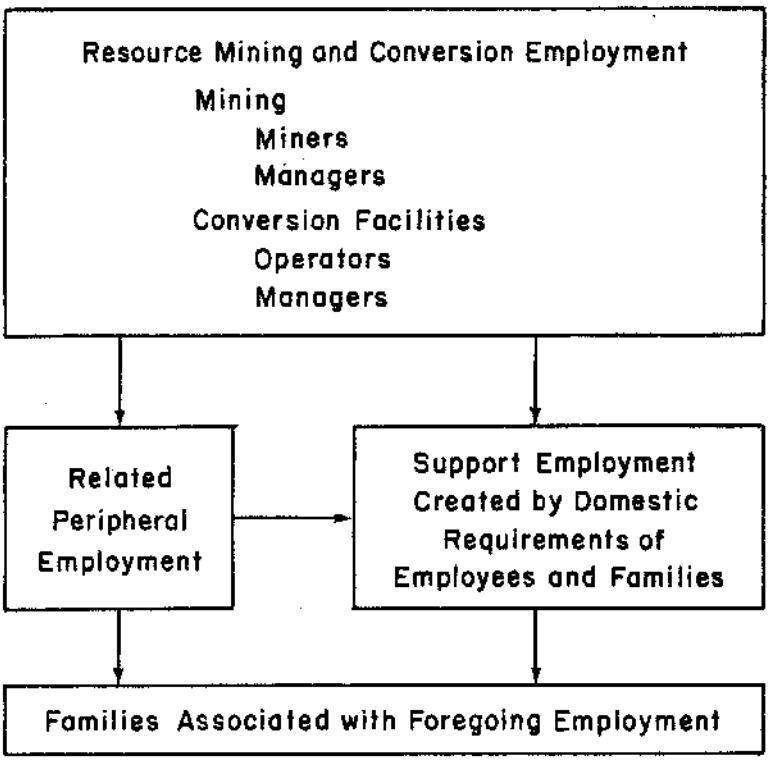
7. Social Consequences

Establishment of a synthetic liquid fuels conversion plants in the vicinity of the mines will result in urbanization of previously rural areas. Table 9 (above) shows the hypothesized MCI geographical distribution of the industry and indicates that some sparsely populated western states, especially parts of Montana, Wyoming, North Dakota, and Colorado, would be at the center of much of this activity.

Each mine or conversion plant can be considered to create new primary employment that would be supplemented by secondary industrial and domestic support employment for workers and their families. Figure 15 shows how primary jobs create additional employment. The overall



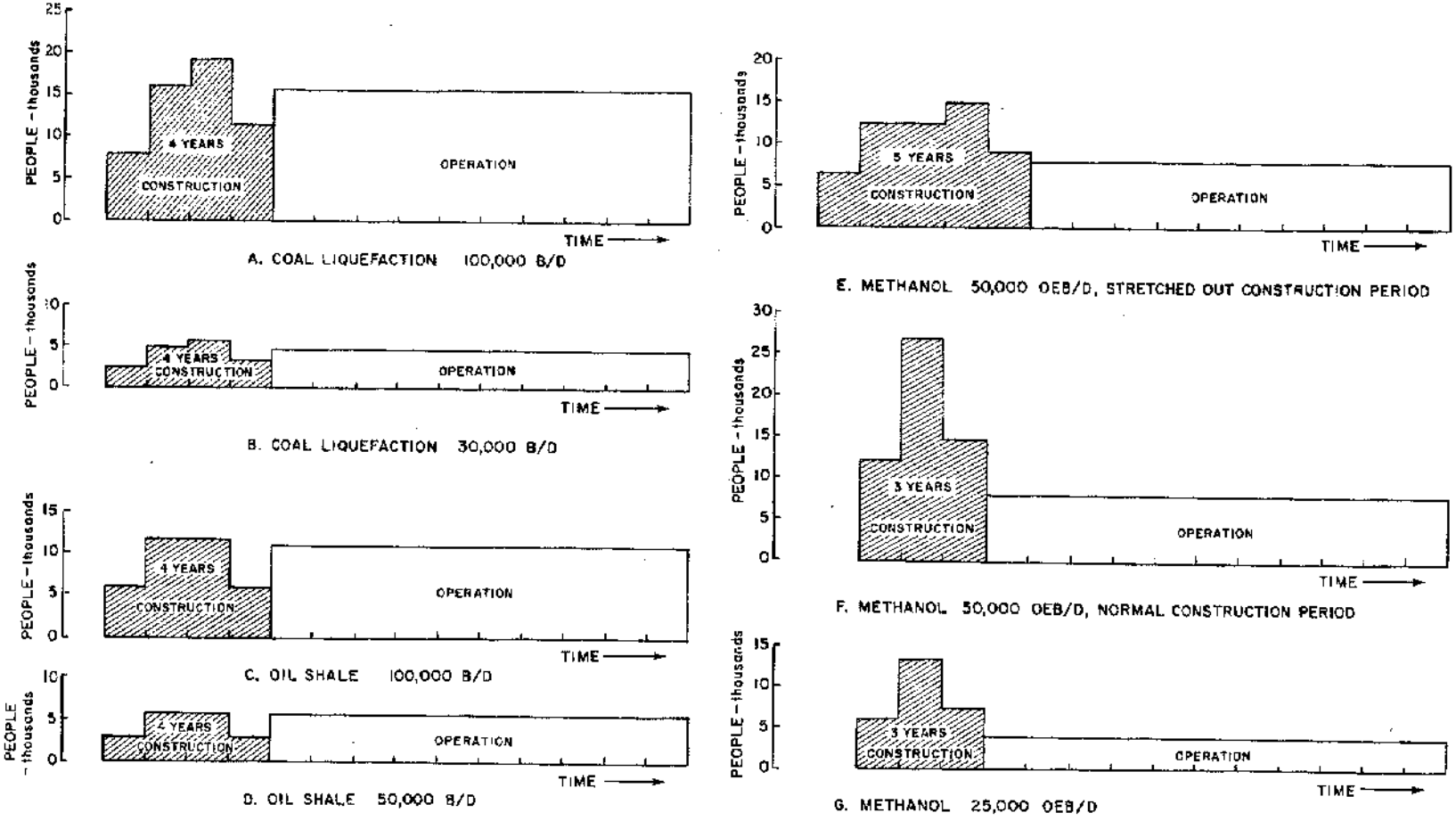
Source: Figure 23-2

FIGURE 15. BASIS OF POPULATION MULTIPLIER

population change can be summarized by defining a population multiplier--a number which, when multiplied by the number of primary jobs, indicates the total associated population. There is considerable uncertainty in the exact value appropriate for population multipliers for the industries in question, but a value of 6.5 has been used since values near this have been judged appropriate to these areas in the past.

