UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER COLORADO 80203

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Dear

In August 1976, the United States Environmental Protection Agency, in cooperation with the State of Montana, established the EPA Montana Energy Operations Office in Helena, Montana. The challenge of this office is to develop an effective mechanism for transferring energy research results from the laboratory to the decision-makers. As a first step in fulfilling this challenge, a survey was initiated in the Fall of 1976 to summarize the federal energy effort in the State of Montana for FY '76. The report "Federally Sponsored Energy Research in the Northern Great Plains -- Montana" is the product of the survey. This document is directed towards those policy level personnel who are in the position of making financial decisions regarding research programs.

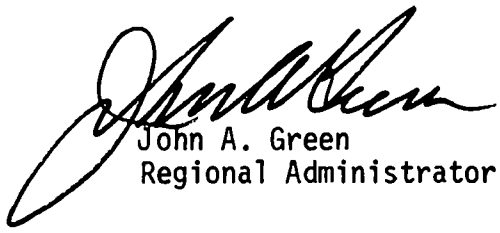
As part of an ongoing energy research information transfer process, the Region's Office of Energy Activities has been involved in working with the State of Montana as well as other states in the Region on a "one-to-one" information exchange basis. This approach is primarily designed to identify existing or potential energy development problems and identify specific energy research results or experts that have the capability to help resolve the problem situation. To complement the "one-to-one" exchange, the Environmental Protection Agency is presently developing, in cooperation with other federal agencies, a Regional Energy Information Library in Denver that will allow decision-makers to gain

better access to energy research information. Simultaneously, the EPA Montana Energy Operations Office is closely working with the State of Montana to assist in developing an integrated statewide energy information transfer system.

Developments for the future include a second document (to be issued in late summer) that will present technical abstracts, contact points for additional technical information, and report bibliographies for energy research that is in progress or completed in the State of Montana. It is anticipated that this document will be made available to the statewide integrated energy information system and distributed to those individuals that require current energy information system and distributed to those individuals that require current energy research information.

Over the past year, a great deal has occurred in the energy area. EPA has worked closely with the states in the Region to transfer energy research information. With expected development pressures in the Region to increase, we know that we will have to work harder to transfer this energy research information in a timely manner to the users. Your help and suggestions are solicited in assisting us in developing effective mechanisms for accomplishing this goal.

Sincerely,



John A. Green
Regional Administrator

EPA-908/4-77-004

FEDERALLY SPONSORED ENERGY RESEARCH IN THE NORTHERN GREAT PLAINS

MONTANA

FY 1976

Allen S. Lefohn
Montana Energy Operations Office
State Capitol
Helena, Montana 59601

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENERGY ACTIVITIES
REGION VIII
DENVER, COLORADO 80295

March 1977

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This report has been reviewed by the Denver Regional Office, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

In August 1976, the U.S. Environmental Protection Agency, in cooperation with the State of Montana, established the EPA Montana Energy Operations Office. An objective of this office is to develop an effective mechanism for transferring energy research results from the laboratory to the decision-makers. As a way to fulfill part of this challenge, a survey was initiated in the Fall of 1976 to summarize the federal energy effort in the State of Montana. This report is a summary of the information obtained from numerous state and federal publications. Recommendations regarding further actions on various aspects of energy research are included. The report serves primarily as an informative document to inform researchers, state and federal government officials, industry, and decision-makers at all government levels how and where the federal energy research dollar is being directed in Montana.

ACKNOWLEDGEMENTS

A very large number of persons have contributed to the development of this summary report. I would like to express my warmest thanks to all.

Members of the following agencies and institutions have been particularly helpful: the Montana Energy Advisory Council (MEAC), State of Montana; the Office of Energy Activities, Environmental Protection Agency, Denver, Colorado; the Office of Research and Development, Environmental Protection Agency, Washington, D.C.; and the Old West Regional Commission, Washington, D.C.

Critical contributions or review of the present document were provided by James Nybo, Sharon Solomon, Terry Wheeling, and Nancy McLane of the Montana Energy Advisory Council, and members of the Office of Energy Activities, Environmental Protection Agency, Denver, Colorado.

