AIR QUALITY:

THE U.S. AND EUROPE COMPARED

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- The 15 E.U. nations have ambient air quality targets that are stricter than the U.S. targets; however, E.U. policy sets a much less ambitious target for the number of exceedances of the target that are allowed, making comparisons with U.S. air quality complex.

- Measures of emissions intensity show the U.S. and E.U. have been reducing emissions at roughly the same rate relative to their economic and population growth.

It is often presumed in press commentary and public discourse that European environmental policy is more sophisticated and enlightened than the United States. One way of testing this impression is a head-to-head comparison of environmental performance between European nations and the U.S. This is surprisingly difficult to do because the European Union (E.U.)[1] has different environmental standards than the U.S. and, moreover, the E.U. measures environmental performance very differently than the U.S. does.

The E.U., for example, measures air pollution concentration in micrograms per cubic meter (ug/m^3) while the U.S. measures in parts per million (ppm). This is probably one reason why there are so few direct comparisons available; our literature search found none, in fact. This edition of the *Index* will compare European and American performance on air quality; future editions will examine other common areas such as water quality and forest health.

As Table 5 shows, the 15 E.U. nations have ambient air quality targets that are stricter than the U.S. targets (only the carbon monoxide target is the same as the U.S. target); however, E.U. policy sets a much less ambitious target for the number of exceedences of the target that are allowed. This makes it difficult to judge whether the U.S. or the E.U. has the tougher air quality standard.

The U.S. ozone standard, with a target of less than one exceedence a year, is likely more difficult to reach than the E.U. ozone target of holding ozone exceedences below 26 a year; an out-of-compliance area in the U.S. might have lower ozone exposure than a European region that is in compliance with E.U. targets. The E.U. target on sulfur dioxide (SO_2) appears stricter than the U.S.; on the other hand, the E.U. has no standard for fine particulates ($PM_{2.5}$) while the U.S. has adopted an aggressive standard. The standards for lead cannot be compared at all, as the E.U. and U.S. measurements are wholly incompatible. The E.U. appears to have a tougher target than the U.S., but lead levels in the U.S. have fallen so low that we would easily make the E.U. target no matter how it was measured.

Like the United States, European nations have made substantial progress in improving air quality. It is difficult to say exactly how much progress, or how it compares to the U.S., because European air quality monitoring efforts have significantly lagged monitoring efforts in the U.S.

In the case of ozone, comprehensive monitoring was not in place until 1994, whereas the U.S. has been systematically monitoring ozone since the mid-1970s. "Current data," the European Environment Agency (EEA) reports, "do not yet allow a systematic assessment of exceedences of the new threshold values," though the EEA also says that "ozone concentrations in Europe commonly exceed the threshold set for protection of human health."

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Systematic monitoring for particulates (PM_{10}) in the EU was only achieved in 1997, while the U.S. has been systematically monitoring PM_{10} since 1988 and has been monitoring the new $PM_{2.5}$ standard since 1999. The EEA does not report ambient levels of air pollution in the same way the U.S. does, and because the EEA uses different standards than the U.S. the exceedence rate cannot be compared either.

Hence it is impossible to make simple head-to-head comparisons of ambient air quality conditions between the U.S. and the E.U. However, the E.U. does have emissions data going back to the early 1980s that can be compared with U.S. emissions data. EU data are available from 1980 to 1998; data from 1999 to 2001 are inconsistent with data from earlier periods probably on account of changes to emissions models the EEA has adopted. There are no data available for E.U. lead or particulate emissions.

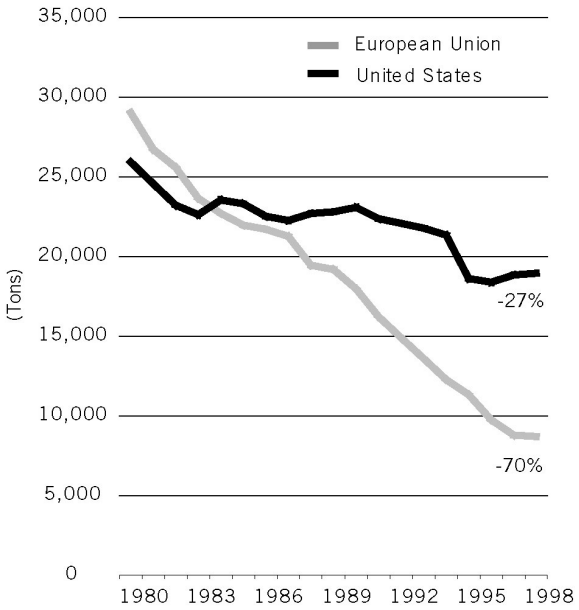
Figures 15–18 compare U.S. and E.U. trends in emissions of sulfur dioxide (SO_2), VOCs, carbon monoxide (CO), and nitrogen oxides (NO_x). At first glance the comparative trends suggest that the E.U. had lower emissions than the U.S. to begin with (with the exception of SO_2—see Figure 15) and has achieved larger emission reductions than the U.S. with the exception of VOCs. Table 6 summarizes the relative emissions reductions of the U.S. and E.U. (In the case of