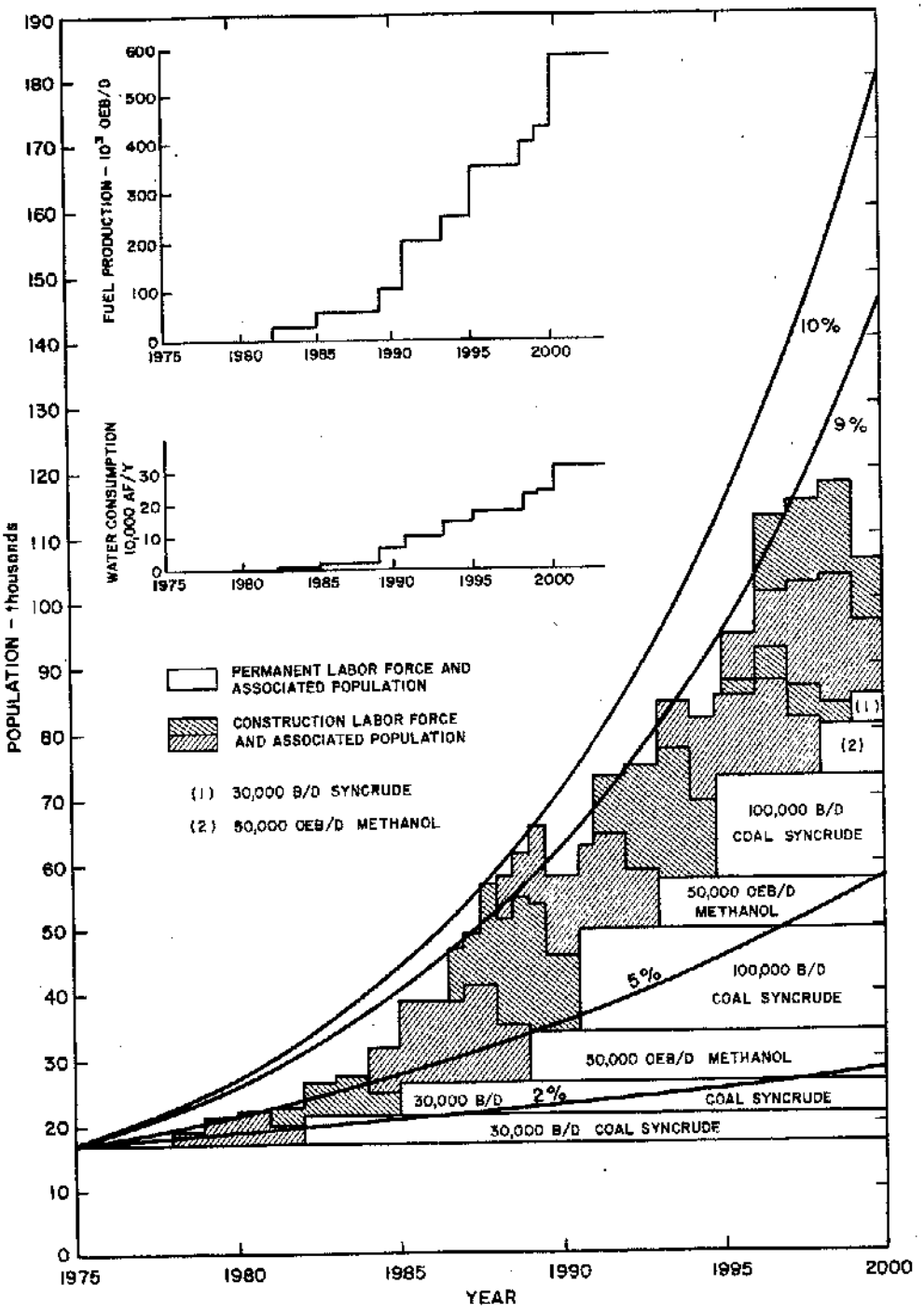
Figure 16 presents time profiles of the total population (including the multiplier effect) expected to be induced by the various kinds and sizes of plants considered in the MCI. For example Figure 16 shows that a single 100,000-B/D (16,000 m^3/D) coal liquefaction facility would have an associated population of more than 15,000 people during its operational phase. If one considers as an example Campbell County in Wyoming's Powder River Basin in which the 1975 population is only about 18,000 people, it is evident that even a single coal liquefaction plant could profoundly alter small existing communities. Figure 17 shows the effect of the MCI on population growth in Campbell County from now to 2000--presuming that only one quarter of the Wyoming activity indicated in Table 9 located there. The population growth rate shown in Figure 17 averages about 9 percent per year, but in some years there are large jumps--as much as 10,000 people in a population of 60,000. Such abrupt changes are not easily absorbed by communities. Figure 18 shows the effect of the MCI on the oil shale region of Colorado. The average annual population growth is about 17 percent.

Whether population growth and community alteration are beneficial or detrimental is a matter of opinion--opinion, which strongly depends on the background, location, and economic interests of the holder. For example, some feel that urbanization is beneficial because of the likely attendant economic prosperity, while others feel that economic prosperity is not worth the change in lifestyle and loss of solitude. Still others believe that the attendant environmental effects



