

# FURTHER ANALYSIS OF SCENARIO RESULTS OBTAINED WITH THE RAINS MODEL

*Interim Report to the*

Ministère de L'Aménagement du  
Territoire et de l'Environnement  
Direction de la Prévention des Pollutions et des Risques  
20, avenue de Ségur  
75302 Paris 07 SP

April 1999



International Institute for Applied Systems Analysis • A-2361 Laxenburg • Austria  
Tel: +43 2236 807 • Fax: +43 2236 71313 • E-Mail: [info@iiasa.ac.at](mailto:info@iiasa.ac.at)

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20, avenue de Ségur  
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on

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**Principal Authors:**

Markus Amann, Imrich Bertok, Janusz Cofala, Frantisek Gyarfas,  
Chris Heyes, Zbigniew Klimont, Sanna Syri, Wolfgang Schöpp

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International Institute for Applied Systems Analysis • A-2361 Laxenburg • Austria  
Tel: +43 2236 807 • Fax: +43 2236 71313 • E-Mail: [info@iiasa.ac.at](mailto:info@iiasa.ac.at)

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# 1 Work Element 1: Further Analysis Of Model Results

Work element 1 of the study carried out for the French Ministry of the Environment conducts an in-depth analysis of scenario results presented in earlier reports of IIASA to the European Commission (Amann *et al.*, 1999a) and to the UN/ECE Task Force on Integrated Assessment Modelling (Amann *et al.*, 1999b). The analysis was carried out for the following scenarios:

- Scenario H1: The central scenario presented in the Seventh Interim Report to the European Commission, addressing ground-level ozone and acidification. This scenario is limited to the EU-15 countries.
- Scenario J1: The central scenario selected by the UN/ECE Working Group on Strategies as the starting point for their negotiations in its updated version (revision of Scenario G5/2). This scenario addresses ground-level ozone, acidification and eutrophication and covers all countries in the EMEP model domain, i.e., the UN/ECE region excluding US and Canada. The scenario was presented at the 23<sup>rd</sup> Meeting of the UN/ECE Task Force on Integrated Assessment Modelling.
- Scenario J1/S1: A variant of scenario J1, in which for France its 'S1 energy scenario' was used instead of the DG-XVII Business as usual scenario.
- Scenario H6/2 presented in IIASA's Seventh Interim Report to the Commission; addressing acidification only.
- The Reference scenario, which depicts the effects of current legislation anticipated for the year 2010.

## 1.1 Measures Assumed For The Current Legislation Scenario

The tables in Annex 1 provide for the Reference Scenario details about the measures and the extent to which they are assumed to be implemented in the year 2010.

## 1.2 Scenario H1

### 1.2.1 Emissions Per Country

National emission ceilings for the H1 scenario are listed in Table 1.1 and Table 1.2.

Table 1.1: Emissions for the central scenario H1 compared to the REF case. Percentage changes relate to the year 1990.

	SO <sub>2</sub>				NO <sub>x</sub>				VOC				NH <sub>3</sub>			
	REF		H1		REF		H1		REF		H1		REF		H1	
	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change
Austria	40	-57%	40	-57%	103	-46%	91	-53%	205	-42%	129	-63%	67	-13%	67	-13%
Belgium	193	-43%	76	-77%	191	-46%	127	-64%	193	-48%	102	-73%	96	-1%	57	-41%
Denmark	90	-51%	77	-58%	128	-53%	127	-54%	85	-53%	85	-53%	72	-6%	71	-8%
Finland	116	-49%	116	-49%	152	-45%	152	-45%	110	-48%	110	-48%	31	-23%	31	-23%
France	448	-64%	218	-83%	858	-54%	679	-64%	1223	-49%	932	-61%	777	-4%	718	-11%
Germany	581	-89%	463	-91%	1184	-56%	1051	-61%	1137	-64%	924	-70%	571	-25%	413	-45%
Greece	546	8%	546	8%	344	0%	264	-23%	267	-21%	173	-49%	74	-8%	74	-8%
Ireland	66	-63%	28	-84%	70	-38%	59	-48%	55	-50%	55	-50%	126	-1%	123	-3%
Italy	567	-66%	566	-66%	1130	-45%	869	-57%	1159	-44%	962	-53%	432	-6%	430	-7%
Luxembourg	4	-71%	3	-79%	10	-55%	8	-64%	7	-63%	6	-68%	7	0%	7	0%
Netherlands	73	-64%	50	-75%	280	-48%	238	-56%	233	-52%	156	-68%	136	-42%	104	-55%
Portugal	141	-50%	141	-50%	177	-15%	144	-31%	144	-32%	102	-52%	67	-6%	67	-6%
Spain	774	-65%	746	-66%	847	-27%	781	-33%	669	-34%	662	-34%	353	0%	353	0%
Sweden	67	-44%	67	-44%	190	-44%	152	-55%	290	-43%	219	-57%	48	-21%	48	-21%
UK	980	-74%	497	-87%	1186	-58%	1181	-58%	1351	-49%	964	-64%	297	-10%	264	-20%
EU-15	4687	-71%	3637	-78%	6849	-48%	5922	-55%	7128	-49%	5581	-60%	3154	-12%	2826	-21%

Table 1.2: Emission control costs for the central scenario H1 compared to the REF case. Control costs in million EURO/year.

	SO <sub>2</sub>			NO <sub>x</sub> /VOC			NH <sub>3</sub>			Total		
	REF	H1	Total	REF	H1	Total	REF	H1	Total	REF	H1	Total
Austria	191	0	191	902	119	1021	0	0	0	1093	119	1212
Belgium	426	127	553	1278	459	1737	0	467	467	1704	1053	2757
Denmark	138	5	143	484	0	484	0	0	0	623	6	629
Finland	247	0	247	642	0	642	0	0	0	889	0	889
France	1276	136	1412	7383	739	8122	0	41	41	8659	916	9575
Germany	3264	244	3508	10549	1048	11597	0	854	854	13813	2147	15960
Greece	434	0	434	1048	338	1386	0	0	0	1482	338	1820
Ireland	132	20	152	477	4	481	9	20	29	618	44	662
Italy	1776	0	1776	7868	403	8271	0	0	0	9644	403	10047
Luxembourg	13	1	14	71	4	75	15	0	15	98	4	102
Netherlands	340	19	359	1731	211	1942	196	741	937	2267	971	3238
Portugal	181	0	181	1349	57	1406	0	0	0	1530	57	1587
Spain	809	9	818	5658	13	5671	28	0	28	6495	22	6517
Sweden	316	0	316	1125	87	1212	113	0	113	1554	87	1641
UK	1269	299	1568	6695	1026	7721	0	23	23	7964	1348	9312
EU-15	10813	861	11674	47258	4508	51766	361	2146	2507	58433	7514	65947



## 1.2.2 Emission Control Costs Per Country And Sector

Table 1.3: Control costs for SO<sub>2</sub> emissions per sector for the H1 scenario

	PP new	PP ex	IND	DOM	TRA	AGRI	TOTAL
Austria	0	0	0	0	0	0	0
Belgium	12	28	59	27	0	0	126
Denmark	0	6	0	0	0	0	6
Finland	0	0	0	0	0	0	0
France	0	3	121	4	9	0	138
Germany	10	2	103	126	0	0	242
Greece	0	0	0	0	0	0	0
Ireland	1	13	5	1	1	0	21
Italy	0	0	0	0	0	0	0
Luxembourg	0	0	1	0	0	0	1
Netherlands	0	0	14	0	5	0	19
Portugal	0	0	0	0	0	0	0
Spain	0	9	0	0	0	0	9
Sweden	0	0	0	0	0	0	0
UK	0	55	184	16	60	0	315
EU-15	23	117	486	174	76	0	875

Table 1.4: Control costs for NO<sub>x</sub> emissions per sector for the H1 scenario

	PP new	PP ex	IND	DOM	TRA	AGRI	TOTAL
Austria	6	0	8	4	5	0	22
Belgium	2	20	127	66	5	0	220
Denmark	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	20	24	258	75	44	0	420
Germany	41	75	116	60	81	0	373
Greece	17	0	41	10	126	0	194
Ireland	0	1	2	1	0	0	4
Italy	64	8	100	30	40	0	243
Luxembourg	0	0	1	0	0	0	2
Netherlands	2	37	29	37	19	0	124
Portugal	4	2	7	0	0	0	13
Spain	0	8	1	0	0	0	9
Sweden	7	2	13	0	18	0	40
UK	0	0	0	0	3	0	3
EU-15	163	177	703	282	342	0	1667

Table 1.5: Control costs for VOC emissions from stationary sources per sector for the H1 scenario

	Fuel process. & distr.	Solvents use in industry	Industr. paint use	Other industry	Domestic	Energy	Transport (2-stroke)	Total
Austria	10	57	5	4	20	0	3	104
Belgium	19	40	54	101	18	0	8	240
Denmark	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0
France	64	131	49	8	12	0	55	328
Germany	20	333	196	46	90	0	7	737
Greece	21	10	2	0	5	0	28	66
Ireland	0	0	0	0	0	0	0	0
Italy	9	29	9	10	5	0	99	172
Luxembourg	0	1	0	0	0	0	0	2
Netherlands	12	24	23	22	1	0	9	113
Portugal	16	20	4	2	3	0	2	48
Spain	0	4	0	0	0	0	0	4
Sweden	12	8	3	9	0	0	13	48
UK	209	402	64	142	159	0	28	1147
EU-15	391	1060	410	344	313	0	253	3009

Table 1.6: Control costs for NH<sub>3</sub> emissions per sector for the H1 scenario

	PP new	PP ex	IND	DOM	TRA	AGRI	TOTAL
Austria	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	467	467
Denmark	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	0	0	0	0	0	41	41
Germany	0	0	0	0	0	854	854
Greece	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	20	20
Italy	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	741	741
Portugal	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0
UK	0	0	0	0	0	23	23
EU-15	0	0	0	0	0	2146	2146

## 1.2.3 Marginal Costs Per Country And Pollutant

### 1.2.3.1 Unit Costs Per PJ

The RAINS model calculates unit costs for the removal of emissions based on annualized investment-related ( $I^{an}$ ) and fixed and variable operating costs ( $OM^{fix}$ ,  $OM^{var}$ ) (Cofala and Syri, 1998) In Equation 1 all expenditures of a control technology are related to one unit of fuel input (in PJ). The investment related costs are converted to fuel input by applying the capacity utilization factor  $pf$  (operating hours/year):

$$c_{PJ} = \frac{I^{an} + OM^{fix}}{pf} + OM^{var} \quad (1)$$

### 1.2.3.2 Unit Costs Per Ton SO<sub>2</sub> Removed

Although the cost coefficient  $c_{PJ}$  is useful for the calculation of the effects of controls on the prices of output fuels (e.g., electricity or heat), the cost efficiency of different control options can only be evaluated by relating the abatement costs to the amount of reduced SO<sub>2</sub> emissions. For this purpose Equation 2 is used ( $ef$  – emission factor and  $\eta$  – emission reduction efficiency):

$$c_{SO_2} = c_{PJ} / (ef * \eta) \quad (2)$$

### 1.2.3.3 Marginal Reduction Costs

Another way to evaluate costs of emission reductions follows the concept of marginal costs. Marginal costs relate the extra costs for an additional measure to the marginal abatement of that measure (compared to the abatement of the less effective option). RAINS uses the concept of marginal costs for ranking the available abatement options according to their cost effectiveness into so-called 'national cost curves'.

If, for a given emission source (category), a number of control options  $M$  is available, the marginal costs  $mc_m$  for control option  $m$  are calculated as

$$mc_m = \frac{c_m \eta_m - c_{m-1} \eta_{m-1}}{\eta_m - \eta_{m-1}}$$

with

- $c_m$  unit costs for option  $m$  and
- $\eta_m$  removal efficiency of option  $m$ .

For Scenario H1, the marginal costs and the corresponding unit costs are presented in Table 1.7 and Table 1.8.

Table 1.7: Marginal costs per country and pollutant for the H1 scenario (in EURO/ton pollutant; for mobile sources EURO/ton NO<sub>x</sub> )

	Sectoral cost curves						
	SO <sub>2</sub>	NO <sub>x</sub> Stationary sources	Passenger cars + off-road- gasoline	Passenger cars - diesel	Heavy duty trucks and off-road	VOC Stationary sources	NH <sub>3</sub>
Austria	0	3571	975	0	2210	4448	0
Belgium	4687	11976	1114	0	2327	10000	40581
Denmark	412	216	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	2509	7171	4404	0	1309	2783	2471
Germany	4336	7981	3461	0	3705	10000	20949
Greece	0	7000	4160	0	3329	3017	0
Ireland	1319	805	0	0	0	0	7965
Italy	0	2863	0	0	1245	1650	10
Luxembourg	550	649	1424	0	2693	1697	0
Netherlands	1662	4955	1203	0	2829	6439	84065
Portugal	0	1212	0	0	0	2841	0
Spain	320	263	0	0	0	550	0
Sweden	0	2717	2873	0	1720	1558	0
UK	2477	567	2914	0	0	10000	1373

A zero means no additional measures compared to the REF case

Table 1.8: Unit costs per country and pollutant for the H1 scenario (in EURO/ton pollutant; for mobile sources EURO/ton NO<sub>x</sub> )

	Sectoral cost curves						
	SO <sub>2</sub>	NO <sub>x</sub> Stationary sources	Passenger cars + off-road- gasoline	Passenger cars - diesel	Heavy duty trucks and off-road	VOC Stationary sources	NH <sub>3</sub>
Austria	0	2863	975	0	1728	4448	0
Belgium	4687	7571	1114	0	1820	10000	15028
Denmark	412	216	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	1674	7171	4404	0	1024	2783	1822
Germany	4336	6506	3461	0	2898	10000	14961
Greece	0	4732	4160	0	2961	3017	0
Ireland	729	805	0	0	0	0	7965
Italy	0	2863	0	0	973	1650	10
Luxembourg	464	649	1424	0	2106	1280	0
Netherlands	1444	3785	1203	0	2212	5587	21288
Portugal	0	1212	0	0	0	2841	0
Spain	320	263	0	0	0	550	0
Sweden	0	2581	2873	0	1345	1326	0
UK	1479	567	2914	0	0	10000	1156

## 1.2.4 Groups Of Measures Taken In The H1 Scenario

The following tables provide information about the groups of measures taken in the optimized H1 scenario. The table distinguishes measures fully or partly implemented already in the 'Current legislation case' and measures which should be taken in addition in order to achieve the emission ceilings of the H1 scenario.

Table 1.9: Legend for Table 1.10 to Table 1.21.

O = fully implemented.in REF	printed in <i>italics</i>
o = partially implemented in REF	
<b>X</b> = fully implemented in H1	printed in <b>bold</b>
<b>x</b> = partially implemented in H1	
N.A. = category not applied to the country in concern	
* = fuel/sector combinations do not appear in the given energy pathway	

Table 1.10: Controls for SO<sub>2</sub> emissions in the electricity sector for the H1 scenario

Fuels	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
<b>New powerplants, Low sulfur fuels</b>															
Other solids															
Heavy fuel oil < 1 %				O											
Light fuel oil < 0.1 %		X				X									
<b>New powerplants, Limestone injection and fluidized bed combustion</b>															
Hard coal															
Brown coal				o											
Other solids								x							
<b>New powerplants, FGD</b>															
Hard coal	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Brown coal	O	O	O		O	o	O	O	O	O	O	O	O	O	O
Other solids	O	X		o		O								o	
Heavy fuel oil	O	O	O		O	O		O	o	O	o	O	O	O	O
<b>New powerplants, Hgh efficiency FGD</b>															
Hard Coal		x													
Brown coal						o/x									
Heavy fuel oilF															
<b>Existing powerplants, Low sulfur fuels</b>															
Hard coal		o			X								x		o/X
Heavy fuel oil < 1 %			x	O											X
Light fuel oil < 0.1 %		X				X									
<b>Existing powerplants, Limestone injection</b>															
Hard coal						o									
Brown coal					O	o									
Other solids															
<b>Existing powerplants, FGD</b>															
Hard coal	O	X		O		o		X	O		O			O	o
Brown coal	o					o								O	
Other solids	o	X												o	
Heavy fuel oil	o	X				O					o			O	o

Table 1.11: Controls for SO<sub>2</sub> emissions in the industrial sector for the H1 scenario

Fuel	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
<b>Industry, Low sulfur fuels</b>															
Hard coal			o	O	o	o/X				o			o	o	
Coke, briquettes															
Heavy fuel oil < 1 %		X			X			X		O					X
Light fuel oil < 0.1 %		X				X									
<b>Industry, Combustion modification</b>															
Hard coal											X				
Brown coal	o					O									
<b>Industry, FGD</b>															
Hard coal	o	X	o	O	o/X	o		o	o	o	o			o	o/X
Brown coal	o	X			o	X				o				o	o
Other solids	o*													o	
Heavy fuel oil		X	O		X	o/X		X		o				o	X
<b>Industrial processes</b>															
Stage 1		o	O						O						
Stage 2	O			O		O				O					
Stage 3		X			X	X		X		o/x	O			O	X

Table 1.12: Control measures for SO<sub>2</sub> emissions for the conversion and transport sectors for the H1 scenario

	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
<b>Conversion sector, Low sulfur fuels</b>															
Hard coal				o	o					o*			o/X		o
Coke, briquettes															
Heavy fuel oil < 1 %		X			X	X									X
Light fuel oil < 0.1 %		X				X									
<b>Conversion sector, Combustion modification</b>															
Hard coal		X				O									
Brown coal						O									
<b>Conversion sector, FGD</b>															
Hard coal	o		o	o	X			o	o		o			o	X
Brown coal	O*				o					o*				o	o*
Other solids	o*					o								o*	
Heavy fuel oil	o		O	O		X		X		o*	X			o	X
<b>Residential &amp; commercial sector, Low sulfur fuels</b>															
Hard coal	O	X	O	O	X	X		X						O	X
Coke, briquettes	O	X			X	X								O	X
Heavy fuel oil < 1 %		X		O	X	X		X							X
Light fuel oil < 0.1 %		X				X									
<b>Off-road transport and machinery, Low sulfur fuel</b>															
Heavy fuel oil < 1 %		X		O											
Diesel < 0.1 %		X													
<b>Inland and coastal shipping, Low sulfur fuels</b>															
Heavy fuel oil					X	o		X			X			o	X
Diesel					X			X			o/X			O	X



Table 1.13: NO<sub>x</sub> control measures for the power plant sector in the H1 scenario

Fuel	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
	<b>New powerplants, SCR</b>														
Hard coal	o/X	o/X	o	O	X	o/X	O		o/X		o*	X		O	
Brown Coal	o*			o*		o/X	O				o*			X	
Coke, briquettes		X			X										
Heavy fuel oil	o/X	o/X	o*	o		o*	O		o/X		o	X		o/X	
Natural gas	o/X	o/X		o	X	o/X			o/x		o/X			O	
	<b>Existing powerplants, Combustion modification</b>														
Hard coal		o	o	O	O	O	O	X	O	O*	O	X	o/X	o	o
Brown Coal	O		O*	o	O*	o	O			O*	O*		o*	O	o*
Coke, briquettes	X	X	X		X	O		X	X	O*	O	X		o/X	
Heavy fuel oil	o	o		o	O*	O	O		o/X	O*	O*	X		O	o
Light fuel oil		X			X	o/X	O		X						
LPG						o/X			X					X	
Natural gas	o	o/X		o	O	o	O	X	o/X	O	O	X	X	O	
	<b>Existing powerplants, SCR</b>														
Hard coal	O	X	o		x	O	X		O		X			o/X	
Brown Coal	O					o									
Coke, briquettes															
Heavy fuel oil	o	X				O	X								
Natural gas	o					o									

Table 1.14: NO<sub>x</sub> control options for the industrial sector in the H1 scenario

Fuel	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
	<b>Industry, Combustion modifications</b>														
Hard coal	O		X		o	o	O	o/X	o	o	O			o	o
Coke, briquettes	O				o	o				o	O			o	o
Other solids	X	X			X	O	O	X	X		X	X		o/X	
Heavy fuel oil	O	o		o	o	o	O	o/X	o	o	O*	o/X	o	o	o
Light fuel oil	X				X	O	O	X	X	X		X		X	
LPG	X	X				O	O		X		X	X		X	X
Natural gas	O	o			o	O	O	X	o/X	o/X	O	o/X	o	o/X	o
	<b>Industry, SCR and SNCR</b>														
Hard coal	X	X		o	X	X			o/X		X	x		X	
Brown coal	X	X		o		X			X						
Coke, briquettes															
Heavy fuel oil	X	X		o	X	o/X			X	x				X	
Natural gas	x	X		o	X	o/x					x				
	<b>Industrial process emissions</b>														
Stage 1		o	O	O			O	x	X	O				o/X	
Stage 2	O				X	O					O	X			
Stage 3		x								X					

Table 1.15: NO<sub>x</sub> control options for the conversion and residential sectors for the H1 scenario

	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
<b>Conversion sector, Combustion modifications</b>															
Hard coal	O				o	o		o	o	o*	O		X	o/X	o
Coke, briquettes	O*				o*	o				o*	O*			o*	o*
Other solids												X*			
Heavy fuel oil	O	o	o/X		o	o	O	o/X		o*	O	o/X	o/X	o/X	o
Light fuel oil	X	X			X	O		X	X			X			
LPG	X	X				O	O		X			X			X
Natural gas	O	o			o	O	O		o/X	o*	O	o/X	o	o	o/X
<b>Conversion sector, SCR and SNCR</b>															
Hard coal	X	X		o	X	o/X			o/X		X				
Brown coal				o*											
Coke, briquettes															
Heavy fuel oil	X	X			X	o/X	O		X		X				
Natural gas		X		o	X	o/X									
<b>Commercial sector, Combustion modifications</b>															
Hard coal															
Coke, briquettes															
Other solids															
Heavy fuel oil	X	X			X	O	O	X	X			X			x
Light fuel oil		X						x							
LPG		X						X							
Natural gas	X	X			X		O		X	X					
<b>Residential sector, Combustion modifications</b>															
Hard coal															
Coke, briquettes															
Heavy fuel oil															
Light fuel oil		X													
LPG		X													
Natural gas															

Table 1.16: NO<sub>x</sub> control options for the conversion and residential sectors for the H1 scenario

	AUS	BEL	DK	FIN	France	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
<b>Road transport, heavy duty trucks and buses</b>															
Diesel EURO--4	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Gasoline Catalytic converters	X	X							X	X	X				
<b>Other transport (agricultural tractors, rail, off-road machinery)</b>															
Heavy fuel oil (for heating, etc.), Combustion modifications		X							X					X	
Diesel EURO-2	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Diesel EURO-3															
Diesel EURO-4	X	X			X	X	X		X	X	X			X	
Gasoline Catalytic converters	X				X	X	X							x	
<b>Road transport, cars and, light duty trucks</b>															
Diesel - EURO-4	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Gasoline and LPG EURO-4	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Natural gas Catalytic converters	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
<b>Other transport, national sea traffic</b>															
Heavy fuel oil - Combustion modification															
Heavy fuel oil - SCR					X		O	X			X				X
Diesel - Combustion modification							O	X	X		X			X	X
Diesel - SCR					X				X					X	X

Table 1.17: VOC control measures in industry selected in the REF and the H1 scenario

	AUS	BEL	DK	FIN	FRA	GER	GRE	ITA	IRE	LUX	NL	POR	SPA	SWE	UK
	<b>Fuel processing and distribution</b>														
Internal floating covers	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>
Leak detection & repair	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>
Covers on oil-water separators	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>
Flaring and incineration	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>O</i>	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>O</i>	<i>o-X</i>	<i>O</i>
Stage I	<i>O</i>	<i>o-X</i>	<i>O</i>		<b>X</b>	<i>O</i>	<b>X</b>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>O</i>	<b>X</b>	<i>O</i>	<i>o-X</i>	<i>o-X</i>
Stage II	<i>O</i>	<i>o-X</i>	<i>O</i>		<b>X</b>	<i>O</i>		<i>o</i>		<i>O</i>	<i>O</i>	<b>X</b>		<i>O</i>	<b>X</b>
Vapor balancing - tankers															<i>O</i>
	<b>Chemical industry</b>														
Internal floating covers	<b>X</b>	<b>X</b>				<i>O</i>					<b>X</b>	<b>X</b>		<b>X</b>	
Leak detection & repair	<b>X</b>	<i>O</i>			<b>X</b>	<i>O</i>	<b>X</b>	<i>O</i>			<i>O</i>	<i>O</i>	<i>O</i>		<i>o-X</i>
Vapor recovery		<b>X</b>				<i>o-X</i>					<b>X</b>				<b>X</b>
Flaring and incineration	<b>X</b>	<i>o-X</i>			<i>o-X</i>	<i>o-X</i>	<b>X</b>	<i>o-X</i>			<i>o-X</i>	<i>o-X</i>	<i>o</i>	<b>X</b>	<i>o-X</i>
	<b>Other industry, waste disposal</b>														
Good housekeeping	<i>O</i>	<i>O</i>			<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>		<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	
Incineration (food & drink)		<b>X</b>				<b>X</b>									<b>X</b>
Emulsion bitumen (road paving)	<i>O</i>	<i>O</i>		<i>O</i>	<i>O</i>	<i>O</i>		<i>O</i>			<i>O</i>			<i>O</i>	
New/improved landfills	<b>X</b>	<i>O</i>			<i>O</i>	<i>O</i>		<i>O</i>			<i>O</i>		<i>O</i>	<b>X</b>	<i>O</i>

Table 1.18: VOC control measures for solvent use selected in the REF and the H1 scenario

	AUS	BEL	DK	FIN	FRA	GER	GRE	ITA	IRE	LUX	NL	POR	SPA	SWE	UK
	<b>Solvent use in industry</b>														
New closed circle machines	<i>o</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o-X</i>
Conventional closed circle machines (existing install.)						<i>O</i>	<b>X</b>	<b>X</b>	<i>O</i>	<b>X</b>		<b>X</b>	<i>O</i>	<b>X</b>	<i>O</i>
Primary measures	<i>PRINT, DEGR, GLUE,</i>  <b>DEGR, WOOD</b>	<i>PRINT, DEGR, GLUE</i>  <b>DEGR</b>	<i>GLUE</i>	<i>PRINT, DEGR, PHARM</i>  <b>PRINT, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>	<i>PRINT, DEGR, GLUE, PHARM, PIS, INDOS</i>  <b>PRINT, DEGR, WOOD, INDOS</b>
Substitution/reformulation	<i>PRINT, PIS, PNIS, INDOS</i>  <b>INDOS</b>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>DEGR, PHARM</b>	<i>PRINT, PIS, PNIST</i>	<i>PRINT, PIS, PNIST</i>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>PRINT, GLUE</b>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>PRINT, PIS</b>	<i>PRINT, PIS,</i>  <b>PRINT, GLUE</b>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>PRINT</b>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>PRINT</b>	<i>PRINT, GLUE, PIS, PNIS,</i>  <b>PRINT, GLUE</b>	<i>PRINT, GLUE, PIS, PNIS, INDOS</i>  <b>PRINT, INDOS</b>	<i>PRINT, GLUE, PIS, PNIS, INDOS</i>  <b>PRINT, INDOS</b>	<i>PRINT, GLUE, PIS, PNIS</i>  <b>PRINT, INDOS</b>	<i>PRINT, PIS, PNIS</i>  <b>PRINT, INDOS</b>	<i>PRINT, GLUE, PIS, PNIS, INDOS</i>  <b>INDOS</b>

Sectors: PRINT ... printing; PHARM ... pharmaceutical industry, WOOD ... wood preservation; DEGR ... degreasing, PIS .. products including solvents, PNIS ... products not including solvents, GLUE ... industrial use of glue and adhesives; INDOS ... other industrial use of solvents ; VEHR ... vehicle refinishing; ARCH ... architectural use of paints, AUTO ... automobile production

Table 1.19: VOC control measures for solvent use selected in the REF and the H1 scenario

	AUS	BEL	DK	FIN	FRA	GER	GRE	ITA	IRE	LUX	NL	POR	SPA	SWE	UK	
<b>Solvent use in industry (continued)</b>																
End-of-pipe	<i>PRINT,</i> <i>PHARM</i> <i>WOOD</i>  <b>PRINT</b> <b>PHARM</b> <b>DEGR,</b> <b>PIS</b> <b>INDOS</b>	<i>PRINT,</i> <i>PHARM</i>  <b>PRINT</b> <b>PHARM</b> <b>DEGR,</b> <b>PIS</b> <b>PNIS</b> <b>GLUE</b>	<i>PRINT,</i> <i>PIS</i>	<i>PRINT,</i> <i>PHARM</i> <i>WOOD</i>	<i>PRINT,</i> <i>PHARM</i>  <b>PRINT</b> <b>PHARM</b> <b>DEGR,</b> <b>PIS</b> <b>INDOS</b>	<i>PRINT,</i> <i>PIS,</i>  <i>PHARM,</i> <i>WOOD,</i> <i>GLUE,</i>  <b>PRINT</b> <b>PHARM</b>  <b>PIS</b> <b>PNIS</b> <b>INDOS</b> <b>GLUE</b> <b>WOOD</b>	<i>PRINT,</i>  <i>PNIS,</i> <i>PHARM,</i> <i>WOOD,</i>  <b>PHARM</b> <b>DEGR,</b> <b>PIS,</b> <b>PNIS,</b> <b>INDOS</b>	<i>PRINT</i>  <i>PHARM,</i>  <b>PRINT,</b>  <b>INDOS</b>	<i>PRINT</i>	<i>PRINT,</i>  <i>WOOD,</i>  <b>PRINT,</b>  <b>DEGR,</b> <b>PIS,</b> <b>PNIS</b>	<i>PRINT,</i>  <i>PNIS</i> <i>PHARM,</i> <i>WOOD,</i>  <b>PRINT</b> <b>PHARM</b>  <b>PIS</b> <b>PNIS</b> <b>INDOS</b> <b>GLUE</b> <b>WOOD</b>	<i>PRINT,</i>  <i>PHARM</i>  <b>PRINT,</b>  <b>DEGR,</b> <b>PIS,</b> <b>PNIS,</b> <b>INDOS</b>	<i>PRINT,</i>  <i>PHARM</i>  <b>PRINT,</b>  <b>INDOS</b>	<i>PRINT,</i>  <i>PHARM,</i> <i>WOOD</i>  <b>PRINT,</b>  <b>INDOS</b>	<i>PRINT,</i>  <i>PHARM,</i> <i>WOOD</i>  <b>PRINT</b> <b>PHARM</b>  <b>PIS</b> <b>PNIS</b> <b>GLUE,</b> <b>WOOD</b>	
<b>Paint use (excluding 'Do It Yourself' applications)</b>																
Primary measures	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	
Low solvent paints	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>IND</b> <b>ARCH</b> <b>AUTO</b>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>	<i>IND,</i> <i>VEHR,</i> <i>ARCH</i>  <b>AUTO</b>
End-of-pipe	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND</i>	<i>IND</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND</i>	<i>IND</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	<i>IND,</i> <i>AUTO</i>	

Sectors: PRINT ... printing; PHARM ... pharmaceutical industry, WOOD ... wood preservation; DEGR ... degreasing, PIS .. products including solvents, PNIS ... products not including solvents, GLUE ... industrial use of glue and adhesives; INDOS ... other industrial use of solvents ; VEHR ... vehicle refinishing; ARCH ... architectural use of paints, AUTO ... automobile production

Table 1.20: VOC control measures selected in the REF and the H1 scenario

	AUS	BEL	DK	FIN	FRA	GER	GRE	ITA	IRE	LUX	NL	POR	SPA	SWE	UK
	<b>Residential (including 'Do It Yourself' paint use)</b>														
Low-solvent paints	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>
Reformulated products	<b>X</b>	<b>X</b>				<b>X</b>	<b>X</b>				<i>O</i>	<b>X</b>			<b>X</b>
New stoves and boilers	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>	<i>o</i>
	<b>Agriculture</b>														
Ban of waste burning	<i>O</i>	<i>O</i>			<i>O</i>		<i>O</i>	<i>O</i>	<i>O</i>				<i>O</i>		<i>O</i>
	<b>Transport</b>														
Small carbon canister	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>	<i>O</i>
Oxidation catalysts	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>	<i>o-X</i>	<i>o</i>	<i>o-X</i>	<i>o-X</i>



Table 1.21: NH<sub>3</sub> control options for the H1 scenario

	AUS	BEL	DK	FIN	FRA	GER	GRE	IRE	ITA	LUX	NL	POR	SPAIN	SWE	UK
	<b>Dairy cows</b>														
Covered storage						X									X
Stable adaptation		X	O							O	X			O	
Low nitrogen feed			O								O				
Low nitrogen applic.		X	O			X		X		O	O			X	
	<b>Other cattle</b>														
Covered storage		X	O			X				O				O	
Stable adaptation											X				
Low nitrogen feed															
Low nitrogen applic.		X	O			X		X		O	O				
	<b>Pigs</b>														
Covered storage		X								O	X			O	
Stable adaptation			O			X									
Low nitrogen feed		X	O			X				O	O				
Low nitrogen applic.		X	O			X		O		O	O			O	
Bio-filtration		X				X				O	X			O	
	<b>Poultry</b>														
Covered storage		X													
Stable adaptation		X	O		X	X		O		O	O			O	X
Low nitrogen feed											O				
Low nitrogen applic.		X	O		X	X		O		O	O		O	O	X
Bio-filtration		X									X				
	<b>Sheep</b>														
Low nitrogen applic.						X				O	O			O	
	<b>Fertilizer use and industry</b>														
Fertilizer - Urea subst.	O	X	O		X	X		O		O	O		O	O	X
Industry - Stripping		X				X		X			O			O	

### 1.2.5 Contribution To Acid Deposition At The Grid Cells Where The 2-Percentile Critical Load Is Exceeded

Table 1.22 to Table 1.33 provide for the H1 scenario the contribution to acid deposition at the grid cells where deposition exceeds the 2-percentile critical loads (grid cells are indicated in Figure 1.1). The tables list depositions of sulfur, oxidized nitrogen and reduced nitrogen, respectively.

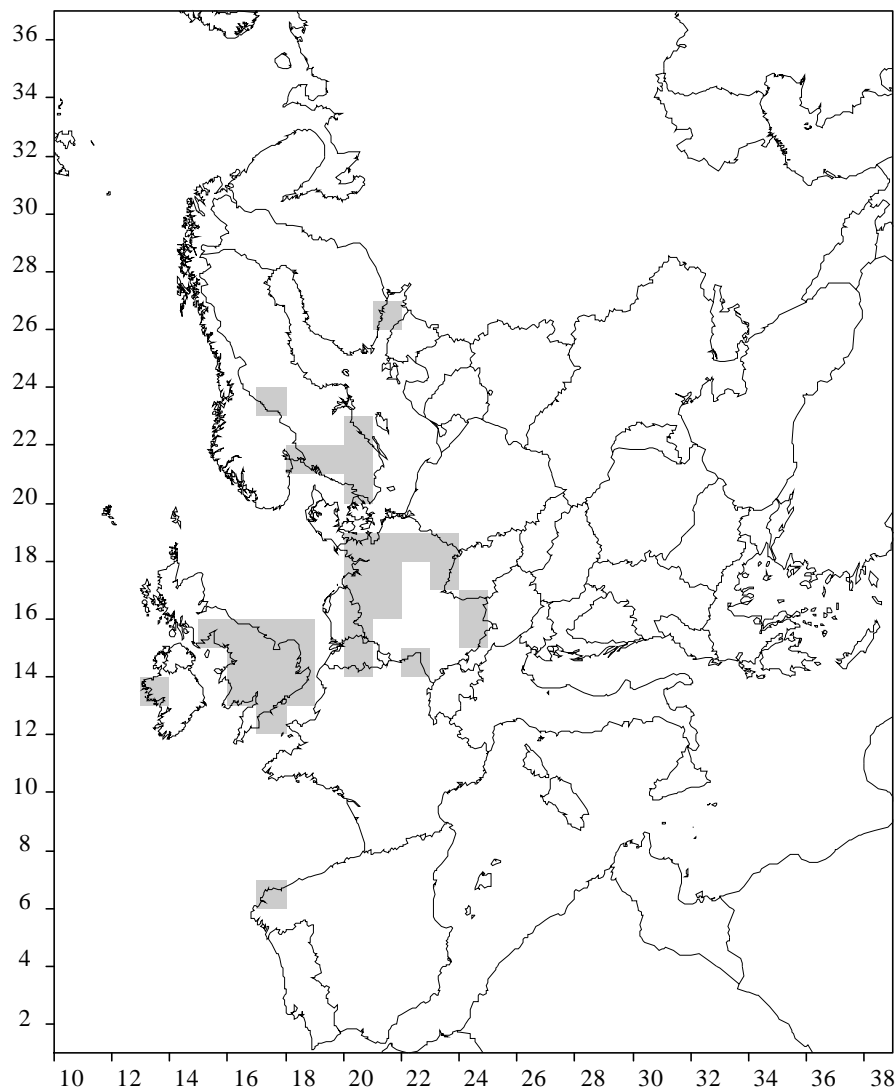


Figure 1.1: Grid cells where acid deposition of the H1 scenario exceeds the 2-percentile critical load

Table 1.22: Contributions to sulfur deposition to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (in milligrams sulfur/m<sup>2</sup>)

	EMEP grid cells																
	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Albania																	
Atlantic Ocean	19.1	22.8	40.8	19.5	11.4	68.1	51.6	25.4	14.8	12.6		25	15.2	11.6	1.8	2.2	14.2
Austria							0			0	0	0.2	0.2	0.2	0.3	0.1	0.3
Baltic Sea					0.1					0.5	1.9			0.5	5.5	9.9	
Belarus		0.3		0.4	0.6		0.2		0.4	1	2.3	0.3	0.4	0.6	2.5	3.1	0.4
Belgium	0.7	1.2	3	2.5	2	0.5	6.2	4.1	4.2	5.7	0.6	13.6	12.9	12.7	2.8	3.3	149
Bosnia-Hercz.		0.1									0.1	0.2	0.3	0.3	1.6	0.3	0.3
Bulgaria							0.1	0	0.6	0.1	0.4		0.1	0.2	0.2	0.1	0.2
Croatia															0.2	0.1	0.1
Czech Republic	0.6	1.7	1.7	2.7	2.1	0.3	4.8	3.2	4.5	5.3	4.1	6.6	7.2	8.9	9.4	9.3	9.3
Denmark	0.1	0.6	0.2	0.4	1.2	0.1	0.6	0.3	0.9	2.4	3.1	0.9	1.3	2.7	15.5	24.9	0.9
Estonia				0.2	0.4					0.3	2.5		0.1	0.3	1.5	2	
Finland		0.1			0.1				0.1	0.2	3.8			0.2	1.7	2.4	
France	1.8	3.3	6.2	4.6	3.9	2.2	17.7	9.3	7.2	8.8	0.7	27.1	18.9	16.2	3.7	3.8	80.8
Germany	2.4	4.5	7.4	6.8	6.2	1.4	15.1	9.5	10.6	16.7	6.1	23.4	23.8	30.9	22.1	20.6	54.9
Greece																	
Hungary		0.2	0.4	0.3	0.3	0.2	1	0.5	1.3	1.3	1.5	1.4	1.7	2.8	3.8	3.9	1.8
Ireland	27.5	8.7	5	4.6	2.7	0.3	2.3	1.9	2.1	2.4	0.1	1.5	1.6	1.8	0.3	0.5	1
Italy	0	0.1	0.3	0.1	0.2	0.1	0.6	0.5	0.4	0.4	0.2	0.9	0.9	0.7	1	0.4	2.6
Latvia				0.1	0.1					0.1	1				1.4	2.7	
Lithuania		0		0.1	0.2		0	0	0.1	0.5	1.3	0	0.1	0.3	1.6	2.7	0.1
Luxembourg			0				0.1					0.1	0	0.1			0.6
Moldova											0.1				0.1	0.1	
Natural sources	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0.4	0.9	1.9	1.8	1.4	0.2	3.5	2.6	3.3	4.7	0.3	7.7	10.4	13.9	2.1	2.5	14
North Sea	4.8	14.9	32.3	23.5	23.5	2.3	330	68.7	44	78.8	6.8	491	168	139	34.9	34.1	85.4

Table 1.23: Contributions to sulfur deposition to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (in milligrams sulfur/m<sup>2</sup>), continued

	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Norway					0.1					0.2	5.8			0.1	30.7	6.1	
Poland	1.4	4.1	3.7	4.3	5.8	1.1	7.2	5.8	9	17.1	16.2	10.3	11.6	18.4	32.6	35.9	11.6
Portugal		0.2	0.3	0.1	0.1	11.3	0.6	0.3	0.2			0.4	0.2	0.1		0.1	0.4
Rem. areas						0	0	0	0			0				0	0
Romania		0.1	0.1	0.1	0	0.2	0.2	0.2	0.6	1.5	0.9	0.2	0.4	0.8	2.8	2.1	0.7
Russia		0.1		0	0.4		0.1		0.1	0.7	5.8	0.3	0.4	0.7	3.3	4.6	0.2
Slovakia		0.1	0.1	0.1	0	0.1	0.3	0.1	0.3	0.6	0.4	0.4	0.6	0.8	1.1	1.4	0.5
Slovenia										0		0.1	0	0.1	0.3	0.2	0.2
Spain	1.8	4.9	3.8	2.9	2.6	1053	12.4	5.8	4	3.5	0.1	10.9	5.7	5.7	0.5	0.9	12.6
Sweden		0.1		0.1	0.3		0.1		0.1	0.5	7.7	0.1	0.2	0.7	21.9	39.8	0.1
Switzerland												0.1			0.1		0.2
Ukraine	0.1	0.7	0.3	0.4	1.3	0.2	0.2	0.3	1.1	1.9	3.9	0.6	1.1	1.6	3.2	4.8	1.2
UK	17.3	113	162	465	468	4.1	66.6	187	313	445	6.6	134	414	193	19.1	22	43.2
Yugoslavia				0.1			0.1	0.1		0.1	0.4		0.2	0.4	0.7	0.3	0.3
SUM	78	183	269	541	535	1146	522	325	423	613	84.7	757	698	466	230	247	487

Table 1.24: Contributions to sulfur deposition to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (in milligrams sulfur/m<sup>2</sup>)

