STATEMENT OF
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Mr. Chairman: I am happy to appear before this subcommittee to discuss the report prepared by the Congressional Budget Office on the potential energy savings of urban transportation. During the discussion surrounding the national energy plan, complaints have been raised that the President's plan overlooks the potential savings of programs that would promote various energy-efficient forms of urban transportation. Proposals have been made to use the revenues from the crude oil equalization tax to fund transportation, and to enact an additional excise tax on gasoline for this purpose. In response to this intensified interest in the energy efficiency of urban transportation, the Congressional Budget Office was asked by the Subcommittee on Transportation to examine the fuel efficiencies of various modes of urban transportation and to explore the implications of our findings for policies geared toward conservation of energy.

In my remarks today I will discuss three related areas:

- Which factors should be considered in computing the energy needed by various modes of transportation;
- How various forms of urban passenger transportation compare in terms of energy efficiency; and
- How current programs might be adopted to encourage development and use of urban transportation modes that are especially efficient in their use of energy.

GETTING THE WHOLE PICTURE

To date, most analyses of energy savings have focused only on the energy used in the actual operation of transportation services. This is, however, a very limited and often misleading measure of the overall energy needs of a transportation system. The amounts of energy used in manufacturing vehicles, building roads or roadbeds, and maintaining systems must be examined if an analysis is to be comprehensive. The total energy saving involved in shifting from one mode to another may differ substantially from the more conspicuous saving in operating energy, because differences in the energy needed to construct roadbeds or manufacture vehicles may offset the energy savings in operations.

Furthermore, the ways people adapt to a new transportation service are as influential in determining how much energy can be saved as are the system's inherent technological features. New or changed service can stimulate more trips, prompt travelers to give up one mode of transportation for another, or change the average number of people a vehicle carries per trip. If improvements in one mode draw passengers from other energy-efficient modes, instead of from automobiles, then the effect on energy can be small--possibly even wasteful. In addition, new transit service usually encourages more trips than were made by the previously existing modes. These trips in turn increase energy consumption and decrease the energy saving likely from a new transit program, no matter how energy-efficient it is.

Energy requirements should be computed on a door-to-door basis, and this introduces further complications since much of the travel on buses and

rail systems depends on private automobiles for access to stations. Combined automobile/transit trips are usually less direct than those made by auto alone. Hence a two-mode trip may yield little energy savings or none at all.

In short, getting the whole picture about transport energy requires looking at much more than the energy needed to run services. In its analysis of urban transportation energy, CBO attempted to take as comprehensive a look at this issue as is possible, taking into account all of the factors that I have just mentioned. Although changes in transportation service can shift peoples' decisions about where to live and shop, as well as business decisions about where to locate, CBO felt that these locational effects could not be included in our analysis because of the scarcity of evidence on them. The findings that I will present are based on the assumption that homes, jobs, and businesses do not relocate because of the changes in transportation programs that are being analyzed.

COMPARISON OF ENERGY REQUIRED FOR EACH MODE

The CBO findings are based upon the actual experience of many U.S. cities and transportation systems. Documentation exists for all of the factors that are needed to compute the total energy requirements for each mode. It should be noted, however, that this evidence shows considerable variation from city to city, from one time of day to another, and from

route to route. Because there is no such thing as an average city, any conclusions about the energy efficiency of transportation modes, or about the conservation potential of transportation programs, must be viewed as rules with numerous exceptions. Nevertheless, the rules that emerge from examination of existing evidence about total energy savings differ sharply from the normally accepted rules, which are based on operating energy alone, and they are worth noting even if they are not universally true. In my comments this morning, I will discuss the typical performance of each of the principal modes of urban transportation. Since individual conditions vary, the charts that I will discuss show high and low estimates of energy requirements, as well as the middle estimates upon which my comparisons will be based. Since some of the modes of transportation shown in the charts may not be familiar, brief descriptions are provided in the glossary.

On the basis of narrowly defined operating energy, bus, commuter rail, and heavy rail systems show up quite well. As illustrated in Figure 1, these public transportation modes require less than one-third of the energy that single-occupant automobiles require to operate per passenger mile. This apparent advantage may disappear, however, as other factors are taken into account.

