GROWING COOLER

THE EVIDENCE ON URBAN DEVELOPMENT AND CLIMATE CHANGE

REID EWING
KEITH BARTHOLOMEW
STEVE WINKELMAN
JERRY WALTERS
DON CHEN

Urban Land Institute

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Overview

The phrase "you can't get there from here" has a new application. For climate stabilization, a commonly accepted target for the year 2050 would require the United States to cut its carbon dioxide (CO_2) emissions by 60 to 80 percent below 1990 levels. Carbon dioxide levels have been increasing rapidly since 1990, and so would have to level off and decline even more rapidly to reach this target level by 2050. This publication demonstrates that the U.S. transportation sector cannot do its fair share to meet this target through vehicle and fuel technology alone. We have to find a way to sharply reduce the growth in vehicle miles driven across the nation's sprawling urban areas, reversing trends that go back decades.

This publication is based on an exhaustive review of existing research on the relationship among urban development, travel, and the CO_2 emitted by motor vehicles. It provides evidence on and insights into how much CO_2 savings can be expected with compact development, how compact development is likely to be received by consumers, and what policy changes will make compact development possible. Several related issues are not fully examined in this publication. These include the energy savings from more efficient building types, the value of preserved forests as carbon sinks, and the effectiveness of pricing strategies—such as tolls, parking charges, and mileage-based fees—when used in conjunction with compact development and expanded transportation alternatives.

The term "compact development" does not imply high-rise or even uniformly high density, but rather higher average "blended" densities. Compact development also features a mix of land uses, development of strong population and employment centers, interconnection of streets, and the design of structures and spaces at a human scale.

THE BASICS

Scientific consensus now exists that greenhouse gas accumulations due to human activities are contributing to global warming with potentially catastrophic consequences (IPCC 2007). International and domestic climate policy discussions have gravitated toward the goal of limiting the temperature increase to 2°C to 3°C by cutting greenhouse gas emissions by 60 to 80 percent below 1990 levels. The primary greenhouse gas is carbon dioxide, and every gallon of gasoline burned produces about 20 pounds of CO_2.

Driving Up CO_2 Emissions

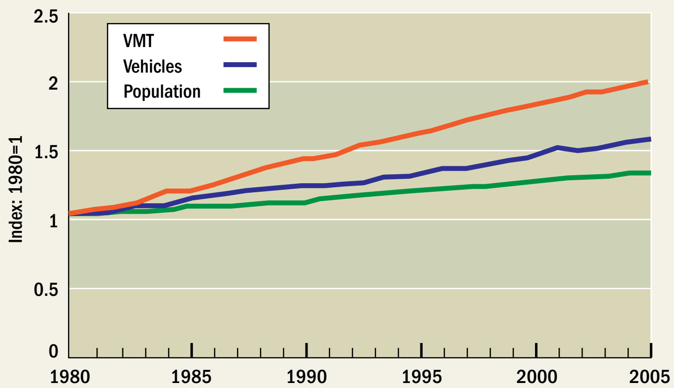
The United States is the largest emitter worldwide of the greenhouse gases (GHGs) that cause global warming. Transportation accounts for a full third of CO_2 emissions in the United States, and that share is growing, rising from 31 percent in 1990 to 33 percent today. It is hard to envision a "solution" to the global warming crisis that does not involve slowing the growth of transportation CO_2 emissions in the United States.

The Three-Legged Stool Needed to Reduce CO_2 from Automobiles

Transportation CO_2 reduction can be viewed as a three-legged stool, with one leg related to vehicle fuel economy, a second to the carbon content of the fuel itself, and a third to the amount of driving or vehicle miles traveled (VMT). Energy and climate policy initiatives at the federal and state levels have pinned their hopes on shoring up the first two legs of the stool, through the development of more efficient vehicles (such as hybrid cars) and lower-carbon fuels (such as biodiesel fuel). Yet a stool cannot stand on only two legs.

As the research compiled in this publication makes clear, technological improvements in vehicles and fuels are likely to be offset by continuing, robust growth in VMT. Since 1980, the number of miles Americans drive has grown three times faster than the U.S. population, and almost twice as fast as vehicle registrations (see Figure 1-1). Average automobile commute times in metropolitan areas have risen steadily over the decades, and many Americans now spend more time commuting than they do vacationing.

FIGURE 1-1
Growth of Population, Vehicle Registration, and VMT in the United States relative to 1980 Values

