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## **Benchmarking of the Legal Frame**

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## 1 Scope of the Report

This report is intended so give a general overview of the European legal framework with respect to

- a) design, manufacturing, and placing on the market of small and medium biomass gasification plants (BPGs), and
- b) construction, putting into service, and commercial operation of BPGs.

The legal areas concerned by these activities have been identified and are described below.

For the purpose of this report, "small and medium biomass gasification plants" have been defined as combined heat and power (CHP) plants producing heat and electricity in internal combustion engines from gas generated by thermochemical gasification of fresh biomass, with an input rating of the gasifier (thermal capacity) in the order of less than 10 MW.

It is acknowledged that the design and manufacturing of plants as well as the procedures necessary to obtain operating permits from regulating authorities are areas where considerable consultancy is currently required and performed. Therefore, it is evident that an analysis of the legal framework within the scope of the Gasification Guide project cannot attempt to remove the need for such consultancy. Rather, the present analysis aims

- to reveal to manufacturers and to operators the various legal areas that may have to be considered with respect to biomass gasification plants and
- to convey a general idea of the classification schemes and criteria which they may find themselves confronted with.

The question which of these regulations, criteria and schemes have to be taken into account for a specific activity will need to be answered individually in each single case.

Unless otherwise mentioned, the information presented in this report refers to December 31, 2007 as the reference date for the validity of legislation and regulations.

## **2 Identification of the relevant legal framework for biomass gasification plants**

In order to determine the relevant legal framework for small and medium biomass gasification plants on the European market, it is useful to draw a rough distinction between those requirements which apply to the design and manufacturing of BGPs and those which apply to ownership and operation – in simple terms, to distinguish between the manufacturer's and the operator's duties.

Such a distinction is arbitrary to some extent, since

- the designer or manufacturer of a BGP will also have to determine technical requirements that may result from individual operating permits, whereas
- the owner or operator may have to demonstrate that the plant has been manufactured according to appropriate standards.

An analysis of the European and national legal framework shows, however, that the distinction is helpful in order to develop an idea what kind of obligations have to be met, since the legal framework for manufacturing is rather homogeneous throughout Europe, whereas the legal framework for plant operation has turned out to have many variations across the European Member States and even within a single state.

Those legal areas will be highlighted which are closely related to technical properties of BGPs and to health, safety and environmental requirements in particular.

### **2.1 *Design, manufacturing, and placing on the market***

This chapter deals with legal requirements which are of particular concern to manufacturers of biomass gasification plants.

"The European Union has developed original and innovative instruments to remove the barriers to free circulation of goods. Among these, the New Approach to product regulation and the Global Approach to conformity assessment take pride of place. The common thread between these complementary approaches is that they limit public intervention to what is essential and leave business and industry the greatest possible choice on how to meet their public obligations. Since 1987 some 20 directives, adopted on the basis of the New Approach and the Global Approach, have progressively come into force."<sup>1</sup>

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<sup>1</sup> Guide to the implementation of directives based on the New Approach and the Global Approach, European Commission, Luxembourg, 2000

With a view to the free circulation of goods, Article 95 of the EC Treaty is the basis for European directives defining essential health and safety requirements that have to be fulfilled by products intended for the European market. The directives are addressed to the Member States, which have transposed them into national legislation.

A biomass gasification plant consists of pieces of equipment which will be or may be in the scope of such European directives. Table 2.1 gives an overview of directives which provide for the CE marking and lay down requirements for the conformity assessment procedure.

Table 2.1: European Directives (providing for the CE marking) which are likely to be applicable to biomass gasification plants or to parts thereof

Directive: Number, Scope	Examples of application (BGP equipment)
73/23/EEC: Low voltage equipment [2006/95/EC]	electrical instruments, drives, control systems, generator
89/336/EEC: Electromagnetic compatibility [2004/108/EC]	electrical instruments, drives, control systems
98/37/EC: Machinery [2006/42/EC]	drives, pumps, blowers, moving mechanical parts, gas engine
94/9/EC: Equipment for use in potentially explosive atmospheres (ATEX directive)	blowers, measuring devices
97/23/EC: Pressure equipment	heat exchangers/boilers, compressed air system

"New Approach directives apply to products which are intended to be placed (or put into service) on the Community market. Usually such products are ready for use, or require only adjustments that can be performed in view of their intended use. [...].