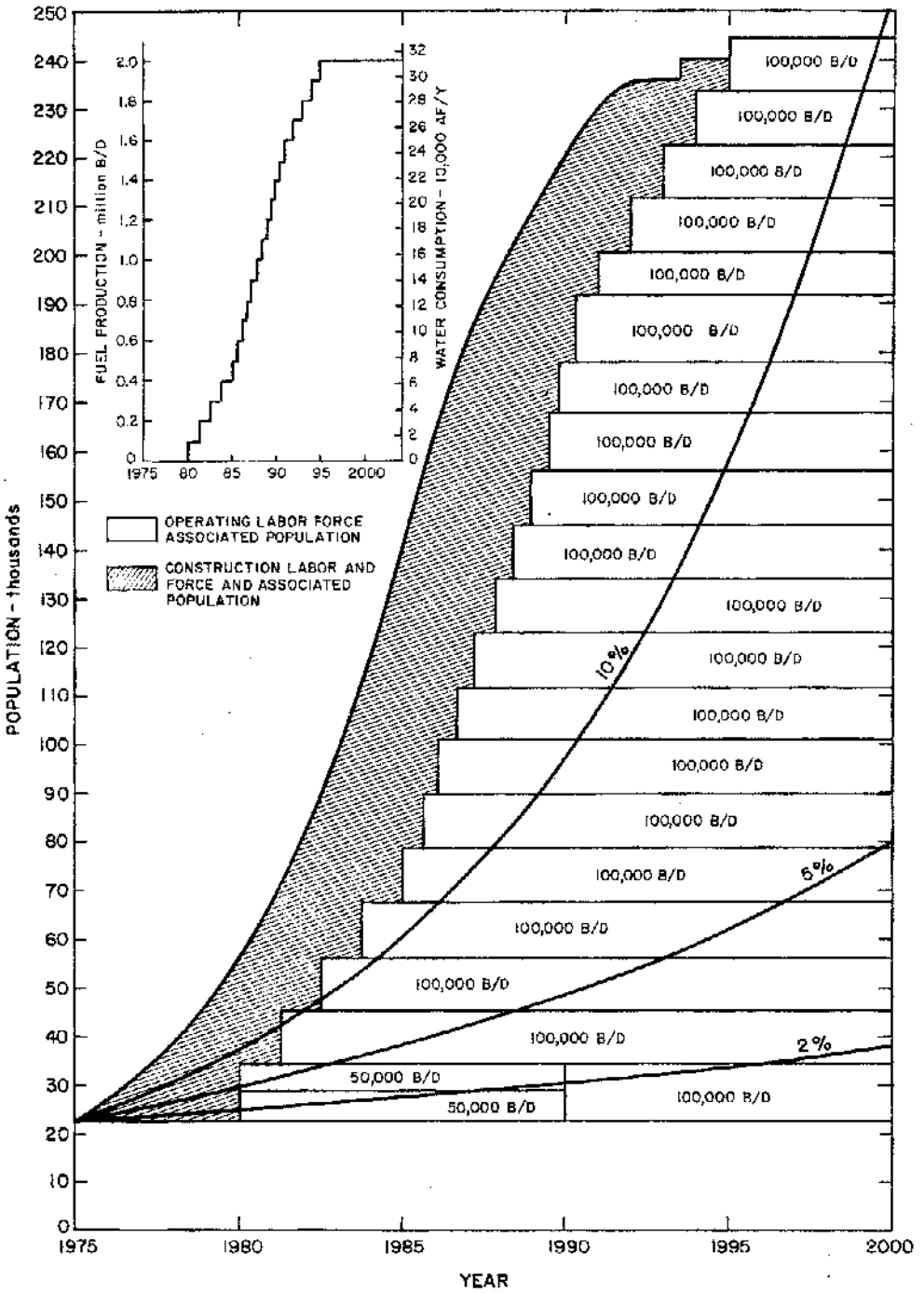
Source: Figure 22-1

FIGURE 16. TOTAL POPULATION ASSOCIATED WITH INDIVIDUAL PLANT CONSTRUCTION AND OPERATION BUILDING BLOCKS. All building blocks include the mines that supply the plants. The actual labor force is multiplied by 6.5 to account for induced secondary employment and families. The data for these building blocks come from the scaling factors derived for the Maximum Credible Implementation Scenario.



Source: Figure 22-2

FIGURE 17. EFFECTS OF THE MAXIMUM CREDIBLE IMPLEMENTATION SCENARIO ON POPULATION IN CAMPBELL COUNTY, WYOMING. Assumes that one quarter of all the Scenario's development in Wyoming occurs in Campbell County. This assumption is expected to be on the low side.



Source: Figure 22-10

FIGURE 18. MAXIMUM CREDIBLE IMPLEMENTATION SCENARIO FOR OIL SHALE DEVELOPMENT IN GARFIELD AND RIO BLANCO COUNTIES, COLORADO. The resulting annual population growth rate is about 17 percent.

(mining, air pollution, use of scarce water resources, etc.) would be intolerable, yet some believe that the nation's need for liquid fuels should override all other considerations.

Certain social consequences of deploying a liquid fuel industry of the size of the MCI in rural areas seem indisputable:

- Creation of a boom town rate of growth and atmosphere.
- Dislocation of the traditional economic base.
- Alterations of the lifestyle of the resource region, from rural to urban-industrial.
- Value conflicts between the newcomers and old timers.

Each of these effects give rise to important social problems.

a. Boom Towns[21,23]

Population growth rates that lead to boom towns, create problems in the establishment and maintenance of reasonable community services. The absence of such services can severely diminish the quality of life. One of the first manifestations of a rapid population growth is a housing shortage. When this occurs, especially in rural or semirural areas with weak zoning, temporary mobile home units substitute for permanent structures. When rapid growth is sustained, these temporary buildings tend to become a permanent rather than transitory feature of the community. This tendency is reinforced because many of the new residents are uncertain how long they will remain in the community, and, as a result, they are skeptical of investing their savings in substantially built homes or commercial buildings.

Another problem endemic to rapid growth is the lag of vital public community services behind their need. There are several causes: first, the need for public investments generally precedes the collection of tax revenues that can pay for them. Second, previously

rural communities, possessing an attitude of independence of action free of social controls urban residents take for granted, are reluctant to accept the planning bureaucracy necessary to organize and coordinate a rapidly growing community.

The first community services to fall behind needs are those that require construction before construction of shelter and business can proceed--potable water supplies and sewerage, for example. Next to lag are those that require trained staff, equipment, and specialized buildings--police and fire protection, hospitals, schools, and welfare counseling, for example. In addition to the lag in public community services, there is usually a lag in privately provided community services--doctors, dentists, and recreational businesses such as theaters and bowling alleys.

Boom towns are usually marked by instability and a high incidence of social malaise--divorce, mental health disorders, alcoholism, crime and suicide--partly because of the attitudes of people attracted to such towns and partly because of the lag in provision of services affecting the quality of life. It is not difficult to see that the effects tend to be reinforcing. An indifferent sense of community, the prevalence of personal problems, and an abundance of temporary or make-do facilities discourages both economic and psychological investment in a permanent, more satisfying community. These effects also contribute to a reduced productivity of workers.

Not all small communities oppose development, and they often induce industries to locate in their vicinity. Frequently the inducement is a forgiving of property tax for several years. This practice naturally adds considerably to the problem of tax lag.

However, some local governments that anticipate a boom caused by industrialization have sought to avert the tax lag problem by requiring prepayment of industrial taxes or requesting, in advance, corporate contributions for hospitals and schools. Acceptance of this notion of providing "front end" money to help avert problems of growth is apparently gaining ground with the major petroleum companies most likely to develop synthetic fuels. They apparently see the practice as enlightened self-interest, for they recognize the productivity benefits of a stable work force living in a satisfying community. Moreover, provision of substantial front end money to a community often adds little to the hundreds of millions of dollars necessary to construct any of the plants considered and has considerable benefit for the corporate image.

b. Value Conflicts[21,23]

In many of the potentially affected communities in western states, the idea of development of coal or oil shale mines and fuel conversion plants is not warmly received because the residents feel they lack a meaningful voice in the decisions that affect their future. The origins of such feelings are easy to discover:

- Coal or oil shale mineral rights are generally held by the federal government while local residents own the surface rights.
- Mineral rights are paramount over surface rights and the federal government can lease* the mineral rights without the surface owners' permission.
- Coal mining, petroleum, and electric power companies seeking to mine and convert the coal represent "outside" interests.
- Pressures for development arise from a national need, while the most acute social and environmental impacts would be felt at the local level.

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*In effect, sell.

As a result, the feeling that the local or regional interests are being subordinated to the national interest is common.* Moreover, local people often recognize that once the process of industrialization begins, their attitudes, values, and political orientations would be displaced by those of the new settlers who will be economically dependent on the new industrialization.

Because of the very real problems associated with boom rates of growth, and the value conflicts that arise between the local or regional interest and the national interest, coping with the social effects of synthetic liquid fuel development will be very important--so important that the social consequences of boom towns are a potential critical inhibiting factor to deployment of the industry.

B. Summary of Factors Critical to MCI Deployment

Several of the considerations discussed above are critical factors, for without alteration in their disposition, deployment of a large synthetic liquid fuels industry will founder. The critical factors can be summarized as follows:

- Economic and risk factors affecting corporate decision making
  - Synthetic fuel compared to conventional fuel costs must be accurately determined.
  - Federal policies towards synthetic fuels subsidization require clarification.
- Water demands compared with its availability
  - Physical transfers of water may be indicated.
  - Institutional resolution of water rights and their transfer is essential.