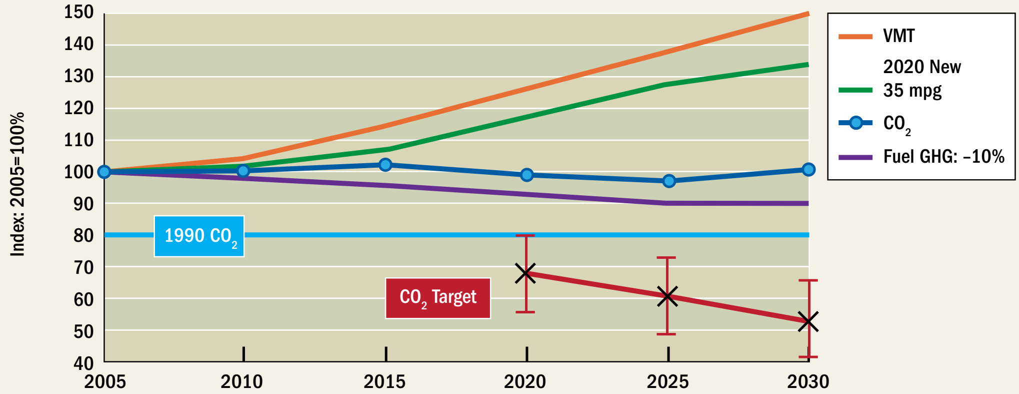


SOURCE: Federal Highway Administration (FHWA). "Vehicle Registrations, Fuel Consumption, and Vehicle Miles of Travel as Indices," *Highway Statistics 2005.* Washington, D.C.: U.S. Department of Transportation, 2006, http://www.fhwa.dot.gov/policy/ohim/hs05/htm/mvfvm.htm.

This raises some questions, which this report addresses. Why do we drive so much? Why is the total distance we drive growing so rapidly? And what can be done to alter this trend in a manner that is effective, fair, and economically benign?

The growth in driving is due in large part to urban development, or what some refer to as the built environment. Americans drive so much because we have given ourselves little alternative. For 60 years, we have built homes ever farther from workplaces, located schools far from the neighborhoods they serve, and isolated other destinations—such as shopping—from work and home. From World War II until very recently, nearly all new development has been planned and built on the assumption that people will use cars every time they travel. As a larger and larger share of our built environment has become automobile dependent, car trips and distances have increased, and walking and public transit use have declined. Population growth has been respon-

FIGURE 1-2
Projected Growth in CO_2 Emissions from Cars and Light Trucks



SOURCE: S. Winkelman (Center for Clean Air Policy) calculations based on EIA's *Annual Energy Outlook 2008 (Early Release)* and the Energy Independence and Security Act of 2007.

sible for only a quarter of the increase in vehicle miles driven over the last couple of decades. A larger share of the increase can be traced to the effects of a changing built environment, namely to longer trips and people driving alone.

As with driving, land is being consumed for development at a rate almost three times faster than population growth. This expansive development has caused CO_2 emissions from cars to rise even as it has reduced the amount of forest land available to absorb CO_2.

How Growth in Driving Cancels Out Improved Vehicle Fuel Economy

Conventional pollutants can be reduced in automobile exhaust with sophisticated emission control systems such as catalytic converters, on-board computers, and oxygen sensors. In contrast, CO_2 is a fundamental end product of burning fossil fuels; there is no practical way to remove or capture it from moving vehicles. At this point in time, the only way to reduce CO_2 emissions from vehicles is to burn less gasoline and diesel fuel.

An analysis by Steve Winkelman of the Center for Clean Air Policy, one of the coauthors of this publication, finds that CO_2 emissions will continue to rise, despite technological advances, as the growth in driving is projected to overwhelm planned improvements in vehicle efficiency and fuel carbon content from the Energy Independence and Security Act of 2007 (U.S. Congress 2007). The act requires passenger vehicle fuel economy improvements to at least 35 miles per gallon (mpg) for new passenger vehicles by 2020, which would lead to a 34 percent increase in fleet-wide fuel economy by 2030 (green line in Figure 1-2). The act also sets renewable fuel requirements that Winkelman calculates would reduce lifecycle GHG emissions by 10 percent by 2025 (purple line). Absent growth in driving, these measures would reduce CO_2 emissions from cars and light trucks by 23 percent below current levels.

Even when these more stringent standards for vehicles and fuels fully penetrate the market, however, transportation-related emissions still would far exceed target levels for stabilizing the global climate. The U.S. Department of Energy's Energy Information Administration (EIA) forecasts a 48 percent increase in driving between 2005 and 2030 (orange line in Figure 1-2), outpacing the projected 23 percent increase in population (EIA 2008).[1] The rapid increase in driving would overwhelm both the increase in vehicle fuel economy and the lower carbon fuel content required by the Energy Independence and Security Act of 2007. Carbon dioxide emissions from cars and light trucks would remain at 2005 levels (blue line), or 26 percent above 1990 levels (light blue line) in 2030. For climate stabilization, the United States must bring the CO_2 level to approximately 33 percent below 1990 levels by 2030 to be on a path to a CO_2 reduction of 60 to 80 percent by 2050 (red line).

As the projections show, the United States cannot achieve such large reductions in transportation-related CO_2 emissions without sharply reducing the growth in the number of miles driven.

