European Commission

Final Report

Collection and analysis of data to support the Commission in reporting in line with Article 73(2)(a) of Directive 2010/75/EU on industrial emissions on the need to control emissions from the combustion of fuels in installations with a total rated thermal input below 50MW

AMEC Environment & Infrastructure UK Limited in partnership with the Regional Environmental Center for Central and Eastern Europe

September 2012

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Report for

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Executive Summary

Introduction

This report is one in a series resulting from the following study: "Collection and analysis of data to inform certain reviews required under Directive 2010/75/EU on industrial emissions (IED) and to inform Commission Guidance on the content of the baseline report under Article 22 of the IED". This report describes the work undertaken to support the Commission in reporting in line with Article 73(2)(a) of the IED on **the need to control emissions from the combustion of fuels in installations with a total rated thermal input below 50MW**. The scope of the study has been focussed on assessing combustion plants of capacities between $1MW_{th}$ and $50MW_{th}$.

This report and appendices has been updated (September 2012) to take into account feedback received from Member States as part of a consultation undertaken during July-August 2012. The consultation was aimed at correcting any errors in the interpretation of information provided by Member States during the study rather than inviting feedback on the findings of the analysis.

Data Gathering and Compilation

Within this study, data on combustion plants less than 50 MW_{th} have been gathered directly from the Member States. This has included data on numbers, capacities, fuel consumption and emissions from the plants, as well as information on relevant national legislation (where applicable), combustion techniques used, abatement measures typically applied, and the degree to which the combustion plants may already be regulated under the IED as directly associated activities. Chapter 3 describes in full the data received in this study.

Where necessary (and possible), the newly gathered data have been supplemented with data from a range of existing sources and studies. From these data, an EU wide dataset of combustion plants of capacities between $1MW_{th}$ and $50MW_{th}$ has been developed through use of extrapolation and other assumptions in an attempt to compile a sufficiently complete dataset with which to assess possible control options. The dataset is separated into three capacity classes of rated thermal inputs 1-5 MW, 5-20 MW and 20-50 MW. The compilation of this EU dataset is described in Chapter 4.

Options for the Possible Control of Emissions from Combustion Installations Less than 50 MW

The following options for controlling emissions to air from combustion plants 1-50 MW_{th} have been assessed:

1. Do nothing: no change to current regulation in each Member State. All other options have been compared against this baseline.

2a. "Full IED": Inclusion of 1-50 MW_{th} installations as a new activity in Annex I of the IED. The option has been assessed assuming EU wide minimum ELVs would be in force set at the level of the most stringent national Member State legislation.

2b. As per 2a, but with EU ELVs set at level of the ELVs for 50-100 MW_{th} existing plants in the IED.

3. "Light IED": Inclusion of 1-50 MW_{th} installations within the IED as a separate chapter but without a full permitting regime and no coverage under Chapter II. Installations would be subject to EU wide emission limit values for atmospheric emissions only as for option 2a.

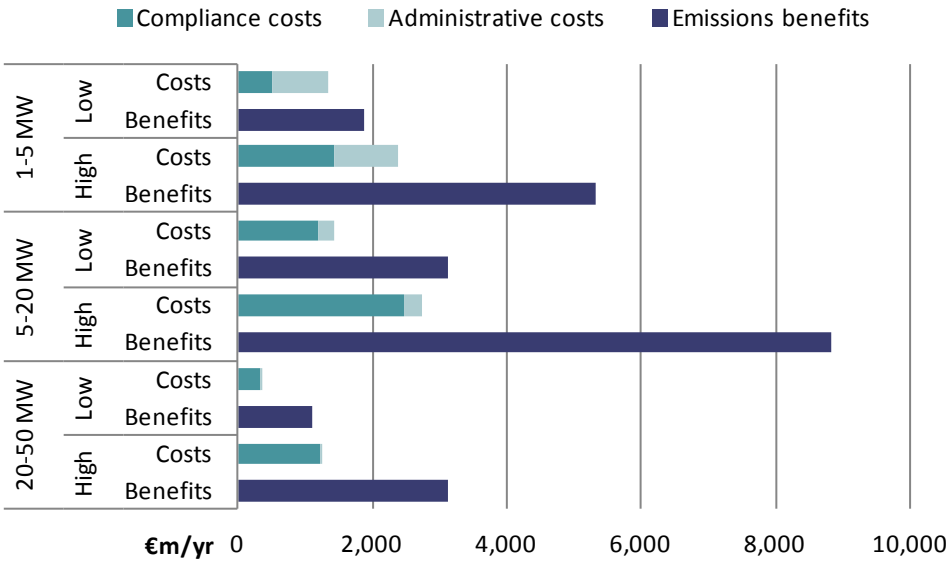
An alternative (or additional) approach for smaller plants of rated thermal input 1 to 5 MW was also considered in which product standards could be developed setting emission limits for selected pollutants, targeted at new units only, similar to those currently being developed under the Ecodesign Directive. Section 5.1 describes each of the options in more detail.

Analysis of Options

For options 2a, 2b and 3, the potential costs have been estimated in terms of compliance costs – due to the need to reduce emissions by implementing abatement measures to meet the relevant ELVs – and administrative costs associated with a permitting or non-permitting regime. Potential SO_2, NO_X and dust emission reductions associated with the implementation of abatement measures have been estimated and monetised using CAFE damage cost functions to derive indicative benefits. The methodology for this analysis is described in Section 5.2.

The results of the analysis, described in Section 5.3, suggest that the estimated average benefits outweigh the average costs (compliance and administrative) for all options (2a, 2b and 3), with the highest cost-benefit ratios for the largest capacity class (20-50 MW_{th}), as shown below in Figure 1 which presents the results for option 2a. However, for some capacity classes the lower range of indicative benefits does not exceed the high end estimate of costs for each of these options. The sensitivity analyses undertaken do not affect the overall conclusion of average benefits exceeding average costs (see Section 5.3.2).

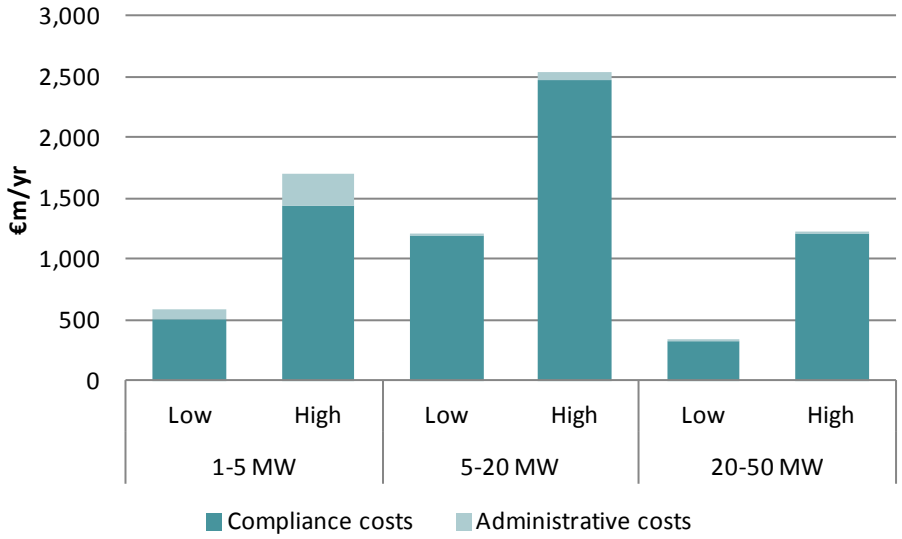
Figure 1 Option 2a costs and benefits across capacity classes



Option 2b is estimated to have 17% higher average costs and 8% higher average benefits compared to option 2a.

The administrative costs associated with a permitting regime are estimated to form an increasingly large component of total costs for the smaller capacity classes; for example, Figure 1 shows these to form around half of total costs for the 1 to 5 MW_{th} capacity class for option 2a. The assessment of option 3 in which a non-permitting approach is assumed to apply suggests that the large administrative cost element associated with permitting a large number of smaller installations could be significantly reduced. Figure 2 below shows the estimated costs for option 3. The benefits estimated for option 3 are the same as for option 2a.

Figure 2 Option 3 costs across capacity classes



In response to anticipated concerns over controlling emissions from a very large number of small sources in the 1 to 5 MW_{th} capacity class, an alternative (or additional) approach for these smaller plants could be the development of product standards that would apply to new plants in this category. However, further investigations would be required to determine how feasible – and suitable – such an approach would be taking into account some of the learning experiences from developments under the Ecodesign Directive.

Conclusions, uncertainties and limitations

The review of current national legislation in place in the Member States for regulating combustion plants 1 to 50MW_{th} has highlighted that many Member States already regulate these plants to some extent, and that many of the various pieces of legislation adopt similar approaches.

The results of the options assessment suggests that the estimated benefits of controlling atmospheric emissions from combustion plants of rated thermal input 1 to 50 MW exceed the estimated costs associated with compliance and administration. The administrative costs associated with the controlling of these plants under the IED or similar legislation are estimated to be higher than those that would be associated with a non-permitted approach. The analysis suggests that the highest benefits may come from controlling of atmospheric emissions from plants in the 5 to 20MW_{th} capacity class. The sensitivity analyses do not affect the conclusions, but their impacts on the cost-benefit ratios begin to establish some aspects of the uncertainties of the analysis. Full conclusions are described in Section 6.2.

A number of assumptions were made in extrapolating data to be considered representative of the EU27, which has led to a number of uncertainties and limitations in the underlying dataset which must be considered when assessing the results of the assessment of control options. The limitations and uncertainties are described in Section 6.2.

Considering the limitations of the data gathered, it is recommended that further work be undertaken to improve data capture on the combustion plants, in particular for the smallest capacity class 1 to 5 MW_{th}. Further work is also recommended to investigate the alternative product standard approach that could be applied for the smallest plants in more detail.

Contents

1. Project Understanding

1.1 This Report

The purpose of this final report is to provide the Commission with the results of the data gathering and analysis for Task 2a of the following study: "Collection and analysis of data to inform certain reviews required under Directive 2010/75/EU on industrial emissions (IED) and to inform Commission Guidance on the content of the baseline report under Article 22 of the IED" (contract number 070307/2011/600007/FRA/C3).

The task covered in this report is Task 2a: **Gathering and analysing information to support the Commission in reporting in line with Article 73(2)(a) of the IED on the need to control emissions from the combustion of fuels in installations with a total rated thermal input below 50MW**.

This report describes the data gathered, how these data have been supplemented and the results of an options analysis for controlling emissions from these combustion installations.

This report and appendices has been updated (September 2012) to take into account feedback received from Member States as part of a consultation undertaken during July-August 2012. The consultation was aimed at correcting any errors in the interpretation of information provided by Member States during the study rather than inviting feedback on the findings of the analysis. In some instances, Member States have provided additional information of relevance to the study. Whilst it has not been possible to take this into account in the report this information has been summarised in the appendices.

1.2 Project Context

1.2.1 IED background

The Commission adopted its proposal for a Directive on industrial emissions (IED [1]) on 21 December 2007, which consolidated seven existing Directives[2] related to industrial emissions into a single legislative instrument. The Commission's accompanying impact assessment[3] identified a number of problems related "*(1) to shortcomings in*

[1] "Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (recast)". Available from: http://ec.europa.eu/environment/ippc/proposal.htm

[2] The titanium dioxide industry related directives (78/176/EEC, 82/883/EEC, 92/112/EEC), the IPPC Directive (96/61/EC, now 2008/1/EC), the Solvent Emission Directive (1999/13/EC), the Waste Incineration Directive (2000/76/EC) and the LCP Directive (2001/80/EC).

[3] "Commission Staff Working Document: Accompanying document to the Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (recast). Impact Assessment." Available from: http://ec.europa.eu/environment/ippc/proposal.htm

the current legislation that lead to unsatisfactory implementation and difficulties in Community enforcement actions and, thereby, to loss of health and environmental benefits and (2) to the complexity and lack of coherence of parts of the current legal framework". The impact assessment and proposed Directive were informed by a series of studies undertaken over several years as part of the review of the IPPC Directive.

Following the co-decision procedure, Directive 2010/75/EU on industrial emissions was formally adopted on 24 November 2010 and published in the Official Journal on 17 December 2010; and entered into force on 6 January 2011.

The Directive places a number of requirements on the European Commission to undertake additional actions over the coming years. The key requirements from the IED of relevance to this task on combustion plants below 50 MW_{th} are:

> *Recitals (28)*
>
> *The combustion of fuel in installations with a total rated thermal input below 50 MW contributes significantly to emissions of pollutants into the air. With a view to meeting the objectives set out in the Thematic Strategy on Air Pollution, it is necessary for the Commission to review the need to establish the most suitable controls on emissions from such installations. That review should take into account the specificities of combustion plants used in healthcare facilities, in particular with regard to their exceptional use in the case of emergencies.*

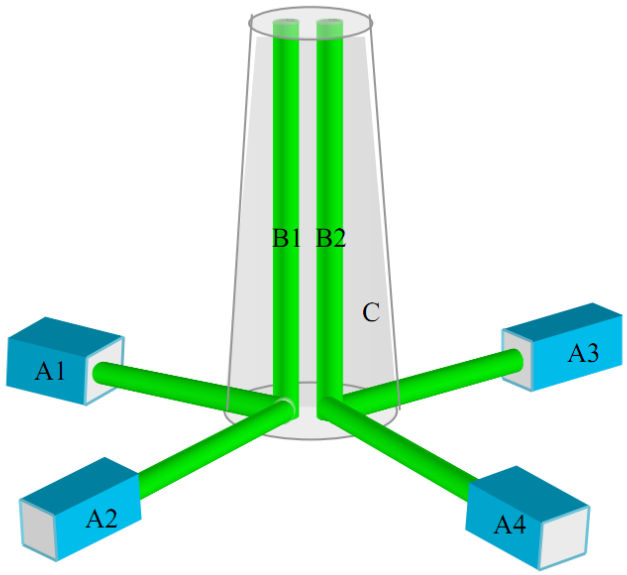
and

> *Article 73 Review*
>
> *2. The Commission shall by 31 December 2012, review the need to control emissions from:*
>
> *(a) the combustion of fuels in installations with a total rated thermal input below 50MW;*
>
> *The Commission shall report the results of that review to the European Parliament and to the Council accompanied by a legislative proposal where appropriate.*

1.2.2 Combustion installations and plants less than 50 MW_{th}

It is important to make clear the distinction between a combustion plant and a combustion installation before describing further the legislative requirements in place. A combustion *plant* is considered under the LCP Directive as being defined with the 'common stack' approach, i.e. that one chimney or stack (regardless of the number of flues contained therein) is one 'plant'. Individual combustion *units* will discharge exhaust gases via *flues* that are contained within the chimney. The figure below represents these three levels of aggregation. A combustion *installation* (as defined in the IPPC Directive) is a site on which there may be multiple combustion plants (i.e. stacks) for one industrial complex.

Figure 1.1 Schematic of (A) boilers exhausting via (B) flues in a (C) common stack



Where:

A = Boilers with A1 and A2 each having a capacity of 40MWth and A3 and A4 each a capacity of 210MWth.

B = Flue in this example B1 having a capacity of 80MWth and B2 a capacity of 420MWth

C = Common Stack in this example being a capacity of 500MWth

The IPPC Directive covers combustion installations with a rated thermal input exceeding 50 MW. It is possible for combustion plants (and units) with a thermal input of less than 50 MW to be covered by the IPPC Directive in situations where the aggregated capacity on site is more than 50 MW (see aggregation rule in chapeau provisions of Annex I to the IPPC Directive) or if they are 'directly associated activities with a technical connection' to other IPPC activities (see definition of "installation" under the IPPC Directive).

In its Proposal for a Directive on industrial emissions (December 2007), the Commission proposed to lower the thermal threshold to include combustion installations in the range of 20 to 50 MW_{th} aggregate total capacity (changing the scope of activity 1.1. of Annex I), while adding a 'de minimis' rules for exclusion of the following combustion units in the aggregation calculations:

- units with a rated thermal input below 3 MW; and
- units with a rated thermal input below 50 MW and operating no more than 350 hours per year.

During the co-decision negotiations on the IED Proposal a number of Member States raised concerns about the inclusion of combustion installations below 50 MW so the proposed change to Annex I was dropped in the IED and a clause requesting the Commission to "review the need to control emissions" from installations below 50 MW was entered under Article 73(2)(a) of the Directive.

The IED will regulate combustion installations and plants through the following provisions:

- Article 3 of the IED defines an installation as including "*any other directly associated activities on the same site which have a technical connection with the activities listed in those Annexes and which could have an effect on emissions and pollution*".

- Article 10 of the IED sets the scope of coverage of **Chapter II** of the IED to the activities listed in Annex I. The relevant combustion activity is "*1.1. Combustion of fuels in installations with a total rated thermal input of 50 MW or more*". I.e. the provisions of Chapter II of the IED (permitting, permit conditions, monitoring, BREFs, BAT) apply to combustion **installations** ≥50MW_{th}.

- **Chapter III** (and the associated Annex V) of the IED has its scope set out in Article 28 which states that it applies to "*combustion **plants**, the total rated thermal input of which is equal to or greater than 50MW*". Article 29 defines the aggregation rules ("common stack" and "de minimis" approaches), which are to be applied for the purpose of Chapter III.

In terms of combustion plants ("common stack" level) less than 50MW_{th}, Chapter II of the IED will regulate such plants in two instances:

i. In the case of combustion installations with a total rated thermal input equal to or greater than 50MW containing combustion plants less than 50 MW_{th}

ii. In the case of an installation operating an activity listed in Annex I, to which a combustion plant of less than 50MW operated on the same site is directly associated and has a technical connection (see definition of "installation" in IED article 3(3)

It should be noted that combustion plants ("common stack" level) of less than 50 MW_{th} are not regulated under Chapter III, while combustion units of less than 50 MW_{th} being part of a combustion plant of 50 MW_{th} or more may be.

1.3 Objectives

The overall objective of Task 2a is to revisit this issue, building on data from existing studies and supplemented with additional data gathering, to provide support to the Commission in reviewing whether or not emissions from combustion installations below the current 50 MW_{th} threshold need to be controlled at the EU level. As set out in Recital 28 of the IED, this should be seen in the context of achieving the objectives set out in the Thematic Strategy on Air Pollution. The scope of this task is not limited to installations between 20 and 50MW_{th} but it considers all (industrial) combustion installations between 1MW_{th} and 50MW_{th}. Some of the smallest plants in this capacity range are not industrial plants, and may be to some extent covered by the Ecodesign Directive 2009/125/EC e.g. if they comprise combustion units of individual capacity less than 0.4 MW. In addition, Article 73(2)(a) does not restrict the scope of this review in terms of the instrument through which emissions from this activity may be controlled, i.e. options for control could include regulation through IED or other legislative instruments, as well as non-legislative instruments.

1.4 Structure of this Report

This report is structured as follows:

- Section 2 provides an overview of the process of data gathering for this study and the status of data collection.

- Section 3 presents the data received from Member States in this study on combustion plants <50 MW_{th}, as well as a summary of currently applicable legislation at an EU level and Member States' national regulations on combustion plants 1-50 MW_{th}.

- Section 4 describes how the data gathered were supplemented with existing data, and how these data were extrapolated to produce a sufficiently complete dataset on combustion plants 1 to 50 MW_{th}.

- Section 5 describes the methodology and results of the assessment of options for the possible control of emissions from combustion plants 1 to 50 MW_{th}.

- Section 6 presents the main conclusions of the study as well as key uncertainties and limitations.

2. Data Gathering

2.1 Overview

The study aimed to gather additional new data on combustion installations less than 50 MW_{th} to help the Commission decide whether there is a need to control emissions from this sector at an EU level. In recognition of the previous work undertaken on this subject in relation to 20-50 MW_{th} installations, some existing data on this topic already exists. In this study we have gathered new data from Member States on combustion plants between 1 MW_{th} and 50 MW_{th}, and where necessary supplemented with existing data that is already held and further extrapolated from the new and existing data in order to compile a sufficiently complete dataset with which to assess possible control options.

This chapter briefly summarises the process and status of collection of data from Member States in relation to combustion plants <50 MW_{th}:

- Numbers;
- Capacity;
- Fuel consumption;
- Emissions;
- Abatement measures; and
- Legislation currently in place.

Summaries of the data provided by Member States are included in Section 3, whilst Section 4 describes how these data were extrapolated to form a sufficiently representative dataset for the EU-27 for the purposes of assessing options for the control of emissions.

2.2 Approach to stakeholder consultation

2.2.1 Member States

All Member States have been consulted as part of this task. This consultation has involved the development of a data collection proforma for this task. A copy of the combustion data collection proforma is included in Appendix A. Follow-up communications by email and telephone were made with the Member State representatives by AMEC in collaboration with the Regional Environmental Center for Central and Eastern Europe (REC).

2.2.2 Other consultees

The consultation with stakeholders other than Member States focussed on gathering the views of a small selection of European-wide energy associations (Cogen Europe and Euro heat and power) and a combustion plant operator (Dalkia) which are most likely to be affected by the inclusion of plants <50 MW_{th}. A response was received from Dalkia and is included in Appendix D.

Further communications were undertaken with CEFIC, IMA Europe and the European Asphalt Pavement Association. However, it was considered that for the purposes of this study which relies on a representative set of data on combustion plants, it was expected that Member States would be in the best position to contribute to the study, and furthermore that not attempting to include separate data from industrial sectors' associations would help to ensure plants in the 1 to 50 MW_{th} category are not overlooked or double counted.

2.3 Status of data collection

A table summarising the Member States that have provided a response to the data collection proforma is included on the next page. This table also provides an overview of the data received from each Member State using a 'traffic light' system to assess the data of interest for each topic. In this table different colours are used to represent whether a Member State has provided full, partial or no information about a particular topic according to the following key.

	Fully completed section in proforma provided by Member State
	Some data provided by Member State
	No data provided by Member State

Table 2.1 Overview of data received from Member States in response to the proforma

Data requested	MW_{th}	AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LU	LT	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Numbers of combustion plants	1-5																											
	5-20																											
	20-50																											
Numbers of combustion plants by sector																												
Capacity of plants	1-5																											
	5-20																											
	20-50																											
Fuel consumption split by fuel type	1-5																											
	5-20																											
	20-50																											
Emissions of key pollutants – quantities	1-5																											
	5-20																											
	20-50																											
Emissions of key pollutants: contribution to national total																												
Typical combustion techniques in use																												
Existing coverage as directly associated activities																												
Legislative requirements																												
Abatement measures																												

3. Data received in this study

This chapter summarises the quantitative data gathered from Member States in the scope of this study and additional descriptive and legislative aspects as requested using the proforma.

As a high level indication of the completeness and/or quality of the data, traffic light colour coding has again been employed for the quantitative data according to the following key for text colour:

The data appear complete, i.e. they represent the entire capacity class with no known omissions
The data appear to be partially complete and not fully representative, e.g. they are known to exclude certain plants
The data appear to be extremely limited, i.e. it is not possible to extrapolate complete data from them

3.1 Overview of data

3.1.1 Note on combustion installations versus combustion plants

Section 1.2 in this report noted that Chapter II of the IED regulates combustion **installations** of 50 MW_{th} or more, with additional provisions in Chapter III for combustion **plants** of 50MW_{th} or more. As described in Section 1.2.2 an installation may comprise multiple plants (stacks), and each plant may comprise multiple combustion units (e.g. boilers). For the purposes of data collection for this study, data has been requested on combustion plants (at the stack level), in accordance with the scope of how large combustion plants are presently regulated in Chapter III of the IED. Nonetheless, some of the data returns from Member States have been indicated to be at the boiler level (Finland, Brussels region of Belgium and Sweden). It is unclear whether any of the data returns are at the installation level.

3.1.2 Numbers of plants

The data reported by Member States on the numbers of combustion plants less than 50 MW_{th} are summarised below in Table 3.1. Any Member States not listed in the table below have not reported numbers of combustion plants. As is noted in the final column of the table, in many cases the data provided by a Member State do not represent a complete picture of combustion plants in that Member State.

Table 3.1 Numbers of combustion plants of rated thermal input less than 50MW reported by Member States to this study, split by capacity class (Note 1)

Member State	Total number of combustion plants				Comments on completeness of the data by Member States and AMEC (denoted separately)
	1-5MW	5-20MW	20-50MW	Total	
Austria	-	190	116	306	MS: These numbers are for steam boilers only. However, we suppose that most of the combustion plants with a rated thermal input > 5 MW are steam boilers. These numbers also exclude any combustion plant < 10 MW that is operated by gaseous fuel or gasoil. The number of 20-50MWth plants should be more or less the correct number. However, the submitted number of plants < 10 MW is very rough information. The number of combustion plants [5-20 MW] is with complete certainty much higher than 190 because of the non-registered plants 5-10 MW using gasoil or natural gas. There is no official view on estimated number of plants, but the correct number could be two or three times higher than 190.
Belgium	2,880	890	144	3,914	MS: The Wallonia figures are indicated to relate to emission trading only (although include plants less than 20MW_{th}) and exclude combustion installations of residential buildings and tertiary sector. The Brussels figures (1-5MW_{th} and 5-20MW_{th} only) are at a boiler level. *AMEC: These numbers are the combined totals from three separate regions Wallonia, Brussels and Flanders.*
Cyprus	172	36	3	211	
Czech Republic	4,068	748	175	4,991	
Estonia	537	174	29	740	
Finland	196	205	181	582	MS: These numbers are at the boiler level. Source of data is the Finnish national emission register VAHTI. In the VAHTI emissions register, data concerning larger units (20 - 50 MW) is more accurate than data concerning smaller units. *AMEC: Estimates of the number of Finnish plants have been derived from the boiler level data using the unique (x,y,z) coordinates of boilers as recommended and supplied by the authorities. These estimates have not been confirmed: 136 1-5MW_{th} plants, 140 5-20MW_{th} plants, 133 20-50MW_{th} plants.*
France	20,000 for category 2 to 20MW_{th}		1,500	21,500	MS: Estimates for range 2 to 20MW_{th}. Rough figures for 20 to 50 MW_{th} Only rough estimates were provided from 2MW – 50MW. Figure of 20,000 is a total for capacity range 2-20MW_{th} *AMEC: The estimates provided by the French authorities appear to be quite high. This point is discussed further in section 4.*
Germany	6,400	118	658	7,176	MS: The figure for capacity class 5-20MW_{th} is for solid biomass fired plant only and excludes any plants not fired with this fuel. The figure for capacity class 1-5MW_{th} includes (a) estimated 400 solid biomass fired plant, and (b) estimated 6000 biogas fired engine plants some of which may fall below 1MW_{th}. Plants fired by fuels other than solid biomass and biogas are excluded from this estimate.
Netherlands	6,995	2,250	110	9,355	The figures presented are a rough estimate.
Poland	-	2	241	243	*AMEC: Submitted data for 5-20MW_{th} class are considered incomplete and have been removed in subsequent analysis.*

Member State	Total number of combustion plants				Comments on completeness of the data by Member States and AMEC (denoted separately)
	1-5MW	5-20MW	20-50MW	Total	
Portugal	-	-	34	34	
Romania	790	370	146	1306	
Slovakia	2,023	600	93	2,716	
Slovenia	222	119	18	359	MS: The numbers in class 1-5MW_{th} are only boilers using solid fuel. The numbers in class 5-20MW_{th} exclude boilers using natural gas below 10 MW.
Spain	-	-	1,130	1,130	*AMEC: the figures provided appear high and may be an overestimate.*
Sweden	4	173	105	282	MS: These figures are at a boiler level. They exclude plants from the inventory with missing capacity category. Data source is the inventory for the NO_X tax. *AMEC: The figures for the 1 to 5MW_{th} capacity class are considered incomplete due to the limitations of the underlying data source.*
United Kingdom	>38	>35	413	486	MS: The numbers in classes 1-5MW_{th} and 5-20MW_{th} are for Northern Ireland only.
Subtotal (17)	**50,235**		**5,096**	**55,331**	

Note 1: Boxes marked with "-" indicate no data provided.

From the data gathered it appears that robust data on numbers of combustion plants less than 50 MW_{th} (in particular below 20 MW_{th}) are not widely held by Member States. Some Member States appear to have provided seemingly robust figures on these (Cyprus, Czech Republic, Estonia, Finland, Romania and Slovakia), but for many Member States the estimates are either only approximate (Netherlands, France) or exclude certain categories of plants or even whole regions (Austria, Germany, Poland, Slovenia, Spain and United Kingdom). Furthermore, no data have been gathered for several Member States: Bulgaria, Denmark, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg and Malta.

As such, the numbers of plants presented in the table above are considered to be an underestimate for the Member States presented, as well as being an underestimate for the EU.

It is also important to note two points in particular for this table: (a) that the estimated figures reported by France make up 40% of the total reported by the Member States which appears high; and (b) some Member States (Belgium [Brussels region], Finland, Sweden) are known to have reported at the boiler level, which can lead to a slight overestimate in the number of plants/installations.

The above estimates of numbers of plants rated 1 to 50 MW_{th} are very much higher than the numbers of large combustion plants currently regulated in the EU: the number of LCPs of capacity 50-100 MW_{th} is reported to be 987, and the total number of LCPs is reported to be 3,243.[4]

3.1.3 Capacity of plants

The data reported by Member States on the capacity of combustion plants 1 to 50 MW_{th} are summarised below in Table 3.2. Any Member States not listed in the table have not reported capacity of combustion plants. The percentage share of total capacity among the three capacity classes has been included for those Member States whose data have been highlighted in green (i.e. whose data appear to be complete).

Table 3.2 Capacity of combustion plants of rated thermal input less than 50 MW_{th} reported by Member States to this study, split by capacity class

Member State	Total capacity of combustion plants (GW_{th})								Comments on completeness of the data by Member States and AMEC (denoted separately)
	1-5MW		5-20MW		20-50MW		Total		
Austria	-		2.2		3.7		**5.9**		MS: These numbers are for steam boilers only, i.e. they exclude combustion plants that exclude steam boilers. However, we suppose that most of the combustion plants with a rated thermal input > 5 MW are steam boilers.
Belgium	6.5		8.5		4.6		**19.7**		MS: The Wallonia figures are indicated to relate to emission trading only (although include plants less than 20MW_{th}) and exclude combustion installations of residential buildings and tertiary sector. The Brussels figures (1-5MW_{th} and 5-20MW_{th} only) are at a boiler level. *AMEC: These numbers are the combined totals from three separate regions Wallonia, Brussels and Flanders. Although the Wallonia figures are indicated to relate to emission trading only they include plants less than 20MW_{th}.*
Cyprus	0.4	(50%)	0.3	(35%)	0.1	(15%)	**0.7**		
Czech republic	8.5	(41%)	7.2	(34%)	5.2	(25%)	**20.9**		
Estonia	1.2	(30%)	1.8	(45%)	1.0	(25%)	**4.0**		
Finland	0.6	(6%)	2.1	(23%)	6.4	(71%)	**9.1**		MS: Source of data is the Finnish national emission register VAHTI. In this register, data concerning larger units (20 - 50 MW) is more accurate than data concerning smaller units.

[4] AMEC (2011) Analysis and summary of the Member State's emission inventories 2007-2009 and related information under the LCP Directive. Final report to the European Commission.

Member State	Total capacity of combustion plants (GW_{th})				Comments on completeness of the data by Member States and AMEC (denoted separately)
	1-5MW	5-20MW	20-50MW	Total	
France	400 for 2 to 20MW_{th} class		75	**475**	MS: No data available on plants 1-2MW_{th}. These figures are maximum capacities, assuming that plants in the capacity class ranges are at the upper end of the scale. *AMEC: Based on the capacity classes, AMEC calculates that the capacities of the French plants will lie within the range of 70 to 475 GWth and are unlikely to be close to the total maximum capacity (475 GWth) provided by the French authorities. A mid-range estimate of around 270 GWth may be more realistic*
Germany	2.3	-	22.5	**25.8**	MS: No capacity data are available for the solid biomass plants reported in the numbers table. Figures for 20-50MW_{th} plants are derived from ETS data. The figure for 1-5MW_{th} plants covers approximately 6000 biogas engine plants which are mostly less than 3MW_{th} *AMEC: The figure for 1-5MW_{th} plants covers approximately 6000 biogas engine plants which are mostly less than 3MW_{th} and much of which must fall below the 1MW_{th} threshold since the average plant capacity of the reported data is <1MW_{th}.*
Netherlands	21 (44%)	23 (48%)	3.7 (8%)	**47.7**	MS: The figures presented are a rough estimate.
Poland	-	0.01	8.1	**8.1**	*AMEC: Submitted data for 5-20MW_{th} class are considered incomplete and have been removed in subsequent analysis.*
Portugal	-	-	1.2	**1.2**	
Romania	1.6 (22%)	2.7 (37%)	3.1 (42%)	**7.4**	
Slovakia	4.3 (35%)	5.4 (43%)	2.8 (22%)	**12.5**	
Slovenia	0.5	1.3	0.5	**2.3**	MS: The numbers in class 1-5MW_{th} are only boilers using solid fuel. The numbers in class 5-20MW_{th} exclude boilers using natural gas below 10 MW.
Sweden	0.02	1.8	3.0	**4.8**	MS: These figures exclude plants from the inventory with missing capacity category. *AMEC: The figures for the 1 to 5MW_{th} capacity class are considered incomplete due to the limitations of the underlying data source.*
United Kingdom	0.1	0.4	13.3	**13.8**	MS: The capacities in classes 1-5MW_{th} and 5-20MW_{th} are for Northern Ireland only. The capacity for 20-50MW_{th} is estimated to lie in a range from 11.3GWth to 15.4GWth.
Subtotal (16)	**503 (combined 1 to 20MW_{th})**		**155**	**659**	

The figures reported by France are estimates based on assuming the average capacity of a plant in a capacity class is the maximum capacity of that class. This assumption is unlikely to be correct, and more realistic figures are calculated by AMEC and noted in the table above.