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TABLES

I. OVERVIEW

Since the Arab oil embargo of late 1973, the energy situation of the United States has been the focus of much analysis and comment. The importance of energy to the nation was real long before this point of public and government revelation. The significance of energy in the American life style has been steadily increasing over the past several decades. For example, gross U.S. energy demand has risen at about 4 percent a year since 1950 until 1973 (U.S. Department of the Interior, 1975). Similarly, for many years electric power demand grew at an annual rate of about 7 percent (U.S. Federal Energy Administration). While the growth rate for electricity fell to about 1 percent in 1974, and in 1975 to 2 percent (U.S. Department of the Interior, 1975), the demand for both gross energy and electricity increased by mid-1976 markedly over 1975 levels (Environmental Quality Council, 1976). National gross energy consumption has fluctuated over the last three years and projections through the year 2000 show an average exponential increase of 2.91 percent per year over the 1972 levels (72.2 quadrillion BTU), (U.S. Energy Research and Development Administration, 1975).

Despite a probable lower rate of growth in U.S. energy consumption during the next quarter century, there probably will be substantial changes in the physical forms, geographic sources and means of production of U.S. energy supplies by the year 2000 (Federal Energy Administration, February 1976). With greater dependence on coal, the Northern Great Plains Region will experience greater development pressures (Nehring, 1976). In excess of 1.5 trillion

tons of coal are estimated to lie at all depths within the Region. About 10 percent of this total amount is actually measured, or at least strongly indicated by local measurements, and is also mineable. This amount equals 160 billion tons and presently represents 37 percent (by weight) of the Nation's coal reserve base. Of this 160 billion tons, half is located within areas where mining by surface methods is feasible (Montana 42.6 billion tons; North Dakota 16.0 billion tons; South Dakota 0.4 billion tons; and Wyoming 21.2 billion tons (Northern Great Plains Resources Program, February 1974). Besides these vast quantities of coal, it is the relatively low cost combined with low sulfur content by weight (in comparison to eastern coals) that attracts the coal industry towards the West.

The coal resource is extensive. It provides an alternative fuel for use of increasingly scarce natural gas and increasingly costly residual fuel oil by electrical utilities. However, its use is not without problems. The mining, transport and conversion of coal may have several adverse effects on the environment. In addition, socio-economic effects (boom town and bust) indirectly impact local areas as well as state institutional systems through population changes associated with developments in each phase of the coal fuel cycle.

It is the public concern for the health, environmental, social and welfare impacts of energy-related activities that has become a critical factor in defining the growth trajectory for domestic energy production. These public concerns are directed at observable as well as suspected deleterious aspects of the discovery, extraction, transport and conversion of fuels, as well as their ultimate use.

During the next several years, the nation will be faced with a series of critical energy-related decisions of utmost priority and importance. The need for increasing the nation's energy supply must be balanced against the need for

minimizing environmental impacts caused by energy production. Any environmental program that is implemented must provide to the nation the basic understanding necessary to project, evaluate, and monitor environmental effects and to suggest appropriate control technology. Successful implementation of an environmental research program will affect all aspects of the energy self-sufficiency program and will be a significant determinant of ultimate energy resource use and development patterns.

The ultimate limitation to resource development is the amount of environmental degradation that the American people are willing to accept for secure, abundant energy supplies. The principal intermediate constraints are the availability of capital and materials, the availability and selection of suitable sites, the economic, social and environmental costs of power generation and delivery systems, the relative efficiencies and availability of alternative energy sources, the availability of effective resource management systems, and the state of pollution control and abatement technologies.

Rational and effective decision-making concerning future coal supply and demand options will depend greatly upon the application of science and engineering to forecast the amount and kinds of effects that will result from various energy production and use options.

II. INTRODUCTION

As a result of a national need for assessing the impacts of various energy-producing activities on the environment, the federal government has launched an extensive research program. In FY '76, the federal government spent approximately $300 million (Energy Research and Development Administration, 1976)

in research and analysis for the specific purpose of assessing the impacts of various energy producing activities on the environment. Table 1 summarizes the total FY '76 and FY '77 federal effort. Results from various energy-related projects are now beginning to be published by the federal agencies who are sponsoring these activities. Recognizing the need for transferring the results of these studies to decision-makers, this report attempts to identify the federally-funded energy research projects that are conducted in the State of Montana. Federal research dealing with technology development was included in the survey. It is anticipated that as new technology breakthroughs occur, appropriate environmental assessment activities will be sponsored to assess possible environmental impacts.

