Sulphur oxides (SO_x) and nitrogen oxides (NO_x) emissions

Atmospheric pollutants from energy transformation and energy consumption, but also from industrial processes, are the main contributors to regional and local air pollution. Major concerns relate to their effects on human health and ecosystems.

In the atmosphere, emissions of sulphur and nitrogen compounds are transformed into acidifying substances such as sulphuric and nitric acid. When these substances reach the ground, acidification of soil, water and buildings arises. Soil acidification is one important factor causing forest damage; acidification of the aquatic environment may severely impair the life of plant and animal species.

Nitrogen oxides (NO_x) also contribute to ground-level ozone formation and are responsible for eutrophication, reduction in water quality and species richness. They are associated with adverse affects on human health as high concentrations cause respiratory illnesses.

Definition

The indicators presented here refer to total emissions from human activities of sulphur oxides (SO_x) and nitrogen oxides (NO_x), given as quantities of SO_2 and NO_2. They show changes in emissions over time, as well as emission intensities per unit of GDP and per capita.

It should be kept in mind that SO_x and NO_x emissions provide only a partial view of air pollution problems. They should be supplemented with information on the acidity of rain and snow in selected regions, and the excedance of critical loads in soil and water, which reflect the actual acidification of the environment.

Overview

Compared to 1990, SO_x emissions have decreased significantly for the OECD as a whole as a combined result of structural changes in the economy, changes in energy demand through energy savings and fuel substitution, pollution control policies and technical progress.

SO_x emission intensities per capita and per unit of GDP show significant variation among OECD countries. A strong decoupling of emissions from GDP is seen in many countries.

The Gothenburg Protocol, adopted in Europe and North America to reduce acid precipitation even further, has been in force since May 2005. Most countries reached the goal they fixed for 2010; some countries (mainly in Northern and Eastern Europe) reached the goal early.

NO_x emissions have decreased in the OECD overall since 1990, but less than SO_x emissions. Major progress in the early 1990s, particularly in OECD Europe, reflects changes in energy demand, pollution control policies and technical progress. However, these results have not compensated in all countries for steady growth in road traffic, fossil fuel use and other activities generating NO_x.

Several countries attained the emission ceilings of the Gothenburg Protocol for 2010, but other countries had difficulties in doing so.

Emission intensities per capita and per unit of GDP show significant variations among OECD countries. Two-thirds of the countries have achieved a strong decoupling from economic growth since the 1990s; in a few countries emissions continue to grow in line with GDP.

Despite large reductions SO_x and NO_x emissions and subsequent improvements in air quality, acid deposition remains a concern, in particular in North America, and more needs to be done to assure the recovery of aquatic and terrestrial ecosystems.

See Annex A for decoupling trends and emission structure.

Comparability

International data on SO_x and NO_x emissions are available for almost all OECD countries. The details of estimation methods for emissions such as emission factors and reliability, extent of sources and pollutants included in estimation, etc., may differ from one country to another.

The high emission levels of SO_x for Iceland are due to SO_x emissions from geothermal energy which represented 77% of total emissions in 2010.

OECD totals do not include Chile and Mexico.

For additional notes, see Annex B.

Sources

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European Monitoring and Evaluation Programme (EMEP) (2012), *www.emep.int/*.

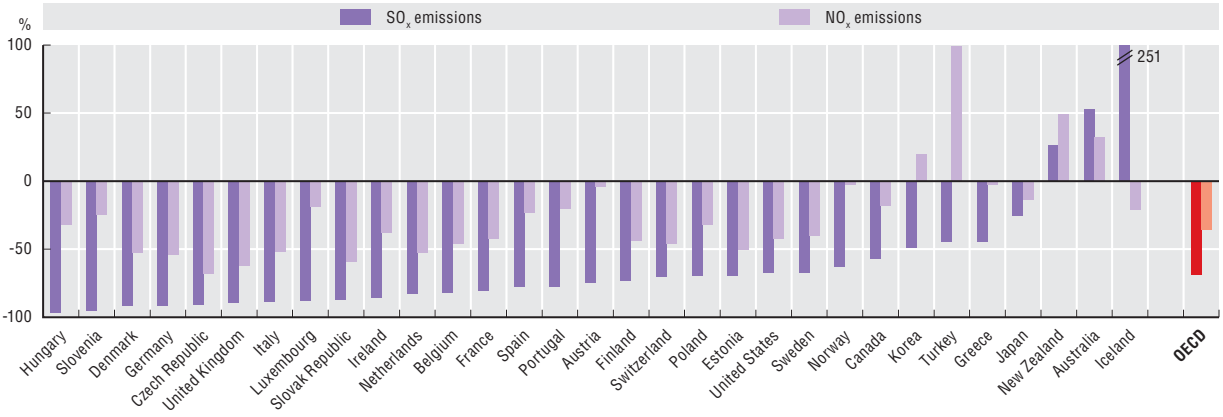
Further information

OECD (2012), "Review of the OECD Environmental Strategy for the First Decade of the 21st Century", OECD, Paris, *www.oecd.org/env/50032165.pdf*.