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*Conversely, in the country at large, the feeling that the national interest was being held hostage to narrow local interests could easily arise.

- Reclamation of mined lands
  - Acceptable procedures that will result in stable ecosystems after close husbandry ceases must be demonstrated.
  - Rules and regulations must be established and stably maintained so that business decisions can be made.
- Air pollution control
  - Nondegradation air quality classifications must be established for candidate regions so that decisions can be made.
  - Emissions control technologies must be improved; otherwise a complex of plants will not meet established standards.
- "Boom" growth rates (especially in the West)
  - Planning and mitigation measures must be undertaken before, rather than after, damage occurs.
  - New mechanisms for cooperation among all levels of government and industry are needed.
- Value conflicts in the West
  - Conflicts between newcomers and previous residents concerning industrialization will occur.
  - Conflicts between states of between regional interests and the national interest will arise.

Although many of these impacts appear to be extremely undesirable and could easily give rise to the sentiment that the idea of a synthetic liquid fuel industry should be abandoned, the impacts of the major alternative course of action--all-out production of domestic oil (Section II) would also lead to significant undesirable impacts. Therefore, the nation and its energy policymakers are faced with an array of very serious tradeoffs that cannot easily be decided to the simultaneous satisfaction of large segments of the public.

VII THE EFFECT OF INTRODUCING A SYNFUEL INDUSTRY ON A CONSTRAINED-GROWTH BASIS

Many of the impacts raised by the critical factors in MCI deployment listed in Section VI-B can be alleviated by limiting the number of conversion plants in a given area since this also restricts the rate of population growth and the amount of water consumed. This would require shipment of coal to other regions for conversion. Dispersing the coal conversion industry, however, does not alleviate problems of mined land reclamation and corporate risk.

Following the procedures in Figures 17 and 18, controlled growth scenarios have been prepared so that their implications for fuel production, population growth, and water demand can be examined. These controlled growth scenarios are presented and discussed below.

A. Growth Constrained Scenarios[22,23]

The growth constrained scenarios that follow relate to experience in urban growth patterns. Annual growth rates of 10 percent or more are essentially unmanageable because urban services continually lag the population and the effects of "boom" growth become chronic. Annual growth rates of 5 percent are also high and considered difficult, but not impossible, to handle.*

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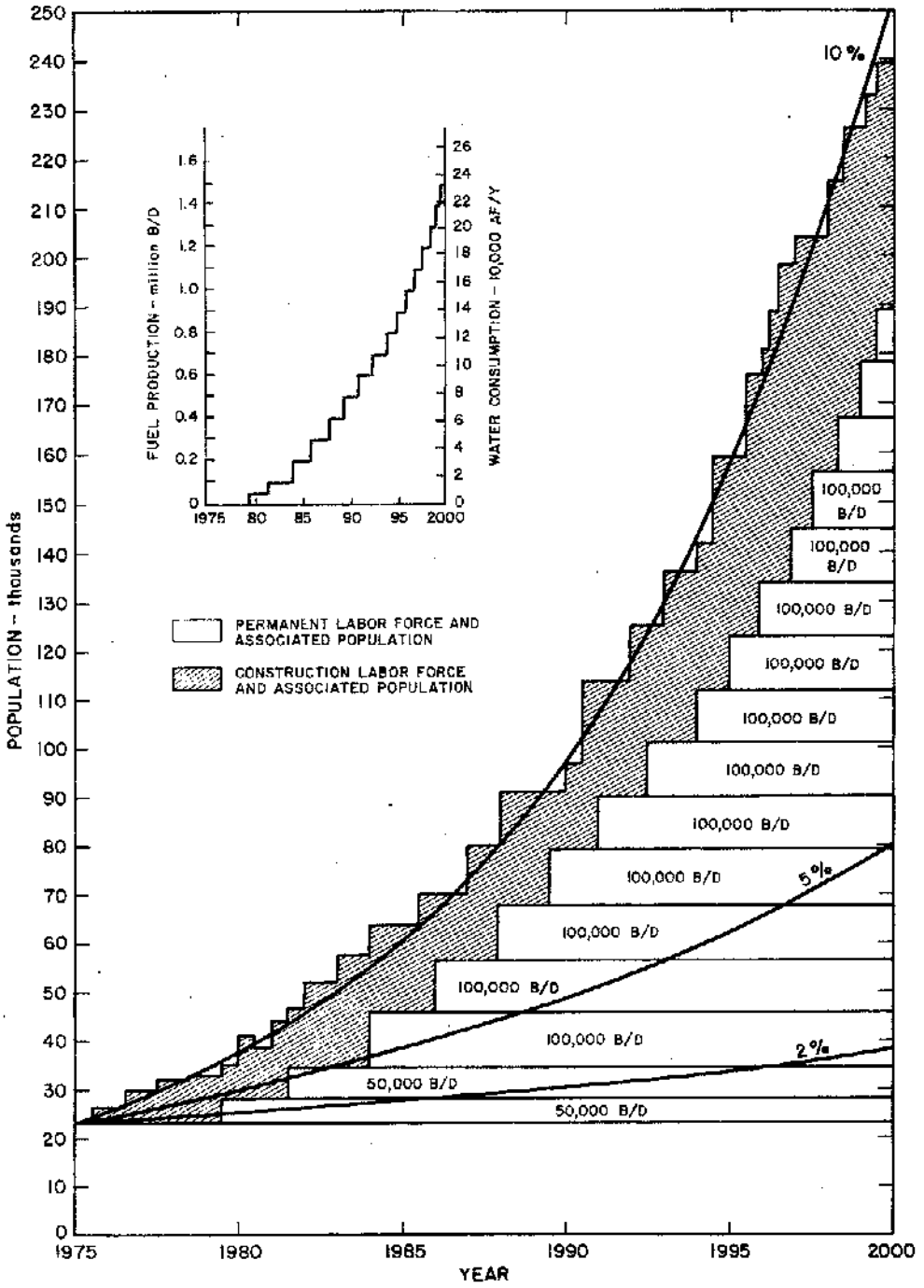
*During the decade of 1960 to 1970 Santa Clara County, California, one of the fastest growing counties in the nation, exhibited about a 5 percent annual growth rate. Yet as part of the four-county urban metropolis in the San Francisco Bay Area, Santa Clara County was able to draw upon services (such as hospitals) in nearby communities which would not be available in the rural resource-rich areas under consideration in this study.

It is assumed in the scenarios that existing small cities and towns serve as nuclei for settlement and receive about 80 percent of the new population with the remaining 20 percent settling nearby. The population multiplier applied to primary jobs in mining and conversion facilities has again been assumed to be 6.5.

