EN05 Energy-related emissions of ozone precursors

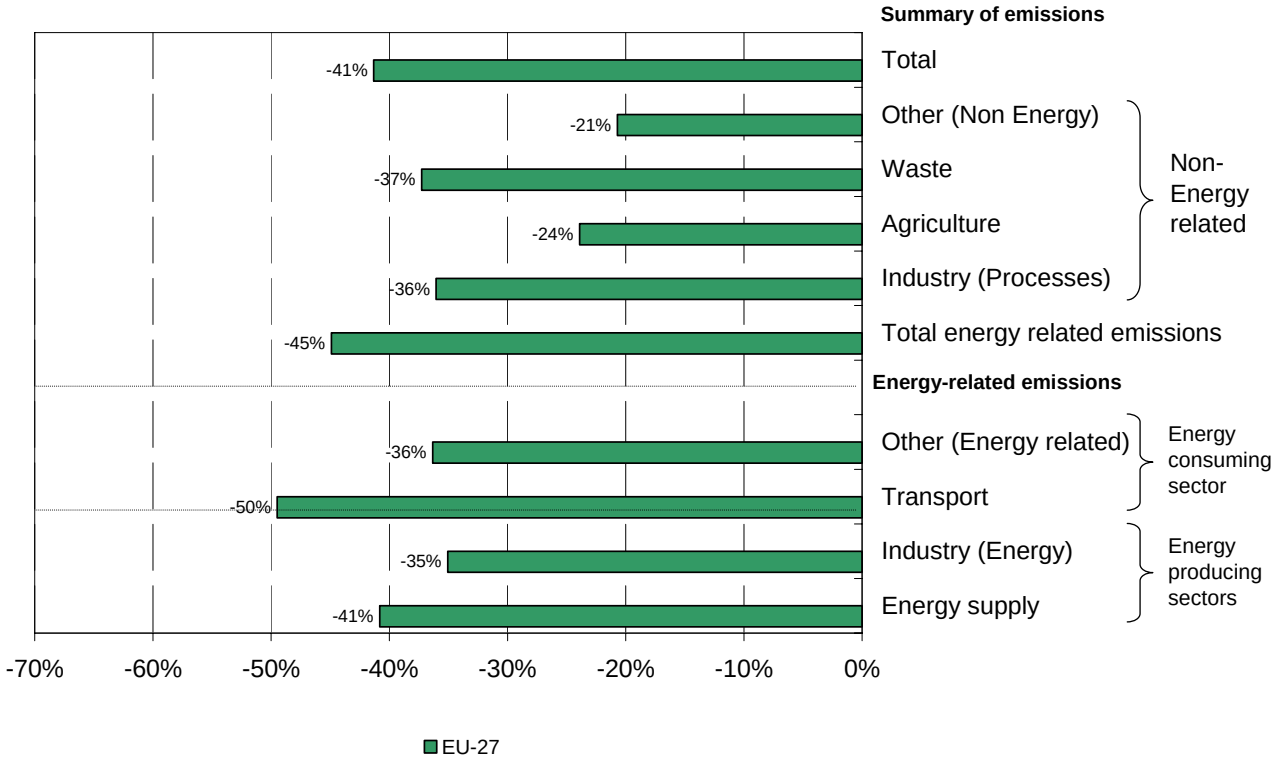
Key message

Emissions of energy-related ozone precursors (CH_4, CO, NMVOC, NO_X) have decreased by 45 % between 1990 and 2005 in the EU-27. The largest reductions in emissions occurred in the transport sector (-50 %), largely as a result of the continued introduction of catalytic converters in new vehicles during this period. However, energy production and use remains a significant source of emission for all these precursor pollutants. Reducing energy-related emissions of ozone precursors therefore remains a key priority for reducing local and transboundary air pollution and in ensuring that countries meet their respective emissions ceiling targets of the National Emissions Ceilings Directive (NECD) and the UNECE Gothenburg Protocol.

Rationale

Emissions of total non-methane volatile organic compounds, nitrogen oxides, carbon monoxide and methane contribute to the formation of ground level (i.e. tropospheric) ozone. Ozone is a powerful oxidant and can have a range of adverse impacts on both human health and ecosystems.

