Chapter IX

Summary of Impacts on Transit Ridership, The Transit Industry, Related Industries, and Energy Consumption

INTRODUCTION

Chapter VIII reviewed the impact of various transit incentive and auto restraint actions on transit riders hip and energy consumption by automobiles. In this chapter, packages of actions are identified and analyzed. Their impacts are compared with the impacts of the alternative economic and energy futures analyzed in Chapters V and VII.

Three packages of transit related actions were developed: a maximum transit incentive package, a maximum auto restraint package, and a combination package incorporating maximum transit incentives and auto restraints.

The maximum transit incentive package includes:

- free fare transit;
- doubling the transit vehicle fleet by 1980; and
- no significant auto restraints—the price of gasoline was assumed to stay constant in real dollar terms.

The maximum auto restraint package includes:

- a 50 percent increase in the price of gasoline in real dollar terms;
- a $1.50/day increase in the cost of commuter parking in employment areas currently well served by transit; and
- no significant transit incentive actions—the transit fleet would increase in size only as necessary to cover 90 percent of the increase in peak period ridership,

The combination package includes:

- no fare transit;
- doubling the transit vehicle fleet by 1980;
- a 50 percent increase in the real price of gasoline; and
- a $1.50/day increase in the cost of commuter parking in employment areas currently well served by transit.

In each of these packages, it is assumed that there is no limitation on the availability of gasoline at the assumed price. The effects of limitations on the supply of crude oil were considered in Chapter VII,

Specifically, three alternative energy decrease futures were considered:

Mild-decrease of 1 million barrels of crude oil/day by 1976 followed by 3 percent/year growth in oil consumption.

Moderate-decrease of 3 million barrels of crude oil/day by 1977 followed by a 1.5 percent/year growth rate.

Severe-decrease of 6 million barrels of crude oil/day by 1980.

Two different futures about economic conditions were also considered:

Recession—9 percent unemployment in 1975.

Depression—10+ percent unemployment through 1975.

Impacts on Transit Ridership of Packages of Transit-Related Actions and Energy and Economic Futures

