Chapter 9

Social Effects and Impacts

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INTRODUCTION

Increased automotive fuel efficiency and production of synthetic fuels will both give rise to a variety of social impacts. The impacts of increasing fuel efficiency will occur primarily as changes in employment conditions, while the impacts of producing synthetic fuels will be felt primarily in communities which experience rapid surges and declines in population as plants are built and begin to operate.

SOCIAL IMPACTS OF CHANGING AUTOMOTIVE TECHNOLOGY

Overview

The characteristics and uses of automobiles sold in the United States indicate that historically Americans have valued automobiles not only for personal transportation but also as objects of style, comfort, convenience, and power. Substantial increases in the costs of owning and operating automobiles that occurred during the 1970's, and that are expected in the future, are motivating consumers to change their attitudes and behavior in order to reduce spending on personal transportation. Some have purchased smaller, more fuel-efficient vehicles. Others have chosen to keep their present vehicles longer. Large numbers are simply driving less. Since January 1979, the combined subcompact and compact share of total sales has climbed from 44 to 61 percent, and gasoline consumption has declined 12 percent. About one-half to three-quarters of these fuel savings can be attributed to increased fuel efficiency of the automobile fleet.

Although about 12 percent of personal consumption expenditures has historically gone to automobile ownership and operation, rising costs may ultimately induce consumers to spend a smaller share of their budgets on automobiles or —at least—not to let that share increase. Recent increases in the small-car proportion of new-car sales suggest that consumers are prepared to trade cargo space and towing capability for high fuel economy and the prospect of relatively low operating costs. in the future, instead of buying vehicles designed for their most demanding transportation needs, people may buy small vehicles for daily use and rent larger vehicles for infrequent trips with several passengers, bulky or heavy cargo, or towing. The movement toward small cars is slowed by the tendency for people to retain cars longer than before. * Purchases of fuel-efficient vehicles and ownership of several vehicles, each suited for different transportation needs, would be facilitated by improved economic conditions.

Ridesharing and mass transit use have become more common and could increase further. Since the 1973-74 oil embargo public transit ridership has increased 25 percent.[1] Ridesharing and transit use are limited by the dispersion of residences and jobs, and, for transit, by the adequacy and availability of facilities. Mass transit capacity is limited during peak commuting periods and often is unavailable or scheduled infrequently in areas outside of central cities.

It should be noted that low-income people are likely to have the fewest options for adjusting to rising automobile costs. People with low incomes already tend to own fewer vehicles, have relatively old vehicles (which were typically bought used), travel less, and share rides or use public transit more than the affluent.

Consumers are likely to respond differently to electric vehicles (EVs) and small conventionally

*Thirty-five percent of private vehicles were over 5 years old in 1969, 51 percent were over 5 years old in 1978.

[1]American Public Transit Association.

powered cars (using internal combustion engines) because of different cost, range, and refueling attributes (see table 64). The conventionally powered car would have two significant advantages over an EV: unlimited range (with refueling) and substantially lower first cost. The EV, on the other hand, would offer the advantage of being powered by a secure source of energy (electricity) and therefore assure mobility in the event of disruption of gasoline supplies. It is not clear how the consumer would weigh these two options, although the degree to which EV manufacturers can reduce the cost differential is certain to be very important.

Employment

In 1980, the Bureau of Labor Statistics estimated that there were fewer than 800,000 people employed in primary automobile manufacturing and automotive parts and accessories manufacturing. This compares with employment levels over 900,000 during the peak automobile production period, 1978-79.[2] These figures, however, present an incomplete picture of employment. Although the Bureau of the Census counts employees in industries producing various primary products, it does not identify how many workers contribute to intermediate products used in automobiles or other finished goods. Thousands of automotive people perform work in support of automobile manufacturing within industries otherwise classified—producing, for example, glass vehicular lighting, ignition systems, storage batteries, and valves. Thus, the Department of Transportation estimated that during 1978 to 1979 about 1.4 million people were employed by auto suppliers overall.[3]

Historically, the growing but cyclical nature of the auto market resulted in a pattern of periodic growth and decline in auto-related employment (see table 65). Current and projected trends for strong import sales, decline in the growth rate of the U.S. auto market, increased use of foreign suppliers and production facilities, and adoption of more capital-intensive production processes and more efficient management by auto manufacturers and suppliers will contribute to a general decline in auto industry employment.

Specific changes in employment will depend on the number of plants closed or operating un-

[2] Bureau of Labor Statistics, Current Employment Statistics Program data.

[3] U. S. Department of Transportation, *The U.S. Automobile Industry*, 1980: *Report* to the President from the Secretary of Transportation (Washington, D.C: Department of Transportation, January 1981).

Table 64.—initial and Lifecycle Costs of Representative Four-Passenger Electric Cars

	Near term					Advanced		
	Pb-Acid	Ni-Fe	Ni-Zn	$Zn\text{-}CL_2$	(ICE)	$Zn\text{-}CL_2$	Li-MS	(ICE)
Initial cost, dollars	8,520	8,400	8,130	8,120	4,740	7,050	6,810	5,140
Vehicle	6,660	5,950	5,720	5,540	4,740	5,410	5,180	5,140
Battery	1,860	2,450	2,410	2,580	—	1,640	1,630	—
Lifecycle cost, cents per mile	23.9	24.9	26.6	22.0	21.4	19.4	20.1	21.8
Vehicle	5.0	4.5	4.3	4.2	4.3	4.1	3.9	4.7
Battery	3.0	4.8	7.0	2.3	—	1.4	2.6	—
Repairs and maintenance	1.5	1.5	1.5	1.5	3.9	1.5	1.5	3.9
Replacement tires	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4
Insurance	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Garaging, parking, tolls, etc.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Title, license, registration, etc.	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5
Electricity	2.3	2.2	2.0	2.2	—	1.7	1.5	—
Fuel and oil	—	—	—	—	4.0	—	—	3.7
Cost of capital	5.5	5.5	5.4	5.4	3.0	4.5	4.4	3.3

NOTE: All costs are In mid-1980 dollars.