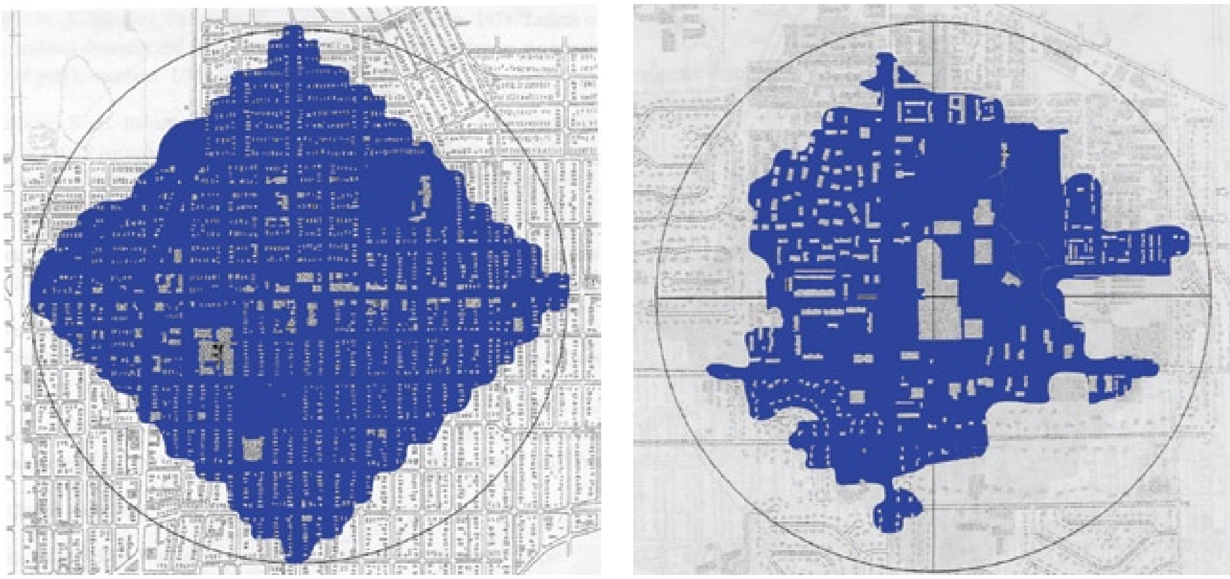
Changing Development Patterns to Slow Global Warming

Recognizing the unsustainable growth in driving, the American Association of State Highway and Transportation Officials (AASHTO), representing state departments of transportation, is urging that the growth of vehicle miles driven be cut in half. How does a growing country—one with 300 million residents and another 120 million on the way by mid-century—slow the growth of vehicle miles driven? Aggressive measures certainly are available, including imposing ever stiffer fees and taxes on driving and parking or establishing no-drive zones or days. Some countries are experimenting with such measures. However, many in this country would view these measures as punitive, given the reality that most Americans do not have a viable alternative to driving. The body of research surveyed here shows that much of the rise in vehicle emissions can be curbed simply by growing in a way that will make it easier for Americans to drive less. In fact, the weight of the evidence shows that, with more compact development, people drive 20 to 40 percent less, at minimal or reduced cost, while reaping other fiscal and health benefits.

How Compact Development Helps Reduce the Need to Drive

Better community planning and more compact development help people live within walking or bicycling distance of some of the destinations they need to get to every day—work, shops, schools, and parks, as well as transit stops. If they choose to use a car, trips are short. Rather than building single-use subdivisions or office parks, communities can plan mixed-use developments that put housing within reach of these other destinations. The street network can be designed to interconnect, rather than end in culs-de-sac and funnel traffic onto overused arterial roads. Individual streets

FIGURE 1-3
Housing within One-Quarter Mile of Commercial Centers for Contrasting Development Patterns in Seattle



SOURCE: A.V. Moudon, P.M. Hess, M.C. Snyder, and K. Stanilov. "Effects of Site Design on Pedestrian Travel in Mixed-Use, Medium-Density Environments." *Transportation Research Record.* Vol. 1578, 1997, pp. 48–55.

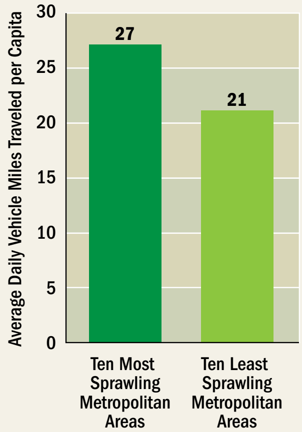
can be designed to be "complete," with safe and convenient places to walk, bicycle, and wait for the bus. Finally, by building more homes as condominiums, townhouses, or detached houses on smaller lots, and by building offices, stores and other destinations "up" rather than "out," communities can shorten distances between destinations. This makes neighborhood stores more economically viable, allows more frequent and convenient transit service, and helps shorten car trips.

This type of development, which has seen a resurgence in recent years, goes by many names, including "walkable communities," "new urbanist neighborhoods," and "transit-oriented developments" (TODs). "Infill" and "brownfield" developments put unused parcels in urban areas to new uses, taking advantage of existing infrastructure and nearby destinations. Some "lifestyle centers" are now replacing single-use shopping malls with open-air shopping on connected streets with housing and office space above stores. And many communities have rediscovered and revitalized their traditional town centers and downtowns, often adding more housing to the mix. These varied development types are collectively referred to in this publication as "compact development" or "smart growth."

