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Informal Report

Regional Issue Identification and Assessment (RIIA)

An Environmental Evaluation of the EIA Mid-Mid Scenario for Federal Region 8

University of California

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FOREWORD

The Department of Energy's (DOE) Office of Technology Impacts (OTI) was established to provide input to DOE energy policy evaluation. OTI's Regional Assessments Division (RAD) is responsible for assessing the impacts of national policy alternatives within the 10 Federal Regions in terms of the national environment, human health and safety, socioeconomic conditions, and relationships to legal-institutional constraints.

This summary report addresses those impacts on Federal Region 8 that are expected from implementation of the National Energy Plan. The states involved are Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

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The Energy Systems and Economic Analysis staff gratefully acknowledges the guidance and support provided by Arthur Katz, Regional Asssessments Division (DOE/Environment).

*This first group of individuals, under the leadership of David Nochumson, undertook lead-lab responsibility for the visibility portions of the national program.

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FEDERAL REGION 8's SUMMARY OF ENVIRONMENTAL IMPACTS OF THE EIA TRENDLONG MID-MID SCENARIO

Our analysis, based upon the EIA Trendlong Mid-Mid Scenario, indicates that the planned energy development and conversion in Federal Region 8 will present a number of conflicts and impacts. The key issues of the entire region generally result from the direct or indirect effects of coal mining and coal-fired electrical generation.

In order of importance, socioeconomic impacts followed by air quality impacts (visibility and local air quality) will have the most limiting constraint on the implementation of the scenario. Minimal and usually localized impacts are expected from water availability, water quality, ecology/land use, solid waste, health/safety and institutional factors.

The following two sections present key findings and conclusions for each study area. These are followed by the Summary Table.

KEY FINDINGS

1. Visibility

   - Region 8's very good visual air quality, or visibility, is very sensitive to degradation by air pollution. Historical records indicate a deterioration in Federal Region 8's visual air quality over the past 20 years. This trend could be continued with increased coal production and use.
   - Medium to high regional haze is projected in 15 Class I areas located in Colorado and the Dakotas.
   - Medium to high plume blight impacts could adversely affect four Class I areas in Colorado and Wyoming.

2. Local Air Quality

   - In 1985 and 1990, Region 8's major source of air pollution will be fossil fuel power generation. As projected by the scenario, Prevention of Significant Deterioration (PSD) increments in Class I or Class II areas will be exceeded in Utah, Montana, Wyoming, and North Dakota.
   - Nonanthropogenic sources of windblown dust will contribute to violations of Total Suspended Particulate (TSP) standards throughout the region.

3. Water

   - Water availability is not likely to act as a physical constraint on development. In the most severe conditions of water scarcity, use of the most effective conservation technologies (especially dry cooling) can greatly reduce the water requirements of energy conversion technologies at a small increase in product prices.
   - While water use for energy production, even assuming use of conventional cooling systems, is a small proportion of total projected use, conflicts with other users (especially of irrigated agriculture) can be expected. Groundwater development and water transfers threaten the rights of existing users. In most states, instream uses--recreation, fisheries, aesthetics--receive little protection under state statutes.
   - Strip coal mining and oil shale development pose the greatest potential for degrading water quality in Region 8. Aside from possible increases in salinity, however, the effects should be localized. Water quality impacts of coal conversion technologies in Region 8 should be negligible, because zero discharge or waste water containment is becoming standard practice for industry.

4. Ecology and Land Use

- o Coal surface mining in the arid environments of Region 8 presents special problems of reclamation because of steep terrain and the necessity of irrigating mine spoils to reestablish vegetative cover.
- o Habitat for endangered fish species and riparian ecosystems may be expected to be adversely affected by increased salts and sediments in runoff from surface-mined areas.

5. Socioeconomic

- o The rapid population increases that accompany energy development will place severe economic burdens on 22 of 23 impacted counties. The threatened change of lifestyle will slow local accommodation to impact mitigation measures.
- o Shortages in construction capital, skilled manpower, machinery, and equipment will pose a constraint on the timely implementation of the Mid-Mid Scenario.

6. Health and Safety

- o Total risk to public health from airborne sulfates is projected to double under the scenario, although the overall effects on public health will be minimal.
- o The projected tenfold increase in coal production over a 15-year period will cause increased safety hazards to the public as a result of coal transportation; and increased occupational hazards as a result of coal mining.

7. Solid Waste

- o In areas where land forms are extreme and energy projects numerous, the urban, mining, and industrial wastes will need to be transported considerable distances to find disposal sites that meet federal and state standards.
- o Adequate waste disposal facilities have not been required in the past, resulting in major problems. Part of the current local objections to new energy projects is based on the past effects of unprotected tailings, boomtown-related typhoid epidemics, and trash scattered for miles when a flash flood distributes the contents of an informal boomtown dump. Such objections have already had an effect on permits for projects in Colstrip, Montana, in Craig, Colorado, and in Emery County, Utah.

8. Institutional

- o Except for Montana, institutional issues that characterize this region will not significantly constrain growth as projected by the Mid-Mid Scenario.
- o Protection of Class I area airsheds will constrain projected utility expansion in Rosebud County, Montana.

CONCLUSIONS

1. Visibility

In comparison with the other Federal regions, Region 8 has an abundance of energy resources, scenic vistas, clean air, and mandatory Class I Federal areas. In 1977, Congress declared as a national goal the protection of visual air quality from impairment in these Class I areas (Public Law 95-95, Subpart 2, Sec. 169A).

Under the Mid-Mid Scenario, conflicts will arise between the siting of fossil fuel combustion facilities (coal-burning facilities, in particular) and the maintenance of very good visual air quality. The substantial projected growth in emissions of sulfur dioxide (a precursor to particulate sulfates) from utility and industrial sources and the long-range transport of light-scattering aerosols (sulfates, in particular) are key factors contributing to the medium to high visibility impacts projected for the region.

2. Local Air Quality

PSD protection of Region 8's large number of Class I areas may restrict siting and expansion of fossil-fueled power generating facilities; in some cases, this constraint could be overcome by application of highly efficient emissions control technology.

Control technology required by state and federal air pollution regulations for new and existing point sources should reduce ambient levels of SO_2 and TSP in metropolitan nonattainment areas to meet ambient air quality standards by 1985.

3. Water

Water use for energy production is a small fraction of total supply and projected use. Moreover, conservation technologies exist to reduce this amount, at a price. But energy is a relatively new participant in the scene, in line behind established users. This factor is the crux of the western water for energy issue.

The regional assessment concludes that western water problems are site specific. However, at least two issues are region-wide. One issue is the potential of the energy industry to modify streamflow, which can alter valued endangered species and sports fishery habitats and wild and scenic river systems. Affected reaches may be far downstream or across state lines. The other issue is stream sedimentation during surface mine stripping and reclamation. Sediment loading curtails food chain productivity.

Federal and state environmental legislation protecting stream and drainage system integrity have yet to be adequately tested. Additionally, dewatering and possible aquifer contamination from oil shale and uranium production are issues in Colorado, Wyoming, and Utah. State groundwater regulations to control this are generally inadequate, unclear, and in flux. Downstream water quality commitment is important in the Upper Colorado River Basin states of Colorado, Utah, and Wyoming. Energy's influence here as a new user is undetermined.

4. Ecology and Land Use

Competition for land and water use will be a major constraint on the scenario. Wilderness and critical habitat designations, increasing Indian assertiveness, and the importance of the agricultural industry may limit areas in which energy development can take place. Environmental quality issues have been used as a basis for litigation, resulting in the postponement of some energy development projects in the region.

5. Socioeconomic

Local sociology, local economics, and regional economics as described in the scenario will provide major constraints to scenario achievement. The projected concentrations of new population in a few counties in five Western States, in some cases, will create unacceptable demands upon local governments and the general public. The provision of funding grants and fiscal devices designed to relieve the existing permanent population of potential tax burdens or public debt in the event of project closedown would need to be essential elements of any impact mitigation program. Nevertheless, financial relief alone will not remove political barriers and local resistance to change.

The massive capital construction costs by a few major companies in the Western States will require significant investment incentives sufficient to overcome competition in capital markets. Similarly, the need to concentrate the necessary labor supply in a timely manner will require manpower training programs clearly designed to focus on the specific skill requirements of the energy companies. Finally, anticipated shortages in mining equipment, electrical generation, and transmission components need to be minimized to achieve the Mid-Mid Scenario goals.

6. Health and Safety

Total risks to health and safety in Federal Region 8 resulting from the projections in the Mid-Mid Scenario are not expected to constrain energy development in the area.

7. Solid Waste

Because a majority of the population live either in very small towns or many miles from other people, solid waste disposal facilities consist of informal landfill operations and an occasional septic tank. As of 1975, five of the six states in the region had no state laws concerning waste disposal. Mining and milling waste problems were overlooked until the early 1970s.

This legal situation changed with the passage of the federal clean air and water acts. New energy developments now must concern themselves not only with federal law but with stringent state and local regulations. These regulations, however, do not cope with the wastes resulting from the radical changes in population, those changes that are present and those projected for more than 20 counties in the area. These population changes will need concomitant changes in solid waste disposal policies and facilities.

Concern over past waste problems and the costs of major new approaches to the problems are definite factors in the growing local opposition to the federal energy development policies reflected in the RIIA-I scenario.

8. Institutional

There are unresolved institutional issues that characterize this region and would seriously constrain energy development in an accelerated scenario. The major issues of air quality maintenance and use of water resources, for example, involve state and federal agencies, Indian tribes, citizens groups, and industry in a struggle for the protection of their individual interests.

SUMMARY TABLE

IMPACT OF ENERGY DEVELOPMENT IN THE EIA TRENDLONG MID-MID SCENARIO
ON REGION 8'S ENVIRONMENTAL QUALITY IN 1990

	Regional Dimensions[a]			Comment or Cause of Constraint or Impact
	Local	Subreg.	Regional	
The Likelihood of Projected Regional Energy Use or Development Producing Significant Environmental Impacts	H	H	H	Visibility
[b]The Likelihood of Not Attaining Projected Regional Energy Mix Because of Adverse Environmental Impacts	H	M	M	PSD Standards, Land-Use Regulations, Socioeconomic
[b]The Likelihood that Specific Technologies or Resources Will Not Attain Projected Level of Use:				
Coal: Electrical Generation	M	M	M	Air Quality, Socioeconomic
Oil:	L	L	L	
Gas:	L	L	L	
Nuclear:	M	M	L	Uranium Mining and Milling, Solid Waste, Water Quality
Conservation:				
-Energy Efficiency Improvements	L	L	L	
-Urban Waste	L	L	L	Institutional
-Cogeneration	M	L	L	
Solar:	L	L	L	
General:				
-Utility	M	M	M	Visibility, Socioeconomic
-Industry	L	L	L	
-Mining	M	M	M	
[c]The Likelihood that Specific Technologies or Resources Could Be Available at Levels Greater Than Projected Development:				
Solar:	L	L	L	
Geothermal:	L	L	L	

[a]Definitions

Local: Local site specific impacts
Subregional: AQCR (Air), ASR (Water), County, State, FEA
Regional: Affects Federal region as a whole

[b]Likelihood of falling short of projected goals

High - Large degree of certainty that conflict will arise at several facilities with no or little opportunity for cost effective mitigation.
Medium - Specified concern could occur at few facilities, but potential cost effective mitigation strategies available.
Low - Conflicts unlikely to occur.

[c]Technologies and resources available to higher degree

Low - Technologies or resources presently available could be substituted at reasonable costs and impacts.
Medium - Technologies or resources presently or potentially available but the acceptability of costs and impacts uncertain.
High - Technologies or resources unavailable or available at high costs or impacts.

REGIONAL ISSUE IDENTIFICATION AND ASSESSMENT (RIIA)

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ABSTRACT

This Regional Issue Identification and Assessment (RIIA) study evaluates the environmental impacts associated with future energy development in Federal Region 8 (Montana, North and South Dakota, Wyoming, Utah, and Colorado). The impacts described are for 1985 and 1990 and are based on a national energy scenario that assumes medium energy demand and fuel supply through 1990, but does not incorporate the policies of the National Energy Act (NEA). The scenario, known as the Projection Series C or the Trendlong Mid-Mid Scenario, is one of six possible energy futures that have been produced by the Energy Information Administration of the Department of Energy for the Department's 1977 annual report to Congress. All of these possible energy futures are based on the assumption that electric power is generated in the federal region where it is used. This assumption has the effect of understating actual production levels and environmental impacts for each of the issues in the region. This report's Key Findings and Conclusions sections synopsize the study's results.

1.0 INTRODUCTION

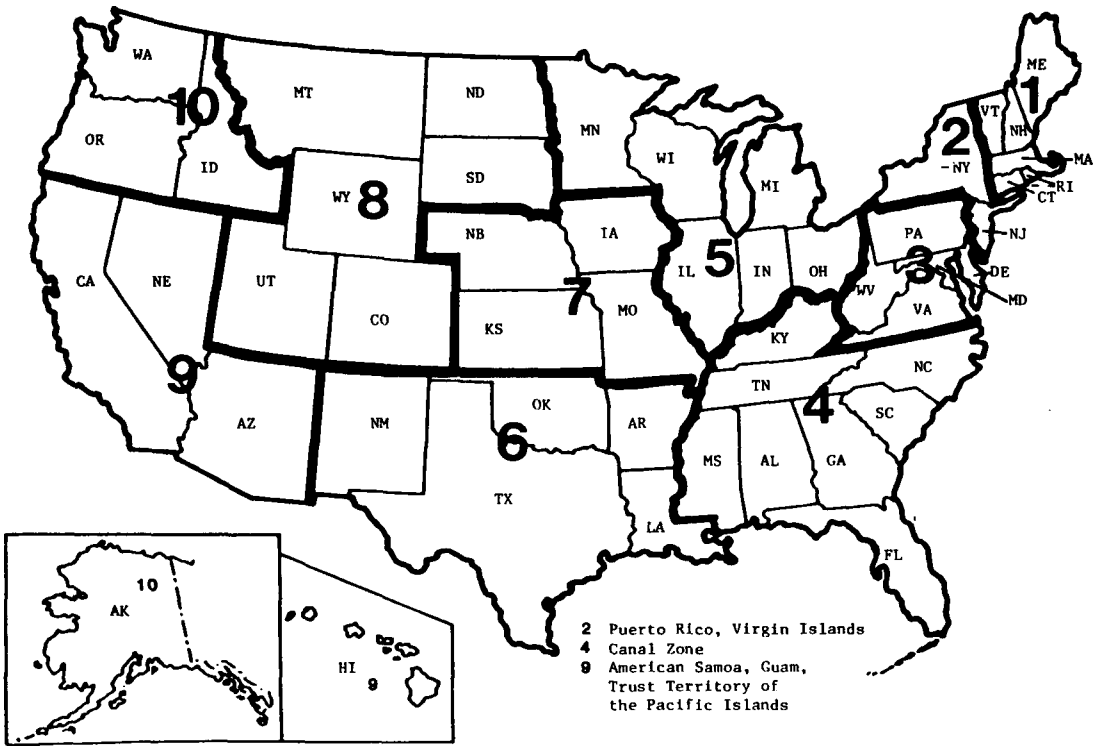
1.1 RIIA STUDY DESCRIPTION

This study, the Regional Issue Identification and Assessment (RIIA), is an evaluation of the regional environmental impacts of future energy development. The study was conducted for the Regional Assessments Division, Office of Technology Impacts, Office of the Assistant Secretary for Environment, Department of Energy. The impacts described for 1985 and 1990 are based on a national energy projection (scenario), which assumes medium energy demand and fuel supply through 1990 but does not incorporate the policies of the National Energy Act (NEA). The scenario, known as the Projection Series C or the Trendlong Mid-Mid Scenario, is one of six possible energy futures that have been produced by the Energy Information Administration of the Department of Energy for the Department's 1977 Annual Report to Congress. All of these possible energy futures are based on the assumption that electric power is generated in the federal region where it is used. It was chosen as representative of the official DOE national energy projections when this project was initiated before passage of the National Energy Act. Because the RIIA program is part of an ongoing review of the regional impact of energy policies, the next phase will examine the National Energy Act (NEA) and initiatives suggested by the President's second National Energy Plan. However, because coal use increases under the NEA, in general, impacts identified in the Trendlong Series C Scenario should provide a framework for the discussion of impacts caused by NEA.

The environmental impacts discussed in this volume are for Federal Region 8. There are nine companion volumes, one for each of the other Federal Regions in the Nation (shown in Fig. 1). This set of reports represents a comprehensive, consistent portrayal of the regional environmental impacts and implications of the future national energy development reflected in the scenario. A detailed description of the methodologies used at each level of this study and a summary of the data developed in the RIIA process for each state will be available in Volume II of this report.

Fig. 1

FEDERAL REGIONS OF THE UNITED STATES



1.2 RIIA METHODOLOGY AND ASSUMPTIONS

1.2.1 Overall Program Methodology

In developing the national energy scenarios, the Energy Information Administration balanced projections of supply and demand at the federal region level. The RIIA studies used the predicted fuel mixes by federal regions derived from the Trendlong Series C Scenario as a starting point for the analyses. County level patterns for utility, industry, and mining activities for 1985 and 1990 were then developed from these federal region totals. Energy sources addressed were coal, nuclear, oil, oil shale, gas, geothermal, hydroelectric, and solar.

Six of the national laboratories, Argonne (ANL), Brookhaven (BNL), Lawrence Berkeley (LBL), Los Alamos (LASL), Oak Ridge (ORNL), and Pacific Northwest (PNL) assumed various lead assignments in

analyzing the impact of these county level patterns on the air, water, and land resources of the country and on the socioeconomic and health and safety aspects of the nation's welfare. When these tasks were complete, each laboratory focused on an assessment of the products of all of the lead-lab analyses from the particular perspective of the states and regions for which they were responsible. Sandia Laboratories provided LASL with the institutional analysis for the Rocky Mountain Region.

1.2.2 Assumptions

The major technology assumptions used in the lead analyses of technologies addressed in the scenario concerned control techniques. These are shown in Table I. In addition to those listed, other, more specific technology assumptions were made in some of the regional assessments of areas or states in which energy production and distribution differed significantly from national trends. For instance, in Region 8:

- Zero utility discharge. In 1976, EPA-approved salinity standards for the Colorado Basin states were put into effect by eliminating industrial discharge except under specified conditions. EPA guidelines concerning thermal discharge and difficulties in obtaining NPDES construction permits have predicated a policy of zero discharge for utility plants. All plants proposed through 1990 contain a zero discharge provision.
- Fifty percent reduction in coal mining residual rates to account for projected impacts of the application of BAT (Best Available Technology) standards.
- Reduced flow rates for selected Aggregated Subareas (ASA) to project low flow conditions more accurately.

1.2.3 Criteria for the Ranking of Impacts

The discussion of each region and each state within the region includes a summary matrix displaying the severity of specific environmental, health, social, and economic impacts of energy and energy technologies imposed by the scenario. The severity is rated as high, medium, or low according to criteria described in Table II.

Table I
CONTROL TECHNOLOGY ASSUMPTIONS

	UTILITY	INDUSTRY	MINING
AIR	EMISSIONS AND LOCAL AIR QUALITY: COAL • EXISTING PLANTS – UNCONTROLLED EMISSIONS BASED ON FPC COAL CHARACTERISTICS FOR ASH, HEAT AND SULFUR (1976) • PLANTS WITH STARTUP DATES PRIOR TO 1983 – SIPS OR NSPS REQUIREMENTS • PLANTS WITH STARTUP DATES AFTER 1983 – BACT. 85% AND 90% CONTROL OR REMOVAL OF SO_2 CONSIDERED OIL • SIPS REQUIREMENTS GAS AND METALLURGICAL COAL • UNCONTROLLED	EMISSIONS AND LOCAL AIR QUALITY: COAL • NEW LARGE SOURCES (250 X 10^6 BTU/HR): SO_2 BACT, 80% REMOVAL; PARTICULATES BACT, 99% REMOVAL • NEW SMALL SOURCES (100–250 X 10^6 BTU/HR): SO_2 1.5 LB/10^6 BTU; PARTICULATES 0.05 LB/10^6 BTU • NEW NON–MFBI PLANTS (100 X 10^6 BTU/HR): SO_2 SIPs WITH PHYSICAL CLEANING; PARTICULATES SIPs, CYCLONES • EXISTING LARGE SOURCES (250 X 10^6 BTU): SO_2 SIPs FOR MFBIs; PARTICULATES SIPs FOR MFBIs • EXISTING SMALL SOURCES (100–250 X 10^6 BTU/HR): SO_2 SIPs FOR MFBIs; PARTICULATES SIPs FOR MFBIs • EXISTING NON–MFBI PLANTS (100 X 10^6 BTU/HR): SO_2 SIPs USING LOCALLY AVAILABLE COAL; PARTICULATES SIPs USING SETTLING CHAMBER/EXPANDED CHIMNEY & CYCLONES OIL AND GAS • SIPs LIMITATIONS ON SULFUR CONTENT OF FUEL, AS A WEIGHT FRACTION. • EMISSIONS FACTORS IN USEPA "COMPILATION OF AIR POLLUTANT FACTORS".	NO ASSUMPTIONS MADE. AIR POLLUTANTS FROM MINING ACTIVITIES NOT CONSIDERED.
WATER QUALITY	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977 UTILITY GENERATING LOAL FACTOR – 55%	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977	MINE DRAINAGE: "COAL SUPPLY REGION" (CSR) DRAINAGE DATABASE – COMPLIANCE WITH EFFLUENT LIMITATIONS ASSUMED. COAL WASHING: ASSUME 50% OF COAL IS CLEANED, 96% OF THAT BY WET METHODS. ALL FACILITIES HAVE ZERO DISCHARGE IN CSRs 7 – 10, 60% OF FACILITIES HAVE ZERO DISCHARGE IN CSRs 1 – 6, CSR 11 AND CSR 12. 40% OF FACILITIES IN THOSE CSRs PRODUCE 2,150 LITERS/METRIC TON OF COAL WASHED. COAL REFUSE FILE: 40% OF ANNUAL PRECIPITATION IN EACH CSR RESULTS IN EFFLUENT RUNOFF: 7.08 X 10^6 HECTARES/METRIC TON OF COAL CLEANED ARE EXPOSED TO RAIN FOR ONE YEAR. RECLAMATION: SEDIMENTATION CAN ACHIEVE 80% CONTROL EFFICIENCY. OTHER RUNOFF RATES ARE FROM EPA NATIONAL ASSESSMENT OF NON–POINT SOURCE POLLUTION.
WATER AVAILABILITY	COOLING OPTION: NUCLEAR (1000 MW) WITHDRAWAL (MGD); NUCLEAR (1000 MW) CONSUMPTION (MGD); FOSSIL (1000 MW) WITHDRAWAL (MGD); FOSSIL (1000 MW) CONSUMPTION (MGD) ONCE THROUGH: 1400; 4; 830; 3 POND OR CANAL: 42; 26; 25; 15 WET COOLING TOWER: 28; 17; 17; 18 DRY COOLING TOWER: 0.3; 0; 0.2; 0	DATA BASE: • WATER CONSUMPTION DATA DEVELOPED FOR THE WATER RESOURCES COUNCIL.	WATER REQUIREMENTS FOR COAL EXTRACTION AND WASHING, DUST CONTROL AND REVEGETATION ARE ASSUMED TO BE NEGLIGIBLE.
SOLID WASTE	• COAL CHARACTERISTICS IN 1985 AND 1990 ARE THE SAME AS IN 1976. DATA FROM FPC TAPES. • USE OF ELECTROSTATIC PRECIPITATORS AND FLUE GAS DESULFURIZATION WITH LIME/LIMESTONE SLURRIES ASSUMED FOR 1985 AND 1990.	• NSPS AND SIPs REQUIREMENTS USED TO DETERMINE ASH AND FGD SLUDGE PRODUCTION AND LAND REQUIREMENTS.	• CONVERSION FACTORS FOR COAL MINING RANGED FROM 0.0818 ACRES/1000 TONS (COAL MINED) IN DEEP MINING IN EASTERN KENTUCKY TO 0.235 ACRES/1000 TONS IN STRIP MINING IN ARKANSAS • PAST BUREAU OF MINES DATA AND MINRES PROGRAM WERE USED TO DETERMINE MINING RESIDUALS.

ABBREVIATIONS:

BACTEA	BEST AVAILABLE CONTROL TECHNOLOGY ECONOMICALLY ACHIEVABLE
BEA	BUREAU OF ECONOMIC ACTIVITY AREA
BPCT	BEST PRACTICABLE CONTROL TECHNOLOGY
BTU	BRITISH THERMAL UNIT
FGD	FLUE GAS DESULFURIZATION
FPC	FEDERAL POWER COMMISSION
MFBI	MAJOR FUEL BURNING INSTALLATIONS
MGD	MILLION GALLONS PER DAY
MW	MEGAWATTS
NSPS	NEW SOURCE PERFORMANCE STANDARDS
SIPs	STATE IMPLEMENTATION PLANS

Table II
DEFINITION OF CRITERIA FOR RATING OF IMPACTS

IMPACT CATEGORY	HIGH IMPACT	MEDIUM IMPACT	LOW IMPACT
AIR QUALITY	MAJOR FACILITIES IN PROPOSED SITING SCENARIO COULD BE CONSTRAINED BY ONE OR ALL OF THE FOLLOWING ISSUES. A) PERSISTENT AND CONTINUED VIOLATIONS OF PRIMARY NATIONAL AMBIENT AIR QUALITY STANDARDS. B) INABILITY TO ATTAIN ACCEPTABLE PSD INCREMENT LIMITATIONS. C) LIMITED PROBABILITY THAT IMPROVED EMISSION CONTROL EFFICIENCIES OR OFFSETS WOULD RESULT IN NAAQS ATTAINMENT.	SOME MAJOR FACILITIES IN PROPOSED SITING SCENARIO COULD BE CONSTRAINED BY HIGH IMPACT ISSUES. VIOLATIONS OCCUR BUT ARE AMENABLE TO EXTENSIVE CONTROL TECHNOLOGY, FUEL (COAL AND OIL) PURCHASING POLICY, AND/OR OFFSET.	AIR QUALITY AND EMISSION LEVEL ARE WITHIN ACCEPTABLE STANDARDS. NO MAJOR ADJUSTMENTS TO SITING OF PLANTS BECAUSE OF AIR QUALITY ISSUES.
VISIBILITY	*THERE IS A SIGNIFICANT DECREASE IN CALCULATED* VISUAL RANGE IN CLASS I AREAS.	*THERE IS A MODERATE DECREASE IN VISUAL RANGE* BUT THE REDUCTION IS AMENABLE TO MITIGATION MEASURES.	*NO DECREASE IN VISUAL RANGE OR NEW SITING IMPACTS* AMENABLE TO MITIGATION MEASURES. NO MAJOR ADJUSTMENT IN SITING.
WATER QUALITY	SIGNIFICANT ECONOMIC BURDEN TO MEET WPCA REQUIREMENTS.	TREATED EFFLUENTS MEET EFFLUENT STANDARDS BUT OCCASIONAL LOCALIZED STREAM STANDARD VIOLATIONS WILL OCCUR IN RECEIVING WATER BODY.	RECEIVING BODY CAPABLE OF HANDLING ALL PROJECTED EFFLUENT ADDITIONS. FEW OR NO VIOLATIONS OF STREAM STANDARDS ANTICIPATED.
WATER AVAILABILITY	NO WATER AVAILABLE WITHOUT MAJOR SHIFTS IN CURRENT WATER USES, E. G., EITHER ENERGY DEVELOPMENT OF AGRICULTURE, EVEN WITH LOW-FLOW AUGMENTATION, OR WATER AVAILABLE THROUGH MAJOR STRUCTURAL AND NON-STRUCTURAL ALTERNATIVES, E. G., STRUCTURAL-CONSTRUCTION OF DAMS AND RESERVOIRS. GROUND WATER MINING WITH NO RECHARGE POTENTIAL.	WATER AVAILABLE AT MODERATE ECONOMIC COST TO THE REGION. GROUND WATER MINING WITH RECHARGE POTENTIAL AVAILABLE OR POSSIBLE.	NO CONFLICTS EXCEPT FOR RECREATIONAL USES. GROUND WATER WITHDRAWAL WHERE ANNUAL RECHARGING OCCURS.
SOLID WASTE	SEVERE POTENTIAL CONTAMINATION PROBLEMS LIKELY TO REQUIRE COMPLETE CONTAINMENT OF WASTES.	MINIMAL ENVIRONMENTAL IMPACTS WITH PROPER CONTROL TECHNOLOGY. INDICATION THAT MANY AREAS MAY EXPERIENCE PROBLEMS AND IN SOME OF THESE AREAS SUITABLE OPTIONS MAY NOT BE AVAILABLE.	MINIMAL ENVIRONMENTAL IMPACTS WITH PROPER CONTROL TECHNOLOGIES. SOME POTENTIAL PROBLEMS BUT GENERALLY AMENABLE TO CURRENT TECHNOLOGY OPTIONS AT ADDITIONAL COST.
ECOLOGY	CRITICAL NATURAL HABITATS WILL BE DISTURBED.	CRITICAL NATURAL HABITAT OR LARGE ACREAGES OF CROPLAND MAY BE DISTURBED.	LOCALIZED IMPACTS WHICH MAY BE READILY MITIGATED BY STRUCTURAL OR SITING ALTERNATIVES.
LAND USE	CONFLICT WITH HIGH VALUE LAND USE, SUCH AS LOSS OF HABITAT, PARKLAND, SEISMIC RISKS, SCENIC RESOURCES, INDIAN LANDS, AGRICULTURAL LAND.	SIMILAR CONFLICTS, WITH ALTERNATIVE SITES OR MITIGATION MEASURES COSTLY BUT AVAILABLE.	FEW CONFLICTS; OR A RANGE OF ALTERNATIVES AVAILABLE.
PUBLIC HEALTH	SIGNIFICANT INCREASES IN MORBIDITY AND MORTALITY RATE DUE TO EXPOSURE TO ENERGY RELATED POLLUTANTS.	MODERATE INCREASES IN MORBIDITY AND MORTALITY RATE DUE TO EXPOSURE TO ENERGY RELATED POLLUTANTS.	NO SIGNIFICANT IMPACT. ALL IMPACTS SUBJECT TO MITIGATION.
OCCUPATIONAL HEALTH AND SAFETY	SIGNIFICANT INCREASES IN OCCUPATIONALLY RELATED DEATHS, INJURIES, AND DISEASE DUE TO INCREASED ENERGY DEVELOPMENT.	POTENTIAL SIGNIFICANT INCREASES IN RESPIRATORY AND OTHER DISEASES BUT IMPROVEMENTS IN OSHA, NRC AND EPA REGULATIONS AND WORKPLACE CONDITIONS EXPECTED TO ALLEVIATE MUCH OF THE PROBLEM.	NO SIGNIFICANT INCREASES IN OCCUPATIONALLY RELATED DEATHS, INJURIES, AND DISEASE DUE TO INCREASED ENERGY DEVELOPMENT.
LOCAL SOCIOLOGICAL FACTORS	IMPLEMENTATION DELAYED OR POSSIBLY BLOCKED DUE TO POTENTIALLY SEVERE CHANGES IN A COMMUNITY'S QUALITY OF LIFE; HEAVY DEMANDS PLACED ON PHYSICAL INFRASTRUCTURE INCLUDING SERVICES, FACILITIES, HOUSING; CONFLICT IN VALUES AND LIFESTYLE BETWEEN IMMIGRANTS AND LONG-TIME RESIDENTS; IMMIGRANTS REPRESENT A STATISTICALLY SIGNIFICANT PORTION OF THE BASELINE POPULATION; EXTENDED NEGOTIATIONS LIKELY BETWEEN DEVELOPER AND AFFECTED COMMUNITIES; AFFECTED COMMUNITIES WILL HAVE GREAT DIFFICULTY ABSORBING HIGH SOCIAL AND ECONOMIC COSTS OF PROJECT WITHOUT OUTSIDE ASSISTANCE.	POTENTIAL DELAYS DUE TO COMMUNITY AND LOCAL GOVERNMENT RESISTANCE TO FACILITY; POTENTIAL INCREASED COSTS TO LOCAL GOVERNMENT; SOME COMMUNITY FEARS FOR CHANGES IN THE QUALITY OF LIFE ACCOMPANYING INFLUX OF POPULATION; MITIGATION STRATEGIES AVAILABLE, BUT USUALLY COSTLY; MODERATE CAPACITY OF AFFECTED COMMUNITIES TO ABSORB THESE IMPACTS.	MINOR CHANGES IN LOCAL GOVERNMENT'S INFRASTRUCTURE; FEW IMMIGRANTS OR FEW CULTURAL AND LIFESTYLE CLASHES EXPECTED; MITIGATION COSTS EASILY ABSORBED BY AFFECTED COMMUNITIES.
LOCAL ECONOMICS	IMPLEMENTATION BLOCKED DUE TO UNACCEPTABLE ECONOMIC DEMANDS ON LOCAL INFRASTRUCTURE.	POTENTIAL DELAYS DUE TO LACK OF SKILLED PERSONNEL, FINANCIAL IMPACTS ON LOCAL GOVERNMENT.	INFRASTRUCTURE IMPACTS MINOR. ADAPTABILITY OF COMMUNITY GOVERNMENT HIGH.
REGIONAL ECONOMICS	*CAUSES ADVERSE CAPITAL OR EMPLOYMENT IMPACTS* ON REGION. DECREASES COMPETITIVE POSITION COMPARED TO OTHER REGIONS.	*POTENTIAL EMPLOYMENT, CAPITAL OR COMPETITIVE* IMPACTS, BUT MITIGATION STRATEGY POSSIBLE.	NO SIGNIFICANT IMPACTS.
INSTITUTIONAL AND LEGISLATIVE	PROHIBITION OF IMPLEMENTATION BASED ON AVAILABLE STRONG LEGAL CONSTRAINTS. ANTICIPATED LEGISLATIVE PROHIBITION. ABSENCE OF EFFECTIVE ORGANIZATIONAL RESPONSIBILITIES, STATUTES, ETC.	DELAY POSSIBLE DUE TO LEGAL OR POLITICAL CONSTRAINTS. LOW TO MODERATE PUBLIC OR PRIVATE INTEREST IN ENFORCEMENT.	NO SIGNIFICANT OPPOSITION, LEGAL CONSTRAINTS, OR ORGANIZATIONAL PROBLEMS.