The concept of product varies between New Approach directives. [...] It is the responsibility of the manufacturer to verify whether or not the product is within the scope of a directive.

A combination of products and parts, which each comply with applicable directives, does not always have to comply as a whole. However, in some cases, a combination of different products and parts designed or put together by the same person is considered as one finished product which, as such, has to comply with the directive. In particular, the manufacturer of the combination is responsible for selecting suitable products to make up the combination, for putting the combination together in such a way that it complies with the provisions of the directives concerned, and for fulfilling all the requirements of the directive in relation to the assembly, the EC declaration of conformity and CE marking. The decision whether a combination of products and parts needs to be considered as one finished product has to be taken by the manufacturer on a case-by-case basis."<sup>2</sup>

It is evident that certain parts of a BGP are likely to be in the scope of directives from table 2.1. The question can be raised, however, whether a biomass gasification plant as a whole can be in the scope of one of these directives (and therefore require CE marking and conformity assessment of the entire plant).

<sup>2</sup> Guide to the implementation of directives based on the New Approach and the Global Approach, European Commission, Luxembourg, 2000

While assemblies are in the scope of directives from table 2.1, the process of installation of products is generally not in the scope but covered by workplace directives according to Art. 137 of the EC Treaty or by domestic legislation of the Member States.

Among the directives listed in table 2.1, only the machinery directive seems to have a scope that comprises all kinds of health and safety hazards which could arise from a product. While it is apparent that some parts of a BGP (e.g. the biomass feedstock conveying system or the gas engine) are likely to be "machinery", the question arises whether the BGP as a whole is in the scope of that directive and needs to undergo the conformity assessment and declaration procedures defined therein.

A preliminary answer can be found in the "Comments on Directive 98/37/EC", published by the European Commission<sup>3</sup>:

"57. Paragraph 2 first defines what the Directive means by machinery. The guiding principle is that machinery is fundamentally 'mechanical'. ..."

"68. The definition of machine assemblies should be applied with common sense and understanding, however. There is no point, for example, in extending it to complete industrial plants such as power stations or oil refineries.

The question of applying the 'machinery' Directive to a complex industrial installation only arises when the new installation is first put into service. Subsequently, the installation is always the responsibility of the manager, who may modify it for operating reasons, and national transposition of Directive 89/655/EEC [concerning the minimum safety and health requirements for the use of work equipment by workers at work] is sufficient to cover the main safety requirements applicable. The 'machinery' Directive does not therefore add anything useful concerning the safety of industrial units and common sense would suggest that it should not apply to complete installations. On the other hand, it will often be possible to identify homogeneous functional units that can be described as machinery as defined in Article 1 of the Directive."

The ATEX Guidelines on the application of Directive 94/9/EC<sup>4</sup> contain the following example of equipment not covered by that directive:

"A common situation is that pieces of already compliant equipment are placed on the market independently by one or more manufacturer(s), and are not placed on the market by a single legal person as a single functional unit [...]. Combining such equipment and installing at the user's premises is not considered as manufacturing and thus does not result in equipment; the result of such an operation is an installation and is outside the scope of Directive 94/9/EC. The installer has to ensure that the initially compliant pieces of equipment still comply when they are taken into service."

Summing up these remarks, it seems appropriate that BGP manufacturers identify those pieces of equipment in their biomass gasification plants that are devices or

<sup>3</sup> [http://ec.europa.eu/enterprise/mechan\\_equipment/machinery/guide/guide\\_en.pdf](http://ec.europa.eu/enterprise/mechan_equipment/machinery/guide/guide_en.pdf)

<sup>4</sup> <http://ec.europa.eu/enterprise/atex/guide/index.htm>

assemblies covered by New Approach Directives, and supply the required CE marking and declarations of conformity (DoC) for these parts. The manufacturer may even choose to install pieces of equipment from third-party suppliers that already bear CE marking and come with declarations of conformity. There seems to be no requirement to deliver a declaration of conformity for an entire biomass gasification plant.

The examination of this issue will be continued in the context of the analysis of results from the upcoming case studies in the Gasification Guide project.

