section 6.3 of this decision paper.

## Appendix A: Application Checklist

| | |
|---|---|
| **CHP Plant Design** | |
| Completed application form Part I | ☐ |
| Evidence of prime mover rating | ☐ |
| Process flow diagram and piping diagram indicating useful heat demands, dump loads and metering arrangements | ☐ |
| **Useful Heat** | |
| Catalogue of useful heat loads and reference to standard loads (e.g. kWh per unit production, kWh/m2 etc) **and/or** | ☐ |
| Demonstration of economically justifiable heat load | ☐ |
| **Measurement Details (as identified on piping diagram)** | |
| Measurement/metering arrangements for fuel input including relevant standards, accuracy and resolution, type test approval and/or calibration certificates | ☐ |
| Measurement/metering arrangements for electricity generation including relevant standards, accuracy and resolution, type test approval and/or calibration certificates | ☐ |
| Measurement/metering arrangements for useful heat including relevant standards, accuracy and resolution, type test approval and/or calibration certificates | ☐ |
| **Operational Data (or projected data/design for units not yet operational)** | |
| Fuel input, useful heat and electricity generation over reporting period | ☐ |
| Fuel input, useful heat and electricity generation over period of operation in HE CHP mode (test report included) | ☐ |
| Actual power to heat ratio | ☐ |
| Plant specific electrical efficiency and test report (for CHP with power loss that does not meet the efficiency level in Annex II of the Directive) | ☐ |
| **Calculated Parameters** | |
| Overall efficiency | ☐ |
| Primary energy savings | ☐ |

## Appendix B: Application Form

Applicants for certification as HE CHP are required to:

- Complete and submit this application form and provide the required operational data.
- Maintain appropriate operational records and where appropriate metering systems are not installed to install such metering.
- Provide full access to operational data
- Provide access to and facilitate inspection of plant and records by auditors as may be appointed by the CER.

Part I – Design specification, detail of useful heat loads

Part II (a) – Operational data for units in operation

Part II (b) – Projected operational data for units not in operation

Part III – Key performance parameters (Electrical efficiency, thermal efficiency, overall efficiency, actual power to heat ratio, electricity for HE CHP and PES)

**Notes:**

This application form should be completed with reference to the CER's decision paper. Calculations of efficiency and primary energy savings should be done using the excel calculation template which is published alongside this decision paper.

The following Attachments are required to accompany this form:

- Process flow diagram (indicating metering and measurement arrangements and useful heat loads)
- Piping diagram (indicating metering and measurement arrangements and useful heat loads)
- Certification, test reports, specification for prime mover detailing rating
- Certification, test reports, specification for meters and measurement
- Annual heat profile
- Daily heat profile
- Heat load duration curve

- Test report detailing power to heat ratio in HE CHP mode
- Test report detailing plant specific electrical efficiency or power loss coefficient

Application forms should be submitted to hechp@cer.ie, Supporting material should be provided in electronic form wherever possible. Hard copies, where required, should be marked "*HE CHP Certification Application*" and addressed to John Lynch at the CER at the following address:

John Lynch
Commission for Energy Regulation
The Exchange
Belgard Square North
Tallaght
Dublin 24

### B.1 Part I – Design specification, detail of useful heat loads

| | | |
|---|---|---|
| Site Name | | |
| MPRN | | |
| Operator Company Name | | |
| Address | | |
| Contact Name | | Position held: |
| Address | | |
| Telephone No: | | Fax No: |
| Email | | |

***B.1.1 Description of CHP plant (Prime mover type(s), model(s) and rating, schematic diagram and piping diagram to be provided***

| |
|---|
| |

***B.1.2 Power to Heat Ratio***

| | |
|---|---|
| Is the power to useful heat ratio fixed (Yes/No) | |
| *If no* | |
| Is there a dump heat load (Yes/No) | |
| Is there a condensing steam turbine and condenser (Yes/No) | |
| Is the power to heat ratio otherwise capable of being controlled? | |
| Please describe means of control | |

### *B.1.3 Primary fuel source (and additional sources where applicable)*

| | |
|---|---|
| Primary Fuel Type | |
| Secondary Fuel Type | |
| Is fuel supply to CHP metered and billed separately or as part of site overall supply (Separately/Combined) | |
| Is condensate returned to boiler feedwater (Yes/No) | |

### *B.1.4 Useful Heat Outputs*

Please Include a catalogue of heat loads claimed as useful heat and justification of these as typical loads.

