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Impacts of Revised Emission Limit Values for Large Combustion Plants on EU15 Countries' Emissions in the Year 2010

Principal Investigator: Dr. Markus Amann

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Sanna Syri, Rainer Kurz, Janusz Cofala, Markus Amann

1 Introduction

In 1998, the European Commission proposed a Directive (COM(98)415) to amend the emission limit values for large combustion plants of the Directive 88/609/EC. In order to provide a basis for an environmental impact analysis of the proposed emission limit values (ELV), a study was carried out to estimate the likely effects of the new ELVs on emissions in the year 2010. For this purpose a database was compiled containing data on fuel consumption and installed boiler capacities for large combustion plants for each of the 15 EU Member States. Combined with the energy use projections of the "Conventional Wisdom" scenario of DG XVII, the total resulting emissions can then be calculated. This report presents the methodology and material used in constructing the database and the results obtained.

Section 2 of the report describes the approach and data sources used for constructing the database on present and future large combustion plants in the 15 Member States of the European Union. Section 3 discusses two alternative methodologies for estimating SO_2 and NO_x emissions from these sources. Section 4 presents calculation results for the different age classes of plants and compares the results of the two calculation methods. Section 5 provides a rough economic estimate of the investments implied by the proposed revision of the emission limit values.

2 The Database on Large Combustion Plants

As outlined above, the main objective of this study was to derive estimates of SO_2 and NO_x emissions from large combustion plants for the year 2010, taking into account present and proposed future emission limit values for the various plant categories.

Due to the lack of a consistent information base on large combustion plants in Europe providing sufficient detail to estimate emissions, a comprehensive database had to be compiled distinguishing the various categories of plants for which different emission limit values are specified in the directives of concern. The construction of the database proceeded in two steps: first, a draft database was compiled using internationally published statistical sources. In the second step, this draft database was submitted by the European Commission to the individual Member States for review and corrections. The final database is therefore a result of published literature and the implementation of the comments received from the Member States.

Figure 2.1 presents a schematic diagram of the approach adopted for constructing the database. Two sectors, (i) the power plant and district heat sector and (ii) industrial boilers, are distinguished.

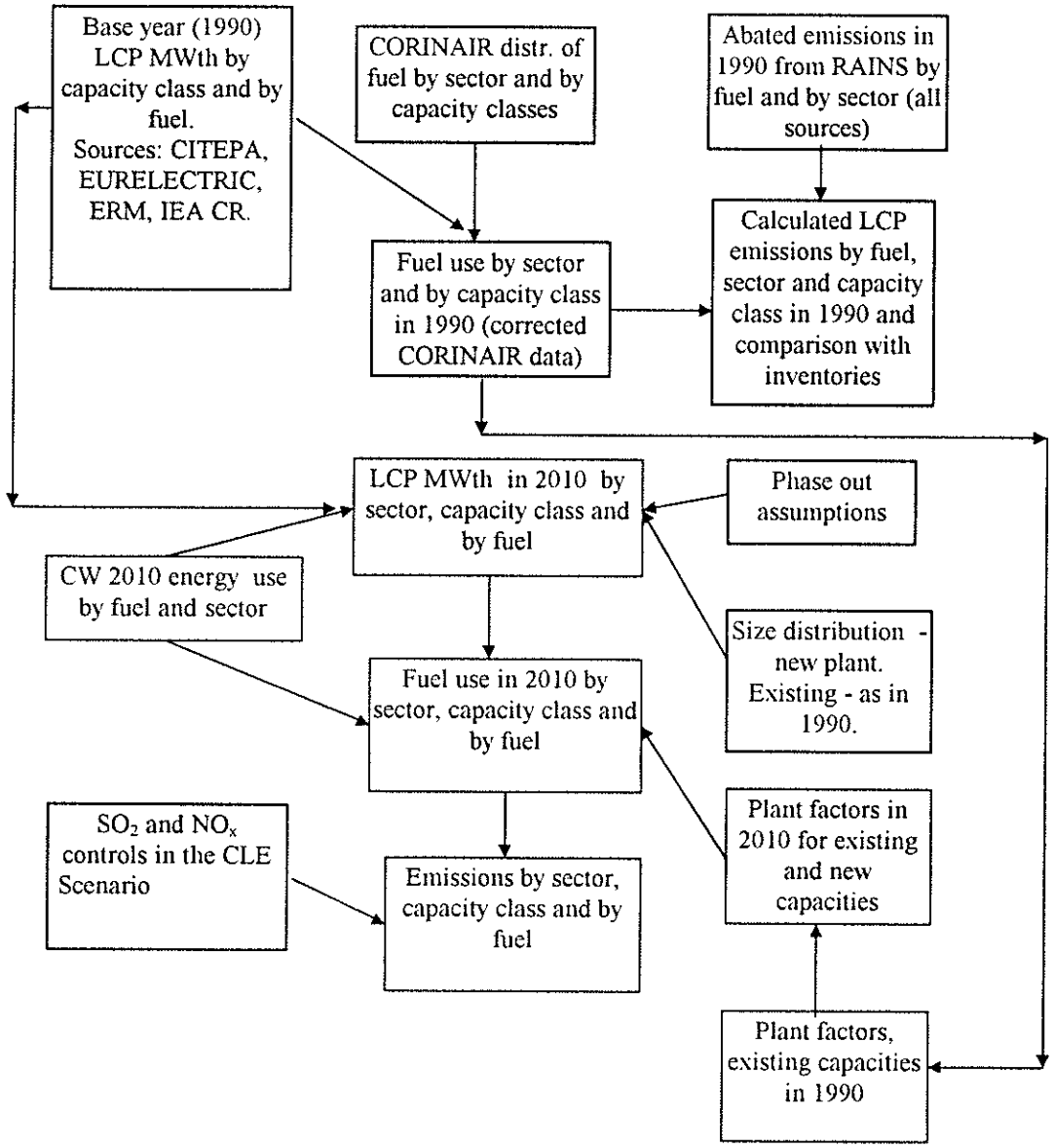

Figure 2.1. Flow of information for deriving the initial estimates on plant capacities, fuel use and future emissions from Large Combustion Plants

2.1 Large Combustion Plants in the Base Year 1990

2.1.1 Database Structure

In order to enable an accurate estimate of the impacts of the existing and proposed emission limit values, a database had to be constructed which distinguishes the plant categories, for which specific emission limit values are specified in the various Directives. Consequently, the database distinguishes large combustion plants in several dimensions for each of the 15 Member States:

- Fuel types:
  - Brown coal
  - Hard coal
  - Other solids
  - Heavy fuel oil
  - Gasoil
  - Natural gas (conventional boilers, gas turbines)

- Economic sectors:
  - Power plants
  - Industrial boilers

- Capacity classes:
  - 50-100 $MW_{thermal}$,
  - 100 - 300 $MW_{thermal}$, and
  - above 300 $MW_{thermal}$
- Age classes:
  - Start-up before 1987,
  - 1987-1999,
  - 2000-2010.

The structure of the LCP database is illustrated in Table 2.1.

Table 2.1. Structure of the data sheets of the LCP database. Such sheets are implemented for installed capacities, fuel consumption, emission limit values, installed control equipment, SO_2 emissions and NO_x emissions for the years 1990 and 2010.

A. Power plants and district heating plants

	Commissioning date								
	Before 1987			1987-1999			2000-2010		
	Capacity range, MWth								
	50-100	100-300	>300	50-100	100-300	>300	50-100	100-300	>300
Brown coal	...	...	...	...	...	...	...	...	...
Hard coal	...	...	...	...	...	...	...	...	...
Other.solid fuels	...	...	...	...	...	...	...	...	...
Heavy fuel oil	...	...	...	...	...	...	...	...	...
Gas	...	...	...	...	...	...	...	...	...
of which boilers	...	...	...	...	...	...	...	...	...
of which turbines	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...

B. Industrial boilers

	Commissioning date								
	Before 1987			1987-1999			2000-2010		
	Capacity range, MWth								
	50-100	100-300	>300	50-100	100-300	>300	50-100	100-300	>300
Brown coal	...	...	...	...	...	...	...	...	...
Hard coal	...	...	...	...	...	...	...	...	...
Other.solid fuels	...	...	...	...	...	...	...	...	...
Heavy fuel oil	...	...	...	...	...	...	...	...	...
Gas	...	...	...	...	...	...	...	...	...
of which boilers	...	...	...	...	...	...	...	...	...
of which turbines	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...

2.1.2 Data Sources

Basic information on installed boiler capacities has been extracted from the CITEPA survey compiled for the European Commission (Fontelle, 1994, 1996). For public power plants, additional data is available in the EURELECTRIC reports (EURELECTRIC, 1996, 1997), while for industrial boilers the estimates of the LCP study performed by ERM (ERM, 1996) were adopted.[1] Additional information on coal-fired boilers is reported in the IEA Coal Research power plant directory (McConville, 1997).

Unfortunately, information on multi-fuel firing plants is not fully and consistently available on the European level. In order to maintain consistency with the energy consumption statistics, some assumptions about the fuel use in few individual power plants had to be made.

[1] ERM estimated industrial capacities as the difference between total boiler capacities in a country and the boiler capacity in the power plant sector.

The resulting databases on capacity distributions and coal consumption in the base year were then used to verify and update the fuel consumption data (by sector and capacity class) and to estimate emissions from LCP (by fuel/sector/capacity class) in the year 1990. For the majority of countries the outcome of this procedure lies within a range of ± 10-15 percent compared to other available inventories (CORINAIR'90 and national LCP inventories), which is in the same order of magnitude as the differences among these inventories. Furthermore, from data on boiler capacities and fuel use, sector-, fuel-, and capacity class-specific plant factors (i.e., annual operating hours at full load) have been derived for the base year.

2.2 *Future Capacities and Fuel Consumption in Large Combustion Plants*

Obviously, any estimate of future emissions depends crucially on the development of the structure of the emission sources. Unfortunately, this will be influenced by a variety of factors and cannot be predicted with full accuracy. It has been therefore decided to adopt a clear and transparent procedure, and to openly present all underlying assumptions.

One of the most important factors determining future emissions from large combustion plants is their future rate of activity. This is strongly determined by overall economic development, and more specifically, by the structural composition of energy demand and supply in the future.

As mentioned above, the analysis in this study is based on the "Conventional Wisdom" (CW) energy pathway supplied by DG XVII of the European Commission. The CW scenario projects the developments of a variety of detailed parameters, such as economic and technological development, sectoral energy demand, evolution of the energy supply structure, etc., and from them derives a sectoral fuel consumption forecast. Thereby, the energy scenario provides the basic trends for the power/district heating plant sector and for industry. It indicates the need for capacity expansions (by fuel type), but unfortunately not by capacity classes. It must be mentioned, however, that since the original decision to construct the database for the Conventional Wisdom scenario, the agreements following the Kyoto conference will most likely modify future development of energy systems in Europe, and thereby also the evolution of energy supply structures.

One factor that has paramount importance on estimating future emissions from existing plants is the timing of the **phase-out of existing capacities**. Little information exists about current planning on this subject on the European level, and the formation of the common electricity market makes it even more difficult to accurately predict future development. The study assumes a generic assumption of a technical lifetime of 30 years for boilers in industry, 40 years for boilers in the power plant sectors, and a uniform age distribution profile of existing capacities.

Another important source of uncertainty when estimating future emissions from large combustion plants is the development of **plant factors (capacity utilization)** in the future. In cases when country-specific information was not available, an assumption was made that until the year 2010 plant factors for (existing and new) power plants will improve by 10 percent compared to 1990 values. This improvement is likely to be

achieved by better load management. No change in the capacity utilization has been assumed for industrial boilers.

Very little precise knowledge is available on the expected **size distributions** of presently existing and expected new capacities in the year 2010. For currently existing power plants still in operation in 2010, and for new industrial boilers, it has been assumed that the size distribution will remain the same as in 1990. The country- and sector-specific size distributions for new power plants were assumed to be the same as the presently existing distributions, with the exception that net increases in the capacities of fossil fuelled plants would fall into the category of > 300 MW_{th}. For new plants using biomass it has been assumed that two thirds of total new capacities will belong to the LCP category (i.e., larger than 50 MW_{th}), of which half will have unit capacities between 50–100 MW_{th} and half between 100–300 MW_{th}.

A further uncertainty relates to the future market penetration of gas turbines. While the energy scenario explicitly specifies the total amount of future gas use for power generation, it does not distinguish conventional boilers and gas turbines. In the absence of consistent EU-wide estimates on this issue, an assumption was made that 75 percent of the new capacities using natural gas in the power sector will be gas turbines, unless specific national information was available. For the industrial sector it was assumed that gas turbines reach a market share of 30 percent for new installations. Together with the above mentioned assumptions on annual operating hours, the calculation results for the year 2010 resulted in a total (new and currently existing) stock of 290 GW_{th} of gas turbines in the 15 EU countries.

These assumptions, together with the projected sectoral fuel use from the Conventional Wisdom scenario, make it possible to calculate LCP capacities and fuel use for the year 2010, distinguishing sector, capacity class and fuel. The results of such calculations for the EU15 countries are presented in Appendix 1.

2.3 National Comments to the LCP Database

Following the procedure outlined above, generic databases on plant capacities and fuel use in the years 1990 and 2010 have been compiled.

During the consultations on the Revision of the Large Combustion Plant Directive in 1997, the draft databases were distributed to Member States and the European Commission invited comments and corrections. Responses are listed in Table 2.2.

It turned out that many of the countries found it difficult to provide detailed estimates for the year 2010, and many of the supplied projections on fuel use were inconsistent with the CW scenario of DG XVII. In some cases the fuel use and capacity estimates provided by countries did not produce plausible capacity utilization figures. Due to these reasons many of the national comments had to be adjusted further.

Concerning the current and projected shares of gas turbines, only Finland, Ireland and Luxembourg provided national information. Therefore, EURELECTRIC (1997) was also

in estimating the shares of gas turbines in EU15 countries in 1990. However, for many countries the fuel-specific total capacities given in EURELECTRIC (1997) were quite different from national comments received in the context of this study. Thus, the projections on future gas turbine capacities rely mainly on the general assumptions stated in the previous section and on the fuel use predictions of the Conventional Wisdom Scenario.

Table 2.2. National responses to the draft LCP database.

	Comments received on:				
Country	Capacities 1990	Fuel use 1990	Capacities 2010	Fuel use 2010	No response
Austria	x	x	x	x	
Belgium	x	x	x	x	
Denmark					x
Finland	x	x	x	x	
France			-		x
Germany	x (without distribution to fuels)	x (sums for all power plants)	-	-	
Greece	x		x	x	
Ireland	x	x			
Italy			x	x	
Luxembourg	x	x	x	x	
Netherlands					x
Portugal	x	x	x	x	
Spain					x
Sweden					x
UK					x

3 Estimating SO_2 and NO_x Emissions from Large Combustion Plants

In those cases where emissions cannot be directly monitored at all sources it is standard practice to estimate emission volumes by multiplying so-called activity rates with appropriate emission factors. While in many cases it is possible to determine activity rates with reasonable accuracy, the selection of an appropriate and representative emission factor can introduce considerable uncertainties into the calculations.

In the case of large combustion plants, activity rates are available from the databases described in the preceding section. Depending on the purpose of the calculation, representative emission factors could either

- illustrate the theoretical maximum emissions resulting from a precise operation of emission control equipment **exactly at** the emission limit values, or
- predict future emissions taking into account the **empirically observed behavior** of plant operators when they have to comply with certain emission limit values.

For these two cases slightly different approaches for estimating emissions are required, which are explained further in the following sections.