Biomass gasification plants in terms of this report are supposed to be professional equipment operated on a commercial scale, which seems inescapable at this stage of development of such plants due to the demanding requirements towards the operator. It cannot be precluded, however, that future development of small biomass gasifier plants might result in equipment which can be operated far more easily, turning such BGPs into an alternative for standard heating equipment which is made available to consumers. Therefore, it may become necessary in future to consider also the application of Directive 2001/95/EC on general product safety for BGPs which are intended for, or likely to be used by, consumers.

## **2.2 Construction, putting into service, and operation**

This chapter deals with legal requirements which are of particular concern to (prospective) owners and operators of biomass gasification plants.

### **2.2.1 Relevant legal areas**

Construction and commercial operation of a biomass gasification plant is affected by various regulations that can have a direct impact on the design of the plant and its operation mode. From an analysis of the requirements towards BGPs which are in operation in Europe, the areas which seem most important have been determined and are enumerated in table 2.2.

Table 2.2: Legal areas which may be relevant for the construction, putting into service, and operation of biomass gasification plants

<b>Main subject</b>	<b>Subject</b>	<b>Relevance for biomass gasification plants</b>
Environmental impact	Permit requirements (Integrated pollution prevention and control)	Although BGPs are not in the scope of the IPPC directive, national regulations may require integrated permits or special permits.
	Environmental impact assessment (EIA)	BGPs may be classified as a type of development that requires EIA screening.
	Emissions to atmosphere: gases, dust, smell	emissions in normal operation from gas engines, flares, or from storage; start-up and shutdown may also cause relevant emissions
	Noise emission	noise from equipment (gas engines, blowers, coolers), from material handling and from vehicles

Table 2.2 (contd.)

Main subject	Subject	Relevance for biomass gasification plants
Environmental impact	Major Accident Hazards	could become relevant if large amounts of hazardous substances are stored on site
	Waste production and treatment	Waste from plant operation may include ashes, tar, and contaminated cleaning fluids. Special considerations may be required if intermediates are recirculated (e.g. tar from the gas cleaning system)
	Waste water discharge	process waste water may require special treatment to meet requirements for discharge to sewer
	Handling of substances hazardous to water / protection of water bodies	tar, cleaning liquids, water treatment chemicals; use of cooling water
	Soil protection	tar, cleaning liquids, water treatment chemicals
Occupational safety and health	Health and safety at work, general	risk assessment, protective measures, operating instructions, personal protective equipment, emergency procedures
	Substances hazardous to health	intermediates: gasification gas (CO), tar; handling of chemicals used in the plant: cleaning liquids, water treatment chemicals, biological agents (storage of feedstock)
	Fire and explosion hazards; explosion protection	flammable gasifier gas; special precautions for gasifier start-up and shutdown
	Installations subject to monitoring	special monitoring may be required for certain types of equipment and installations
	Pressure equipment	requirements towards installation and maintenance, (regular) testing
	Electrical equipment	requirements towards installation and maintenance, (regular) testing
	Machinery	requirements towards installation and maintenance, (regular) testing
Other Regulations	Renewable energies and biomass	possible effects of plant design, type of feedstock, and mode of operation: feed-in tariffs, combined heat and power, guarantee of origin (renewables) distinction: (fresh) biomass / waste
	Energy feed-in	requirements towards feeding electrical energy to the power grid
	Land use planning	selection of appropriate site (industrial activity)
	Safety of buildings	fire safety, building stability

Table 2.2 may be regarded and used as a checklist to determine the statutory obligations which become relevant for a specific BGP installation in a European state. The requirements have been found to be laid down in national or regional regulations, which show a wide variation in scope and detail.

Table 2.3: National regulations transposing the IPPC Directive and pertaining permit requirements for small and medium BGPs using fresh biomass