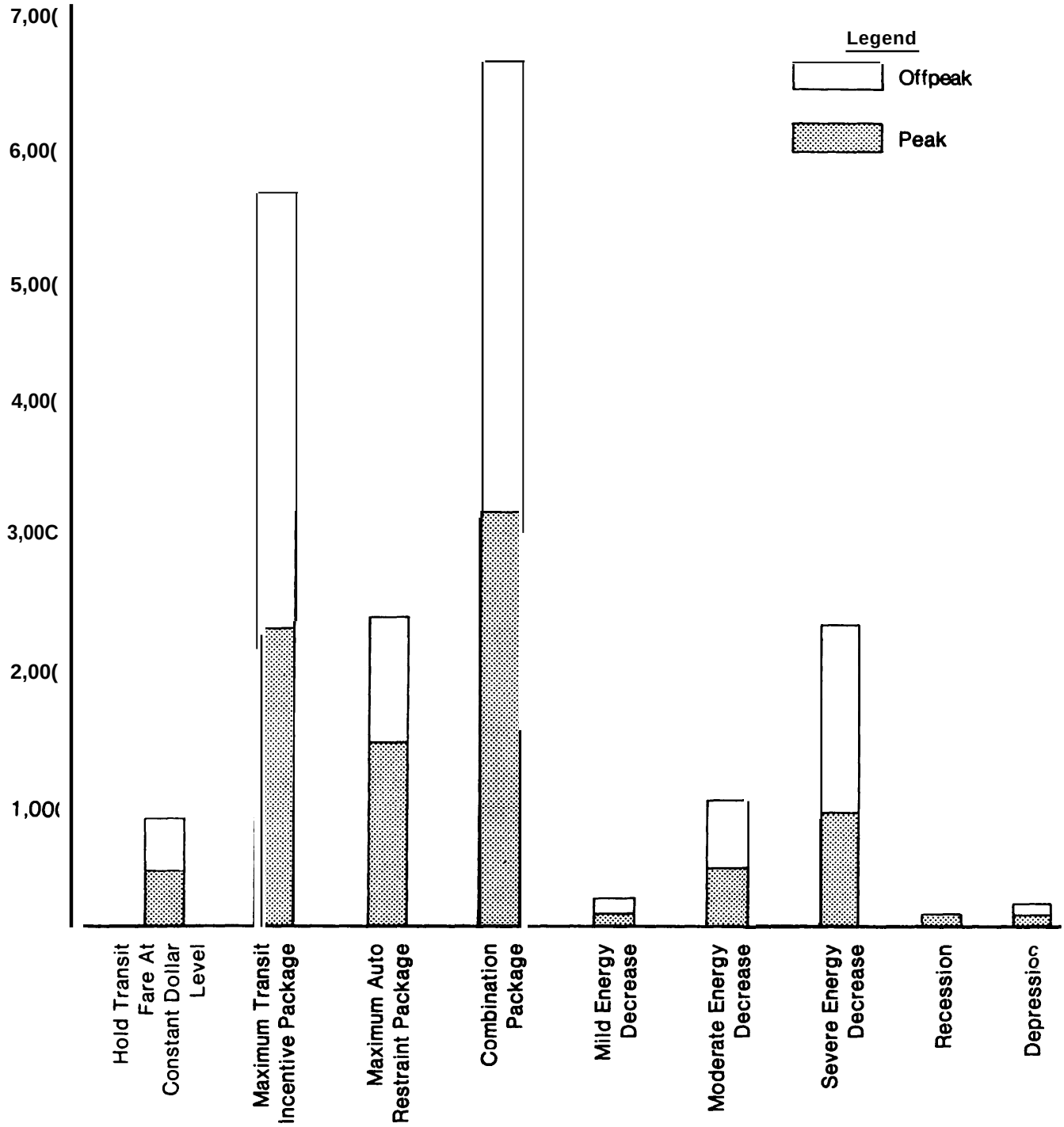
The impacts on 1980 transit ridership of the three packages of transit-related actions and the alternative energy and economic conditions are illustrated in figure 14,

The transit ridership increases were disaggregate into "peak" period and "offpeak" period increases. This is because of the importance of the peak-to-base ratio in determining needs for rolling stock--as will be discussed in the next section.

The estimates of the transit ridership increases associated with the three energy decrease/futures

FIGURE 14

INCREASES IN TRANSIT RIDERSHIP ASSOCIATED WITH PACKAGES OF ACTIONS AND ECONOMIC AND ENERGY FUTURES
(millions of passengers annually)



presented in Figure 14 each incorporate the assumptions that transit fares will be held at a constant dollar level and that passenger car engine efficiencies will increase from 13.3 miles per gallon in 1974 to 17,0 miles per gallon in 1980. As can be seen by comparing the bar at the far left of Figure 14 with the bars for the three energy decrease assumptions, the assumption of constant dollar level fare contributed a major portion of the ridership increases associated with the energy decrease futures. Alternatively, had it been assumed that transit fares will grow at the same rate as the consumer price index through 1980 (i.e.. remain constant in real dollar terms), the forecasts of 1980 total annual transit passenger would be as follows:

Mild Decrease—13 percent decline from 1974 to 1980;

Moderate Decrease—3 percent increase from 1974 to 1980; and

Severe Decrease—23 percent increase from 1974 to 1980.

The improvement in fuel efficiency assumed for each of the energy decrease futures (from 13.3 miles per gallon ,in 1974 to 17 miles per gallon in 1980) is roughly the same as the automobile market response to a so percent increase in the price of gasoline. If the reduction in demand for gasoline required for the mild energy decrease future is brought about through an increase in the retail price of gasoline and there are no other incentives for the purchase of more fuel efficient automobiles (such as a horsepower tax), then the automobile market response to the mild energy decrease future would be a smaller improvement in fuel efficiency than that assumed. In this case, the transit ridership increase for the mild energy decrease future with constant dollar level fares would be greater than that shown in Figure 19. on the other hand, if fuel efficiency improvements larger than that assumed occur (such as would probably be the case with the severe decrease future), then the transit ridership increases would be less than those shown in Figure 14 for the energy decrease futures with constant dollar level fares.