Please include a process flow diagram or piping schematic indicating the CHP plant and the heat loads claimed as useful heat demands. This should include any other heat supply (e.g. boilers), an indication of the boundary around the CHP plant, supply to useful heat end uses and location of heat metering. Where heat is provided by extraction steam the process flow diagram should indicate points of extraction and pressure and temperature.

### *B.1.5 Economically Justifiable Useful Heat Demand*

**Please provide details of economic evaluation and justification of heat loads with reference to objective information on markets and prices. Please refer to the CER decision paper for guidance.**

### *B.1.6 Measurement Details (please copy these tables where there are multiple inputs or outputs)*

| Fuel Input | |
|---|---|
| Meter/measurement type | |

| | |
|---|---|
| Meter/measurement make and model | |
| Standard to which meter/measurement conforms | |
| Class to which meter/measurement conforms | |
| Describe measurement method and data recording provisions. Type approval/calibration certs/manufacturer's data sheet to be provided. For steam cycles measurement of condensate return to be detailed). For fuels of varying quality, moisture content or calorific value details of the sampling and analysis arrangements should be provided. Where the fuel input is calculated indirectly, a detailed description of the method and its accuracy should be provided. Please refer to Section 5.3 for detailed guidance on the requirement for measurement of fuel input. | |
| Electricity | |
| Meter/measurement type | |
| Meter/measurement make and model | |
| Standard to which meter/measurement conforms | |
| Class to which meter/measurement conforms | |
| Describe measurement method and data recording provisions. Type approval/calibration certs/manufacturer's data sheet to be provided. | |
| Useful Heat | |
| Meter/measurement type | |

| | |
|---|---|
| Meter/measurement make and model | |
| Standard to which meter/measurement conforms | |
| Class to which meter/measurement conforms | |
| Describe measurement method and data recording provisions. Type approval/calibration certs/manufacturer's data sheet to be provided. The location of the meter should be indicated on the process flow diagram. | |

### B.2 Part II(a) – Operational Records (Annual)

#### *B.2.1 Annual Summary*

Summary of Annual Production to be provided. Monthly records to be provided for the following.

| | |
|---|---|
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| Percentage of electricity exported (%) | |
| Condensate Return (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

**Operation in HE CHP Mode** (where power to heat ratio varies) Test report to be provided as an attachment.

**Period #1 - Summary of production**

| | |
|---|---|
| Start of period (time/date) | |
| End of period (time/date) | |
| Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

**Period #2 - Summary of production (copy for additional periods)**

| | |
|---|---|
| Start of period (time/date) | |
| End of period (time/date) | |
| Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

**Summary of total production in HE CHP Mode**

| | |
|---|---|
| Total Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |
| Actual power to heat ratio in HECHP Mode | |

**For CHP failing to meet the efficiency level in Annex II to the Directive.**

Details of test and calculation method and test results to be appended)

| | |
|---|---|
| Plant specific Electrical Efficiency | |
| Power loss coefficient | |

### *B.2.2 Production Records*

| Month # | Month/Year | Fuel Input (MWh) | Useful Heat Output (MWh) | Electricity Generation (MWh) | Overall Efficiency (%) | Power to Heat Ratio |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| **Total Energy Capacity (as electrical output) = $CHP_{TPC}$** | | | | | | |

## B.3 Part II(b) – Projected operational data for units not in operation

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).

What is the state of development of the proposed Scheme?

(e.g. specification/tendering/detail design/procurement/construction/commissioning)

| | |
|---|---|
| Maximum projected Useful Heat Demand* | MW |
| Minimum projected Useful Heat Demand* | MW |
| Average projected Useful Heat Demand | MW |
| CHP Total Power Capacity under MaxHeat conditions | $kW_e$ |

*Useful heat output measured as indicated on the process flow and piping diagram

| |
|---|
| Provide a detailed description of heat loads<br><br>(Please describe the annual heat profile, daily heat profile, heat load duration curve and provide detailed load profiles as attachments). |

**Summary of Projected Annual Production.**

| | |
|---|---|
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |
| Condensate return (MWh) | |
| Percentage electricity exported (%) | |