State	Regulation(s) transposing the IPPC directive	Permit requirements for biomass gasification plants
(Europe)	(Directive 96/61/EC concerning integrated pollution prevention and control – IPPC directive)	(According to Annex I, BGPs are not in the scope of the IPPC directive.)
Austria	Trade, Commerce and Industry Regulation Act 1994, last amended 2006 [Gewerbeordnung GewO 1994, zuletzt geändert 2006] Immission Protection Act - Air [IG-L Immissionsschutzgesetz - Luft]	yes  yes
Belgium (Example: Brussels)	[Ordonnance du 5 juin 1997 relative aux permis d'environnement du Ministère de la Région de Bruxelles-Capitale] [Arrêté du Gouvernement de la Région de Bruxelles-Capitale fixant la liste des installations de classe IB, II et III]	yes, for gasification of carbonaceous material (< 500 t/d)
Bulgaria	Environmental Protection Act (SG 91/2002) [Закон за опазване на околната среда (ДВ 91/2002)] Regulation №5 on risk assessment (SG 47/1999) [Наредба №5 за оценка на риска (ДВ 47/1999)]	yes
Denmark	Environmental Protection Act Statutory Order no. 943 of 16 September 2004 from the Ministry of the Environment on Approval of Listed Activities (Approval Order)	yes, if thermal rating is > 1 MW
France	Environmental Act [Code de l'environnement] [Nomenclature des installations classées pour la protection de l'environnement] [Arrêté du 2 février 1998 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation]	yes, for production of flammable gas yes, for combustion of non-standard fuel if thermal rating is > 0.1 MW
Germany	Federal Immission Control Act [Bundesimmissionsschutzgesetz, BImSchG] Ordinance on Installations Requiring a Permit [4. BImSchV]	yes [as of September 30, 2007]; yes, if thermal rating for the produced gas is > 1 MW [upcoming change in legislation]
Ireland	Protection of the Environment (PoE) Act 1992 and 2003	(BGPs not in the scope)
Italy	[Decreto Legislativo 18 febbraio 2005, n. 59 "Attuazione della direttiva 96/61/CE relativa alla prevenzione e riduzione integrate dell'inquinamento"]	(BGPs not in the scope)

Table 2.3 (contd.)

State	Regulation(s) transposing the IPPC directive	Permit requirements for biomass gasification plants
Netherlands	Environmental Act [Wet milieubeheer, Wm] Ordinance on Installations and Permits [Inrichtingen- en vergunningenbesluit milieubeheer (lvb)] Water Act [Wet verontreiniging oppervlaktewateren, Wvo]	probably yes (combustion installations > 130 kW)
Spain	IPPC Act [Ley 16/2002 de 1 de julio de Prevención y Control Integrados de la Contaminación (Ley IPPC)]	(BGPs not in the scope)
Sweden	The Environmental Code [SFS 1998:808 Miljöbalk] Ordinance on environmentally hazardous activities [Förordning (1998:899) om miljöfarlig verksamhet och hälsoskydd]	no, for gasifiers and gas engines < 10 MW, but notification required (40-5 and 40.1-2)
Switzerland	(No Swiss transposition of IPPC directive!) Environmental Protection Act [Bundesgesetz über den Umweltschutz (Umweltschutzgesetz, USG)]	probably yes
United Kingdom	The Pollution Prevention and Control (England and Wales) Regulations 2000	probably yes, cf. Schedule 1 Part 1, Section 1.1 (Combustion Activities) and Section 1.2 (Gasification, Liquefaction and Refining Activities)

The situation of licensing (permit) requirements resulting from national or regional legislation transposing the IPPC Directive 96/61/EC and defining integrated permit procedures is given in table 2.3 for a number of European countries.

The investigation into the various national or regional legal requirements for environmental permits according to the IPPC directive with a view to biomass gasification plants has revealed two different approaches.

In some European states, Annex 1 of the European IPPC directive has been transposed into national law on a 1:1 basis, which means that BGPs are not in the scope of these national regulations.

Other European states have combined the requirements from the IPPC directive with their own schedules for plants and activities subject to licensing, and a wide variety can be found with regard to the characteristic properties which may subject a BGP to licensing requirements or not.

Even if a BGP is not in the scope of national regulations transposing the IPPC directive, individual permits for construction and operation (e.g. building permits) or notification of regulatory authorities may still be required due to other national or regional regulations. A detailed identification and description of these statutory obligations would go far beyond the scope of this report.

## 2.2.2 Classification Criteria for formal and substantial legal requirements

The analysis of legal requirements for construction and operation of BGPs in Europe has revealed that there is a multitude of classification schemes and criteria applying to different properties of BGPs. An overview of these criteria is presented below.