How We Know That Compact Development Will Make a Difference: The Evidence

As these forms of development have become more common, planning researchers and practitioners have documented the fact that residents of compact, mixed-use, transit-served communities drive less than their counterparts in sprawling communities. Studies have looked at the issue from varying angles. They have:

FIGURE 1-4
Average Daily Vehicle Miles Traveled



SOURCE: R. Ewing, R. Pendall, and D. Chen. *Measuring Sprawl and Its Impact.* Washington, D.C.: Smart Growth America/U.S. Environmental Protection Agency, 2002, p. 18.

- compared travel statistics for regions and neighborhoods of varying compactness and auto orientation;
- analyzed the travel behavior of individual households in various settings; and
- simulated the effects on travel of different future development scenarios at the regional and project scales.

Regardless of the approach, researchers have found significant potential for compact development to reduce the miles that residents drive.

A comprehensive sprawl index developed by coauthor Reid Ewing of the National Center for Smart Growth at the University of Maryland ranked 83 of the largest metropolitan areas in the United States by their degree of sprawl, measured in terms of population and employment density, mix of land uses, strength of activity centers, and connectedness of the street network (Ewing, Pendall, and Chen 2002, 2003). Even accounting for income and other socioeconomic differences, residents drove about 25 percent less in the more compact regions. In sprawling Atlanta and Raleigh, residents racked up more than 30 miles driving each day for every person living in the region. In more compact Boston and Portland, Oregon, residents drove less than 24 miles per person per day.

This finding holds up in studies that focus on the travel habits of individual households. The link between urban development patterns and individual or household travel has become the most heavily researched subject in urban planning, with more than 100 rigorous empirical studies completed. These studies have been able to account for factors such as the tendency of higher-income households to make more and longer trips than lower-income families.

One of the most comprehensive studies, conducted in King County, Washington, by Larry Frank of the University of British Columbia (Frank, Kavage, and Appleyard 2007), found that residents of the most walkable neighborhoods drive 26 percent fewer miles per day than those living in the most sprawling areas. A meta-analysis of many of these types of studies shows that people living in places with twice the density, diversity of uses, accessible destinations, and interconnected streets drive about a third less than otherwise comparable residents of low-density sprawl.

Many studies have been conducted by or in partnership with public health researchers interested in how the built environment can be better designed to encourage daily physical activity. These studies show that residents of communities designed to be walkable both drive fewer miles and also make more trips by foot and bicycle, which improves individual health. A recent literature review found that 17 of 20 studies, all dating from 2002 or later, have established statistically significant links between some aspect of the built environment and obesity.

Two other types of studies also find strong associations between development patterns and driving: simulations that predict the impacts of various growth options for entire regions and simulations that predict the impacts of individual development projects when sited and designed in different ways. In regional growth simulations, planners compare the effect of a metropolitan-wide business-as-usual scenario with more compact growth options. Coauthor Keith Bartholomew of the University of Utah analyzed 23 of these studies and found that compact scenarios generate up to one-third fewer miles driven than business-as-usual scenarios (Bartholomew 2005, 2007). The better-performing scenarios are those with higher degrees of land use mixing, infill development, and population density, as well as a larger amount of expected growth. Under a plausible set of assumptions, the reduction of miles driven with compact development would be 18 percent by 2050. Even this may be on the low side, since the travel models used in these studies only crudely account for travel within neighborhoods and disregard walk and bike trips entirely.


JACOBY DEVELOPMENT COMPANY

Atlantic Station today.

Of the project-level studies, one of the best known evaluated the impact of building a very dense, mixed-use development at an abandoned steel mill site in the heart of Atlanta versus spreading the equivalent amount of commercial space and number of housing units in the prevailing patterns at three suburban locations. Analysis using travel models enhanced by coauthor Jerry Walters of Fehr & Peers Associates (Walters, Ewing, and Allen 2000), and supplemented by the U.S. Environmental Protection Agency's Smart Growth Index (to capture the effects of site design) found that the infill location would generate about 36 percent less driving and emissions than the outlying comparison sites. The results were so compelling that the development was deemed a transportation control measure by the federal government for the purpose of improving the region's air quality.

The Atlantic Station project in Midtown Atlanta has become a highly successful reuse of central city industrial land. An early evaluation of travel by residents and employees of Atlantic Station suggests even larger VMT reductions than projected originally. On average, Atlantic Station residents are estimated to generate eight VMT per day, and employees to generate 11 VMT per day. These estimates compare favorably with a regional average VMT of more than 32 miles per person per day, among the highest in the nation.

The Potential of Smart Growth

The potential of smart growth to curb the rise in GHG emissions will, of course, be limited by the amount of new development and redevelopment that takes place over

WHAT SMART GROWTH WOULD LOOK LIKE

How would this shift to compact development change U.S. communities? Many more developments would look like the transit-oriented developments and new urbanist neighborhoods already going up in almost every city in the country, and these developments would fill in vacant lots, replace failing strip shopping centers, and revitalize older town centers, rather than displacing forests or farmland. Most developments would no longer be single-use subdivisions or office parks, but would mix shops, schools, and offices together with homes. They might feature ground-floor stores and offices with living space above, or townhomes within walking distance of a retail center. Most developments would be built to connect seamlessly with the external street network.