Assumptions:

Electricity price	S0.03 per kilowatt-hour
Gasoline price	$1.25 per gallon
Electric vehicle life	12 years
Internal combustion engines vehicle life	10 years
Annual travel	10,000 miles
Car end battery salvage value	10 percent
Cost of capital	10 percent per year

Car and battery purchases are 100 percent financed over their useful lives.
Electricity cost includes a road use tax equal to that paid by typical gasoline vehicles of equal weight via State and Federal gasoline taxes.

SOURCE: General Research Corp. Cost categories and many entries, such as tires, Insurance, garaging, etc., are based on periodic cost analyses by the Department of Transportation (see footnote 13). All costs shown were computed by the Electric Vehicle Weight and Cost Model (EVWAC) (see footnote 14).

Table 65.—Auto Industry Employment Data

Year	(1) Average annual unemployment rate in the motor vehicle industry SIC 371 (percent)	(2) Average annual employment in primary auto manufacturing and parts and accessories manufacturing, SIC 3711 and SIC 3714 (000)
1970. . . .	7.0	733.4
1971	5.1	781.3
1972	4.4	798.2
1973. . . .	2.4	891.5
1974	9.3	818.9
1975. . . .	16.0	727.8
1976. . . .	6.0	814.9
1977	3.9	869.5
1978. . . .	4.1	921.7
1979. . . .	7.4	908.6
1980	20.3	775.6

SOURCE Column 1 data are from the Bureau of Labor Statistics, household sample survey Column 2 data are from the Bureau of Labor Statistics establishment survey, Data in the two columns are not directly comparable. “SIC” refers to “Standard Industrial Classification.”

der capacity, the capacity of the plants, and the degree to which production at affected plants is labor-intensive. The long-term effects on workers depend on personal characteristics such as skills (many production workers have few transferable skills), the levels of local and national unemployment, information about job opportunities, and personal mobility (greatest for the young, the skilled, and those with some money).

The Department of Transportation estimates that each unemployed autoworker costs Federal and State Governments almost $15,000 per year in transfer payments and lost tax revenues. This estimate implies, for example, that if 100,000 to 500,000 manufacturer and supplier workers are unemployed for a year their cost to government is about $1.5 billion to $7.5 billion. During 1980, payments to unemployed workers of General Motors (GM), Ford, and Chrysler in Michigan included about $380 million in unemployment insurance, $100 million in extended benefits, and $800 million in “trade adjustment assistance” (provided by a program established in the Trade Expansion Act of 1962 and modified by the Trade Act of 1974).[4]

Growing use of labor-saving machinery by auto manufacturers and major suppliers to implement complex technologies, cut costs, and improve product quality is reducing job opportunities in the auto industry. GM, for example, expects to invest almost $1 billion by 1990 for 13,000 new robots for automobile assembly and painting and parts handling. A new robotic clamping and welding system developed by GM and Robogate Systems, Inc., will enable GM to reduce labor costs for welding by about 70 percent, improve welding consistency, and reduce vibration and rattling in finished automobiles. s

MacLennan and O’Donnell, analysts at DOT, have calculated that today’s new and refurbished plants can assemble 70 cars/hour with an average employment level of 4,500, while older plants typically produce 45 to 60 cars/hour using about 5,400 workers. Such plant modernization implies that three fewer assembly plants and 23,000 fewer workers are needed to assemble 2 million cars annually.[6] The United Auto Workers estimates that labor requirements in auto assembly, which has been a relatively labor-intensive aspect of auto manufacture, will be reduced by up to 50 percent by 1990 through the use of robots and other forms of automation. ’

Foreign-designed automobiles manufactured in the United States also provide jobs. Current and anticipated local production by foreign firms (only Volkswagen (VW) to date) largely involves vehicle assembly, using primarily imported components and parts. VW’s Pennsylvania plant employs 7,500 workers to assemble over 200,000 cars and contributes to about 15,000 domestic supplier jobs;[8] a comparably sized domestic--owned plant would support a total of about 35,000 domestic jobs. New U.S. manufacturing and supplier jobs will grow with local production and purchasing from U.S. suppliers by foreign firms in proportion to the amount of local production content in the automobiles. The planned increase in local content for Rabbits made here by VW—from 70 percent in model

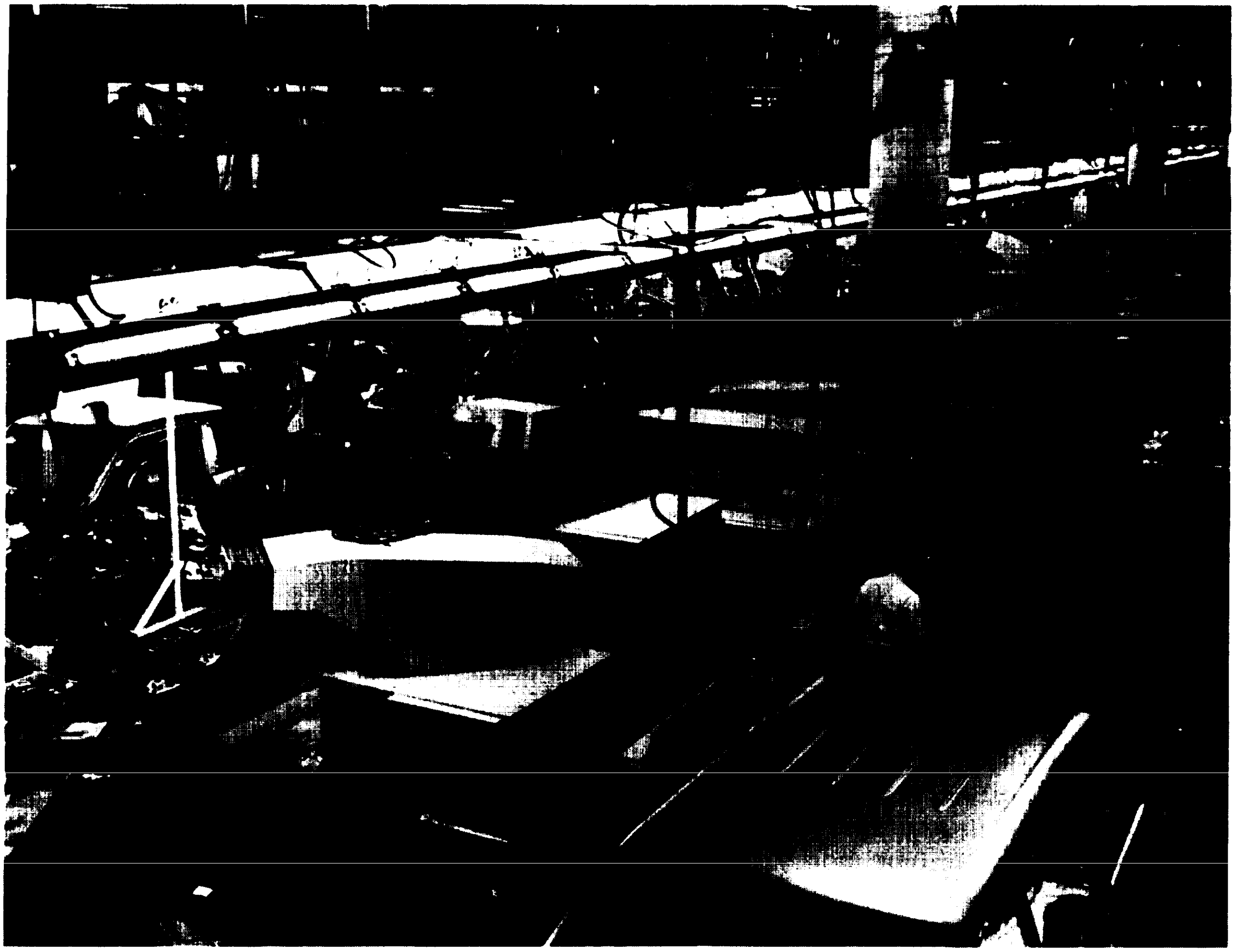
[4] Michigan Employment Security Commission, personal communication.