As such, the total capacity of plants presented in the table above are considered to be on the one hand an underestimate due to those plants excluded in some Member State reports and the Member States that have not reported, and on the other hand to be an overestimate for the Member States presented, due to the French estimates (which, as reported, comprise over 70% of the reported capacity).

For comparison with the above estimates of capacities of plants rated 1 to 50 MW_{th}: the total capacity of large combustion plants 50-100 MW_{th} is reported to be 74 GW_{th}, and the total capacity of all LCPs (> 50 MW) is reported to be 1,354 GW_{th} in 2009.[5]

3.1.4 Fuel consumption of plants

The data reported by Member States on the fuel consumption of combustion plants between 1 and 50MW_{th} are summarised below in Table 3.3. Any Member States not listed in the table below have not reported these data.

Table 3.3 Fuel consumption reported by Member States from combustion plants < 50MW_{th}, split into five fuel types

Member State	Fuel type	Fuel consumption (PJ)				% of MS total	Notes
		1-5MW	5-20MW	20-50MW	Total		
Cyprus	Biomass		0.03		**0.03**	1%	Cyprus provided combined data for a 1-20 MW band
	Liquid		1.5	1.2	**2.7**	91%	Includes Gas oil & fuel oil, Cyprus provided combined data for a 1-20 MW band
	Other gases		0.2		**0.2**	8%	Cyprus provided combined data for a 1-20 MW band
Czech republic	Biomass	1.8	1.8	2.9	**6.5**	2%	
	Other solid	1.8	1.1	6.0	**8.9**	3%	Mostly brown coal
	Liquid	0.7	0.4	2.0	**3.2**	1%	Mostly heating oil
	Natural Gas	74.6	214.0	18.7	**307**	94%	
Estonia	Biomass	2.1	2.5	2.8	**7.3**	30%	firewood & wood waste
	Other solid	0.1	0.1	0.3	**0.5**	2%	coal, peat & oil shale
	Liquid	1.2	1.4	0.7	**3.3**	13%	light heating oil, shale oil, waste oil & diesel fuel
	Natural gas	2.4	4.5	2.1	**9.0**	37%	
	Other gases	0.2	0.1	4.2	**4.5**	18%	pyrolysis process gases & biogas

[5] AMEC (2012) Analysis and summary of the Member State's emission inventories 2007-2009 and related information under the LCP Directive. Final report to the European Commission.

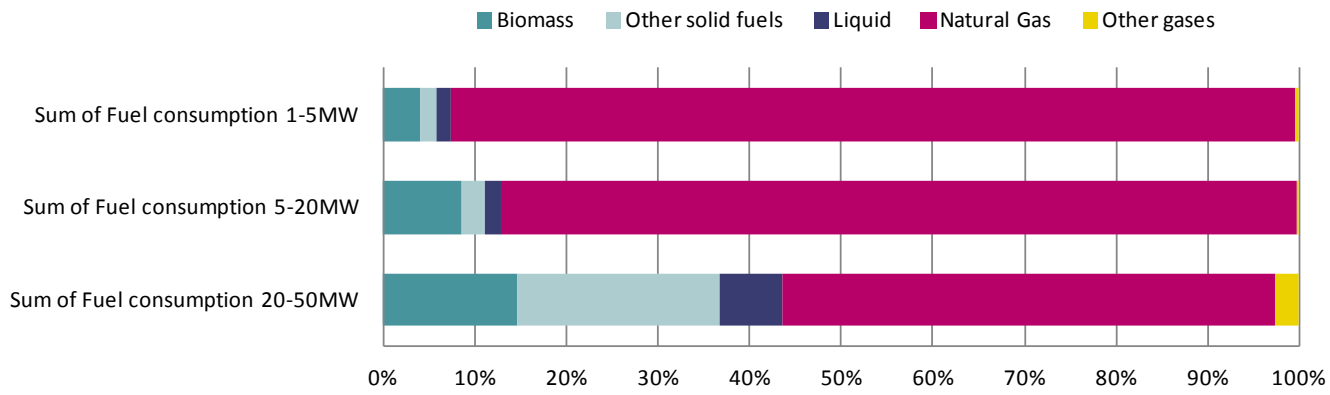
Member State	Fuel type	Fuel consumption (PJ)				% of MS total	Notes
		1-5MW	5-20MW	20-50MW	Total		
Finland	Biomass	4	4	9	**17**	28%	Typically wood-based
	Other solid	1	1	8	**11**	17%	Includes: Peat, some coal in larger units
	Liquid	1	5	10	**17**	27%	Includes: Heavy oil &some light oil
	Natural gas	2	4	9	**15**	24%	
	Other gases	0.5	1	1	**2**	3%	Includes: biogas, waste gas, liquid gas
France	Biomass	-	-	-	**-**	15%	
	Other solid	-	-	-	**-**	2%	Other solid fuel is coal
	Liquid	-	-	-	**-**	25%	Liquid fuel is LPG, HFO and domestic heating fuel oil
	Natural gas	-	-	-	**-**	56%	
Germany	Biomass			10	**174**		Other solid fuels are coal and lignite. Figures for total 1-50MW_{th} plants are derived from the national emission inventory. Figures for 20-50MW_{th} plants are derived from ETS data. The figure for 1-5MW_{th} plants covers approximately 6000 biogas engine plants which are mostly less than 3MW_{th} and so some of this may be below the 1MW_{th} threshold. The data presented in earlier tables on solid biomass plants are not represented in this table due to lack of fuel consumption data on the solid biomass plants.
	Other solid			13	**52**		
	Liquid			6	**83**		
	Natural gas			117	**426**		
	Other gases	130		5	**135**		
Netherlands	Biomass	1			**1**	0.3%	All figures presented are a rough estimate.
	Natural gas	130	160	40	**330**	99%	
	Other fuels	1			**1**	0.3%	
Poland	Biomass			0.2	**0.2**	0.4%	Biomass includes biomass from waste (code: 030105). Other solid includes black coal and sub-bituminous coal. Liquid includes diesel, furnace oil, HFO and light oil. Natural gas includes Natural gas with high methane concentration & Nitrogen-rich natural gas. Other gases includes coke oven gas, mine gas and biogas. *AMEC: Submitted data for 5-20MW_{th} class are considered incomplete and have been removed in subsequent analysis.*
	Other solid		0.01	44	**44**	77.8%	
	Liquid		1.3	0.2	**1.5**	2.6%	
	Natural gas			10.5	**10.5**	18.6%	
	Other gases			0.3	**0.3**	0.6%	
Portugal	Biomass	-	-	4.4	**4.4**	29%	
	Liquid	-	-	4.0	**4.0**	27%	Liquid fuels include diesel, fuel oil, and LPG
	Natural gas	-	-	6.7	**6.7**	44%	
Slovakia	Biomass	0.7	1.7	3.1	**5.4**	13%	Includes wood and woodchips & other vegetal matter
	Other solid	0.5	1.0	1.9	**3.4**	8%	Includes: anthracite, Polish black coal CZ black coal, Czech brown coal , Slovak brown coal SK, lignite, coke, other solid fuels, waste from agriculture, horticulture,

Member State	Fuel type	Fuel consumption (PJ) 1-5MW	5-20MW	20-50MW	Total	% of MS total	Notes
							forestry, hunting and fishing, aquaculture production, food production and processing, waste from wood processing and manufacturing of paper, paperboard, pulp, sawn timber and furniture and waste from medical or veterinary care or related research
	Liquid	0.006	0.024	0.004	**0.03**	0.1%	Include: heavy fuel oil, medium fuel oil, light fuel oil, other liquid fuels, diesel and propane-butane
	Natural gas	11.2	14.9	7.5	**33.6**	79%	
	Other gases	0.17	0.01	0.04	**0.2**	0.5%	Include: Biogas & propane-butane
Sweden	Biomass	0.5	28.9	28.0	**57.3**	57%	Other solid fuels include coal, peat and waste. Liquid fuel is fuel oil. *AMEC: Fuel data have been estimated from the MWh energy data supplied by the authorities, together with the supplied percentage fuel splits.*
	Other solid		8.9	17.7	**26.6**	24%	
	Liquid		0.5	4.1	**4.6**	5%	
	Natural gas		2.1	9.6	**11.7**	12%	
United Kingdom	Biomass			2	**2**	0.1%	Data are only applicable to Northern Ireland. No data for England, Scotland or Wales. Liquid fuels include heavy fuel oil and gas oil
	Other solid			0.1	**0.1**	0.01%	
	Liquid		0.1	1	**1**	0.1%	
	Natural gas	3	85	1,695	**1,783**	91%	
	Other gases		1	174	**184**	9%	

The data in the above table that are highlighted in green are also summarised in Figure 3.1. This figure shows that the dominant fuel for reported small combustion plants is natural gas (92% for plants 1-5MW_{th}, 87% for plants 5-20MW_{th} and 54% for plants 20-50MW_{th}). With increasing capacity, usage of solid fuels (biomass and other solid fuels) increases. Biomass makes up less than 15% of fuels in all capacity classes. Liquid fuels make up less than 7% of fuels in all capacity classes. Other gaseous fuels make up less than 3% in all capacity classes.

In some countries the main fuel used differs from the overall EU average. For example, in Poland, the use of other solid fuels dominates, in Sweden biomass is the primary fuel type and Cyprus mainly uses liquid fuels.

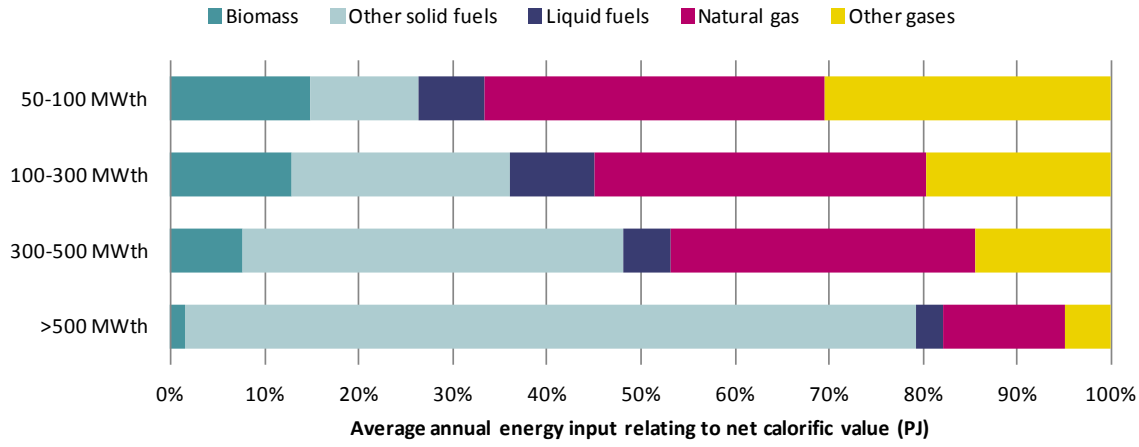
Figure 3.1 Split of reported fuel consumption of combustion plants 1 to 50MW$_{th}$ by fuel type and capacity class



Note: fuel consumption data reported by CY for combined capacity classes was split equally among the classes for the purposes of producing this figure.

By way of comparison against large combustion plants, fuel consumption of currently regulated >50MW plants are presented below in Figure 3.2.

Figure 3.2 Split of reported fuel consumption of large combustion plants across five fuel types and four capacity classes (source: AMEC, 2012)



Note: this figure represents the total from the Member States whose data are presented in Figure 3.1 (i.e. CY, CZ, EE, FI, DE, NL, PL, PT, SK, SE).

3.1.5 Emissions of key pollutants

The data reported by Member States on the emissions of combustion plants between 1 and 50MW$_{th}$ are summarised below in Table 3.4, including data provided by Member States on the percentage of total Member State emissions

that the emissions from 1 to 50 MW_{th} combustion plants make up. Any Member States not listed in the table below have not reported these data to this study. For those Member States that did not provide an estimate of the proportion of national emissions, national totals have been retrieved from CLRTAP submissions and included in *italics*.

No information has been gathered to identify whether the emissions data submitted by Member States have mainly been calculated or monitored. Whilst no Member States have declared the method by which the emissions data have been derived, some Member States have indicated that emissions have been extracted from national databases, e.g. Estonia, whilst for others the data are considered a reliable source (e.g. Swedish NO_X emissions are from the Swedish NO_X tax database).

Table 3.4 Dust/PM_{10}, SO_2/SO_X and NO_X emissions of combustion plants of rated thermal input less than 50MW reported by Member States to this study, split by capacity class

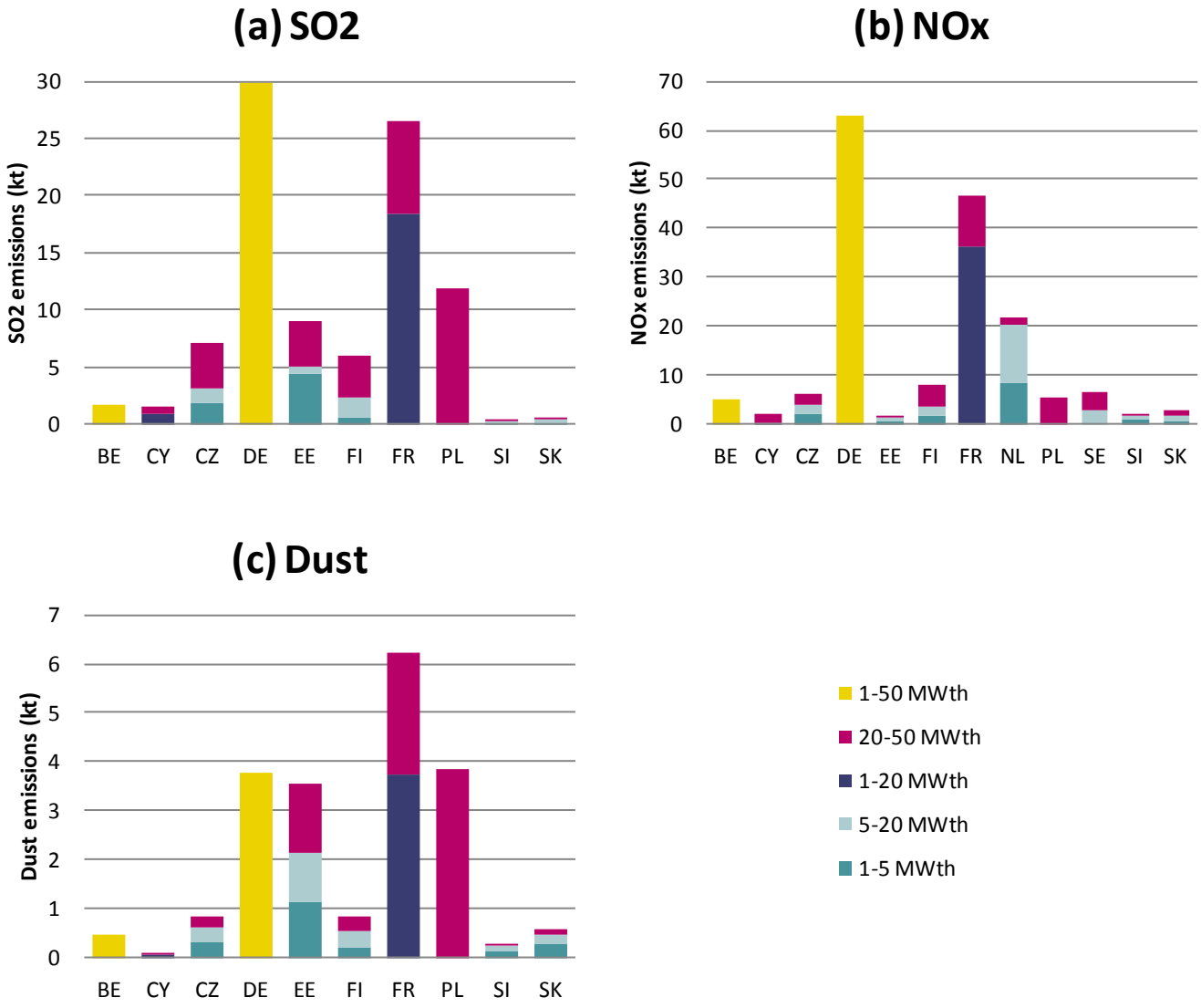
Member State	Pollutant	Emissions from combustion plants (t)					Notes
		1-5MW	5-20MW	20-50MW	1-50MW	% of MS total emissions	
Belgium	Dust	-	-	-	487	3%	The figures presented are for the Wallonia region only. The boilers around 1MWth of the tertiary sector were not taken into account (hospitals, schools). The boilers of residential buildings above 1MWth are not taken into account. Total emissions of heavy metals were also reported.
	PM_{10}	-	-	-	393	5%	
	SO_2 (SO_X)	-	-	-	1,726	8%	
	NO_X	-	-	-	5,176	6%	
Cyprus	Dust	65		44	**109**	2%	The Member State also provided data for emissions of Pb, Cd , Hg As , Cr , Cu , Ni , Se and Zn. Cyprus has provided aggregated figures for the capacity class 1 to 20MW_{th}
	SO_2	972		494	**1,466**	8%	
	NO_X	212		1,959	**2,171**	11%	
Czech republic	Dust	321	308	223	**852**	1%	
	SO_2	1,807	1,248	4,080	**7,136**	4%	
	NO_X	1,941	1,958	2,236	**6,135**	3%	
Estonia	Dust	1,141	1,015	1,386	**3,542**	13%	Data were also provided for emissions of HCl, Pb, Hg, Ni, As, Cd, Cr, Cu & Zn
	SO_2	4,431	648	3,990	**9,069**	17%	
	NO_X	552	754	529	**1,835**	6%	
Finland	Dust	220	320	320	**860**	-	
	SO_2	560	1,800	3,680	**6,040**	-	
	NO_X	1,680	1,940	4,420	**8,040**	-	

Member State	Pollutant	Emissions from combustion plants (t)					Notes
		1-5MW	5-20MW	20-50MW	1-50MW	% of MS total emissions	
France	Dust		3,739	2,479	**6,218**	1%	France has provided aggregated figures for the capacity class 1 to 20MW_{th}
	SO_2		18,480	8,034	**26,514**	9%	
	NO_X		36,242	10,284	**46,526**	4%	
Germany	Dust				**3,770**	1%	Data were also provided for emissions of Mercury. Germany provided combined 1-50MW figures for emissions.
	SO_2				**29,800**	7%	
	NO_X				**62,900**	5%	
Netherlands	NO_X	8,600	11,700	1,600	**21,900**	8%	The figures presented are a rough estimate. Additional information provided as part of the consultation on the final report (July 2012) indicates SO_2 and dust emissions of 0.5kt for both pollutants for plants <50MWth.
Poland	Dust	-	2	3,832	**3,834**	*1%*	*AMEC: Submitted data for 5-20MW_{th} class are considered incomplete and have been removed in subsequent analysis.* *The year of the provided emissions data was not indicated. Latest national totals (2009) were used.*
	SO_2	-	3	11,866	**11,869**	*1%*	
	NO_X	-	1	5,629	**5,630**	*1%*	
Slovakia	Dust	269	192	111	**572**	*2%*	The Member State also provided data for emissions of Pb, Cd, As, Hg, Cr, Cu, Ni, Se, Zn Emissions data for year 2010.
	SO_2	160	260	222	**642**	*1%*	
	NO_X	698	1,185	845	**2,728**	*3%*	
Slovenia	Dust	126	126	24	**276**	*1%*	The numbers in class 1-5MW_{th} are only boilers using solid fuel. The numbers in class 5-20MW_{th} exclude boilers using natural gas below 10 MW.
	SO_2	107	193	137	**437**	*4%*	
	NO_X	926	794	541	**2,261**	*5%*	
Sweden	NO_X	39	2,923	3,761	**6,723**	*4%*	*AMEC has estimated NO_X emissions from the reported 2009 data on mg NO_X/MWh using supplied energy data with assumptions on plant efficiencies supplied by the Swedish authorities.* *The figures for the 1 to 5MW_{th} capacity class are considered incomplete due to the limitations of the underlying data source.*

Note: The figures of % of MS total emissions for Poland, Slovakia, Slovenia and Sweden have been calculated by AMEC on the basis of supplied emissions data for the combustion plants together with national total emissions reported to CLRTAP.

The SO_2, NO_X and dust emissions data in the above table (excluding those highlighted in red) are summarised below in Figure 3.3.

Figure 3.3 **(a) SO_2 (b) NO_X and (c) dust emissions data reported by Member States from small combustion plants, split by capacity class where available**

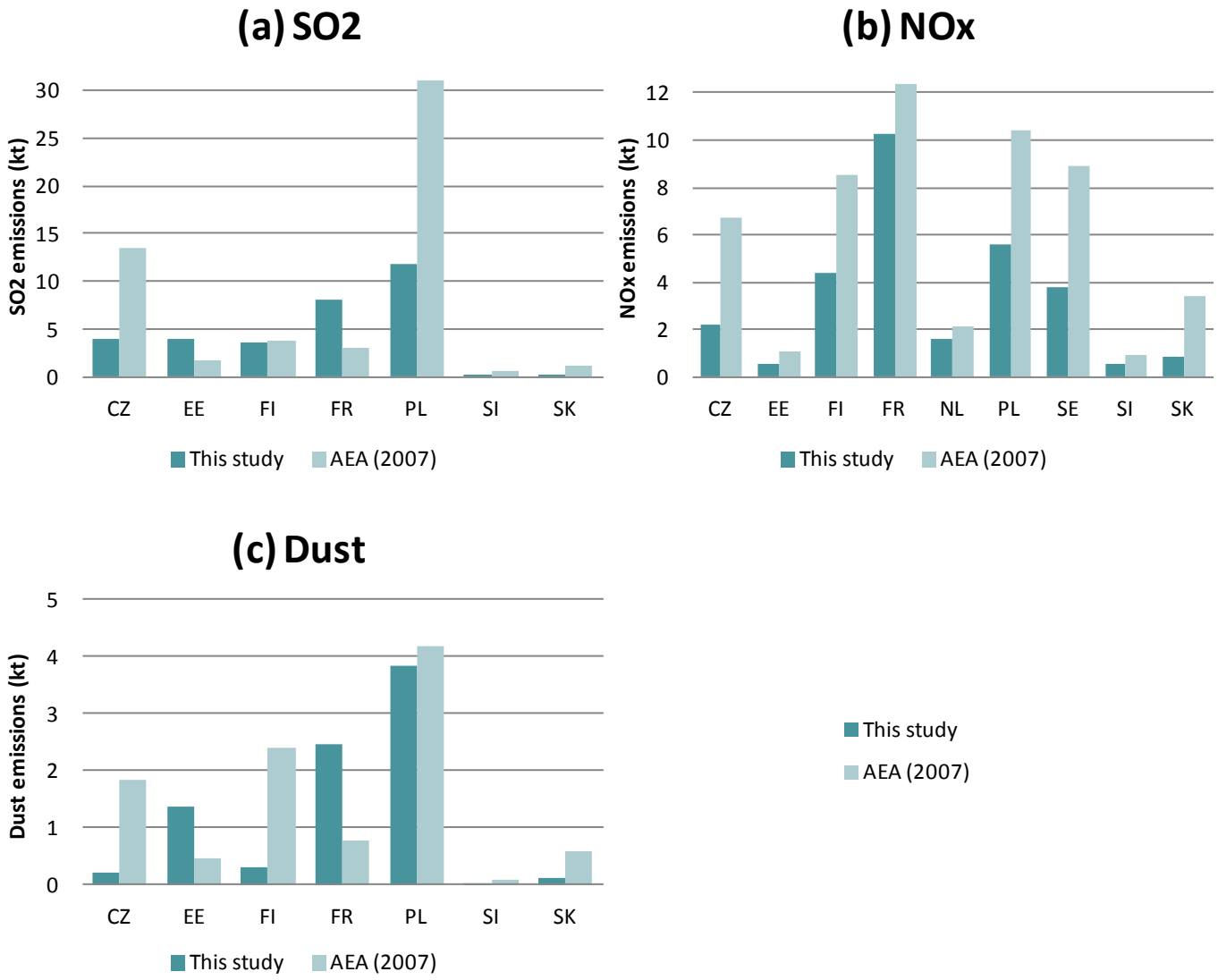


The emissions data for capacity class 20 to 50MW_{th} provided by Member States have been compared to the emissions estimates assumed in the AEA (2007) study. This comparison is shown in the Figure below. It shows that:

- For SO_2 emissions, two Member States (EE and FR) reported to this study significantly higher SO_2 emissions than were estimated in AEA (2007), whilst the opposite is true for most MS (CZ, PL, SI and SK). For only one MS do the two data sources match closely (FI).
- For NO_X emissions, all the Member States reported to this study significantly lower NO_X emissions than were estimated in AEA (2007).

- For dust emissions, most Member States (CZ, FI, SI, SK) reported to this study significantly lower dust emissions than were estimated in AEA (2007), whilst the opposite is true for two MS (EE, FR). For only one MS do the two data sources match closely (PL).

Figure 3.4 (a) SO_2 (b) NO_X and (c) dust emissions data reported by Member States from 20-50MW_{th} plants, compared to estimates in AEA (2007)



Note: AEA (2007) refers to 'PM' emissions. It has been assumed that this represents the pollutant PM_{TSP}.

3.1.6 Typical combustion techniques used

The information reported by Member States on the typical combustion techniques used in combustion plants less than 50MW are summarised below in Table 3.5. Any Member States not listed in the table have not reported this information.

Table 3.5 Typical combustion techniques used by combustion plants of rated thermal input less than 50MW reported by Member States to this study, split by capacity class

Member State	Typical combustion techniques used			Member State comments
	1-5MW	5-20MW	20-50MW	
Austria	-	-	-	Data in above tables relates to steam boilers only. No further data available on use of furnaces, turbines or engines.
Cyprus	Boilers	Boilers	Engines	
Czech republic	Mostly gas furnaces (80%)	Mostly gas furnaces (80%)	Mostly gas furnaces (60%) and coal boilers (20%)	
Estonia	Boilers	Boilers	Boilers	
Finland	Boilers	Boilers	Boilers	
Germany	Boilers, turbines, furnaces, engines	Boilers, turbines, furnaces, engines	Boilers, turbines, furnaces	
Netherlands	gas engines 41%, boilers 33%, furnaces 22%, turbines 3%, diesel engines 1%	Boilers 49%, gas engines 24%, furnaces 19%, turbines 7%, diesel engines 1%	Boilers 32%, turbines 26%, furnaces 41%, gas engines 1%	Percentages are estimates
Poland	-	Boilers	Boilers mostly	
Portugal	-	-	boilers, turbines, engines	
Romania	furnaces, boilers	furnaces, boilers, blast furnace, turbogenerators, thermal/heat treatment furnaces	furnaces, blast furnaces, boilers	
Slovakia	Boilers	Boilers	Boilers	
Slovenia	Boilers, turbines, furnaces, engines	Boilers, turbines, furnaces, engines	Boilers, turbines, furnaces, engines	
Sweden	1 boiler, 3 CHP	69 boilers, 93 CHP, 11 GT	45 boilers, 51 CHP, 9 GT	
United Kingdom	33 burners, 5 boilers	33 boilers, 2 furnaces	81% boilers, 1% turbines, 18% engines	The classes 1-5MW_{th} and 5-20MW_{th} are for Northern Ireland only.

The reported techniques in the table above indicate that boilers make up the majority of the combustion units in EU combustion plants of rated thermal input 1 to 50 MW, and for each sub-capacity class 1-5MW_{th}, 5-20MW_{th} and 20-50MW_{th}. All the other combustion techniques – turbines, furnaces and engines – are reported by at least two Member States to be in use at all capacity ranges 1-5MW_{th}, 5-20MW_{th} and 20-50MW_{th}.

On the basis of this conclusion – that the majority of the combustion units for small combustion plants are boilers – this will be used for the assessment for analysing options for the control of emissions in this sector in order to simplify the analysis.

3.1.7 Typical sectors in which the combustion plants operate

Table 3.6 below contains the data received from Member States on the typical sectors within which the combustion plants less than 50 MW_{th} operate. It is important to note that the numbers presented in this figure exclude (i) those Member States that did not report data; and (ii) those plants for which sector data was unavailable. Due to the latter point, the numbers presented in this table may not agree with those included in Table 3.1 (which should be assumed to be correct).

Table 3.6 Sectoral information received from Member States on combustion plants 1 to 50 MW_{th}

Member State	Sector	Number of plants	Notes
Cyprus	Public electricity generation	3	
	Hospitals and universities	13	
	Food industry (excl. greenhouses)	97	
	Industrial (other than food)	98	Includes: pharmaceutical Ind. Rendering Plants, Laundries, Carton industries, Production of Paints & Varnishes, Cement Plants etc
Czech republic	Public heat generation (incl. district heating)	986	Includes: Public electricity generation / Public heat generation (including district heating) / Combined heat and power generation
	Hospitals and universities	1454	Includes: Hospitals and universities administrative institutions and office buildings). *AMEC: This data appears high compared to other Member States except the Netherlands. The plants reported by the Member State are almost exclusively in the 1 to 5 MW_{th} category.*
	Food industry (excl. greenhouses)	945	Includes: Agriculture, silviculture and aquaculture
	Industrial (other than food)	179	Includes: Mineral oil refineries, Coal processing, Production and processing of iron and steel, Production and processing of non-ferrous metals, Chemical industry, Pulp, paper and printing
	Other	1427	
Estonia	Public electricity generation	6	
	Public heat generation (incl. district heating)	241	
	Hospitals and universities	7	
	Food industry (excl. greenhouses)	54	
	Industrial (other than food)	167	Includes: textiles, wood, chemicals , metal products, furniture
	Other	265	Includes oil terminals, asphalt concrete plants, farms, heating in service sector.

Member State	Sector	Number of plants	Notes
Finland	Public heat generation (incl. district heating)	442	Includes public electricity generation, public heat generation (including district heating) and combined heat and power generation
	Food industry (excl. greenhouses)	16	Includes: fodder production
	Industrial (other than food)	112	Includes: mining industry, chemical industry, metal industry, pulp and paper manufacturing, mechanical forest industry, construction industry, other industry
	Other	12	Includes: (waste incineration, wastewater treatment plants, fuel storage)
Germany	Public electricity generation	225	These figures exclude the approximate 6000 biogas plants in capacity class 1-5MW_{th} of unknown sector.
	Public heat generation (incl. district heating)	662	
	Combined heat and power generation	10	
	Hospitals and universities	18	
	Food industry (excl. greenhouses)	43	
	Industrial (other than food)	189	
	Other	29	
Netherlands	Public heat generation (incl. district heating)	10	Includes: Public electricity generation & Public heat generation (including district heating)
	Combined heat and power generation	95	
	Hospitals and universities	1830	*AMEC: This datum appears high compared to other Member States apart from the Czech Republic. The plants reported by the Member State are almost exclusively in the 1 to 5 MW_{th} category.*
	Greenhouses	4460	
	Food industry (excl. greenhouses)	350	
	Industrial (other than food)	860	
	Other	1750	
Portugal	Public electricity generation	6	
	Public heat generation (incl. district heating)	1	
	Combined heat and power generation	16	
	Food industry (excl. greenhouses)	3	
	Industrial (other than food)	8	Textile, Agroforestry, others

Member State	Sector	Number of plants	Notes
Romania	Public electricity generation	18	
	Public heat generation (incl. district heating)	325	
	Combined heat and power generation	84	
	Hospitals and universities	147	
	Greenhouses	1	
	Food industry (excl. greenhouses)	159	
	Industrial (other than food)	503	
	Other	69	
Slovakia	Public heat generation (incl. district heating)	759	
	Food industry (excl. greenhouses)	150	Includes: Crop and animal production, hunting and related service activities, Manufacture of food products, Manufacture of beverages, Food and beverage service activities
	Industrial (other than food)	622	The Slovak authorities provided a breakdown of plants according to a significant list of sectors. AMEC has grouped industrial activities together.
	Other	1185	
United Kingdom (data only represent Northern Ireland)	Combined heat and power generation	3	
	Hospitals and universities	2	
	Food industry (excl. greenhouses)	19	
	Industrial (other than food)	49	Includes: Rendering; Paper and Pulp; Tyre Manufacture; Combustion; Tobacco Production, Incineration; Animal Feed; Slaughtering; Galvanising; Pharmaceutical; Aluminium casting, coating process, Road stone coating, mineral drying; coating

3.1.8 Degree to which the combustion installations below 50 MW_{th} may be already covered under IED

Article 3(3) of Directive 2010/75/EU on industrial emissions (IED) defines an installation as, '*a stationary technical unit within which one or more activities listed in Annex I or in Part VII are carried out, and any other directly associated activities on the same site which have a technical connection with the activities listed in those Annexes and which could have an effect on emissions and pollution*'.

Therefore combustion units with a rated thermal input less than 50MW_{th} may already be regulated under IED as part of installations where the aggregated combustion capacity on site is at least 50 MW_{th} or where combustion is a ***directly associated activity with a technical connection*** to the IED activity**.** Competent authorities were requested to estimate the number of combustion units in each capacity class which are already regulated under the IED. The response from competent authorities was limited and is summarised in Table 3.7 (below).

Table 3.7 Proportion of reported combustion plants below 50MW_{th} that are considered to be covered by the IED as directly associated activities because the aggregated combustion capacity on site is at least 50 MW_{th}

Member State	Actual data / Estimate	Proportion of plants <50MW_{th} covered by IED as DAAs		
		1-5MW_{th}	5-20MW_{th}	20-50MW_{th}
Cyprus	Actual Data	23%	19%	100%
Czech Republic	Estimate	(not split by capacity class) 20 – 30%		
Finland	Actual Data	0%	1%	77%
France	Estimate	15% (combined 1-20MW_{th})		46%
Netherlands	Estimate	27 installations or fewer (In industry only)		
Portugal	Actual data	no data	no data	24%

For the data received for the six Member States listed in Table 3.7, it is apparent that a greater proportion of 20 to 50 MW_{th} combustion plants may be covered as directly associated activities with IED installations than plants less than 20MW_{th}. It is not considered sufficiently robust to try to estimate the proportions covered as directly associated activities from supplied sectoral information.