Comparative Impacts of Assumed Alternative Economic and Energy Futures and Selected Packages of Actions on Transit-Related Industries

This section will briefly examine some of the effects of transit ridership changes induced by the changes in economic and energy conditions (see Chapters V and VII) and by the selected packages of actions (discussed above). The effects of these ridership changes will be discussed in terms of transit operating costs, revenues, deficits, labor required for transit operation, additional vehicles required, employment generated in vehicle production, and potential justification for fixed guideway systems.

The alternative futures and packages of actions to be discussed are listed below:

- Recession and Depression Futures;
- Combined Energy Reductions with Recession and Depression Futures;
- Maximum Transit Incentive Package;
- Maximum Auto Restraint Package; and
- Combination of Transit Incentive and Auto Restraint Package.

The effects on energy consumption of these futures and packages are discussed in the next section,

Impacts on Transit and Related Industries of Economic and Energy Futures

This section will briefly examine some of the effects of transit ridership changes induced by the changes in economic and energy conditions which have been summarized earlier in this chapter,

The discussion of the effects will treat the recession and depression conditions separately from the energy and combined energy/economic conditions, The recession and depression conditions have rather minor effects on the transit industry and will be only briefly described. The effects of the various energy assumptions will be quite significant on the transit industry. These energy related effects so far outweigh the recession and depression related effects that the combination of the energy and economic conditions creates net conditions so similar to the energy effects alone that they are treated together here.

Impacts on Transit of Ridership Reductions Attributed to Recession and Depression Futures

The declines in ridership of 2.5 percent which are expected under recession and depression conditions will worsen the financial position of the U.S. transit

industry. Revenues can be expected to decline proportionately to ridership losses; operating costs will probably rise compared to current conditions, due to the current inflationary trend. The net effect of the economic conditions on costs of operations would probably be to cause a very slight decrease in operating costs, assuming some curtailment of peak service, but probably less than in proportion to the revenue losses due to transit ridership declines. The net effect on overall transit fiscal conditions is likely to be an additional loss of about 2 percent, i.e., slightly under the 2.5 percent ridership losses.

Buses would not be replaced quite as fast, thus impacting negatively on the bus manufacturing industry to a moderate extent. These conditions are similar to past trends in the industry.

Based upon these assumptions it would be somewhat more difficult to justify new fixed rail systems because of the net ridership losses caused. Justification would have to rely more on the employment created. The recession or depression effects on the transit operator, however, would only be temporary, and therefore would have no effect on traffic revenue or operating costs by the time any new fixed guideway system would be complete and open to traffic. The jobs created in the construction of such a system would be substantial. In Chapter X of this report it is estimated that in both Atlanta and Washington construction-related jobs would be at least 1 percent of the regional labor force. It should also be noted that our shortrun ridership forecasts are national ones and are based on a transit service level approximating past service levels on a national basis. Obviously a new fixed guideway system would be a significant improvement in the level of service in that metropolitan area and would be justified to a large extent on the basis of local patronage expected rather than on trends in ridership resulting from national conditions.

Impacts on the Transit Industry Associated with Ridership Changes of Assumed Energy and Combined Energy/Economic Futures

One of the worsening problems within the transit industry in recent decades is the peak-to-base ratio—the ratio of peak hour ridership to the base period ridership. Manpower and capital requirements (bus-driver units on the street) must be large enough to meet the short peak hour demand.

In the offpeak period buses stand idle or make runs nearly empty, and drivers collect wage bonuses for split shifts. Any shifts in ridership which reduce the peak-to-base ratio will improve the financial picture of a transit operation.