[5] “GM’s Ambitious Plans to Employ Robots, ” Business Week, Mar. 16, 1981.

[6] Carol MacLennan and John O’ Donnell, “The Effects of the Automotive Transition on Employment: A Plant and Community Study” (Washington, D.C: U.S. Department of Transportation, December 1980).

[7] *Business* Week, op. cit.

[8] Department of Transportation, op. cit.



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year 1981 to 74 percent in model year 1983–implies more work in the United States.[9]

The Departments of Labor and Transportation estimate that there are between one and two supplier jobs overall for each primary auto manufacturing job.[10] Change in supplier employment associated with declining manufacturing employment is uncertain, and will depend on the nature of the supplied product, how it is made, and the amount that auto manufacturers buy. While some supplier jobs, like auto manufacturing jobs, depenal on production volume, other supplier jobs (e.g., in machine tool manufacture and plastics processing) are tied to the implementation of new technology. Trends toward foreign sourcing and vehicle production and automation among suppliers suggest that supplier employment overall will decline.

Steel and rubber industry jobs are especially vulnerable to automotive weight and volume reductions. Many of these supplier jobs have already been lost with automotive weight reductions during the 1970's. For example, MacLennan and O' Donnell estimate that reduced automotive use of iron and steel in 1975 to 1980 led to a permanent loss of 20,000 jobs, a loss only

[9] "VW Projects Increases in U.S. Content," *Ward's* Automotive Reports, May 27, 1981.

[10] MacLennan and O'Donnell, Op. cit.

partially offset by a gain of 8,000 jobs in processing plastics and aluminum for automotive use.[11] During the same period, employment in the tire and rubber industry declined at a compound annual rate of 4.1 percent.[12]

Jobs with parts and component manufacturers are also relatively vulnerable, although, again, many have already been lost. Mac Lennan and O'Donnell estimate that the closing of almost 100 materials, parts, and component plants in 1979 to 1980 eliminated over 80,000 supplier jobs.[13] Because of the predominance of small firms among auto suppliers, near-term supplier job losses may occur incrementally.

Automobile importation supports some domestic jobs and results in the loss of others. There are over 125,000 people employed by importers, primarily in dealerships.[14] Growth in import-related employment stems from increases in the number and market shares of importers, in the number of dealerships per importer, and in employment per dealership. On the other hand, imports cause loss of industrial jobs. DOT estimates that loss of 100,000 vehicle sales to imports results in the loss of about 8,500 primary manufacturing and 13,000 to 16,000 supplier jobs.[15] This implies, for example, that the almost 400,000-unit increase in import sales in 1978 to 1980 caused a loss of 34,000 jobs in automobile manufacturing and up to 64,000 supplier jobs.

Employment in automotive services, including repair, parking, renting and leasing, washing, and other services (Standard Industrial Classification 75) grew at a compound annual rate of 5.7 percent in 1975 to 1980 to a total level of almost 540,000 people, according to the Department of Commerce.[16] Employment in these areas is expected to continue to grow.

Occupational and Regional Issues

Improvements in automotive technology cause changes in the skills required for production jobs. Major design and technology changes increase demands for engineers, who have been in short supply, while cost-cutting strategies eliminate other white-collar positions. GM, for example, eliminated about 10,000 white-collar jobs beginning in 1980 to save about $300 million, and may eliminate up to 20,000 more.[17] Automation reduces the number of routine and hazardous tasks, while increasing equipment maintenance and service tasks. GM, for example, plans to have equal numbers of skilled and unskilled workers by the 1990's, although it presently has one skilled worker for each five to six unskilled workers.[18]

Auto production jobs are concentrated in Michigan, Ohio, Indiana, New York, and Illinois (see fig. 20). The geographic distribution of auto-related jobs is likely to change somewhat for several reasons. First, some nontraditional auto suppliers are located away from traditional areas of auto production. Major plastics-producing States, for example, include California, New Jersey, and Texas as well as Ohio and Illinois. Furthermore, many of today's suppliers are located abroad and many U.S. suppliers are opening plants abroad. Second, foreign or domestic firms may establish production facilities outside of the East-North Central area to gain lower labor and utility costs, For example, Nissan chose to build a plant in Tennessee. Third, domestic firms are closing inefficient and unneeded plants. Table 66 summarizes the factors considered in locating parts-supplier plants.

