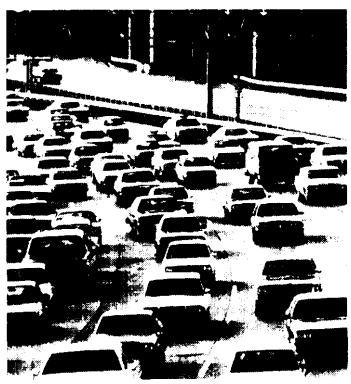
Introduction 1

The focus of this report is transportation energy use in the United States and the potential for reducing that use. The quality of an area's transportation system is central to its over-till quality of life. A system's characteristics impact numerous vital areas: the accessibility of employment. recreational, and cultural opportunities; the availability of leisure time to its users, as well as their levels of frustration and tension; environmental parameters such as air pollution, noise, visual intrusion of roads, and their disruption of communities; the economic and social viability of inner cities and the shape of new development: the ability to move goods easily and inexpensively, which is crucial to economic competitiveness: and the safety of users and the general public. Moreover, these impacts are intertwined with wider impacts at a national level—the U.S. use of oil and its implications for global warming, energy security. and balance of payments.

By some important measures, the United States has a transportation system of very high quality, U.S. citizens enjoy the highest level of personal mobility in the world[1]--at least on the average. They travel more miles--13,500 miles per person per year[2]—than the citizens of any other country, nearly twice as far as the citizens of the richest European nations.[3] They own the



[1] In terms of relatively simple quantitative measures. Measuring mobility directly—in terms of actual access to activities and services—is more problematic.

[2] Data for 1990 obtained from L. Schipper and N. Kiang, International Energy Studies, Lawrence Berkeley Laboratory, in advance of publication in Oak Ridge National Laboratory, *Transportation Energy Data Book*, Ed. 14 (Oak Ridge, TN: forthcoming).

[3] Some 1990 examples from Schipper and Kiang: France, 7,800 miles; West Germany, 7,100 miles; United Kingdom, 7,000 miles.

most vehicles—nearly six autos or light trucks for every 10 persons, or almost two vehicles per household, compared with fewer than five per 10 persons for West Germany (the European leaders in vehicle ownership,) and fewer than three vehicles per 10 persons for Japan.[4] They also benefit from an efficient freight system that allows rapid delivery of everything from mail to oil to manufactured goods, virtually anywhere in the country.

However, the United States also faces daunting transportation problems. First, the U.S. transport system uses enormous quantities of oil—almost 65 percent of the total U.S. oil consumption,[5] and more oil than produced by all U.S. oil fields,[6] despite the United States' position as one of the world's largest oil producers (second in 19907). The average U.S. citizen consumes nearly five times the transportation energy used by the average Japanese citizen and three times that used by the average citizen of France, Britain, or West Germany.[8] Although this higher level of consumption is not solely', and perhaps not even primarily, a function of relative "inefficiency" (at least not in the usual sense of the word) compared with Japan or Western Europe, it still represents a combined problem involving national economic security, balance of trade, and greenhouse gas emissions.

Second, the automobile's dominance of the transportation system contributes greatly to the Nation's problems with urban air quality. Today, almost two decades after passage of the Clean Air Act, about 100 urban areas (depending on weather conditions) still violate the ozone air quality standard.[9] Transportation sources, primarily automobiles and trucks, account for about 30 percent of the emissions of volatile organic compounds and 39 percent of the nitrogen oxides, which are precursors of ozone.

Further, other environmental impacts from U.S. auto dominance include high percentages of urban land devoted to highways, parking facilities, and other auto uses; the loss of wetlands and other ecologically sensitive lands from both the highways themselves and the diffuse land use that the highways support; and high emissions of greenhouse gases.

Third, although the *average* U.S. citizen enjoys great mobility, the dependence of the transportation system on privately owned vehicles leaves many lower-income people with the consequences of poor mobility—inability to get to decent jobs, limited access to convenient (or lower-cost) shopping, and inaccessibility to many recreational and other amenities that most citizens take for granted. [10]

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4 L. Schipper and N. Kiang, op. cit., footnote 2, 1990 data, except for Japan (1988 data).

5 Energy Information Administration, *Annual Energy Outlook 1993*, DOE' EIA-1383(93) (Washington, DC: U.S. Department of Energy, January 1993), table A.8.

6 In 1990 transportation oil products consumption was 21.8 quads versus domestic liquids production (crude oil, lease condensate, and natural gas plant liquids) of 17,91 quads. Ibid., tables G1 and G2.

7 In 1990, (rely the Soviet Union outproduced the United States. Energy Information Administration, "International Energy Outlook 1992," DOE/E1A-0484(92), April 1992.

8 Schipper and Kiang, op. cit., footnote 2.

9 As of 1991, according to U.S. Environmental Protection Agency, *National Air Quality and Emissions Trends Report, /99/, 450-R-92-001* (Washington, DC: October 1992),

10 It is important to note that, in the United States, autos are so inexpensive and fuel prices are so low that many poor people do own and operate automobile s." For example, according to Pisarski, 60 percent of workers in the poverty population (defined in 1989 as a family of four with annual income less than $ 12,674) commute to work in single-occupancy vehicles (A. E. Pisarski, *Travel Behavior Issues in the 90's*, Federal Highway Administration, July 1992). Of course, a less positive view of this high level of auto ownership and use among the poor is that the U.S. transportation system gives poor people few other options than to somehow obtain an auto, and that doing so forces them to forgo other uses of their limited income. Also, any move to increase fuel prices and auto ownership costs could reduce the access of the poor to automobiles. In fact, a forthcoming increase in the "waiver limit" in emission inspections required by the Clean Air Act Amendments, to $450 per vehicle, may have a similar effect by forcing retirement of many older autos.