It is very likely that small increases in transit ridership will continue to come during peak periods. These additional trips will probably be largely work trips to CBD'S, using the existing transit service which is already oriented to this type of travel. Other types of trips (social, shopping, non-CBD, etc.) are less well served by most transit operations and thus are not likely to be among the first to be attracted to transit even under a noticeable fuel shortage. Severe energy shortage conditions would presumably be so disruptive to all types of auto trips, that large increases in transit ridership would be experienced in the peak and moderate increases on the weekends and workday offpeak.

The 6 **to** 8 percent increase in transit ridership forecast for 1975 (if any of the three energy and combined energy/economic assumptions materialize) would create some immediate shortrun problems for the transit industry, It is unlikely that within this year the agencies and industries would be able to finance, produce, and buy the additional rolling stock or train additional drivers required to meet the additional demand over and above replacements already planned for the year. It is likely that peak load factors would have to be increased to handle additional riders. While this is uncomfortable for passengers, it is a financial blessing to operators. Revenues should increase proportionately to ridership while operating and capital costs should remain close to the level that would otherwise occur in 1975.

The transit patronage increases after 1975 associated with mild decreases in highway fuel would be of little help to the transit industry financially. Revenues would increase in proportion to ridership advances (and decline from 1977 on), but operating costs would probably increase at a faster rate due to inflation and increased peak-to-base ratios in the first and second years. Few additional new buses (old buses could be kept in service longer) can be justified to serve temporary increases in ridership. A few more drivers and mechanics could be justified in ***1975*** and ***1976,*** but in ***1978, 1979,*** and 1980 fewer drivers would be required and the number of transit employees could be reduced. By 1980, service, employees, and rolling stock would have increased by about 5 percent, while the deficit will increase by about 5 percent (plus inflation) over the 1974 levels.

A moderate decrease in highway fuel will generate additional revenues in proportion with ridership increases. It may even be possible that the large ridership increases in 1975, 1976, and 1977 may include a reasonable number of offpeak riders. However, most of the increases will occur in the peak periods.

By 1980 the ridership increase would average about 20 percent with the peak period increase likely to reach 25" percent, exceeding the average ridership increase. A 20 percent increase in service, operating costs, vehicles, and manpower should be sufficient to handle the peak period increase, assuming that transit systems couId be operated more efficiently under conditions of increased ridership and fewer vehicles on the roads.

Since operating costs and revenues (ridership) would increase by the same percent, the deficit from transit operations would increase by about the same 20 percent (before the effects of inflation are added).

The 20 percent increase in transit employees would add about 30,000 jobs to the transit labor force, and add about another 15,000 jobs to the labor force in general through the multiplier effect.

The 10,000 new buses required to serve the new riders would cost about $650 million at today's prices and generate about 54,000 man-years of employment in the bus and related industries. (In Chapter VI it was estimated that about 83 jobs were created per $1 million in bus production.)

The severe energy condition with its 40 percent increase in ridership by 1980 would be good for transit. Such a severe energy shortage is likely to attract substantial offpeak as well as peak riders, thereby lowering the peak-to-base ratio compared to the milder energy reduction conditions. The energy-caused dislocations would also justify measures to force spreading of the peak period so that transit's full capacity could be used over 2 or 3 hours in the morning and evening rush period instead of today's 1- or 2-hour rush periods. Furthermore, the increase in transit ridership might justify exclusive use of more streets for transit, and this, in combination with fewer autos on the shared streets, would improve transit operating speeds, in turn allowing shorter turnaround times and more efficient use of manpower and equipment.

In order to accommodate the 40 percent increase in ridership that would occur under a severe energy shortage, an increase of about 35 percent would be required in the level of transit service, operating costs, rolling stock, and transit personnel, Since the increased ridership will generate about a 40 percent increase in operating revenue, whereas operating expenses will only increase by about 35 percent, the increase in the deficit would be only about 27 percent. Thus, the systems in the United States would increase ridership by about 40 percent, but require a subsidy increase of only 27 percent, In 1974 a subsidy increase of 27 percent would equal about $340 million. By 1980 the subsidy would be considerably higher due to the effects of inflation,

The increase in operations would create about 53,000 jobs in the transit industry. Added to that would be about 27,000 more jobs due to the multiplier effect, for a total of about 80,000 new jobs directly and indirectly attributable to a 35 percent increase in transit activity alone (not including jobs required to produce more rolling stock).