Automotive plant closings primarily affect employment in the East-North Central region, because automobile production is concentrated there. Ongoing and future losses of automobile-related employment in this region are largely a reflection of the structural changes in the auto industry described earlier in this chapter, although there will continue to be cyclical changes

11 Ibid.

12 U.S. Department of commerce, *1981 U.S. Industrial Outlook* (Washington, D.C: Department of Commerce, 1981).

13 Mac Len nan and O' Donnell, Op. cit.

14 Patricia Hinsberg, "Study Finds Imports Create U.S. Jobs," *Automotive News*, Aug. 20, 1979.

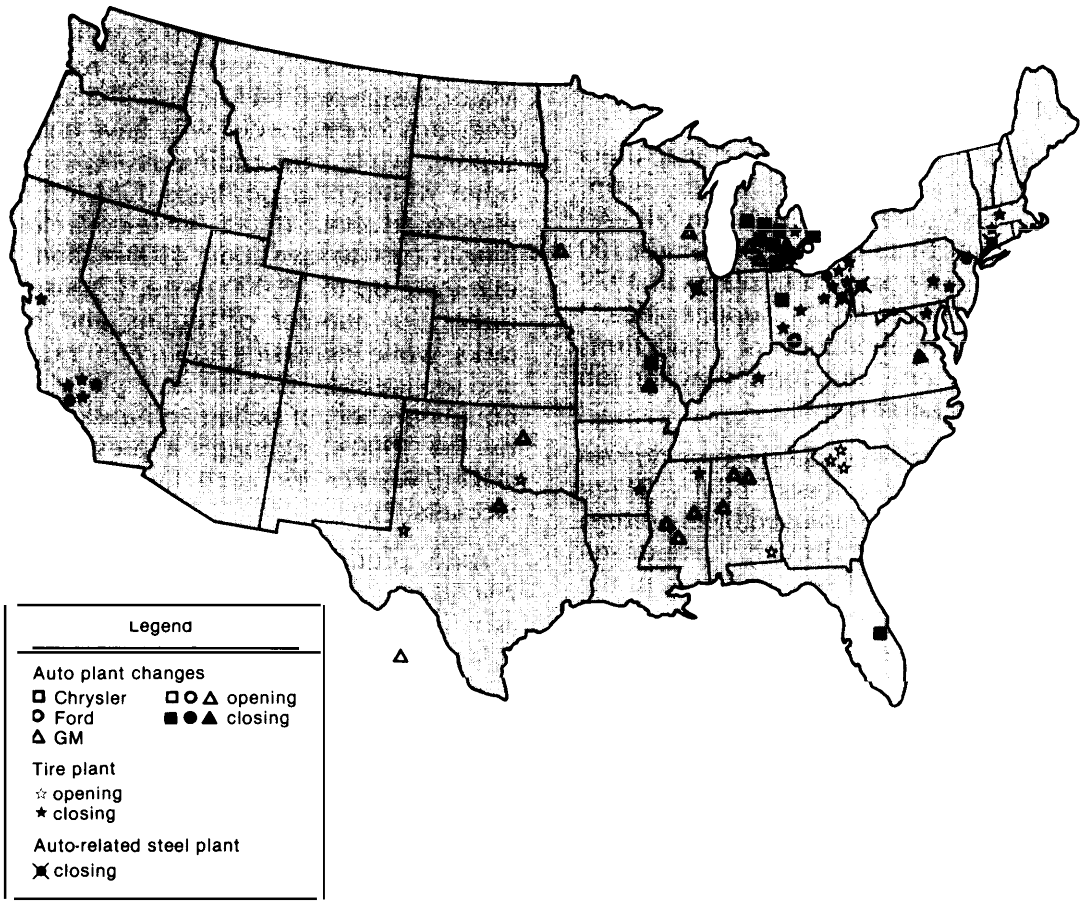
15 Department of Transportation, op. cit.

16 Department of Commerce, op. cit.

17 "GM May Chop Another 19,000 Salaried jobs," Automotive News, Mar. 2, 1981.

18 *Wall Street Journal,* January 1981.

Figure 20.–Auto, Steel, and Tire Plant Changes, 1975=80



SOURCE: U.S. Department of Transportation, "The U.S. Automobile industry, 1980," DOT-P-1 O-81-O2, p. xviii, January 1981.

Table 66.—Factors to Consider in Locating Parts-Supplier Plants

Factor	Relative ranking 1970's	1980's
Availability and cost of skilled labor		1
Availability and cost of energy	2;	2
State and local taxes, incentives	3	3
Availability and cost of raw materials	2	4
Work ethic of area	4	5
State and local permits, regulations	5	6
Worker's compensation insurance	7	7
Availability and cost of capital	7	8
Right-to-work state (union relations)	6	9
Freight costs	10	10
Quality of living environment	8	11
Community attitude .,	9	11
Customer service	12	11
Available land	11	12

SOURCE: Arthur Andersen & Co. and the Michigan Manufacturer Association, ***Worldwide Competitiveness of the*** U.S. ***Automotive*** Industry ***and Its*** Parts Suppliers ***During*** the ***1980s,*** **February** 1981.

in automobile-related employment. Because of local and regional employment dependence on one industry—motor vehicles—other businesses (such as retail and service establishments) and their employment also suffer as employment in the local population declines.

Unemployment and out-migration will jeopardize other businesses and strain local tax bases, and Michigan will be especially vulnerable. Loss of employment, population, and business recently induced Moody's Investers Service, Inc., to lower bond ratings for Akron, Ohio, which has depended on the tire and rubber industry for its economic vitality; bond ratings for other auto-dependent cities have also been lowered.

Photo credit: Michigan Employment Security Commission

Shifts in plant location associated with investments in fuel efficiency may create unemployment problems in traditional manufacturing centers

SOCIAL IMPACTS OF SYNFUELS DEVELOPMENT

Overview

The principal social consequences of developing a synthetic fuels industry arise from large and rapid population increases and fluctuations caused by the changing needs of industry for employees during a facility's useful life. Such population changes disproportionately affect small, rural communities that have limited capacity to absorb and manage the scale of growth involved; these types of communities characterize the locations where oil shale and many coal deposits are found.

In general, whether the consequences of growth from synfuels development will be beneficial or adverse will depend on the ability of communities to manage the stresses which accompany rapid change. Although impacts can be generally characterized, the extent and nature of their occurrence will be site-specific depending on both community factors (size, location, tax base) and technology-related factors (the location, size, number, and type of synfuels facilities; the rate and timing of development; and associated labor requirements).