Sources	EMEP grid cells																	
	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16	
Albania															0			
Atlantic Ocean	10.4	7.9	6.7	5.3	3.3	2.2		5.9	4.3	3.5		8.5	2.4	2.2	2.2	4.1	3.5	
Austria	0.3	0.3	0.4	0.4	0.3	0.2	0	0.7	0.7	0.7	0.1	1.1	1	2.4	2	14.7	12.5	
Baltic Sea	0.1	0.5	1.6	23.4	24	15.5	12.9	0.5	1.6	6.5	20.2		3.1	1	2.5	0.2	0.2	
Belarus	0.6	0.6	1.2	2	3.3	5.1	7.8	1	1.4	1.7	22.7	0.2	1.9	2.1	2.8	0.5	0.8	
Belgium	136	41.4	17.4	9.2	4.5	3.9	1.7	36.2	18.8	11.4	0.7	9.3	9.6	8.1	8	8.5	7.5	
Bosnia-Hercz.	0.2	0.2	0.1	0.2	0.4	0.4	0.9	0.3	0.4	0.4	0.9	1.1	1.4	0.8	2.2	2.3	2.1	
Bulgaria	0	0	0.3	0.7	0.2	0.2	0.3	0.2	0.4	0.5	2.7	0.4	0.7	1.2	1.6	1.3	1.7	
Croatia						0.1		0.1	0.1	0.1	0.1	0.2	0.3	0.5	0.7	1.3	1	
Czech Republic	11.4	13.7	15.8	16	13.5	10.9	8.9	23.3	28.2	26.6	5.7	14.2	48.9	750	170	33.1	76.5	
Denmark	1.6	2.4	5.5	35.6	105	36.1	10.3	2.3	4.3	12.2	2.6	0.6	6.3	2.6	4.9	1.1	1.1	
Estonia	0.1		0.2	0.1	1.8	3.2	7.4	0.1	0.2	0.3	107		0.3	0.1	0.4		0.2	
Finland		0.1	0.1	0.3	1	2.6	6	0.1	0.1	0.3	124		0.2	0.1	0.4		0.1	
France	44.4	25.7	15.4	9.7	5.1	4.6	2	26.3	15.7	11.4	0.9	68.1	11.1	12.9	11.5	29.1	19.4	
Germany	256	202	120	106	34.1	28.1	15.8	249	177	116	7.4	99.3	190	224	297	136	108	
Greece																	0.2	0.2
Hungary	2.6	2.9	3.1	3.8	5.3	4.9	4.3	4.3	6	6.3	4.5	5.2	10.2	10.4	15.2	9.6	13.6	
Ireland	1	1.2	1.1	0.9	0.5	0.4	0.1	0.8	0.7	0.6	0	0.4	0.3	0.3	0.3	0.3	0.3	
Italy	1.4	1.4	1.4	1.5	0.8	1.2	0.5	2.5	2.3	1.5	0.7	9.7	2.2	4.8	4.2	37.1	13	
Latvia				0.3	1.7	3.4	6.3	0.1	0.1	0.3	15.7			0.1	0.4		0.1	
Lithuania	0.2	0.2	0.5	0.9	2.9	4	5.2	0.5	0.6	1.1	8.3	0.1	0.8	0.6	0.8	0.1	0.5	
Luxembourg	0.5	0.3	0.1	0.1	0			0.9	0.3	0.2		2	0.3	0.4	0.3	0.8	0.6	
Moldova											0.5		0.1		0.1			
Natural sources	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Netherlands	76.6	43.5	19.6	9.6	3.6	3	1.2	20.3	13.5	9	0.4	2.9	6	4.5	4.6	3.5	3.3	
North Sea	102	107	142	133	39.4	29.6	12.6	53.8	59.1	57.6	4	17.9	31.3	20.5	24.3	17.7	14.9	

Table 1.25: Contributions to sulfur deposition to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (in milligrams sulfur/m<sup>2</sup>), continued

	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16
Norway		0.1	0.1	0.4	1.7	2.8	2.3		0.1	0.2	0.6		0.1	0.1	0.1		
Poland	14.5	18.8	28.3	45.2	55.7	57.2	48.9	27.3	36	58.5	35.9	14.1	81	68.6	180	29.8	50
Portugal	0.1	0.1		0.1		0.1		0.1		0.1		0.8			0.1	0.1	
Rem. areas	0	0						0	0			0		0	0	0	0
Romania	0.5	0.5	0.7	1.1	2.6	2.3	2.4	1.1	1.1	1.6	3.5	0.8	2.7	2.6	4.3	2.7	3.8
Russia	0.3	0.4	0.5	1.1	3.2	5.2	12.8	0.6	0.5	1.3	42.7	0.1	1	0.9	1.3	0.2	0.5
Slovakia	0.9	0.9	1.1	1.4	1.9	2	1.5	1.5	2	2.2	1.3	1.3	3.3	3.7	5.7	2.9	4.4
Slovenia	0.1	0.1	0.2	0.4	0.1	0.2	0.1	0.2	0.5	0.4	0.2	0.6	0.6	1.3	1.2	4.3	2.7
Spain	7.4	6.3	5.3	3.1	1.4	1.8	0.4	5.4	3.7	3.1	0.4	19.5	3.1	3.4	3.4	8.1	6.5
Sweden	0.2	0.3	0.7	1.6	38.6	29.3	33.9	0.3	0.7	1.2	4.6	0	0.9	0.5	0.9	0.2	0.2
Switzerland	0.1	0.1	0.1	0.1				0.2	0.1	0.1		2.6	0.2	0.7	0.4	12.6	3.7
Ukraine	1.4	1.4	2.1	3.3	4	5.8	8.6	2.2	2.9	4.1	12	1.1	4.5	3.8	6.2	2.3	3.6
UK	55.2	60.5	58.2	49.2	27.6	21.2	8.5	37	34.7	30.2	3.5	12.3	19.7	14.6	15.8	12.9	11.1
Yugoslavia	0.1	0.1	0.3	0.1	0.8	0.6	0.8	0.2	0.3	0.4	1	0.5	0.9	1	1.4	1.9	1.6
SUM	726	541	450	466	389	288	224	505	419	372	435	295	447	1150	777	380	369

Table 1.26: Contributions to deposition of oxidized nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (milligrams nitrogen/m<sup>3</sup>)

Sources	EMEP grid cells																
	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Atlantic Ocean	26.7	29.3	41.3	21.7	13.6	69.3	46.8	29.5	18	12	0.3	29.3	18.3	11	3.1	4.7	22.2
Austria								0	0.1	0.1		0.3	0.2	0.2	0.5	0.2	0.5
Baltic Sea					0.3					0.3	1.8			0.3	4.4	6	
Belarus				0.3	0.5				0.3	0.6	1.3		0.1	0.1	1.7	2.1	0.3
Belgium	0.9	1.5	3.3	2.9	2.7	1.1	3.6	4.6	4.7	4.8	0.9	7.3	8.5	6.4	4.2	4.9	66.2
Bosnia-Hercz.															0.1		
Bulgaria									0.3	0.1					0.1		
Croatia															0.3	0.1	
Czech Republic	0.3	1	0.8	1.6	1.3	0.3	1.8	1.9	3	2.4	2.1	2.4	3.3	2.5	6.2	5.6	4.8
Denmark	0.1	1.1	0.4	0.9	2	0.3	0.4	0.6	1.4	2.8	4.2	0.9	1.7	2.4	15.5	19.4	1.1
Estonia											0.4				0.2	0.6	
Finland		0.1			0.2				0.1	0.3	3.4			0.2	1.6	2.1	
France	5.5	8.8	14	10.2	9.3	6.9	22.2	19	14.8	13.8	1.8	29.8	24.3	18.1	10.1	9.3	94.5
Germany	5.7	9.2	12.4	13	13	4	15.5	17.4	19.7	21.4	10	22.4	28.1	24.9	39.4	34.1	66.3
Hungary						0.1			0.3	0.2	0.1	0.1	0.3	0.3	1	1.1	0.2
Ireland	15	12.6	7.4	7.5	5	0.6	2.6	3.1	3.8	2.9	0.1	2	2.6	2.3	0.8	1.1	1.9
Italy	0	0.1	0.7	0.2	0.2	0.2	0.5	0.7	0.7	0.6	0.2	0.7	1.1	0.5	1.2	0.7	2.7
Latvia					0.3					0.3	1				0.9	2.2	
Lithuania		0.1		0.1	0.3				0.1	0.4	1.3		0.2	0.3	1.7	2.4	0.1
Luxembourg			0				0	0				0	0	0	0		0.8
Netherlands	1.8	3.9	6.4	6.8	6.1	1.7	6.2	8.7	11.4	11.1	2.4	11.7	19.5	18.6	10.8	12.1	32.2
North Sea	8	17.6	32.3	26	25.6	5.7	70.2	56.9	45.3	40.9	9	107.8	84.2	54.9	36.6	38.3	78.6

Table 1.27: Contributions to deposition of oxidized nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems, H1 scenario (milligrams nitrogen/m<sup>2</sup>), continued

	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Norway		0.4		0.2	1.3		0.1		0.7	1.4	24		1.2	1.4	28.4	13.7	0.2
Poland	0.5	2.5	1.9	2.6	4	1.1	2.3	3.1	5.7	9.1	7.9	3.4	5.1	5.6	18.3	17.7	4.6
Portugal	0.1	0.4	0.6	0.1	0.1	10.9	1.2	0.4	0.2			0.6	0.2			0.1	0.6
Romania		0.1			0.1	0.2		0.1	0.4	1	0.1		0.1	0.2	1.2	0.7	0.2
Russia		0.1		0.1	0.4			0.1	0.1	0.6	1.5	0.4	0.2	0.2	1.3	2.5	
Slovakia				0.1		0.1	0.1	0.1	0.3	0.3		0.1	0.2	0.1	0.7	0.8	0.1
Slovenia																	0.1
Spain	1.3	2.8	2.6	1.9	1.6	117.6	7	3.6	2.8	1.9		7	3.8	2.9	0.4	0.7	9.5
Sweden	0	0.5	0.1	0.5	1.2	0.1	0.1	0.1	0.6	1.2	10.6	0.2	0.8	1.5	14.7	24.8	0.4
Switzerland			0.1		0	0	0.1	0.1	0.1		0	0.3	0.2		0.1	0.1	0.8
Ukraine		0.8	0.2	0.3	1.7	0.3			1.1	2	4.2	0.2	0.8	0.8	3.1	4.2	0.5
UK	31.5	121	146.9	260.7	244.2	13.7	68.3	192.1	276.5	197	14.2	147.5	239.4	151.5	43.7	49.6	95.8
Yugoslavia																	
SUM	97.4	213.9	271.4	357.7	335	234.2	249	342.1	412.5	329.5	102.8	374.4	444.4	307.2	252.4	261.9	485.1



Table 1.28: Contributions to deposition of oxidized nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario

Sources	EMEP grid cells																
	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16
Atlantic Ocean	15.2	11.5	10.5	10.2	5	5.2	0.5	9.4	6	5.5		13.1	4.2	3.7	5	7.1	5.5
Austria	0.7	0.5	0.6	0.7	0.6	0.7	0.2	1	1.1	1	0.3	1.7	1.6	3.3	3.2	12.2	9.5
Baltic Sea	0.1	0.5	1.1	4.8	9	9.3	6.9	0.5	1.1	3.5	7.3		2	1	2.4	0.1	0.4
Belarus		0.1	0.1	0.6	1.9	3.4	4.1	0.5	0.6	0.6	10.9		0.8	1	1.6	0.1	0.4
Belgium	56	27.5	15	9.8	5.5	5.3	2.4	32	18.4	12.5	1.2	12.2	11	12.2	11.5	12.3	10.6
Bosnia-Hercz.																	
Bulgaria										0.1	0.8		0.2	0.2	0.3	0.2	0.3
Croatia														0.1	0.5	0.6	0.4
Czech Republic	5.4	5.6	6.8	7.3	8.1	6.9	5.2	10.5	12.3	12.3	4	7	21.6	96.2	53.2	15.8	31.1
Denmark	1.7	2.5	4.6	15	39.3	25.9	10.3	2.4	4	9.3	4.7	0.7	5.6	3.7	6.1	1.5	1.7
Estonia					0.2	0.7	2.8					15.8					
Finland		0.1	0.1	0.2	1	2.6	5.4	0.1		0.3	28.7		0.3	0.2	0.6		
France	57	37.2	26.5	19.5	10.8	11.1	4.9	46.4	28	21.7	2.8	102.5	22.9	31.4	28.9	70.8	45.8
Germany	135	131.1	106.8	90.5	49.1	45.9	25.8	206.9	163.9	127.6	15.1	99	156.5	174.9	184	179.3	158.8
Hungary	0.4	0.4	0.4	0.4	1.2	1.1	1	0.8	1	1.3	1.1	1	2.4	2.3	3.6	2	3
Ireland	2.1	2.2	2.4	2.2	1.3	1.1	0.1	1.4	1.3	1.2		0.6	0.6	0.7	0.7	0.6	0.3
Italy	1.4	1.5	1.8	1.8	1.1	1.6	0.6	3.1	2.5	1.8	1.1	11.3	2.8	6.2	6.2	40	16
Latvia				0.1	1.8	3	4.6	0.1			10.2			0.1	0.4		
Lithuania	0.1	0.1	0.3	0.7	2.8	3.5	4.4	0.3	0.3	0.8	7.9	0.2	0.6	0.4	0.8		0.2
Luxembourg	0.6	0.4	0.2	0.1	0			1.3	0.6	0.3		2.4	0.6	0.9	0.8	1.4	1.1
Netherlands	79.4	84.8	53.3	32.8	15.1	13.5	5.8	52.8	42.7	31.6	3	10.3	22.2	20.3	21.7	15	13.7
North Sea	83.9	85.2	91.9	82.2	41.9	35.9	14.3	54.9	55.3	53.9	7	20.3	33.3	29.6	33.6	24	21.3

Table 1.29: Contributions to deposition of oxidized nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario, continue

	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16
Norway	0.6	0.7	1.6	2.8	6.3	9.4	7.8	0.8	1.3	2	4.3		1.3	0.7	1.3	0.5	0.5
Poland	5.7	7.2	10.1	16.8	25	27.7	24.8	11.7	14.2	22	20	5.3	29.5	26.6	49.9	11.7	19
Portugal	0.3	0.1	0.1	0.1	0.1	0.1		0.1		0.1		1.4	0.1		0.1		
Romania	0.2	0.2	0.2	0.4	0.8	0.9	1.5	0.4	0.5	0.5	2	0.1	1.2	1.2	2	1.4	2.2
Russia		0.1	0.6	0.6	1.8	3.7	8.2	0.3	0.2	0.8	25.6		0.6	0.6	0.9	0.1	0.3
Slovakia	0.5	0.4	0.3	0.4	1.1	1.2	1	0.8	1.1	1.2	0.7	0.7	1.9	2.4	3.2	1.5	2.4
Slovenia												0.1	0.1	0.3	0.2	1.2	0.8
Spain	5.6	4.1	3.3	2.2	0.6	1.2	0.1	3.6	2.2	2.2	0.1	17.4	1.9	2.7	2.6	6.2	4.8
Sweden	0.6	0.9	1.4	2.7	19.7	25.4	22.4	1	1.3	2.4	9.3	0.2	1.8	1.5	2.5	0.8	0.8
Switzerland	0.5	0.2	0.6	0.2	0.2	0.2		0.8	0.5	0.3	0	5.2	0.8	2.1	1.8	22.9	8.1
Ukraine	0.3	0.8	1.2	2.3	2.6	5	7.8	1.6	2.2	2.9	10.2	0.2	3.4	2.9	4.5	1.4	2.3
UK	107	108.4	107.2	100.4	56.2	46.7	17.5	73.7	66.1	59.5	9.6	28.6	40.3	37	40.2	31.4	27.5
Yugoslavia																	0.3
SUM	560.3	514.3	449	407.8	310.1	298.2	190.4	519.2	428.7	379.2	203.7	341.5	372.1	466.4	474.3	462.4	388.8

Table 1.30: Contributions to deposition of reduced nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario

Sources	EMEP grid cells																
	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Austria				0.1				0.1	0.1	0.3	0.1	0.2	0.3	0.3	0.9	0.2	0.8
Belarus		0.2		0.3	0.4				0.3	0.8	1.4	0.1	0.1	0.1	1.3	1.8	0.2
Belgium	0.4	1	2.9	2.2	1.9	0.4	3.6	4	4.1	4.4	0.2	10.4	11.5	9.2	2.6	2.7	350.4
Bosnia-Hercz.															0.1		
Bulgaria									0.1	0	0.1				0		
Croatia															0.1		
Czech Republic		0.4		0.4	0.4		0.6	0.4	1.1	1.3	0.6	0.7	1.3	1.2	3.4	3	1.9
Denmark	0.1	1	0.3	0.5	1.8	0.2	0.3	0.4	1.3	3.5	3.4	0.7	1.5	3.3	22.2	33.5	0.9
Estonia											0.3				0.3	0.5	
Finland											1.4				0.3	0.3	
France	9.5	17.5	34.6	21.4	17.3	13.4	111.9	48.6	32.4	27.9	1.5	130.3	62.7	43.2	12.1	10.9	467.5
Germany	1.5	5.1	6.1	7.2	7.6	1.2	8.1	8.5	12.1	14.7	7.3	11.9	15	19.5	30.2	24.6	27.2
Hungary						0.1			0.4	0.1	0.4	0.1	0.2	0.4	1.4	1	0.3
Ireland	507.6	75.1	41.3	36.3	17.9	1.4	12.7	11.6	11.6	9.5	0.3	7.6	7.8	7.5	1.3	2.5	5.9
Italy		0.2	0.3		0.1		0.2	0.2	0.4	0.2	0.1	0.4	0.6	0.1	1	0.3	1.7
Latvia					0.1					0.1	0.1				0.5	1.3	
Lithuania				0.1	0.3				0.2	0.4	1.2			0.1	1.3	2.6	
Luxembourg							0.1										1.4
Moldova															0.1	0.1	
Netherlands	0.7	2.3	4.5	3.8	3.2	0.7	4.3	5.7	7	8.7	1.3	9.5	14.8	20.8	7.4	7.8	33.4

Table 1.31: Contributions to deposition of reduced nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario, continue

	13_13	15_15	16_13	16_14	16_15	17_6	17_12	17_13	17_14	17_15	17_23	18_13	18_14	18_15	18_21	19_21	20_14
Norway										0.1	10.7			0.1	27.9	2.9	
Poland	0.3	2.4	1.4	3	4.2	0.7	2.1	3	5.9	11.2	11.2	3.2	4.6	6.7	25.3	23	4.1
Portugal		0.1	0.1			8.9	0.1	0.1	0.1			0.1					0.1
Romania						0.2		0.1	0.4	1	0.2		0.1	0.1	2.4	1.2	0.3
Russia					0.2					0.2	0.5		0.1	0.1	0.5	0.8	
Slovakia							0.1		0.1	0.2			0.2		0.4	0.3	
Slovenia															0.1		
Spain	0.5	1.3	1.2	0.7	0.6	425.6	4	1.8	1.3	0.6		4.2	1.9	1.2	0.1	0.1	5.5
Sweden		0.2			0.2					0.3	7.8		0.1	0.4	32.1	146.9	
Switzerland			0.1				0.1		0.1			0.2	0.1		0.2		0.6
Ukraine		0.7	0.3	0.4	1.7	0.1	0.1	0.1	0.9	1.6	3.6	0.1	0.6	0.9	2.6	3.4	0.5
UK	12.9	487.4	558.4	651.3	476.2	4	197.6	576	481.3	213.9	3.7	203.4	277.9	124.5	11.4	13	34.6
Yugoslavia											0.1			0.1	0.2	0.1	
SUM	533.5	594.9	651.5	727.7	534.1	456.9	345.9	660.6	561.2	301	57.5	383.1	401.4	239.8	189.7	284.8	937.3

Table 1.32: Contributions to deposition of reduced nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario

Sources	EMEP grid cells																
	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16
Austria	0.7	0.5	0.6	0.7	0.6	0.7	0.2	1	1.1	1	0.3	1.7	1.6	3.3	3.2	12.2	9.5
Belarus		0.1	0.1	0.6	1.9	3.4	4.1	0.5	0.6	0.6	10.9		0.8	1	1.6	0.1	0.4
Belgium	56	27.5	15	9.8	5.5	5.3	2.4	32	18.4	12.5	1.2	12.2	11	12.2	11.5	12.3	10.6
Bosnia-Hercz.																	
Bulgaria										0.1	0.8		0.2	0.2	0.3	0.2	0.3
Croatia														0.1	0.5	0.6	0.4
Czech Republic	5.4	5.6	6.8	7.3	8.1	6.9	5.2	10.5	12.3	12.3	4	7	21.6	96.2	53.2	15.8	31.1
Denmark	1.7	2.5	4.6	15	39.3	25.9	10.3	2.4	4	9.3	4.7	0.7	5.6	3.7	6.1	1.5	1.7
Estonia					0.2	0.7	2.8				15.8						
Finland		0.1	0.1	0.2	1	2.6	5.4	0.1		0.3	28.7		0.3	0.2	0.6		
France	57	37.2	26.5	19.5	10.8	11.1	4.9	46.4	28	21.7	2.8	102.5	22.9	31.4	28.9	70.8	45.8
Germany	135	131.1	106.8	90.5	49.1	45.9	25.8	206.9	163.9	127.6	15.1	99	156.5	174.9	184	179.3	158.8
Hungary	0.4	0.4	0.4	0.4	1.2	1.1	1	0.8	1	1.3	1.1	1	2.4	2.3	3.6	2	3
Ireland	2.1	2.2	2.4	2.2	1.3	1.1	0.1	1.4	1.3	1.2		0.6	0.6	0.7	0.7	0.6	0.3
Italy	1.4	1.5	1.8	1.8	1.1	1.6	0.6	3.1	2.5	1.8	1.1	11.3	2.8	6.2	6.2	40	16
Latvia				0.1	1.8	3	4.6	0.1			10.2			0.1	0.4		
Lithuania	0.1	0.1	0.3	0.7	2.8	3.5	4.4	0.3	0.3	0.8	7.9	0.2	0.6	0.4	0.8		0.2
Luxembourg	0.6	0.4	0.2	0.1	0			1.3	0.6	0.3		2.4	0.6	0.9	0.8	1.4	1.1
Netherlands	79.4	84.8	53.3	32.8	15.1	13.5	5.8	52.8	42.7	31.6	3	10.3	22.2	20.3	21.7	15	13.7

Table 1.33: Contributions to deposition of reduced nitrogen to grid cells where the critical loads are exceeded for the 2 percentile ecosystems (milligrams nitrogen/m<sup>2</sup>), H1 scenario, continue

	20_15	20_16	20_17	20_18	20_20	20_21	20_22	21_16	21_17	21_18	21_26	22_14	22_18	23_17	23_18	24_15	24_16
Norway			0.2	0.4	1	1.5	1.2			0.2	0.3						
Poland	5.2	6.3	11.5	23	32.7	35.5	32.7	11.6	14.3	27.2	27	4.6	35.1	29.9	203.4	13	18.3
Portugal												0.5					
Romania	0.4	0.2	0.2	0.4	1.1	1.3	1.2	0.7	0.3	0.6	3.2	0.2	0.9	1.1	1.6	1.6	2
Russia		0.1		0.3	0.5	1.2	3.5	0.1	0.2	0.2	12.6		0.3	0.2	0.3	0.1	0.3
Slovakia	0.2	0.2	0.1	0.1	0.4	0.7	0.4	0.4	0.4	0.5	0.4	0.2	0.6	1.2	1.5	0.9	1.4
Slovenia														0.2	0.1	1.2	0.8
Spain	3.3	2.2	1.7	0.8	0.3	0.5		2	1.1	0.9		12.5	0.5	0.8	1	3.6	2.6
Sweden		0.2	0.4	1.8	166.3	112.4	76.5	0.2	0.4	1.3	3.9		0.9	0.5	1.4	0.2	0.2
Switzerland	0.3	0.2	0.4	0.3		0.2		1	0.4	0.1		7.9	0.5	1.7	1.4	46.5	11.2
Ukraine	0.9	0.9	1.4	2.5	2.2	4.1	6	1.7	1.8	2.9	10.9	0.4	3.4	2.6	4.4	1.7	2.5
UK	38.6	36.5	35.8	32.4	14.9	12.1	4	23.7	20.1	16.5	1.9	8.9	10.1	9.5	9.5	9.5	7.8
Yugoslavia					0.1	0.1	0.2				0.2					0.3	0.2
SUM	1437.7	1304.3	955	804.3	388.5	283.6	184.4	785.2	639.3	699.2	175.6	665.5	620.7	825.6	757.3	1060.6	836.1

## 1.3 Scenario J1

### 1.3.1 Emissions Per Country

Table 1.34: NO<sub>x</sub> and VOC emissions for the central scenario J1 compared to the REF case. Percentage changes relate to the year 1990.

	NO <sub>x</sub>				VOC			
	REF		J1		REF		J1	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	103	-46%	91	-53%	205	-42%	142	-60%
Belgium	191	-46%	127	-64%	193	-48%	103	-72%
Denmark	128	-53%	113	-59%	85	-53%	85	-53%
Finland	152	-45%	152	-45%	110	-48%	110	-48%
France	858	-54%	704	-62%	1223	-49%	989	-58%
Germany	1184	-56%	1081	-59%	1137	-64%	995	-68%
Greece	344	0%	344	0%	267	-21%	261	-22%
Ireland	70	-38%	55	-51%	55	-50%	55	-50%
Italy	1130	-45%	901	-56%	1159	-44%	1030	-50%
Luxembourg	10	-55%	8	-64%	7	-63%	7	-63%
Netherlands	280	-48%	266	-51%	233	-52%	157	-68%
Portugal	177	-15%	144	-31%	144	-32%	102	-52%
Spain	847	-27%	726	-38%	669	-34%	648	-36%
Sweden	190	-44%	159	-53%	290	-43%	241	-53%
UK	1186	-58%	1181	-58%	1351	-49%	1101	-59%
EU-15	6849	-48%	6054	-54%	7128	-49%	6024	-57%
Albania	36	50%	36	50%	41	32%	41	32%
Belarus	316	-21%	290	-28%	309	-17%	298	-20%
Bosnia-H	60	-25%	53	-34%	48	-6%	48	-6%
Bulgaria	297	-16%	266	-25%	190	-3%	185	-5%
Croatia	91	11%	87	6%	111	8%	86	-17%
Czech Rep.	296	-46%	188	-66%	305	-31%	156	-65%
Estonia	73	-13%	73	-13%	49	9%	49	9%
Hungary	198	-10%	137	-37%	160	-22%	137	-33%
Latvia	118	1%	118	1%	56	-11%	56	-11%
Lithuania	138	-10%	134	-12%	105	-5%	105	-5%
Norway	178	-19%	142	-35%	195	-34%	195	-34%
Poland	879	-28%	654	-46%	807	1%	475	-40%
R.of Moldova	66	-24%	64	-26%	42	-16%	42	-16%
Romania	458	-12%	328	-37%	504	0%	500	-1%
Russia	2653	-24%	2653	-24%	2787	-21%	2723	-23%
Slovakia	132	-40%	115	-47%	140	-7%	140	-7%
Slovenia	36	-40%	34	-43%	40	-27%	40	-27%
Switzerland	79	-52%	76	-53%	144	-48%	144	-48%
FYR of Maced.	29	-26%	29	-26%	19	0%	19	0%
Ukraine	1433	-24%	1222	-35%	851	-27%	770	-34%
Yugoslavia	152	-28%	132	-37%	139	-2%	138	-3%
Non-EU	7718	-24%	6830	-33%	7041	-18%	6345	-26%
Total	16196	-35%	14513	-42%	14168	-37%	12370	-45%

Table 1.35: SO<sub>2</sub> and NH<sub>3</sub> emissions of the central scenario J1 compared to the REF case. Percentage changes relate to the year 1990.

	SO <sub>2</sub>				NH <sub>3</sub>			
	REF		J1		REF		J1	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	40	-57%	35	-62%	67	-13%	66	-14%
Belgium	193	-43%	76	-77%	96	-1%	60	-38%
Denmark	90	-51%	60	-67%	72	-6%	69	-10%
Finland	116	-49%	116	-49%	31	-23%	31	-23%
France	448	-64%	219	-82%	777	-4%	642	-20%
Germany	581	-89%	463	-91%	571	-25%	413	-45%
Greece	546	8%	546	8%	74	-8%	73	-9%
Ireland	66	-63%	36	-80%	126	-1%	116	-9%
Italy	567	-66%	290	-83%	432	-6%	356	-23%
Luxembourg	4	-71%	3	-79%	7	0%	7	0%
Netherlands	73	-64%	50	-75%	136	-42%	105	-55%
Portugal	141	-50%	141	-50%	67	-6%	65	-8%
Spain	774	-65%	747	-66%	353	0%	353	0%
Sweden	67	-44%	67	-44%	48	-21%	48	-21%
UK	980	-74%	499	-87%	297	-10%	264	-20%
EU-15	4687	-71%	3349	-80%	3154	-12%	2668	-25%
Albania	55	-24%	55	-24%	35	9%	32	0%
Belarus	494	-41%	494	-41%	163	-26%	140	-36%
Bosnia-H	415	-15%	162	-67%	23	-26%	22	-29%
Bulgaria	846	-54%	378	-79%	126	-11%	105	-26%
Croatia	70	-61%	23	-87%	37	-8%	29	-28%
Czech Rep.	366	-80%	283	-85%	108	1%	101	-6%
Estonia	175	-36%	175	-36%	29	0%	29	0%
Hungary	546	-40%	296	-68%	137	14%	77	-36%
Latvia	104	-14%	104	-14%	35	-19%	35	-19%
Lithuania	107	-50%	107	-50%	81	1%	72	-10%
Norway	32	-38%	18	-65%	21	-9%	21	-9%
Poland	1397	-53%	722	-76%	541	7%	468	-7%
R.of Moldova	117	-41%	38	-81%	48	2%	41	-13%
Romania	594	-55%	148	-89%	304	4%	227	-22%
Russia	2344	-53%	2186	-56%	894	-30%	894	-30%
Slovakia	137	-75%	92	-83%	47	-22%	39	-35%
Slovenia	71	-65%	14	-93%	21	-9%	16	-30%
Switzerland	26	-40%	23	-47%	66	-8%	63	-13%
FYR of Maced.	81	-24%	81	-24%	16	-6%	15	-12%
Ukraine	1488	-60%	1457	-61%	649	-11%	588	-19%
Yugoslavia	269	-54%	217	-63%	82	-9%	64	-29%
Non-EU	9732	-55%	7071	-67%	3462	-13%	3077	-23%
Total	15571	-60%	11572	-70%	6616	-12%	5745	-24%



### 1.3.2 Emission Control Costs

Table 1.36: Control costs for NO<sub>x</sub>, VOC and SO<sub>2</sub> of central scenario J1 compared to the REF case (in million EURO/year).

	NO <sub>x</sub> and VOC			SO <sub>2</sub>		
	REF	J1	TOTAL	REF	J1	TOTAL
Austria	902	70	972	191	5	196
Belgium	1278	452	1730	426	122	548
Denmark	484	8	492	138	13	151
Finland	642	0	642	247	0	247
France	7383	437	7820	1276	132	1408
Germany	10549	484	11033	3264	240	3504
Greece	1048	2	1050	434	0	434
Ireland	477	10	487	132	12	144
Italy	7868	245	8113	1776	87	1863
Luxembourg	71	2	73	13	0	13
Netherlands	1731	112	1843	340	19	359
Portugal	1349	57	1406	181	0	181
Spain	5658	42	5700	809	9	818
Sweden	1125	45	1170	316	0	316
UK	6695	353	7048	1269	295	1564
EU-15	47258	2318	49576	10813	935	11748
Albania	0	0	0	0	0	0
Belarus	0	3	3	0	0	0
Bosnia-H	1	2	3	0	55	55
Bulgaria	4	10	14	153	58	211
Croatia	1	5	6	52	18	70
Czech Rep.	568	235	803	411	36	447
Estonia	0	0	0	0	0	0
Hungary	420	112	532	166	113	279
Latvia	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0
Norway	567	12	579	56	10	66
Poland	2487	373	2860	855	283	1138
R.of Moldova	0	0	0	0	30	30
Romania	2	100	102	155	137	292
Russia	21	0	21	694	54	748
Slovakia	331	11	342	91	25	116
Slovenia	93	1	94	35	23	58
Switzerland	831	2	833	118	1	119
FYR of Maced.	1	0	1	0	0	0
Ukraine	0	44	44	328	8	336
Yugoslavia	3	6	9	88	27	115
Non-EU	5332	917	6249	3202	879	4081
Total	52590	3235	55825	14016	1814	15830

Table 1.37: Control costs for NH<sub>3</sub> and total costs of the central scenario J1 compared to the REF case (in million EURO/year).

	NH <sub>3</sub>			TOTAL		
	REF	J1	TOTAL	REF	J1	TOTAL
Austria	0	1	1	1093	76	1169
Belgium	0	312	312	1704	886	2590
Denmark	0	2	2	623	22	645
Finland	0	0	0	889	0	889
France	0	367	367	8659	936	9595
Germany	0	842	842	13813	1567	15380
Greece	0	0	0	1482	2	1484
Ireland	9	146	155	618	168	786
Italy	0	85	85	9644	417	10061
Luxembourg	15	0	15	98	2	100
Netherlands	517	672	1189	2588	803	3391
Portugal	0	2	2	1530	59	1589
Spain	28	0	28	6495	51	6546
Sweden	113	0	113	1554	45	1599
UK	0	23	23	7964	671	8635
EU-15	682	2450	3132	58754	5704	64458
Albania	0	1	1	0	1	1
Belarus	0	9	9	0	12	12
Bosnia-H	0	1	1	1	58	59
Bulgaria	0	13	13	157	81	238
Croatia	0	3	3	52	26	78
Czech Rep.	0	9	9	979	280	1259
Estonia	0	0	0	0	0	0
Hungary	0	319	319	586	545	1131
Latvia	0	0	0	0	0	0
Lithuania	0	4	4	0	4	4
Norway	0	3	3	623	25	648
Poland	0	182	182	3342	838	4180
R.of Moldova	0	3	3	0	33	33
Romania	0	304	304	157	541	698
Russia	0	0	0	715	54	769
Slovakia	0	7	7	423	43	466
Slovenia	0	2	2	128	25	153
Switzerland	0	6	6	949	9	958
FYR of Maced.	0	1	1	1	1	2
Ukraine	0	30	30	328	82	410
Yugoslavia	0	94	94	92	128	220
Non-EU	0	991	991	8534	2787	11321
Total	682	3442	4124	67288	8490	75778

### 1.3.3 Sectoral Emissions And Costs For The J1 Scenario

#### 1.3.3.1 SO<sub>2</sub>

Table 1.38: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Albania	Power plants, of which:	18.9	18.9	0.0	0.0
	- existing plants	10.2	10.2	0.0	0.0
	- new plants	8.7	8.7	0.0	0.0
	Refineries, other conversion	3.1	3.1	0.0	0.0
	Industry, of which:	19.0	19.0	0.0	0.0
	- combustion installations	17.0	17.0	0.0	0.0
	- processes	2.0	2.0	0.0	0.0
	Domestic	5.9	5.9	0.0	0.0
	Transport, of which:	8.1	8.1	0.0	0.0
	- road	6.9	6.9	0.0	0.0
	- off-road	1.2	1.2	0.0	0.0
Total	55.0	55.0	0.0	0.0	
Austria	Power plants, of which:	4.9	4.8	28.6	28.7
	- existing plants	3.4	3.2	23.0	23.2
	- new plants	1.6	1.6	5.6	5.6
	Refineries, other conversion	3.4	2.5	3.1	3.4
	Industry, of which:	17.2	12.5	21.6	26.3
	- combustion installations	7.1	5.2	12.0	13.2
	- processes	10.1	7.2	9.6	13.2
	Domestic	13.9	13.9	27.8	27.8
	Transport, of which:	0.7	0.7	110.0	110.0
	- road	0.7	0.7	94.0	94.0
	- off-road	0.0	0.0	16.0	16.0
Total	40.4	34.7	191.2	196.3	
Belarus	Power plants, of which:	326.9	326.9	0.0	0.0
	- existing plants	217.3	217.3	0.0	0.0
	- new plants	109.6	109.6	0.0	0.0
	Refineries, other conversion	45.8	45.8	0.0	0.0
	Industry, of which:	55.6	55.6	0.0	0.0
	- combustion installations	18.9	18.9	0.0	0.0
	- processes	36.7	36.7	0.0	0.0
	Domestic	38.0	38.0	0.0	0.0
	Transport, of which:	27.2	27.2	0.0	0.0
	- road	17.9	17.9	0.0	0.0
	- off-road	9.3	9.3	0.0	0.0
Total	493.5	493.5	0.0	0.0	

Table 1.39: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Belgium	Power plants, of which:	28.9	7.3	66.3	100.2
	- existing plants	22.0	1.8	4.0	31.9
	- new plants	6.9	5.5	62.3	68.3
	Refineries, other conversion	14.0	7.2	19.0	23.1
	Industry, of which:	131.1	51.5	39.3	94.1
	- combustion installations	56.5	17.7	30.6	68.0
	- processes	74.7	33.9	8.7	26.2
	Domestic	17.3	9.1	97.1	124.1
	Transport, of which:	1.0	1.0	211.5	211.6
	- road	0.9	0.9	200.1	200.1
	- off-road	0.2	0.1	11.5	11.5
	Total	192.7	76.4	433.4	553.1
	Bosnia H.	Power plants, of which:	363.7	110.4	0.0
- existing plants		166.8	100.3	0.0	20.4
- new plants		196.9	10.1	0.0	34.5
Refineries, other conversion		13.7	13.7	0.0	0.0
Industry, of which:		25.9	25.9	0.0	0.0
- combustion installations		7.3	7.3	0.0	0.0
- processes		18.7	18.7	0.0	0.0
Domestic		5.8	5.8	0.0	0.0
Transport, of which:		6.1	6.1	0.0	0.0
- road		4.8	4.8	0.0	0.0
- off-road		1.3	1.3	0.0	0.0
Total		415.2	161.9	0.0	54.9
Bulgaria		Power plants, of which:	657.4	199.6	62.7
	- existing plants	617.0	169.5	0.0	55.0
	- new plants	40.4	30.1	62.7	63.1
	Refineries, other conversion	8.5	8.5	2.5	2.5
	Industry, of which:	103.9	93.9	33.0	36.5
	- combustion installations	66.1	66.1	33.0	33.0
	- processes	37.7	27.8	0.0	3.5
	Domestic	67.2	67.2	1.6	1.6
	Transport, of which:	9.1	9.1	53.4	53.4
	- road	2.0	2.0	49.4	49.4
	- off-road	7.1	7.1	4.0	4.0
	Total	846.1	378.3	153.3	212.1
	Croatia	Power plants, of which:	26.4	4.8	15.5
- existing plants		24.9	3.3	5.3	12.6
- new plants		1.5	1.5	10.3	10.3
Refineries, other conversion		7.0	2.7	3.7	5.4
Industry, of which:		12.9	4.9	2.9	6.3
- combustion installations		2.8	1.8	2.9	3.5
- processes		10.1	3.0	0.0	2.9
Domestic		22.9	9.8	12.5	18.8
Transport, of which:		1.1	1.1	17.0	17.0
- road		0.6	0.6	15.2	15.2
- off-road		0.5	0.5	1.8	1.8
Total		70.3	23.3	51.8	70.5

Table 1.40: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Czech Rep.	Power plants, of which:	250.8	213.3	324.5	339.0
	- existing plants	165.6	162.7	214.9	216.7
	- new plants	85.3	50.5	109.6	122.3
	Refineries, other conversion	1.4	0.9	0.4	0.6
	Industry, of which:	67.9	30.8	29.8	48.7
	- combustion installations	45.8	18.4	22.1	35.2
	- processes	22.0	12.4	7.7	13.5
	Domestic	42.4	33.8	4.9	8.1
	Transport, of which:	3.7	3.7	50.8	50.8
	- road	2.0	2.0	45.9	45.9
	- off-road	1.7	1.7	4.9	4.9
Total	366.2	282.5	410.4	447.1	
Denmark	Power plants, of which:	67.3	42.7	48.8	59.1
	- existing plants	60.9	36.4	18.1	28.4
	- new plants	6.3	6.3	30.8	30.8
	Refineries, other conversion	1.2	0.8	1.5	1.7
	Industry, of which:	13.0	9.1	12.9	14.8
	- combustion installations	7.5	5.5	11.0	11.8
	- processes	5.5	3.5	1.9	3.0
	Domestic	2.9	2.8	11.5	11.5
	Transport, of which:	4.7	3.9	63.8	64.2
	- road	0.4	0.4	42.9	42.9
	- off-road	4.3	3.5	20.9	21.3
Total	90.0	60.3	138.5	151.3	
Estonia	Power plants, of which:	143.9	143.9	0.0	0.0
	- existing plants	87.6	87.6	0.0	0.0
	- new plants	56.3	56.3	0.0	0.0
	Refineries, other conversion	2.8	2.8	0.0	0.0
	Industry, of which:	13.2	13.2	0.0	0.0
	- combustion installations	11.6	11.6	0.0	0.0
	- processes	1.6	1.6	0.0	0.0
	Domestic	8.9	8.9	0.0	0.0
	Transport, of which:	5.8	5.8	0.0	0.0
	- road	4.8	4.8	0.0	0.0
	- off-road	1.0	1.0	0.0	0.0
Total	174.6	174.6	0.0	0.0	
Finland	Power plants, of which:	21.3	21.3	102.8	102.8
	- existing plants	13.4	13.4	63.0	63.0
	- new plants	7.9	7.9	39.8	39.8
	Refineries, other conversion	3.0	3.0	2.3	2.3
	Industry, of which:	85.4	85.4	86.7	86.7
	- combustion installations	55.7	55.7	28.7	28.7
	- processes	29.6	29.6	58.0	58.0
	Domestic	4.6	4.6	11.2	11.2
	Transport, of which:	1.7	1.7	44.2	44.2
	- road	1.0	1.0	34.7	34.7
	- off-road	0.7	0.7	9.5	9.5
Total	116.0	116.0	247.2	247.2	