3.1 The Strict Interpretation: Operating Emission Control Equipment Exactly at the Emission Limit Value

At least in theory, emission control equipment could be permanently operated exactly at the proposed emission limit value (ELV_{max}). In such a case, total emissions from a source would be calculated as

$$\textit{Total emissions} = \textit{Activity rate [PJ]} * ELV_{max}\ [mg/m^3] * \textit{flue gas volume}\ [m^3/PJ]$$

The emission limit values of the COM(98)415 proposed Directive on Large Combustion Plants and the corresponding emission factors ELV_{max} used in the further analysis are summarized in Tables 3.1 and 3.2 for SO_2 and NO_x respectively. In cases when emission limit values are expressed as a function of boiler size, the arithmetic average of the appropriate range was used.

Table 3.1. Emission limit values for SO_2 proposed by the COM(98)415 proposed Directive (summary).

Capacity range (MW_{th})	50-100	100-300	>300
Emission limit values expressed in mg SO_2/Nm^3			
Solid fuels [1]	850	525	200
Liquid fuels [2]	850	525	200
Natural gas [2]	35	35	35
Resulting emission factors expressed in kt SO_2/PJ			
Solid fuels [1]	0.298	0.184	0.070
Liquid fuels [2]	0.238	0.147	0.056
Natural gas [2]	0.009	0.009	0.009

1) 6 % O_2 content 2) 3 % O_2 content 3) 15 % O_2 content

Table 3.2. Emission limit values for NO_x proposed by the COM(98)415 proposed Directive (summary).

Capacity range (MW_{th})	50-100	100-300	>300
Emission limit values expressed in mg NO_x/Nm^3			
Solid fuels [1]	400	300	200
Liquid fuels [2]	400	300	200
Natural gas - boilers [2]	150	150	100
Natural gas - turbines [3]	50	50	50
Resulting emission factors expressed in kt NO_x/PJ			
Solid fuels [1]	0.140	0.105	0.070
Liquid fuels [2]	0.112	0.084	0.056
Natural gas - boilers [2]	0.041	0.041	0.027
Natural gas - turbines [3]	0.041	0.041	0.041

1) 6 % O_2 content 2) 3 % O_2 content 3) 15 % O_2 content

3.2 *The Empirical Approach: Reflecting the Observed Behavior of Plant Operators*

3.2.1 Operating Experience

Experience shows that plant operators usually operate equipment in such a way that the long-term average concentrations of pollutants in the flue gas are significantly below the required emission limit values (Ekono Energy, 1998; Lange, 1997). From discussions with plant operators in several countries a number of reasons for this operation mode emerged:

- In all cases plant operators are interested in maintaining a certain safety margin to the imposed emission limit values so that unexpected events (e.g., short-term changes in fuel quality, failure of parts of the equipment, etc.), would not lead to an interruption of the electricity production. In practice, safety margins between 20 and 40 percent were quoted.
- In some countries, the existence of emission fees (for remaining emissions) makes it economically interesting to maximize the control efficiency in order to minimize the charges and to abate more emissions than is required by the emission limit value alone. There are significant cost savings to be made, since the additional operating costs of increased emission control efficiencies (within the technical design efficiency) are relatively small. For instance, the removal of an additional percent of SO_2 emissions in FGD installations increases total desulfurization costs between 0.1 and 0.2 percent.
- Since additional costs are small, some operators also mentioned an interest in improving/maintaining a positive public opinion about the environmental performance of their company. For instance, operators of large power stations are interested in removing their plant from published lists of the worst polluters in a country.
- Frequently it is good engineering practice to operate existing technical equipment at the best possible mode.

It is important to note that such an over-fulfillment of emission limit values is not only a micro-economic feature, but is clearly confirmed by official emission inventories also on a national scale. For instance, the latest German inventory on the emissions of large combustion plants reports SO_2 emissions of 295 kt for the "old Länder" for the year 1990 (UBA, 1998). Calculating emissions based on German emission limit values in force, however, would result in total emissions of 525 kt. Similar situations for many other countries are documented in the CORINAIR inventories.

3.2.2 Simulating the Operating Experience

This study attempts to simulate the observed operating experience by assuming that imposed emission limit values determine the required level of emission control and thereby essentially also the type of emission control measures. As documented in all the available emission statistics, the "starting" situation for emission control (e.g., sulfur content, fuel quality, etc.), varies greatly over Europe. Furthermore, standard emission control equipment is usually designed to operate in a limited range of removal efficiency. Consequently, a given emission control technology, if operated at its standard design efficiency, will in many cases not result in exactly the pollutants concentrations in the flue gas required by the emission limit value, but will overachieve the legal requirement to some extent.

In order to simulate this effect, the empirical approach starts, for each source category in each country, from the uncontrolled situation (e.g., as implied by the fuel quality) and determines the type of abatement measures determined (e.g., combustion modification, flue gas desulfurization, use of low sulfur fuels) sufficient to meet given emission limit values. In a second step it is assumed that the selected emission control technology will be operated at its typical removal efficiency, accepting that this might result in lower emissions than implied by a strict interpretation of the emission limit values. Experience shows that the emission estimates produced by this empirical approach are in close agreement, e.g., with the CORINAIR emission inventory for the year 1990.

The implementation of the empirical approach for this study relies to a large extent on the databases and methodologies of the RAINS (Regional Air Pollution Information and Simulation) model. The RAINS methodology uses information from the CORINAIR emission inventory to capture the country- and sector-specific fuel parameters influencing the emissions and combines this with information about technical and economic features of emission control technologies required by the present legislation in a particular country.

The following provides a brief description of the methodology and data sources of the RAINS model.

3.2.3 The "RAINS" Methodology to Estimate Emissions

The basic resolution of the emission and cost databases of the RAINS model is the country-level. For each country, the activities generating sulfur and nitrogen oxides emissions are defined according to economic sectors and fuels used in each sector. The following sectors are distinguished in the RAINS database:

- centralized power plants and district heating (PP),
- fuel conversion other than power plant (CON),
- domestic, commercial and agricultural use (DOM),
- transportation (TRA),
- industrial (IN),
- non-energy use - feedstocks (NONEN) and
- other emission sources (OTHER).

If necessary, sectors are further disaggregated into sub-sectors, as shown in Table 3.3. The main reason for distinguishing parts of sectors is that emission factors, applicabilities and effectiveness of control technologies are not always uniform for entire sectors.

Table 3.3. RAINS sectors of the SO_2/NO_x modules for stationary sources considered in this study and their relation to the main activity groups of the CORINAIR'90 inventory.

RAINS sectors		CORINAIR SNAP code
Primary	Secondary	
Power plants and district heating plants (PP)	New boilers (PP_NEW) Existing boilers, wet bottom (PP_EX_WB) Existing boilers, dry bottom (PP_EX_OTH)	01
Fuel production and conversion (other than power plant) (CON)	Combustion (CON_COMB) Losses (CON_LOSS)	0103 to 0105, 05
Industry (IN)	Combustion in boilers, gas turbines and stationary engines (IN_BO)	0301
	Other combustion (IN_OC)	03 excl. 0301

Annual SO_2 and NO_x emissions are determined based on sectoral fuel consumption. Emissions are calculated with the help of country- and fuel-specific unabated emission factors. For SO_2, these depend on fuel-specific heat values, sulfur contents of the fuels and amount of sulfur retained in ash. In addition, the control technologies applied in each country and their reduction efficiencies are used in determining the annual SO_2 and NO_x emissions from each country. The fuel quality parameters and resulting unabated emission factors for SO_2 are presented in Cofala and Syri (1998).

For the reduction of SO_2 emissions from large combustion plants, RAINS represents the possible future emission reductions and related costs by four categories of measures:

- the use of low sulfur fuels (low sulfur coal and coke, low sulfur heavy fuel oil, low sulfur gas oil), including fuel desulfurization,
- in-furnace control of SO_2 emissions (e.g., through limestone injection or fluidized bed combustion) with removal efficiencies of 50 to 60 percent and relatively low investment costs,
- conventional wet flue gas desulfurization with typical sulfur removal rates between 85 and 95 percent at moderate costs, and
- advanced (regenerative) methods for capturing sulfur from the flue gases with emission reductions of up to 98 percent and relatively high costs.

A list of the control options for SO_2 emissions from large combustion plants, their removal efficiencies is provided in Table 3.4.

Table 3.4. Emission control options for SO_2 in the power plant and industrial sector considered in RAINS.

Sector/control option	Removal efficiency
Retrofit of existing boilers (power plants)	
Limestone injection	60 %
Wet flue gas desulfurization (FGD) - boilers already retrofitted in the base year	90 %
Wet flue gas desulfurization (FGD) - boilers not yet retrofitted	95 %
Regenerative flue gas desulfurization	98 %
New boilers (power plants)	
Limestone injection	60 %
Wet flue gas desulfurization (FGD)	95 %
Regenerative flue gas desulfurization	98 %
Industrial boilers and furnaces	
Limestone injection	60 %
Wet flue gas desulfurization (FGD)	85 %

In order not to interfere with general energy policy, the potential of structural changes of the energy system, particularly fuel substitution (such as the replacement of coal by natural gas), is excluded from consideration in the RAINS model.

For the reduction of NO_x emissions from large combustion plants, the following options are taken into account:

- primary measures through combustion modification (CM), such as staged combustion, exhaust gas recirculation, low-NO_x burners, etc.,
- selective catalytic reduction (SCR),
- combustion modification together with selective catalytic reduction (CM+SCR), and
- combustion modification together with selective non-catalytic reduction (CM+SNCR).

The efficiencies of these options depend on fuel type (i.e., brown coal, hard coal, liquid and gaseous fuels) and sector (power generation, industrial combustion). The efficiencies used are shown in Table 3.5.

Table 3.5. NO_x control options and their removal efficiencies.

	Brown coal	Hard coal	Liquid fuels	Gaseous fuels
		Power plant sector		
Combustion Modification (CM)	65 %	50 %	65 %	65 %
CM + Selective Catalytic Reduction (SCR) - existing plants	80 %	80 %	80 %	80 %
SCR, new plants *)	80 %	80 %	80 %	80 %
		Industry, conversion sector		
Combustion Modification (CM)	50 %	50 %	50 %	50 %
CM + Selective Catalytic Reduction (SCR)	80 %	80 %	80 %	80 %
CM+Selective Non-catalytic Reduction	70 %	70 %	70 %	70 %

*) Combustion modification measures are assumed by default. Thus, new plants have lower unabated emission factors.

3.2.4 The Reference Case: Current Legislation for the Year 2010

A crucial point in estimating the impacts of revised emission limit values for large combustion plants in the year 2010 is the exact description of the reference situation, i.e., the case without the stricter emission limit values proposed by the COM(98)415 proposed Directive.

To derive a realistic expectation about emissions in the year 2010 and to implement the empirical approach, it is necessary to review for each country the emission related legislation expected to be in force in the year 2010 and to derive from it the likely emission control measures.

In practice, the analysis considers the national legislation in force in the individual countries, international regulations imposed, e.g., by Community legislation, and obligations contained in the various protocols to the Convention on Long-range Transboundary Air Pollution. The starting point for the analysis is a detailed inventory of present regulations on emission controls. Surveys on national legislation are available in Bouscaren & Boucherau (1996), and McConville (1997). In addition to the legislation in the individual European countries, the following international regulations were considered:

- The "Large Combustion Plant Directive" 88/609/EC (OJ, 1988) of the European Union,

- the directives on sulfur content of liquid fuels (Johnson & Corcelle, 1995; COM(97)88) of the European Union,
- the obligatory clauses on emission standards of the protocols under the Convention on Long-range Transboundary Air Pollution (for instance, the Second Sulfur Protocol (UN/ECE, 1994) requires emission control according to "Best Available Technology" (BAT) for new plants).

These legal requirements were then translated into the emission control options distinguished in the RAINS model (Amann *et al.*, 1998) (see Tables 3.6 for SO_2, and Table 3.7 for NO_x emissions).

Concerning gas turbines, it was assumed in the CLE scenario that all gas turbines would be equipped with primary combustion modification measures to limit NO_x emissions. According to Arigho and Cleirigh (1997), typical gas turbine emissions with low NO_x combustion are between 55–260 mg/Nm^3 (3% O_2). The NO_x emission factors for gas turbines with combustion modifications used in this study for existing gas turbines were on the conservative side of the range given in Arigho and Cleirigh (1997), between 180–260 mg/Nm^3 (3% O_2).

Table 3.6. Measures assumed for the "Current Legislation" (CLE) scenario for SO_2 emissions from large combustion plants.

Country Capacity class, MW_{th}	New plants Coal	 Oil	Existing plants Coal	 Oil
Austria				
50 - 300	FGD	FGD	FGD/LSCO(1)	LSHF
> 300	FGD	FGD	FGD	FGD
Belgium (6)				
Coal	Oil			
50 - 100	50 - 300	LSCO	LSHF	LSCO	LSHF
100 - 500	300 - 500	LSCO/FGD(2)	FGD	LSCO	FGD
>500	>500	FGD	FGD	LSCO	FGD
Denmark(6):				
Coal	Oil			
50 - 100	50 - 300	LSCO	LSHF	LSCO	LSHF
100 - 500	300 - 500	FGD	FGD	FGD	FGD
>500	>500	FGD	FGD	FGD	FGD
Finland(6):				
50 - 200		FGD	FGD	FGD	FGD
>200		FGD	FGD	FGD	FGD
France:				
Coal	Oil			
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	FGD	-	-
>500	>500	FGD	FGD	-	-
Germany(6):				
50 - 100		LSCO	LSHF	LSCO	LSHF
100 - 300		FGD	FGD	FGD	FGD
> 300		FGD	FGD	FGD	FGD
Greece:				
Coal	Oil			
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	LSHF	-	-
>500	>500	FGD	FGD	-	-
Ireland(6)				
Coal	Oil			
50 - 100	50 - 300	LSCO	LSHF	LSCO	-
100 - 500	300 - 500	LSCO/FGD(2)	FGD	LSCO	-
>500	>500	FGD	FGD	LSCO	-

Table 3.6. (*Continued.*) Measures assumed for the "Current Legislation" (CLE) scenario for SO_2 emissions.

Country		New plants		Existing plants	
Capacity class, MW_{th}		Coal	Oil	Coal	Oil
Italy:					
Coal	Oil				
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	FGD	-	-
>500	>500	FGD	FGD	FGD	-
Luxembourg(6):					
Coal	Oil				
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	FGD	-	FGD
>500	>500	FGD	FGD	-	FGD
Netherlands:					
<300(3)		FGD	FGD	LSCO/FGD	LSHF/FGD
>300		FGD	FGD	FGD	FGD
Portugal:					
Coal	Oil				
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	LSHF	-	-
>500	>500	FGD	FGD	-	-
Spain:					
Coal	Oil				
50 - 100	50 - 300	LSCO	LSHF	-	-
100 - 500	300 - 500	LSCO/FGD(2)	LSHF	-	-
>500	>500	FGD	FGD	-	-
Sweden:					
<50		FGD (4)	FGD (5)	FGD (4)	FGD (5)
>50		FGD	FGD	FGD	FGD
UK(6):					
Coal	Oil				
50 - 100	50 - 300	LSCO	LSHF	LSCO	-
100 - 500	300 - 500	LSCO/FGD(2)	FGD	LSCO	-
>500	>500	FGD	FGD	FGD	FGD

(1) Lignite/hard coal
(2) Below 300 MW_{th}/above 300 MW_{th}
(3) Includes also sources below 50 MW_{th}
(4) Requires at least 70 % desulfurization when low sulfur coal (0.8 % S) is used
(5) Requires at least 50 % desulfurization when low sulfur fuel oil (0.8 % S) is used
(6) Emissions determined by the national emission ceiling from the Second Sulfur Protocol

Explanations of abbreviations:

FGD - Flue gas desulfurization
LSCO - Low sulfur coal
LSHF - Low sulfur heavy fuel oil
Stage 1,2,3 - Abatement technologies for process emissions

Table 3.7. NO_x emission control measures in the EU15 for stationary sources in the CLE scenario for large combustion plants.