Small changes in the design and in technical parameters of BGPs as well as different sites for operation of the BGPs (even within one EU country) may result in significantly different requirements in terms of permit procedures and performance parameters (e.g. admissible emissions).

The original idea of developing a benchmark of legal requirements for BGPs in different European countries by comparing the country-specific requirements for a "standard" BGP with exactly defined technical properties had to be aborted, as the result could in no way have been representative for the legal situation of BGP construction and operation.

Instead, the procedure has been adopted for the purpose of this report to derive from the various national regulations those classification criteria which seem to have the most significant impact on legal requirements towards BGP construction and operation.

The key classification criteria for BGPs determined from this analysis are:

- **Type of gasifier feedstock: waste biomass or fresh biomass**
- **Thermal input rating (thermal capacity) of the BGP with regard to gasifier feedstock**
- Thermal input rating (thermal capacity) of the BGP with regard to the produced gas
- Electrical rating of the CHP gas engine
- Gas engine type (e.g. compression ignition, spark ignition)
- Type of "standard" gas engine fuel used for classification of the gasifier gas by way of comparison (e.g. biogas, landfill gas, mine gas, natural gas, lean gas, other gases)
- Operating time per year of the gas engine (peak load operation or continuous operation)
- Date of putting the plant into service
- Properties of the site and its surroundings (e.g. industrial, commercial, agricultural, or residential area)
- Does the BGP require the discharge of waste water?

Several of the above criteria apply to formal requirements (Is a notification of the regulatory authority or an environmental permit required?) and to substantive requirements and consequences (emission limits, electricity feed-in tariff).

The majority of these criteria are valid for some Member States only. For individual criteria (e.g. thermal input rating), the classification limits<sup>5</sup> have been found to vary between different countries and even within one Member State for different

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<sup>5</sup> e.g. "< 0.1 MW / 0.1 – 1 MW / > 1 MW"

regulatory targets (e.g. different class limits for thermal input rating with regard to the type of permit procedures, to emission limit values, and to feed-in tariffs.)

In addition, some of the criteria are interrelated. For a BGP that does not fall in the range of activities requiring an environmental permit in a European state, for instance, the criteria and classification limits for emission values in that state may be different from those applicable to plants which require an environmental permit.

### 3 Interpretation of the legal framework

In chapter 2 of this report, procedures and checklists have been presented which can be used to determine the basic legal requirements for a specific biomass gasification plant in a European state. The results will have to be interpreted in any case with regard to the planned activity.

This chapter presents some examples intended to demonstrate the bandwidth and the degree of uncertainty of such interpretation with regard BGP construction and operation.

#### 3.1 Scope of interpretation of legal requirements

Classification of BGPs according to the schedules of environmental legislation has proven to be an area of considerable uncertainty in some cases.

One principal reason for this is that small-scale and medium-scale gasification technology for fresh biomass conversion to electrical energy did not play any significant role in the past<sup>6</sup>.

- Where gasification technology has been addressed in regulations, reference is generally made to plants using fossil feedstock (e.g. coal or crude oil) and to large-scale installations (e.g. coke ovens, gas works).
- Where gas engines have been addressed, the types of gas fuel considered in general do not include gas from (thermal) biomass gasification, but refer to standard fuel gases and to gases like landfill gas, mining gas, or biogas.
- Where thermal use of biomass has been addressed, reference is often made to the incineration of waste, but not to fresh biomass.

Some typical examples for uncertainty in BGP classification with regard to permit procedures and emission limit values are given below.

#### Germany:

A schedule for environmental permit requirements can be found in the 4<sup>th</sup> Ordinance for the Implementation of the Federal Immission Control Act (Ordinance on Installations Requiring a Permit – 4<sup>th</sup> BImSchV). Installations for heat generation, mining, and energy are listed in no. 1 of the annex to that Ordinance. As of September 2007, thermal biomass gasification plants have predominantly been classified as subpara. 1.13 installations ("Installations for the production of generator gas or water gas from solid fuels"), independent of the thermal rating. Related gas engines with a rated thermal input between 1 MW and 10 MW have been classified as subpara. 1.4 b) aa) installations ("Stationary internal combustion engines for the generation of electricity, steam, hot water, process heat and hot waste gas using ... gaseous fuels (especially coke oven gas, mine gas, basic oxygen furnace gas, refinery gas, synthesis gas, petroleum gas from tertiary mineral oil production, sewage gas, biogas), except untreated natural gas, liquid gas, gases from public gas

<sup>6</sup> In the Year 2005 Reports pursuant to Art. 3 (3) of Directive 2001/77/EC on electricity consumption from renewable energy sources in the European states, "biomass gasification" has not even been mentioned.

supply or hydrogen, ..."). Gas engines with a lower thermal rating have been treated as auxiliary facilities to the gasifier.