**Projected total production in HE CHP Mode (Where power to heat ratio varies)**

| | |
|---|---|
| Total Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |
| Actual power to heat ratio | |

**For CHP failing to meet the efficiency level in Annex II to the Directive.**

Details of operating parameters across a range of heat outputs to be appended)

| | |
|---|---|
| Plant specific Electrical Efficiency | |
| Power loss coefficient | |

## B.4 Part III – Key performance parameters

### *B.4.1 Summary Parameters*

| | |
|---|---|
| Electrical efficiency (%) | |
| Thermal efficiency (%) | |
| Overall efficiency (%) | |
| Actual power to heat ratio | |
| Electricity from HE CHP (MWh) | |
| Primary Energy Savings (%) | |

### B.5 Part IV - Declaration

I hereby declare that:

I will respond to any requests for information from the CER;

I will provide full access to the plant and records for the purposes of auditing by the CER;

the information provided is accurate and complete in all respects;

Signed

| |
|---|
| |

Full name(s) of Signatory

| | |
|---|---|
| | |

Position held

| | |
|---|---|
| | |

Date:

## Appendix C: Annual Reporting Form

For CHP plants previously certified as high efficiency CHP and where no material changes have been made to the plant design and useful heat loads as detailed in the application for certification, operators are required to submit annual operating records using this form.

**Notes:**

This reporting form should be completed with reference to the CER's decision paper. Calculations of efficiency and primary energy savings should be done using the template calculation spreadsheet which is published alongside this decision paper.

Completed reporting forms should be submitted to hechp@cer.ie,

Supporting material should be provided in electronic form wherever possible. Hard copies, where required, should be marked "*HE CHP Annual Reporting*" and addressed to John Lynch at the CER at the following address:

John Lynch
Commission for Energy Regulation
The Exchange
Belgard Square North
Tallaght
Dublin 24

## C.1 Part I – Operational Records (Annual)

### *C.1.1 Annual Summary*

Summary of Annual Production to be provided. Monthly records to be provided for the following.

| | |
|---|---|
| Date of commencement of records | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| Percentage of electricity exported (%) | |
| Condensate Return (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

Operation in HE CHP Mode (where power to heat ratio varies) Test report to be provided as an attachment.

**Period #1 - Summary of production**

| | |
|---|---|
| Start of period (time/date) | |
| End of period (time/date) | |
| Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

Period #2 - Summary of production (copy for additional periods)

| | |
|---|---|
| Start of period (time/date) | |
| End of period (time/date) | |
| Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |

Summary of total production in HE CHP Mode

| | |
|---|---|
| Total Duration (hours) | |
| CHP Total Fuel Input (MWh) | |
| CHP Total Electricity Output (MWh) | |
| CHP Total Useful Heat Output (MWh) | |
| Actual power to heat ratio in HECHP Mode | |

### *C.1.2 Production Records*

| Month # | Month/Year | Fuel Input (MWh)) | Useful Heat Output (MWh) (net of condensate return) | Electricity Generation (MWh) | Overall Efficiency (%) | Power to Heat Ratio |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| **Total** | | | | | | |

## C.2 Part II – Key performance parameters

### *C.2.1 Summary Parameters*

| | |
|---|---|
| Electrical efficiency (%) | |
| Thermal efficiency (%) | |
| Overall efficiency (%) | |
| Actual power to heat ratio | |
| Electricity from HE CHP (MWh) | |
| Primary Energy Savings (%) | |

### C.3 Part III - Declaration

I hereby declare that:

The CHP plant and the nature of the useful heat loads have not materially changed and are as per the details provided to the CER in the application for certification.

I will respond to any requests for information from the CER;

I will provide full access to the plant and records for the purposes of auditing by the CER;

the information provided is accurate and complete in all respects;

Signed

| |
|---|
| |

Full name(s) of Signatory

| | |
|---|---|
| | |

Position held

| | |
|---|---|
| | |

Date:

## Appendix D: Worked examples

The following tables provide details of the full calculations for the worked examples summarises in Section 3.3.7 of the consultation document.