Fig. 1: Changes (%) in emissions of ozone precursors by source category, 1990-2005, EU-27 (weighted by tropospheric ozone formation potential)



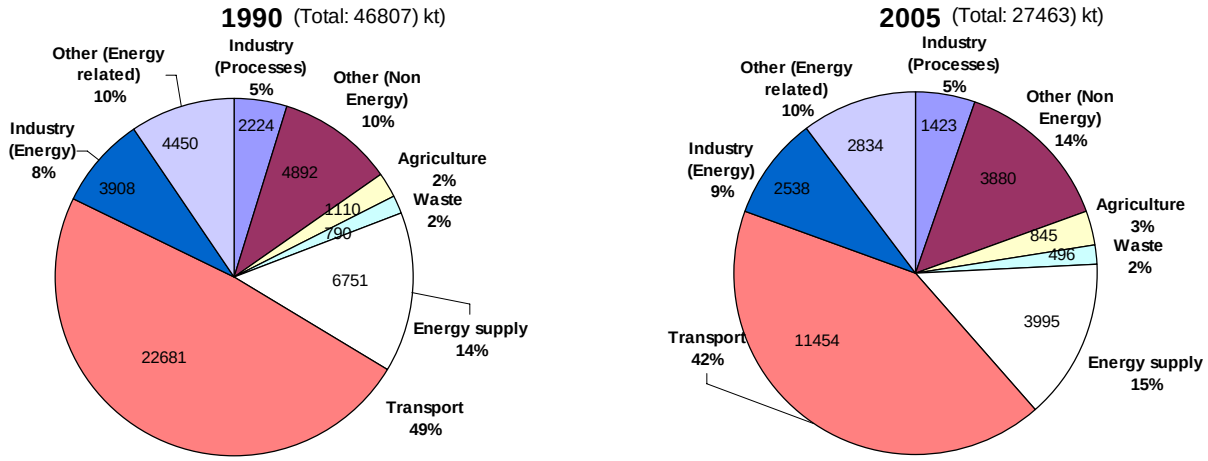
Source: EEA-ETC/ACC 2007

Note: The graph above shows the emissions of ozone precursors (methane CH_4; carbon monoxide CO; non-methane volatile organic compounds NMVOCs; and nitrogen oxides NO_x) each weighted by a factor prior to aggregation to represent their respective tropospheric ozone formation potential (TOFP). The TOFP factors are: NO_x 1.22, NMVOC 1, CO 0.11 and CH_4 0.014 (de Leeuw 2002). Results are expressed in NMVOC equivalents (kilotonnes - kt). Data not available for Iceland (emissions of CO, NMVOC, NOx were not reported) and Malta (CO).

The energy supply sector includes public electricity and heat production (power plants), oil refining, production of solid fuels and fugitive emissions from fuels. The transport sector includes emissions from road and off-road sources (e.g. railways and vehicles used for

agriculture and forestry). Industry (energy) relates to emissions from combustion processes used in the manufacturing industry including boilers, gas-turbines and stationary engines. 'Other (energy-related)' covers energy use principally in the services and household sectors.

Fig. 2: Sectoral shares of tropospheric ozone precursors (energy and non-energy components) in total emissions, EU-27. Values within the segments indicate the level of TOFP emissions (kt) emitted from each sector.



Source: EEA-ETC/ACC 2007.

1. Indicator assessment

EU-27 emissions of energy-related ozone precursors (weighted by tropospheric ozone formation potentials) decreased by 45 % between 1990 and 2005 (Fig. 3). In 2005, the production and use of energy was responsible for over three-quarters of the total emissions of ozone precursors. Of this fraction, NO_x was the most significant pollutant (weighted by tropospheric ozone formation potential) contributing 64 % of the total energy-related emissions. The changes in the emissions of energy-related ozone precursors are thus strongly correlated with the changes observed in NO_x emissions (see EN06), as this is the most important energy-related ozone precursor.

In the EU-27, the transport sector is the dominant source of ozone precursors and contributed 55 % of the energy-related ozone precursor emissions in 2005 (and 42% of total ozone precursor emissions). Transport sector is also represents the sector with the highest emissions per capita (Fig. 4). The 'energy supply', 'other' and 'industry energy' sources each contributed less than 20 % of the energy-related emissions, respectively.

Although presently the dominant source of ozone precursor emissions, the EU-27 transport sector has experienced the largest decrease in precursor emissions between 1990 and 2005, both in relative (35%) and absolute (55%) terms. These emission reductions were mainly due to the continuing increase in the share of passenger cars equipped with catalytic converters. The energy supply sector also experienced a significant decrease in emissions during this period (-41 %). The decreases in emissions from this sector (primarily NO_x) can be attributed to a range of measures, including the increased use of abatement technologies (SCR, EGR,3-way catalytic converters), fuel-switching from coal to gas prompted by the liberalisation of the energy market, the requirements of the IPPC and Large Combustion Plant Directives and improved technology efficiencies (see also EN09; EN19 and EN27). An assessment of NO_x trends and discussion of progress towards meeting NECD ceilings is included in the fact-sheet 'EN06: Energy-related emissions of acidifying substances'.