The extensive research information systems established by the Montana Energy Advisory Council (MEAC), (Nybo, 1976a), and the Old West Regional Commission (Old West Regional Commission, 1975) provided the momentum for initiating this search to identify how and where the federal research dollar is being directed in Montana. The accuracy and completeness of these information systems are susceptible to error, but it is believed these information data bases are reasonably comprehensive. Those studies that are carried out over a several state area are identified and appropriate funding levels are listed. Future reports will be published and will describe federal energy research activities in the states of Wyoming, North Dakota, South Dakota, Colorado, Utah, and New Mexico.

Information describing ongoing, federally-funded Montana energy research is organized as follows:

Air Quality/Meteorology (baseline monitoring),

Alternate Sources (solar, wind, geothermal, small-scale hydro power),

Biological (fish, vegetation and wildlife),

Coal (conversion and new technologies),

Economics (impacts on local economics),

Energy Policy,

Geology and Soils,

Governmental Studies (impacts on local governments),

Land (use, ownership and reclamation),

Oil, Gas, Electricity and Uranium (transmission, explorative, and new sources),

Population/Demographic,

Resource Allocation (energy conservation and fuel substitution),

Sociological Studies,

Water Quality (baseline monitoring and impact degradation),

Water Use/Supply (allocation, diversion, water rights).

The Old West Regional Commission and the Montana Energy Advisory Council monitor the energy research that is being sponsored by the federal government, the State of Montana, industry, university system, and the combination of state and federal government, and industry and federal government. Their sources of energy research information include university research offices, individual researchers, state agencies, federal agencies, Smithsonian Science Information Exchange, Oakridge National Laboratory Energy Information Center, Montana Congressional delegates, newspaper and newsletter articles, and industry.

III. RESULTS

Federal funding for energy research in Montana represents approximately 90 percent of the total spent by the federal government, Montana, and industry (Nybo, 1976b). Tables 2 through 17 summarize the federal effort in Montana. Because the state does have vast resources of coal, a substantial amount of the federally-sponsored research does deal with the development of coal and with ameliorating the effects associated with this development. For example, of the total energy research dollars spent during FY '76 in Montana by the U.S. Government ($9.7M), 15.3 percent was associated with coal technology development projects. Environmental assessments associated with biological research represented 17.6 percent of the federal effort. Land reclamation activities comprised 15.2 percent. Water quality and water use monitoring programs (11.8 percent and 10.5 percent, respectively) were directed toward assessing baseline conditions and developing control measures in the State of Montana. Air quality and meteorology studies represented approximately 4.3 percent of the total funds that the federal government spent on energy research projects in the state. Energy policy research did receive approximately 2.3 percent of the effort. Geology and soils received 0.5 percent, governmental studies 3.2 percent, population/demographic 0.4 percent, and resource allocation 7.9 percent. Alternative energy sources research and sociological studies were funded at 1.6 percent and 2.9 percent, respectively.

The Environmental Protection Agency provided approximately 31.8 percent of the federal funds for energy research in and for Montana. Most of this research was associated with air quality, water quality, meteorology, biological assessment, economic and energy policy research efforts. On the other hand, ERDA, which contributed

18.1 percent of the federal energy research funds for the State of Montana, committed most of its resources toward coal technology development. The Department of the Interior (27.9 percent) devoted a majority of its resources to the area of water use and supply and land reclamation. The Department of Agriculture (5.5 percent) directed its research toward the land reclamation and biological assessments. The Old West Regional Commission (6.3 percent) sponsored governmental studies, population/demographic and sociological studies. The Water Resources Council (7.9 percent) sponsored resource allocation research.

