AIR QUALITY

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. Human exposure is particularly high in urban areas where economic activities are concentrated. Causes of growing concern are concentrations of fine particulates, NO_2, toxic air pollutants, and acute ground-level ozone pollution episodes in both urban and rural areas. Air pollution may also damage ecosystems, buildings and monuments, for example through acid precipitation and deposition.

Degraded air quality can result from and cause unsustainable development patterns. It can have substantial economic and social consequences, from medical costs and building restoration needs to reduced agricultural output, forest damage and a generally lower quality of life. Performance can be assessed against domestic objectives and international commitments. In Europe and North America, acidification has led to several international agreements. For example, under the Convention on Long-Range Transboundary Air Pollution (Geneva, 1979), protocols to reduce emissions of sulphur (Helsinki, 1985, Oslo, 1994, Gothenburg, 1999), nitrogen oxides (Sofia, 1988, Gothenburg, 1999) and VOCs (Geneva, 1991, Gothenburg, 1999) have been adopted. Two other protocols are aimed at reducing emissions of heavy metals (Aarhus 1998) and persistent organic pollutants (Aarhus 1998). The main challenges are to further reduce emissions of NO_x and other local and regional air pollutants in order to achieve a strong de-coupling of emissions from GDP and to limit the exposure of the population to air pollution.

Indicators presented here relate to:

- *SO_X and NO_X emissions and changes in them over time, as well as emission intensities expressed as quantities emitted per unit of GDP and per capita, presented with related changes in economic growth and fossil fuel supply. These indicators should be supplemented with information on the acidity of rain and snow in selected regions, and the exceedance of critical loads in soils and waters which reflect the actual acidification of the environment.*
- *air quality expressed as trends in annual SO_2 and NO_2 concentrations for selected cities. In the longer term, indicators should focus on population exposure to air pollution. They should be complemented with information on ground-level ozone and on other air pollutants.*

AIR QUALITY: ONGOING WORK AND REFERENCES

♦ **OECD CORE SET AND RELATED INDICATORS**

Pressure		State	Response
Indirect pressures	Direct pressures		
☑ Economic growth ❶ ❷*p.73*	☐ Index of acidifying substances ❸	☑ Urban air quality trends ❶	☐ Capacity of air pollution abatement equipment (stationary sources, motor vehicles) ❸
☐ Road traffic ❷ *p.87*	☑ Emissions of air pollutants ❶	☐ Population exposure to air pollution ❸	☐ Expenditure on air pollution abatement and control❷ *p.103*
☑ Fossil fuel supply ❶ ❷ *p.16,82*	☐ Urban air emissions ❸	☐ Exceedance of critical loads of PH ❸	

❶ *indicator presented here* ❷ *indicator presented elsewhere in this publication* ❸ *indicator not presented*