The density increases required to achieve the changes proposed in this publication would be moderate. In 2003, the average density of residential development in U.S. urban areas was about 7.6 units per acre. As a result of shifting market demand, new developments between 2007 and 2025 would average 13 units per acre, and the average density of metropolitan areas overall would rise to approximately nine units per acre.

Two recent publications—*This is Smart Growth* (Smart Growth Network 2006) and *Visualizing Density* (Campoli and MacLean 2007)—provide a glimpse of what this future might look like.

the next few decades, and by the share of it that is compact in nature. A great deal of new building will take place as the U.S. population grows to 420 million in 2050. According to the best available analysis, by Arthur "Chris" Nelson of Virginia Tech, 89 million new or replaced homes—and 190 billion square feet of new offices, institutions, stores, and other nonresidential buildings—will be constructed through 2050. If Nelson's forecasts are correct, two-thirds of the development on the ground in 2050 will be built between 2007 and then. Pursuing smart growth is a low-cost climate change strategy, because it involves shifting investments that have to be made anyway.

Smart Growth Meets Growing Market Demand for Choice

There is no doubt that moving away from a fossil fuel–based economy will require many difficult changes. Fortunately, smart growth is a change that many Americans will embrace. Americans are demanding more choices in where and how they live, and changing demographics will accelerate this change in demand.

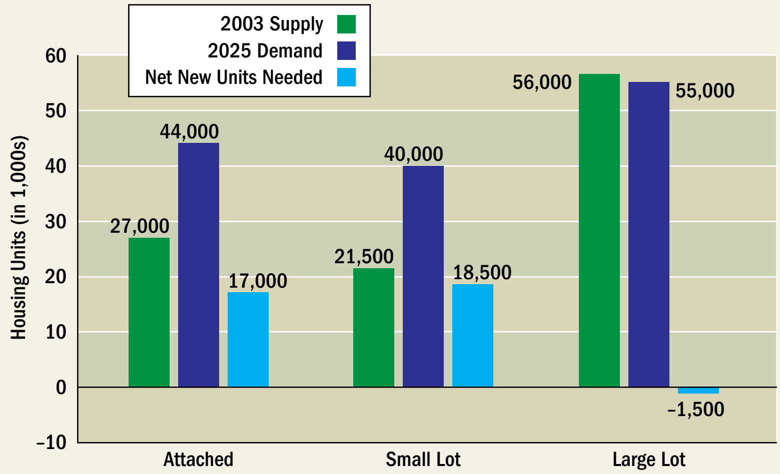
While prevailing zoning and development practices make sprawling development easier to build, developers who make the effort to create compact communities are encountering a responsive public. In 2003, for the first time in the country's history, the sales price per square foot for attached housing—that is, condominiums and townhouses—was higher than that of detached housing. The real estate analysis firm Robert Charles Lesser & Co. has conducted a dozen consumer preference surveys in suburban and urban locations[2] for a variety of builders to help them design their projects. In every location examined, about one-third of respondents prefer smart growth housing products and communities. Other studies by the National Association of Homebuilders, the National Association of Realtors, the Fannie Mae Foundation, high-production builders, and university researchers have corroborated these results—some estimating even greater demand for smart growth housing products. When smart growth also offers shorter commutes, it appeals to another one-quarter of the market, because many people are willing to trade lot or house size for shorter commutes.

Because the demand is greater than the current supply—according to a study by Chris Leinberger of the Brookings Institution—the price-per-square-foot values of houses in mixed-use neighborhoods show price premiums ranging from 40 to 100 percent, compared to houses in nearby single-use subdivisions.

This market demand is only expected to grow over the next several decades, as the share of households made up of older Americans rises with the aging of the baby boomers. Through 2025, households without children will account for close to 90 percent of new housing demand, and single-person households will account for one-third. Nelson projects that the demand for attached and small-lot housing will exceed the current supply by 35 million units (71 percent), while the demand for large-lot housing actually will fall short of the current supply.

FIGURE 1-5

2003 Housing Supply versus 2025 Housing Demand



SOURCE: A.C. Nelson. "Leadership in a New Era." *Journal of the American Planning Association.* Vol. 72, Issue 4, 2006, pp. 393–407.

Total Estimated VMT Reduction and Total Climate Impact

When viewed in total, the evidence on land use and driving shows that compact development will reduce the need to drive between 20 and 40 percent, as compared with development at the outer suburban edge with isolated homes, workplaces, and other destinations. So, as a rule of thumb, it is realistic to assume a 30 percent cut in VMT with compact development.

Making reasonable assumptions about growth rates, the market share of compact development, and the relationship between VMT and CO_2, smart growth could, by itself, reduce total transportation-related CO_2 emissions from current trends by 7 to 10 percent in 2050. This reduction is achievable with land use changes alone. It does not include additional reductions from complementary measures, such as higher fuel prices and carbon taxes, peak-period road tolls, pay-as-you drive insurance, paid parking, and other policies designed to make drivers pay more of the full social costs of auto use.