Country	New plants			Existing plants		
Capacity class, MW_{th}	Coal	Oil	Gas	Coal	Oil	Gas
Austria						
10 - 50	CM	CM	CM	-	-	-
50 - 300	CM/SCR(1)	SCR	SCR	CM	CM	CM
> 300	SCR	SCR	SCR	SCR	SCR	SCR
Belgium						
>50	SCR (4)	CM	CM	CM	CM	CM
Denmark:						
>50	SCR	SCR	CM/SCR(2)	CM	CM	CM
Finland:						
50 - 150	CM	CM	CM	CM	CM	-
150 - 300	SCR	CM	SCR	CM	CM	-
>300	SCR	SCR	SCR	CM	CM	CM
France:						
>50	CM	CM	CM	CM	CM	-
Germany:						
50 - 100	CM	CM	-	CM	CM	-
100 - 300	CM	CM	CM	CM	CM	CM
> 300	CM/SCR (1)	SCR	SCR	CM/SCR (1)	SCR	SCR
Greece:						
>50	CM	CM	CM	CM	CM	-
Ireland:						
>50	CM	CM	CM	CM	-	-
Italy:						
50 - 300	CM	CM	CM	-	-	-
>300	SCR	CM/SCR (2)	CM/SCR (2)	SCR	CM	CM
Luxembourg:						
>50	CM	CM	CM	CM	CM	CM
Netherlands:						
<300(3)	SCR	SCR	SCR	CM	CM	CM
>300	SCR	SCR	SCR	CM/SCR	CM	CM
Portugal:						
>50	CM	CM	CM	CM	-	-
Spain:						
>50	CM	CM	CM	CM(4)	CM(4)	CM(4)
Sweden:						
<50	CM	CM	CM	CM	CM	CM
50 - 150	SCR	SCR	SCR	CM	CM	CM
>150	SCR	SCR	SCR	SCR	SCR	SCR
UK:						
>50	CM	CM	CM	CM	CM	-

(1) for lignite/hard coal (2)- Standard slightly below of what is achievable with CM (3) includes also sources below 50 MWth
(4) only in the power plant sector

3.2.5 Additional Measures Implied by the COM(98)415 proposed Directive

It has been argued in Section 3.2 that a closer examination of the operating experience of emission control equipment suggests that prescribed emission limit values induce the selection of the technological solution to control emissions. Once this decision is made and the appropriate equipment is installed, experience indicates that this equipment is usually operated at its technical design efficiency, often resulting in significantly lower emissions than prescribed through the limit value.

Following this line of argument, the question arises to what extent the stricter emission limit values of the new Large Combustion Plant Directive would, in practice, require the construction of additional (or more efficient) emission control technologies. These additional controls would then contribute to lower emissions of the sector and possibly go beyond what is strictly implied by the new emission limit value. On the other hand, emission statistics indicate that in many cases the presently installed equipment (perhaps with minor modifications) will already suffice to meet the new emission limit values.

In order to quantify the possible magnitude of this effect, an attempt has been made to compare the situation of the current legislation case with the new emission limit values for each country, and to identify sectors where investments into additional emission controls seem necessary in order to comply with the new standards. It must be pointed out that the additional measures listed in Tables 3.8 and 3.9 are calculated based on the controls of the CLE scenario, their typical efficiencies and the limit values of the COM(98)415 proposed Directive, **independent of the actual fuel use scenario**. This means that, even if the Conventional Wisdom scenario used in the study predicts zero fuel use for a certain country, the additional controls needed to fulfill the COM(98)415 are listed in the table. The additional investment costs reported in Section 5 are calculated based on the capacities implied by the CW scenario.

Table 3.8. Estimate of measures case for SO_2 emissions implied on top of the "Current Legislation" (CLE) by the emission limit values of the new Large Combustion Plant Directive.

	New plants	
	Solid fuels	Oil
Austria		
50-100	-	-
100-300	-	-
> 300	FGD (other solids)	-
Belgium		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	-
Denmark		
50-100	FGD	-
100-300	-	FGD
> 300	-	-
Finland		
50-100	-	-
100-300	-	-
> 300	Low sulfur fuel (other solids)	-
France		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	-
Germany		
50-100	FGD	FGD
100-300	-	-
> 300	-	-
Greece:		
50-100	-	FGD
100-300	-	FGD
> 300	-	-
Ireland		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	-
Italy		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	-
Luxembourg	-	-
Netherlands	-	-
Portugal		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	FGD
Spain		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	FGD
Sweden	-	-
UK		
50-100	FGD	FGD
100-300	FGD	FGD
> 300	-	-

Table 3.9. Estimate of measures for NO_x emissions implied by the new Large Combustion Plant Directive on top of the "Current Legislation" (CLE) case.

Country Capacity class, MW_{th}	New plants Coal, other solid fuels	Oil	Gas
Austria			
50-100	-	-	-
100-300	SCR (for other solids)	-	-
> 300	-	-	-
Belgium			
50-100	-	-	-
100-300	-	SCR	SCR
> 300	-	SCR	SCR
Denmark			
50-100	-	-	-
100-300	-	-	-
> 300	-	-	-
Finland			
50-100	-	-	-
100-300	-	SCR	-
> 300	-	-	-
France			
50-100	SCR	-	-
100-300	SCR	-	-
> 300	SCR	SCR	SCR
Germany			
50-100	-	-	CM
100-300	SCR	-	SCR
> 300	-	-	-
Greece			
50-100	-	-	-
100-300	SCR	-	-
> 300	SCR	SCR	-
Ireland			
50-100	-	-	-
100-300	SCR	-	-
> 300	SCR	SCR	SCR

Table 3.9. *(Continued.)* Estimate of measures for NO_x emissions implied by the new Large Combustion Plant Directive on top of the "Current Legislation" (CLE) case.

Capacity class, MW_{th}	New plants		
	Coal, other solid fuels	Oil	Gas
Italy			
50-100	SCR	-	SCR
100-300	SCR	SCR	SCR
> 300	-	-	SCR
Luxembourg			
50-100	-	-	-
100-300	-	-	-
> 300	-	-	SCR
Netherlands	-	-	-
Portugal			
50-100	-	-	-
100-300	-	-	-
> 300	SCR	-	SCR
Spain			
50-100	-	-	-
100-300	-	-	SCR
> 300	SCR	SCR	SCR
Sweden	-	-	-
UK			
50-100	-	-	-
100-300	SCR	-	-
> 300	SCR	SCR	SCR

4 Emissions from Large Combustion Plants in the Year 2010

This section presents emission estimates for large combustion plants for the year 2010. As indicated in Section 2 on the LCP database, the stock of large combustion plants is differentiated according to economic sectors, fuel type, boiler size and age. Since different emission regulations apply to the various plant vintages, the following estimates distinguish

- plants, which came in operation before 1987, i.e., the "existing" plants according to the definition of the 88/609/EC Directive,
- plants with start-ups between 1987 and 1999, which are subject to the ELVs for "new" plants of the 88/609/EC Directive, and
- plants expected to come into operation from the year 2000 onwards, for which the ELVs of the COM(98)415 proposed Directive applies.

4.1 Emissions from Plants Commissioned Before 1987

For the plants built before 1987 two types of calculations were carried out: using the empirical approach, the first assessment estimates the emissions resulting from this category, if the current practice of plant operators is applied to existing national and international regulations (the "Current Legislation" - CLE - case). The emission controls listed in Tables 3.6 and 3.7, together with the respective penetration rates of the control equipment as contained in the database, were applied to the activity rates of the Conventional Wisdom energy scenario. For comparison, the empirical approach was repeated for the revised emission limit values, assuming the emission control measures listed in Tables 3.8 and 3.9.

Alternatively, calculations have been performed for a hypothetical case if the existing plants were subject to the ELVs of the 88/609/EC Directive. It has to be stressed that this calculation is purely theoretical, since the 88/609/EC does not specify emission limit values for this "existing" group of plants. (The directive imposed national caps on the total emissions of these plants, which is however not analyzed further here.) This calculation is then compared to a strict interpretation of the ELVs contained in COM(98)415.

The results for SO_2 shown in Table 4.1 illustrate that in many cases national regulations on existing plants and the observed practice of the operators produces significantly lower emissions than a strict implementation of the ELVs for new plants specified in the 88/609/EC Directive. For the EU15 as a whole, however, SO_2 emissions from this group of plants would be 14 percent lower than expected from current legislation. Using the empirical approach, a hypothetical application of the proposed COM(98)415 ELVs would decline these emissions by 83 percent compared to the current legislation case. It must be stressed that also this calculation was done to illustrate the significance of existing plants in total LCP emissions, on the one hand, and the differences between Directive 88/609/EC and proposal COM(98)415, on the other hand. Neither of these texts specify emission limits for existing plants. The results for NO_x are given in Table 4.2.

Table 4.1. SO_2 emissions in the year 2010 from the plants built before 1987 (in kilotons). The meaning of the columns is explained in the preceding paragraph.

	Empirical approach		Strict interpretation	
	Current legislation (CLE)	ELVs of COM(98) 415	ELVs of 88/609/EC	ELVs of COM(98) 415
Austria	4	1	11	3
Belgium	45	4	35	28
Denmark	8	4	30	8
Finland	12	7	75	21
France	135	9	41	10
Germany	336	157	728	190
Greece	172	9	51	13
Ireland	32	3	16	4
Italy	179	45	219	54
Luxembourg	0	0	0.1	0
Netherlands	6	3	30	9
Portugal	110	6	45	11
Spain	213	13	73	19
Sweden	7	4	37	8
UK	658	60	258	64
EU15	1918	324	1650	441

Table 4.2. NO_x emissions in the year 2010 from the plants built before 1987 (in kilotons). The meaning of the columns is explained in the preceding paragraph.

	Empirical approach		Strict interpretation	
	Current legislation (CLE)	ELVs of COM(98) 415	ELVs of 88/609/EC	ELVs of COM(98) 415
Austria	3	3	11	3
Belgium	15	8	24	17
Denmark	15	6	21	7
Finland	23	11	39	14
France	23	9	32	10
Germany	166	136	540	168
Greece	17	10	40	13
Ireland	10	3	11	3
Italy	125	53	166	53
Luxembourg	0	0	0.6	0
Netherlands	13	9	36	10
Portugal	25	10	36	11
Spain	41	17	55	18
Sweden	6	5	17	6
UK	144	62	199	64
EU15	627	343	1229	396

For NO_x, current practice is estimated to result in only half of the emissions than suggested by a strict interpretation of the ELVs of the 88/609/EC Directive. The revised standards, if applied to existing plants, would cut NO_x emissions by another 45 percent.

4.2 *Emissions from Plants taken into Operation Between 1987 and 1999*

Similar calculations have been carried out for plants for which the ELVs of the 88/609/EC Directive apply, i.e., plants taken into operation between 1987 and 1999. The resulting estimates presented in Tables 4.3 and 4.4 show a similar pattern as observed for plants built before 1987. Current regulations and practice yields total emissions below the strict interpretation of the existing emission limit values. If the revised ELVs were applied, SO_2 emissions are expected to be further reduced by 55 percent and NO_x emissions by 26 percent. Again, it must be stressed that this calculation is purely illustrative to demonstrate the contributions of this plant age class in total LCP emissions, and to explore the differences between the emission limit values 88/609/EC and COM(98)415. However, neither of these directives specify emission limits for existing plants.

Table 4.3. SO_2 emissions from plants taken into operation between 1987 and 1999 (in kilotons).

	Empirical approach		Strict interpretation	
	Current legislation (CLE)	ELVs of COM(98)415	ELVs of 88/609/EC	ELVs of COM(98)415
Austria	7	7	36	12
Belgium	9	3	10	4
Denmark	3	1	17	6
Finland	4	4	46	16
France	14	7	29	8
Germany	61	30	225	77
Greece	16	7	51	10
Ireland	6	6	26	7
Italy	28	9	52	15
Luxembourg	0	0	0.1	0
Netherlands	2	2	27	9
Portugal	7	3	25	7
Spain	36	12	77	23
Sweden	4	4	72	26
United Kingdom	45	27	107	36
EU15	241	121	800	254

Table 4.4. NO_x emissions from plants taken into operation between 1987 and 1999 (in kilotons).

	Empirical approach		Strict interpretation	
	Current legislation (CLE)	ELVs of COM(98)415	ELVs of 88/609/EC	ELVs of COM(98)415
Austria	3	3	19	8
Belgium	4	3	13	6
Denmark	1	1	12	6
Finland	4	4	29	13
France	9	6	29	12
Germany	32	28	190	75
Greece	6	4	33	11
Ireland	4	3	14	6
Italy	18	16	80	32
Luxembourg	0	0	0	0
Netherlands	6	6	46	19
Portugal	8	4	25	9
Spain	19	12	69	27
Sweden	9	8	60	25
United Kingdom	44	32	162	68
EU15	168	129	782	316

4.3 Emissions from Plants taken into Operation from 2000 Onwards

The third group of installations addresses the power plant stock planned to come into operation from the year 2000 onwards, for which the COM(98)415 on large combustion plants proposes stricter emission limit values. The results are shown in Tables 4.5 and 4.6.

Compared to the current status, a strict interpretation of the new ELVs would suggest 11 percent lower emissions for SO_2; the empirical approach would suggest for the year 2010 a 54 percent cut in SO_2 emissions from this group of plants.

For NO_x, a strict interpretation of the new ELVs would yield higher emissions than predicted for current legislation using the empirical approach. On the same methodological basis, however, the new ELVs are expected to cut total NO_x emissions by 26 percent.

Table 4.5. SO_2 emissions from plants taken into operation after 1999 (in kilotons).

	Empirical approach		Strict interpretation
	Current legislation (CLE)	ELVs of COM(98)415	ELVs of COM(98)415
Austria	4	4	7
Belgium	6	2	2
Denmark	2	1	4
Finland	3	3	10
France	9	4	5
Germany	39	19	49
Greece	11	4	6
Ireland	4	4	4
Italy	18	6	10
Luxembourg	0	0	0
Netherlands	1	1	6
Portugal	4	2	5
Spain	23	8	15
Sweden	2	2	16
United Kingdom	29	17	23
EU15	156	78	163

Table 4.6. NO_x emissions from plants taken into operation after 1999 (in kilotons).

	Empirical approach		Strict interpretation
	Current legislation (CLE)	ELVs of COM(98)415	ELVs of COM(98)415
Austria	2	2	5
Belgium	3	2	4
Denmark	1	1	4
Finland	3	3	8
France	6	4	8
Germany	21	18	48
Greece	4	2	7
Ireland	3	2	4
Italy	12	8	21
Luxembourg	0	0	0
Netherlands	5	3	12
Portugal	5	2	5
Spain	12	8	17
Sweden	5	5	16
United Kingdom	28	21	44
EU15	108	80	**203**

4.4 Total Emissions from Large Combustion Plants

In order to provide a complete picture, the detailed data presented above are summarized for three different cases:

- the "Current legislation" case estimates the likely situation in the year 2010 without the stricter emission limit values of the 1998 Large Combustion Plant Directive;
- the "1998 Directive" case, which illustrates the expected impacts of the new Directive using the empirical approach, and
- the hypothetical "Full penetration" case, in which the revised emission limit values are applied to all large combustion plants, irrespective of their age. This case attempts a rough quantification of a situation in a more distant future, when all boilers constructed before the year 2000 will be phased out and all remaining plants will be subject to the new emission limit values. Obviously, this analysis ignores the changes in the energy structure expected in the longer run. For estimating emissions, the empirical approach is applied for all sources.

The results of these calculations are presented in Table 4.7 and Table 4.8. There is clear evidence that the low expectations for new capacities to be built between 2000 and 2010 limits the improvements in the year 2010. The COM(98)415 proposed Directive is estimated to decrease SO_2 emissions from large combustion plants by about four percent (compared to the present legal situation), and NO_x emissions by some three percent. The tables also show that this low effect is clearly linked to the limited penetration of new plants before the year 2010. If the new ELVs were applied to the entire stock, SO_2 emissions from LCPs would be cut by 78 percent, and NO_x emissions by 40 percent.