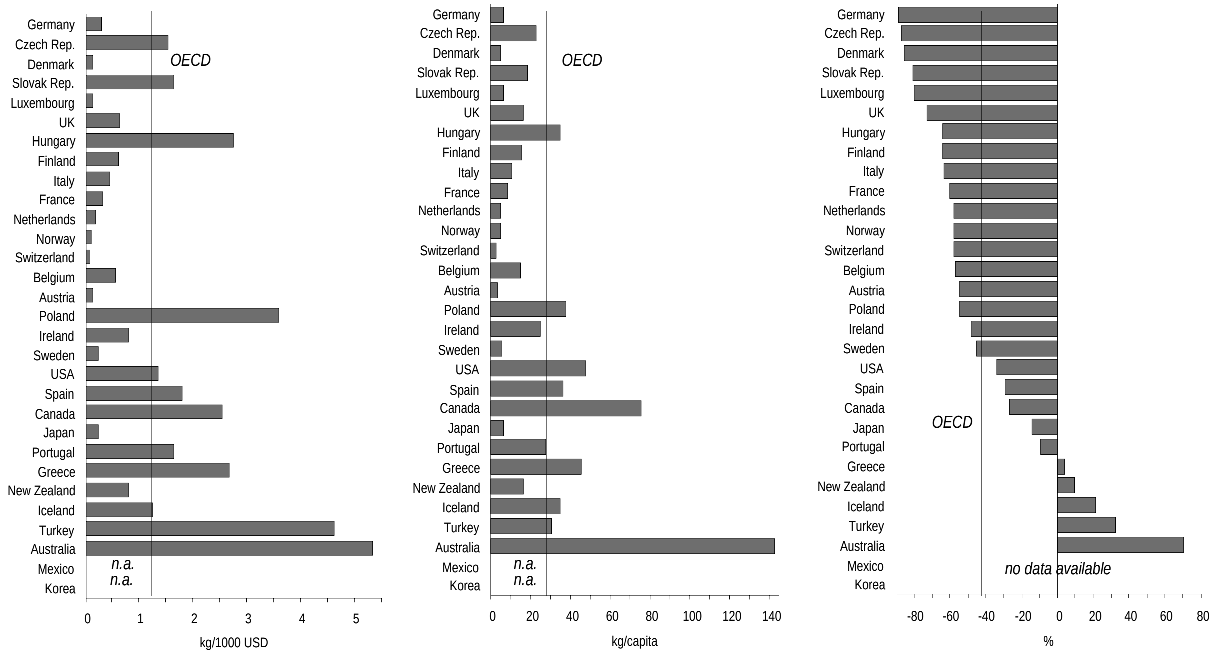
♦ **REFERENCES**

🕮 OECD (1998), Advanced Air Quality Indicators and Reporting
🕮 OECD (2001), OECD Environmental Outlook, Chapter 15, Air Quality
🕮 OECD (2004), OECD Environmental Data — Compendium 2004

AIR EMISSION INTENSITIES 5

Sulphur oxide (SO_x) emissions

Emission intensities per unit of GDP 2002 — **Emission intensities per capita** 2002 — **Change in total emission** since 1990