2.0 REGIONAL OVERVIEW

Federal Region 8 comprises the states of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming and is a significant producer and exporter of most energy resources consumed in the US today. Wyoming and Montana will continue to be major energy-producing states. Although Colorado will be a major consumer as its population continues to grow, the state still will manage to export 30% of its energy products. Solar, including wind, and geothermal resources in the region will account for some local energy needs as experimentation in these areas is realized by the private sector.

Land area in the region is 20% of the total US area, yet the region constitutes only 3.5% of the nation's population. Population density is quite low--only 3.4 people per square mile in Wyoming, for example--and is clustered in the metropolitan districts of Denver, Salt Lake City, and other smaller, urbanized areas.

Growth trends are higher than in the rest of the US, with recreational and resource development the key factors in these increases. There is considerable concern as to the adequacy of the region to supply goods, services, and natural resources to the growing population. A great deal of land is in federal ownership or trust, leaving little private land available for development. Water rights are not necessarily tied to land ownership, as these rights are a separate property. Riparian laws associated with water in the East do not apply to this region.

Environmental sacrifices may be made as energy resource development continues to increase in the region. Regional concerns about the effect that energy development will have on environmental quality include some fear that economic benefits from energy development may be offset by damage to other economic activities tied to the environment, especially agriculture, recreation, and tourism. It would be a case of regenerative resources displaced by ones that are nonrenewable.

3.0 THE TRENDLONG MID-MID SCENARIO

3.1 THE NATIONAL SCENARIO

The Mid-Mid Scenario represents a mid-range (that is, 1985-90) projection of energy development based on the assumption of median supply, median demand, and constant world oil prices. It projects the future on the basis of the continuation of policies before implementation of the National Energy Act (NEA). The basic assumptions for the scenario are as follows.

- o Slight increase of domestic oil production as a result of Alaskan oil field and outer continental shelf development.
- o Continued decline of natural gas production in the lower 48 states.
- o Dramatic increase in coal production, particularly in the Western States, as a result of an increasing demand coupled with rising oil and gas prices.
- o Decrease in the growth of electricity sales from the historic 7% to 4.8% per year, representing saturation of air conditioning and major appliances that penetrated the market during the 1960s. The projected growth is consistent with 5% growth from 1970 to 1976 and 4.2% from 1976 to 1977.
- o Shift in the industrial sector from gas to oil and, to a lesser extent, to electricity; indicated by fuel shares in the industrial economic sector.
- o Constant oil price of $15.32 a barrel in 1978 dollars.

Table III shows the overall Mid-Mid Scenario projections for the total US energy supply and demand for 1985 and 1990. Total energy flow is projected to increase from 72.6 quadrillion Btu (quads) in 1975 to 96.9 quads in 1985 and 110.9 quads in 1990. The total electricity distribution in 1975 was 2,036 billion kWh. The scenario projects that it will reach 3,045 billion kWh in 1985 and 3,692 billion kWh in 1990.

Table III

US 1990 ENERGY SUPPLY/DEMAND BALANCE

(Quadrillion Btu Per Year)

PROJECTION SERIES [a]	1975	1985	1990
Domestic Production			
Crude Oil	17.9	19.0	18.0
NGL & Butane	2.6	2.0	1.8
Shale Oil	0.0	.1	.3
Natural Gas	19.0	17.2	16.7
Coal	14.6	23.1	27.5
Nuclear	1.8	6.2	10.3
Hydro & Geothermal	3.2	4.2	5.0
TOTAL DOMESTIC PRODUCTION	59.1	71.8	79.6
Imports			
Crude Oil	8.7	16.5	20.9
Petroleum Products	3.8	6.7	7.8
Natural Gas	1.0	1.9	2.6
TOTAL IMPORTS	13.5	25.1	31.3
TOTAL SUPPLY	72.6	96.9	110.9
Domestic Consumption			
Oil	32.8	43.9	48.5
Natural Gas	20.0	19.1	19.3
Coal	12.8	21.2	25.4
Nuclear	1.8	6.2	10.3
Hydro & Geothermal	3.2	4.2	5.0
TOTAL DOMESTIC CONSUMPTION	70.6	94.6	108.5
Exports			
Coal	1.8	1.9	2.1
Refinery Loss	.2	.4	.3
TOTAL CONSUMPTION & EXPORT	72.6	96.9	110.9
Domestic Consumption by Sector			
Residential	14.7	19.0	21.2
Commercial	11.3	13.5	15.0
Industrial	26.0	40.7	49.0
Transportation	18.6	21.4	23.3
TOTAL DOMESTIC CONSUMPTION	70.8	94.6	108.5

[a]For the EIA Mid-Mid Projection.

3.2 THE REGIONAL SCENARIOS

3.2.1 Federal Regional Scenarios

The energy supply and demand scenario for Federal Region 8 is summarized in Table IV and its corresponding pie charts (Fig. 2). These projections were the basis for community-level utility, industrial, and mining siting patterns developed by ORNL, BNL, and Mitre Corp., which, in turn, provide the baseline for the impact assessments.

The Mid-Mid Scenario for Region 8 is inconsistent with utilities' plans for energy development in the region. Several utility plants already under construction were not included in the scenario. Also, most existing and planned plants were shown operating at a small fraction of potential capacity. Because of the assumption that all electric power is generated in the federal region where it is used, the model does not allow for interregional transfer of electricity. Over 50% of the region's planned capacity is owned by investor utilities from outside Federal Region 8 and will be used by their customers. These omissions and assumptions have the effect of understating actual production levels and environmental impacts for each of the issues in the region.

Table IV

REGION 8'S PROJECTED ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL AND URANIUM PRODUCTION

	1975	1985	1990	1975-90 Total Change
ELECTRICAL GENERATING CAPACITY (Megawatts)[a]				
[1] Hydro, Conventional	5,017	6,155	6,155	1,138
[2] Hydro, Pumped Storage	162	530	530	368
[3] Coal Steam	8,150	14,436	16,176	8,026
[4] Nuclear	0	330	330	330
[5] Gas Turbine	30	360	360	330
[6] Gas Steam	252	247	226	-26
[7] Oil Turbine	610	2,390	2,660	2,050
[8] Oil Steam	1,054	1,168	1,167	113
[9] Geothermal	0	0	900	900
[10] Solar	0	0	300	300
TOTAL	15,275	25,636	28,704	13,529
INDUSTRIAL FUEL USE (10^{12} BTU)[b]				
Bituminous Coal	49.5	212.1	331.7	282.2
Metalurgical Coal	82.5	91.7	97.1	14.6
Coal	132.0	303.8	428.8	296.8
Middle Distillates	34.6	116.3	186.3	151.7
Residual Oils	37.4	33.9	43.4	6.0
Liquified Gasses	9.8	40.5	67.3	57.5
Oil	81.8	190.7	297.0	215.2
Natural Gas	241.9	165.8	61.3	-180.6
TOTAL	455.7	660.3	787.1	331.4
COAL PRODUCTION (10^6 Tons)[c]				
Deep Mines	10.84	51.59	126.24	115.40
Surface Mines	58.71	353.70	487.57	428.86
TOTAL	69.55	405.29	613.81	544.26
URANIUM PRODUCTION (10^3 Tons of U_3O_8)[d]	11.6	21.9	23.3	35.7

[a] Supplied by ORNL.

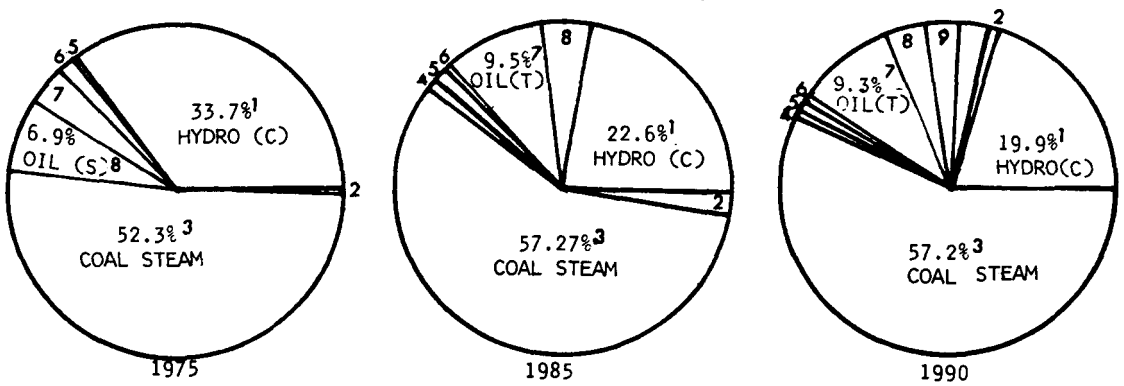
[b] Supplied by ORNL from IR&T disaggregation data.

[c] Supplied by BNL.

[d] Estimates supplied by EIA.

Fig. 2

REGION 8'S ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION, IN PERCENT



NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

4.0 REGIONAL ASSESSMENT

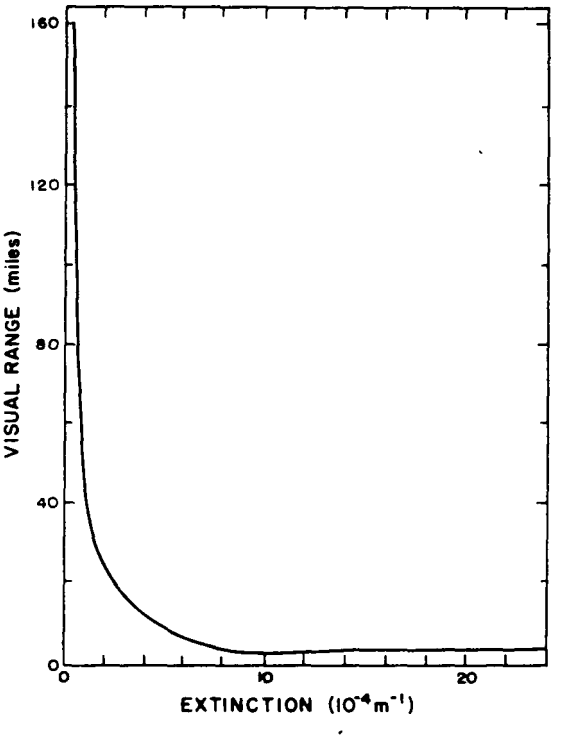
4.1 NATIONAL ISSUES WITH REGIONAL IMPACTS

Many energy issues cannot be limited to state or even regional boundaries. This section includes those impacts that are the product of national or multiregional developments. Specifically, they are visibility effects as a result of long-range transport of pollutants, national socioeconomics, and national water policies.

4.1.1 Long-Range Transport/Visibility

Secondary pollutants, especially particulate sulfates, can be transported over distances of hundreds to a few thousand kilometers before they are removed by precipitation scavenging and dry removal processes. Air pollution sources located outside the region can contribute to air quality problems within the region. Distant, extraregional sources can contribute to visibility impairment, acid rain, elevated levels of photochemical oxidants, air pollution-related health effects, and possible climate modification in a region. Except for visibility impairment, those effects related to long-range transport of air pollutants are much less of a problem in Federal Region 8 than in the eastern US because of the much higher air pollutant emission densities in the East and because of west to east average air flow across our country.

Fig. 3
VISUAL RANGE VS. THE LIGHT EXTINCTION COEFFICIENT



A plot of visual range versus the light extinction coefficient, according to the Koschmieder relationship, is shown in Fig. 3. The light extinction coefficient is related to the capacity of atmospheric particles and

gases to scatter and absorb light. The visual range plot has a large negative slope at high values of visual range (very good visual air quality) and a small negative slope at low visual range (very poor visual air quality). This relationship between visual range and light extinction indicates that areas with very good visual air quality are the ones most sensitive to degradation by air pollution. Federal Region 8 has an abundance of areas with very good visual air quality and, thus, is very sensitive to visibility degradation caused by the growth of air pollutant emissions.

4.1.2 National Socioeconomic

The plans for extensive development and conversion of coal resources represent the major source of socioeconomic impacts in 22 of the region's 23 impacted counties. Only Sweetwater County, Wyoming, is expected to be able to accommodate growth because of existing governmental infrastructure.

Overall construction capital requirements will pose a constraint on the implementation of the Mid-Mid Scenario. The massive capital investment required of a few major companies in a few Western States may find severe competition in capital markets.

The need to concentrate the necessary labor supply in a timely manner will require a national manpower training program clearly designed to provide skilled miners and construction workers and mining and electrical engineers.

Related impacts may occur in other parts of the country to avoid delays in almost every supply category from mining equipment, draglines, trucks, and railroad cars, to electrical transformers and substation components, generators, turbines, and even manpower.*

4.1.3 National Water Availability Issues

As discussed in Section 4.2.3, water availability is not an important national consideration in terms of constraining energy policy options. Water development in the West does conflict with national interests to preserve streamflows on federal lands, protect endangered species, and deliver adequate quality water to Mexico.

*For further information, see the Government Accounting Office, Report to Congress, "Rocky Mountain Energy Resource Development: Status, Potential, and Socioeconomic Issues," EMD-77-23 (July 1977).

4.2 REGIONAL ISSUES

4.2.1 Visibility

In the past, industrial process facilities and smelters in particular have been the major contributors to visibility impairment in Federal Region 8. As sulfur dioxide emission control technology is installed, less polluting smelter processes replace existing ones, and new energy facilities come on-line, energy facilities will become a more significant contributor to visibility impairment in the region. Of the projected energy facilities to be located in the region, the major source categories projected to contribute to impairment of visual air quality are coal-fired utility and industrial boilers.

Regional haze is projected to occur in 15 Class I areas located in Colorado and the Dakotas. Plume blight could affect four Class I areas located in Colorado and Wyoming.

Information on power plants now under construction or permitted indicates that the capacity in place by 1985 in Federal Region 8 is substantially greater than that projected for the Mid-Mid Scenario. This unaccounted-for capacity can cause significant impairment affecting Class I areas as a result of plume blight and regional haze.

4.2.2 Local Air Quality

Federal Prevention of Significant Deterioration (PSD) regulations will constrain scenario-projected utility siting in Utah, Montana, and North Dakota. Parts of North Dakota currently are being impacted from air quality degradation occurring in Canada along the Poplar River Basin north of Fort Peck, Montana.

Our analysis shows that state ambient air quality standards and emission regulations in Region 8 may constrain development where national standards would not be violated. Wyoming, Colorado, and Montana, in particular, have adopted ambient air quality standards that are stricter than federal primary standards.

Violations of air quality standards for SO_2 and Total Suspended Particulates (TSP) occur primarily in Region 8's metropolitan areas. In addition, agricultural activities and nonanthropogenic

sources of windblown dust often produce violations of 24-hour ambient TSP standards.

Nonferrous metal smelters are major sources of air pollution in this region. The introduction of highly efficient, constant sulfur dioxide control technology by smelters will depend on the economic vitality of the industry or may be postponed by nonferrous smelter orders obtained under Sec. 119 of the Clean Air Act.

Air Quality Control Regions (AQCR) contain more than one county and may contain counties from more than one state. The results of the local air quality analysis in RIIA-I can be distorted seriously by aggregation to the AQCR level; many issues are site and industry specific.

4.2.3 Water

The key water-related issues are that water shortages may constrain energy development and that water use for energy production may have a negative impact on other users. Table V shows projected consumption for electricity generation by subbasin compared with available supply and projected use in other sectors (from lead-lab analysis). The projection assumes use of conventional cooling systems and streamflows. Most striking is that in no subbasin is the projected use for electricity generation greater than 5% of the remaining surface water available. This is not the last word on water-related issues, however.

Table VI shows water use for coal production and conversion in New Mexico's San Juan Basin. Water use varies depending on coal quality, meteorological conditions, and environmental regulations. But the key consideration is that conservation technologies (especially dry cooling) are available at a relatively small increment in product prices. In any case, far less costly sources of supply are usually available. Thus, it is reasonable to conclude that water availability is not a significant constraint to development.*

*See David Abbey, "Water Supply/Demand Alternatives for Electricity Generation in the Colorado Basin," Los Alamos Scientific Laboratory report LA-7662-MS (1979); and D. Abbey, "Water Use for Coal Gasification: How Much is Appropriate?," report to DOE's Assistant Secretary for Environment (1979).

Table V

REGION 8'S PROJECTED WATER USE FOR ELECTRICAL GENERATION IN 1985 AND 1990

ASR[a] Number	Basin Name	Available Supply (10^6 gal/d)	Projected Consumption for Energy (10^6 gal/d)		Projected Water Consumption by the Energy Sector As a Percentage of Available Supply		Projected Water Consumption by All Sectors As a Percentage of Available Supply	
			1985	1990	1985	1990	1985	1990
1004	Yellowstone	12 256	10	14	0.1	0.1	93.9	92.7
1007	North and South Platte	13 982	20	20	0.1	0.1	96.6	102.1
1102	Arkansas	2 780	9	10	0.3	0.4	93.4	85.7
1302	Rio Grande	670	4	4	0.4	0.4	89.6	82.9
1401	Green	4 568	42.4	43.4	1.0	1.1	88.9	89.6
1402	Upper Colorado	7 230	1	1	--	--	59.2	64.1
1403	San Juan	9 493	41	38	1.6	1.4	105.5	106.3
1501	Little Colorado	288	10	8	4.5	3.3	65.3	69.5
1502	Lower Colorado Mainstem	15 103	29	31	1.7	1.7	92.3	92.9
1503	Gila	3 273	23	65	0.4	1.1	86.0	83.3

[a]Basins with no projected energy facilities or those primarily outside the Rocky Mountain Region are excluded.

Table VI

WATER USE FOR COAL PRODUCTION AND CONVERSION IN THE SAN JUAN BASIN
(Activities Scaled to Coal Input of 9.3×10^6 TPY)

Activity	Acre-Feet/Year
Surface Coal Mine [a]	< 2500
Rail Transportation	Nil
Slurry Pipeline [b]	6,800
2,300 MW Coal-Fired Electric Plant [c]	26,450 (All-Wet Cooling) 10,600 (40% Wet/60% Dry) 4,600 (10% Wet/90% Dry) 2,300 (All Dry Cooling)
250 Million Cubic Feet/Average Day [d] High BTU Gas Plant (Lurgi)	7,700 (High Wet Cooling) 5,400 (Low Wet Cooling)

[a] Could be lower in wet years or with use of trickle irrigation.

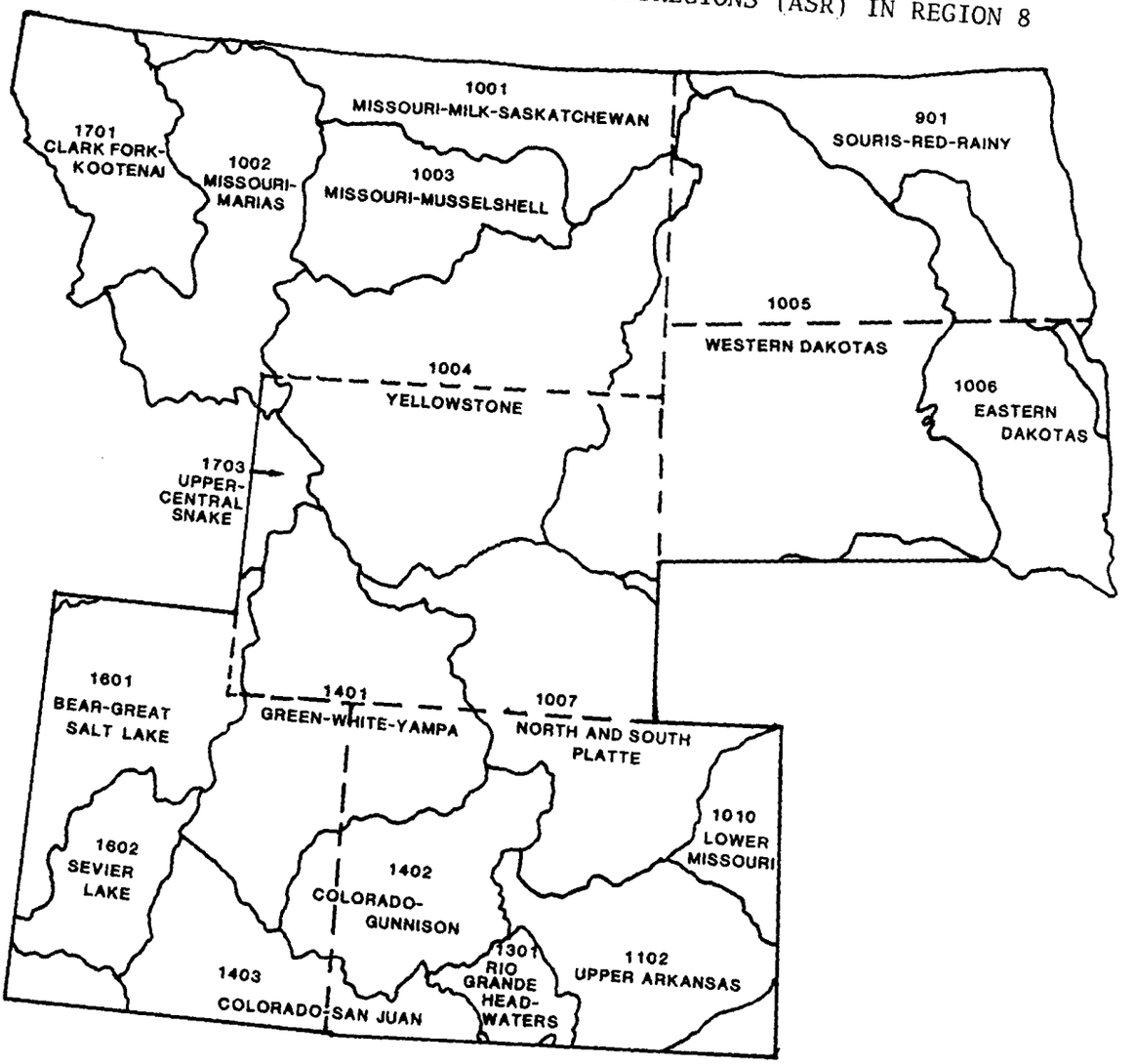
[b] 8,600 Btu/lb Coal: Slurry 50% (Wt.) water.

[c] 80% annual capacity factor, 33% thermal efficiency, wet flue gas desulfurization.

[d] Assumes extensive waste water treatment and recovery.

Fig. 4

WATER RESOURCES COUNCIL AGGREGATED SUBREGIONS (ASR) IN REGION 8



Water use for energy production affects instream uses, water quality, and existing water users. Assuming containment of liquid wastes by industrial users, the principal water quality effect is from mining--modification of surface runoff and shallow aquifers. The effects on instream values--recreation, fisheries, endangered species, and aesthetics--are mostly local and site specific. (A LASL survey of critical stream reaches is nearing completion.) The effect on existing users is twofold. First, water development or reallocation (transfer) affects the quality of existing water rights--the reliability in time, quantity, and quality. While surface water users are generally given adequate protection under state law, groundwater users are not. They face the prospect of falling water tables and well yields and higher pumping costs. Second, water transfers from agriculture to the energy industry have economic and social impacts not borne by the parties to the transfer. Considering the vast discrepancy between the value of water use in agriculture and industry,* the parties suffering economic losses (farm equipment dealers, ditch companies, etc.) could be compensated easily, but there is no guarantee of compensation. Furthermore, some individuals reject notions of value based on economics.

4.2.4 Ecology/Land Use

Throughout Region 8, constraints to energy development may result from the enforcement of regulations such as the Federal Endangered Species Act of 1973, the Surface Mining Control and Reclamation Act of 1977, and various state laws.

Although many rare and endangered species are found within the region, direct energy development impacts on these species will probably be limited to degradation of fish habitat in streams. Indirectly, the increase in population that accompanies energy development can lead to increased game law violations and habitat destruction from construction-related activities, such as the mining of streambeds for gravel.

*See M. Gisser et al., "Water: Agriculture vs. Energy Development in the Four Corners Area," Los Alamos Scientific Laboratory report LA-7643-MS (1979).

Table VII

ENDANGERED FAUNA OF FEDERAL REGION 8 AS OF 1978 BY STATE STATUS

NAME		COLORADO	MONTANA	NORTH DAKOTA	SOUTH DAKOTA	UTAH	WYOMING
COMMON	SCIENTIFIC						
MAMMALS							
Bat, fringed	*Myotis thysanodes*		X				
Bear, grizzly	*Ursus horribilis*		X				
Cougar	*Felis concolor*		X				
Ferret, black-footed	*Mustela nigripes*	X	X	X	X	X	
Fox, kit	*Vulpes macrotis*			X	X		
Fox, swift	*Vulpes velox*						X
Lemming, northern bog	*Synaptomys borealis*		X				
Lynx, Canada	*Lynx canadensis*	X	X				
Marmot, hoary	*Marmota caligata*		X				
Otter, river	*Lutra canadensis*		X				
Otter, river	*Lutra canadensis sonora*	X					
Prairie Dog, Utah	*Cynomys parvidens*					X	
Pronghorn, Sonoran	*Antilocapra americana*	X					
Shrew, Merriam's	*Sorex merriami*		X				
Shrew, Preble's	*Sorex preblei*		X				
Shrew, pygmy	*Microsorex hoyii*		X				
Vole, sage-brush	*Lagurus curtatus*		X				
Weasel, least	*Mustela nivalis*		X				
Wolf, gray	*Canis lupus monstrabilis*		X				
Wolf, Mexican	*Canis lupus baileyi*		X				
Wolf, Northern Rocky Mountain	*Canis lupus irremotus*		X				
Wolverine	*Gulo gulo*	X					
Wolverine	*Gulo luscus*		X				
BIRDS							
Bittern, least	*Ixobrychus exilis*		X				
Bobwhite	*Colinus virginianus*		X				
Chicken, greater prairie	*Tympanuchus cupido*	X					
Crane, greater sandhill	*Grus canadensis tabida*	X					
Crane, whooping	*Grus Americana*	X	X	X	X		
Cuckoo, yellow-billed	*Coccyzus americanus*		X				
Eagle, southern bald	*Haliaeetus leucocephalus*	X				X	
Falcon, American peregrine	*Falco peregrinus anatum*	X	X	X	X	X	
Flycatcher, alder	*Empidonax alnorum*		X				
Flycatcher, great-crested	*Myiarchus crinitus*		X				
Godwit, Hudsonian	*Limosa haemastica*		X				
Grouse, prairie sharp-tailed	*Pediocetes phasianellus jamesi*	X					
Gull, glaucous	*Larus hyperboreus*		X				
Hawk, broad-winged	*Buteo pltypterus*		X				
Hawk, red-shouldered	*Buteo lineatus*		X				
Heron, green	*Butorides virescens*		X				
Hummingbird, Anna's	*Calypte anna*		X				
Hummingbird, ruby-topaz	*Chrysolampis mosquitus*		X				
Jaeger, parasitic	*Stercorarius parasiticus*		X				
Junco, grayheaded	*Junco capiceps*		X				

NAME		COLORADO	MONTANA	NORTH DAKOTA	SOUTH DAKOTA	UTAH	WYOMING
COMMON	SCIENTIFIC						
BIRDS (Continued)							
Loon, arctic	*Gavia artica*		X				
Murrelet, ancient	*Synthiboramphus antiquus*		X				
Owl, barred	*Strix varia*		X				
Owl, boreal	*Aegolis funereus*		X				
Owl, flammulated	*Otus flammeolus*		X				
Owl, great-gray	*Strix nebulosa*		X				
Plover, snowy	*Charadrius alexandrinus*		X				
Ptarmigan, willow	*Lagopus lagopus*		X				
Rail, yellow	*Coturnicops noveboracensis*		X				
Sandpiper, buff-breasted	*Pryngites subruficollis*		X				
Sandpiper, curlew	*Calidris Ferruginea*		X				
Sparrow, black-throated	*Amplispiza bilineata*		X				
Sparrow, sharp-tailed	*Ammopiza caudactus*		X				
Thrush, wood	*Hylocichla mustelina*		X				
Turnstone, black	*Arenaria melancephala*		X				
Vireo, Philadelphia	*Vireo philadelphicus*		X				
Warbler, bay-breasted	*Dendroica castenea*		X				
Warbler, black-throated blue	*Dendorica caerulescens*		X				
Warbler, black-throated green	*Dendroica virens*		X				
Warbler, Connecticut	*Geothypis agilis*		X				
Warbler, magnolia	*Dendroica magnolia*		X				
Warbler, mourning	*Geothlypis philadelphia*		X				
Woodcock, American	*Scolopax minor*		X				
Wren, short-billed marsh	*Cistothorus platensis*		X				
REPTILES AND AMPHIBIANS							
Frog, spotted chorus	*Rana clarki*		X				
Hognose, plains	*Heterodon nasicus*		X				
Salamander, Cour d' Alene	*Plethodon vandukei*		X				
Snake, milk	*Lampropeltis triangulum*		X				
FISH							
Chub, bonytail	*Gila elegans*	X					
Chub, creek	*Semotilus atromaculatus*		X				
Chub, humpback	*Gila cypha*	X	X			X	X
Chub, sturgeon	*Hybopsis gelida*		X				
Dace, finescale	*Phoxinus neogaeus*		X				
Sculpin, shorthead	*Cottus confusus*		X				
Sculpin, spoonhead	*Cottus ricei*		X				
Squawfish, Colorado River	*Ptychocheilus*	X				X	X
Sucker, blue	*Cycleptus elongatus*		X				
Trout, lake	*Salvelinus namycush*		X				
Trout, perch	*Peropsis omiscomaycus*		X				
Woundfin	*Plagopterus argentissimus*					X	

NOTE: Only fauna are listed here, and only those fauna listed as endangered in Federal Region 8.