Total energy-related emissions of CO decreased by 55 % during the period 1990-2005 in the EU-27, again mainly due to reduced emissions from the transport sector. Decreases in CO emissions in transport have occurred mainly as a result of catalytic converters on road vehicles. The remaining energy-related sectors also all reduced their CO emissions between 1990 and 2005, although in absolute (kt) terms, their combined emission reduction (-44kt) was significantly less than the reduction achieved by the transport sector (-61 kt).

Total energy-related NMVOC emissions decreased by 56 % in the region over the same period and accounted for less than half (46%) of the total NMVOC emissions in 2005. The majority of energy-related emissions arose from the road transport sector and petrol evaporation in the energy supply sector. NMVOC emissions from the transport sector have decreased by more than half since 1990, again primarily due to the introduction of catalytic converters on cars. For the EU-15, emissions of NMVOC in 2005 are significantly higher than the 2010 targets of the NECD for EU Member States (expressed as TOFP) and substantial emission reductions are therefore still required to reach the target. However, across the new EU-12 Member States, good progress has been made in reducing NMVOC emissions, and energy-related and non-energy related emissions are already below the aggregated 2010 emission target.

Methane emissions formed less than 1 % of total ozone precursor emissions in 2005, largely as a result of its low tropospheric ozone formation potential weighting factor relative to the other pollutants. Compared with the other pollutants that contribute to ozone formation, the significance of methane is therefore relatively small.

2. Indicator rationale

2.1 Environmental context

Tropospheric (ground level) ozone has adverse effects on human health and ecosystems. NO_x, NMVOC, CO and CH_4 are known as ozone precursors. High concentrations of ground level ozone have been shown to adversely affect the human respiratory system, and there is evidence that long-term exposure to raised ozone concentrations accelerates the decline in lung function with age and may impair the development of lung function. In the environment, high concentrations of ozone are harmful to crops and forests, decreasing yields, causing leaf damage and decreasing disease resistance. Ozone is also capable of causing damage to man made polymeric materials such as plastics and rubbers.

2.2 Policy context

This indicator monitors the trend in emissions of energy-related ozone precursors. Emissions of NO_x and NMVOCs are both covered by the EU National Emission Ceilings Directive (NECD; 2001/81/EC) and the Gothenburg protocol under the United Nations Convention on Long-range Transboundary Air Pollution (LRTAP Convention; UNECE 1999). Both these instruments contain emission ceilings targets that EU Member States and other countries must meet by 2010. Emission reduction targets for the new Member States have been specified in the Treaties of Accession to the European Union (2003 and 2005)[1] in order that they can comply with the National Emission Ceilings Directive. In addition, the Treaty of Accession for Bulgaria and Romania (2005)[2] also includes a new target for the EU-27 region as a whole. Targets for the new Member States are temporary and are without prejudice to the review of the NECD. A proposal for a revised NEC Directive (which will set 2020 emission ceiling targets for these ozone precursors pollutants), is expected in spring 2008. Targets for Bulgaria and Romania are provisional and not binding. Hence, the existing EU25 NECD Target has been used in the following analysis.

The NECD generally involves slightly stricter emission reduction targets than the Gothenburg Protocol. For example, during the period 1990-2010 the EU-15 has NO_x emission reduction targets of 52 % and 51% under the NECD and Gothenburg Protocol respectively. For NMVOC, the EU-15 reduction required under the NECD is 55 %, under the Gothenburg reduction target the reduction required is 54 %.