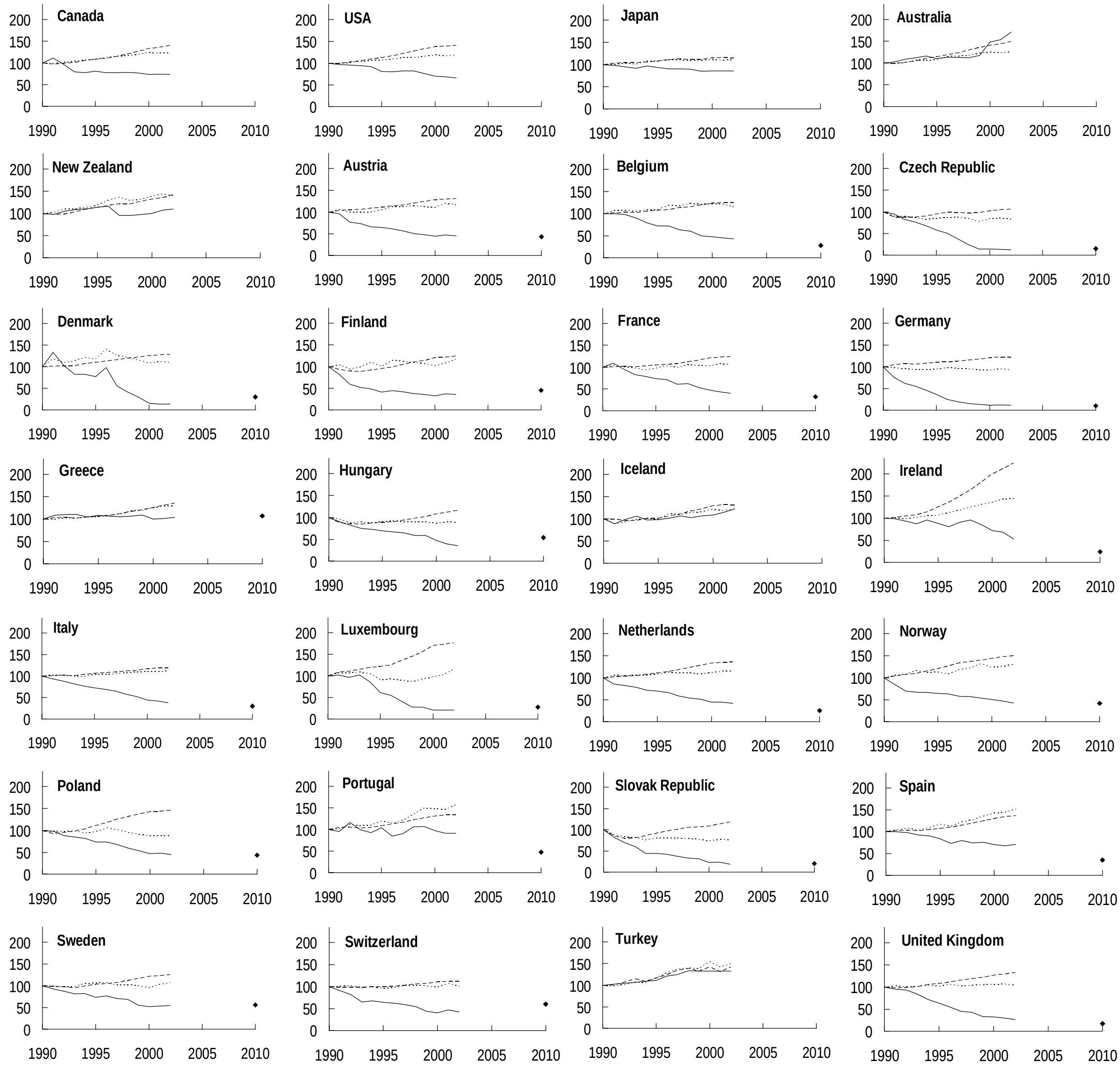


		Emissions of sulphur oxides						Fossil fuel supply	GDP
		Total		Intensities per unit of GDP		Intensities per capita			
		1 000 t. 2002	% change since 1990	kg/1 000 USD 2002	% change since 1990	kg/cap. 2002	% change since 1990	% change since 1990	% change since 1990
Canada		2394	-27	2.6	-48	76	-35	22	40
Mexico	♦	..	..	..	..	..	..	27	41
USA	♦	13847	-34	1.4	-53	48	-43	19	42
Japan		857	-14	0.3	-26	7	-17	12	16
Korea	♦	..	..	..	..	..	..	116	97
Australia		2803	71	5.3	15	143	49	27	49
New Zealand		68	10	0.8	-22	17	-6	40	42
Austria		36	-55	0.2	-66	4	-57	17	31
Belgium		151	-57	0.6	-66	15	-59	16	26
Czech Rep.	♦	237	-87	1.5	-88	23	-87	-16	7
Denmark		24	-86	0.2	-89	5	-87	10	29
Finland		85	-64	0.6	-71	16	-66	17	24
France		537	-60	0.3	-67	9	-61	6	25
Germany		611	-89	0.3	-91	7	-89	-7	22
Greece		509	4	2.7	-24	46	-5	30	36
Hungary	♦	359	-64	2.8	-69	35	-64	-11	16
Iceland		10	22	1.3	-7	35	8	22	32
Ireland		96	-48	0.8	-77	25	-53	44	125
Italy		665	-63	0.5	-69	11	-63	11	20
Luxembourg	♦	3	-80	0.1	-89	7	-82	15	78
Netherlands		85	-58	0.2	-69	5	-61	16	36
Norway		22	-58	0.1	-72	5	-61	29	50
Poland	♦	1455	-55	3.6	-69	38	-55	-13	46
Portugal		295	-9	1.6	-32	28	-13	56	34
Slovak Rep.	♦	102	-81	1.6	-84	19	-81	-24	18
Spain		1541	-29	1.8	-48	37	-33	52	37
Sweden		58	-45	0.2	-57	6	-48	7	26
Switzerland		19	-58	0.1	-62	3	-61	1	13
Turkey	♦	2112	33	4.7	-7	31	11	50	42
UK		1003	-73	0.6	-80	17	-74	4	32
OECD	♦	32104	-41	1.2	-56	28	-46	17	34