Growth will tend to concentrate in established communities where services are already available, if they are within commuting distance to synfuels facilities. New towns may be established to accommodate growth in some areas. Large towns will serve as regional service centers. Isolated communities will more likely experience greater impacts than areas where well-linked communities can share the population influx. Energy conversion facilities which are sited near mines will result in the greatest concentration of local impacts.

Most synfuels production from oil shale in the Nation will be concentrated in four Western counties, affecting about a dozen communities in sparsely populated areas of northwestern Colorado and northeastern Utah, and eventually southwestern Wyoming. These communities are widely separated, are connected by a skeletal transportation network, and have had historically small populations. Oil shale cannot be economically transported offsite because of the large quantities of shale involved per barrel of product.

Coal presents a more flexible set of options than oil shale with respect to the location of conversion facilities in relation to mines. The coal used for synfuels production will most likely be dispersed among all the Nation's major coal regions.

In the West, coal sites will be in the oil shale States (Colorado, Utah, and Wyoming) as well as in Montana, North Dakota, and New Mexico. Most of the increase in Western coal production for synfuels will be in Wyoming and Montana.[19] Midwestern sites will most likely be in Illinois, western Kentucky, and Indiana. The coal counties to be most severely affected in Appalachia will be in rural parts of southwestern Pennsylvania, southern West Virginia, and eastern Kentucky. Parts of Illinois will also be affected. In central Appalachia, communities are typically small, congested, and in rural mountain valleys.

The major differences between the Eastern and Western coalfields, in general, are that in the West, counties are larger, towns are smaller and more scattered, the economic base is more diversified, more land is under Federal jurisdiction, water is relatively more scarce, and the terrain is less rugged and variable. To the extent that coal is transported, there could be additional environmental and safety hazards, noise, and disruption or fragmentation of communities, farms, and ranch lands.

The social consequences of producing synthetic fuels from biomass are discussed in detail in a previous OTA report, *Energy From Biological Processes*. Unlike the social consequences associated with fossil fuels, the social impacts of biomass arise from production rather than processing. For example, 90 percent of the employment impacts from biomass are expected from cultivation and harvesting (mostly forestry).

Manpower Requirements

Manpower requirements for synfuels production are generally of two types: 1) labor is required for the construction of energy facilities and supporting service infrastructures, and 2) workers are needed for the operation and maintenance of facilities. As discussed in chapter 8, the ability to attract and retain an adequate labor force—particularly experienced chemical engineers and skilled craftsmen, who are already in short supply—could become a constraint on synfuels development.

Construction manpower requirements for single projects lead to large, rapid, yet temporary, increases in the local population. The construction phase usually lasts 4 to 6 years, peaking over a 2- to 4-year period as construction activities near completion.[20] The shorter the scheduled construction period, the higher the peak labor force.[21] Labor requirements will change significantly during the construction phase, in terms of both size and occupational mix. Labor requirements for the daily, routine operation and maintenance of a plant are relatively stable during the useful life of the facility; scheduled yearly and major maintenance work would cause only brief increases in the operations labor force.

Estimates of manpower requirements for generic 50,000 barrel per day (bbl/d) synthetic fuel

[19] E. J. Bentz & Associates, Inc., "Selected Technical and Economic Comparisons of Synfuel Options," contractor report to OTA, April 1981.

[20] Ibid.

[21] Peter D. Miller, "Stability, Diversity, and Equity: A Comparison of Coal, Oil Shale, and Synfuels," in Supporting Paper *5:* Sociopolitical Effects of Energy Use and Policy, CONAES, Washington, D. C., 1979.

plants are shown in table 67. They are highly uncertain, in large part because of the lack of experience with commercial-size plants. In addition, major components of uncertainty in the construction manpower estimates include such unpredictable situations as regulatory delays, lawsuits, delays in the receipt of materials, labor unrest, and the weather; and major components of uncertainty in the estimates of operations manpower relate to the age of the plant, maturity of the technology, and novelty of the plant design.

Even for well-known technologies such as coal-fueled electric powerplants, initial estimates of the peak construction labor force required for selected rural-sited plants have varied from about 50 to 270 percent of the actual peak levels.[22] This range of uncertainty may be applicable to the estimates of construction manpower requirements for synfuels plants in general, but should prove to be overly broad when considering a specific technology. The uncertainty surrounding requirements for operational manpower is expected to be narrower, perhaps on the order of + 25 percent.[23]

The estimates shown in table 67 are plant-gate employment requirements; other synfuels-related activities such as mining, beneficiation, and transportation are not included unless indicated. The manpower requirements for these additional activities will be site-specific and could alter the relative ordering of alternative technologies. For example, on the national average, production per miner per day is approximately three times greater in surface mines than in underground mines. This ratio can be expected to vary, depending on many factors including types of methods and equipment used and geology for underground mining, and geology and environmental considerations for surface mining.[24]

Population Growth

Local population will grow where synfuels are produced because workers directly employed at the synfuels plants, employees in secondary industries and services, and accompanying families will move into these areas. Population growth rates will depend on the nature of the area where the plant is located and on the phase of plant development.

Estimates of population growth due to synfuels development usually assume that for each new worker entering an area, the population increases between three and five persons.[25] The demand

[22] John S. Gilmore, "Socioeconomic Impact Management: Are Impact Assessments Good Enough to Help?" paper presented at the Conference on Computer Models and Forecasting Impacts of Growth and Development, University of Alberta, Jasper Park Lodge, Alberta, Apr. 21, 1980 (revised June 1980).

[23] George Wang, Bechtel Group, Inc., personal communication.

[24] The average national production per miner per day was 8.38 tons in underground mines and 25.78 tons in surface mines for bituminous and lignite in 1978. Nationwide, productivity varied: for underground mining, from approximately 2 to 15 average tons per miner per day and, for surface mining, from approximately 7 to 98 average tons per miner per day. (Department of Energy, Energy Information Administration, Bituminous Coal and Lignite Production and Mine Operations— 1978, Energy Data Report, June 16, 1980.)

[25] As an example, White, et al., use a population/employment multiplier of 3.0 for the construction phase and 4.0 for the operation phase (Energy From the West, Science and Public Policy Program, University of Oklahoma, prepared for the Environmental Protection Agency, March 1979). Miller uses a uniform "conservative" population/employ merit multiplier of 5.o (see footnote 21 above).