Table 1.41: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
France	Power plants, of which:	30.7	21.2	15.7	19.2
	- existing plants	28.9	19.4	0.1	3.5
	- new plants	1.8	1.8	15.6	15.6
	Refineries, other conversion	45.5	26.0	41.6	51.1
	Industry, of which:	277.6	94.7	103.1	211.8
	- combustion installations	101.3	59.5	103.1	139.5
	- processes	176.3	35.3	0.0	72.4
	Domestic	60.6	51.4	195.3	199.3
	Transport, of which:	18.1	10.3	921.1	930.3
	- road	5.8	5.8	818.6	818.6
	- off-road	12.4	4.5	102.6	111.7
Total		448.0	219.2	1276.8	1411.6
Germany	Power plants, of which:	247.2	246.6	1617.4	1620.9
	- existing plants	203.5	203.0	1382.4	1384.7
	- new plants	43.7	43.7	235.0	236.2
	Refineries, other conversion	51.3	8.9	0.8	25.9
	Industry, of which:	174.4	131.4	422.4	501.1
	- combustion installations	83.9	66.8	336.5	382.8
	- processes	90.5	64.6	85.9	118.3
	Domestic	77.9	45.3	296.5	422.8
	Transport, of which:	7.5	7.5	927.7	927.7
	- road	7.2	7.2	827.1	827.1
	- off-road	0.3	0.3	100.6	100.6
Total		581.1	462.6	3264.8	3498.4
Greece	Power plants, of which:	379.2	379.2	93.2	93.2
	- existing plants	338.3	338.3	19.2	19.2
	- new plants	40.9	40.9	74.0	74.0
	Refineries, other conversion	9.8	9.8	11.3	11.3
	Industry, of which:	95.2	95.2	51.7	51.7
	- combustion installations	75.7	75.7	51.7	51.7
	- processes	19.5	19.5	0.0	0.0
	Domestic	14.1	14.1	121.7	121.7
	Transport, of which:	47.4	47.4	165.8	165.8
	- road	5.5	5.5	112.6	112.6
	- off-road	41.8	41.8	53.3	53.3
Total		546.5	546.5	443.7	443.7
Hungary	Power plants, of which:	239.3	29.9	93.6	169.7
	- existing plants	213.7	11.4	7.0	69.9
	- new plants	25.7	18.4	86.5	99.7
	Refineries, other conversion	11.5	4.4	7.0	10.1
	Industry, of which:	23.9	6.0	7.2	22.6
	- combustion installations	4.3	2.1	7.2	14.6
	- processes	19.6	3.9	0.0	8.0
	Domestic	267.8	253.3	6.8	19.5
	Transport, of which:	3.7	2.5	51.7	57.3
	- road	2.1	2.1	46.9	46.9
	- off-road	1.7	0.4	4.8	10.4
Total		546.3	296.0	166.3	279.2

Table 1.42: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Ireland	Power plants, of which:	33.4	15.5	24.5	31.6
	- existing plants	26.1	8.2	0.0	7.1
	- new plants	7.3	7.3	24.5	24.5
	Refineries, other conversion	0.6	0.6	1.0	1.0
	Industry, of which:	16.1	7.5	15.2	18.9
	- combustion installations	13.5	6.7	15.2	18.2
	- processes	2.6	0.8	0.0	0.7
	Domestic	13.0	11.1	31.5	32.4
	Transport, of which:	2.8	1.1	61.1	61.9
	- road	0.5	0.5	57.0	57.0
	- off-road	2.3	0.6	4.0	4.9
Total	66.0	35.8	133.2	145.9	
Italy	Power plants, of which:	355.0	104.3	497.4	572.1
	- existing plants	279.4	62.2	330.6	398.7
	- new plants	75.5	42.0	166.8	173.3
	Refineries, other conversion	39.6	37.0	62.8	63.6
	Industry, of which:	130.8	108.4	82.2	93.6
	- combustion installations	39.2	30.6	50.1	53.9
	- processes	91.6	77.8	32.1	39.7
	Domestic	19.8	19.8	173.7	173.7
	Transport, of which:	19.5	19.0	960.9	961.2
	- road	4.9	4.9	762.0	762.0
	- off-road	14.6	14.0	198.9	199.2
Total	566.5	290.1	1776.9	1864.1	
Latvia	Power plants, of which:	48.9	48.9	0.0	0.0
	- existing plants	24.3	24.3	0.0	0.0
	- new plants	24.6	24.6	0.0	0.0
	Refineries, other conversion	0.0	0.0	0.0	0.0
	Industry, of which:	12.8	12.8	0.0	0.0
	- combustion installations	12.6	12.6	0.0	0.0
	- processes	0.2	0.2	0.0	0.0
	Domestic	23.8	23.8	0.0	0.0
	Transport, of which:	18.5	18.5	0.0	0.0
	- road	8.0	8.0	0.0	0.0
	- off-road	10.5	10.5	0.0	0.0
Total	103.9	103.9	0.0	0.0	
Lithuania	Power plants, of which:	29.9	29.9	0.0	0.0
	- existing plants	29.9	29.9	0.0	0.0
	- new plants	0.0	0.0	0.0	0.0
	Refineries, other conversion	13.3	13.3	0.0	0.0
	Industry, of which:	17.2	17.2	0.0	0.0
	- combustion installations	7.3	7.3	0.0	0.0
	- processes	9.9	9.9	0.0	0.0
	Domestic	28.4	28.4	0.0	0.0
	Transport, of which:	17.3	17.3	0.0	0.0
	- road	9.8	9.8	0.0	0.0
	- off-road	7.5	7.5	0.0	0.0
Total	106.9	106.9	0.0	0.0	

Table 1.43: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Luxembourg	Power plants, of which:	0.0	0.0	0.1	0.1
	- existing plants	0.0	0.0	0.0	0.0
	- new plants	0.0	0.0	0.1	0.1
	Refineries, other conversion	0.0	0.0	0.0	0.0
	Industry, of which:	3.5	2.7	3.9	4.4
	- combustion installations	0.9	0.9	2.5	2.5
	- processes	2.5	1.8	1.5	1.9
	Domestic	0.5	0.5	3.2	3.2
	Transport, of which:	0.1	0.1	5.4	5.4
	- road	0.1	0.1	4.7	4.7
	- off-road	0.0	0.0	0.7	0.7
	Total	4.0	3.2	12.7	13.2
Netherlands	Power plants, of which:	10.2	10.2	89.9	89.9
	- existing plants	9.7	9.7	89.9	89.9
	- new plants	0.6	0.6	0.0	0.0
	Refineries, other conversion	21.7	8.6	18.5	28.7
	Industry, of which:	27.0	24.7	45.0	48.5
	- combustion installations	7.5	5.2	5.1	8.6
	- processes	19.4	19.4	39.9	39.9
	Domestic	0.0	0.0	0.0	0.0
	Transport, of which:	12.5	5.2	187.7	193.0
	- road	1.3	1.3	149.1	149.1
	- off-road	11.2	4.0	38.6	43.9
	Total	72.9	50.2	341.1	360.2
Norway	Power plants, of which:	0.5	0.5	2.3	2.3
	- existing plants	0.5	0.5	2.3	2.3
	- new plants	0.0	0.0	0.0	0.0
	Refineries, other conversion	0.0	0.0	0.0	0.0
	Industry, of which:	24.9	11.3	13.5	23.6
	- combustion installations	4.1	3.3	5.6	7.1
	- processes	20.8	8.0	7.9	16.5
	Domestic	1.7	1.7	4.2	4.2
	Transport, of which:	4.5	4.5	36.1	36.1
	- road	0.5	0.5	27.0	27.0
	- off-road	4.0	4.0	9.2	9.2
	Total	31.7	18.1	56.1	66.2
Poland	Power plants, of which:	893.9	388.8	574.5	792.9
	- existing plants	808.1	304.0	44.9	262.9
	- new plants	85.8	84.7	529.6	530.0
	Refineries, other conversion	39.0	23.5	7.5	14.0
	Industry, of which:	171.7	59.5	22.3	70.1
	- combustion installations	49.6	22.9	22.3	35.4
	- processes	122.1	36.6	0.0	34.8
	Domestic	274.7	233.3	53.5	70.5
	Transport, of which:	17.1	16.4	196.9	197.3
	- road	7.9	7.9	175.6	175.6
	- off-road	9.2	8.5	21.4	21.7
	Total	1397.0	721.9	854.8	1144.8



Table 1.44: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Portugal	Power plants, of which:	75.3	75.3	22.5	22.5
	- existing plants	72.8	72.8	3.7	3.7
	- new plants	2.5	2.5	18.8	18.8
	Refineries, other conversion	5.8	5.8	5.8	5.8
	Industry, of which:	54.0	54.0	18.3	18.3
	- combustion installations	28.6	28.6	18.3	18.3
	- processes	25.4	25.4	0.0	0.0
	Domestic	5.4	5.4	16.7	16.7
	Transport, of which:	0.8	0.8	117.5	117.5
	- road	0.8	0.8	101.0	101.0
	- off-road	0.0	0.0	16.4	16.4
Total		141.4	141.4	180.8	180.8
Rep. of Moldova	Power plants, of which:	70.2	9.4	0.0	23.6
	- existing plants	50.3	7.9	0.0	18.0
	- new plants	19.9	1.5	0.0	5.6
	Refineries, other conversion	0.0	0.0	0.0	0.0
	Industry, of which:	15.9	7.6	0.0	3.3
	- combustion installations	15.9	7.6	0.0	3.3
	- processes	0.0	0.0	0.0	0.0
	Domestic	24.7	15.3	0.0	3.8
	Transport, of which:	5.8	5.8	0.0	0.0
	- road	2.2	2.2	0.0	0.0
	- off-road	3.5	3.5	0.0	0.0
Total		116.6	38.0	0.0	30.7
Romania	Power plants, of which:	433.6	62.9	55.6	162.9
	- existing plants	413.3	42.7	0.0	107.2
	- new plants	20.3	20.3	55.6	55.7
	Refineries, other conversion	17.6	5.0	4.8	10.3
	Industry, of which:	96.1	34.2	18.9	45.7
	- combustion installations	30.9	14.6	18.9	27.1
	- processes	65.2	19.6	0.0	18.6
	Domestic	34.5	33.7	14.8	15.1
	Transport, of which:	11.8	11.8	61.3	61.3
	- road	2.1	2.1	52.0	52.0
	- off-road	9.6	9.6	9.3	9.3
Total		593.6	147.7	155.5	295.3
Russia	Power plants, of which:	1022.2	995.2	87.6	95.0
	- existing plants	1000.9	973.9	4.2	11.7
	- new plants	21.3	21.3	83.3	83.3
	Refineries, other conversion	44.4	44.4	18.1	18.1
	Industry, of which:	798.7	667.3	128.4	174.4
	- combustion installations	246.5	243.9	128.4	129.3
	- processes	552.2	423.4	0.0	45.1
	Domestic	434.2	434.2	20.2	20.2
	Transport, of which:	44.4	44.4	451.5	451.5
	- road	15.6	15.6	368.1	368.1
	- off-road	28.8	28.8	83.4	83.4
Total		2343.9	2185.5	705.7	759.1

Table 1.45: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Slovakia	Power plants, of which:	28.8	24.8	34.6	36.3
	- existing plants	22.3	21.1	28.9	29.7
	- new plants	6.5	3.7	5.7	6.6
	Refineries, other conversion	9.7	2.6	3.0	6.9
	Industry, of which:	40.3	14.3	14.5	31.5
	- combustion installations	32.4	11.1	11.7	25.0
	- processes	8.0	3.2	2.8	6.5
	Domestic	55.4	47.7	1.6	4.4
	Transport, of which:	2.6	2.6	39.9	39.9
	- road	1.5	1.5	36.7	36.7
	- off-road	1.1	1.1	3.1	3.1
	Total	137.1	92.1	93.5	119.0
Slovenia	Power plants, of which:	59.5	6.2	15.1	35.9
	- existing plants	56.2	2.8	0.2	21.0
	- new plants	3.4	3.4	14.8	14.8
	Refineries, other conversion	0.4	0.2	0.1	0.2
	Industry, of which:	6.8	3.4	4.9	7.2
	- combustion installations	2.2	1.3	3.3	3.8
	- processes	4.6	2.2	1.6	3.3
	Domestic	3.4	3.4	4.4	4.4
	Transport, of which:	0.9	0.9	10.3	10.3
	- road	0.6	0.6	9.3	9.3
	- off-road	0.3	0.3	1.0	1.0
	Total	71.0	14.2	34.7	57.9
Spain	Power plants, of which:	410.0	382.5	129.1	137.9
	- existing plants	394.6	367.1	36.9	45.7
	- new plants	15.4	15.4	92.2	92.2
	Refineries, other conversion	42.0	41.9	42.5	42.5
	Industry, of which:	219.3	219.3	53.5	53.5
	- combustion installations	59.8	59.8	53.5	53.5
	- processes	159.5	159.5	0.0	0.0
	Domestic	25.1	25.1	73.4	73.4
	Transport, of which:	48.6	48.6	512.2	512.2
	- road	3.6	3.6	442.1	442.1
	- off-road	45.0	45.0	70.1	70.1
	Total	774.4	746.8	810.6	819.5
Sweden	Power plants, of which:	7.3	7.3	95.7	95.7
	- existing plants	3.5	3.5	37.5	37.5
	- new plants	3.9	3.9	58.2	58.2
	Refineries, other conversion	3.5	3.5	3.2	3.2
	Industry, of which:	40.2	40.2	118.3	118.3
	- combustion installations	21.0	21.0	78.9	78.9
	- processes	19.2	19.2	39.4	39.4
	Domestic	11.2	11.2	29.3	29.3
	Transport, of which:	4.2	4.2	76.9	76.9
	- road	1.1	1.1	44.1	44.1
	- off-road	3.1	3.1	32.8	32.8
	Total	66.6	66.6	323.5	323.5

Table 1.46: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year	
		REF	J1	REF	J1
Switzerland	Power plants, of which:	1.6	1.3	3.6	3.7
	- existing plants	1.0	0.7	0.4	0.5
	- new plants	0.6	0.6	3.2	3.2
	Refineries, other conversion	1.8	1.1	1.2	1.5
	Industry, of which:	11.5	9.6	8.1	9.0
	- combustion installations	7.4	6.3	6.6	7.1
	- processes	4.2	3.3	1.5	1.9
	Domestic	9.4	9.4	49.6	49.6
	Transport, of which:	0.8	0.8	55.9	55.9
	- road	0.7	0.7	47.2	47.2
	- off-road	0.0	0.0	8.6	8.6
	Total	25.5	22.7	118.2	119.6
	Rep. of Macedonia	Power plants, of which:	62.2	62.2	0.0
- existing plants		32.5	32.5	0.0	0.0
- new plants		29.7	29.7	0.0	0.0
Refineries, other conversion		3.8	3.8	0.0	0.0
Industry, of which:		11.0	11.0	0.0	0.0
- combustion installations		10.3	10.3	0.0	0.0
- processes		0.7	0.7	0.0	0.0
Domestic		1.2	1.2	0.0	0.0
Transport, of which:		2.9	2.9	0.0	0.0
- road		2.2	2.2	0.0	0.0
- off-road		0.7	0.7	0.0	0.0
Total		81.1	81.1	0.0	0.0
Ukraine		Power plants, of which:	796.8	765.7	76.3
	- existing plants	780.5	749.4	4.5	12.6
	- new plants	16.3	16.3	71.8	71.8
	Refineries, other conversion	29.8	29.8	14.4	14.4
	Industry, of which:	240.7	240.7	39.6	39.6
	- combustion installations	76.4	76.4	39.6	39.6
	- processes	164.3	164.3	0.0	0.0
	Domestic	402.3	402.3	6.8	6.8
	Transport, of which:	18.0	18.0	194.5	194.5
	- road	6.7	6.7	161.8	161.8
	- off-road	11.3	11.3	32.6	32.6
	Total	1487.7	1456.6	331.6	339.7
	UK	Power plants, of which:	353.2	235.2	529.1
- existing plants		352.1	234.1	524.3	567.7
- new plants		1.1	1.1	4.8	4.8
Refineries, other conversion		55.7	21.7	31.8	61.6
Industry, of which:		398.6	154.3	114.5	264.6
- combustion installations		194.4	113.4	114.5	180.8
- processes		204.2	40.8	0.0	83.8
Domestic		78.9	43.4	13.7	29.6
Transport, of which:		66.3	16.7	594.4	654.5
- road		5.8	5.8	536.4	536.4
- off-road		60.6	11.0	58.0	118.1
Total		980.0	498.6	1283.6	1582.8

Table 1.47: SO<sub>2</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO/year		
		REF	J1	REF	J1	
Yugoslavia	Power plants, of which:	196.1	177.5	81.8	92.7	
	- existing plants	185.9	167.2	0.0	10.9	
	- new plants	10.3	10.3	81.8	81.8	
	Refineries, other conversion	11.9	4.6	3.8	7.8	
	Industry, of which:	39.2	14.2	2.9	14.7	
	- combustion installations	15.4	7.1	2.9	7.9	
	- processes	23.8	7.1	0.0	6.8	
	Domestic	7.9	7.3	0.0	0.3	
	Transport, of which:	13.4	13.4	0.0	0.0	
	- road	9.4	9.4	0.0	0.0	
	- off-road	4.0	4.0	0.0	0.0	
	Total		268.6	217.0	88.6	115.6
	Total Europe (sea regions not included)	Power plants, of which:	7695.5	5174.3	4788.9	5580.7
- existing plants		6717.2	4492.4	2845.2	3555.6	
- new plants		978.3	681.8	1943.7	2025.1	
Refineries, other conversion		562.6	387.5	311.6	416.9	
Industry, of which:		3492.4	2443.2	1514.9	2140.1	
- combustion installations		1437.7	1120.4	1216.5	1482.2	
- processes		2054.7	1322.8	298.4	657.9	
Domestic		2105.4	1922.0	1283.6	1503.8	
Transport, of which:		458.7	388.8	6179.6	6261.7	
- road		147.8	147.8	5261.5	5261.5	
- off-road		310.9	241.0	918.1	1000.1	
Total			14418.3	10419.4	14078.6	15903.2

### 1.3.3.2 NO<sub>x</sub> —

Table 1.48: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Albania	Power plants, of which:	1.7	1.4	0.0	0.0
	- existing plants	1.1	0.7	0.0	0.0
	- new plants	0.6	0.6	0.0	0.0
	Refin., oth. conversion	0.5	0.4	0.0	0.0
	Industry, of which:	5.4	5.4	0.0	0.0
	- combustion installations	3.8	3.8	0.0	0.0
	- processes	1.6	1.6	0.0	0.0
	Domestic	1.4	1.4	0.0	0.0
	Transport, of which:	27.3	27.3	0.0	0.0
	- road	24.3	24.3	0.0	0.0
	- off-road	3.0	3.0	0.0	0.0
Total	36.3	35.9	0.0	0.1	
Austria	Power plants, of which:	10.3	7.3	24.6	30.7
	- existing plants	5.5	4.7	20.2	20.6
	- new plants	4.8	2.6	4.3	10.2
	Refin., oth. conversion	2.6	1.6	0.6	2.0
	Industry, of which:	18.7	15.4	35.3	41.5
	- combustion installations	11.7	8.4	3.8	10.0
	- processes	7.0	7.0	31.5	31.5
	Domestic	19.4	17.5	0.0	3.6
	Transport, of which:	50.3	47.7	713.0	718.0
	- road	37.0	36.8	706.2	706.4
	- off-road	13.3	10.8	6.9	11.6
Total	102.8	91.1	773.5	795.8	
Belarus	Power plants, of which:	91.3	65.7	0.0	2.5
	- existing plants	62.3	36.8	0.0	2.5
	- new plants	29.0	29.0	0.0	0.0
	Refin., oth. conversion	9.2	8.8	0.0	0.1
	Industry, of which:	33.7	33.4	0.0	0.0
	- combustion installations	14.0	13.8	0.0	0.0
	- processes	19.6	19.6	0.0	0.0
	Domestic	13.6	13.6	0.0	0.0
	Transport, of which:	168.1	168.1	0.0	0.0
	- road	129.8	129.8	0.0	0.0
	- off-road	38.3	38.3	0.0	0.0
Total	315.9	289.8	0.0	2.7	
Belgium	Power plants, of which:	19.8	14.2	46.5	68.7
	- existing plants	9.4	4.2	4.3	24.8
	- new plants	10.4	9.9	42.3	43.9
	Refin., oth. conversion	8.7	3.2	0.2	7.5
	Industry, of which:	63.3	24.0	8.4	128.3
	- combustion installations	33.8	10.8	1.0	45.8
	- processes	29.5	13.3	7.4	82.6
	Domestic	28.8	18.9	0.0	65.7
	Transport, of which:	69.2	66.0	1158.6	1164.0
	- road	58.3	57.0	1152.6	1154.0
	- off-road	10.9	9.0	6.0	10.0
Total	190.7	127.2	1213.7	1434.2	

Table 1.49: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Bosnia H.	Power plants, of which:	17.9	12.4	1.0	2.3
	- existing plants	10.6	5.1	1.0	2.3
	- new plants	7.3	7.3	0.0	0.0
	Refin., oth. conversion	1.4	1.0	0.1	0.2
	Industry, of which:	7.1	6.1	0.1	0.8
	- combustion installations	1.7	1.1	0.1	0.5
	- processes	5.4	5.1	0.0	0.3
	Domestic	1.2	1.2	0.0	0.0
	Transport, of which:	32.1	32.1	0.0	0.0
	- road	27.4	27.4	0.0	0.0
	- off-road	4.6	4.6	0.0	0.0
	Total	59.6	52.8	1.2	3.3
Bulgaria	Power plants, of which:	63.1	44.0	1.9	5.5
	- existing plants	38.4	19.3	1.9	5.5
	- new plants	24.7	24.7	0.0	0.0
	Refin., oth. conversion	1.7	1.2	0.1	0.4
	Industry, of which:	59.1	50.8	1.6	5.9
	- combustion installations	20.6	13.1	1.6	5.0
	- processes	38.5	37.6	0.0	0.8
	Domestic	5.3	4.9	0.0	0.4
	Transport, of which:	165.0	162.4	0.1	1.3
	- road	132.8	132.8	0.1	0.1
	- off-road	32.2	29.6	0.0	1.2
	Total	296.5	265.6	3.7	13.4
Croatia	Power plants, of which:	9.4	7.1	0.2	0.8
	- existing plants	4.1	1.8	0.2	0.8
	- new plants	5.3	5.3	0.0	0.0
	Refin., oth. conversion	2.5	1.6	0.2	0.6
	Industry, of which:	9.5	8.7	0.2	0.5
	- combustion installations	3.9	3.0	0.2	0.5
	- processes	5.6	5.6	0.0	0.0
	Domestic	7.0	7.0	0.0	0.0
	Transport, of which:	62.1	62.1	0.0	0.0
	- road	56.2	56.2	0.0	0.0
	- off-road	5.9	5.9	0.0	0.0
	Total	90.5	86.5	0.6	2.0
Czech Rep.	Power plants, of which:	138.9	54.5	3.0	52.8
	- existing plants	100.4	44.7	3.0	10.8
	- new plants	38.6	9.8	0.0	42.1
	Refin., oth. conversion	2.0	1.3	0.5	0.9
	Industry, of which:	42.1	30.3	9.8	20.1
	- combustion installations	17.0	11.5	3.6	7.6
	- processes	25.1	18.8	6.3	12.5
	Domestic	12.1	12.1	0.0	0.0
	Transport, of which:	100.9	89.4	548.0	574.5
	- road	76.5	70.8	542.5	557.0
	- off-road	24.4	18.6	5.5	17.5
	Total	296.1	187.7	561.2	648.3

Table 1.50: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Denmark	Power plants, of which:	33.4	26.6	17.7	21.6
	- existing plants	21.0	14.6	2.5	6.0
	- new plants	12.5	12.1	15.2	15.6
	Refin., oth. conversion	1.7	0.9	0.1	0.5
	Industry, of which:	13.1	9.4	3.8	5.6
	- combustion installations	7.4	3.7	0.0	1.7
	- processes	5.7	5.7	3.8	3.8
	Domestic	4.9	4.8	0.0	0.1
	Transport, of which:	69.3	65.6	418.3	419.9
	- road	19.8	19.8	406.2	406.2
	- off-road	49.5	45.8	12.1	13.7
	Total	128.0	113.0	439.8	447.7
	Estonia	Power plants, of which:	21.0	21.0	0.0
- existing plants		13.3	13.3	0.0	0.0
- new plants		7.7	7.7	0.0	0.0
Refin., oth. conversion		1.0	1.0	0.0	0.0
Industry, of which:		7.0	7.0	0.0	0.0
- combustion installations		4.1	4.1	0.0	0.0
- processes		3.0	3.0	0.0	0.0
Domestic		2.5	2.5	0.0	0.0
Transport, of which:		41.8	41.8	0.0	0.0
- road		37.0	37.0	0.0	0.0
- off-road		4.8	4.8	0.0	0.0
Total	73.4	73.4	0.0	0.0	
Finland	Power plants, of which:	32.9	32.9	24.3	24.3
	- existing plants	25.1	25.1	2.5	2.5
	- new plants	7.8	7.8	21.8	21.8
	Refin., oth. conversion	2.0	2.0	0.2	0.2
	Industry, of which:	50.8	50.8	7.6	7.6
	- combustion installations	44.6	44.6	3.5	3.5
	- processes	6.2	6.2	4.1	4.1
	Domestic	6.3	6.3	0.0	0.0
	Transport, of which:	58.5	58.5	563.2	563.2
	- road	28.9	28.9	555.6	555.6
	- off-road	29.6	29.6	7.6	7.6
Total	152.5	152.5	595.3	595.3	
France	Power plants, of which:	20.1	12.1	23.1	43.2
	- existing plants	8.0	7.4	3.4	3.6
	- new plants	12.1	4.7	19.7	39.6
	Refin., oth. conversion	18.2	6.9	2.9	29.2
	Industry, of which:	178.7	93.9	6.1	115.1
	- combustion installations	88.8	40.6	6.1	74.7
	- processes	89.9	53.3	0.0	40.4
	Domestic	103.5	92.2	0.0	42.1
	Transport, of which:	500.7	461.6	7008.7	7054.1
	- road	281.9	281.9	6962.3	6962.3
	- off-road	218.8	179.7	46.3	91.8
Total	858.4	704.0	7040.7	7283.7	

Table 1.51: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Germany	Power plants, of which:	236.4	213.6	553.9	594.1
	- existing plants	192.7	191.2	477.4	479.7
	- new plants	43.7	22.4	76.5	114.3
	Refin., oth. conversion	13.9	7.8	5.0	11.8
	Industry, of which:	179.7	142.6	366.7	430.2
	- combustion installations	132.1	94.9	152.3	215.8
	- processes	47.6	47.6	214.4	214.4
	Domestic	152.3	143.3	0.0	31.2
	Transport, of which:	561.9	534.0	8133.7	8214.7
	- road	417.9	417.9	8039.5	8039.5
	- off-road	143.9	116.1	94.3	175.2
	Total	1183.9	1081.0	9059.4	9281.9
	Greece	Power plants, of which:	49.7	49.7	26.6
- existing plants		35.1	35.1	7.7	7.7
- new plants		14.6	14.6	18.9	18.9
Refin., oth. conversion		2.3	2.3	0.9	0.9
Industry, of which:		38.7	38.7	18.2	18.2
- combustion installations		19.2	19.2	5.2	5.2
- processes		19.5	19.5	13.0	13.0
Domestic		17.7	17.7	0.1	0.1
Transport, of which:		224.9	224.9	932.2	932.2
- road		100.2	100.2	892.2	892.2
- off-road		124.6	124.6	40.0	40.0
Total		344.2	344.2	978.0	978.0
Hungary		Power plants, of which:	48.4	14.5	1.2
	- existing plants	22.0	9.2	1.2	6.4
	- new plants	26.4	5.3	0.0	41.8
	Refin., oth. conversion	2.8	0.9	0.3	3.8
	Industry, of which:	20.7	12.1	0.5	8.7
	- combustion installations	7.7	4.2	0.5	3.5
	- processes	13.1	7.8	0.0	5.2
	Domestic	18.8	16.4	0.0	6.8
	Transport, of which:	107.6	93.0	426.5	468.9
	- road	89.7	79.4	421.1	451.7
	- off-road	18.0	13.5	5.4	17.2
	Total	198.2	136.8	428.5	536.4
	Ireland	Power plants, of which:	19.3	11.5	13.5
- existing plants		8.8	4.0	0.0	1.1
- new plants		10.5	7.5	13.5	17.6
Refin., oth. conversion		0.2	0.1	0.0	0.1
Industry, of which:		12.1	6.7	0.2	3.7
- combustion installations		8.4	4.5	0.2	2.2
- processes		3.7	2.2	0.0	1.5
Domestic		9.4	8.0	0.0	1.1
Transport, of which:		27.0	26.5	453.4	453.6
- road		20.3	20.3	450.3	450.3
- off-road		6.8	6.2	3.1	3.3
Total		69.7	54.5	467.1	477.2



Table 1.52: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Italy	Power plants, of which:	173.9	105.5	119.9	145.2
	- existing plants	117.0	63.9	35.3	43.5
	- new plants	57.0	41.6	84.5	101.7
	Refin., oth. conversion	30.3	12.5	0.5	11.6
	Industry, of which:	260.0	159.7	14.7	94.9
	- combustion installations	97.5	62.1	14.7	29.8
	- processes	162.6	97.5	0.0	65.0
	Domestic	77.7	77.0	0.0	0.5
	Transport, of which:	551.7	510.7	7175.7	7215.6
	- road	309.6	309.6	7120.8	7120.8
	- off-road	242.2	201.2	55.0	94.9
	Total	1129.5	901.4	7310.9	7467.8
	Latvia	Power plants, of which:	14.2	14.1	0.0
- existing plants		9.7	9.6	0.0	0.0
- new plants		4.5	4.5	0.0	0.0
Refin., oth. conversion		0.0	0.0	0.0	0.0
Industry, of which:		6.8	6.8	0.0	0.0
- combustion installations		4.2	4.2	0.0	0.0
- processes		2.6	2.6	0.0	0.0
Domestic		5.7	5.7	0.0	0.0
Transport, of which:		91.2	91.2	0.0	0.0
- road		52.2	52.2	0.0	0.0
- off-road		39.1	39.1	0.0	0.0
Total		118.1	118.0	0.0	0.0
Lithuania		Power plants, of which:	16.1	12.4	0.0
	- existing plants	13.2	9.5	0.0	0.4
	- new plants	2.9	2.9	0.0	0.0
	Refin., oth. conversion	2.4	2.4	0.0	0.0
	Industry, of which:	17.4	17.2	0.0	0.0
	- combustion installations	4.1	4.0	0.0	0.0
	- processes	13.2	13.2	0.0	0.0
	Domestic	5.2	5.2	0.0	0.0
	Transport, of which:	96.6	96.6	0.0	0.0
	- road	65.2	65.2	0.0	0.0
	- off-road	31.4	31.4	0.0	0.0
	Total	138.0	134.1	0.0	0.4
	Luxembourg	Power plants, of which:	0.0	0.0	0.0
- existing plants		0.0	0.0	0.0	0.0
- new plants		0.0	0.0	0.0	0.0
Refin., oth. conversion		0.0	0.0	0.0	0.0
Industry, of which:		5.7	4.7	2.0	2.8
- combustion installations		3.0	1.9	0.2	0.9
- processes		2.7	2.7	1.8	1.8
Domestic		1.3	1.1	0.0	0.5
Transport, of which:		2.6	2.4	66.7	67.0
- road		1.8	1.8	66.1	66.2
- off-road		0.8	0.7	0.5	0.9
Total		9.7	8.4	68.8	70.3

Table 1.53: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Netherlands	Power plants, of which:	33.3	32.2	23.0	24.9
	- existing plants	28.9	28.9	5.7	5.7
	- new plants	4.3	3.3	17.3	19.2
	Refin., oth. conversion	9.4	7.8	4.0	7.4
	Industry, of which:	53.8	52.9	107.7	109.2
	- combustion installations	36.6	35.8	30.4	31.9
	- processes	17.2	17.2	77.2	77.2
	Domestic	44.5	44.5	0.0	0.0
	Transport, of which:	137.5	126.8	1447.9	1466.8
	- road	76.3	76.3	1422.3	1422.4
	- off-road	61.2	50.5	25.6	44.4
Total	280.5	266.3	1582.5	1608.2	
Norway	Power plants, of which:	31.3	18.0	4.9	7.5
	- existing plants	29.0	15.7	4.9	7.5
	- new plants	2.3	2.3	0.0	0.0
	Refin., oth. conversion	0.0	0.0	0.0	0.0
	Industry, of which:	17.6	12.9	5.2	7.9
	- combustion installations	10.3	5.6	0.3	3.0
	- processes	7.3	7.3	4.9	4.9
	Domestic	3.1	3.1	0.0	0.0
	Transport, of which:	118.3	100.6	532.4	539.5
	- road	23.4	23.4	516.2	516.2
	- off-road	94.9	77.2	16.2	23.3
Total	178.0	142.4	542.5	555.0	
Poland	Power plants, of which:	387.5	184.7	11.8	218.8
	- existing plants	177.8	124.5	11.8	18.8
	- new plants	209.7	60.2	0.0	199.9
	Refin., oth. conversion	15.0	9.9	1.7	3.7
	Industry, of which:	63.5	52.4	24.0	29.5
	- combustion installations	32.8	21.7	3.6	9.0
	- processes	30.7	30.7	20.5	20.5
	Domestic	70.3	66.0	0.0	3.5
	Transport, of which:	335.5	334.3	2430.3	2430.8
	- road	249.0	249.0	2387.6	2387.6
	- off-road	86.6	85.4	42.7	43.2
Total	878.4	653.8	2467.7	2686.2	
Portugal	Power plants, of which:	41.5	21.0	8.5	14.7
	- existing plants	33.5	16.2	0.0	2.2
	- new plants	8.0	4.7	8.5	12.4
	Refin., oth. conversion	3.2	1.7	0.1	0.7
	Industry, of which:	24.6	14.4	1.2	7.1
	- combustion installations	15.7	9.0	1.2	3.5
	- processes	9.0	5.4	0.0	3.6
	Domestic	8.4	8.2	0.0	0.2
	Transport, of which:	97.9	97.9	1312.8	1312.8
	- road	80.9	80.9	1291.6	1291.6
	- off-road	17.0	17.0	21.2	21.2
Total	176.6	144.1	1322.5	1335.4	

Table 1.54: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Rep. of Moldova	Power plants, of which:	24.9	23.6	0.0	0.1
	- existing plants	18.0	16.7	0.0	0.1
	- new plants	6.9	6.9	0.0	0.0
	Refin., oth. conversion	0.0	0.0	0.0	0.0
	Industry, of which:	4.4	4.4	0.0	0.0
	- combustion installations	4.4	4.4	0.0	0.0
	- processes	0.0	0.0	0.0	0.0
	Domestic	4.4	4.4	0.0	0.0
	Transport, of which:	32.0	32.0	0.0	0.0
	- road	17.5	17.5	0.0	0.0
	- off-road	14.5	14.5	0.0	0.0
Total	65.7	64.3	0.0	0.1	
Romania	Power plants, of which:	120.7	61.8	0.0	17.5
	- existing plants	86.3	31.0	0.0	11.6
	- new plants	34.4	30.8	0.0	5.9
	Refin., oth. conversion	9.4	4.7	0.0	2.2
	Industry, of which:	79.7	44.9	0.0	25.6
	- combustion installations	43.2	23.1	0.0	11.0
	- processes	36.4	21.9	0.0	14.6
	Domestic	13.8	13.8	0.0	0.0
	Transport, of which:	228.6	196.5	0.2	55.6
	- road	156.9	134.4	0.2	44.0
	- off-road	71.7	62.2	0.0	11.6
Total	458.2	327.7	0.2	100.9	
Russia	Power plants, of which:	579.4	579.4	14.0	14.0
	- existing plants	361.3	361.3	14.0	14.0
	- new plants	218.1	218.1	0.0	0.0
	Refin., oth. conversion	62.8	62.8	1.4	1.4
	Industry, of which:	288.0	288.0	6.2	6.2
	- combustion installations	186.1	186.1	6.2	6.2
	- processes	102.0	102.0	0.0	0.0
	Domestic	130.4	130.4	0.0	0.0
	Transport, of which:	1592.3	1592.3	1.2	1.2
	- road	1236.7	1236.7	1.2	1.2
	- off-road	355.5	355.5	0.0	0.0
Total	2652.9	2652.9	22.8	22.8	
Slovakia	Power plants, of which:	20.3	12.2	1.0	4.1
	- existing plants	13.7	7.3	1.0	2.0
	- new plants	6.6	4.9	0.0	2.2
	Refin., oth. conversion	2.0	1.2	0.2	0.7
	Industry, of which:	22.5	16.6	5.2	9.7
	- combustion installations	13.9	10.1	3.1	5.4
	- processes	8.6	6.4	2.1	4.3
	Domestic	8.0	8.0	0.0	0.0
	Transport, of which:	72.6	70.8	322.1	325.2
	- road	57.4	57.4	318.6	318.6
	- off-road	15.2	13.4	3.5	6.6
Total	131.6	115.0	328.5	339.8	

Table 1.55: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Slovenia	Power plants, of which:	8.0	5.6	0.4	1.0
	- existing plants	4.5	2.2	0.4	1.0
	- new plants	3.4	3.4	0.0	0.0
	Refin., oth. conversion	0.3	0.3	0.0	0.0
	Industry, of which:	4.2	4.0	0.2	0.2
	- combustion installations	2.3	2.1	0.2	0.2
	- processes	1.9	1.9	0.0	0.0
	Domestic	1.3	1.3	0.0	0.0
	Transport, of which:	22.4	22.4	90.7	90.7
	- road	19.4	19.4	89.8	89.8
	- off-road	3.0	3.0	0.9	0.9
	Total	36.2	33.7	91.3	92.0
Spain	Power plants, of which:	176.7	113.1	32.8	41.0
	- existing plants	147.8	84.1	2.3	10.5
	- new plants	28.9	28.9	30.5	30.5
	Refin., oth. conversion	22.2	13.6	0.3	3.7
	Industry, of which:	160.2	132.9	1.9	12.7
	- combustion installations	63.1	35.8	1.9	12.7
	- processes	97.1	97.1	0.0	0.0
	Domestic	27.4	27.4	0.0	0.0
	Transport, of which:	449.4	428.5	5406.1	5415.5
	- road	234.6	234.6	5370.0	5370.0
	- off-road	214.8	193.9	36.1	45.5
	Total	846.7	726.2	5441.0	5472.9
Sweden	Power plants, of which:	15.4	14.4	18.3	18.7
	- existing plants	7.9	6.9	3.6	4.0
	- new plants	7.5	7.5	14.7	14.7
	Refin., oth. conversion	1.5	1.2	0.2	0.3
	Industry, of which:	46.1	29.9	6.8	14.0
	- combustion installations	33.6	18.9	0.9	6.7
	- processes	12.5	11.0	5.9	7.4
	Domestic	15.1	15.1	0.0	0.0
	Transport, of which:	109.8	97.1	990.7	1004.5
	- road	30.7	30.7	973.8	973.8
	- off-road	79.1	66.4	16.9	30.7
	Total	189.6	159.4	1016.1	1037.6
Switzerland	Power plants, of which:	1.6	1.6	1.6	1.6
	- existing plants	0.6	0.6	1.1	1.1
	- new plants	1.0	1.0	0.5	0.5
	Refin., oth. conversion	0.7	0.5	0.1	0.2
	Industry, of which:	13.6	10.6	24.9	26.5
	- combustion installations	8.2	5.3	0.9	2.5
	- processes	5.3	5.3	24.0	24.0
	Domestic	14.9	14.9	0.0	0.0
	Transport, of which:	41.7	41.7	729.0	729.0
	- road	30.2	30.2	720.1	720.1
	- off-road	11.4	11.4	8.9	8.9
	Total	79.1	75.9	755.7	757.3

Table 1.56: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Rep. of Macedonia	Power plants, of which:	8.2	8.2	0.5	0.5
	- existing plants	5.2	5.2	0.5	0.5
	- new plants	3.0	3.0	0.0	0.0
	Refin., oth. conversion	0.4	0.4	0.0	0.0
	Industry, of which:	3.2	3.2	0.2	0.2
	- combustion installations	2.9	2.9	0.2	0.2
	- processes	0.3	0.3	0.0	0.0
	Domestic	0.5	0.5	0.0	0.0
	Transport, of which:	16.4	16.4	0.0	0.0
	- road	14.0	14.0	0.0	0.0
	- off-road	2.3	2.3	0.0	0.0
	Total	28.6	28.6	0.7	0.7
Ukraine	Power plants, of which:	418.4	233.5	0.0	34.2
	- existing plants	315.7	130.8	0.0	34.2
	- new plants	102.7	102.7	0.0	0.0
	Refin., oth. conversion	25.2	20.6	0.0	1.2
	Industry, of which:	204.0	196.3	0.0	1.9
	- combustion installations	134.8	127.1	0.0	1.9
	- processes	69.2	69.2	0.0	0.0
	Domestic	91.9	91.9	0.0	0.0
	Transport, of which:	693.8	680.0	0.3	5.7
	- road	530.9	530.9	0.3	0.3
	- off-road	162.9	149.1	0.0	5.4
	Total	1433.3	1222.2	0.3	42.8
UK	Power plants, of which:	192.1	192.1	115.0	115.0
	- existing plants	152.0	152.0	40.5	40.5
	- new plants	40.2	40.2	74.4	74.4
	Refin., oth. conversion	27.7	27.7	8.3	8.3
	Industry, of which:	227.4	227.4	27.8	27.8
	- combustion installations	105.5	105.5	27.8	27.8
	- processes	121.9	121.9	0.0	0.0
	Domestic	103.6	103.6	0.0	0.0
	Transport, of which:	549.5	544.4	5896.8	5911.8
	- road	327.0	327.0	5823.0	5823.0
	- off-road	222.5	217.3	73.8	88.8
	Total	1186.1	1181.0	6047.9	6062.8
Yugoslavia	Power plants, of which:	49.3	33.3	2.9	6.8
	- existing plants	31.1	15.1	2.9	6.8
	- new plants	18.2	18.2	0.0	0.0
	Refin., oth. conversion	2.7	2.0	0.2	0.5
	Industry, of which:	13.8	10.5	0.4	2.6
	- combustion installations	5.7	3.4	0.4	1.5
	- processes	8.1	7.0	0.0	1.1
	Domestic	1.8	1.8	0.0	0.1
	Transport, of which:	84.4	84.4	0.0	0.0
	- road	70.5	70.5	0.0	0.0
	- off-road	13.9	13.9	0.0	0.0
	Total	152.1	132.0	3.5	9.9