♦ *See Technical Annex for data sources, notes and comments.*

5 AIR EMISSION INTENSITIES

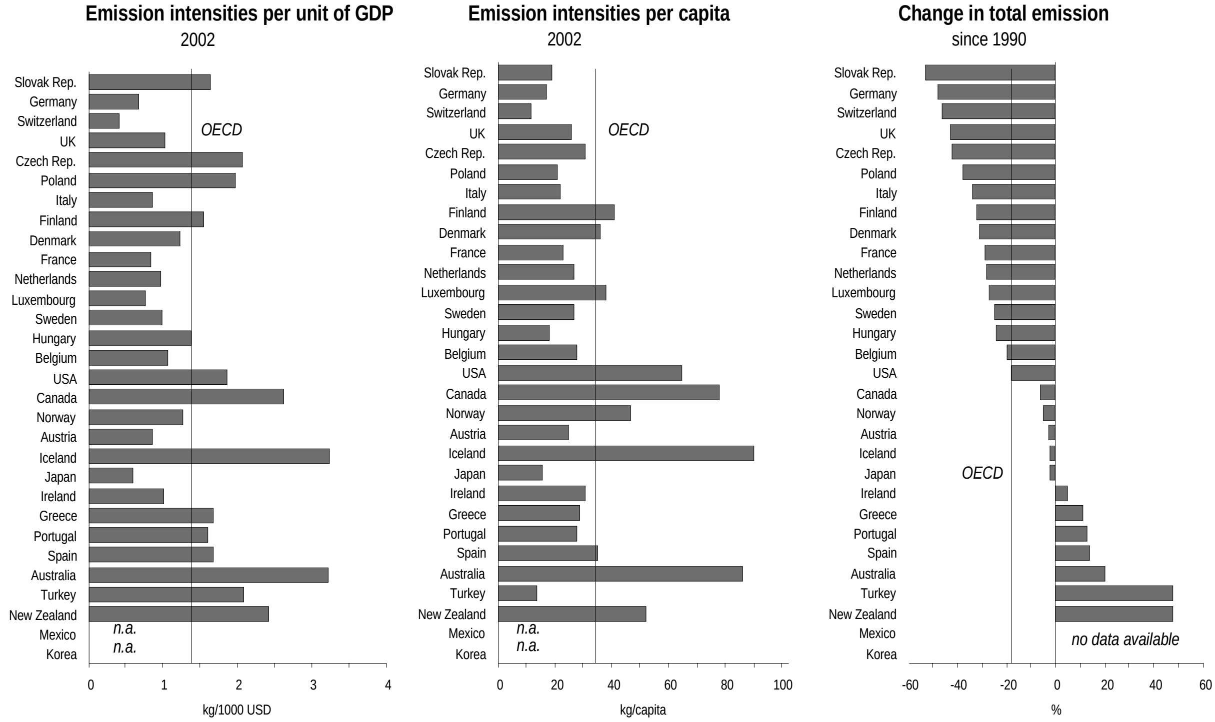
Trends in SOx emissions, Index 1990 = 100



