TRANSPORTATION AND THE ENERGY CRISIS

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This information was circulated in March as a newsletter by TRB's Transportation Systems Planning Group as a result of numerous inquiries from transportation agencies. Despite the recent easing in the fuel situation, the future is still uncertain, and we feel that the statistics contained in this article will continue to be valid and are worthy of widespread publication. Views and opinions expressed in the text are those of the authors and do not necessarily reflect the official views of the Transportation Research Board.—Ed.

Of the energy consumed in the United States, 44.6 percent comes from petroleum, 31.6 percent from natural gas, 19.7 percent from coal, 3.8 percent from water power, and 0.3 percent from nuclear power. Of the energy produced, 32 percent is consumed by industry, 25 percent by utilities, 24 percent by transportation, 14 percent by private homes, and 5 percent by other businesses. Ninety-six percent of the fuel consumed by transportation, our primary interest here, comes from petroleum. Of crude petroleum, 46.25 percent goes into gasoline, of which roughly 71 percent is used in cars.

Effect of Crisis Countermeasures

In response to the Arab oil embargo and in an effort to ensure equal distribution of existing oil supplies, Congress passed the Emergency Allocation Act of 1973,

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which gave priority to certain industries and certain fuels and limited gasoline production in an attempt to minimize consumption. The act also provided that oil available be sold at an average price of $5.25 a barrel, even though the imported price is $10.00 a barrel. Although the information has not been verified, the result, as reported in the Washington Post of February 24, 1974, was a diversion of ships bringing oil to major companies in the United States to other countries where greater profit could be made. Therefore, the United States did not receive all the oil that it had access to. No figures are yet available on the number of barrels of oil saved as a result of closing of gas stations on Sundays, but the effect on business dependent on weekend travel is an estimated reduction of about 40 percent. The effects of reducing the speed limits to 55 mph are based on an estimated savings of 24 to 25 percent per vehicle. However, according to the American Association of State Highway and Transportation Officials, only 42 percent of all miles are driven above speeds of 50 mph so that the real savings may prove to be substantially less than the estimate.

A major benefit of speed reduction is a decrease in the number of fatalities. The National Safety Council reports that chances of being killed in an accident double with each 10-mph increase in speed over 50 mph. In North Carolina, the lower speed limit has resulted in a 20 percent reduction in fatalities for November and December 1973. However, reduction in the total number of accidents per se would probably not be so significant since half of all accidents occur at speeds under 30 mph. The Washington Department of Highways reports that initial evidence indicates that lower speeds are tending to increase rear-end collisions and that accidents are increasing near freeway on-ramps where motorists are having difficulty merging with slowly moving traffic.

Transit as an Alternative

Some economists and transportation officials feel that transit is the answer and suggest that substantial savings in energy would be achieved by shifting a large segment of automobile users to transit. Passenger Transport, a newspaper for the transit industry, quotes Robert Pollock, president of the American Transit Association, as saying that if, 20 percent of the nation's automobile commuters were to switch to transit, more than 5 million of the expected 6.8 million new rush-hour riders would be left "waiting at the bus stop." Pollock further states that present systems could accommodate, with existing equipment, facilities, and personnel, 1.5 million additional riders, or 15 percent more than the present transit load. To provide service for the 5.3 million riders who cannot be accommodated by existing service, Pollock estimates that it will require 26,500 more transit vehicles, 73,400 more employees, $530 million more in storage and maintenance facilities, and $330 million above the $680 million local communities are already providing to support transit operations. Although this program is desirable from an energy-conservation viewpoint, it is essentially a long-term project and cannot be implemented completely in the foreseeable future.

Potential Energy Savings From Greater Use of Transit

Let us review the data:

25 percent of energy is consumed by transportation;
44.6 percent of energy consumed comes from petroleum;
46.25 percent of petroleum goes into gasoline;
71 percent of gasoline is used by automobiles; and
34.1 percent of automobile trips are journey-to-work trips.

We can then mathematically determine the amount of energy saved if all trips to work were by transit, and if we do not consider the energy used by transit, as follows:

0.446 x 0.4625 x 0.71 x 0.341 = 5 percent saving in energy
0.71 x 34.1 = 24 percent saving in gasoline

This represents a 100 percent shift from automobile to transit. However, transit can accommodate only a 15 percent shift, so a realistic figure for energy savings for using transit to its maximum for the journey-to-work is a 1 percent energy saving and a 4 percent gasoline saving, about 1 year's average increase in the level of gasoline consumption.