IV. CONCLUSIONS AND RECOMMENDATIONS

As anticipated, the Environmental Protection Agency is heavily involved in assessing environmental impacts of energy activities in the State of Montana. On the other hand, the Energy Research and Development Administration in the State of Montana is committed toward development of various coal-oriented technologies. The U.S. Department of Agriculture was heavily involved in land reclamation activities and the U.S. Department of the Interior was involved in water use and supply determinations and land reclamation. While the federal involvement has been heavily directed toward engineering/physical and biological monitoring, there has been very little research sponsored by the federal government in the socio-economic research area. It is unclear why little emphasis on this area has developed. This low-level of federal effort may reflect the lack of any one federal agency having clear responsibility for assessing socio-economic impacts. In addition, it may reflect that presently the emphasis on the environmental impact statement procedure is one of biological and physical characterization. It might be assumed that federal research efforts in the socio-economic area could be increased if additional emphasis were given to this area during the EIS review process.

It is also apparent that federally sponsored research in Montana dealing with alternative sources (renewable energy supplies) and resource allocation (conservation programs) is minimal. Additional effort needs to be directed towards those energy areas that can provide adequate supplies with socially acceptable environmental impact.

As part of an ongoing energy research information transfer process, the Environmental Protection Agency has been involved in working with the decision-makers on a "one-to-one" information exchange basis. This approach is primarily designed to identify existing or potential energy development problems and identify specific energy results or experts that have the capability to help resolve the problem situation. As a part of this approach, a second document will be issued that will present technical abstracts, contact points for additional technical information, and report bibliographies for energy research that is in progress or completed in the State of Montana.

The energy decisions that Northern Great Plains states, such as the State of Montana, will have to face over these coming years will be very critical to regional development as well as to the national energy supply. The research activities that are being sponsored by the federal government will play a major role in providing the data that assist the states and the national government in making these major decisions. The challenge to the federal government is how to develop viable information systems that will allow the decision-makers to astutely apply the research data and results that are presently being generated.

Table 1

National Energy R&D Federal Expenditures

Agency	FY '76 $(M)	FY '77 $(M)
ERDA	1800.0	2413.0
USDI	150.0	161.5
EPA	120.0	120.0
NRC	86.0	103.2
NASA	1.0	0.8
NSF	74.2	106.9
Total	2231.2	2905.4

Source: Energy Research and Development Administration, "A National Plea for Energy Research, Development, and Administration: Creating Energy Choices for the Future 1976", Volume 2, P. XVII.

FEDERALLY SPONSORED ENERGY RESEARCH CONDUCTED IN MONTANA
$(K) -- FY '76

	NSF	USDA	EPA	USDI	FEA	ERDA	OTHER	TOTAL	PERCENT
Air Quality/Meteorology	--	--	420	--	--	--	--	420	4.3
Alternative Sources	--	--	40	33	--	--	80	153	1.6
Biological	--	186	1,005	143	--	370	--	1,704	17.6
Coal	52	--	--	151	23	1,256	--	1,482	15.3
Economics	--	20	217	1	32	--	--	270	2.8
Energy Policy	--	--	222	3	--	--	--	225	2.3
Geology & Soils	--	--	--	50	--	--	--	50	0.5
Government Studies	--	--	--	--	--	--	314	314	3.2
Land	--	304	116	967	--	76	10	1,473	15.2
Oil, Gas, Elec., Ur.	--	--	--	290	14	51	--	355	3.7
Population/Demographic	--	--	--	--	--	--	39	39	0.4
Resource Allocation	--	--	--	--	--	--	767	767	7.9
Sociological Studies	--	18	--	--	--	--	258	276	2.9
Water Quality	--	--	1,066	82	--	--	--	1,148	11.8
Water Use/Supply	34	--	--	987	--	--	--	1,021	10.5
Total	86	528	3,086	2,707	69	1,753	1,468	9,697	100.0
Percent	0.9	5.5	31.8	27.9	0.7	18.1	15.1	100	

Table 3

AIR QUALITY / METEOROLOGY

Project Title	Sponsoring Agency	$(K)	Investigator
Study and Monitoring of Fort Union Basin - Air Quality	EPA	72	D. Maughan, Montana Department of Health and Environmental Sciences
Eastern Montana Air Quality Monitoring	EPA	31	D. Maughan, Montana Department of Health and Environmental Sciences
Pilot Balloon Observations in the Northern Great Plains - Temperature Soundings in the Northern Great Plains	EPA	32	Aeromet, Norman, Oklahoma
Integrated Aerosol Characterization Monitoring - Colstrip, Montana	EPA	132	Pueschel and McNice, NOAA, Boulder, Colorado
Health Study Phase I & II	EPA	20	D. Haddow, Department of Health and Environmental Sciences
Air Monitoring Characterization at the Hay Coulee Site, Colstrip, Montana	EPA	118	R. Lewis, EPA, Corvallis Oregon
A Remote Sensing Study of the Bioenvironmental Effects of Stack Emissions from the Colstrip, Montana, Power Plant	EPA	15	J. Taylor, Montana State University