In September 2005 the European Commission released a thematic strategy on air pollution. This strategy sets interim objectives for reducing air pollution impacts across Europe by 2020. Other directives influencing emissions of ozone precursors include:

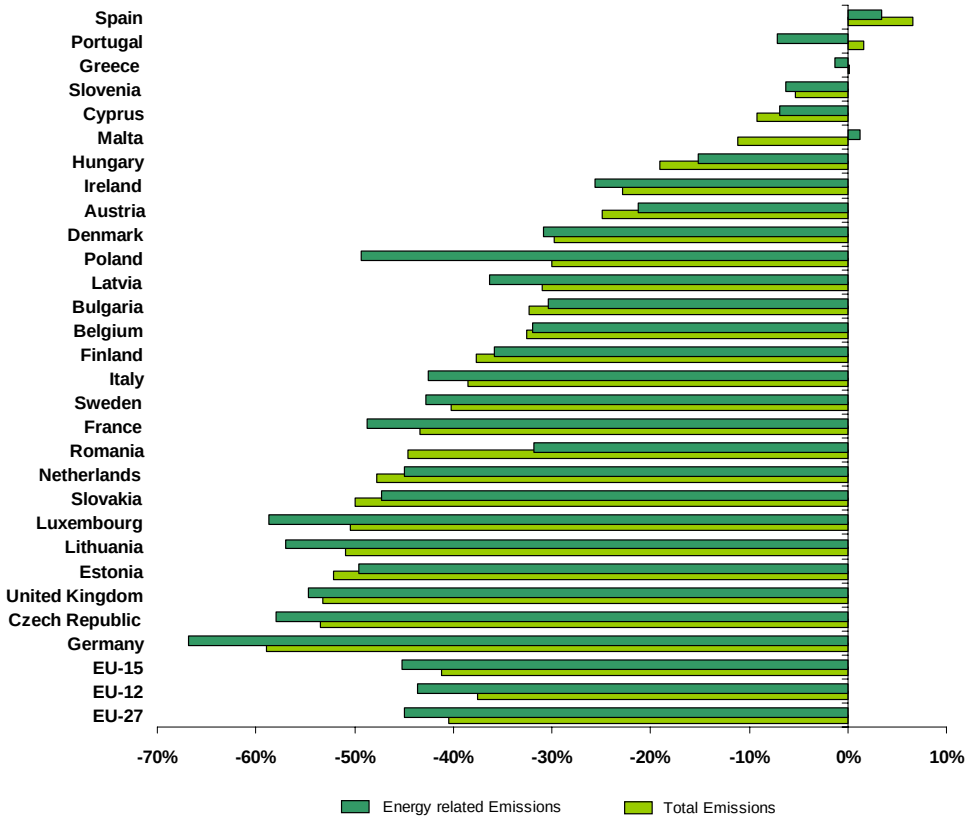
- The Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC) aims to prevent or minimise pollution of water, air and soil by industrial effluent and other waste from industrial installations, including energy industries, by defining basic obligations for operating licences or permits and by introducing targets, or benchmarks, for energy efficiency. It also requires the application of Best Available Techniques (BAT) in new installations from now on (and for existing plants over the next 10 years according to national legislation).
- The Large Combustion Plant Directive (2001/80/EC) sets emission limits for licensing of new plants and requires Member States to establish programmes for reducing total emissions.
- Emissions from transport are controlled by a number of Directives. These include: emissions from passenger cars and light commercial vehicles (70/220/EEC, as last amended by Directive 2001/100/EC targeting CO, NMVOCs and NO_x); quality of petrol and diesel fuels (98/70/EC) as last amended by Directive 2003/17/EC specifying lower sulphur contents of fuels, (but also indirectly targeting emissions of the primary pollutants CO, NMVOCs and NO_x; emissions from non-road mobile machinery (97/68/EC) as amended by Directive 2002/88/EC specifying limits for CO, NMVOC and NO_x emissions; and for heavy duty vehicles Directive 88/77/EEC as last amended by Directives 1999/96/EC (which provides the Euro 3 (from October 2000), Euro 4 (from October 2005) and Euro 5 (from October 2008) emission standards for CO, NMVOCs and NO_x) and Directive 2001/27/EC (adapting to technical progress Directive 88/77/EEC).

[1] The Treaty of Accession 2003 of the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia and Slovenia. AA2003/ACT/Annex II/en 2072 / 2005 European Union Consolidated Versions of the Treaty on European Union and of the Treaty Establishing the European Community C 321 E/1

[2] http://ec.europa.eu/environment/air/pdf/eu27_nat_emission_ceilings_2010.pdf

- The 1994 VOCs Directive (94/63/EC) applies to the operations, installations, vehicles and vessels used for storage, loading and transport of petrol from one terminal to another or from a terminal to a service station
- There are no specific EU emission targets set for either carbon monoxide (CO) or methane (CH_4). However, there are several Directives and Protocols that affect the emissions of CO and CH_4. Carbon monoxide is covered by the second daughter Directive under the Air Quality Directive. This gives a limit of 10 mg m^{-3} for ambient air quality to be met by 2005. Methane is included in the basket of six greenhouse gases under the Kyoto protocol to the United Nations Framework Convention on Climate Change (UNFCCC), under which limits for greenhouse gas emissions for the period 2008-2012 have been agreed by certain countries.