In the near future, probably before the end of December 2007, a change in federal German legislation will result in biomass gasifiers of less than 1 MW equivalent thermal rating of the produced gas not to be in the scope of the 4<sup>th</sup> BImSchV anymore.

A different classification may result if intermediate liquid or solid products (e.g. wood tar) are recirculated to the gasifier or burned in separate devices of the gasification plant, which could be regarded as the combustion of non-standard fuels according to no. 1.3 of the annex. In this case, a permit would be required if the rated thermal input of the recirculated material is 0.1 MW or more.

Discussion of the appropriate classification with the competent authority will therefore be required in some cases.

### **United Kingdom:**

The Pollution Prevention and Control (England and Wales) Regulations 2000, referred to as "PPC Regulations", offer two alternatives in Section 1.2 for the classification of BGPs where all of the gas produced in normal operation will undergo combustion in the same installation.

#### *Section 1.2 - Gasification, Liquefaction and Refining Activities, Part A(1)*

...

*(e) Producing gas from oil or other carbonaceous material or from mixtures thereof, other than from sewage, unless the production is carried out as part of an activity which is a combustion activity (whether or not that combustion activity is described in Section 1.1).*

*(f) Purifying or refining any product of any of the activities falling within paragraphs (a) to (e) or converting it into a different product.*

...

*(j) Activities involving the pyrolysis, carbonisation, distillation, liquefaction, gasification, partial oxidation, or other heat treatment of coal (other than the drying of coal), lignite, oil, other carbonaceous material or mixtures thereof otherwise than with a view to making charcoal.*

#### *Interpretation of Part A(1):*

*1. Paragraph (j) does not include the use of any substance as a fuel or its incineration as a waste or any activity for the treatment of sewage.*

...

*3. In this Part, "carbonaceous material" includes such materials as charcoal, coke, peat, rubber and wood.*

If the basic assumption is made that a BGP serves the purpose to produce electricity and/or heat from biomass (in particular, from wood) by a combination of gasification and combustion processes, the BGP as a whole may be regarded as a biomass combustion plant. The steps typical of solid-fuel combustion (drying, pyrolysis, reduction, oxidation) are all present in the BGP; they are, however, performed in different apparatus rather than in a single combustion chamber.

The production of flammable gas in the gasification reactor is *"carried out as part of an activity which is a combustion activity"*, and hence it is covered by the exclusion in paragraph (e). As the production of gas does not fall within paragraph (e), purification of the producer gas does also not fall within paragraph (f).

If the rated thermal input of any or all of the appliances in the BGP does not exceed the 20 MW limit of Section 1.1 Part (b) [*"Burning any fuel, other than a fuel mentioned in paragraph (b) of Part A(1) of this Section, in a boiler or furnace or a gas turbine or compression ignition engine ..."*], both the gasification and the combustion activities associated with the BGP are excluded from the scope of the PPC Regulations.

The above classification is also supported by the IPPC Technical Guidance Note for the Combustion Sector, table 1.3.1 ("Combustion, gasification plus combustion or pyrolysis (where gas is produced) plus combustion"):

For a "Fuel not comprising Waste" and a rated thermal input < 20 MW, the activity is deemed "Not regulated under PPC".

If the gasification process carried out within a BGP is deemed a separate activity (i.e. not as part of a combustion activity), or if the process is deemed an *"activity involving the ... gasification ... of ... other carbonaceous material"*, it will fall within paragraph (e) or (j) of Section 1.2 Part A(1).

Purification of the producer gas (removal of tar), in case of subparagraph (e), may also be regarded as *"purifying ... [a] product of an activity falling within paragraphs (a) to (e)"*, covered by paragraph (f).

As a result, the gasification and gas purification processes in the BGP will subject the activity as a whole to the PPC Regulations.