Table 4

ALTERNATIVE SOURCES

Project Title	Sponsoring Agency	$(K)	Investigator
Color Infrared Aerial Photography -- Geothermal Resource Areas in Montana and Wyoming 1/	USDI	13	J. Stroebele, U.S. Fish and Wildlife Service, Billings, Mt.
Geothermal Reconnaissance of Southwestern Montana	USDI	20	R. Chadwick, Montana State University
State of Montana Solid Waste Management and Resource Recovery Study	EPA	40	T. Carmody, Solid Waste Management Bureau, Helena, Montana
National Center for Appropriate Technology	Community Services Admin.	50	MHD Institute, Butte, Montana
Review Report -- Missouri River -- North Dakota, South Dakota, Nebraska and Montana 2/	U.S. Army Corps of Engineers	30	C. Garvey, U.S. Army Corps of Engineers, Omaha, Neb.

1/ Total project funded at $26K.
2/ Total project funded at $133 K.

Table 5

BIOLOGICAL (FISH, VEGETATION & WILDLIFE)

Project Title	Sponsoring Agency	$(K)	Investigator
Reproduction Biology of Genus Artemisia L. in Eastern Montana	USDA	4	T. Weaver, Montana State University
Assessment and Implementation of In-Stream Studies for the Northern Great Plains	EPA	25	A. Silverman, University of Montana
Toxic Effects on the Aquatic Biota From Coal and Oil Shale Development 3/	EPA	287	R. K. Skogerboe and V. Thurston, Colorado State and Montana State University
Investigation of the Bioenvironmental Impact of Fossil Fuel Power Plants in the Fort Union Basin, Montana	EPA	52	C. C. Gordon, University of Montana
Effects of Coal Extraction and Related Development on Wildlife Population	USDI	9	R. Phillips, U.S. Fish and Wildlife Res. Center, Denver, Colorado
Distribution and Abundance of Breeding Birds on Surface Mineable Coal Lands in the Northern Great Plains	USDI	12	J. Hickey, University of Wisconsin
Habitat Requirements and Locations of Spawning and Nursery Areas in the East Poplar River, Montana	EPA	8	J. Keiser, Montana Water Quality Bureau, Billings, Montana
Monitoring Plant Community Changes Due to Fossil Fuel Power Plants in Eastern Montana	EPA	56	J. Taylor, Montana State University
A Cooperative Evaluation of Potential Air Pollution Injury and Damage to Coniferous Habitats on National Forest Lands Near Colstrip, Montana	USDA	36	C. C. Gordon, University of Montana

3/ Total project is funded at $ 575K.

Table 5 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Rosebud Creek Study	EPA	22	A. Elser, Mt. Fish and Game, Helena, Mt.
An Evaluation of the Environmental Impact of the Existing Surface Mining Methods for Western Coal Mines 4/	EPA	58	W. Kelly, Mathematica, Inc., Princeton, N.J.
Ranking of Wildlife Values on Federal Coal Lands	USDI	26	J. Wambaugh, Mt. Fish and Game, Helena, Mt.
Predicted Impact of Coal Development on the Fishery Resources of the Tongue River Reservoir, Mt.	USDI	20	R. Penkal, Montana State University
Survey of Grasses, Forbs and Shrubs in Preparation for Land Reclamation	USDA	36	D. Eddleman, University of Montana
Prediction of the Effects of Energy Development on the Aquatic Resources of Two Upper Missouri River Reservoir Ecosystems 5/	EPA/USDI	12/12	B. Nelson, U.S. Fish and Wildlife Services, Pierre, S.D.
Decker-Birney Wildlife Study.	USDI	17	S. Knapp, Montana Fish and Game, Birney, Mt.
Fisheries Investigations of the Yellowstone River, as Related to Water Quality Investigations of the Yellowstone River, Montana	USDI	26	L. Peterman, Montana Fish and Game, Miles City, Montana
Impact of Coal Strip Mining on the Aquatic Resources of Sarpy Creek Drainage, Mt.	USDI/EPA	6/17	R. Gregory, Montana State University

4/ Total project is funded at $173K.
5/ Total project is funded at $25K/$25K.