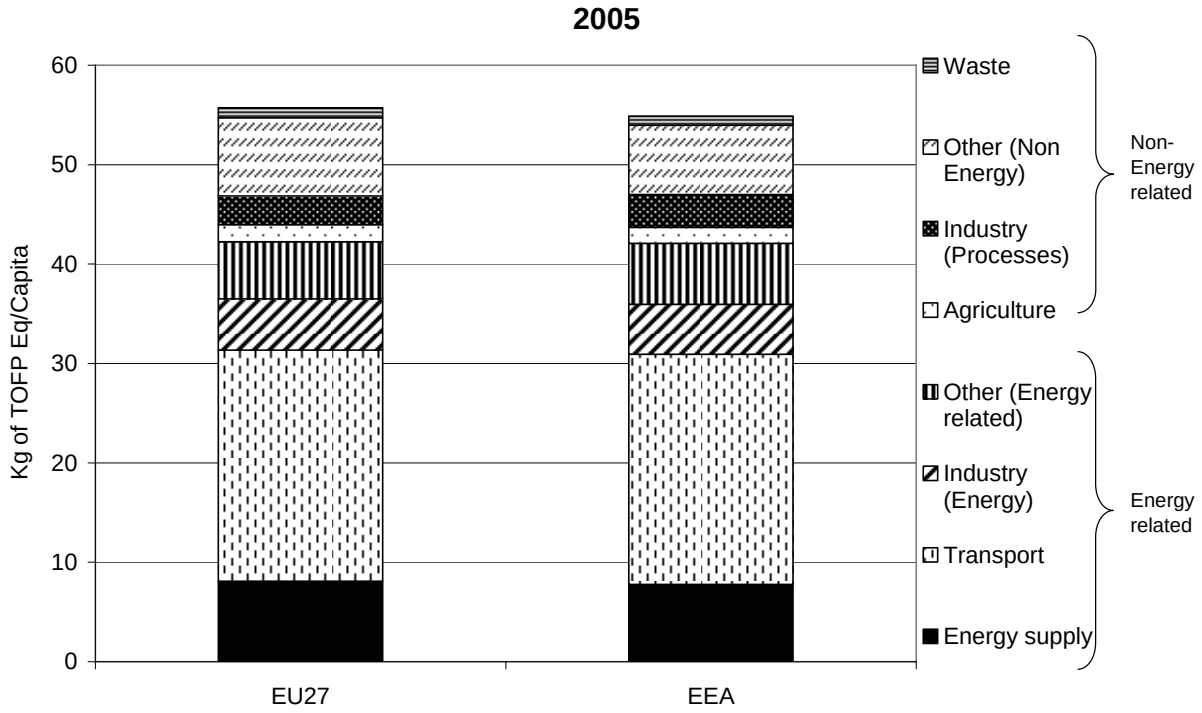
Fig. 3: Overall change in emissions of ozone precursors by country, 1990-2005



Note: The graph shows the emissions of ozone precursors (NOx, NMVOC, CO and CH4) each weighted by an ozone formation factor prior to aggregation to represent their respective ozone forming potentials. The relative impact of the combined contribution of NOx, NMVOC, CO and CH_4 to ozone formation can be assessed based on their tropospheric ozone forming potentials (TOFP): nitrogen oxides 1.22, non-methane volatile organic compounds 1.0, carbon monoxide 0.11 and methane 0.014 (de Leeuw 2002).

Source: EEA/ETC-ACC 2007.