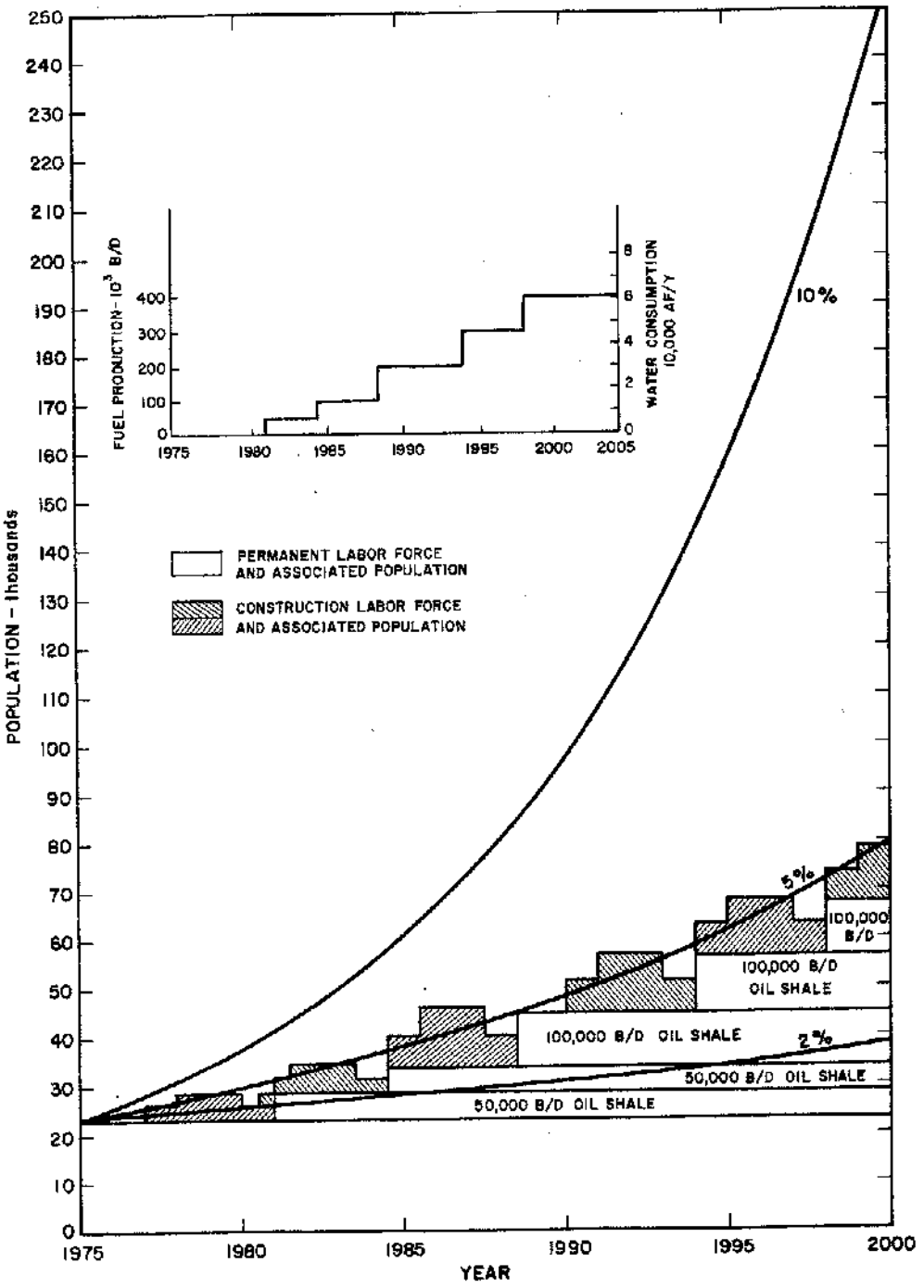
Figures 19 and 20 show, respectively, 10 percent and 5 percent population growth constrained scenarios for the oil shale region of Colorado. These seem tame compared to the growth rate of about 17 percent implied by the MCI and shown in Figure 18. Of course, the fuel outputs in the year 2000 are correspondingly less than the 2 million B/D (320,000 m^3/D) of the MCI--1.5 million B/D (240,000 m^3/D) in the 10 percent case and 0.4 million B/D (64,000 m^3/D in the 5 percent case. Water demands also decline proportionately to the fuel output.

Figure 21 shows a 5 percent population growth constrained scenario for Campbell County, Wyoming, and can be compared with Figure 17. As in the oil shale case, the total liquid fuel produced in the region is much reduced--down from the 600,000 B/D of the MCI scenario to about 300,000 B/D (48,000 m^3/D) in the year 2000. In Figure 19 the abrupt jumps in population, which cause large problems in communities, remain; however, Figure 20 shows that the abrupt jumps in population can be avoided by restricting conversion plants to the 30,000-B/D (4,800 m^3/D) size and by carefully phasing the start of construction. In this case the same 300,000 B/D (48,000 m^3/D) can be produced by the year 2005 but with a population growth history that is considerably more manageable. Figure 22 clearly illustrates the potential value to the impacted community of controlling plant size and construction starts while only delaying the achievement of the 300,000-B/D fuel output by 5 years, to the year 2005.