This estimate also does not include the energy saved in buildings with compact development, or the CO_2-absorbing capacity of forests preserved by compact development. Whatever the total savings, it is important to remember that land use changes provide a permanent climate benefit that would compound over time. The second 50 years of smart growth would build on the base reduction from the first 50 years, and so on into the future. More immediate strategies, such as gas tax increases, do not have this degree of permanence.

The authors calculate that shifting 60 percent of new growth to compact patterns would save 79 million metric tons of CO_2 annually by 2030. The savings over that period equate to a 28 percent increase in federal vehicle efficiency standards, generating one-half of the cumulative savings of the new 35 mpg CAFE standards. Every resident of a compact neighborhood would provide the environmental benefit expected from, say, driving one of today's efficient hybrid cars. This effect would be compounded, of course, if the resident also drove such an efficient car whenever he or she chose to make a vehicle trip. Smart growth would become an important "third leg" in the transportation sector's fight against global warming, along with more efficient vehicles and lower-carbon fuels.

A Climate-Sparing Strategy with Multiple Payoffs

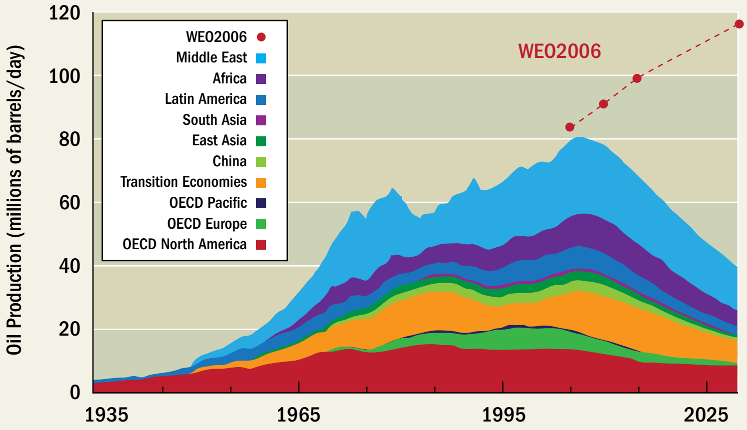
Addressing climate change through smart growth is an attractive strategy because, in addition to being in line with market demand, compact development provides many other benefits. Documented co-benefits include preservation of farmland and open space, protection of water quantity and quality, improvement of health by providing more opportunities for physical activity, and reduction of road and other infrastructure costs. For example, the Envision Utah scenario planning process resulted in a compact growth plan that will save the region about $4.5 billion in infrastructure spending, leave 171 square miles of additional open space, and reduce per capita water use by more than 10 percent.

Among the co-benefits of compact development, perhaps the most important is greater energy security. Compact development uses less energy per capita than does sprawl. As the world approaches and then passes peak production of conventional oil, in the face of ever-rising demands, Americans in compact urban areas will be better able to weather the economic storm of rapidly rising gasoline prices. Moreover, to the degree that the United States makes the transition to compact development, the country as a whole will be less dependent on regions of the world that are unstable, hostile, and/or especially vulnerable to terrorist attacks.

Finally, unlike hydrogen and cellulosic ethanol, which get a lot of attention in the climate change debate as substitutes for gasoline, the "technology" of compact, walkable communities exists today, as it has in one form or another for thousands of years. We can begin using this technology in the service of a cooler planet right now.

FIGURE 1-6

World Oil Production in the Best and Worst Cases*



* The International Energy Agency's optimistic forecast in *World Energy Outlook* (IEA 2007) shows worldwide oil production continuing to rise (the WEO line on top), while the sobering assessment of the Energy Watch Group in *Crude Oil: The Supply Outlook* suggests that oil production already has peaked (the curve on the bottom). Most forecasts lie between these two extremes, with the peak production of conventional oil occurring between now and 2020 (Hirsch et al. 2005). While oil substitutes such as liquified coal, oil shale, and tar sands will fill some of the gap, they are more expensive than conventional oil and worse from the standpoint of global warming potential.

SOURCE: Energy Watch Group. *Crude Oil: The Supply Outlook.* Ottobrunn, Germany: October 2007, http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Oilreport_10-2007.pdf.

The Combined Effect of Compact Development, Transportation Investments, and Road Pricing

Accurately forecasting the implications of compact development for VMT requires an understanding of the network of interactive effects of population growth, land use, transportation investments, and road pricing on driving patterns. Analyses of historical data make it clear that VMT responds to a variety of forces in a complex way. Growth of metropolitan areas during the past 20 years has been characterized by an actual decrease in population density, as urbanized areas have expanded faster than population. This trend has started to reverse itself, but current conditions reflect the legacy of this era of sprawl.

During this period, the emphasis in the majority of urbanized areas has been on increasing highway capacity and the result has been a steady rise in VMT that has exceeded population growth (see Figure 1-2). Increases in average income during this period have contributed to substantially greater use of and reliance on personal vehicles. Rising personal income, while positive in other respects, has worked to promote sprawl, discourage mass transit ridership, and increase VMT.

During the decade from 1985 to 1995, decreases in inflation-corrected gas prices appear to have contributed to increases in VMT. During the past ten-year period, however, gas prices have increased as has traffic congestion, and both of these forces have begun to create pressures to reduce VMT.