These are:

1. Internal combustion engine operating primarily in ‘high efficiency CHP’ mode (for example on large commercial or small industrial site)

2. Gas turbine operating primarily in ‘high efficiency CHP’ mode (for example on large industrial site)

3. Combined cycle gas turbine operating primarily in ‘high efficiency CHP’ mode (for example on large, energy intensive industrial site)

4. Biomass CHP plant operating on an industrial site or adjacent to a significant heat load

5. Waste to energy plant adjacent to industrial site or district heating scheme

**Description**

| | |
|---|---|
| Type | Internal combustion engine |
| Fuel | Natural gas |
| Rating | 900 kWe, 1,000 kWth |
| Year of construction | 2001 |
| Grid Connection | 0.4-50 kV |
| On-site electricity use | 80% |

**Overall Efficiency**

| | | |
|---|---|---|
| Electricity Generation | 4,500 | MWh |
| Useful Heat Output | 5,200 | MWh |
| Fuel Input | 12,900 | MWh |
| Electric Efficiency | 35% | |
| Thermal Efficiency | *40%* | |
| Overall Efficiency | 75% | |
| Threshold Efficiency | 75% | |

**Actual Power to Heat Ratio** (measured during period of full CHP operation)

| | | |
|---|---|---|
| Heat output | 5,200 | MWh |
| Electricity output | 4,500 | MWh |
| $C_{actual}$ | 0.865 | |

**Electricity from HE CHP**

| | | |
|---|---|---|
| Useful Heat Output | 5,200 | MWh |
| $E_{CHP}$ | 4,500 | MWh |
| E non-CHP | - | MWh |

**Primary Energy Savings**

| | | |
|---|---|---|
| non-CHP Fuel | - | MWh |
| CHP Fuel | 12,900 | MWh |
| CHP Hn | 40.3% | |
| Ref Hn | 90.0% | Note 1 |
| CHP En | *35%* | |
| Ref En | 51.1% | |
| Climate Adjustment | 0.6% | |
| Grid loss correction | 0.929 | |
| Ref En (Adjusted) | 48.0% | Note 2 |
| PES | 15% | |

Notes

1) NG from Annex II of 2007/74/EC

2) NG, 2001 adjusted from Annex I of 2007/74/EC

Worked Example 1 – Internal Combustion Engine

| **Description** | |
|---|---|
| Type | Gas turbine |
| Fuel | Natural gas |
| Rating | 10 MWe, 18 MWth |
| Year of construction | 2005 |
| Grid Connection | 0.4-50 kV |
| On-site electricity use | 90% |

| **Overall Efficiency** | | |
|---|---|---|
| Electricity Generation | 117,000 | MWh |
| Useful Heat Output | 188,000 | MWh |
| Fuel Input | 417,000 | MWh |
| Electric Efficiency | *28.1%* | |
| Thermal Efficiency | *45%* | |
| *Overall Efficiency* | *73%* | |
| Threshold Efficiency | 80% | |

| **Actual Power to Heat Ratio**<br>(measured during period(s) of operation in full CHP mode) | | |
|---|---|---|
| Heat output | 90,909 | MWh |
| Electricity output | 50,000 | MWh |
| Fuel input | 177,936 | MWh |
| $C_{actual}$ | 0.550 | |

| **Electricity from HE CHP** | | |
|---|---|---|
| Useful Heat Output | 188,000 | MWh |
| $E_{CHP}$ | 103,400 | MWh |
| E non-CHP | 13,600 | MWh |

| **Primary Energy Savings** | | |
|---|---|---|
| Plant Specific efficiency for elec production | 28.1% | |
| non-CHP Fuel | 48,472 | MWh |
| CHP Fuel | 368,528 | MWh |
| CHP Hn | 51.0% | |
| Ref Hn | 90.0% | Note 1 |
| CHP En | 28% | |
| Ref En | 52.4% | |
| Climate Adjustment | 0.6% | |
| Grid loss correction | 0.927 | |
| Ref En (Adjusted) | 49.1% | Note 2 |
| PES | 12.1% | |