Table 1.57: NO<sub>x</sub> emissions and emission control costs in 2010 for the REF and the J1 scenarios

Country	Sector	Emissions, kilotons		Control costs, MEURO per year	
		REF	J1	REF	J1
Total Europe (sea regions not included)	Power plants, of which:	3126.4	2255.2	1092.0	1606.1
	- existing plants	2110.9	1498.9	649.4	778.8
	- new plants	1015.5	756.4	442.6	827.3
	Refin., oth. conversion	285.6	210.4	28.0	100.2
	Industry, of which:	2256.1	1824.9	686.9	1164.9
	- combustion installations	1226.6	950.3	270.0	530.4
	- processes	1029.5	874.7	416.9	634.5
	Domestic	1033.5	991.8	0.1	155.6
	Transport, of which:	7590.8	7327.7	46758.5	47136.1
	- road	5122.3	5082.3	46230.1	46320.7
	- off-road	2468.5	2245.4	528.5	815.4
	Total	14565.9	12883.4	48565.6	50163.0

### 1.3.3.3 VOC

Table 1.58: VOC emissions and costs for the REF and J1 scenarios

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Albania	Energy industry	0.2	0.2	0.0	0.0
	Fuel processing and distribution	4.0	4.0	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	3.9	3.9	0.0	0.0
	Paint use (excluding DIY)	7.0	6.8	0.0	0.0
	Other industry, waste	1.5	1.5	0.0	0.0
	Transport	12.5	12.5	0.0	0.0
	Domestic (including paint use-DIY)	11.5	11.5	0.0	0.0
	Agriculture	0.5	0.5	0.0	0.0
	Total	41.1	40.9	0.0	0.0
Austria	Energy industry	1.1	1.1	0.0	0.0
	Fuel processing and distribution	22.6	2.4	10.6	20.5
	Chemical industry	8.3	1.5	0.0	3.6
	Solvent use in industry	77.4	55.2	92.5	118.6
	Paint use (excluding DIY)	14.2	8.7	11.1	16.2
	Other industry, waste	5.6	5.6	0.1	0.1
	Transport	26.0	21.9	8.8	12.0
	Domestic (including paint use-DIY)	49.7	45.3	5.0	6.6
	Agriculture	0.0	0.0	0.0	0.0
	Total	205.0	141.8	128.2	177.5
Belarus	Energy industry	4.0	4.0	0.0	0.0
	Fuel processing and distribution	95.3	87.0	0.0	0.0
	Chemical industry	4.5	4.5	0.0	0.0
	Solvent use in industry	36.7	36.2	0.0	0.0
	Paint use (excluding DIY)	16.2	14.4	0.0	0.0
	Other industry, waste	11.0	11.0	0.0	0.0
	Transport	100.5	100.6	0.0	0.0
	Domestic (including paint use-DIY)	20.9	20.0	0.0	0.0
	Agriculture	20.0	20.0	0.0	0.0
	Total	309.0	297.7	0.0	0.0
Belgium	Energy industry	7.1	7.1	0.0	0.0
	Fuel processing and distribution	24.3	8.0	19.1	38.4
	Chemical industry	29.4	6.9	3.4	83.5
	Solvent use in industry	19.5	5.6	6.3	46.4
	Paint use (excluding DIY)	33.8	12.5	20.7	74.8
	Other industry, waste	5.4	3.9	0.1	15.9
	Transport	44.5	34.0	11.9	20.0
	Domestic (including paint use-DIY)	29.1	24.6	1.6	19.8
	Agriculture	0.2	0.2	0.1	0.1
	Total	193.3	102.8	63.2	298.9

Table 1.59: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Bosnia - Hercegovina	Energy industry	1.8	1.8	0.0	0.0
	Fuel processing and distribution	6.4	6.4	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	3.7	3.7	0.0	0.0
	Paint use (excluding DIY)	8.6	8.6	0.0	0.0
	Other industry, waste	3.2	3.2	0.0	0.0
	Transport	19.5	19.5	0.0	0.0
	Domestic (including paint use-DIY)	3.7	3.7	0.0	0.0
	Agriculture	1.0	1.0	0.0	0.0
	Total	47.9	47.9	0.0	0.0
Bulgaria	Energy industry	2.8	2.8	0.0	0.0
	Fuel processing and distribution	29.2	29.2	0.0	0.0
	Chemical industry	15.6	15.6	0.0	0.0
	Solvent use in industry	20.1	20.1	0.0	0.0
	Paint use (excluding DIY)	5.7	5.7	0.0	0.0
	Other industry, waste	8.4	7.6	0.1	0.2
	Transport	74.1	74.1	0.0	0.0
	Domestic (including paint use-DIY)	25.5	25.5	0.0	0.0
	Agriculture	8.1	4.0	0.0	0.2
	Total	189.5	184.7	0.2	0.4
Croatia	Energy industry	2.3	2.3	0.0	0.0
	Fuel processing and distribution	16.7	13.0	0.0	0.4
	Chemical industry	1.3	1.3	0.0	0.0
	Solvent use in industry	13.0	11.0	0.0	0.1
	Paint use (excluding DIY)	11.7	7.7	0.0	0.0
	Other industry, waste	3.2	2.5	0.0	0.0
	Transport	47.2	37.9	0.0	2.2
	Domestic (including paint use-DIY)	15.1	10.0	0.0	0.6
	Agriculture	0.0	0.0	0.0	0.0
	Total	110.6	85.7	0.0	3.3
Czech Republic	Energy industry	4.8	4.8	0.0	0.0
	Fuel processing and distribution	27.0	2.3	0.0	14.4
	Chemical industry	41.2	14.0	0.0	15.6
	Solvent use in industry	71.9	30.2	0.6	71.4
	Paint use (excluding DIY)	49.0	21.0	0.0	25.9
	Other industry, waste	33.5	33.5	0.6	0.6
	Transport	50.5	29.6	3.3	14.8
	Domestic (including paint use-DIY)	26.5	20.4	0.3	2.5
	Agriculture	0.0	0.0	0.0	0.0
	Total	304.5	155.9	4.7	145.3



Table 1.60: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Denmark	Energy industry	2.1	2.1	0.0	0.0
	Fuel processing and distribution	6.3	6.3	10.5	10.5
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	8.1	8.1	1.4	1.4
	Paint use (excluding DIY)	17.3	17.3	26.5	26.5
	Other industry, waste	1.2	1.2	0.0	0.0
	Transport	34.0	34.0	5.1	5.1
	Domestic (including paint use-DIY)	16.1	16.1	0.7	0.7
	Agriculture	0.0	0.0	0.0	0.0
	Total	85.0	85.0	44.1	44.1
Estonia	Energy industry	0.6	0.6	0.0	0.0
	Fuel processing and distribution	1.7	1.7	0.0	0.0
	Chemical industry	8.6	8.6	0.0	0.0
	Solvent use in industry	0.8	0.8	0.0	0.0
	Paint use (excluding DIY)	3.6	3.6	0.0	0.0
	Other industry, waste	1.5	1.5	0.0	0.0
	Transport	25.3	25.3	0.0	0.0
	Domestic (including paint use-DIY)	7.0	7.0	0.0	0.0
	Agriculture	0.0	0.0	0.0	0.0
	Total	49.1	49.1	0.0	0.0
Finland	Energy industry	3.5	3.5	0.0	0.0
	Fuel processing and distribution	16.9	16.9	4.2	4.2
	Chemical industry	11.1	11.1	0.0	0.0
	Solvent use in industry	12.2	12.2	6.2	6.2
	Paint use (excluding DIY)	20.7	20.7	27.0	27.0
	Other industry, waste	5.8	5.8	0.0	0.0
	Transport	26.6	26.6	9.3	9.3
	Domestic (including paint use-DIY)	12.7	12.7	0.9	0.9
	Agriculture	0.0	0.0	0.0	0.0
	Total	109.5	109.5	47.6	47.6
France	Energy industry	9.4	9.4	0.0	0.0
	Fuel processing and distribution	149.8	97.4	39.0	99.4
	Chemical industry	41.7	27.8	2.1	10.6
	Solvent use in industry	206.3	178.2	39.2	65.7
	Paint use (excluding DIY)	192.4	141.8	152.7	185.3
	Other industry, waste	57.7	57.7	0.7	0.7
	Transport	340.5	274.6	86.7	141.6
	Domestic (including paint use-DIY)	224.2	200.8	14.7	26.6
	Agriculture	0.8	0.8	0.4	0.4
	Total	1222.8	988.6	335.6	530.4

Table 1.61: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Germany	Energy industry	32.2	32.2	0.0	0.0
	Fuel processing and distribution	45.0	36.6	174.0	182.0
	Chemical industry	28.8	22.0	73.0	81.5
	Solvent use in industry	339.4	260.4	691.7	854.1
	Paint use (excluding DIY)	199.6	182.9	384.2	406.8
	Other industry, waste	48.4	48.4	0.5	0.5
	Transport	233.1	218.2	179.8	186.7
	Domestic (including paint use-DIY)	210.4	194.4	11.1	78.3
	Agriculture	0.0	0.0	0.0	0.0
	Total	1137.0	995.2	1514.4	1790.0
Greece	Energy industry	1.9	1.9	0.0	0.0
	Fuel processing and distribution	40.2	34.1	6.8	8.5
	Chemical industry	0.3	0.3	0.0	0.0
	Solvent use in industry	38.8	38.8	10.7	10.7
	Paint use (excluding DIY)	4.7	4.7	7.2	7.2
	Other industry, waste	4.4	4.4	0.0	0.0
	Transport	144.1	144.1	41.2	41.2
	Domestic (including paint use-DIY)	31.0	31.0	0.9	0.9
	Agriculture	1.9	1.9	1.0	1.0
	Total	267.3	261.2	67.8	69.4
Hungary	Energy industry	2.1	2.1	0.0	0.0
	Fuel processing and distribution	40.6	22.7	0.7	5.5
	Chemical industry	1.6	1.2	0.0	0.1
	Solvent use in industry	9.9	9.9	0.1	0.1
	Paint use (excluding DIY)	6.7	6.7	0.0	0.0
	Other industry, waste	3.0	3.0	0.0	0.0
	Transport	60.1	57.8	5.8	5.8
	Domestic (including paint use-DIY)	35.5	33.4	0.4	1.3
	Agriculture	0.0	0.0	0.0	0.0
	Total	159.6	136.8	7.1	12.9
Ireland	Energy industry	1.2	1.2	0.0	0.0
	Fuel processing and distribution	8.3	8.3	1.1	1.1
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	11.8	11.8	2.4	2.4
	Paint use (excluding DIY)	3.1	3.1	5.6	5.6
	Other industry, waste	2.0	2.0	0.0	0.0
	Transport	20.6	20.6	0.5	0.5
	Domestic (including paint use-DIY)	7.2	7.2	0.7	0.7
	Agriculture	0.4	0.4	0.2	0.2
	Total	54.7	54.7	10.5	10.5

Table 1.62: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Italy	Energy industry	16.4	16.4	0.0	0.0
	Fuel processing and distribution	130.1	114.8	123.8	132.5
	Chemical industry	39.5	23.5	4.7	15.2
	Solvent use in industry	167.9	145.5	69.1	81.8
	Paint use (excluding DIY)	147.1	140.3	201.4	205.0
	Other industry, waste	29.5	29.5	0.5	0.5
	Transport	410.5	348.5	150.4	201.7
	Domestic (including paint use-DIY)	217.1	210.5	5.0	8.1
	Agriculture	1.0	1.0	0.6	0.6
	Total	1159.2	1030.0	555.4	645.3
Latvia	Energy industry	0.9	0.9	0.0	0.0
	Fuel processing and distribution	2.0	2.0	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	1.3	1.3	0.0	0.0
	Paint use (excluding DIY)	4.9	4.9	0.0	0.0
	Other industry, waste	0.6	0.6	0.0	0.0
	Transport	38.7	38.7	0.0	0.0
	Domestic (including paint use-DIY)	7.5	7.5	0.0	0.0
	Agriculture	0.0	0.0	0.0	0.0
Total	55.9	55.9	0.0	0.0	
Lithuania	Energy industry	15.6	15.6	0.0	0.0
	Fuel processing and distribution	18.0	18.0	0.0	0.0
	Chemical industry	0.4	0.4	0.0	0.0
	Solvent use in industry	8.4	8.4	0.0	0.0
	Paint use (excluding DIY)	2.7	2.7	0.0	0.0
	Other industry, waste	1.3	1.3	0.0	0.0
	Transport	47.3	47.3	0.0	0.0
	Domestic (including paint use-DIY)	11.5	11.5	0.3	0.3
	Agriculture	0.0	0.0	0.0	0.0
Total	105.3	105.3	0.3	0.3	
Luxembourg	Energy industry	0.6	0.6	0.0	0.0
	Fuel processing and distribution	0.8	0.6	1.0	1.1
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	1.5	1.4	0.4	0.5
	Paint use (excluding DIY)	0.5	0.4	0.5	0.6
	Other industry, waste	0.7	0.7	0.0	0.0
	Transport	1.9	1.8	0.1	0.1
	Domestic (including paint use-DIY)	1.1	1.0	0.0	0.0
	Agriculture	0.0	0.0	0.0	0.0
Total	7.1	6.6	2.1	2.4	

Table 1.63: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Netherlands	Energy industry	6.6	6.6	0.0	0.0
	Fuel processing and distribution	42.5	30.7	47.5	59.0
	Chemical industry	26.4	5.9	5.3	26.3
	Solvent use in industry	21.0	11.2	23.8	46.8
	Paint use (excluding DIY)	44.8	22.6	51.6	74.8
	Other industry, waste	23.0	23.0	0.7	0.7
	Transport	49.3	38.4	15.8	24.5
	Domestic (including paint use-DIY)	19.5	18.2	2.4	3.7
	Agriculture	0.0	0.0	0.0	0.0
	Total	233.0	156.6	147.1	235.9
Norway	Energy industry	4.2	4.2	0.0	0.0
	Fuel processing and distribution	80.3	80.3	19.3	19.3
	Chemical industry	0.7	0.7	0.1	0.1
	Solvent use in industry	4.0	4.0	0.1	0.1
	Paint use (excluding DIY)	37.6	37.6	0.4	0.4
	Other industry, waste	2.0	2.0	0.0	0.0
	Transport	34.1	34.1	2.4	2.4
	Domestic (including paint use-DIY)	31.7	31.7	2.3	2.3
	Agriculture	0.0	0.0	0.0	0.0
	Total	194.6	194.6	24.6	24.6
Poland	Energy industry	47.9	47.9	0.0	0.0
	Fuel processing and distribution	102.0	33.3	0.0	32.6
	Chemical industry	29.4	17.2	0.0	6.4
	Solvent use in industry	43.7	24.0	0.0	26.8
	Paint use (excluding DIY)	71.9	35.5	0.0	23.0
	Other industry, waste	70.1	53.3	0.5	1.1
	Transport	222.0	128.6	21.8	49.0
	Domestic (including paint use-DIY)	202.2	117.8	0.0	25.3
	Agriculture	1.0	0.7	0.0	0.0
	Total	790.2	458.3	22.3	164.1
Portugal	Energy industry	4.2	4.2	0.0	0.0
	Fuel processing and distribution	19.1	6.6	6.2	22.4
	Chemical industry	4.7	2.7	0.7	2.3
	Solvent use in industry	34.5	13.6	2.4	22.2
	Paint use (excluding DIY)	7.8	4.6	6.2	10.0
	Other industry, waste	8.5	8.5	0.1	0.1
	Transport	41.5	39.2	6.4	8.5
	Domestic (including paint use-DIY)	24.0	23.0	3.5	6.2
	Agriculture	0.0	0.0	0.0	0.0
	Total	144.2	102.4	25.4	71.6

Table 1.64: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Rep. of Moldova	Energy industry	0.9	0.9	0.0	0.0
	Fuel processing and distribution	1.4	1.4	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	0.9	0.9	0.0	0.0
	Paint use (excluding DIY)	4.6	4.5	0.0	0.0
	Other industry, waste	2.3	2.3	0.0	0.0
	Transport	22.3	22.3	0.0	0.0
	Domestic (including paint use-DIY)	9.2	9.2	0.0	0.0
	Agriculture	1.0	1.0	0.0	0.0
	Total	42.4	42.4	0.0	0.0
Romania	Energy industry	16.3	16.3	0.0	0.0
	Fuel processing and distribution	81.5	81.5	0.0	0.0
	Chemical industry	32.5	32.5	0.0	0.0
	Solvent use in industry	117.9	117.9	0.0	0.0
	Paint use (excluding DIY)	37.8	37.8	0.0	0.0
	Other industry, waste	19.7	19.7	0.2	0.2
	Transport	101.9	97.4	0.0	0.0
	Domestic (including paint use-DIY)	44.1	44.1	0.0	0.0
	Agriculture	52.5	52.5	1.3	1.3
	Total	504.2	499.7	1.6	1.6
Russia	Energy industry	40.7	40.7	0.0	0.0
	Fuel processing and distribution	492.4	445.3	0.0	0.0
	Chemical industry	86.8	86.8	0.0	0.0
	Solvent use in industry	392.2	391.3	0.0	0.0
	Paint use (excluding DIY)	230.3	223.6	0.0	0.0
	Other industry, waste	117.3	117.3	0.0	0.0
	Transport	981.0	981.3	0.0	0.0
	Domestic (including paint use-DIY)	937.8	386.8	0.0	0.0
	Agriculture	50.0	50.0	0.0	0.0
	Total	3328.5	2723.1	0.0	0.0
Slovak Republic	Energy industry	9.3	9.3	0.0	0.0
	Fuel processing and distribution	17.7	17.7	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	6.1	6.1	0.1	0.1
	Paint use (excluding DIY)	55.6	55.6	0.0	0.0
	Other industry, waste	9.5	9.5	0.0	0.0
	Transport	24.8	24.5	2.0	2.0
	Domestic (including paint use-DIY)	16.7	16.7	0.1	0.1
	Agriculture	0.9	0.9	0.2	0.2
	Total	140.5	140.2	2.3	2.3

Table 1.65: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Slovenia	Energy industry	0.5	0.5	0.0	0.0
	Fuel processing and distribution	5.8	5.8	1.1	1.1
	Chemical industry	0.5	0.5	0.0	0.0
	Solvent use in industry	2.6	2.6	0.0	0.0
	Paint use (excluding DIY)	10.2	10.2	2.6	2.6
	Other industry, waste	0.6	0.6	0.0	0.0
	Transport	16.6	16.6	1.7	1.7
	Domestic (including paint use-DIY)	3.5	3.5	0.0	0.0
	Agriculture	0.0	0.0	0.0	0.0
	Total	40.5	40.5	5.5	5.5
Spain	Energy industry	20.8	20.8	0.0	0.0
	Fuel processing and distribution	84.8	84.8	42.7	42.7
	Chemical industry	14.9	8.7	2.2	6.4
	Solvent use in industry	110.4	98.3	19.2	25.9
	Paint use (excluding DIY)	72.2	72.2	76.6	76.6
	Other industry, waste	47.8	47.8	0.3	0.3
	Transport	205.7	203.4	66.3	68.3
	Domestic (including paint use-DIY)	109.7	109.7	5.7	5.7
	Agriculture	2.2	2.2	1.2	1.2
	Total	668.5	647.9	214.2	227.1
Sweden	Energy industry	6.1	6.1	0.0	0.0
	Fuel processing and distribution	35.5	11.7	24.9	31.7
	Chemical industry	7.1	1.2	0.0	3.1
	Solvent use in industry	33.4	31.6	14.1	15.1
	Paint use (excluding DIY)	28.8	26.4	39.1	41.2
	Other industry, waste	15.3	15.3	0.4	0.4
	Transport	64.8	55.0	22.5	30.5
	Domestic (including paint use-DIY)	98.8	93.3	7.3	11.1
	Agriculture	0.0	0.0	0.0	0.0
	Total	290.0	240.7	108.3	133.0
Switzerland	Energy industry	0.9	0.9	0.0	0.0
	Fuel processing and distribution	9.2	9.2	16.0	16.0
	Chemical industry	1.6	1.6	0.1	0.1
	Solvent use in industry	48.8	48.5	36.1	36.3
	Paint use (excluding DIY)	32.6	32.6	8.0	8.0
	Other industry, waste	11.1	11.1	0.3	0.3
	Transport	25.5	25.5	12.7	12.7
	Domestic (including paint use-DIY)	14.1	14.1	1.7	1.7
	Agriculture	0.2	0.2	0.0	0.0
	Total	144.0	143.7	75.0	75.1

Table 1.66: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
F.Y.R. of Macedonia	Energy industry	0.7	0.7	0.0	0.0
	Fuel processing and distribution	2.5	2.5	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	0.2	0.2	0.0	0.0
	Paint use (excluding DIY)	3.2	3.2	0.0	0.0
	Other industry, waste	1.1	1.1	0.0	0.0
	Transport	9.3	9.3	0.0	0.0
	Domestic (including paint use-DIY)	2.0	2.0	0.0	0.0
	Agriculture	0.0	0.0	0.0	0.0
	Total	19.0	19.0	0.0	0.0
Ukraine	Energy industry	32.5	32.5	0.0	0.0
	Fuel processing and distribution	136.4	119.0	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	74.0	65.9	0.0	0.1
	Paint use (excluding DIY)	61.0	42.5	0.0	0.0
	Other industry, waste	23.0	18.9	0.0	0.1
	Transport	316.3	316.3	0.0	0.0
	Domestic (including paint use-DIY)	157.5	153.6	0.0	0.0
	Agriculture	50.0	21.3	0.0	1.7
	Total	850.7	770.0	0.0	2.0
United Kingdom	Energy industry	11.1	11.1	0.0	0.0
	Fuel processing and distribution	185.0	141.8	67.8	142.3
	Chemical industry	96.8	49.3	99.1	131.8
	Solvent use in industry	383.1	297.1	189.7	344.1
	Paint use (excluding DIY)	110.8	83.6	185.5	223.7
	Other industry, waste	165.9	165.9	0.8	0.8
	Transport	199.2	162.4	92.3	120.5
	Domestic (including paint use-DIY)	195.8	186.8	3.2	18.2
	Agriculture	3.5	3.5	1.9	1.9
	Total	1351.1	1101.4	640.4	983.4
Yugoslavia	Energy industry	3.1	3.1	0.0	0.0
	Fuel processing and distribution	21.0	19.5	0.0	0.0
	Chemical industry	0.0	0.0	0.0	0.0
	Solvent use in industry	6.5	6.5	0.0	0.0
	Paint use (excluding DIY)	24.1	24.0	0.0	0.0
	Other industry, waste	4.5	4.5	0.0	0.0
	Transport	67.6	67.6	0.0	0.0
	Domestic (including paint use-DIY)	11.3	11.3	0.0	0.0
	Agriculture	1.0	1.0	0.0	0.0
	Total	139.2	137.5	0.0	0.0

Table 1.67: VOC emissions and costs for the REF and J1 scenarios (continued)

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
EUROPE	Energy industry	316	316	0	0
	Fuel processing and distribution	2002	1603	616	886
	Chemical industry	534	346	191	387
	Solvent use in industry	2332	1962	1206	1777
	Paint use (excluding DIY)	1583	1331	1207	1441
	Other industry, waste	750	726	6	23
	Transport	4140	3790	747	961
	Domestic (including paint use-DIY)	2841	2116	68	221
	Agriculture	196	163	7	9
	Total	14694	12353	4048	5705



### 1.3.3.4 NH<sub>3</sub>

Table 1.68: NH<sub>3</sub> emissions and costs by sectors in the REF and J1 scenario

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Albania	Livestock	27.9	27.9	0.0	0.0
	Fertilizer use	6.8	3.6	0.0	1.3
	Industry	0.2	0.2	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	34.9	31.7	0.0	1.3
Austria	Livestock	58.3	57.8	0.0	0.6
	Fertilizer use	2.5	2.2	0.0	0.3
	Industry	1.5	1.5	0.0	0.0
	Other	4.6	4.6	0.0	0.0
	Total	66.9	66.1	0.0	0.9
Belarus	Livestock	116.1	114.9	0.0	0.8
	Fertilizer use	44.6	23.3	0.0	8.6
	Industry	2.2	2.2	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	163.0	140.4	0.0	9.4
Belgium	Livestock	88.2	54.0	0.0	311.1
	Fertilizer use	3.7	3.4	0.0	0.3
	Industry	3.7	2.8	0.0	6.3
	Other	0.1	0.1	0.0	0.0
	Total	95.8	60.4	0.0	317.6
Bosnia - Hercegovina	Livestock	22.3	21.6	0.0	0.9
	Fertilizer use	0.7	0.3	0.0	0.2
	Industry	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	23.0	21.9	0.0	1.1
Bulgaria	Livestock	61.5	57.7	0.0	6.7
	Fertilizer use	33.8	17.1	0.0	6.7
	Industry	3.6	3.6	0.0	0.0
	Other	26.7	26.7	0.0	0.0
	Total	125.6	105.1	0.0	13.4
Croatia	Livestock	23.7	23.4	0.0	0.2
	Fertilizer use	12.2	4.6	0.0	3.1
	Industry	1.2	1.2	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	37.1	29.2	0.0	3.3
Czech Republic	Livestock	90.3	85.2	0.0	7.7
	Fertilizer use	15.3	13.9	0.0	1.3
	Industry	1.8	1.8	0.0	0.0
	Other	0.6	0.6	0.0	0.0
	Total	108.0	101.5	0.0	8.9
Denmark	Livestock	61.9	61.1	0.0	0.6
	Fertilizer use	9.1	7.5	0.0	1.0
	Industry	0.4	0.4	0.0	0.0
	Other	0.2	0.2	0.0	0.0
	Total	71.7	69.2	0.0	1.6

Table 1.69: NH<sub>3</sub> emissions and costs by sectors in the REF and J1 scenario, continued

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Estonia	Livestock	18.0	18.0	0.0	0.0
	Fertilizer use	9.9	9.9	0.0	0.0
	Industry	0.5	0.5	0.0	0.0
	Other	0.3	0.3	0.0	0.0
	Total	28.7	28.7	0.0	0.0
Finland	Livestock	27.8	27.8	0.0	0.0
	Fertilizer use	2.5	2.5	0.0	0.0
	Industry	0.6	0.6	0.0	0.0
	Other	0.2	0.2	0.0	0.0
	Total	31.1	31.1	0.0	0.0
France	Livestock	606.0	522.0	0.0	255.3
	Fertilizer use	144.0	104.5	0.0	28.3
	Industry	23.3	11.9	0.0	80.2
	Other	4.1	4.1	0.0	0.0
	Total	777.4	642.5	0.0	363.8
Germany	Livestock	485.4	370.6	0.0	823.2
	Fertilizer use	75.0	31.5	0.0	30.9
	Industry	1.9	1.5	0.0	3.0
	Other	9.2	9.2	0.0	0.0
	Total	571.5	412.8	0.0	857.2
Greece	Livestock	59.0	58.9	0.0	0.0
	Fertilizer use	14.2	13.2	0.0	0.1
	Industry	0.5	0.5	0.0	0.0
	Other	0.2	0.2	0.0	0.0
	Total	74.0	72.8	0.0	0.1
Hungary	Livestock	87.4	57.3	0.0	315.4
	Fertilizer use	47.2	18.3	0.0	3.4
	Industry	2.1	1.0	0.0	7.2
	Other	0.1	0.1	0.0	0.0
	Total	136.8	76.8	0.0	326.0
Ireland	Livestock	115.0	105.1	1.6	144.8
	Fertilizer use	3.7	3.7	7.6	7.6
	Industry	1.0	0.5	0.0	3.7
	Other	6.3	6.3	0.0	0.0
	Total	126.0	115.6	9.2	156.1
Italy	Livestock	312.1	293.7	0.0	17.8
	Fertilizer use	89.7	31.9	0.0	68.4
	Industry	14.7	14.7	0.0	0.0
	Other	15.4	15.4	0.0	0.0
	Total	431.8	355.6	0.0	86.3
Latvia	Livestock	22.3	22.3	0.0	0.0
	Fertilizer use	12.5	12.5	0.0	0.0
	Industry	0.2	0.2	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	34.9	34.9	0.0	0.0

Table 1.70: NH<sub>3</sub> emissions and costs by sectors in the REF and J1 scenario, continued

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Lithuania	Livestock	57.5	57.4	0.0	0.0
	Fertilizer use	21.2	11.4	0.0	3.9
	Industry	2.6	2.6	0.0	0.0
	Other	0.1	0.1	0.0	0.0
	Total	81.3	71.5	0.0	4.0
Luxembourg	Livestock	4.5	4.5	14.5	14.5
	Fertilizer use	0.4	0.4	0.1	0.1
	Industry	0.0	0.0	0.0	0.0
	Other	1.8	1.8	0.0	0.0
	Total	6.7	6.7	14.6	14.6
Netherlands	Livestock	121.8	90.3	179.1	858.3
	Fertilizer use	8.2	8.2	0.1	0.1
	Industry	2.9	2.9	19.8	19.8
	Other	3.1	3.1	0.0	0.0
	Total	136.0	104.5	199.0	878.2
Norway	Livestock	13.9	13.7	0.0	1.3
	Fertilizer use	4.1	4.1	0.0	0.0
	Industry	0.9	0.7	0.0	1.5
	Other	2.4	2.4	0.0	0.0
	Total	21.4	20.9	0.0	2.8
Poland	Livestock	428.2	380.9	0.0	175.4
	Fertilizer use	64.2	38.0	0.0	5.4
	Industry	40.2	40.2	0.0	0.0
	Other	8.6	8.6	0.0	0.0
	Total	541.2	467.7	0.0	180.9
Portugal	Livestock	56.7	56.5	0.0	0.0
	Fertilizer use	8.5	7.2	0.0	1.7
	Industry	1.4	1.4	0.0	0.0
	Other	0.1	0.1	0.0	0.0
	Total	66.7	65.3	0.0	1.7
Rep. of Moldova	Livestock	32.6	32.5	0.0	0.0
	Fertilizer use	15.1	8.6	0.0	2.6
	Industry	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	47.7	41.2	0.0	2.6
Romania	Livestock	248.7	202.0	0.0	283.8
	Fertilizer use	48.3	21.8	0.0	4.4
	Industry	6.3	3.2	0.0	22.1
	Other	0.2	0.2	0.0	0.0
	Total	303.5	227.2	0.0	310.3
Russia	Livestock	751.0	751.0	0.0	0.0
	Fertilizer use	131.0	130.7	0.0	0.1
	Industry	11.9	11.9	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	893.9	893.6	0.0	0.1

Table 1.71: NH<sub>3</sub> emissions and costs by sectors in the REF and J1 scenario, continued

Country	Sector	Emissions [kt]		Costs [million EURO]	
		REF	J1	REF	J1
Slovak Republic	Livestock	24.7	23.4	0.0	4.7
	Fertilizer use	17.2	10.7	0.0	2.6
	Industry	2.9	2.9	0.0	0.0
	Other	2.1	2.1	0.0	0.0
	Total	46.9	39.1	0.0	7.3
Slovenia	Livestock	13.5	13.2	0.0	0.1
	Fertilizer use	7.0	2.9	0.0	1.7
	Industry	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	20.5	16.2	0.0	1.8
Spain	Livestock	297.0	297.0	0.0	0.0
	Fertilizer use	43.2	43.2	27.9	27.9
	Industry	12.4	12.4	0.0	0.0
	Other	0.5	0.5	0.0	0.0
	Total	353.0	353.0	27.9	27.9
Sweden	Livestock	41.3	41.3	110.0	110.0
	Fertilizer use	2.8	2.8	0.3	0.3
	Industry	0.3	0.3	1.9	1.9
	Other	3.7	3.7	0.0	0.0
	Total	48.0	48.0	112.1	112.1
Switzerland	Livestock	51.6	49.6	0.0	3.8
	Fertilizer use	2.0	0.8	0.0	2.1
	Industry	2.3	2.3	0.0	0.0
	Other	10.2	10.2	0.0	0.0
	Total	66.1	62.9	0.0	5.9
F.Y.R. of Macedonia	Livestock	15.4	14.7	0.0	0.5
	Fertilizer use	0.2	0.1	0.0	0.1
	Industry	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	15.7	14.8	0.0	0.6
Ukraine	Livestock	534.4	523.5	0.0	9.6
	Fertilizer use	105.6	55.1	0.0	20.4
	Industry	9.0	9.0	0.0	0.0
	Other	0.0	0.0	0.0	0.0
	Total	649.0	587.6	0.0	30.0
United Kingdom	Livestock	219.7	206.7	0.0	13.2
	Fertilizer use	41.1	20.9	0.0	10.3
	Industry	1.6	1.6	0.0	0.0
	Other	35.1	35.1	0.0	0.0
	Total	297.5	264.3	0.0	23.5
Yugoslavia	Livestock	72.7	60.8	0.0	92.0
	Fertilizer use	9.4	3.5	0.0	2.4
	Industry	0.3	0.1	0.0	1.0
	Other	0.0	0.0	0.0	0.0
	Total	82.4	64.5	0.0	95.3
EUROPE	Livestock	5268	4798	305	3452
	Fertilizer use	1057	674	36	247
	Industry	154	137	22	147
	Other	136	136	0	0
	Total	6616	5745	363	3847

## 1.4 Scenario J1 With The S1 Energy Scenario For France (Scenario J1/S1)

### 1.4.1 Emissions Per Country

Table 1.72: NO<sub>x</sub> and VOC emissions for the scenario J1/S1 compared to the J1 case. Percentage changes relate to the year 1990.

	NO <sub>x</sub>				VOC			
	J1/S1		J1		J1/S1		J1	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	91	-53%	91	-53%	152	-57%	142	-60%
Belgium	127	-64%	127	-64%	103	-72%	103	-72%
Denmark	113	-59%	113	-59%	85	-53%	85	-53%
Finland	152	-45%	152	-45%	110	-48%	110	-48%
France	783	-58%	704	-62%	909	-62%	989	-58%
Germany	1080	-59%	1081	-59%	960	-69%	995	-68%
Greece	344	0%	344	0%	261	-22%	261	-22%
Ireland	55	-51%	55	-51%	55	-50%	55	-50%
Italy	901	-56%	901	-56%	1008	-51%	1030	-50%
Luxembourg	7	-68%	8	-64%	6	-68%	7	-63%
Netherlands	266	-51%	266	-51%	156	-68%	157	-68%
Portugal	144	-31%	144	-31%	102	-52%	102	-52%
Spain	726	-38%	726	-38%	654	-35%	648	-36%
Sweden	166	-51%	159	-53%	263	-49%	241	-53%
UK	1175	-59%	1181	-58%	1091	-59%	1101	-59%
EU-15	6131	-54%	6054	-54%	5914	-58%	6024	-57%
Albania	36	50%	36	50%	41	32%	41	32%
Belarus	290	-28%	290	-28%	298	-20%	298	-20%
Bosnia-H	53	-34%	53	-34%	48	-6%	48	-6%
Bulgaria	266	-25%	266	-25%	186	-5%	185	-5%
Croatia	87	6%	87	6%	86	-17%	86	-17%
Czech Rep.	172	-68%	188	-66%	155	-65%	156	-65%
Estonia	73	-13%	73	-13%	49	9%	49	9%
Hungary	137	-37%	137	-37%	137	-33%	137	-33%
Latvia	118	1%	118	1%	56	-11%	56	-11%
Lithuania	134	-12%	134	-12%	105	-5%	105	-5%
Norway	142	-35%	142	-35%	195	-34%	195	-34%
Poland	654	-46%	654	-46%	475	-40%	475	-40%
R.of Moldova	64	-26%	64	-26%	42	-16%	42	-16%
Romania	329	-36%	328	-37%	500	-1%	500	-1%
Russia	2653	-24%	2653	-24%	2723	-23%	2723	-23%
Slovakia	115	-47%	115	-47%	140	-7%	140	-7%
Slovenia	34	-43%	34	-43%	40	-27%	40	-27%
Switzerland	76	-53%	76	-53%	143	-49%	144	-48%
FYR of Maced.	29	-26%	29	-26%	19	0%	19	0%
Ukraine	1222	-35%	1222	-35%	775	-33%	770	-34%
Yugoslavia	132	-37%	132	-37%	138	-3%	138	-3%
Non-EU	6815	-33%	6830	-33%	6351	-26%	6345	-26%
Total	14575	-42%	14513	-42%	12265	-46%	12370	-45%

Table 1.73: SO<sub>2</sub> and NH<sub>3</sub> emissions. Percentage changes relate to the year 1990.

	SO <sub>2</sub>				NH <sub>3</sub>			
	J1/S1		J1		J1/S1		J1	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	35	-62%	35	-62%	66	-14%	66	-14%
Belgium	76	-77%	76	-77%	57	-41%	60	-38%
Denmark	42	-77%	60	-67%	69	-10%	69	-10%
Finland	116	-49%	116	-49%	31	-23%	31	-23%
France	373	-70%	219	-82%	634	-21%	642	-20%
Germany	457	-91%	463	-91%	403	-47%	413	-45%
Greece	546	8%	546	8%	73	-9%	73	-9%
Ireland	36	-80%	36	-80%	116	-9%	116	-9%
Italy	261	-84%	290	-83%	356	-23%	356	-23%
Luxembourg	3	-79%	3	-79%	7	0%	7	0%
Netherlands	50	-75%	50	-75%	104	-55%	105	-55%
Portugal	141	-50%	141	-50%	65	-8%	65	-8%
Spain	746	-66%	747	-66%	353	0%	353	0%
Sweden	67	-44%	67	-44%	48	-21%	48	-21%
UK	494	-87%	499	-87%	264	-20%	264	-20%
EU-15	3443	-79%	3349	-80%	2645	-26%	2668	-25%
Albania	55	-24%	55	-24%	32	0%	32	0%
Belarus	494	-41%	494	-41%	140	-36%	140	-36%
Bosnia-H	159	-67%	162	-67%	22	-29%	22	-29%
Bulgaria	378	-79%	378	-79%	105	-26%	105	-26%
Croatia	23	-87%	23	-87%	29	-28%	29	-28%
Czech Rep.	282	-85%	283	-85%	101	-6%	101	-6%
Estonia	175	-36%	175	-36%	29	0%	29	0%
Hungary	296	-68%	296	-68%	77	-36%	77	-36%
Latvia	104	-14%	104	-14%	35	-19%	35	-19%
Lithuania	107	-50%	107	-50%	72	-10%	72	-10%
Norway	18	-65%	18	-65%	21	-9%	21	-9%
Poland	721	-76%	722	-76%	469	-7%	468	-7%
R.of Moldova	38	-81%	38	-81%	41	-13%	41	-13%
Romania	148	-89%	148	-89%	227	-22%	227	-22%
Russia	2186	-56%	2186	-56%	894	-30%	894	-30%
Slovakia	92	-83%	92	-83%	39	-35%	39	-35%
Slovenia	14	-93%	14	-93%	16	-30%	16	-30%
Switzerland	23	-47%	23	-47%	63	-13%	63	-13%
FYR of Maced.	81	-24%	81	-24%	15	-12%	15	-12%
Ukraine	1457	-61%	1457	-61%	588	-19%	588	-19%
Yugoslavia	213	-64%	217	-63%	64	-29%	64	-29%
Non-EU	7064	-67%	7071	-67%	3079	-23%	3077	-23%
Total	11659	-70%	11572	-70%	5724	-24%	5745	-24%

## 1.4.2 Emission Control Costs

Table 1.74: Control costs for NO<sub>x</sub>, VOC and SO<sub>2</sub> of central scenario J1/S1 compared to the J1 case (in million EURO/year).

	NO <sub>x</sub> and VOC		SO <sub>2</sub>	
	J1/S1	J1	J1/S1	J1
Austria	48	70	5	5
Belgium	453	452	128	122
Denmark	8	8	28	13
Finland	0	0	0	0
France	705	437	901	132
Germany	681	484	254	240
Greece	2	2	0	0
Ireland	10	10	12	12
Italy	267	245	107	87
Luxembourg	13	2	1	0
Netherlands	113	112	19	19
Portugal	57	57	0	0
Spain	39	42	9	9
Sweden	20	45	0	0
UK	394	353	306	295
EU-15	2809	2318	1771	935
Albania	0	0	0	0
Belarus	3	3	0	0
Bosnia-H	2	2	56	55
Bulgaria	10	10	58	58
Croatia	5	5	18	18
Czech Rep.	283	235	36	36
Estonia	0	0	0	0
Hungary	112	112	113	113
Latvia	0	0	0	0
Lithuania	0	0	0	0
Norway	12	12	10	10
Poland	373	373	284	283
R.of Moldova	0	0	30	30
Romania	98	100	137	137
Russia	0	0	54	54
Slovakia	11	11	25	25
Slovenia	1	1	23	23
Switzerland	2	2	1	1
FYR of Maced.	0	0	0	0
Ukraine	44	44	8	8
Yugoslavia	6	6	30	27
Non-EU	962	917	884	879
Total	3771	3235	2654	1814

Table 1.75: Control costs for NH<sub>3</sub> and total costs of the scenario J1/S1 compared to the J1 case (in million EURO/year).