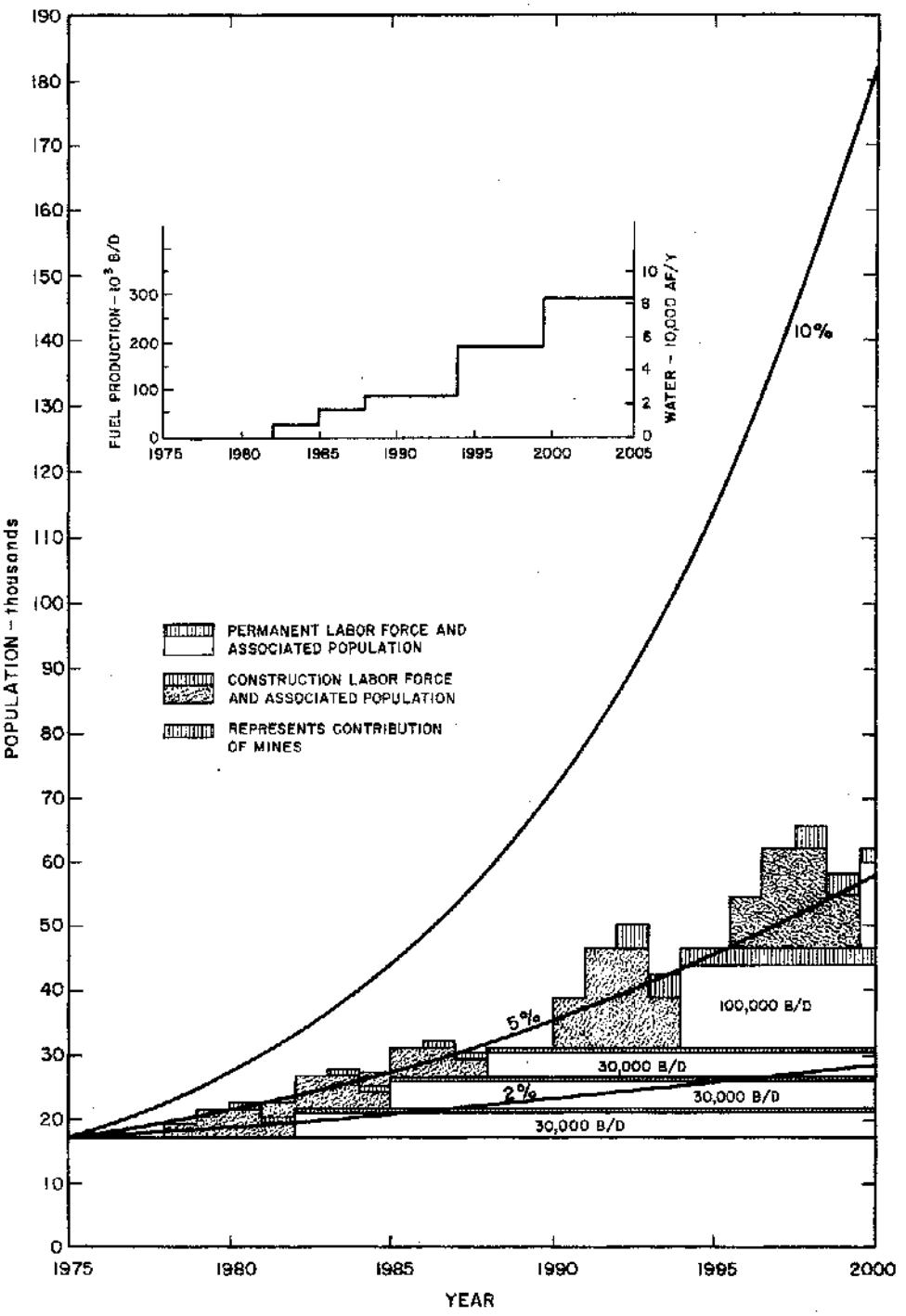
Source: Figure 22-9

FIGURE 19. TEN PERCENT CONSTRAINED POPULATION GROWTH SCENARIO FOR OIL SHALE DEVELOPMENT IN GARFIELD AND RIO BLANCO COUNTIES, COLORADO



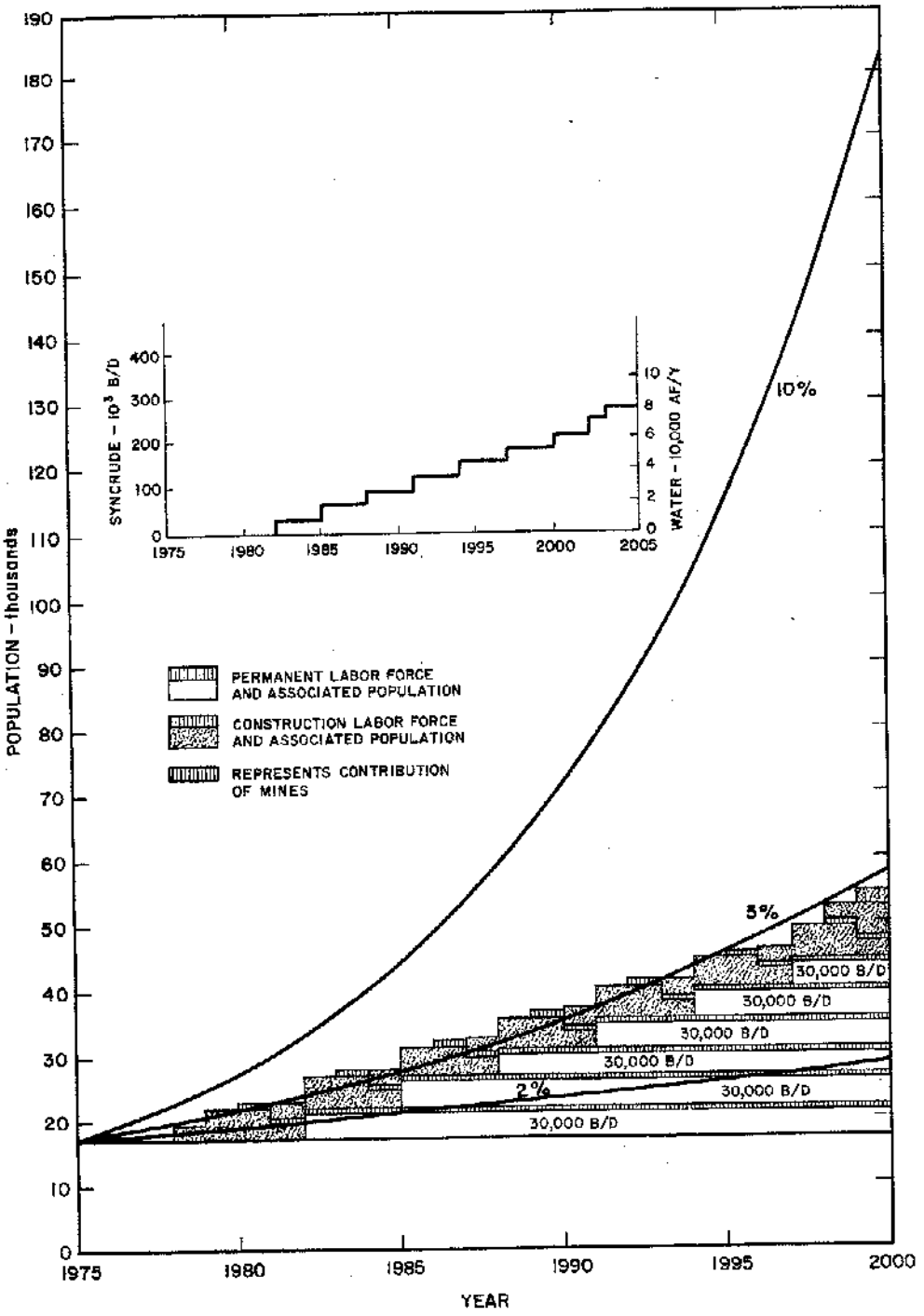
Source: Figure 22-8

FIGURE 20. FIVE PERCENT CONSTRAINED POPULATION GROWTH SCENARIO FOR OIL SHALE DEVELOPMENT IN GARFIELD AND RIO BLANCO COUNTIES, COLORADO