Both rail capacity and buses might have to be increased to handle the increase in ridership, The required increase in rail capacity can be achieved through the implementation of already programed rail extensions or new systems in Washington, Atlanta, Baltimore, Boston, New York, Philadelphia, and possibly in other areas about to make commitments to new rail systems.

The bus fleet would require an increase of about 35 percent or about 17,500 new buses. At $65,000 for each bus, the total cost of these additional buses would be $1,138 million. In Chapter VI, an investigation of the employment generating ability of the bus industry indicated that for every $1 million increase in bus production about 83 jobs (including all jobs directly or indirectly attributed to bus manufacturing) would be created,

The total employment impact of the production of 17,500 buses more than current production rates would be about 94,000 man-years of employment. Due to the capacity constraints in the bus manufacturing industry, this increased production would have to be spread over 4 years (see Chapter VI).

The large increases in ridership will increase the likelihood that additional fixed guideway systems will be built. However, only those new rail facilities already under construction (Washington, Baltimore, Atlanta, New York, Boston, San Francisco, etc.) are likely to be in even limited operation before 1980.

Impacts on Transit and Related Industries of Selected Packages of Actions

Of the three packages discussed above, two have very similar effects on the transit industry. These

two, Maximum Transit Incentive and the combined, are discussed together following the Maximum Auto Restraint Package.

Impacts on the Transit Industry Associated with Ridership Increases Resulting from the Maximum **Auto Restraint Package**

The overall increase in ridership of about 39 percent in 1980 associated with this package is quite similar to the increase associated with the increase estimated for severe energy conditions; however, due to the large increase in peak period riders, the financial picture is worse and the rolling stock and manpower requirements are greater.

In order to handle the 48 percent increase in the peak period ridership, a 43 percent increase in service and operating costs has been assumed. The increase in service does not equal the peak period patronage increase because of assumed faster running speeds on the less crowded highways (more efficient use of manpower and equipment) and higher vehicle occupancy. Since the percentage increase in costs (43 percent) exceeds the percentage increase in overall ridership and revenues (39 percent), the difference between them (i.e., the deficit) would increase by an even greater percentage. The deficit in this package would increase by 49 percent. In 1974 the national transit operating deficit was $1,271,275,000,[1] a 49 percent increase would add over $600 million. By 1980, this deficit will be increased even further by inflationary pressures. However, because fares have been assumed to increase with the rate of inflation in this package, some of the effects of inflation on the deficit will be offset by increases in revenues due to the higher fares,

A comparison of this package with the severe energy decrease future reveals that although they both generate about the same percentage increase in ridership, the increase in the deficit is remarkably different (49 percent for the auto restraint versus only 27 percent for the severe energy decrease future). Because the auto restraint package restricts auto work trips through its parking tax, a much greater number of work trips are diverted to transit, requiring much greater increases in service during peak periods. The severe energy decrease future will create shortages of energy for all types of auto trips, thus resulting in a lesser increase in peak trips (compared with the auto restraint package) and a greater number of offpeak trips, and thus requiring a smaller expansion for the more costly peak hour service.

Therefore, under the severe energy decrease conditions, transit can handle the increase in ridership in a less costly manner, and can probably incur a significantly smaller deficit.

of course, two of the actions in the auto restraint package generate revenue which could be used to offset-the transit deficit. A very rough calculation indicates that the gas tax could "generate about $12 billion[2] and the parking tax could possibly generate up to $1 billion,[3]

The 43 percent increase in transit operations will require about an additional 65,000 employees. With another 33,000 added by the multiplier, the total employment effect is about 100,000 jobs.