UNECE (2012), "Convention on Long-Range Transboundary Air Pollution", *www.unece.org/env/lrtap/multi_h1.html*.

Information on data for Israel: *http://dx.doi.org/10.1787/888932315602*.

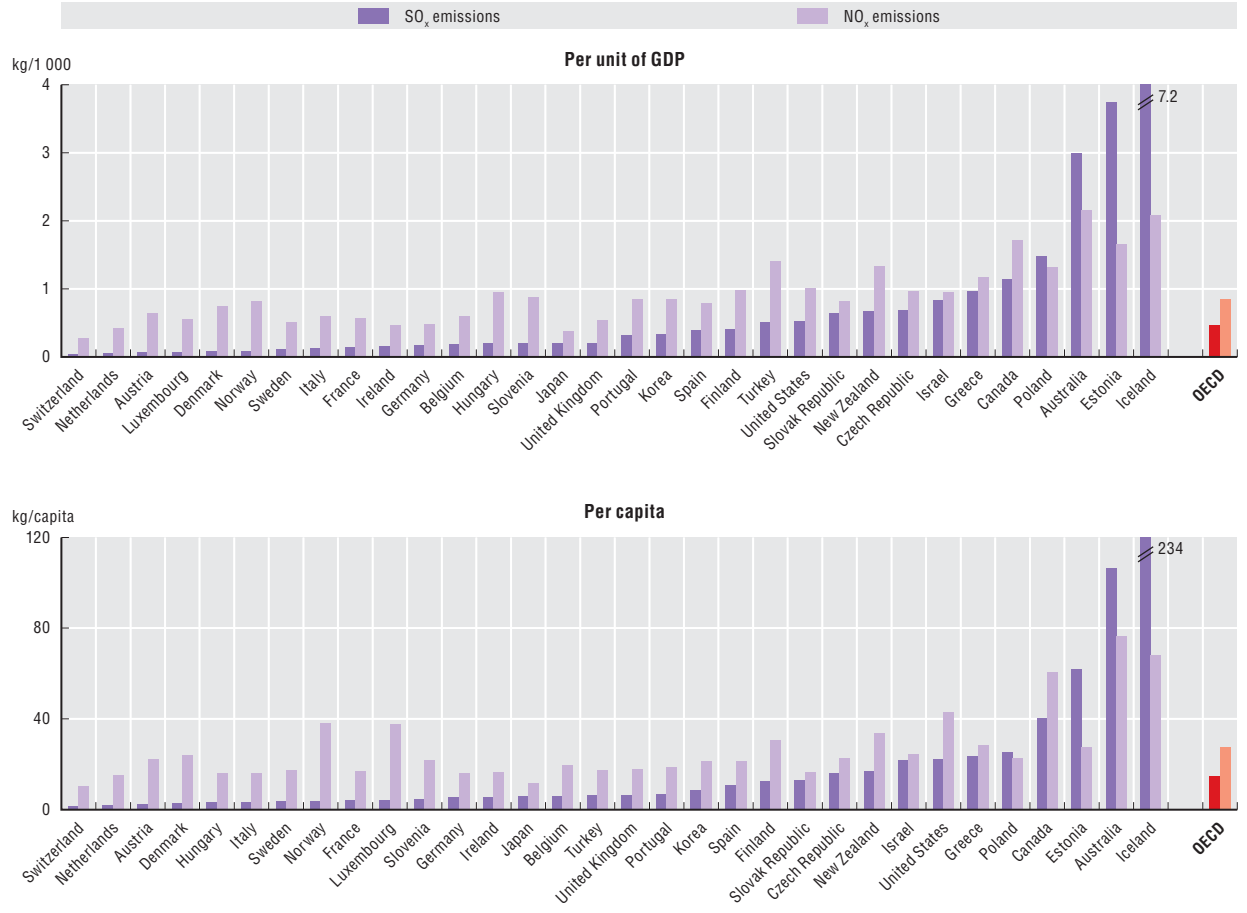
Figure 1.11. **Change in SO_x and NO_x emissions, since 1990**



Source: European Monitoring and Evaluation Programme (EMEP) (2012); *OECD Environment Statistics* (database); UNFCCC, "National Inventory Submissions 2012".

StatLink http://dx.doi.org/10.1787/888932976840

Figure 1.12. **SO_x and NO_x emission intensities, 2010**



Source: European Monitoring and Evaluation Programme (EMEP) (2012); *OECD Environment Statistics* (database); UNFCCC, "National Inventory Submissions 2012".