	NH <sub>3</sub>		TOTAL	
	J1/S1	J1	J1/S1	J1
Austria	1	1	54	76
Belgium	467	312	1048	886
Denmark	2	2	38	22
Finland	0	0	0	0
France	431	367	2037	936
Germany	1049	842	1984	1567
Greece	0	0	2	2
Ireland	146	146	168	168
Italy	84	85	458	417
Luxembourg	0	0	14	2
Netherlands	741	672	873	803
Portugal	2	2	59	59
Spain	0	0	48	51
Sweden	0	0	20	45
UK	23	23	723	671
EU-15	2947	2450	7527	5704
Albania	1	1	1	1
Belarus	9	9	12	12
Bosnia-H	1	1	59	58
Bulgaria	13	13	81	81
Croatia	3	3	26	26
Czech Rep.	9	9	328	280
Estonia	0	0	0	0
Hungary	319	319	544	545
Latvia	0	0	0	0
Lithuania	4	4	4	4
Norway	3	3	25	25
Poland	173	182	830	838
R.of Moldova	3	3	33	33
Romania	304	304	539	541
Russia	0	0	54	54
Slovakia	7	7	43	43
Slovenia	2	2	26	25
Switzerland	6	6	9	9
FYR of Maced.	1	1	1	1
Ukraine	30	30	82	82
Yugoslavia	94	94	130	128
Non-EU	982	991	2828	2787
Total	3929	3442	10354	8490



Table 1.76: Ozone exposure indices for the J1/S1 and J1 scenarios

	Population exposure index				Vegetation exposure index			
	Cumulative index		Average index		Cumulative index		Average index	
	J1/S1	J1	J1/S1	J1	J1/S1	J1	J1/S1	J1
Austria	1	1	0.2	0.2	193	194	3.7	3.7
Belgium	22	22	2.1	2.1	115	115	7.4	7.4
Denmark	1	1	0.2	0.2	30	30	1.0	1.0
Finland	0	0	0.0	0.0	0	0	0.0	0.0
France	55	54	1.0	1.0	1926	1865	6.0	5.8
Germany	90	91	1.1	1.1	892	901	4.2	4.2
Greece	3	3	0.3	0.3	145	146	2.7	2.7
Ireland	0	0	0.1	0.1	3	3	0.1	0.1
Italy	39	40	0.7	0.7	988	993	6.3	6.3
Luxembourg	1	1	2.1	2.1	11	11	7.4	7.4
Netherlands	26	26	1.8	1.8	62	63	4.8	4.8
Portugal	6	6	0.6	0.6	230	229	4.0	4.0
Spain	3	3	0.1	0.1	1053	1046	3.4	3.4
Sweden	0	0	0.0	0.0	7	7	0.0	0.0
UK	49	49	0.8	0.9	109	111	1.3	1.4
EU-15	297	298	0.8	0.8	5764	5714	3.1	3.1
Albania	0	0	0.0	0.0	45	0	2.6	0.0
Belarus	0	0	0.0	0.0	44	44	0.5	0.5
Bosnia-H	0	0	0.0	0.0	125	126	3.3	3.3
Bulgaria	0	0	0.0	0.0	228	228	3.0	3.0
Croatia	1	1	0.3	0.3	172	173	4.8	4.9
Czech Rep.	5	5	0.5	0.5	214	218	3.9	3.9
Estonia	0	0	0.0	0.0	0	0	0.0	0.0
Hungary	6	6	0.6	0.6	288	290	4.4	4.5
Latvia	0	0	0.0	0.0	2	2	0.1	0.0
Lithuania	0	0	0.0	0.0	9	9	0.2	0.2
Norway	0	0	0.0	0.0	1	1	0.0	0.0
Poland	17	18	0.4	0.5	522	529	2.3	2.3
R.of Moldova	0	0	0.1	0.1	43	43	2.5	2.5
Romania	1	1	0.0	0.0	457	458	2.9	2.9
Russia	5	5	0.0	0.0	862	861	0.4	0.4
Slovakia	3	3	0.6	0.6	151	153	4.2	4.3
Slovenia	1	1	0.3	0.4	77	78	5.9	5.9
Switzerland	1	1	0.1	0.1	70	70	4.0	3.9
FYR of Maced.	0	0	0.0	0.0	33	33	2.1	2.1
Ukraine	5	6	0.1	0.1	969	971	2.5	2.5
Yugoslavia	1	1	0.1	0.1	193	195	2.9	2.9
Non-EU	46	48	0.1	0.2	4506	4481	1.3	1.3
Total	343	346	0.5	0.5	10270	10194	1.9	1.9

Table 1.77: Ecosystems with deposition above critical loads for the J1/S1 and J1 scenarios

	Acidification				Eutrophication			
	1000 hectares		Percent		1000 hectares		Percent	
	J1/S1	J1	J1/S1	J1	J1/S1	J1	J1/S1	J1
Austria	69	68	1.4	1.4	2468	2477	41.4	41.5
Belgium	53	52	7.5	7.4	561	572	79.9	81.4
Denmark	5	5	1.2	1.2	84	85	26.8	26.9
Finland	756	756	2.8	2.8	1750	1738	10.6	10.5
France	87	84	0.3	0.3	21807	21632	68.6	68.1
Germany	570	567	5.6	5.5	7215	7312	70.3	71.3
Greece	0	0	0	0.0	85	85	3.4	3.5
Ireland	8	8	0.9	0.9	29	29	3.2	3.2
Italy	51	51	0.5	0.5	2521	2508	21.0	20.9
Luxembourg	1	1	0.9	0.8	63	63	71.9	72.2
Netherlands	76	76	23.8	23.7	278	278	86.9	87.0
Portugal	1	1	0	0.0	634	580	22.4	20.5
Spain	17	17	0.2	0.2	877	850	10.3	10.0
Sweden	1150	1166	3	3.0	621	620	3.3	3.3
UK	638	636	6.7	6.6	62	62	0.7	0.7
EU-15	3481	3486	2.3	2.3	39058	38890	32.4	32.2
Albania	0	0	0	0.0	160	160	15.1	15.1
Belarus	686	686	13.6	13.6	925	924	18.4	18.4
Bosnia-H	0	0	0	0.0	460	460	31.8	31.7
Bulgaria	0	0	0	0.0	1263	1263	25.5	25.5
Croatia	0	0	0	0.0	10	10	3.6	3.6
Czech Rep.	80	81	3	3.0	1969	1983	74.1	74.6
Estonia	8	8	0.4	0.4	598	598	31.6	31.6
Hungary	37	37	13	13.0	126	125	44.1	44.1
Latvia	0	0	0	0.0	1418	1417	52.2	52.2
Lithuania	5	5	0.3	0.3	895	894	47.2	47.2
Norway	1928	1928	8.7	8.7	35	35	0.3	0.3
Poland	172	173	1	1.0	14897	14894	85.9	85.9
R.of Moldova	10	10	0.9	0.9	0	0	0.0	0.0
Romania	17	17	0.3	0.3	1770	1770	28.4	28.4
Russia	1027	1026	0.3	0.3	23131	23123	6.7	6.7
Slovakia	149	149	7.4	7.4	936	939	46.7	46.8
Slovenia	4	4	0.4	0.4	87	87	9.6	9.6
Switzerland	36	35	2.9	2.8	1477	1468	64.8	64.4
FYR of Maced.	0	0	0	0.0	108	108	10.1	10.1
Ukraine	237	237	2.9	2.9	3859	3859	46.8	46.8
Yugoslavia	0	0	0	0.0	1280	1280	37.5	37.5
Non-EU	4397	4397	1	1.0	55402	55396	13.1	13.1
Total	7878	7883	1.4	1.4	94461	94287	17.3	17.3

## 1.5 Scenario H6/2

### 1.5.1 Emissions

Table 1.78: Emissions for the acidification scenario H6/2 compared to the REF case. Percentage changes relate to the year 1990.

	SO <sub>2</sub>				NO <sub>x</sub>				VOC				NH <sub>3</sub>			
	REF		H6/2		REF		H6/2		REF		H6/2		REF		H6/2	
	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change	kt	Change
Austria	40	-57%	40	-57%	103	-46%	103	-46%	205	-42%	205	-42%	67	-13%	67	-13%
Belgium	193	-43%	76	-77%	191	-46%	144	-59%	193	-48%	192	-49%	96	-1%	57	-41%
Denmark	90	-51%	72	-60%	128	-53%	127	-54%	85	-53%	85	-53%	72	-6%	71	-8%
Finland	116	-49%	116	-49%	152	-45%	152	-45%	110	-48%	110	-48%	31	-23%	31	-23%
France	448	-64%	193	-85%	858	-54%	738	-60%	1223	-49%	1220	-49%	777	-4%	682	-15%
Germany	581	-89%	462	-91%	1184	-56%	1138	-57%	1137	-64%	1136	-64%	571	-25%	413	-45%
Greece	546	8%	546	8%	344	0%	344	0%	267	-21%	267	-21%	74	-8%	74	-8%
Ireland	66	-63%	28	-84%	70	-38%	58	-49%	55	-50%	55	-50%	126	-1%	124	-2%
Italy	567	-66%	566	-66%	1130	-45%	1130	-45%	1159	-44%	1159	-44%	432	-6%	430	-7%
Luxembourg	4	-71%	3	-79%	10	-55%	9	-59%	7	-63%	7	-63%	7	0%	7	0%
Netherlands	73	-64%	50	-75%	280	-48%	237	-56%	233	-52%	232	-53%	136	-42%	104	-55%
Portugal	141	-50%	141	-50%	177	-15%	177	-15%	144	-32%	144	-32%	67	-6%	67	-6%
Spain	774	-65%	746	-66%	847	-27%	803	-31%	669	-34%	669	-34%	353	0%	353	0%
Sweden	67	-44%	67	-44%	190	-44%	190	-44%	290	-43%	290	-43%	48	-21%	48	-21%
UK	980	-74%	496	-87%	1186	-58%	1094	-61%	1351	-49%	1351	-49%	297	-10%	264	-20%
EU-15	4687	-71%	3604	-78%	6849	-48%	6444	-51%	7128	-49%	7120	-49%	3154	-12%	2790	-22%

Table 1.79: Emission control costs for the central scenario H6/2 compared to the REF case. Control costs in million EURO/year.

	SO <sub>2</sub>			NO <sub>x</sub> /VOC			NH <sub>3</sub>			Total		
	REF	H6/2	Total	REF	H6/2	Total	REF	H6/2	Total	REF	H6/2	Total
Austria	191	0	191	902	0	902	0	0	0	1093	0	1093
Belgium	426	129	555	1278	66	1344	0	467	467	1704	662	2366
Denmark	138	8	146	484	0	484	0	0	0	623	8	631
Finland	247	0	247	642	0	642	0	0	0	889	0	889
France	1276	209	1485	7383	104	7487	0	135	135	8659	448	9107
Germany	3264	246	3510	10549	63	10612	0	860	860	13813	1170	14983
Greece	434	0	434	1048	0	1048	0	0	0	1482	0	1482
Ireland	132	20	152	477	5	482	9	14	23	618	40	658
Italy	1776	0	1776	7868	0	7868	0	0	0	9644	0	9644
Luxembourg	13	1	14	71	1	72	15	0	15	98	1	99
Netherlands	340	19	359	1731	123	1854	196	741	937	2267	883	3150
Portugal	181	0	181	1349	0	1349	0	0	0	1530	0	1530
Spain	809	9	818	5658	4	5662	28	0	28	6495	13	6508
Sweden	316	0	316	1125	0	1125	113	0	113	1554	0	1554
UK	1269	301	1570	6695	98	6793	0	23	23	7964	422	8386
EU-15	10813	942	11755	47258	464	47722	361	2241	2602	58433	3647	62080

Table 1.80: Emission control costs for variations in ambition levels for acidification (Scenarios H6/1, H6/2 and H6/3), in million EURO/year.

	SO <sub>2</sub>				NO <sub>x</sub> /VOC				NH <sub>3</sub>				Total			
	REF	H6/1 Low ambition	H6/2 Central ambition	H6/3 High ambition	REF	H6/1 Low ambition	H6/2 Central ambition	H6/3 High ambition	REF	H6/1 Low ambition	H6/2 Central ambition	H6/3 High ambition	REF	H6/1 Low ambition	H6/2 Central ambition	H6/3 High ambition
Costs	total	on top of REF			total	on top of REF			total	on top of REF			total	on top of REF		
Austria	191	0	0	3	902	0	0	1	0	0	0	0	1093	0	0	4
Belgium	426	93	129	154	1278	10	66	220	0	43	467	467	1704	146	662	841
Denmark	138	0	8	48	484	0	0	36	0	0	0	6	623	0	8	90
Finland	247	0	0	0	642	0	0	0	0	0	0	0	889	0	0	0
France	1276	47	209	348	7383	1	104	460	0	0	135	1104	8659	48	448	1912
Germany	3264	60	246	331	10549	1	63	1295	0	111	860	1385	13813	172	1170	3011
Greece	434	0	0	0	1048	0	0	0	0	0	0	0	1482	0	0	0
Ireland	132	20	20	40	477	1	5	36	9	6	14	11	618	27	40	87
Italy	1776	0	0	83	7868	0	0	11	0	0	0	0	9644	0	0	94
Luxembourg	13	0	1	3	71	0	1	4	15	0	0	0	98	0	1	7
Netherlands	340	19	19	19	1731	2	123	618	196	342	741	741	2267	363	883	1379
Portugal	181	0	0	0	1349	0	0	1	0	0	0	0	1530	0	0	1
Spain	809	10	9	301	5658	0	4	31	28	0	0	0	6495	10	13	332
Sweden	316	0	0	0	1125	0	0	10	113	0	0	0	1554	0	0	10
UK	1269	92	301	580	6695	0	98	1605	0	4	23	314	7964	96	422	2499
EU-15	10813	342	942	1911	47258	15	464	4328	361	506	2241	4028	58433	863	3647	10267

## 1.5.2 Marginal Costs

Table 1.81: Marginal costs per country and pollutant for the H6/2 scenario (in EURO/ton pollutant; for mobile sources EURO/ton NO<sub>x</sub>)

	Sectoral cost curves						
	SO <sub>2</sub>	NO <sub>x</sub> Stationary sources	Passenger cars + off-road- gasoline	Passenger cars - diesel	Heavy duty trucks and off-road	VOC Stationary sources	NH <sub>3</sub>
Austria	0	0	0	0	0	0	0
Belgium	4687	4954	1114	0	2327	0	4081
Denmark	412	216	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	3538	1282	0	0	1309	0	3820
Germany	4336	2780	0	0	2434	0	20949
Greece	0	0	0	0	0	0	0
Ireland	1319	1000	0	0	0	0	7166
Italy	0	0	0	0	0	0	10
Luxembourg	550	649	0	0	0	0	0
Netherlands	1662	4954	0	0	2829	0	84065
Portugal	0	0	0	0	0	0	0
Spain	320	210	0	0	0	0	0
Sweden	0	0	0	0	0	0	0
UK	2477	2105	0	0	1652	0	1373

A zero means no additional measures compared to the REF case

Table 1.82: Unit costs per country and pollutant for the H6/2 scenario (in EURO/ton pollutant; for mobile sources EURO/ton NO<sub>x</sub>)

	Sectoral cost curves						
	SO <sub>2</sub>	NO <sub>x</sub> Stationary sources	Passenger cars + off-road- gasoline	Passenger cars - diesel	Heavy duty trucks and off-road	VOC Stationary sources	NH <sub>3</sub>
Austria	0	0	0	0	0	0	0
Belgium	4687	4732	1114	0	1820	0	15028
Denmark	412	216	0	0	0	0	0
Finland	0	0	0	0	0	0	0
France	2425	1282	0	0	1024	0	2791
Germany	4336	1682	0	0	2054	0	14961
Greece	0	0	0	0	0	0	0
Ireland	729	1000	0	0	0	0	7166
Italy	0	0	0	0	0	0	10
Luxembourg	464	649	0	0	0	0	0
Netherlands	1444	3785	0	0	2212	0	21288
Portugal	0	0	0	0	0	0	0
Spain	320	210	0	0	0	0	0
Sweden	0	0	0	0	0	0	0
UK	1479	1159	0	0	1652	0	1156

A zero means no additional measures compared to the REF case

## 2 Work Element 2: Effects of Reducing the Disparity in the Level of Efforts per Country

It has been shown by earlier work that cost-effectiveness implies differentiated requirements for emission reductions, taking into account regional differences in environmental sensitivities, differences in the potential and the costs for further emission controls, and in meteorological conditions. The presently observed variations of these factors in Europe lead to the fact, however, that the burden for additional emission control measures imposed by cost-optimized strategies on individual European countries might show certain variations.

In order to explore the gains in cost-effectiveness achieved by the optimization approach for the H1 scenario, two alternative sets of scenarios are constructed:

Scenario H9 constructs a 'flat rate' emission control scenario, in which the average reduction rates for the four pollutants of the H1 scenario are applied uniformly to all European countries. The following section compares the changes in emission control costs against the changes in the environmental indicators for acidification and ground-level ozone (Section 2.1.1).

Starting from the optimized H1 scenario and maintaining the environmental targets of this scenario, a series of scenarios (H10/1 to H10/5) explore the changes in emission control costs if the deviations from the average emission reduction levels (of the H9 scenario) were gradually restricted (Section 2.1.2).

### 2.1.1 A 'Flat-rate' Emission Control Scenario (H9) for the EU-15

The rationale for the illustrative 'flat rate' scenario is to fix - as far as possible - each country's emissions to the value corresponding to the average percentage reduction across all EU-15 countries that was obtained for the H1 scenario. The average reductions from 1990 emission levels for each pollutant for the H1 scenario are as follows:

SO <sub>2</sub>	-78 %
NO <sub>x</sub>	-55 %
VOC	-60 %
NH <sub>3</sub>	-21 %

For some combinations of countries and pollutants the EU-15 average emission reduction would lead to emission values which lie outside the range available for control. In such cases the emissions for this sensitivity scenario were set to the relevant bound, i.e. "MFR" or REF, as appropriate. Country/pollutant combinations where this was necessary may be identified in Table 2.1

#### 2.1.1.1 Emissions, Costs and Environmental impacts

The emissions, costs and exposure indices obtained for this non-optimized "flat-rate" scenario H9 are summarized in Table 2.1 - Table 2.3.

Table 2.1 Emissions for the 'flat-rate' scenario H9. Percentage changes relate to the year 1990.

Country	NO <sub>x</sub>		VOC		SO <sub>2</sub>		NH <sub>3</sub>	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	86	-55%	140	-60%	31	-67%	61	-21%
Belgium	157	-55%	149	-60%	75	-78%	77	-21%
Denmark	123	-55%	72	-60%	40	-78%	61	-21%
Finland	124	-55%	85	-60%	71	-69%	31	-23%
France	836	-55%	947	-60%	278	-78%	637	-21%
Germany	1108	-58%	1088	-65%	468	-91%	571	-24%
Greece	248	-28%	155	-54%	112	-78%	63	-21%
Ireland	50	-55%	44	-60%	40	-78%	111	-13%
Italy	912	-55%	817	-60%	374	-78%	365	-21%
Luxembourg	10	-55%	7	-63%	3	-78%	7	-5%
Netherlands	242	-55%	195	-60%	50	-75%	136	-42%
Portugal	100	-52%	90	-57%	63	-78%	56	-21%
Spain	536	-54%	459	-54%	487	-78%	278	-21%
Sweden	151	-55%	203	-60%	53	-55%	48	-21%
United Kingdom	1181	-58%	1061	-60%	847	-78%	260	-21%
EU-15	5864	-56%	5513	-61%	2993	-82%	2762	-23%

Table 2.2 Emission control costs above the REF case for the 'flat-rate' scenario H9, M.EURO/year.

Country	SO <sub>2</sub>	NO <sub>x</sub> /VOC	NH <sub>3</sub>	Total	Diff from H1
Austria	18	116	26	160	41
Belgium	155	59	69	283	-770
Denmark	30	11	77	117	112
Finland	106	20	0	126	126
France	68	300	405	773	-143
Germany	282	235	0	517	-1630
Greece	266	612	63	940	602
Ireland	11	37	455	502	458
Italy	58	748	73	879	476
Luxembourg	1	0	0	1	-3
Netherlands	19	122	0	141	-830
Portugal	42	368	35	445	388
Spain	104	1397	378	1878	1856
Sweden	80	136	0	216	129
UK	47	503	45	595	-754
EU-15	1285	4662	1626	7573	58



Table 2.3: Cumulative exposure indices for the flat-rate scenario H9

Country	Unprotected area – acid, 1000 ha		Population exposure index, 10 <sup>6</sup> person ppm.hours		Vegetation exposure index, 10 <sup>3</sup> km <sup>2</sup> .excess ppm.hours	
	H9	Diff. from H1	H9	Diff. from H1	H9	Diff. from H1
Austria	121	22	2	0	223	5
Belgium	101	49	28	5	129	13
Denmark	7	1	2	1	41	3
Finland	1085	-65	0	0	0	0
France	102	14	68	15	2045	147
Germany	1184	457	118	19	1073	106
Greece	0	0	2	0	133	-3
Ireland	8	-1	0	0	4	0
Italy	56	-2	37	-1	991	-26
Luxembourg	3	2	1	0	13	2
Netherlands	156	80	32	5	71	8
Portugal	0	-1	3	-3	169	-80
Spain	6	-11	2	-2	750	-435
Sweden	1390	-30	0	0	10	0
UK	879	230	58	13	114	12
EU-15	5099	748	353	53	5766	-247

Compared to the H1 scenario, the flat-rate scenario H9 would require increased control measures in Austria, Denmark, Finland, Greece, Ireland, Italy, Portugal, Spain and Sweden. In contrast, Belgium, France, Germany, Luxembourg, Netherlands and United Kingdom would benefit from reduced emission control costs. For the EU-15 as a whole, the flat-rate scenario H9 would cost 58 million EURO more than H1, an increase of 1%.

Table 2.3 shows that the flat-rate scenario H9 would result in a generally lower environmental improvement – for the EU-15 as a whole – than the H1 scenario. For acidification, the countries where the largest increases in unprotected area would occur are Germany, UK, Netherlands and Belgium. Health-related ozone exposure, in terms of the cumulative population exposure index, would increase most in Germany, France, UK, Belgium and the Netherlands. For vegetation-related ozone exposure the largest increases would be found in France and Germany, while benefits in Spain and Portugal lead to an average overall improvement (across the EU area) for this measure (see Table 2.3).

A graphical comparison of the changes in the environmental indicators in relation to emission control costs is provided in Figure 2.3 to Figure 2.5. From these graphs it is obvious that, for the EU-15 as a whole, flat-rate emission reductions of the H9 scenario result in a significantly lower cost-effectiveness for two of the environmental problems considered (acidification and health-related ozone exposure).

### **2.1.1.2 Non-Achievement of H1 Targets**

Table 2.3 indicated how the environmental improvements that would be achieved by the flat-rate reduction scenario H9 compared with those expected from H1. It is also of interest to investigate which H1 targets would not be met by the flat-rate scenario. Table 2.4 lists the grid cells at which the absolute ceilings set in the H1 scenario would be exceeded in the H9 scenario.

Table 2.4 Grid cells where the H1 absolute ceilings would not be achieved by the flat-rate H9 scenario.

Environmental measure	Grid cell	Country	Ceiling, ppm.hours	Flat-rate scenario, ppm.hours
Excess AOT40	20/12	FRA	10.0	10.63
	25/12	ITA		10.07
AOT60	20/13	FRA	2.9	2.97
	20/14	BEL/FRA		3.61
	20/15	NL/D/BEL		3.34
	20/16	NL/D		3.28
	21/14	LUX/FRA/D/NL		3.59
	21/16	D		3.02

In the H1 scenario, gap closure targets were specified in the context of a balancing mechanism in which individual grid targets could be exceeded provided that such target violation was compensated by additional improvements in other grid cells in the same country. Comparison of the flat-rate scenario H9 with H1 in terms of meeting gap closure targets, therefore, needs to be carried out on a country basis. This is done in Table 2.5 which lists the mean exposure indices which would result from exactly meeting the full set of H1 targets, and indicates in which countries that (H1) level of environmental improvement would not be attained by the flat-rate reduction scenario.

Table 2.5 Non-achievement of the H1 country balance targets by the flat-rate scenario H9.

Country	Accumulated excess acidity, equivalents/hectare/year		Average population exposure index, excess ppm.hours		Average vegetation exposure index, excess ppm.hours	
	H1 target	%Excess	H1 target	%Excess	H1 target	%Excess
Austria	9.48		0.45		4.96	
Belgium	34.97	20%	2.19	18%	7.44	12%
Denmark	7.18		0.54		1.77	
Finland	5.52		0.00		0.00	
France	5.68		1.36		7.03	
Germany	32.25		1.57		5.57	
Greece	5.00		0.31		2.81	
Ireland	5.08		0.26		0.35	
Italy	6.94		1.05		7.24	
Luxembourg	13.10		2.18	16%	9.35	
Netherlands	90.54	133%	1.86	16%	5.17	6%
Portugal	4.58		0.59		4.25	
Spain	5.12		0.17		4.13	
Sweden	6.03		0.04		0.06	
UK	21.63		0.94	8%	1.44	
EU-15	9.07		1.07		3.70	

The H1 acidification targets would not be met in Belgium and the Netherlands; the AOT60 targets would not be achieved in Belgium, Luxembourg, the Netherlands and the UK; and in Belgium and the Netherlands the H1 AOT40 targets would also be exceeded. It is worth noting that in several cases where the H1 targets would not be met those targets are themselves relatively high in comparison with the corresponding targets in other countries.

### 2.1.2 Reducing the Variation in Emission Reductions while achieving the H1 Targets

Another series of scenarios was developed with the aim of keeping emission reductions as uniform as possible within the EU-15 countries but at the same time ensuring that the H1 targets would be achieved.

In practice, the mathematical optimization problem was extended by a 'regularization' term, which puts a (quadratic) penalty on each deviation of an optimized emission reduction level from an exogeneously specified 'target' emission level. The goal function of the optimization problem as presented in Section 2.7.1.5 in Part A of the Sixth Interim Report is extended by a regularization term

$$\varepsilon \| z - \tilde{z} \|^2$$

where  $z$  denotes the vector of the decision variables (emissions relative to 1990) and  $\bar{z}$  the vector of the 'target' emission levels (relative to 1990). For the particular case of the H10 scenarios, the emission levels of the H9 scenario was used as the target level.

Depending on the weight  $\varepsilon$  given to the regularization, the optimization balances the deviations from these target levels against the overall emission control costs. With sufficiently small regularization coefficients, the optimization ends up with the emission levels of the original H1 scenario, while an increase of this coefficient would ultimately push all emission reductions to the target levels of the H9 scenario (if these achieved the H1 targets).

To this end, five scenarios (H10/1 to H10/5) were carried out with values for  $\varepsilon$  of 1, 10, 100, 1000 and 10000, respectively. The variation in emission control costs as a function of the regularization weight  $\varepsilon$  is shown in Figure 2.1. Figure 2.2 displays the changes in national emission control costs for these five scenarios. For sake of brevity, only the penultimate scenario H10/4 is presented here in more detail (Table 2.6. to Table 2.8).

### **2.1.2.1 Emissions, Costs and Environmental Impacts**

Table 2.6 shows the emissions of the H10/4 scenario. Comparison with Table 2.1 shows where it proves necessary for some countries to make greater emission reductions than the average in order to ensure that the H1 targets are met. For  $\text{NH}_3$ , for example, the results suggest that the Netherlands, Germany and Belgium are required to make above-average emission reductions if the H1 targets are to be achieved.

Table 2.6 Emissions for the H10/4 scenario. Percentage changes relate to the year 1990.

Country	$\text{NO}_x$		VOC		$\text{SO}_2$		$\text{NH}_3$	
	kt	Change	kt	Change	kt	Change	kt	Change
Austria	86	-55%	133	-62%	31	-67%	61	-21%
Belgium	127	-64%	116	-69%	75	-78%	67	-31%
Denmark	122	-55%	72	-60%	40	-78%	62	-20%
Finland	124	-55%	85	-60%	73	-68%	31	-23%
France	671	-64%	851	-64%	193	-85%	628	-22%
Germany	997	-63%	915	-71%	448	-92%	441	-42%
Greece	254	-26%	159	-53%	115	-77%	63	-21%
Ireland	50	-55%	44	-60%	39	-78%	113	-11%
Italy	931	-54%	897	-56%	375	-78%	366	-21%
Luxembourg	10	-55%	7	-63%	3	-78%	7	-5%
Netherlands	224	-59%	166	-66%	50	-75%	104	-55%
Portugal	103	-50%	94	-56%	64	-78%	56	-21%
Spain	582	-50%	486	-52%	480	-78%	283	-20%
Sweden	148	-56%	201	-61%	54	-55%	48	-21%
United Kingdom	1181	-58%	957	-64%	444	-88%	256	-22%
EU-15	5609	-58%	5183	-63%	2485	-85%	2586	-28%

Compared to the H1 scenario, only Belgium and Luxembourg would benefit from reduced emission costs in the H10/4 scenario (Table 2.7). The overall costs (above REF) to the EU countries are some 3.8 billion EURO greater than in H1, a 51% increase (Figure 2.1).

The cumulative exposure indices for the H10/4 scenario, shown in Table 2.8, suggest that in many cases the H10/4 scenario would achieve a similar environmental improvement to that of the H1 scenario, with further improvements in some measures in a number of countries, as might be hoped for given the considerable additional costs involved.

The overall cost-effectiveness of these scenarios is displayed graphically in Figure 2.3 to Figure 2.5.

Table 2.7 Emission control costs above the REF case for the H10/4 scenario, M.EURO/year.

Country	SO <sub>2</sub>	NO <sub>x</sub> /VOC	NH <sub>3</sub>	Total	Diff from H1
Austria	17	145	25	188	68
Belgium	155	371	189	715	-337
Denmark	30	10	59	99	94
Finland	88	20	0	107	107
France	211	1077	476	1764	848
Germany	314	1625	589	2528	381
Greece	256	493	59	807	469
Ireland	11	37	216	264	220
Italy	58	432	72	562	159
Luxembourg	1	0	0	1	-3
Netherlands	19	271	741	1032	60
Portugal	41	280	33	354	297
Spain	107	652	341	1101	1079
Sweden	43	155	0	198	112
UK	474	1071	62	1607	259
EU-15	1824	6639	2863	11326	3812

Table 2.8 Cumulative exposure indices for the H10/4 scenario.

Country	Unprotected area – acid, 1000 ha		Population exposure index, 10 <sup>6</sup> person ppm.hours		Vegetation exposure index, 10 <sup>3</sup> km <sup>2</sup> .excess ppm.hours	
	H10/4	Diff. from H1	H10/4	Diff. from H1	H10/4	Diff. from H1
Austria	89	-10	2	0	208	-10
Belgium	52	0	22	-1	115	-1
Denmark	5	-1	1	0	34	-4
Finland	1073	-77	0	0	0	0
France	83	-5	50	-3	1737	-161
Germany	711	-16	96	-3	927	-39
Greece	0	0	2	0	134	-2
Ireland	8	-1	0	0	3	-1
Italy	53	-5	37	-1	984	-32
Luxembourg	1	0	1	0	11	0
Netherlands	76	0	26	-1	64	0
Portugal	0	-1	3	-3	175	-74
Spain	6	-11	1	-3	777	-408
Sweden	1288	-132	0	0	8	-2
UK	552	-97	44	-1	94	-8
EU-15	3996	-355	286	-14	5271	-743

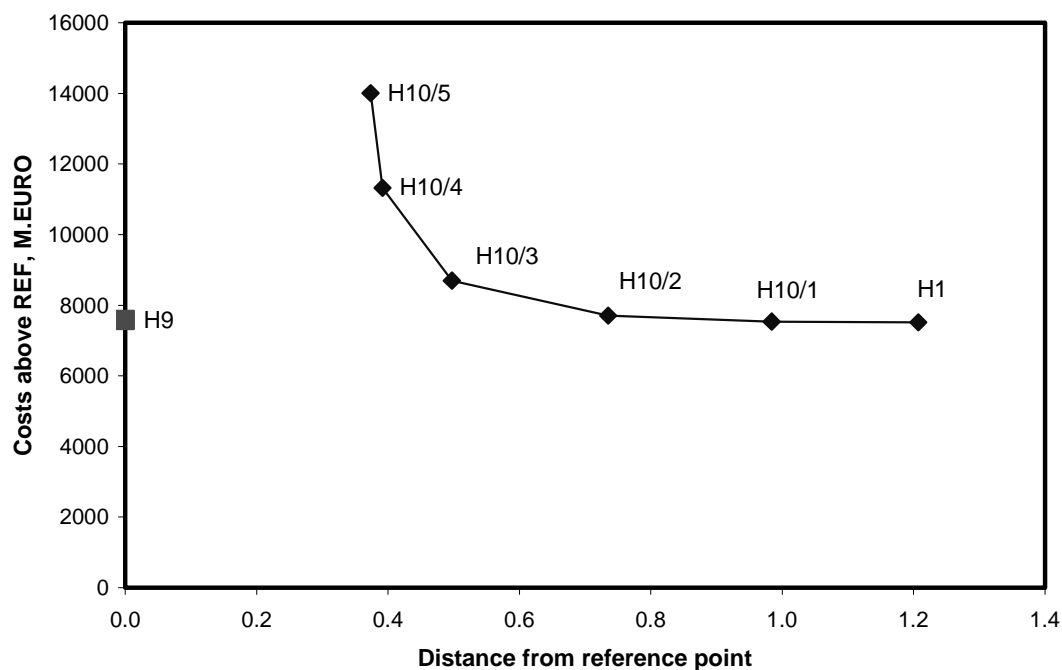


Figure 2.1: Emission control costs (above REF) of the flat-rate scenario (H9) and the sensitivity runs H10 compared to those of the central scenario

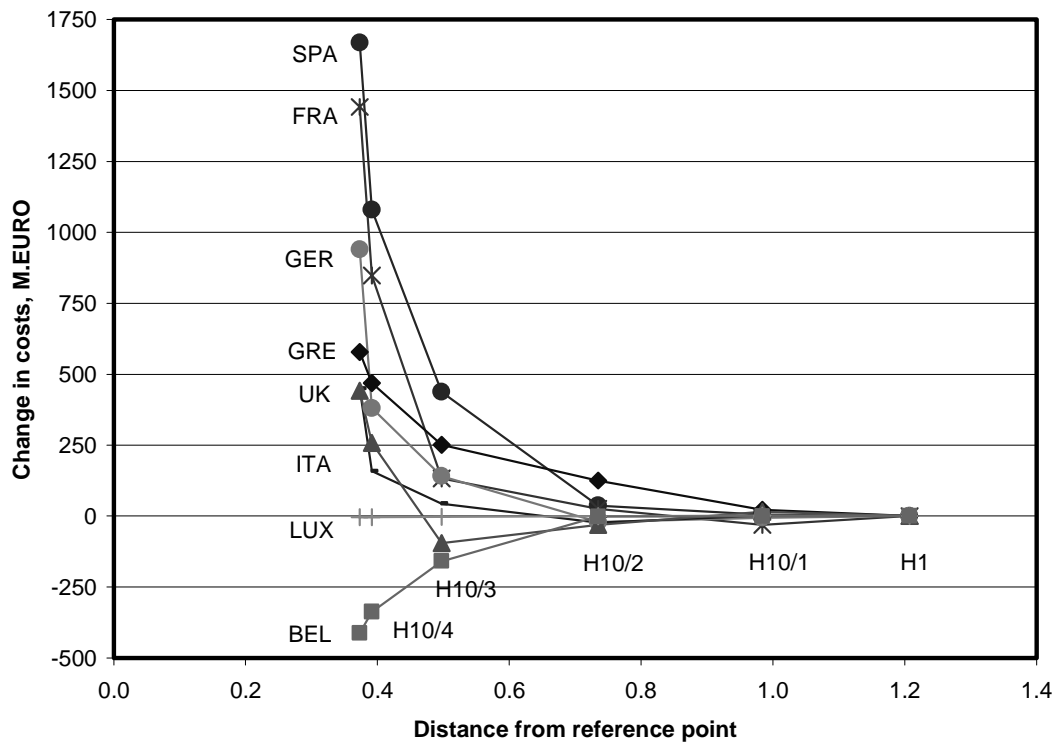


Figure 2.2: Changes in emission control costs for the sensitivity runs H10/1 to H10/5

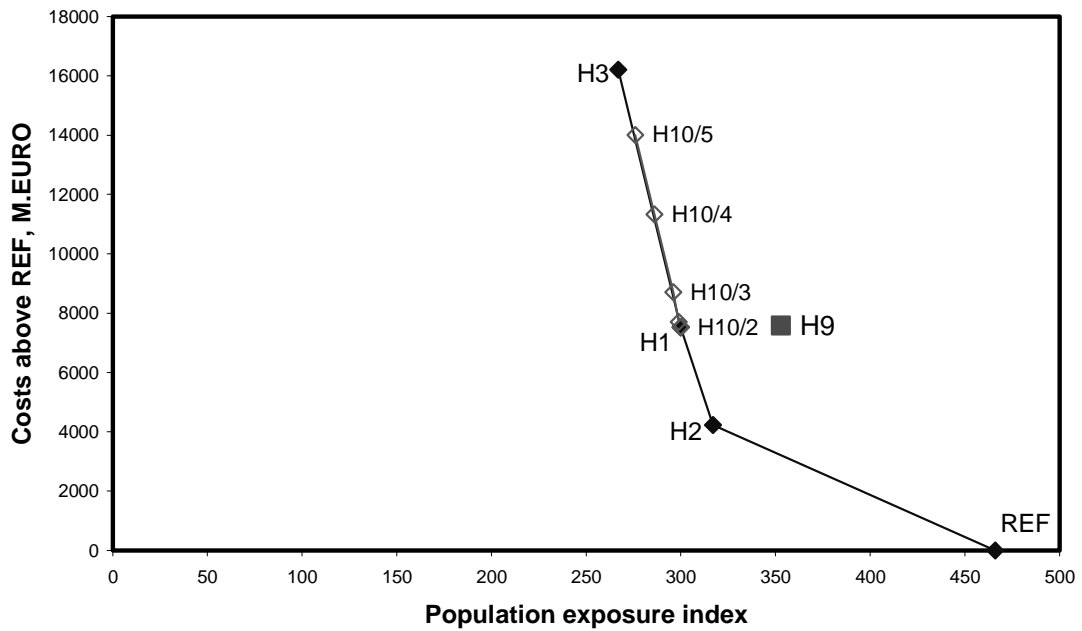


Figure 2.3: Cost-effectiveness in terms of the population exposure index for the flat-rate scenario (H9) and the sensitivity runs (H10) compared to the central scenarios

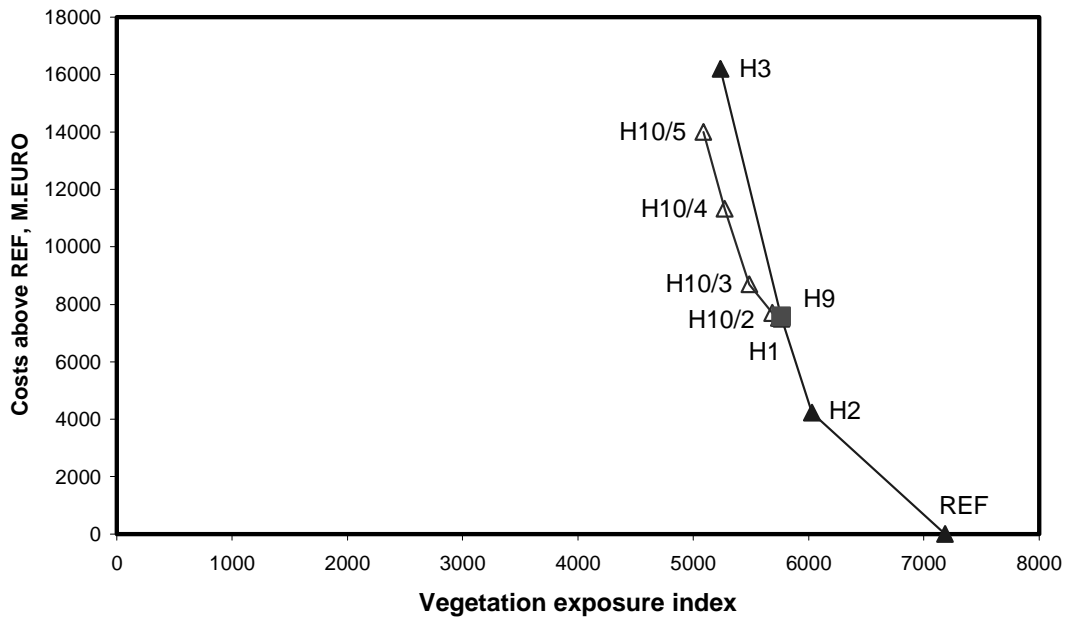


Figure 2.4: Cost-effectiveness in terms of the vegetation exposure index for the flat-rate scenario (H9) and the sensitivity runs (H10) compared to the central scenarios

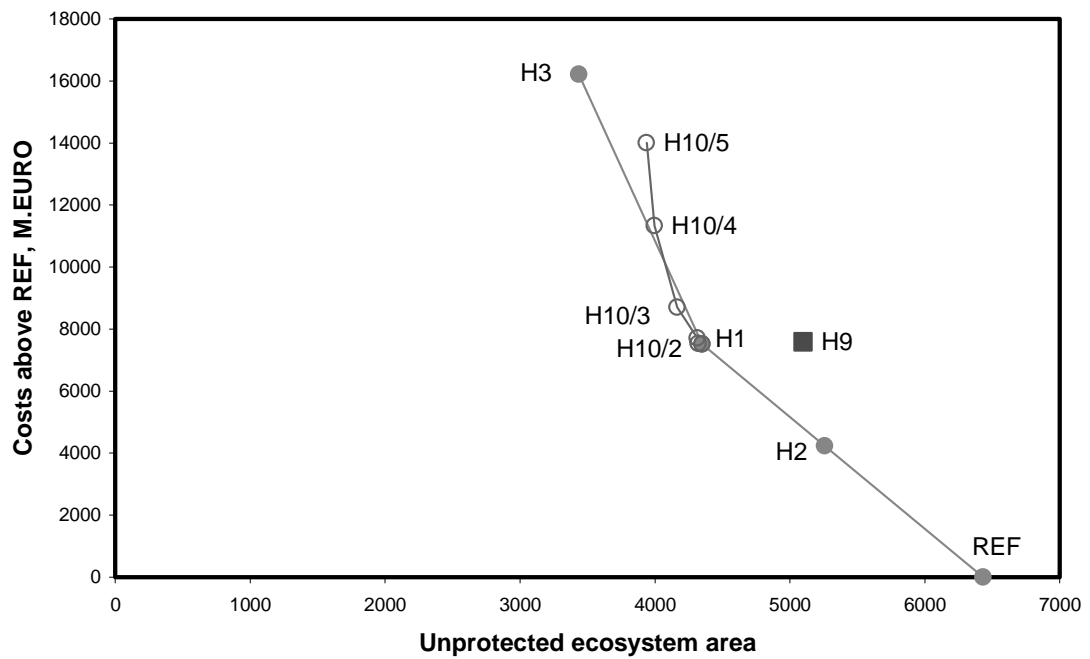


Figure 2.5: Cost-effectiveness in terms of the ecosystems protection (acidification) for the flat-rate scenario (H9) and the sensitivity runs (H10) compared to the central scenarios



## 2.2 'Flat-Rate' Emission Control Scenarios For The ECE

The concept of a 'flat rate' scenario was repeated with a pan-European focus, i.e., uniform emission reductions were examined for the ECE region. In practice, the rationale is to fix - as far as possible - each country's emissions to the value corresponding to the average percentage reduction across all ECE countries that is obtained for the J1 scenario. The average reductions from 1990 emission levels for each pollutant for the J1 scenario are as follows:

SO <sub>2</sub>	-73 %
NO <sub>x</sub>	-45 %
VOC	-45 %
NH <sub>3</sub>	-24 %

For some combinations of countries and pollutants the ECE average emission reduction would lead to emission values which lie outside the range available for control. In such cases the emissions for this sensitivity scenario were set to the relevant bound, i.e. "MFR" or REF, as appropriate.