— SOx emissions ····· Fossil fuel supply (FFS) – – GDP ◆ Gothenburg protocol

AIR EMISSION INTENSITIES 5

Nitrogen oxide (NO_x) emissions

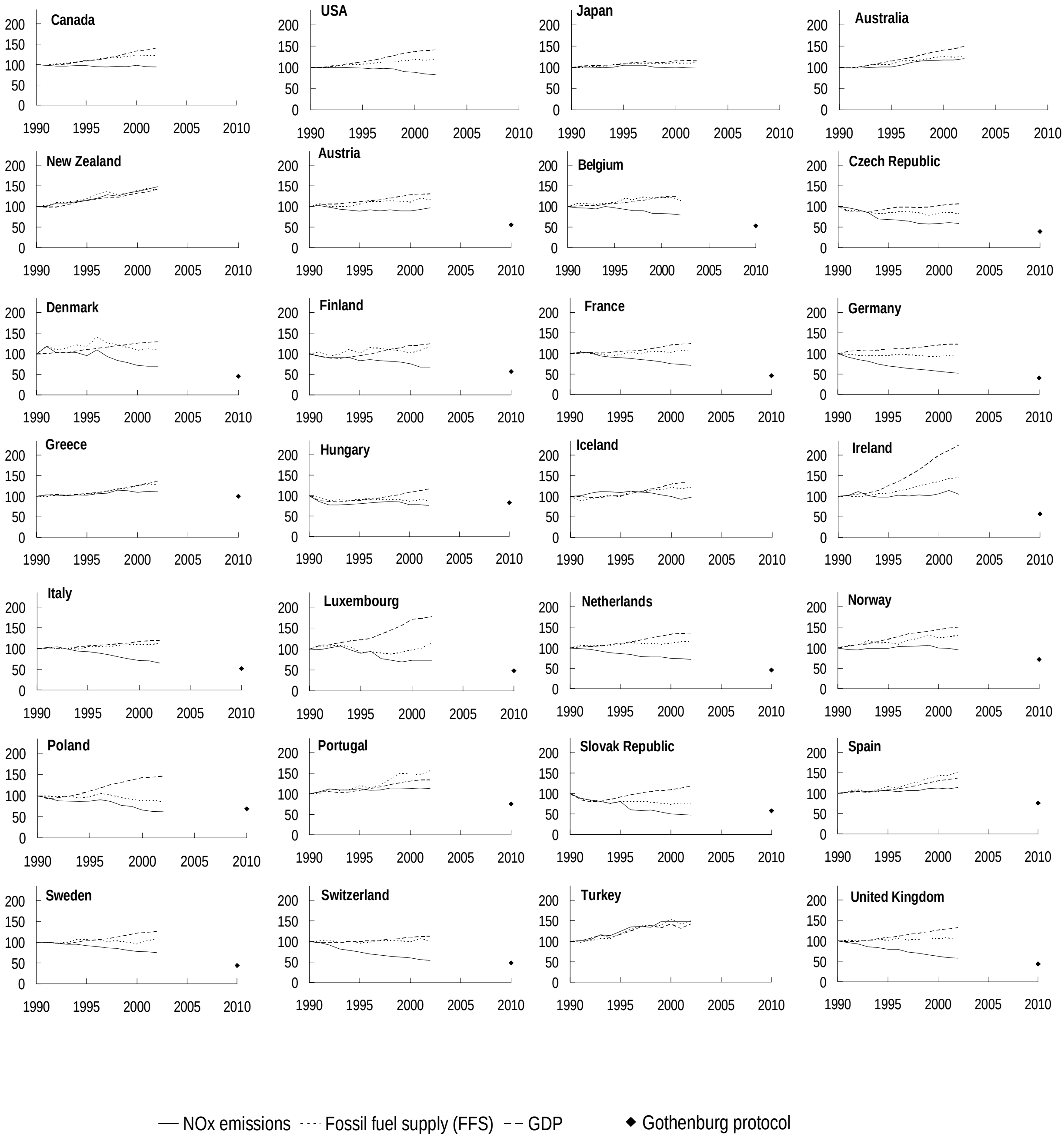


		Emissions of nitrogen oxides						Fossil fuel supply	GDP
		Total		Intensities per unit of GDP		Intensities per capita			
		1 000 t. 2002	% change since 1990	kg/1 000 USD 2002	% change since 1990	kg/cap. 2002	% change since 1990	% change since 1990	% change since 1990
Canada		2459	-6	2.6	-33	78	-17	22	40
Mexico	♦	..	..	..	..	..	..	27	41
USA	♦	18833	-18	1.9	-42	65	-28	19	42
Japan		2018	-2	0.6	-15	16	-5	12	16
Korea	♦	..	..	..	..	..	..	116	97
Australia	♦	1691	20	3.2	-19	86	4	27	49
New Zealand	♦	204	48	2.4	4	52	26	40	42
Austria		200	-3	0.9	-26	25	-7	17	31
Belgium		290	-20	1.1	-37	28	-23	16	26
Czech Rep.	♦	318	-42	2.1	-45	31	-41	-16	7
Denmark		191	-31	1.2	-46	36	-34	10	29
Finland		211	-32	1.6	-46	41	-35	17	24
France		1350	-29	0.9	-43	23	-32	6	25
Germany		1417	-48	0.7	-58	17	-50	-7	22
Greece		318	11	1.7	-19	29	2	30	36
Hungary	♦	180	-24	1.4	-35	18	-23	-11	16
Iceland		26	-2	3.3	-26	90	-13	22	32
Ireland		121	5	1.0	-53	31	-6	44	125
Italy		1267	-34	0.9	-45	22	-36	11	20
Luxembourg	♦	17	-27	0.8	-59	38	-37	15	78
Netherlands		430	-28	1.0	-47	27	-34	16	36
Norway		213	-5	1.3	-37	47	-11	29	50
Poland	♦	796	-38	2.0	-58	21	-38	-13	46
Portugal		288	13	1.6	-16	28	8	56	34
Slovak Rep.	♦	102	-53	1.6	-60	19	-53	-24	18
Spain		1432	14	1.7	-17	35	8	52	37
Sweden		242	-25	1.0	-41	27	-28	7	26
Switzerland		90	-46	0.4	-52	12	-50	1	13
Turkey		951	48	2.1	4	14	23	50	42
UK		1587	-43	1.0	-57	26	-45	4	32
OECD	♦	39530	-17	1.4	*-38*	34	-25	17	*34*

♦ *See Technical Annex for data sources, notes and comments.*

5 AIR EMISSION INTENSITIES

Trends in NO_x emissions, Index 1990 = 100



AIR EMISSION INTENSITIES 5

STATE AND TRENDS SUMMARY

SOX EMISSIONS

SO_x emission intensities per capita and per unit of GDP show significant variations among OECD countries. A strong de-coupling of emissions from GDP is seen in many countries and European countries' early commitments to reduce SO_x emissions have been achieved. The Gothenburg Protocol, adopted in Europe and North America to reduce acid precipitation even further is not yet in force. Some countries (mainly northern and eastern European countries) have already reached their goal for 2010 but further reductions are necessary for others.