SOURCE: The Regional Environmental Data Books for the Rocky Mountain and Midwest Regions.

Increased SO_2 levels from coal-fired electricity generating facilities may adversely affect crops, endangered plant species, and wildlife habitat containing sensitive plant species.

Both federal and state laws require revegetation of mined areas to the appropriate land use, which in the Western States has generally meant grazing. Because of the aridity of the region, irrigation is usually necessary for reclamation in addition to the usual soil amendments, seeding, and mulching. The cost of these reclamation processes is high and their success has been limited.

4.2.5 Socioeconomic

The 1985 Mid-Mid Scenario projects nearly 70,000 new jobs related to coal development in the 40 counties of the Western States. Between 1986 and 1990, another 80,000 new jobs will be added, bringing the total to nearly 150,000 new jobs. In 1990, 92% of the new jobs will be concentrated in the 23 counties of the region. These counties will experience over 10% population growth in at least 1 year of the development period.

Nearly 15,000 MW of new generating capacity are sited in 11 of the 23 coal-producing counties in five states. The typical household in the impacted communities will pay an average of $840 per year for required basic, local government services. This ranges from approximately $217 per year in Sweetwater County, Wyoming, to nearly $2100 per year in Moffat County, Colorado.

The sparsely populated Western States will experience profound direct and indirect socioeconomic impacts associated with the migration of workers and their families. Commercial centers and transportation services near the mine sites and conversion facilities will experience indirect impacts from construction material supply and maintenance services. Local residents generally will resist major changes in their lifestyles and will be reluctant to vote for additional tax assessments to provide for community services necessary to accommodate rapid growth.

TABLE VIII

SOCIOECONOMICALLY IMPACTED COUNTIES[a] IN FEDERAL REGION EIGHT:
A COMPARISON OF GROWTH ABOVE BASE POPULATIONS AND PUBLIC COSTS
AS PRESENTED IN THE RIIA-I MID-MID SCENARIO

Code[b]	County	1978 Base Pop.	Peak Year Pop.	Peak Year Projected Population	% Over Normal Base Growth[a]	Annual $/Capita for Local Gov't Services[c]
COLORADO						
1	Gunnison	7,649	1990	22,735	240.24	$424
2	Huerfano	6,550	1989	7,493	13.48	$ 72
3	Los Animas	16,541	1988	18,029	30.73	$169
4	Moffat	9,797	1982	28,224	201.42	$599
5	Pitkin	11,147	1983	23,438	47.64	$182
6	Rio Blanco	5,582	1989	16,789	146.79	$368
7	Routt	11,828	1987	53,210	128.16	$347
MONTANA						
8	Big Horn	11,116	1988	17,042	33.98	$149
9	Rosebud	11,843	1981	22,378	41.70	$151
NORTH DAKOTA						
10	Bowman	4,205	1987	5,287	12.63	$ 64
11	Dunn	4,804	1987	5,836	21.00	$ 98
12	McLean	11,726	1982	17,909	42.24	$193
13	Mercer	6,680	1988	10,975	44.96	$183
14	Oliver	2,409	1983	3,663	52.83	$196
SOUTH DAKOTA: No counties listed as impacted.						
UTAH						
15	Emery	8,345	1981	17,699	72.20	$229
16	Kane	3,635	1988	57,983	860.46	$525
17	Sevier	12,576	1987	19,295	17.87	$ 91
18	Wayne	1,808	1989	14,497	512.98	$518
WYOMING						
19	Campbell	14,605	1988	52,155	211.93	$399
20	Carbon	18,539	1988	38,373	34.54	$151
21	Platte	8,045	1983	11,997	28.13	$130
22	Sweetwater	37,745	1982	62,339	10.33	$ 62
23	Uinta	11,144	1990	33,679	52.33	$211

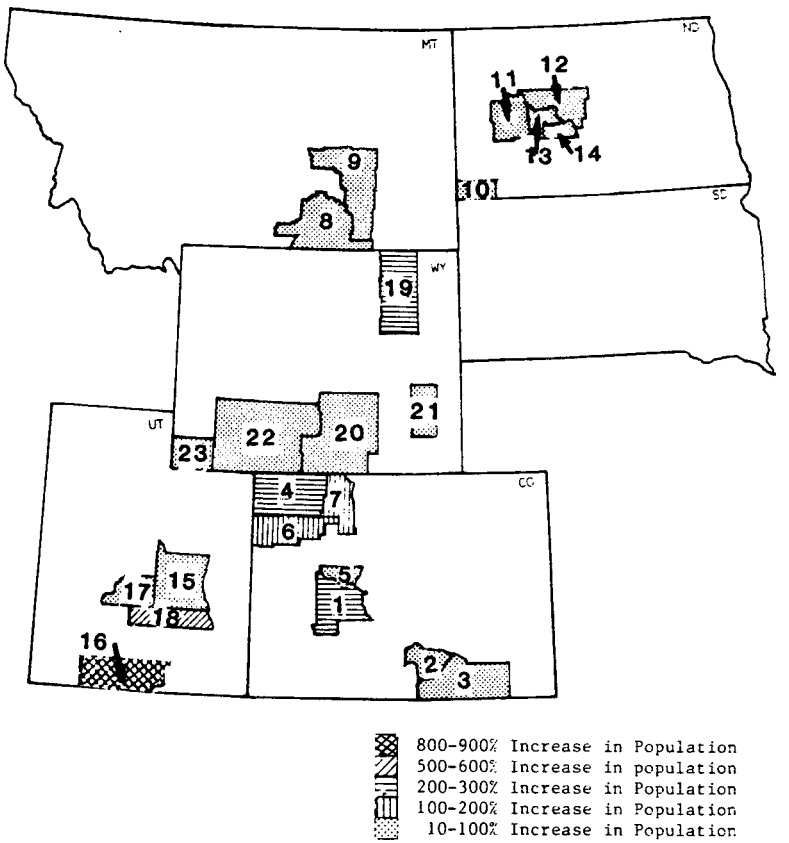
[a] Includes only counties that will experience a greater than 10% growth per year, entirely as a result of energy development described in the Mid-Mid Scenario.

[b] These numbers correspond to those in the counties on the adjacent map.

[c] Annual cost of public services and facilities for social welfare, hospitals, police, fire, sewage, solid waste disposal, recreational services, general government, water treatment, libraries, and education. Costs are based on SEAM Model average costs for Federal Region 8.

Fig. 5

COUNTIES[a,b] WITH SEVERE SOCIOECONOMIC IMPACTS IN FEDERAL REGION 8
AS IDENTIFIED IN THE RIIA-I MID-MID SCENARIO



[a] The counties are identified by matching the code numbers with the adjacent table.

[b] Includes only counties that will experience a greater than 10% growth per year, entirely as a result of energy development described in the Mid-Mid Scenario.

4.2.6 Health and Safety

Federal Region 8, simply because its air is clean and its land sparsely populated, will experience minimal ill-health effects from increased coal use. Although the effects on the general public will be slight, burning coal to generate electricity and run synthetic natural gas plants will have a greater impact on those persons who have migrated to the region because of respiratory health reasons.

Public safety depends on the action taken by the general public and their local governmental bodies. In heavily populated, industrialized states (for example, many in the East), the public and their representatives are more experienced in coping with public safety hazards than their counterparts in Region 8. Therefore, Region 8's lack of experience is expected to cause growing public safety concerns.

Items listed below are matters for concern but are not likely to constrain energy development in the region.

- Increased coal use, combined with Region 8's inexperience in handling public safety hazards, will threaten public safety.
- Per Btu supplied, coal mining is the energy supply activity most hazardous to workers.
- Occupational health and safety are mainly controlled by national industry policies; regional considerations are secondary.
- Total risk to public health from airborne sulfates is projected to double under the scenario; still the overall effects on public health will be minimal.

4.2.7 Solid Waste

Solid waste problems in Federal Region 8 are a function of land form, aridity, and patterns of land ownership; these vary radically from county to county.

In the eastern plains region of the Dakotas, Montana, Wyoming, and Colorado, mitigation of solid waste problems is relatively simple. In the mountains, however, almost all of the underground mining is being planned for areas where land forms are quite rugged. In these areas, partly because of difficult terrain, federal land control approaches totality, populations are miniscule,

and waste controls are rare and expensive. Land legally appropriate for the disposal of wastes from underground mines is limited or distant from most mine sites. The situation is further complicated by the effects of historical mining practices, which have left whole valleys unreclaimed after 50 years or more.

Table IX

A COMPARISON OF PUBLIC AND PRIVATE LAND OWNERSHIP, 1970 CENSUS
(Thousands of Acres)

State	Urban Areas	Farmsteads, Farm Roads, and Lands	Total	Acreage of State	% of Land in Private Ownership
Colorado [a]	365	35,902	36,267	66,486	54%
Montana [a]	93	62,158	63,141	93,271	68%
North Dakota [b]	84	42,357	42,441	44,452	95%
South Dakota [b]	106	45,978	46,084	48,882	96%
Utah [a]	273	10,610	10,883	52,696	21%
Wyoming [a]	61	34,272	34,333	63,343	54%

SOURCES: Regional Energy/Environment Data Book Drafts, 1978, Rocky Mountain [a] and Midwest [b] Regions.

Another type of waste problem arises in those western counties of Utah with desert conditions. Here, as in the mountains, tiny populations cluster near water sources, most of the land is public domain, and the disruption or contamination of limited water supplies carries the potential for disaster for many miles. Typhoid continues to be a serious problem in all three types of terrain because approved solid waste disposal facilities are inadequate or nonexistent for more than 50% of the population, federal regulations notwithstanding.

4.2.8 Institutional

Many of the institutional issues that affect power generation in Federal Region 8 are applicable to more than one state, if not to all of the states.

The criteria by which state utility commissions determine the need for new electricity generating stations are broadening to encompass a larger number of issues of concern to both rate-payers and special interest groups. Today, utility commissions in Montana and Colorado are looking beyond markets and rates and becoming increasingly concerned with three additional issues: the resolution of environmental concerns, power export policies, and the distribution of benefits and costs.

Coal and electric power export policies are growing in importance in several Region 8 states, especially in Montana, which has an implicit policy of "strip and ship." Other states, less sensitive about the environmental effects of power generation, are concerned that the export of electricity not adversely impact state residents through higher base rates that subsidize construction of new capacity for out-of-state consumers. Much of the new generating capacity in the West is being built to serve the expansion of the coal and uranium mining industries. Present power customers are justifiably asking why they should subsidize these export industries.

The inventory of Bureau of Land Management (BLM) and US Forest Service roadless tracts through the region has two significant impacts on the use of federal land for energy development: it removes all roadless areas from use for the duration of the study period, and it removes tracts ultimately designated for wilderness from productive use forever. Both of these activities make energy facility siting and access more difficult, increase the lead-times needed for planning and construction, and ultimately increase project costs.

The BLM leasing moratorium is also delaying coal production. Opponents of the leasing moratorium have argued that many existing BLM leases do not contain a sufficient amount of economically recoverable coal. Moreover, it is becoming increasingly difficult for a coal operator to assemble an economic mining unit without including federal land. The moratorium on BLM leasing has made it difficult for western utilities to obtain reliable sources of coal.

Western utility managers are concerned about the costs of air pollution control technology required by federal legislation and the compatibility of this technology with power generation equipment requirements. Lead-time may be extended for the construction of new power generating sources by the ambient air monitoring required by PSD regulations.

Siting of fossil-fueled power generating facilities must comply with PSD regulations, which are especially restrictive for Class I area airsheds. In addition to the designation of some Indian lands as Class I areas (including the Northern Cheyenne Reservation in Montana), national park lands and wilderness areas also are designated Class I. National forests and monuments and potential Bureau of Land Management wilderness areas are being studied for possible Class I designation.

In several of Region 8's states, institutional issues are influenced by the actions, concerns, and legal status of Indian tribes. These include the Navajo in Utah and the Northern Cheyenne, the Crow, and the Federated Salish and Kootenai Tribes on the Flathead Reservation in Montana. With the exception of the Crow, who generally favor energy development, the actions of Indian tribes have limited the sites available for power and mining and increased the financial risks of project development.

Recent Indian assertiveness is motivated in part by the desire for sovereignty, but also by a desire to protect the environment, control the use of resources, improve reservation communities, increase Indian employment, and increase tribal revenues. Indian tribes are employing several institutional tools to achieve their goals: disapproving power plant sites and transmission corridors, imposing taxes, renegotiating mineral leases, withholding right-of-way permits, and obtaining Class I area air quality designations. Both the Navajo Land Administration Department and the Environmental Protection Commission can disapprove proposed transmission corridors and power plant sites because they find the development proposals dangerous or environmentally unsound.

The Crow and Northern Cheyenne have gone to court for higher royalties on their coal leases. The court found the royalties too low and the coal companies are appealing this decision. The Navajo Tribe successfully renegotiated its coal leases with El Paso Natural Gas and Consolidation Coal Corporation. Now the Navajo Land Administration Department is using right-of-way permits as leverage to renegotiate other coal leases. The new permit conditions are still under consideration, but are likely to be much more stringent.

Table X.

ENVIRONMENTAL IMPACTS[a] OF THE EIA TRENDLONG MID-MID SCENARIO ON FEDERAL REGION 8

	Air		Water		Land		Health & Safety[c]	Social and Economic			
Energy Source	Quality	Visibility	Quality	Availability[b]	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio-logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
COAL											
-Electric	M	H	L	L	M	M	L	H	H	H	L
OIL	L	L		L	M	L	L	L	L	L	L
GAS	L	L		L	L	L	L	L	L	L	L
NUCLEAR	L	L		L	M	M	L	L	L	L	L
CONSERVATION											
-Energy Efficiency Improvements	L	L	L	L	L	L	L	L	L	L	L
-Urban Waste	L	L	L	L	L	L	L	L	L	L	L
-Cogeneration	L	L	L	L	L	L	L	L	L	L	L
SOLAR	L	L	L	L	L	L	L	L	L	L	L
GENERAL											
-Utility	M	H	L	L	M	M	L	H	H	H	M
-Industry	L	H	L	L	L	L	L	L	L	L	L
-Mining	L	L	M	M	M	L	L	H	H	H	M

[a] Criteria for ranking impacts are found in Table II.
[b] Includes groundwater.
[c] Includes health effects not covered by air quality.

5.0 STATE ISSUES

5.1 COLORADO

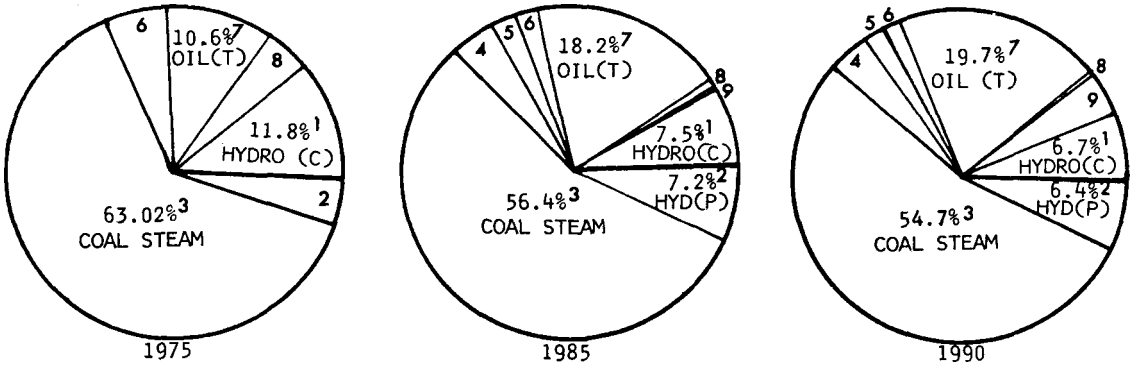
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for Colorado, as shown on Table XI and its companion pie charts (Fig. 6).

Table XI

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN COLORADO
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	452 (11.8%)	552 (7.5%)	552 (6.7%)	100
[2]Hydro, Pumped Storage	162 (4.2%)	530 (7.2%)	530 (6.4%)	368
[3]Coal Steam	2,405 (63.0%)	4,146 (56.4%)	4,526 (54.7%)	2,121
[4]Nuclear	0 (0%)	330 (4.5%)	330 (4.0%)	330
[5]Gas Turbine	0 (0%)	180 (2.5%)	180 (2.2%)	180
[6]Gas Steam	250 (6.6%)	182 (2.5%)	161 (1.9%)	-89
[7]Oil Turbine	403 (10.6%)	1,339 (18.2%)	1,624 (19.6%)	1,221
[8]Oil Steam	144 (3.8%)	70 (1.0%)	70 (0.9%)	-74
[9]Solar	0 (0%)	20 (0.3%)	300 (3.6%)	300
TOTAL	3,816	7,349	8,273	4,457
Coal Production				
Deep Mines	84	427	456	372
Surface Mines	109	716	1,402	1,393

Fig. 6

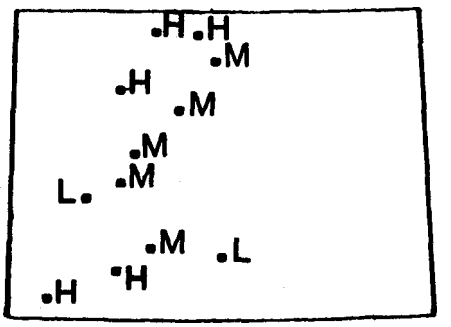


NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

5.1.1 Visibility

Fig. 7

COLORADO'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



- Medium to high impairment of visual air quality is projected to occur in 11 of the 12 Class I areas located in the state.
- The projected tripling by 1990 of sulfur dioxide emissions from the state's industrial and utility fossil fuel combustion facilities is a major factor contributing to visibility impairment.
- The long-range transport of particulate sultates into the state also is expected to be a major factor contributing to visibility impairment.

5.1.1.1 Description

The current visual air quality in the nonurban areas of the state is superior to that experienced in most other states in the US. The long-range transport of light-scattering aerosols (sulfates, in particular) is an important factor contributing to the light extinction budgets in nonurban areas of the state. The median visual range based upon measurements at four nonurban/suburban sites for the period 1974-76 ranged from 70 to 90 miles. Median visual ranges calculated for the 12 Class I areas in the state for baseline year 1977 ranged from 74.5 to 82.9 miles.

According to measurements taken at airports, visibility in the state generally has deteriorated over the past 20 years. From 1953-55 to 1970-72, median visual range changed -13% in Denver, -12% in Colorado Springs, -4% in Grand Junction, and +35% in Pueblo. This deterioration is most likely related to increased concentrations of anthropogenically-generated light-scattering aerosols in the atmosphere, which are caused by human activities that accompanied economic and population growth during the period.

5.1.1.2 Background Issues

- Visual air quality is most sensitive to degradation in areas with very good visibility. The state has an abundance of such areas.

- The 12 Class I areas in the state are covered by recent Congressional legislation (Public Law 95-95, Subpart 2, Sec. 169A), which declared as a national goal the protection of visual air quality in mandatory Class I Federal areas where impairment in visual air quality results from manmade air pollution. Regulations that quantitatively define impairment and that define measures to prevent future impairment and remedy existing impairment are required to be promulgated by August 1979.

5.1.1.3 Scenario-Induced Issues

- By 1990, 1 Class I area is projected to have high impacts, 10 to have medium impacts, and 1 to have low impacts. Calculated visual range and its percent change for the 12 Class I areas in the state are shown in Table XII.
- Eleven Class I areas are projected to have medium to high regional haze impacts. One Class I area--Weminuche Wilderness--is projected to have a greater than 20% decrease in median visual range from 1977 to 1990, rated as high impacts. Ten Class I areas--Eagles Nest Wilderness, Flat Tops Wilderness, Great Sand Dunes Wilderness, La Garita Wilderness, Maroon Bells-Snowmass Wilderness, Mesa Verde National Park, Mount Zirkel Wilderness, Rawah Wilderness, Rocky Mountain National Park, and West Elk Wilderness--are projected to have a 10-20% decrease in median visual range from 1977 to 1990, rated as medium impacts.
- High impairment from plume blight could affect Mount Zirkel Wilderness and Flat Tops Wilderness as a result of 1140 MW of increased coal steam capacity projected by the scenario to be sited in Moffat County.
- The state's substantial projected growth of emitted sulfur dioxide, which converts to particulate sulfates, is a major factor contributing to the projected impairments. Sulfur dioxide emissions are projected to increase from 1975 to 1990 by 139.1% and 670.5% for utility and industrial fossil fuel combustion facilities, respectively.
- Air pollution sources located outside of the state are predicted to have a major impact on impairment of visual air quality in the state. Of the state's predicted area-weighted sulfate concentrations, which are caused by sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities, 66% was due to emissions from sources located outside the state.

Table XII

COLORADO: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

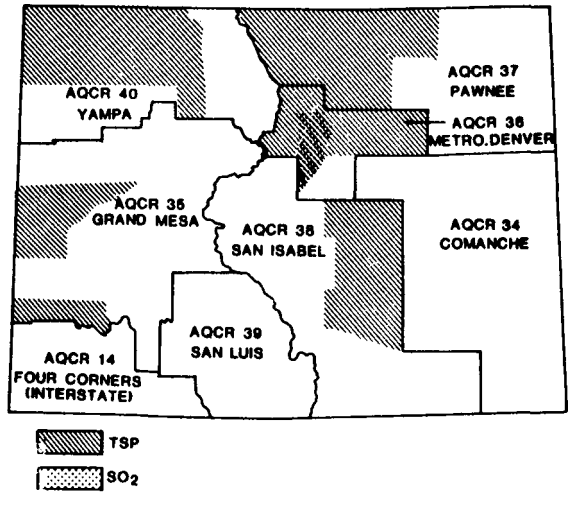
Class I Area	Visual Range (miles) Calculated 1977	1985	1990	Percent Change From 1977 To 1985	1990
Black Canyon of the Gunnison Wilderness	75.4	69.5	68.8	- 7.8	- 8.8
Eagles Nest Wilderness	80.6	66.1	64.9	-18.0	-19.5
Flat Tops Wilderness	80.5	69.9	68.7	-13.2	-14.7
Great Sand Dunes Wilderness	75.0	67.9	67.0	- 9.2	-10.7
La Garita Wilderness	79.8	70.2	69.4	-12.1	-13.0
Maroon Bells-Snowmass Wilderness	75.1	62.8	61.7	-16.4	-17.9
Mesa Verde National Park	77.7	69.8	69.3	-10.1	-10.8
Mount Zirkel Wilderness	82.9	69.1	68.0	-16.6	-18.0
Rawah Wilderness	82.6	73.9	72.7	-10.5	-11.9
Rocky Mountain National Park	79.7	66.3	64.4	-16.8	-19.2
Weminuche Wilderness	77.9	56.4	55.3	-27.6	-29.0
West Elk Wilderness	74.5	63.5	62.8	-14.9	-15.8

5.1.2 Local Air Quality

- Continued TSP and SO_2 violations are projected for several areas in six AQCRs. (See adjacent map.)
- Thirty-four percent of the projected industrial SO_2 emission increases will occur in counties already in nonattainment for SO_2.
- The large number of Class I areas in Colorado may constrain energy development.

Fig. 8

COLORADO'S PROJECTED NONATTAINMENT AREAS IN 1990



5.1.2.1 Description

According to state ambient air quality data and Mid-Mid Scenario projections, there will be continuing nonattainment for TSP in parts of seven AQCRs and continuing nonattainment for SO_2 in two of those areas. Because SO_2 monitors have only recently been installed and operational, there are few recorded violations of

ambient SO_2 standards and 1975 data exist for only three counties. More violations of SO_2 standards might have been predicted had baseline year SO_2 concentrations been available to include in modeling calculations.

5.1.2.2 Background Issues

- o The air quality throughout urban and industrialized areas of Colorado is characterized by violations of state and federal TSP standards.
- o Violations of state TSP standards are widespread in Colorado.

5.1.2.3 Scenario-Induced Issues

- o Thirty-four percent of the projected industrial SO_2 emission increases will occur in counties already in nonattainment for SO_2.
- o Continuing nonattainment for TSP is projected in AQCRs 35, 36, 37, and 38, which contain the metropolitan areas of Grand Junction, Denver, Boulder, Greeley, Pueblo, and Colorado Springs.
- o No PSD increment violations, however, are predicted in the Mid-Mid Scenario.
- o Approximately three-fourths of the proposed industrial growth in Colorado will occur in nonattainment areas for TSP.
- o Thirty-eight percent of the projected 1990 TSP emissions and 62% of the 1990 SO_2 emissions are from utility coal combustion. Although no significant air quality issues exist for the scenario-projected utility coal expansion, serious air quality problems will arise if utility expansion proceeds as planned by the utility companies.

5.1.3 Water-Related Issues

- o Constraints to the development of new water supplies include funding challenges to new storage projects and enforcement of environmental legislation, especially the Clean Water Act and the Endangered Species Act.
- o The potential for aquifer contamination and drawdown from in situ oil shale conversion must be considered on a per case basis.

5.1.3.1 Description

Colorado's principal basins are the Platte, the Arkansas, the Rio Grande, and the Colorado. The Colorado Basin, especially the Yampa and White Subbasins, contains coal, oil shale, and uranium resources. While on paper (that is, permit applications) the Colorado

River is vastly overappropriated, about 800,000 acre-feet are not presently being used. New storage projects will almost certainly be necessary to make use of this water.

In the Front Range communities of the Eastern Slope (the South Platte Subbasin), substantial quantities of water have been transferred from agricultural to municipal use. Further east, on the High Plains, irrigated acreage has expanded with the use of sprinkler irrigation and groundwater mining from bedrock aquifers.

Aside from their development potential, Colorado's rivers also support a number of highly valued instream uses. The Dolores, the Yampa, and the Green, among others, are being studied for inclusion in the US Wild and Scenic Rivers System. In addition, the natural flowing waters of the Colorado River support two endangered and three threatened fishes. Blue ribbon sport fisheries abound throughout the state.

5.1.3.2 Background Issues

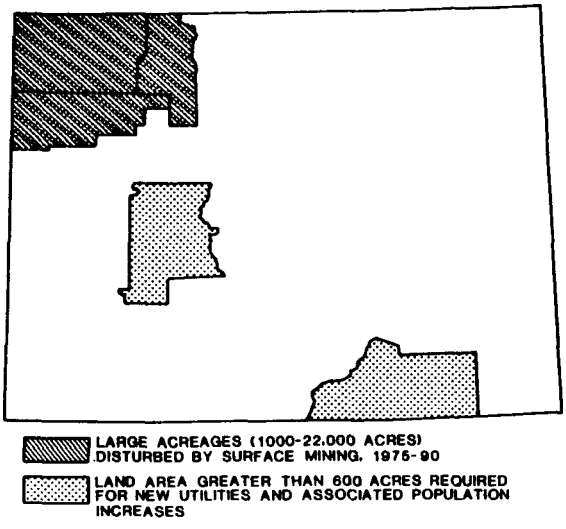
- o Leaching from inactive uranium mine and mill tailings is a major concern in the state.
- o The funding status of new Bureau of Reclamation water development projects is uncertain.
- o The prospect of oil shale commercialization is uncertain; so is the choice of conversion method--surface or in situ retorting.

5.1.3.3 Scenario-Induced Issues

- o Streamflows will provide most of the water for energy development, although the Platte River Power Authority intends to use Ft. Collins waste water for its Rawhide plant. While depletions for energy production constitute a very small fraction of total projected use or supply, they do affect instream uses (critical whooping crane habitat on the central Platte, habitat for the Colorado squawfish, and so forth), however slightly.
- o Water quality impacts from coal mining and shale oil production may be pronounced along reaches of the Yampa, the White, and Piceance Creek.

Fig. 9

COLORADO'S PROJECTED 1990 LAND-USE CHANGES BY SURFACE MINING OR UTILITY CONSTRUCTION



LARGE ACREAGES (1000-22,000 ACRES) DISTURBED BY SURFACE MINING, 1976-90

LAND AREA GREATER THAN 600 ACRES REQUIRED FOR NEW UTILITIES AND ASSOCIATED POPULATION INCREASES

5.1.4 Ecological and Land-Use Impacts

- Large areas of land disturbed by mining, power plant construction, transmission corridors, and associated boomtown development adversely affect croplands, natural vegetation, and fauna including nine endangered animal species and five endangered plant species. Reclamation of steep and often arid slopes is rarely successful in restoring original plant communities, leading to destruction of habitat and changes in species composition.
- Erosion problems in transmission corridors contribute to degradation of water quality and may affect endangered fish, riparian habitats, and recreational values in downstream national parks.

5.1.4.1 Description

Colorado encompasses mountain, prairie, and high plateau with vegetation ranging from grasslands and scrub to arctic-alpine regions extending above timberline. The high altitudes, steep slopes, and arid nature of the western counties, where most energy development will take place, contribute to the difficulty of mitigating land disturbances. The popularity of Colorado as a recreational resource and, increasingly, as a place of permanent residence has brought many ecological idealists to the political fore. Preservation of the natural environment is a major issue in many areas and has temporarily stopped the development of new mines in at least one case.

5.1.4.2 Background Issues

- The erosion of disturbed lands degrades water quality in the Yampa, Green, and Colorado River tributaries, which harbor four endangered species of fish.
- Of the 65,000 acres disturbed by mining prior to 1975, only 14,000 acres have been successfully reclaimed.
- In boomtown areas, game law violations and land disturbance from off-road vehicles have increased sharply.

5.1.4.3 Scenario-Induced Issues

- The threat of energy development activities to nine endangered animal species and five endangered plant species may constrain achievement of the scenario.
- Primary development is in two northwestern counties, which have traditionally been recreation- and ranching-oriented areas.
- SO_2 increases may diminish crop values in one county and limit forage species for the prairie sharp-tailed grouse, which survives in Colorado only in that one county.

