Green Public Procurement

Combined Heat and Power Technical Background Report

Report for the European Commission – DG Environment by AEA, Harwell, June 2010

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Table of contents

Appendices

1 Introduction

1.1 Background

Following on from previous work in developing GPP criteria for ten product groups and services[1], a further ten products and sub-products have been identified for the development of GPP purchasing criteria to add to the European Commission's GPP Training Toolkit Module 3, which presents recommended GPP criteria for products and services. The process of deciding on products for which to develop criteria was achieved using a methodology that included a review of studies identifying priority product groups and those product groups for which GPP purchasing criteria has already been recommended. GPP is a voluntary instrument.

Cogeneration, also known as **Combined Heat and Power (CHP)**, has been identified as a product group for criteria development. This report provides background information on the environmental impact of CHP and outlines the key relevant European legislation affecting this product group. It then goes on to describe existing standards and ecolabels that cover this technology. Finally it outlines the rationale for the core and comprehensive environmental purchasing criteria that are being proposed for consultation.

Whilst Cogeneration is the term used in Directive 2004/8/EC, the term Combined Heat and Power (CHP) is probably more commonly used with the same meaning. Although the two terms are used interchangeably CHP has been used throughout this report.

This report accompanies the associated **Product Sheet** that contains the proposed purchasing green/environmental criteria and ancillary information for green tender specifications and as such they should be read alongside one another.

The format for the purchasing recommendations comes in the form of two sets of criteria:

- The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases.
- The comprehensive criteria are for those who wish to purchase the best products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

Within the core and comprehensive criteria, the guidance follows the various stages of a public procurement procedure and explains how best to integrate environmental criteria at each stage:

- Subject matter. It means the title of the tender, i.e. a short description of the product, works or service to be procured.
- Technical Specifications. Provide a clear, accurate and full description of the requirement and standard to which goods, works or services should conform. Description of the minimal technical specifications which all bids need to comply with. Set specific environmental criteria, including hurdles and levels that need to be met for specific products.
- Selection Criteria. It is based in the capacity / ability of the bidders to perform the contract. Assist in the identification of appropriate suppliers, for example to ensure adequately trained personnel or relevant environmental policies and procedures are in place.
- Award Criteria. The award criteria on the basis of which the contracting authority will compare the offers and base its award. Award criteria are not pass/fail criteria, meaning that offers of products that don't comply with the criteria may still be considered for the final decision, depending on their score on the other award criteria.

[1] http://www.ec.europa.eu/environment/gpp

- Contract Performance Clause - Specify the conditions that must be met in the execution of the contract, for example as to how the goods or services are to be supplied, including information or instructions on the products to be provided by the supplier.

It should be noted that the contractor is bound by the existing legal framework.

Where the verification for the criteria states that other appropriate means of proof can be used, this could include a technical dossier from the manufacturer, a test report from a recognised body, or other relevant evidence. The contracting authority will have to satisfy itself on a case by case basis, from a technical/legal perspective, whether the submitted proof can be considered appropriate.

2 Abbreviations

CHP	Combined Heat and Power
EPBD	Energy Performance of Buildings Directive
EU	European Union
GoO	Guarantee of Origins
GPP	Green Public Procurement
MS	Member States
PES	Primary Energy Savings

3 Definition, Scope and Background

For the purposes of this green public procurement specification CHP is defined as plant that is used for the simultaneous production of electricity and heat, both of which are utilised.

It is proposed that the scope is for CHP plant across the range of scales, including micro, small, medium and large. This is because of the likely GPP purchase of CHP plant by Government organisations for the types of application listed in Section 3.1, Table 2. As well as the public sector buildings, such as schools and hospitals, CHP may also be purchased for smaller buildings, such as individual community housing, or for district heating schemes at a range of scales.

It is important to remember that this specification is for the purchasing of CHP plant not electricity produced by CHP. The latter is covered separately by the already existing GPP specification for Electricity. The key element for this specification is ensuring the CHP plant produces high efficient CHP.

It is important when deciding whether to choose CHP or not that the economically justifiable heat demand is taken into consideration as well as the electricity demand. The contracting authority should consider if there is sufficient heat demand to warrant CHP and also analyse the advantages and disadvantages of other options e.g. grid electricity before choosing CHP.

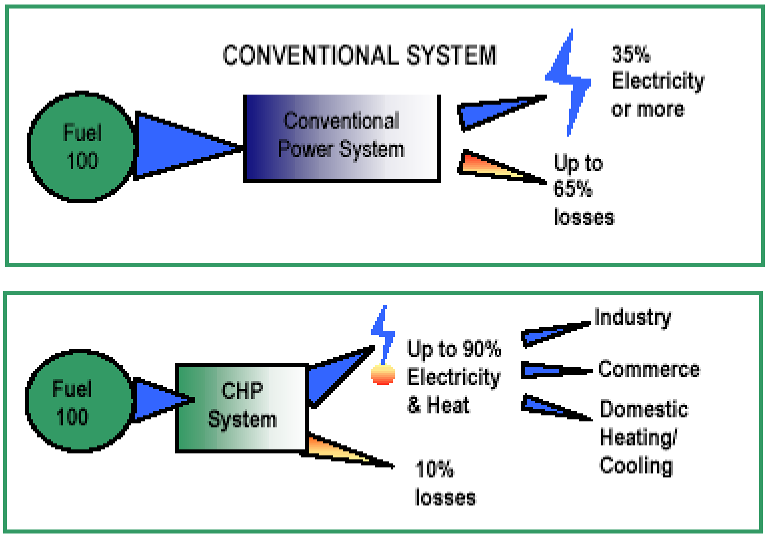
CHP is the simultaneous production of electricity and heat, both of which are utilised. Figure 1 illustrates the CHP process compared to conventional electricity generation. Conventional power stations result in heat emission losses of up to 65%[2], whereas CHP uses the heat generated in the production of electricity for other uses such as space heating, thus resulting in increased efficiency of the fuel source and therefore energy savings.

The electricity and heat outputs can also be used for cooling, however the cooling itself is not a direct output from the CHP plant, and is therefore not included or considered further in these GPP criteria. For example the heat generated from the CHP plant can be used to drive an absorption cooling unit or an air conditioning unit, however the effectiveness of the cooling will be a factor of the actual cooling unit and not the CHP plant. GPP criteria have been developed for air conditioning as part of a separate product group.

Reliable and efficient provision of energy to buildings is a central aspect in their design and construction. CHP therefore has an important role and application in being able to provide both electrical power and heat energy to single or groups of buildings in an efficient way and should be considered with other sources of energy at the tendering stage of a new building development or refurbishment.