In particular, new heavy rail systems appear much less energy-efficient than new bus services, when the energy needed to build roadways

and track, the energy needed to manufacture and maintain vehicles, the energy used to heat and light stations, the energy required to drive to stations, and the directness of alternative modes of travel are taken into consideration. The principal reason for this is that the limited route mileage of rail systems necessitates a high degree of auto travel to and from stations, resulting in overall, door-to-door travel patterns that are less energy-efficient than rail travel by itself. As illustrated in Figure 2, a typical trip on a new heavy rail system requires about twice as much energy per mile as does a typical trip by bus, all things considered. Old heavy rail systems, located in concentrated urban areas where stations are easily reached by foot and by bus, rank only slightly behind bus in terms of their modal energy requirements. Vanpools use the least energy, whereas single-occupant automobiles and dial-a-ride service use the most.

In computing the energy savings of new programs, it is necessary to go one more step: since most of the passengers on a new service formerly made comparable trips by some other mode, the energy savings associated with these shifts in travel behavior must take into account the fuel efficiency of the former mode of travel as well as that of the new mode. Experience across the country indicates that patronage on new public transport services is more apt to be drawn from existing public transport services and from carpools. As a result, the net savings in energy can be surprisingly small or even negative. Our findings, which are illustrated in Figure 3, show that a typical trip on a new heavy rail system actually

requires more energy than before, while new trips by bus, carpool, and vanpool show substantial energy savings per passenger mile.

PROGRAM IMPLICATIONS

A well-based urban transportation policy depends on environmental, developmental, cost, and other considerations in addition to energy. Nonetheless, because of the current emphasis on energy policy, it is useful to isolate this objective and ask how well it is served by alternative programs. In particular, in view of recent proposals calling for massive federal support of public transportation services as a way to conserve fuel, the relative performance of the two leading public modes--bus and heavy rail--becomes a key issue.

Bus and Heavy Rail. Of the conventional urban public transportation modes, bus appears to offer the greatest fuel savings. Although its operating-energy requirements are typically only slightly better than other modes of public transportation, its access requirements and route coverage are generally such that, all things considered, bus requires only about half the energy of new rail or trolley systems. Furthermore, because express bus service can be designed to draw heavily from segments of the market that are now heavily automobile-oriented, the energy savings of programs that promote new bus service are probably greater than programs aimed at any other public transportation modes.

Some innovative services have shown that additional bus services can be operated at little or no expense to the public. The growth of new

subscription bus services, express bus services, rush-hour services, and other services that are tailored to the needs of special groups of travelers appear to be limited by local regulations that protect existing operators and by the concerns of labor. To promote bus service, massive expansion of existing capital or operating subsidies appears to be less promising than federal programs that permit local governments to experiment with innovative services by providing job security for existing transit employees.

Giving buses (along with carpools, vanpools, and other energy-efficient modes) priority in traffic by means of special traffic signaling or exclusive right-of-ways could greatly enhance the attractiveness and patronage of bus service. A more aggressive federal program in the area of acquisition and construction of exclusive right-of-ways promises to be a productive way to encourage this kind of service. Such a program could be broadly interpreted to include relocating on-street parking to off-street, which would yield additional capacity from existing facilities, and constructing bridges, by-passes, and other facilities to enhance the movement of high-occupancy vehicles. Additional incentives could be provided if separate federal operating assistance over and above the present operating aid program were available for those specific projects with relatively high energy-saving potential.

The findings of this study indicate that under typical conditions, new heavy rail systems actually increase energy use rather than reduce it. This surprising finding appears to conflict with the fact that, in terms of propulsion energy per passenger mile, rail ranks among the most energy-efficient modes. But when such factors as construction and station energy, the energy used to get to and from stations, and the roundaboutness of rail travel are considered, the energy per passenger mile computed from door-to-door for rail rapid transit is greater than that for any other public mode except dial-a-ride. A principal reason for this poor showing on total energy use is that private cars, typically with only one or two passengers, are commonly used to get to new rapid transit stations. Admittedly, exceptions can be found to the general patterns that underpin these estimates about how many people ride a vehicle on average, how many walk to stations, how many formerly rode bus, and the like. Variations in judgments could lead to a revised set of computations in which the energy impact of rapid rail transit appears somewhat favorable. But, even though it is possible to argue about the precise value of all of the factors bearing on the potential energy savings of rail rapid transit, the fundamental conclusion remains the same. In this regard, CBO also explored the potential fuel savings of new heavy rail systems under a set of assumptions that gave this mode every reasonable benefit of the doubt. Even under these ideal conditions, new heavy rail transit systems were found to offer very little aid to the nation's efforts to save fuel.