Additional rolling stock will also be required. It has been assumed that the already programed rail improvements will sufficiently increase the rapid rail rolling stock; however, 43 percent more buses will be required. These 20,000 new buses would cost about $1,300 million in 1974 (at $65,000 each). The employment estimate developed in Chapter VI indicated that for every $1 million in bus production, about 83 jobs are created in industries directly and indirectly affected by bus production. Thus, about 107,77o man-years of employment (above that which would be required for current production levels) could be credited to the production of 20,000 more buses. The capacity constraints of the bus manufacturers would limit additional production to an average of about 5,000 per year, over the next 4 years, thus spreading the delivery of these additional buses and the employment generated over the same time period.

The 48 percent increase in peak hour ridership will certainly increase interest in additional fixed guideway systems. However, only those facilities already under construction (Washington, Baltimore, Atlanta, New York, Boston, San Francisco, etc.) are likely to be providing even limited service by 1980.

The very large increase in the transit deficit resulting from this package, is likely to increase interest in the development of systems with low operating costs, Thus, a significant increase in R & D funds for proposed low operating cost systems would be justified,

[1] APTA, '74. '75 Transit Fact *Book*.

[2] 60 billion gallons of gas sold in the United States reduced to 42 billion by a 30¢ tax generates about $12.6 billion less taxes lost on the 16 billion gallons not sold.

[3] Of the 50 million U.S. workers, 20 percent would be in parking tax areas, 25 percent of the affected employees would pay up to $1.50 which generates about $938 million.

TABLE 38

SUMMARY OF APPROXIMATE EFFECTS ON TRANSIT AND RELATED INDUSTRIES OF ALTERNATIVE ASSUMED ECONOMIC AND ENERGY FUTURES AND PACKAGES OF TRANSIT-RELATED ACTIONS

Assumed Economics and Energy Future or Packages of Transit-Related Actions	Percent Transit Ridership Change: 1974-80	Percent Increase in Operations: 1974-80	Percent Increase in Deficit (Excludes Inflation) 1974 = $1,271,275,000	1980 Employment Generated by Changes in Transit Operations (Includes Multiplier)	Additional Buses in Operation by 1980	Cost in Millions by 1974 Dollars (At $65,000 each)	Total Man Years of Employment Generated by Additional Bus Production (Includes Multiplier)	Additional Rail Cars Required (Above Those Already Programmed)	Cost in Millions of 1974 Dollars (At $500,000 each)	Total Man-years of Employment Generated by Additional Bus Production (Includes Multiplier)
Depression Future	-3	0	2	0	0	—	—	0	—	—
Mild Energy Decrease Future	+5	5	5	10,500	2,500	162	13,430	0	—	—
Moderate Energy Decrease Future	+20	20	20	45,000	10,000	650	53,885	0	—	—
Severe Energy Decrease Future	+40	35	27	80,000	17,500	1,138	94,340	0	—	—
Maximum Auto Restraint Program	+39	43	[1]49	98,000	20,000	1,300	107,770	0	—	—
Maximum Transit Incentive Package	+100	100	470	225,000	50,000	3,250	269,425	3,000	1,500	119,850
Combined Package	+120	100	470	225,000	50,000	3,250	269,425	3,000	1,500	119,850

[1] Inflationary increases will have less impact on the Auto Restraint Package deficit than on the deficits of the other packages and futures. Only in the Auto Restraint Package are fares assumed to increase with inflation, thus somewhat offsetting the inflationary increases in operating costs.

SOURCE: System Design Concepts, Inc.

Impacts on the Transit Industry Associated with Ridership Increases Resulting from the Maximum Transit Incentive and the Combined Packages

The Maximum Transit Incentive Package and the Combined Packages have very similar impacts on the transit industry. Costs, deficits, manpower, and rolling stock requirements are identical in both packages. The only differences which are discussed here are that the Combined Packages have higher ridership and also have the potential for use of gas and parking tax revenues to cover transit deficits.