[2] UNEP Energy Technology Factsheet - Cogeneration

Figure 1: Schematic of Conventional Power System and CHP System (from UNEP Energy Technology Factsheet – Cogeneration)

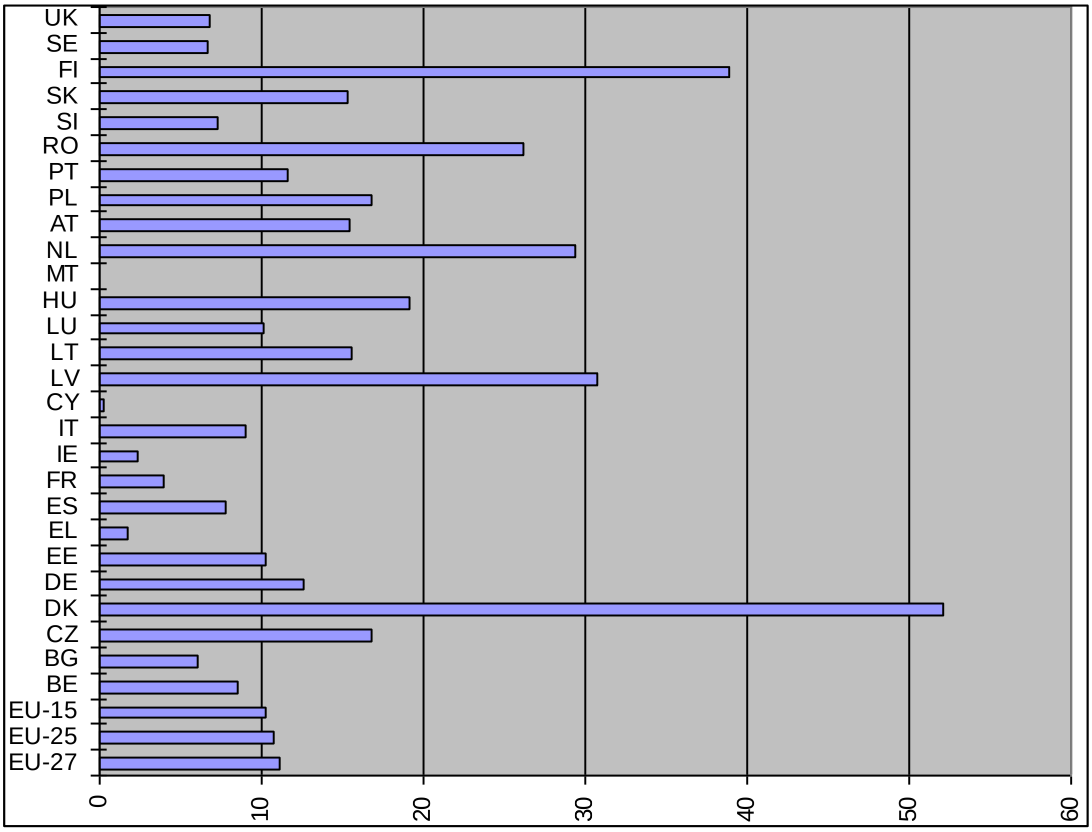


As an energy efficient 'product', CHP is seen as one of the key ways in which Europe and its Member States (MS) can meet their environmental goals. In 'An Energy Policy for Europe[3]' published in 2007 by the Commission to the European Council, the Commission states its intention to continue improving efficiency in energy generation, and specifically mentions promoting high efficient CHP as one way of achieving this.

Using equipment such as CHP will help meet Kyoto climate change targets by reducing carbon dioxide emissions for a given amount of energy produced, when compared to conventional electricity and heat production methods. Using CHP specifically also increases the security of energy supplies. This is because it's designed to be used locally, near to where it is produced and can also increase the range of different energy sources relied upon. However it is important to note that the share of electricity produced by CHP varies significantly across Member States, with shares ranging from 0% (in Malta) to 52.1% (in Denmark) of electricity production[4]. Figure 2 illustrates this range across the different Member States.

[3] COM (2007)1
[4] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-08-002/EN/KS-QA-08-002-EN.PDF

Figure 2: 2005 - Share of CHP in total electricity generation (%)



The difference in the use of CHP across Member States can be partly attributed to the policies individual Member States instigate to promote the use of CHP, but also the availability of fuels and the general economic situation, in particular the cost of fuel and price of electricity.

3.1 Technologies

CHP, as illustrated in Figures 1 and 2 above, is a method that is widely used for the simultaneous production of electricity and heat both of which are utilised. This is in contrast to conventional electricity production, whereby the heat generated is lost to the atmosphere.

There are a variety of CHP technologies available, which also differ greatly in the scale that they can operate at and the fuel types that they use. The exact purpose, scale and location of a CHP plant will influence the choice of CHP technology used. Possible technologies include, but are not limited to:

- Steam turbines
  - Steam turbines generally consist of 3 elements; a heat source, a steam turbine and a heat sink. These systems can be configured in a variety of ways, but typically high-pressure steam raised in a boiler is expanded within the turbine to produce mechanical energy, which can be used to drive an electrical generator.
- Gas turbines
  - In recent years gas turbines have been widely used in CHP. Fuel is burnt in a pressurised chamber; the pressurised gases then turn blades, which are mounted on a shaft to produce mechanical energy. The mechanical energy

    - is then usually used to produce electricity with a generator or can be used to drive pumps, compressors, or blowers.
- Reciprocating internal combustions engines (includes petrol and diesel engines)
    - These internal combustion engines operate in similar ways to engines in the automotive industry. Generally the concept is the same as for gas turbines, however reciprocating engines give a higher electrical efficiency, but the heat is more difficult to use.
- Combined cycle systems
    - A combined cycle is generally used for larger CHP system, and will consist of a steam turbine and a gas turbine. In these systems the hot exhaust gases from the gas turbine are used to produce steam for the steam turbine.
- Fuel cells
    - Fuel cells are based on the oxidation of hydrogen, which can be derived from a variety of sources. For example hydrogen can be chemically reformed from natural gas, or other types of gas such as biogas, methanol, gasoline and propane. It can also be provided directly as hydrogen stored as a high-pressure gas or liquid. The fuel cells convert the chemical energy of hydrogen and oxygen directly into electricity. Fuel cells do not involve combustion or mechanical work, which is typical of turbines and engines.
- Stirling engines
    - These are external combustion engines, which have been developed more recently with regards to CHP. They have the potential for high efficiencies, with low emissions.

For further information Section 3 of The European Educational Tool on Cogeneration, Second Edition, December 2001[5] provides a detailed description of these different technologies.

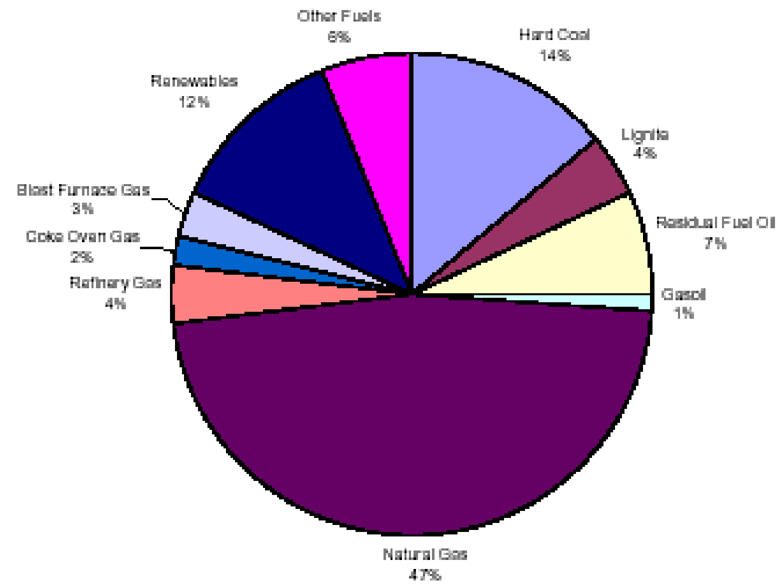
These technologies predominately still use fossil fuels, such as gas or liquid fuels, however it is possible to use renewable fuels such a biomass in some CHP plant. Figure 3 illustrates the different fuels used in CHP and their relative scale of use. It is clearly apparent that natural gas dominates (as of 2000).