In the report "Regulation of Energy from Solid Biomass Plants", produced in 2006 for the Environment Agency, advice is given that "... to determine whether an installation falls in each of these categories, reference should be made to the PPC Regulations and discussions held with the appropriate regulator."

#### **Denmark:**

In the Danish "Order on limitation of emission of nitrogen oxides, uncombusted carbon hydrides and carbon monoxide etc. from engines and turbines" (Order No. 621 of 23/06/2005), emission limit values for NO<sub>x</sub>, CO, unburnt hydrocarbons and smell have been fixed for gas engines using gasification gas as fuel. The definition of the scope of that order, however, refers to gasification gas from gasification plants using coal, or from gasification plants using biomass waste. Fresh biomass as gasifier feedstock has not been considered in that order.

Discussion with the competent authority will therefore be required if fresh biomass is used as feedstock as to whether the emission limit values in the afore mentioned order are to be applied.

### **3.2 Application of emission limit values based on "Best Available Techniques" (BAT)**

In the European IPPC directive<sup>7</sup>, the requirement is set out for installations in the scope of this directive that emission limit values, parameters, or equivalent technical measures need to be based on the best available techniques, without prescribing the use of one specific technique or technology and taking into consideration the technical characteristics of the installation concerned.

Annex I of the IPPC directive contains a conclusive list of industrial activities covered by that directive. Category 1 (Energy industries) includes

- 1.1 Combustion installations with a rated thermal input exceeding 50 MW,
- 1.2 Mineral oil and gas refineries,
- 1.3 Coke ovens,
- 1.4 Coal gasification and liquefaction plants.

Due to the thermal rating and to the feedstock used, biomass gasification plants as considered in this project are clearly not in the scope of this category of the IPPC directive. Neither can these BGPs be classified as any of the "Other activities" listed in Category 6 of Annex I to the IPPC directive. Therefore, there is no requirement at the European level from the IPPC directive to apply emission limit values based on BAT to small and medium BGPs.

At the national level, however, the scope of the regulations transposing the IPPC directive into national law can be more comprehensive than the IPPC directive itself, which means that national regulations may require emission limit values for BGPs to be based on best available techniques.

In the BREF document on large combustion plants<sup>8</sup>, gasification of biomass is described as an "emerging technique" in chapter 5.6 which is currently performed in demonstration units only. This is an indicator that the techniques for flue-gas cleaning of biomass gasification plants, large-scale or small-scale, are in the stage of development, too. The questions

- which emission-limiting techniques from standard combustion applications can be successfully transferred to biomass gasification plants and
- which emission values may thus be achieved, taking both environmental and economic considerations into account,

are yet to be answered. It is evident that emission limit values based on available and proven techniques for standard combustion activities cannot be directly applied to BGPs, since the key process parameters of these activities are different, and long-term efficiency of emission-limiting techniques for BGPs is still a matter of investigation. Rather, it will be necessary to determine appropriate emission limits for BGPs from experience with plants in operation and from measurements performed in these plants. The Gasification Guide project offers a chance to contribute to that task.

<sup>7</sup> COUNCIL DIRECTIVE 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control, last amended by Regulation (EC) No 1882/2003 of the European Parliament and of the Council of 29 September 2003

<sup>8</sup> Reference Document on Best Available Techniques for Large Combustion Plants, July 2006, <http://www.jrc.es/pub/english.cgi/0/733169>

### **3.3 Emission limit values for atmospheric emissions from BGPs**

According to the results from interviews with biomass gasification plant manufacturers, the emission limits for the flue gas from BGPs have in many cases given rise to discussion with the competent regulatory authorities. In particular, these discussions have referred to the CO concentration in gas engine flue gas. To a lesser degree, flue gas components like NO<sub>x</sub>, SO<sub>2</sub>, organic hydrocarbons, dust, and smell have been regarded.

Up to now, only incomplete information has become available on the emission limit values that have been applied to BGPs in the past. Results from case studies in the frame of the Gasification Guide project are expected to provide information

- on the regulations concerning emission limit values that have been referred to,
- on the interpretation of "best available techniques" with regard to biomass gasification plants, and
- on the strategies that have been adopted so far by regulatory authorities and operators to agree on emission limit values.