Notes

1) NG from Annex II of 2007/74/EC

2) NG, 2005 adjusted from Annex I of 2007/74/EC

| **Description** | |
|---|---|
| Type | CCGT with steam extraction |
| Fuel | Natural Gas |
| Rating | 270 MWe, 280 MWth |
| Year of construction | 2000 |
| Grid Connection | 100-200 kV |
| On-site electricity use | 30% |

| **Overall Efficiency** | | |
|---|---|---|
| Electricity Generation | 1,574,000 | MWh |
| Useful Heat Output | 1,488,000 | MWh |
| Fuel Input | 4,295,000 | MWh |
| Specific Elec Efficiency | *37%* | |
| Thermal Efficiency | *35%* | |
| *Overall Efficiency* | *71%* | |
| Threshold Efficiency | 80% | (a) CCGT |

| **Actual Power to Heat Ratio** | | |
|---|---|---|
| (measured during period(s) of operation in full CHP mode) | | |
| Heat output | 1,111,111 | MWh |
| Electricity output | 1,000,000 | MWh |
| Fuel input | 2,857,143 | MWh |
| $C_{actual}$ | 0.900 | |

| **Electricity from HE CHP** | | |
|---|---|---|
| Useful Heat Output | 1,488,000 | MWh |
| $E_{CHP}$ | 1,339,200 | MWh |
| E non-CHP | 234,800 | MWh |

| **Primary Energy Savings** | | |
|---|---|---|
| Plant Specific efficiency for elec production | 37% | |
| non-CHP Fuel | 640,703 | MWh |
| CHP Fuel | 3,654,297 | MWh |
| CHP Hn | 40.7% | |
| Ref Hn | 90.0% | |
| CHP En | *37%* | |
| Ref En | 51.4% | |
| Climate Adjustment | 0.6% | |
| Grid loss correction | 0.979 | |
| Ref En (Adjusted) | 50.9% | Note 2 |
| PES | 14.7% | |

Notes

1) NG from Annex II of 2007/74/EC

2) NG, 2005 adjusted from Annex I of 2007/74/EC

Worked Example 3 – CCGT

| **Description** | |
|---|---|
| Type | Biomass CHP |
| Fuel | Wood Residues |
| Rating | 5 MWe, 3 MWth |
| Year of construction | Post 2006 |
| Grid Connection | 0.4-50 kV |
| On-site electricity use | 60% |

| **Overall Efficiency** | | |
|---|---|---|
| Electricity Generation | 24,000 | MWh |
| Useful Heat Output | 14,400 | MWh |
| Fuel Input | 109,091 | MWh |
| Electrical Efficiency | 22% | |
| Thermal Efficiency | 13% | |
| Overall Efficiency | 35% | |
| Threshold Efficiency | 80% | Note 1 |

Note - (c) Condensing extraction turbine

| **Actual Power to Heat Ratio** | | |
|---|---|---|
| (measured during period(s) of operation in full CHP mode) | | |
| Heat output | 1000 | MWh |
| Electricity output | 600 | MWh |
| Fuel Input | | |
| $C_{actual}$ | 0.600 | |

| **Electricity from HE CHP** | | |
|---|---|---|
| Useful Heat Output | 14400 | MWh |
| $E_{CHP}$ | 8640 | MWh |
| E non-CHP | 15,360 | MWh |

| **Primary Energy Savings** | | |
|---|---|---|
| Plant Specific efficiency for elec production | 22% | |
| non-CHP Fuel | 69,818 | MWh |
| CHP Fuel | 39,273 | MWh |
| CHP Hn | 36.7% | |
| Ref Hn | 86.0% | Note 1 |
| CHP En | 22% | |
| Ref En | 32.6% | |
| Climate Adjustment | 0.6% | |
| Grid loss correction | 0.933 | |
| Ref En (Adjusted) | 31.0% | Note 2 |
| PES | 12% | |

Notes

1) Wood Fuel from Annex II of 2007/74/EC

2) Wood Fuel, 2005 from Annex I of 2007/74/EC

| **Description** | |
|---|---|
| Type | Waste to Energy |
| Fuel | Municipal waste |
| Rating | 20 MWe, 15MWth |
| Year of construction | Post 2006 |
| Grid Connection | 0.4-50 kV |
| On-site electricity use | 20% |

| **Overall Efficiency** | | |
|---|---|---|
| Electricity Generation | 100,000 | MWh |
| Useful Heat Output | 90,000 | MWh |
| Fuel Input | 480,000 | MWh |
| Elec Efficiency | *20.8%* | |
| Thermal Efficiency | *18.8%* | |
| *Overall Efficiency* | *39.6%* | |
| Threshold Efficiency | 80.0% | |