TABLE 5: EUROPEAN AND U.S. AIR QUALITY STANDARDS COMPARED

	Standard		Exceedence Target	
	E.U.	U.S.	E.U.	U.S.
Ozone (8-hr)	120 ug/m^3	157ug/m^3	<26 days/year	<1 day/year
PM_{10} (24-hr)	50ug/m^3	150ug/m^3	<35 days/year	<1 day/year
$PM_{2.5}$ (ann. avg.)	No std.	15 ug/m^3	n/a	<1 day/year
SO_2 (24-hr)	125 ug/m^3	365 ug/m^3	<4 days/year	<1 day/year
NO_2 (ann. avg).	40 ug/m^3	100 ug/m^3	None	<1 day/year
NO_2 (1-hr)	200ug/m^3	No 1 hr std	<20 days/year	n/a
CO (8-hr)	10 mg/m^3	10 mg/m^3	None	<1 day/year

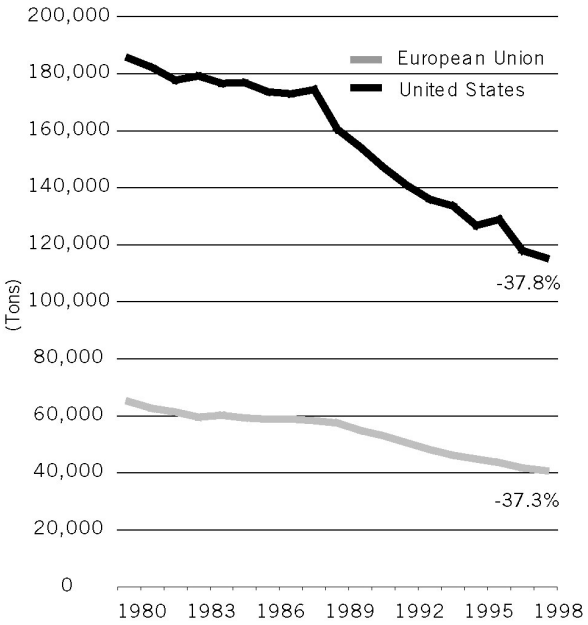
Source: EPA and European Environment Agency (EEA)

FIGURE 15: SULPHUR DIOXIDE (SO_2) EMISSION TRENDS,1980–1998



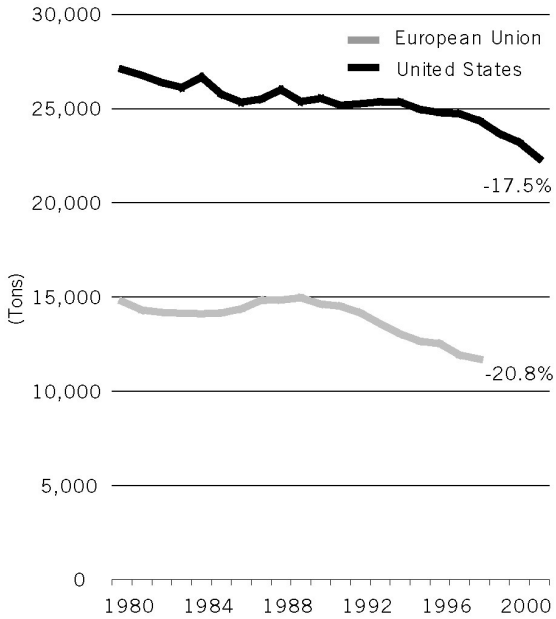
Source: EPA and European Environment Agency (EEA)