StatLink http://dx.doi.org/10.1787/888932976859

Table 1.3. **Sulphur oxides (SO_x) emissions and intensities**

	Total SO_x emissions		Emission intensities per unit of GDP		Emission intensities per capita		GDP
	1 000 tonnes	% change	kg/1 000 USD	% change	kg/cap	% change	% change
	2010	1990-2010	2010	1990-2010	2010	1990-2010	1990-2010
Australia	2 370	53	3.0	-19	106	17	89
Austria	19	-75	0.1	-83	2	-77	49
Belgium	66	-82	0.2	-87	6	-83	43
Canada	1 371	-57	1.1	-73	40	-65	61
Chile[1]	893	-61	4.1	-84	..	..	182
Czech Republic[1]	170	-91	0.7	-95	16	-91	73
Denmark	15	-92	0.1	-94	3	-92	37
Estonia	83	-70	3.7	-82	62	-64	67
Finland	67	-73	0.4	-81	12	-75	44
France	262	-81	0.1	-86	4	-83	36
Germany	449	-92	0.2	-93	5	-92	28
Greece	265	-44	1.0	-64	23	-50	55
Hungary[1]	32	-97	0.2	-98	3	-97	42
Iceland[1]	75	251	7.2	120	234	181	59
Ireland	26	-86	0.2	-94	6	-89	146
Israel	164	..	0.8	..	22	..	141
Italy	211	-88	0.1	-90	4	-89	22
Japan	756	-25	0.2	-38	6	-27	20
Korea[1]	418	-49	0.3	-81	9	-55	183
Luxembourg[1]	2	-88	0.1	-94	4	-91	114
Mexico	..	..	..	..	..	..	65
Netherlands	34	-82	0.1	-89	2	-84	56
New Zealand	74	26	0.7	-26	17	-3	72
Norway	19	-63	0.1	-78	4	-68	67
Poland[1]	974	-70	1.5	-86	25	-70	112
Portugal	72	-78	0.3	-84	7	-79	43
Slovak Republic	69	-87	0.6	-94	13	-87	118
Slovenia	10	-95	0.2	-97	5	-95	83
Spain	488	-78	0.4	-86	11	-81	62
Sweden	35	-67	0.1	-78	4	-70	51
Switzerland	12	-70	0.0	-77	2	-75	31
Turkey	463	-45	0.5	-74	6	-58	110
United Kingdom	406	-89	0.2	-93	7	-90	53
United States[1]	6 812	-67	0.5	-80	22	-74	63
OECD[1]	**16 288**	**-69**	**0.5**	**-80**	**15**	**-73**	**54**

1. See Annex B for country notes.

Source: European Monitoring and Evaluation Programme (EMEP) (2012); *OECD Environment Statistics* (database); UNFCCC, "National Inventory Submissions 2012".

StatLink http://dx.doi.org/10.1787/888932978132

Table 1.4. **Nitrogen oxides (NO_x) emissions and intensities**

	Total NO_x emissions		Emission intensities per unit of GDP		Emission intensities per capita		GDP
	1 000 tonnes	% change	kg/1 000 USD	% change	kg/cap	% change	% change
	2010	1990-2010	2010	1990-2010	2010	1990-2010	1990-2010
Australia[1]	1 703	32	2.2	-30	76	1	89
Austria	187	-4	0.6	-35	22	-11	49
Belgium	214	-46	0.6	-62	20	-51	43
Canada	2 066	-18	1.7	-49	61	-34	61
Chile[1]	302	100	1.4	-19	..	..	182
Czech Republic[1]	239	-68	1.0	-81	23	-68	73
Denmark	133	-52	0.7	-65	24	-56	37
Estonia	37	-50	1.7	-70	27	-42	67
Finland	165	-44	1.0	-61	31	-48	44
France	1 079	-42	0.6	-57	17	-48	36
Germany	1 319	-54	0.5	-64	16	-56	28
Greece	322	-2	1.2	-37	28	-12	55
Hungary[1]	162	-32	1.0	-52	16	-29	42
Iceland	22	-21	2.1	-50	68	-36	59
Ireland	75	-38	0.5	-75	17	-51	146
Israel	187	..	0.9	..	25	..	141
Italy	969	-52	0.6	-60	16	-55	22
Japan	1 479	-14	0.4	-28	12	-16	20
Korea[1]	1 045	20	0.8	-55	21	5	183
Luxembourg[1]	19	-19	0.5	-62	38	-38	114
Mexico	..	..	..	..	..	..	65
Netherlands	256	-53	0.4	-70	15	-58	56
New Zealand[1]	147	49	1.3	-13	34	15	72
Norway	186	-3	0.8	-42	38	-16	67
Poland[1]	867	-32	1.3	-68	23	-33	112
Portugal	197	-21	0.9	-44	19	-25	43
Slovak Republic	89	-59	0.8	-81	16	-60	118
Slovenia	45	-25	0.9	-59	22	-26	83
Spain	984	-23	0.8	-52	21	-35	62
Sweden	162	-40	0.5	-60	17	-45	51
Switzerland	81	-46	0.3	-59	10	-53	31
Turkey	1 281	99	1.4	-5	18	50	110
United Kingdom	1 101	-62	0.5	-75	18	-64	53
United States[1]	13 264	-42	1.0	-64	43	-53	63
OECD[1]	**30 082**	**-36**	**0.8**	**-58**	**27**	**-44**	**54**

1. See Annex B for country notes.

Source: European Monitoring and Evaluation Programme (EMEP) (2012); *OECD Environment Statistics* (database); UNFCCC, "National Inventory Submissions 2012".

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