The following EU level assumptions have been made for the Member States not listed in Table 3.7: 5% of plants in 1-5 MW_{th} capacity class, 10% of plants in 5-20 MW_{th} capacity class and 40% of plants in 20-50 MW_{th} capacity class. These assumptions feed into the estimation of administrative costs. The figure of 40% of plants in the 20-50MW_{th} category being directly associated activities is consistent with the limited data on the subject presented in AEA (2007).

3.2 Overview of Current Regulation of Combustion Plants/Installations Less than 50 MW

3.2.1 EU legislation

The table below provides a summary of some of the key EU legislation other than IPPC/IED that could affect combustion plants less than 50 MW_{th}.

Table 3.8 Summary of EU level policies other than IPPC/IED with implications for small combustion plants

Policy	Summary	Relevant Scope	Relevant Timescales	Requirements	Implication for business as usual trends of SCPs
EU ETS Directive (2003/87/EC) as amended by Directive 2009/29/EC	GHG emissions trading scheme for the largest emitting industrial sectors.	Installations >20MW_{th} in any sector (aggregation rules exclude combustion units <3MW_{th} and units which exclusively use biomass).	Phase II currently in force. Phase III (2013-2020) will significantly restrict the allocation of free allowances.	Submit allowances to cover GHG emissions.	Increases financial incentives for installations to invest in GHG abatement measures. This will - Encourage more efficient SCPs; - Encourage fuel-switching to natural gas and biomass / other biofuels.
Renewable Energy Directive 2009/28/EC	Directive 2009/28/EC establishes a common framework for the production and promotion of energy from renewable sources. Introduces national targets for the share of energy produced from renewable sources.	Targets are set at Member State level and implicitly include combustion plants <50MW_{th}.	Targets are set for 2020.	No direct requirements for individual installations.	- Reduction in number of SCPs due to encouragement of generation from non-combustion renewable sources. Consequent reduction in fuel consumption and emissions. - Increase in uptake of biomass, biofuel and biogas (either for new installations or fuel switching at existing plants). The impact on emissions to air will depend on the fuel types being switched from/to.
Effort Sharing Decision 406/2009/EC	Establishes binding national GHG emissions targets for non-ETS sectors (relevant examples: buildings, agriculture).	Targets are set at Member State level and implicitly include combustion plants <50MW_{th}.	Targets are set for the period 2013-2020.	No direct requirements for individual installations.	More efficient heating systems will be encouraged. Increased uptake of renewable fuels.
CHP Directive 2004/8/EC ***(to be replaced by the Energy Efficiency Directive)***	Promotes cogeneration based on useful heat demand.	All CHP plants (and all plants which could be converted to CHP).	Implemented in 2004.	Encourages the introduction of subsidies and removal of barriers for cogeneration at a Member State level.	Increase the number of CHP SCPs. *Increase combustion efficiency, reducing fuel consumption and emissions.*
Eco-Design of Energy Using Products Directive 2009/125/EC	Provides consistent EU-wide rules for improving the environmental performance of energy related products (ERPs) through ecodesign. Described in more detail following this table.	Energy-using products (EUPs), which use, generate, transfer or measure energy, such as boilers.	Preparatory studies on different product groups are produced over time. The boilers preparatory study was finalised in 2007.	Encourage the selection of more efficient EUPs.	Considered to be small as the largest category of boiler considered in the preparatory study (2007) was <1MW. However, the approach is being considered in this study as one option for controlling emissions from 1-5MW_{th} plants.

The current Ecodesign Directive 2009/125/EC extends the scope of past Ecodesign Directive 2005/32/EC on energy-using products. It establishes a framework for setting product-specific requirements along with legislation on energy efficiency and other design standards using a life-cycle approach. Directive requirements are introduced on a product-by-product basis using a combination of Implementing measures (IM) to be adopted by the Commission and voluntary agreements. It is a supply side approach, to be considered alongside the Energy Labelling Directive 2010/30/EU which targets consumer demand by setting product-specific requirements for standard information on energy efficiency. Implementing measures are adopted for new products meeting the three criteria of significant environmental considerations, significant potential for improvement and significant trade and sales volume (with an indicative threshold of 200 000 units per year).

Recently adopted Regulations under the Directive have included measures for circulators, electric motors, household refrigerating appliances, televisions and fans. Other measures under preparation include commercial refrigerators, computers, pumps, room air-conditioners, domestic lighting products, other refrigerating & freezing equipment, boilers and solid fuel small combustion installations. The latter two products are perhaps of most relevance to the plants under consideration in this study:

- **Boilers (Lot 1):** Technologies covered under this lot are fossil-fuel boilers, heat pumps and micro cogeneration, with the draft Regulation establishing ecodesign requirements "for the placing on the market and/or putting into service of heaters with a rated heat output ≤400 kW"[6]. There are a number of proposed exclusions, for example heaters using predominantly biomass or solid fuels, those falling under the IED, or cogeneration space heaters with a maximum electrical capacity over 50kW. Draft proposed ELVs for NOx emissions for new appliances range from 70 to 120 mg/kWh; and

- **Solid fuel small combustion installations (Lot 15):** This lot addresses energy efficiency and emissions of biomass and coal fired small combustion installations below 500 kW, including local room heaters (ovens, stoves) and central heating products. Current progress includes a completed Preparatory study and background study for the Impact Assessment. Draft proposed ELVs for particulate matter emissions range from 50 to 100 mg/m³. Other emissions to be addressed include CO, Organic Gaseous Carbon and VOCs. NO_X is not considered as it is fuel as opposed to product related.

Whilst the current Eco-Design Directive (and ongoing investigations) is unlikely to have much impact on 1-50 MW_{th} combustion plants, the overall framework could potentially be applied to the smaller sized plants under consideration in this study i.e. 1-5 MW_{th}. The relative pros and cons of considering such an approach are discussed further in Section 5.

3.2.2 Member States' national legislation

Although emissions to air from combustion installations with a rated thermal input less than 50 MW are not regulated at an EU level, some Member States are regulating this. Table 3.9 (below) summarises information received during the study on Member States' national legislation. This information has been used in this study to

[6] http://www.eceee.org/Eco_design/products/boilers/resolveuid/b722b7a390d03a04259e5b2f3dea0f7b

help develop possible options for the control of emissions from these plants as well as to understand which plants may already be able to meet any minimum ELVs if they were to be set at an EU level.

Table 3.9 Summary of National Legislation regulating combustion plants less than 50MW$_{th}$

Member State	Legislation	Covers permitting?	Includes ELVs?	Specifies monitoring requirements?
Austria	BGBI.II Nr. 312/2011 concerning furnaces which are not steam boilers and BGBI Nr.19/1989 idf. BGBL. II Nr. 153/2011 concerning steam boilers and gas turbines <50 MW.	X	✓	✓
Belgium - Flanders	VLAREM II (Order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety). Legislative requirements for combustion installations are described in chapter 43 and for stationary engines in chapter 31 of VLAREM II.	✓	✓	✓
Belgium - Brussels	'Ordonnance relative au permis d'environnement (1997)'	Not known (English language translation not available)		
Belgium - Walloonia	Unknown	Not known	✓	✓
Bulgaria	*No information received.*			
Cyprus	The Control of Atmospheric Pollution (Non Licensable Installations) Regulation of 2004 (P.I. 170/2004)» and «The Control of Atmospheric Pollution (Non Licensable Installations) (Amendment) Regulations of 2008 (P.I. 198/2008)	No permits are required	✓	✓
Czech Republic	Government Ordinance No. 146/2007 Coll. In wording No. 476/2009 Coll. (ELVs) Decree No. 205/2009 Coll. In wording No. 17/2010 Coll. (Monitoring) As part of the consultation on the final report, the Czech authorities have indicated that a new air protection act has been introduced (No. 201/2012 Coll. in force from 01/09/2012), which replaces older legislation. This is summarised in the appendices.	X	✓	✓
Denmark	*No information received.*			
Estonia	Välisõhu kaitse seadus, Vastu võetud 05.05.2004 RT I 2004, 43, 298 (ambient air protection act)	✓ (indefinite permit specifying ambient air limits)	✓ (permit specific)	✓ (permit specific)
Finland	Environmental Protection Act Government Decree on environmental protection requirements for energy production installations with a total fuel capacity below 50 MW	✓	✓	Not known (English language translation not available)
France	Inspection des Installations Classees (Permitting – separate regimes for 2-20MW$_{th}$ and 20-50MW$_{th}$) NOR: ATEP9760321A Version consolidée au 15 décembre 2008 (ELVs 2-20MW$_{th}$) ELVs for >20MW$_{th}$ (various regulations, depending on age of plant)	✓ (English language translation not available)	✓ (English language translation not available)	✓ (English language translation not available)

Member State	Legislation	Covers permitting?	Includes ELVs?	Specifies monitoring requirements?
Germany	Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über kleine und mittlere Feuerungsanlagen - 1. BImSchV) (ELVs). This is relevant for combustion plants firing solid fuels (<1MW) and gaseous and liquid fuels (<20MW). These plants are regularly monitored but no permitting process is applied; instead a notification procedure applies. First General Administrative Regulation Pertaining the Federal Immission Control Act (Technical Instructions on Air Quality Control – TA Luft) (24 July 2002) (Monitoring)	X (licensing is only mandatory under TA Luft)	✓	✓
Hungary	*No information received.*			
Ireland	Air Pollution Act 1987 (if the combustion plant is associated with an activity licensable under the Act)	No	No. May be set but site-specific.	No. May be set but site-specific.
Italy	*No information received.*			
Latvia	*No information received.*			
Lithuania	*No information received.*			
Luxembourg	*No information received.*			
Malta	*No information received.*			
Netherlands	BEES-B (Existing installations <50MW_{th}) BEMS (New installations; and from 2017 (2019 in some cases) will replace BEES-B in covering existing installations)	✓ (English language translation not available)	✓ GBR	✓
Poland	Environmental Protection Law (Permits) Emission standards regulation (ELVs for 1-50MW_{th}) ROZPORZÑDZENIE MINISTRA ÂRODOWISKA (Monitoring)	Not required	✓(English language translation not available)	✓(English language translation not available)
Portugal	Decree-Law 78/2004, April 3rd (http://dre.pt/pdf1s/2004/04/080A00/21362149.pdf) Ordinance 675/2009, June 23rd (http://dre.pt/pdf1sdip/2009/06/11900/0410804111.pdf)	✓	✓	✓
Romania	Ministerial Order no 1798/2007 for the approval of the procedure of issuing the environmental permit ELVs in accordance with Ministerial Order no. 462/1993 – Technical conditions regarding air protection, Annex 2	✓	✓	✓
Slovakia	Extracts provided, but not references	✓	✓	✓
Slovenia	UREDBO o emisiji snovi v zrak iz malih in srednjih kurilnih naprav (based on TA Luft)	✓	✓	✓
Sweden	Permit conditions for plants are set on a case-by-case basis.	?	Case-by-case basis	?
Spain	ELVs are set by Autonomous Communities. General binding rules do not exist. (No references provided)	X	X	X
UK	Environmental Permitting, England and Wales (2010) – Part B Regulations apply to boilers 20-50MW_{th}	✓ (>20MW_{th} only)	✓ (>20MW_{th} only)	✓ (>20MW_{th} only)

A compilation of the various ELVs applied by Member States in their national legislation is included in Appendix F.

3.2.3 Gothenburg Protocol and revision

The 1979 Convention on Long-Range Transboundary Air Pollution, was established within the framework of the United Nations Economic Commission for Europe (UNECE), entered force in 1983 and has since been extended by eight specific protocols. The most recent protocol[7], is commonly referred to as the Gothenburg protocol and entered force in 2005.

In June 2012, agreement was reached in revising the Gothenburg Protocol. Certain aspects of the revision widen the Protocol's scope in relation to combustion plants less than 50MW_{th}. The elements of the newly revised protocol which are relevant to combustion plants between 1 MW_{th} and 50 MW_{th} can be summarised as follows:

- Annex II sets national SO_2, NO_X, NH_3 and VOC emissions ceilings for 2010 until 2020 and emission reduction commitments (additionally for $PM_{2.5}$) for 2020 and beyond for signatories to the protocol. These ceilings and reduction commitments are not sector specific but may influence the need to control emissions from combustion plants between 1 MW_{th} and 50 MW_{th}.
- Annexes IV, V, VI and X (new) specify limit values for emissions of sulphur, nitrogen oxides, volatile organic compounds and particulate matter respectively from stationary sources. For combustion plants with a rated thermal input between 1 MW_{th} and 50 MW_{th}, the following provisions are relevant:
  - Annex IV (SO_2): limit for sulphur content of gas oil at <0.1% by January 2008;
  - Annex V (NOx): limit values for *new* stationary engines which run for more than 500 hours per year, differentiated by fuel, size and combustion type, as follows: specifically for gas engines and dual fuel engines greater than 1MW_{th}, and diesel engines greater than 5MW_{th};

Gas (Otto) engines	>1MW_{th}	95-190 mg NOx/Nm^3
Dual-fuel engines (in gaseous mode)	>1MW_{th}	190 mg NOx/Nm^3
Dual-fuel engines (liquid mode):	1-20MW_{th} and >20MW_{th}	225 mg NOx/Nm^3
Slow / medium speed (<1,200 rpm) diesel engines (heavy fuel oil and bio-oils)	5-20MW_{th}	225 mg NOx/Nm^3
	>20MW_{th}	190 mg NOx/Nm^3
Slow / medium speed (<1,200 rpm) diesel engines (light fuel oil and natural gas)	>5MW_{th}	190 mg NO_x/Nm^3
All high speed (>1,200 rpm) diesel engines		190 mg NO_x/Nm^3

[7] 'Protocol to the 1979 Convention on long-range transboundary air pollution to abate acidification, eutrophication and ground-level ozone'. Available from: http://www.unece.org/fileadmin/DAM/env/lrtap/full%20text/1999%20Multi.E.Amended.2005.pdf

- Annex X (particulate matter): recommended but not binding dust limit values for solid and liquid fuel-fired boilers and process heaters with rated thermal input from 1 MW_{th} to 50 MW_{th}

New solid and liquid fired	>1-50 MW_{th}	20 mg dust/m^3
Existing solid and liquid fired	>1-5 MW_{th}	50 mg dust/m^3
	>5-50 MW_{th}	30 mg dust/m^3

- In addition, these limit values are not the only option for compliance; new stationary sources may alternatively '*apply different emission reduction strategies that achieve equivalent overall emission levels for all source categories together*'.
- A provision to review an evaluation of mitigation measures for black carbon emissions.
- Lastly, the protocol states, '*Each Party should apply best available techniques (…) to each stationary source covered by annexes IV, V, VI and X, and, as it considers appropriate, measures to control black carbon as a component of particulate matter, taking into account guidance adopted by the Executive Body*'.

3.3 Overview of abatement measures typically used in combustion plants less than 50 MW_{th}

Limited data were received on the typical abatement measures that are currently used in small combustion plant. The data that were received are summarised below in Table 3.10.

Table 3.10 Summary of abatement techniques reported by Member States as being currently employed at 1-50MW_{th} combustion plants

Pollutant	Member State	1-5MW_{th}	5-20MW_{th}	20-50MW_{th}
SO_2	Czech Republic	End-of-pipe technologies are not employed. Older boilers using solid fuels would be required to install a gas-fired boiler		
	Belgium	Studies on the BAT for SCPs are available for the Flemish Region of Belgium.		
	Germany	N/A	Dry sorbent injection	Dry sorbent injection (spray dryer)
	Poland	-	-	Dust settling chamber 30% abatement (one case) Limestone semi dry process 50% abatement (one case)

Pollutant	Member State	1-5MW$_{th}$	5-20MW$_{th}$	20-50MW$_{th}$
NOx	Czech Republic	End-of-pipe technologies are not employed	End-of-pipe technologies are not employed	End-of-pipe technologies are not employed
	Belgium	Studies on the BAT for SCPs are available for the Flemish Region of Belgium.		
	Netherlands	New plants - SCR for gas engines. SNCR for wood burning. LNB for all.	New plants - As for smaller plants, but wood burning installations require SCR.	
	Sweden	Combustion modifications on 25% of plants.	Waste Gas Recirculation (32% plants), SNCR (30%), combustion modification (4%) and others.	Waste Gas Recirculation (13% plants), SNCR (73%), Over Fire Air (4%) and other techniques.
	Germany	N/A	Low-NO_x-burner	Low-NO_x-burner and SNCR
	Poland	-	SCR (20% abatement)	-
Dust/PM	Czech Republic	End-of-pipe technologies are not employed, as most are natural gas-fired.		
	Belgium	Studies on the BAT for SCPs are available for the Flemish Region of Belgium.		
	Estonia	ELVs and abatement techniques required are set at installation level, depending on the fuel-type; cyclones are most commonly required.		
	Germany	Fabric filter (Note 1)	Fabric filter (Note 1)	Fabric filter or ESP (Note 1)
	Netherlands	Multicyclones	Fabric filter	Fabric filter
	Poland	Multicyclone, 80-95% abatement Dry cyclone, 70-95% abatement Bag filters, 85% abatement (one case) Dust settling chamber, 20-32% abatement Wet scrubber, 96% abatement (one case)	Multicyclone, 70-98% abatement Dry cyclone,72-99% abatement Dry electrostatic precipitator, 90-98% abatement Bag filters, 75-99.9% abatement Dust settling chamber, 20% abatement (one case)	Multicyclone, 72-98% abatement Dry cyclone, 44-92% abatement Dry electrostatic precipitator, 85-98% abatement Bag filters, 95-99.9% abatement Limestone dry process, 73% abatement (one case)

Note 1: it remains unclear whether these are recommended or applied for both new and existing plants.

The information gathered on the abatement options – supplemented with information available from previous studies – has informed the abatement option matrix that has been developed for the assessment of control options in section 5.

4. Development of an EU dataset of combustion plants 1 to 50 MW_{th}

4.1 Overview

As identified in Section 2, and evident from the presentation of data in Section 3, there is a need to make adjustments and additions to the data gathered from the Member States during this study. This is in order to obtain a representative dataset of estimates of combustion plants between 1 and 50 MW_{th} (numbers, capacities and emissions) so as to be able to assess the total EU potential costs and benefits for controlling their emissions. Three mains sets of amendments have been carried out:

i. Adjustment of data gathered from Member States in instances where the data have been flagged by the Member State or AMEC as being only partially complete. These data were highlighted with the amber colour in the tables in Section 3.

ii. Supplementing the data gathered from Member States during this study with existing data to fill in gaps.

iii. Extrapolating the adjusted new and supplemented existing data to cover those Member States and/or capacity classes for which no data (new or existing) are available.

Each of these steps is described in turn in the following sections.

4.2 Adjusting partially complete data gathered

This step involves the use of factors to adjust the data provided by Member States for those instances in which the data have been indicated by the Member State – or identified by AMEC – as being only partially complete. Typically, partially complete has meant, for example, that the data provided cover only some of the plants within a particular capacity class. If no adjustments were made to such partially complete data, the assessment of potential costs and benefits may be inaccurate.

Each of the partially complete data has been adjusted on the basis of the specifics of the particular data gap. Appendix E documents the issues and resolutions adopted to adjust the partially complete data.

Notice in particular is drawn to the discussion around the French data which concludes to not reject the original data provided by the French authorities.

4.3 Supplementing with existing data on 20 to 50 MW_{th}

Previous work undertaken on 20-50 MW_{th} combustion installations has led to there being existing datasets which can be drawn upon to supplement the data gathered in this study in order to try to fill some of the remaining gaps.

Three sources of data on numbers / capacity / fuel consumption / emissions of combustion plants 20-50 MW_{th} have been identified:

i. AMEC (then Entec) undertook a previous study for the Commission to gather data on combustion installations of capacities 20MW_{th} to 50MW_{th} as a support contract during the negotiation of the IE Directive (Entec, 2009)[8]. A summary of the data and information gathered from this study are included in Appendix C.

ii. Preceding Entec (2009) was AEA (2007)[9] which provided background material to the Commission for the proposal for the IED extending to cover 20 to 50 MW_{th} installations.

iii. AMEC (as Entec) undertook for Defra in the UK an impact assessment for the initially proposed IED, which included an assessment of the impacts on combustion installations 20 to 50 MW_{th} (Entec 2008).

Although the distinction between combustion plants and installations has previously been recognised, due to the need to draw on additional data whilst retaining a pragmatic approach, it has been necessary to neglect the differences and utilise the data for combustion installations interchangeably with combustion plant.

The table below summarises the utilisation of existing data on 20 to 50 MW_{th} plants to supplement data gathered from the Member States.

Table 4.1 Summary of which existing data sources on 20 to 50 MW_{th} combustion plants and installations have been utilised to supplement new data gathered from Member States

Member State	Data gap	Filled using data from Entec (2009)	Filled using data from AEA (2007)	Filled using data from Entec (2008)
AT	Fuel mix		✓	
BE	Fuel mix		✓	
BG	Number of plants	✓		
	Capacity	✓		
	Fuel consumption	✓		
DK	Capacity		✓	
	Fuel consumption		✓	
	Emissions		✓	

[8] Entec (2009) Study to inform on-going discussions on the proposal for a Directive on industrial emissions. Part 1: Combustion Activities. Final Report to the European Commission.

[9] AEA (2007) Assessment of the benefits and costs of the potential application of the IPPC Directive (EC/96/61) to industrial combustion installations with 20-50 MW rated thermal input. Final Report to the European Commission.

Member State	Data gap	Filled using data from Entec (2009)	Filled using data from AEA (2007)	Filled using data from Entec (2008)
EL	Capacity		✓	
	Fuel consumption		✓	
	Emissions		✓	
ES	Number of plants	✓ (Note 1)		
	Total fuel consumption	✓		
	Fuel mix		✓	
HU	Number of plants	✓		
	Capacity	✓		
	Fuel mix	✓		
	Emissions		✓	
IE	Capacity		✓	
	Fuel consumption		✓	
	Emissions		✓	
IT	Number of plants	✓		
	Capacity	✓		
	Fuel consumption		✓	
	Emissions		✓	
LT	Capacity		✓	
	Fuel consumption		✓	
	Emissions		✓	
LU	Number of plants		Note 2	
	Fuel mix		✓	
LV	Capacity		✓	
	Fuel consumption		✓	
	Emissions		✓	
MT	(all)		Note 3	
RO	Fuel mix		✓	
SI	Fuel mix		✓	
UK	Number of plants			✓
	Fuel consumption			✓
	Emissions			✓

Note 1: the data from Entec (2009) have been used preferentially to those provided by the Spanish authorities to this study.
Note 2: data was missing in the AEA (2007) for LU. Data were obtained instead from 'IEEP (2006) Data gathering and impact assessment for a possible review of the IPPC Directive Fact sheet C1 Combustion Installations'.
Note 3: no data source for Malta was identified; in this absence, all Malta data has been set equal to data for Cyprus.

4.4 Extrapolating to missing Member States and capacity classes

4.4.1 Number of plants

In some cases (DK, EL, IE, LT, LV), it was necessary to estimate the number of plants in the 20 to 50 MW_{th} capacity class from data on total capacity. This was undertaken by dividing the capacity by the EU average size of plant in the category (Table 4.2). The average plant size in each capacity class was determined from complete data gathered from Member States on both numbers and capacity of plant.

Table 4.2 Assumed average capacity per plant

Capacity class	Assumed EU average plant capacity (MW_{th})
1-5 MW_{th}	2.3
5-20MW_{th}	8.9
20-50 MW_{th}	32

Estimates for the number of plants in the capacity classes 1 to 5MW_{th} and 5 to 20 MW_{th} were derived from the numbers in the capacity class 20 to 50 MW_{th} by utilising average ratios between the number of plants in the smaller capacity classes and the 20-50MW_{th} category, shown below in Table 4.3. These ratios were derived from complete data provided by Member States.

Table 4.3 Ratio of numbers of plants at each capacity class

Capacity class	Number of plants at each capacity class as a function of the number of 20-50MW_{th} plants
1-5 MW_{th}	26
5-20MW_{th}	7.5
20-50 MW_{th}	1

4.4.2 Capacity of plants

The estimation of the total capacity of combustion plants in the 1 to 5 MW_{th} and 5 to 20 MW_{th} capacity classes has been undertaken using the average capacity per plant shown above in Table 4.2 multiplied by the numbers of plants.

As a sensitivity, it is also possible to switch the dataset to deriving capacity for the 1-5 MW_{th} and 5-20 MW_{th} categories from the capacity of plants in the 20-50 MW_{th} capacity class. This, if selected, is undertaken by utilising

average ratios of the capacity of plants in the smaller capacity classes to the capacity of plants in the 20-50 MW_{th} category, shown below in Table 4.4. These ratios were derived from complete data provided by Member States.

Table 4.4 Ratio of capacity of plants at each capacity class

Capacity class	Capacity of plants at each capacity class as a function of the capacity of 20-50MW_{th} plants
1-5 MW_{th}	1.7
5-20MW_{th}	1.9
20-50 MW_{th}	1

4.4.3 Fuel consumption of plants

Percentage fuel mix

For those Member States for which fuel mix data were not gathered or gap filled using existing data, additional assumptions were necessary on the average fuel mix across the five fuel types of biomass, other solid fuels, liquid fuels, natural gas and other gaseous fuels. This in-filling was necessary for the fuel mix of 1-5MW_{th} and 5-20MW_{th} capacity categories. It was assumed that the fuel mix in these smaller capacity classes was the same as that in the 20 to 50 MW_{th} capacity class.

Total fuel consumption

Where data have not already been gathered, the total fuel consumption of plants has been estimated in the central case by using average load factors together with the capacity data. The average load factors have been calculated separately for each capacity class from those data provided by Member States which were considered complete. The derived average load factors are shown below in Table 4.5. These load factors are similar to the range of load factors assumed in AEA (2007) of 1000 to 3000 annual operating hours.

Table 4.5 Average load factors for each capacity class

Capacity class	Load factor (%)	Load factor (hours/year)
1-5 MW_{th}	24%	2100
5-20MW_{th}	35%	3100
20-50 MW_{th}	21%	1850

As a sensitivity, it is also possible to switch the dataset to estimating fuel consumption for the 1-5MW_{th} and 5-20MW_{th} capacity classes from the fuel consumption of plants in the 20-50 MW_{th} capacity class. This, if selected, is undertaken by utilising the average ratios of the capacity of plants in the smaller capacity classes to the capacity of plants in the 20-50 MW_{th} category that were shown above in Table 4.4.

4.4.4 SO_2, NO_X and dust emissions of plants

Where no emissions data had been gathered, annual mass emissions of SO_2, NO_X and dust were estimated using the fuel consumption (FC) for each fuel type, together with the fuel-specific flue gas volume (FGV) and the estimated emission level (EL) for each fuel type *f*, according to the following equation:

$$\sum_f \left(FC_f \times EL_f \times FGV_f \right)$$

It is worth noting that throughout this report, it is assumed that no SO_2 emissions arise from natural gas or biomass combustion, and that gaseous fuels do not give rise to emissions of dust.

The fuel-specific flue gas volumes assumed in this study have been taken from AMEC (2012)[10], assuming gaseous plants are primarily boilers, and are reproduced in Table 4.6.

Table 4.6 Specific flue gas volumes assumed in this study

Fuel	Specific flue gas volume	Excess air (% oxygen)
Biomass	331	6%
Other solid fuels	370	6%
Liquid fuels	279	3%
Natural gas	251	3%
Other gaseous fuels	251	3%

The emission levels are assumed, in the central case, to be at the same level as the identified emission limit value applied by that Member State, or in the absence of national legislation prescribing limit values for the particular capacity class in question, at the same level as a determined general EU case emission level. This aspect is described further in Section 5.

[10] AMEC (2012) Analysis and summary of the Member States' emission inventories 2007-2009 and related information under the LCP Directive (2001/80/EC). Final Report for the European Commission.

4.5 Overview of resulting EU27 dataset

The table below provides an overview of the resulting EU-27 dataset with all of the amendments, additions and assumptions as described above. Member State level data underpinning this Table are presented in Appendix G.

Table 4.7 Resulting EU27 dataset

Datum	1-5 MW	5-20 MW	20-50 MW
Number of plants	107,506	29,958	5,078
Capacity of plants (GW_{th})	251	273	165
Biomass (PJ)	200	280	148
Other solid fuel (PJ)	122	198	103
Liquid fuel (PJ)	206	358	198
Natural gas (PJ)	1,130	1,959	892
Other gaseous fuel (PJ)	20	31	26
Total fuel consumption (PJ)	1,678	2,826	1,367
SO_2 emissions (kt)	170	277	78
NO_x emissions (kt)	179	268	110
Dust emissions (kt)	26	32	19

5. Options for the Possible Control of Emissions from Combustion Installations Less than 50 MW

5.1 Overview of Options

A number of options have been developed – in consultation with the Commission – for the possible control of emissions from combustion installations below 50MW_{th}. It is noted that, whilst this list of options refers to regulation through the IED, it should not be assumed that regulating through the IED would be the only mechanism to be considered for controlling emissions from these installations. Other legislative instruments could be developed in lieu of the IED with similar requirements. The different control options that have been considered are:

Option 1	No regulation.
Option 2a	"Full IED". Inclusion of 1-50 MW_{th} installations as a new activity in Annex I of the IED, such that the installations would need to meet all the requirements of the IED Chapters I and II. A BAT regime and/or EU wide minimum ELVs would be in force. For the purposes of the modelling these have been set for each capacity class at the level of most stringent national MS legislation.
Option 2b	As per 2a, but with EU ELVs for all capacity classes set at level of ELVs for 50-100 MWt_h in IED for existing plants.
Option 3	"Light IED". Inclusion of <50MW_{th} installations within the IED as a separate chapter but without a full permitting regime and no coverage under Chapter II (i.e. not listed as a new activity in Annex I). Installations would be subject to EU wide emission limit values for atmospheric emissions only as for option 2a.
Alternative approach for smaller plants	Product standards could be developed for smaller plants (1-5 MW_{th}) targeted at new units only – similar in approach to those currently being developed under the Ecodesign Directive for much smaller units.

Option 2 of the above list would lead to combustion installations less than 50 MW_{th} not already covered as directly associated activities needing to meet all the requirements of the IED, including permitting, monitoring and BAT-based permit conditions (a BREF document would need to be developed for the sector or the existing combustion plant BREF revised). During negotiation of the IED, one of the reasons that contributed to the removal of the proposed increased coverage to include 20-50 MW_{th} combustion installations was concerns over the level of administrative burden that would be necessary to permit the high numbers of installations. This concern would presumably remain with some of the Member States at present, in particular those that either do not regulate these installations or those whose regulation of these installations is simpler.

Although the recently revised Gothenburg Protocol includes some aspects related to combustion plants smaller than 50MW_{th}, such that harmonised requirements may appear at first sensible, it may not be possible to harmonise EU controls with the Protocol because its approach for the control of dust emissions from <50MW_{th} plants is voluntary in nature. The Protocol does however include limit values for new gas and diesel stationary engines, but the definition of 'new' differs from that in the IED (in the Gothenburg protocol a *new stationary source* is one whose construction or major modification commenced after 17 May 2006) among other scope divergences.

The small combustion plants that would not already be covered under the IED as directly associated activities are, in many cases, relatively simple plants and whose most important environmental impact is atmospheric emissions. The data gathered in the study indicates that a large proportion are fired with natural gas so SO_2 and dust emissions are not significant for the majority of these plants. With this in mind, **Option 3** presents a simpler approach for controlling emissions from the sector whereby a separate chapter could be included in the IED setting out specific requirements (including ELVs) without needing to comply with the wider requirements of the Directive (an alternative to this would be development of a new Directive which only includes these requirements).

Alternative approach for smaller plants: Developing a different approach to controlling emissions from new combustion installations by way of product standards offers a potentially simpler option for the smallest plant without imposing any requirements on the large numbers of existing plant. However, because such an approach can only affect new installations, this option would return benefits over a longer time period. This option could be considered for the smallest plant in addition to some of the other options for larger plants (i.e. a hybrid approach).

Without any specific EU intervention in the form of regulating emissions from combustion installations less than 50 MW_{th} (**option 1**), existing national legislation of the Member States would continue to apply and the recent amendments to the Gothenburg Protocol's requirements would come into force for parties to the convention (see section 3.2).

5.2 Assessment methodology

5.2.1 Overview

Our approach for developing the dataset used in the study was described in Section 4. The following sections describe how we have used this dataset for assessing the potential costs and benefits of different options for the control of emissions from these plants.

5.2.2 Emission levels

Emission levels – per capacity class / fuel / Member State – are assumed to be the same as the ELVs applicable to existing plants in current national legislation (as listed in Appendix F) or, in the absence of national legislative ELVs, the same as the assumed general case emission levels. A sensitivity analysis has been run with emission levels assumed to be 20% lower than the ELVs.

The general case emission levels have been set as equal to the least stringent ELVs in force in any Member State legislation at each capacity class. The general case emission levels are reproduced below in Table 5.1. It is important to note that the classification of 'existing plant' varies among Member States.