Table 5 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Impact of Energy Development on the Wildlife of Northwestern Wyoming, Northwestern South Dakota and Southeastern Montana 6/	USDI	15	F. Schitoskey, South Dakota State University
Effects of SO_2 and Other Coal-Fired Plant Emissions on Producer, Invertebrate Consumer and Decomposer Structure and Function in an Eastern Montana Grassland	EPA	155	J. Dodd, Colorado State University
Use of Lichens as Indicators and Predictors of Air Pollution Around a Coal-Fired Power Plant	EPA	15	S. Eversman, Montana State University
Physiological Responses of Vegetation to Coal-Fired Power Plants	EPA	30	D. Tingey, EPA, Corvallis, Oregon
Investigations of the Effects of Coal-Fired Power Plant Emissions Upon Insects	EPA	28	J. Bromenshenk University of Montana
Effects of Coal-Fired Power Plant Emissions on Vertebrate Animals in Southeastern Montana	EPA	200	R. Lewis, EPA, Corvallis, Oregon
The Field Experimental Component: Evaluation of the Zonal Air Pollution Systems	EPA	40	E. Lewis, EPA, Corvallis, Oregon
Atmospheric Sciences: Potential of Energy Extraction and Conversion Processes in the Northern Great Plains for Sulfur, Fluorine, Heavy Metals Contamination in Terrestrial and Aquatic Ecosystems and Its Impact on Plant Community Productivity and Stability Including Secondary Effects on Animal Species in the Food Chain	ERDA	370	J. O'Toole, ERDA, Ames, Iowa

6/ Total project funded at $44K.

Table 5 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Effects of Species Root Distribution in Soil Biota -- Genesis Hydrological Characteristics	USDA	110	G. Nielsen, Agricultural Experiment Station, Montana State University

Table 6

COAL

Project Title	Sponsoring Agency	$(K)	Investigator
Field Evaluation of Low Sulfur Subbituminous Coal Reserves in the Fort Union Basin of Montana and Wyoming 7/	USDI	100	R. Matson, Montana Bureau of Mines and Geology, Butte, Montana
Field Sampling of Future Strip Mine Areas, Fort Union Region, Eastern Montana	USDI	10	R. Matson, Montana Bureau of Mines and Geology, Butte, Montana
MHD Systems Instrumentation and Control -- Recovery and Utilization of Dilute Nitric Oxide From a MHD Generator	ERDA	42	F. P. McCandless, Montana State University
Preliminary Design of a Direct-Fired, Falling-Bed Air Preheater for a MHD Generator Test Facility	ERDA	82	R. Mussulman, Montana State University
Physical Properties of Coal Slags Related to MHD Systems	ERDA	73	G. Lapeyre, Montana State University
MHD Systems, Instrumentation and Control -- MHD System Instrumentation and Data Acquisition	ERDA	47	R. Johnson, Montana State University
Slag Physical Properties	ERDA	71	V. H. Schmidt, Montana State University
Slag Flow Characteristics and NO_x Kinetics in MHD Heat Exchangers	ERDA	307	H. W. Townes, Montana State University
MHD Systems, Instrumentation and Control (Cycle Analysis and Control)	ERDA	95	D. Pierre, Montana State University

7/ Total project funded at $200K.