| **Actual Power to Heat Ratio** | | |
|---|---|---|
| (measured during period(s) of operation in full CHP mode) | | |
| Heat output | 1,200 | MWh |
| Electricity output | 1,000 | MWh |
| Fuel input | 5,000 | |
| $C_{actual}$ | 0.8330 | |

| **Electricity from HE CHP** | | |
|---|---|---|
| Useful Heat Output | 90,000 | MWh |
| $E_{CHP}$ | 74,970 | MWh |
| E non-CHP | 25,030 | MWh |

| **Primary Energy Savings** | | |
|---|---|---|
| Plant Specific efficiency for elec production | 25% | |
| non-CHP Fuel | 100,120 | MWh |
| CHP Fuel | 379,880 | MWh |
| CHP Hn | 23.7% | |
| Ref Hn | 80.0% | Note 1 |
| CHP En | 20% | |
| Ref En | 24.1% | Note 2 |
| PES | 10.3% | |

Notes

1) Municipal waste from Annex II of 2007/74/EC

2) Municipal waste, post 2006 adjusted from Annex I of 2007/74/EC

Worked Example 5 – Waste to Energy

## Appendix E: Glossary of Terms

**Combined Heat and Power (or cogeneration)** means the simultaneous generation in one process of—

(a) thermal energy and electrical energy,

(b) thermal energy and mechanical energy, or

(c) thermal, electrical and mechanical energy

**Economically justifiable demand** means the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration

**Efficiency** means efficiency calculated on the basis of 'net calorific values' of fuels

**Electricity production from combined heat** and power means electricity produced from combined heat and power calculated in accordance with section 7 of the Electricity Regulation Act, 1999

**Full CHP mode** occurs when the CHP unit operates with maximum heat recovery (i.e. no heat dumped, for example as turbine exhaust gas or condensed steam turbine exhaust steam)

**High efficiency combined heat and power** means combined heat and power production which on an annual basis—

(a) in the case of small scale combined heat and power and micro-combined heat and power, achieves primary energy savings calculated in accordance with paragraphs 3 and 4 of Schedule 3 of the Electricity Regulation Act, 1999, and

(b) in the case of all other combined heat and power, achieves primary energy savings calculated in accordance with paragraphs 3 and 4 of Schedule 3 of at least 10 per cent compared with the references for separate production of heat and electricity"

**Overall efficiency** means the annual sum of electricity and mechanical energy production and useful heat output divided by the fuel input used for heat produced in a cogeneration process and the gross electricity and mechanical energy production

**Power to heat ratio** means the ratio between electricity from cogeneration and useful heat when operating in full cogeneration mode using operational data of the specific unit

**Total fuel energy** is the total fuel energy based on lower heating value (LHV) needed in a CHP plant to generate electrical/mechanical energy and useful heat in a reporting period -(not defined in the Directive)

**Useful heat** means heat produced in a cogeneration process to satisfy an economically justifiable demand for heat or cooling

## Appendix F: Sample Certificates

# High Efficiency CHP Certification for an existing CHP Plant

This is to certify that, based on operational records from START-DATE to FINISH-DATE, the CHP plant at ADDRESS produces high efficiency combined heat and power.

The primary energy savings over the period were X%

The power to heat ratio is X

This certificate will be updated based on annual operational records.

This certificate may be revoked should material inaccuracies relative to the information provided to the CER for the purposes of HE CHP certification transpire.

---

*Additional information.*

During the reporting period,

The overall efficiency was X%

The total useful heat output was X MWh

The electricity generated from high efficiency CHP, ECHP, was X MWh

# High Efficiency CHP Certification for a Planned CHP Plant

This is to certify that, based on design data and projected annual operational data, the planned CHP plant at ADDRESS will produce high efficiency combined heat and power.

Date of Issue: dd/mm/yy

The projected primary energy savings are X%

The projected power to heat ratio is X

This certificate will remain valid until 14 months after commissioning. From the date of the anniversary of commissioning the operator may apply for certification based on operational records for the 12 month operating period .

This certificate will lapse if commissioning has not taken place within five years of the date of this certificate.

This certificate may be revoked should material inaccuracies relative to the information provided to the CER for the purposes of HE CHP certification transpire.

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