Although fossil fuels are still predominately used, the key advantage of CHP is that the electricity and heat are produced and utilised in a more efficient way resulting in primary energy savings (PES) when compared to separate conventional electricity and heat generation i.e. less fuel needs to be burnt to provide the same amount of electricity and heat, which in turn will result in lower carbon dioxide emissions and a reduction in the impact from the fuel life cycle.

It is possible to use alternative fuel types to fossil fuels, but as Figure 3 indicates, these are a relatively small proportion of the overall total. Alternative fuels may include biogas and renewable biomass, which will have additional impact in terms of reducing carbon dioxide emissions further. In this respect CHP technology bridges the gap between conventional energy and renewable options depending on the mix of fuel types used.

5 http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Tool.pdf

Figure 3: Fuel use of CHP operation in 2000
(From 'Benchmarking Report: Status of CHP in EU Member States'[6])



CHP can be used for a number of different applications. This includes Utility applications, such as district heating (and cooling in hotter climates, where the heat can be used to drive an absorption cooling unit or an air conditioning unit).

District heating can be used to meet the demands of residential and commercial properties; examples of its use include space heating and water heating. The heat is generated in a central location and then distributed via a network of pipes to where it is needed. Due to the efficiencies offered by CHP, district heating schemes predominately use CHP as their main component. For example, in Southampton, UK where district heating has been used for more than ten years, over 70 % is produced by CHP[7].

Other technologies are also used for district heating, but to a lesser extent. These include heat-only boiler stations, geothermal heating, central solar heating and energy from waste incinerators. In the case of Southampton, UK, the remainder of the heat demand, which is not met by CHP is provided by geothermal heating (15 %) and conventional boilers. The later are used to provide top-up heating to ensure peaks due to seasonal demands can be met.

Geothermal heating is the main component for district heating in Iceland, due to the availability of this source of natural heat, however it is not as easily available in the majority of European countries. In addition power generation from geothermal heat, for example by using a low boiling point working fluid and an organic vapour turbine process, is generally only economically viable unless the heat is utilised. A number of examples exist including Neustadt-Glewe in Germany and Altheim and Bad Blumau in Austria (Personal Communication EGEC). Energy from waste is a more recent development and in some cases the technology used is CHP, but the fuel is waste instead of the usual fossil fuels. For example, in the UK a district heating scheme has been developed in Sheffield that uses energy from waste to generate electricity which is sold to the national grid and heat for over 140 buildings[8].

6 www.sei.ie/getFile.asp?FC_ID=1772&docID=57
7 http://www.iea-dhc.org/download/KN1640%20Southampton%20v2.pdf
8 http://www.veoliaenvironmentalservices.co.uk/sheffield/pages/district.asp

Due to the focus on CHP for district heating it is considered appropriate at the present time to include them in this report and use the same criteria that has been developed for CHP. In the future, if there is a significant change in the predominant technologies used in district heating this position may need to be reviewed.

The heat from CHP can also be used in industrial process where heat is required in order to complete the process. There is significant potential in the food and drink, textile, lumber, pulp and paper, chemicals, petroleum refineries, cement and primary metals sectors[9].

Along with district heating, the use of CHP in buildings is the main area that will be of relevance to public contracting authorities. Public authorities own a large number of buildings at a range of sizes, for example large offices, schools, hospitals and individual houses, for example as part of a community housing scheme. CHP could be applicable to these various buildings. They may also commission the construction of such buildings and it is therefore important to consider energy efficiency at this stage.

Whilst the electricity has an obvious and direct application in running energy using products, the heat produced can also be put to good use: for hot water, space heating, laundry systems and swimming pool water heating amongst other things.

The Energy Performance of Buildings Directive, which is outlined in Section 6 below, promotes energy efficiency in buildings and provides an opportunity for Public Authorities to motivate other property owners to carry out energy efficiency improvements by leading by example. Public Authority buildings (above 500m^{2}and subsequently falling to 250m^2) must clearly display an energy performance certificate.

With this in mind it is important at the construction or renovation phase that Public Authorities consider energy efficiency of their buildings. This will inevitably lead to the consideration at some level of CHP as an option. Whilst CHP may not be applicable in all circumstances there are likely to be some instances where it can be used to improve building energy efficiency. Table 1 provides a more complete list of possible applications of CHP.

Table 1: Possible opportunities for application of CHP[10]

Industrial	• Pharmaceuticals & fine chemicals • Paper and board manufacture • Brewing, distilling & malting • Ceramics • Brick • Cement • Food processing • Textile processing • Minerals processing • Oil Refineries • Iron and Steel • Motor industry • Horticulture and glasshouses • Timber processing
Buildings	• District heating • Hotels • Hospitals • Leisure centres & swimming pools • College campuses & schools • Airports • Prisons, police stations, barracks etc

9 http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Tool.pdf
10 'A Guide to Cogeneration', March 2001, EDUCOGEN

	• Supermarkets and large stores • Office buildings • Individual Houses

CHP plant can operate at a number of different scales, from micro to industrial. A number of definitions for the different scales are used, however the Cogeneration Directive defines a micro cogeneration unit as a unit with a maximum capacity below 50kWe and a small-scale cogeneration unit as a unit with an installed capacity below 1 MWe.

Table 2 presents the range of different scales together with typical applications to provide some perspective on the use of CHP at different scales. It is feasible that public procurement could involve the purchase of CHP plant at a variety of different scales.

Table 2: Range, Scale and Applications of CHP[11]

1-3kW	Micro	Domestic use
2-50kW	Micro/Small	Primary schools, guest houses, pubs/restaurants and small offices
50kW-5MW	Small Scale and Mid Scale	Public sector buildings, Community energy schemes, Leisure centres, Hotels, Commercial, Light Industrial, Hospitals and Universities and small blocks of flats
5MW plus	Large	Industrial application and large Industrial District Energy Schemes

It has been demonstrated above that there are a range of scales of CHP plant that can often overlap in terms of how they are described and defined.

The scope for the purposes of this GPP specification is defined further using the Cogeneration Directive as a basis. For the purposes of this GPP specification cogeneration is defined as ‘the simultaneous generation of thermal energy and electrical and/or mechanical energy’. The criteria are applicable to cogeneration units, which shall mean a unit that can operate in cogeneration mode.

Where the criteria refer to different sizes of cogeneration unit i.e. small or micro, the following definitions shall apply:

- Micro cogeneration unit shall mean a cogeneration unit with a maximum capacity below 50 kWe
- Small Scale Cogeneration shall mean cogeneration units with an installed capacity below 1 MWe

These definitions are consistent with the Cogeneration Directive.
Further information regarding the Cogeneration Directive is provided in Section 6.1 below.

11 http://www.chpa.co.uk/

4 Key Environmental Impacts

There are a number of environmental impacts, beneficial and adverse, associated with CHP plant that need to be considered. These are briefly outlined below.

The key benefit of CHP over conventional power stations is the increased efficiency gained from the use of both heat and electricity generated from the input fuel that is combusted. Typically the generation of electricity and heat recovery from CHP can achieve overall efficiencies of 60-80 %; this is compared to an efficiency of 25-50% from conventional power stations[12]. Higher efficiencies from CHP may be achieved, depending on specific circumstances, as Figure 1 indicates.

The use of heat generated by CHP means that the heat does not need to be generated by the burning of additional fuels and reduces primary energy consumption. The knock on effect of course is that there are reduced emissions, in particular carbon dioxide, the main greenhouse gas of concern.