FIGURE 16: CARBON MONOXIDE (CO) EMISSION TRENDS, 1980–1998



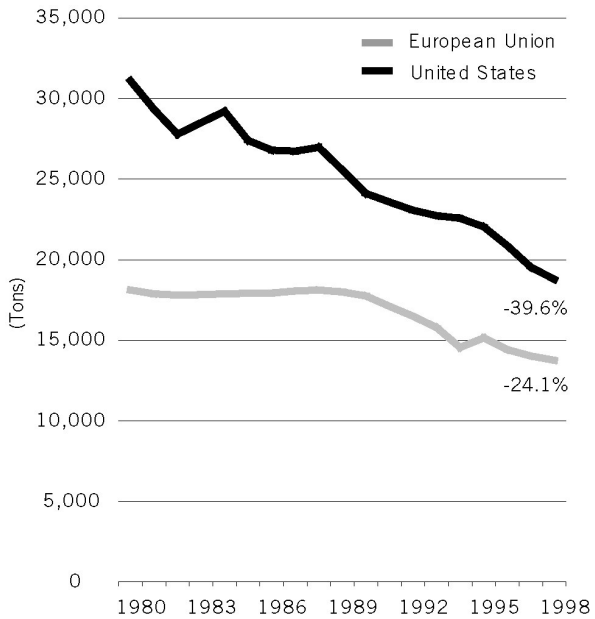
Source: EPA and European Environment Agency (EEA)

FIGURE 17: NITROGEN OXIDES (NO_X) EMISSION TRENDS, 1980–2001



Source: EPA and European Environment Agency (EEA)

FIGURE 18: VOLATILE ORGANIC COMPOUNDS (VOC) EMISSION TRENDS, 1980–1998



Source: EPA and European Environment Agency (EEA)

TABLE 6: U.S. AND E.U. EMISSIONS REDUCTIONS COMPARED, 1980–1998

	U.S.	E.U.
SO_2	-26.9%	-70.0%
VOCs	-39.6%	-24.1%
NO_X	-10.1%	-20.8%
CO	-37.8%	-37.3%

Source: EPA and European Environment Agency (EEA)

TABLE 7: PER-CAPITA U.S. AND E.U. EMISSIONS REDUCTIONS COMPARED, 1982–1998

	U.S.	E.U.
SO_2	-67.6%	-31.4%
VOCs	-43.2%	-26.4%
NO_X	-22.4%	-21.4%
CO	-45.4%	-36.7%

Source: EPA and European Environment Agency (EEA)

NO_x and SO_2, we have added more recent data for the U.S., as a new tier of emissions targets that took effect in 1999 show an increase in the rate of emission reduction in the last three years.) On the surface, at least, the European experience may be said to indicate that larger reductions can be expected in the U.S.

Several qualifying factors should be considered when evaluating these comparisons, however. Some of the obvious differences between the economic and energy profiles of the U.S. and the E.U. come to mind, such as the much higher proportion of electricity generation from emission-free nuclear power, as much as 70 percent of the total in France, for example, versus less than 20 percent in the U.S. As most air pollution is a byproduct of combustion to produce energy, Europe's high fuel and energy taxes suppress energy consumption far below the rate of the U.S.

THESE MEASURES OF EMISSIONS INTENSITY SHOW THAT THE U.S. AND THE E.U. HAVE BEEN REDUCING EMISSIONS AT ROUGHLY THE SAME RATE RELATIVE TO THEIR ECONOMIC AND POPULATION GROWTH.

Population growth in the U.S. has been substantially higher during this period: the E.U.'s population grew by about five percent, while the U.S. population grew 20 percent. The economies of the two regions grew at about the same pace during the last two decades and are roughly the same size, but the E.U.'s larger population means that U.S. per-capita income is nearly 40-percent higher than the E.U.

TABLE 8: U.S. AND E.U. EMISSIONS REDUCTIONS PER DOLLAR OF GDP, 1982–1998

	U.S.	E.U.
SO_2	-69.8%	-88.1%
VOCs	-75.0%	-73.0%
NO_X	-65.8%	-71.1%
CO	-76.8%	-76.0%

Source: EPA and European Environment Agency (EEA)

One way of equalizing the population and economic differences of the two spheres is to compare emissions reductions on a per-capita basis and on the basis of emissions per dollar of Gross Domestic Product (GDP). Table 7 displays emissions reductions on a per-capita basis, and Table 8 compares emissions per dollar of GDP. (E.U. GDP information was only available back to 1982 from the U.N. Economic Commission for Europe.) These measures of emissions intensity show that the U.S. and the E.U have been reducing emissions at roughly the same rate relative to their economic and population growth.

Notes

1 The 15 members of the European Union are: Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Sweden. The European Environmental Agency (EEA) collects some data on non-E.U. nations, but we have not included these here because of their incompleteness.