Nationally, mass transit has contributed relatively little thus far to reducing reliance on personal vehicle use in the majority of urbanized areas. Increasingly, cities are attempting to build more mass transit capacity, and it is clear that such a development could act to reduce VMT if the right set of associated circumstances prevails. Internal

FIGURE 1-7
Urban VMT Reduction under a Low-Carbon Scenario (2030)

	Elasticities of VMT with Respect to Policy Variables	Change in Annual Growth Rates of Policy Variables (Percent above/below Trend)	Effect on Annual VMT Growth Rate (Percent below Trend)
Population density	–0.30	1	–7.7
Highway lane miles	0.55	–1	–11.4
Transit revenue miles	–0.06	2.5	–4.6
Real fuel price	–0.17	2.7	–14.4
Total effect	NA	NA	–38.1

forces such as further increases in traffic congestion and delays, along with sustained elevated fuel prices, can be expected to automatically produce reductions in VMT as they affect personal decisions. A deliberate strategy of compact development and smart growth has the potential to reverse historic trends to an even greater degree.

In Chapter 8, we mathematically model the interactions described above using a statistical technique called structural equation modeling (SEM) and relying on historical data for 84 urbanized areas. Two models were estimated with our combined dataset: a cross-sectional model for 2005 and a longitudinal model for the two ten-year periods between 1985 and 2005. The cross-sectional model was used to capture long-term relationships between transportation and land use. Each urbanized area has had decades to arrive at quasi equilibrium among density, road capacity, transit capacity, and VMT. However, there is not enough spatial variation in fuel prices across the United States to detect effects on VMT in a cross-sectional sample. So a longitudinal analysis was required to capture short- and medium-term responses to fuel price fluctuations.

Together, the cross-sectional and longitudinal models give us a sound basis for deducing the elasticities of urban VMT with respect to different urban variables. An elasticity is the percentage change in one variable, such as VMT, with respect to a 1 percent change in another variable, such as density or average gasoline price. Using reasonable assumptions about future density, average gasoline price, and other variables, we project that under a trend scenario, urban VMT in the United States will experience a rise of 48 percent by 2030 and 102 percent by 2050, leaving the nation far off a climate-stabilizing CO_2 path. In contrast, under a low-carbon scenario of higher densities, higher gasoline prices, less highway expansion, and more transit service, the nation can come close to a climate-stabilizing CO_2 path by 2030 (see Figure 1-7).

Policy and Program Recommendations

Intentionally or not, many current public policies increase sprawl, auto dependence and, hence, GHG emissions. Many local zoning codes require low-density, single-use development. Public spending frequently supports development at the urban fringe rather than in already developed areas. Transportation policies remain focused on accommodating the automobile. Implementing an effective smart growth strategy for climate stabilization will require reorienting these and many other policies and programs.

Here, we summarize key policy initiatives at each level of government that could form the basis for this policy transformation. The specifics of these initiatives can be found in Chapter 9.

Federal Actions

Enact a "Green-TEA" Transportation Act. Beginning in 1991 with the Intermodal Surface Transportation Efficiency Act (known as ISTEA), federal surface transportation acts have put increasing emphasis on alternatives to the automobile, as well as on community involvement, environmental goals, and coordinated planning. The next surface transportation bill, scheduled for adoption in 2009, could bring yet another paradigm shift by emphasizing environmental performance, climate protection, and green development. We refer to this proposed new legislation as "Green-TEA."

The key feature of Green-TEA would be a requirement that states and metropolitan areas achieve articulated national goals when spending federal transportation funds. These goals would include GHG emission reductions necessary for eventual climate stabilization, "fix-it-first" prioritization for transit and highway rehabilitation and maintenance, and "complete streets" that provide for all transportation modes.

Other Green-TEA provisions would:

- create state and metropolitan funding formulas with incentives for reducing transportation demand instead of rewarding increased driving, as current legislation does;
- eliminate funding and procedural inequities between highway and transit projects;
- give deteriorating roads, bridges, and transit systems priority in funding, limiting highway expansion until existing facilities are brought up to reasonable standards;
- require any subsequent highway expansions to meet economic, transportation, and climate performance standards;
- provide direct project funding for metropolitan planning organizations (MPOs) instead of routing federal funds through state departments of transportation;
- provide technical assistance to MPOs and state and local governments, including improved data, models, and scenario planning tools to help in developing and implementing smart growth solutions; and
- establish a new National Transportation System Administration to oversee a national high-speed rail network and integrate that network with the nation's aviation system.

Extend Transportation Conformity Requirements to GHGs. In *Massachusetts v. EPA*, the U.S. Supreme Court affirmed the EPA's authority and duty to regulate GHG emissions under the current federal Clean Air Act. The EPA could meet its obligation by adopting national GHG reduction targets, requiring states to develop state implementation plans for meeting these targets, and mandating that state and metropolitan transportation plans and programs conform to state implementation plans.