In order to maximise efficiency benefits from CHP, the plant should be designed according to the heat demand of the application it will be used for. It is normally the case that where this principle is followed more electricity is produced than required[13]. Where surplus electricity is produced it can be sold back to the main electricity grid or network or be supplied more directly to another customer via a distribution (grid) system.

The majority of CHP plant burn fossil fuels, predominantly natural gas, and whilst there is an environmental impact associated with the extraction of fossil fuels, the increased efficiency of CHP plants means less fuel is required. As well as the reduction in direct emissions of CO_2 from the combustion of the fuel, there is also a concomitant reduction in the embedded impacts of the fuel: reduced emissions for the fuel life cycle from exploration, extraction, refining, processing, transportation and storage.

Due to the limited economically viable distance that heat can be transferred, typically 10km before it is used[14], the majority of CHP plants are located close to where the heat is required. This has a subsequent benefit for the electricity portion of the energy generation. Transmission losses from the distribution of electricity from conventional power stations through networks are typically 5-10 %, as these power stations are usually relatively remote from where the electricity is used[15]. The international energy agency states that in 1999 losses from transmission and distribution lines equalled 9.5% of total global supply of electricity[16]. As CHP plant is normally far closer to the end-use point these transmissions losses could be greatly reduced.

In addition to the global climate change benefits of CHP, it can also have a more localised negative impact on air quality emissions.

The local impact will depend on the type of CHP technology and the fuel used compared to the fuel that would have been used in a conventional power station. Exhaust gases can include carbon dioxide, carbon monoxide, nitrogen oxides, sulphur dioxides, unburned hydrocarbons and particulates. Mercury from coal combustion is also an issue where coal is used as the fuel.

A number of issues need to be considered that may affect emissions when planning a CHP plant. If not properly designed and located it is possible that CHP could have an adverse affect on the local air quality, even though it saves fuel use and thus contributes to reducing CO_2 emissions.

12 CHPQA Standard, Issue 2, November 2007 https://www.chpqa.com/guidance_notes/documents/CHPQA_Standard_Issue2.pdf
13 http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Cogen_Guide.pdf
14 http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Tool.pdf, Chapter 5
15 http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Cogen_Guide.pdf
16 http://www.localpower.org/ben_efficiency.html

CHP plants are often located close to urban areas where the heat is required, for example in buildings such as offices, hospitals and apartment blocks. Relatively short stacks and the urban environment mean that dispersion of pollutants can be limited. In urban areas, the urban environment itself may limit the dispersion of pollutants. For example building may act as barriers providing a more enclosed environment.

In addition the tolerance for additional emissions in urban areas may be limited depending on the existing state of local air quality from other sources of air quality pollutants, such as transport and industry. Emissions of nitrogen oxides are of particular concern in these cases, especially as diesel and petrol engines are commonly used in buildings.

CHP can also have other local affects such as increased noise and vibration from the plant itself and also from its installation and regular fuel deliveries.

To minimise these potential local environmental impacts it is important to ensure the correct technology is used (with low emissions of pollutants), consideration is given to its location, and appropriate abatement measures are implemented, for example adequate stack height and sound insulation.

Consideration should also be given to the use of fuel types other than fossil fuels. Renewable fuels are now starting to be used in CHP plants and include biogas and sustainable biomass. These are increasingly viable, where previously they were not. Therefore it is still appropriate to have a specification for CHP that includes the range of possible fuel types and technologies, but ensures high efficient CHP is used for the electricity and heat generated.

5 Cost Considerations

The initial investment in CHP can be significant and payback can take a number of years. Therefore in order to maximise cost savings resulting from the increased efficiency gained through the use of both electricity and heat generated the feasibility of the CHP plant needs to be fully assessed. In order to compare the cost of CHP in relation to other technology options it is important that the full life cycle costs of CHP and the alternative options are considered. This will include not only the investment costs, but also the operational, maintenance and de-commissioning/disposal costs.

The economic viability of a CHP plant will depend on the demand for heat and electricity. These two factors must be accurately assessed when looking into the feasibility of a CHP plant to ensure the sizing of the plant is correct and thus ensure long-term viability. Where plant is sized incorrectly, for example where not all of the heat is utilised, the economic viability of the CHP plant will be negatively affected.

The main running costs for CHP is the fuel input, therefore the longer term cost benefits of the plant will be greatly influenced by the cost of fuel, for example gas, which is still the predominant fuel type used in CHP. This is important when setting up a fuel supply contract and future increases need to be carefully considered to ensure the CHP plant will remain economically viable in the longer term.

Maintenance costs may also be an important cost consideration and will depend on the size and type of plant. It is important these are considered as the CHP plant will need to be maintained in accordance with the supplier instructions to ensure effective performance is maintained. If the plant does not operate at its optimum then the other benefits will be affected, for example primary energy savings.

To maximise savings in relation to the initial capital investment, running hours (and equivalent full load running hours) should be as long a possible, therefore sizing is important[17]. If the plant is idle this will reduce the potential savings. Effective maintenance will also ensure any downtime is minimised.

In order to give some examples, there are a number of CHP plant in the UK that have demonstrated significant costs savings. These are across a range of scales and used in a variety of different buildings.

Table 3: Summary of CHP plant and cost savings[18]

York University	Campus buildings	1995	1030 kW_e engine	€187,500	4
London Borough of Enfield	Southbury Leisure Centre	2002	80 kW_e micro turbine	€15,000 (projected)	6 (projected)
Freeman Hospital, Newcastle	Acute services hospital	1997	2 x 1.35 MW_e spark ignition engines	€337,500	N/A
Southampton City Council	Various large public and commercial buildings – community heading	1998	5.7 MW_e engine	€312,500 11,000 tonnes of CO_2	N/A

17 Combined Heat and Power for Buildings: Selecting, installing and operating CHP in buildings – a guide for building service engineers. (http://files.harc.edu/Sites/GulfCoastCHP/ProjectDevelopment/UKGoodPracticeGuide.pdf)
18 http://www.lboro.ac.uk/service/estates/pages/downloads/GPG388.pdf
19 Savings have been converted from Pounds Sterling to Euros using an exchange rate of €1.25 to £1

In addition to these UK examples, COGEN has provided details of some smaller scale projects. These also demonstrate savings that can be made and pay back times[20].

Vlagtwedde (NL)	Living and working quarters	2008	5.5 kWe	€3700 cost reduction	Pay back time 4 years
Schiphol airport	Ibis Hotel	2007	130 kWe	€75,000 cost reduction	Payback time <3 years

20 http://www.miniwkk.info/referenties/

21 Savings have been converted from Pounds Sterling to Euros using an exchange rate of € 1.25 to £1

6 Relevant EU Legislation and Policy

6.1 Directive 2004/8/EC[22] on the promotion of cogeneration based on useful heat demand in the internal energy market and amending Directive 92/42/EEC

Adopted on 21 February 2004, Article 1 of the Cogeneration Directive outlines its purpose as follows:

'to increase energy efficiency and improve security of supply by providing a framework for the promotion and development of high efficiency cogeneration of heat and power based on useful heat demand and primary energy savings in the internal energy market, taking into account the specific national circumstances especially concerning climatic and economic conditions'

The Directive says that Member States are to incentivise CHP over alternative generation of heat and electricity by conventional means. High efficiency CHP is defined by energy savings of more than 10 % when compared to the separate production of heat and electricity.

"High efficiency cogeneration is in this Directive defined by the energy savings obtained by combined production instead of separate production of heat and electricity. Energy savings of more than 10 % qualify for the term 'high-efficiency cogeneration'."