Fig. 4: Ozone precursors emission per capita by sectors, 2005



Source: EEA/ETC-ACC 2007, Eurostat, 2007

Table 1: Energy-related substance emissions 1990-2005 weighted by tropospheric ozone formation potential (TOFP units kt)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Change 1990-2005
Austria	527	546	514	498	470	453	478	438	443	419	411	419	419	430	417	415	-21%
Belgium	705	712	703	693	685	659	592	574	620	570	571	547	519	510	493	480	-32%
Bulgaria	602	424	420	431	388	439	400	342	385	354	367	336	372	382	395	419	-30%
Croatia	217	166	141	141	149	151	169	170	176	179	177	165	160	161	153	153	-30%
Cyprus	37	37	40	41	43	43	43	44	45	46	47	47	47	46	37	34	-7%
Czech Republic	1140	1123	1073	912	798	736	766	754	731	682	691	580	538	556	566	479	-58%
Denmark	539	605	550	543	533	511	557	489	452	425	403	398	391	403	383	373	-31%
Estonia	172	159	98	90	100	105	116	116	103	97	97	92	100	102	98	87	-50%
Finland	563	540	525	517	511	481	493	480	466	467	453	443	420	423	403	361	-36%
France	5078	5283	5149	4893	4548	4355	4246	3952	3861	3646	3384	3225	2984	2857	2750	2604	-49%
FYR of Macedonia	25	25	25	25	25	25	25	25	45	50	56	57	57	79	60	61	145%
Germany	6791	5801	5253	4788	4241	4017	3755	3590	3379	3242	2936	2855	2681	2567	2470	2251	-67%
Greece	712	736	749	757	773	772	787	794	817	796	779	791	744	799	702	702	-1%
Hungary	490	422	396	384	384	396	403	405	404	401	379	376	369	381	382	416	-15%
Ireland	269	273	283	262	257	254	266	265	275	249	241	239	220	209	203	200	-26%
Italy	4396	4545	4680	4534	4380	4310	4185	3977	3728	3474	3134	3019	2743	2679	2525	2525	-43%
Latvia	183	146	131	124	119	118	120	115	113	112	108	111	111	112	116	117	-36%
Liechtenstein	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	-71%
Lithuania	332	351	208	167	169	153	163	164	167	149	129	123	125	129	122	143	-57%
Luxembourg	67	66	66	65	60	55	54	43	36	32	33	32	32	32	28	28	-59%
Malta	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	1%
Netherlands	1029	981	947	903	869	828	803	727	684	700	655	626	611	617	584	566	-45%
Norway	575	567	593	620	626	640	649	648	636	647	636	644	589	539	502	454	-21%
Poland	3141	2990	2901	2869	2510	2310	2354	2304	2052	2028	1634	1603	1603	1620	1592	1591	-49%
Portugal	550	572	605	580	571	576	560	549	556	558	546	537	543	513	508	510	-7%
Romania	1048	882	734	689	682	703	724	742	761	603	669	728	725	721	718	714	-32%
Slovakia	370	333	310	304	290	300	244	235	236	217	214	216	199	200	201	195	-47%
Slovenia	113	104	106	115	122	122	130	129	114	104	119	115	112	109	109	106	-6%
Spain	2345	2425	2512	2421	2467	2423	2391	2405	2416	2461	2432	2402	2422	2398	2425	2425	3%
Sweden	719	683	661	612	622	594	579	547	522	502	479	456	447	440	421	412	-43%
Switzerland	376	357	327	300	279	265	255	239	230	221	212	205	192	184	177	168	-55%
Turkey	1627	1625	1682	1853	1813	1925	2053	2070	2029	2138	2029	1879	2214	2549	2549	2549	57%
United Kingdom	5856	5661	5494	5190	4982	4698	4501	4236	3991	3730	3485	2740	3046	2917	2758	2651	-55%
EU27	37790	36417	35124	33399	31592	30428	29727	28433	27375	26079	24411	23072	22543	22168	21425	20820	-45%
EEA	40370	38968	37728	36175	34312	33260	32685	31391	30271	29086	27290	25800	25539	25442	24653	23992	-41%

No data for Iceland – only reported CH_4, no data was reported for CO, NMVOC, NO_x
Source: EEA-ETC/ACC 2007.

References

de Leeuw, F.A.A.M. (2002). *A set of emission indicators for long-range transboundary air pollution.* Environmental Science & Policy, 5, 135-145.

NECD (2001). Directive 2001/81/EC, on national emissions ceilings (NECD) for certain atmospheric pollutants.

UNECE (1999). Protocol to the 1979 Convention on Long-range Transboundary Air Pollution (LRTAP Convention) to abate acidification, eutrophication and ground-level ozone, Gothenburg, Sweden, 1 December 1999.