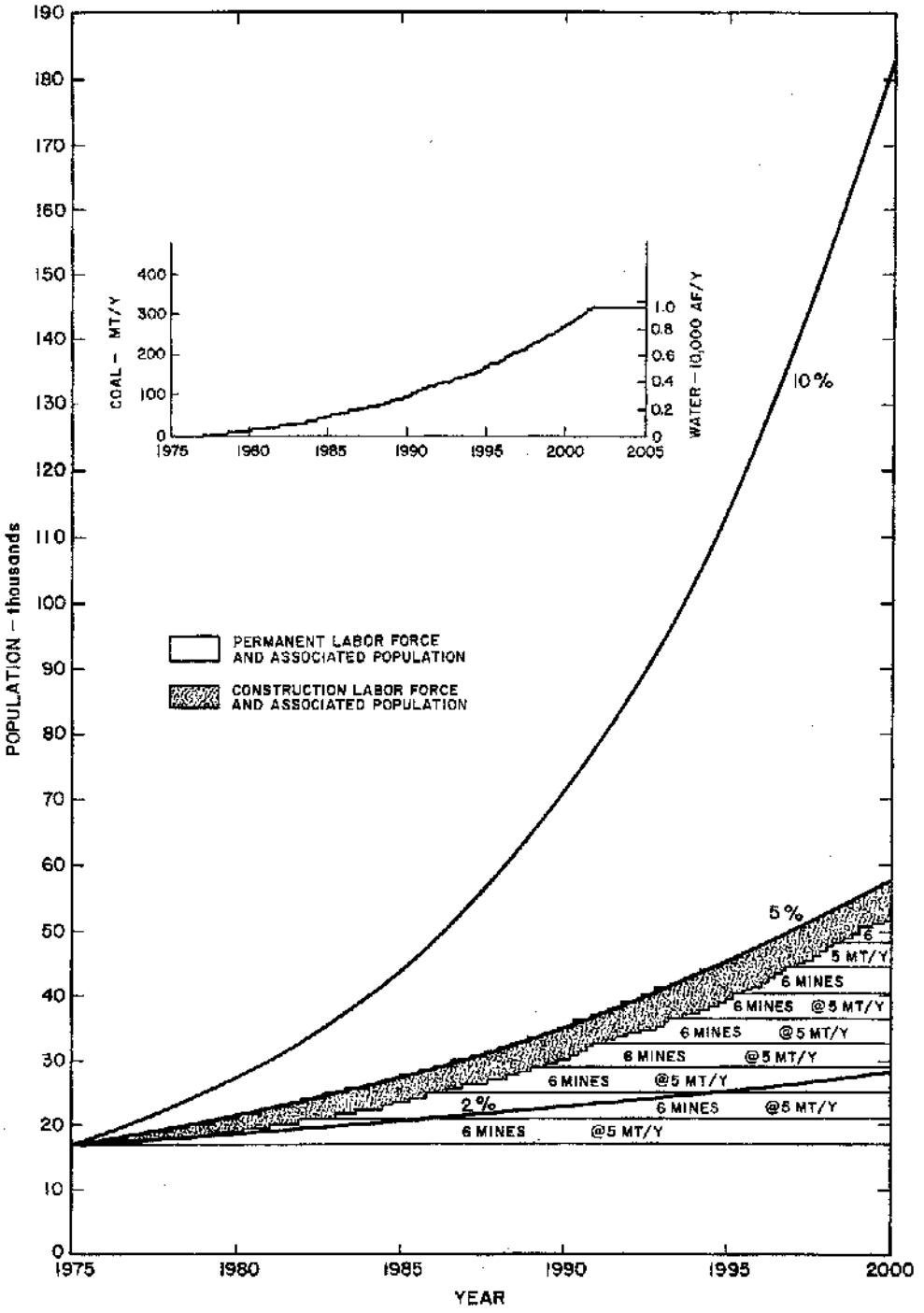
Source: Figure 22-3

FIGURE 21. FIVE PERCENT CONSTRAINED POPULATION GROWTH RATE SCENARIO FOR CAMPBELL COUNTY, WYOMING ILLUSTRATED WITH COAL LIQUEFACTION PLANTS AND ASSOCIATED MINES. The larger sized plants cause rapid changes in population.



Source: Figure 22-4

FIGURE 22 . MODIFIED FIVE PERCENT CONSTRAINED POPULATION GROWTH SCENARIO FOR CAMPBELL COUNTY, WYOMING ILLUSTRATED WITH COAL LIQUEFACTION PLANTS AND ASSOCIATED MINES. By building only the smaller sized coal liquefaction plants, large fluctuations in population can be avoided



Source: Figure 22-5

FIGURE 23 . FIVE PERCENT CONSTRAINED POPULATION GROWTH SCENARIO FOR CAMPBELL COUNTY, WYOMING IN WHICH ONLY COAL MINES ARE DEVELOPED. Under these conditions growth in population can be made very smooth. By 2000, 54 mines, each producing 5 million tons/year, would be exporting 270 million tons of coal per year.

Figure 23 shows that a coal-rich area such as Campbell County, Wyoming, can control its future even more by allowing coal mines but disallowing conversion plants, thereby forcing coal to be shipped to other regions for conversion. The growth rate shown in Figure 23 is almost smooth, and yet mining activity reaches a very high level--some 300 million tons per year (270 billion kg/yr) in the year 2000. (This level of production can support about 17 coal syncrude plants.) This mitigation measure of exporting coal from the region is much less feasible in regions with low quality coals, such as the lignite areas of North Dakota, and is not available at all to the oil shale regions.

Table 14 compares fuel production, water demand, and total population for the MCI and the 5-percent population growth constrained scenarios of Figures 18 and 20.

Table 14

COMPARISON OF MCI AND FIVE PERCENT POPULATION GROWTH CONSTRAINED SCENARIOS, FOR THE YEAR 2005

	MCI	Growth Constrained	Coal Export by Rail
Campbell County (coal)			
Fuel production (10^3 B/D)*	600	300	--
Water demand (10^3 acre-ft/yr)	300	80	~0
Population (10^3 people)	108	55	52
Garfield and Rio Blanco counties (oil shale)			
Fuel production (10^3 B/D)*	2000	400	--
Water demand (10^3 acre-ft/yr)†	314	60	--
Population (10^3 people)	244	78	--

*10^3 B/D is about 160 m^3/D.
†10^3 acre-ft/yr is about 1.2 × $10^6 m^3$/yr.

B. Implications of Constrained Growth

While the implications of the growth constrained scenarios are favorable for the communities involved, they clearly result in much less fuel production and thus may not be favorable to the national interest. It seems clear, however, that the difference in fuel production could be made up by locating conversion facilities in other regions.

Although the local impacts are lessened in the growth constrained scenarios, many underlying problems persist:

- The need for front-end money for community services.
- Value conflicts between previous residents and newcomers.
- Occasional abrupt changes unless both plant size and construction timing is closely managed.
- Water demands that strain water allocation procedural institutions.
- Air quality degradation and other adverse environmental impacts.

Managing these impacts would still require planning to a degree untypical in such areas. New degrees of government and industrial cooperation would be required to put growth constraints into practice.

An important side benefit of the growth constrained approach it permits time for those on whom the responsibility for water allocation rests to face up to the problems and to devise a solution in an atmosphere that is less tense than it might otherwise be.

VIII PUBLIC POLICY CONSIDERATIONS RAISED BY THE IMPACT ISSUES

There are many ways in which public policy--especially at the federal level--can affect the prospects for realization of a synthetic liquid fuels industry and thereby help determine the consequences of such an industry.

The federal government has broader concerns than merely the profit realized on a synthetic fuel plant. It recognizes the need to provide a stable long-term domestic source of energy to the nation and appreciates the long lead time necessary to put a new industry in place. The deployment of synthetic fuels plants is also seen as an instrument of foreign policy by the federal government. At the same time, since the government is concerned with human welfare and environmental quality, it is also rightfully interested in the adverse as well as beneficial aspects of the synthetic fuels plants.

A. Financial Aspects of a Synfuel Industry[9,10]

For synthetic liquid fuels to be produced commercially, the parties who must either raise or provide the large amounts of capital needed must be convinced that the plants will provide a profit and that the associated risks are commensurate with the expected return on investment. Currently, the sentiment is that there are many far less risky investment opportunities open to both the oil industry (such as investing in more conventional sources of oil or diversifying) and the investment bankers who have many investment opportunities beyond the energy industries.

The federal government has been debating measures designed to get the synthetic liquid fuels industry under way--at least far enough along to determine more accurately its true economic, environmental, and social costs. The government has considered various forms of subsidization:

- Loan guarantees
- Federal lending
- Tax incentives
- Price supports
- Guaranteed product purchases.