As part of the Directive Member States were required to submit Reports on the progress of the following aspects by 6th August 2007.

- Member State National potential for cogeneration
- Barriers to achieving the identified potential
- A review of support mechanisms for cogeneration in the Member State for compliance with Directive.
- The existence of a mechanism for issuing guarantees of origin for high efficiency cogeneration and identifying the independent body responsible for administering the system.

The latest position regarding reporting by Member Sates is provided in the CODE update report, dated December 2009[23] . The CODE project was set up in October 2008 by COGEN, under the EU's Intelligent Energy Europe (IEE) programme, to monitor the implementation of the Cogeneration Directive. The latest update indicates that 23 member states have now reported on national potential. There are still three member states to report on barriers and eight member states to report on their schemes for guarantees or origins. Full details are available in the CODE update report referenced above.

The information relating to the national potential for cogeneration that has been developed by member states will provide useful information to assist contracting authorities make their decisions.

The Commission has been in the process of preparing Implementation Guidelines for the Directive, which were published in November 2008 and are discussed in Section 6.3 below. The time taken to develop and publish these guidelines has lead to delays in many Member States in implementing schemes/systems to demonstrate compliance with the Directive.

22 OJ L 52, 21.2.2004, p. 50–60 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:052:0050:0060:EN:PDF

23 http://www.code-project.eu/wp-content/uploads/2010/02/290110-CODE-European-summary-report1.pdf

However Article 12 of the Directive does allow for alternative means to demonstrate compliance with the Directive by Member States.

Now that the Implementation Guidelines have been published, it should help the development of a harmonised system allowing equal comparison of CHP in different Member States.

6.2 Decision 2007/74/EC of 21 December 2006, establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC of the European Parliament and of the Council[24]

The Cogeneration Directive was updated by this Commission Decision, Article 4 of which included the requirement for the Commission to establish harmonised efficiency reference values for separate production of electricity and heat for the purpose of determining the efficiency of cogeneration in accordance with Annex III of the Directive. This Commission Decision provides details of these reference values following a period of analysis. Furthermore, correction factors are included for different climate zones and grid loss.

6.3 Commission Decision of 19 November 2008 (2008/952/EC) establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC

This Commission Decision (2008/952/EC)[25], dated 19 November 2008 provides the detailed guidelines for the implementation of Annex II of the Cogeneration Directive. Annex II outlines the calculation of electricity from cogeneration. Until this Decision there had been no detailed guidelines for the implementation and application of this Annex.

Now that this detailed guidance has been published, Member States that have not implemented alternative calculation methodologies should be able to progress with the implementation of the Cogeneration Directives requirements.

6.4 The Energy Performance of Buildings Directive (EPBD) 2010/31/EU

This Directive[26] is a recast of Directive 2002/91/EC and is concerned with promoting energy efficiency in buildings across Europe using cost effective measures, whilst at the same time harmonising standards across Europe to those of the more ambitious Member States. The original Directive has been recast for the purposes of clarity in light of previous amendments and further substantive amendments to be made.

It is widely recognised as important to tackle the construction sector as energy use in buildings, for space heating, cooling and lighting accounts for around 40 % of total energy use in Europe.

[24] OJ L 32, 6.2.2007, p. 183–188 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:032:0183:0188:EN:PDF

[25] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:338:0055:0061:EN:PDF

[26] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF

This Directive centres around four key strands:

- Providing a methodology framework for calculating the energy performance of buildings, taking into account local climatic conditions;
- Applying energy performance requirements to both new buildings and existing building stock;
- Providing a certification scheme for all buildings together with;
- Regular assessments of any heating and cooling equipment installed.

The recast Directive ensures that all new buildings must comply with high energy-performance standards as well as generating a significant proportion of their own energy through renewables after 2020. The intention is that the public sector will lead the way through using buildings with "nearly zero" energy standards two years earlier, from January 2019. However the definition of "nearly zero" was left vague, and this will allow member states to define their own standards.

Buildings with a useful floor area over $500m^2$ that are occupied by public authorities and frequently visited by the public will be required to display the energy performance certificate in a prominent place, where one has been issued. The $500m^2$ threshold will be lowered to $250m^2$ on 9 July 2015.

The provision for existing buildings states that where major renovations are carried out these must increase energy-savings if doing so is "technically, functionally and economically feasible". In addition Member States will have to develop national plans that encourage owners to install smart meters, heat pumps and heating and cooling systems using renewables energy sources, as well as listing incentives from technical assistance and subsidies to low-interest loans by mid-2011 for the transition to near zero-energy buildings.

6.5 Directive on the Promotion of Energy from Renewable Energy Sources 2009/28/EC

The Directive on the promotion of the use of energy from renewable sources and amending and subsequently appealing Directive 2001/77/EC and 2003/30/EC was adopted on 23rd April 2009 and published in the official journal of 5th June 2009[27]. Member States are required to implement it by December 2010.

The Directive aims to promote the use of renewable energy through the setting of overall and Member State specific targets. For the EU as a whole, a target of a 20% share of energy from renewable sources by 2020 has been set and a 10% share of renewable energy specifically in the transport sector. Each Member State has been set their own target to contribute towards these overarching targets.

In addition to setting these targets the Directive outlines an improved framework to promote the use of renewable electricity. It requires Member States to develop action plans for the development of renewable energy sources that need to be published by June 2010, following a template that has been developed.

Sustainability criteria are also included in relation to biofuels and cooperation mechanisms created to help achieve the targets cost effectively.

27 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

6.6 The Classification, Packaging and Labelling of Dangerous Substances Directive 67/548/EEC

This Directive[28] is concerned with chemical safety. It categorises substances that are considered to be dangerous under the following headings: explosives (E), oxidizing agents (O), flammable (F or F+), toxic (T or T+), harmful (Xn), corrosive (C), irritants (Xi), sensitisers, carginogens (Carc.), mutagens (Mut.), dangerous to the environment (N), and toxic for reproduction (Repr.). Some of the binding agents used in wood panel will come under one or more of these headings.

A major update of the Directive in September 2008 added several hundred chemical compounds to the list of substances.

The requirements under this Directive will ultimately be replaced by the CLP Regulation (No.1272/2008).

6.7 The CLP Regulation (EC) No 1272/2008

The Regulation of 16 December 2008[29] on classification, labelling and packaging of substances and mixtures entered into force on 20 January 2009 and will ultimately replace the current rules on classification, labelling and packaging of substances (Directive 67/548/EEC) and preparations (Directive 1999/45/EC). Substance classification and labelling must all be consistent with the new rules by 1 December 2010 and for mixtures 1 June 2015.

The Regulation aims to ensure a high level of protection of human health and the environment, as well as the free movement of chemical substances, mixtures and certain specific articles, whilst enhancing competitiveness and innovation. This should be achieved by ensuring that the same hazards will be described and labelled in the same way all around the world.

6.8 Directive on Common Rules for the Internal Market in Electricity 2003/54/EC and 2009/72/EC

This Directive[30] establishes common rules for the generation, transmission and distribution of electricity.

It sets out the rules regarding the organisation and functioning of the electricity sector, access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorisations and the operation of systems. This Directive repealed Directive 96/92/EC.

Although this Directive is currently still in force, it is due to be repealed by Directive 2009/72/EC[31] on the 3rd March 2011. This new Directive, which is part of the 'Third Energy Package' aims to improve the functioning of the internal market for electricity. The exiting rules are complemented by a number of changes to provide a competitive market and ensure greater security of supply. These include the separation of production and supply from transmission networks, ensuring universal service and consumer protection provisions.