Table 6 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
MHD Systems, Instrumentation and Control - Inverter	ERDA	42	R. Durnford, Montana State University
Coal Hydrogenation and Hydrocracking Using a Metal Chloride-Gaseous HCl Catalyst System	NSF	28	F. P. McCandless Montana State University
Catalytic Hydrogenation of Coal Derived Liquids	ERDA	52	F. P. McCandless, Montana State University
Environmental Effects From Leaching of Coal Conversion By-Products	ERDA	75	W. VanMeter, University of Montana
Heat Transfer From Horizontal Finned Tube Bundles in a Fluidized Bed	NSF	24	W. Genetti, Montana State University
Characterization of Coal for Open-Cycle MHD Power Generation System	ERDA	118	F. E. Diebold, Montana College of Mineral Sciences and Tech., Butte, Montana
Corrosion Studies of Pre-Heater Materials - Task B	ERDA	130	W. D. Callister Montana College of Mineral Sciences and Tech., Butte, Montana
Preparation of Coals for Utilization in Direct Coal-Fired MHD Generation - Task C	ERDA	122	G. F. Ziesing, Montana College of Mineral Sciences and Tech., Butte, Montana
An Analysis of the Applicability of the Production of Synthetic Liquid Fuels From Coal in Montana	FEA	3	J. McBride, University of Montana
Cost/Demand Analysis	FEA	20	MHD Institute, Butte, Montana
Limits and Cost Sensitivity of Alternate Parting Handling Methods	USDI	41	T. Finch, Montana College of Mineral Sciences and Technology, Butte, Montana

Table 7

ECONOMICS

Project Title	Sponsoring Agency	$(K)	Investigator
Estimate Economic, Social and Cultural Consequences of Coal and Oil Shale Development to Support Integrated Assessment Studies 8/	EPA/USDA	92/20	USDA, Economic Research Division, Washington, D.C.
Economics of Coal and Oil Shale Development on Environmental Quality in Rural Areas 9/	EPA	57	J. Green, Colorado State University
Western Regional Energy Development Study -- Phase III -- Socioeconomic Impacts and Secondary Impacts 10/	EPA	68	J. Gilmore, University of Denver
Economic Analysis of Oil Refining in Montana	FEA	2	P. E. Polzin, University of Montana
Site Tradeoff Study	FEA	30	D. Brelsford, MHD Institute, Butte, Montana
State Government's Use of Funds Allocated from Mineral Leasing Act Receipts 11/	USDI	1	M. Johnson, University of Montana

8/ Total project funded at $460K/$100K.
9/ Total project funded at $115K.
10/ Total project funded at $270K.
11/ Total project funded at $5K.

Table 8

ENERGY POLICY

Project Title	Sponsoring Agency	$(K)	Investigator
Laws Relating to Wildlife and Energy Development 12/	USDI	3	R. Beck, University of North Dakota
Technology Assessment of Western Energy Resource Development 13/	EPA	217	J. White, University of Oklahoma
Energy-Environment Information Transfer System	EPA	5	C. C. Gordon, University of Montana

12/ Total project funded at $15K.
13/ Total project funded at $1,300K.

Table 9

GEOLOGY & SOILS

Project Title	Sponsoring Agency	$(K)	Investigator
Geochemical Survey of the Western Coal Regions 14/	USDI	50	J. Connor, U.S.G.S., Denver, Colorado

Table 10

GOVERNMENTAL STUDIES

Project Title	Sponsoring Agency	$(K)	Investigator
Montana Community Technical Assistance Program	OWRC	314	Montana Department of Community Affairs

14/ Total project funded at $500K.

Table 11

LAND (USE, OWNERSHIP AND RECLAMATION)

Project Title	Sponsoring Agency	$(K)	Investigator
Premining Evaluation of Overburden at Coal Strip Mining Areas of Powder River Basin, Wyoming-Montana	USDA	26	T. Yamamoto, South Dakota School of Mines and Tech
Effects of Different Rehabilitation Treatment Methods on Surface Runoff Quantity and Quality and Erosional Behavior of Surface Mine Spoils in the Intermountain West 15/	USDA	3	P. E. Packer Forestry Sci. Lab. Logan, Utah
Photo Interpretation as a Tool for Assessing the Revegetation of Surface Mined Areas 16/	USDA	8	B. Richardson Forestry Sci. Lab. Logan, Utah
Demonstration of Revegetation Techniques	USDA	5	F. Kenney, Decker Coal Company, Sheridan, Wyoming
Effects of Fertilizer Rate and Time of Application on a Mine Spoil Rehabilitation Seeding	USDA	25	R. L. Meyn, Montana State University
Characterization of Physical and Chemical Properties of Spoils 17/	USDA	63	F. Sandoval, Northern Great Plains Research Center, North Dakota
Preliminary Evaluation of Strip Mine Spoils and Methods for Their Revegetation. Commodity: Coal 18/	USDA	7	F. Sandoval, Northern Great Plains Research Center, North Dakota
Energy Minerals Rehabilitation Inventory and Analysis -- EMRIA 19/	USDI	547	R. Kuhlman, U.S. Bureau of Land Management, Denver, Colorado

15/ Total project funded at $80K.
16/ Total project funded at $16K.
17/ Total project funded at $190K.
18/ Total project funded at $20K.
19/ Total project funded at $821K.