5.1.5 Socioeconomic Impacts

- Severe socioeconomic impacts will result from rapid population increases in sparsely populated counties. The burden of amenity development for newcomers and transients rests largely with the current populations.
- Limited availability of private lands in certain development areas is likely to lead to grossly inflated property values.

5.1.5.1 Description

Most energy development in Colorado will occur in areas with small, rural-based populations. The local labor force will be totally inadequate to meet the demands of the new industries. An influx of relatively prosperous wage earners into what have been basically farm and ranch communities will drive prices for goods and services out of reach of the local people on fixed incomes, as demand for limited resources escalates.

5.1.5.2 Background Issues

- Local socioeconomic impacts are defined by the demographic, economic, and social changes associated with the siting, construction, and operation of energy-generating facilities. The interdependencies among labor supply, local public capital, and the availability of accessible sources of goods and services define the most important spheres of socioeconomic impact.
- Characteristic socioeconomic trends attributable to energy developments include the following.
  - --Construction of energy facilities creates an almost instantaneous demand for employees.
  - --If the local labor force is insufficient to fill these demands, new workers and their families create rapid increases in local populations.

--The timing of energy facility construction and operation and the availability of local labor determine the levels of population increase that may be realized in a given county.

--The direct demands of the industry and the increased incomes paid to workers expand wholesale, retail, commercial, industrial, and service employment and, concomitantly, population.

--The larger the demographic differences between the new and existing populations, the more severe are sociocultural problems relating to social organization and particular service needs.

--Revenue imbalance arises as a result of immediate need for services (for example, schools, sewers, police, fire, utilities, and hospitals) and the delayed collection of revenues during plant construction.

--Shortfalls in public revenues and subsequent inadequacies in the provision of public services may have the undesirable consequence of stimulating population turnover, thereby worsening socioeconomic impacts.

--The provision of public services and facilities determines the quality of life that will be experienced by both the new and existing population living in the county.

--If the quality of life decreases enough because of these problems, the productive labor force may leave, resulting in lower productivity in the energy industry, less provision of services, and further social dissolution.

- Increases in population of 10% or more during any given period are considered severe. While the literature will ascribe a 7-15% increase range, the 10% figure used in this analysis is based on Gilmore and Duff's study,* which indicates that such a change is sufficient to result in social problems such as increased crime, divorce, out-migration, labor turnover, etc.

- The capacity for counties to assimilate new employment and population growth is a function of base population size and density, manufacturing employment, and distance to the nearest trade center.

- As a rough guide, counties with different assimilative capacities can absorb, without adverse population in-migration, the following types of energy activities.

  --Extra low assimilative capacity: no commercial scale energy facility or mine.

  --Low assimilative capacity: small mining operations.

*See John S. Gilmore and Mary K. Duff, Boom Town Growth Management: A Case Study of Rock Springs-Green River, Wyoming (Westview Press, Boulder, Colorado, 1975).

--Moderate assimilative capacity: single plants or mines of moderate size.

--High assimilative capacity: single large-scale facilities or multiple facilities of smaller sizes.*

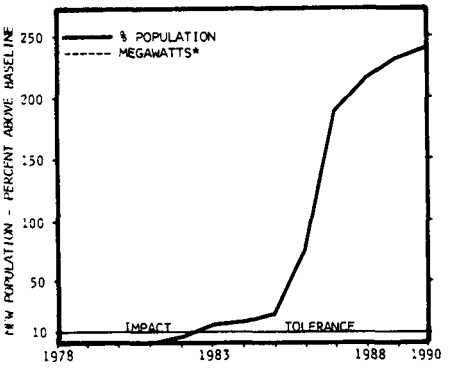
- The Colorado counties identified as potential sites for future mines and energy-generating facilities span the range from extra low to low assimilative capacity.
- Colorado has a long history of mining boomtowns that quickly became ghost towns when the mineral resource was exhausted. The state and local governments are now determined to plan for orderly development and consumption of their resources.

5.1.5.3 Scenario-Induced Issues

- Of 16 counties identified in the scenario, 7 will observe population impacts in excess of 10% growth in one or more years of development activity.
- Most of the proposed development will take place in four counties with extra low to low population assimilative capacity.
- Socioeconomic impacts are expected to be most pronounced in Gunnison, Moffat, Rio Blanco, and Routt Counties, where 71% of the scenario's 56,177 projected new jobs are found.
- Two of the most heavily-impacted counties--Rio Blanco and Moffat--are also subject to future impacts from oil shale deposits in the area.
- All 16 counties identified in the scenario have mining activities for other minerals now in operation.
- Two counties--Moffat and Routt--are expected to observe over 300% actual growth over the 12 years of the scenario.

Fig. 10

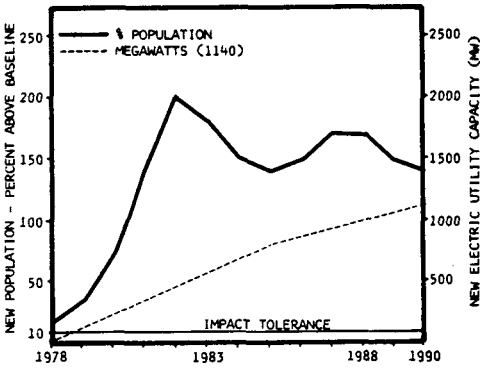
GUNNISON COUNTY, COLORADO,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 11

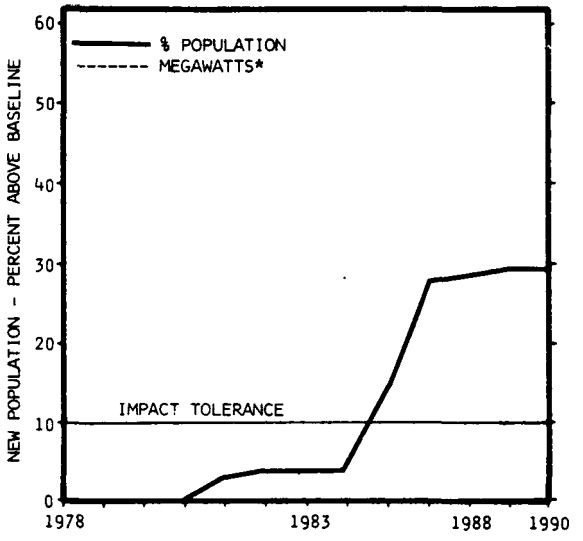
MOFFAT COUNTY, COLORADO,
LOW ASSIMILATIVE CAPACITY



*The above general descriptive statement (five bullets) was drafted by the Energy and Environmental Systems Division of Argonne National Laboratory, May 1979.

Fig. 12

RIO BLANCO COUNTY, COLORADO,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 13

ROUTT COUNTY, COLORADO,
LOW ASSIMILATIVE CAPACITY

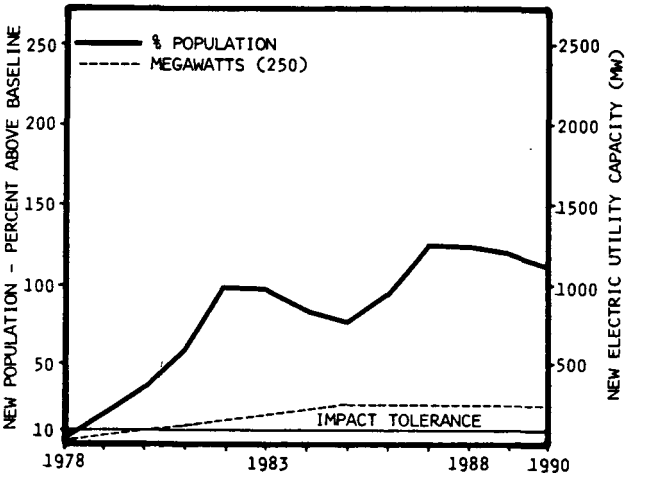
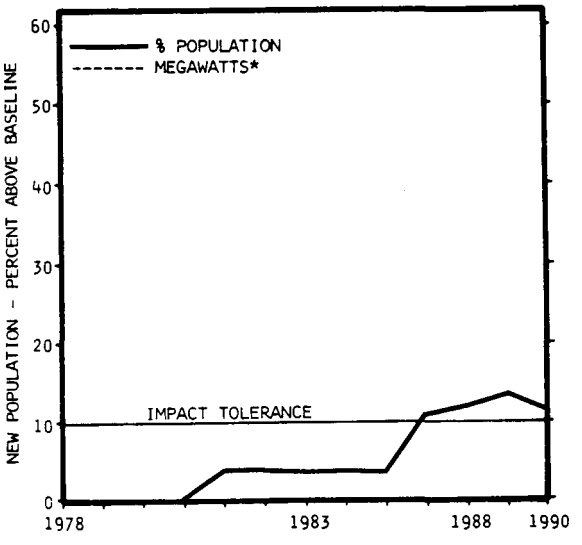


Fig. 14

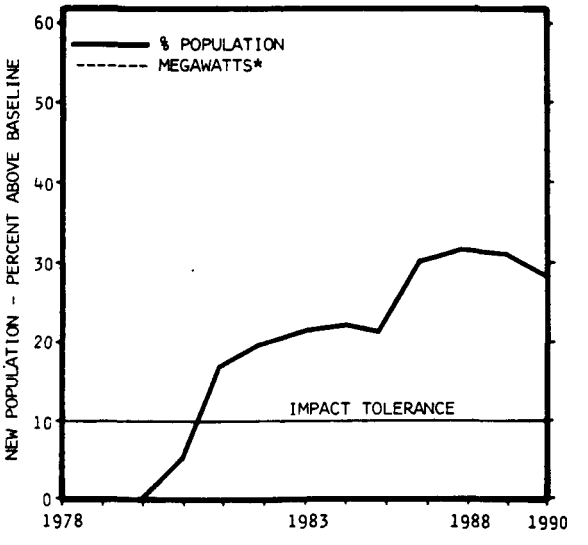
HUERFANO COUNTY, COLORADO,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 15

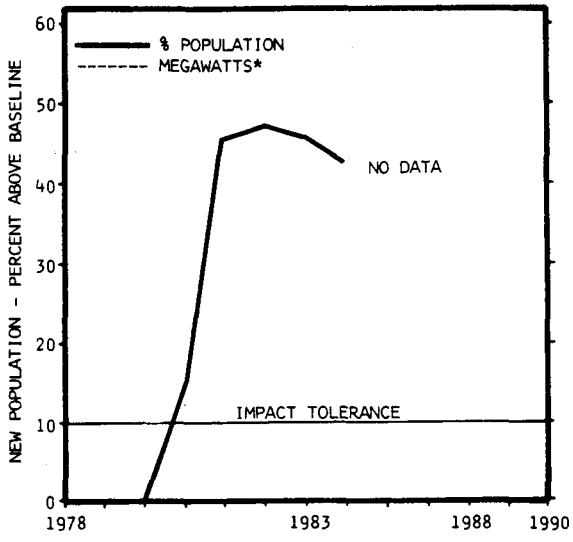
LAS ANIMAS COUNTY, COLORADO,
LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 16

PITKIN COUNTY, COLORADO,
LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

5.1.6 Health and Safety Impacts

- Public health costs as a result of emissions from the state's coal-fired power and gasification plants are expected to be twice that of New Mexico, a producer of more energy but much less densely populated.

5.1.6.1 Description

Colorado is more subject to health and safety impacts than other states in the region because of its greater population and large number of mining activities.

5.1.6.2 Background Issues

- Clean air and associated lack of respiratory problems are important parts of the Colorado "image," which affects tourism and migration.
- Respiratory disease (notably "black lung") is not considered here because it is thought to be preventable, provided coal dust concentrations in inhaled air are to be held to a maximum of 2 mg/m^3 in accordance with present standards.
- Mine safety estimates are less uncertain than those of air pollution-caused health effects largely because the former are based on ample experience and because data have been easy to measure (for example, deaths and injuries). We assume here that improvements in mine safety will not be forthcoming until after 1990.

5.1.6.3 Scenario-Induced Issues

- o Degraded health from increased air pollution will cost the state both in dollars and lost productivity in terms of person-days of work per year.
- o From 1975 to 1990, there will be an order of magnitude increase in coal mining deaths in Colorado.
- o Public health effects from airborne sulfates in Colorado are expected roughly to double from 1975 to 1990, as coal use increases greatly but stringent emission controls are implemented.

Fig. 17

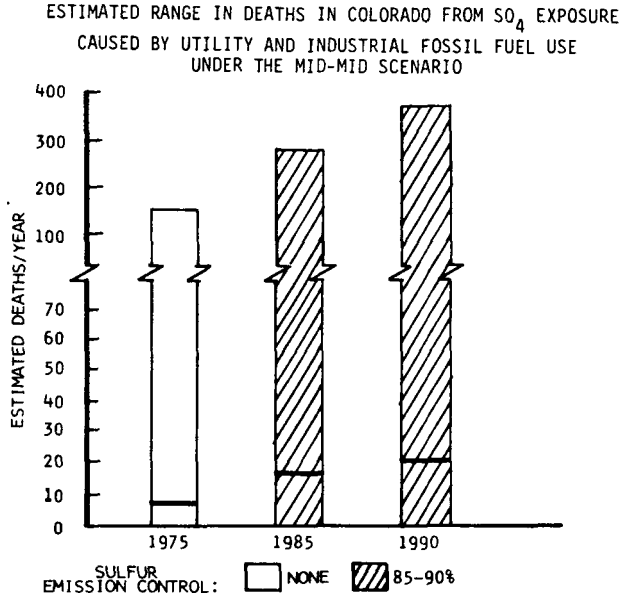
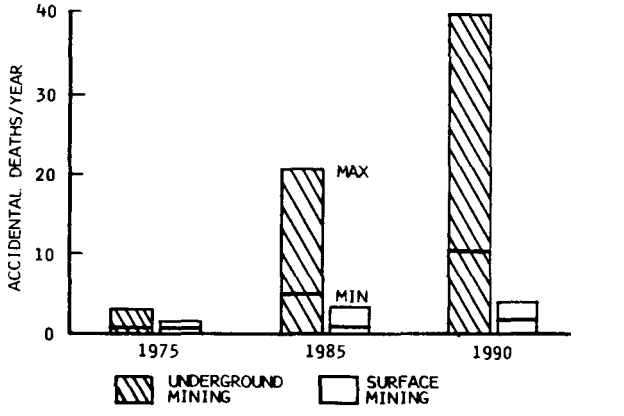


Fig. 18



5.1.7 Solid Waste Impacts

- o Inactive uranium mine and mill tailings are considered a major solid waste problem in Colorado.
- o Increasing local objection to new energy projects is projected because of problems caused by inadequate waste disposal facilities in the past.
- o In some areas, urban, mining, and industrial wastes will have to be transported considerable distances to find disposal sites that meet federal and state standards.

5.1.7.1 Description

Much of Colorado is steep, mountainous terrain encompassing fragile alpine ecosystems, easily-damaged watersheds, and habitat for endangered species. Either because of this steep terrain or the

large amount of federally-owned land in most of Colorado's energy impacted areas, there is little appropriate land available for disposal of urban wastes or mine tailings related to underground mining.

5.1.7.2 Background Issues

- o Uranium mine and mill tailings are contaminating water supplies and being used as gravel supplies and building sites.
- o Colorado no longer allows mine wastes to be dumped on steep slopes that contain critical watersheds.
- o Mine waste leaching contributes to the total dissolved solids (TDS) and total suspended solids (TSS) loads of the Colorado River; the levels of this pollution are controlled by interstate compact.
- o Successful reclamation of mine spoil piles in the mountainous areas of Colorado is difficult. Surface mining had destroyed approximately 65,000 acres by 1965, of which 14,000 acres still have not been reclaimed.
- o In some areas, reclamation permits are being withheld from the energy industry because of limited availability of appropriate land for mine wastes.
- o Whole valleys in Ouray and San Juan Counties have been filled with mine tailings, through which streams filter.
- o Gunnison County contains slopes that usually exceed 45°. In addition, less than 38,000 acres of the county's 2 million acres are available for private development.

5.1.7.3 Scenario-Induced Issues

- o Water contamination from increased human and mine wastes will cause severe problems for hundreds of miles downstream.
- o In Gunnison County, six new coal mines and one uranium mine will increase the population 57.8% by 1985. . In this area of high altitudes, steep slopes, and the headwaters of tributaries of the Colorado River, waste disposal will be difficult. As a result, these energy developments may be constrained.
- o Routt County (6,592 population in 1970) will receive 28,000 temporary and 3,100 permanent new residents according to the scenario. Moffat County (6,332 population in 1970) will acquire 26,000 new, permanent residents as a result of energy development. Gunnison County (7,578 population in 1970) is expected to get 16,000 new residents. The capability or willingness of such small base populations to finance waste facilities alone for these levels of growth will constrain development.

Fig. 19

SOLID WASTE GENERATION FROM INDUSTRIAL COAL USE IN COLORADO

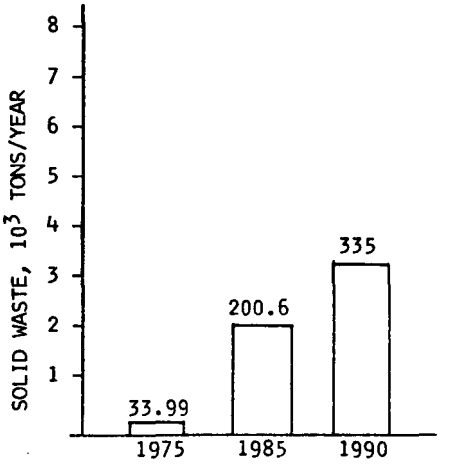


Fig. 20

LAND USE FOR COAL PRODUCTION IN COLORADO

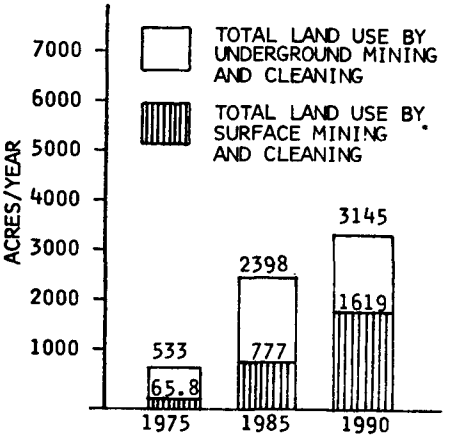


Fig. 21

TOTAL AREA USED FOR INDUSTRIAL ASH AND SLUDGE DISPOSAL IN COLORADO

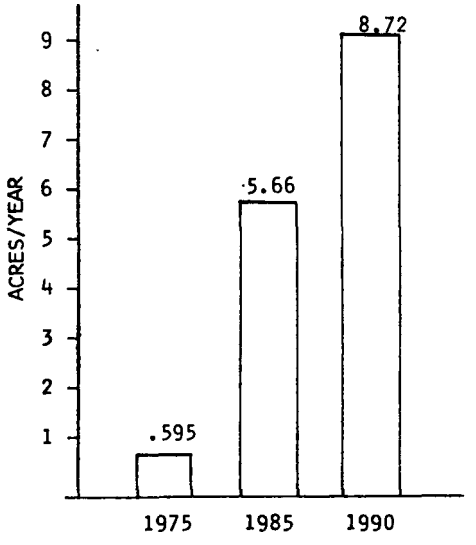


Fig. 22

TOTAL AREA USED FOR UTILITY ASH AND SLUDGE DISPOSAL IN COLORADO

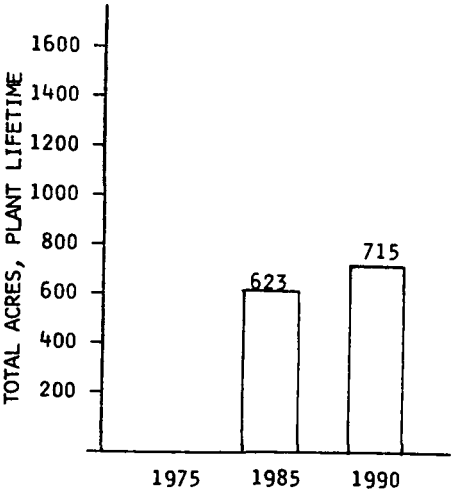
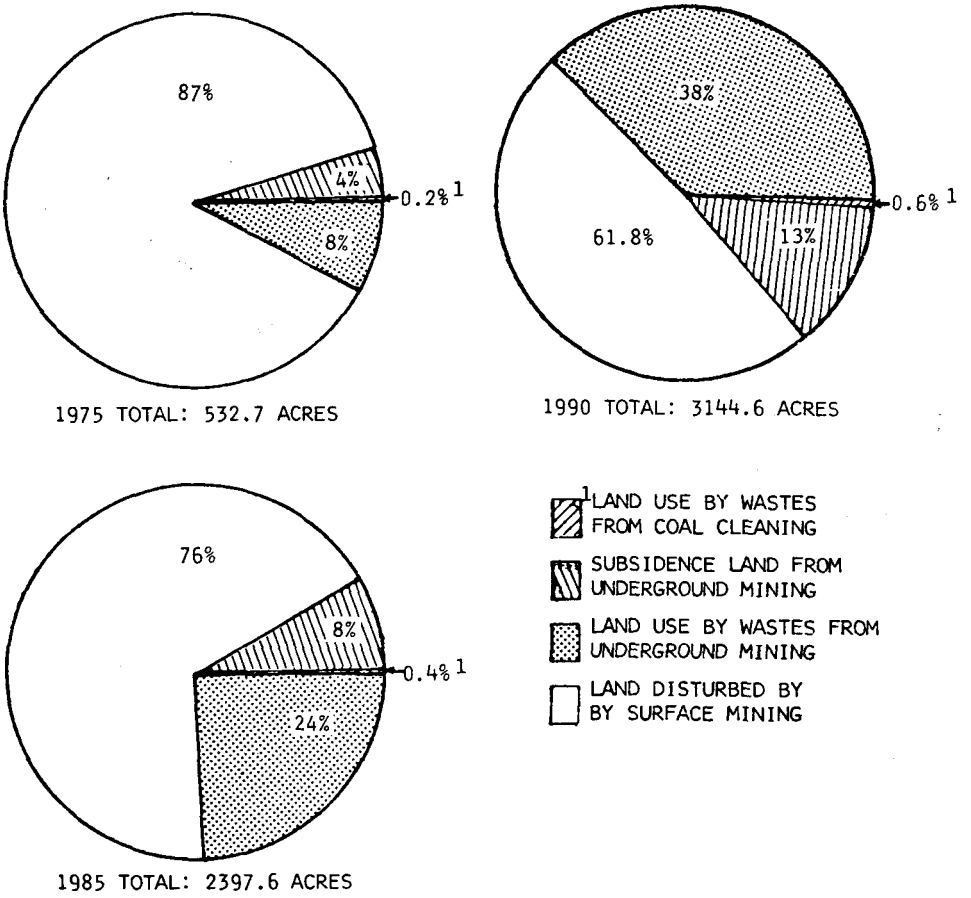


Fig. 23

LAND USE IN COAL MINING AND CLEANING --COLORADO
(Scenario numbers often total more than 100%.)



5.1.8 Institutional Issues

- The Mid-Mid Scenario will not be constrained by existing institutional issues.
- The most important institutional issues related to power plant siting in Colorado are those involving the resolution of environmental concerns and the permitting process.

The primary environmental concern in Colorado is the protection of air quality. Issues that have arisen include EPA's formulation of regulations, the relationship between EPA headquarters and its Denver regional office, and the handling of air quality programs by the state's Department of Health.

Industry officials have criticized the state permitting process for requiring too many permits and being too lengthy. While there is no coordinated permitting process in the state, Colorado is

developing an administrative process for a more coordinated review. State officials feel that the existing siting procedures will be shortened when more experience is gained and a solid data base is established. However, problems of high staff turnover and overlapping state and federal jurisdictions (especially between EPA and the State Air Pollution Control Division) are expected to continue.

5.2 MONTANA

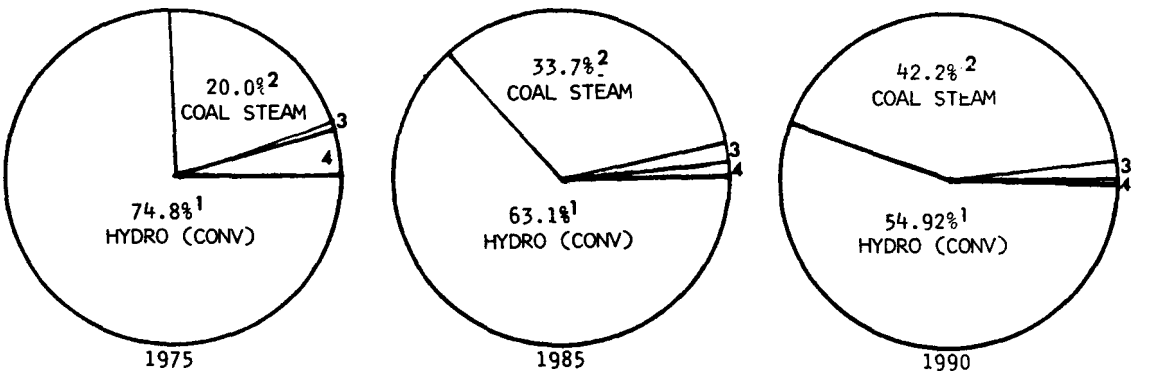
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for Montana, as shown on Table XIII and its companion pie charts (Fig. 24).

Table XIII

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN MONTANA
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	2,069 (74.8%)	2,968 (63.1%)	2,968 (54.9%)	899
[2]Coal Steam	554 (20.0%)	1,584 (33.7%)	2,284 (42.2%)	1,730
[3]Gas Turbine	22 (0.7%)	102 (2.2%)	102 (1.9%)	80
[4]Oil Steam	120 (4.3%)	50 (1.1%)	50 (0.9%)	-70
TOTAL	2,765	4,704	5,404	2,639
Coal Production				
Deep Mines	0	0	0	0
Surface Mines	409	1,296	1,799	1,390

Fig. 24



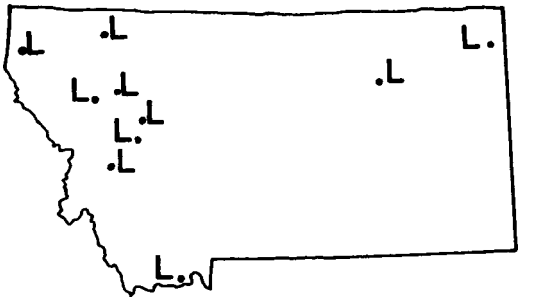
NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

5.2.1 Visibility

- o No significant impairment of visual air quality is projected for the 12 Class I areas located in the state.

Fig. 25

MONTANA'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



5.2.1.1 Description

The visual air quality in nonurban areas of the state is generally superior to that experienced in most other states in the US, but is subject to significant variation. The long-range transport of light-scattering aerosols (sulfates, in particular) is an important factor contributing to the light extinction budgets in nonurban areas of the state.

Visibility is poorest in the northwestern part of the state. The median visual range based upon measurements made at three nonurban/suburban sites for the period 1974-76 ranged from 41 to 65 miles. Median visual ranges calculated for the 12 Class I areas in the state for baseline year 1977 ranged from 38.4 to 77.6 miles.

5.2.1.2 Background Issues

- o Visual air quality is most sensitive to degradation in areas with very good visibility. There is an abundance of such areas in the state.
- o The state's 12 Class I areas are protected against impairment of visual air quality according to recent Congressional legislation.

5.2.1.3 Scenario-Induced Issues

- o All 12 Class I areas in the state are projected to have low impacts. Calculated visual range and its percent change for these areas are shown in Table XIV. No large fossil fuel combustion facilities are projected by the scenario to be sited in counties located near the 12 Class I areas. The projected changes in median visual ranges from 1977 to 1990 are calculated to decrease less than 10%.

- Sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities are projected to be relatively low in 1990, although a growth of 294% is projected from 1975 to 1990.
- The state's imported fraction of the area-weighted particulate sulfate concentration caused by the utility and industrial fossil fuel combustion facilities is predicted to account for 77% of the total.

Table XIV

MONTANA: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

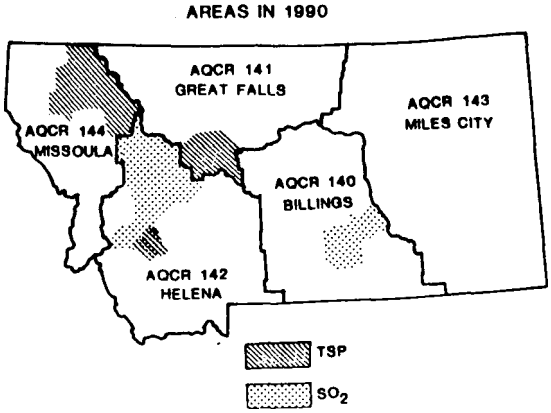
	Visual Range (miles)				
	Calculated			Percent Change From 1977 To	
Class I Area	1977	1985	1990	1985	1990
Anaconda-Pintlar Wilderness	38.4	39.0	38.5	1.4	0.2
Bob Marshall Wilderness	73.7	75.5	75.2	2.4	1.9
Cabinet Mountains Wilderness	51.4	54.6	54.1	6.3	5.4
Gates of the Mountain Wilderness	59.7	60.3	60.0	0.9	0.4
Glacier National Park	77.6	79.5	78.6	2.4	1.3
Medicine Lake Wilderness	73.7	73.3	72.2	-0.5	-2.1
Mission Mountain Wilderness	72.3	73.5	73.1	1.6	1.1
Red Rock Lakes Wilderness	71.1	70.0	69.5	-1.4	-2.1
Scapegoat Wilderness	59.7	60.3	60.0	0.9	0.4
Selway-Bitterroot Wilderness	54.2	58.5	58.3	7.9	7.4
U.L. Bend Wilderness	72.9	71.5	70.4	-2.0	-3.4
Yellowstone National Park	67.2	65.4	64.9	-2.7	-3.5

5.2.2 Local Air Quality

- There is continuing non-attainment for SO_2 in three counties through 1990 and continuing non-attainment projected for TSP in four counties through 1985, and in two of these counties through 1990. (See adjacent map.)
- Designation of Indian reservations as Class I areas will constrain siting of new energy facilities.

Fig. 26

MONTANA'S PROJECTED NONATTAINMENT AREAS IN 1990



5.2.2.1 Description

Smelters are major sources of SO_2 emissions, exceeding state and federal ambient air quality standards both locally and in adjacent counties. There is a large number of Class I areas in Montana. With one important exception, however, Class I areas are not seriously impacted by scenario-projected industrial and utility emissions. SO_2 emissions from the projected power generating units in Rosebud County would exceed the PSD increment for the Northern Cheyenne Indian Reservation, now designated as a Class I area. It should be noted that permission has been denied for the construction of this projected capacity in Rosebud County.

5.2.2.2 Background Issues

- o Violations of ambient air quality standards (AAQS) occur primarily in metropolitan areas and in the vicinity of industrial process plants.
- o Smelter emissions should be reduced by 1990 through compliance with state regulations. New sources, however, will be constrained by offset requirements.