[28] OJ *196, 16.08.1967 p.1 – 98* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML

[29] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF

[30] OJ L 176, 15.7.2003, p. 37–56 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:176:0037:0055:EN:PDF

[31] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF

6.9 Directive establishing a framework for the setting of ecodesign requirements for energy related products 2009/125/EC

The original Directive (2005/32/EC) on the ecodesign of energy using products was adopted in July 2005 and focused on energy using products. This Directive has subsequently been repealed by Directive 2009/125/EC[32], which is a recast and increases the scope from energy using product to energy related products.

It provides clear EU wide rules for ecodesign, aimed at avoiding disparities in regulation amongst individual Member States, which could impede the free movement of products within the internal market.

The Ecodesign Directive does not in itself set binding requirements for specific products, however it does define conditions and criteria for setting, through subsequent implementing measures, minimum requirements regarding environmentally relevant product characteristics and allows them to be improved quickly and efficiently.

The framework provided by the Directive aims to encourage manufacturers to develop products where they have taken into account the environmental impact of the product throughout its entire life cycle.

Regulations setting binding requirements for specific product groups are gradually been developed, and would only be set for those energy related products which meet certain criteria, for example, key environmental impact and volume of trade across the internal market and only if there is clear potential for improvement of a product. Under the Ecodesign Directive, self-regulation, including voluntary agreements offered as unilateral commitments by the industry can, under certain conditions, be recognised as a valid alternative to implementing measures.

6.10 Integrated Pollution Prevention and Control Directive 2008/1/EC

The IPPC Directive[33] (originally 1996/61/EC) provides a framework for permitting and controlling pollution from industrial sites. This Directive has recently been codified as 2008/1/EC to consolidate previous amendments and make minor linguistic changes.

The IPPC Directive provides an integrated approach, promotes best available techniques (BAT), allows flexibility and encourages public participation. To assist in the determination of BAT, a number of BAT Reference Documents (BREFs) have been produced for different industrial sectors.

It should be noted that the European Commission adopted a Proposal for a Directive on Industrial Emissions[34] in December 2007. This recasts seven existing Directives related to industrial emissions into a single Directive, including the IPPC Directive. This is not due to come into effect for several years.

32 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

33 OJ L 24, 29.1.2008, p. 8–29 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF

34 http://ec.europa.eu/environment/ippc/proposal.htm

6.11 Directive on Energy End-use Efficiency and Energy Services 2006/32/EC

The aim of this Directive[35] is to improve energy efficiency, manage demand and reduce energy consumption across Europe. Member States will be required to save at least an additional 1% of their final energy consumption each year from 2008 for nine years. Within these targets are savings targets for the public sector of 1.5%[36] as it is expected that a particular contribution will have to be made by this sector, a large part of which will be as a result of public procurement.

Where CHP plant falls under the remit of the IPPC Directive, i.e. an output > 50 MWe, the relevant BREFs will need to be considered, including those on Large Combustion Plants, Waste Incineration and Energy Efficiency.

6.12 Other Policies

There is a Community Strategy on CHP, as well as various initiatives and projects across Europe to promote the use of CHP.

The strategy known is the ***"Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - A Community strategy to promote combined heat and power (CHP) and to dismantle barriers to its development - (COM(97)0514"*** [37]

In summary it states that the European Parliament supports the promotion of CHP across Europe as it makes good energy efficiency as well as business sense. It further supports removing the barriers to installing CHP but recommends increasing its share from 18 % to 25 %. It recommends that this should be underpinned and encouraged by administrative and economic measures at Commission and Member State level. Two of the main projects are described briefly here with further information available via the web links provided.

The **COGEN Challenge**[38], supported by the Commission under the Intelligent Energy – Europe (IEE) Programme, is a consortium of eight organisations that work with CHP that has been going since early 2006 in making efforts to develop a thousand small-scale CHP projects across European cities and towns. Their goals are as follows (from their website)

- *Enhance local and regional capacity for the successful development of small-scale and micro-cogeneration projects up to an electrical capacity of 1 megawatt*
- *Support the transition of Europe's energy system towards high-efficiency and low-carbon distributed electricity generation by facilitating the development of a significant number of small-scale and micro cogeneration projects*
- *Transfer good practice and know-how between regional and local energy agencies*
- *Improve the market for energy services and new energy technologies focussed on small-scale cogeneration*
- *Encourage pioneers and accelerate the market penetration of existing and new small-scale cogeneration technologies*
- *Improve our understanding of micro-barriers to small-scale cogeneration by analysing specific success factors and barriers*
- *Support the implementation of the European Cogeneration, Renewables, Buildings, and Energy End-use Efficiency and Energy Services Directives*

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35 OJ L 114, 27.4.2006, p. 64–85 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:0085:EN:PDF

36 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/03/1687&format=HTML&aged=0&language=EN&guiLanguage=en

37 http://www.europarl.europa.eu/pv2/pv2?PRG=CALDOC&TPV=DEF&FILE=980515&SDOCTA=7&TXTLST=1&POS=1&LASTCHAP=7&Type_Doc=FIRST&LANGUE=EN

38 http://www.cogen.org/cogen-challenge/index.htm

The **Future Cogen** Project[39] consisted of several organisations across Europe, which researched the potential of CHP. They concluded that Government-led incentives with the correct regulation and harmonised policy would promote CHP. Many of their recommendations were taken up, such as a European Cogeneration Directive.

[39] http://tecs.energyprojects.net/

7 Existing Ecolabels and Standards for CHP

7.1 Ecolabels

Only limited ecolabel criteria have been developed specifically for CHP plant. There is no EU Ecolabel Flower criterion for CHP, however criteria have been developed by the Blue Angel for Small-Scale Gas Fired Cogeneration Modules[40] and Small-Scale Liquid Fired Cogeneration Modules[41]. A summary of the criteria used by these standards is outlined below.

The key point to note is that both standards are fuel specific (gas or liquid fired) and only relate to small-scale CHP with an electric power of up to and including 30 kW. To date only one product is registered under the criteria for small-scale gas fired cogeneration modules. There are currently no products registered under the criteria for a small-scale liquid fired cogeneration module. Under the Cogeneration Directive, CHP plant covered by the Blue Angel Ecolabel are classified as micro-cogeneration units i.e. maximum capacity below 50kW.

Under the Blue Angel ecolabels there is a general requirement for products to have the CE label. The standards then set out a number of more specific criteria. These focus on emission requirements, requirements for a rational use of energy, setting and operating instructions, auxiliary power demand and product take back.

For emission requirements the ecolabel sets limits for nitrogen dioxide, carbon monoxide and dust (PM_{10}) (where appropriate). Appendix 1 provides a summary of the key requirements for small cogeneration plants.

The total efficiency of the plant must not fall below 85% for liquid fired plants and 89 % for gas-fired plants. The ecolabel also outlines the operating conditions under which efficiency should be calculated.

The Setting Instructions should provide full details on how to adjust the plant to meet the emissions and efficiency requirements. They should also detail how to connect the plant to the exhaust gas unit as well recommendations on how to prevent structure borne noise. Operating instructions need to provide details about inspections and maintenance work that is required.

The different auxiliary power demand values (sleep mode and whilst in operation) and water-side flow resistance shall be determined in accordance with the guidelines provided in Annex 2 of the ecolabel and shall be listed in the test report.

The ecolabel criteria also require the product manufacturer to accept the return of their own end of life products to ensure they are sent for recycling or material recovery.