Emissions have decreased significantly for the OECD as a whole, compared to 1990 levels, 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, including countries' efforts to control large stationary emission sources.

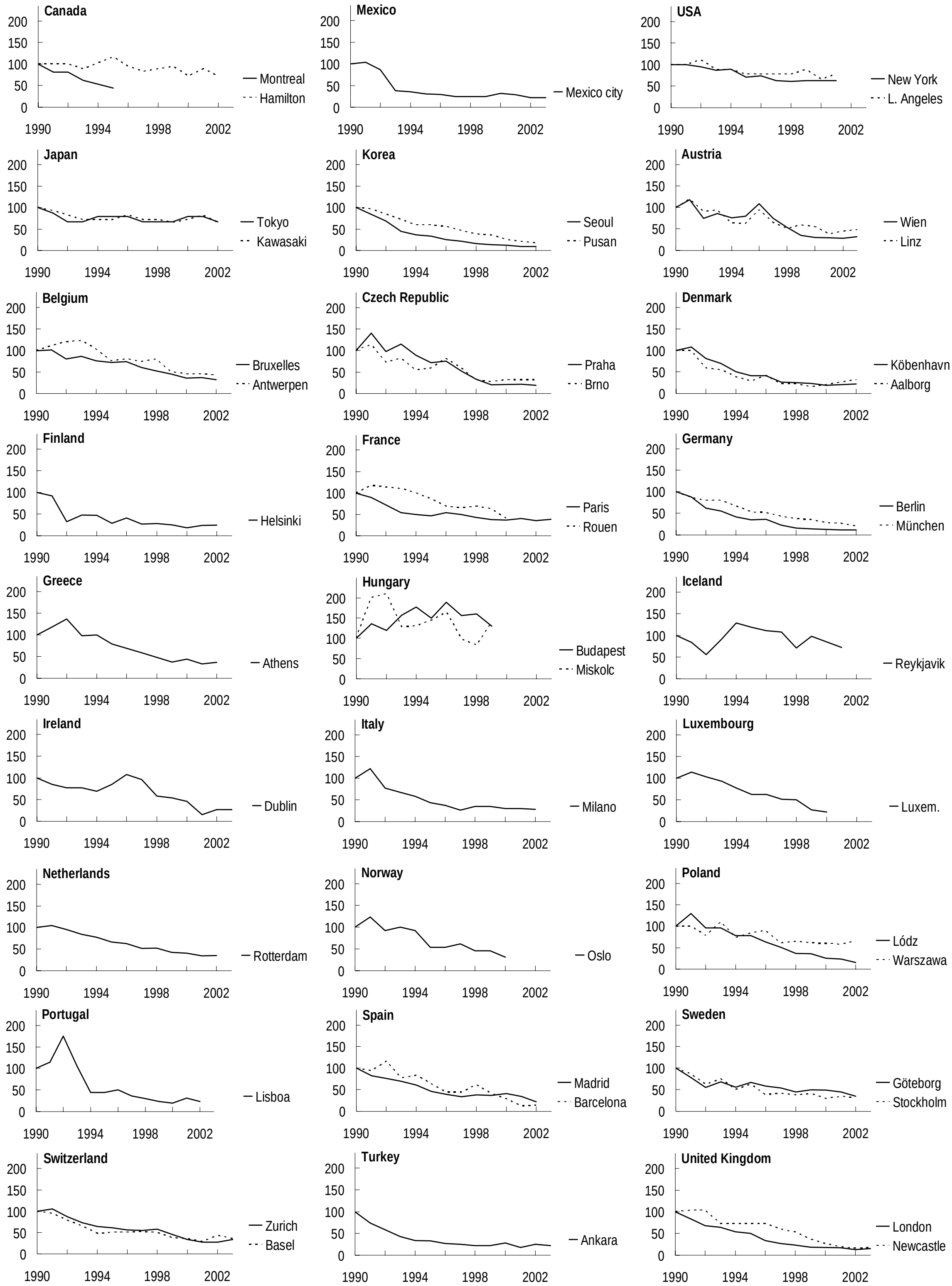
NOX EMISSIONS

NO_x emissions have decreased in the OECD overall compared to 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. The emissions ceilings of the Gothenburg protocol for 2010 may be difficult to attain.

Emission intensities per capita and per unit of GDP show significant variations among OECD countries, and a weak de-coupling of emissions from GDP in a number of countries.