Repeating the concept of the H10/4 scenario, a further scenario was developed in which the emission reductions were kept as close as possible at the average reduction level while maintaining the achievement of the environmental targets (Scenario J8).

The emissions, costs and exposure indices obtained for these "flat-rate" scenarios J7 and J8 are summarized in Table 2.9 - Table 2.14.

Compared to the J1 scenario, the flat-rate scenario J7 would require increased control measures in Denmark, Finland, Greece, Ireland, Portugal, Spain and Sweden and in most non-EU countries. In contrast, Austria, Belgium, France, Germany, Italy, Luxembourg, Netherlands and United Kingdom, and the Czech Republic, Hungary and Slovenia would experience reduced emission control costs. For the ECE as a whole, the flat-rate scenario J7 would cost 2.9 billion EURO more than J1, an increase of 34 percent.

Table 2.15 and Table 2.16 show that the flat-rate scenario J7 would result in a generally lower environmental improvement – for the ECE as a whole – than the J1 scenario.

Health-related ozone exposure, in terms of the cumulative population exposure index, would increase by 38 percent, particularly in the high-ozone area of Germany, France, UK, Belgium and the Netherlands. For vegetation-related ozone exposure the largest increases would be found in France and Germany. For acidification, 4.1 instead of 3.5 million hectares in the EU would remain unprotected (+17 percent), while additional measures in the eastern Europe achieve additional environmental benefits there.

A graphical comparison of the changes in the environmental indicators in relation to emission control costs is provided in Figure 2.7 to Figure 2.9. From these graphs it is obvious that, for the ECE as a whole, flat-rate emission reductions of the J7 scenario result in a significantly lower cost-effectiveness for two of the environmental problems considered (vegetation- and health-related ozone exposure).

In the J8 scenario, where it proves necessary some countries make greater emission reductions than the average in order to ensure that the environmental targets of J1 are met. For NH<sub>3</sub>, for example, the results suggest that the Netherlands, Germany and Belgium are required to make above-average emission reductions if the J1 targets are to be achieved.

Compared to the J1 scenario, only Belgium, Luxembourg, Italy, Slovenia and the Czech Republic would benefit from reduced emission costs in the J8 scenario. The overall costs

(above REF) to the ECE countries are twice as high as in J1, i.e., they increase by 8.6 billion EURO.

Table 2.9: NO<sub>x</sub> emissions for the flat rate emission control scenarios.. Percentage changes relate to the year 1990.

	J1		J7		J8	
	Central case kt	Change	Uniform kt	Change	Reduced var. kt	Change
Austria	91	-53%	103	-46%	96	-50%
Belgium	127	-64%	191	-46%	150	-57%
Denmark	113	-59%	128	-53%	127	-54%
Finland	152	-45%	152	-45%	152	-45%
France	704	-62%	858	-54%	648	-65%
Germany	1081	-59%	1184	-56%	953	-64%
Greece	344	0%	248	-28%	254	-26%
Ireland	55	-51%	62	-45%	62	-45%
Italy	901	-56%	1122	-45%	988	-51%
Luxembourg	8	-64%	10	-55%	10	-55%
Netherlands	266	-51%	280	-48%	256	-53%
Portugal	144	-31%	114	-45%	115	-45%
Spain	726	-38%	640	-45%	646	-44%
Sweden	159	-53%	186	-45%	175	-48%
UK	1181	-58%	1186	-58%	1181	-58%
EU-15	6054	-54%	6464	-51%	5811	-56%
Albania	36	50%	16	-33%	16	-33%
Belarus	290	-28%	221	-45%	222	-45%
Bosnia-H	53	-34%	44	-45%	44	-45%
Bulgaria	266	-25%	195	-45%	197	-45%
Croatia	87	6%	45	-45%	45	-45%
Czech Rep.	188	-66%	296	-46%	278	-49%
Estonia	73	-13%	46	-45%	47	-44%
Hungary	137	-37%	120	-45%	120	-45%
Latvia	118	1%	65	-44%	65	-44%
Lithuania	134	-12%	84	-45%	84	-45%
Norway	142	-35%	125	-43%	129	-41%
Poland	654	-46%	670	-45%	651	-47%
R.of Moldova	64	-26%	48	-45%	48	-45%
Romania	328	-37%	286	-45%	287	-45%
Russia	2653	-24%	1920	-45%	2006	-42%
Slovakia	115	-47%	121	-45%	120	-45%
Slovenia	34	-43%	33	-45%	33	-45%
Switzerland	76	-53%	79	-52%	78	-52%
FYR of Mac.	29	-26%	21	-46%	21	-46%
Ukraine	1222	-35%	1039	-45%	1049	-44%
Yugoslavia	132	-37%	116	-45%	116	-45%
Non-EU	6830	-33%	5592	-45%	5656	-44%
Total	14513	-42%	13685	-45%	13097	-48%

Table 2.10: VOC emissions for the flat rate emission control scenarios. Percentage changes relate to the year 1990.

	J1		J7		J8	
	Central case kt	<i>Change</i>	Uniform kt	<i>Change</i>	Reduced var. kt	<i>Change</i>
Austria	142	-60%	192	-45%	173	-51%
Belgium	103	-72%	193	-48%	145	-61%
Denmark	85	-53%	85	-53%	85	-53%
Finland	110	-48%	110	-48%	110	-48%
France	989	-58%	1223	-49%	976	-59%
Germany	995	-68%	1137	-64%	912	-71%
Greece	261	-22%	184	-45%	184	-45%
Ireland	55	-50%	55	-50%	55	-50%
Italy	1030	-50%	1123	-45%	1037	-50%
Luxembourg	7	-63%	7	-63%	7	-63%
Netherlands	157	-68%	233	-52%	194	-60%
Portugal	102	-52%	116	-45%	116	-45%
Spain	648	-36%	551	-45%	560	-44%
Sweden	241	-53%	279	-45%	266	-48%
UK	1101	-59%	1351	-49%	957	-64%
EU-15	6024	-57%	6838	-51%	5774	-59%
Albania	41	32%	17	-45%	17	-45%
Belarus	298	-20%	203	-45%	203	-45%
Bosnia-H	48	-6%	28	-45%	28	-45%
Bulgaria	185	-5%	107	-45%	107	-45%
Croatia	86	-17%	56	-46%	56	-46%
Czech Rep.	156	-65%	241	-45%	225	-49%
Estonia	49	9%	25	-44%	25	-44%
Hungary	137	-33%	111	-46%	111	-46%
Latvia	56	-11%	34	-46%	34	-46%
Lithuania	105	-5%	61	-45%	61	-45%
Norway	195	-34%	162	-45%	163	-45%
Poland	475	-40%	436	-45%	426	-47%
R.of Moldova	42	-16%	27	-46%	27	-46%
Romania	500	-1%	275	-45%	278	-45%
Russia	2723	-23%	1935	-45%	1951	-45%
Slovakia	140	-7%	82	-46%	82	-46%
Slovenia	40	-27%	30	-45%	30	-45%
Switzerland	144	-48%	144	-48%	143	-49%
FYR of Mac.	19	0%	10	-47%	10	-47%
Ukraine	770	-34%	634	-45%	636	-45%
Yugoslavia	138	-3%	77	-46%	78	-45%
Non-EU	6345	-26%	4696	-45%	4692	-45%
Total	12370	-45%	11534	-49%	10466	-54%

Table 2.11: SO<sub>2</sub> emissions of the flat rate emission control scenarios. Percentage changes relate to the year 1990.

	J1		J7		J8	
	Central case kt	Change	Uniform kt	Change	Reduced var. kt	Change
Austria	35	-62%	31	-67%	31	-67%
Belgium	76	-77%	92	-73%	75	-78%
Denmark	60	-67%	50	-73%	50	-73%
Finland	116	-49%	71	-69%	73	-68%
France	219	-82%	343	-73%	238	-81%
Germany	463	-91%	468	-91%	444	-92%
Greece	546	8%	138	-73%	141	-72%
Ireland	36	-80%	49	-72%	48	-73%
Italy	290	-83%	461	-73%	397	-76%
Luxembourg	3	-79%	4	-71%	4	-71%
Netherlands	50	-75%	55	-73%	50	-75%
Portugal	141	-50%	78	-73%	78	-73%
Spain	747	-66%	601	-73%	586	-73%
Sweden	67	-44%	53	-55%	54	-55%
UK	499	-87%	980	-74%	493	-87%
EU-15	3349	-80%	3475	-79%	2762	-83%
Albania	55	-24%	20	-72%	20	-72%
Belarus	494	-41%	232	-72%	232	-72%
Bosnia-H	162	-67%	134	-72%	130	-73%
Bulgaria	378	-79%	506	-73%	492	-73%
Croatia	23	-87%	49	-73%	48	-73%
Czech Rep.	283	-85%	366	-80%	280	-85%
Estonia	175	-36%	75	-73%	76	-72%
Hungary	296	-68%	296	-68%	296	-68%
Latvia	104	-14%	33	-73%	33	-73%
Lithuania	107	-50%	59	-72%	59	-72%
Norway	18	-65%	17	-67%	17	-67%
Poland	722	-76%	824	-73%	701	-77%
R.of Moldova	38	-81%	54	-73%	54	-73%
Romania	148	-89%	366	-73%	330	-75%
Russia	2186	-56%	1377	-73%	1402	-72%
Slovakia	92	-83%	137	-75%	111	-80%
Slovenia	14	-93%	55	-73%	54	-73%
Switzerland	23	-47%	12	-72%	12	-72%
FYR of Mac.	81	-24%	29	-73%	29	-73%
Ukraine	1457	-61%	1018	-73%	1015	-73%
Yugoslavia	217	-63%	161	-72%	154	-74%
Non-EU	7071	-67%	5818	-73%	5544	-74%
Total	11572	-70%	10446	-73%	9458	-76%

Table 2.12: NH<sub>3</sub> emissions for the central scenario J1 compared to the flat rate emission control scenarios. Percentage changes relate to the year 1990.

	J1		J7		J8	
	Central case kt	Change	Uniform kt	Change	Reduced var. kt	Change
Austria	66	-14%	59	-23%	59	-23%
Belgium	60	-38%	74	-24%	64	-34%
Denmark	69	-10%	58	-25%	60	-22%
Finland	31	-23%	31	-23%	31	-23%
France	642	-20%	613	-24%	601	-26%
Germany	413	-45%	570	-25%	444	-41%
Greece	73	-9%	61	-24%	61	-24%
Ireland	116	-9%	111	-13%	113	-11%
Italy	356	-23%	351	-24%	346	-25%
Luxembourg	7	0%	7	0%	7	0%
Netherlands	105	-55%	136	-42%	104	-55%
Portugal	65	-8%	54	-24%	54	-24%
Spain	353	0%	268	-24%	274	-22%
Sweden	48	-21%	46	-25%	47	-23%
UK	264	-20%	250	-24%	249	-24%
EU-15	2668	-25%	2689	-25%	2513	-30%
Albania	32	0%	25	-22%	25	-22%
Belarus	140	-36%	163	-26%	163	-26%
Bosnia-H	22	-29%	23	-26%	23	-26%
Bulgaria	105	-26%	107	-24%	107	-24%
Croatia	29	-28%	30	-25%	30	-25%
Czech Rep.	101	-6%	81	-24%	82	-23%
Estonia	29	0%	22	-24%	22	-24%
Hungary	77	-36%	91	-24%	75	-38%
Latvia	35	-19%	33	-23%	33	-23%
Lithuania	72	-10%	61	-24%	61	-24%
Norway	21	-9%	18	-22%	18	-22%
Poland	468	-7%	384	-24%	403	-20%
R.of Moldova	41	-13%	36	-23%	36	-23%
Romania	227	-22%	222	-24%	226	-23%
Russia	894	-30%	891	-30%	891	-30%
Slovakia	39	-35%	45	-25%	45	-25%
Slovenia	16	-30%	17	-26%	17	-26%
Switzerland	63	-13%	55	-24%	55	-24%
FYR of Mac.	15	-12%	13	-24%	13	-24%
Ukraine	588	-19%	554	-24%	566	-22%
Yugoslavia	64	-29%	68	-24%	68	-24%
Non-EU	3077	-23%	2938	-26%	2959	-26%
Total	5745	-24%	5627	-26%	5471	-28%

Table 2.13: Control costs on top of the REF scenarios for SO<sub>2</sub>, NO<sub>x</sub> and VOC emissions for the flat rate emission control scenarios (in million EURO/year)

	NO <sub>x</sub> & VOC			SO <sub>2</sub>		
	J1 Central	J7 Uniform	J8 Reduced var	J1 Central	J7 Uniform	J8 Reduced var.
Austria	70	3	18	5	18	18
Belgium	452	0	88	122	68	154
Denmark	8	0	0	13	22	22
Finland	0	0	0	0	106	88
France	437	0	1003	132	38	105
Germany	484	0	2166	240	282	331
Greece	2	490	408	0	203	197
Ireland	10	2	2	12	6	6
Italy	245	21	147	87	30	51
Luxembourg	2	0	0	0	0	0
Netherlands	112	0	76	19	11	19
Portugal	57	141	136	0	27	27
Spain	42	288	259	9	57	61
Sweden	45	4	13	0	80	43
UK	353	0	1071	295	0	310
EU-15	2318	949	5387	935	948	1433
Albania	0	89	88	0	15	15
Belarus	3	96	95	0	93	93
Bosnia-H	2	26	26	55	64	65
Bulgaria	10	181	176	58	42	44
Croatia	5	146	147	18	6	6
Czech Rep.	235	23	38	36	0	40
Estonia	0	54	54	0	42	42
Hungary	112	231	241	113	113	113
Latvia	0	128	127	0	33	33
Lithuania	0	129	128	0	20	20
Norway	12	198	127	10	16	16
Poland	373	492	614	283	232	305
R.of Moldova	0	16	16	30	23	23
Romania	100	340	330	137	52	60
Russia	0	1133	887	54	333	322
Slovakia	11	57	58	25	0	10
Slovenia	1	8	8	23	6	7
Switzerland	2	0	1	1	34	34
FYR of Mac.	0	15	15	0	28	28
Ukraine	44	283	263	8	155	156
Yugoslavia	6	60	60	27	72	77
Non-EU	917	3705	3497	879	1379	1509
Total	3235	4654	8885	1814	2327	2943

Table 2.14: Control costs for NH<sub>3</sub> emissions and total costs on top of the REF for the flat rate emission control scenarios (in million EURO/year)

	NH <sub>3</sub>			Total		
	J1 Central	J7 Uniform	J8 Reduced var.	J1 Central	J7 Uniform	J8 Reduced var.
Austria	1	38	39	76	60	75
Belgium	312	95	235	886	163	477
Denmark	2	120	91	22	142	112
Finland	0	0	0	0	106	88
France	367	586	682	936	624	1790
Germany	842	1	535	1567	283	3033
Greece	0	95	84	2	788	689
Ireland	146	455	216	168	463	224
Italy	85	96	113	417	147	311
Luxembourg	0	0	0	2	0	0
Netherlands	672	0	741	803	11	837
Portugal	2	51	49	59	220	212
Spain	0	497	421	51	841	741
Sweden	0	33	25	45	117	81
UK	23	95	108	671	95	1489
EU-15	2450	2164	3340	5704	4061	10161
Albania	1	56	53	1	160	155
Belarus	9	0	0	12	189	188
Bosnia-H	1	0	0	58	90	91
Bulgaria	13	10	9	81	232	229
Croatia	3	3	3	26	154	157
Czech Rep.	9	160	152	280	184	230
Estonia	0	6	6	0	103	103
Hungary	319	94	385	545	438	738
Latvia	0	1	1	0	162	161
Lithuania	4	58	55	4	207	203
Norway	3	74	71	25	287	214
Poland	182	1056	655	838	1779	1574
R.of Moldova	3	21	21	33	60	60
Romania	304	385	323	541	777	712
Russia	0	5	5	54	1472	1214
Slovakia	7	1	1	43	58	69
Slovenia	2	1	1	25	15	16
Switzerland	6	105	105	9	139	140
FYR of Mac.	1	7	7	1	50	50
Ukraine	30	134	87	82	572	507
Yugoslavia	94	57	54	128	189	191
Non-EU	991	2234	1995	2787	7319	7002
Total	3442	4398	5336	8490	11380	17163

Table 2.15: Cumulative ozone exposure indices for the flat rate emission control scenarios

	Population			Vegetation		
	J1 Central	J7 Uniform	J8 Reduced var.	J1 Central	J7 Uniform	J8 Reduced var.
Austria	1	2	1	194	232	193
Belgium	22	32	22	115	138	115
Denmark	1	2	1	30	45	30
Finland	0	0	0	0	0	0
France	54	83	50	1865	2278	1763
Germany	91	130	89	901	1133	873
Greece	3	2	2	146	110	105
Ireland	0	1	0	3	7	3
Italy	40	55	41	993	1107	988
Luxembourg	1	1	1	11	14	11
Netherlands	26	36	26	63	76	62
Portugal	6	5	5	229	210	205
Spain	3	4	2	1046	963	901
Sweden	0	0	0	7	12	7
UK	49	73	44	111	152	96
EU-15	298	426	284	5714	6476	5350
Albania	0	0	0	0	0	0
Belarus	0	0	0	44	22	18
Bosnia-H	0	0	0	126	125	111
Bulgaria	0	0	0	228	178	172
Croatia	1	2	1	173	175	158
Czech Rep.	5	9	6	218	269	220
Estonia	0	0	0	0	0	0
Hungary	6	6	5	290	292	261
Latvia	0	0	0	2	1	0
Lithuania	0	0	0	9	2	1
Norway	0	0	0	1	1	1
Poland	18	24	17	529	593	481
R.of Moldova	0	0	0	43	32	30
Romania	1	0	0	458	399	371
Russia	5	2	2	861	460	477
Slovakia	3	4	3	153	161	143
Slovenia	1	1	1	78	85	76
Switzerland	1	2	0	70	83	68
FYR of Mac.	0	0	0	33	25	24
Ukraine	6	2	2	971	747	715
Yugoslavia	1	1	0	195	183	167
Non-EU	48	53	39	4481	3834	3494
Total	346	479	323	10194	10310	8844



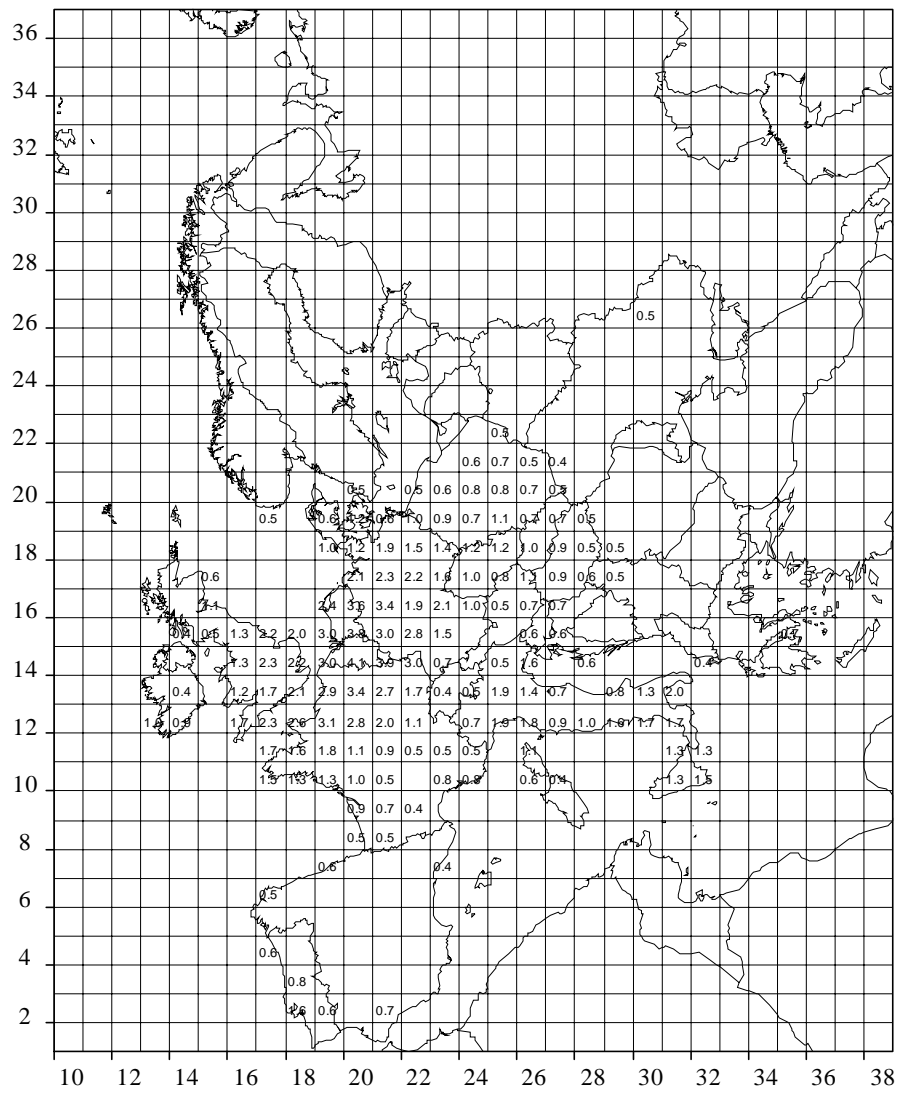


Figure 2.6: AOT60 (second highest occurrence in meteorological conditions of five years) for the emissions of the uniform J7 scenario

Table 2.16: Ecosystems with deposition above critical loads (1000 hectares)

	Acidification			Eutrophication		
	J1 central	J7 uniform	J8	J1 central	J7 uniform	J8
Austria	68	108	67	2477	2860	2280
Belgium	52	106	51	572	628	563
Denmark	5	6	4	85	72	58
Finland	756	360	335	1738	1457	1381
France	84	105	81	21632	21182	20447
Germany	567	1142	551	7312	8763	7236
Greece	0	0	0	85	47	46
Ireland	8	9	8	29	28	28
Italy	51	56	51	2508	2671	2345
Luxembourg	1	4	1	63	70	61
Netherlands	76	163	76	278	287	277
Portugal	1	0	0	580	349	356
Spain	17	10	9	850	204	173
Sweden	1166	1124	925	620	667	566
UK	636	944	565	62	58	56
EU-15	3486	4136	2726	38890	39344	35874
Albania	0	0	0	160	109	105
Belarus	686	72	41	924	894	884
Bosnia-H	0	0	0	460	496	445
Bulgaria	0	0	0	1263	1114	884
Croatia	0	0	0	10	10	9
Czech Rep.	81	170	66	1983	2016	1845
Estonia	8	3	3	598	560	554
Hungary	37	38	37	125	129	125
Latvia	0	0	0	1417	1230	1187
Lithuania	5	0	0	894	850	840
Norway	1928	2015	1746	35	43	26
Poland	173	208	140	14894	13925	13573
R.of Moldova	10	10	10	0	0	0
Romania	17	17	17	1770	1730	1717
Russia	1026	111	109	23123	18565	18731
Slovakia	149	173	154	939	1031	931
Slovenia	4	4	4	87	89	85
Switzerland	35	39	33	1468	1522	1363
FYR of Mac.	0	0	0	108	83	80
Ukraine	237	221	136	3859	3663	3586
Yugoslavia	0	0	0	1280	1269	1158
Non-EU	4397	3084	2497	55396	49328	48128
Total	7883	7220	5222	94287	88672	84002

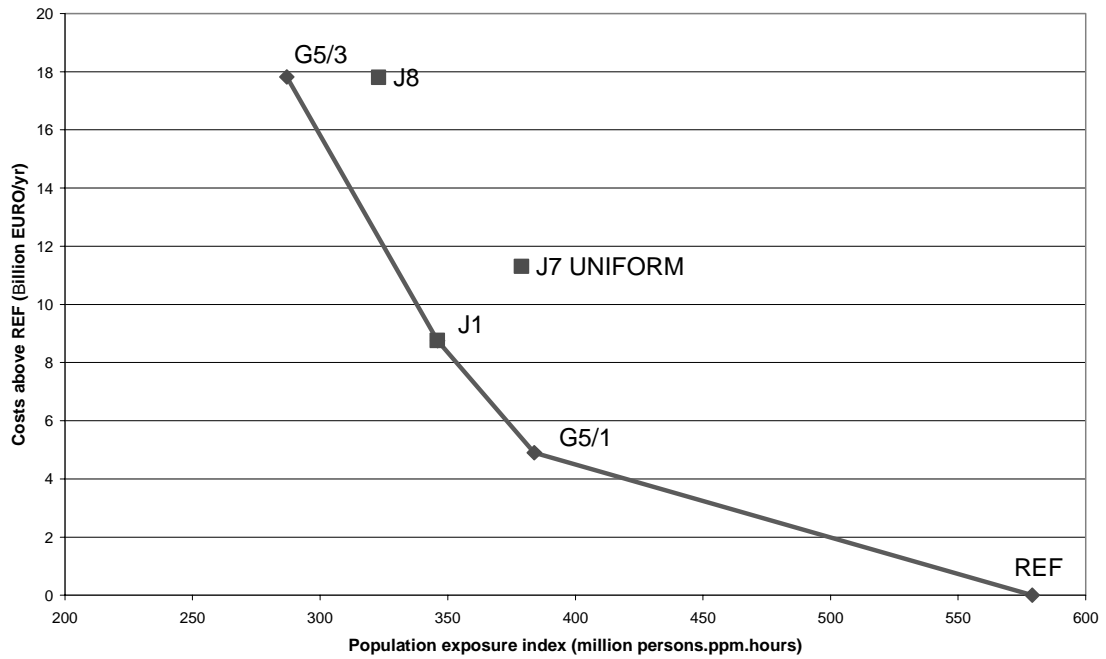


Figure 2.7: Cost-effectiveness of the 'flat rate' reduction scenarios in relation to the population exposure index

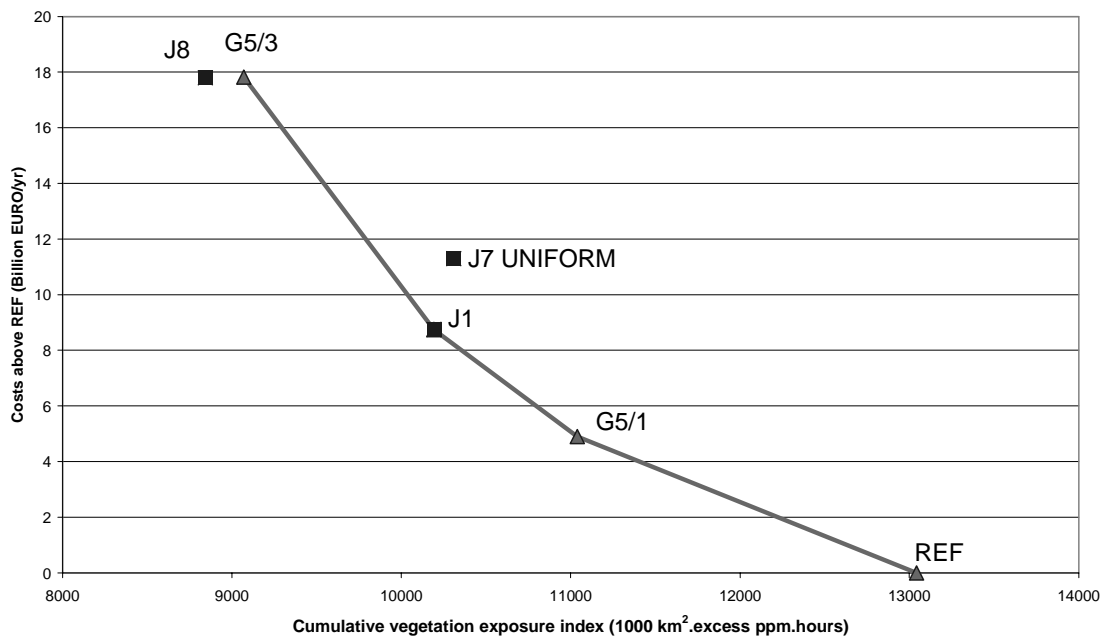


Figure 2.8: Cost-effectiveness of the 'flat rate' reduction scenarios in relation to the vegetation exposure index

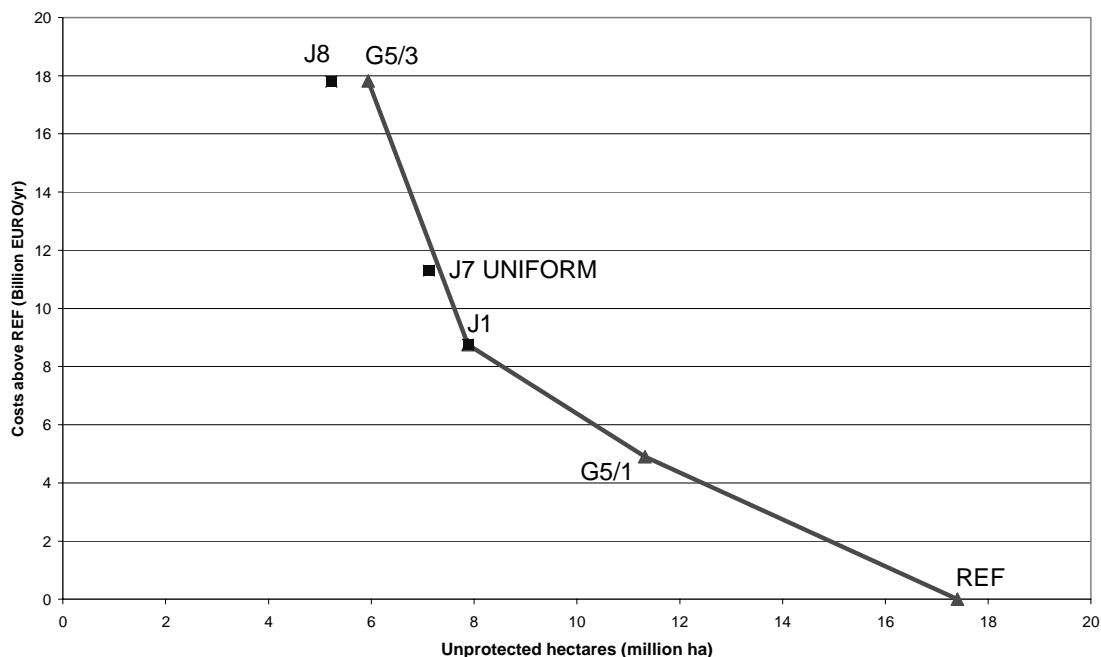


Figure 2.9: Cost-effectiveness of the 'flat rate' reduction scenarios in relation to the area of ecosystems not protected against acidification

## 2.3 Uniform Per-capita Emission Reduction Scenarios

As an alternative concept, it was proposed to relate international emission reduction requirements to a 'per-capita' indicator for emissions.

### 2.3.1 Uniform Per-capita Emission Reductions

The rationale for the illustrative 'uniform per-capita' scenario is to fix - as far as possible - each country's emissions to the value corresponding to the average per capita emission rates across Europe that were obtained for the J1 scenario. The average per capita emission rates for each pollutant for the J1 scenario are as follows:

SO <sub>2</sub>	15.5 kg capita <sup>-1</sup> year <sup>-1</sup>
NO <sub>x</sub>	19.1 kg capita <sup>-1</sup> year <sup>-1</sup>
VOC	18.3 kg capita <sup>-1</sup> year <sup>-1</sup>
NH <sub>3</sub>	8.5 kg capita <sup>-1</sup> year <sup>-1</sup>

For some combinations of countries and pollutants the European average emission rates would lead to emission values which lie outside the range available for control. In such cases the emissions for this sensitivity scenario were set to the relevant bound, i.e. "MFR" or REF, as appropriate.

### 2.3.2 Uniform Gap Closure For Per-Capita Emissions

As an alternative, a concept was explored in which the target is to close, for each country and pollutant, the gap between 1990 per-capita emissions and the lowest per-capita emissions of the REF scenario by an equal percentage, so that overall emissions are the same as in the J1 scenario. The following targets and gap-closure percentages were used:

	Gap closure	Target level (kg/capita)	corresponds to per-capita emissions in 1990 of
SO <sub>2</sub>	77.8 %	3.78	Switzerland
NO <sub>x</sub>	66.2 %	11.15	Albania
VOC	62.0 %	9.01	FYR. Macedonia
NH <sub>3</sub>	43.6 %	5.04	Norway

If for a particular country these reductions fall outside the REF - MFR range, then the REF/MFR values were used instead.

Results of the analysis are presented in Table 2.17 to Table 2.24.

Table 2.17: NO<sub>x</sub> emissions for the 'per-capita' emission control scenarios. Percentage changes relate to the year 1990.

	J1 Central case		J11 Equal per-capita emissions		J13 Per-capita gap closure.	
	kt	<i>Change</i>	kt	<i>Change</i>	kt	<i>Change</i>
Austria	91	-53%	103	-46%	103	-46%
Belgium	127	-64%	191	-46%	191	-46%
Denmark	113	-59%	98	-64%	128	-53%
Finland	152	-45%	95	-66%	130	-53%
France	704	-62%	858	-54%	858	-54%
Germany	1081	-59%	1184	-56%	1184	-56%
Greece	344	0%	248	-28%	248	-28%
Ireland	55	-51%	67	-41%	64	-43%
Italy	901	-56%	1100	-46%	1113	-45%
Luxembourg	8	-64%	7	-68%	10	-55%
Netherlands	266	-51%	280	-48%	280	-48%
Portugal	144	-31%	177	-15%	143	-31%
Spain	726	-38%	713	-39%	668	-43%
Sweden	159	-53%	164	-51%	178	-47%
UK	1181	-58%	1095	-61%	1186	-58%
EU-15	6054	-54%	6380	-52%	6484	-51%
Albania	36	50%	36	50%	32	33%
Belarus	290	-28%	195	-51%	211	-48%
Bosnia-H	53	-34%	60	-25%	60	-25%
Bulgaria	266	-25%	172	-52%	186	-48%
Croatia	87	6%	90	10%	62	-24%
Czech Rep.	188	-66%	198	-64%	261	-52%
Estonia	73	-13%	30	-64%	40	-52%
Hungary	137	-37%	198	-10%	150	-32%
Latvia	118	1%	59	-50%	59	-50%
Lithuania	134	-12%	71	-54%	79	-48%
Norway	142	-35%	125	-43%	125	-43%
Poland	654	-46%	729	-40%	693	-43%
R.of Moldova	64	-26%	66	-24%	62	-29%
Romania	328	-37%	443	-14%	346	-33%
Russia	2653	-24%	1971	-43%	1940	-44%
Slovakia	115	-47%	101	-54%	113	-48%
Slovenia	34	-43%	36	-40%	35	-42%
Switzerland	76	-53%	79	-52%	79	-52%
FYR of Mac.	29	-26%	29	-26%	29	-26%
Ukraine	1222	-35%	967	-49%	1011	-46%
Yugoslavia	132	-37%	152	-28%	149	-29%
Non-EU	6830	-33%	5808	-43%	5723	-44%
Total	14513	-42%	13817	-45%	13836	-45%

Table 2.18: VOC emissions for the 'per-capita' emission control scenarios. Percentage changes relate to the year 1990.

	J1 Central case		J11 Equal per-capita emissions		J13 Per-capita gap closure.	
	kt	<i>Change</i>	kt	<i>Change</i>	kt	<i>Change</i>
Austria	142	-60%	142	-60%	177	-50%
Belgium	103	-72%	193	-48%	193	-48%
Denmark	85	-53%	85	-53%	85	-53%
Finland	110	-48%	92	-57%	109	-49%
France	989	-58%	1038	-56%	1221	-49%
Germany	995	-68%	1137	-64%	1137	-64%
Greece	261	-22%	184	-45%	184	-45%
Ireland	55	-50%	55	-50%	55	-50%
Italy	1030	-50%	1056	-49%	1102	-46%
Luxembourg	7	-63%	7	-63%	7	-63%
Netherlands	157	-68%	233	-52%	233	-52%
Portugal	102	-52%	144	-32%	135	-36%
Spain	648	-36%	669	-34%	592	-41%
Sweden	241	-53%	174	-66%	242	-53%
UK	1101	-59%	1051	-61%	1334	-50%
EU-15	6024	-57%	6260	-55%	6805	-52%
Albania	41	32%	41	32%	30	-3%
Belarus	298	-20%	188	-49%	198	-47%
Bosnia-H	48	-6%	48	-6%	45	-12%
Bulgaria	185	-5%	165	-15%	124	-36%
Croatia	86	-17%	86	-17%	65	-37%
Czech Rep.	156	-65%	190	-57%	226	-49%
Estonia	49	9%	29	-36%	26	-42%
Hungary	137	-33%	160	-22%	135	-34%
Latvia	56	-11%	42	-33%	39	-38%
Lithuania	105	-5%	68	-39%	63	-43%
Norway	195	-34%	135	-55%	136	-54%
Poland	475	-40%	700	-12%	516	-35%
R.of Moldova	42	-16%	42	-16%	42	-16%
Romania	500	-1%	426	-15%	321	-36%
Russia	2723	-23%	1861	-47%	1922	-46%
Slovakia	140	-7%	97	-36%	87	-42%
Slovenia	40	-27%	36	-35%	32	-42%
Switzerland	144	-48%	124	-55%	143	-49%
FYR of Mac.	19	0%	19	0%	19	0%
Ukraine	770	-34%	836	-28%	724	-38%
Yugoslavia	138	-3%	139	-2%	112	-21%
Non-EU	6345	-26%	5431	-37%	5006	-42%
Total	12370	-45%	11691	-48%	11811	-48%

Table 2.19: SO<sub>2</sub> emissions for the 'per-capita' emission control scenarios. Percentage changes relate to the year 1990.

	J1 Central case		J11 Equal per-capita emissions		J13 Per-capita gap closure.	
	kt	<i>Change</i>	kt	<i>Change</i>	kt	<i>Change</i>
Austria	35	-62%	40	-57%	40	-57%
Belgium	76	-77%	169	-50%	107	-68%
Denmark	60	-67%	79	-57%	56	-69%
Finland	116	-49%	77	-66%	71	-69%
France	219	-82%	448	-64%	444	-64%
Germany	463	-91%	581	-89%	521	-90%
Greece	546	8%	155	-69%	142	-72%
Ireland	36	-80%	54	-70%	50	-72%
Italy	290	-83%	566	-66%	543	-68%
Luxembourg	3	-79%	4	-71%	4	-71%
Netherlands	50	-75%	73	-64%	73	-64%
Portugal	141	-50%	141	-50%	92	-68%
Spain	747	-66%	577	-74%	596	-73%
Sweden	67	-44%	67	-44%	53	-55%
UK	499	-87%	886	-77%	980	-74%
EU-15	3349	-80%	3918	-76%	3771	-77%
Albania	55	-24%	50	-31%	26	-64%
Belarus	494	-41%	158	-81%	218	-74%
Bosnia-H	162	-67%	70	-86%	121	-75%
Bulgaria	378	-79%	145	-92%	436	-76%
Croatia	23	-87%	70	-61%	54	-70%
Czech Rep.	283	-85%	267	-86%	366	-80%
Estonia	175	-36%	24	-91%	66	-76%
Hungary	296	-68%	296	-68%	296	-68%
Latvia	104	-14%	42	-65%	35	-71%
Lithuania	107	-50%	58	-73%	58	-73%
Norway	18	-65%	32	-38%	24	-54%
Poland	722	-76%	590	-80%	780	-74%
R.of Moldova	38	-81%	67	-66%	57	-71%
Romania	148	-89%	359	-73%	364	-73%
Russia	2186	-56%	1632	-67%	1418	-72%
Slovakia	92	-83%	91	-83%	137	-75%
Slovenia	14	-93%	30	-85%	50	-75%
Switzerland	23	-47%	26	-40%	26	-40%
FYR of Mac.	81	-24%	33	-69%	30	-72%
Ukraine	1457	-61%	782	-79%	973	-74%
Yugoslavia	217	-63%	162	-72%	161	-72%
Non-EU	7071	-67%	4983	-77%	5695	-74%
Total	11572	-70%	10053	-74%	10618	-73%



Table 2.20: NH<sub>3</sub> emissions for the 'per-capita' emission control scenarios. Percentage changes relate to the year 1990.