Appendix 1 provides a summary of the requirements for small cogeneration modules under the Blue Angel standards. Equipment used for testing needs to be calibrated as detailed in Section 4 of the ecolabel criteria. Due to its limited scope in terms of fuel type, size of CHP plant and limited product availability would make it difficult to use these as the basis of the criteria.

Other standards are available that are aimed at the supply of 'green' electricity. Whilst these generally focus on renewable sources, some do include CHP as a 'green' energy source. A key example in Europe of this is The European Network for Green Electricity (Eugene) Standard.

[40] http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-108.pdf
[41] http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-109.pdf

The Eugene standard is a European wide standard aimed at promoting the use of renewable/green electricity. This covers the use of CHP to provide the green electricity, however it does not specify standards in terms of the actual CHP plant. More information on this is given on the Europa GPP website for green electricity[42]. This current GPP specification is aimed at those contracting authorities that wish to purchase CHP plant, the direct purchase of electricity is dealt with by the existing GPP specification for green electricity.

7.2 Other Standards

Some individual Member States have schemes/supportive measures e.g. financial incentives to promote the use of CHP and thus help meet the requirements of the Cogeneration Directive. Whilst these measures are not necessarily environmental standards some do define good quality CHP or are based on other environmental criteria, which act as qualifying criteria.

The UK CHPQA Scheme[43] defines good quality CHP by a number of different parameters. Assessing the quality of the CHP is based on energy efficiency and environmental impact. This scheme is the most advanced in existence for defining good quality CHP.

The CHPQA standard defines good quality CHP by setting a number of threshold criteria for Quality Index and Power Efficiency. The normal threshold criteria under annual operation are:

- Quality Index equals or exceeds 100 - This is an indicator of the energy efficiency and environmental performance of the CHP.

- Power Efficiency equals or exceeds 20% - This is the total annual power output divided by the total annual fuel energy input.

There are circumstances where the threshold criteria may vary, for example under initial operating conditions. Full details are provided in the CHPQA Standard and Guidance notes.

The CHPQA standard defines good quality CHP and is used to assess the eligibility of CHP plant for Climate Change Levy exemption, Enhanced Capital Allowances and exemption from Business Rating of CHP plant and machinery.

Other countries also have supportive measures in place for CHP. These vary greatly in their scope and environmental criteria used. A few of these are briefly mentioned below.

The Blue Certificate Scheme in the Netherlands has financial rewards for each kWh of 'free CO_2' produced by CHP. Belgium has a number of certificate schemes for renewable energy sources and CHP for its different regions. Each of the schemes are slightly different but financial rewards are provided for CO_2 emission savings when compared to reference emissions based on best available technology for separate production.

The Cogeneration Directive requires Member States to provide a mechanism for the guarantee of origin of electricity from high-efficiency cogeneration, to date only a limited number have reported progress on this. In the UK it is administered under the CHPQA scheme.

The Directive requires a mechanism for monitoring useful heat and calculating electricity from the CHP plant in order to define good quality CHP for the guarantee of origin. The recently published guidelines for Annex II of the Co-generation Directive will help with this. Other countries have developed their own alternative methodologies, some of which are complex e.g. UK CHPQA, whilst other are simple. In order to be able to compare the quality of CHP across Member States a harmonised approach is required, however this will still take time to develop despite the recent publication of the Implementing Guidelines.

42 http://ec.europa.eu/environment/gpp/toolkit_en.htm
43 http://www.chpqa.com/

The different approaches used by Member States to define and monitor CHP mean that is difficult to propose a single definition of good quality or high efficiency CHP. The different approaches are not easily transferred between Members States as they are designed to be used in one country or region only and will take into account national targets and policies regarding CHP.

Member States are required by the Cogeneration Directive to put a system of Guarantee of Origins (GoO) in place. This system is used to demonstrate that electricity has been produced using high efficiency CHP as defined by the Directive. Whilst this is a potentially useful system, it does have its limitations in terms of its use in this specification. Firstly the GoO systems relates electricity produced over a specified period, and therefore uses actual data is not a mechanism by which the potential of a CHP scheme can be assessed. Secondly, some Member States do not yet have systems in place or where they do exist, they are not used because other national schemes are preferred.

Where CHP plant is larger than 50MWe, the IPPC Directive will be applicable and the contracting authority should ensure that any BAT standards outlined in the appropriate BREFs, for example those regarding Large Combustion Plant and Waste Incineration, are taken into account where applicable.

There are some other standards that are worth highlighting, although in terms of criteria development they have limited use, due to the product approach undertaken. They do however provide a wider framework and context for the use of CHP plant. In particular the following two EN standards are worth noting:

- EN 15603 on ‘Energy performance of buildings – overall energy use and definition of energy ratings’

- EN 15316 on ‘Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems’

8 Conclusion & Summary

There is a large range of CHP technology available that uses a variety of fuel types and can be implemented at different scales for a large number of applications. This quite clearly adds to the complexity of the technology and therefore in devising criteria. A limited number of ecolabel criteria have been developed and are available for specific CHP technologies at a defined scale. In addition there are also a number of mechanisms in different Member States that are used to assess whether CHP is eligible to receive incentives, if any are provided by that Member State to promote CHP.

These mechanisms help the Member States meet the requirements of the Cogeneration Directive, however many are still in their early stages and need to be developed further to meet the full requirements of the Directive. Some do however define good quality CHP. It is apparent though that the main drive for CHP is to be as fuel efficient as possible and therefore this forms the basis of any proposed criteria.

With a large number of parameters influencing the design and make-up of a potential CHP plant it is not a straight forward process to propose specific quantitative GPP criteria. Now that the detailed guidelines have been published, see Section 6.3 above, it should help in the development of a harmonised methodology for comparing CHP plant across different Member States, although it is likely to be sometime before a fully functional system is in place.

The Cogeneration Directive is aiming to promote High Efficiency CHP. Progress appears to have been slow so far with delays in implementing the Directive at Member State level. It is therefore believed to currently be unfeasible to include core criteria that go beyond the regulatory requirements due to various uncertainties and variations at the European level. Nonetheless, comprehensive criteria (as optional) can be proposed that build on the core criteria.

It is deemed appropriate that guidance and criteria can be developed for procurement officials using the Cogeneration Directive as the starting point and core reference point.

Furthermore, it is important the contracting authority considers the environmental impact of a proposed CHP plant in the context of the purpose that they are buying it; location, regional or national legislation, size, building type, proposed fuel type and so on, and it is therefore proposed that the GPP criteria used offer flexibility in an area with significant variability.

The local energy mix should definitely be considered: will CHP deliver real reductions in CO_2? Contracting authorities may need to consider this, but where CHP is identified as a means of helping reduce the main environment impact of energy production i.e. CO_2 emissions, then high efficient CHP should be considered as defined by the Directive. If Public Authorities are purchasing well-designed, modern CHP systems then the issue of how to calculate primary energy savings and associated targets should not be the concern it is with older CHP plant.

9 Proposal for core and comprehensive criteria

It is proposed to set core and comprehensive criteria for CHP. The proposed GPP criteria are designed to reflect the key environmental risks. This approach is summarised in the following table:

Key Environmental Impacts	GPP Approach
• Impact related to the extraction of fossil fuels • Increased fuel consumption in separate energy and heat production • Emission of carbon dioxide from the generation of energy and heat • Pollution of air from other emissions to air e.g. CO, NOx, SO, dust	• Promote the use of CHP units that convert fuels into heat and power with a maximum efficiency to save resources and to minimize greenhouse gas emissions • Promote the use of CHP that produce low emissions of air pollutants • Promote CHP, to reduce fossil fuel consumption when compared with the separate production of energy and heat • Use of high efficient CHP to contribute towards reductions in carbon dioxide emissions • Promote the use of CHP that produce low emissions of air pollutants • Encourage the use of high efficient CHP beyond the legislative requirements

Please note that the order of impacts does not necessarily translate to the order of their importance.