Table 4.7. EU15 estimates of SO_2 emissions from large combustion plants for the year 2010 (in kilotons)

	Age class			Total LCPs
	<1987	1987-1999	2000-2010	
"Current legislation" case	1918	266	156	2339
"1998 Directive" case	1918	266	78	2261 (-3%)
"Full penetration" case	324	121	78	523 (-78 %)

Table 4.8. EU15 estimates of NO_x emissions from large combustion plants for the year 2010 (in kilotons)

	Age class			Total LCPs
	<1987	1987-1999	2000-2010	
"Current legislation" case	627	168	108	903
"1998 Directive" case	627	168	80	875 (-3 %)
"Full penetration" case	343	129	80	551 (-40 %)

4.5 Context with the Acidification Strategy

This section presents the annual emissions from Large Combustion Plants in the EU15 countries under various control requirements in relation to total emissions. The contribution of sources other than LCPs has been assumed to be constant at the REF level (Amann *et al.*, 1996).

Table 4.9. Comparison of SO_2 emissions of different LCP scenarios with the range indicated in the EU acidification strategy.

	LCP emissions	Other emission sources	Total	
	kt	kt	kt	Compared to CLE
"Current legislation" (CLE) case	2339	4214	6553	--
"1998 Directive" case	2261	4214	6475	-1 %
"Full penetration" case	523	4214	4737	-27 %
Range given in the Acidification Strategy	--	--	2700-3800	-42% - -59%

Table 4.10. Comparison of NO_x emissions of different LCP scenarios with the range indicated in the EU acidification strategy.

	LCP emissions	Other emission sources	Total	
	kt	kt	kt	Compared to CLE
"Current legislation" (CLE) case	903	6050	6953	--
"1998 Directive" case	875	6050	6925	-0.4 %
"Full penetration" case	551	6050	6601	-5 %
Range given in the Acidification Strategy	--	--	5920-5970	-14% - -15%

The tables clearly indicate that in the year 2010 the additional emission reductions implied by the COM(98)415 proposed Directive will only make a limited contribution to the indicative targets given in the EU Acidification Strategy. It is clear, however, that in the long run, i.e., after renewal of the entire plant stock, the new emission limit values will be important elements for achieving the environmental targets of the Acidification Strategy.

5 Additional Investments Implied by the New Emission Limit Values

A further aspect of the study addresses the costs for additional investments induced by the emission limit values of the new Large Combustion Plant Directive. As described in earlier parts of this report, the "Current Legislation" case serves as the starting point, against which additional investments are identified. The methodology for determining additional investments and a survey on the required measures is provided in Section 3.2.4. In brief, only the investment costs of control equipment beyond the CLE controls are considered in this section.

As with all other calculations presented in this report, the analysis is performed for each source category separately in order to guarantee that all plants in each fuel and capacity class fulfill the new emission limit values. Therefore, even though in some cases the total country emissions calculated for the CLE case are already below country totals resulting from the new ELVs, further controls might be necessary if individual source categories are not yet in compliance with the new emission limit values.

As a general finding, additional investments for SO_2 control are mainly necessary when the CLE regulations can be satisfied by low sulfur fuels. There are, however, some cases where even the maximum 95 percent desulfurization rate of wet flue gas scrubbing will not be sufficient to meet the emission limit value of 200 mg/Nm^3 (O_2 content 6 %). Reflecting the derogation of Annex VIII of the new Large Combustion Plant Directive (90-95 - percent desulfurization rate or ELV of 300 mg/Nm^3), the calculations do not assume the use of high-efficiency regenerative measures with 98 percent removal efficiency, although such options are considered in the RAINS database. For NO_x emissions, additional investments (SCR) occur usually in cases where the CLE demands only primary measures.

5.1 Cost Calculation Methodology

This study used the RAINS methodology for calculating the costs of additional investments (Cofala and Syri, 1998). Thereby, compatibility with the model calculations underlying the EU acidification and ozone strategies is ensured.

The methodological framework for cost calculation in RAINS follows the approach recommended for the work within the Convention on Long-range Transboundary Air Pollution (compare Rentz *et al.*, 1987). Investments in flue gas cleaning depend on the boiler size and the (fuel specific) flue gas volume treated (Equation 1). Since this study focuses only on investments, fixed and variable operating costs of the additional equipment have not been considered.

The investments include the expenditure accumulated until the start-up of an installation, such as delivery of the installation, construction, civil works, ducting, engineering and consulting, license fees, land requirement and capital. The costs have been calculated with the help of investment functions where these cost components are aggregated into one function.

Investments in flue gas desulfurization depend on the boiler size *bs* and the (fuel specific) flue gas volume *v* treated. The form of the function is described by its coefficients ci^f and ci^v. Since for SO_2 control the coefficients *ci* reflect the situation for hard coal fired boilers, a correction factor *v* is used to account for different flue gas volume to be handled when other fuel is used (for brown coal v=1.2, for oil and gas v=0.9). For NO_x control, the correction factors are already introduced in the values of the coefficients. The coefficients *ci* have been estimated separately for two LCP capacity classes: from 50 to 300 MW_{th} and above 300 MW_{th}. The shape of the investment function used is given by the following equation:

$$I = (ci^f + \frac{ci^v}{bs}) * v \qquad (1)$$

The parameter values used for the calculations are provided in Table 5.1, Table 5.2 and Table 5.3.

Table 5.1. Parameter values for the calculation of investment costs for SO_2 emission control with wet flue gas desulfurization (FGD).

Coefficient	Unit	Capacity range [MW_{th}]	
		20-300	>300
ci^f	ECU/kW_{th}	68	36
ci^v	10^3 ECU	243	10000

Table 5.2. Parameter values for the calculation of investment costs for NO_x control with selective catalytic reduction (SCR).

Fuel	Coefficient	Unit	Capacity range [MW_{th}]	
			20-300	>300
Brown coal	ci^f,	ECU/kW_{th}	17.5	6.1
	ci^v	10^3 ECU	122	3540
Hard coal	ci^f	ECU/kW_{th}	14.6	5.1
	ci^v	10^3 ECU	102	2950
Other solids	ci^f	ECU/kW_{th}	14.6	5.1
	ci^v	10^3 ECU	102	2950
Gas, fuel oil	ci^f	ECU/kW_{th}	11.3	4.7
	ci^v	10^3 ECU	68.9	1990

Table 5.3. Parameter values for the calculation of investment costs for NOx control with combustion modifications (CM).

Fuel	Coefficient	Unit	Capacity range [MW_{th}] < 100
Gas	ci^f,	ECU/kW_{th}	5.18
	ci^v	10^3 ECU	22.5

5.2 *Results of the Cost Calculation*

The estimates of the implied additional costs are given in Table 5.4. For SO_2 control, the additional investments induced by the proposed emission limit values sum to about 500 million ECU for the EU15 countries; 900 million ECU would emerge for extra NO_x control. The costs are calculated only for plants coming into operation after 1999, considering the needs for each fuel- and capacity class to achieve the COM(98)415 proposed Directive.

Table 5.4. Estimate of the investment costs implied up to the year 2010 by the new ELVs for SO2 and NOx (in million ECU).

	SO_2	NO_x
Austria	0	0
Belgium	12	22
Denmark	5	0
Finland	0	0
France	7	74
Germany	38	118
Greece	22	9
Ireland	0	15
Italy	33	153
Luxembourg	0	2
Netherlands	0	0
Portugal	32	39
Spain	320	172
Sweden	0	0
United Kingdom	61	294
EU15	530	900

It must be emphasized that these cost estimates are mainly based on general assumptions about future distributions of capacity classes and fuel use, as explained in Section 2.2. All uncertainties in these estimates are inevitably reflected in the cost calculations. Furthermore, another major source of uncertainty is connected to the underlying energy scenario, i.e., the "Conventional Wisdom" energy scenario of DG-XVII (1996). This

scenario was compiled in 1995/1996 and reflects therefore a "pre-Kyoto" view of energy development. It has been shown elsewhere that the agreements of the Kyoto conference on limiting the emissions of greenhouse gases may have a fundamental influence on overall energy development, and may significantly alter earlier plans for new plants after the year 2000.

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Appendix I

CALCULATION RESULTS FOR LCP CAPACITIES,
FUEL USE AND EMISSIONS OF SO_2 AND NO_x
FOR THE EU15 COUNTRIES

Austria LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	608	1,172	-	-	-
Hard coal	-	-	2,645	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	58	441	304	-	-	800
Gas	224	1,289	4,658	67	420	-
of which boiler	224	289	4,658	67	420	-
of which turbine	-	1,000	-	-	-	-
Total	282	2,338	8,779	67	420	800

12,686

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	94	126	109	-	-	-
Hard coal	62	17	109	-	-	-
Oth.solid	341	525	296	-	-	-
H. fuel oil	152	317	159	-	-	-
Gas	702	1,220	637	-	-	-
of which boiler	702	1,220	637	-	-	-
of which turbine	-	-	-	-	-	-
Total	1,351	2,205	1,309	-	-	-

4,866

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	304	586	-	-	996
Hard coal	-	-	1,323	-	-	3,911
Oth.solid	-	-	-	1,987	1,987	-
H. fuel oil	-	221	-	351	2,672	1,842
Gas	112	645	2,329	34	210	1,071
of which boiler	28	161	582	8	53	268
of which turbine	84	483	1,747	25	158	803
Total	112	1,169	4,238	2,372	4,869	7,821

20,580

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	31	42	36	54	72	62
Hard coal	21	6	36	60	16	104
Oth.solid	114	175	99	-	-	-
H. fuel oil	51	106	53	557	1,162	583
Gas	234	407	212	884	1,538	803
of which boiler	164	285	149	619	1,076	562
of which turbine	70	122	64	265	461	241
Total	450	735	436	1,554	2,788	1,551

7,515

Austria

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	24	-	-	-
Hard coal	-	-	35	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	2	5	-	-	12
Gas	-	7	25	-	2	-
of which boiler	-	2	25	-	2	-
of which turbine	-	5	-	-	-	-
Total	-	9	89	-	2	12

112

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	3	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	5	-	-	-
H. fuel oil	4	6	5	-	-	-
Gas	3	6	4	-	-	-
of which boiler	3	6	4	-	-	-
of which turbine	-	-	-	-	-	-
Total	7	15	9	-	-	-

31

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	4	6	-	-	12
Hard coal	-	-	15	-	-	50
Oth.solid	-	-	-	16	18	-
H. fuel oil	-	1	-	2	18	10
Gas	2	12	33	1	4	17
of which boiler	0	3	8	0	1	4
of which turbine	1	9	25	0	3	13
Total	2	17	55	19	40	89

222

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0	1	0	1	1	1
Hard coal	0	0	0	0	0	0
Oth.solid	-	-	-	-	-	-
H. fuel oil	0	1	0	3	8	3
Gas	1	1	1	3	6	2
of which boiler	0	1	0	2	4	2
of which turbine	0	0	0	1	2	1
Total	1	3	1	7	15	7

34

Austria

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	5.3	-	-	-
Hard coal	-	-	2.3	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	1.9	0.8	-	-	1.0
Gas	-	0.0	0.0	-	0.0	-
of which boiler	-	0.0	0.0	-	0.0	-
of which turbine	-	0.0	-	-	-	-
Total	-	1.9	8.4	-	0.0	1.0

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	2.1	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	0.4	-	-	-
H. fuel oil	2.4	1.0	0.9	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	2.4	3.2	1.3	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	0.3	0.5	-	-	0.6	
Hard coal	-	-	1.0	-	-	2.3	
Oth.solid	-	-	-	2.9	2.5	-	
H. fuel oil	-	1.4	-	0.3	2.0	0.7	
Gas	-	-	-	0.0	0.0	0.0	
of which boiler	-	-	-	0.0	0.0	0.0	
of which turbine	-	-	-	-	-	-	
11.3 Total	-	1.7	1.4	3.2	4.5	3.7	14.5

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	0.0	0.1	0.1	0.2	0.2	0.1	
Hard coal	-	-	-	0.0	0.0	0.0	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	0.0	0.1	0.0	0.7	1.3	0.4	
Gas	-	-	-	0.0	0.0	0.0	
of which boiler	-	-	-	0.0	0.0	0.0	
of which turbine	-	-	-	-	-	-	
7 Total	0.1	0.2	0.1	0.9	1.5	0.5	3.3

Austria

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	1.3	-	-	-
Hard coal	-	-	2.1	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	0.4	0.6	-	-	2.4
Gas	-	1.1	3.7	-	0.3	-
of which boiler	-	0.2	3.7	-	0.3	-
of which turbine	-	0.8	-	-	-	-
Total	-	1.4	7.7	-	0.3	2.4

11.9

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	0.6	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	0.7	-	-	-
H. fuel oil	0.6	1.0	0.9	-	-	-
Gas	0.2	0.4	0.3	-	-	-
of which boiler	0.2	0.4	0.3	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.8	2.1	1.8	-	-	-

5

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	0.4	1.3	-	-	1.8
Hard coal	-	-	0.9	-	-	2.3
Oth.solid	-	-	-	1.5	1.5	-
H. fuel oil	-	0.1	-	0.1	0.8	0.3
Gas	0.1	0.3	1.0	0.0	0.1	0.4
of which boiler	0.1	0.3	1.0	0.0	0.0	0.1
of which turbine	-	-	-	0.0	0.0	0.2
Total	0.1	0.9	3.2	1.6	2.4	4.8

12.9

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.0	0.1	0.0	0.1	0.1	0.0
Hard coal	-	-	-	0.0	0.0	0.0
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	0.1	0.0	0.2	0.4	0.1
Gas	0.0	0.0	0.0	0.1	0.1	0.0
of which boiler	0.0	0.0	0.0	0.1	0.1	0.0
of which turbine	-	-	-	0.0	0.0	0.0
Total	0.1	0.1	0.0	0.4	0.7	0.2

1.6

Belgium LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	1,239	8,140	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	943	-	-	100	554
Gas	241	1,105	4,805	-	-	-
of which boiler	241	605	4,305	-	-	-
of which turbine	-	500	500	-	-	-
Total	241	3,287	12,945	-	100	554

17,127

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	70	274	-	-	-	-
Oth.solid	192	-	-	-	-	-
H. fuel oil	725	770	404	28	-	-
Gas	1,113	1,986	509	88	100	-
of which boiler	1,113	1,748	509	88	100	-
of which turbine	-	238	-	-	-	-
Total	2,100	3,030	913	116	100	-

6,259

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	2,935	-	-	5,125
Hard coal	-	1,200	4,000	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	472	-	-	-	730
Gas	121	553	2,145	-	3,000	4,655
of which boiler	30	138	2,145	-	-	-
of which turbine	90	414	-	-	3,000	4,655
Total	121	2,224	9,080	-	3,000	10,510

24,935

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	23	30	60	372	1,455	-
Oth.solid	64	-	-	-	-	-
H. fuel oil	242	257	135	956	1,016	533
Gas	371	662	170	981	1,750	449
of which boiler	260	463	119	687	1,225	314
of which turbine	111	199	51	294	525	135
Total	700	949	364	2,309	4,221	982

9,524

Belgium

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	17	137	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	1	-	-	0	5
Gas	4	32	40	-	-	-
of which boiler	4	18	36	-	-	-
of which turbine	-	15	4	-	-	-
Total	4	51	176	-	0	5

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1	2	-	-	-	-
Oth.solid	192	-	-	-	-	-
H. fuel oil	7	12	7	0	-	-
Gas	10	18	10	1	1	-
of which boiler	10	16	10	1	1	-
of which turbine	-	2	-	-	-	-
Total	18	32	17	1	1	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	20	54	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	11	-	-	-	13
Gas	2	10	32	-	61	77
of which boiler	1	3	32	-	-	-
of which turbine	2	8	-	-	61	77
Total	2	41	86	-	61	90

236 280

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0	0	0	1	3	-
Oth.solid	64	-	-	-	-	-
H. fuel oil	2	3	1	10	12	5
Gas	3	6	1	9	18	4
of which boiler	2	4	1	6	13	3
of which turbine	1	2	0	3	6	1
Total	5	9	3	20	34	9