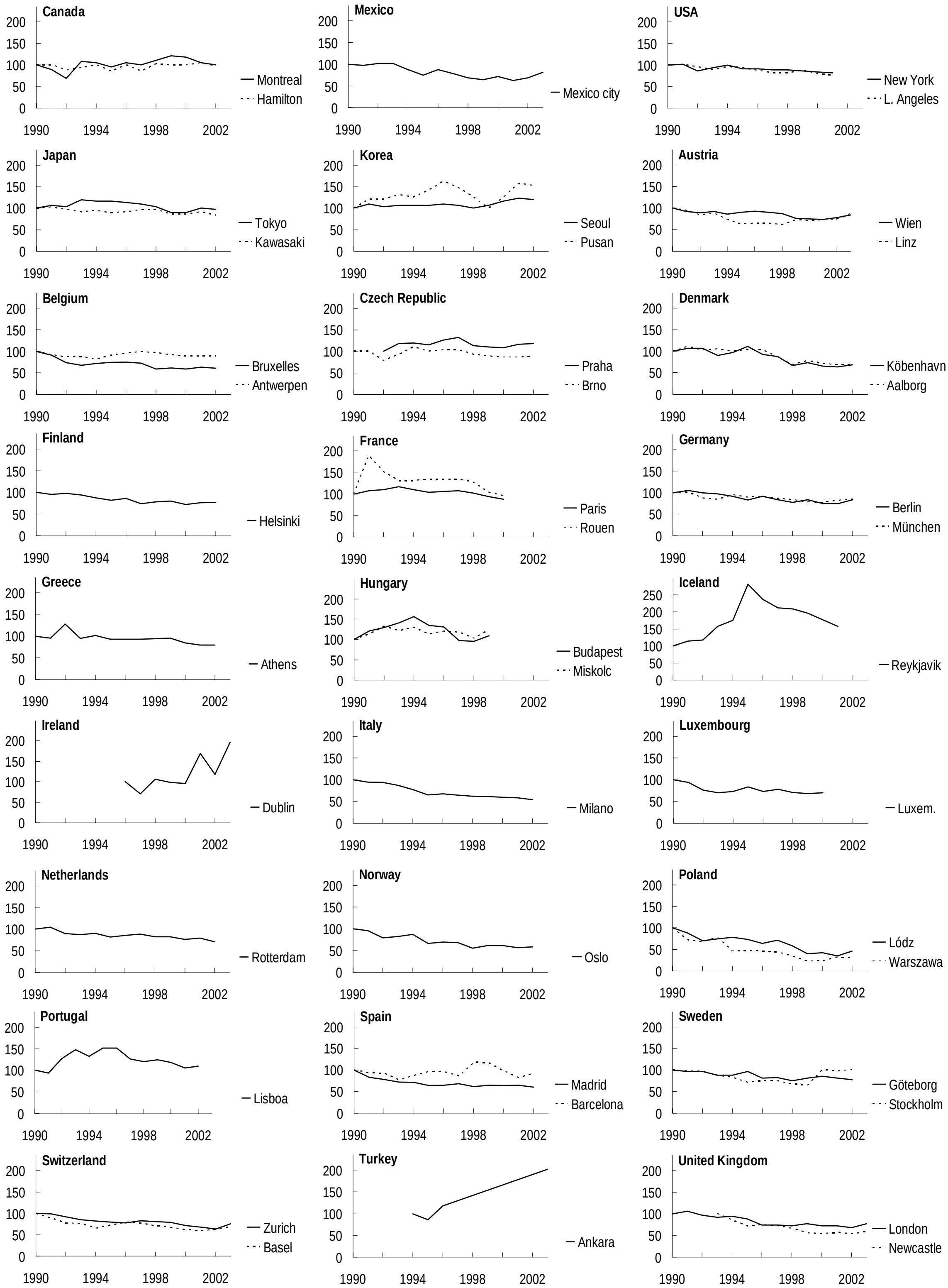
6 URBAN AIR QUALITY

Trends in SO_2 concentrations in selected cities, Index 1990 = 100



URBAN AIR QUALITY 6

Trends in NO_2 concentrations in selected cities, Index 1990 = 100



6 URBAN AIR QUALITY

			Annual concentrations of sulphur dioxide						Annual concentrations of nitrogen dioxide					
			base reference (µg/m³)	(Index 1990 = 100)					base reference (µg/m³)	(Index 1990 = 100)				
			1990	1992	1995	1998	2000	2002-3	1990	1992	1995	1998	2000	2002-3
Canada	Montreal	♦	16.0	81	44	..	..	..	38.0	68	95	..	118	100
	Hamilton	♦	18.0	100	117	89	72	72	41.0	88	85	102	100	98
Mexico	Mexico City	♦	144.0	87	31	25	32	22	78.0	101	74	69	72	82
USA	New York	♦	38.0	95	71	61	63	..	80.0	86	91	89	84	..
	Los Angeles	♦	9.0	111	78	78	67	..	76.0	96	93	82	80	..
Japan	Tokyo	♦	24.0	67	79	67	79	67	61.0	103	116	103	90	97
	Kawasaki	♦	29.0	83	72	72	72	66	71.0	97	89	97	86	83
Korea	Seoul	♦	133.5	69	33	16	12	10	56.4	103	107	100	117	120
	Pusan	♦	102.1	85	59	38	26	18	35.7	121	142	126	126	153
Austria	Wien	♦	18.5	75	80	54	30	32	40.2	89	91	87	75	84
	Linz	♦	10.1	90	63	52	56	48	40.7	84	63	61	71	87
Belgium	Bruxelles	♦	22.6	80	72	53	36	32	54.4	74	74	59	59	61
	Antwerpen	♦	34.3	121	76	80	45	43	54.1	87	91	96	89	89
Czech Rep.	Praha	♦	45.0	98	71	33	21	19	30.4	100	115	113	108	118
	Brno	♦	22.0	73	59	32	32	31	28.0	79	100	93	87	88
Denmark	København	♦	17.2	81	42	25	19	22	48.6	107	111	67	65	69
	Aalborg	♦	12.0	59	29	22	..	32	37.0	103	104	69	71	68
Finland	Helsinki	♦	15.5	33	29	27	18	25	42.3	97	82	79	73	77
France	Paris	♦	28.0	71	46	43	36	38	49.0	110	104	102	88	..
	Rouen	♦	29.0	114	86	69	41	..	29.0	152	134	128	97	..
Germany	Berlin	♦	51.0	63	35	16	12	12	36.0	100	83	78	75	84