Table 5.1 General case emission levels (applied in the absence of Member State-specific ELVs)

Capacity class	SO_2 emission levels (mg/Nm^3)			NO_X emission levels (mg/Nm^3)					Dust emission levels (mg/Nm^3)		
	Other solid fuel	liquid fuel	Other gaseous fuel	Biomass	Other solid fuel	Liquid fuel	Natural gas	Other gaseous fuel	Biomass	Other Solid Fuel	Liquid Fuel
1-5MW_{th}	2500	1700	350	650	650	900	400	400	300	250	150
5-20MW_{th}	2500	1700	350	650	650	900	400	400	250	150	150
20-50MW_{th}	2500	1700	800	650	650	600	400	300	300	150	150

Source: highest Member State specific ELVs at each capacity class identified in this study

5.2.3 EU wide limit values

EU-wide ELVs would most likely need to be set separately for different fuel and technology types, and potentially for different capacity classes, depending on what, if any, threshold would be applied. The introduction of EU-wide ELVs would increase harmonisation across the EU (allowing Member States to apply more stringent limit values) and would impact on some Member States more than others depending on the level and stringency of Member States' existing national legislation. There would be a need for the Commission to determine what limit values would be seen as representing BAT, to be conceptually in-line with the IED e.g. via the development of a new BREF or revision of the existing combustion plant BREF. A pragmatic approach has been taken to simplify the analysis by assuming that all combustion plants are boilers (and assumptions and ELVs are appropriately selected). This simplification has been made following the data gathered from Member States indicating that the majority of plants comprised boiler combustion units. A sensitivity analysis around this assumption (focussed on engines) has been carried out (which primarily affects costs).

The EU wide ELVs are set at the level of the most stringent national legislation (at each capacity class) for existing plants (where specified). It should be noted that there may be differences between Member States in the definition of "existing" plants. A sensitivity has been run (as Option 2b) in which the EU wide ELVs are set at the level of the ELVs applied in the IED for 50 to 100 MW_{th} existing large combustion plants. The EU wide limit values are listed in Table 5.2.

Table 5.2 EU wide ELVs applied in this study

Option	Rated thermal input capacity class	SO_2 ELVs (mg/Nm^3)			NO_X ELVs (mg/Nm^3)					Dust ELVs (mg/Nm^3)		
		Other solid fuel (Note 1)	Liquid fuel	Other gaseous fuel	Biomass	Other solid fuel	Liquid fuel	Natural gas	Other gaseous fuel	Biomass	Other solid fuel	Liquid fuel
Option 2a: most stringent national legislation	1-5	1100	850	100	250	400	200	110	200	50	50	45
	5-20	400	850	50	250	350	200	100	200	20	20	45
	20-50	400	500	50	250	350	200	100	200	20	20	40
Option 2b: as per IED 50-100MW_{th} existing plants	1-5	400	350	35	300	300	450	100	200	30	30	30
	5-20	400	350	35	300	300	450	100	200	30	30	30
	20-50	400	350	35	300	300	450	100	200	30	30	30

Note 1: This excludes biomass; combustion of biomass was assumed in this analysis to lead to zero SO_2 emissions.

The EU-wide dust ELVs applied under Option 2b are 30 mg/Nm^3 for all capacity classes and fuel types. This is largely in-line with the newly adopted 'recommendatory' limit values of the revised Gothenburg Protocol (set out in Section 3.2.3) for solid and liquid fired boilers and process heaters of thermal input 1 MW_{th} to 50 MW_{th}: 20 mg/m^3 for new plant, 50 mg/m^3 for existing plant 1-5 MW_{th} and 30 mg/m^3 for existing plant 5-50 MW_{th}.

It is worth noting that the application in option 2b of the ELVs from the IED for existing 50-100 MW_{th} plants does not necessarily mean that these ELVs are feasible for smaller plants 1-50 MW_{th}. There are a number of instances in the above table where the ELVs assumed in option 2b are lower (i.e. more stringent) than option 2a.

The possible techniques that could be required in order to meet the ELVs set out in Table 5.2are identified in Table 5.3 below. A more detailed discussion of possible abatement techniques for these plants as well as details of the data sources reviewed is provided in Section 5.2.6 below.

Table 5.3 Typical techniques assumed to be applied to meet the hypothetical EU-wide ELVs for those plants / sectors modelled as having emission levels exceeding the limits

Pollutant abatement measures	Fuel	Rated thermal input class	Option 2a: most stringent national legislation	Option 2b: as per IED 50-100MW$_{th}$ existing plants
SO2 abatement measures	Other solid fuel	1-5	Co-fire with biomass, dry FGD or low sulphur coal	Dry FGD or fuel switch to natural gas
		5-20 and 20-50	Dry FGD or fuel switch to natural gas	Dry FGD or fuel switch to natural gas
	Liquid fuels	1-50	Dry FGD	Dry FGD or low sulphur gas oil
	Other gaseous fuels	1-50	Dry FGD	Dry FGD
NOx abatement measures	Biomass	1-50	Combustion modification, SCR or SNCR	Combustion modification, SCR or SNCR
	Other solid fuel	1-50	Combustion modification or SNCR (Note 1)	Combustion modification, SCR or SNCR (Note 1)
	Liquid fuels	1-50	SNCR or SCR	SNCR or SCR
	Natural gas	1-5	Low NOx burner or SCR	Low NOx burner, SNCR or SCR
		5-20 and 20-50	Low NOx burner, SNCR or SCR	Low NOx burner, SNCR or SCR
	Other gaseous fuels	1-50	Low NOx burner, SNCR or SCR	SNCR or SCR
Dust abatement measures	Biomass	1-50	Cyclone or fabric filter	Cyclone or fabric filter
	Other solid fuels	1-5	Fabric filter	Cyclone or fabric filter (Note 1)
		5-20 and 20-50	Cyclone or fabric filter (Note 1)	Cyclone or fabric filter (Note 1)
	Liquid fuels	1-50	Cyclone or fabric filter	Cyclone or fabric filter

Note 1: In cases where SO_2 measure of switch to natural gas is already taken up, the abatement efficiency for NOx/dust associated with this measure is assumed, and no further NOx/dust abatement is assumed.

5.2.4 Administrative costs

Administrative costs are estimated separately for a permitting and non permitting regime. In both cases, the number of assumed plants to which the costs apply is the total number that are not directly associated with IPPC activities. For those Member States that provided this information (Table 3.7), exact figures are utilised; for the remaining Member States the assumptions set out in Section 3.1.8 are adopted.

Cost data presented in Annex 8 of the IED impact assessment have been utilised. These costs represent the costs to operators and authorities (separately) associated with the permit application (assumed lifetime of 20 years) as well as annual on-going costs. The annual on-going costs for authorities include the costs of checking compliance, maintaining systems to make information available to the public and updating permit conditions (without amounting to a full reconsideration of the permit). The annual on-going costs for operators include providing

monitoring reports, accommodating site visits by inspectors and reporting changes in operation. The cost data presented in the IED impact assessment have been uplifted to 2011 prices from assumed 2007 price levels and are summarised below in Table 5.4. The cost of permitting is assumed to be 50% lower for those Member States already identified as permitting combustion installations 1 to 50 MW_{th} (Table 3.9). The cost data in the IED impact assessment were presented as EU average ranges from low to high costs; these EU average ranges have been retained in this analysis and no differences between Member States are assumed.

For the options assessment in which a non-permitting regime is assumed, a much lower value for administrative cost is assumed based on the results of a study by VROM which was reported in the IED impact assessment.

Table 5.4 Administrative cost data assumed in this study

Approach	Element	Bearer	Cost per plant LOW	Cost per plant HIGH
Permitting	One-off costs (€)	Authorities	€ 5,398	€ 23,135
		Operators	€ 22,034	€ 22,034
	Annual costs (€/yr)	Authorities	€ 6,610	€ 6,610
		Operators	€ 3,305	€ 3,305
	Total annualised costs (€/yr)	Authorities	€ 7,160	€ 8,967
		Operators	€ 5,549	€ 5,549
No permitting	Total annualised costs (€/yr)	Authorities	€ 835	€ 2,690
		Operators	€ 647	€ 1,665

5.2.5 Compliance costs

To estimate the potential cost impacts of introduction of EU wide limit values, emission levels for each capacity class in each Member State are compared against the scenario limit values to determine the required emission reductions (taking into account daily ELVs being 10% higher than annual ELVs) and consequently if additional abatement measures would need to be implemented in the Member State to meet the scenario limit values. The compliance costs for implementing the abatement measures are looked up in the abatement matrices (see Section 5.2.6) and applied (per plant) utilising the numbers of plants for each fuel type. The number of plants using each fuel type in a Member State is estimated simply using the percentage fuel mix applied to the total number of plants.

5.2.6 Abatement matrix

A number of literature sources have been reviewed in order to compile information on the most pertinent and applicable abatement measures for combustion plants less than 50MW_{th} (including assessments of Best Available Techniques (BAT) for such plants) and associated pollution abatement efficiencies and costs. The following sources have been reviewed:

- JRC (2007) Small combustion installations: Techniques, emissions and measures for emission reduction. Joint Research Centre.[11]
- AEA (2007)[12]
- (Summary of) Best Available Techniques in Small 5-50 MW Combustion Plants in Finland.[13]
- EGTEI (2010) Options for limit values for emissions of dust from small combustion installations < 50 MW_{th}.[14]
- VITO (2011) Beste Beschikbare Technieken (BBT) voor nieuwe, kleine en middelgrote stookinstallaties, stationaire motoren en gasturbines gestookt met fossiele brandstoffen.[15]
- ECN (2008) Onderbouwing actualisatie BEES B: Kosten en effecten van de voorgenomen wijziging van het besluit emissie-eisen stookinstallaties B.[16]
- AMEC's multi pollutant abatement measures database.[17]

The majority of the costs have been taken from VITO (2011) (taken as raw CAPEX and OPEX costs to allow for flexibility in annualising the data; default values of a 4% discount rate and an annualisation period of 10 years have been used in the central case) with some additional costs taken from AEA (2007) and AMEC (2009) with figures updated to 2011 prices in all cases. The abatement matrices for each of the 1-5MW_{th}, 5-20MW_{th} and 20-50MW_{th} capacity classes are included below in Table 5.5, Table 5.6 and Table 5.7 respectively. VITO (2011) includes both low and high cost scenarios, which represent the uncertainty around the cost estimates for the abatement measures, and so both the low and high costs are reproduced in this analysis. For some abatement measures the low and high costs are the same, which is assumed to reflect a single underlying cost data source, whilst for other abatement measures (SCR in particular) there is a significant difference between the low and high costs.

[11] http://publications.jrc.ec.europa.eu/repository/handle/111111111/229

[12] http://www.cafe-cba.org/assets/ippc_ec_thernal_input.pdf

[13] Summary provided by personal communication with Competent Authority, 22.12.2008. Available in Finnish at http://www.environment.fi/default.asp?contentid=23847&lan=fi

[14] http://www.unece.org/fileadmin/DAM/env/documents/2010/eb/wg5/wg47/Informal%20documents/Info.%20doc%209_Options%20for%20PM%20ELVs%20for%20SCI%20%20final.pdf

[15] http://www.emis.vito.be/bbt-studie-stookinstallaties-en-stationaire-motoren-nieuwe-kleine-en-middelgrote

[16] http://www.ecn.nl/docs/library/report/2008/e08020.pdf

[17] Currently being revised. Last published version available at http://archive.defra.gov.uk/environment/quality/air/airquality/publications/airqual-climatechange/documents/measures-database.pdf

The cost data for fuel switching from coal to natural gas are taken from AEA (2007). The data for this abatement measure do appear to be high. No supporting information is included in AEA (2007) to describe what elements the cost data assume, but considering that almost all the total annualised cost for this measure is from the operating costs, it is assumed that the costs for this measure embody the additional commodity cost premium of natural gas over coal. The costs used may not remain representative for the EU.

The abatement measure for the reduction of SO_2 emissions from the combustion of other gaseous fuels is assumed to be as per the installation of end of pipe SO_2 treatment at liquid-firing plants (dry FGD). It is known however that some of the plants firing other gases will be at refineries and steelworks where it may be more cost effective to desulphurise fuel feedstocks rather than fit end-of-pipe SO_2 abatement. As such, for this measure, the costs that have been assumed may be an overestimate. No sensitivity analysis is undertaken on this assumption however, because the total costs for SO_2 abatement for other gaseous fuels is less than 0.5% of total compliance costs under option 2a.

Table 5.5 Abatement matrix for 1-5MW$_{th}$ plants

Fuel(s)	Pollutant	Measure	SO_2 abatement (%)	NO_X abatement (%)	Dust abatement (%)	Total annual cost LOW (€/plant)	Total annual cost HIGH (€/plant)
Biomass and other solid fuels	NO_X	Combustion modification - assumed exhaust gas recirculation	0%	30%	0%	€ 933	€ 933
Biomass and other solid fuels	NO_X	SNCR	0%	35%	0%	€ 2,982	€ 4,489
Biomass and other solid fuels	NO_X	SCR	0%	80%	0%	€ 4,008	€ 19,700
Biomass and other solid fuels	Dust	Cyclone	0%	0%	65%	€ 2,718	€ 2,898
Biomass and other solid fuels	Dust	Fabric filter	0%	0%	99%	€ 3,697	€ 9,911
Other solid fuels	SO_2	Co-fire biomass	20%	0%	0%	€ 59,493	€ 59,493
Other solid fuels	SO_2	Fuel switch to low sulphur coal	50%	0%	0%	€ 5,605	€ 5,605
Other solid fuels	SO_2	Dry FGD	70%	0%	0%	€ 2,074	€ 2,592
Other solid fuels	SO_2	Fuel switch to natural gas	100%	50%	99%	€ 84,912	€ 84,912
Liquid fuels and other gaseous fuels	SO_2	Dry FGD	70%	0%	0%	€ 1,593	€ 2,116
Liquid fuels	SO_2	Fuel switch to 0.1% gas oil	90%	0%	0%	€ 37,368	€ 37,368
Liquid fuels	NO_X	SNCR	0%	35%	0%	€ 2,874	€ 4,033
Liquid fuels	NO_X	SCR	0%	80%	0%	€ 3,665	€ 15,124
Liquid fuels	Dust	Cyclone	0%	0%	65%	€ 1,670	€ 2,805
Liquid fuels	Dust	Fabric filter	0%	0%	99%	€ 3,438	€ 7,609
Natural gas and other gaseous fuels	NO_X	Low NO_X burner	0%	30%	0%	€ 357	€ 357
Natural gas and other gaseous fuels	NO_X	SNCR	0%	35%	0%	€ 2,873	€ 4,075
Natural gas and other gaseous fuels	NO_X	SCR	0%	80%	0%	€ 3,688	€ 15,772

Table 5.6 Abatement matrix for 5-20MW$_{th}$ plants

Fuel(s)	Pollutant	Measure	SO_2 abatement (%)	NO_X abatement (%)	Dust abatement (%)	Total annual cost LOW (€/plant)	Total annual cost HIGH (€/plant)
Biomass and other solid fuels	NO_X	Combustion modification - assumed exhaust gas recirculation	0%	30%	0%	€ 5,614	€ 5,614
Biomass and other solid fuels	NO_X	SNCR	0%	40%	0%	€ 4,933	€ 12,476
Biomass and other solid fuels	NO_X	SCR	0%	85%	0%	€ 10,059	€ 98,503
Biomass and other solid fuels	Dust	Cyclone	0%	0%	65%	€ 3,604	€ 3,604
Biomass and other solid fuels	Dust	Fabric filter	0%	0%	99%	€ 18,486	€ 44,701
Other solid fuels	SO_2	Co-fire biomass	20%	0%	0%	€ 375,988	€ 375,988
Other solid fuels	SO_2	Fuel switch to low sulphur coal	50%	0%	0%	€ 36,120	€ 36,120
Other solid fuels	SO_2	Dry FGD	75%	0%	0%	€ 10,373	€ 13,123
Other solid fuels	SO_2	Fuel switch to natural gas	100%	50%	99%	€ 545,025	€ 545,025
Liquid fuels and other gaseous fuels	SO_2	Dry FGD	75%	0%	0%	€ 7,964	€ 10,747
Liquid fuels	SO_2	Fuel switch to 0.1% gas oil	90%	0%	0%	€ 37,368	€ 37,368
Liquid fuels	NO_X	SNCR	0%	40%	0%	€ 4,394	€ 10,193
Liquid fuels	NO_X	SCR	0%	80%	0%	€ 8,323	€ 75,621
Liquid fuels	Dust	Cyclone	0%	0%	65%	€ 3,347	€ 3,347
Liquid fuels	Dust	Fabric filter	0%	0%	99%	€ 14,191	€ 34,317
Natural gas and other gaseous fuels	NO_X	Low NOx burner	0%	30%	0%	€ 1,381	€ 1,381
Natural gas and other gaseous fuels	NO_X	SNCR	0%	40%	0%	€ 4,317	€ 10,305
Natural gas and other gaseous fuels	NO_X	SCR	0%	80%	0%	€ 8,366	€ 78,855

Table 5.7 Abatement matrix for 20-50MW$_{th}$ plants

Fuel(s)	Pollutant	Measure	SO_2 abatement (%)	NO_X abatement (%)	Dust abatement (%)	Total annual cost LOW (€/plant)	Total annual cost HIGH (€/plant)
Biomass and other solid fuels	NO_X	Combustion modification - assumed exhaust gas recirculation	0%	30%	0%	€ 14,453	€ 14,453
Biomass and other solid fuels	NO_X	SNCR	0%	45%	0%	€ 12,335	€ 42,540
Biomass and other solid fuels	NO_X	SCR	0%	90%	0%	€ 32,799	€ 394,013
Biomass and other solid fuels	Dust	Cyclone	0%	0%	65%	€ 6,927	€ 6,927
Biomass and other solid fuels	Dust	Fabric filter	0%	0%	99%	€ 44,814	€ 101,128
Other solid fuels	SO_2	Co-fire biomass	20%	0%	0%	€ 922,258	€ 922,258
Other solid fuels	SO_2	Fuel switch to low sulphur coal	50%	0%	0%	€ 88,599	€ 88,599
Other solid fuels	SO_2	Dry FGD	80%	0%	0%	€ 41,494	€ 53,136
Other solid fuels	SO_2	Fuel switch to natural gas	100%	50%	99%	€ 1,340,565	€ 1,340,565
Liquid fuels and other gaseous fuels	SO_2	Dry FGD	80%	0%	0%	€ 31,855	€ 43,665
Liquid fuels	SO_2	Fuel switch to 0.1% gas oil	90%	0%	0%	€ 37,368	€ 37,368
Liquid fuels	NO_X	SNCR	0%	45%	0%	€ 10,166	€ 33,394
Liquid fuels	NO_X	SCR	0%	85%	0%	€ 25,853	€ 302,487
Liquid fuels	Dust	Cyclone	0%	0%	65%	€ 5,898	€ 5,898
Liquid fuels	Dust	Fabric filter	0%	0%	99%	€ 56,766	€ 77,637
Natural gas and other gaseous fuels	NO_X	Low NOx burner	0%	30%	0%	€ 4,966	€ 4,966
Natural gas and other gaseous fuels	NO_X	SNCR	0%	45%	0%	€ 9,812	€ 33,804
Natural gas and other gaseous fuels	NO_X	SCR	0%	85%	0%	€ 26,015	€ 315,417

5.2.7 Emission reductions and monetised benefits

To estimate the potential emissions (benefits) impacts of introducing EU wide limit values, a first step was undertaken to split out reported total emissions (E) at each capacity class into emissions associated with each fuel combusted (E_f). This step utilises the assumed emission level associated with each fuel (EL_f) referred to in Section 5.2.2 and the fuel consumption for each fuel type (FC_f) together with the fuel-specific flue gas volumes (FGV_f, Table 4.6) according to the following equation:

$$E_f = E \times \frac{EL_f \times FC_f \times FGV_f}{\sum_f (EL_f \times FC_f \times FGV_f)}$$

The abatement efficiencies of the abatement measure selected by the model for compliance are applied to the fuel-specific emissions to estimate total emissions reduced of SO_2, NO_X and dust. Monetisation of the emission reductions is undertaken by way of the CAFE damage cost functions.[18] An additional step is necessary to estimate the $PM_{2.5}$ fraction of the dust emissions in order to utilise the CAFE damage cost function for $PM_{2.5}$ emissions; this step is undertaken by assuming the fractionation profile of $PM_{2.5}$ emissions implicit in GAINS emission projections for public power combustion.

5.3 Results

5.3.1 Main results

The main results of the modelling of the costs and benefits of meeting the options set out at the beginning of Section 5 are shown below in Table 5.8. It has not been possible to model the potential impacts of introducing product standards for the smaller plants ('alternative approach for smaller plants') due to a lack of available information such that Table 5.8 does not include a row for this alternative approach; this is discussed, however, in more detail below.

Table 5.9 shows, for the same options, the cost-benefit ratios.

[18] The damage cost functions are uplifted to 2011 prices from assumed 2005 prices. Functions for Bulgaria, Cyprus and Romania are assumed to be the EU average.

Table 5.8 Summary of total additional costs and benefits (low and high)

Option	Capacity class	Costs LOW (€m/yr)			Costs HIGH (€m/yr)			Monetised benefits LOW (€m/yr)				Monetised benefits HIGH (€m/yr)			
		Compliance	Admin.	Total	Compliance	Admin.	Total	SO_2 emission reductions	NO_X emission reductions	$PM_{2.5}$ emission reductions	Total	SO_2 emission reductions	NO_X emission reductions	$PM_{2.5}$ emission reductions	Total
1				0			0				0				0
2a	1-5 MW	497	847	**1,345**	1,439	940	**2,379**	723	667	495	**1,886**	2076	1809	1433	**5319**
	5-20 MW	1,187	227	**1,414**	2,471	252	**2,722**	1,573	985	567	**3,124**	4512	2666	1642	**8820**
	20-50 MW	329	20	**349**	1,209	23	**1,232**	418	352	331	**1,100**	1203	957	960	**3121**
	1-50 MW	**2,014**	**1,095**	**3,108**	**5,119**	**1,214**	**6,333**	**2,713**	**2,004**	**1,393**	**6,110**	**7,791**	**5,432**	**4,036**	**17,260**
2b	1-5 MW	1,355	847	**2,202**	2,208	940	**3,148**	1,063	642	518	**2,223**	3054	1740	1501	**6295**
	5-20 MW	1,291	227	**1,518**	2,473	252	**2,725**	1,736	937	580	**3,252**	4983	2535	1682	**9199**
	20-50 MW	335	20	**355**	1,073	23	**1,096**	419	327	346	**1,093**	1209	891	1004	**3104**
	1-50 MW	**2,980**	**1,095**	**4,075**	**5,754**	**1,214**	**6,968**	**3,218**	**1,906**	**1,444**	**6,568**	**9,245**	**5,166**	**4,187**	**18,598**
3	1-5 MW	497	92	**589**	1,439	262	**1,701**	723	667	495	**1,886**	2,076	1,809	1,433	**5,319**
	5-20 MW	1,187	24	**1,211**	2,471	67	**2,538**	1,573	985	567	**3,124**	4,512	2,666	1,642	**8,820**
	20-50 MW	329	1	**330**	1,209	4	**1,213**	418	352	331	**1,100**	1,203	957	960	**3,121**
	1-50 MW	**2,014**	**117**	**2,131**	**5,119**	**333**	**5,453**	**2,713**	**2,004**	**1,393**	**6,110**	**7,791**	**5,432**	**4,036**	**17,260**

The results suggest that the monetised benefits outweigh the costs across all quantified options and across all capacity classes when comparing low costs with low benefits and high costs with high benefits. When comparing high costs against low benefits, the costs exceed the benefits: in option 2a for the 1-5MW_{th} and 20-50MW_{th} capacity classes; in option 2b for the 1-5 MW_{th} capacity class, and in option 3 for the 20 to 50 MW_{th} capacity class.

Option 3 can be seen to have identical benefits to option 2a but with reduced administrative burden leading to higher cost-benefit ratios.

Table 5.9 Summary of total cost-benefit ratios

Option	Capacity class	Cost-benefit ratio			
		Low-Low	High-High	Low-High	High-Low
1		-	-	-	-
2a	1-5 MW	1.4	2.2	4.0	0.8
	5-20 MW	2.2	3.2	6.2	1.1
	20-50 MW	3.2	2.5	8.9	0.9
	1-50 MW	**2.0**	**2.7**	**5.6**	**1.0**
2b	1-5 MW	1.0	2.0	2.9	0.7
	5-20 MW	2.1	3.4	6.1	1.2
	20-50 MW	3.1	2.8	8.7	1.0
	1-50 MW	**1.6**	**2.7**	**4.6**	**0.9**
3	1-5 MW	3.2	3.1	9.0	1.1
	5-20 MW	2.6	3.5	7.3	1.2
	20-50 MW	3.3	2.6	9.5	0.9
	1-50 MW	**2.9**	**3.2**	**8.1**	**1.1**
Alternative approach for smaller plants	1-5 MW	*Not quantified*			

Option 1 – Do nothing

Option 1 is to not introduce any new controls on the emissions from combustion installations less than 50MW_{th}. In the absence of introducing additional controls, Section 3.2.1 described the various EU legislation that is expected to potentially have impacts on small combustion plants. Primarily, the legislation identified may serve to (i) encourage greater efficiencies in combustion processes, and (ii) encourage switching to renewable fuels, both of which are driven by goals to reduce greenhouse gas emissions. The consequent impact on emissions of air

pollutants from the first of these two potential changes is to reduce emissions (i.e. if fuel consumption drops due to efficiency gains, total mass emissions may also reduce[19]). Regarding the second of the two potential changes, the fuel switching could be from a range of different fuels to a number of different biofuels (solid, liquid or gaseous), each of which potentially has different impacts on emissions of air pollutants. Existing Member State national legislation (as described in Section 3.2.2) would continue to apply.

Each of the subsequent options have been compared against this option i.e. additional costs and benefits.

Option 2a

The results for the 'full IED' option modelled with EU limit values set at the most stringent Member State national legislation are explored further below. As the 'full' IED option, this option assumes permitting: installations are assumed to fully comply with all parts of the IED, i.e. including not only aspects associated with releases to air, but also with consideration for e.g. releases to water and soil contamination. It has not been possible to assimilate costs for these wider elements within the scope of this study although these elements may be small relative to the costs of controlling emissions considering the generally relatively simple nature of installations concerned.

The 'full IED' option would also include a BAT regime across the EU. Due to the flexibility associated with such a BAT regime (cf. derogations under IED Article 15(4)) benefits in some Member States may be reduced if an interpretation of BAT leads to a choice of an abatement measure with less extensive emission reductions. A key driver of an alternative choice of an abatement measure may be one of cost, such that with reduced benefits there may be reduced compliance costs too. An alternative to a BAT regime would be the application of EU-wide emission limit values, which would reduce the abovementioned flexibility.

Figure 5.1 below compares the compliance and administrative costs for Option 2a across each of the capacity classes. The plot shows clearly the decreasing proportion that the administrative costs make up of the total costs with larger capacity classes. This reflects the much higher numbers of plants at lower capacity classes. For the smallest capacity class of 1-5MW_{th}, the administrative costs are modelled to comprise around half the total costs, whereas this falls to around one eighth for the 5-20MW_{th} capacity class and less than 3% for the 20 to 50MW_{th} capacity class. The percentage that the administrative costs make up of the total costs in the 20-50MW_{th} capacity class is low due to the (relatively) small number of plants in the capacity class compared to the other smaller capacity classes.

[19] Total mass emissions of NO_X may not necessarily decrease depending on the measure taken.

Figure 5.1 Option 2a costs across capacity classes

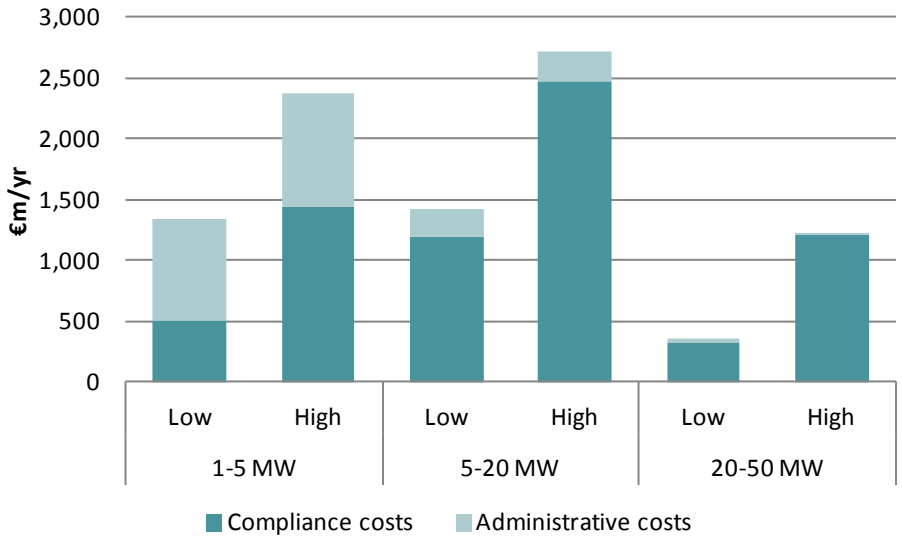


Figure 5.2 plots the monetised benefits for Option 2a across the three capacity classes. The significant difference between the high and the low figures reflects the significant range in the damage cost functions for all three pollutants (SO_2, NO_X and $PM_{2.5}$).

Figure 5.2 Option 2a benefits across capacity classes

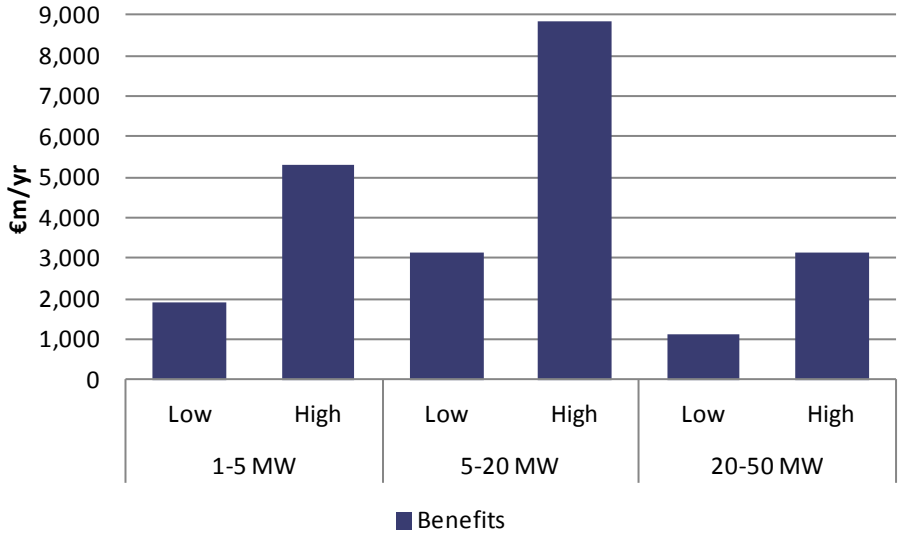
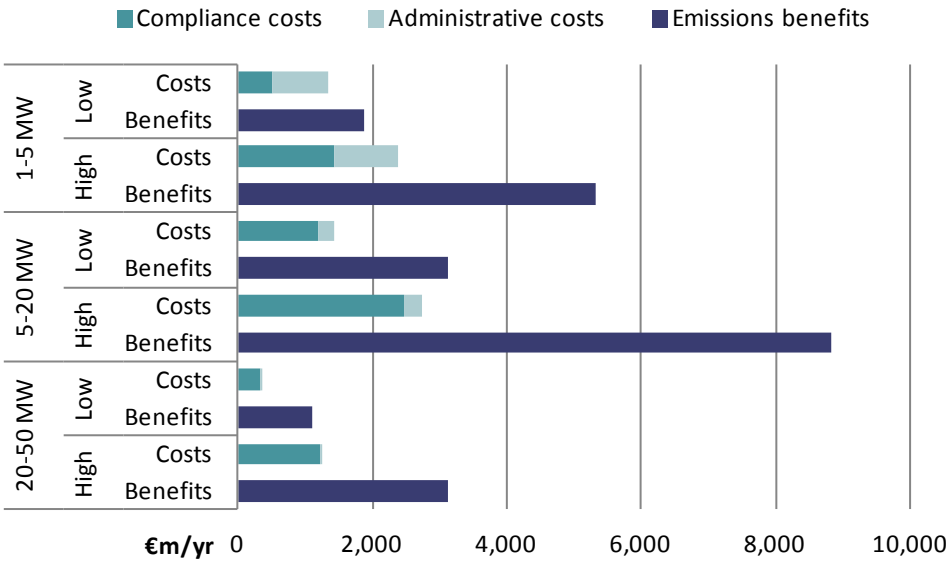


Figure 5.3 below compares the costs and benefits together (both plotted as positive values) across the capacity classes. The plot makes it more noticeable that the high value of costs exceeds the adjacently plotted low valuation of benefits for the 1-5MW_{th} and 20-50MW_{th} capacity classes. Only for the 5-20MW_{th} capacity class does the modelled low valuation of benefits exceed the high costs.

Figure 5.3 Option 2a costs and benefits across capacity classes



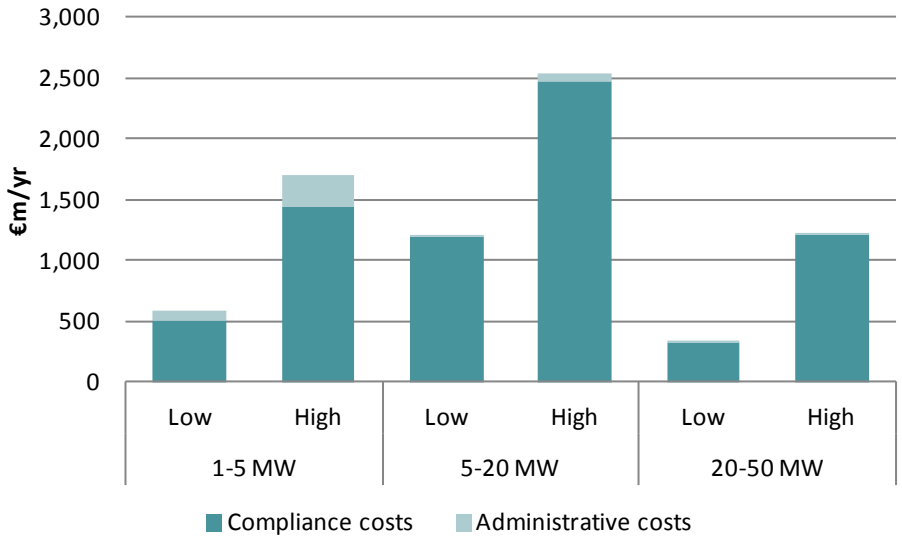
Option 2b

Option 2b is the application of alternative EU wide limit values to those applied in Option 2a. The limit values are those for existing 50-100MW_{th} plants under the IED. Table 5.2 compared the limit values applied to Option 2a and 2b; the principle differences are that the SO_2 limit values for liquid fuels are much lower under Option 2b whilst the NO_X limit values for liquid fuels are much lower for Option 2a. This principle difference is evident in the change in benefits: benefits from SO_2 emission reductions are greater for Option 2b than Option 2a but benefits from NO_X emission reductions are lower for Option 2b than Option 2a. Overall, the compliance costs under Option 2b are higher than under Option 2a.