5.2.2.3 Scenario-Induced Issues

- o Scenario-projected industrial emissions are small and will not constitute violations of state or federal AAQS.
- o The expansion of coal-fired power plants constitutes 55% of the projected SO_2 emissions increase in Montana.
- o The utility expansion in Rosebud County will be constrained by the proximity of a newly-designated Class I area. More efficient control technology might reduce emissions to meet PSD requirements.

5.2.3 Water-Related Issues

- o Groundwater and surface water development and water reallocation (transfer) are greatly constrained by Montana statutes. Conversion facilities probably will require extensive use of water conservation technologies and imaginative or expensive sources of supply.
- o Water quality impacts of coal mining are a major concern.

5.2.3.1 Description

The Yellowstone River Basin, especially the Powder and Tongue River Subbasins, encompasses immense low sulfur, strippable coal

reserves (the Ft. Union formation). While rapid expansion of mining is a possibility, air quality constraints and the attitudes of Montanans favor the export of coal by rail rather than conversion at the minemouth. (Export of water in a coal slurry pipeline requires consent of the legislature.)*

Virgin annual flow of the Yellowstone is about 8 million acre-feet/year; present use is about 2.4 million acre-feet/year. In 1979, acting under authority of the Water Use Act of 1973, the state Department of Natural Resources and Conservation reserved stream-flows for fish, wildlife, and water quality equivalent to about 5.5 million acre-feet/year. In addition, the Crow and Northern Cheyenne have potential claims to as much as 1 million acre-feet/year. Thus, new surface water applications for energy conversion facilities are not promising.

Water from Ft. Peck Reservoir on the Missouri River is an alternative source of supply, but it is not clear who has leasing authority--the state or the Bureau of Reclamation. The immense, deep, groundwater resources of the Madison formation are another possible source for development.

5.2.3.2 Background Issues

- Montana is perhaps the most restrictive state in the West with respect to the transfer of water rights from agriculture to industry. A strong burden of proof rests on the transferee to demonstrate that rights of existing users will not be impaired.
- Montana statutes seem to prohibit groundwater mining.
- Montana statutes require that turbidity not be increased above "natural" levels.

5.2.3.3 Scenario-Induced Issues

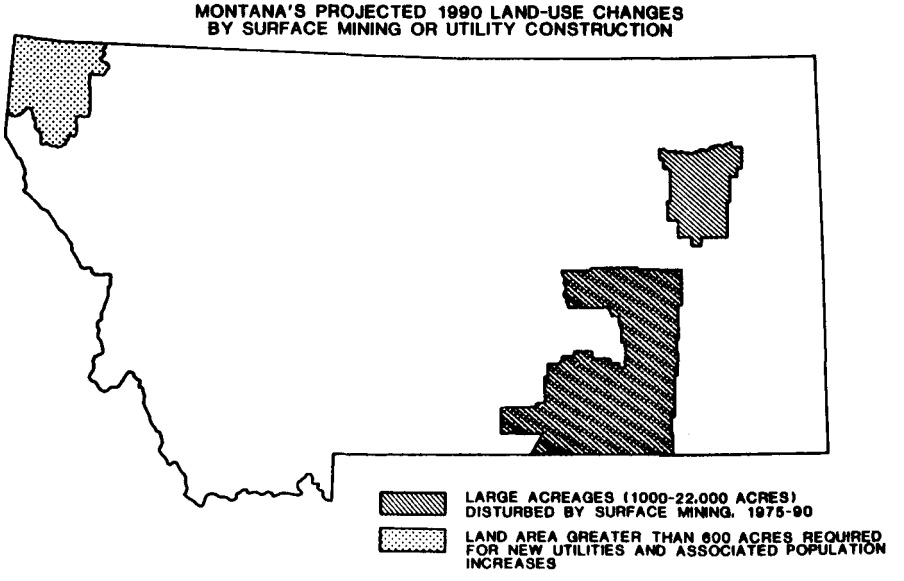
- Modification of runoff patterns and drainage from coal overburden and reclaimed plots add to existing dissolved and suspended solids concentrations in portions of the Big Horn, Tongue, and Powder Rivers.

*For further information, see George Gould, "State Water Law in the West: Implications for Energy Development," Los Alamos Scientific Laboratory report LA-7588-MS, p. 217 (1979).

5.2.4 Ecological and Land-Use Impacts

- o The state has many endangered species of plants and small plains animals. Conflicts at the state and national level can be anticipated as these species continue to decrease in number. Grassland species will be most affected by coal mining activities.
- o The northern floodplain forest ecosystem provides riparian habitat, an uncommon ecotype in this area, and contains critical habitat for many grassland species. Local problems can be anticipated from the effect of predicted SO_2 levels on sensitive species of fescue grasses, some endangered. These are essential to the natural grasslands habitat and maintenance of grazing values. Problems are anticipated in the west-central area of Montana by 1985.

Fig. 27



5.2.4.1 Description

Montana provides critical habitat for a number of animals such as the grizzly bear, which has been eliminated from most of its native range by increasing human populations.

The relatively flat and open high plains of central and eastern Montana will accommodate planned coal mining activity, whereas the rugged mountainous terrain in the western part of the state is scheduled for hydroelectric development.

5.2.4.2 Background Issues

- o One hydroelectric project has been halted by litigation brought by sportsmen and environmentalists in an attempt to preserve wildlife habitat and environmental values. Other projects face intense opposition for similar reasons.

- o Deterioration of water quality in terms of TDS and TSS in the Yellowstone River system is affecting both wildlife habitat and crops.
- o Constraints on water use by the mining industry will compound the difficulty of reclaiming strip-mined lands.

5.2.4.3 Scenario-Induced Issues

- o Peaking use of reservoirs causes fluctuation of reservoir water levels, destroying wildlife habitat and recreational value along shorelines.
- o Hydroelectric facilities alter wild river flow, decreasing the recreational value as a wild river but possibly increasing some other recreational values, such as boating.
- o Increased TDS and TSS loadings in eastern Montana rivers, which are already marginal in quality, may threaten the existence of critical habitats, bringing mining development into conflict with federal and state wildlife and water quality regulations.
- o SO_2 damage to crops in Deer Lodge County is expected to reach $1.2 million by 1990. The annual dollar value of these crops (1977) is $1.9 million.

5.2.5 Socioeconomic Impacts

- o Two counties will experience sharp increases in population. A 40% increase in one county will be followed by a rapid decline over a 3-year period. Problems of financing amenities may delay development.
- o All major projects presently in the planning or permitting stage are highly controversial largely because of widespread opposition to export of electricity.

5.2.5.1 Description

In Montana, the energy production plans are likely to have primary impact on Big Horn and Rosebud Counties. In Big Horn County, 1.59 million acres belong to the Crow and Northern Cheyenne Indian Reservations. The four major new strip mines are just on the edge of the Crow Reservation, in an area where over half of the non-Indian land is federally-owned. The population of the county increased only 8.4% between 1970 and 1975.

5.2.5.2 Background Issues

- o (See 5.1.5.2.)
- o Both impacted Montana counties have low assimilative capacity.

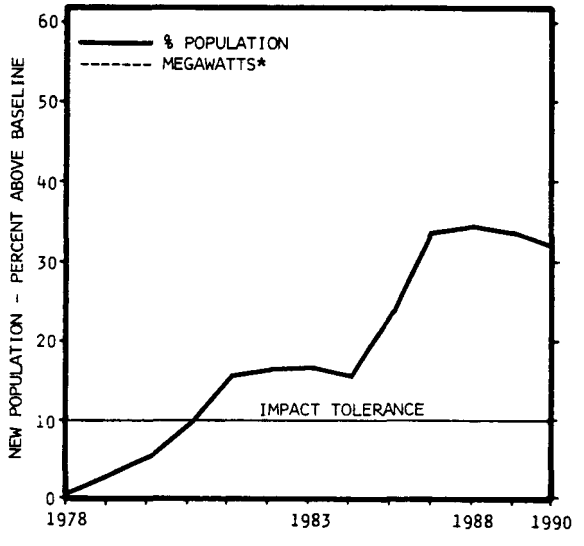
- Energy-related litigation in Montana includes Montana Power's challenge of the Northern Cheyenne Reservation as a Class I air quality area; EPA's challenge of a lower court ruling that Colstrip III and IV projects are not subject to PSD regulation; and a citizens' group claim that there are irregularities in the state's siting process.
- Montana Power has had difficulty in obtaining transmission corridor rights of way from both state and federal agencies.
- Opposition to hydroelectric development has been so intense that new projects are likely to be blocked for the foreseeable future.

5.2.5.3 Scenario-Induced Issues

- Significant delay and the potential for permanent blockage of energy development result from unfavorable local perception of the projects, state environmental standards, and legislative and executive actions of state government.
- Interest groups concerned about the socioeconomic and air quality impacts of the construction of generating units intended to export power will make the development of each successive power unit increasingly difficult through litigation. Pressure is being applied to cancel or reduce the size of plants that do not primarily serve Montana's needs.

Fig. 28

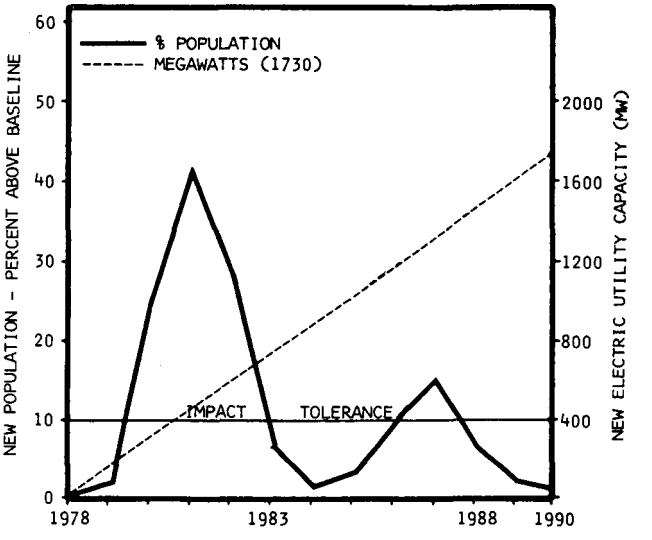
BIG HORN COUNTY, MONTANA,
LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 29

ROSEBUD COUNTY, MONTANA,
LOW ASSIMILATIVE CAPACITY



5.2.6 Health and Safety Impacts

- o Impacts in Montana as a result of scenario-induced changes are expected to be limited largely to the occupational safety hazards of the energy extractive industries.

Fig. 30

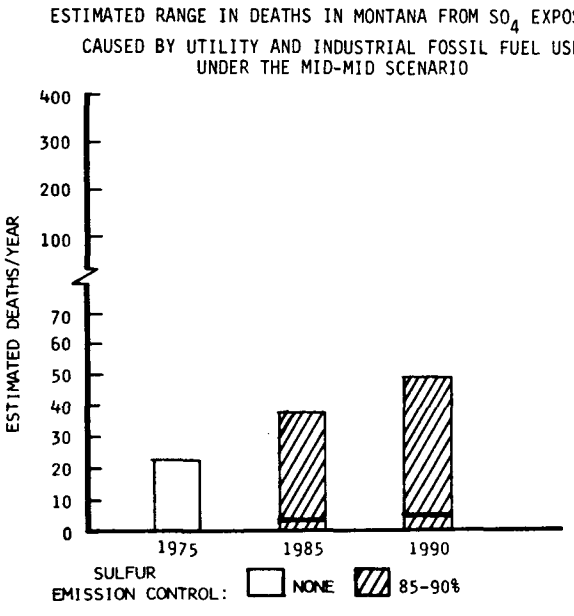
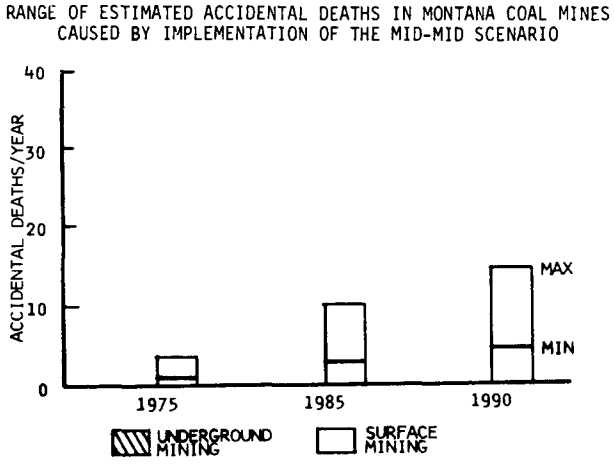


Fig. 31



5.2.7 Solid Waste Impacts

- o Increased populations will cause severe solid waste disposal problems in counties with low permanent populations and much federally-owned or -controlled land.
- o Leaching, wind erosion, and fires at landfill and mine dump sites will impact the Yellowstone River and Indian reservations, thus diminishing air and water quality.

5.2.7.1 Description

In western Montana, the rugged terrain and large areas of federal or Indian lands severely limit the availability of suitable mine and urban waste disposal sites. The ability of the towns in energy-impacted areas to provide waste disposal services is limited by the willingness of these small base populations to accept a doubling and tripling of their financial burden. Eastern Montana, part of the Great Plains, must protect its limited and multi-use water supply, even though it has no other problems in finding waste disposal sites.

5.2.7.2 Background Issues

- Montana does not have state laws governing solid waste disposal, but a local permit is required. About 61% of the population is served by locally-approved waste facilities, the best percentage in the region.
- Leaching from old mine wastes has affected the water quality in the Powder River for many years.
- Butte, Montana, has been concerned about the former use of uranium mine tailings as gravel in the walls of school buildings and as fill for macadam in its city streets. In addition, many of the old mill and mine tailing sites have not yet been identified.
- Montana has an overt policy of "strip and ship" and, therefore, has little problem with utility and industrial ash and sludge.
- The enforcement of reclamation regulations in the Great Plains part of Montana has been quite effective, including the burial of coal wastes before the overburden is dropped on a long-wall cut.
- Montana coal has little need for cleaning. Policy requires burial of cleaning wastes in land already disturbed by surface mining.

5.2.7.3 Scenario-Induced Issues

- New hydroelectric plants are projected to produce 900 additional MWe of electricity in Lincoln County by 1990. Libby, the county seat, had a population of 3,286 in 1970. The capability of such a town to provide the infrastructure for the population needed to construct three major hydroelectric plants without assistance is doubtful.

Fig. 32

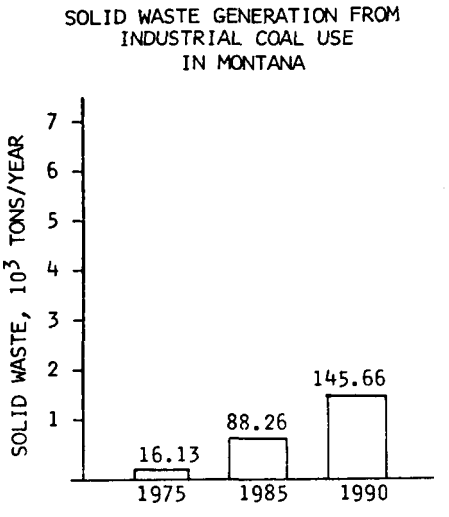


Fig. 33

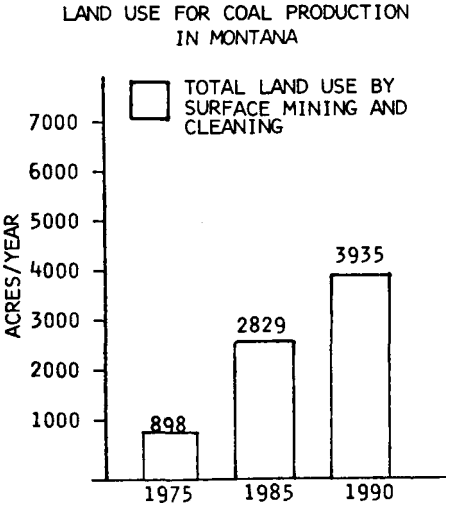


Fig. 34

TOTAL AREA USED FOR INDUSTRIAL
ASH AND SLUDGE DISPOSAL
IN MONTANA

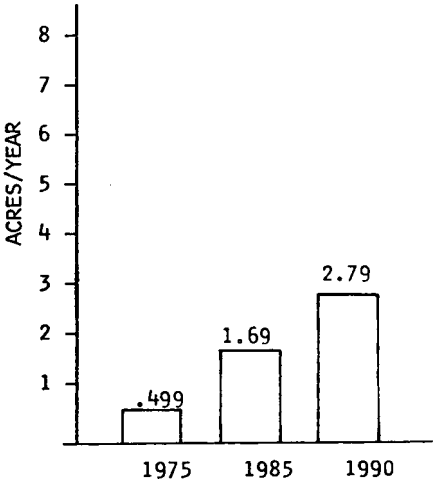


Fig. 35

TOTAL AREA USED FOR UTILITY
ASH AND SLUDGE DISPOSAL
IN MONTANA

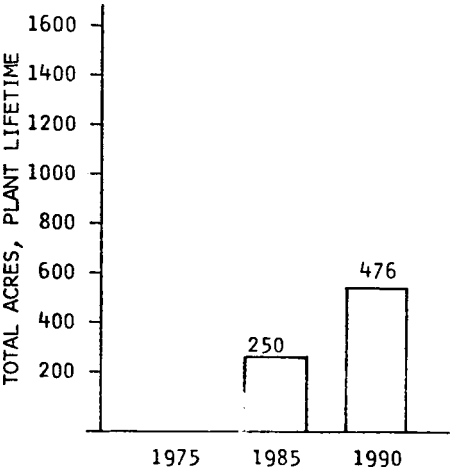
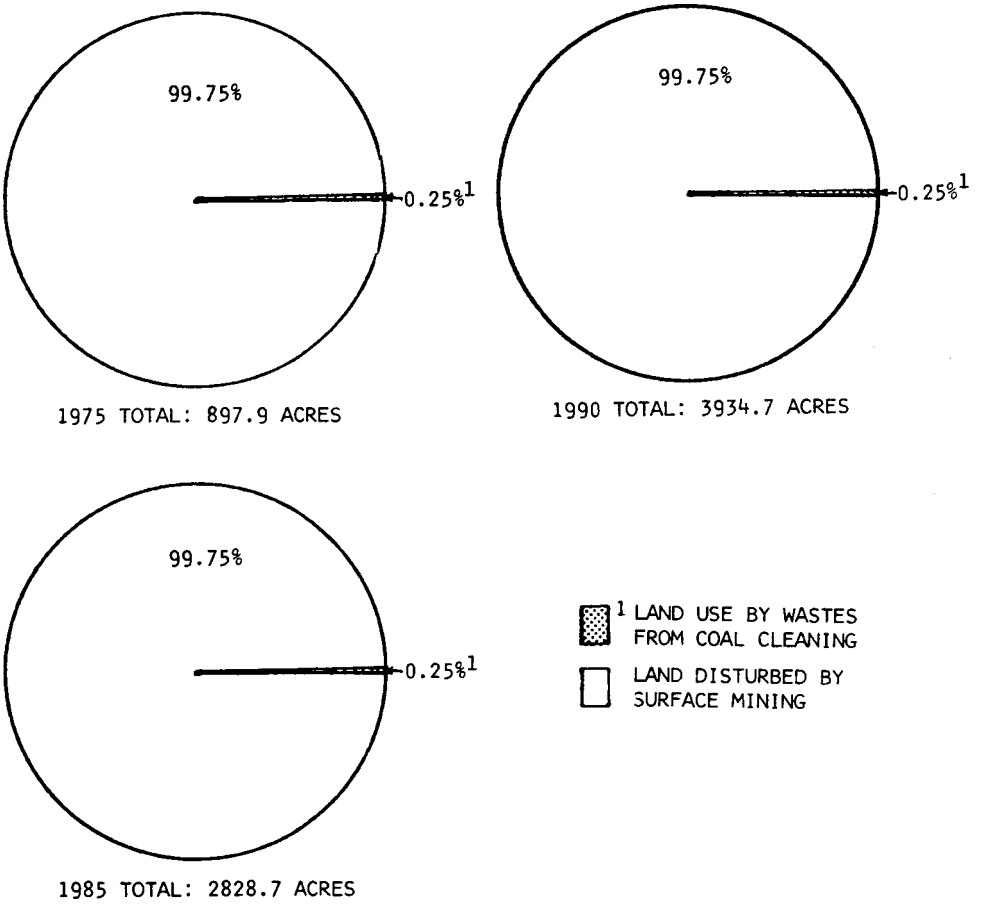


Fig. 36

LAND USE IN COAL MINING AND CLEANING--MONTANA



5.2.8 Institutional Issues

- o Protection of Class I area airsheds will constrain projected utility expansion in Rosebud County.
- o Institutional issues that may arise beyond 1990 or in the case of an accelerated scenario are state policies on the export of electricity and on the determination of need, as described in the following paragraphs.

The state is likely to play an increasingly important role in the determination of need; any project built for the export of power will be highly controversial. Montana has an implicit "strip and ship" policy and questions its responsibility for satisfying the power needs of other states. Without an explicit export policy, it is difficult to define the need for additional generating capacity to be constructed in the state. The difficulty in addressing this question has complicated siting proceedings for all interest groups. As a result, the Department of Natural Resources and Conservation has introduced legislation that would provide them with an in-house forecasting capability to help define the need for additional capacity.

Disagreement with the need for new power plants is based only partly on the export of power issue. Environmentalists also believe that the industry has not adequately supported conservation and alternative technologies, which they believe will reduce the need for new large-scale generating capacity. The opposition is also a reaction to the federal forecasts of the early 1970s, which alarmed Montanans by suggesting that vast coal resources would be exploited and that many new power plants would be built.

The major environmental issues relate to air quality management. Environmental regulations probably will be maintained in their present form; however, the available airshed will be diminished. A major issue is the designation of the Northern Cheyenne Reservation, near the Colstrip units, as a Class I air quality area and the potential for other such designations. Class I designations seriously limit the areas in which power plants may be located and affect the air pollution control technologies that must be utilized.

5.3 NORTH DAKOTA*

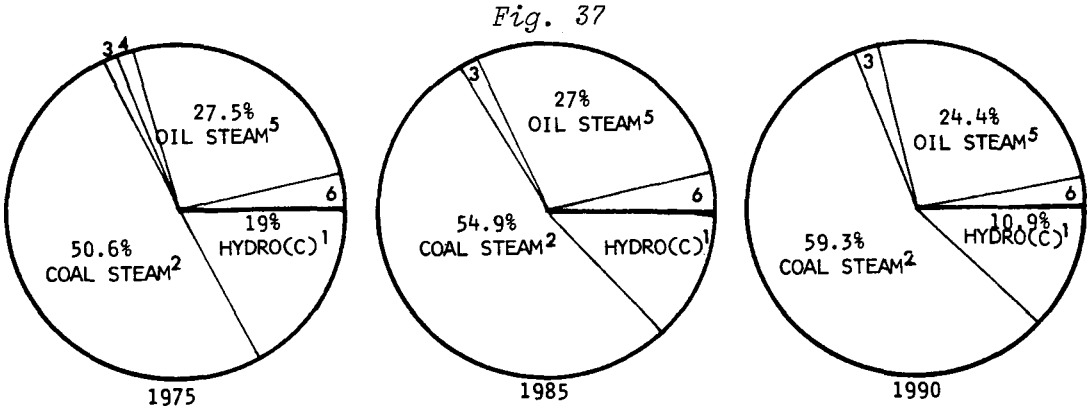
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for North Dakota, as shown on Table XV and its companion pie charts (Fig. 37)

Table XV

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN NORTH DAKOTA
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	459 (19.0%)	459 (12.1%)	459 (10.9%)	0
[2]Coal Steam	1,221 (50.6%)	2,088 (54.9%)	2,498 (59.3%)	1,277
[3]Gas Turbine	8 (0.3%)	58 (1.5%)	58 (1.4%)	50
[4]Gas Steam	2 (0.1%)	0 (0%)	0 (0%)	-2
[5]Oil Turbine	60 (2.5%)	170 (4.5%)	168 (4.0%)	108
[6]Oil Steam	664 (27.5%)	1,029 (27.1%)	1,028 (24.4%)	364
TOTAL	2,414	3,804	4,211	1,797
Coal Production				
Deep Mines	0	0	0	0
Surface Mines	115	778	1,200	1,085

Fig. 37



NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

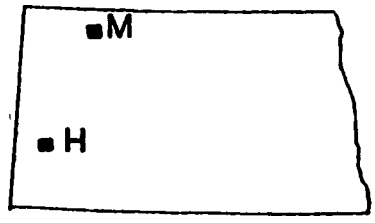
*Parts of this section were provided by Argonne National Laboratory.

5.3.1 Visibility

- o High to medium impairment of visual air quality is projected for the two Class I areas located in the state.
- o The long-range transport of particulate sulfates into the state is expected to be a major factor contributing to visibility impairment.

Fig. 38

NORTH DAKOTA'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



5.3.1.1 Description

The visual air quality in nonurban areas of the state is not as good as in similar areas in the Rocky Mountain portion of the region, but is generally superior to that found in most other states in the US. The long-range transport of light-scattering aerosols (sulfates, in particular) is a major factor contributing to the impairment of visual air quality in urban and nonurban areas of the state.

Visibility is best in the western part of the state where the two Class I areas are located. According to an isopleth map* of median visual ranges for the US for the period 1974-76, median visual ranges in the state ranged from less than 25 miles in the eastern part of the state to greater than 45 miles in the western part. (These numbers are subject to substantial uncertainty because the data used to draw the isopleth were scant in this area.) Median visual ranges calculated for the two Class I areas in the state for baseline year 1975 ranged from 67.2 to 75.3 miles.

5.3.1.2 Background Issues

- o Visual air quality is most sensitive to degradation in areas with very good visibility. Good visibility is found in the western part of the state.
- o The two Class I areas in the state are protected against impairment of visual air quality according to recent Congressional legislation.

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*J. Trijonis and D. Shapland, "Existing Visibility Levels in the US," Technology Service Corporation, Santa Fe, New Mexico (1978).

5.3.1.3 Scenario-Induced Issues

- o Lostwood Wilderness is projected to have a 10-20% decrease in visual range from 1975 to 1990, rated as a medium regional haze impact.
- o Theodore Roosevelt National Monument is projected to have a greater than 20% decrease in visual range from 1975 to 1990, rated as a high regional haze impact.
- o Calculated visual range and its percent changes for the two Class I areas in the state are shown in Table XVI.
- o Air pollution sources located outside the state are predicted to have a major impact on the impairment of visual air quality in the state. The state's imported fraction of the area-weighted particulate sulfate concentration caused by utility and industrial fossil fuel combustion facilities is predicted to account for 83% of the total.
- o Sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities in the state are projected to grow 54.7% during the period 1975-90.

Table XVI

NORTH DAKOTA: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

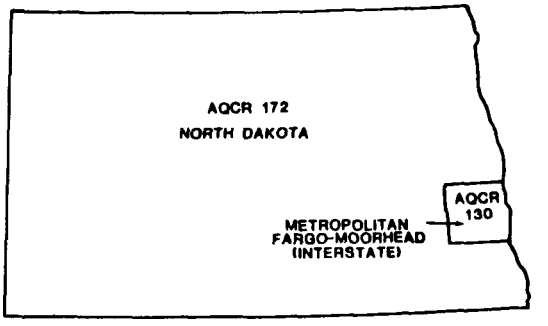
	Visual Range (miles)				
	Calculated			Percent Change From 1975 To	
Class I Area	1975	1985	1990	1985	1990
Lostwood Wilderness	76.3	64.8	62.2	-15.1	-18.6
Theodore Roosevelt National Memorial Park	68.0	50.3	4 .0	-26.0	-31.0

5.3.2 Local Air Quality

- o North Dakota's entire proposed coal growth is adjacent to PSD Class I protected areas. PSD regulations are likely to place significant constraints on such growth.

Fig. 39

NORTH DAKOTA'S AIR QUALITY CONTROL REGIONS (NO PROJECTED NONATTAINMENT AREAS IN 1990)



5.3.2.1 Description

North Dakota has no counties that have failed to achieve primary or secondary sulfur dioxide and particulate air quality standards. Air quality throughout the state appears to be sufficiently good to allow

increased combustion while maintaining standards. Approximately 75,000 acres of North Dakota have been designated as PSD Class I. Lostwood National Wilderness area is located on the northwestern border. Theodore Roosevelt National Memorial Park is located on the central western border of the state. About 77% of the state's fossil fuel for electrical generation comes from coal; 17% comes from natural gas. North Dakota uses local fuel ranging in sulfur content from 0.4 to 0.7%.

5.3.2.2 Background Issues

- o North Dakota has over 75,000 acres of PSD Class I designated area. This region will be protected with stringent limitations on new emissions within the designated area. Surrounding areas will be influenced by PSD regulations.

5.3.2.3 Scenario-Induced Issues

- o All of North Dakota's proposed coal growth must comply with PSD regulations.

5.3.3 Water-Related Issues

- o At least until 1990, the quantity of water consumed for energy production will be trivial compared to available supply.
- o Substantial coal mining activity may affect water quality and streamflow patterns on the prairie/badland streams of the western Dakotas.

5.3.3.1 Description

Substantial lignite resources of the Ft. Union formation, south and west of the Missouri River, are likely to fuel minemouth electricity and coal gasification facilities. Several streams run through the coalfields--the Little Missouri, the Heart, the Cannonball, and the Knife. The Little Missouri, running through Theodore Roosevelt National Park, is a state-designated Wild and Scenic River. Segments of the Heart, the Cannonball, and the Knife Rivers are designated Class I by the North Dakota Game and Fish Department for high-valued fishery, aesthetic, and other instream resources.

The principal sources of water available for energy development are Lakes Sakakawea and Oahe, storage facilities of the Bureau of Reclamation on the Upper Missouri River. The Bureau proposes to

lease up to 1 million acre-feet to industrial users from these and four other reservoirs in the Upper Missouri River Basin. One million acre-feet represents 3.5% of the average annual flow of the Missouri River at Sioux City, Iowa. Groundwater from the Madison formation represents an alternative source of supply.

5.3.3.2 Background Issues

- o American Natural Resources submitted an application to the state for 335,000 acre-feet/year, enough for over thirty 250 million ft^3/d coal gas plants. The magnitude of the request unnecessarily aroused the concern of many North Dakotans.*
- o Non-point source pollution is a problem, particularly on the intermittent streams of the western Dakotas.

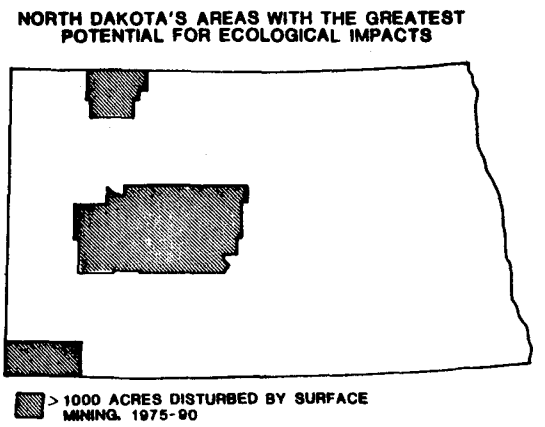
5.3.3.3 Scenario-Induced Issues

- o According to Argonne National Laboratory, western Dakota's streams will experience a tenfold increase in total dissolved solids concentrations from coal mining (22 mg/ℓ in 1975 to 220 mg/ℓ in 1990).