Both packages assume a doubling of transit service and the elimination of fares. These assumptions double the operating costs and eliminate fare box revenue, thus making the entire cost of operations equal to the deficit. In 1974, the national transit operating expenses were just over $3 billion.A In 1974 a doubling of operations while eliminating fares would have created a $6 billion deficit, compared to the $1,271 million deficit in 1974 which is about a 47o percent increase in the deficit.

Deficits of these proportions would justify extensive increases in funding for research and development of techniques and systems with lower operating costs. In addition, the very large increases in ridership (100-120 percent) which accompany these packages would increase the market for fixed guideway systems, especially if they could handle high volumes of passengers at low operating costs.

The Combined Packages incorporate the two revenue producing actions used in the auto restraint package. As mentioned in the preceding section, these restraints could produce about $13 billion dollars annually, more than enough to cover the transit deficit.

The doubling of transit service will require a doubling of the transit labor force or an addition of about 150,000 employees. With the addition of the employment multiplier, the total employment impact of this expansion of transit service is an increase of about 225,000 jobs.

The additional rolling stock required will equal 3,000 new rail cars (plus those already programed) and 50,000 new buses by 1980. Orders for these additional vehicles will strain the capacity of both the rail and bus manufacturers.

However, with an increase in bus plant capacity and significantly greater production in the latter years, these vehicles could be produced and in operation by 1980,

Today's cost of 50,000 buses and 3,000 heavy rail cars is $3,250 million for the buses (at $65,000 each) and $1,500 million for the rail cars (at $500,000 each), for a total of $4,75o million. Using the employment generating ability of these industries (see chapter VI), the man-years required to produce these vehicles is 269,425 for the buses and 119,850 for rail cars for a total of about 390,000. Since this production would be spread over 6 years, the average additional annual employment generated by these increases in transit's rolling stock would be about 65,000 jobs for the 6 years of production.

4AmA, op. cit.

Impacts on Energy Consumption of Packages of Transit-Related Actions

The impacts on 1980 total energy consumption (including fuel consumed by transit) of each of the packages of transit-related assumptions is shown in Figure 15. For the Auto Restraint and Combination Packages, only a small share of the energy savings are due to auto drivers shifting to transit. The primary effect is the reduction in gasoline consumption due to improvements in engine efficiency.

SUMMARY

The admittedly rough analyses summarized in Chapters VIII and IX lead to conclusions which, if shown to be correct in more detailed analyses, have major implications for public policy regarding energy, the economy, and mass transit:

- The impact on 1980 energy consumption of a 50 percent increase in the price of gasoline is an order of magnitude greater than the impact of any transit incentive action.

- However, considering its impact on energy consumption, the impact of a 50 percent increase in the price of gasoline on transit ridership is relatively slight causing a less than 10 percent increase. This is because the primary long-term response of motorists to gasoline price increases is to purchase more fuel efficient automobiles rather than alter their travel behavior,

- An auto restraint action aimed at that sector of the travel market best served by transit—a $1.50/day increase in the price of commuter parking—has a far greater effect on transit ridership than does a 50 percent increase in the price of gasoline.
- In terms of energy saved per new rider attracted, generating additional ridership through auto restraints is more than twice as efficient as generating additional ridership through transit incentives.
- Transit ridership increases generated through auto restraint actions would have a negative impact on transit agency finances, since ridership increases would occur primarily in the peak period. As a result, required increases in rolling stock would be proportionally greater than ridership increases generated by auto restraint actions.
- A combined strategy incorporating both transit incentives and auto restraints should be implemented to promote energy conservation without lowering the efficiency (measured in passengers per vehicle) of the transit fleet.
- Opportunities exist for funding major transit improvements through revenue generated by auto restraints. For example, no fare transit fleet could be funded by a 50 percent increase in the price of gasoline.

FIGURE 15

NET 1980 ENERGY REDUCTIONS ASSOCIATED WITH PACKAGES OF ACTIONS
(Barrels of Gasoline Per Day)