68 80

Belgium

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	11.1	76.8	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	2.4	-	-	0.2	5.0
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	13.5	76.8	-	0.2	5.0

B. Industrial boilers [kt SO2] 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.4	0.8	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	5.7	9.0	4.3	0.1	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	6.1	9.8	4.3	0.1	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	7.7	20.5	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	11.2	-	-	-	1.0
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
95.4 Total	-	18.9	20.5	-	-	1.0

40.4

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.0	0.0	0.2	0.7	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.4	2.9	0.3	4.1	4.6	0.9
Gas	-	-	-	0.0	0.0	0.0
of which boiler	-	-	-	0.0	0.0	0.0
of which turbine	-	-	-	-	-	-
20 Total	2.4	2.9	0.3	4.3	5.4	0.9

16.3

Belgium

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	4.8	37.2	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	0.3	-	-	0.0	1.0
Gas	0.6	4.9	6.0	-	-	-
of which boiler	0.6	2.7	5.3	-	-	-
of which turbine	-	2.2	0.6	-	-	-
Total	0.6	9.9	43.1	-	0.0	1.0

54.6

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.2	0.4	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.1	2.1	1.1	0.0	-	-
Gas	0.7	1.2	0.7	0.1	0.1	-
of which boiler	0.7	1.1	0.7	0.1	0.1	-
of which turbine	-	0.1	-	-	-	-
Total	2.1	3.7	1.8	0.1	0.1	-

8

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	3.0	8.0	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	0.7	-	-	-	0.6
Gas	0.1	0.5	1.7	-	1.6	2.0
of which boiler	0.1	0.5	1.7	-	0.7	0.8
of which turbine	-	-	-	-	1.0	1.2
Total	0.1	4.3	9.7	-	1.6	2.6

18.4

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.0	0.0	0.1	0.3	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.2	0.2	0.1	1.0	1.1	0.4
Gas	0.1	0.2	0.0	0.3	0.7	0.1
of which boiler	0.1	0.2	0.0	0.3	0.6	0.1
of which turbine	-	-	-	0.0	0.1	0.0
Total	0.3	0.5	0.2	1.4	2.1	0.5

4.9

Denmark LCP

CAPACITY

A. Power plants and district heating plants — MWth — 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	1,603	14,307	-	-	3,190
Oth.solid	-	300	-	-	-	-
H. fuel oil	-	525	2,013	-	-	-
Gas	-	230	-	115	136	823
of which boiler	-	-	-	115	136	823
of which turbine	-	230	-	-	-	-
Total	-	2,658	16,320	115	136	4,013

B. Industrial boilers — MWth — 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	149	124	-	-	-	-
Oth.solid	-	100	-	-	-	-
H. fuel oil	224	336	-	-	-	-
Gas	257	385	-	-	-	-
of which boiler	257	-	-	-	-	-
of which turbine	-	385	-	-	-	-
Total	630	945	-	-	-	-

A. Power plants and district heating plants — MWth — 2010

	Capacity range, MWth					
	Existing			New		
Fuel	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	802	7,154	-	-	-
Oth.solid	-	150	-	1,685	1,685	-
H. fuel oil	-	263	1,007	-	1,388	3,241
Gas	-	115	-	58	68	5,561
of which boiler	-	29	-	14	17	1,390
of which turbine	-	86	-	43	51	4,170
23,242 Total	-	1,329	8,160	1,743	3,142	8,801

23,175

B. Industrial boilers — MWth — 2010

	Existing			New		
Fuel	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	50	41	-	86	72	-
Oth.solid	-	33	-	-	1	-
H. fuel oil	75	112	-	-	-	-
Gas	86	128	-	129	243	-
of which boiler	60	90	-	90	170	-
of which turbine	26	39	-	39	73	-
1,575 Total	210	315	-	215	316	-

1,056

Denmark

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	25	175	-	-	39
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	1	3	-	-	-
Gas	-	1	-	0	0	2
of which boiler	-	-	-	0	0	2
of which turbine	-	1	-	-	-	-
Total	-	26	179	0	0	41

247

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	11	75	-	-	-
Oth.solid	-	2	-	17	19	-
H. fuel oil	-	1	3	-	6	10
Gas	-	2	-	1	2	94
of which boiler	-	1	-	0	0	23
of which turbine	-	2	-	1	1	70
Total	-	15	78	18	26	104

242

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1	1	-	-	-	-
Oth.solid	-	1	-	-	-	-
H. fuel oil	1	2	-	-	-	-
Gas	1	1	-	-	-	-
of which boiler	1	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	3	5	-	-	-	-

8

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0	0	-	1	1	-
Oth.solid	-	0	-	-	0	-
H. fuel oil	0	1	-	-	-	-
Gas	0	1	-	1	1	-
of which boiler	0	0	-	0	1	-
of which turbine	0	0	-	0	0	-
Total	1	2	-	1	2	-

6

Denmark

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	14.2	90.1	-	-	8.0
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	1.3	3.8	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	15.6	93.9	-	-	8.0

B. Industrial boilers [kt SO2] 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.7	0.7	-	-	-	-
Oth.solid	-	0.1	-	-	-	-
H. fuel oil	0.2	0.4	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.9	1.1	-	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	0.8	5.5	-	-	-
Oth.solid	-	0.1	-	2.0	1.4	-
H. fuel oil	-	1.0	0.5	-	2.1	0.8
Gas	-	-	-	0.0	0.0	0.1
of which boiler	-	-	-	0.0	0.0	0.1
of which turbine	-	-	-	-	-	-
117.5 Total	-	1.9	6.0	2.0	3.5	0.9	14.3

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.1	0.0	-	0.2	0.1	-
Oth.solid	-	0.0	-	-	0.0	-
H. fuel oil	0.1	0.0	-	-	-	-
Gas	-	-	-	0.0	0.0	-
of which boiler	-	-	-	0.0	0.0	-
of which turbine	-	-	-	-	-	-
2 Total	0.2	0.1	-	0.2	0.1	-	0.6

Denmark

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	7.2	50.8	-	-	13.3
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	0.2	0.7	-	-	-
Gas	-	0.1	-	0.1	0.1	0.3
of which boiler	-	-	-	0.1	0.1	0.3
of which turbine	-	0.1	-	-	-	-
Total	-	7.6	51.5	0.1	0.1	13.6

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.2	0.2	-	-	-	-
Oth.solid	-	0.1	-	-	-	-
H. fuel oil	0.2	0.3	-	-	-	-
Gas	0.1	0.1	-	-	-	-
of which boiler	0.1	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.5	0.7	-	-	-	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	1.8	12.8	-	-	-	
Oth.solid	-	0.1	-	1.0	0.9	-	
H. fuel oil	-	0.1	0.2	-	0.2	0.4	
Gas	-	0.1	-	0.0	0.0	1.9	
of which boiler	-	0.1	-	0.0	0.0	0.8	
of which turbine	-	-	-	0.0	0.0	1.1	
72.8 Total	-	2.1	13.0	1.1	1.2	2.3	19.7

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	0.0	0.0	-	0.1	0.0	-	
Oth.solid	-	0.0	-	-	0.0	-	
H. fuel oil	0.0	0.0	-	-	-	-	
Gas	0.0	0.0	-	0.0	0.0	-	
of which boiler	0.0	0.0	-	0.0	0.0	-	
of which turbine	-	-	-	0.0	0.0	-	
1 Total	0.1	0.1	-	0.1	0.1	-	0.3

Finland LCP

CAPACITY

A. Power plants and district heating plants — MWth — 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	153	11,461	100	100	800
Hard coal	300	600	6,700	-	-	-
Oth.solid	-	200	-	-	-	-
H. fuel oil	1,500	532	1,959	-	-	-
Gas	100	1,000	400	-	200	-
of which boiler	100	200	400	-	-	-
of which turbine	-	800	-	-	200	-
Total	1,900	2,485	20,520	100	300	800

26,105

B. Industrial boilers — MWth — 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	400	400	-	-	-	-
Hard coal	300	1,100	-	-	-	-
Oth.solid	600	800	-	200	200	-
H. fuel oil	200	1,200	-	-	-	-
Gas	400	1,000	200	-	-	-
of which boiler	400	800	200	-	-	-
of which turbine	-	200	-	-	-	-
Total	1,900	4,500	200	200	200	-

7,000

A. Power plants and district heating plants — MWth — 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	1,600	-	1,000	1,200	1,200
Hard coal	200	1,500	6,300	-	-	5,500
Oth.solid	200	400	-	800	600	-
H. fuel oil	1,000	1,000	400	400	200	-
Gas	-	600	400	400	2,200	2,400
of which boiler	-	200	400	400	200	-
of which turbine	-	400	-	-	2,000	2,400
Total	1,400	5,100	7,100	2,600	4,200	9,100

29,500

B. Industrial boilers — MWth — 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	100	100	-	300	400	-
Hard coal	100	-	-	200	-	-
Oth.solid	200	200	-	1,000	300	-
H. fuel oil	100	500	300	-	-	-
Gas	100	700	-	700	1,400	-
of which boiler	100	500	-	400	300	-
of which turbine	-	200	-	300	1,100	-
Total	600	1,500	300	2,200	2,100	-

6,700

Finland

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	4	12	1	2	1
Hard coal	4	12	81	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2	5	-	-	-	-
Gas	-	7	3	-	1	-
of which boiler	-	1	3	-	-	-
of which turbine	-	6	-	-	1	-
Total	6	28	96	1	4	1

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	5	5	-	-	-	-
Oth.solid	-	10	-	-	2	-
H. fuel oil	4	7	-	-	-	-
Gas	7	11	4	-	-	-
of which boiler	7	9	4	-	-	-
of which turbine	-	2	-	-	-	-
Total	16	32	4	-	2	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	26	-	15	22	16
Hard coal	3	25	79	-	-	76
Oth.solid	4	8	-	16	14	-
H. fuel oil	6	7	2	3	2	-
Gas	-	10	6	7	43	37
of which boiler	-	3	6	7	4	-
of which turbine	-	7	-	-	39	37
Total	13	77	87	40	80	130

136 427

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	2	-	-	4	-	-
Oth.solid	1	1	-	3	1	-
H. fuel oil	1	8	4	-	-	-
Gas	1	7	-	7	16	-
of which boiler	1	5	-	4	4	-
of which turbine	-	2	-	3	13	-
Total	5	16	4	14	18	-

54 56

Finland

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	0.7	2.4	0.3	0.5	0.2
Hard coal	2.5	5.9	32.4	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.7	6.1	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	4.2	12.8	34.7	0.3	0.5	0.2

B. Industrial boilers [kt SO2] 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	3.1	3.2	-	-	-	-
Oth.solid	-	1.8	-	-	0.4	-
H. fuel oil	2.7	4.6	-	-	-	-
Gas	0.3	0.4	0.1	-	-	-
of which boiler	0.3	0.4	0.1	-	-	-
of which turbine	-	-	-	-	-	-
Total	6.0	10.0	0.1	-	0.4	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	0.5	-	1.8	1.7	0.6
Hard coal	0.2	1.3	4.2	-	-	3.3
Oth.solid	0.3	0.8	-	2.7	1.8	-
H. fuel oil	0.7	0.8	0.3	0.4	0.2	-
Gas	-	-	-	0.0	0.0	-
of which boiler	-	-	-	0.0	0.0	-
of which turbine	-	-	-	-	-	-

52.6 Total 1.2 3.5 4.5 4.9 3.6 3.9 21.6

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.2	-	-	0.7	-	-
Oth.solid	0.0	0.1	-	0.5	0.1	-
H. fuel oil	0.2	1.3	0.6	-	-	-
Gas	0.0	0.3	-	0.2	0.4	-
of which boiler	0.0	0.3	-	0.2	0.4	-
of which turbine	-	-	-	-	-	-

17 Total 0.5 1.7 0.6 1.4 0.6 - 4.7

Finland

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	0.9	3.0	0.3	0.6	0.2
Hard coal	1.2	3.2	22.3	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.3	1.1	-	-	-	-
Gas	-	1.1	0.5	-	0.2	-
of which boiler	-	0.2	0.5	-	-	-
of which turbine	-	0.9	-	-	0.2	-
Total	1.5	6.3	25.7	0.3	0.8	0.2

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1.0	1.1	-	-	-	-
Oth.solid	-	1.2	-	-	0.3	-
H. fuel oil	0.7	1.1	-	-	-	-
Gas	0.5	0.8	0.3	-	-	-
of which boiler	0.5	0.6	0.3	-	-	-
of which turbine	-	0.2	-	-	-	-
Total	2.2	4.2	0.3	-	0.3	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	2.3	-	1.1	1.2	0.7	
Hard coal	0.4	3.5	11.2	-	-	3.5	
Oth.solid	0.1	0.3	-	1.2	0.7	-	
H. fuel oil	0.4	0.5	0.2	0.2	0.1	-	
Gas	-	1.6	0.3	0.2	0.9	0.8	
of which boiler	-	1.6	0.3	0.2	0.3	0.2	
of which turbine	-	-	-	-	0.6	0.6	
34.9 Total	1.0	8.2	11.7	2.7	2.9	4.9	31.4

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	0.2	-	-	0.5	-	-	
Oth.solid	0.1	0.1	-	0.4	0.1	-	
H. fuel oil	0.1	0.6	0.3	-	-	-	
Gas	0.1	0.5	-	0.3	0.4	-	
of which boiler	0.1	0.5	-	0.2	0.2	-	
of which turbine	-	-	-	0.0	0.2	-	
7 Total	0.5	1.3	0.3	1.2	0.5	-	3.8

France LCP

CAPACITY

A. Power plants and district heating plants — MWth — 1990

	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	1,700	-	-	660
Hard coal	-	-	24,345	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	16,897	-	-	-
Gas	-	-	4,782	-	-	-
of which boiler	-	-	2,782	-	-	-
of which turbine	-	-	2,000	-	-	-
Total	-	-	47,724	-	-	660

48,384

A. Power plants and district heating plants — MWth — 2010

	Capacity range, MWth					
	Existing			New		
Fuel	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	850	-	-	1,094
Hard coal	-	-	12,173	-	-	-
Oth.solid	-	-	-	1,620	1,620	-
H. fuel oil	-	-	8,449	-	-	-
Gas	-	-	2,391	-	-	14,026
of which boiler	-	-	598	-	-	3,507
of which turbine	-	-	1,793	-	-	10,520
Total	-	-	23,862	1,620	1,620	15,121

42,222

B. Industrial boilers — MWth — 1990

	Existing			New		
Fuel	50-100	100-300	>300	50-100	100-300	>300
Br. coal	76	114	-	-	-	-
Hard coal	1,328	1,992	4,270	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,009	1,513	13,244	-	-	-
Gas	4,227	6,341	3,836	-	-	-
of which boiler	4,227	6,341	3,836	-	-	-
of which turbine	-	-	-	-	-	-
Total	6,640	9,960	21,350	-	-	-

37,950

B. Industrial boilers — MWth — 2010

	Existing			New		
Fuel	50-100	100-300	>300	50-100	100-300	>300
Br. coal	25	38	-	228	341	-
Hard coal	443	664	1,423	476	714	1,530
Oth.solid	-	-	-	-	-	-
H. fuel oil	336	504	4,415	587	880	7,706
Gas	1,409	2,114	1,279	4,042	6,063	3,668
of which boiler	986	1,480	895	2,829	4,244	2,568
of which turbine	423	634	384	1,213	1,819	1,100
Total	2,213	3,320	7,117	5,332	7,999	12,904

38,885

France

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	17	-	-	7
Hard coal	-	-	238	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	40	-	-	-
Gas	-	-	30	-	-	-
of which boiler	-	-	18	-	-	-
of which turbine	-	-	13	-	-	-
Total	-	-	324	-	-	7