5.3.4 Ecological and Land-Use Impacts

- o Ninety-eight percent of North Dakota's land is used for agricultural development, much of it in grain production. Large acreages will be impacted by surface mining, creating erosion and reclamation problems in those areas. There are three endangered plant species and two endangered animal species in North Dakota, the northern kit fox and the black-footed ferret, which may be affected by energy development, and, therefore, may constrain industrial development.

Fig. 40



*For further information, see William Humm and Edward Selig, "Water Availability for Energy Industries in Water-Scarce Areas: Case Studies and Analyses," prepared by Energy Resources Company for US Department of Energy, Division of Policy Analysis (1979).

5.3.5 Socioeconomic Impacts

- Severe socioeconomic impacts are projected for five scenario-defined sites for energy development in North Dakota. The number of available workers in these and adjacent counties is insufficient to fill all the newly-created jobs. These areas will experience shortages of local public services and subsequent price effects on private sector goods.

5.3.5.1 Description

North Dakota is the eighth most sparsely-settled state within the US, averaging only 8.7 persons per square mile. The primary industry is agriculture, with 98% of the 69,280 square miles devoted to the production of barley, flaxseed, wheat, rye, and oats; agricultural employment was 46,071 in 1975. The fuel sector, excluding processing, employs 1,413 persons out of the total state employment of 313,702.

Through its legislative powers, North Dakota has already dealt with some of the social and economic problems encountered in the accelerated pace of energy developments and coal extraction rates. It has established programs and policies to subsidize and compensate the communities for the fiscal impacts they have already experienced. These impacts resulted from increased drilling for oil and natural gas, development of coal mined to generate electric power, and construction of extra-high voltage lines and direct current transmissions to markets.

5.3.5.2 Background Issues

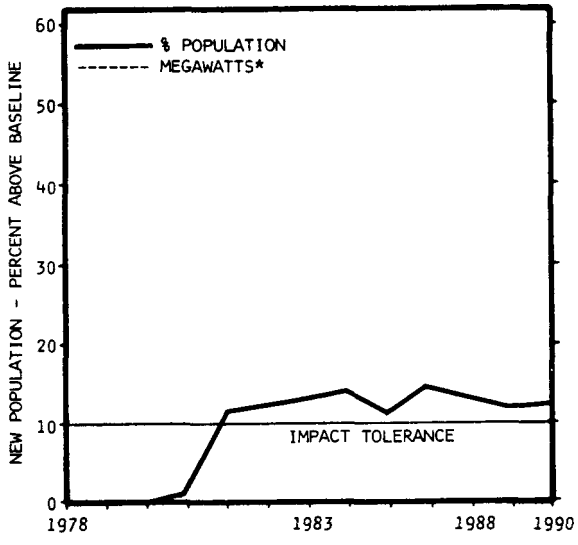
- (See 5.1.5.2.)
- All five North Dakota counties identified as potential sites for future mining or energy-generating facilities have extra low assimilative capacity.
- North Dakota has adopted administrative tools to provide impact mitigation assistance to local governments.

5.3.5.3 Scenario-Induced Issues

- The scenario projects additional construction and expansion where existing energy developments are presently causing impacts.
- The impacted counties--Bowman, Dunn, McLean, Mercer, and Oliver--are situated in the west-central and southwestern sections of the state and are projected to absorb 100% of the coal generating capacity, 80% of the oil, and 95% of the new mining identified in the state scenario.
- These identified counties are characterized as coal resource rural areas with very small populations and nonindustrialized economies, and without accessible commuting distances to trade centers.
- The intense coal development and minemouth generating facilities risk potentially adverse socioeconomic impacts, fiscal difficulties of expanding services and providing consumer goods, shortages of housing, social disruption, and dissolution and interference with agricultural land and activities.
- The construction period population influx is estimated to be 12,078 persons, of which 5,624 are required for the operation of the minemouth generating plants and for mining activities. The weighted average construction phase population growth occurring in each of the five impacted counties is 38.4%, whereas the permanent in-migrants account for an average 16.9% increase.
- During operation of the new generating facilities and mines, all five counties require additional in-migrant labor beyond the construction phase. This additional growth will significantly increase public expenditures for education, water treatment, sewage, and hospitals, with smaller increases for all other public services analyzed in the scenario.
- It is presently uncertain whether the established programs within the state would mitigate the scenario-projected profile of fiscal and employment impacts attributable to the energy developments.

Fig. 41

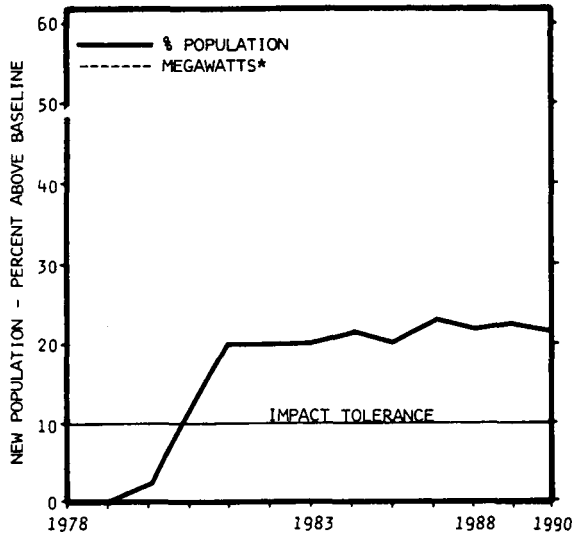
BOWMAN COUNTY, NORTH DAKOTA,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 42

DUNN COUNTY, NORTH DAKOTA,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 43

MC LEAN COUNTY, NORTH DAKOTA,
EXTRA LOW ASSIMILATIVE CAPACITY

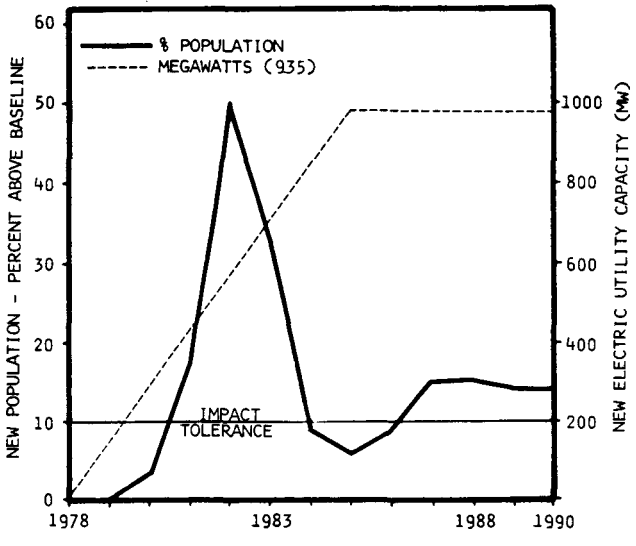


Fig. 44

MERCER COUNTY, NORTH DAKOTA ,
EXTRA LOW ASSIMILATIVE CAPACITY

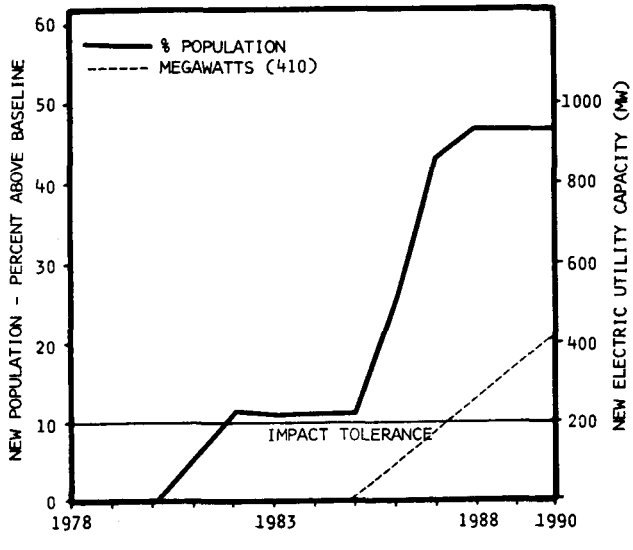
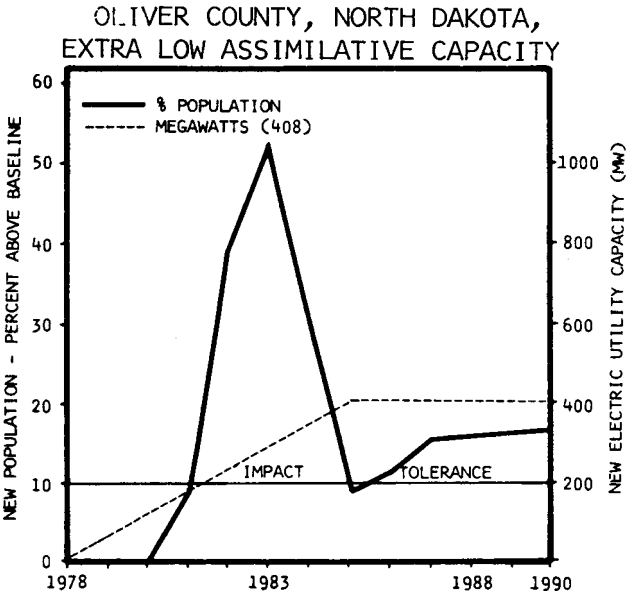


Fig. 45



5.3.6 Health and Safety Impacts

- o Occupational health impacts of projected energy-related development in North Dakota will be minimal.
- o Public health impacts also will be minimal.

5.3.6.1 Description

North Dakota is sparsely-settled and has low levels of coal production (mostly surface).

5.3.6.2 Background Issues

- o Health issues are restricted to occupational safety hazards associated with energy-extractive industries.
- o Relatively low-risk surface techniques of coal extraction will keep accidents and incidence of respiratory disease low.

5.3.6.3 Scenario-Induced Issues

- o From 1975 to 1990, coal production in North Dakota will increase by an order of magnitude, with subsequent doubling of its population's exposure to airborne sulfates.
- o Occupational hazard levels in terms of deaths per year are low under the scenario, relative to those in other states in the region.

- Oil production and refining and the low levels of natural gas production and electricity generation under the scenario will not contribute significantly to occupational or public health effects.

Fig. 46

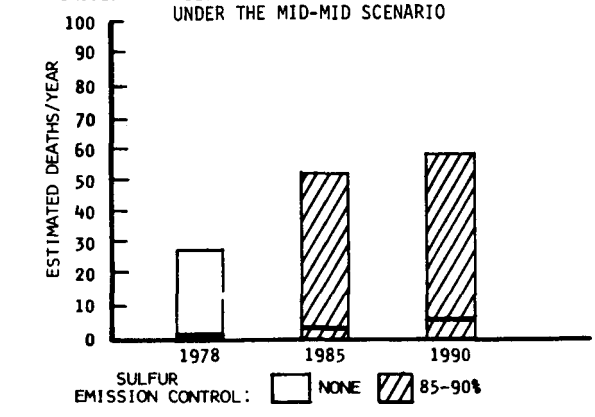
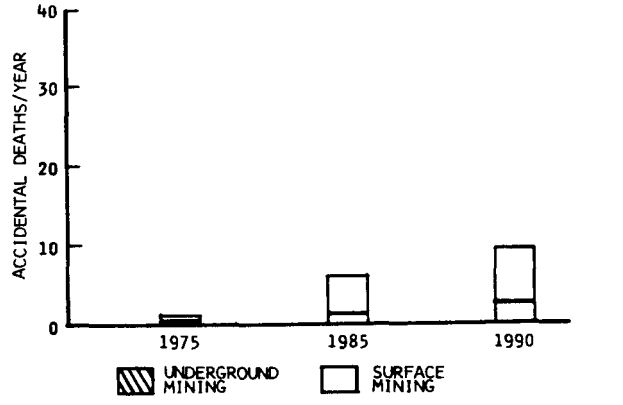


Fig. 47



5.3.7 Solid Waste Impacts

- Although a significant percentage increase in industrial solid waste generation is projected, the actual amount is relatively small and no disposal problems are foreseen.
- Land requirements for utility solid waste disposal should pose no significant problems.

5.3.7.1 Description

Most of North Dakota is part of the Great Plains and, thus, has plenty of appropriate disposal sites, if erosion problems are avoided. However, the presence of the Black Hills, several Indian reservations, and national parks could delay permit approval for solid waste sites.

5.3.7.2 Background Issues

- Industrial coal use is low--only 90,000 tons in 1975.
- Land use for industrial solid waste disposal amounted to 0.1 acre in 1975.

5.3.7.3 Scenario-Induced Issues

- Industrial coal use is projected to increase by over 600% for the period 1975-90; however, coal use in 1990 still only amounts to 660,000 tons/year.

- Land use for industrial disposal will increase by over 800%, but this will amount to slightly over 1 acre/year.
- No waste disposal problems are projected for North Dakota.
- Installed coal-fired capacity is projected to increase to 2500 MW by 1990, a 166% increase over 1975. Disposal requirements for the lifetime of the new plants amount to 558 acres.

Fig. 48

SOLID WASTE GENERATION FROM INDUSTRIAL COAL USE IN NORTH DAKOTA

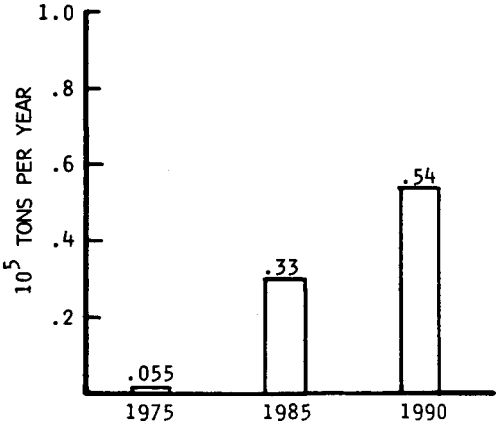


Fig. 49

LAND USE FOR COAL PRODUCTION IN NORTH DAKOTA

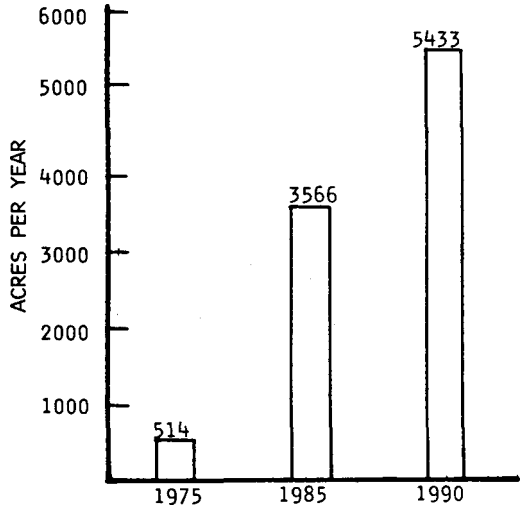
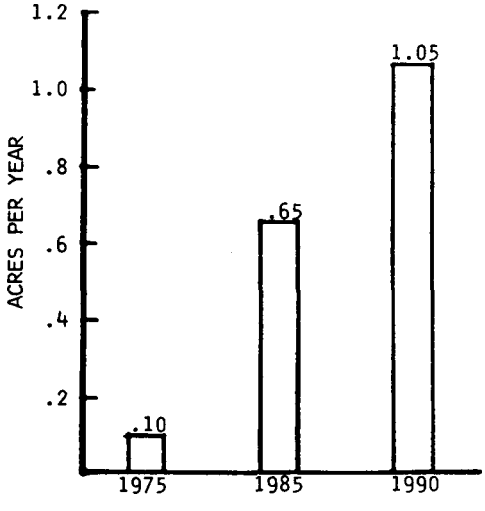


Fig. 50

TOTAL AREA USED FOR INDUSTRIAL ASH AND SLUDGE DISPOSAL IN NORTH DAKOTA



5.4 SOUTH DAKOTA*

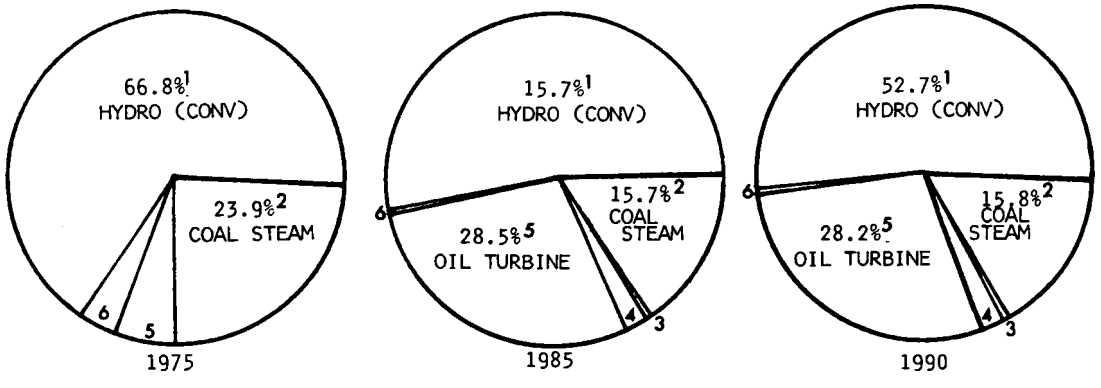
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for South Dakota, as shown on Table XVII and its companion pie charts (Fig. 51).

Table XVII

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN SOUTH DAKOTA
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	1,615 (66.8%)	1,615 (52.5%)	1,615 (52.7%)	0
[2]Coal Steam	577 (23.9%)	483 (15.7%)	483 (15.8%)	-94
[3]Gas Turbine	0 (0%)	20 (0.7%)	20 (0.7%)	20
[4]Gas Steam	0 (0%)	65 (2.1%)	65 (2.1%)	65
[5]Oil Turbine	143 (5.9%)	877 (28.5%)	864 (28.2%)	721
[6]Oil Steam	84 (3.5%)	19 (0.6%)	19 (0.6%)	-65
TOTAL	2,419	3,079	3,066	647
Coal Production	0	0	0	0

Fig. 51



NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

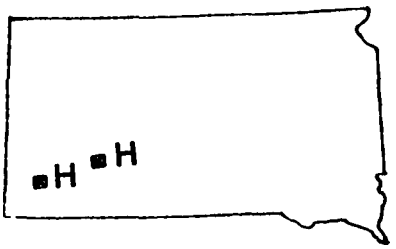
*Parts of this section were provided by Argonne National Laboratory.

5.4.1 Visibility

- o High impairment of visual air quality is projected for the two Class I areas located in the state.
- o The long-range transport of particulate sulfates into the state is expected to be a major factor contributing to visibility impairment.

Fig. 52

SOUTH DAKOTA'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



5.4.1.1 Description

The visual air quality in nonurban areas of the state is not as good as in similar areas in the Rocky Mountain portion of the region. The long-range transport of light-scattering aerosols (sulfates, in particular) is a major factor contributing to the impairment of visual air quality in urban and nonurban areas of the state.

Visibility is best in the western part of the state where the two Class I areas are located. The median visual range based upon measurements made at two nonurban/suburban sites for the period 1974-76 ranged from 20 to 45 miles. Median visual ranges calculated for the two Class I areas in the state ranged from 60.2 to 66.9 miles for baseline year 1975.

5.4.1.2 Background Issues

- o Visual air quality is most sensitive to degradation in areas with very good visibility. Good visibility is found in the western part of the state.
- o The two Class I areas in the state are protected against impairment of visual air quality according to recent Congressional legislation.

5.4.1.3 Scenario-Induced Issues

- o The two Class I areas--Badlands Wilderness and Wind Cave National Park--are projected to have a greater than 20% decrease in visual range from 1975 to 1990, rated as high regional haze impacts. Calculated visual range and its percent change for the two Class I areas are shown in Table XVIII.

- Air pollution sources located outside of the state are predicted to have a major impact on the impairment of visual air quality in the state. The state's imported fraction of the area-weighted particulate sulfate concentration for the state caused by utility and industrial fossil fuel combustion facilities is predicted to account for 95% of the total.
- Sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities in the state are projected to grow 73% during the period 1975-90.

Table XVIII

SOUTH DAKOTA: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

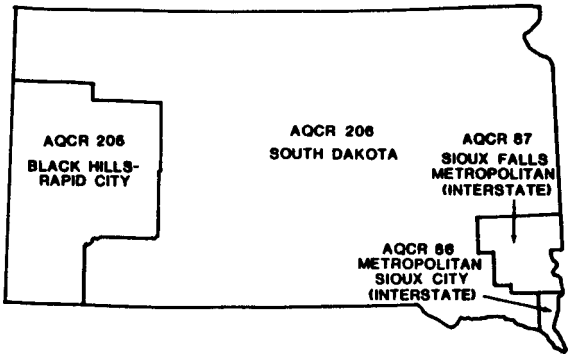
	Visual Range (miles)				
	Calculated			Percent Change From 1975 To	
Class I Area	1975	1985	1990	1985	1990
Badlands Wilderness	67.7	50.1	46.8	-26.0	-31.0
Wind Cave National Park	60.8	42.2	39.0	-30.6	-36.0

5.4.2 Local Air Quality

- Over one-third of South Dakota's oil growth has been proposed in a PSD Class I area.

Fig. 53

SOUTH DAKOTA'S AIR QUALITY CONTROL REGIONS (NO PROJECTED NONATTAINMENT AREAS IN 1990)



5.4.2.1 Description

South Dakota's air quality is sufficiently good to allow increased fossil development without violation of Federal air quality standards. Over 92,000 acres of land have been designated as PSD Class I area, thus requiring visibility and air quality protection. In 1975, the majority of the electricity generated instate came from hydro facilities; approximately 600 MW came from coal-fired plants. North Dakota supplies most of the coal used in the state.

5.4.2.2 Background Issues

- South Dakota contains over 92,000 acres of protected PSD Class I area.

5.4.2.3 Scenario-Induced Issues

- o PSD protection of Class I areas may limit oil development in this state.

5.4.3 Water-Related Issues

- o Possible aquifer disruption and dewatering are projected in Fall River County as a result of underground uranium mining.
- o Uranium mining will cause heavy metal loading of the Cheyenne River.

5.4.3.1 Description

South Dakota has almost no projected energy development. An exception is the southern Black Hills. In this area, the Tennessee Valley Authority has purchased and is reopening the Burdock uranium mine in Fall River County. The mine is expected to reach full production by mid-1981. South Dakota's primary water issues stem not from energy development, but from agriculture non-point runoff.

5.4.3.2 Background Issues

- o A major concern is heavy metal pollution, particularly mercury, caused by the reopening of gold mines.

5.4.3.3 Scenario-Induced Issues

- o Water quality and availability will not be altered by scenario-projected activity.

5.4.4 Ecological and Land-Use Impacts

- o No adverse effects on land use or ecology from energy development are expected in South Dakota.

5.4.5 Socioeconomic Impacts

- o No severe socioeconomic impacts are projected for South Dakota, because the state has no scenario-defined sites for energy development.

5.4.5.1 Description

South Dakota has a population of 686,000 distributed over a land area encompassing 77,050 square miles. The state ranks among the

least populated states, with a density of 8.9 people per square mile, while maintaining one of the highest per capita consumption rates. This is attributed to the fact that there are long distances between urban centers within the state, causing the transportation sector to absorb 39% of the total energy consumed. Because 95% of the state's energy needs are imported, the residential and commercial sectors increase this dependence by consuming an additional 28% of the imported oil and natural gas.

The total labor force in the state is 314,000 persons. They are employed by the manufacturing industries (principally food and food processing activities) or agriculture. The total agricultural acreage in the state is approximately 45 million divided among 43,000 farms. One of the major new employment areas is near Edgemont, where Burlington Northern is developing facilities to haul coal from Gillette, Wyoming.

5.4.5.2 Background Issues

- There are no pertinent background issues to be discussed.

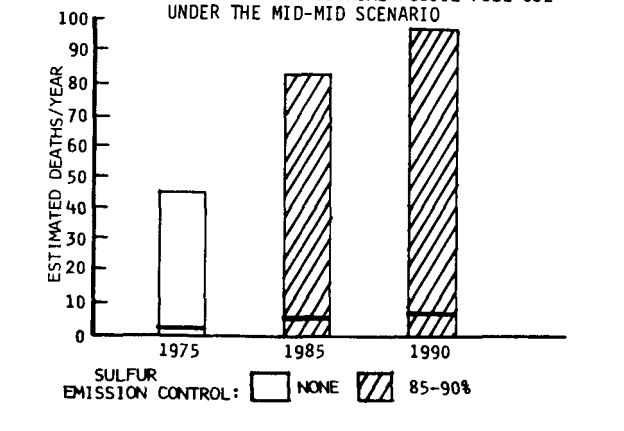
5.4.5.3 Scenario-Induced Issues

- The scenario does not project labor-intensive energy facility developments within South Dakota.

5.4.6 Health and Safety Impacts

- No coal or natural gas extraction and only low levels of oil production, oil refining, uranium mining, and electricity generation are projected in South Dakota.
- Energy-related occupational health and safety impacts will be small compared to those estimated for other states in the region.

Fig. 54

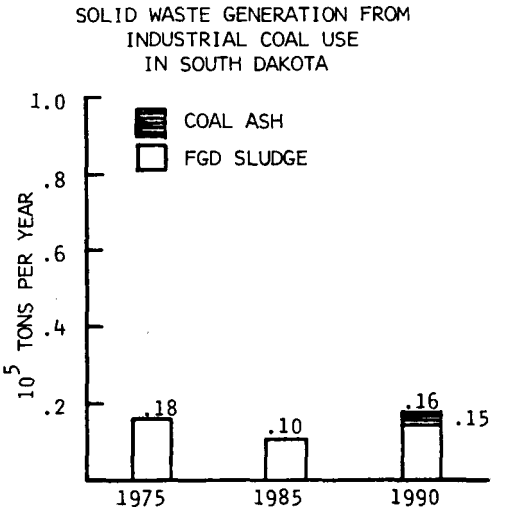


- Public exposure to airborne sulfates will double because of inflow from states upwind and conversion of local utilities to coal.

5.4.7 Solid Waste Impacts

- Industrial coal use is projected to decline. No disposal problems are anticipated.
- Installed coal-fired utility capacity will remain the same for the period 1975-90.

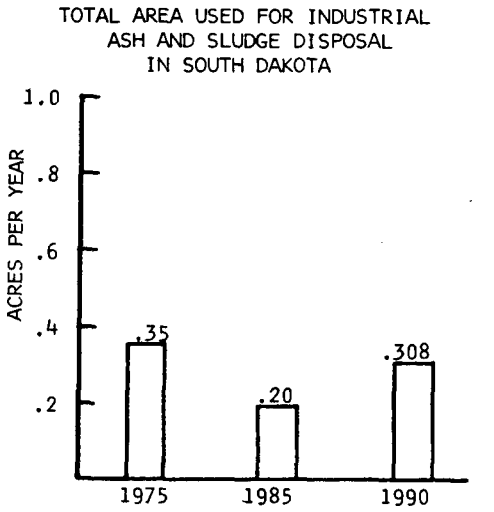
Fig. 55



5.4.7.1 Description

Most of South Dakota is part of the Great Plains and, as such, has plenty of appropriate disposal sites, if erosion problems are avoided. In the Black Hills area to the west, and in the several Indian reservations, permits for solid waste sites have taken as much as 5 years to acquire.

Fig. 56



5.4.7.2 Background Issues

- Industrial coal use is low--only 330,000 tons in 1975.
- Land use for industrial waste disposal amounted to less than 0.4 acre in 1975.

5.4.7.3 Scenario-Induced Issues

- Industrial coal use is projected to decrease from the already low 330,000 tons/year to 240,000 tons/year by 1990.
- Land use for disposal will decrease to 0.3 acre/year.
- No waste disposal problems are projected for South Dakota.
- No increase in coal-fired utility capacity for the period 1975-90 is projected. Disposal requirements for the lifetime of the new plants amount to 82 acres.

5.5 UTAH

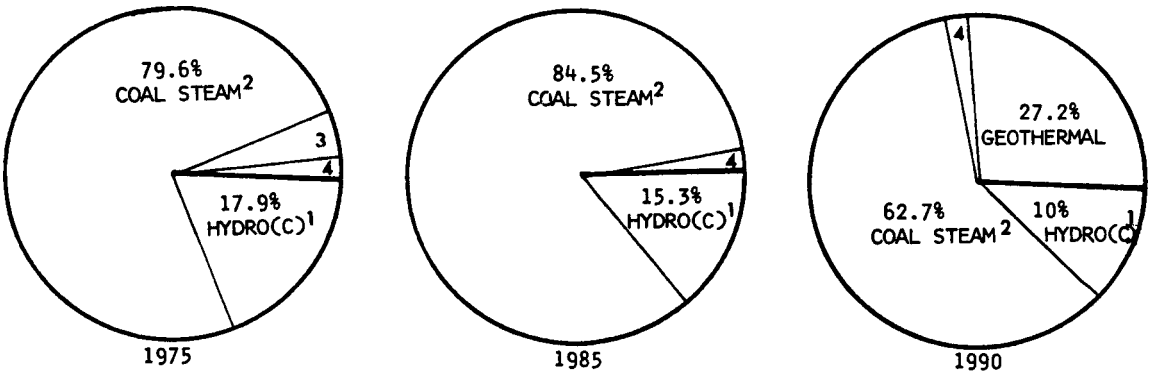
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for Utah, as shown on Table XIX and its companion pie charts (Fig. 57).

Table XIX

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN UTAH
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	198 (17.9%)	331 (15.3%)	331 (10.0%)	133
[2]Coal Steam	880 (79.6%)	1,825 (84.5%)	2,075 (62.7%)	1,195
[3]Oil Turbine	3 (0.3%)	3 (0.1%)	3 (0.1%)	0
[4]Oil Steam	24 (2.2%)	0 (0%)	0 (0%)	-24
[5]Geothermal	0 (0%)	0 (0%)	900 (27.2%)	900
TOTAL	1,105	2,159	3,309	2,204
Coal Production				
Deep Mines	176	496	1,248	1,072
Surface Mines	0	258	280	280

Fig. 57



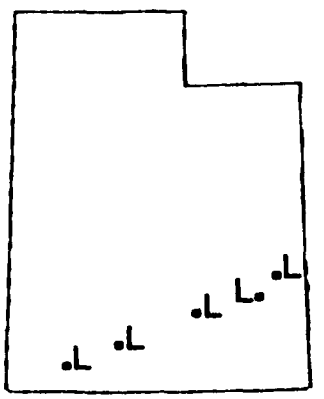
NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

5.5.1 Visibility

- o No significant impairment of visual air quality is projected for the five Class I areas located in the state.

Fig. 58

UTAH'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



5.5.1.1 Description

The visual air quality in nonurban areas of the state is superior to that found in most other states of the US. The long-range transport of light-scattering aerosols (sulfates, in particular) is an important factor contributing to the light extinction budgets in nonurban areas of the state. The median visual range based upon measurements made at three nonurban/suburban sites for the period 1974-76 ranged from 74 to 81 miles. Median visual ranges calculated for the five Class I areas in the state for baseline year 1977 ranged from 76.4 to 81.1 miles.

