

Climate Change and Urban Development

Accumulating evidence indicates that increasing concentrations of greenhouse gases, primarily carbon dioxide, are raising average temperatures, acidifying and raising the level of oceans, and accelerating natural rates of carbon dioxide emissions. Uncertainties abound, but the carbon dioxide concentration in the earth's atmosphere has risen by 31 percent since 1850 and now exceeds levels experienced over the past 420,000 years. Recent estimates from North America (for 2003) indicate that its anthropogenic carbon dioxide emissions (mainly from burning fossil fuels) were about 1856 million metric tons per year, or about a quarter of all such global emissions.

Urban areas have two important stakes in global climate change. First, urban development can play an important role in mitigation, that is, reducing carbon dioxide emissions directly related to urban activity. And second, urban areas must adapt to the consequences of climate change when those impacts are unavoidable.

What is the contribution of urban areas to emissions? An inventory of North American carbon dioxide emissions [*State of the Carbon Cycle Report*, U.S. Climate Change Science Program, 2008] reports that 31 percent comes from transportation, 42 percent from commercial energy (mainly electricity generation), 12 percent from industry, 11 percent from on-site use of energy in buildings (mainly heating), and the balance from other sources including agricultural production. About 70 percent of the electricity generated is used in buildings (space conditioning, water heating, lighting, refrigeration, electronics, etc.).

In the United States, 37 percent of total carbon dioxide emissions are related to buildings (from electric use in buildings plus on-site energy use), and the emissions are divided about evenly between residential and commercial space. Of the total emissions from transportation, about six-tenths (or 18 percent of all carbon dioxide emissions) come from light vehicles—cars whose use is heavily concentrated in metropolitan areas. Automobile and building emissions, both largely urban phenomena, therefore account for 18 plus 37 or about 55 percent of all carbon dioxide emissions in North America.



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While national policies, such as fuel efficiency standards for vehicles, will be important instruments in reducing emissions, the large shares of building and vehicle emissions mean that local regulations affecting building codes, patterns of urban development, and transport use will be critical emission reducing instruments.

How can cities adapt to and mitigate the consequences of climate change? While

coastal cities face specific problems related to rising sea levels, cities generally will confront challenges of changing weather patterns, more extreme events including flooding and drought, water supply shortfalls, and public health issues caused by the geographic spread of diseases. These will require adaptive responses. Some states, such as Washington and California, have already moved to mitigate some of these effects by requiring reductions in greenhouse gas emissions, and there is ongoing discussion of the need to reduce carbon dioxide emissions to 80 percent below 1990 levels by 2050.

Reducing emissions will require supply-side changes—typically shifting away from fossil fuels—as well as reductions in demand that involve improved end-user efficiency and changes in consumer behavior and settlement patterns. In urban areas these changes include more compact development patterns that involve less automobile use and support transit, and more energy-efficient buildings, such as those with common walls.

There is much work and analysis yet to be done on how to proceed, but several tools and techniques already exist that can help local planners and policy makers begin to address these problems. Several of these tools are described in our recent policy focus report, *Urban Planning Tools for Climate Change Mitigation* (see page 24). Another product of the Institute's work on climate change and urban development is the online working paper, "Climate Change and the Resilience of New Orleans: The Adaptation of Deltaic Urban Form," by Armando Carbonell and Douglas J. Meffert. Other related publications will be available on our Web site in 2010. [I](#)