

# 10

## Urban Air Pollution



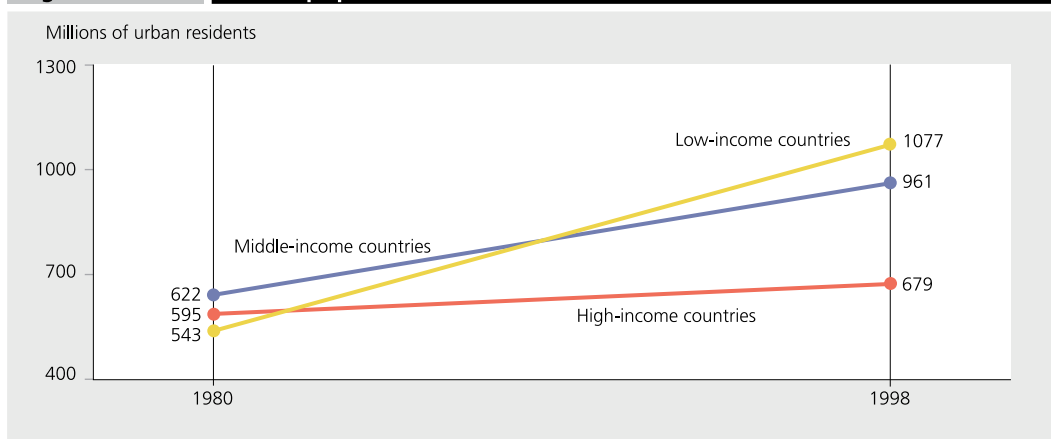
Urbanization is a process of relative growth in a country's urban population accompanied by an even faster increase in the economic, political, and cultural importance of cities relative to rural areas. There is a worldwide trend toward urbanization. In most countries it is a natural consequence and stimulus of **economic development** based on **industrialization** and **postindustrialization** (see Chapter 9). Thus the level of urbanization, as measured by the share of a country's urban population in its total population, is highest in the most developed, **high-income countries** and lowest in the least developed, **low-income countries** (see Data Table 4).

However, because the population of **developing countries** is larger, percent-

ages of this population represent more people. In addition, urbanization in the developing world is progressing much faster than in **developed countries** (see Fig. 10.1). As a result, by the late 1990s about three-quarters of the world's 2.5 billion urban residents lived in developing countries. The share of the urban population in the total population of low- and middle-income countries increased from less than 22 percent in 1960 to 41 percent in 1998 and is expected to exceed 50 percent by 2015.

A rough indication of the urban contribution to GDP is the combined share of GDP produced in the industry and service sectors relative to agriculture. Judging by this indicator, cities in developing countries are already more economically

**Figure 10.1** Urban population, 1980 and 1998



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## Why is urban air pollution often higher in developing countries?

important than rural, primarily agricultural areas, because more than half of the developing world's GDP originates in cities. (This is not yet true for every country, as you can see in Data Table 4.)

While urbanization is characteristic of nearly all developing countries, levels of urbanization vary quite significantly by region. Most Latin American countries are as urbanized as Europe, with about three-quarters of the population living in urban areas. At the same time, South Asia, East Asia, and Sub-Saharan Africa remain predominantly rural, though they are urbanizing rapidly (see Fig. 10.2).

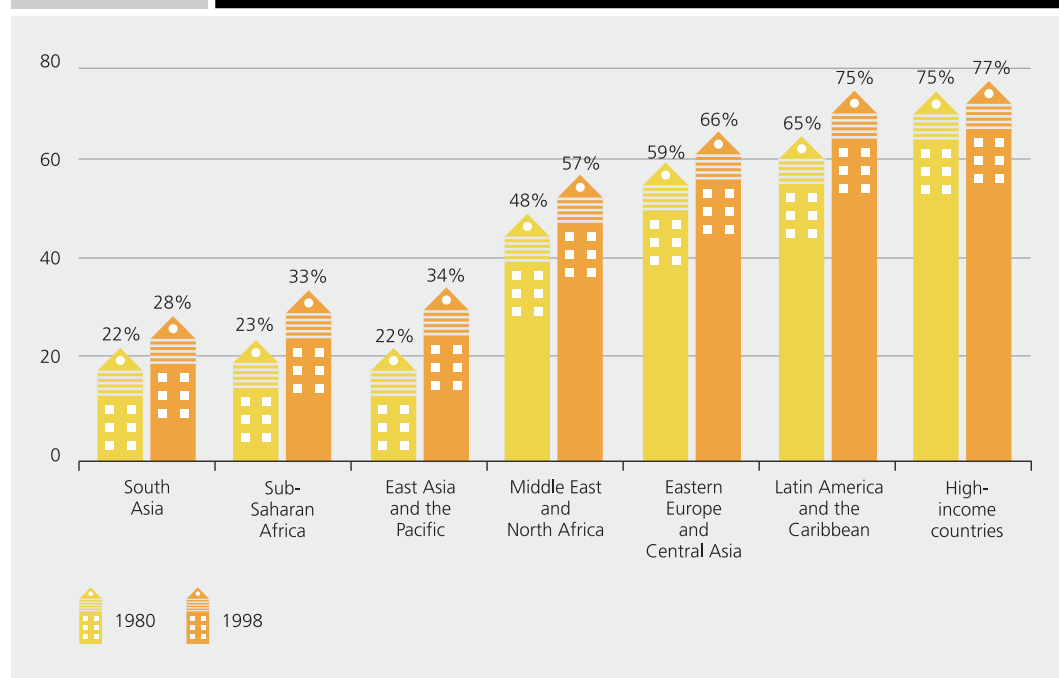
Most of the world's most populous cities are in developing countries. Many of