EEA (2006): EMEP/CORINAIR Atmospheric Emission Inventory Guidebook 3rd edition; EEA Technical Report No. 30 (http://reports.eea.europa.eu/EMEPCORINAIR4/en/page002.html)

IPCC (2006). Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Further Reading

EEA (2007). Europe's Environment: the fourth assessment. Environmental Assessment Report No 1/2007, European Environment Agency, Copenhagen, Denmark (http://reports.eea.europa.eu/state_of_environment_report_2007_1/en)

EEA (2006). Energy and environment in the European Union, Tracking progress towards integration ReportNo 8/2006 European Environment Agency, Copenhagen, Denmark

EEA (2005) The European Environment - State and Outlook 2005. State of Environment report No 1/2005 European Environment Agency, Copenhagen, Denmark (http://reports.eea.europa.eu)

Meta data

Technical information

1. Data Source: Officially reported national total and sectoral emissions to UNECE/EMEP (United Nations Economic Commission for Europe/Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe) Convention on Long-range Transboundary Air Pollution (LRTAP Convention), submission 2007. Base data are available on the EMEP website (http://webdab.emep.int/). CH_4 emissions are from officially reported national total and sectoral emissions, reported to UNFCCC and EU Monitoring Mechanism, submission 2007 (National Annual Greenhouse Gas Inventories). Gross inland energy consumption data from Eurostat (July 2007 download: http://epp.eurostat.ec.europa.eu/). Emissions of ozone precursors is one of the European Environment Agency's core-set indicators. More information can be found at http://themes.eea.europa.eu/IMS/CSI

2. Description of data: Emissions of TOFP in ktonnes in terms of NMVOC Equivalent. TOFP is the Tropospheric Ozone Forming Potential of each of the air pollutants that contribute to ozone formation in the troposphere i.e. 'ground-level' ozone. Gaps in reported data are filled by EEA-ETC/ACC where necessary using simple interpolation techniques (see 6).

3. Geographical Coverage: EU-27 for comparison with EU National Emission Ceilings Directive (NECD 2001). Other analyses include data for EFTA-4 countries (Iceland, Liechtenstein, Switzerland and Norway) and Croatia, FYR Macedonia and Turkey. The EEA-32 country grouping includes EU-27, EFTA-4 and Turkey.

4. Temporal Coverage: 1990–-2005

5. Methodology and frequency of data collection: Officially reported national total and sectoral emissions to UNECE/EMEP (United Nations Economic Commission for Europe/Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe) Convention on Long-range Transboundary Air Pollution (CLRTAP), submission 2007. CO_2 emissions are from officially reported national total and sectoral emissions, reported to UNFCCC and EU Monitoring Mechanism, submission 2007 (National Annual Greenhouse Gas Inventories).Recommended methodologies for emission inventory data collection are compiled in the Joint EMEP/CORINAIR Atmospheric Emission Inventory Guidebook 3rd edition EEA Copenhagen EEA (2006) and Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories IPCC (2006).

6. Methodology of data manipulation: EEA-ETC/ACC gap-filling methodology. To allow trend analysis, where countries have not reported data for one, or several years, data has been interpolated to derive annual emissions. If the reported data is missing either at the beginning or at the end of the time series period, the emission value has been considered to equal the first (or last) reported emission value. It is recognised that the use of gap-filling can potentially lead to artificial trends, but it is considered unavoidable if a comprehensive and comparable set of emissions data for European countries is required for policy analysis purposes. The gap-filled spreadsheet containing the data used in this indicator is available on the EEA dataservice website. The relative impact of the combined contribution of NO_x, NMVOC, CO and CH_4 to ozone formation can be assessed based on their tropospheric ozone forming potentials (TOFP): nitrogen oxides 1.22, non-methane volatile organic compounds 1.0, carbon monoxide 0.11 and methane 0.014 (de Leeuw 2002).
   Thus, total acid equivalent emission = w(SO2)*Em(SO2) + w(NOx)*Em(NOx) + w(NH3)*Em(NH3) where weight factors are given by:

   w(SO2) = 2/64 acid eq/g = 31.25 acid eq/kg

   w(NOx) = 1/46 acid eq/g = 21.74 acid eq/kg

   w(NH3) = 1/17 acid eq/g = 58.82 acid eq/kg

   Results are in NMVOC equivalents (kilotonnes - kt), except where specified. These factors are assumed to be representative for Europe as a whole; on the (very) local scale different factors might be estimated; see de Leeuw (2002) for a more extensive discussion on the uncertainties in these factors. Due to the variation in potential TOFP factors that might be determined on a local scale, the use such factors does not always have wide support or recognition in EU Member States. The energy supply sector includes public electricity and heat production, oil refining, production of solid fuels and fugitive emissions from fuels. The transport sector includes emissions from road and off-road sources (e.g. railways and vehicles used for agriculture and forestry). Industry (energy) relates to emissions from combustion processes used in the manufacturing industry including boilers, gas turbines and stationary engines. 'Other (energy-related)' covers energy use principally in the services and household sectors.
   Base data, reported in SNAP, draft NFR or NFR are converted into EEA sector codes to obtain a common reporting format across all countries and pollutants:

- Energy industry: Emissions from public heat and electricity generation - Fugitive emissions: Emissions from extraction and distribution of solid fossil fuels and geothermal energy

- Industry (Energy): relates to emissions from combustion processes used in the manufacturing industry including boilers, gas turbines and stationary engines

- Industry (Processes): Emissions from production processes

- Road transport: light and heavy duty vehicles, passenger cars and motorcycles;

- Off-road transport: railways, domestic shipping, certain aircraft movements, and non-road mobile machinery used in agriculture, forestry;

- Agriculture: manure management, fertiliser application, field-burning of agricultural wastes

- Waste: incineration, waste-water management.

- Other (energy-related) covers energy use principally in the services and household sectors

- Other (Non Energy): Emissions from solvent and other product use.

The following table shows the conversion of NFR sector codes into EEA sector codes (EEA, 2006):

EEA classification		Non-GHGs (NFR)	GHGs (CRF)
0	National totals	National Total	National totals without LUCF (sector 5)
1	Energy industries	1A1	1A1
3	Industry (Energy)	1A2	1A2
2	Fugitive emissions	1B	1B
11	Transport	n.a.	n.a.
7	Road transport	1A3b	1A3b
8	Other transport (non-road mobile machinery)	1A3 (excl 1A3b) + sectors mapped to 8 in table below	1A3a, 1A3c, 1A3d, 1A3e
9	Industry (Processes)	2	2
4	Agriculture	4 + 5B	4
5	Waste	6	6
6	Other (Energy)	1A4a, 1A4b, 1A4b(i), 1A4c(i), 1A5a	1A4+1A5
10	Other (non-energy)	3 + 7	3+7
14	Unallocated	Difference between NT and sum of sectors (1-12)	
12	Energy Industries (Power Production 1A1a)	1A1a	1A1a
15	residential	n.a.	1A4 b
16	services, agriculture and other sectors	n.a.	1A4a + 1A4c + 1A5

Quality information

7. Strengths and weaknesses (at data level):
   Strength: officially reported data following agreed procedures and compiled according to published emission inventory guidance (e.g. the EMEP/CORINAIR Atmospheric Emission Inventory Guidebook, the IPCC Guidelines for National Greenhouse Gas Inventories etc),. Weakness: available datasets do not include full time series for all years and/or sectors. Reporting to LRTAP Convention/EMEP and UNFCCC can be inconsistent for some countries in terms of precise sector definitions, missing data etc. Incomplete reporting and resulting intra- and extrapolation may obscure some trends.

8. Reliability, accuracy, robustness, uncertainty (at data level): The individual uncertainties of the estimates for individual gases are discussed in the respective EEA Air Pollution fact sheets for these gases. The trend is likely to be much more accurate than to individual absolute annual values - the annual values are not independent of each other.NO_x emission estimates in Europe are thought to have an uncertainty of about +/-30%, as the NO_x emitted comes both from the fuel burnt and the combustion air and so cannot be estimated accurately from fuel nitrogen alone. EMEP has compared modelled and measured concentrations throughout Europe (EMEP 1998). From these studies differences for individual monitoring stations of up to a factor of two have been found. This is consistent with an inventory of national annual emissions having an uncertainty of +/-30% (there are also uncertainties in the measurements and especially the modelling). Uncertainties in emissions of CO are likely to have a similar magnitude of uncertainty as for NO_x. NMVOC emissions data have been verified by EMEP and others by means of comparison between modelled and measured concentration throughout Europe. From these studies total uncertainty ranges have been estimated to about +/-50%. Some main source categories are less uncertain.CH_4 estimates are reasonably reliable as they are based on a few well-known emission sources. The IPCC believes that the uncertainty in CH_4 emission estimates from all sources, in Europe, is likely to be about +/-20 %. CH_4 emissions from some sources, such as rice fields, are much larger (possibly an order of magnitude), but are a minor emission source in Europe. In 2004, EU Member States reported uncertainties in their estimates of CH_4 emissions from enteric fermentation as ranging between 0.5 % (UK) and 2.8 % (Ireland) of the total national GHG emissions (EEA 2004).

9. Overall scoring (1 = no major problems, 3 = major reservations):
   Relevancy: 1
   Accuracy: 2
   Comparability over time: 2
   Comparability over space: 2