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0	0	-	-	-	-
Hard coal	3	4	8	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	8	14	99	-	-	-
Gas	19	34	16	-	-	-
of which boiler	19	34	16	-	-	-
of which turbine	-	-	-	-	-	-
Total	30	52	123	-	-	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	10	-	-	14
Hard coal	-	-	80	-	-	-
Oth.solid	-	-	-	10	12	-
H. fuel oil	-	-	3	-	-	-
Gas	-	-	35	-	-	231
of which boiler	-	-	9	-	-	58
of which turbine	-	-	27	-	-	173
Total	-	-	128	10	12	245

331 395

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0	0	-	0	0	-
Hard coal	1	1	2	1	2	3
Oth.solid	-	-	-	-	-	-
H. fuel oil	3	4	31	5	9	60
Gas	6	10	5	19	33	16
of which boiler	4	7	4	13	23	11
of which turbine	2	3	2	6	10	5
Total	9	16	38	25	43	79

205 211

France

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	48.5	-	-	18.9
Hard coal	-	-	158.7	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	67.2	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	274.4	-	-	18.9

B. Industrial boilers [kt SO2] 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.1	0.1	-	-	-	-
Hard coal	1.7	2.9	5.0	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	7.9	13.7	87.0	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	9.7	16.7	92.0	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	40.3	-	-	2.2
Hard coal	-	-	53.5	-	-	-
Oth.solid	-	-	-	1.6	1.3	-
H. fuel oil	-	-	2.7	-	-	-
Gas	-	-	-	-	-	0.2
of which boiler	-	-	-	-	-	0.2
of which turbine	-	-	-	-	-	-
Total	-	-	96.5	1.6	1.3	2.4

293.2 101.7

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.1	0.1	-	0.1	0.2	-
Hard coal	0.5	0.8	1.4	0.3	0.5	0.2
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.4	4.2	29.5	1.2	1.7	10.0
Gas	-	-	-	0.0	0.1	0.0
of which boiler	-	-	-	0.0	0.1	0.0
of which turbine	-	-	-	-	-	-
Total	3.0	5.1	30.9	1.6	2.4	10.3

118 53.4

France

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	4.5	-	-	1.8
Hard coal	-	-	71.3	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	7.9	-	-	-
Gas	-	-	4.5	-	-	-
of which boiler	-	-	2.6	-	-	-
of which turbine	-	-	1.9	-	-	-
Total	-	-	88.3	-	-	1.8

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.0	0.0	-	-	-	-
Hard coal	0.6	1.0	1.8	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.3	2.3	16.0	-	-	-
Gas	1.4	2.4	1.1	-	-	-
of which boiler	1.4	2.4	1.1	-	-	-
of which turbine	-	-	-	-	-	-
Total	3.3	5.7	18.9	-	-	-

90.1

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	1.0	-	-	0.7
Hard coal	-	-	12.0	-	-	-
Oth.solid	-	-	-	0.8	0.7	-
H. fuel oil	-	-	0.2	-	-	-
Gas	-	-	5.3	-	-	5.8
of which boiler	-	-	5.3	-	-	3.1
of which turbine	-	-	-	-	-	2.7
Total	-	-	18.5	0.8	0.7	6.5

26.5

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.0	0.0	-	0.0	0.0	-
Hard coal	0.1	0.1	0.2	0.1	0.2	0.3
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.2	0.4	2.5	0.5	0.7	4.2
Gas	0.4	0.7	0.4	0.7	1.2	0.5
of which boiler	0.4	0.7	0.4	0.6	1.1	0.5
of which turbine	-	-	-	0.1	0.2	0.1
Total	0.7	1.2	3.1	1.3	2.1	5.0

28

13.4

Germany LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	174	-	110,860	-	-	4,029
Hard coal	1,031	20,232	81,083	-	134	626
Oth.solid	-	-	-	104	-	-
H. fuel oil	3,911	-	1,082	-	-	1,616
Gas	-	-	16,174	121	292	915
of which boiler	-	-	11,174	121	292	915
of which turbine	-	-	5,000	-	-	-
Total	5,117	20,232	209,199	225	426	7,187

242,386

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1,241	2,159	7,521	-	-	1,000
Hard coal	1,075	3,111	898	-	128	274
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,604	3,506	9,700	1,807	128	-
Gas	8,761	19,155	26,500	262	256	-
of which boiler	8,761	19,155	21,500	262	256	-
of which turbine	-	-	5,000	-	-	-
Total	12,681	27,931	44,618	2,069	512	1,274

89,086

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	87	-	65,430	-	-	-
Hard coal	516	10,116	50,541	-	567	33,028
Oth.solid	-	-	-	4,316	4,316	-
H. fuel oil	1,956	-	541	2,995	-	1,829
Gas	-	-	10,087	61	146	45,204
of which boiler	-	-	2,522	15	37	11,301
of which turbine	-	-	7,565	45	110	33,903
Total	2,559	10,116	126,600	7,372	5,029	80,061

231,736

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	414	720	3,507	30	53	2,184
Hard coal	358	1,037	299	2,453	7,100	2,048
Oth.solid	-	-	-	-	-	-
H. fuel oil	535	1,169	3,233	3,740	8,178	22,623
Gas	2,920	6,385	8,833	-	-	-
of which boiler	2,044	4,469	6,183	-	-	-
of which turbine	876	1,915	2,650	-	-	-
Total	4,227	9,310	15,873	6,224	15,331	26,856

77,821

Germany

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1	-	1,449	-	-	53
Hard coal	8	114	1,266	-	1	10
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	254	3	10	14
of which boiler	-	-	176	3	10	14
of which turbine	-	-	79	-	-	-
Total	9	114	2,970	3	10	77

3,183

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	22	37	149	-	-	20
Hard coal	10	16	12	-	1	4
Oth.solid	-	-	-	-	-	-
H. fuel oil	6	22	75	7	1	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	38	76	236	7	1	23

381

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1	-	995	-	-	-
Hard coal	11	238	918	-	15	667
Oth.solid	-	-	-	68	78	-
H. fuel oil	28	-	7	47	-	26
Gas	-	-	173	1	3	860
of which boiler	-	-	43	0	1	215
of which turbine	-	-	130	1	3	645
Total	40	238	2,093	116	96	1,552

4,136

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	6	11	43	0	1	30
Hard coal	1	4	1	8	27	6
Oth.solid	-	-	-	-	-	-
H. fuel oil	2	6	13	18	46	102
Gas	-	-	100	-	-	-
of which boiler	-	-	70	-	-	-
of which turbine	-	-	30	-	-	-
Total	9	21	157	27	74	138

426

Germany

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1.9	-	2,328.7	-	-	4.8
Hard coal	1.5	15.4	93.4	-	0.0	0.3
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	3.4	15.4	2,422.0	-	0.0	5.1

2446.0

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	49.8	85.9	341.9	-	-	45.5
Hard coal	5.6	9.3	6.7	-	0.4	2.1
Oth.solid	-	-	-	-	-	-
H. fuel oil	4.0	14.2	48.5	4.5	0.5	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	59.4	109.5	397.2	4.5	0.9	47.5

619

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1.7	-	200.9	-	-	-
Hard coal	4.4	16.4	63.1	-	1.4	32.2
Oth.solid	-	-	-	10.5	5.9	-
H. fuel oil	15.6	-	0.7	17.8	-	1.3
Gas	-	-	-	0.0	0.0	0.8
of which boiler	-	-	-	0.0	0.0	0.8
of which turbine	-	-	-	-	-	-
Total	21.7	16.4	264.7	28.3	7.2	34.3

372.6

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	8.8	4.4	16.6	0.5	0.3	7.8
Hard coal	0.4	0.3	0.1	2.8	3.5	0.5
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.3	0.8	1.9	7.0	6.7	11.1
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	9.5	5.6	18.5	10.3	10.4	19.4

73.8

Germany

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	0.2	-	190.0	-	-	13.4	
Hard coal	1.4	16.9	156.4	-	0.3	3.6	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	-	-	-	-	-	-	
Gas	-	-	38.1	0.4	1.4	2.2	
of which boiler	-	-	26.3	0.4	1.4	2.2	
of which turbine	-	-	11.8	-	-	-	
Total	1.5	16.9	384.5	0.4	1.7	19.2	424.2

B. Industrial boilers [kt NOx] 1990

	Existing			New			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	3.5	6.0	23.7	-	-	3.2	
Hard coal	2.4	3.9	2.8	-	0.2	0.9	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	1.0	3.6	12.4	1.2	0.1	-	
Gas	-	-	-	-	-	-	
of which boiler	-	-	-	-	-	-	
of which turbine	-	-	-	-	-	-	
Total	6.9	13.5	39.0	1.2	0.3	4.0	65

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	0.1	-	34.8	-	-	-	
Hard coal	2.0	44.7	68.8	-	1.3	30.4	
Oth.solid	-	-	-	5.1	4.8	-	
H. fuel oil	1.9	-	0.3	3.0	-	0.9	
Gas	-	-	5.2	0.1	0.1	17.7	
of which boiler	-	-	5.2	0.0	0.0	7.5	
of which turbine	-	-	-	0.0	0.0	10.2	
Total	4.0	44.7	109.1	8.2	6.1	49.0	221.1

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	0.4	0.8	3.2	0.0	0.1	2.2	
Hard coal	0.1	0.4	0.0	1.0	3.1	0.4	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	0.2	0.5	0.4	1.8	3.9	4.4	
Gas	-	-	1.6	-	-	-	
of which boiler	-	-	1.6	-	-	-	
of which turbine	-	-	-	-	-	-	
Total	0.8	1.8	5.2	2.8	7.1	6.9	24.6

Greece LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	153	11,461	-	-	928
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	532	1,959	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	685	13,420	-	-	928

15,033

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	249	260	-	-	-	-
Gas	64	260	-	-	-	-
of which boiler	64	260	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	313	520	-	-	-	-

833

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	7,000	-	-	7,000
Hard coal	-	-	-	-	-	1,526
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	266	980	53	-	1,025
Gas	-	-	-	-	-	2,841
of which boiler	-	-	-	-	-	710
of which turbine	-	-	-	-	-	2,131
Total	-	266	7,980	53	-	12,392

20,690

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	249	260	-	-	-	-
Gas	64	510	-	-	-	-
of which boiler	64	260	-	-	-	-
of which turbine	-	250	-	-	-	-
Total	313	770	-	-	-	-

1,083

Greece

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	4	263	-	-	21
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	9	25	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	13	289	-	-	21

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	4	4	-	-	-	-
Gas	1	6	-	-	-	-
of which boiler	1	6	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	5	11	-	-	-	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	162	-	-	180
Hard coal	-	-	-	-	-	26
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	5	13	1	-	15
Gas	-	-	-	-	-	62
of which boiler	-	-	-	-	-	15
of which turbine	-	-	-	-	-	46
Total	-	5	175	1	-	283

323 464

B. Industrial boilers — PJ — 2010

0	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	1	7	-	-	-	-
of which boiler	1	4	-	-	-	-
of which turbine	-	4	-	-	-	-
Total	1	7	-	-	-	-

16 8

Greece

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	4.2	248.9	-	-	20.2
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	10.0	27.6	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	14.1	276.5	-	-	20.2

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	3.5	4.2	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	3.5	4.2	-	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	153.2	-	-	10.1
Hard coal	-	-	-	-	-	1.2
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	4.9	13.7	0.6	-	10.0
Gas	-	-	-	-	-	0.1
of which boiler	-	-	-	-	-	0.1
of which turbine	-	-	-	-	-	-
Total	-	4.9	166.9	0.6	-	21.4

310.8 193.8

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	-	-	-	-

8 -

Greece

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	1.2	71.1	-	-	5.8
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	1.7	5.1	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	2.9	76.2	-	-	5.8

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.5	0.6	-	-	-	-
Gas	0.1	0.4	-	-	-	-
of which boiler	0.1	0.4	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.6	1.1	-	-	-	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	15.3	-	-	8.8	
Hard coal	-	-	-	-	-	1.9	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	-	0.3	0.9	0.1	-	0.7	
Gas	-	-	-	-	-	1.6	
of which boiler	-	-	-	-	-	0.8	
of which turbine	-	-	-	-	-	0.7	
84.9 Total	-	0.3	16.2	0.1	-	12.9	29.5

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	-	-	-	-	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	-	-	-	-	-	-	
Gas	0.1	0.5	-	-	-	-	
of which boiler	0.1	0.5	-	-	-	-	
of which turbine	-	-	-	-	-	-	
2 Total	0.1	0.5	-	-	-	-	0.6

Ireland LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	476	844	322	-	-	-
Hard coal	-	-	2,390	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	3,919	-	-	-
Gas	-	288	2,421	-	-	-
of which boiler	-	-	669	-	-	-
of which turbine	-	288	1,752	-	-	-
Total	476	1,132	9,052	-	-	-

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	500	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	500	-	-	-

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	238	422	-	-	-	2,190
Hard coal	-	-	1,195	-	-	1,000
Oth.solid	-	-	-	907	907	-
H. fuel oil	-	-	1,960	-	-	10,596
Gas	-	144	1,211	-	-	1,629
of which boiler	-	36	303	-	-	407
of which turbine	-	108	908	-	-	1,222
Total	238	566	4,365	907	907	15,416

10,660 22,399

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	531
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	167	-	-	896
Gas	-	-	-	-	-	238
of which boiler	-	-	-	-	-	167
of which turbine	-	-	-	-	-	72
Total	-	-	167	-	-	1,666

500 1,832

Ireland

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	5	16	5	-	-	-
Hard coal	-	-	51	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	13	-	-	-
Gas	-	-	35	-	-	-
of which boiler	-	-	10	-	-	-
of which turbine	-	-	25	-	-	-
Total	5	16	104	-	-	-

125

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	2	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	2	-	-	-

2

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	3	5	-	-	-	21
Hard coal	-	-	26	-	-	24
Oth.solid	-	-	-	9	10	-
H. fuel oil	-	-	7	-	-	42
Gas	-	2	13	-	-	19
of which boiler	-	1	3	-	-	5
of which turbine	-	2	10	-	-	15
Total	3	7	46	9	10	107

181

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	6
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	2	-	-	9
Gas	-	-	-	-	-	2
of which boiler	-	-	-	-	-	2
of which turbine	-	-	-	-	-	1
Total	-	-	2	-	-	17

19

Ireland

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	5.1	15.6	4.9	-	-	-
Hard coal	-	-	59.9	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	22.8	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	5.1	15.6	87.5	-	-	-

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	3.2	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	3.2	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1.5	3.0	-	-	-	1.2
Hard coal	-	-	18.4	-	-	1.5
Oth.solid	-	-	-	1.3	1.0	-
H. fuel oil	-	-	7.4	-	-	3.2
Gas	-	-	-	-	-	0.0
of which boiler	-	-	-	-	-	0.0
of which turbine	-	-	-	-	-	-
Total	1.5	3.0	25.8	1.3	1.0	5.9

108.2 38.4

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	0.6
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	1.3	-	-	1.4
Gas	-	-	-	-	-	0.0
of which boiler	-	-	-	-	-	0.0
of which turbine	-	-	-	-	-	-
Total	-	-	1.3	-	-	2.0

3 3.3

Ireland

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	1.4	4.3	1.4	-	-	-
Hard coal	-	-	18.4	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	2.6	-	-	-
Gas	-	-	7.0	-	-	-
of which boiler	-	-	1.9	-	-	-
of which turbine	-	-	5.1	-	-	-
Total	1.4	4.3	29.3	-	-	-

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	0.4	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	0.4	-	-	-

NOx Emissions 10.2

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.1	0.2	-	-	-	1.0
Hard coal	-	-	4.7	-	-	1.8
Oth.solid	-	-	-	0.6	0.6	-
H. fuel oil	-	-	1.4	-	-	1.8
Gas	-	0.4	2.6	-	-	0.5
of which boiler	-	0.4	2.6	-	-	0.3
of which turbine	-	-	-	-	-	0.2
35.0 Total	0.1	0.6	8.7	0.6	0.6	5.1 15.7