Car Pooling as an Alternative

Car pooling is another means for conserving energy. Since the average journey-to-work trip transports only 1.6 people, then an increase in occupancy would decrease fuel consumption and eliminate a great deal of the rush-hour traffic. If every third car were removed from the rush-hour traffic, the saving realized would be of major significance. The problem with car pooling has been the unwillingness of the commuter to sacrifice the privacy and convenience of the automobile and to give up a certain amount of independence and freedom of action. It has been suggested that psychological ramifications are more important concerns in car pooling than the cost and energy saving. Incentives may be necessary to encourage car pooling, such as using exclusive bus lanes, special parking privileges, and maybe even allowing those who form car pools to charge a fee or be given reimbursements.

Energy and Environmental Standards

As a result of the energy crisis, environmental standards relating to air quality have been relaxed. The implementation of the National Ambient Air Quality Standards, which set 1975 as the date by which the automobile industry must clean up automobile emissions, has been delayed until 1976, partly because emission control techniques carry a fuel penalty of about 7 to 10 percent. Faced with a choice betweeen dirty air or more miles per gallon, officials may delay implementation of air quality standards until the technology has been developed to provide the desired air quality with minimum penalties to energy deficiency. Substantial research is now under way to develop a low-polluting, energy-

efficient engine. Such engines are already in the development state; examples include Rankine, rotary, stratified charge, and lightweight diesel engines.

New Fuels and Energy Sources

The idea of novel fuels is also of interest since petroleum is a limited resource. Many substitutes for petroleum have been offered, but all fall short in Btu's per gallon, storage problems, volatility, toxicity, safety, and ease of handling. At present there does not appear to be a substitute for gasoline, and the most possible short-term solutions appear to be greater oil exploration, development of oil shale extraction techniques, and liquefication of coal.

Electric vehicles have been offered as an alternative, but problems arise from the size and weight of batteries they require to equal or even approach the performance of today's automobiles. Weight and range are the most important factors limiting the use of the lead acid batteries, and until a smaller, more efficient rechargeable battery is developed, electric vehicles may only be available for short-range, low-speed transport. In addition, although they shift the generation of energy from the vehicle itself to an electric power generating station, electric vehicles have yet to prove themselves more energy efficient than the internal combustion engine.

The Small Car

The small car that gets more mileage per gallon is causing a major shift in the size of vehicles being demanded by the public. Smaller, more energy-efficient cars are now accounting for half of new car sales.

A major problem with small cars is safety. Present small cars in mixed traffic have a poorer safety record than large cars. E. J. Campbell, director of the Highway Safety Center at the University of North Carolina, found in his study of late model standard and subcompact cars that subcompact drivers have more than 1½ times as many serious injuries under similar crash circumstances. The fundamental decision, according to Campbell, that society must make is whether to opt for the fuel savings of small cars despite the injury consequences.

Energy—A World Picture

We have tried to briefly set forth some of the consequences to transportation of the energy shortage. Experts say that there will be an energy shortage even after the current politically and economically induced shortage is resolved and gasoline is in more abundant supply. They indicate that, with 7 percent of the world's population, the United States is consuming more than a third of the total energy available. With limited fossil fuel resources on earth and with the growing demand for energy all over the world, there will be an ever-increasing demand for a limited supply.

The high price of oil and the massive political and economic changes affecting the oil industry will cause a rapid development of oil reserves. Whether this will result in a subsequent glut of oil on the market and a reduction in prices is not known. For the short run, the high prices and the scarcity of supply will dictate major efforts at energy conservation in the transportation sector. Environmentalists contend that, if we return to the previous attitudes of wasting energy, we will cause an even greater energy crisis in the future.

Needed Research

We have few data on the long-term consequences of the energy shortage and need to develop research and data bases so that we may better define the issues, alternatives, and trade-offs. The following are some of the areas that might be addressed:

1. Planning and construction of transportation systems that minimize energy requirements;
2. Changes in vehicle characteristics to achieve greater energy efficiency per vehicle-mile traveled;
3. Safety consequences of changes in vehicle size, weight, and traffic mix in response to energy considerations;
4. Changes in demand for transportation and modal-choice changes resulting from the energy shortage;
5. Social and economic effects of reduction in demand for transportation and substitution of alternative transportation services as a consequence of high fuel prices and short supply;
6. Transportation environmental issues in relation to energy conservation;
7. Impact of the energy shortage on sources of revenue for transportation programs;
8. Redefinition of transportation "needs" to take into consideration energy issues;
9. Short- and long-term strategies and processes for including energy in the continuing transportation planning process; and
10. Immediate stepped-up research to develop new transport technology to be available when fossil fuels are exhausted.