	J1 Central case		J11 Equal per-capita emissions		J13 Per-capita gap closure.	
	kt	<i>Change</i>	kt	<i>Change</i>	kt	<i>Change</i>
Austria	66	-14%	66	-14%	61	-21%
Belgium	60	-38%	93	-4%	79	-19%
Denmark	69	-10%	44	-43%	55	-29%
Finland	31	-23%	31	-23%	31	-23%
France	642	-20%	526	-35%	580	-28%
Germany	413	-45%	571	-25%	571	-25%
Greece	73	-9%	74	-8%	67	-16%
Ireland	116	-9%	111	-13%	111	-13%
Italy	356	-23%	432	-6%	387	-16%
Luxembourg	7	0%	7	0%	7	0%
Netherlands	105	-55%	127	-45%	136	-42%
Portugal	65	-8%	67	-6%	62	-13%
Spain	353	0%	318	-10%	281	-20%
Sweden	48	-21%	48	-21%	48	-21%
UK	264	-20%	297	-10%	297	-10%
EU-15	2668	-25%	2811	-21%	2772	-23%
Albania	32	0%	28	-13%	25	-22%
Belarus	140	-36%	103	-53%	146	-33%
Bosnia-H	22	-29%	23	-26%	23	-26%
Bulgaria	105	-26%	86	-39%	99	-30%
Croatia	29	-28%	37	-8%	33	-18%
Czech Rep.	101	-6%	88	-18%	83	-22%
Estonia	29	0%	16	-45%	20	-31%
Hungary	77	-36%	88	-27%	90	-25%
Latvia	35	-19%	23	-47%	30	-30%
Lithuania	72	-10%	49	-39%	53	-34%
Norway	21	-9%	21	-9%	21	-9%
Poland	468	-7%	368	-27%	369	-27%
R.of Moldova	41	-13%	37	-21%	36	-23%
Romania	227	-22%	206	-29%	216	-26%
Russia	894	-30%	836	-35%	891	-30%
Slovakia	39	-35%	45	-25%	45	-25%
Slovenia	16	-30%	17	-26%	17	-26%
Switzerland	63	-13%	58	-19%	56	-22%
FYR of Mac.	15	-12%	16	-6%	14	-18%
Ukraine	588	-19%	431	-41%	523	-28%
Yugoslavia	64	-29%	82	-9%	74	-18%
Non-EU	3077	-23%	2659	-33%	2864	-28%
Total	5745	-24%	5470	-28%	5635	-25%

Table 2.21: Control costs on top of the REF scenarios for SO<sub>2</sub>, NO<sub>x</sub> and VOC for the 'per-capita' emission control scenarios (in million EURO/year)

	NO <sub>x</sub> & VOC			SO <sub>2</sub>		
	J1 Central	J11 Equal per- capita emissions	J13 per-capita gap closure.	J1 Central	J11 Equal per- capita emissions	J13 per-capita gap closure.
Austria	70	51	8	5	0	0
Belgium	452	0	0	122	9	45
Denmark	8	32	0	13	5	17
Finland	0	98	5	0	74	106
France	437	127	0	132	0	2
Germany	484	0	0	240	0	51
Greece	2	489	490	0	164	195
Ireland	10	0	1	12	4	6
Italy	245	74	32	87	0	5
Luxembourg	2	9	0	0	0	0
Netherlands	112	0	0	19	0	0
Portugal	57	0	21	0	0	20
Spain	42	44	163	9	65	58
Sweden	45	397	29	0	0	80
UK	353	625	13	295	33	0
EU-15	2318	1946	761	935	354	586
Albania	0	0	5	0	1	10
Belarus	3	172	123	0	125	99
Bosnia-H	2	0	0	55	85	68
Bulgaria	10	229	192	58	182	50
Croatia	5	4	67	18	0	4
Czech Rep.	235	141	40	36	86	0
Estonia	0	114	67	0	73	48
Hungary	112	0	73	113	113	113
Latvia	0	192	176	0	22	30
Lithuania	0	170	140	0	21	20
Norway	12	310	278	10	0	3
Poland	373	131	259	283	422	254
R.of Moldova	0	0	0	30	18	22
Romania	100	12	129	137	53	52
Russia	0	1021	1074	54	286	317
Slovakia	11	89	63	25	32	0
Slovenia	1	2	6	23	16	8
Switzerland	2	21	0	1	0	0
FYR of Mac.	0	0	0	0	26	28
Ukraine	44	408	312	8	256	175
Yugoslavia	6	0	4	27	71	71
Non-EU	917	3013	3009	879	1887	1374
Total	3235	4959	3770	1814	2240	1960

Table 2.22: Control costs for NH<sub>3</sub> emissions and total costs on top of the REF for the 'per-capita' emission control scenarios (in million EURO/year)

	NH <sub>3</sub>			Total		
	J1 Central	J11 Equal per- capita emission s	J13 Per- capita gap closure.	J1 Central	J11 Equal per- capita emission s	J13 Per- capita gap closure.
Austria	1	2	29	76	53	37
Belgium	312	4	53	886	12	98
Denmark	2	539	195	22	575	211
Finland	0	0	0	0	173	111
France	367	1592	843	936	1719	846
Germany	842	0	0	1567	0	51
Greece	0	0	20	2	654	705
Ireland	146	455	455	168	460	462
Italy	85	0	46	417	74	83
Luxembourg	0	0	0	2	9	0
Netherlands	672	108	0	803	108	0
Portugal	2	0	8	59	0	50
Spain	0	101	357	51	210	578
Sweden	0	0	0	45	397	109
UK	23	0	0	671	658	13
EU-15	2450	2801	2006	5704	5100	3354
Albania	1	10	42	1	11	57
Belarus	9	433	7	12	729	229
Bosnia-H	1	0	0	58	85	68
Bulgaria	13	262	50	81	673	292
Croatia	3	0	2	26	4	73
Czech Rep.	9	86	134	280	312	173
Estonia	0	83	21	0	270	136
Hungary	319	124	102	545	237	288
Latvia	0	33	2	0	247	208
Lithuania	4	246	143	4	437	304
Norway	3	0	0	25	310	281
Poland	182	1455	1428	838	2007	1941
R.of Moldova	3	12	19	33	29	41
Romania	304	764	479	541	829	660
Russia	0	34	7	54	1340	1397
Slovakia	7	1	1	43	122	64
Slovenia	2	2	1	25	20	15
Switzerland	6	45	87	9	66	88
FYR of Mac.	1	0	2	1	26	29
Ukraine	30	1334	307	82	1998	793
Yugoslavia	94	0	11	128	71	87
Non-EU	991	4922	2844	2787	9822	7226
Total	3442	7723	4850	8490	14922	10580

Table 2.23: Cumulative ozone exposure indices for the 'per-capita' emission control scenarios

	Population			Vegetation		
	J1 Central	J11 Equal per-capita emissions	J13 Per- capita gap closure.	J1 Central	J11 Equal per-capita emissions	J13 Per- capita gap closure.
Austria	1	2	2	194	227	233
Belgium	22	30	32	115	133	138
Denmark	1	2	2	30	38	45
Finland	0	0	0	0	0	0
France	54	76	83	1865	2195	2283
Germany	91	121	129	901	1085	1131
Greece	3	2	2	146	122	117
Ireland	0	1	1	3	5	7
Italy	40	52	55	993	1098	1116
Luxembourg	1	1	1	11	13	14
Netherlands	26	34	36	63	73	76
Portugal	6	7	7	229	262	240
Spain	3	5	4	1046	1133	1044
Sweden	0	0	0	7	8	11
UK	49	61	73	111	123	150
EU-15	298	394	427	5714	6516	6605
Albania	0	0	0	0	0	45
Belarus	0	0	0	44	20	21
Bosnia-H	0	0	0	126	148	140
Bulgaria	0	0	0	228	205	187
Croatia	1	2	2	173	197	189
Czech Rep.	5	7	8	218	260	269
Estonia	0	0	0	0	0	0
Hungary	6	9	8	290	348	318
Latvia	0	0	0	2	0	0
Lithuania	0	0	0	9	2	2
Norway	0	0	0	1	1	1
Poland	18	25	24	529	622	612
R.of Moldova	0	0	0	43	40	37
Romania	1	3	1	458	512	447
Russia	5	2	2	861	484	474
Slovakia	3	4	4	153	175	168
Slovenia	1	1	1	78	86	87
Switzerland	1	1	2	70	78	83
FYR of Mac.	0	0	0	33	32	30
Ukraine	6	4	3	971	805	782
Yugoslavia	1	2	1	195	218	200
Non-EU	48	62	57	4481	4234	4092
Total	346	456	484	10194	10750	10697

Table 2.24: Ecosystems with deposition above critical loads for the 'per-capita' emission control scenarios (1000 hectares)

	Acidification			Eutrophication		
	J1 Central	J11 Equal per-capita emissions	J13 Per- capita gap closure.	J1 Central	J11 Equal per-capita emissions	J13 Per- capita gap closure.
Austria	68	117	117	2477	2989	2907
Belgium	52	118	111	572	633	629
Denmark	5	6	6	85	18	60
Finland	756	289	339	1738	1164	1394
France	84	108	108	21632	19658	20598
Germany	567	1227	1246	7312	8676	8772
Greece	0	0	0	85	48	47
Ireland	8	9	9	29	28	28
Italy	51	62	59	2508	3566	3333
Luxembourg	1	4	4	63	69	70
Netherlands	76	177	174	278	286	288
Portugal	1	1	1	580	691	596
Spain	17	9	10	850	477	286
Sweden	1166	1126	1146	620	574	671
UK	636	1029	1119	62	95	123
EU-15	3486	4281	4448	38890	38972	39804
Albania	0	0	0	160	130	118
Belarus	686	2	62	924	597	794
Bosnia-H	0	0	0	460	590	541
Bulgaria	0	0	0	1263	1200	1173
Croatia	0	0	0	10	17	16
Czech Rep.	81	125	182	1983	2028	2017
Estonia	8	2	3	598	479	544
Hungary	37	38	38	125	130	130
Latvia	0	0	0	1417	719	1030
Lithuania	5	0	0	894	594	732
Norway	1928	2055	2091	35	33	52
Poland	173	161	204	14894	13449	13622
R.of Moldova	10	10	10	0	0	0
Romania	17	17	17	1770	1706	1721
Russia	1026	54	86	23123	16534	18294
Slovakia	149	156	174	939	1037	1036
Slovenia	4	4	5	87	98	94
Switzerland	35	44	43	1468	1615	1541
FYR of Mac.	0	0	0	108	93	92
Ukraine	237	16	191	3859	3249	3557
Yugoslavia	0	0	0	1280	1818	1553
Non-EU	4397	2686	3107	55396	46116	48655
Total	7883	6967	7555	94287	85087	88460

## **ANNEX 1: Description of Measures Assumed for the REF Scenario for SO<sub>2</sub> Emissions**



# Description of control strategies

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Country: **AUSTRIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Limestone injection	10	
		Wet flue gases desulphurisation	90	
	Industry - other combustion	Limestone injection	10	
		Wet flue gases desulphurisation	90	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	90	
	Power plants, new	Wet flue gases desulphurisation	100	
Coke and briquettes	Refineries and other conversion	Wet flue gases desulphurisation	100	
	Domestic	Low sulphur coke	100	
Gas oil (diesel, light fuel oil)	Power plants, new	Low sulphur coke	100	
		Domestic	Low sulphur gas oil - 0.05 % S	65
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Other transport - land based	Low sulphur gas oil - 0.2 % S	36	
	Power plants existing, other	Low sulphur gas oil - 0.005 % S	100	
		Low sulphur gas oil - 0.05 % S	65	
	Power plants, new	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Domestic	Low sulphur coal	100
		Industry - combustion in boilers	Low sulphur coal	10
			Wet flue gases desulphurisation	90
		Industry - other combustion	Low sulphur coal	10
Wet flue gases desulphurisation			90	
Other transport - land based		Low sulphur coal	100	
Power plants existing, other		Wet flue gases desulphurisation, already retrofitted	100	
Power plants existing, wet bottom boilers		Wet flue gases desulphurisation, already retrofitted	100	
Power plants, new		Wet flue gases desulphurisation	100	
Refineries and other conversion		Low sulphur coal	10	
		Wet flue gases desulphurisation	90	
Heavy fuel oil		Domestic	Low sulphur fuel oil	100
	Industry - combustion in boilers	Low sulphur fuel oil	85	
		Low sulphur fuel oil	85	
	Other transport - land based	Low sulphur fuel oil	100	
	Power plants existing, other	Low sulphur fuel oil	25	
		Wet flue gases desulphurisation, already retrofitted	75	
Power plants, new	Wet flue gases desulphurisation	100		
Refineries and other conversion	Wet flue gases desulphurisation	80		
Other solid - high S	Industry - combustion in boilers	Wet flue gases desulphurisation	60	
		Wet flue gases desulphurisation	60	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	75	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Wet flue gases desulphurisation	60	
	Industry - process emissions	Stage 2 control	100	



## Description of control strategies

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Country: **BELGIUM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
Hard coal	Power plants existing, other	Low sulphur coal	33
	Power plants, new	Wet flue gases desulphurisation	100
Heavy fuel oil	Domestic	Low sulphur fuel oil	79
	Industry - combustion in boilers	Low sulphur fuel oil	85
		Low sulphur fuel oil	85
	Other transport - land based	Low sulphur fuel oil	79
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	85
Industry - process emissions		Stage 1 control	50

Country: **BULGARIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
		Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Industry - combustion in boilers	Wet flue gases desulphurisation	60
	Industry - other combustion	Wet flue gases desulphurisation	60
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	60

## Description of control strategies

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Country: **CROATIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Domestic	Low sulphur fuel oil	33
	Industry - combustion in boilers	Low sulphur fuel oil	18
		Wet flue gases desulphurisation	60
	Industry - other combustion	Low sulphur fuel oil	18
		Wet flue gases desulphurisation	60
	Other transport - land based	Low sulphur fuel oil	70
	Power plants existing, other	Low sulphur fuel oil	70
	Power plants, new	Wet flue gases desulphurisation	100
Refineries and other conversion	Wet flue gases desulphurisation	70	

Country: **CZECH REPUBLIC**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	30	
	Industry - other combustion	Wet flue gases desulphurisation	30	
	Power plants existing, other		Limestone injection	45
			Wet flue gases desulphurisation, already retrofitted	55
	Power plants, new		Limestone injection	30
			Wet flue gases desulphurisation	70
Gas oil (diesel, light fuel oil)	Refineries and other conversion	Wet flue gases desulphurisation	30	
	Domestic	Low sulphur gas oil - 0.2 % S	100	
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100	
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100	
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100	
	Power plants, new	Low sulphur gas oil - 0.2 % S	100	
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100	
Hard coal	Road transport	Low sulphur gas oil - 0.05 % S	100	
	Industry - combustion in boilers	Wet flue gases desulphurisation	30	
	Industry - other combustion	Limestone injection	50	
	Power plants existing, other	Limestone injection	100	
	Power plants, new	Limestone injection	100	
Refineries and other conversion	Wet flue gases desulphurisation	30		
Heavy fuel oil	Domestic	Low sulphur fuel oil	80	
	Industry - combustion in boilers	Low sulphur fuel oil	70	

## Description of control strategies

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Country: **CZECH REPUBLIC**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Industry - combustion in boilers	Wet flue gases desulphurisation	30
	Industry - other combustion	Low sulphur fuel oil	70
		Wet flue gases desulphurisation	30
	Other transport - land based	Low sulphur fuel oil	70
	Power plants existing, other	Low sulphur fuel oil	52
		Wet flue gases desulphurisation, already retrofitted	35
	Power plants, new	Low sulphur fuel oil	40
Wet flue gases desulphurisation		50	
Other solid - high S	Refineries and other conversion	Wet flue gases desulphurisation	50
	Industry - combustion in boilers	Wet flue gases desulphurisation	30
		Wet flue gases desulphurisation	30
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100
	Refineries and other conversion	Wet flue gases desulphurisation	30
	Industry - process emissions	Stage 1 control	100

Country: **DENMARK**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
	Hard coal	Domestic	Low sulphur coal
Industry - combustion in boilers		Wet flue gases desulphurisation	25
Industry - other combustion		Low sulphur coal	25
Other transport - land based		Low sulphur coal	100
Power plants existing, other		Low sulphur coal	10
Power plants, new		Wet flue gases desulphurisation	100
Refineries and other conversion		Wet flue gases desulphurisation	25
Heavy fuel oil	Domestic	Low sulphur fuel oil	90
	Industry - combustion in boilers	Low sulphur fuel oil	90
		Low sulphur fuel oil	90
	Other transport - land based	Low sulphur fuel oil	90
	Power plants existing, other	Low sulphur fuel oil	90
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	90
	Industry - process emissions	Stage 1 control	100

## Description of control strategies

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Country: **FINLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Limestone injection	25
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
	Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation
Industry - other combustion		Wet flue gases desulphurisation	90
Power plants existing, other		Wet flue gases desulphurisation, already retrofitted	100
Power plants existing, wet bottom boilers		Wet flue gases desulphurisation, already retrofitted	100
Power plants, new		Wet flue gases desulphurisation	100
Refineries and other conversion		Low sulphur coal	10
Heavy fuel oil	Domestic	Wet flue gases desulphurisation	46
		Low sulphur fuel oil	100
	Industry - combustion in boilers	Low sulphur fuel oil	100
	Industry - other combustion	Low sulphur fuel oil	90
	Other transport - land based	Low sulphur fuel oil	100
	Power plants existing, other	Low sulphur fuel oil	100
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	10
Other solid - high S	Power plants, new	Wet flue gases desulphurisation	70
		Wet flue gases desulphurisation	50
	Industry - process emissions	Stage 2 control	6
		Stage 3 control	94

## Description of control strategies

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Country: **FRANCE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	6
	Industry - other combustion	Wet flue gases desulphurisation	6
	Power plants existing, other	Limestone injection	100
	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Wet flue gases desulphurisation	6
		Low sulphur gas oil - 0.05 % S	65
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
Hard coal	Industry - combustion in boilers	Low sulphur coal	16
		Wet flue gases desulphurisation	2
	Industry - other combustion	Low sulphur coal	16
		Wet flue gases desulphurisation	2
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur coal	16
Heavy fuel oil	Domestic	Low sulphur fuel oil	50
	Industry - combustion in boilers	Low sulphur fuel oil	85
		Low sulphur fuel oil	85
	Industry - other combustion	Low sulphur fuel oil	85
	Other transport - land based	Low sulphur fuel oil	86
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	85

# Description of control strategies

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Country: **GERMANY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Limestone injection	100	
	Industry - other combustion	Limestone injection	100	
	Power plants existing, other	Limestone injection	2	
		Wet flue gases desulphurisation, already retrofitted	98	
	Power plants, new	High eff-cy flue gases desulphurisation	3	
Gas oil (diesel, light fuel oil)	Refineries and other conversion	Wet flue gases desulphurisation	97	
		Limestone injection	100	
	Domestic	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Power plants, new	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Industry - combustion in boilers	Limestone injection	25
			Wet flue gases desulphurisation	75
		Industry - other combustion	Limestone injection	100
Limestone injection			4	
Power plants existing, other		Wet flue gases desulphurisation, already retrofitted	96	
		Limestone injection	4	
Power plants existing, wet bottom boilers		Wet flue gases desulphurisation, already retrofitted	96	
		Wet flue gases desulphurisation	100	
Refineries and other conversion		Limestone injection	100	
Heavy fuel oil		Domestic	Low sulphur fuel oil	80
	Industry - combustion in boilers	Wet flue gases desulphurisation	100	
		Low sulphur fuel oil	100	
	Industry - other combustion	Low sulphur fuel oil	80	
	Other transport - land based	Low sulphur fuel oil	80	
	Other transport - maritime activitie	Low sulphur fuel oil	80	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100	
Power plants, new	Wet flue gases desulphurisation	100		
Other solid - high S	Industry - combustion in boilers	Wet flue gases desulphurisation	40	
		Wet flue gases desulphurisation	40	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Wet flue gases desulphurisation	40	
	Industry - process emissions	Stage 2 control	100	

## Description of control strategies

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Country: **GREECE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Br. coal, 0.3 kg SO <sub>2</sub> /GJ	Power plants, new	Wet flue gases desulphurisation	100	
Br. coal, 0.9 kg SO <sub>2</sub> /GJ		Wet flue gases desulphurisation	100	
Br. coal, 2.9 kg SO <sub>2</sub> /GJ		Wet flue gases desulphurisation	100	
Br. coal, 4.1 kg SO <sub>2</sub> /GJ		Wet flue gases desulphurisation	100	
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Power plants, new	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Power plants, new	Wet flue gases desulphurisation	100
	Heavy fuel oil	Domestic	Low sulphur fuel oil	86
Low sulphur fuel oil			86	
Industry - combustion in boilers		Low sulphur fuel oil	86	
		Low sulphur fuel oil	86	
Power plants existing, other		Low sulphur fuel oil	35	
Power plants, new		Low sulphur fuel oil	61	
Refineries and other conversion	Low sulphur fuel oil	86		

Country: **HUNGARY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
		Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
		Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
		Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
Road transport	Low sulphur gas oil - 0.05 % S	100	
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
		Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Domestic	Low sulphur fuel oil	33
		Low sulphur fuel oil	18
	Industry - combustion in boilers	Wet flue gases desulphurisation	60
		Low sulphur fuel oil	18
	Other transport - land based	Wet flue gases desulphurisation	60
	Low sulphur fuel oil	70	

## Description of control strategies

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Country: **HUNGARY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Power plants existing, other	Low sulphur fuel oil	70
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	70

Country: **IRELAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
Road transport	Low sulphur gas oil - 0.005 % S	100	
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	57
	Industry - other combustion	Wet flue gases desulphurisation	57
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	57
Heavy fuel oil	Domestic	Low sulphur fuel oil	86
	Industry - combustion in boilers	Low sulphur fuel oil	82
	Industry - other combustion	Low sulphur fuel oil	82
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	86



## Description of control strategies

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Country: **ITALY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	36
	Industry - other combustion	Wet flue gases desulphurisation	36
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	36
Heavy fuel oil	Domestic	Low sulphur fuel oil	100
		Low sulphur fuel oil	85
	Industry - combustion in boilers	Low sulphur fuel oil	85
		Low sulphur fuel oil	85
	Other transport - land based	Low sulphur fuel oil	88
	Power plants existing, other	Low sulphur fuel oil	50
		Wet flue gases desulphurisation	50
	Power plants, new	Low sulphur fuel oil	88
		Stage 1 control	100
Refineries and other conversion	Low sulphur fuel oil	88	
Industry - process emissions	Stage 1 control	100	

Country: **LUXEMBOURG**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	6
	Industry - other combustion	Wet flue gases desulphurisation	6
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	6
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
Road transport	Low sulphur gas oil - 0.005 % S	100	

## Description of control strategies

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Country: **LUXEMBOURG**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Hard coal	Industry - combustion in boilers	Low sulphur coal	16
		Wet flue gases desulphurisation	2
	Industry - other combustion	Low sulphur coal	16
		Wet flue gases desulphurisation	2
Heavy fuel oil	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur coal	16
	Domestic	Low sulphur fuel oil	86
		Wet flue gases desulphurisation	66
	Industry - combustion in boilers	Low sulphur fuel oil	30
		Wet flue gases desulphurisation	66
	Other transport - land based	Low sulphur fuel oil	86
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	70
Industry - process emissions	Stage 1 control	50	
	Stage 2 control	50	

Country: **NETHERLANDS**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100	
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Power plants, new	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	60
			Wet flue gases desulphurisation	60
Power plants existing, other		Wet flue gases desulphurisation, already retrofitted	100	
Power plants existing, wet bottom boilers		Wet flue gases desulphurisation, already retrofitted	100	
Power plants, new		Wet flue gases desulphurisation	100	
Refineries and other conversion		Wet flue gases desulphurisation	60	
Heavy fuel oil	Domestic	Low sulphur fuel oil	65	
		Low sulphur fuel oil	60	
	Industry - combustion in boilers	Low sulphur fuel oil	50	
		Low sulphur fuel oil	65	
	Other transport - land based	Low sulphur fuel oil	65	
		Wet flue gases desulphurisation, already retrofitted	10	
	Power plants existing, other	Low sulphur fuel oil	65	
		Wet flue gases desulphurisation, already retrofitted	10	
	Power plants, new	Low sulphur fuel oil	65	
		Wet flue gases desulphurisation	10	
Refineries and other conversion	Low sulphur fuel oil	80		
Industry - process emissions	Stage 3 control	100		

# Description of control strategies

Country: **NORWAY**

Region: **WHOLE COUNTRY**

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	50	
		Wet flue gases desulphurisation	50	
	Industry - other combustion	Wet flue gases desulphurisation	50	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100	
	Power plants, new	Wet flue gases desulphurisation	100	
Coke and briquettes	Domestic	Low sulphur coke	100	
		Low sulphur gas oil - 0.05 % S	65	
Gas oil (diesel, light fuel oil)	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.05 % S	65	
	Other transport - land based	Low sulphur gas oil - 0.2 % S	36	
		Low sulphur gas oil - 0.005 % S	100	
	Other transport - maritime activitie	Low sulphur gas oil - 0.2 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Power plants, new	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Domestic	Low sulphur coal	100
			Low sulphur coal	100
		Industry - combustion in boilers	Low sulphur coal	50
			Wet flue gases desulphurisation	50
		Industry - other combustion	Low sulphur coal	50
			Wet flue gases desulphurisation	50
		Other transport - land based	Low sulphur coal	100
			Wet flue gases desulphurisation, already retrofitted	100
		Power plants existing, wet bottom boilers	Wet flue gases desulphurisation, already retrofitted	100
Power plants, new		Wet flue gases desulphurisation	100	
Refineries and other conversion		Wet flue gases desulphurisation	50	
Heavy fuel oil		Domestic	Low sulphur fuel oil	100
			Low sulphur fuel oil	70
		Industry - combustion in boilers	Wet flue gases desulphurisation	30
			Low sulphur fuel oil	50
	Industry - other combustion	Wet flue gases desulphurisation	50	
		Low sulphur fuel oil	100	
	Other transport - land based	Low sulphur fuel oil	100	
	Other transport - maritime activitie	Low sulphur fuel oil	100	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Low sulphur fuel oil	70	
Other solid - high S	Industry - combustion in boilers	Wet flue gases desulphurisation	30	
		Wet flue gases desulphurisation	60	
	Industry - other combustion	Wet flue gases desulphurisation	70	
		Wet flue gases desulphurisation, already retrofitted	60	
	Power plants existing, other	Wet flue gases desulphurisation	70	
	Power plants, new	Wet flue gases desulphurisation	50	
Refineries and other conversion	Wet flue gases desulphurisation	69		
Industry - process emissions	Stage 2 control	69		

## Description of control strategies

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Country: **POLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Coke and briquettes	Domestic	Low sulphur coke	60
Gas oil (diesel, light fuel oil)		Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Domestic	Low sulphur coal	70
	Other transport - land based	Low sulphur coal	70
	Power plants existing, other	Low sulphur coal	37
	Power plants, new	Wet flue gases desulphurisation	100
Heavy fuel oil	Industry - combustion in boilers	Low sulphur fuel oil	20
		Wet flue gases desulphurisation	30
	Industry - other combustion	Low sulphur fuel oil	20
		Wet flue gases desulphurisation	30
	Power plants existing, other	Low sulphur fuel oil	20
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	80
Other solid - high S	Power plants, new	Wet flue gases desulphurisation	100

Country: **PORTUGAL**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Road transport	Low sulphur gas oil - 0.005 % S	100
Hard coal	Power plants, new	Wet flue gases desulphurisation	100
		Wet flue gases desulphurisation	100
Heavy fuel oil	Domestic	Low sulphur fuel oil	79
	Industry - combustion in boilers	Low sulphur fuel oil	79
	Industry - other combustion	Low sulphur fuel oil	79
	Power plants existing, other	Low sulphur fuel oil	79
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	79

## Description of control strategies

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Country: **ROMANIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Industry - combustion in boilers	Wet flue gases desulphurisation	60
	Industry - other combustion	Wet flue gases desulphurisation	60
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	60

Country: **RUSSIAN FEDERATION**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Industry - combustion in boilers	Wet flue gases desulphurisation	60
	Industry - other combustion	Wet flue gases desulphurisation	60
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	60

# Description of control strategies

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Country: **SLOVAK REPUBLIC**

Region: **WHOLE COUNTRY**

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	30
	Industry - other combustion	Wet flue gases desulphurisation	30
	Power plants existing, other	Limestone injection	45
		Wet flue gases desulphurisation, already retrofitted	55
	Power plants, new	Limestone injection	30
Gas oil (diesel, light fuel oil)	Refineries and other conversion	Wet flue gases desulphurisation	70
		Wet flue gases desulphurisation	30
	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	30
	Industry - other combustion	Limestone injection	50
	Power plants existing, other	Limestone injection	100
	Power plants existing, wet bottom boilers	Wet flue gases desulphurisation, already retrofitted	100
	Power plants, new	Limestone injection	100
Heavy fuel oil	Refineries and other conversion	Wet flue gases desulphurisation	30
		Low sulphur fuel oil	80
	Industry - combustion in boilers	Low sulphur fuel oil	70
		Wet flue gases desulphurisation	30
	Industry - other combustion	Low sulphur fuel oil	70
		Wet flue gases desulphurisation	30
	Other transport - land based	Low sulphur fuel oil	70
		Low sulphur fuel oil	52
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	35
		Low sulphur fuel oil	40
Wet flue gases desulphurisation		50	
Refineries and other conversion	Wet flue gases desulphurisation	50	
	Wet flue gases desulphurisation	50	
Other solid - high S	Industry - combustion in boilers	Wet flue gases desulphurisation	30
	Industry - other combustion	Wet flue gases desulphurisation	30
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100
	Refineries and other conversion	Wet flue gases desulphurisation	30
	Industry - process emissions	Stage 1 control	100

## Description of control strategies

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Country: **SLOVENIA**

Region: **WHOLE COUNTRY**

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
	Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation
Industry - other combustion		Wet flue gases desulphurisation	24
Power plants existing, other		Wet flue gases desulphurisation	1
Power plants, new		Wet flue gases desulphurisation	100
Refineries and other conversion		Wet flue gases desulphurisation	24
Heavy fuel oil	Domestic	Low sulphur fuel oil	33
	Industry - combustion in boilers	Low sulphur fuel oil	18
		Wet flue gases desulphurisation	60
		Low sulphur fuel oil	18
	Industry - other combustion	Wet flue gases desulphurisation	60
		Low sulphur fuel oil	70
	Other transport - land based	Low sulphur fuel oil	70
	Power plants existing, other	Low sulphur fuel oil	70
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	70
Process emissions	Stage 1 control	100	

Country: **SPAIN**

Region: **WHOLE COUNTRY**

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants, new	Wet flue gases desulphurisation	100
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.05 % S	65
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	36
		Low sulphur gas oil - 0.005 % S	100
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
Low sulphur gas oil - 0.2 % S		36	
Road transport	Low sulphur gas oil - 0.005 % S	100	
Hard coal	Industry - combustion in boilers	Low sulphur coal	6
	Industry - other combustion	Low sulphur coal	6
	Power plants, new	Wet flue gases desulphurisation	100
Refineries and other conversion	Low sulphur coal	6	
	Low sulphur fuel oil	86	

## Description of control strategies

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Country: **SPAIN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Industry - combustion in boilers	Low sulphur fuel oil	78
	Industry - other combustion	Low sulphur fuel oil	78
	Other transport - land based	Low sulphur fuel oil	86
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Low sulphur fuel oil	78

Country: **SWEDEN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	50	
	Industry - other combustion	Wet flue gases desulphurisation	50	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Wet flue gases desulphurisation	50	
Coke and briquettes	Domestic	Low sulphur coke	100	
Gas oil (diesel, light fuel oil)		Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100	
	Other transport - maritime activitie	Low sulphur gas oil - 0.2 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Power plants, new	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Road transport	Low sulphur gas oil - 0.005 % S	100	
	Hard coal	Domestic	Low sulphur coal	100
		Industry - combustion in boilers	Low sulphur coal	50
Wet flue gases desulphurisation			50	
Industry - other combustion		Low sulphur coal	50	
		Wet flue gases desulphurisation	50	
Other transport - land based		Low sulphur coal	100	
Power plants existing, other		Wet flue gases desulphurisation, already retrofitted	100	
Power plants, new		Wet flue gases desulphurisation	100	
Refineries and other conversion		Wet flue gases desulphurisation	50	
Heavy fuel oil		Domestic	Low sulphur fuel oil	100
	Industry - combustion in boilers	Low sulphur fuel oil	70	
		Wet flue gases desulphurisation	30	
	Industry - other combustion	Low sulphur fuel oil	50	
		Wet flue gases desulphurisation	50	
	Other transport - land based	Low sulphur fuel oil	100	
	Other transport - maritime activitie	Low sulphur fuel oil	50	
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	100	
Power plants, new	Wet flue gases desulphurisation	100		
Refineries and other conversion	Low sulphur fuel oil	70		
		Wet flue gases desulphurisation	30	



## Description of control strategies

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Country: **SWEDEN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Other solid - high S	Industry - combustion in boilers	Wet flue gases desulphurisation	60
	Industry - other combustion	Wet flue gases desulphurisation	70
	Power plants existing, other	Wet flue gases desulphurisation, already retrofitted	60
	Power plants, new	Wet flue gases desulphurisation	70
	Refineries and other conversion	Wet flue gases desulphurisation	50
	Industry - process emissions	Stage 3 control	100

Country: **SWITZERLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	5	
	Industry - other combustion	Wet flue gases desulphurisation	5	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Wet flue gases desulphurisation	5	
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100	
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65	
		Low sulphur gas oil - 0.2 % S	36	
		Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36	
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65	
Low sulphur gas oil - 0.2 % S		36		
Road transport	Low sulphur gas oil - 0.005 % S	100		
Hard coal	Industry - combustion in boilers	Low sulphur coal	12	
		Wet flue gases desulphurisation	1	
	Industry - other combustion	Low sulphur coal	12	
		Wet flue gases desulphurisation	1	
Power plants, new	Wet flue gases desulphurisation	100		
Heavy fuel oil	Domestic	Low sulphur fuel oil	75	
		Industry - combustion in boilers	Low sulphur fuel oil	51
	Industry - other combustion	Wet flue gases desulphurisation	24	
		Low sulphur fuel oil	51	
	Other transport - land based	Wet flue gases desulphurisation	24	
		Low sulphur fuel oil	75	
	Power plants existing, other	Low sulphur fuel oil	75	
	Power plants, new	Wet flue gases desulphurisation	100	
	Refineries and other conversion	Low sulphur fuel oil	51	
		Wet flue gases desulphurisation	24	
Industry - process emissions	Stage 1 control	100		

## Description of control strategies

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Country: **UKRAINE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.2 % S	100
	Industry - combustion in boilers	Low sulphur gas oil - 0.2 % S	100
	Industry - other combustion	Low sulphur gas oil - 0.2 % S	100
	Other transport - land based	Low sulphur gas oil - 0.2 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.2 % S	100
	Power plants, new	Low sulphur gas oil - 0.2 % S	100
	Refineries and other conversion	Low sulphur gas oil - 0.2 % S	100
	Road transport	Low sulphur gas oil - 0.05 % S	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	24
Heavy fuel oil	Industry - combustion in boilers	Wet flue gases desulphurisation	60
	Industry - other combustion	Wet flue gases desulphurisation	60
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	60

Country: **UNITED KINGDOM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	32
	Industry - other combustion	Wet flue gases desulphurisation	32
	Power plants, new	Wet flue gases desulphurisation	100
	Refineries and other conversion	Wet flue gases desulphurisation	32
Gas oil (diesel, light fuel oil)	Domestic	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - combustion in boilers	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Industry - other combustion	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Other transport - land based	Low sulphur gas oil - 0.005 % S	100
	Power plants existing, other	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Power plants, new	Low sulphur gas oil - 0.05 % S	65
		Low sulphur gas oil - 0.2 % S	36
	Refineries and other conversion	Low sulphur gas oil - 0.05 % S	65
Low sulphur gas oil - 0.2 % S		36	
Road transport	Low sulphur gas oil - 0.005 % S	100	
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	32
	Industry - other combustion	Wet flue gases desulphurisation	32
	Power plants existing, other	Low sulphur coal	19
		Wet flue gases desulphurisation, already retrofitted	64
	Power plants, new	Wet flue gases desulphurisation	100
Heavy fuel oil	Domestic	Low sulphur fuel oil	85
	Industry - combustion in boilers	Low sulphur fuel oil	85
	Industry - other combustion	Low sulphur fuel oil	85

## Description of control strategies

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Country: **UNITED KINGDOM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Other transport - land based	Low sulphur fuel oil	85
	Power plants existing, other	Low sulphur fuel oil	86
	Power plants, new	Wet flue gases desulphurisation	100

Country: **YUGOSLAVIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
Hard coal	Industry - combustion in boilers	Wet flue gases desulphurisation	24
	Industry - other combustion	Wet flue gases desulphurisation	24
	Power plants, new	Wet flue gases desulphurisation	100
Heavy fuel oil	Industry - combustion in boilers	Low sulphur fuel oil	60
	Industry - other combustion	Low sulphur fuel oil	60
	Power plants, new	Wet flue gases desulphurisation	100

## **ANNEX 2: Description of Measures Assumed for the REF Scenario for NO<sub>x</sub> Emissions**



# Description of control strategies

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Country: **AUSTRIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	26
		Euro 1 (1992/93) standards	7	
		Euro 3 (2000) standards	31	
	Road transp - heavy duty trucks and buses	Euro 4 (post-2005) standards	36	
		Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	5	
		Euro 3 (2000) standards	51	
		Euro 4 (post-2005) standards	40	
Hard coal	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	50	
	Power plants, new	Comb. modification + selective cat. reduction	50	
	Refineries and other conversion	Selective catalytic reduction	50	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Combustion modification	100	
		Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	11	
		Euro 3 (2000) standards	35	
		Euro 4 (post-2005) standards	50	
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	50	
	Power plants, new	Comb. modification + selective cat. reduction	50	
	Refineries and other conversion	Selective catalytic reduction	40	
	Road transp - cars and light duty vehic. 4-stroke	Combustion modification	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Industry - process emissions	Three-way catalytic converter	100	
		Stage 2 control	100	

## Description of control strategies

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Country: **BELGIUM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Power plants, new	Selective catalytic reduction	50	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	27	
		Euro 1 (1992/93) standards	2	
		Euro 3 (2000) standards	27	
		Euro 4 (post-2005) standards	44	
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	6	
		Euro 3 (2000) standards	54	
		Euro 4 (post-2005) standards	40	
Hard coal	Power plants existing, other	Combustion modification	75	
		Comb. modification + selective cat. reduction	25	
Heavy fuel oil	Power plants, new	Selective catalytic reduction	90	
	Industry - combustion in boilers	Combustion modification	14	
	Industry - other combustion	Combustion modification	14	
	Power plants existing, other	Combustion modification	60	
	Power plants, new	Selective catalytic reduction	90	
Light fractions (e.g., gasoline, LPG)	Refineries and other conversion	Combustion modification	14	
		Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	0
			Euro 2 (1995/96) standards	8
			Euro 3 (2000) standards	34
			Euro 4 (post-2005) standards	57
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	21	
		Combustion modification	21	
	Power plants existing, other	Combustion modification	60	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	21	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Industry - process emissions	Stage 1 control	50	

Country: **BOSNIA HERZEG.**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
		Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Hard coal	Industry - combustion in boilers	Combustion modification	24
		Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
		Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
		Combustion modification	24
	Refineries and other conversion	Combustion modification	24

## Description of control strategies

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Country: **BULGARIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24

Country: **CROATIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24



## Description of control strategies

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Country: **CZECH REP.**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	20
	Refineries and other conversion	Combustion modification	20
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	50
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	69
	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	27
		Euro 2 (1995/96) standards	8
Hard coal	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	50
	Refineries and other conversion	Combustion modification	50
Heavy fuel oil	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	50
	Refineries and other conversion	Combustion modification	50
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	14
		Euro 2 (1995/96) standards	83
Natural gas (incl. other gases)	Industry - other combustion	Combustion modification	90
	Power plants existing, other	Combustion modification	90
	Refineries and other conversion	Combustion modification	60
	Industry - process emissions	Stage 1 control	50

Country: **DENMARK**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	35
		Euro 3 (2000) standards	15
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	7
		Euro 1 (1992/93) standards	36
		Euro 3 (2000) standards	38
		Euro 4 (post-2005) standards	0
Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	7	
	Euro 2 (1995/96) standards	53	
	Euro 3 (2000) standards	39	
	Euro 4 (post-2005) standards	88	
Hard coal	Power plants existing, other	Combustion modification	13
	Power plants, new	Comb. modification + selective cat. reduction	90
Heavy fuel oil	Power plants, new	Selective catalytic reduction	90
	Refineries and other conversion	Selective catalytic reduction	80
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Combustion modification	13
		Euro 1 (1992/93) standards	24
		Euro 2 (1995/96) standards	30
		Euro 3 (2000) standards	33
Natural gas (incl. other gases)	Power plants, new	Euro 4 (post-2005) standards	50
	Road transp - cars and light duty vehic. 4-stroke	Selective catalytic reduction	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
	Industry - process emissions	Three-way catalytic converter	100
		Stage 1 control	100

## Description of control strategies

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Country: **F.YU.R. OF MACEDONIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24

Country: **FINLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Comb. modification + selective cat. reduction	6	
	Industry - other combustion	Comb. modification + selective cat. reduction	6	
	Power plants existing, other	Combustion modification	54	
	Power plants, new	Selective catalytic reduction	54	
	Refineries and other conversion	Comb. modification + selective cat. reduction	6	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	13
		Euro 1 (1992/93) standards	5	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	40	
		Euro 4 (post-2005) standards	42	
		Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	5	
		Euro 3 (2000) standards	51	
		Euro 4 (post-2005) standards	40	
Hard coal	Industry - combustion in boilers	Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
	Industry - other combustion	Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
		Comb. modification + selective cat. reduction	43	
	Power plants existing, other	Combustion modification	100	
		Combustion modification	100	
		Combustion modification	100	
		Power plants, new	Selective catalytic reduction	100
Selective catalytic reduction		100		
Selective catalytic reduction		100		
Refineries and other conversion	Comb. modification + selective cat. reduction	43		
	Comb. modification + selective cat. reduction	43		
	Comb. modification + selective cat. reduction	43		
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	9	
		Comb. modification + selective cat. reduction	6	

## Description of control strategies

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Country: **FINLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Industry - other combustion	Combustion modification	9
		Comb. modification + selective cat. reduction	6
	Power plants existing, other	Combustion modification	18
		Selective catalytic reduction	50
	Power plants, new	Combustion modification	9
		Comb. modification + selective cat. reduction	6
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	4
		Euro 2 (1995/96) standards	12
		Euro 3 (2000) standards	37
		Euro 4 (post-2005) standards	47
Natural gas (incl. other gases)	Industry - combustion in boilers	Comb. modification + selective cat. reduction	7
	Industry - other combustion	Comb. modification + selective cat. reduction	7
	Power plants existing, other	Combustion modification	31
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Comb. modification + selective cat. reduction	7
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
	Industry - process emissions	Stage 1 control	100