Option 3

Option 3 is the control of emissions from the sub 50MW_{th} combustion plant sector without mandatory permitting. Therefore, whilst the compliance costs remain the same as for Option 2a (as the EU wide emission limit values are set at the same level), the administrative costs are reduced. Figure 5.4 plots the compliance and administrative costs across the three capacity classes for Option 3. By comparison of Figure 5.4 against the equivalent figure for option 2a (Figure 5.1) it is clear that by using this approach the total costs for the smallest capacity class reduce.

Figure 5.4 Option 3 costs across capacity classes



Alternative approach for smaller plants

This alternative approach for smaller plants can be considered in addition / or as an alternative to the other options considered in the study whereby product standards (essentially emission limits) could apply to new combustion plants in the lower capacity range (1-5 MW_{th}) rather than all existing plants of this size having to meet minimum ELVs. This could follow a similar framework to that already being applied under the Ecodesign Directive (see Section 3.2.1 for further details) whereby maximum emission levels are specified for different technologies and fuels. The aim of this option is to try and control emissions from these sized plants in the most cost effective manner. As the analysis presented above for the other options shows, a potentially high cost burden could be placed on these plants. In particular, under a potential permitting regime, administrative costs could make up around half of total costs for these plants.

Whilst it has not been feasible within the scope of this study to undertake a detailed assessment of the costs and benefits of this option the following points can be made:

- Product standard requirements would only apply to new units placed on the market. Therefore, the benefits of these standards would only be realised when an existing unit/plant is replaced or a new plant constructed. Estimates for the average lifetime of typical boilers in the 1-5MW_{th} capacity category range from around 20-30 years[20] giving an average annual turnover of around 3-5%. At an EU level, a total of around 108,000 plants (i.e. in some cases made up of more than one boiler) have been estimated in the 1-5MW_{th} capacity range which would equate to an average annual turnover of around 3,000 to 5,000 plants.

[20] AMEC expert estimate.

- The level at which any emission limits are set would of course influence the emission reductions that are realised. Further work would be required in order to identify the levels that would be appropriate for any standards. Under the current Ecodesign Directive, the process of design standard development includes collating preparatory studies with technical, environmental and economic analysis, reviews of product functionality, health and safety and competition assessments, followed by Impact assessment and interservice consultation, WTO notification, vote in Regulatory Committee, and further scrutiny/right of objection of the European Parliament and Council, before standards are finally adopted. A simpler framework could be established focussing solely on atmospheric emissions which should allow for a more streamlined approach. Information on current limits set by Member States and BAT definition (e.g. by Finland) provides a good starting point for considering achievable options for standards.

- Further investigations would be required to investigate the most appropriate plants to target in terms of capacity. Current discussions under the Ecodesign Directive are focussed on much smaller plants ($<1MW_{th}$) due to their heterogeneity in terms of design and high production volumes. Whilst there is possible scope for considering larger plants under a product standard approach, consideration would have to be given to the variation in terms of design and application (and associated emission levels) of larger plants to avoid overcomplicating matters i.e. requiring a wide range of standards to suit all designs.

- The costs of meeting a specific limit/standard should be significantly lower for new units in comparison to existing units as it allows for proper design and integration of any abatement technologies into the unit as opposed to having to retrofit technologies. In some cases, design/space constraints may even limit or prevent the retrofit of certain technologies to existing plant e.g. low NOx burners.

- The administrative burden of such an approach would be significantly lower as the burden would rest with a small number of manufacturers/suppliers rather than each individual plant. It should be feasible for manufacturers/suppliers to pass on the additional costs of meeting any standards to operators purchasing new units.

5.3.2 Sensitivity analysis

A number of sensitivity analyses were undertaking with a view to identifying key variables among the assumptions employed in the methodology. Table 5.11 summarises the results of the sensitivity analysis. The following variables were tested as sensitivities against the main results for Option 2a:

i. Assuming current emission levels of plants (for all three pollutants SO_2, NO_X and dust) are 20% below the applicable ELVs from the national legislation, rather than assuming as in the base case that plants operate with emissions at the level of the ELVs. The results suggest that costs drop by between 1% and 15%, whilst benefits reduce by around 20% (i.e. following the emission level reduction).

ii. An alternative approach for some Member States / capacity classes to estimating capacity of plants was implemented. This alternative approach had no impact on the costs, but reduced benefits by 4%.

iii. An alternative approach for some Member States / capacity classes to estimating fuel consumption of plants was implemented. This alternative approach does not impact on costs, but reduces benefits by 6%.

iv. Capital costs of abatement measures are currently assumed to be spread over 10 years. An alternative scenario of this cost being annualised over a period 50% longer (15 years) was undertaken. This as expected reduced costs: by 4% of the low costs and by 13% of the high costs.

v. A second demonstration of the sensitivity of results to changes in the annualisation of the capital costs was undertaken by the utilisation of a (private) discount rate of 8% rather than the (public) discount rate of 4%. This lead to an increase of between 5% and 12% on costs.

vi. Assuming 100% of plants firing liquid and gaseous fuels are engines (as opposed to 0% in option 2a). In combination with the results of option 2a, this attempts to provide an overall range rather than suggesting that all combustion plants 1MWth to 50MWth are engines. This sensitivity utilises cost data from VITO (2011) specific to engines as included in Table 5.10, and further assumes that the percentage emission reductions within each Member State modelled under option 2a remain.

Table 5.10 Abatement matrix for engine plants

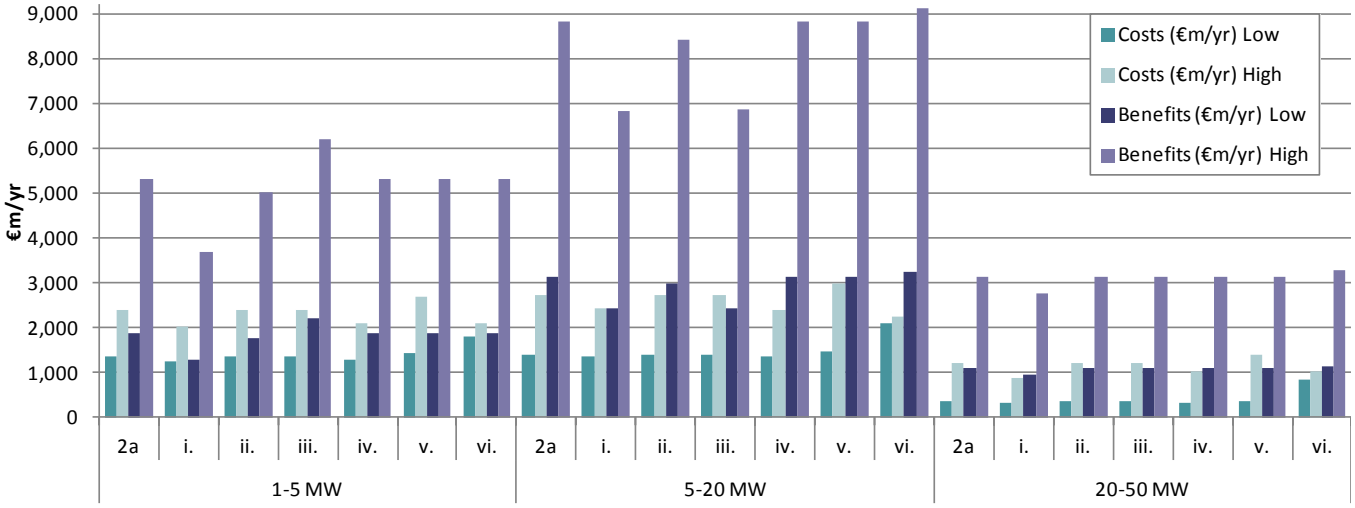
Fuel(s)	Pollutant	Measure	Capacity class	SO_2 abatement (%)	NO_X abatement (%)	Dust abatement (%)	Total annual cost (€/plant)
Liquid fuels and gaseous fuels other than natural gas	SO_2	Dry FGD	1-5MW_{th}	70%	0%	0%	€ 1,749
			5-20MW_{th}	75%	0%	0%	€ 8,912
			20-50MW_{th}	80%	0%	0%	€ 36,319
Liquid fuels	SO_2	Fuel switch to 0.1% gas oil	(all)	90%	0%	0%	€ 37,368
Liquid fuels	NO_X	SCR	1-5MW_{th}	0%	90%	0%	€ 17,001
			5-20MW_{th}	0%	95%	0%	€ 69,619
			20-50MW_{th}	0%	95%	0%	€ 278,480
Liquid fuels	Dust	Fabric filter	1-5MW_{th}	0%	0%	90%	€ 6,837
			5-20MW_{th}	0%	0%	90%	€ 26,457
			20-50MW_{th}	0%	0%	90%	€ 95,125
Natural gas and other gaseous fuels	NO_X	Advanced lean burn	1-5MW_{th}	0%	50%	0%	€ 1,292
			5-20MW_{th}	0%	50%	0%	€ 6,458
			20-50MW_{th}	0%	50%	0%	€ 25,384
Natural gas and other gaseous fuels	NO_X	SCR	1-5MW_{th}	0%	90%	0%	€ 10,472
			5-20MW_{th}	0%	90%	0%	€ 34,947
			20-50MW_{th}	0%	90%	0%	€ 139,790

Table 5.11 Summary of sensitivity analyses on option 2a

Sensitivity	Capacity class	Costs (€m/yr)		Benefits (€m/yr)	
		Low	High	Low	High
Option 2a	1-5 MW	1,345	2,379	1,886	5,319
	5-20 MW	1,414	2,722	3,124	8,820
	20-50 MW	349	1,232	1,100	3,121
i. Emission levels -20% below ELVs for all capacity classes	1-5 MW	1,247	2,024	1,302	3,672
	5-20 MW	1,365	2,434	2,421	6,834
	20-50 MW	325	886	967	2,748
ii. Capacity estimated from ratios of capacity classes	1-5 MW	1,345	2,379	1,773	5,003
	5-20 MW	1,414	2,722	2,976	8,403
	20-50 MW	349	1,232	1,100	3,121
iii. Fuel consumption estimated from ratios of capacity data rather than using average load factors	1-5 MW	1,345	2,379	2,200	6,205
	5-20 MW	1,414	2,722	2,435	6,874
	20-50 MW	349	1,232	1,100	3,121
iv. Abatement measures annualised over 15 rather than 10 years	1-5 MW	1,305	2,093	1,886	5,319
	5-20 MW	1,372	2,397	3,124	8,820
	20-50 MW	318	1,013	1,100	3,121
v. Costs discounted at 8% rather than annualised using 4%	1-5 MW	1,431	2,691	1,886	5,319
	5-20 MW	1,462	2,998	3,124	8,820
	20-50 MW	374	1,402	1,100	3,121
vi. Liquid and gas-fired plants are engines rather than boilers	1-5 MW	1,817	2,083	1,888	5,328
	5-20 MW	2,090	2,263	3,231	9,117
	20-50 MW	854	1,015	1,154	3,271

The data presented in Table 5.11 are plotted below in Figure 5.5.

Figure 5.5 Comparison of sensitivity analyses on option 2a



6. Conclusions

6.1 Overall conclusions

The study aimed to gather additional new data on combustion installations less than $50MW_{th}$ to help the Commission decide whether there is a need to control emissions from these installations at an EU level.

In this study we have gathered new data from Member States on numbers, capacity, fuel consumption and emissions of combustion plants between $1MW_{th}$ and $50MW_{th}$, and where necessary supplemented with existing data and further extrapolated from the new and existing data in order to compile a sufficiently complete dataset with which to assess possible control options. A number of assumptions were made in extrapolating data to be considered representative of the EU27; this process has lead to a number of uncertainties and limitations in the underlying dataset which must be considered when assessing the results of the assessment of control options. The limitations and uncertainties are described below in Section 6.2.

Of the data received (which may not be fully representative of the EU due to the limited data gathered) the sectors in which the $1\text{-}50MW_{th}$ combustion plants operate are disparate, with the largest share of plants (22%) being 'other sector', followed by greenhouses (21%), public heat and electricity generation (including district heating) (18%), hospitals and universities (16%), industrial (other than food) (13%) and food industry (excluding greenhouses) (9%). For the largest capacity plants, the share for the public heat and electricity generation sector increases, whilst at smaller capacities, the share for hospitals and universities increases.

The current national legislation in place in the Member States for regulating combustion plants 1 to $50MW_{th}$ has been reviewed. This review has highlighted that many Member States already regulate these plants to some extent, and that many of the various pieces of legislation adopt similar approaches, i.e. setting ELVs for different fuel and capacity combinations, with some adopting a permitting approach and others adopting a general binding rules (without mandatory permits) approach. The legislative review has provided a consideration of the likely emission levels of plants operating in Member States which has helped to identify where there may be high or low impacts as a result of implementing EU wide minimum ELVs. The analysis also takes into account reductions in administrative costs for those Member States that already have a permitting regime in place.

The options for control of emissions from these combustion installations have been set in the context of the IED, but it is recognised that Article 73(2)(a) of the IED does not restrict the scope of this review in terms of the instrument through which emissions from this activity may be controlled, i.e. options for control could include regulation through IED or other legislative instruments, as well as non-legislative instruments. The control options that have been assessed are: do nothing (option 1); inclusion of $1\text{-}50MW_{th}$ installations as a new activity in Annex I of the IED with EU wide ELVs for emissions to air (option 2a); a variation of option 2a with alternative ELVs (option 2b); inclusion of $1\text{-}50MW_{th}$ installations within the IED as a separate chapter but without a full permitting regime (option 3); and an assessment of the feasibility for developing product standards for new combustion plants in line with the EcoDesign Directive as an alternative approach for smaller ($1\text{-}5MW_{th}$) plants. This latter alternative approach has not been assessed quantitatively in the same manner as options 2 and 3.

From the options assessment, the following key points are made:

- For the 'full IED' option 2, estimated average annual benefits exceed estimated average annual costs for all capacity classes investigated, with highest cost-benefit ratios for the largest capacity class (20-50 MW_{th}). For the largest and smallest capacity classes, the high end estimate of costs slightly exceeds the low valuation of benefits;
- The modelled benefits from the reduction of emissions from the 5 to 20MW_{th} capacity class are nearly three times as high as the modelled benefits from controlling emissions from the 20-50MW_{th} capacity class;
- The level at which EU wide ELVs are set affects both the compliance costs and potential benefits in particular for the smallest capacity class, but does not markedly change the benefit-cost ratio. Further sensitivity analyses on a number of the assumptions made in the modelling showed that these assumptions did not change the outcome of the benefits exceeding costs but did lead to variations in the cost-benefit ratio;
- The administrative costs associated with a permitting regime form an increasingly large component of total costs for the smaller capacity classes (around half of total costs for the 1-5MW_{th} capacity class for option 2a);
- The assessment of option 3 in which permitting of the combustion installations is dropped in favour of implementing a non-permitting approach suggests that the large administrative cost element associated with permitting a large number of smaller installations could be significantly reduced (improving the cost-benefit ratio); and
- In response to anticipated concerns over controlling emissions from a very large number of small sources in the 1 to 5 MW_{th} capacity class, an alternative (or additional) approach for these smaller plants could be the potential development of product standards that could apply to new plants in this category.

6.2 Uncertainties and Limitations

Inevitably, the development of a dataset on combustion plants 1-50MW_{th} that is based only partially on data provided by Member States and has necessarily relied on extrapolation to cover missing Member States and other data points has a number of uncertainties and limitations associated with it. The principle points to note which should be considered when reviewing the results of the assessment of control options are:

- Greater uncertainty is associated with the data and results for smaller capacity classes due to their reliance on a greater proportion of extrapolation;
- Some Member States provided data that was marked as being rough or approximate and in some cases is questionable over the realism of the figures. Gross estimates for some of the larger Member States of the EU could have a disproportionate effect on the overall figures (which are presented at EU level), and may unfortunately mask figures that may be more robust for some of the EU's smaller Member States;

- In some cases a pragmatic approach was adopted in order to be able to produce estimates which would otherwise place unrealistic demands on data gathering. For example, although it is recognised that a number of other combustion techniques aside from boilers are used in combustion plants less than 50MW_{th}, for the purposes of the main analysis all plants were assumed to be based on boiler technologies. This assumption was made following indications from information returned from the Member States that the primary technique used is boilers (but uptake of other techniques was not negligible). This assumption has implications in:

  - Gathering of Member State ELVs: different ELVs are often set for different combustion techniques due both to their technical and emission characteristics as well as the different oxygen content of flue gases from each fuel/technique.

  - Estimating emissions: both as emission levels which have been based on ELVs, as well as annual mass emissions which have been split into those arising from each principle fuel type assumed using specific flue gas volumes, which, again vary depending on the combustion technique.

  Clearly, the simplification for modelling purposes that all plants 1-50 MW_{th} are boilers is inaccurate; as such a sensitivity analysis that assumes all liquid and gas fired plants are engines has been assessed.

- The estimated costs and benefits identified in section 5 are presented as indicative figures but which are known to not take all possible costs and benefits into account. For example, the assessment of Option 2 does not consider the additional costs to installations of meeting IED requirements wider than those associated with emissions to air (e.g. emissions to water, soil contamination). However, it is considered that the primary costs for the installations considered will be associated with the regulation of emissions to air.

- Applying the CAFE damage cost functions to estimate benefits is only intended to provide an indication of the likely benefits associated with each option. There are a number of uncertainties associated with the use of the functions e.g. they do not take into account the geographical location where these reductions are taking place (for example, reductions in emissions from a plant close to a highly populated area will result in greater health benefits than a plant located further away).

6.3 Further work

Considering the limitations of the data gathered, an improved analysis of control options would result from decreasing the proportion of the EU dataset that has been extrapolated; i.e. increase the amount of raw data on the combustion plants, in particular for the smallest capacity class for which the least amount of robust data was available. Primary data gaps to fill in this regard are numbers of plants, fuel types, total emissions, and typical emission levels.

Further work should also be undertaken to investigate the alternative product standard approach that could be applied for the smallest plants in more detail in terms of the emission standards that could be set, the plant sizes that could be covered and whether or not it should take place within the framework of the Ecodesign Directive and associated process.

Appendix A
Proforma

Category of data		Rated thermal input category		
		1-5MWth	5-20MWth	20-50MWth
Number of combustion plants in each sector	Public electricity generation			
	Public heat generation (including district heating)			
	Combined heat and power generation			
	Hospitals and universities			
	Greenhouses			
	Food industry (excluding greenhouses)			
	Industrial (please specify particular sectors)			
	Other (please specify)			
	TOTAL all sectors			
Capacity of combustion plants	MW_{th}			
Typical combustion techniques	e.g. boilers, turbines, furnaces, engines			
Total fuel consumption split by fuel type	Biomass (please specify type(s) and units)			
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)			
	Liquid (please specify type(s) and units)			
	Natural gas (please specify units)			
	Other gases (please specify type(s) and units)			
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust or PM_{10} (please specify)			
	SO_2			
	NOx			
	HCl			
	Heavy metals			
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage			
	How do you expect this % contribution to change by 2015, 2020, 2025?			
How many plants would already be covered by the IED as 'directly associated activities'?				
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?			
	What ELVs are applied?			
	What are the monitoring requirements?			
	What other requirements are made?			
Current/future abatement measures	Type, costs, effectiveness			

Appendix B
Summary of existing data on 20 to 50 MW_{th} combustion installations

Table B1 Summary of existing data available on the <50MW_{th} sector, which is primarily drawn from Entec (2009) which focussed on 20-50MW_{th} installations

Data to be gathered from EU-27	Data already available
Number of installations	Entec (2009) included information on 20-50MW_{th} MCIs from 13 Member States: ▪ BG:73 installations ▪ CZ: 136 installations (aggregation rules applied) ▪ FI: 204 boilers 20-50MW_{th} ▪ DE: 11 installations in hospitals, 15 in universities, 12 in other public institutions ▪ IT: 274 plants (unclear if installation, stack or unit level) ▪ HU: 86 installations ▪ NL: 200-400 installations ▪ PL: 360 boilers exhausting to 20-50MWth stacks ▪ RO: 71 installations ▪ SK: approximately 100 installations ▪ ES: 254 installations 20-50MW_{th} ▪ SE: approximately 140 installations (de minimis not applied) ▪ UK: 451 installations Ecofys (2006) had some information for (in addition to above Member States) PT, SI, IE
Capacity (including aggregation rules) of installations	Entec (2009) summarised some information on 20-50MWth MCIs from selected Member States: ▪ BG:2.3 GWth ▪ CZ: 3.99 GWth (taking into account aggregation rules) ▪ FI: 7 GWth ▪ IT: 9.3 GWth (takes into account de minimis rule) ▪ HU: 3.8GWth ▪ PL: 4.8Gwth ▪ UK Ecofys (2006) had some information for (in addition to above Member States) PT, SI, IE
Technology type (e.g. boiler, turbine, engine, furnace)	Very little information on this. Information available: ▪ SE: hospitals use diesel engines as backup <350h/year ▪ FI refers to boilers as comprising its installations
Sector in which installations operate	Entec (2009) summarised some information on 20-50MWth MCIs from selected Member States: ▪ BG: split into 14 sectors (most significant are greenhouses, gas transport and district heating) ▪ FI: according to IPCC source categories (three quarters public electricity/heat production; 10% pulp/paper)

Data to be gathered from EU-27	Data already available
	▪ IT:8 sectors (most significant are heat production, electricity production and food)NL: 60-100 greenhouse installations ▪ SE: almost all are district heating ▪ UK But this coverage is still sparse.
Fuel use	Entec (2009) summarised some information on 20-50MWth MCIs from selected Member States: ▪ BG: (by energy, GJ): 69% nat gas, 23% HFO, 7.5% biomass, <0.5% coal ▪ CZ (by capacity, MW_{th}): approximately 66% nat gas, 26% coal/lignite, 5% liquid, 2% biomass, 1% other gas ▪ FI: (by energy) : approximately one third biomass, one third natural gas, one quarter coal and HFO, 10% other ▪ HU: primarily natural gas, secondarily oil ▪ SE: mostly biomass CITL[21] reports country level data on CO_2 emissions from combustion installations. If CO_2 emissions from >50MW combustion installations (EPRTR) were subtracted from these, we'd presumably have <50MW combustion installation CO_2 emissions, from which we may be able to estimate fuel consumption.
Importance in the overall emissions of the key pollutants (dust, SO2, NOx, HCl, heavy metals) within the Member State and EU, as well as the projected evolution of their share	Entec (2009) gathered little on this: ▪ SE: only have typical emission concentrations in flue gases ▪ PL: emissions compared to LCPs LCP inventory cumulative SO_2 NO_X and dust emissions by MW_{th} category could provide context
Coverage under the current IPPC Directive (e.g. as directly associated activities);	Only available for CZ in Entec (2009): ▪ CZ: 32 of 136 plants already covered as DAAs
Permit regime, ELVs and monitoring requirements applicable for such installations under current Member State environmental legislation;	Entec (2009) gathered this for some Member States: ▪ Yes in detail for FI, DE, HU, SK, UK, FR, NL (NB: late 2008 proposed tightening of legislation may now be in force) ▪ Some limit value information in addition for BE, IT, LV, PO, PT, SI
Emission prevention and abatement techniques currently applied and applicable in the future, their costs and emission reduction potential;	Limited information provided on current and future abatement measures. Some data provided on measures for greenhouses and small scale CHP. Specifically: ▪ FI interpretation of BAT for MCIs. ▪ NL – general techniques used ▪ UK: IA covered total compliance costs and monetised benefits
Particular socio-economic situation and context in which the particular sectors operate.	Some information provided for hospitals, greenhouses and district heating.

[21] http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=473

Appendix C
Member State profiles

Austria

New data has been received from the authorities.

New quantitative data

The competent authority has not provided a completed proforma document, but has instead provided information on the number of **steam** boilers at a plant level; no information was provided on the number of furnaces, engines, or gas turbines. This information is taken from a database on emissions from steam boilers which meet any one of the following criteria:

- Any steam boiler >10MW;
- Any solid-fuelled (all types of solid fuel) steam boiler >2MW.

- Therefore gas and liquid-fuelled boilers <10MW and any boilers <1MW are not accounted for in the figures. It should be noted that the reporting unit varies between installations, but is generally defined by the number of stacks. Information on emissions from these plants and the split by fuel and sector were not provided. The data provided can be summarised as:

Capacity class	Summary of data provided	Additional Comments
20-50MW_{th}	Number of installations: 116 Rated thermal input: 3,711 (MW_{th})	The estimate of the total number of plants in this size category is expected to reflect the true number.
5-20MW_{th}	Number of installations: 190 Rated thermal input: 2,213 (MW_{th})	The estimate of the total number of plants in this size category is expected to be an underestimate of the true number due to the reporting criteria (see above). The true number of plants is expected to be 2 or 3 times this figure.

Current regulatory regime for combustion installations <50MW_{th}

Small combustion plants <50MW_{th} are regulated through two pieces of legislation[22], referred to as 'general binding rules' which came into force in 2011. The legislation introduces limit values which apply to new plants immediately, but existing furnaces have until 2013 to apply. The pollutants regulated vary according to plant and fuel type and the ELVs are differentiated by size.

[22] BGBI.II Nr. 312/2011 concerning furnaces which are not steam boilers and BGBI Nr.19/1989 idf. BGBL. II Nr. 153/2011 concerning steam boilers and gas turbines <50 MW.

Measures and techniques for suggested for reduction of emissions from combustion installations <50MW$_{th}$

None received from competent authority.

Socio-economic situations or contexts

None received from competent authority.

Belgium

The competent authorities have provided a completed proforma document pertaining to the Flemish area of Belgium and two spreadsheets detailing the situation in the Brussels and Walloon regions; this information is summarised below.

New quantitative data

The competent authority has provided estimates of the number and capacity of SCPs present within Belgium, which is summarised in the table below:

Data	Region	Reporting level	1-5MW$_{th}$	5-20MW$_{th}$	20-50MW$_{th}$
Number of plants	Brussels	Boilers	581	50	0
	Flanders	Unknown	2,180	700	113
	Wallonia	Installations	119	140	31
	Total		**2,880**	**890**	**144**
Total capacity of plants (MW$_{th}$)	Brussels		1156	433	0
	Flanders		5080	6630	3688
	Wallonia		319	1478	956
	Total		**6,555**	**8,541**	**4,644**

Note: When summarising the data it was assumed that all CHP plants within the Brussels region (9 plants) had a rated thermal input of 20-50MWth. Information on the fuel consumption of the SCPs was not provided for the Flemish or Walloon regions. Information on the emissions from SCPs was not provided for the Flemish or Brussels regions.

Data on the emissions from SCPs <50MW$_{th}$ in the Walloon region in 2009 were provided: PM_{10} (393 t), Dust (487 t) SO_x (1,726 t), NO_x (5,176 t).

Current regulatory regime for combustion installations <50MW$_{th}$

Flanders

Legislative requirements for stationary engines are described in chapter 31 of VLAREM II (Order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety). Legislative requirements for combustion installations are described in chapter 43 of VLAREM II[23].

Brussels

Legislative requirements for stationary engines are described in, 'Ordonnance relative au permis d'environnement (1997)'[24].

[23] http://navigator.emis.vito.be (English language translations of the relevant sections are not available).

Walloonia

A reference to the relevant legislation was not provided by the competent authority, but a summary table of the relevant ELVs was included.

Measures and techniques for suggested for reduction of emissions from combustion installations <50MW$_{th}$

Flemish BAT-studies (Combustion installations and stationary engines (2002) and New, small and medium combustion installations, stationary engines and gas turbines on fossil fuels (2011))[25], describe BAT for SCPs. No information was received concerning the Brussels and Flemish regions.

Socio-economic situations or contexts

None received from competent authority.

Bulgaria

No information has been received from the competent authority to date.

[24] http://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=fr&la=F&cn=1997060533&table_name=loi (English language translations of the relevant sections are not available).

[25] www.emis.vito.be/vlaamse-bbt-studies (English language translations of the relevant sections are not available).

Cyprus

The competent authority has provided a completed proforma document; the information relates to the year 2009. The proforma is included below without amendment.

Category of data		**Rated thermal input category**		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation			3 Internal Combustion Engines 38MWth each installed to cover peak demand
	Public heat generation (including district heating)	--	--	--
	Combined heat and power generation	--	--	--
	Hospitals and universities	**2** (1-2.5MWth)	**11**	--
	Greenhouses			
	Food industry (excluding greenhouses)	**29** (2.5–5MWth) + **53** (1-2.5MWth) = **82**	**15**	--
	Industrial (please specify particular sectors) (Pharmaceutical Ind., Rendering Plants, Laundries, Carton industries, Production of Paints & Varnishes, Cement Plants etc)	**26** (2.5 – 5 MWth) + **62** (1 – 2.5MWth) = **88**	**10**	--
	Other (please specify)			
	TOTAL all sectors	**170**	**36**	**3**
Total capacity of combustion plants	MW_{th}	**195MW_{th}** (2.5 – 5 MWth) +**175MW_{th}** Plants (1 – 2.5MWth) = **Total 370MW_{th}**	**Total 260MW_{th}**	**Total 114MW_{th}**
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	Boilers	Boilers	Internal Combustion Engines
Total fuel consumption split by fuel type	Biomass (please specify type(s) and units)	2580tn		NA
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)	--		NA
	Liquid (please specify type(s) and units)	Gasoil: 11830tn Fuel Oil: 23330tn		Fuel Oil: 30100tn
	Natural gas (please specify units)	NA		NA
	Other gases (please specify type(s) and units)	Liquefied Petroleum Gas (LPG): 5160tn		NA
Emissions of key pollutants – annual	Dust or PM_{10} (please specify)	65tn (Total Suspended Particulates) (reference CLRTAP 2009 data)		44tn

quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	SO_2	972tn (reference CLRTAP 2009 data)	494tn
	NOx	212tn (reference CLRTAP 2009 data)	1959tn
	HCl	No available data	
	Heavy metals	Pb Emissions (tn) 0.034 Cd Emissions (tn) 0.001 Hg Emissions (tn) 0.00024 As Emissions (tn) 0.002 Cr Emissions (tn) 0.026 Cu Emissions (tn) 0.015 Ni Emissions (tn) 0.528 Se Emissions (tn) 0.000028 Zn Emissions (tn) 0.023 (reference CLRTAP 2009 data)	0,006 0,001 0,00037 0,005 0,003 0,007 0,313 0,003 0,108
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage	Total Suspended Particulates 1.14% SO_2 5.4% NOx 1.1% Pb 1.26% Cd 1.2% Hg 0.16% As 0.95% Cr 6.19% Cu 0.4% Ni 4.2% Se 0.02% Zn 0.4%	Total Suspended Particulates 0.77% SO_2 2.8% NOx 10% Pb 0.22% Cd 1.25% Hg 0.24% As 2.4% Cr 0.71 % Cu 0.18 % Ni 2.5% Se 2.3% Zn 1.86%
	How do you expect this % contribution to change by 2015, 2020, 2025?	Not estimated	The 3 Internal Combustion Engines will not be in operation in 2015.
How many plants would already be covered by the IE Directive as 'directly associated activities'?		**39**	**7** / **3**
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?	According to the Legislation in Cyprus and specifically «The Control of Atmospheric Pollution (Non Licensable Installations) Regulation of 2004 (P.I. 170/2004)» and «The Control of Atmospheric Pollution (Non Licensable Installations) (Amendment) Regulations of 2008 (P.I. 198/2008)» (web link http://www.mlsi.gov.cy/dli) no Air Emission Permit is Required for combustion installations with a total rated thermal input below 50MW. Operators of these combustion installations are obliged to	
		comply with certain emission limit values and associated operating conditions set in the relevant legislation mentioned above. The 3 Internal Combustion Engines (ICE Engines) 38MWth each are installed within an IPPC installation. Therefore a permit was granted for these 3 ICE Engines.	

	What ELVs are applied?	***For combustion installations with a total rated thermal input between 5-50MWth the following ELVs are applied:*** For the use of liquid fuels • Bacharach smoke scale 3 (at the same time the CO_2 content in air emissions should be greater than 10% v/v and the O_2 content less than 7,5% v/v) • Total Dust 100mg/Nm^3 (O_2 reference value 3%) • CO 100mg/Nm^3 (O_2 reference value 3%) For the use of coal or wood or olive seeds • Total Dust 100mg/Nm^3 (O_2 reference value 7% for coal and 11% for wood or olive seeds) • CO 200mg/Nm^3 (O_2 reference value 7% or coal and 11% for wood or olive seeds) ***For combustion installations with a total rated thermal input less than 5MWth the following ELVs are applied:*** For the use of liquid fuels • Bacharach smoke scale 3 (at the same time the CO_2 content in air emissions should be greater than 10% v/v and the O_2 content less than 7,5% v/v) For the use of coal or wood or paper or olive seeds • Total Dust 150mg/Nm^3 (O_2 reference value 7% for coal, 11% for wood or olive seeds and 12% for paper) • CO 200mg/Nm^3 (O_2 reference value 7% or coal and 11% for wood or olive seeds) For the 3 ICE Engines an Air Emission Permit was granted since these engines are installed within an IPPC installation. These ICE Engines were permitted to operate for a limited time every year in order to cover peak demand. The operation of these 3 ICE Engines is expected to be terminated in 2015. The ELVs included in the Air Emission Permit are the following (O_2 reference value 15%): Dust: 50mg/Nm^3 NOx: 1800 mg/Nm^3 SO_2: 565mg/Nm^3 CO: 120 mg/Nm^3	
	What are the monitoring requirements?	a) For the 3 Internal Combustion Engines operator is obliged to perform continuous emission monitoring for NOx and SO_2 and spot measurement for dust every 3 months. b) For combustion installations < 5MWth, operators are obliged to monitor at least once/year after maintenance c) For combustion installations >5MWth, monitoring is carried out by the Competent Authority in Cyprus.	
	What other requirements are made?		
Abatement measures – current and future	Type, costs, effectiveness		

Czech Republic

The competent authority has provided a completed proforma document which is included below without amendment.