Sufficient historical data were available to calculate the historical trend of visibility for Salt Lake City. According to airport measurements over a 20-year period from 1953-55 to 1970-72, median visual range changed -27% for Salt Lake City. This deterioration is most likely related to increased air pollution emissions that accompanied the economic and population growth in the Salt Lake area.

5.5.1.2 Background Issues

- o Visual air quality is most sensitive to degradation in areas with very good visibility. There is an abundance of such areas in the state.
- o The five Class I areas located in the southern part of the state are protected against impairment of visual air quality according to recent Congressional legislation.

5.5.1.3 Scenario-Induced Issues

- All five Class I areas in the state are projected to have low impacts. The calculated visual range and its percent change for these areas in the state are shown in Table XX. The scenario projects that no large fossil fuel combustion facilities will be sited in counties located near the five Class I areas. The projected changes in median visual ranges from 1977 to 1990 for these areas are calculated to decrease less than 10%.
- Sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities are projected to be relatively low in 1990, although a growth of 221.6% from 1975 to 1990 is projected.
- The state's imported fraction of the area-weighted particulate sulfate concentration caused by utility and industrial fossil fuel combustion facilities is predicted to account for 67% of the total.

Table XX

UTAH: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

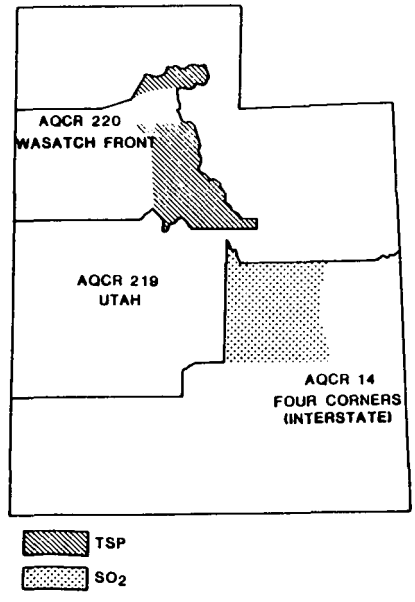
	Visual Range (miles)				
	Calculated			Percent Change From 1977 To	
Class I Area	1977	1985	1990	1985	1990
Arches National Park	76.4	72.5	72.3	-5.2	-5.4
Bryce Canyon National Park	81.1	81.3	80.9	0.1	-0.3
Canyonlands National Park	77.3	73.9	73.7	-4.5	-4.7
Capital Reef National Park	77.9	75.1	74.8	-3.6	-3.9
Zion National Park	81.0	81.7	81.4	0.8	0.4

5.5.2 Local Air Quality

- Nonattainment for TSP will continue in the Wasatch Front AQCR where metropolitan area source emissions and industrial process emissions produce high ambient particulate levels. (See adjacent map.)
- Scenario-projected utility expansion may be constrained by PSD requirements.

Fig. 59

UTAH'S PROJECTED NONATTAINMENT AREAS IN 1990



5.5.2.1 Description

In all but three counties, current and projected ambient air quality meet the national

and state standards. There will be continuing nonattainment, however, in counties containing metropolitan areas and industrial processing plants. Dispersion modeling of utility emissions projects violations of federal ambient SO_2 standards in Emery County, although no Class I areas will be adversely affected.

5.5.2.2 Background Issues

- o Air quality outside of metropolitan AQCR 220 is excellent.
- o The high concentration of Class I areas in the southern third of Utah must be considered in the siting of future utility and industrial facilities.

5.5.2.3 Scenario-Induced Issues

- o The scenario projects a net decrease in TSP emissions; however, control of metropolitan area sources may not achieve national ambient air quality standards to bring the Wasatch Front AQCR into attainment by 1990.
- o Three-fourths of the scenario-projected utility expansion may be constrained by PSD regulations applied to Class II areas. Efficient control of SO_2 emissions may meet state and federal requirements.

5.5.3 Water-Related Issues

- o Water development projects in Utah are under attack on a variety of fronts--protection of endangered fishes, reserved Indian water rights, federal funding cutbacks, and salinity controls. The state wants to develop its full entitlement to Colorado River water.

5.5.3.1 Description

Most coal and oil shale resources are found in the Colorado Basin. About 500,000 acre-feet/year of Colorado River water are available for development under interstate compact agreements. Much of the Green River, from Fontanelle Dam to the confluence with the Colorado mainstem, and the Colorado River, from the Colorado state line to Lake Powell, provide habitat for the endangered Colorado squawfish and the humpback chub. Waste water discharges from industrial users are prohibited by agreement with the EPA. Thus, nonpoint source pollution--dissolved and suspended solids--is the primary water quality concern.

5.5.3.2 Background Issues

- o Utah has probably the greatest free-market orientation among the Western States, that is, water is regarded as an economic resource.
- o Several tributaries of the Colorado River--the Price and San Rafael Rivers and Muddy Creek--presently have high concentrations of dissolved solids.

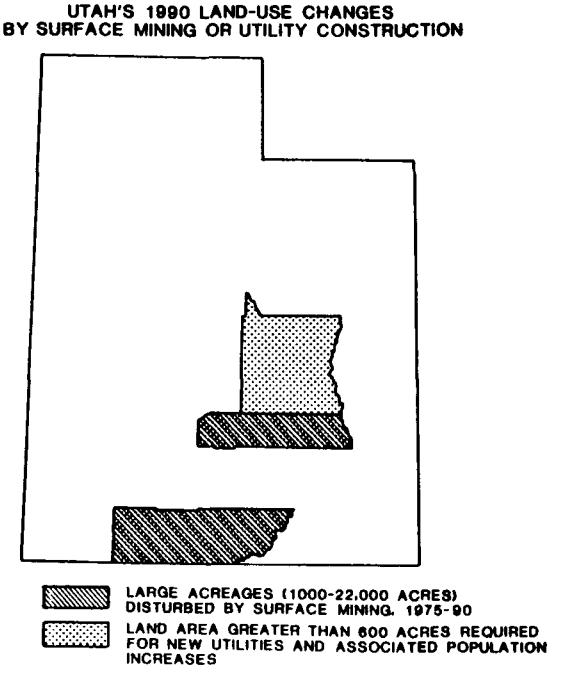
5.5.3.3 Scenario-Induced Issues

- o The Intermountain Power Project purchased 40,000 acre-feet/year from irrigators along the Sevier River for a 3,000 MW electric plant at Lyndyll, at a cost of $40 million ($1,750/acre foot). The Washington Post used this fact to illustrate the coming demise of irrigated agriculture in the West.

5.5.4 Ecological and Land-Use Impacts

- o The fragile ecosystems of arid southwestern states, including Utah, are very slow to recover from disruption, whether mechanical (as in the case of transportation and mining activities) or chemical (as in the case of airborne pollutants from fossil fuel use). In view of the four new fossil fuel generating plants projected for Utah, clean air and undisturbed ecosystems must be considered potentially scarce resources, especially in the Colorado Plateau region of the state.

Fig. 60



5.5.4.1 Description

Utah contains some 60,000 acres of waterfowl habitat in the form of marshes, an unusual ecotype for Region 8. These areas are created by internal drainages in the north, central, and western areas of the state. The Colorado River and its tributaries, which drain the southern and eastern sections of Utah, harbor several nationally endangered species of fish. Another endangered Utah resident is the black-footed ferret, which has recently been sighted by game biologists in eastern Utah.

5.5.4.2 Background Issues

- Environmentalists within the state have little backing from the public in pursuing environmental/energy issues.

5.5.4.3 Scenario-Induced Issues

- SO_2 damage to crops in Salt Lake County is estimated at $5.4 million by 1990. This will be a significant impact because most of the land holdings in the county are small, and the crops produced are essential fresh food sources for human and dairy animal consumption.
- Utah's tule marshes are critical habitat for some endangered species of migratory waterfowl. SO_2 concentrations in the area of these marshes may threaten the survival of this ecosystem. In addition, alteration of surface flow or aquifer pumping may threaten the existence of the marsh habitat. Federal and state endangered species regulations may come into play in siting energy development.

5.5.5 Socioeconomic Impacts

- Proposed development may be blocked in part in all but one county because of unacceptable demands upon local governments.

5.5.5.1 Description

During 1970-75, Utah's population grew 3.5%. However, with the development of new mines and power plants will come large increases in resident populations, both transients of construction phases and permanent residents for operational phases. The small base populations of the impacted counties probably will be neither able nor willing to pay for amenity development for the influx of new residents.

5.5.5.2 Background Issues

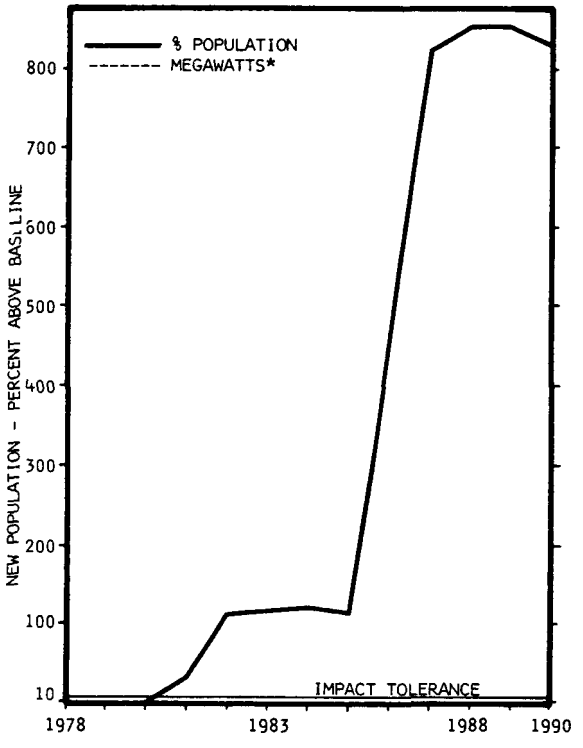
- (See 5.1.5.2.)
- Two Utah counties--Emery and Sevier--have low assimilative capacities, whereas Kane and Wayne Counties have extra low capacity.
- The state government has not adopted any significant impact assistance programs for local governments as a direct response to energy-development activities.
- The state government has tended to encourage energy resource development to provide the taxes necessary to finance community facilities and services by local initiative.

5.5.5.3 Scenario-Induced Issues

- o Kane County will experience a population change of over 475% above the baseline population in 4 successive years.
- o Wayne County will observe a population change of over 400% in one year, followed by over 800% in the next 3 years.
- o Emery County population will peak at 70% in 3 years followed by 3 years of total decline.
- o Only Sevier County is expected to be able to accommodate the scenario projection.

Fig. 61

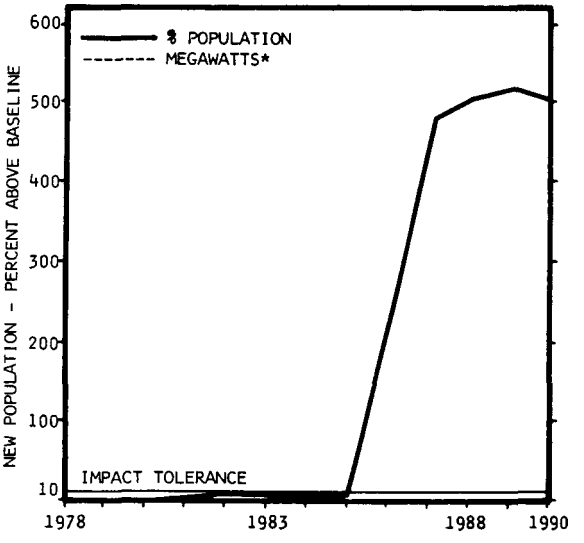
KANE COUNTY, UTAH,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 62

WAYNE COUNTY, UTAH,
EXTRA LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 63

EMERY COUNTY, UTAH,
LOW ASSIMILATIVE CAPACITY

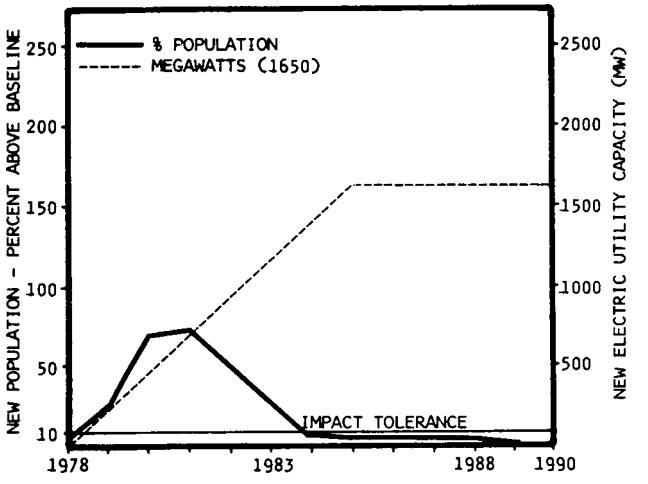
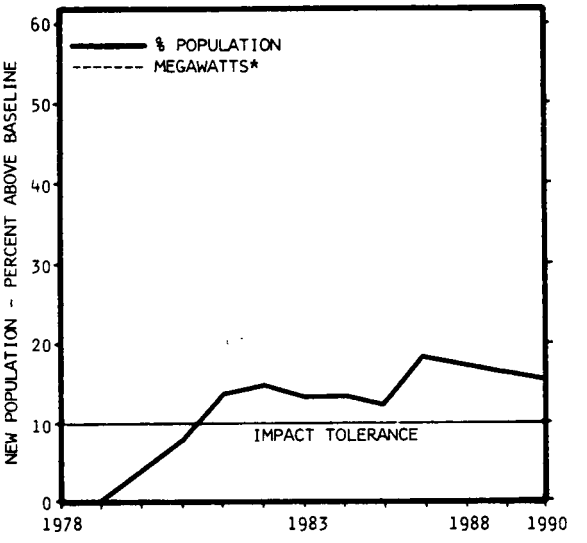


Fig. 64

SEVIER COUNTY, UTAH,
LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

5.5.6 Health and Safety Impacts

- Greatly-increasing production through 1990, as assumed in the scenario, is forecast to cause steadily-increasing numbers of injuries and deaths annually unless new, stringent measures are taken.
- Rapid population influx will expose a larger number of persons to the localized public health hazards associated with mining and conversion activities and related transportation problems.
- Because the Salt Lake City area carries a heavy pollution load that already constitutes a public health hazard, public opposition to energy development growth may increase.
- Underground mining hazards will yield increasing numbers of injuries and deaths through 1990.

5.5.6.1 Description

Like Colorado and unlike the other states in the region, Utah is relatively industrialized and well populated, with a major urbanized

area. The majority of Utah's coal and uranium is mined underground. Utah's voters tend to be rather well disposed to increased industrial development in the state, although concern for environmental quality is becoming increasingly manifest.

5.5.6.2 Background Issues

- o There will be 3.5 GWe of coal-fired generating capacity built in Utah to supply loads outside the region.

5.5.6.3 Scenario-Induced Issues

- o The scenario's projected increase in coal production and use is expected to heavily impact Utah, as shown in the following two figures.

Fig. 65

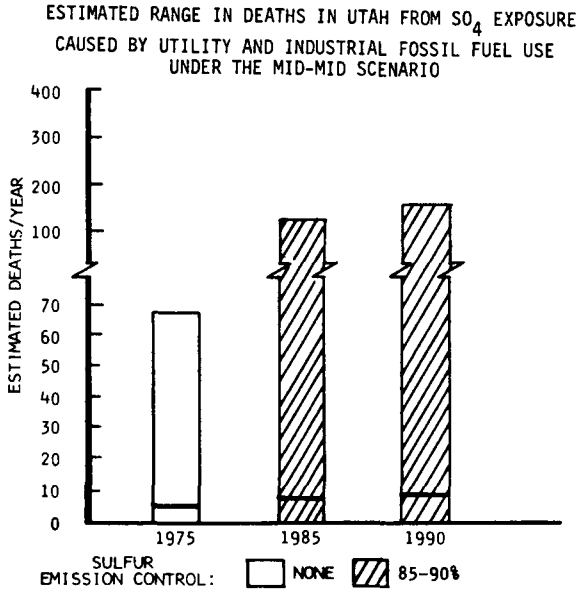
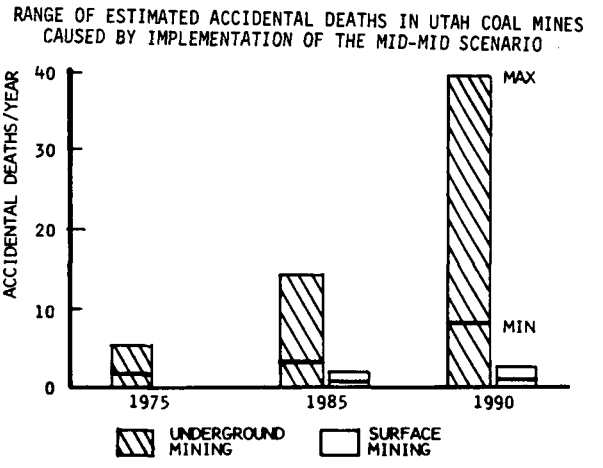


Fig. 66



5.5.7 Solid Waste Impacts

- o Energy development activities are expected to greatly accelerate growth in the next few years.
- o Federal and Federal Trust Lands comprise 69.3% of the land area of the state, limiting the areas available for disposal of urban and industrial wastes.

5.5.7.1 Description

In central Utah, 33 new coal mines and 21 uranium mines are planned. Fourteen of the uranium mines are scheduled for San Juan

County. With 79% of this county's land under federal control, private land is widely-scattered. As a result, land available for urban and industrial waste disposal is limited. Also, the uranium mining sites are a considerable distance from even tiny population centers and required amenities.

5.5.7.2 Background Issues

- o Utah does not regulate solid waste disposal and does not report the percentage of people who are served by approved facilities.
- o Small existing populations in impacted counties have not required the development of waste disposal facilities beyond the complexity of local landfill and private septic tank.

5.5.7.3 Scenario-Induced Issues

- o According to the scenario, the 87,000 acres presently used for coal production will increase to > 2 million acres by 1990.
- o The scenario projects 231 acres per year for mine waste disposal. The lack of available land appropriate for waste disposal may constrain the scenario.
- o The total area of Wayne County is 1.6 million acres, 81% of which is federally-owned land. The small base population, with few existing public services, will need financial assistance to absorb the solid waste costs of the new population required to service the combination of a strip mine, a 10 million ton underground mine, and the Intermountain Power Project.
- o Most valleys in the impacted areas include at least an intermittent watercourse that provides critically-needed water supplies for people downstream. If either the RIIA-I or the BOM projections are valid, a whole new waste infrastructure will be required to protect water suppplies.

Fig. 67

SOLID WASTE GENERATION FROM INDUSTRIAL COAL USE IN UTAH

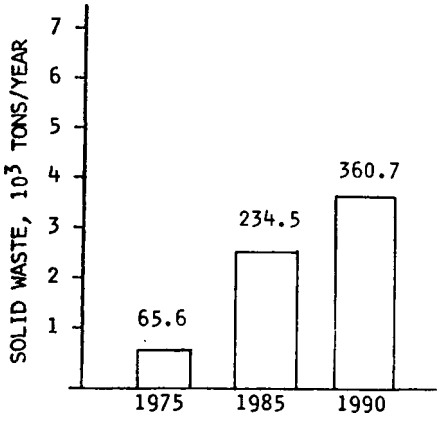


Fig. 68

LAND USE FOR COAL PRODUCTION IN UTAH

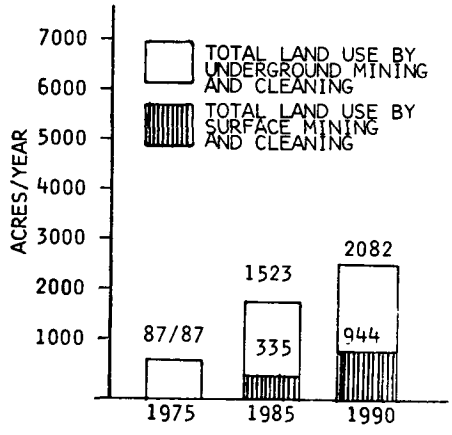


Fig. 69

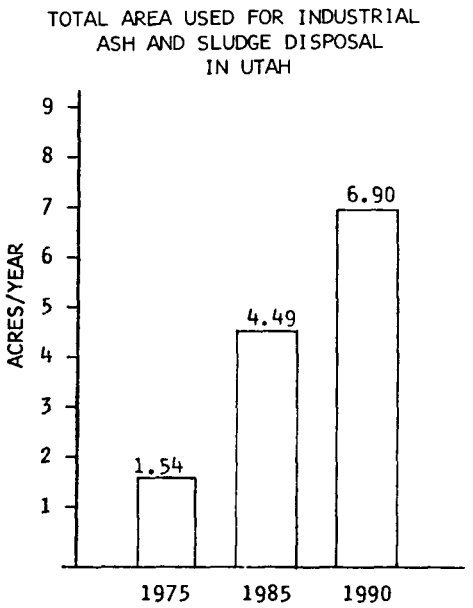


Fig. 70

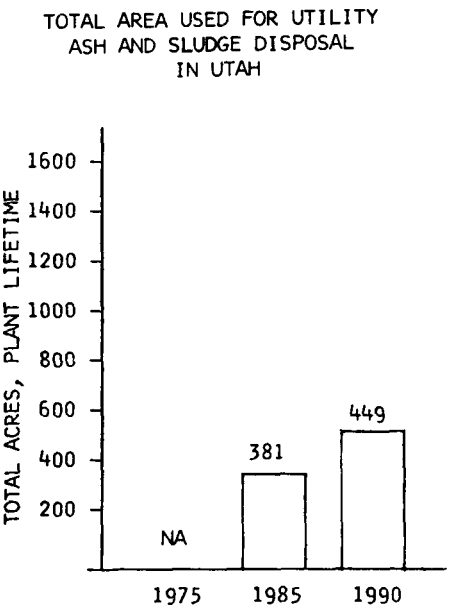
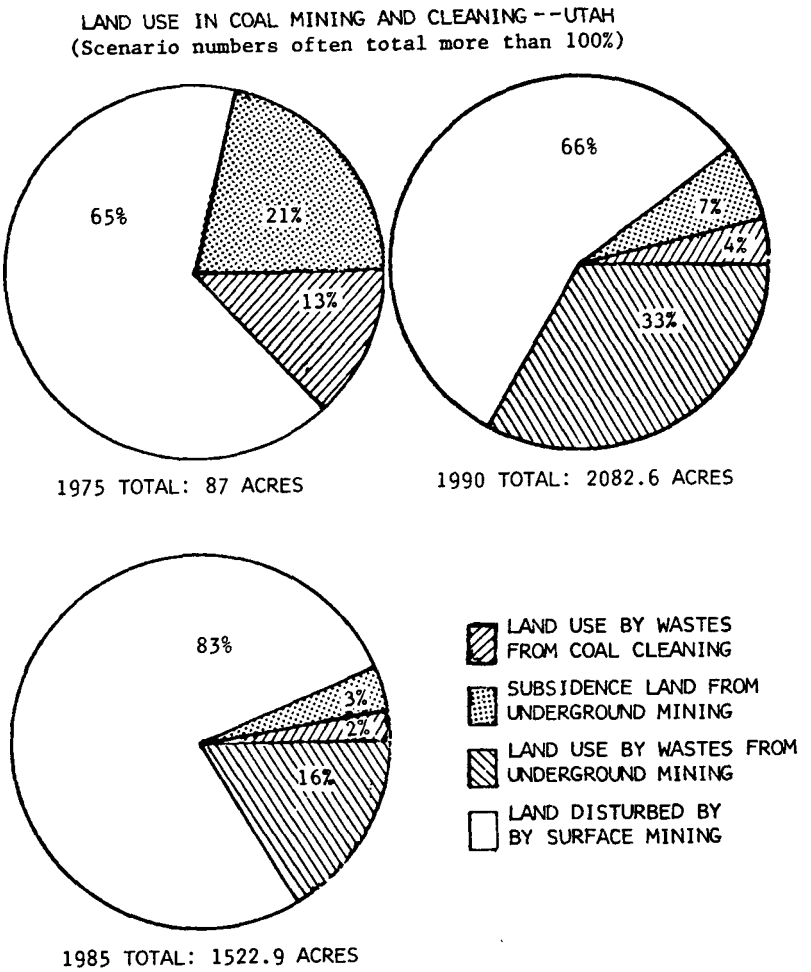


Fig. 71



5.5.8 Institutional Issues

- o Energy development projected by the Mid-Mid Scenario will not be constrained by institutional issues in Utah.
- o Institutional issues that may arise beyond 1990 or in the case of an accelerated scenario are air quality maintenance and the use of water resources, as described in the following paragraphs.

Air quality presently is the principal environmental issue in Utah. Utility siting and selection of control technology must comply with PSD protection of the large number of Class I areas in the southern third of the state.

Water use depends on the outcome of conflicting interests rather than on the small fraction of supply required for energy development. Energy, as a relatively new user, must contend with established interests.

5.6 WYOMING

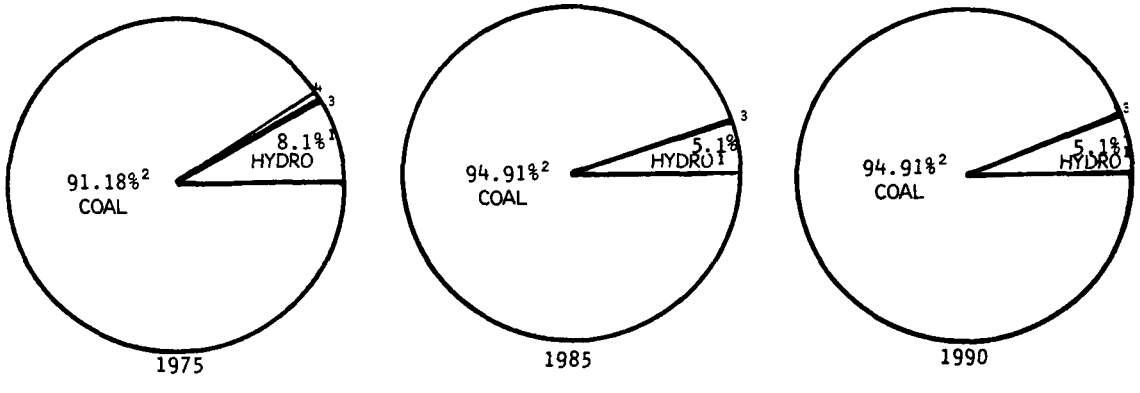
The RIIA-I Scenario projects electrical generating capacity and industrial fuel use as well as coal production for Wyoming, as shown on Table XXI and its companion pie charts (Fig. 72).

Table XXI

ELECTRICAL GENERATING CAPACITY, INDUSTRIAL FUEL USE, AND COAL PRODUCTION IN WYOMING
(Capacity in Megawatts)

	1975	1985	1990	Total Change
Electrical Generating Capacity and Industrial Fuel Use				
[1]Hydro, Conventional	224 (8.1%)	230 (5.1%)	230 (5.1%)	6
[2]Coal Steam	2,513 (91.2%)	4,310 (94.9%)	4,310 (94.9%)	1,797
[3]Oil Turbine	1 (0%)	1 (0%)	1 (0%)	0
[4]Oil Steam	18 (0.7%)	0 (0%)	0 (0%)	-18
TOTAL	2,756	4,541	4,541	1,785
Coal Production				
Deep Mines	10	37	165	155
Surface Mines	479	3,449	4,725	4,246

Fig. 72



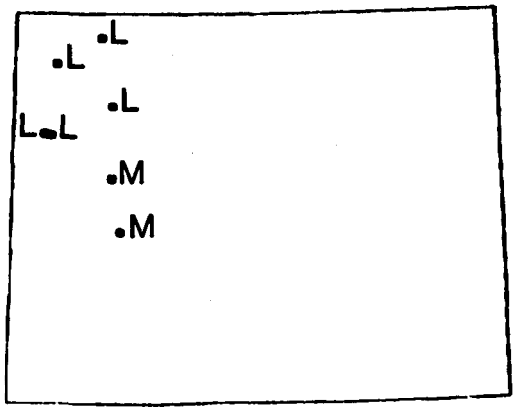
NOTE: Reference numbers on these pie charts correspond to those listed beside each power source in the table above.

5.6.1 Visibility

o Medium impacts are projected for two of the seven Class I areas located in the state.

Fig. 73

WYOMING'S PROJECTED VISUAL AIR QUALITY IMPACTS FOR CLASS I AREAS



5.6.1.1 Description

The visual air quality in nonurban areas of the state is generally superior to that experienced in most other states of the US. The long-range transport of light-scattering aerosols (sulfates, in particular) is an important factor contributing to the light extinction budgets in nonurban areas of the state. The median visual range based upon measurements made at two nonurban/suburban sites for the period 1974-76 ranged from 64 to 76 miles. Median visual ranges calculated for the seven Class I areas in the state ranged from 62.3 to 72.2 miles for baseline year 1977.

5.6.1.2 Background Issues

o Visual air quality is most sensitive to degradation in areas with very good visibility. There is an abundance of such areas in the state.

o The seven Class I areas located in the state are protected against impairment of visual air quality according to recent Congressional legislation.

5.6.1.3 Scenario-Induced Issues

o A medium impairment from plume blight could affect the Bridger Wilderness and Fitzpatrick Wilderness as a result of a 1000-MW increase of coal steam capacity projected by the scenario to be sited in Sweetwater County by 1990.

o Impairment caused by regional haze is not projected. The projected changes in median visual ranges from 1977 to 1990 for the seven Class I areas are calculated to decrease less than 10%. Calculated visual range and its percent change for these areas in the state are shown in Table XXII.

- Sulfur dioxide emissions from utility and industrial fossil fuel combustion facilities are projected to grow 370.4% during the period 1975-90.
- The state's imported fraction of the area-weighted particulate sulfate concentration as a result of utility and industrial fossil fuel combustion facilities is predicted to account for 62% of the total.

Table XXII

WYOMING: CALCULATED VISUAL RANGE AND PERCENT CHANGE IN VISUAL RANGE

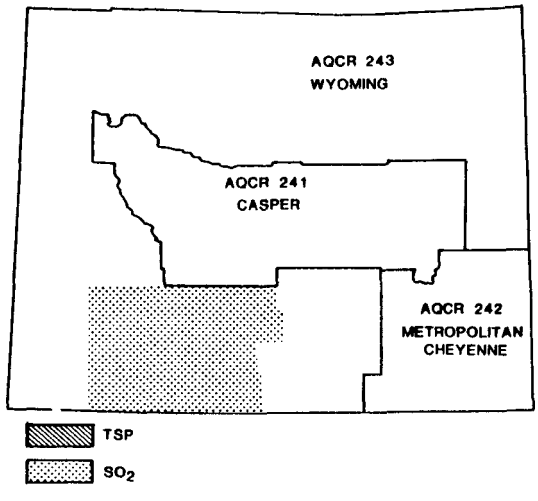
	Visual Range (miles)				
	Calculated			Percent Change From 1977 To	
Class I Area	1977	1985	1990	1985	1990
Bridger Wilderness	72.2	68.4	67.7	-5.3	-6.3
Fitzpatrick Wilderness	70.4	69.2	68.9	-1.7	-2.1
Grand Teton National Park	62.3	59.8	59.5	-4.0	-4.5
North Absaroka Wilderness	66.6	65.5	64.9	-1.7	-2.6
Teton Wilderness	62.3	59.8	59.5	-4.0	-4.5
Washakie Wilderness	65.3	63.2	62.7	-3.2	-4.0
Yellowstone National Park	67.2	65.4	64.9	-2.7	-3.5

5.6.2 Local Air Quality

- Only one county is projected to remain in nonattainment for SO_2 through 1990. (See adjacent map.)
- While projected ambient TSP levels in two counties will violate state AAQS in 1985, 1990 projections do not constitute violations.
- Increased utility emissions will exceed the PSD Class II area increment for TSP in one county by 1985.