Such measures have been debated in Congress, but, so far, none has been accepted. The U.S. Energy Research and Development Administration (ERDA), however, does have a limited budget allocated to demonstration plants.

One possible federal alternative that has not yet received much attention is direct federal participation in investment. In World War II, the federal government financed synthetic rubber plants (because sources of natural rubber fell into enemy hands) and these plants were operated by industry under contract. After the war was over, the plants were sold--usually to the previous operating corporation. Although the analogy is not wholly apt (because wartime conditions do not prevail and the alternative of importing oil still exists), this approach appears to offer several advantages over the more indirect approaches to subsidization:

- Successful historical precedent
- Clear cut federal role
- Involvement of industrial expertise
- Intended transfer of plants to industrial ownership
- Option of aborting industry if impacts warrant.

Besides government intervention in the financial aspects of the synthetic fuels industry, the federal and state governments could, perhaps,

stimulate the industry by clarifying and solidifying policy with respect to

- Coal and oil shale resource leasing procedures
- Coal and oil shale strip mine regulation legislation
- Crude oil price regulation.

The corporations most likely to develop and operate a synthetic liquid fuels industry view the present uncertainty in these subjects as a large risk that inhibits their entry into the synfuel business.

B. Water Rights[18]

As noted above, the availability of water is potentially an important constraint on development of the synthetic fuels industry in many locations. Federal and state policies with regard to water resources and rights are at the heart of the matter. Here, too, uncertainty in either the form of the policies or their stability is perceived as a risk, not only to industry but to the other claimants to the water.

Several possible federal water-related policy actions could significantly mitigate adverse water-related impacts while stimulating the industry:

- Encourage shipment of coal from water-poor regions for conversion elsewhere.
- Coordinate federal, state, and Indian interests in water to eliminate conflicts among the regulators of water rights.

As discussed previously, the shipment of coal from resource-rich but water-poor regions may sometimes be better accomplished through the use of coal slurry pipelines in preference to unit trains. However, until definitive action either for or against the power of eminent domain needed by the slurry pipeline companies comes from Congress, neither the pipeline companies, the railroads, nor the potential users

of either mode know the constraints that will be operative in the future. If the decision goes against slurry pipelines, it may be necessary to promulgate public policies intended to revitalize the railroads to ensure that they can handle the traffic implied.

Coordination of federal, state, and Indian water interests will probably require:

- A comprehensive inventory of federal and Indian rights and requirements.
- New laws providing compensation for the "taking" (legal sense) of water rights predating the 1963 Arizona vs California decision.
- Redrawing of interstate water compacts.
- Development of federal-interstate compacts for arid but resource-rich regions.

The need for additional legislation at the state level is apparent to set forth

- Preservation of in-stream values (aesthetics, wildlife, etc.)
- Relationships between groundwater and surface water
- Rules governing the transferability of water rights.

At both the state and federal level, the economic value of water in arid regions should be reexamined because pressures to base new water allocations on the basis of the highest bid are growing. Historically, federal water projects have provided water to agriculture at very low prices.* As a result, irrigated agriculture has received an indirect subsidy; continuation of that federal policy and practice should be reexamined for its compatibility with future federal policy intended to stimulate a synthetic fuel industry.

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*Even, some argue, below its true cost.

C. Strip Mine Reclamation and Resource Leasing

Much of western coal and most of the oil shale are owned by the federal government even though the surface estate is often in private hands. States and Indian tribes control other resources. There has been a moratorium on federal leasing since 1973. Since leasing is a contract between private parties (even when the government is involved), any stipulations that are acceptable to both parties are admissible. When federal leasing resumes, the Department of Interior is expected to make it a practice to require that strip-mine reclamation follow rules very similar to those twice vetoed in strip-mine legislation. Thus, it appears that much of the rejected legislation will be applied by administrative action. Although such regulations are stringent, many spokesmen in the industries likely to develop coal resources assert that the uncertainty of whether or when reclamation rules will change is more constraining than the proposed rules themselves.

Reestablishment of federal leasing and a policy of requiring a standard set of provisions would help remove some uncertainty about where and when fossil mineral resources would be available to a synthetic liquid fuels industry.

D. Air Quality Control[16]

1. Ambient

Federal primary ambient air quality standards are intended to protect human health and, in principle, are not to be violated anywhere. Federal secondary standards are intended to protect economic and other values and are stricter than primary standards but are not so readily attained. Moreover, in some states, such as Colorado, state air quality standards are stricter than federal primary standards. It is up to the states to specify the standard that will apply in a given area. Many of

the resource-rich regions that are candidates for location of the first synthetic liquid fuels plants have very clean air, and thus one of the nondegradation standards should apply. (See Section VI-A-6c.) However, states have been slow in designating the classes that apply. This uncertainty inhibits deployment of a synthetic liquid fuels industry.

Imposition of standards for sulfates is quite likely in the future. Since synthetic liquid fuel plants emit sulfur dioxide that can be photochemically transformed to sulfates in the atmosphere, standards established for sulfates will affect the synthetic fuels industry. It would be preferable for these standards to be set before plant design (and choice of coal resources) is undertaken.

2. Emissions

Since there is no commercial synthetic liquid fuels industry today, there are no new-source emission standards for the industry to use in designing synfuel plants. The best designers can do is use analogous new-source standards that have been set for fossil-fueled boilers and coal drying. Until actual new-source standards are set for the coal conversion and oil shale plants, no one can be sure of the extent to which today's best available controls will be adequate or will require improvements.

3. Acceptability

Since air quality limitations have been shown in this study to be potentially a limiting factor in the synthetic liquid fuels industry, before an industry could be deployed the following regulatory policies will require clarification.

- Ambient air quality standards to be applied in any given area.

- New-source emissions performance standards clearly applicable to the industry.
- Current disagreement about the acceptability of tall stacks (these disperse pollutants over a larger region but often offer compliance with local ambient standards).

E. Population Growth Control (Boom Towns)

Meeting the challenge of producing synthetic fuels while avoiding the worst aspects of rapid population growth in rural regions and the creation of boom towns will not be easy. Nevertheless, the federal government through its control of leasing of mineral rights, its potential control of vital western water supplies, and its possible financial participation in the industry, has the opportunity to exert influence on the rate and location of synthetic fuels development.

It may prove feasible, for example, to require that corporations accepting federal investment assistance provide advance financial contributions to impacted communities. Government acknowledgment of such front-end contributions to communities as a proper business expense would do much to legitimatize the practice. In a similar fashion, the federal government might use its mineral leasing contracts to require that any coal extracted be processed at locations distant from the mine.

Federal and state governments, moreover, could jointly establish planning assistance grants to impacted areas, perhaps through the Economic Development Administration.

F. Summary

The areas in which governmental policy initiatives seem warranted are mainly those in which there now exists an undue amount of uncertainty about future federal (or state) action:

- Financing and mitigating the risks of synthetic liquid fuel plants.
- Resource leasing procedures and stipulations
- Strip-mine reclamation requirements.
- Uncertainty in water allocation institutions.
- Air quality standards.
- Control of population growth (boom towns).

Clarifying policies in these areas would greatly facilitate the combined government/industry efforts to assess the viability of a synthetic liquid fuels industry.

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