these cities are in Asian countries with low per capita incomes but big populations, such as China, India, and Indonesia. These cities have high concentrations of poor residents and suffer from social and environmental problems including severe air pollution.

### Particulate Air Pollution

Suspended particulate matter is made up of airborne smoke, soot, dust, and liquid droplets from fuel combustion. The amount of suspended particulate matter, usually measured in micrograms per cubic meter of air, is one of the most important indicators of the quality of the air that people breathe. According to

**Figure 10.2** Urban population as a percentage of total population, 1980 and 1998



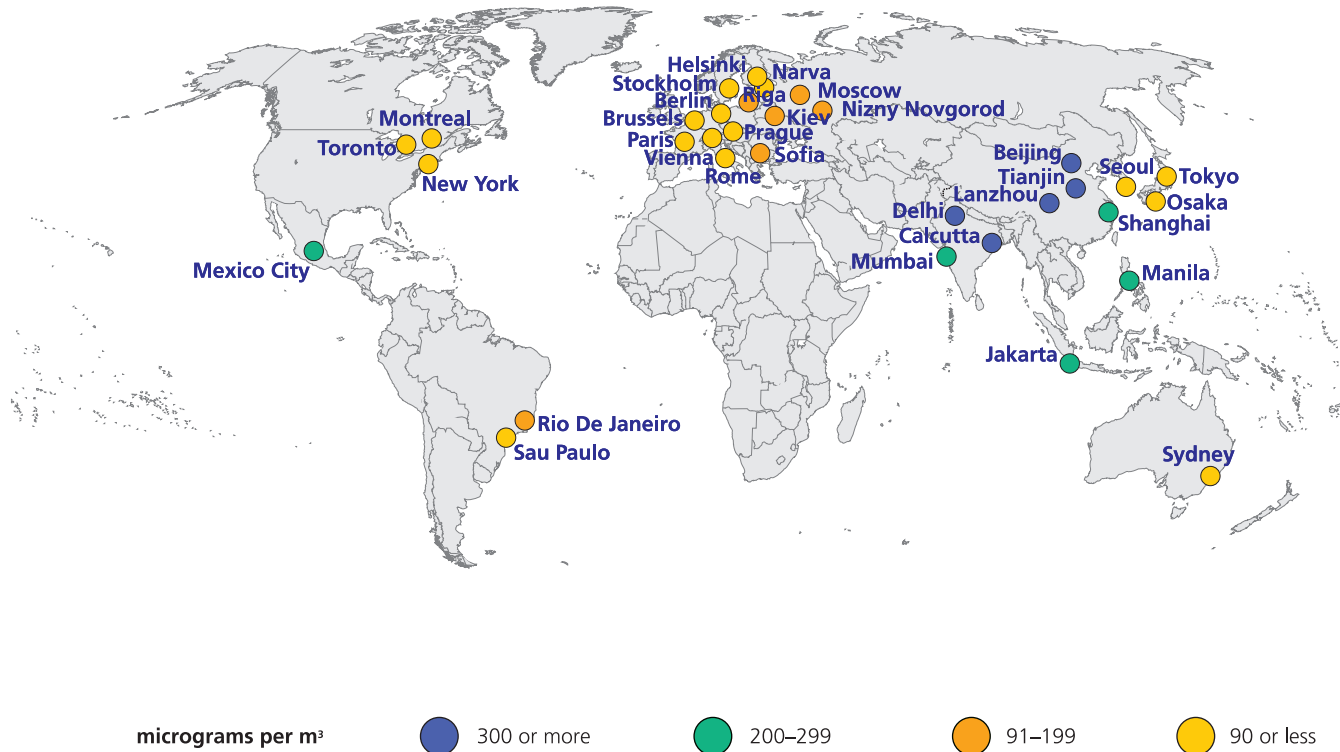
the World Health Organization's air quality standards, the concentration of suspended particulates should be less than 90 micrograms per cubic meter. In many cities, however, this number is several times higher (see Table 10.1 and Map 10.1).