Other modes. Besides the potential savings in fuel to be gained from the conventional public transportation modes, potential savings are also available from other modes such as vanpools and carpools. Although in general these modes are less directly influenced by federal policy than are the conventional public transportation modes, they nevertheless have some significant contributions to make.

Vanpools can produce large fuel savings in special circumstances, although these circumstances apply to only a small segment of the overall travel market. Vanpool operations require little or no public financial support. Currently, however, state and federal regulations inhibit the expansion of vanpools, and these could be removed by the Congress if it chooses to encourage this mode of transportation. In particular, the exemption from Interstate Commerce Commission and state regulation contained in the proposed National Energy Act could be extended to apply to nonfederal vanpooling without damaging existing public transportation services.

Carpools are also a potentially significant source of fuel savings. A typical mile of travel diverted to carpools saves more energy than does diversion to any mode other than vanpools. Unlike vanpools, for which the potential market is very small, carpools could be used for a large percentage of all commuter travel. Federal support for this mode of travel could be increased in the following ways: extension of federal support for reserved right-of-ways for buses, vanpools, and carpools; increased

federal support for carpooling incentives such as reduced tolls and parking fees; and expansion of current carpool information and matching services. Although the savings in fuel per mile of travel by carpool are impressive, federal policy in this area has historically been fairly limited, and it is not clear to what extent additional public spending can increase the popularity of carpooling.

Long term effects. CBO confined its examination of fuel efficiency to current conditions, even though some significant shifts in vehicular technology are expected in the near future. At present automobiles require twice as much energy per mile as do new rail rapid transit systems, and continued growth in automobile travel is clearly in conflict with fuel conservation goals. The gap between automobile energy requirements and those of other modes will shrink, however, as the fuel economy standards for new cars set out in the Energy Policy and Conservation Act and the other automotive fuel economy measures now being considered by the Congress start to increase the average fuel economy of the nation's auto fleet. The relative advantage that bus and rail modes offer in terms of fuel savings will thus be eroded somewhat, while that of carpools and vanpools will increase.

Conclusion. The existing evidence on the energy used in urban transportation shows wide variations from one city to another, and any generalized mode-by-mode analysis, such as this one, must be carefully weighed within the context of each urban area. Based on our analysis of

this evidence, CBO finds that bus services probably offer the greatest potential for saving fuel among urban transportation modes, that vanpools and carpools have an important contribution to make, and that new heavy rail services are surprisingly ineffective. These general conclusions should be weighed along with other social concerns and along with exceptional local conditions in designing an effective national urban transportation program.

Mr. Chairman, I would be happy to answer any questions that you or members of the committee may have.

GLOSSARY

A comparative evaluation of the energy efficiencies of various means of transportation involves distinguishing among many modes that are available today or under consideration. For clarity, terms that may be unfamiliar are described as follows:

Carpool: A group of people who voluntarily band together to use one automobile to get to and from work.

Commuter Rail: A rail system usually used to carry people between suburbs and cities, mostly to and from work. Most commuter rail systems today use heavy rail technology and operate over track owned by intercity railroad companies.

Dial-A-Ride: A public service similar to a call cab except that dial-a-ride services attempt to combine individual trips into as few vehicle journeys as possible. Unlike most taxicab services, dial-a-ride may take you on detours to pick up or drop off other passengers.

Fixed Rail Transit: Any system with vehicles that must follow routes along which rails are installed. Both heavy and light rail as well as commuter rail fall into this category.

Heavy Rail Transit: Rail systems such as the Bay Area Rapid Transit (BART) in San Francisco or the METRO in Washington, D.C. These are examples of what are refered to as "new" heavy rail systems built during the last decade. "Old" systems, such as those in New York City, Boston, and Chicago, generally started operation at least 50 years ago.

Light Rail Transit: Trolleys are the best example. Light rail systems use smaller cars than heavy rail, have fewer cars per train, and may share a roadway with other wheeled vehicles.

Vanpool: A large carpool, typically riding in a van or miniature bus. The vehicles used in this service are usually furnished by, or rented from, an employer; the riders are workers who live in the same general area.