Fig. 74

WYOMING'S PROJECTED NONATTAINMENT AREAS IN 1990



5.6.2.1 Description

The emission increases projected by the Mid-Mid Scenario contribute to the deterioration of air quality in Natrona and Sweetwater Counties where increments constitute violations of state and

national air standards. Because ambient SO_2 data for 1975 were not available for 8 of the 12 counties in this analysis, results of the model could be misleading.

5.6.2.2 Background Issues

- o Ambient SO_2 data for 1975 are unavailable; consequently, NAAQS violations for 1990 are impossible to predict accurately.

5.6.2.3 Scenario-Induced Issues

- o The major sources of pollution in Wyoming will be utility and industrial coal combustion.
- o Utility expansion in Sweetwater County will produce violations of NAAQS for SO_2 continuing into 1990. Siting of new sources in this county will be constrained by offset requirements.
- o Scenario-projected TSP emissions from industrial expansion will violate state ambient air standards in two counties in 1985; projected emission reductions will alleviate this impact by 1990.

5.6.3 Water-Related Issues

- o Aquifer contamination and dewatering caused by uranium mining, the conversion of water from agriculture to industrial use, and the degradation of water quality as a result of coal mining are major concerns in Wyoming.

5.6.3.1 Description

The principal subbasins in the energy fields are the Green, the North Platte, the Powder, and the Tongue. Almost 400,000 acre-feet/year are available for development on the Green, a tributary of the Colorado River. Rights to 57,000 acre-feet/year are held by industry and the state has an agreement to contract even more water from Flaming Gorge Reservoir. Interstate compacts and court decrees greatly complicate determination of water availability in other basins, but even in the smaller plains' streams--the Cheyenne and the Belle Fourche--water supplies in excess of 10,000 acre-feet/year might be developed.

Groundwater development, especially from the Madison formation, represents an alternative source of supply. Annual recharge to this formation is about 75,000 acre-feet/year and pumping in excess of this rate--that is, mining--may be permissible.

5.6.3.2 Background Issues

- o Endangered species protection on reaches of the Green and the Platte outside Wyoming may affect development.
- o Indian reserved rights on the Bighorn, the Powder, and Tongue may constrain future water development.
- o The concentration of the nation's most attractive low sulfur, strippable coal deposits in Campbell and Converse Counties threatens to cause severe water quality degradation in the Powder, the Tongue, and their tributaries.
- o Aquifer recharge and discharge rates, well discharge rates, and water quality from the Madison formation are the subjects of an intensive US Geological Survey study.
- o Attempts of industrial users to transfer groundwater and surface water rights along the North Platte and Laramie Rivers encountered severe opposition from farmers and ranchers.

5.6.3.3 Scenario-Induced Issues

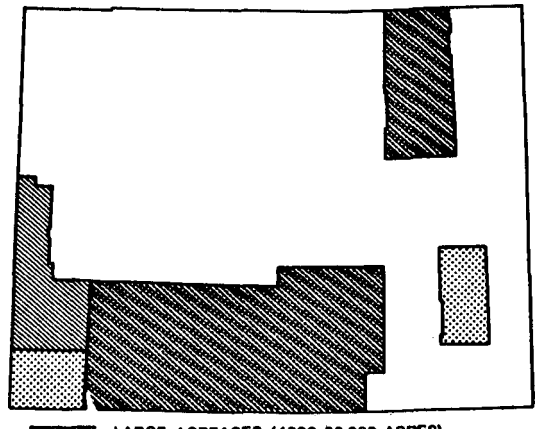
- o A lawsuit and enforcement of the Endangered Species Act forced the Missouri Basin Power Project (MBPP) to contribute $7.5 million to a whooping crane habitat mitigation fund. Furthermore, MBPP agreed to lobby the state legislature for a statute increasing the burden of proof on water right transferees.
- o A proposal to export Wyoming water in a coal slurry pipeline was vetoed by Governor Herschler, pending further study of interstate compact and other issues.

5.6.4 Ecological and Land-Use Impacts

- o Wyoming has many endangered species of plants and animals. Although the state does have a good reclamation record, replacement flora may not provide suitable habitat for endangered animal species.
- o Population increases accompanying energy development affect not only land use but also water resources within the state and agriculture in downstream states.

Fig. 75

WYOMING'S PROJECTED 1990 LAND-USE CHANGES BY SURFACE MINING OR UTILITY CONSTRUCTION



5.6.4.1 Description

Eastern and central Wyoming, where the majority of scenario-projected energy development will take place, are high plains country

suitable mainly for grazing and dry-land farming. The availability of water in the area is limited, making surface water quality and quantity important issues in maintaining wildlife habitat and agricultural land use in competition with energy industries.

5.6.4.2 Background Issues

- o Wyoming's reclamation record minimizes but does not eliminate concern over the usual problems associated with erosion of mine wastes.
- o Introduction of new species in reclamation efforts, instead of slow-growing native plants, alters the suitability of the area as habitat for native fauna.
- o Endangered fish species in the Colorado River system are adversely affected by increased TDS and TSS levels, a fact that may act as a constraint on mining activities.
- o The issue of water users' rights and the protection of wildlife habitat in downstream states came to a head in the Grayrocks Dam case. An out-of-court settlement was reached, which will enable the plant to be constructed while protecting the whooping crane habitat and other water interests of Wyoming and Nebraska.

5.6.4.3 Scenario-Induced Issues

- o Because extensive surface mining can disrupt or destroy critical habitat for rare and endangered species, mine development may be limited by federal and/or state endangered species law.

5.6.5 Socioeconomic Impacts

- o In two of the five impacted counties, the population will increase beyond the county's capacity to absorb new demands for services, thus development may be temporarily blocked.

5.6.5.1 Description

Wyoming is the least populated of the Rocky Mountain States, but the most prosperous in terms of per capita income. Primary employment is in the coal and petroleum industries. The state contains 8% of US coal reserves, currently being stripped by 15 surface mines, and very large uranium reserves. Of great national importance are Wyoming's extensive natural areas, including Yellowstone and Grand Teton National Parks, which attract over 4 million visitors yearly. Wyoming may face serious economic decline as fossil fuels and uranium reserves are depleted.

5.6.5.2 Background Issues

- o (See 5.1.5.2.)
- o Wyoming counties identified as potential sites for future mines and generating facilities span the range from extra low to moderate assimilative capacity.
- o Wyoming is 48.6% federal land. Another 2 million acres are Indian lands. Area available for development, therefore, is restricted.
- o From time to time, the Wyoming legislature has seriously considered the desirability of limiting the amount of electricity generating in the state because of environmental considerations. The consequences of such limits would alter plans for new generation facilities and, very likely, mining activities projected in the Mid-Mid Scenario.
- o Several counties have experienced growth impacts and have the infrastructure in place to accommodate growth.

5.6.5.3 Scenario-Induced Issues

- o Five of the eight Wyoming counties identified in the Mid-Mid Scenario are expected to experience significant socioeconomic impacts resulting from an annual population increase in excess of 10% in at least 1 year of the development activity.
- o Campbell County will observe a population change that exceeds the baseline population in excess of 200% for 4 successive years. In this case, the change represents an absolute growth of 150% between 1978 and 1985, and 209% growth between 1978 and 1990.
- o By 1985, the average new household will pay over $675 per year for local services. However, in the two most heavily-impacted counties, the cost of local services to the average household will range between $1050 and $1250 per year. As the population continues to grow, the cost of local government services will decline to an average of $475 per year.
- o At least one county will continue to require over $1000 per year for local government services.

Fig. 76

CAMPBELL COUNTY, WYOMING,
LOW ASSIMILATIVE CAPACITY

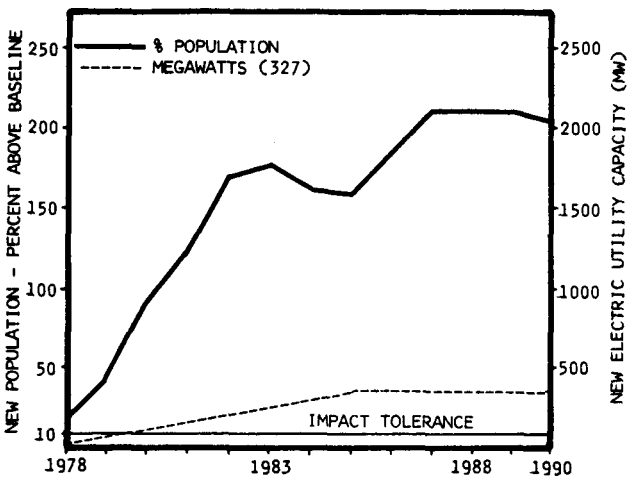
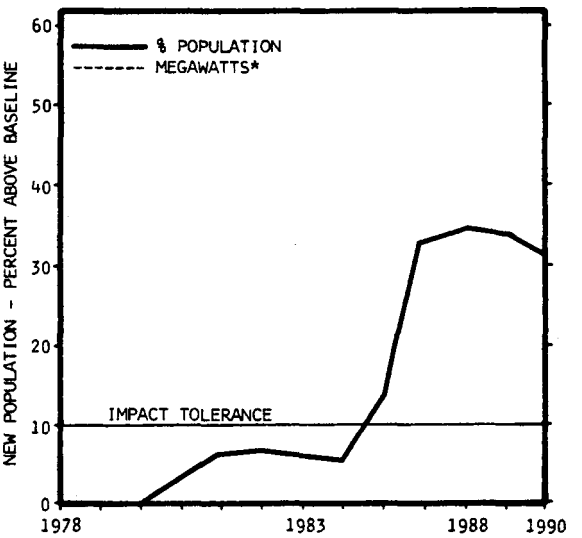


Fig. 77

CARBON COUNTY, WYOMING,
MODERATE ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

Fig. 78

PLATTE COUNTY, WYOMING,
EXTRA LOW ASSIMILATIVE CAPACITY

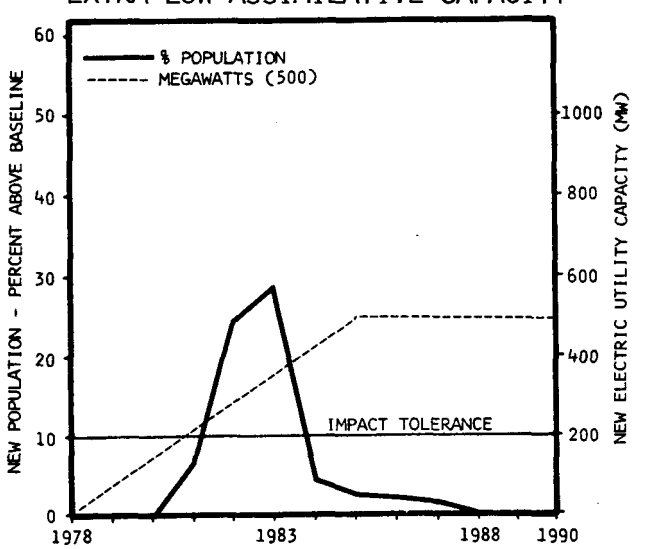


Fig. 79

SWEETWATER COUNTY, WYOMING,
MODERATE ASSIMILATIVE CAPACITY

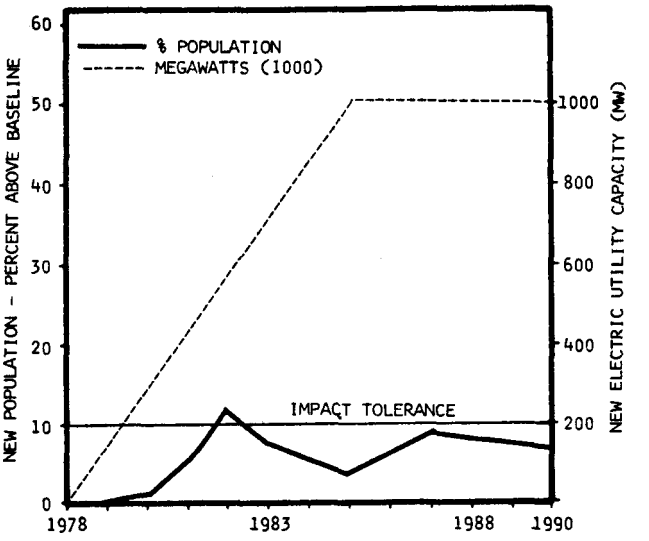
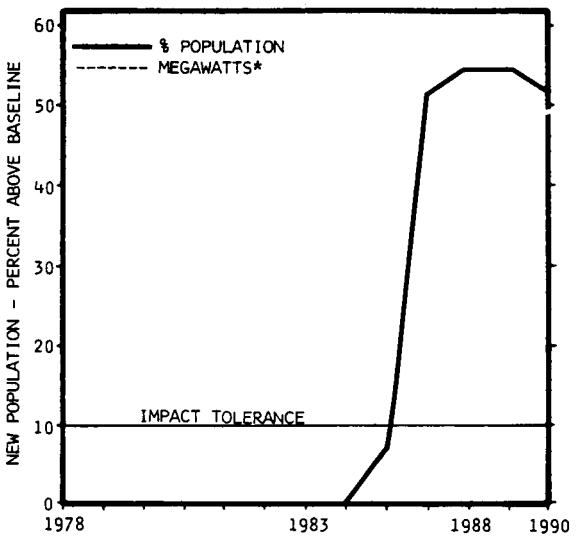


Fig. 80

UINTA COUNTY, WYOMING,
LOW ASSIMILATIVE CAPACITY



*No new electric utility capacity is projected for this county.

5.6.6 Health and Safety Impacts

- o Occupational and public safety hazards will increase under the scenario.
- o The increased use of coal within the state will not cause major public health hazards because the state is sparsely-populated.
- o Oil and gas production and transportation will constitute additional occupational and public safety hazards.
- o Uranium mining and milling will require extra care to contain the expected increase in occupational and radiation hazards.

5.6.6.1 Description

Occupational health hazards in energy development industries will be combatted on an industry-wide level, while public safety will depend on the astuteness of individual local officials. The small and widely-dispersed populations in most areas of the state should serve to counteract many potential public health and safety problems.

5.6.6.2 Background Issues

- o Residents of rural, western areas tend to have more transportation-related accidents than residents of other states. This problem is magnified by increased highway and rail haulage of coal.

5.6.6.3 Scenario-Induced Issues

- o As in other states in the region, deaths and injuries from mining activities are expected to increase dramatically through 1990.
- o Although utilities will control 85-90% of emissions, public health effects related to SO_4 are expected to double in severity through 1990.

Fig. 81

ESTIMATED RANGE IN DEATHS IN WYOMING FROM SO_4 EXPOSURE CAUSED BY UTILITY AND INDUSTRIAL FOSSIL FUEL USE UNDER THE MID-MID SCENARIO

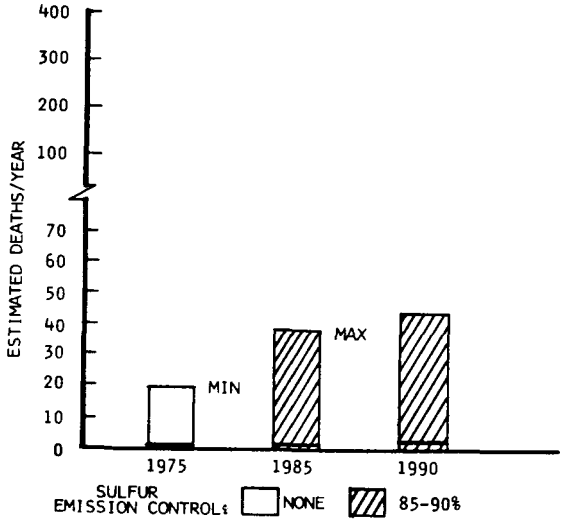
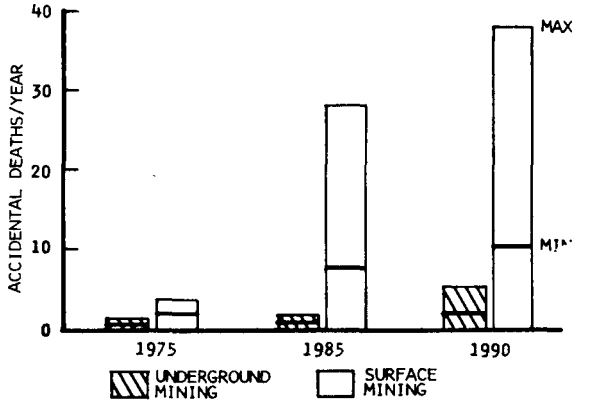


Fig. 82

RANGE OF ESTIMATED ACCIDENTAL DEATHS IN WYOMING COAL MINES CAUSED BY IMPLEMENTATION OF THE MID-MID SCENARIO



5.6.7. Solid Waste Impacts

- o In Wyoming, uranium mine and mill tailings have been accumulating since 1948. Hundreds of old spoil piles have been ignored for many years.
- o The western half of the state includes the Continental Divide, the Tetons, and Yellowstone National Park, which implies the need to protect the nation's major watersheds.

5.6.7.1 Description

Wyoming is more than 50% federal or Indian land, which may be unavailable for use as mine, mill, or urban waste disposal sites. In some areas, the visual impact of waste disposal may be a problem because of the proximity of development to national parks or scenic areas.

5.6.7.2 Background Issues

- o There are no state laws governing solid waste disposal, but a local permit is required.

- o In some areas, waste disposal has meant dumping into arroyos without benefit of treatment or fill.
- o Septic tanks are the common sewage treatment system in many counties. Only 37% of the population is served by approved facilities.
- o One county is scheduled to open seven new uranium mines and three uranium mills by 1980. A natural gas processing plant, a coal strip mine, and a power plant are also planned.
- o The influx of people needed to run these facilities will present a major waste disposal problem for the area even if the facilities themselves do not. Other counties will experience similar impacts.

5.6.7.3 Scenario-Induced Issues

- o There are 6,407 acres projected for surface coal mining by 1990 as compared with 557 in 1975.
- o As a result of the scenario, the Wyoming legislature is contemplating a "strip and ship" policy comparable to that in Montana. Industry and utility fuel consumption will continue to be minimal.

Fig. 83

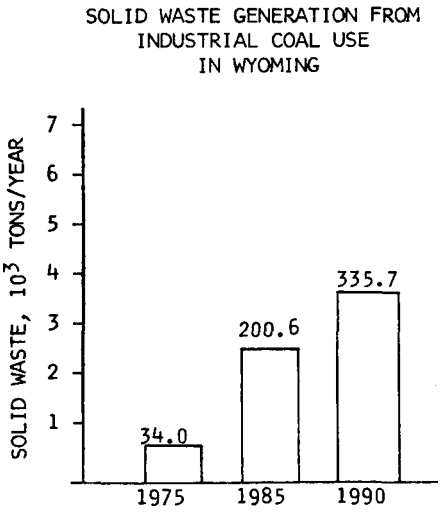


Fig. 84

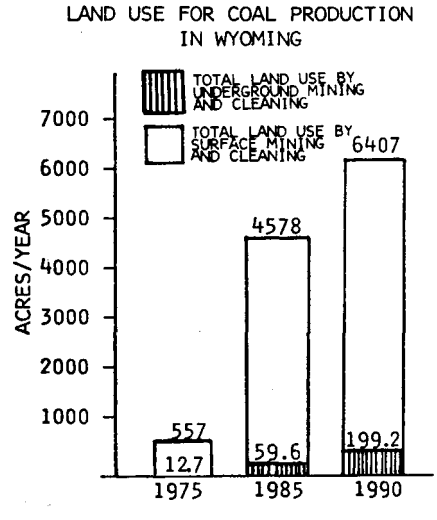


Fig. 85

TOTAL AREA USED FOR INDUSTRIAL
ASH AND SLUDGE DISPOSAL
IN WYOMING

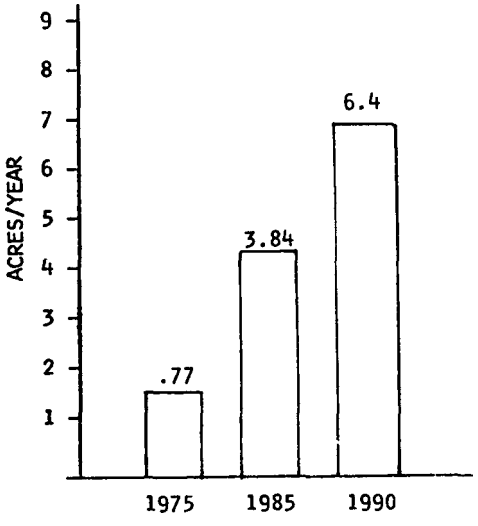


Fig. 86

TOTAL AREA USED FOR UTILITY
ASH AND SLUDGE DISPOSAL
IN WYOMING

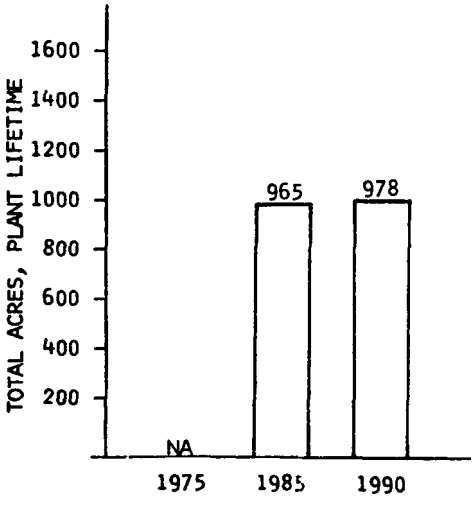
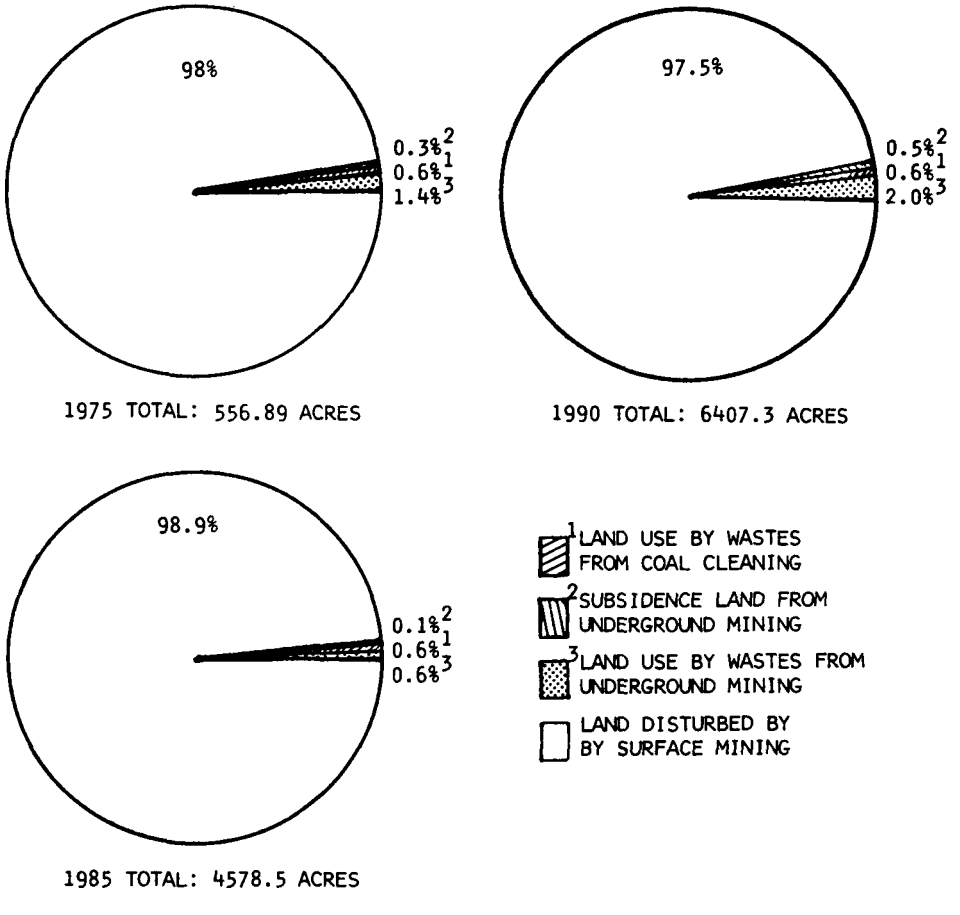


Fig. 87

LAND USE IN COAL MINING AND CLEANING--WYOMING
(Scenario numbers often total more than 100%.)



5.6.8 Institutional Issues

- Current institutional issues in Wyoming will not constrain energy development as projected by the Mid-Mid Scenario.
- Institutional issues that may arise beyond 1990 or in the case of an accelerated scenario are the cost and availability of water rights, possible legislation to limit export of electric power, and financing problems, as described in the following paragraphs.

The water rights issue revolves around three concerns: the absolute amount of water available, its highest and best use, and the rights of surface water users in downstream states. The Office of the State Engineer and the University of Wyoming are currently conducting research to create a better definition of the size of the state's water supply. There appears to be little interest in addressing the issue of highest and best use in the absence of an actual shortage. Although the state has a large supply of marketable water rights, only those companies that acquired their water rights many years ago (for example, Pacific Power and Light) are in a good position to develop new facilities. The issue of the rights of water users and the protection of wildlife habitat in downstream states came to a head in the Grayrocks Dam case. An out-of-court settlement was reached, which will enable the plant to be constructed while protecting the whooping crane habitat and the other water interests of Wyoming and Nebraska.

The Wyoming legislature is edging toward passage of legislation that would limit the amount of electric power that can be exported to other states relative to the amount that is consumed in Wyoming. The principal motivation behind this legislation is environmental. Early versions of the bill would have set the amount to be consumed in Wyoming as high as 20%. Passage of this legislation would make power generation in Wyoming uneconomical for the state's major generators, all of whom serve out-of-state markets.

Until recently financing problems were not significant for electric power companies. The states where Wyoming's energy is consumed are becoming increasingly resistant to the utilities' plea for rate increases to underwrite developmental costs. This means

that development costs must be paid out of the utilities' current cash flow, or from outside borrowing. Additional financing charges cause project costs to escalate. Costs for pollution control, even when financed with tax-exempt industrial development revenue bonds, also add significantly to the cost of the project.

In Wyoming, the response to all this had led to (1) curtailed long-term plans for additional generating capacity, (2) the formation of mineral mining subsidiaries to develop and sell utility coal and uranium holdings to other companies that are better able to use them, and (3) the seeking of foreign investors to supply utility capital needs. All these reflect growing constraints on the funding of additional conventional power generating facilities in this state.

Table XXIII

ENVIRONMENTAL IMPACTS[a] OF THE EIA TRENDLONG MID-MID SCENARIO ON COLORADO

	Air		Water		Land		Health & Safety[c]	Social and Economic			
Energy Source	Quality	Visibility	Quality	Availability[b]	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio-logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
COAL											
-Electric	H	H	L	L	H	M	L	H	H	H	L
OIL	L	L		L	M	L	L	L	L	L	L
GAS	L	L		L	L	L	L	L	L	L	L
NUCLEAR	L			L	M	M	L	L	L	L	L
CONSERVATION											
-Energy Efficiency Improvements					L	L	L	L	L	L	
-Urban Waste					L	L	L	L	L	L	
-Cogeneration					L	L	L	L	L	L	
SOLAR											
GENERAL											
-Utility	H	H	L	L	M	M	L	H	H	H	M
-Industry	M	H	L	L	M	M	L	L	L	L	
-Mining	L	L	M	H	M	M	M	H	H	H	

[a]Criteria for ranking impacts found in Table II.
[b]Includes groundwater.
[c]Includes health effects not covered by air quality.

Table XXV

ENVIRONMENTAL IMPACTS[a] OF THE EIA TRENDLONG MID-MID SCENARIO ON UTAH

	Air		Water		Land		Health & Safety[c]	Social and Economic			
Energy Source	Quality	Visibility	Quality	Availability[b]	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio-logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
COAL											
-Electric	H	L	L	L	H	M	L	H	H	H	L
OIL	L	L		L	M	L	L	L	L	L	
GAS	L	L		L	L	L	L	L	L	L	
NUCLEAR											
CONSERVATION											
-Energy Efficiency Improvements					L	L	L	L	L	L	
-Urban Waste					L	L	L	L	L	L	
-Cogeneration					L	L	L	L	L	L	
SOLAR											
GENERAL											
-Utility	H	L	L	L	M	M	L	H	H	H	L
-Industry	M	L	L	L	L	L	L	L	L	L	
-Mining	L	L	M	L	L	L	M	H	H	H	

[a] Criteria for ranking impacts found in Table II.
[b] Includes groundwater.
[c] Includes health effects not covered by air quality.

Table XXIV

ENVIRONMENTAL IMPACTS[a] OF THE EIA TRENDLONG MID-MID SCENARIO ON MONTANA

Energy Source	Air		Water		Land		Health[c] & Safety	Social and Economic			
	Quality	Visibility	Quality	Availability[b]	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio-logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
COAL											
-Electric	M	L	L	L	H	M	L	H	H	H	L
OIL	L	L		L	M	L	L	L	L	L	
GAS		L									
NUCLEAR											
CONSERVATION											
-Energy Efficiency Improvements					L	L	L	L	L	L	
-Urban Waste					L	L	L	L	L	L	
-Cogeneration					L	L	L	L	L	L	
SOLAR											
GENERAL											
-Utility	M	L	L	L	M	M	L	H	H	H	M
-Industry	L	L	L	L	L	L	L	L	L	L	
-Mining	L	L	M	L	M	M	M	H	H	H	

[a] Criteria for ranking impacts found in Table II.
[b] Includes groundwater.
[c] Includes health effects not covered by air quality.

Table XXVI

ENVIRONMENTAL IMPACTS[a] OF THE EIA TRENDLONG MID-MID SCENARIO ON WYOMING

	Air		Water		Land		Health & Safety[a]	Social and Economic			
Energy Source	Quality	Visibility	Quality	Availability[b]	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio-logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
COAL											
-Electric	M	M	L	L	H	M	L	H	H	H	L
OIL	L	L		L	M	L	L	L	L	L	
GAS	L	L		L	L	L	L	L	L	L	
NUCLEAR											
CONSERVATION											
-Energy Efficiency Improvements					L	L	L	L	L	L	
-Urban Waste					L	L	L	L	L	L	
-Cogeneration					L	L	L	L	L	L	
SOLAR											
GENERAL											
-Utility	M	M	L	L	M	M	L	H	H	H	L
-Industry	L	L	L		M	L	L	L	L	L	
-Mining	L	L	M	H	M	L	M	H	H	H	

[a] Criteria for ranking impacts found in Table II.
[b] Includes groundwater.
[c] Includes health effects not covered by air quality.

☆ U.S. Government Printing Office: 1979 — 677—115/223