High concentrations of suspended particulates adversely affect human health, provoking a wide range of respiratory diseases and exacerbating heart disease and other conditions. Worldwide, in 1995 the ill health caused by such pollution resulted in at least 500,000 premature deaths and 4–5 million new cases of chronic bronchitis. Most of the people at risk are urban dwellers in developing countries, especially China and India. In many Chinese cities air quality is so poor that nationwide, economic losses caused by excess illness and mortality of urban residents are estimated at 5 percent of GDP. According to estimates for 18 cities in Central and Eastern Europe, 18,000 premature deaths a year could be prevented and \$1.2 billion a year in working time lost to illness could be regained by achieving European Union pollution standards for dust and soot.

The level of air pollution depends on a country's technologies and pollution control, particularly in energy production. Using cleaner **fossil fuels** (such as natural gas and higher-grade coal), burning these fuels more efficiently, and increasing reliance on even cleaner,

**Table 10.1 Particulate air pollution in the largest cities, 1995**

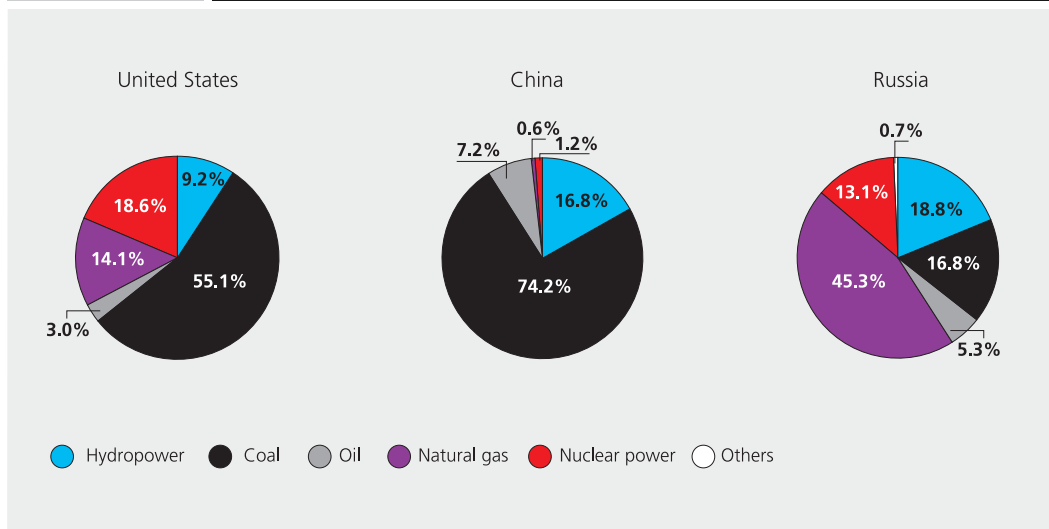
<i>Country</i>	<i>City</i>	<i>City population (thousands)</i>	<i>SPM (micrograms per m<sup>3</sup>)</i>
Brazil	São Paolo	16,533	86
Australia	Sydney	3,590	54
Austria	Vienna	2,060	47
Belgium	Brussels	1,122	78
Brazil	Sao Paolo	16,533	86
	Rio de Janeiro	10,187	139
Bulgaria	Sofia	1,188	195
Canada	Toronto	4,319	36
	Montreal	3,320	34
China	Shanghai	13,584	246
	Beijing	11,299	377
	Taiwan	2,502	568
	Lanzhou	1,747	732
Czech Republic	Prague	1,225	59
Finland	Helsinki	1,059	40
France	Paris	9,523	14
Germany	Berlin	3,317	50
India	Bombay	15,138	240
	Calcutta	11,923	375
	Delhi	9,948	415
Indonesia	Jakarta	8,621	271
Italy	Rome	2,931	73
Japan	Tokyo	26,959	49
	Osaka	10,609	43
Korea, Rep.	Seoul	11,609	84
Mexico	Mexico City	16,562	279
Philippines	Manila	9,286	200
Russian Federation	Moscow	9,269	100
	Nizhny Novgorod	1,456	170
Sweden	Stockholm	1,545	9
Ukraine	Kiev	2,809	100
United States	New York (1987-90)	16,332	61