Category of data		**Rated thermal input category** [26]		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation / Public heat generation (including district heating) / Combined heat and power generation	708	213	65
	Hospitals and universities (and administrative institutions and office buildings)	1263	159	32
	Greenhouses	0	0	0
	Food industry (excluding greenhouses)	369	98	22
	Mineral oil refineries	1	0	1
	Coal processing	3	2	0
	Production and processing of iron and steel	33	7	2
	Production and processing of non-ferrous metals	11	3	2
	Chemical industry	30	21	6
	Pulp, paper and printing	43	9	5
	Agriculture, silviculture and aquaculture	445	10	1
	Other industry	1162	226	39
	TOTAL all sectors	**4068**	**748**	**175**
Total capacity of combustion plants	MW_{th}	**8492**	**7166**	**5247**
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	Mostly gas furnaces (80%)	Mostly gas furnaces (80%)	Mostly gas furnaces (60%) and coal boilers (20%)
Total fuel consumption split by fuel type	Biomass (TJ)	1 783	1 784	2 945
	Other solid fuels, mostly brown coal (TJ)	1 777	1 146	6 012
	Liquid, mostly heating oil (TJ)	676	439	2 035
	Gas, mostly natural gas (TJ)	74 552	213 958	18 710
Emissions of key pollutants – annual quantities emitted to air	Dust (t.p.a.)	321.08	307.54	223.37
	SO2 (t.p.a.)	1806.8	1248.28	4080.44

[26] Based on processed raw data from national database Register of Emissions and Air Pollution Sources (REZZO – REAPS)

(tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	NOx (t.p.a.)	1941.45	1958.28	2235.54
	HCl (kt.p.a.)			
	Heavy metals			
Emissions of key pollutants – contribution to total national emissions	Dust (%)	0,5	0,49	0,36
	SO2 (%)	1,04	0,72	2,35
	NOx (%)	0,77	0,78	0,89
	How do you expect this % contribution to change by 2015, 2020, 2025?	Predictions focused on these particulars combustion plants are not available.		
How many plants would already be covered by the IE Directive as 'directly associated activities'?		20 – 30% (estimate)		
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?	General requirements in the Act. No. 86/2002 Coll., on air protection. Links: http://www.mzp.cz/www/platnalegislativa.nsf/d79c09c54250df0dc1256e8900296e32/ed2986242760af40c125754b003bb44a?OpenDocument In English available here: http://www.mzp.cz/ris/vis-legcz-en.nsf/		
	What ELVs are applied?	ELVs and other requirements are included at Government Ordinance No. 146/2007 Coll. In wording No. 476/2009 Coll. http://www.mzp.cz/www/platnalegislativa.nsf/d79c09c54250df0dc1256e8900296e32/362eb9e24eac4fe5c1257313003fcf03?OpenDocument In English available here: http://www.mzp.cz/ris/vis-legcz-en.nsf/		
	What are the monitoring requirements?	Monitoring requirements are included at Decree No. 205/2009 Coll. In wording No. 17/2010 Coll. http://www.mzp.cz/www/platnalegislativa.nsf/d79c09c54250df0dc1256e8900296e32/f91856a80bc1a55bc12576270027caf2?OpenDocument In English available here: http://www.mzp.cz/ris/vis-legcz-en.nsf/		
	What other requirements are made?	Pollutant emission (NOx, CO, SO2, dust are due to charge (see The Act on air protection)		
Abatement measures – current and future	Type, costs, effectiveness	Reduction of Dust – End-of-pipe-techniques are not applied (mostly natural gas as fuel). Reduction of SO2 – End-of-pipe-techniques are not applied (in case of new requirement existing older boiler using solid fuels would be change to gas boilers). Reduction ox NOx – End-of-pipe-techniques are not applied. General requirements on boilers and also fuel quality (Decree No. 13/2009 Coll.) Links http://www.mzp.cz/www/platnalegislativa.nsf/d79c09c54250df0dc1256e8900296e32/2a03bd8dfcc00b90c12576420036c832?OpenDocument		

As part of the consultation on the final report, the Czech authorities have provided details of new legislation that has been introduced for small combustion plants. The information provided is presented below:

"There is a new air protection act No. 201/2012 Coll. (in force from 01/09/2012), which replaces older legislation. According to new air protection act (§ 11) the regional authority is permitting stationary sources of air emission over 0,3 MW. Studies of dispersion, expert evaluation, rules for operation and compensation measures are required for this sources (all as a part of operation permit).

Expert evaluations are not applied on

- *sources under codes 1.1 – 1.4 of the annex 2 of the air protection act, which uses natural gas as the only fuel and is below 5 MW.*

- *cases of permit changes without changes of output, capacity and emissions (but they are applicable if emission limit is replaced by technical condition replacing emission limit).*

Studies of dispersion are not required

- *for sources under codes 1.1 – 1.4 of the annex 2 of the air protection act if natural gas is used in sources bellow 5 MW.*

- *for sources under codes 3.1 of the annex 2 of the air protection act if natural gas is used in sources bellow 1 MW.*

- *in cases of permit changes without impact on pollution (decision on impact of changes is on permitting authority – if there are any doubts on this issue).*

Compensation measures are not applied

- *if natural gas is used in sources 0,3 – 5 MW.*

- *if the type of source has not specific emission limit for particular pollutant in legislation*

- *if the contribution of the source to the level of pollution is bellow the value in legislation"*

Denmark

No information has been received from the competent authority to date.

Estonia

The competent authority has provided a completed proforma document which is included below without amendment.

Category of data		Rated thermal input category		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation	4	2	
	Public heat generation (including district heating)	172	55	14
	Combined heat and power generation			
	Hospitals and universities	5	2	
	Greenhouses			-
	Food industry (excluding greenhouses)	34	19	1
	Industrial (Textiles-, wood-, chemicals- , metal products-, furniture-, etc industry)	127	34	6
	Other (oil terminals, asphalt concrete plants, farms, heating in service sector etc)	195	62	8
	TOTAL all sectors	537	174	29
Total capacity of combustion plants	MW_{th}	1 202,6	1 793,7	1 024,5
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	boilers	boilers	boilers
Total fuel consumption split by fuel type **(liquid and solid fuels are in tonnes; gaseous fuels are in thousand cubic meter)**	Biomass (firewood, wood waste)	173391.9	205 847	232 227.2
	Other solid fuels (coal, peat, oil shale etc)	14486.3	12 445.8	43 173.9
	Liquid (light heating oil, shale oil, waste oil, diesel fuel)	28376.4	33 471.2	15 196
	Natural gas	70193.3	132 500	62 783.2
	Other gases (pyrolysis process gases, biogas)	7432.2	4 474.5	1 96341
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (OSIS- air emissions data system for the point sources)	TSP (tonnes)	1141.5	1014.6	1386.6
	SO_2 (tonnes)	4431.2	648	3990.7
	NOx (tonnes)	552.5	754.6	529.4
	HCl (tonnes)	0.86	0.038	-
	Heavy metals:			
	Pb (kg)	206.4	252.8	345.3
	Hg(kg)	1.4	1.9	2.8
	Ni (kg)	71.1	32.4	96.7
	As (kg)	30.3	29.6	39.7
	Cd (kg)	5.2	4.8	6
	Cr (kg)	40.7	90.1	47.2
	Cu (kg)	22.3	19.2	27.7
	Zn (kg)	403.1	441.8	363.1
Emissions of key pollutants – contribution to total	Expressed as a percentage			
	TSP (%)	4.1	3.6	4.9

national emissions	SO2 (%)	8.1	1.2	7.3
	NOx (%)	1.9	2.6	1.8
	HCl	-	-	-
	Heavy metals:	-	-	-
	Pb	0.7	0.9	1.2
	Hg(%)	0.0	0.0	0.0
	Ni (%)	1.4	0.7	2.0
	As (%)	0.4	0.4	0.5
	Cd (%)	1.1	1.0	1.3
	Cr (%)	0.6	1.2	0.7
	Cu (%)	0.4	0.4	0.5
	Zn (%)	1.0	1.1	0.9
	How do you expect this % contribution to change by 2015, 2020, 2025? Preliminary prognosis for **NECD 100% - 2005** level. Prognosis done as % from total emissions is not best measure. Prognose in actual data (m3, kg, t etc) are much better.	2015 – 2009 level 2020 - % will rise, because total emissions should be reduced 2025 -% will rise, because total emissions should be reduced	2015 – 2009 level 2020 -% will rise, because total emissions should be reduced 2025 - % will rise, because total emissions should be reduced	2015 + all substances (new pyrolysis plant launched 2011) **2020 - 29% SO2; +4,8% NOx, PM2,5 - 26%** 2025 – 2020 level
How many plants would already be covered by the IE Directive as 'directly associated activities'?		NA, but if small CP operates inside IED annex 1 cathegories (except 1.1) it is included into integrated permit	NA, but if small CP operates inside IED annex 1 cathegories (except 1.1) it is included into integrated permit	NA,but if small CP operates inside IED annex 1 cathegories (except 1.1) it is included into integrated permit
Legislative requirements. Please provide copies of the legislation or weblinks. https://www.riigiteataja.ee/akt/105072011026	What is the permitting regime?	Ambient air pollution permit without time limit, but regular overview required	Ambient air pollution permit without time limit, but regular overview required	Ambient air pollution permit without time limit, but regular overview required
	What ELVs are applied?	Set into individual permit	Set into individual permit	Set into individual permit
	What are the monitoring requirements?	Regular measurements (substances, freaquency etc) set into individual	Regular measurements (substances, freaquency etc) set into individual	Regular measurements (substances, freaquency etc) set into individual permit.

		permit.	permit.	
	What other requirements are made?	Commonly no need	Commonly no need	Commonly no need
Abatement measures – current and future	Type, costs, effectiveness	Set into individual permit application and in the permit. Depending of fuel type. Mainly dedusting precipitators (cyclons) Cost - NA	Set into individual permit application and in the permit. Depending of fuel type. Mainly dedusting precipitators (cyclons) Cost - NA	Set into individual permit application and in the permit. Chem pyrolysis of oil shales also scubbers (for SO2) Cost - NA

Finland

The competent authority has provided a completed proforma document which is included below without amendment. Data is taken from the Finnish national emission register VAHTI for the year 2010 which records fuel consumption and emissions at the boiler level. The underpinning boiler-level dataset has also been provided which also includes (x,y,z) coordinates for each emission source, which allows an estimation of the number of combustion **plants**. It should be noted that data concerning larger units (20 - 50 MW) is more accurate than data concerning smaller units.

Category of data		**1-5MWth**	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation + Public heat generation (including district heating) + Combined heat and power generation	127	157	158
	Hospitals and universities	data not available		
	Greenhouses + Food industry (incl. fodder production)	10	5	1
	Industrial:			
	Mining industry	3		1
	Chemical industry	13	11	2
	Metal industry	5	3	5
	Pulp and paper manufacturing	3	7	9
	Mechanical forest industry	11	9	1
	Construction industry	4	2	
	Other industry	13	7	3
	Other (waste incineration, wastewater treatment plants, fuel storage)	7	4	1
	TOTAL all sectors	196	205	181
Total capacity of combustion plants	MWth	550	2,100	6,430
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	boilers	boilers	boilers
Total fuel consumption split by fuel type	Biomass (typically wood-based) (GJ)	3,787,000	4,403,000	9,018,000
	Other solid fuels (typically peat, some coal in larger units) (GJ)	1,225,000	1,493,000	8,044,000
	Liquid (typically heavy oil,	1,242,000	5,489,000	10,173,000

	some light oil) (GJ)			
	Natural gas (GJ)	2,140,000	4,024,000	8,932,000
	Other gases (biogas, waste gas, liquid gas) (GJ)	457,000	550,000	1,107,000
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust	220	320	320
	SO2	560	1800	3680
	NOx	1680	1940	4420
	HCl	data not available		
	Heavy metals	detailed data not available		
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage			
	How do you expect this % contribution to change by 2015, 2020, 2025?			
How many plants would already be covered by the IE Directive as 'directly associated activities'?		0	2	140
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?	Please refer to links to legislation[27]		
	What ELVs are applied?			
	What are the monitoring requirements?			
	What other requirements are made?			
Abatement measures – current and future	Type, costs, effectiveness	Implementation of the IED		

[27] Environmental Protection Act (English translation): http://www.finlex.fi/en/laki/kaannokset/2000/en20000086.pdf

Government Decree on environmental protection requirements for energy production installations with a total fuel capacity below 50 MW (in Finnish): http://www.finlex.fi/fi/laki/alkup/2010/20100445

Appendix 1 (in Finnish) Liite 1: http://www.finlex.fi/data/sdliite/liite/5794.pdf

France

The competent authority has provided a completed proforma document which is included below without amendment. The data has been estimated from the national emission inventory using a specific methodology to distinguish emissions from SCPs in the rated thermal input categories. It should be noted that no data is available for plants <2MW_{th}.

Category of data		**Rated thermal input category**		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation Public heat generation (including district heating) Combined heat and power generation Hospitals and universities Greenhouses Food industry (excluding greenhouses) Industrial (please specify particular sectors) Other (please specify)	No data available for each sector Estimated 20 000 combustion plants for all sectors from 2MWth to 20 MWth Roughly 1500 combustion plants from 20MWth and 50MWth		
	TOTAL all sectors			
Total capacity of combustion plants	MW_{th}	No data available but if we apply the maximum thermal input of the range, we have roughly 20 000 x 20MWth = 400 000 MWth and 1500 x 50MWth = 75 000 MWth the maximum capacity can be estimated to 475 000MWth		
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	No data available.		
Total fuel consumption split by fuel type	Biomass (please specify type(s) and units) Other solid fuels (coal, lignite, etc.: please specify type(s) and units) Liquid (please specify type(s) and units) Natural gas (please specify units) Other gases (please specify type(s) and units)	Only data of the distribution between fuel are available (this data includes domestic plants) : biomass : 15% charbon : 2% liquified gas :4% natural gas :56% heavy fuel oil : 1% domestic heating fuel oil : 20%		
Emissions of key pollutants – annual	Dust or PM_{10} (please specify) SO_2	2-20MWth : 3739 t (dust) (3% to the total national emission) 2-20MWth : 18480 t (36% to the total national		2479 t (dust) (0,2% to the total national emission)

quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	NOx	emission) 2-20MWth : 36242 t (3% to the total national emission)	8034 t (2% to the total national emission) 10284 t (0,9% to the total national emission)
	HCl	No data available	
	Heavy metals	No data available	
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage	-	
	How do you expect this % contribution to change by 2015, 2020, 2025?	-	
How many plants would already be covered by the IE Directive as 'directly associated activities'?		We estimate that 15% of the combustion plants between 2 and 20MWth are in a IPPC site. No data can be given for the range of 20 to 50MWth (we only estimate than 46% of the combustion plants above 20MWth are in a IPPC site).	
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?	Below 2MWth : no permitting regime From 2 to 20MWth : declaration regime (for more information about this system, see : http://www.installationsclassees.developpementdurable.gouv.fr/-Declaration-system-.html) Above 20MWth : permit system with authorization (see http://www.installationsclassees.developpement-durable.gouv.fr/-Permitsystem-.html), except for combustion plants using non conventional fuels (ie other than natural gas, domestic fuel oil, heavy fuel oil, liquified gas, peat or biomass) for which the authorization system begins at 0,1 MWth Note that for combustion plants using specific biogas, there is a specific regimes from 0,1MWth (Declaration, registration, Authorization) – ELV in progress	
	What ELVs are applied?	**Below 2MWth :** no ELV but reference values given during the emission measurment (from 400 kW to 2MW) or the emission evaluation (from 4 kW to 400kW) : from 400kW to 2MW : http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000021217870&fastPos=4&fastReqId=35865877&categorieLien=cid&oldAction=rechTexte from 4 kW to 400 kW : http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000021217854&fastPos=3&fastReqId=1770373592&categorieLien=cid&oldAction=rechTexte **From 2 to 20MWth, ELV are given in the following text :** http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000202304&fastPos=1&fastReqId=365744241&categorieLien=cid&oldAction=rechTexte **Above 20MWth, ELV are given in differents texts, depending on the date of the first permit and of the type of combustion technique :** **boiler, before 2002 :** http://www.legifrance.gouv.fr/affichTexte.do;jsessionid=B94586878FD81FCD5676DD728CF0426D.tpdjo10v_2?cidTexte=JORFTEXT000000248169&dateTexte=20111125 **boiler, after 2002 :** http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000779198&fastPos=2&fastReqId=1937199808&categorieLien=cid&oldAction=rechTexte **boiler, after 2010 :** http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000022818485&fastPos=10&fastReqId=1398058617&categorieLien=cid&oldAction=rechTexte **turbines and engines :** http://www.ineris.fr/aida/?q=consult_doc/navigation/2.250.190.28.8.2179/4/2.250.190.28.6.13	
	What are the monitoring requirements?	Cf weblinks below :the monitoring requirements mainly depends on the type of fuel and of the total rated thermal input	

	What other requirements are made?	Cf weblinks below : national legislation set provisions regarding air emission, water emission, risk, waste,...
Abatement measures – current and future	Type, costs, effectiveness	-

Germany

New data has been received from the authorities.

New quantitative data

The competent authority has provided a completed proforma document. This has been filled out using three data sources: fuel consumption and emissions data from the national emission inventory for 1-50MW_{th} plants; numbers of combustion plants and their fuel consumption for 20-50 MW_{th} plants derived from ETS data; numbers of solid biomass plants in public electricity and/or heat production each in 1-5MW_{th} and 5-20MW_{th} capacity classes, derived from statistical data on renewable energy plant data; and approximate aggregate number, capacity and fuel consumption of biogas plants. The authorities have noted that the data provided exclude estimates of numbers of plants in the sub 20MW_{th} classes firing fuels other than solid biomass. The data provided can be summarised as:

Capacity class	Summary of data provided
1-50MW_{th}	Total fuel consumption of 755,000 TJ, split into five categories: natural gas (56%), biomass (23%), liquid fuels (11%), other solid fuels (7%) and other gases (3%). Emissions of SO_2: 30kt; NO_X: 63kt; PM_{10}: 3.8kt; mercury: 130kg
20-50MW_{th}	658 installations, split into sectors as: public heat generation (38%), industrial (29%), public electricity generation (19%), food industry excluding greenhouses (7%), other (4%), hospitals/universities (3%), CHP (2%). Total capacity of 22.5 GWth Total fuel consumption of 151,000 TJ, split into five categories: natural gas (77%), other solid fuels (9%), biomass (7%), liquid fuels (4%), and other gases (3%).
5-20MW_{th}	118 solid biomass fired plants, 55% of which are for public electricity generation, and the rest for public heat generation.
1-5MW_{th}	400 solid biomass fired plants, 90% of which are for public heat generation, and the rest for public electricity generation
0-5MW_{th}	6,000 biogas engine plants (mostly less than 1MW_e or 3MW_{th}) of aggregate capacity more than 2.3 GW_e (~ 6.6GW_{th} if assume 35% efficient), and which consumes around 130,000 TJ/yr.

Current regulatory regime for combustion installations <50MW_{th}

Revised legislation[28] covering small combustion plants firing solid fuels including biomass came into force in 2010. The legislation introduces limit values (including for existing plants) and makes the use of best available technology mandatory. The TA Luft[29] also sets out monitoring requirements.

[28] Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über kleine und mittlere Feuerungsanlagen - 1. BImSchV) , which came into force on 22 March 2011

[29] First General Administrative Regulation Pertaining the Federal Immission Control Act (Technical Instructions on Air Quality Control – TA Luft) (24 July 2002)

Measures and techniques for suggested for reduction of emissions from combustion installations <50MW$_{th}$

For the smallest plants (1-5MW$_{th}$) the use of fabric filters is suggested for dust abatement. For 5-20MW$_{th}$ plants, the abatement options suggested for smaller plants are also valid, as well as dry sorbent injection for SO_2 emissions and low NO_X burners for NO_X emissions. For 20-50MW$_{th}$ plants, in addition to the abatement options suggested for smaller plants, electrostatic precipitators (ESPs) are also suggested for dust abatement, as well as spray dryers for SO_2 abatement and Selective Non-Catalytic Reduction (SNCR) for NO_X abatement.

Socio-economic situations or contexts

None received from competent authority.

Hungary

No information has been received from the competent authority to date.

Ireland

The competent authority responded on the current regulation of SCPs:

'Such plant may be regulated as an associated activity if on an IPPC/IED installation, or is associated with an activity licensable under the Air Pollution Act 1987, or may otherwise be regulated under planning legislation. Under IPPC ELVs and monitoring requirements will be set in accordance with BAT and to prevent breaches of EQS. For other regimes, it is not possible to specify how ELVs or monitoring requirements might be set.'

No other data or comments have been provided.

Italy

The only information received from the competent authority relates to current legislation relevant for these plants. Since permits for such installation are issued at Regional and Provincial level, according to art. 269 of Decree n. 152 of the 3rd of April 2006 (http://www.camera.it/parlam/leggi/deleghe/06152dl.htm), as amended by the Decree n. 128 of the 29th of June 2010 (http://www.camera.it/parlam/leggi/deleghe/testi/10128dl.htm), data are not collected at central level (ELVs to be applied are reported in Annex I and IX to part V of the above mentioned Decree, depending on type and size of the installations), although many competent authorities constantly update their websites with the permits issued.

Latvia

No information has been received from the competent authority to date.

Lithuania

No information has been received from the competent authority to date.

Luxembourg

No information has been received from the competent authority to date.

Malta

No information has been received from the competent authority to date.

Netherlands

The competent authority has provided a completed proforma document which is included below without amendment. The figures presented are a rough estimate, based on several sources. The data are aggregated at the plant (stack) level, in line with the 'common stack' approach under the LCP Directive.

Category of data		**Rated thermal input category**		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation	5	5	-
	Public heat generation (including district heating)	-	-	-
	Combined heat and power generation (excl. decentral CHP in other sectors)	90	5	-
	Hospitals and universities	1800	30	
	Greenhouses	2400	2000	60
	Food industry (excluding greenhouses)	300	40	10
	Industrial (excl. food industry, incl. oil and gas)	700	120	40
	Other services sectors	1700	50	
	TOTAL all sectors	6995	2250	110
Total capacity of combustion plants	MWth	21000	23000	3700
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	boilers, engines, turbines, furnaces	boilers, engines, turbines, furnaces	boilers, engines, turbines, furnaces
Total fuel consumption split by fuel type	Total [PJ]	132	160	40
	Wood [PJ]	1		
	Coal [PJ]	0		
	Oil [PJ]	0		
	Natural gas (please specify units)	130	160	40
	Waste [PJ]	1	0	
	Other gases (please specify type(s) and units)			
Emissions of key pollutants – annual quantities emitted to	Dust or PM10 (please specify)			

air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	SO2 NOx [kton] HCl Heavy metals	8.6	11.7	1.6
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage How do you expect this % contribution to change by 2015, 2020, 2025?	3% NOx emission of gas engines will go down. Share in total NOx emissions will increase due to NOx emission reduction in transport.	4% NOx emission of gas engines will go down. Share in total NOx emissions will increase due to NOx emission reduction in transport.	1% NOx emission of gas engines will go down. Share in total NOx emissions will increase due to NOx emission reduction in transport.
How many plants would already be covered by the IE Directive as 'directly associated activities'?		Limited number, only in industry	Limited number, only in industry	Limited number, only in industry
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime? What ELVs are applied? What are the monitoring requirements? What other requirements are made?	See document 'Legislative requirements'		
Abatement measures – current and future	Type, costs, effectiveness	SCR on gas engines, NSCR on wood, Low NOx burners	SCR on gas engines, SCR on wood, Low NOx burners	SCR on gas engines, SCR on wood, Low NOx burners

New quantitative data

The competent authority has provided a completed proforma document. This has been filled out using rough estimates from several sources that were not specified; the data was aggregated in line with the 'common stack' approach under LCP directive. The data provided can be summarised as[30]:

Capacity class	Summary of data provided
20-50MW$_{th}$	110 installations split into sectors as: CHP (1%) Hospitals and universities (26%) food industry (excl greenhouses) (4%), greenhouses (34%), Industrial (excluding food industry, but including oil and gas) (10%), Other sectors (24%) Total capacity of 21 GWth Total fuel consumption of 132,000 TJ, split between 3 categories: natural gas (98%), Wood (1%), Waste (1%)
5-20MW$_{th}$	2250 installations, split into sectors as: Hospitals and universities (1%) food industry (excl greenhouses) (2%), greenhouses (89%), Industrial (excluding food industry, but including oil and gas) (5%), Other sectors (2%) Total capacity of 23 GWth Total fuel consumption of 160, 000 TJ all natural gas

[30] Of these installations 27 are already covered by IPPC as directly associated activities.

Capacity class	Summary of data provided
1-5MW_{th}	6995 installations, split into sectors as: food industry (9%), greenhouses (55%), Industrial (excluding food industry, including oil and gas) (36%) Total capacity of 3.7 GWth Total fuel consumption of 40,000 TJ, all natural gas

Current regulatory regime for combustion installations <50MW_{th}

Emission-regulations for boilers, stationary engines and turbines under 50 MWth have been in force since April 1st 2010. The legislation introduces emissions limit values (ELVs) dependent upon installation type and fuel input, it does not make the use of best available technology mandatory. There are two regimes, summarised as;

- BEES A and B (for existing installations)
- BEMS[31] (for installations installed after April 1st 2010)

Measures and techniques for suggested for reduction of emissions from combustion installations <50MW_{th}

For the smallest plants (1-5MW_{th}) the use of Selective Catalytic Reduction (SCR) on gas engines, Non-Selective Catalytic Reduction (NSCR) for wood burning installations and Low NO_X burners for NO_X emissions. For 5-20MW_{th} plants and 20-50MW_{th} plants, the abatement options suggested for smaller plants are also used, except SCR is used for wood burning installations.

Socio-economic situations or contexts

None received from competent authority.

[31] http://www.infomil.nl/english/subjects/air/combustion-plants/bems-sets-new/

Poland

The competent authority has provided a completed proforma document which is included below without amendment. The national inventory was used as the primary data source for completing the proforma. It should be noted that plants < 20MWth are in the most part not included as these plants are not regulated under national legislation.

Category of data		**Rated thermal input category**		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation Public heat generation (including district heating) Combined heat and power generation Hospitals and universities Greenhouses Food industry (excluding greenhouses) Industrial (please specify particular sectors) Other (please specify)			
	TOTAL all sectors			241
Total capacity of combustion plants	MW_{th}			8135
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines			Boilers mostly
Total fuel consumption split by fuel type	*Biomass (please specify type(s) and units) * biomass definition comply with ETS definition so it's different than definition used in directives 2001/80/WE and 2010/75/UE.			198942,87 m3 742,55 Mg Biomass as waste (code: 030105) 17288,73 Mg
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)			Black coal – 1635657,77 Mg Sub-bituminous coal – 4156,94
	Liquid (please specify type(s) and units)			Diesel oil – 1,8 Mg Furnace oil – 2713,29 Mg Heavy oil – 1489,77 Mg Light oil – 1266,42 Mg
	Natural gas (please specify units)			Natural gas – 110394793,00 m3 Natural gas with high methane concentration – 169357962,58 m3 Nitrogen-rich natural gas – 29646907,00
	Other gases (please specify type(s) and units)			Coke-oven gas –

				78186400,00 m3 Mine gas – 3640060,00 Biogas – 3518776,00
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust or PM_{10} (please specify)			Dust – 3832 t
	SO_2			11866 t
	NOx			5629 t
	HCl			-
	Heavy metals			-
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage			
	How do you expect this % contribution to change by 2015, 2020, 2025?			
How many plants would already be covered by the IE Directive as 'directly associated activities'?				
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime? What ELVs are applied? What are the monitoring requirements? What other requirements are made?	Environmental Protection Law[32] in art. 180 states that emission to air from the installation should be regulated in appropriate permit (single media or integrated permit). ELVs for combustion plants are set according to Emission standards regulation[33] and in case of installation with rated thermal capacity > 50 MW also BAT requirements are taken into account. Regulation concerning emission standards from installation covers combustion plants with rated thermal capacity > 1 MW and following pollutants (dust, SO2, NOx) with consideration of age and thermal capacity of installation. Cases when permit for emission to air is not required are listed in relevant regulation[34]. Operators of some installations for which permit is not required are obliged to make a notification to the competent authority. Such a cases are also listed in relevant regulation[35]. Operators of combustion plants for witch permit for emission to air is required should monitor emission of following pollutants SO2, NO2, dust and CO. Continuous monitoring is required for installations with rated thermal capacity > 100 MW. Periodical monitoring should be conducted at least twice a year (one in winter season and another in summer season). In case of installations working temporary in 6 months period one measurement (during the period when installation is operated) in a year is required. Detailed provisions concerning monitoring requirements are set in relevant regulation[36].		
Abatement measures – current and future	Type, costs, effectiveness	Answers presented in tables below		

[32] http://isap.sejm.gov.pl/DetailsServlet?id=WDU20080250150
[33] http://isap.sejm.gov.pl/RelatedServlet?id=WDU20052602181&type=13&isNew=true
[34] http://isap.sejm.gov.pl/DetailsServlet?id=WDU20101300881
[35] http://isap.sejm.gov.pl/DetailsServlet?id=WDU20101300880
[36] http://isap.sejm.gov.pl/DetailsServlet?id=WDU20082061291

1 – 5 MW

	Abatement equipment	Abatement efficiency %	Pollutant
1	Multicyclone	80 - 95	dust
2	Dry cyclone	70 - 95	dust
3	Bag filters	85 (one case)	dust
4	Dust settling chamber	20 - 32	dust
5	Wet scrubber	96,36 (one case)	dust

5 – 20 MW

	Abatement equipment	Abatement efficiency %	Pollutant
1	Multicyclone	70 - 98	dust
2	Dry cyclone	72,3 – 99,2	dust
3	Dry electrostatic participator	90 – 98,3	dust
4	Bag filters	75 – 99,9	dust
5	Dust settling chamber	20 (one case)	dust
6	SCR	20	NOx

20 – 50 MW

	Abatement equipment	Abatement efficiency %	Pollutant
1	Multicyclone	72 – 97,7	dust
2	Dry cyclone	44 – 92	dust
3	Dry electrostatic participator	85 – 98	dust
4	Bag filters	95 – 99,9	dust
5	Dust settling chamber	30 (one case)	SO2
6	Limestone semi dry process	50 (one case)	SO2
7	Limestone dry process	73 (one case)	dust

Please find below information concerning two sources provided by Economic Society Polish Power Plants.

Category of data		Rated thermal input category		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation			
	Public heat generation (including district heating)			
	Combined heat and power generation			
	Hospitals and universities			
	Greenhouses			
	Food industry (excluding greenhouses)			
	Industrial (please specify particular sectors)			
	Other (please specify)		Ignition boiler (working less than 160h/a)	
	TOTAL all sectors		1	
Total capacity of combustion plants	MW_{th}		6,7	
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines		boiler	
Total fuel consumption split by fuel type	*Biomass (please specify type(s) and units) * biomass definition comply with ETS definition so it's different than definition used in directives 2001/80/WE and 2010/75/UE.			
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)			
	Liquid (please specify type(s) and units)		Light oil – 30228 Mg	
	Natural gas (please specify units)			
	Other gases (please specify type(s) and units)			
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust or PM_{10} (please specify)		0 Mg	
	SO_2		0,023 Mg	
	NOx		0,207 Mg	
	HCl			
	Heavy metals			

Category of data		Rated thermal input category		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation			
	Public heat generation (including district heating)			
	Combined heat and power generation			

	Hospitals and universities			
	Greenhouses			
	Food industry (excluding greenhouses)			
	Industrial (please specify particular sectors)			
	Other (please specify)		Donkey boiler	
	TOTAL all sectors		1	
Total capacity of combustion plants	MW_{th}		6,7	
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines		Boiler OR-35	
Total fuel consumption split by fuel type	*Biomass (please specify type(s) and units) * biomass definition comply with ETS definition so it's different than definition used in directives 2001/80/WE and 2010/75/UE.			
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)		Black coal – 312,7 Mg	
	Liquid (please specify type(s) and units)			
	Natural gas (please specify units)			
	Other gases (please specify type(s) and units)			
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust or PM_{10} (please specify)		2,360 Mg	
	SO_2		2,652 Mg	
	NOx		1,250 Mg	
	HCl			
	Heavy metals			
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage			
	How do you expect this % contribution to change by 2015, 2020, 2025?			
How many plants would already be covered by the IE Directive as 'directly associated activities'?			Directly connected witch installation covered by IED	
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?			
	What ELVs are applied?	NO2 – 400 mg/Nm3 SO2 – 1300 mg/Nm3 Dust – 400 mg/Nm3		
	What are the monitoring requirements?	Once a year , boiler was operated 83,6 h in 2010		
	What other requirements are made?			
Abatement measures – current and future	Type, costs, effectiveness			

Portugal

No information has been received from the competent authority.

Romania

No information has been received from the competent authority.

Slovakia

New data has been received from the authorities.