Fourth. growing congestion is beginning to rob many travelers, especially in urban areas, of a precious commodity-time. Congestion also adversely affects freight movement and degrades U.S. economic competitiveness. Further, congestion reduces the efficiency of vehicle use, adding to fuel use and to pollution levels. Although widely cited projections of impending highway gridlock deserve careful (and perhaps skeptical) scrutiny, congestion represents an important and increasing problem for U.S. highway and air travel.

The combination of high mobility and daunting problems contributes to sharply different perceptions about U.S. transportation energy use and travel demand. Some observers of the U.S. transport system see the measures of high U.S. personal travel (e. g., 13,500 miles of travel per year per capita) as distinctly positive indications of a high quality of life. In this view, high levels of travel are directly translated into access to a wide range of employment, educational, recreational, cultural, personal, and shopping opportunities. Others, however, question whether this level of travel is, at least in part, a reflection of how inefficiently U.S. cities are laid out, how widely separated its residences are from centers of employment, and how distant its sterile suburbs are from exciting recreational and cultural opportunities. Similarly. the high levels of energy use are viewed differently. To some, they are an indication of high mobility, albeit inflated by certain technical inefficiencies in the transport system (which should be corrected). To others, they are a measure of systemic inefficiencies involving hidden subsidies for energy-intensive travel modes and the abovementioned failure to build habitats that put a di - versity of employment, recreational, and cultural opportunities within easy reach of where people live.

The existence of these conflicting views represents a problem to policymakers because some significant opportunities for transportation energy conservation involve reductions in the number of trips made and miles traveled. For example, not only will raising energy and other transportation prices encourage improvements in the technical efficiency of transportation and shifts to more effi - cient modes, it also will reduce travel. Is this a positive or a negative outcome? Economists would consider this outcome positive only to the extent that transportation may have previously been underpriced because of subsidies (e.g., road maintenance and services paid out of general revenues rather than through user taxes), externalities (e. g., uncontrolled vehicle emissions causing damages to the general public), or inefficient pricing (e.g.. parking costs for shopping malls embedded in the price of goods rather than priced separately). To the extent that fuel prices. parking costs, and other transportation costs might be raised to a level that exceeded the full societal costs of transportation (market price plus subsidy costs plus externalities), any travel reductions caused by the portion of the price that exceeds total costs are a negative outcome. To place this issue in better perspective, chapter 4 explores the externalities, subsidies, and inefficient pricing associated with automobile travel. Chapter 5 discusses options for "internal-·izing some of the hidden costs of transportation, as well as pricing some transportation services more efficiently.

Valuing transportation services and energy conservation measures that involve reduced tripmaking is further complicated by the reality that transportation is not an end in itself, but a means to attain access to economic and personal opportuni - t y. The concept of access to a variety of opportunities is easy to grasp but difficult to measure, so transportation services are generally measured simply in miles traveled and trips made. Thus, there is a constant danger that a traveler who must commute several hours to work will be judged (at least in the "benefits" value of some transportation analysis) to have obtained more value from transportation services than another who walks 20 minutes to work. Also, those judging proposed changes in transportation policy must distinguish carefully between changes that reduce travel and access to opportunity, and those that reduce travel by bringing opport unit y closer. This compli cat ion conceivably could be resolved by introducing a factor that measured accessibility. Although this is a worthy goal, it is not attempted here. In discussing alternative policy measures to reduce trans-

port energy use, however, the attempt is made to distinguish qualitatively between reduced travel and reduced access to opportunity.

Transportation and energy policy makers are faced with other dilemmas, as well, in addressing potential reductions in transport energy use. For example, they must deal with the essential incompatibility of attempts to simultaneously improve both private and public transportation modes: because public transport is generally at a severe disadvantage in competing with the private auto, in terms of comfort, flexibility, and travel time, in most cases transit can thrive only when auto travel is allowed to become congested or otherwise restricted. Further, policy makers face a highly polarized public and analytical view of mass transit potential, ranging from a basic rejection of any large additional role to continued hopes for a massive increase in transit usage. And efforts to improve highways, to reduce congestion and the environmental damages it causes, are controversial because of continuing arguments about the likelihood that adding new highway capacity will ultimately prove self-defeating by attracting more travel and creating the same levels of congestion and even greater oil use, air pollution, and other damages.

Policy makers also are faced with critical disagreements about the nature of the forces that have shaped the patterns of urban development in the United States. Because land use patterns are important determinants of travel demand and modal choice, changing these patterns could be a critical component of a transportation energy conservation strategy. But substantial controversy exists about whether the U.S. pattern of low-density development is due primarily to policy choices that can be changed (zoning rules, tax treatment of mortgage interest and parking costs, etc.) or to basic economic and technological forces that cannot be altered.

Energy costs are only a moderate fraction of the total costs of transportation, and energy use is rarely the critical driver of transportation decisions. In recognizing this, the report explores transportation's energy conservation potential in the wider context of the range of problems associated with the U.S. transportation system and the various market forces driving transportation decisions.

Given the diversity and complexity of the transportation sector, this report is not intended to be a comprehensive and quantitative evaluation of transportation problems and policy options. Instead, the report seeks to survey the transportation "landscape," to integrate the previous transportation energy work of the Office of Technology Assessment into a common framework, and to add selected analysis and evaluation of a few critical issues. OTA views this report as an introduction to the issue of transportation energy conservation, placing earlier OTA work in context and framing key issues that deserve further analysis.