Country: **FRANCE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	5	
	Industry - other combustion	Combustion modification	5	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	5	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	20
		Euro 1 (1992/93) standards	4	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	36	
		Euro 4 (post-2005) standards	36	
		Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	6	
Hard coal	Industry - combustion in boilers	Euro 3 (2000) standards	54	
		Euro 4 (post-2005) standards	40	
	Industry - other combustion	Combustion modification	16	
	Power plants existing, other	Combustion modification	16	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	16	
	Heavy fuel oil	Industry - combustion in boilers	Combustion modification	55
Industry - other combustion		Combustion modification	55	
Power plants existing, other		Combustion modification	100	
Power plants, new		Selective catalytic reduction	50	
Refineries and other conversion		Combustion modification	55	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	2	
		Euro 2 (1995/96) standards	21	
		Euro 3 (2000) standards	35	
		Euro 4 (post-2005) standards	40	

## Description of control strategies

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Country: **FRANCE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	30
	Industry - other combustion	Combustion modification	30
	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	30
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100

Country: **GERMANY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	85	
	Industry - other combustion	Combustion modification	85	
	Power plants existing, other	Combustion modification	94	
		Comb. modification + selective cat. reduction	6	
	Power plants, new	Selective catalytic reduction	50	
Fuelwood and other low S solid	Refineries and other conversion	Combustion modification	85	
	Power plants existing, other	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	25
			Euro 1 (1992/93) standards	4
			Euro 3 (2000) standards	34
		Euro 4 (post-2005) standards	34	
	Road transp - heavy duty trucks and buses		Euro 1 (1992/93) standards	0
			Euro 2 (1995/96) standards	6
			Euro 3 (2000) standards	54
			Euro 4 (post-2005) standards	40
Hard coal	Industry - combustion in boilers	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	
	Industry - other combustion	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants existing, wet bottom boilers	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	65	
Comb. modification + selective cat. reduction		20		
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	
	Industry - other combustion	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	6	
		Euro 2 (1995/96) standards	20	
		Euro 3 (2000) standards	35	
		Euro 4 (post-2005) standards	39	
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	65	
		Comb. modification + selective cat. reduction	20	

## Description of control strategies

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Country: **GERMANY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Natural gas (incl. other gases)	Industry - other combustion	Combustion modification	65
		Comb. modification + selective cat. reduction	20
	Power plants existing, other	Combustion modification	80
		Comb. modification + selective cat. reduction	20
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	65
		Comb. modification + selective cat. reduction	20
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
Industry - process emissions	Stage 2 control	100	

Country: **GREECE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Br. coal, 0.3 kg SO <sub>2</sub> /GJ	Industry - combustion in boilers	Combustion modification	100
	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
Br. coal, 0.9 kg SO <sub>2</sub> /GJ	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
Br. coal, 2.9 kg SO <sub>2</sub> /GJ		Selective catalytic reduction	50
Br. coal, 4.1 kg SO <sub>2</sub> /GJ	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
Fuelwood and other low S solid	Industry - combustion in boilers	Combustion modification	100
Gas oil (diesel, light fuel oil)	Industry - other combustion	Combustion modification	47
		Combustion modification	100
		Combustion modification	25
	Other transp. - maritime activ. - medium ships	Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	35
	Power plants existing, other	Combustion modification	100
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards
	Euro 1 (1992/93) standards		12
	Euro 3 (2000) standards		25
	Euro 4 (post-2005) standards		25
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	9
		Euro 2 (1995/96) standards	17
		Euro 3 (2000) standards	29
		Euro 4 (post-2005) standards	15
	Hard coal	Industry - combustion in boilers	Combustion modification
Power plants, new		Selective catalytic reduction	50
Heavy fuel oil	Domestic	Combustion modification - commercial boilers	100
	Industry - combustion in boilers	Combustion modification	100
	Industry - other combustion	Combustion modification	24
	Other transp. - maritime activ. - large ships	Comb. modification + selective cat. reduction	25
	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	100
	Refineries and other conversion	Combustion modification	100
	Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Combustion modification
Euro 1 (1992/93) standards			20
Euro 2 (1995/96) standards			23
Euro 3 (2000) standards			25
		Euro 4 (post-2005) standards	25

## Description of control strategies

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Country: **GREECE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Natural gas (incl. other gases)	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	100
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
	Industry - process emissions	Stage 1 control	100

Country: **HUNGARY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	96
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	86
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24

Country: **IRELAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Power plants, new	Selective catalytic reduction	50	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	24
		Euro 1 (1992/93) standards	5	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	35	
		Euro 4 (post-2005) standards	35	
		Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	7	
		Euro 3 (2000) standards	54	
		Euro 4 (post-2005) standards	39	
Hard coal	Industry - combustion in boilers	Combustion modification	57	
	Industry - other combustion	Combustion modification	57	
	Power plants, new	Selective catalytic reduction	50	
Heavy fuel oil	Industry - combustion in boilers	Selective catalytic reduction	50	
		Combustion modification	57	
		Combustion modification	30	
	Industry - other combustion	Combustion modification	30	

## Description of control strategies

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Country: **IRELAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Heavy fuel oil	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	30
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	2
		Euro 2 (1995/96) standards	28
		Euro 3 (2000) standards	33
		Euro 4 (post-2005) standards	37
Natural gas (incl. other gases)	Power plants, new	Selective catalytic reduction	50
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100

Country: **ITALY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	35
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	19
		Euro 1 (1992/93) standards	10
		Euro 3 (2000) standards	35
		Euro 4 (post-2005) standards	36
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	3
		Euro 2 (1995/96) standards	18
		Euro 3 (2000) standards	50
		Euro 4 (post-2005) standards	29
Hard coal	Industry - combustion in boilers	Combustion modification	36
		Comb. modification + selective cat. reduction	36
	Industry - other combustion	Combustion modification	36
		Comb. modification + selective cat. reduction	36
	Power plants existing, other	Comb. modification + selective cat. reduction	100
	Power plants, new	Selective catalytic reduction	90
	Refineries and other conversion	Combustion modification	36
		Comb. modification + selective cat. reduction	36
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	42
	Industry - other combustion	Combustion modification	42
	Power plants existing, other	Combustion modification	50
	Power plants, new	Selective catalytic reduction	50
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	8
		Euro 2 (1995/96) standards	25
		Euro 3 (2000) standards	31
		Euro 4 (post-2005) standards	33
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	44
	Industry - other combustion	Combustion modification	44
	Power plants existing, other	Combustion modification	50
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	44
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	

# Description of control strategies

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Country: **LUXEMBOURG**

Region: **WHOLE COUNTRY**

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	5	
	Industry - other combustion	Combustion modification	5	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	5	
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	15
		Euro 1 (1992/93) standards	0	
		Euro 3 (2000) standards	40	
	Road transp - heavy duty trucks and buses	Euro 4 (post-2005) standards	44	
		Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	1	
		Euro 3 (2000) standards	44	
		Euro 4 (post-2005) standards	55	
Hard coal	Industry - combustion in boilers	Combustion modification	16	
	Industry - other combustion	Combustion modification	16	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	16	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	55	
	Industry - other combustion	Combustion modification	55	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	55	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	3	
		Euro 3 (2000) standards	41	
		Euro 4 (post-2005) standards	55	
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	30	
	Industry - other combustion	Combustion modification	30	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	30	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Industry - process emissions	Stage 1 control	100	



## Description of control strategies

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Country: **NETHERLANDS**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	21
		Euro 1 (1992/93) standards	1	
		Euro 3 (2000) standards	38	
	Road transp - heavy duty trucks and buses	Euro 4 (post-2005) standards	40	
		Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	2	
		Euro 3 (2000) standards	49	
		Euro 4 (post-2005) standards	50	
Hard coal	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	0	
		Euro 2 (1995/96) standards	6	
		Euro 3 (2000) standards	45	
		Euro 4 (post-2005) standards	48	
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	100	
	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Industry - process emissions	Stage 2 control	100	

# Description of control strategies

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Country: **NORWAY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	80	
	Industry - other combustion	Combustion modification	80	
	Power plants existing, other	Combustion modification	100	
	Refineries and other conversion	Combustion modification	80	
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	21
		Euro 1 (1992/93) standards	7	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	35	
		Euro 4 (post-2005) standards	37	
		Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	5	
		Euro 3 (2000) standards	50	
		Euro 4 (post-2005) standards	40	
Hard coal	Industry - combustion in boilers	Combustion modification	80	
	Industry - other combustion	Combustion modification	80	
	Power plants existing, other	Combustion modification	35	
	Power plants, new	Comb. modification + selective cat. reduction	65	
	Refineries and other conversion	Selective catalytic reduction	90	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	80	
	Industry - other combustion	Combustion modification	80	
	Power plants existing, other	Combustion modification	80	
	Power plants, new	Comb. modification + selective cat. reduction	20	
	Refineries and other conversion	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	80	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	17	
		Euro 3 (2000) standards	39	
		Euro 4 (post-2005) standards	39	
Natural gas (incl. other gases)	Industry - other combustion	Combustion modification	80	
	Power plants existing, other	Combustion modification	65	
	Refineries and other conversion	Combustion modification	80	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Industry - process emissions	Stage 1 control	100	

## Description of control strategies

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Country: **POLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	60
	Refineries and other conversion	Combustion modification	50
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	50
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
		Euro 1 (1992/93) standards	27
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	69
		Euro 1 (1992/93) standards	8
		Euro 2 (1995/96) standards	89
Hard coal	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	65
	Refineries and other conversion	Combustion modification	50
Heavy fuel oil	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	50
	Refineries and other conversion	Combustion modification	50
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	14
		Euro 2 (1995/96) standards	83
Natural gas (incl. other gases)	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	50
	Refineries and other conversion	Combustion modification	50
	Industry - process emissions	Stage 1 control	100

Country: **PORTUGAL**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Power plants, new	Selective catalytic reduction	50	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	28
		Euro 1 (1992/93) standards	6	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	32	
		Euro 4 (post-2005) standards	33	
		Euro 1 (1992/93) standards	10	
		Euro 2 (1995/96) standards	18	
Hard coal	Power plants, new	Euro 3 (2000) standards	31	
		Euro 4 (post-2005) standards	16	
		Selective catalytic reduction	50	
		Combustion modification	20	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	20	
	Industry - other combustion	Combustion modification	20	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	20	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	11	
		Euro 2 (1995/96) standards	24	
		Euro 3 (2000) standards	30	
		Euro 4 (post-2005) standards	31	
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	80	
	Industry - other combustion	Combustion modification	80	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	80	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	

## Description of control strategies

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Country: **RUSSIAN FEDER.**

Region: KALININGRAD REGION

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Hard coal	Power plants existing, other	Combustion modification	100
Heavy fuel oil		Combustion modification	74

Country: **RUSSIAN FEDER.**

Region: KOLA, KARELIA

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Hard coal	Power plants existing, other	Combustion modification	100
Heavy fuel oil		Combustion modification	29

Country: **RUSSIAN FEDER.**

Region: REMAINING RUSSIA

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - other combustion	Combustion modification	100
	Power plants existing, other	Combustion modification	100
Hard coal	Industry - other combustion	Combustion modification	100
	Power plants existing, other	Combustion modification	100
	Refineries and other conversion	Combustion modification	100
Heavy fuel oil	Industry - other combustion	Combustion modification	100
	Power plants existing, other	Combustion modification	100
	Refineries and other conversion	Combustion modification	100
Natural gas (incl. other gases)	Power plants existing, other	Combustion modification	8

Country: **RUSSIAN FEDER.**

Region: ST PETERSBURG REGION

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Hard coal	Power plants existing, other	Combustion modification	100
Heavy fuel oil		Combustion modification	54

## Description of control strategies

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Country: **SLOVAK REP.**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	20
	Refineries and other conversion	Combustion modification	20
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	50
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	69
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	27
Hard coal	Industry - other combustion	Euro 2 (1995/96) standards	8
	Power plants existing, other	Combustion modification	89
	Refineries and other conversion	Combustion modification	50
Heavy fuel oil	Industry - other combustion	Combustion modification	50
	Power plants existing, other	Combustion modification	50
	Refineries and other conversion	Combustion modification	50
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	14
		Euro 2 (1995/96) standards	83
Natural gas (incl. other gases)	Industry - other combustion	Combustion modification	90
	Power plants existing, other	Combustion modification	90
	Refineries and other conversion	Combustion modification	60
	Industry - process emissions	Stage 1 control	50

Country: **SLOVENIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	96
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	86
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24

## Description of control strategies

Country: **SPAIN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Power plants existing, other	Combustion modification	40	
	Power plants, new	Selective catalytic reduction	50	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	12	
		Euro 1 (1992/93) standards	17	
		Euro 3 (2000) standards	34	
		Euro 4 (post-2005) standards	36	
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	6	
		Euro 2 (1995/96) standards	21	
Hard coal	Power plants existing, other	Combustion modification	40	
	Power plants, new	Selective catalytic reduction	50	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	12	
	Industry - other combustion	Combustion modification	12	
	Power plants, new	Selective catalytic reduction	50	
	Refineries and other conversion	Combustion modification	12	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	9	
		Euro 2 (1995/96) standards	21	
		Euro 3 (2000) standards	31	
		Euro 4 (post-2005) standards	33	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	
	Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	20
		Industry - other combustion	Combustion modification	20
		Power plants, new	Selective catalytic reduction	50
Refineries and other conversion		Combustion modification	20	
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100	

Country: **SWEDEN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	80
	Industry - other combustion	Combustion modification	80
	Power plants existing, other	Combustion modification	100
	Refineries and other conversion	Combustion modification	80
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	50
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	35
	Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	25
		Euro 1 (1992/93) standards	3
		Euro 3 (2000) standards	35
		Euro 4 (post-2005) standards	37
	Road transp - heavy duty trucks and buses	Euro 1 (1992/93) standards	4
		Euro 2 (1995/96) standards	5
Euro 3 (2000) standards		50	
Euro 4 (post-2005) standards		40	
Hard coal	Industry - combustion in boilers	Combustion modification	80
	Industry - other combustion	Combustion modification	80
	Power plants existing, other	Combustion modification	50

## Description of control strategies

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Country: **SWEDEN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Hard coal	Power plants existing, other	Comb. modification + selective cat. reduction	50	
	Power plants, new	Selective catalytic reduction	100	
	Refineries and other conversion	Combustion modification	80	
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	80	
	Industry - other combustion	Combustion modification	60	
	Power plants existing, other	Combustion modification	100	
	Power plants, new	Selective catalytic reduction	80	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Refineries and other conversion	Combustion modification	60
		Euro 1 (1992/93) standards	2	
		Euro 2 (1995/96) standards	6	
		Euro 3 (2000) standards	45	
Natural gas (incl. other gases)	Industry - combustion in boilers	Euro 4 (post-2005) standards	47	
		Combustion modification	80	
		Combustion modification	80	
		Combustion modification	100	
	Road transp - cars and light duty vehic. 4-stroke	Power plants, new	Selective catalytic reduction	100
		Refineries and other conversion	Combustion modification	80
		Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
		Industry - process emissions	Stage 1 control	80

Country: **SWITZERLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Brown coal/lignite	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Refineries and other conversion	Combustion modification	100	
Fuelwood and other low S solid	Power plants existing, other	Combustion modification	100	
Gas oil (diesel, light fuel oil)	Other transport - land based	Euro 1 (1992/93) standards	38	
		Euro 2 (1995/96) standards	35	
		Road transp - cars and light duty vehic. 4-stroke	Euro 2 (1995/96) standards	11
		Euro 1 (1992/93) standards	7	
	Road transp - heavy duty trucks and buses	Euro 3 (2000) standards	40	
		Euro 4 (post-2005) standards	42	
		Euro 1 (1992/93) standards	4	
		Euro 2 (1995/96) standards	5	
		Euro 3 (2000) standards	50	
		Euro 4 (post-2005) standards	40	
Hard coal	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
	Refineries and other conversion	Combustion modification	100	
Heavy fuel oil	Industry - other combustion	Combustion modification	100	
	Power plants existing, other	Comb. modification + selective cat. reduction	100	
	Power plants, new	Selective catalytic reduction	90	
Light fractions (e.g., gasoline, LPG)	Road transp - cars and light duty vehic. 4-stroke	Refineries and other conversion	Combustion modification	100
		Euro 1 (1992/93) standards	2	
		Euro 2 (1995/96) standards	6	
		Euro 3 (2000) standards	45	
Natural gas (incl. other gases)	Industry - other combustion	Euro 4 (post-2005) standards	47	
		Combustion modification	60	

## Description of control strategies

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Country: **SWITZERLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Natural gas (incl. other gases)	Power plants existing, other	Combustion modification	100
	Refineries and other conversion	Combustion modification	60
	Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100
	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100
	Industry - process emissions	Stage 2 control	100

Country: **UNITED KINGDOM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	32
	Industry - other combustion	Combustion modification	32
	Power plants existing, other	Combustion modification	60
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	32
Fuelwood and other low S solid	Industry - other combustion	Combustion modification	100
Gas oil (diesel, light fuel oil)	Other transport - land based	Combustion modification	100
		Euro 1 (1992/93) standards	38
		Euro 2 (1995/96) standards	35
	Other transp. - maritime activ. - large ships	Comb. modification + selective cat. reduction	25
		Combustion modification	25
	Other transp. - maritime activ. - medium ships	Combustion modification	25
		Combustion modification	100
	Power plants existing, other	Combustion modification	100
		Euro 2 (1995/96) standards	25
		Euro 1 (1992/93) standards	3
		Euro 3 (2000) standards	36
		Euro 4 (post-2005) standards	36
		Road transp - heavy duty trucks and buses	Euro 2 (1995/96) standards
Euro 3 (2000) standards		55	
Euro 4 (post-2005) standards	40		
Hard coal	Industry - combustion in boilers	Combustion modification	100
	Industry - other combustion	Combustion modification	100
	Power plants existing, other	Combustion modification	100
	Power plants, new	Selective catalytic reduction	50
	Refineries and other conversion	Combustion modification	100
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	100
	Industry - other combustion	Combustion modification	100
	Other transp. - maritime activ. - large ships	Comb. modification + selective cat. reduction	25
	Power plants existing, other	Combustion modification	60
	Power plants, new	Selective catalytic reduction	50
Refineries and other conversion	Combustion modification	100	
	Combustion modification	40	
	Road transp - cars and light duty vehic. 4-stroke	Euro 1 (1992/93) standards	1
	Euro 2 (1995/96) standards	10	
	Euro 3 (2000) standards	44	
Light fractions (e.g., gasoline, LPG)	Euro 4 (post-2005) standards	45	
	Industry - combustion in boilers	Combustion modification	32
	Industry - other combustion	Combustion modification	100
	Power plants existing, other	Combustion modification	100
Power plants, new	Selective catalytic reduction	50	
	Combustion modification	32	
	Combustion modification	100	
Road transp - cars and light duty vehic. 4-stroke	Three-way catalytic converter	100	



## Description of control strategies

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Country: **UNITED KINGDOM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Natural gas (incl. other gases)	Road transp - heavy duty trucks and buses	Three-way catalytic converter	100

Country: **YUGOSLAVIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Brown coal/lignite	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Hard coal	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	24
Heavy fuel oil	Industry - combustion in boilers	Combustion modification	60
	Industry - other combustion	Combustion modification	60
	Power plants existing, other	Combustion modification	45
	Refineries and other conversion	Combustion modification	60
Natural gas (incl. other gases)	Industry - combustion in boilers	Combustion modification	24
	Industry - other combustion	Combustion modification	24
	Refineries and other conversion	Combustion modification	24

## **ANNEX 3: Description of Measures Assumed for the REF Scenario for VOC Emissions**



## Description of control strategies

Country: **ALBANIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100

Country: **AUSTRIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Hard coal	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Brown coal/lignite		New, improved small (residential) boiler with accumulation tank	100
Other solid (biomass, wood)		New, improved small (residential) boiler with accumulation tank	89
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
Paint and glue produced	Products incorporating solvents	Primary measures, end-of-pipe and substitution	70
		Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
		Water based inks	55
		Water based inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
	Emissions of NMVOC	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen
Other industrial use of solvents		Agrochemicals - new products	100
Stubble burning and other agr. waste		Ban stubble burning	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping	70
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

## Description of control strategies

Country: **BELGIUM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	20
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions and water-based paints	60
	Domestic use of paints	Emulsions and water-based paints	100
Brown coal/lignite	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Other solid (biomass, wood)		New, improved small (residential) boiler with accumulation tank	100
Hard coal		New, improved small (residential) boiler with accumulation tank	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
Paint and glue produced	Products incorporating solvents	Primary measures, end-of-pipe and substitution	70
		Product reformulation	100
Emissions of NMVOC	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100
	Products not incorporating solvents	Solvent management plan and substitution	100
	Stubble burning and other agr. waste	Ban stubble burning	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
		Water based inks	55
		Water based inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
	Rotogravure in publication, new installations	Water based inks	100
	Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution
Other industrial sources		Good housekeeping in steel industry and switch to emulsion bitumen	100
Waste treatment and disposal		Improved Landfills	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **BULGARIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	69
		Quarterly inspection, covers on oil/water separators, flaring	31
Paint use	Vehicle refinishing	Improved application (HVLP), gunwash, SMP	100
	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100

## Description of control strategies

Country: **CZECH REP.**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Emissions of NMVOC	Other industrial use of solvents	Agrochemicals - new products	100
Printing inks	Printing, offset	Primary measures (offset) and solvent free inks	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping	100
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Rotogravure in publication	Low solvent or water based inks	100
Solvent use	Degreasing	Basic emissions management techniques	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Paint use	Vehicle refinishing	Improved application (HVLPL), gunwash, SMP	100
	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Emissions of NMVOC	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen	100
	Stubble burning and other agr. waste	Ban stubble burning	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	63

Country: **DENMARK**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	38
		Emission management, reformulation, adsorption or incineration	62
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	48
		Water based inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

## Description of control strategies

Country: **FINLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	72
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	50
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water bsaed inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Emissions of NMVOC	Other industrial sources	Switch from cutback to emulsion bitumens (road paving)	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **FRANCE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
Emissions of NMVOC	Waste treatment and disposal	Improved Landfills	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Emissions of NMVOC	Stubble burning and other agr. waste	Ban stubble burning	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Emissions of NMVOC	Other industrial sources	Good houseking in steel industry and switch to emulsion bitumen	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water bsaed inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100

## Description of control strategies

Country: **FRANCE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Emissions of NMVOC	Organic chemical industry, process	Flaring	100
	Application of glues and adhesives in industry	Good housekeeping and substitution	62
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **GERMANY**

Region: NEW LANDS

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water sep., flaring, inciner	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	IFC and Stage IA (single stage) controls	100
Textiles (clothing)	Dry cleaning	Conventional closed circuit machine	100
	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing (new installations)	Water-based sytem, plasma process	70
Paint use	Architectural use of paints	Emulsions and water-based paints	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Paint use	Domestic use of paints	Emulsions and water-based paints	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	80
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	80
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	60
		Primary measures, end-of-pipe and substitution	40
Paint and glue produced	Products incorporating solvents	Basic emission management measures, adsorption or incineration	0
		Emission management, reformulation, adsorption or incineration	40
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	80
Printing inks	Flexography and rotogravure in packaging	Low solvent/water based inks, enclosure and adsorption	100
	Flexography and rotogravure in packaging, new installat	Water bsaed inks, incineration (for new inst. with enclosure)	45
		Water based inks	55
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
	Rotogravure in publication, new installations	Water based inks	100
	Screen printing	Water based inks	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	80
		Good housekeeping, substitution, therm./cat. incineration	20
	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	80
		Quarterly inspection and maintenance, flaring, incineration	20
	Organic chemical industry, storage	Internal floating covers/sec.seals,vapour recovery (single stage)	30
	Other industrial sources	Good houseking in steel industry and switch to emulsion bitumen	100
	Waste treatment and disposal	Improved Landfills	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	80
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	70



## Description of control strategies

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Country: **GERMANY**

Region: OLD LANDS

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water sep., flaring, inciner	100	
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100	
	Gasoline distribution - service stations	Stage II and IB at service station	100	
	Gasoline distribution - transport and depots	IFC and Stage IA (single stage) controls	100	
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40	
Solvent use	Degreasing (new installations)	Water-based sytem, plasma process	70	
Paint use	Architectural use of paints	Emulsions, water-based and high-solid paints	100	
	Domestic use of paints	Emulsions, water-based and high-solid paints	100	
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100	
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100	
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90	
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90	
	Other industrial use of paints	Good housekeeping, improved application and substitution	30	
		Primary measures, end-of-pipe and substitution	70	
Paint and glue produced	Products incorporating solvents	Emission management, reformulation, adsorption or incineration	100	
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100	
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	80	
Printing inks	Flexography and rotogravure in packaging	Low solvent/water based inks, enclosure and adsorption	100	
		Water bsaed inks, incineration (for new inst. with enclosure)	45	
		Water based inks	55	
	Printing, offset	Primary measures (offset) and solvent free inks	100	
	Printing, offset, new installations	Incineration	80	
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100	
	Rotogravure in publication, new installations	Water based inks	100	
	Screen printing	Water based inks	100	
	Screen printing, new installations	Water based inks	100	
	Emissions of NMVOC	Other industrial sources	Good houseeking in steel industry and switch to emulsion bitumen	100
		Waste treatment and disposal	Improved Landfills	100
		Other industrial use of solvents	Process modification	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100	
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	80	
		Good housekeeping, substitution, therm./cat. incineration	20	
	Organic chemical industry, process	Quarterly inspection and maintenance, flaring, incineration	100	
	Organic chemical industry, storage	Internal floating covers/sec.seals,vapour recovery (single stage)	55	
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	100	
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	100	

## Description of control strategies

Country: **GREECE**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	79
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Emissions of NMVOC	Products not incorporating solvents	Adsorption, incineration	50
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water bsaed inks, incineration (for new inst. with enclosure)	45
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Emissions of NMVOC	Stubble burning and other agr. waste	Ban stubble burning	100
	Other industrial sources	Good housekeeping	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **HUNGARY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	39
		Quarterly inspection and maintenance programs	61
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
Paint use	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Vehicle refinishing	Improved application (HVLPP), gunwash, SMP	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100

## Description of control strategies

Country: **IRELAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage IB controls at service stations	14
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water sep., flaring, inciner	100
Textiles (clothing)	Dry cleaning	Conventional closed circuit machine	100
	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Hard coal		New, improved small (residential) boiler with accumulation tank	100
Paint use	Architectural use of paints	Emulsions and water-based paints	100
	Domestic use of paints	Emulsions and water-based paints	100
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
Paint and glue produced		Primary measures, end-of-pipe and substitution	70
	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
	Stubble burning and other agr. waste	Ban stubble burning	100
	Application of glues and adhesives in industry	Good housekeeping and substitution	100
Printing inks	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water bsaed inks, incineration (for new inst. with enclosure)	45
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100

Country: **ITALY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	80
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Emissions of NMVOC	Stubble burning and other agr. waste	Ban stubble burning	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	7
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Other industrial sources	Good houseking in steel industry and switch to emulsion bitumen	100
	Products not incorporating solvents	Solvent management plan and substitution	100
	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	88
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water bsaed inks, incineration (for new inst. with enclosure)	45
		Printing, offset	Primary measures (offset) and solvent free inks

## Description of control strategies

Country: **ITALY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Printing inks	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
	Screen printing	Water based inks, enclosure and incineration	100
Emissions of NMVOC	Waste treatment and disposal	Improved Landfills	100
	Application of glues and adhesives in industry	Good housekeeping and substitution	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **LITHUANIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	67
		Quarterly inspection, covers on oil/water separators, flaring	33
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	50
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Vehicle refinishing	Improved application (HVLP), gunwash, SMP	100

Country: **LUXEMBOURG**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	94
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
Paint and glue produced	Products incorporating solvents	Primary measures, end-of-pipe and substitution	70
		Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water bsaed inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Emissions of NMVOC	Other industrial sources	Good housekeeping	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

## Description of control strategies

Country: **NETHERLANDS**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100	
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100	
	Gasoline distribution - service stations	Stage II and IB at service station	100	
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100	
	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50	
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50	
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40	
Solvent use	Degreasing	Basic emissions management techniques	100	
Emissions of NMVOC	Waste treatment and disposal	Improved Landfills	100	
	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen	100	
Population	Domestic use of solvents (other than paint)	Product reformulation	100	
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100	
	Domestic use of paints	Emulsions and water-based paints	89	
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100	
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90	
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90	
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30	
Paint and glue produced	Products incorporating solvents	Primary measures, end-of-pipe and substitution	70	
		Product reformulation	100	
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	19	
		Solvent management, substitution, adsorption or incineration	81	
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60	
Emissions of NMVOC	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100	
Printing inks	Printing, offset	Primary measures (offset) and solvent free inks	100	
		Incineration	80	
	Flexography and rotogravure in packaging	Low solvent or water based inks	100	
	Flexography and rotogravure in packaging, new installat	Water based inks	30	
		Water based inks, incineration (for new inst. with enclosure)	70	
		Rotogravure in publication, new installations	Water based inks	100
		Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100	
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	100	
	Other industrial use of solvents	Waterborne coating for leather	35	
		Primary, biofiltration, waterborne coating and new agrochemical	65	

Country: **NORWAY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	3
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Emissions of NMVOC	Extraction,proc.,distr.of lq.fuels (incl. new (Un)Load	Vapour balancing on tankers and loading facilities	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Water-based paints (not emulsions)	29
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Hard coal		New, improved small (residential) boiler with accumulation tank	100
Paint use	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
Paint and glue produced	Products incorporating solvents	Product reformulation	100
		Products not incorporating solvents	Solvent management plan and substitution
Emissions of NMVOC	Other industrial sources	Good housekeeping	100
	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100
	Other industrial use of solvents	Waterborne coating for leather	100
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100

## Description of control strategies

Country: **NORWAY**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Printing inks	Flexography and rotogravure in packaging, new installat	Water based inks	100
	Rotogravure in publication	Low solvent or water based inks	100
	Printing, offset	Primary measures (offset) and solvent free inks	100

Country: **POLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	100
		Quarterly inspection, covers on oil/water separators, flaring	0
Emissions of NMVOC	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen	38
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	45
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
	Vehicle refinishing	Improved application (HVLV), gunwash, SMP	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **PORTUGAL**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions and water-based paints	76
	Domestic use of paints	Emulsions and water-based paints	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
		Primary measures, end-of-pipe and substitution	70
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Printing inks	Flexography and rotogravure in packaging	Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Water based inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent or water based inks	100
Emissions of NMVOC	Other industrial use of solvents	Agrochemicals - new products	100
	Application of glues and adhesives in industry	Good housekeeping and substitution	100
	Other industrial sources	Good housekeeping	100
	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

## Description of control strategies

Country: **ROMANIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	46
		Quarterly inspection, covers on oil/water separators, flaring	54
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Paint use	Domestic use of paints	Emulsions, water-based dispersion paints	100
		Architectural use of paints	100
		Vehicle refinishing	100
		Other industrial use of paints	100
Solvent use	Degreasing	Good housekeeping and improved application (primary measures)	100
		Basic emissions management techniques	20

Country: **SLOVAK REP.**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	55
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
		Domestic use of paints	100
		Vehicle refinishing	100
		Other industrial use of paints	100
Solvent use	Degreasing	Good housekeeping and improved application (primary measures)	100
		Basic emissions management techniques	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100

Country: **SLOVENIA**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection and maintenance programs	28
		Quarterly inspection, covers on oil/water separators, flaring	72
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
Vehicles	Manufacture of automobiles	Process modification and substitution	90
Paint use	Other industrial use of paints	Good housekeeping and improved application (primary measures)	100
		Architectural use of paints	100
		Domestic use of paints	100
Emissions of NMVOC	Other industrial sources	Good housekeeping	100
Light fractions (e.g. gasoline)	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100

## Description of control strategies

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Country: **SPAIN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>	
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water sep., flaring, inciner	100	
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100	
	Gasoline distribution - service stations	Stage IB controls at service stations	100	
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100	
	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50	
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50	
Textiles (clothing)	Dry cleaning	Conventional closed circuit machine	100	
	Dry cleaning (new installations)	New generation closed circuit machine	40	
Solvent use	Degreasing	Basic emissions management techniques	100	
Paint use	Architectural use of paints	Emulsions and water-based paints	100	
	Domestic use of paints	Emulsions and water-based paints	100	
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100	
Hard coal		New, improved small (residential) boiler with accumulation tank	100	
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100	
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90	
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90	
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30	
Paint and glue produced		Primary measures, end-of-pipe and substitution	70	
	Products incorporating solvents	Product reformulation	100	
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100	
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60	
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	100	
Printing inks	Printing, offset	Primary measures (offset) and solvent free inks	100	
	Printing, offset, new installations	Incineration	80	
	Flexography and rotogravure in packaging	Low solvent or water based inks	100	
	Flexography and rotogravure in packaging, new installat	Water based inks	55	
		Water bsaed inks, incineration (for new inst. with enclosure)	45	
	Screen printing	Water based inks	100	
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100	
	Rotogravure in publication, new installations	Water based inks	100	
	Emissions of NMVOC	Other industrial sources	Good housekeeping	100
		Waste treatment and disposal	Improved Landfills	100
Organic chemical industry, process		Quarterly inspection and maintenance programs and flaring	100	
Stubble burning and other agr. waste		Ban stubble burning	100	
Other industrial use of solvents		Process modification	30	



## Description of control strategies

Country: **SWEDEN**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	45
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	IFC and Stage IA (single stage) controls	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures)	30
Paint and glue produced	Products incorporating solvents	Primary measures, end-of-pipe and substitution	70
		Product reformulation	15
		Emission management, reformulation, adsorption or incineration	85
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging, new installat	Water based inks	55
		Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks, incineration (for new inst. with enclosure)	45
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
Solvent use	Preservation of wood (new installations)	Low solvent inks, enclosure and adsorption	100
		Activated carbon adsorption	100
Emissions of NMVOC	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen	100
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **SWITZERLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water separators, flaring	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage II and IB at service station	100
	Gasoline distribution - transport and depots	IFC and Stage IA (single stage) controls	100
Textiles (clothing)	Dry cleaning (new installations)	New generation closed circuit machine	79
Solvent use	Degreasing	Basic emissions management techniques	100
	Degreasing (new installations)	Low temperature plasma process	41
Paint use	Architectural use of paints	Emulsions and water-based paints	100
	Domestic use of paints	Water-based paints (not emulsions)	100
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
Paint and glue produced	Products incorporating solvents	Good housekeeping and improved application (primary measures)	100
		Product reformulation	100
		Solvent management plan and substitution	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good Housekeeping and Carbon Adsorption	75
Printing inks	Printing, offset	Primary measures (offset) and solvent free inks	100
		Low solvent or water based inks	100
	Flexography and rotogravure in packaging, new installat	Water based inks	100
	Rotogravure in publication	Low solvent or water based inks	100
	Rotogravure in publication, new installations	Water based inks	100
Screen printing	Screen printing	Water based inks	100
	Screen printing, new installations	Water based inks	100

## Description of control strategies

Country: **SWITZERLAND**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	50
	Other industrial use of solvents	Waterborne coating for leather	100
	Organic chemical industry, process	Quarterly inspection and maintenance programs and flaring	100
	Other industrial sources	Good housekeeping in steel industry and switch to emulsion bitumen	79
	Waste treatment and disposal	Improved Landfills	100
Other solid (biomass, wood)	Stubble burning and other agr. waste	Ban stubble burning	100
	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

Country: **UNITED KINGDOM**

Region: WHOLE COUNTRY

<i>Fuel/activity</i>	<i>Sector</i>	<i>Technology</i>	<i>Percentage applied</i>
Crude oil	Refineries - process	Quarterly inspection, covers on oil/water sep., flaring, inciner	100
Light fractions (e.g. gasoline)	Evaporative emissions from cars	Small carbon canister (in cars)	100
	Gasoline distribution - service stations	Stage IB controls at service stations	100
	Gasoline distribution - transport and depots	Internal floating covers or secondary seals	100
Emissions of NMVOC	Extraction, proc., distr. of lq. fuels (incl. new (Un)Load	Vapour balancing on tankers and loading facilities	100
Textiles (clothing)	Dry cleaning	Conventional closed circuit machine	100
	Dry cleaning (new installations)	New generation closed circuit machine	40
Solvent use	Degreasing	Basic emissions management techniques	100
Paint use	Architectural use of paints	Emulsions, water-based dispersion paints	100
	Domestic use of paints	Emulsions, water-based dispersion paints	100
Vehicles	Manufacture of automobiles (new installations)	Adsorption, incineration	100
Paint use	Vehicle refinishing	Primary measures and 40% high solids, 60% water based paints	90
	Vehicle refinishing (new installations)	Substitution with 40% high solids, 60% water based paints	90
	Other industrial use of paints	Good housekeeping and improved application (primary measures) Primary measures, end-of-pipe and substitution	30 70
Other solid (biomass, wood)	Combustion in residential and commercial sector	New, improved small (residential) boiler with accumulation tank	100
Hard coal		New, improved small (residential) boiler with accumulation tank	100
Paint and glue produced	Products incorporating solvents	Product reformulation	100
Emissions of NMVOC	Products not incorporating solvents	Solvent management plan and substitution	100
Solvent use	Pharmaceutical industry	Good housekeeping and cat. or th. incineration	60
Printing inks	Flexography and rotogravure in packaging	Low solvent/water based inks, enclosure and adsorption	100
	Flexography and rotogravure in packaging, new installat	Water based inks, incineration (for new inst. with enclosure)	100
	Printing, offset	Primary measures (offset) and solvent free inks	100
	Printing, offset, new installations	Incineration	80
	Rotogravure in publication	Low solvent inks, enclosure and adsorption	100
	Screen printing, new installations	Water based inks	100
	Rotogravure in publication, new installations	Water based inks	100
Emissions of NMVOC	Screen printing	Water based inks	100
	Other industrial use of solvents	Primary, biofiltration, waterborne coating and new agrochemical	100
Solvent use	Preservation of wood (new installations)	Activated carbon adsorption	100
Emissions of NMVOC	Application of glues and adhesives in industry	Good housekeeping and substitution	100
	Organic chemical industry, process	Quarterly inspection and maintenance, flaring, incineration	65
	Waste treatment and disposal	Improved Landfills	100
	Stubble burning and other agr. waste	Ban stubble burning	100
Light fractions (e.g. gasoline)	Transport road - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50
	Transport other - 2 stroke engines	Oxidation catalyst for 2 stroke engines	50

## **ANNEX 4: Description of Measures Assumed for the REF Scenario for NH<sub>3</sub> Emissions**



## Description of control strategies

Country: **DENMARK**

Region: WHOLE COUNTRY

<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Animal house adaptation and low ammonia appl.	80
Laying hens	Animal house adaptation and low ammonia appl.	80
Pigs - liquid (slurry) systems	Low N feed,covered storage,low NH3 appl.	90
Dairy cows - liquid (slurry) systems	Low N feed,housing adaptation,low NH3 appl.	80
Pigs - solid systems	Low N feed and low ammonia application-high	90
Other cattle - liquid (slurry) systems	Covered storage and low ammonia application	80
Other cattle - solid systems	Low ammonia application - high efficiency	80
Dairy cows - solid systems	Low N feed and low ammonia application-high	80

Country: **IRELAND**

Region: WHOLE COUNTRY

<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Low ammonia application - high efficiency	100
Laying hens	Animal house adaptation	100
Fertilizer use - urea	Substitution of urea fertilizer	100
Pigs - liquid (slurry) systems	Low ammonia application - high efficiency	67

Country: **LUXEMBOURG**

Region: WHOLE COUNTRY

<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Animal house adaptation and low ammonia appl.	100
Fertilizer use - urea	Substitution of urea fertilizer	100
Laying hens	Animal house adaptation and low ammonia appl.	100
Other cattle - solid systems	Low ammonia application - high efficiency	100
Pigs - solid systems	Low N feed,biofiltration,low NH3 appl.-high	100
Dairy cows - liquid (slurry) systems	Animal house adaptation and low ammonia appl.	100
Other cattle - liquid (slurry) systems	Covered storage and low ammonia application	100
Sheep and goats	Low ammonia application - high efficiency	100
Dairy cows - solid systems	Low ammonia application - high efficiency	100
Pigs - liquid (slurry) systems	Low N feed,biofiltr.,cov.storage, low NH3 app	93

Country: **NETHERLANDS**

Region: WHOLE COUNTRY

<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Animal house adaptation and low ammonia appl.	100
Fertilizer use - urea	Substitution of urea fertilizer	100
Laying hens	Low N feed,housing adaptation,low NH3 appl.	100
Pigs - liquid (slurry) systems	Low ammonia application - high efficiency	100
Dairy cows - liquid (slurry) systems	Low Nitrogen feed and low ammonia application	100
Pigs - solid systems	Low N feed and low ammonia application-high	100
Other cattle - liquid (slurry) systems	Low ammonia application - high efficiency	100
Fertilizer production	Stripping	100
Other cattle - solid systems	Low ammonia application - high efficiency	100
Sheep and goats	Low ammonia application - high efficiency	100
Dairy cows - solid systems	Low N feed and low ammonia application-high	49

## Description of control strategies

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Country: **SPAIN**

Region: WHOLE COUNTRY

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<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Low ammonia application - high efficiency	100
Fertilizer use - urea	Substitution of urea fertilizer	83

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Country: **SWEDEN**

Region: WHOLE COUNTRY

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<i>Category</i>	<i>Technology</i>	<i>Percentage applied</i>
Other poultry	Animal house adaptation and low ammonia appl.	100
Fertilizer use - urea	Substitution of urea fertilizer	100
Other cattle - liquid (slurry) systems	Covering manure storage - high efficiency	100
Dairy cows - liquid (slurry) systems	Animal house adaptation	100
Laying hens	Animal house adaptation and low ammonia appl.	100
Dairy cows - solid systems	Low Nitrogen feed	100
Sheep and goats	Low ammonia application - high efficiency	100
Fertilizer production	Stripping	100
Pigs - solid systems	Biofiltration, low ammonia application-high	100
Pigs - liquid (slurry) systems	Biofiltration, covered storage, low NH3 appl.	40

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