New quantitative data

The competent authority has provided a database of SCPs in Slovakia which shows the number of SCPs disaggregated by capacity class and NACE code for the year 2010. The combined fuel consumption and combined emissions of air pollutants for all SCPs is also provided. This information can be summarised as follows:

Capacity class	Summary of data provided
1-5MW_{th}	2,023 plants (boilers) in total: Electricity and heat supply (20%), Education and health facilities (17%), crop and animal production (2%), Manufacture of food products (3%), Other manufacturing (industrial) (23%) and other (35%). Total capacity of installations: 4,334 MW_{th}. Main fuels combusted: 89% natural gas, 5% biomass, 1% brown coal, 1% biogas, 1% paper based waste, 1% agricultural/food waste. Emissions of – Dust: 269t, SO_2: 161t, NO_x: 699t, Heavy metals: 1.15t. It has not been possible to express these figures as a proportion of the total emissions in Slovakia.
5-20MW_{th}	600 plants (boilers) in total: Electricity and heat supply (52%), Education and health facilities (9%), crop and animal production (1%), Manufacture of food products (5%), Other manufacturing (industrial) (22%) and other (11%). Total capacity of installations: 5,393 MW_{th}. Main fuels combusted: 85% natural gas, 9% biomass, 3% hard coal, 2% paper based waste. Emissions of – Dust: 269t, SO_2: 192t, NO_x: 1,185t, Heavy metals: 2.42t. It has not been possible to express these figures as a proportion of the total emissions in Slovakia.
20-50MW_{th}	93 plants (boilers) in total: Electricity and heat supply (49%), Education and health facilities (9%), crop and animal production (1%), Manufacture of food products (8%), Other manufacturing (industrial) (32%) and other (1%). Total capacity of installations: 2,815 MW_{th}. Main fuels combusted: 60% natural gas, 25% biomass, 10% paper based waste, 2% brown coal,.2% other solid fuels, 1% agricultural/food waste. Emissions of – Dust: 112t, SO_2: 223t, NO_x: 845t, Heavy metals: 4.585t. It has not been possible to express these figures as a proportion of the total emissions in Slovakia.

Note: Numbers of installations in each sector were aggregated on the basis of NACE codes.

Current regulatory regime for combustion installations <50MW_{th}

The competent authority has indicated that existing legislation exists which included ELVs for SCPs 1-50MW_{th}, although a reference to the legislation has not been provided. The ELVs are differentiated by fuel type, size of plant, age of plant and combustion technique. The legislation also sets out monitoring requirements.

Measures and techniques for suggested for reduction of emissions from combustion installations <50MW$_{th}$

No information has been received from the competent authority.

Socio-economic situations or contexts

No information has been received from the competent authority.

Slovenia

The competent authority has provided a completed proforma document which is included below without amendment. In addition, the competent authority stated that SCPs are not currently required to hold a permit, but that ELVs and other requirements have been taken from TA Luft and entered into national legislation in 2009[37].

Category of data		**Rated thermal input category**		
		1-5MWth	**5-20MWth**	**20-50MWth**
Number of combustion plants in each sector	Public electricity generation			
	Public heat generation (including district heating)			
	Combined heat and power generation			
	Hospitals and universities			
	Greenhouses			
	Food industry (excluding greenhouses)			
	Industrial (please specify particular sectors)			
	Other (please specify)			
	TOTAL all sectors	222*	119**	18
Total capacity of combustion plants	MW_{th}	535*	1266**	501
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines	boilers & turbines & furnaces& engines	boilers & turbines & furnaces& engines	boilers & turbines & furnaces& engines
Total fuel consumption split by fuel type	Biomass (please specify type(s) and units)	n.a	n.a	n.a
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units)	n.a	n.a	n.a
	Liquid (please specify type(s) and units)	n.a	n.a	n.a
	Natural gas (please specify units)	n.a	n.a	n.a
	Other gases (please specify type(s) and units)	n.a	n.a	n.a
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust	126*	126**	23,5
	SO_2	107*	193**	137
	NOx	926*	794**	541

[37] http://www.uradni-list.si/1/content?id=102899 No English translation is available.

Emissions of key pollutants – contribution to total national emissions	HCl	n.a	n.a	n.a
	Heavy metals	n.a	n.a	n.a
	Expressed as a percentage	n.a	n.a	n.a
	How do you expect this % contribution to change by 2015, 2020, 2025?	n.a	n.a	n.a
How many plants would already be covered by the IE Directive as 'directly associated activities'?				
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?			
	What ELVs are applied?			
	What are the monitoring requirements?			
	What other requirements are made?			
Abatement measures – current and future	Type, costs, effectiveness			

* Only boilers using solid fuel

** Not included boilers using natural gas below 10 MW

Sweden

New quantitative data

The competent authority has provided a dataset which shows for each boiler in Sweden: capacity (MW), electricity produced, percentage fuel consumption by fuel type, combustion technique, abatement technique and emissions of NO_x for the year 2009.

No fuel consumption was reported, but AMEC has calculated fuel input using the supplied total heat and electricity output by assuming efficiency factors (agreed with the Swedish authorities).

The data provided can be summarised as:

Capacity class	Summary of data provided
1-5MW_{th}	4 plants with a combined capacity of 16 MW_{th}. Information supplied on the generation techniques employed was found to include errors, but it can be said that the majority of plants are CHP or steam boilers, with a small number of gas turbines and electricity generating plants. The fuel consumption for all plants is 46TJ: Solid biofuels (100%). Total NO_2 emissions: 39t.
5-20MW_{th}	173 plants with a combined capacity of 1,802 MW_{th}. Information supplied on the generation techniques employed was found to include errors, but it can be said that the majority of plants are CHP or steam boilers, with a small number of gas turbines and electricity generating plants. The fuel consumption for all plants is 40TJ: Gas (5%), Fuel-oil (1%), peat (1%), waste (21%), and solid biofuel (72%). Total NO_2 emissions: 2,923t
20-50MW_{th}	105 plants with a combined capacity of 2,975 MW_{th}. Information supplied on the generation techniques employed was found to include errors, but it can be said that the majority of plants are CHP or steam boilers, with a small number of gas turbines and electricity generating plants. The fuel consumption for all plants is 59TJ: Gas (16%), Fuel-oil (7%), peat (3%), waste (27%), and biofuel (47%). Total Total NO_2 emissions: 6,723t

Current regulatory regime for combustion installations <50MW_{th}

The competent authority has stated that permit conditions for <50MW_{th} plants in Sweden are decided on a case-by-case basis; the only General Binding Rules for ELVs applied are from the LCP and Waste Incineration Directives.

Measures and techniques suggested for reduction of emissions from combustion installations <50MW_{th}

The dataset provided by the Swedish competent authorities also included details of the NOx emission reduction measures applied at each plant, which is summarised in the table below.

NO_x Abatement measure	1-5MW_{th} (% of plants)	5-20MW_{th} (% of plants)	20-50MW_{th} (% of plants)
Waste Gas Recirculation (WGR)	0%	32%	13%
Unspecified	0%	1%	2%
Low-NO_x burners	0%	3%	3%
Combustion modification	25%	4%	1%
Over Fire Air (including rotary)	0%	3%	4%

NO_x Abatement measure	1-5MW_{th} (% of plants)	5-20MW_{th} (% of plants)	20-50MW_{th} (% of plants)
ECOTUBE (injection of reducing agents)	0%	3%	1%
ROTAMIX (injection of reducing agents)	0%	1%	1%
Selective Catalytic Reduction	0%	1%	1%
Selective Non-Catalytic Reduction	0%	30%	73%

Socio-economic situations or contexts

None received from competent authority.

Spain

The competent authority has provided a completed proforma document which is included below without amendment.

Category of data		Rated thermal input category		
		1-5MWth	5-20MWth	20-50MWth
Number of combustion plants in each sector	Public electricity generation			104
	Public heat generation (including district heating)			
	Combined heat and power generation (include cogeneration and combustion in industries different from the ones on the industrial category below)			422
	Hospitals and universities			
	Greenhouses			
	Food industry (excluding greenhouses)			
	Industrial (please specify particular sectors: mineral oil refinery, coke ovens, metal ore roasting or sintering, pig iron or steel, cement clinker or lime, glass included glass fibre, ceramic products by firing, pulp, paper and board)			604
	Other (please specify)			
	TOTAL all sectors			1130
Total capacity of combustion plants	MW_{th}			
Typical combustion techniques in use	e.g. boilers, turbines, furnaces, engines			
Total fuel consumption split by fuel type	Biomass (please specify type(s) and units)			
	Other solid fuels (coal, lignite, etc.: please specify type(s) and units): coal			26 installations
	Liquid (please specify type(s) and units): fuel oil			10 installations
	Natural gas (please specify units)			
	Other gases (please specify type(s) and units)			
Emissions of key pollutants – annual quantities emitted to air (tonnes). Please provide the reference (e.g. CLRTAP, CITL, other please specify)	Dust or PM_{10} (please specify)			
	SO_2			
	NOx			
	HCl			
	Heavy metals			
Emissions of key pollutants – contribution to total national emissions	Expressed as a percentage			
	How do you expect this % contribution to change by 2015, 2020, 2025?			

How many plants would already be covered by the IE Directive as 'directly associated activities'?				
Legislative requirements. Please provide copies of the legislation or weblinks.	What is the permitting regime?			Permits in accordance to de IE Directive for > 50 MW installations
	What ELVs are applied?			The ELV reflected in their permits. They are set out by the competent authorities of the Autonomous Communities. This values are based on national o local legislation.
	What are the monitoring requirements?			
	What other requirements are made?			
Abatement measures – current and future	Type, costs, effectiveness			

United Kingdom

The UK competent authority have responded that their most up-to-date information on SCPs is contained in AEA (2007), 'Assessment of the benefits and costs of the potential application of the IPPC Directive (EC/96/61) to industrial combustion installations with 20-50 MW rated thermal input'. More up-to-date information on the number of plants and fuel combustion in Northern Ireland has been provided, but this cannot be used to update the existing information, as data in AEA (2007) is not disaggregated between countries within the UK.

Current regulatory regime for combustion installations <50MW$_{th}$

In the UK MCIs (20-50 MWth) are generally regulated under Part B of the LAPPC regime; Part B activities are regulated at a local authority level and only for air pollution emissions. A number of guidance documents have been developed by Defra for 20-50 MWth combustion installations:

- PG 1/3 (95) – for boilers and furnaces of 20 – 50 MWth;
- PG 1/4 (95) – for gas turbines of 20 -50 MWth.

The Scottish Environmental Protection Agency (SEPA) have indicated that plants below 20MW$_{th}$ would not normally be regulated unless the plant was directly associated to a Part A activity under IPPC. The majority of plants less than 20MW$_{th}$ are regulated by Local Authorities under the statutory nuisance provisions included in the Environmental Protection Act 1990[38]; this regulation does not stipulate mandatory ELVs.

Typical abatement equipment currently in use (provided by DALKIA)

- Gas boilers typically use low NOx burners (150mg/nm3)
- Gas turbines can get down to 25mg/Nm3 NOx or lower
- Gas engines operate at 250mg/Nm3 NOx, although NOx vs. CO is an issue in engines particularly
- For oil boilers, low sulphur fuel and technology similar to gas burners is acceptable
- Small biomass plants use high efficiency cyclones, over fire air and possibly economisers and combustion air preheat to maximise efficiency and improve combustion

[38] http://www.legislation.gov.uk/ukpga/1990/43/part/III/enacted

Appendix D
Industry responses to the proforma

Dalkia

September 2012
Doc Reg No. 30310-02 12277i2

IED emission control on plant rated below 50MW

Have Dalkia begun to consider the impact of the IED on its operations?
Dalkia have been closely involved with the IED and prior legislation (IPPC, EPR, LCPD and WID for example) and are continuing to liaise with customers, suppliers and other industry groups on the implementation of the IED. We have begun the process of understanding how our existing permitted sites will be impacted by the new directive. In particular, we have a number of sites covered by the LCPD which will need to adhere to new (lower) emission limit values in the future. It is likely that these new limits will imply an improvement notice on these permitted sites. In some instances, meeting this improvement notice will only be achievable through investment. The number of sites in our portfolio impacted by the current de minimis level (50MW) is relatively limited and the large scale of the associated activity means it is usually better placed than smaller sites to invest in Best Available Techniques. If the limit was to drop to a lower MW level, the effect of the IED will be felt much more widely across our portfolio and the wider UK industry. This would force many sites to incur the considerable cost of permitting, both direct and administrative, and often pay for plant or abatement techniques that might be totally disproportionate for the site, either in terms of size, space, cost of installation, or cost of operation. These additional costs would typically represent a much larger fraction of the overall operating cost of smaller sites relative to that for existing IPPC sites.
How the sector (<50MW combustion plant) is likely to develop going forward; what growth do you foresee in these units? and in which industrials sectors?
It is difficult to foresee how each industrial sector will evolve in the coming years. The manufacturing industry in the chemical, pharmaceutical and metal sectors appears to be shrinking in the UK (Alcan are closing their aluminium smelter because they cannot afford the environmental compliance demands) and even food and drink plants are less widespread, with breweries closing and other foods being imported. Nonetheless, assuming the nature of industry remains broadly consistent in the UK, most sites on the gas network will likely continue to rely on gas-fired steam boilers in the short to medium term (the 10 tonne 10 bar boiler being the standard unit in many factories). Modern gas-fired systems are very efficient, have low emissions, and are less costly to operate so this 'combustion sector' is likely to remain and grow as the gas network evolves and industry locates itself close to the network. Sites currently off the gas network are typically reliant on heavy fuel oil or coal. As the cost and environmental implications of running these sites grow, more will likely look to

biomass to help reduce their operational costs. Biomass is unlikely to be a complete solution for these sites with fossil-fuel boilers usually being required to provide top-up and back-up steam since biomass boilers require more maintenance and are often not suited to rapid load modulation which is typical in industry. This need for a wider variety of boiler solutions will often lead to an increase in the total boiler capacity for a given site off the gas network (thus pulling some of these sites with an equivalent thermal demand into the IPPC net). In the long term, this will lead to a closure of industrial sites in rural towns (not supplied with gas) and a concentration of industry closer to cities.

One sector which will continue to have many combustion plants in the 20MW to 50MW range is the health sector. Hospitals typically require redundancy of boiler plant to maintain supply in all eventualities. They also require back-up generators to maintain electricity supply during mains failure. Furthermore, they regularly incorporate CHP in order to reduce energy costs and limit their carbon exposure. A 2MWe gas engine will typically add 6MW of thermal input to a site. As a result, it would not be uncommon to see a hospital with a 12MW peak thermal demand have over 40MW of thermal input capacity to ensure the energy needs of the site are delivered continuously and at the lowest possible cost. It would seem inappropriate to impose permitting obligations on such a site, especially since onsite CHP is a carbon-friendly solution.

Comment on the policy landscape of EU policies that will impact on these plants (e.g. the impact of the Renewable Heat Incentive in UK)

There are a number of different policies which are impacting upon the operation of plant, which include:

Renewable Heat Incentive and the potential implication when Phase II commences to place emissions limits of 30g/GJ for particulates and 150g/GJ for NOx. We understand from Government decisions on the RHI that these limits are intended for sub 20MWth installations. It shall be challenging to achieve these limits unless significant post combustion cleanup of the emissions takes place - which is likely to absorb a significant proportion of the 1p/kWh RHI payment for 'Large Commercial Biomass' and almost certainly defer some organisations from progressing a biomass solution.

We have experienced an increasing degree of regulation and costs surrounding CO2 emissions. We have single installations which are within the scope of the EU Emissions Trading System, The CRC Energy Efficiency Scheme and potentially, the Carbon Price Support system. Whilst we accept the need to impose an absolute cap on carbon emissions, we would prefer some legislative simplification to lower our own (administrative) cost burden.

Typical technologies and fuel types used; currently and in future

Natural gas is the current fuel of choice and will remain so in the short to medium term. This means no sulphur, very limited particulates, and relatively easy NOx management, in boiler plant and gas engines/turbines.

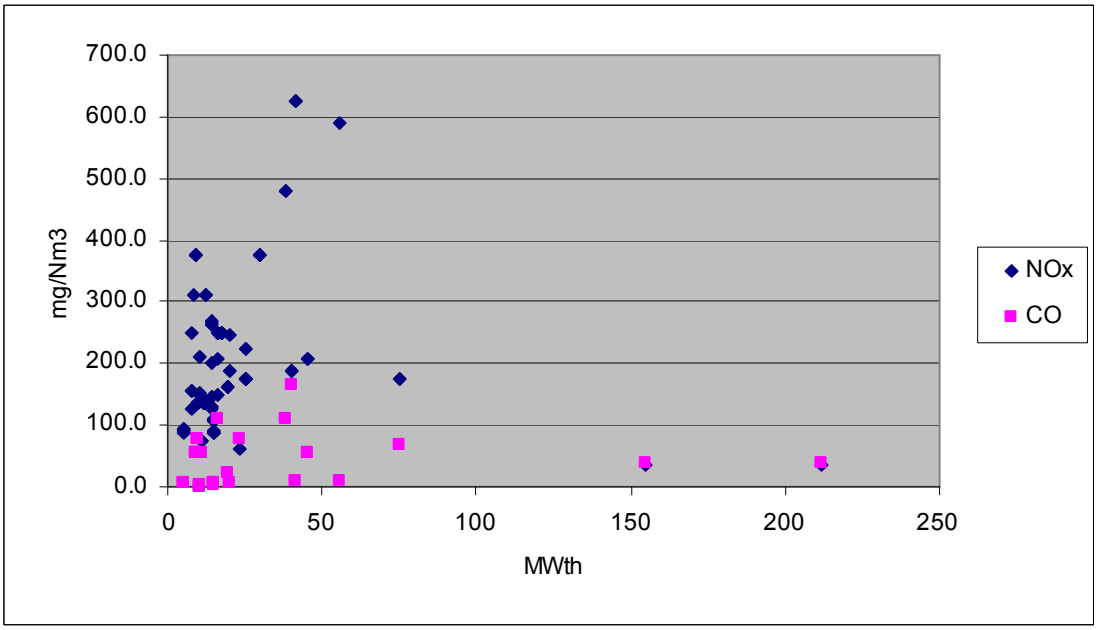
Biomass plants are increasing in popularity and some fall into the IPPC already because of the fuel source (e.g clean waste wood combustion plant > 3MWth). A whole range of possible pollutants and abatement issues can arise with biomass plant since fuel composition can vary and the solid fuel combustion process is often not as simple and regular as that for liquid or gas fuels. In order to truly control emissions from these installations, expensive abatement plant and Continuous Energy Monitoring systems (CEMs) could be required by the regulatory authority. This equipment is costly to install and maintain and, since these installations are often installed to save energy and environmental cost, this negatively impacts the business case for biomass. This is particularly the case for smaller installations since the cost of abatement equipment and CEMs becomes proportionally much greater (£/MW input) as combustion capacity decreases.

Coal is unlikely to return in any great amount in the UK, being restricted to a few very large power plants. Large WID plants already have to fit ESP or bag filters, SNCR, HCL and metals abatement, and other costly techniques.

Typical pollutant emissions concentrations from different technology and fuel-type combinations

Most of the sites that we operate are not currently covered by the IPPC meaning emissions monitoring is not a regulatory requirement. The emissions data we do have relates to installations that are either Large Combustion Plant (>50MW) or smaller plant which are covered by the IPPC as a result of the manufacturing activity on those sites. The installations for which we do have emissions data are generally gas-fired sites.

The Combustion Engineering Association (CEA), of which Dalkia is a member, recently produced a Large Combustion Plant BREF review submission to put forward its views to the Technical Working Group (TWG) charged with reviewing the LCP BREF document. As part of the submission, the members of the CEA gathered existing emissions data from our respective sites. The graph below depicts the NOx and CO emissions data for a range of gas fired boilers. Many of the installations in the lower capacity range of the graph are Dalkia sites.



We would not have sufficient data to demonstrate clearly the respective emission levels that prevail for other fuels. However, we would like to stress that the emissions achievable from biomass combustion plant depends strongly on the boiler technology employed which in turn depends on other key project parameters (fuel type, fuel quality, scale, schedule, economic feasibility, available space etc.).

Typical abatement techniques already applied and abatement techniques which would be required to meet the proposed ELVs and the costs of these abatement techniques.

Most abatement for smaller installations is delivered through NOx management and fuel choice. Typically:

- Gas boilers will have low NOx burners (150mg or less)
- Gas turbines can get down to 25mg NOx or lower
- Gas engines are already at 250mg NOx, although NOx vs. CO is an issue in engines particularly
- For oil boilers, low sulphur fuel and technology similar to gas burners is acceptable
- Small biomass plants use high efficiency cyclones, over fire air and possibly economisers and combustion air preheat to maximise efficiency and improve combustion

It is difficult to know what additional abatement would be required to meet new ELVs without knowing what they are but presumably some sites which do not have recent gas or oil burners would need to upgrade them to achieve target emissions levels. In some instances, this will bring forward the need to replace the site boiler(s). Existing and

future biomass plant could be required to employ very expensive abatement solutions (beyond cyclone(s)):

- Bag filters
- Electrostatic precipitators
- SNCR
- SCR

For prospective installations (notably in the smaller range), the need to employ abatement technologies such as these could lead to the project being shelved at the evaluation stage. Biomass boiler projects are most often undertaken as retrofit solutions to existing sites for the purposes of reducing energy costs. In this instance, as financial savings is the main driver for the project, the considerable additional capital cost required for the abatement equipment can render the solution uneconomic. It will be very difficult for the UK to meet its renewable heat targets if support mechanisms such as the RHI for large biomass plants (>1MW) are only offered to plants that the meet the proposed stringent emission limits.

Appendix E
Adjustments made to data provided by Member States

Note: Member States not listed in this appendix either provided complete data for the MS or provided no data (and were therefore gap-filled in an alternative manner).

Austria

Number and capacity of plants (5-20MW$_{th}$)

The information provided by the MS covers estimated numbers of plants (=stack) with steam boilers firing solid fuels, biomass and non-standard fuels in capacity classes 5-20MW and 20-50MW. The data originate from a data bank about emission reports from plant operators of steam boilers.

The reported numbers of plants in the 20-50MW capacity class are suggested to be correct, but that those in the 5-20MW capacity class are likely to be an underestimate, and potentially a significant underestimate.

Adjustments need to be made to the data to take account of the following exclusions:

- The number of plants excludes combustion plants that are not steam boilers. The MS has indicated that "*most of the combustion plants with a rated thermal input > 5 MW are steam boilers*".
- The number of plants excludes combustion plants 5-10MW using gas oil or natural gas.

The following adjustments have been made to the 5-20MW numbers and capacities:

vii. Based on a review of indications submitted by other Member States, assumed that approximately 75% are steam boilers, therefore multiply numbers and capacity by a factor of 1.33 to take account of missing data.

viii. Assume that one third of the plants are in the capacity range 5-10MW$_{th}$., i.e. one third of the capacity range 5 to 20MW$_{th}$.[39] The data for Slovakia (a neighbouring MS) suggest that 80% of fuel consumption is natural gas. We assume this ratio is also true for numbers/capacity of plants in AT, i.e. that the data provided for 5-10MW$_{th}$ (which excludes plants using gas oil or natural gas) represents

[39] Although it could be argued that a greater number of plants than a third would lie in the capacity bracket 5-10MW$_{th}$, without robust data to suggest an alternative figure, a simple assumption of one third is adopted. For capacity of plants, the assumption of one third may well be more appropriate than for numbers of plants.

20% of all plants. Therefore adjust the number of plants in the (sub) 5-10MW_{th} category by a factor of 5. This leads to an overall multiplying factor of 2.33 for the 5-20MW sector.[40]

Belgium

Data for Belgium comprises data provided separately from each of the three regions of Flanders, Wallonia and Brussels.

Wallonia

The data on numbers, capacity and emissions provided by the Wallonia authorities exclude data on the following plants:

- Boilers in the tertiary sector (hospitals, schools) above 1 MW_{th}
- Boilers in the residential sector above 1 MW_{th}

In order to account for these two exclusions, the following adjustments are made:

ix. To account for missing tertiary sector, the average contribution this sector comprises of each capacity class from other MS data (Figure 3.4 in the interim report) is utilised for data on numbers and capacity (and as a total of 1-50MW_{th} for emissions): 25% 1-5MW_{th}, 9% 5-20MW_{th}, 9% 20-50MW_{th}, 18% 1-50MW_{th}. I.e. the numbers and capacity data for capacity classes 1-5, 5-20 and 20-50MW_{th} are multiplied by factors 1.33, 1.1 and 1.1 respectively. The emissions data are multiplied by a factor of 1.22.

x. To account for the missing residential sector, comparison was made with the detailed sector data provided by SK, in which the residential sector comprised only an appreciate proportion of total number of plants in the 1-5MW_{th} capacity class, and in this instance comprised 4% of the total. Therefore an uplift factor for the 1-5MW_{th} capacity class of 1.04 is used for numbers and capacity data only.

The emissions data were provided as a total for the three capacity classes. In order to apportion these data across the three capacity classes:

xi. It is proposed to use the ratio of installed capacity among the three capacity classes to split the emissions data. This inherently assumes that plant emission levels across the three capacity classes are the same. A comparison of the ELVs for Flanders and Wallonia suggests that this is a reasonable assumption.

[40] This is in-line with an approximate factor estimated by the Austrian authorities.

Flanders and Brussels

The data provided by the Brussels region is provided at the boiler level. We are unable to convert these data into the stack level, and so are accepted as a known limitation of the data. Note: we have not attempted to adjust the boiler-level data into a number of stacks as per the approach for Sweden and Finland, as the ratio of boilers to stacks for Brussels is not necessarily the same as for the Scandinavian countries. The implication is that the number of plants for Brussels (and Belgium) and thus estimates based on this (e.g. costs) may be overestimates.

Neither of the regions provided emissions data whilst Wallonia did. Therefore, there is a gap in the emissions data for Belgium.

xii. It is proposed to utilise the ratio in capacity data of the Flanders and Brussels region to that of the Wallonia region to extrapolate estimated emissions for the whole of Belgium. This inherently assumes that plant emission levels across the three Belgian regions are the same. A comparison of the ELVs for Flanders and Wallonia suggests that this is a reasonable assumption.

Cyprus

Data on fuel consumption and emissions were provided by the MS as an aggregate for the capacity class 1 to 20MW_{th}. Data on numbers and capacity of plants were however provided separately for the two capacity classes 1-5MW_{th} and 5-20MW_{th}.

xiii. The fuel consumption and emissions data for the combined capacity class 1-20MW_{th} are proposed to be split into the two separate capacity classes in accordance with the ratio of the capacity classes.

Finland

The data provided by Finland are provided at the boiler level. It is possible from the data provided to make preliminary estimates of the number of Finnish plants (stack) using the unique (x,y,z) coordinates of boilers supplied by the Finnish authorities. These estimates have not been confirmed by the authorities.

xiv. Propose to use estimated revised numbers at the stack level: 136 1-5MW_{th} plants, 140 5-20MW_{th} plants, 133 20-50MW_{th} plants.

France

The data on numbers (and capacity) provided appear to be high. There is a need to try to verify the figures. The number of plants 1-20MW_{th} provided is 20,000, and that of 20-50MW_{th} is 1,500.

The estimate for the number of 20-50MW_{th} plants has been checked as follows:

- The number of combustion installations >20MW_{th} in the 2009 CITL database is 787
- The number of combustion facilities >50MW_{th} in the 2009 E-PRTR database is 137

- The number of combustion plants >50MW$_{th}$ in the 2009 LCPD dataset is 241

- From the above data points it is implied (assuming one facility is equivalent to one installation) that there are approximately 650 combustion installations 20-50MW$_{th}$. Looking at the ratio of the number of combustion plants (stack) vs. installation >50MW$_{th}$ suggests a ratio of plant:installation of 241:137. If the same ratio remained true for 20-50MW$_{th}$ installations, the estimated number of combustion plants(stack) 20-50MW$_{th}$ is (241/137)*650 = 1143 plants.

The estimate derived of 1,143 is 25% lower than the estimate provided by the FR authorities. It should be noted that it is the same order of magnitude, and because of this, it is proposed to retain the estimate provided by the French authorities.

The estimate of the number of 1-20MW$_{th}$ plants has been checked as follows:

- The average ratio of number of plants 1-20MW to 20-50MW from those MS that provided full data is 30:1. Such a ratio applied to either estimate of FR 20-50MW$_{th}$ plants yields a figure much higher than 20,000.

- Compared against the estimate by AMEC for Germany (data not provided by the DE authorities) of 1-20MW$_{th}$ plants of 21,430, and against the estimate for NL by the Dutch authorities of 9,245, the estimate for France appears plausible.

To adopt the figures provided by the FR authorities, it is necessary to split the data into the 1-5MW$_{th}$ and 5-20MW$_{th}$ capacity classes. This is proposed to be undertaken by adopting the average split of data between these two capacity classes from Member States where full data have been provided.

Germany

Fuel consumption data were provided both for the 20-50MW$_{th}$ capacity class and for a 1-50MW$_{th}$ capacity class. Therefore, combined data on fuel consumption for a 1-20MW$_{th}$ capacity class are derivable through simple subtraction.

The average load factor implied for the 20-50MW$_{th}$ capacity class (from the capacity and fuel consumption data; of 1864hrs/annum), is used to calculate the capacity of a 1-20MW$_{th}$ capacity class from the derived 1-20MW$_{th}$ fuel consumption. The capacity and fuel consumption estimates for 1-20MW$_{th}$ plants are split into the 1-5MW$_{th}$ and 5-20MW$_{th}$ plants by using the average ratio of capacity for those EU MS that did provide data. The numbers of plants are estimated from the capacity data by assuming average plant sizes as reported by those MS that did provide data (average plant size in the 1-5MW$_{th}$ and 5-20MW$_{th}$ capacity categories are 2.5MW$_{th}$ and 10MW$_{th}$).

The emissions data – which were provided by the DE authorities as a total for the 1-50MW$_{th}$ capacity class, have been split across the three capacity sub classes in the ratio of the estimated fuel consumption for each capacity class. This is because the applicable recommended limit values for plants <50MW$_{th}$ in Germany are the same for all plants 1-50MW$_{th}$.

The German authorities provided some additional descriptive information about biogas plants on top of the numeric data on 1-50MW_{th} plants. We have been unable to match these data and thus they have not been included. It is noted however that some of the biogas plant fall below the 1MW_{th} threshold for inclusion in this study.

Poland

The data provided for capacity class 5-20MW_{th} represent only two plants and are considered incomplete. These data have not been included in the database.

Slovenia

1-5MW_{th} plants

The data (numbers, capacity and emissions) on plants 1-5MW_{th} represent only plants fired with solid fuel. It is therefore necessary to adjust these data to be representative of all plants in Slovenia. It is proposed to use the ratio of fuels used in 20-50MW_{th} SI plants to fill this gap.[41]

xv. The data provided (on solid fuel plants) on numbers and capacity should be multiplied by a factor of 9 in order to be representative of all fuels, since it is assumed that a total of 11% of the fuel consumption is of solid fuels (biomass and other solid fuels).

xvi. The data provided (on solid fuel plants) on emissions should not be multiplied by a factor of 9 as the emission level of fuels other than solid fuels (primarily natural gas) are lower than solid fuels. It is proposed to multiply the NO_X emissions data (only) by a factor of [9*[emission level of natural gas plant]/[emission level of coal plant]]. Since SO_2 and dust emissions from natural gas are ignored, no change is proposed to these emissions.

5-20MW_{th} plants

The data (numbers, capacity and emissions) on plants 5-20MW_{th} excludes data for those plants which are <10MW_{th} and which are fired with natural gas. It is therefore necessary to adjust these data to be representative of all plants in Slovenia.

xvii. It is proposed to use the ratio of fuels at 20-50MW_{th} plants in SI[42], shown below, coupled with an assumption that natural gas consumption at plants 5-10MW_{th} is one third of natural gas consumption at

[41] The data for Slovakia, a country considered to have similar fuel mix profile was also investigated, i.e. whether the SK data on the fuel mix in the 1-5MW_{th} capacity class could be used instead of the SI data on the fuel mix in 20-50MW_{th} plants. The results of this investigation show that a very similar factor would result (SK proportion of fuel consumption that is solid fuels is 9% in 1-5MW_{th} capacity class compared to the 11% in SI 20-50MW_{th} plants).

[42] As for 1-5MW_{th} plants, data on 5-20MW_{th} plants in Slovakia were also investigated for use instead of utilising the fuel mix of Slovanian 20-50MW_{th} plants. The results of this investigation show that a very similar factor would

5-20MW$_{th}$ plants. These two assumptions leads to an estimate that the data provided on numbers and capacity represent 71% of the actual situation, i.e. that the data on numbers and capacity should be multiplied by a factor of 1.4.

xviii. The data provided on emissions should not be multiplied by a factor of 1.4 as the emission levels of natural gas are lower than for other fuels. It is proposed to multiply the NO_X emissions data (only) by a factor of [1.4*[emission level of natural gas plant]/[emission level of coal plant]]. Since SO_2 and dust emissions from natural gas are ignored, no change is proposed to these emissions.

Fuel consumption of all plants

xix. Total fuel consumption data should be estimated from Slovenian capacity data using EU average load factors in line with other Member States.

xx. The split among fuel types should be adopted (from Table 3-5 of the AEA (2007) study) as:

Biomass	Other Solid	Liquid	Nat Gas	Other
6.0%	5.0%	2.4%	86.6%	0.0%

Sweden

The data for the capacity class 1-5MW$_{th}$ appear quite small. The data source from the SE authorities for all the plants is the NO_X charge databank; since the NO_X charge applies to boilers producing >25GWh per year, this effectively means that it will not cover any plants in the 1-5MW$_{th}$ capacity class. Therefore the small amount of data provided by the MS for this capacity class will be gap-filled.