Table 67.—Manpower Requirements for a 50,000 bbl/d Generic Synfuels Plant

	Liquefaction			
	Direct	Indirect	Coal gases	Oil shale
Total construction (person-years)	11,000	20,000	11,000	11,000[a]
Peak construction (persons)	3,500	6,800[b]	3,800	3,500[a]
Operations and maintenance (persons)	360[c] 2,300[d]	360[c] 3,800[d]	360[c] 1,200[d]	2,000[e]

[a] Surface retorting will generally have higher construction manpower requirements than modified in-Situ Processes.
[b] Manpower requirements of 17,000 persons have been projected by Fluor Corp. based on a SASOL tYPe coal conversion plant ("A Fluor Perspective on Synthetic Liquids: Their Potential and Problems").
[c] Daily, routine O&M requirments (E. J. Bentz & Associates, Inc., "Selected Technical and Economic Comparisons of Synfuels Options," April 1981).
[d] Annual aggregation of scheduled yearly and major maintenance work. Technology specific (Bechtel National, Inc., "production of Synthetic Liquids From Coal: 19S0-2000," December 1979).
[e] Oil shale requirements include mining. Modified in-situ (MIS) processes will generally have higher O&M requirements than surface retorting (e.g., MIS Involves an ongoing mining process).

SOURCE: Office of Technology Assessment

for support services in nearby communities increases with the absolute size of the work force during the peak construction period. The larger the work force required during peak construction relative to that required for operations and maintenance, the greater the likelihood that nearby communities will experience large population fluctuations.

In general, if several facilities are located in the same area, the impacts from population growth and fluctuation could be disproportionately large unless construction and operation activities are coordinated; on the other hand, population growth associated with construction can be stabilized if an indigenous construction work force develops. *

Estimates of population increases associated with the fossil synfuels development scenarios presented in chapter 6 are shown in table 68. On a regional basis, population growth associated with oil shale will be concentrated in only several counties in the Mountain Region (see fig. 21). population increases associated with coal-based synfuels will be dispersed throughout the Nation, with the East North Central experiencing the biggest population increases and the West South Central experiencing the smallest population increases.

Table 69 shows energy-related population growth during the last decade in selected communities. In small communities, and in sparsely populated counties and States, energy-related population growth could represent a significant proportion of future population growth. For example, official population projections by the Colorado West Area Council of Governments (CWACOG) show increases by 1985, relative to 1977, of up to 400 percent in Rio Blanco County (1977 special census population was 5,100) and 300 percent in Garfield County (1 977 special census population was 18,800), assuming the industry develops according to the 1979 plans of companies active in the area.

*A succession of projects in an area should lead to an indigenous and more stable construction manpower work force, depending on whether workers perceive a permanence of industrial expansion in the area. Some proportion of the construction work force may also be employed in operations and maintenance activities once construction is completed.

Table 68.—Estimates of Regional Population Growth Associated With Fossil Synfuels Development [a] (thousands)

	1990	1995	2000
Low estimate:			
South Atlantic	4-6	12-20	30-51
East North Central	14-24	46-76	115-192
East South Central	5-9	17-28	42-71
West North Central	5-9	17-28	42-71
West South Central	2-3	6-10	15-25
Mountain:			
Coal	7-12	23-38	58-96
Shale	66-110	90-150	81-135
Total	103-173	211-350	383-641
High estimate:			
South Atlantic	11-18	33-55	86-144
East North Central	33-56	105-174	275-458
East South Central	11-18	33-55	86-144
West North Central	17-29	54-90	141-235
West South Central	5-8	15-25	39-65
Mountain:			
Coal	19-32	60-100	122-203
Shale	132-220	213-355	108-180
Total	228-381	513-854	857-1,429

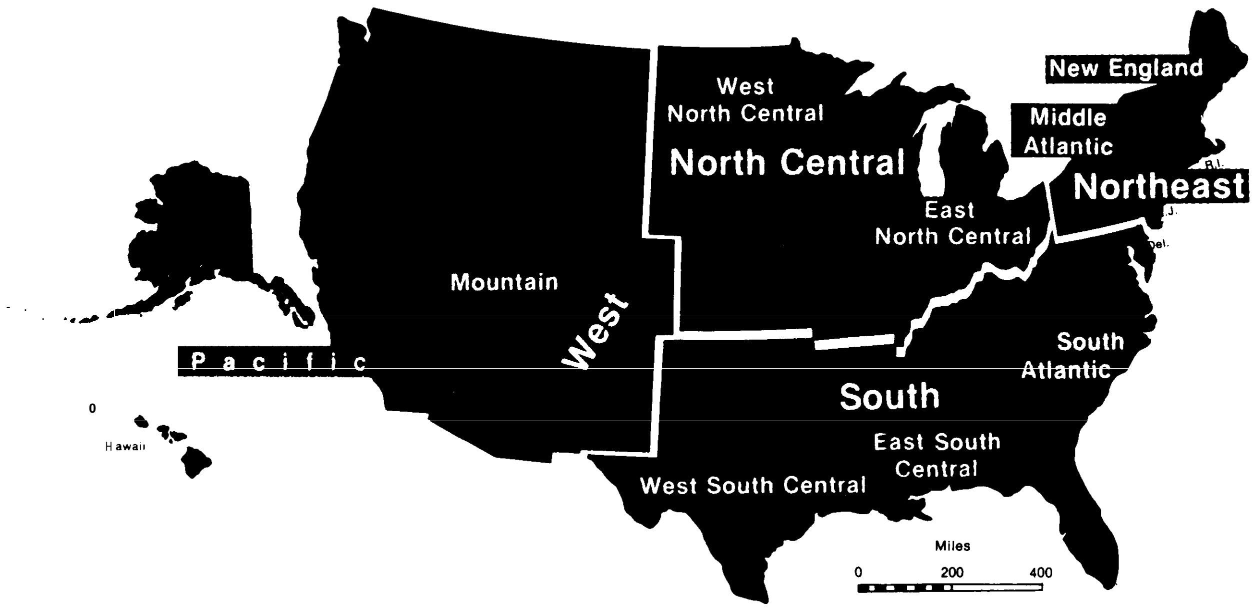
[a]Estimate are relative to 1985 (for plants coming online in the Year shown) and are based on OTA's development scenarios presented in ch. 8. Population multipliers of 3 and 5 were applied to develop the ranges shown. Aggregated estimates should not be extrapolated to determine the ability of any State or localitv. to absorb this population.
[b]Production is distributed among the regions, according to the low and high scenario distributions used In the Bechtel report for, respectively, the low and high scenarios developed herein (Bechtel National, Inc., December 1979). It is further assumed that direct and indirect liquids will be representad equally. Only dally, routine O&M requirements are included.
Regional estimates are for coal processes unless other wise indicated.