	München	♦	15.0	80	53	37	28	21	59.0	88	90	84	77	84
Greece	Athens	♦	50.2	137	79	..	45	36	74.9	128	93	..	84	79
Hungary	Budapest	♦	12.8	120	149	160	..	..	36.8	130	135	95	..	..
	Miskolc	♦	25.9	210	145	83	..	..	25.6	133	113	103	..	..
Iceland	Reykjavik	♦	3.8	55	118	71	..	..	14.8	118	281	208	..	..
Ireland	Dublin	♦	26.0	77	85	58	46	27	17.0	..	..	106	96	196
Italy	Milano	♦	46.0	77	43	35	30	29	120.0	93	65	62	59	54
Luxembourg	Luxembourg	♦	32.0	103	63	50	22	..	67.0	76	84	71	70	..
Netherlands	Rotterdam	♦	22.1	96	67	52	40	35	54.0	90	82	83	76	71
Norway	Oslo	♦	13.0	92	54	46	31	..	61.5	80	67	55	62	59
Poland	Lódz	♦	27.0	96	78	37	26	16	59.0	69	73	59	43	45
	Warszawa	♦	19.0	79	84	65	60	66	68.0	68	47	34	24	30
Portugal	Lisboa	♦	20.0	175	45	30	20	23	33.0	127	152	121	119	110
Spain	Madrid	♦	52.9	76	46	37	41	22	96.2	78	64	62	64	61
	Barcelona	♦	27.8	117	64	61	29	13	57.8	93	96	117	97	92
Sweden	Göteborg	♦	9.0	55	67	45	49	35	33.0	97	97	75	85	77
	Stockholm	♦	8.0	63	63	38	30	32	28.6	97	71	67	101	100
Switzerland	Zurich	♦	17.8	88	61	58	34	34	48.7	92	80	80	72	76
	Basel	♦	13.8	78	51	50	36	36	40.5	78	72	71	62	69
Turkey	Ankara	♦	170.0	..	32	21	28	22	50.0	..	86	..	..	202
UK	London	♦	45.6	68	50	23	17	15	71.7	97	88	73	73	78
	Newcastle	♦	30.0	103	73	53	27	17	54.4	..	73	67	54	59

♦ *See Technical Annex for data sources, notes and comments.*

STATE AND TRENDS SUMMARY

Urban air quality has slowly continued to improve, particularly with respect to SO_2 concentrations; but ground-level ozone, NO_2 concentrations, toxic air pollutants and related health effects raise growing concern, largely due to the concentration of pollution sources in urban areas and to the increasing use of private vehicles for urban trips