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	0.5
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	0.3	-	-	0.7
Gas	-	-	-	-	-	0.1
of which boiler	-	-	-	-	-	0.1
of which turbine	-	-	-	-	-	0.0
0.4 Total	-	-	0.3	-	-	1.3 1.6

Italy LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	180	-	1,100	-	-	-
Hard coal	60	185	30,645	-	-	2,520
Oth.solid	60	-	-	-	-	-
H. fuel oil	2,825	6,845	35,510	-	-	6,940
Gas	727	779	24,320	-	-	-
of which boiler	727	779	20,320	-	-	-
of which turbine	-	-	4,000	-	-	-
Total	3,852	7,809	91,575	-	-	9,460

112,696

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	90	-	550	-	-	-
Hard coal	-	-	15,323	-	-	4,500
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	7,600	41,700	-	7,500	-
Gas	-	9,800	4,000	-	-	50,894
of which boiler	-	2,450	1,000	-	-	12,723
of which turbine	-	7,350	3,000	-	-	38,170
Total	90	17,400	61,573	-	7,500	55,394

141,956

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	1,700	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,890	5,810	6,300	-	-	-
Gas	1,360	5,600	7,140	-	-	-
of which boiler	1,360	5,600	7,140	-	-	-
of which turbine	-	-	-	-	-	-
Total	3,250	11,410	15,140	-	-	-

29,800

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	41	41	164	205	328	369
Oth.solid	-	-	-	-	-	-
H. fuel oil	767	4,181	910	702	1,035	2,401
Gas	1,863	7,417	3,600	1,490	2,607	9,687
of which boiler	1,304	5,192	2,520	1,043	1,825	6,781
of which turbine	559	2,225	1,080	447	782	2,906
Total	2,671	11,639	4,674	2,397	3,970	12,457

37,808

Italy

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	2	-	9	-	-	-
Hard coal	1	2	258	-	-	21
Oth.solid	1	-	-	-	-	-
H. fuel oil	28	78	325	-	-	63
Gas	11	14	350	-	-	-
of which boiler	11	14	292	-	-	-
of which turbine	-	-	58	-	-	-
Total	42	94	942	-	-	85

1,163

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	5	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	7	13	43	-	-	-
Gas	32	54	184	-	-	-
of which boiler	32	54	184	-	-	-
of which turbine	-	-	-	-	-	-
Total	39	67	232	-	-	-

338

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	384	-	-	125
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	45	208	-	49	-
Gas	-	191	57	-	-	800
of which boiler	-	48	14	-	-	200
of which turbine	-	143	42	-	-	600
Total	-	236	649	-	49	925

1,860

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0	0	1	2	3	3
Oth.solid	-	-	-	-	-	-
H. fuel oil	6	40	7	6	11	19
Gas	24	111	41	21	43	123
of which boiler	17	78	29	15	30	86
of which turbine	7	33	12	6	13	37
Total	30	151	49	29	58	145

462

Italy

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	2.7	-	14.9	-	-	-
Hard coal	0.4	1.3	167.5	-	-	13.8
Oth.solid	0.1	-	-	-	-	-
H. fuel oil	14.0	39.1	162.3	-	-	31.7
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	17.1	40.4	344.7	-	-	45.5

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	1.6	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	5.2	7.8	10.0	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	5.2	7.8	11.6	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	24.9	-	-	5.9	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	-	22.5	104.2	-	17.9	-	
Gas	-	-	-	-	-	0.7	
of which boiler	-	-	-	-	-	0.7	
of which turbine	-	-	-	-	-	-	
447.7 Total	-	22.5	129.1	-	17.9	6.6	176.1

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	0.2	0.2	0.1	0.6	0.9	0.2	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	3.2	20.4	3.4	2.5	4.0	4.0	
Gas	-	-	-	0.1	0.1	0.3	
of which boiler	-	-	-	0.1	0.1	0.3	
of which turbine	-	-	-	-	-	-	
25 Total	3.3	20.6	3.5	3.2	5.1	4.6	40.2

Italy

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	0.4	-	2.5	-	-	-
Hard coal	0.1	0.4	56.4	-	-	7.0
Oth.solid	0.1	-	-	-	-	-
H. fuel oil	6.2	17.2	71.4	-	-	14.0
Gas	2.3	2.8	69.9	-	-	-
of which boiler	2.3	2.8	58.4	-	-	-
of which turbine	-	-	11.5	-	-	-
Total	9.1	20.5	200.3	-	-	21.0

250.8

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	1.2	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.5	2.5	8.5	-	-	-
Gas	3.7	6.3	21.4	-	-	-
of which boiler	3.7	6.3	21.4	-	-	-
of which turbine	-	-	-	-	-	-
Total	5.1	8.8	31.1	-	-	-

45

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	25.3	-	-	5.7
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	9.9	16.0	-	4.6	-
Gas	-	38.2	4.0	-	-	16.5
of which boiler	-	38.2	4.0	-	-	7.0
of which turbine	-	-	-	-	-	9.5
Total	-	48.1	45.3	-	4.6	22.2

120.3

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.1	0.1	0.1	0.3	0.5	0.2
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.6	10.6	0.9	0.8	1.2	1.3
Gas	2.7	12.6	2.3	1.1	2.2	4.0
of which boiler	2.7	12.6	2.3	1.0	2.0	3.4
of which turbine	-	-	-	0.1	0.2	0.6
Total	4.5	23.3	3.3	2.2	4.0	5.6

42.8

Luxembourg LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	24	-	-	-
Gas	-	-	350	-	-	-
of which boiler	-	-	350	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	374	-	-	-

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	44	13	-	-	-	-
Gas	96	102	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	96	102	-	-	-	-
Total	140	115	-	-	-	-

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	100
of which boiler	-	-	-	-	-	25
of which turbine	-	-	-	-	-	75
Total	-	-	-	-	-	100

374 100

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	4	-	-	-	-
Gas	-	215	-	-	-	300
of which boiler	-	151	-	-	-	210
of which turbine	-	65	-	-	-	90
Total	-	219	-	-	-	300

254 519

Luxembourg

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	7	-	-	-
of which boiler	-	-	7	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	7	-	-	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	2
of which boiler	-	-	-	-	-	1
of which turbine	-	-	-	-	-	2
Total	-	-	-	-	-	2

7 2

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0	0	-	-	-	-
Gas	1	7	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	2	7	-	-	-	-

B. Industrial boilers — PJ — 2010

0	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	6	-	-	-	7
of which boiler	-	4	-	-	-	5
of which turbine	-	2	-	-	-	2
Total	-	6	-	-	-	7

9 13

Luxembourg

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	-	-	-	-

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.2	0.1	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.2	0.1	-	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	0.0
of which boiler	-	-	-	-	-	0.0
of which turbine	-	-	-	-	-	-
0.0 Total	-	-	-	-	-	0.0

0.0

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	0.0
of which boiler	-	-	-	-	-	0.0
of which turbine	-	-	-	-	-	-
0 Total	-	-	-	-	-	0.0

0.0

Luxembourg

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	0.4	-	-	-
of which boiler	-	-	0.4	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	0.4	-	-	-

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	0.0	-	-	-	-
Gas	0.1	0.5	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.1	0.5	-	-	-	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	-	-	-	-	0.0
of which boiler	-	-	-	-	-	0.0
of which turbine	-	-	-	-	-	0.0
Total	-	-	-	-	-	0.0

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	-	-	-	-
Gas	-	0.2	-	-	-	0.2
of which boiler	-	0.2	-	-	-	0.2
of which turbine	-	-	-	-	-	0.0
Total	-	0.2	-	-	-	0.2

0.4 0.0 0.6 0.4

Netherlands LCP

CAPACITY

A. Power plants and district heating plants — MWth — 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	7,680	-	-	3,540
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	1,700	-	-	-
Gas	-	-	15,980	-	-	-
of which boiler	-	-	13,980	-	-	-
of which turbine	-	-	2,000	-	-	-
Total	-	-	25,360	-	-	3,540

B. Industrial boilers — MWth — 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1,023	1,534	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	185	12,278	-	-	-	-
Gas	9,042	1,564	350	-	-	-
of which boiler	9,042	1,564	350	-	-	-
of which turbine	-	-	-	-	-	-
Total	10,250	15,376	350	-	-	-

A. Power plants and district heating plants — MWth — 2010

Fuel	Capacity range, MWth						
	Existing			New			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	3,840	-	-	1,497	
Oth.solid	-	-	-	843	843	-	
H. fuel oil	-	-	850	-	-	811	
Gas	-	-	7,990	-	-	29,700	
of which boiler	-	-	1,998	-	-	7,425	
of which turbine	-	-	5,993	-	-	22,275	
Total	-	-	12,680	843	843	32,007	46,373

28,900

B. Industrial boilers — MWth — 2010

Fuel	Existing			New			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	341	511	-	559	839	-	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	62	4,093	-	375	24,864	-	
Gas	3,014	521	117	6,831	1,182	264	
of which boiler	2,110	365	82	4,782	827	185	
of which turbine	904	156	35	2,049	354	79	
Total	3,417	5,125	117	7,765	26,884	264	43,572

25,976

Netherlands

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	159	-	-	73
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	10	-	-	-
Gas	-	-	211	-	-	-
of which boiler	-	-	185	-	-	-
of which turbine	-	-	26	-	-	-
Total	-	-	380	-	-	73

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	4	7	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0	6	-	-	-	-
Gas	113	23	4	-	-	-
of which boiler	113	23	4	-	-	-
of which turbine	-	-	-	-	-	-
Total	117	35	4	-	-	-

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	85	-	-	37
Oth.solid	-	-	-	12	14	-
H. fuel oil	-	-	5	-	-	6
Gas	-	-	119	-	-	492
of which boiler	-	-	30	-	-	123
of which turbine	-	-	89	-	-	369
Total	-	-	209	12	14	534

454 769

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1	2	-	2	4	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0	2	-	0	12	-
Gas	35	7	1	88	18	3
of which boiler	25	5	1	62	12	2
of which turbine	11	2	0	26	5	1
Total	36	11	1	91	33	3

157 176

Netherlands

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	26.6	-	-	11.0
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	8.6	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	35.2	-	-	11.0

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	2.1	3.6	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	2.5	-	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	2.1	6.0	-	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	4.1	-	-	1.5
Oth.solid	-	-	-	1.5	1.1	-
H. fuel oil	-	-	0.5	-	-	0.3
Gas	-	-	-	-	-	0.5
of which boiler	-	-	-	-	-	0.5
of which turbine	-	-	-	-	-	-
46.2 Total	-	-	4.6	1.5	1.1	2.3

9.4

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.4	0.7	-	0.4	0.5	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	0.8	-	0.0	1.5	-
Gas	-	-	-	0.2	0.0	0.0
of which boiler	-	-	-	0.2	0.0	0.0
of which turbine	-	-	-	-	-	-
8 Total	0.4	1.5	-	0.6	2.0	0.0

4.6

Netherlands

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	30.2	-	-	21.2
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	2.0	-	-	-
Gas	-	-	29.6	-	-	-
of which boiler	-	-	25.9	-	-	-
of which turbine	-	-	3.7	-	-	-
Total	-	-	61.9	-	-	21.2

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1.0	1.7	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	0.9	-	-	-	-
Gas	7.9	1.6	0.3	-	-	-
of which boiler	7.9	1.6	0.3	-	-	-
of which turbine	-	-	-	-	-	-
Total	8.9	4.1	0.3	-	-	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	4.9	-	-	1.7
Oth.solid	-	-	-	0.8	0.7	-
H. fuel oil	-	-	0.4	-	-	0.2
Gas	-	-	5.8	-	-	10.1
of which boiler	-	-	5.8	-	-	4.3
of which turbine	-	-	-	-	-	5.8
83.1 Total	-	-	11.1	0.8	0.7	12.0

24.6

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.2	0.3	-	0.3	0.3	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.0	0.1	-	0.0	0.6	-
Gas	1.2	0.2	0.0	3.3	0.7	0.1
of which boiler	1.2	0.2	0.0	2.9	0.6	0.0
of which turbine	-	-	-	0.4	0.1	0.0
13 Total	1.4	0.7	0.0	3.6	1.6	0.1

7.3

Portugal LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	6,560	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	224	4,411	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	224	10,971	-	-	-

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	235	336	-	-	-
H. fuel oil	112	262	847	-	-	-
Gas	117	-	2,048	-	-	85
of which boiler	117	-	1,448	-	-	85
of which turbine	-	-	600	-	-	-
Total	229	497	3,231	-	-	85

A. Power plants and district heating plants MWth 2010

	Capacity range, MWth						
	Existing			New			
Fuel	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	6,073	-	-	4,000	
Oth.solid	-	-	-	268	268	-	
H. fuel oil	-	112	4,411	-	-	-	
Gas	-	-	-	-	-	4,132	
of which boiler	-	-	-	-	-	1,033	
of which turbine	-	-	-	-	-	3,099	
11,195 Total	-	112	10,484	268	268	8,132	19,263

B. Industrial boilers MWth 2010

	Existing			New			
Fuel	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	-	71	154	1,000	
Oth.solid	-	78	112	-	-	-	
H. fuel oil	37	87	282	179	419	1,355	
Gas	39	-	683	234	-	4,080	
of which boiler	27	-	478	164	-	2,856	
of which turbine	12	-	205	70	-	1,224	
4,042 Total	76	166	1,077	483	573	6,435	8,810

Portugal

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	85	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	4	73	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	4	158	-	-	-

162

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2	3	12	-	-	-
Gas	0	-	2	-	-	0
of which boiler	0	-	1	-	-	0
of which turbine	-	-	1	-	-	-
Total	2	3	14	-	-	0

19

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	146	-	-	107
Oth.solid	-	-	-	4	4	-
H. fuel oil	-	0	12	-	-	-
Gas	-	-	-	-	-	75
of which boiler	-	-	-	-	-	19
of which turbine	-	-	-	-	-	57
Total	-	0	158	4	4	182

348

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	0	1	5
Oth.solid	-	-	-	-	-	-
H. fuel oil	0	1	1	1	3	8
Gas	0	-	7	3	-	47
of which boiler	0	-	5	2	-	33
of which turbine	0	-	2	1	-	14
Total	1	1	9	4	4	60

78

Portugal

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	57.9	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	5.0	91.2	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	5.0	149.1	-	-	-

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.2	3.8	13.6	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	2.2	3.8	13.6	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	99.1	-	-	5.1
Oth.solid	-	-	-	0.5	0.4	-
H. fuel oil	-	0.3	9.2	-	-	-
Gas	-	-	-	-	-	0.1
of which boiler	-	-	-	-	-	0.1
of which turbine	-	-	-	-	-	-
Total	-	0.3	108.3	0.5	0.4	5.2

154.1 114.7

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	0.1	0.3	0.5
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.2	0.4	1.1	0.5	1.1	2.6
Gas	-	-	-	0.0	-	0.1
of which boiler	-	-	-	0.0	-	0.1
of which turbine	-	-	-	-	-	-
Total	0.2	0.4	1.1	0.6	1.4	3.2

20 7.0

Portugal

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	25.5	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	0.8	14.6	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	0.8	40.1	-	-	-

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.3	0.6	2.0	-	-	-
Gas	0.0	-	0.1	-	-	0.0
of which boiler	0.0	-	0.1	-	-	0.0
of which turbine	-	-	0.0	-	-	-
Total	0.3	0.6	2.1	-	-	0.0

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	21.8	-	-	7.8	
Oth.solid	-	-	-	0.3	0.2	-	
H. fuel oil	-	0.1	2.4	-	-	-	
Gas	-	-	-	-	-	1.9	
of which boiler	-	-	-	-	-	1.0	
of which turbine	-	-	-	-	-	0.9	
40.9 Total	-	0.1	24.3	0.3	0.2	9.7	34.5