SOURCE: Office of Technology Assessment.

Under CWACOG's high-growth scenario (500,000 bbl/d in 1990 and 750,000 bbl/d in 1995 and 2000), increases of up to 800 percent in Rio Blanco County and 350 percent in Garfield County are projected.[26] In three counties in Kentucky where the construction of four major synfuels plants had recently been planned to commence (H-Coal, SRC-1, W. R. Grace, and Texas Eastern), the expected maximum number of synfuels workers (excluding accompanying family members) was projected to increase 1980 population levels by about 3 percent in Daviess County (1 980 census population was 86,000) to over 30 percent in Breckinridge County (1980 census population was 17,000) and over 50 percent in Henderson County (1980 census population was 41 ,000); population increases during the operation phase

[26]*An Assessment of Oil Shale Technologies*, OTA-M-118 (Washington, D. C.: U.S. Congress, Office of Technology Assessment, June 1980).

Figure 21 .—Census Regions and Geographic Divisions of the United States



SOURCE: U.S. Department of Commerce, Bureau of the Census.

Table 69.–Population Growth in Selected Communities, 1970-80

State	City	Energy resource impact [a]	Population [b] 1970	Population [b] 1980	Percent increase: Total	Percent increase: Average annual (compounded)
West Virginia	Buckhannon, Upshur County (Union District)	coal	248	587	136.7	9.0
Kentucky	Caseyville, Union County	coal			87.0	6.5
Utah	Huntington, Emergy County	coal, powerplant	857	2,316	170.2	10.5
	Orangeville, Emery County	coal, powerplant	511	1,309	156.2	9.9
	Helper, Carbon County	coal	1,964	2,724	38.7	3.3
Wyoming	Douglas, Converse County	coal, uranium, oil, gas	2,677	6,030	125.3	8.5
	Gillette, Campbell County	coal	7,194	12,134	68.7	5.4
	Rocksprings, Sweetwater County	coal, oil, gas, trona, powerplant, uranium	11,657	19,458	66.9	5.3
North Dakota	Washburn, McLean County	coal, powerplant	804	1,767	119.8	8.2
	Beulah, Mercer County	coal, powerplant	1,344	2,878	114.1	7.9
Montana	Forsyth, Rosebud County	coal, powerplant	1,873	2,553	36.3	3.2
	Hardin, Big Horn County	coal	2,733	3,300	20.7	1.9
	Colstrip, Rosebud County [c]	coal, powerplant	<200	3,500	1,650.0	33.1
Colorado	Craig, Moffat County	coal, powerplant	4,205	8,133	93.4	6.8
	Rifle, Garfield County	oil shale, minerals, coal	2,150	3,215	49.5	4.1
	Hayden, Routt County	coal, powerplant	763	1,720	125.4	8.5

[a]Identified by the Department of community Development within the respective States.
[b]Bureau of the Census, *1980 Census* of Population and Housing, *Advance Reports*.
[c]Estimates by Sunlight Development, Inc.

SOURCE: Office of Technology Assessment.

were projected to be respectively 0.4, 4, and 15 percent (excluding accompanying family members).[27] Table 70 shows statewide population estimates, based on an extrapolation of only demographic trends, for some of the States that are most likely to experience population increases from synfuels development.

Small rural communities (under 10,000 residents) that experience high population growth rates are vulnerable to institutional breakdowns. Such breakdowns could occur in the labor market, housing market, local business activities, public services, and systems for planning and financing public facilities. Symptoms of social stress (such as crime, divorce, child abuse, alcoholism, and suicide) can be expected to increase.

The term "modern boomtown" has been used to describe communities that experience strains on their social and institutional structure from sudden increases and fluctuations in the population. Communities are also concerned about the possibility of a subsequent "bust." Large fluctuations in population size could lead to a situation where a community expands services at one point in time only to have such services underutilized in the future if demands fail to materialize or be sustained.

[27] C. Gilmore Dutton, "Synfuel Plants and Local Government Fiscal Issues," memorandum to the Interim Joint Committee on Appropriations and Revenue, Frankfort, Ky., Dec. 18, 1980.

Private Sector Impacts

The principal social gains from synfuels development in the private sector are increased wages and profits; direct and secondary employment opportunities will be created and expanded; disposable income will increase; profits from energy investments should be realized; and local trade and service sectors will be stimulated. The ability of the private sector to absorb growth will depend, in large part, on the degree of economic diversification already present. Western communities, in general, have more diversified economies and broader service bases than those in the East, where many communities (as in central Appalachia) have historically been economically dependent on coal.

Many private sector benefits, however, will not be distributed to local communities, at least during the early periods of rapid growth. For example, synfuels development would be located in areas where the required manpower skills are already scarce; unemployment in local communities may thus not be significantly lowered unless local populations can be suitably trained. Where synfuels development competes with other sectors for scarce labor, fuel and material inputs, and capital resources, traditional activities may be curtailed and the price of the scarce resources inflated. Local retail trade and service industries may experience difficulties in providing and expanding services to keep pace with demands, re-

Table 70.—Statewide Population Estimates

State	Total State population 1980[a] (millions)	Statewide population percent increase 1970-80: Total	Annual compounded	Projected State population 2000[b]: 1990	2000
Kentucky	3.66	13.7	1.3	4.08	4.43
West Virginia.	1.95	11.8	1.1	2.08	2.20
Colorado	2.89	30.7	2.7	3.50	4.00
Montana.	0.79	13.3	1.3	0.90	0.98
North Dakota.	0.65	5.6	0.5	0.70	0.73
Wyoming	0.47	41.6	3.5	0.54	0.60
Utah	1.46	37.9	3.3	1,73	1.95

[a] Bureau of the Census, *1980 Census* of Population and Housing, Advanced *Reports*.
[b] Bureau of the census, *Illustrative* Projections of State Populations by Age, Race, and Sex: *1975 to 2000.* Projected estimates are from Series II-B which assumes a continuation from 1975 through 2000 of the civilian non-college interstate migration patterns by age, race, and sex observed for the 1970-75 period. Has been corrected by the percent difference between the 1980 projections and the 19S0 census. Note that these projections are extensions of recent trends with respect to demographic factors only.