As outlined in section 7, there are limited ecolabel standards available for CHP. It is therefore considered that the core criteria shall reflect the requirements of the Cogeneration Directive in terms of efficiency and primary energy savings, to ensure high efficient CHP is used. This is in line with the aims of the Directive, which are to promote the use of high efficient CHP.

The main environmental impacts that CHP can help reduce are through the simultaneous efficient production of electricity and heat. The core criteria therefore include specific efficiency levels that the CHP plant must achieve and the percentage primary energy savings the CHP plant should deliver when compared with the separate production of electricity and heat. These directly reflect the requirements of the Cogeneration Directive.

The efficiency levels have been included in the criteria to ensure that all electricity produced by the CHP plant is considered as high efficient CHP. If this criterion is not included then the amount of electricity attributed to high efficiency CHP can be scaled back to meet the required level of PESs. It is important to maximise the amount of electricity produced by high efficient CHP and the criteria have been developed to ensure that this will be the case.

The comprehensive criteria build on the core criteria by promoting CHP plant that can use renewable fuels. This will reduce the key environmental impacts further, for example carbon dioxide emissions by using non-fossil fuel sources such as biogas and biomass.

In addition to the core and comprehensive criteria, a number of award criteria have been developed. These are further considerations that the contracting authority should taken into account depending on the specific nature of the proposed CHP plant. They include encouraging higher primary energy savings and efficiency beyond those stipulated in the Cogeneration Directive and core criteria and plant that go beyond the minimum requirements with respect to air emissions.

Full details of the proposed purchasing criteria are provided in the associated Product Sheet for this product group.

10 Relevant EU legislation and information sources

10.1 European Legislation

- Directive 2004/8/EC on the promotion of cogeneration based on useful heat demand in the internal energy market and amending Directive 92/42/EEC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:052:0050:0060:EN:PDF

- Decision 2007/74/EC of 21 December 2006, establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC of the European Parliament and of the Council
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:032:0183:0188:EN:PDF

- Commission Decision (2008/952/EC) of 19 November 2008 establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:338:0055:0061:EN:PDF

- Energy Performance of Buildings Directive (EPBD) 2010/31/EU
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF

- The Energy Performance of Buildings Directive (EPBD) 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings, adopted on 16th December 2002
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF

- Directive 2003/54/EC concerning common rules for the internal market in electricity and repealing Directive 96/92/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:176:0037:0055:EN:PDF

- Directive 2009/72/EC concerning rules for the internal market in electricity and repealing Directive 2003/54/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF

- Directive on the Promotion of Energy from Renewable Energy Sources 2009/28/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF

- Directive 2008/1/EC concerning integrated pollution prevention and control (Codified version)
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF

- The Classification, Packaging and Labelling of Dangerous Substances Directive 67/548/EEC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML

- The CLP Regulation (EC) No 1272/2008

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF

- Directive on the Energy End-use Efficiency and Energy Services 2006/32/EC
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:0064:en:pdf

- Resolution on the communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions on a Community strategy to promote combined heat and power (CHP) and to dismantle barriers to its development (COM(97)0514 - C4-0596/97)
  http://www.europarl.europa.eu/pv2/pv2?PRG=CALDOC&TPV=DEF&FILE=980515&SDOCTA=7&TXTLST=1&POS=1&LASTCHAP=7&Type_Doc=FIRST&LANGUE=EN

- Communication from the Commission to the European Council and the European Parliament – An Energy Policy For Europe (COM(2007)1)
  http://ec.europa.eu/energy/energy_policy/doc/01_energy_policy_for_europe_en.pdf

- Directive establishing a framework for the setting of Ecodesign Requirements for Energy-related Products 2009/125/EC:
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

10.2 Ecolabels and Standards

- Blue Angel – Small-Scale Gas-Fired Cogeneration Modules RAL-UZ 108
  http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-108.pdf

- Blue Angel – Small-Scale Liquid-Fired Cogeneration Modules RAL-UZ 109
  http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-108.pdf

- UK CHPQA Scheme
  http://www.chpqa.com/

10.3 Studies and Other Sources of Information

- European Commission's GPP Training Toolkit
  http://www.ec.europa.eu/environment/gpp

- UNEP Energy Technology Factsheet – Cogeneration
  http://www.cogen.org/Downloadables/Publications/Fact_Sheet_CHP.pdf

- EDUCOGEN (2001) The European Educational Tool on Cogeneration, Second Edition, December 2001
  http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Tool.pdf

- EDUCOGEN (2001) A Guide to Cogeneration, March 2001
  http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Cogen_Guide.pdf

- Report commissioned by the CHP Policy Group. (Conducted by COGEN Europe) (2006) Benchmarking Report: Status of CHP in EU Member States
  www.sei.ie/getFile.asp?FC_ID=1772&docID=57

- Urban Community Heating and Cooling: the Southampton District Energy Scheme
  http://www.iea-dhc.org/download/KN1640%20Southampton%20v2.pdf

- District Energy Case Study – Sheffield, UK
  http://www.veoliaenvironmentalservices.co.uk/sheffield/pages/district.asp

- Action Energy From the Carbon Trust (2004) GPG388 Good Practice Guide Combined heat and power for buildings, Selecting, installing and operating CHP in buildings – a guide for building services engineers
  http://www.lboro.ac.uk/service/estates/pages/downloads/GPG388.pdf

- http://www.cogen.org/cogen-challenge/index.htm

- http://tecs.energyprojects.net/

- Information on the use of renewable raw materials, e.g. bio-based products: http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/biobased-products/index_en.htm

Appendices

Appendix 1: Summary of Blue Angel requirements for small cogeneration plants

Appendix 1

Summary of Blue Angel requirements for small cogeneration plants

Product	**Efficient energy use**			**Emissions**[1]		
	Total efficieny η_{total} (%)	Electrical efficiency η_{el} (%)	Partial-laod requirenments for plants with modulation of the electrical power (with 50% nominal load or max. power)	NO_x (mg/Nm^3)	CO (mg/Nm^3)	Dust (mg/Nm^3)
Gas fired cogeneration plant module (RAL-UZ 108) $\leq 30\ kW_{el}$	≥ 89	$\eta_{el} \geq 2{,}5 \cdot \ln(P_{el})+21{,}5$ 1) $\eta_{el} \geq 2{,}5 \cdot \ln(P_{el})+20{,}5$ 2)	η_{total} maximum 2% lower than with full load η_{el} maximum 3% lower than with full load	≤ 250	≤ 300	
Diesel fired cogeneration plant module (RAL-UZ 109) $\leq 30\ kW_{el}$	≥ 85	$\eta_{el} \geq 3{,}5 \cdot \ln(P_{el})+22{,}5$ 1) $\eta_{el} \geq 2{,}5 \cdot \ln(P_{el})+24$ 2)	η_{ges} um maximal 2% geringer als bei Volllast η_{el} um maximal 3% geringer als bei Volllast	≤ 2500	≤ 300	≤ 150

1) with fixed electrical power

2) with modulation of the electrical power