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	-	0.0	0.1	0.5	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	0.0	0.1	0.3	0.1	0.3	0.6	
Gas	0.0	-	0.5	0.1	-	1.6	
of which boiler	0.0	-	0.5	0.1	-	1.4	
of which turbine	-	-	-	0.0	-	0.2	
3 Total	0.1	0.1	0.8	0.3	0.4	2.7	4.2

Spain LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	155	9,325	-	-	-
Hard coal	-	210	20,645	-	600	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,615	1,605	12,995	-	600	-
Gas	-	-	5,000	-	-	-
of which boiler	-	-	5,000	-	-	-
of which turbine	-	-	-	-	-	-
Total	1,615	1,970	47,965	-	1,200	-

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	872	1,307	1,162	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,882	2,823	2,510	-	-	-
Gas	2,496	3,744	3,328	-	-	-
of which boiler	2,496	3,744	3,328	-	-	-
of which turbine	-	-	-	-	-	-
Total	5,250	7,874	7,000	-	-	-

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth						
	Existing			New			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	4,663	-	-	-	
Hard coal	-	105	10,323	-	300	9,401	
Oth.solid	-	-	-	2,121	2,121	-	
H. fuel oil	808	803	6,498	1,515	1,506	12,190	
Gas	-	-	2,500	-	-	24,489	
of which boiler	-	-	625	-	-	6,122	
of which turbine	-	-	1,875	-	-	18,367	
Total	808	908	23,983	3,636	3,927	46,080	

52,750 79,341

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	291	436	387	511	765	681
Oth.solid	-	-	-	-	-	-
H. fuel oil	627	941	837	1,096	1,643	1,461
Gas	832	1,248	1,109	4,272	6,409	5,697
of which boiler	582	874	777	2,991	4,486	3,988
of which turbine	250	374	333	1,282	1,923	1,709
Total	1,750	2,625	2,333	5,879	8,818	7,838

20,124 29,243

Spain

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	3	162	-	-	-
Hard coal	-	5	355	-	13	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	6	7	45	-	3	-
Gas	-	-	20	-	-	-
of which boiler	-	-	20	-	-	-
of which turbine	-	-	-	-	-	-
Total	6	15	582	-	16	-

619

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0	0	0	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	13	23	16	-	-	-
Gas	9	16	11	-	-	-
of which boiler	9	16	11	-	-	-
of which turbine	-	-	-	-	-	-
Total	22	38	27	-	-	-

88

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	2	195	-	8	198
Oth.solid	-	-	-	23	27	-
H. fuel oil	3	4	23	7	8	49
Gas	-	-	37	-	-	400
of which boiler	-	-	9	-	-	100
of which turbine	-	-	28	-	-	300
Total	3	6	256	30	42	647

983

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0	0	0	0	0	0
Oth.solid	-	-	-	-	-	-
H. fuel oil	4	7	5	8	14	10
Gas	3	5	3	16	27	19
of which boiler	2	3	2	11	19	14
of which turbine	1	1	1	5	8	6
Total	7	12	8	24	41	29

121

Spain

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	20.6	992.4	-	-	-
Hard coal	-	3.9	305.2	-	11.1	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	10.7	12.3	79.4	-	4.6	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	10.7	36.8	1,377.0	-	15.7	-

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.1	0.1	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	15.5	26.8	19.1	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	15.6	26.9	19.1	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	2.1	167.9	-	3.0	10.6
Oth.solid	-	-	-	3.5	2.8	-
H. fuel oil	3.3	3.8	24.6	2.7	2.8	16.7
Gas	-	-	-	-	-	0.4
of which boiler	-	-	-	-	-	0.4
of which turbine	-	-	-	-	-	-
Total	3.3	5.9	192.5	6.2	8.6	27.6

1440.1 244.2

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.0	0.0	0.0	0.0	0.0
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.9	5.0	3.5	2.4	3.7	2.3
Gas	-	-	-	0.0	0.1	0.1
of which boiler	-	-	-	0.0	0.1	0.1
of which turbine	-	-	-	-	-	-
Total	2.9	5.0	3.6	2.5	3.8	2.4

62 20.1

Spain

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	1.0	48.6	-	-	-
Hard coal	-	1.5	117.1	-	4.3	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	1.3	1.5	10.0	-	0.6	-
Gas	-	-	4.0	-	-	-
of which boiler	-	-	4.0	-	-	-
of which turbine	-	-	-	-	-	-
Total	1.3	4.0	179.7	-	4.8	-

189.9

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.0	0.0	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.2	3.8	2.7	-	-	-
Gas	0.9	1.6	1.1	-	-	-
of which boiler	0.9	1.6	1.1	-	-	-
of which turbine	-	-	-	-	-	-
Total	3.1	5.4	3.8	-	-	-

12.3

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	0.4	32.2	-	0.7	14.2
Oth.solid	-	-	-	1.7	1.6	-
H. fuel oil	0.2	0.3	1.8	0.4	0.4	2.1
Gas	-	-	2.6	-	-	10.1
of which boiler	-	-	2.6	-	-	5.3
of which turbine	-	-	-	-	-	4.8
Total	0.2	0.7	36.6	2.2	2.7	26.4

68.8

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.0	0.0	0.0	0.0	0.0	0.0
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.7	1.2	0.8	0.7	1.1	0.7
Gas	0.3	0.5	0.3	0.7	1.3	0.8
of which boiler	0.3	0.5	0.3	0.7	1.1	0.7
of which turbine	-	-	-	0.1	0.1	0.1
Total	1.0	1.7	1.2	1.5	2.4	1.5

9.2

Sweden LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	88	690	1,130	-	317	440
Oth.solid	55	1,520	370	419	277	-
H. fuel oil	216	800	9,230	60	479	-
Gas	-	-	780	197	142	-
of which boiler	-	-	-	197	142	-
of which turbine	-	-	780	-	-	-
Total	359	3,010	11,510	676	1,215	440

17,210

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	565	-	-	-
Gas	70	105	485	-	-	-
of which boiler	70	105	-	-	-	-
of which turbine	-	-	485	-	-	-
Total	70	105	1,050	-	-	-

1,225

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	345	565	-	159	7,000
Oth.solid	-	760	-	3,500	3,500	-
H. fuel oil	108	400	4,615	2,150	-	-
Gas	-	-	390	99	71	19,000
of which boiler	-	-	98	25	18	4,750
of which turbine	-	-	293	74	53	14,250
Total	108	1,505	5,570	5,748	3,730	26,000

42,661

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	188	-	-	375
Gas	23	35	162	111	167	771
of which boiler	16	25	113	78	117	540
of which turbine	7	11	49	33	50	231
Total	23	35	350	111	167	1,145

1,832

Sweden

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	1	8	11	-	4	4
Oth.solid	0	8	2	2	2	-
H. fuel oil	0	1	8	0	1	-
Gas	-	-	3	1	1	-
of which boiler	-	-	-	1	1	-
of which turbine	-	-	3	-	-	-
Total	1	17	24	3	7	4

57

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	8	10	-	4	134
Oth.solid	-	10	-	44	52	-
H. fuel oil	2	7	67	34	-	-
Gas	-	-	8	2	2	413
of which boiler	-	-	2	1	0	103
of which turbine	-	-	6	2	1	309
Total	2	25	84	80	58	547

796

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	4	-	-	-
Gas	1	1	3	-	-	-
of which boiler	1	1	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	1	1	7	-	-	-

8

B. Industrial boilers — PJ — 2010

0	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	1	-	-	3
Gas	0	0	1	1	1	5
of which boiler	0	0	1	1	1	4
of which turbine	0	0	0	0	0	2
Total	0	0	2	1	1	8

13

Sweden

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.2	1.8	1.9	-	0.6	0.5
Oth.solid	0.0	0.7	0.1	0.2	0.1	-
H. fuel oil	0.0	0.1	0.7	0.0	0.0	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.3	2.6	2.7	0.2	0.7	0.5

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	0.5	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	0.5	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	0.5	0.6	-	0.4	6.1	
Oth.solid	-	0.1	-	5.3	3.9	-	
H. fuel oil	0.1	0.6	5.3	4.0	-	-	
Gas	-	-	-	0.0	0.0	0.4	
of which boiler	-	-	-	0.0	0.0	0.4	
of which turbine	-	-	-	-	-	-	
7.0 Total	0.1	1.1	5.9	9.3	4.3	6.4	27.1

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	-	-	-	-	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	-	-	0.2	-	-	0.3	
Gas	-	-	-	0.0	0.0	0.0	
of which boiler	-	-	-	0.0	0.0	0.0	
of which turbine	-	-	-	-	-	-	
1 Total	-	-	0.2	0.0	0.0	0.3	0.5

Sweden

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.1	1.2	1.6	-	1.1	1.3
Oth.solid	0.0	1.1	0.2	0.3	0.2	-
H. fuel oil	0.0	0.2	1.7	0.0	0.1	-
Gas	-	-	0.5	0.1	0.1	-
of which boiler	-	-	-	0.1	0.1	-
of which turbine	-	-	0.5	-	-	-
Total	0.2	2.5	4.0	0.4	1.6	1.3

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	0.6	-	-	-
Gas	0.0	0.1	0.2	-	-	-
of which boiler	0.0	0.1	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	0.0	0.1	0.8	-	-	-

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	1.2	0.6	-	0.2	6.1
Oth.solid	-	0.3	-	2.8	2.5	-
H. fuel oil	0.1	0.5	2.7	1.9	-	-
Gas	-	-	0.2	0.1	0.0	9.9
of which boiler	-	-	0.2	0.0	0.0	5.0
of which turbine	-	-	-	0.0	0.0	4.9
9.9 Total	0.1	2.0	3.5	4.7	2.8	16.0

29.2

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	-	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	-	-	0.0	-	-	0.1
Gas	0.0	0.0	0.0	0.0	0.0	0.1
of which boiler	0.0	0.0	0.0	0.0	0.0	0.1
of which turbine	-	-	-	0.0	0.0	0.0
0.9 Total	0.0	0.0	0.1	0.0	0.0	0.2

0.3

United Kingdom LCP

CAPACITY

A. Power plants and district heating plants MWth 1990

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	82,816	-	-	-
Oth.solid	-	-	300	-	-	-
H. fuel oil	-	-	21,790	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	104,906	-	-	-

B. Industrial boilers MWth 1990

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	2,114	3,171	6,000	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	4,228	6,342	12,000	-	-	-
Gas	4,228	6,342	12,000	-	-	-
of which boiler	2,114	3,171	6,000	-	-	-
of which turbine	2,114	3,171	6,000	-	-	-
Total	10,570	15,855	30,000	-	-	-

104,906

A. Power plants and district heating plants MWth 2010

Fuel	Capacity range, MWth					
	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	41,408	-	-	-
Oth.solid	-	-	-	10,376	10,376	-
H. fuel oil	-	-	10,895	-	-	5,177
Gas	-	-	-	-	-	73,689
of which boiler	-	-	-	-	-	18,422
of which turbine	-	-	-	-	-	55,266
Total	-	-	52,303	10,376	10,376	78,865

151,921

B. Industrial boilers MWth 2010

Fuel	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	705	1,057	2,000	1,730	2,596	4,911
Oth.solid	-	-	-	-	-	-
H. fuel oil	1,409	2,114	4,000	5,048	7,572	14,327
Gas	1,409	2,114	4,000	3,947	5,920	11,202
of which boiler	987	1,480	2,800	2,763	4,144	7,842
of which turbine	423	634	1,200	1,184	1,776	3,361
Total	3,523	5,285	10,000	10,725	16,088	30,440

56,425

76,062

United Kingdom

FUEL

A. Power plants and district heating plants — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	1,988	-	-	-
Oth.solid	-	-	2	-	-	-
H. fuel oil	-	-	286	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	2,275	-	-	-

2,275

B. Industrial boilers — PJ — 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	9	15	23	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	16	28	42	-	-	-
Gas	90	155	234	-	-	-
of which boiler	45	77	117	-	-	-
of which turbine	45	77	117	-	-	-
Total	115	198	299	-	-	-

612

A. Power plants and district heating plants — PJ — 2010

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	704	-	-	-
Oth.solid	-	-	-	58	67	-
H. fuel oil	-	-	145	-	-	76
Gas	-	-	-	-	-	1,724
of which boiler	-	-	-	-	-	431
of which turbine	-	-	-	-	-	1,293
Total	-	-	849	58	67	1,801

2,774

B. Industrial boilers — PJ — 2010

	Existing			New		
0	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	3	5	7	7	13	19
Oth.solid	-	-	-	-	-	-
H. fuel oil	5	9	13	20	34	52
Gas	28	48	72	86	148	224
of which boiler	19	33	50	60	104	157
of which turbine	8	14	22	26	44	67
Total	35	61	92	113	195	295

792

United Kingdom

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	2,299.9	-	-	-
Oth.solid	-	-	0.1	-	-	-
H. fuel oil	-	-	428.4	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	2,728.4	-	-	-

B. Industrial boilers [kt SO2] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	10.2	17.6	26.6	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	27.1	46.8	70.9	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	37.3	64.4	97.5	-	-	-

SO2 Emissions

A. Power plants and district heating plants [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	-	-	488.9	-	-	-	
Oth.solid	-	-	-	8.7	7.1	-	
H. fuel oil	-	-	130.3	-	-	5.2	
Gas	-	-	-	-	-	1.6	
of which boiler	-	-	-	-	-	1.6	
of which turbine	-	-	-	-	-	-	
2728.4 Total	-	-	619.2	8.7	7.1	6.8	641.7

B. Industrial boilers [kt SO2] 2010

	Existing (built <1987)			New (built >1987)			
	50-100	100-300	>300	50-100	100-300	>300	
Br. coal	-	-	-	-	-	-	
Hard coal	2.0	3.4	5.2	4.2	6.6	2.7	
Oth.solid	-	-	-	-	-	-	
H. fuel oil	5.3	9.1	13.7	8.2	13.0	9.5	
Gas	-	-	-	0.2	0.4	0.6	
of which boiler	-	-	-	0.2	0.4	0.6	
of which turbine	-	-	-	-	-	-	
199 Total	7.2	12.5	18.9	12.6	19.9	12.7	83.9

United Kingdom

NOx Emissions

A. Power plants and district heating plants [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	656.0	-	-	-
Oth.solid	-	-	0.2	-	-	-
H. fuel oil	-	-	62.8	-	-	-
Gas	-	-	-	-	-	-
of which boiler	-	-	-	-	-	-
of which turbine	-	-	-	-	-	-
Total	-	-	719.1	-	-	-

B. Industrial boilers [kt NOx] 1990

	Existing			New		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	2.3	3.9	6.0	-	-	-
Oth.solid	-	-	-	-	-	-
H. fuel oil	2.9	5.0	7.5	-	-	-
Gas	7.7	13.3	20.1	-	-	-
of which boiler	3.8	6.6	10.0	-	-	-
of which turbine	3.8	6.6	10.0	-	-	-
Total	12.9	22.2	33.6	-	-	-

719.1 68.6

NOx Emissions

A. Power plants and district heating plants [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	-	-	116.2	-	-	-
Oth.solid	-	-	-	4.3	4.1	-
H. fuel oil	-	-	11.1	-	-	3.3
Gas	-	-	-	-	-	43.4
of which boiler	-	-	-	-	-	22.9
of which turbine	-	-	-	-	-	20.5
Total	-	-	127.4	4.3	4.1	46.7

B. Industrial boilers [kt NOx] 2010

	Existing (built <1987)			New (built >1987)		
	50-100	100-300	>300	50-100	100-300	>300
Br. coal	-	-	-	-	-	-
Hard coal	0.4	0.6	1.0	1.0	1.6	2.1
Oth.solid	-	-	-	-	-	-
H. fuel oil	0.5	0.8	1.2	2.0	3.1	4.1
Gas	2.3	4.0	6.0	3.5	6.1	8.4
of which boiler	2.3	4.0	6.0	3.1	5.4	7.3
of which turbine	-	-	-	0.4	0.7	1.1
Total	3.1	5.4	8.2	6.6	10.8	14.7

182.4 48.9