SOURCE: Office of Technology Assessment.

cruiting and retaining employees, and competing with out-of-State concerns. Both the Eastern and western sites for synfuels development have generally depended on imported capital, and profits to and reinvestments of the energy companies are likely to be distributed to locations remote from plant sites.

High local inflation rates often accompany rapid growth, due to both excess demand for goods and services and high industrial wage rates. Local inflation penalizes those whose wages are independent of energy development and those on fixed incomes.[28]

Housing can be a major problem for the private sector in areas that grow rapidly from synfuels development: the existing housing stock is usually already in short supply and often of poor quality; local builders often lack the experience and capability to undertake projects of the large scale required; shortages of construction financing and mortgage money are common; and land may not be available for new construction because of terrain, land prices, or overall patterns of ownership. Housing shortages have already led to dramatic price increases in the Western oil shale areas. The need for temporary housing for construction workers aggravates housing supply problems, and mobile homes are often used by both temporary and permanent workers.

Public Sector Impacts

Communities experiencing rapid growth are vulnerable to the overloading of public facilities and services, due both to large front-end capital costs and to constraints which limit a community's ability to make the necessary investments in a timely fashion. * Ability of a community to absorb and provide for a growing population will be community-specific and depend on many factors—such as the size of the predevelopment tax base, availability of developable land, existing social and institutional structure, extent and rate of growth of demand for public services, local planning capabilities and management skills, and political attitudes.

In the long run, local governments should benefit from expanded tax bases arising from the capital intensity of energy facilities and the establishment of associated economic activity. In the aggregate, sufficient additional tax revenue should be produced to pay for the upgrading and expansion of public facilities and services as required for the growing population.[29] In the short run, however, raising local revenues under conditions of rapid growth is often made difficult because of the unequal distribution of incurred costs and revenue-generating capacity among different levels of government.

For example, energy development activities are typically sited outside municipal boundaries, with the result that revenues go to the county, school district, and/or State. However, the population growth accompanying this energy development, and hence the need for services, typically occurs within cities and towns that do not receive additional revenues from the new industry. The separation between taxing authority and public service responsibility can also occur across State lines. In addition, the availability of local tax revenues can lag behind the need for services, because industrial taxes are often based on assessed property values and are not received until full plant operation. * Note also that the total tax burden on the mineral industry and the proportion of State taxes distributed to localities vary from State to State.

There is no clear consensus on the cost of providing additional new public facilities and services in communities affected by energy development. The economics of the decision to expand from an existing service base, or to build a new town, will depend on such factors as the availability of land, accessibility to employment, extent and

[28] *An* Assessment of *Oil* Shale Technologies, op. cit.

*investments in the public sector can be constrained by, as examples, existing tax bases, debt limitations, bonding capacity, and the 2- to 5-year leadtime typically required for planning and implementing services. In addition, ceilings are often established on the rate of expansion of local government budgets, and there is a tendency either not to tax or to undervalue undeveloped mineral wealth.

[29] *Management* of *Fuel* and *Nonfuel* Minerals in Federal Lands, OTA-M-88 (Washington, D. C.: U.S. Congress, Office of Technology Assessment, April 1979).

*Note that mobile homes generate little, if any, property taxes; and local governments have had difficulty in providing services to such sites.

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Synfuels development will require the creation of new communities in sparsely populated areas recovery or other funding/revenue mechanisms have been applied.

Health care is particularly vulnerable to overloading from rapid growth because rural communities often have inadequate health services prior to development and experience difficulties in attracting and retaining physicians. Synfuels development will change the health care needs of local communities because of the influx of young families, the increase in sources of social stress, and new occupational environments that will give rise to special health care needs. Hospital facilities as well as health, mental health, and social services will be required. Educational facilities are also likely to be overloaded. Both Eastern coal communities and Western oil shale communities are presently having difficulty in attracting and retaining personnel and in funding the provision and expansion of facilities and programs,

Public sector dislocations caused by synfuels development on Indian lands could be more severe than on other rural areas. Tribes have limited ability to generate revenues, there will be large cultural differences between tribal members and workers who immigrate to an area to work on a project, and land has religious significance to some tribes and individual landownership is commonly prohibited (so that, for example, conventional patterns of housing development may not be possible).

Most reservations are also sparsely populated, with few towns, and public services and facilities are severely inadequate and overburdened. Significant amounts of coal are owned by Indians in New Mexico and Arizona, lesser amounts in Montana, North and South Dakota, and Colorado. Although in the aggregate current coal leases represent only a fraction of the total coal under lease, Indian leases are important because of their size and coherence. About 8 percent of the oil-shale mineral rights in the Uinta Basin are owned by Indians, but most of the associated deposits are of low grade.[32]

Managing Growth

Unmanaged growth, although not well understood, appears nevertheless to be a leading source of conflict and stress associated with energy development. All involved parties-the Federal, State, and local governments; industry; and the public—have an interest in and are contributing in varying degrees to growth management by providing planning, technical, and financial assistance to communities experiencing the effects of synfuels development. These mechanisms, which vary among States in terms of their scope, detail, and development, are discussed in detail in previous OTA reports.[33] 3435 I n general, the effectiveness of existing mechanisms has yet to be tested in the face of rapid and sustained industrial expansion. Major issues to be resolved include who will bear the costs of and responsibilities for both anticipating and managing social impacts, and how up-front capital will be made available when needed to finance public services.

[32] U.S. Geological Survey, Synthetic Fuels Development, Earth-Science Considerations, 1979.

[33] *An* Assessment of *Oil* Shale Technologies, op.cit.

[34] *Management* of *Fuel* and *Nonfuel* Minerals *in* Federal Lands, op. cit.

[35] The *Direct Use* of *Coal:* Prospects and Problems of Production and Combustion, OTA-E-86 (Washington, D. C.: U.S. Congress, Office of Technology Assessment, April 1979).