Use Cap and Trade to Support Smart Growth. Many Congressional proposals for climate stabilization would authorize a national cap-and-trade market system similar to those in use in Europe and under development in several states. The revenues generated from auctioning allowances under these systems could be used to support smart growth. Uses of funds might include providing technical assistance to MPOs and state and local governments, including improved data, models, and scenario planning tools; a "Smart Location Tax Credit" targeted at compact development; and support for travel alternatives such as transit, bicycling, and pedestrian infrastructure that are important complements to compact development. Although land development is unlikely to become a regulated activity (like electrical power generation) under cap-and-trade systems, it may have a role to play in "offset" markets. It could be included as an allowable offset in any cap-and-trade climate legislation.

State Actions

Adopt and Suballocate VMT Reduction Targets. In the absence of federal leadership, many states have adopted goals for GHG reduction. These goals could be translated into VMT reduction targets. The targets could be proportionally allocated to metropolitan regions within a state, and each MPO could be charged with developing a plan for meeting its respective target. VMT targets could even be suballocated to localities.

Align State Spending with Climate and Smart Growth Goals. After adopting targets, states will want to ensure that funding programs—whether carried out directly by the state or executed through grants to local governments—support such targets. States can begin by analyzing the criteria used to distribute all state and federal funds in housing, economic development, water and sewer infrastructure, schools, transportation, and recreation. States could earmark and distribute at least a portion of these funds according to local performance in meeting GHG and VMT reduction targets.

Adopt a Statewide "Complete Streets" Policy and Funding Program. A complete streets policy would require that pedestrian and bicycle facilities be provided on all new and reconstructed streets and highways, and that pedestrian and bicyclists' needs be considered in routine roadway operation and maintenance. To create complete communities, the policy might mandate that new streets be interconnected and culs-de-sac be discouraged so that travel distances for pedestrians and bicyclists are minimized.

Regional Actions

Give Funding Priority to Compact, Transit-Served Areas. By giving funding priority to compact, transit-served areas, MPOs can help reduce GHG emissions. In concert with local governments, MPOs would designate "priority funding areas" where local governments have planned for compact development. In addition to receiving priority for public funds, areas could qualify for streamlined development approvals and other financial incentives.

Establish a Regional Transfer of Development Rights Program. Transfer of development rights (TDR) programs enable landowners to sell their development rights to other landowners through a market-based system. Effectively crafted, TDR programs can help reduce VMT by directing growth to compact, transit-served areas and away from low-density greenfield sites, thus reducing the need for long-distance travel. While TDR programs typically have been administered by local governments, a regional TDR program likely would encompass more rural and urban areas, thereby providing greater market opportunities for TDR transfers.

Create a Carbon Impact Fee for New Development. Suburban and exurban development has a cost advantage over urban infill development because of low land costs and subsidized infrastructure. Regulatory reforms alone cannot overcome this advantage. For decades, governments have charged impact fees on new development to offset the costs of schools, libraries, sewers, parks, and transportation. Creating and implementing a regional CO_2 emissions impact fee would internalize carbon impacts into development costs, thereby rewarding best development practices and raising the price of carbon-inefficient development. Fee revenues could be used to help fund transit, bicycling facilities, sidewalks and other pedestrian amenities, and similar projects in compact areas.

Local Actions

Change the Development Rules. Local regulations often prohibit the type of climate-friendly, compact development discussed in this book. Outdated land development codes—often from the 1970s or earlier—effectively mandate sprawl by restricting the mix of land uses and requiring large amounts of parking as well as large minimum building setbacks. Many localities have tried to address these issues on a development-by-development basis, granting exceptions to the rules through arduous review and approval processes. Instead, a better approach would be to amend local policies and regulations—including general plans, zoning and subdivision ordinances, parking standards, annexation rules, adequate public facilities requirements, and design guidelines—to facilitate smart growth through normal approval processes. They also should consider ways that permitting processes might be accelerated for compact development projects that meet specified standards.

Channel Growth into Compact Development Areas. With surprising regularity, MPOs and localities have settled on a common approach to VMT reduction—channeling growth into dense, walkable areas that can be efficiently served by transit, and giving these areas priority for infrastructure funding. This is the idea behind "smart growth areas" in the San Diego region, "urban development areas" in Virginia, and "metropolitan activity centers" in Orlando. Public infrastructure, amenities, and good urban design will guarantee that such areas are attractive places to live, work, and shop.

Provide for Workforce Housing near Jobs. In most metropolitan areas, the cost of housing declines with distance from job centers and other desired destinations, while the cost of transportation increases. With gasoline costs rising, the financial tradeoff between a longer commute and less-expensive housing is changing, and the potential savings from living in a convenient location with transportation choices is becoming a more important aspect of affordability. Local governments could make the provision of affordable "workforce" housing a condition of approval for large-scale residential and commercial developments. In addition, localities could give priority to transit accessibility when allocating housing assistance funds.

The Organization of this Book

Chapter by chapter, this book addresses the impacts of the following:

- emerging market and policy trends on urban development;
- vehicular travel on GHG emissions;
- urban development on vehicular travel;
- residential preferences on urban development and travel;
- highway building on urban development and travel;
- urban development on residential energy use;
- the combination of urban development, transit enhancements, and roadway pricing on vehicular travel; and, finally
- policy options to encourage compact development and reduce vehicular travel.