**Map 10.1** Particulate air pollution in selected cities, 1990–1995


renewable sources of energy (hydro, solar, geothermal, wind) are some of the best ways to control and reduce air pollution without limiting **economic growth**. See Figure 10.3 for the main sources of electricity in China, the United States, and Russia. Judge these data against the concentrations of suspended particulates in the biggest cities of these three countries as shown in Table 10.1. Note that coal and oil are considered to be the “dirtiest” of the sources shown, although a lot depends on their quality and methods of combustion. In many ways nuclear energy is

one of the “cleanest” sources of electricity, but safe disposal of nuclear waste and the risks of radioactive pollution in case of a serious accident are of major concern. Sources with the least environmental impact, such as solar and wind energy, are not shown because they account for only a small fraction of generated electricity in these countries.

Fuel combustion by motor vehicles is another major source of suspended particulate emissions in urban areas. These emissions are particularly detrimental to human health because pollutants are

**Figure 10.3** Sources of electricity, 1997

**Is it possible to reduce air pollution without slowing economic growth?**

emitted at ground level. Motor vehicles are much more common in developed countries: in 1998 there were 585 of them per 1,000 people in high-income countries compared with just 9 per 1,000 people in low-income countries and 104 in middle-income countries. (See Data Table 4 for the number of motor vehicles in individual countries.) But motor vehicles in developing countries still cause serious air pollution because they are concentrated in a few large cities, many are in poor mechanical condition, and few emission standards exist.

According to World Bank estimates, demand for gasoline in developing countries tends to grow 1.2–1.9 times faster than **GNP per capita**. Then, with per capita income growth rates of 6–8 percent a year observed in some fast-growing developing countries, growth

rates in motive fuel consumption of 10–15 percent a year are possible. And in many transition countries, the number of cars in use grew rapidly despite the contraction in economic activity and reduced per capita incomes in the late 1980s and early 1990s. For example, in Moscow (Russian Federation) the passenger car fleet grew 10 percent a year during 1984–94 and 17.5 percent a year during 1990–94. Without effective policies to curb motor vehicle emissions, the growing number of cars can have grave consequences for urban residents' health.

### **Airborne Lead Pollution**

Airborne lead is one of the most harmful particulate pollutants. Young children are especially vulnerable: lead poisoning of children leads to permanent brain damage, causing learning disabilities,

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hearing loss, and behavioral abnormalities. In adults lead absorption causes hypertension, blood pressure problems, and heart disease. The main sources of airborne lead are motor vehicles using leaded gasoline, industrial processes such as ferrous and nonferrous metallurgy, and coal combustion.

While governments increasingly control large industrial sources of pollution, motor traffic is rapidly growing. In many urban areas vehicles using leaded gasoline cause more than 80 percent of lead pollution. Therefore, since the 1970s—when medical evidence on the adverse health impacts of lead became available—many countries have reduced or eliminated lead additives in gasoline. The elimination of leaded gasoline has been achieved, for example, in Austria, Japan, and Sweden. But in much of the developing world lead additives are still widely used, especially in Africa. Experts suspect that in developing countries all children under 2 and more than 80 percent of those between 3 and 5 have blood lead levels exceeding World Health Organization standards. Economists have calculated that, with the technological options available today, phasing out leaded gasoline is highly cost-effective. Shifting production from leaded to unleaded gasoline rarely costs more than 2 cents a liter, and countries can save 5 to 10 times as much as that, mostly in health savings from reduced illness and mortality. When the

United States converted to unleaded gasoline, it saved more than \$10 for every \$1 it invested thanks to reduced health costs, savings on engine maintenance, and improved fuel **efficiency**. Recognizing the high costs of the damage to human health caused by lead emissions and adopting appropriate national policy are matters of high urgency for many developing countries.

International experience shows that in most countries air quality deteriorates in the early stages of industrialization and urbanization. But as countries become richer their priorities shift—they recognize the value of their **natural resources** (clean air, safe water, fertile topsoil, abundant forests), enact and enforce laws to protect those resources, and have the money to tackle environmental problems. As a result air quality and other environmental conditions start to improve. Certain experts have even calculated the average levels of per capita income at which levels of various pollutants peaked for a panel of countries between 1977 and 1988. Smoke, for example, tended to peak in the urban air when a country reached a per capita income of about \$6,000, after which this kind of air pollution tended to decrease. For airborne lead, peak concentrations in urban air were registered at considerably lower levels of per capita income—about \$1,900. However, these past observations should not be interpreted as comforting

and automatic “laws of nature.” An improved quality of air does not result directly from economic growth. Any environmental benefits are usually achieved only as a result of political

pressures from environmentally concerned population groups, and only through democratic mechanisms can these pressures translate into regulatory and technological changes.