It is unclear whether the Swedish figures for numbers of plants are at a boiler level. For Finland, an estimate has been made on the number of plants the boiler inventory represents. Although this ratio used in Finland could be utilised for Sweden, the existing data appear robust in terms of the average capacity per plant being 10MW$_{th}$ in the 5-20MW$_{th}$ category and 28MW$_{th}$ in the 20-50MW$_{th}$ category.

United Kingdom

The data provided for capacity classes 1-5MW$_{th}$ and 5-20MW$_{th}$ are representative for the region of Northern Ireland only. Since this is only a small part of the United Kingdom it is not thought that these data are representative of the UK as a whole. Therefore, the gap-filling process for 1-5MW$_{th}$ and 5-20MW$_{th}$ capacity classes is proposed to be as if no data were provided.

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result (SK proportion of fuel consumption that is natural gas is 85.0% in 5-20MW$_{th}$ capacity class, compared to 86.6% in SI 20-50MW$_{th}$ plants).

xxi. Overwrite UK provided data on 1-5MW_{th} and 5-20MW_{th} plants and estimate these from other methods as per all MS.

For the capacity class 20-50MW_{th}, it is proposed to utilise a dataset developed for the UK Government by AMEC instead of the data provided. As this is a separate, existing dataset, it is documented in Section 4.3.

Appendix F
ELVs applied in Member State national legislation on combustion plants less than 50MW$_{th}$.

This appendix lists the emission limit values from Member States' national legislation that apply to combustion plants between 1MW$_{th}$ and 50MW$_{th}$. The pragmatic approach taken to gathering the limit values from national legislation has been to select limit value most likely to be most widely applied when considering that legislation often differentiates by age category of the plant. Each piece of national legislation has a different definition of what is a 'new' plant compared to an 'existing' plant. The pragmatic approach taken has considered, for the period 2015 to 2020, and taking into account plant lifetimes ranging from 10 to 30 years, which ELV (i.e. for 'existing' plants or for 'new' plants) is most likely to be most widely in force. In the absence of readily available information (for example legislation that is not in English), the default choice has been the ELVs for 'existing' plants.

Table F.2 General case emission levels (applied in the absence of Member State-specific ELVs)

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
AT	Dust	1-50 MW	Biomass	13% O2	new steam boilers / existing from 2018	50
AT	NOx	1-5 MW	Biomass	13% O2	steam boilers. Average 250-500 range	375
AT	NOx	5-20 MW	Biomass	13% O2	steam boilers. Average 200-350 range	275
AT	NOx	20-50 MW	Biomass	13% O2	steam boilers. Average 200-350 range	275
AT	Dust	1-50 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	50
AT	NOx	1-5 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	400
AT	NOx	5-20 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	350
AT	NOx	20-50 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	350
AT	SO2	5-20 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	400
AT	SO2	20-50 MW	Other solid fuels	6% O2	new steam boilers / existing from 2018	400
AT	NOx	1-5 MW	Natural gas	3% O2	new steam boilers / existing from 2018	125
AT	Dust	1-5 MW	Liquid fuels	11% O2	steam boilers. Average of 30-60 range	45
AT	Dust	5-20 MW	Liquid fuels	11% O2	steam boilers. Average of 30-60 range	45
AT	Dust	20-50 MW	Liquid fuels	11% O2	steam boilers. Average of 30-50 range	40
AT	NOx	1-5 MW	Liquid fuels	11% O2	steam boilers. 150 gasoil	400
AT	NOx	5-20 MW	Liquid fuels	11% O2	steam boilers. 150 gasoil	350
AT	NOx	20-50 MW	Liquid fuels	11% O2	steam boilers. 150 gasoil	350
AT	NOx	5-20 MW	Natural gas	3% O2	new steam boilers / existing from 2018	100
AT	NOX	20-50MWth	Natural gas	3% O2	new steam boilers / existing from 2018	100
BE/Flanders	Dust	1-50 MW	Other solid fuels		plants licensed 1996-2005	50
BE/Flanders	NOx	1-50 MW	Other solid fuels		plants licensed 1996-2005	400
BE/Flanders	SO2	1-50 MW	Other solid fuels		plants licensed 1996-2005	1250

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
BE/Flanders	Dust	1-50 MW	Liquid fuels		plants licensed 1996-2005	50
BE/Flanders	SO2	1-50 MW	Liquid fuels		plants licensed 1996-2005	1700
BE/Flanders	NOx	1-5 MW	Liquid fuels		plants licensed 1996-2005	400
BE/Flanders	NOx	5-20 MW	Liquid fuels		plants licensed 1996-2005	400
BE/Flanders	NOx	20-50 MW	Liquid fuels		plants licensed 1996-2005	300
BE/Flanders	Dust	1-5 MW	Biomass	Wood (contaminated and non-)	Incineration ELV	150
BE/Flanders	Dust	5-20 MW	Biomass	Wood (contaminated and non-)	Incineration ELV	30
BE/Flanders	Dust	20-50 MW	Biomass	Wood (contaminated and non-)	Incineration ELV	30
BE/Flanders	NOx	1-5 MW	Biomass	Wood (contaminated and non-)		400
BE/Flanders	NOx	5-20 MW	Biomass	Wood (contaminated and non-)	Incineration ELV. Expressed in NO2	200
BE/Flanders	NOx	20-50 MW	Biomass	Wood (contaminated and non-)	Incineration ELV. Expressed in NO2	200
BE/Flanders	NOx	1-50 MW	Natural gas		plants licensed 1996-2005	150
BE/Wallonia	NOx	1-50 MW	Natural gas		Existing	200
BE/Wallonia	NOx	1-5 MW	Natural gas		New	150
BE/Wallonia	NOx	5-20 MW	Natural gas		New	100
BE/Wallonia	NOx	20-50 MW	Natural gas		New	100
BE/Wallonia	NOx	1-5 MW	Biomass	clean wood	For existing plant. New plants = 400	500
BE/Wallonia	NOx	5-20 MW	Biomass	clean wood	For existing plant. New plants = 250	400
BE/Wallonia	NOx	20-50 MW	Biomass	clean wood	For existing plant. New plants = 250	400
BE/Wallonia	Dust	1-5 MW	Biomass	clean wood	For existing plant. New plants = 50	150
BE/Wallonia	Dust	5-20 MW	Biomass	clean wood	For existing plant. New plants = 20	50
BE/Wallonia	Dust	20-50 MW	Biomass	clean wood	For existing plant. New plants = 20	50

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
CZ	SO2	1-5 MW	Other solid fuels	Solid fuel		2500
CZ	SO2	5-20 MW	Other solid fuels	Solid fuel	800 in fluidised bed	2500
CZ	SO2	20-50 MW	Other solid fuels	Solid fuel	800 in fluidised bed	2500
CZ	SO2	1-50 MW	Biomass	Solid fuel		2500
CZ	NOx	1-5 MW	Other solid fuels	Solid fuel	Other furnace, biomass. 400mg/Nm3 for fluid combustion chamber	650
CZ	NOx	5-20 MW	Other solid fuels	Solid fuel		650
CZ	NOx	20-50 MW	Other solid fuels	Solid fuel		650
CZ	NOx	1-50 MW	Biomass	Solid fuel	Other furnace, biomass. 400mg/Nm3 for fluid combustion chamber	650
CZ	Dust	1-50 MW	Biomass	Solid fuel	Biomass	250
CZ	Dust	5-20 MW	Other solid fuels	Solid fuel	100mg/Nm3 for fluid combustion chamber	150
CZ	Dust	20-50 MW	Other solid fuels	Solid fuel	100mg/Nm3 for fluid combustion chamber	150
CZ	Dust	1-5 MW	Other solid fuels	Solid fuel		250
CZ	SO2	1-5 MW	Liquid fuels			1700
CZ	SO2	5-20 MW	Liquid fuels			1700
CZ	SO2	20-50 MW	Liquid fuels			1700
CZ	NOx	1-5 MW	Liquid fuels			500
CZ	NOx	5-20 MW	Liquid fuels			450
CZ	NOx	20-50 MW	Liquid fuels			450
CZ	Dust	1-5 MW	Liquid fuels			100
CZ	Dust	5-20 MW	Liquid fuels			100
CZ	Dust	20-50 MW	Liquid fuels			100
CZ	Dust	1-50 MW	Natural gas	Natural gas	Average 50-100 range	75
CZ	SO2	1-50 MW	Natural gas	Natural gas	Except for outside of public distribution networks	35

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
CZ	NOx	1-50 MW	Natural gas	Natural gas		200
PT	NOx	20-50 MW	Natural gas			500
PT	SO2	20-50 MW	Liquid fuels			500
PT	NOx	20-50 MW	Liquid fuels			500
PT	Dust	20-50 MW	Liquid fuels			150
PT	SO2	20-50 MW	Other solid fuels			500
PT	NOx	20-50 MW	Other solid fuels			500
PT	Dust	20-50 MW	Other solid fuels			150
PT	NOx	20-50 MW	Biomass			500
PT	Dust	20-50 MW	Biomass			150
CY	Dust	5-20 MW	Liquid fuels			100
CY	Dust	20-50 MW	Liquid fuels			100
CY	Dust	5-20 MW	Biomass			100
CY	Dust	20-50 MW	Biomass			100
CY	Dust	1-5 MW	Liquid fuels			150
CY	SO2	20-50 MW	Liquid fuels		Specific permit for ICE back up plants	565
CY	NOx	20-50 MW	Liquid fuels		Specific permit for ICE back up plants	1800
DE	SO2	1-50 MW	Natural gas			5
DE	NOx	1-50 MW	Natural gas		100 for boiler temperatures <110C and pressure <0.05MPa; 110 for boiler temperatures 110-210C and pressure 0.05-1.8 MPa; 150 for boiler temperatures >210C and pressure >1.8 MPa.	110
DE	Dust	1-50 MW	Natural gas			10
DE	SO2	1-50 MW	Other solid fuels		350 for fluidised bed furnaces	1300
DE	NOx	1-5 MW	Other solid fuels		300 for fluidised bed furnaces	500
DE	NOx	5-20 MW	Other solid fuels		300 for fluidised bed furnaces	400

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
DE	NOx	20-50 MW	Other solid fuels		300 for fluidised bed furnaces	400
DE	Dust	1-5 MW	Other solid fuels			50
DE	Dust	5-20 MW	Other solid fuels			20
DE	Dust	20-50 MW	Other solid fuels			20
DE	SO2	1-50 MW	Liquid fuels			850
DE	NOx	1-50 MW	Liquid fuels		180 for boiler temperatures <110C and pressure <0.05MPa; 200 for boiler temperatures 110-210C and pressure 0.05-1.8 MPa; 250 for boiler temperatures >210C and pressure >1.8 MPa.	200
DE	Dust	1-50 MW	Liquid fuels			50
DE	Dust	1-5 MW	Biomass			100
DE	Dust	5-20 MW	Biomass			20
DE	Dust	20-50 MW	Biomass			20
DE	NOx	1-50 MW	Biomass			250
DE	NOx	1-50 MW	Other gaseous fuels			200
DE	SO2	1-50 MW	Other gaseous fuels			350
FI	SO2	1-50 MW	Liquid fuels		New and existing	850
FI	NOx	1-5 MW	Liquid fuels		800 for new plants	900
FI	NOx	5-20 MW	Liquid fuels		800 for new plants	900
FI	NOx	20-50 MW	Liquid fuels		500 for new plants	600
FI	NOx	1-5 MW	Natural gas		340 for new plants	400
FI	NOx	5-20 MW	Natural gas		340 for new plants	400
FI	NOx	20-50 MW	Natural gas		200 for new plants	300
FI	NOx	1-5 MW	Other gaseous fuels		340 for new plants	400

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
FI	NOx	5-20 MW	Other gaseous fuels		340 for new plants	400
FI	NOx	20-50 MW	Other gaseous fuels		200 for new plants	300
FI	SO2	1-50 MW	Other solid fuels		850 for new plants	1100
FI	NOx	1-50 MW	Other solid fuels		270 for new plants	420
FI	Dust	1-5 MW	Other solid fuels			50
FI	Dust	5-20 MW	Other solid fuels		40 for new plants	50
FI	Dust	20-50 MW	Other solid fuels		40 for new plants	50
FI	SO2	1-50 MW	Biomass			200
FI	NOx	1-50 MW	Biomass		375 for new plants	450
FI	Dust	1-5 MW	Biomass		200 for new plants	300
FI	Dust	5-20 MW	Biomass		50 for 1-10MW new plants	150
FI	Dust	20-50 MW	Biomass		40 for new plants	50
FR	SO2	1-5 MW	Biomass			200
FR	SO2	5-20 MW	Biomass			200
FR	NOx	1-5 MW	Biomass			500
FR	NOx	5-20 MW	Biomass			500
FR	Dust	1-5 MW	Biomass			150
FR	Dust	5-20 MW	Biomass			100
FR	SO2	1-5 MW	Liquid fuels			1700
FR	SO2	5-20 MW	Liquid fuels			1700
FR	NOx	1-5 MW	Liquid fuels			550
FR	NOx	5-20 MW	Liquid fuels			500
FR	Dust	1-5 MW	Liquid fuels			150
FR	Dust	5-20 MW	Liquid fuels			100
FR	SO2	1-5 MW	Natural gas			35

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
FR	SO2	5-20 MW	Natural gas			35
FR	NOx	1-5 MW	Natural gas			200
FR	NOx	5-20 MW	Natural gas			150
FR	Dust	1-5 MW	Natural gas			5
FR	Dust	5-20 MW	Natural gas			5
FR	SO2	20-50 MW	Liquid fuels			1700
FR	NOx	20-50 MW	Liquid fuels			600
FR	Dust	20-50 MW	Liquid fuels			100
FR	SO2	20-50 MW	Natural gas			35
FR	NOx	20-50 MW	Natural gas			225
FR	Dust	20-50 MW	Natural gas			5
FR	SO2	20-50 MW	Biomass			2000
FR	NOx	20-50 MW	Biomass			600
FR	Dust	20-50 MW	Biomass			100
HU	SO2	1-50 MW	Natural gas		boilers	35
HU	NOx	1-50 MW	Natural gas		boilers	350
HU	Dust	1-50 MW	Natural gas		boilers	5
HU	SO2	1-50 MW	Liquid fuels		boilers	1700
HU	NOx	1-50 MW	Liquid fuels		boilers	450
HU	Dust	1-50 MW	Liquid fuels		boilers	80
HU	SO2	1-50 MW	Other solid fuels		boilers	2000
HU	NOx	1-50 MW	Other solid fuels		boilers	650
HU	Dust	1-50 MW	Other solid fuels		boilers	150
HU	SO2	1-50 MW	Biomass		boilers	2000

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
HU	NOx	1-50 MW	Biomass		boilers	650
HU	Dust	1-50 MW	Biomass		boilers	150
LV	SO2	20-50 MW	Natural gas			35
LV	NOx	20-50 MW	Natural gas			350
LV	Dust	20-50 MW	Natural gas			5
LV	SO2	20-50 MW	Liquid fuels			1700
LV	NOx	20-50 MW	Liquid fuels			450
LV	Dust	20-50 MW	Liquid fuels			50
LV	SO2	20-50 MW	Other solid fuels			2300
LV	NOx	20-50 MW	Other solid fuels			600
LV	Dust	20-50 MW	Other solid fuels			500
LV	SO2	20-50 MW	Biomass			200
PL	SO2	20-50 MW	Other solid fuels		800 for coke	1500
PL	NOx	20-50 MW	Other solid fuels			400
PL	Dust	20-50 MW	Other solid fuels			400
PL	SO2	20-50 MW	Biomass			800
PL	NOx	20-50 MW	Natural gas			300
PL	SO2	20-50 MW	Other gaseous fuels			800
PL	NOx	20-50 MW	Other gaseous fuels			300
PL	Dust	20-50 MW	Other gaseous fuels			10
RO	The details of the applicable legislation in Romania were provided too late to be included within the analysis.					
UK	SO2	20-50 MW	Natural gas			35
UK	NOx	20-50 MW	Natural gas			140

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
UK	Dust	20-50 MW	Natural gas			5
UK	SO2	20-50 MW	Other solid fuels		3000 for indigenous coal, 2000 for imported	2500
UK	NOx	20-50 MW	Other solid fuels		450 for stoker firing, 650 for other methods	550
UK	Dust	20-50 MW	Other solid fuels			300
UK	SO2	20-50 MW	Liquid fuels			1700
UK	NOx	20-50 MW	Liquid fuels		450 for HFO; 200 for distillates	325
UK	Dust	20-50 MW	Liquid fuels		150 for HFO; 100 for distillates	125
UK	SO2	20-50 MW	Biomass		as solid fuels	2500
UK	NOx	20-50 MW	Biomass		as solid fuels	550
UK	Dust	20-50 MW	Biomass		as solid fuels	300
SI	Dust	1-5 MW	Biomass			50
SI	Dust	5-20 MW	Biomass			20
SI	Dust	20-50 MW	Biomass			20
SI	Dust	1-5 MW	Other solid fuels			50
SI	Dust	5-20 MW	Other solid fuels			20
SI	Dust	20-50 MW	Other solid fuels			20
SI	NOx	1-50 MW	Biomass		new: 250 (Art 23 makes overriding exception for existing plant)	650
SI	NOx	1-5 MW	Other solid fuels		new: 400 (Art 23 makes overriding exception for existing plant)	650
SI	NOx	5-20 MW	Other solid fuels		new: 500 (Art 23 makes overriding exception for existing plant)	650
SI	NOx	20-50 MW	Other solid fuels		new: 500 (Art 23 makes overriding exception for existing plant)	650
SI	SO2	1-50 MW	Other solid fuels		new plants: 1300; existing plants (Art 23): 1700	1700
SI	Dust	5-20 MW	Liquid fuels			50
SI	Dust	20-50 MW	Liquid fuels			50

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
SI	NOx	1-50 MW	Liquid fuels		new plants: 180 for boiler temperatures <110C and pressure <0.05MPa; 200 for boiler temperatures 110-210C and pressure 0.05-1.8 MPa; 250 for boiler temperatures >210C and pressure >1.8 MPa. Overriding applicable ELV for existing plants (Art. 23)	300
SI	SO2	5-20 MW	Liquid fuels		new plants: 850 for fuels other than HFO; 1300 for HFO existing plants (Art 23): 1700	1700
SI	SO2	20-50 MW	Liquid fuels		new plants: 850 for fuels other than HFO; 1300 for HFO existing plants (Art 23): 1700	1700
SI	NOx	1-50 MW	Natural gas		new plants: 100 for boiler temperatures <110C and pressure <0.05MPa; 110 for boiler temperatures 110-210C and pressure 0.05-1.8 MPa; 150 for boiler temperatures >210C and pressure >1.8 MPa. Existing plants subject to overriding ELV in Art 23	200
SI	NOx	1-50 MW	Other gaseous fuels			200
SI	SO2	5-20 MW	Other gaseous fuels			50
SI	SO2	20-50 MW	Other gaseous fuels			50
SK	Dust	1-5 MW	Biomass		150 for 2.5MW to 7MW; 150 for 1 to 2.5MW new after 31.08.2009; 250 for 1 to 2.5MWth new before 31.08.2009	200
SK	Dust	5-20 MW	Biomass			150
SK	Dust	20-50 MW	Biomass			150
SK	NOx	1-50 MW	Biomass			650
SK	Dust	1-5 MW	Other solid fuels		150 for 2.5MW to 7MW; 150 for 1 to 2.5MW new after 31.08.2009; 250 for 1 to 2.5MWth new before 31.08.2009	200
SK	Dust	5-20 MW	Other solid fuels			100
SK	Dust	20-50 MW	Other solid fuels			100
SK	NOx	1-5 MW	Other solid fuels		400 for 2.5MW to 7MW; 650 for 1 to 2.5MW	525
SK	NOx	5-20 MW	Other solid fuels			400
SK	NOx	20-50 MW	Other solid fuels			400
SK	SO2	1-50 MW	Other solid fuels			2500
SK	SO2	1-50 MW	Liquid fuels			1700

Member State	Pollutant	Capacity class	Fuel	Fuel detail	Notes	limit value (mg/Nm3)
SK	NOx	1-5 MW	Liquid fuels			500
SK	NOx	5-20 MW	Liquid fuels			450
SK	NOx	20-50 MW	Liquid fuels			450
SK	Dust	1-50 MW	Liquid fuels			100
SK	NOx	1-50 MW	Natural gas			200
SK	SO2	1-50 MW	Other gaseous fuels		800 for biogas, and industrial gases	100
SK	NOx	1-50 MW	Other gaseous fuels			200

Appendix G
EU27 dataset on 1-50 MW_{th} combustion plants

This appendix presents the dataset on numbers, capacity, fuel consumption and emissions of combustion plants between $1MW_{th}$ and $50MW_{th}$ (at Member State level) as described in Section 4. The dataset comprises (i) data provided by Member States, (ii) data from existing studies on the sector, and (iii) data extrapolated from (i) and (ii).

Table G.3 Number of combustion plants

Member State	1-5MW$_{th}$	5-20MW$_{th}$	20-50MW$_{th}$	Total
AT	3,043	591	116	**3,750**
BE	2,926	904	147	**3,977**
BG	1,915	549	73	**2,536**
CY	172	36	3	**211**
CZ	4,068	748	175	**4,991**
DE	18,000	5,472	658	**24,130**
DK	7,111	2,037	271	**9,419**
EE	537	174	29	**740**
EL	300	86	11	**397**
ES	6,663	1,909	254	**8,826**
FI	136	140	133	**409**
FR	15,547	4,453	1,500	**21,500**
HU	2,256	646	86	**2,988**
IE	1,650	473	63	**2,186**
IT	7,188	2,059	274	**9,521**
LT	1,050	301	40	**1,391**
LU	157	45	6	**208**
LV	990	284	38	**1,311**
MT	172	36	3	**211**
NL	6,995	2,250	110	**9,355**
PL	6,322	1,811	241	**8,374**
PT	892	255	34	**1,181**
RO	790	370	146	**1,306**
SE	2,754	173	105	**3,032**
SI	2,018	168	18	**2,204**
SK	2,023	600	93	**2,716**
UK	11,831	3,389	451	**15,671**
EU27	**107,506**	**29,958**	**5,078**	**142,542**

Table G.4 Capacity of combustion plants (GW_{th})

Member State	1-5MW_{th}	5-20MW_{th}	20-50MW_{th}	Total
AT	7.0	6.9	3.7	**17.6**
BE	6.7	8.7	4.7	**20.1**
BG	4.4	4.9	2.3	**11.6**
CY	0.4	0.3	0.1	**0.7**
CZ	8.5	7.2	5.2	**20.9**
DE	41.4	48.7	22.5	**112.6**
DK	16.4	18.1	8.7	**43.2**
EE	1.2	1.8	1.0	**4.0**
EL	0.7	0.8	0.4	**1.8**
ES	15.3	17.0	8.1	**40.4**
FI	0.6	2.1	6.4	**9.1**
FR	35.8	39.6	48.0	**123.4**
HU	5.2	5.8	3.8	**14.8**
IE	3.8	4.2	2.0	**10.0**
IT	16.5	18.3	9.3	**44.2**
LT	2.4	2.7	1.3	**6.4**
LU	0.4	0.4	0.2	**1.0**
LV	2.3	2.5	1.2	**6.0**
MT	0.4	0.3	0.1	**0.7**
NL	21.0	23.0	3.7	**47.7**
PL	14.5	16.1	8.1	**38.8**
PT	2.1	2.3	1.2	**5.5**
RO	1.6	2.7	3.1	**7.4**
SE	6.3	1.8	3.0	**11.1**
SI	4.9	1.8	0.5	**7.1**
SK	4.3	5.4	2.8	**12.5**
UK	27.2	30.2	13.3	**70.7**
EU27	**251**	**273**	**165**	**689**

Table G.5 Total fuel consumption of combustion plants (PJ)

Member State	1-5MW$_{th}$	5-20MW$_{th}$	20-50MW$_{th}$	Total
AT	47	77	28	**152**
BE	45	97	36	**177**
BG	29	54	13	**97**
CY	1	1	1	**3**
CZ	79	217	30	**326**
DE	277	326	151	**754**
DK	109	202	86	**398**
EE	6	9	10	**25**
EL	5	9	4	**17**
ES	103	189	103	**395**
FI	9	16	37	**62**
FR	239	442	365	**1,046**
HU	35	64	29	**128**
IE	25	47	20	**92**
IT	111	204	93	**408**
LT	16	30	13	**59**
LU	2	4	1	**8**
LV	15	28	12	**56**
MT	1	1	1	**3**
NL	132	160	40	**332**
PL	97	180	55	**332**
PT	14	25	15	**54**
RO	11	30	23	**65**
SE	42	40	59	**142**
SI	33	20	4	**56**
SK	13	18	13	**43**
UK	182	336	123	**641**
EU27	**1,678**	**2,826**	**1,367**	**5,871**

Table G.6 Fuel consumption of 1-5MW$_{th}$ combustion plants (PJ)

Member State	Biomass (PJ)	Other solid fuel (PJ)	Liquid fuel (PJ)	Natural gas (PJ)	Other gaseous fuel (PJ)	Total
AT	16.4	0.0	0.0	30.5	0.0	**47**
BE	0.6	0.0	8.5	35.6	0.0	**45**
BG	2.6	0.0	7.3	19.5	0.0	**29**
CY	0.0	0.0	0.9	0.0	0.1	**1**
CZ	1.8	1.8	0.7	74.6	0.0	**79**
DE	75.0	18.0	35.0	142.0	7.0	**277**
DK	6.0	0.0	27.2	76.3	0.0	**109**
EE	2.1	0.1	1.2	2.4	0.2	**6**
EL	0.3	0.0	1.1	3.2	0.0	**5**
ES	3.4	0.0	17.4	81.8	0.0	**103**
FI	3.8	1.2	1.2	2.1	0.5	**9**
FR	36.6	4.9	51.3	136.8	9.8	**239**
HU	1.7	0.0	3.5	29.5	0.0	**35**
IE	2.8	0.0	12.6	10.1	0.0	**25**
IT	0.0	0.0	22.1	88.5	0.0	**111**
LT	0.9	0.0	5.3	10.0	0.0	**16**
LU	0.0	0.0	0.0	2.4	0.0	**2**
LV	6.4	0.0	1.5	7.3	0.0	**15**
MT	0.0	0.0	0.9	0.0	0.1	**1**
NL	1.0	1.0	0.0	130.0	0.0	**132**
PL	0.4	77.5	0.4	18.6	0.6	**97**
PT	4.0	0.0	3.6	6.1	0.0	**14**
RO	0.6	0.0	1.5	8.6	0.0	**11**
SE	30.3	9.3	0.6	2.2	0.0	**42**
SI	0.8	1.9	1.6	28.2	0.0	**33**
SK	0.7	0.5	0.0	11.2	0.2	**13**
UK	1.8	6.2	0.3	172.6	1.2	**182**
EU27	**200**	**122**	**206**	**1,130**	**20**	**1,678**

Table G.7 Fuel consumption of 5-20MW$_{th}$ combustion plants (PJ)

Member State	Biomass (PJ)	Other solid fuel (PJ)	Liquid fuel (PJ)	Natural gas (PJ)	Other gaseous fuel (PJ)	Total
AT	26.9	0.0	0.0	49.9	0.0	**77**
BE	1.2	0.0	18.4	77.1	0.0	**97**
BG	4.8	0.1	13.5	36.1	0.0	**54**
CY	0.0	0.0	0.6	0.0	0.1	**1**
CZ	1.8	1.1	0.4	214.0	0.0	**217**
DE	88.0	21.0	41.0	167.0	9.0	**326**
DK	11.0	0.0	50.3	140.8	0.0	**202**
EE	2.5	0.1	1.4	4.5	0.1	**9**
EL	0.5	0.0	2.1	5.9	0.0	**9**
ES	6.2	0.0	32.1	151.0	0.0	**189**
FI	4.4	1.5	5.5	4.0	0.6	**16**
FR	67.6	9.0	94.7	252.4	18.0	**442**
HU	3.2	0.0	6.4	54.5	0.0	**64**
IE	5.1	0.0	23.2	18.6	0.0	**47**
IT	0.0	0.0	40.8	163.4	0.0	**204**
LT	1.6	0.0	9.8	18.4	0.0	**30**
LU	0.0	0.0	0.0	4.5	0.0	**4**
LV	11.9	0.0	2.7	13.6	0.0	**28**
MT	0.0	0.0	0.6	0.0	0.1	**1**
NL	0.0	0.0	0.0	160.0	0.0	**160**
PL	0.7	143.0	0.7	34.3	1.0	**180**
PT	7.3	0.0	6.7	11.3	0.0	**25**
RO	1.6	0.0	4.2	24.5	0.0	**30**
SE	28.9	8.9	0.5	2.1	0.0	**40**
SI	0.5	1.2	1.0	17.2	0.0	**20**
SK	1.7	1.0	0.0	14.9	0.0	**18**
UK	3.3	11.4	0.6	318.7	2.3	**336**
EU27	**280**	**198**	**358**	**1,959**	**31**	**2,826**

Table G.8 Fuel consumption of 20-50MW$_{th}$ combustion plants (PJ)

Member State	Biomass (PJ)	Other solid fuel (PJ)	Liquid fuel (PJ)	Natural gas (PJ)	Other gaseous fuel (PJ)	Total
AT	9.9	0.0	0.0	18.3	0.0	**28**
BE	0.5	0.0	6.9	28.7	0.0	**36**
BG	1.2	0.0	3.3	8.8	0.0	**13**
CY	0.0	0.0	1.2	0.0	0.0	**1**
CZ	2.9	6.0	2.0	18.7	0.0	**30**
DE	10.0	13.0	6.0	117.0	5.0	**151**
DK	4.7	0.0	21.4	60.0	0.0	**86**
EE	2.8	0.3	0.7	2.1	4.2	**10**
EL	0.2	0.0	0.9	2.5	0.0	**4**
ES	3.4	0.0	17.5	82.5	0.0	**103**
FI	9.0	8.0	10.2	8.9	1.1	**37**
FR	55.9	7.4	78.2	208.6	14.9	**365**
HU	1.5	0.0	2.9	24.7	0.0	**29**
IE	2.2	0.0	9.9	8.0	0.0	**20**
IT	0.0	0.0	18.6	74.4	0.0	**93**
LT	0.7	0.0	4.2	7.8	0.0	**13**
LU	0.0	0.0	0.0	1.5	0.0	**1**
LV	5.2	0.0	1.2	6.0	0.0	**12**
MT	0.0	0.0	1.2	0.0	0.0	**1**
NL	0.0	0.0	0.0	40.0	0.0	**40**
PL	0.2	44.0	0.2	10.5	0.3	**55**
PT	4.4	0.0	4.0	6.7	0.0	**15**
RO	1.2	0.0	3.3	19.0	0.0	**23**
SE	28.0	17.7	4.0	9.6	0.0	**59**
SI	0.1	0.2	0.2	3.3	0.0	**4**
SK	3.1	1.9	0.0	7.5	0.0	**13**
UK	1.2	4.2	0.2	116.6	0.8	**123**
EU27	**148**	**103**	**198**	**892**	**26**	**1,367**

Table G.9 Emissions (kt) of combustion plants

Member State	SO2 emissions (kt)			NOX emissions (kt)			Dust emissions (kt)		
	1-5 MW	5-20 MW	20-50 MW	1-5 MW	5-20 MW	20-50 MW	1-5 MW	5-20 MW	20-50 MW
AT	0.0	0.0	0.0	3.0	3.7	1.4	0.3	0.4	0.2
BE	5.1	6.6	3.6	15.3	19.9	10.9	1.4	1.9	1.0
BG	3.5	6.5	1.6	3.9	7.1	1.5	0.5	1.0	0.2
CY	0.6	0.4	0.5	0.1	0.1	2.0	0.6	0.3	0.0
CZ	1.8	1.2	4.1	1.9	2.0	2.2	0.3	0.3	0.2
DE	10.9	12.9	6.0	23.1	27.2	12.6	1.4	1.6	0.8
DK	12.9	23.8	4.5	13.9	25.6	8.8	1.6	3.0	1.2
EE	4.4	0.6	4.0	0.6	0.8	0.5	1.1	1.0	1.4
EL	0.5	1.0	0.2	0.6	1.1	0.4	0.1	0.1	0.1
ES	8.2	15.2	1.5	11.6	21.4	4.1	1.0	1.9	0.4
FI	0.6	1.8	3.7	1.7	1.9	4.4	0.2	0.3	0.3
FR	8.8	9.7	8.0	17.2	19.1	10.3	1.8	2.0	2.5
HU	1.6	3.0	2.1	3.4	6.3	2.7	0.2	0.3	0.3
IE	6.0	11.0	2.1	4.3	7.9	2.2	0.8	1.4	0.6
IT	10.5	19.4	3.7	12.5	23.1	9.1	0.9	1.7	0.7
LT	2.5	4.6	0.9	2.2	4.1	1.3	0.3	0.5	0.2
LU	0.0	0.0	0.0	0.2	0.4	0.1	0.0	0.0	0.0
LV	0.7	1.3	0.5	2.3	4.3	1.5	0.6	1.1	0.5
MT	0.6	0.4	0.5	0.1	0.1	2.0	0.6	0.3	0.0
NL	0.9	0.0	0.0	8.6	11.7	1.6	0.2	0.0	0.0
PL	71.8	132.6	5.6	20.4	37.7	11.9	7.2	8.0	3.8
PT	1.7	3.2	0.6	2.2	4.0	2.1	0.5	0.9	0.4
RO	0.7	2.0	1.6	1.2	3.4	2.3	0.1	0.3	0.2
SE	8.9	8.5	18.3	9.1	2.9	3.8	3.4	2.9	3.5
SI	0.1	0.2	0.1	2.3	0.2	0.5	0.1	0.1	0.0
SK	0.1	0.3	0.2	0.7	1.2	0.8	0.3	0.2	0.1
UK	5.9	10.9	4.0	16.8	31.0	9.0	0.7	0.9	0.6
EU27	**170**	**277**	**78**	**179**	**268**	**110**	**26**	**32**	**19**