Table 11 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Establishment, Succession and Stability of Vegetation on Surface Mined Lands in Eastern Montana	ERDA	76	B. Sindelar, Montana State University
Column Leaching Studies of Coal Mine Spoil Material	EPA	2	G. Pagenkopf, Montana State University
Evaluation of Solid Waste as Physical and Chemical Amendments in Revegetation of Coal Surface Mine Spoils	USDA	27	H. Peavy, Montana State University
Trend-Surface Analysis of Powder River Basin, Wyoming-Montana, and Williston Basin, North Dakota 20/	USDA	5	T. Yamamoto, Forest Res. Lab., S.D. School of Mines and Technology South Dakota
Remote Sensing Resources Project	NASA	10	Larry Reddin, Montana Dept. of Natural Resources and Conservation, Helena, Mt.
Program Development for Measurement of Erodibility of Spoil Banks	USDA	10	W. Hunt, Montana State University
Effects of Surface Configuration in Water Pollution Control 21/	EPA	108	R. Hodder, Montana State University
Effect of Selective Replacement of Coal Surface Mine Overburden Strata on Soil and Hydrology Relationships	USDI	420	R. Hodder, Montana State University
Establishment and Seed Development of Species Grown on Reclaimed Areas	USDA	50	L. Wiesner, Montana State University
Development of a Simulation Model for Evaluation of Surface Mining Operations and Reclamation Plans 22/	USDA	4	D. Gibson, Montana State University

20/ Total project funded at $9K.
21/ Total project funded at $269K.
22/ Total project funded at $13K.

Table 11 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Performance of Individual Species in Various Grass Mixtures Growing on Mine Overburden Piles 23/	USDA	2	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Hydromulching as an Alternative Mulching Method on High Sodium Surface Mine Disturbances	USDA	7	B. Richardson, Intermountain Forest and Research Station, Logan, Utah
Develop Grass, Shrub and Tree Planting Techniques on Coal Surface Mine Spoils 24/	USDA	2	S. Monson, Intermountain Forest and Research Station, Logan, Utah
Develop Automatic Irrigation Systems for Grasses, Shrubs and Trees 25/	USDA	1	B. Richardson, Intermountain Forest and Research Station, Logan, Utah
Development of Improved Varieties of Grasses Tolerant to Acid and Saline Soils for Reclamation of Surface Mined Areas 26/	USDA	7	D. Dewey, U.S. Agriculture Research Service, Logan, Utah
Develop Criteria for Utilization of Irrigation to Ameliorate Adverse Site Conditions for Initial Plant Cover Establishment	USDA	1	B. Richardson, Intermountain Forest and Research Station, Logan, Utah
Efficiency of CO_2 Fixation of Plants on Different Mine Spoils 27/	USDA	3	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Evaluate and Determine Species Adaptability on Surface Mine Overburden and Spoils Resulting From Coal Mining in Eastern Montana Assessed by Greenhouse Bioassay Techniques	USDA	6	R. Richardson, Intermountain Forest and Research Station, Logan, Utah

23/ Total project funded at $13K.
24/ Total project funded at $7K.
25/ Total project funded at $2K.
26/ Total project funded at $20K.
27/ Total project funded at $8K.

Table 11 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
The Influence of Topsoil Depth on Plant Cover Establishment and Growth on Sodi Coal Mine Overburden Piles	USDA	10	B. Richardson, Intermountain Forest and Research Station, Logan, Utah
Reduction of High Sodium Content in Coal Mine Spoils with Time	USDA	7	B. Richardson, Intermountain Forest and Research Station, Logan, Utah
Development of Rehabilitation Methods for Alpine Disturbances 28/	USDA	2	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Develop Seed Sources for Adapted Alpine Plants for Use in Alpine Surface Mine Revegation 29/	USDA	1	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Effect of Different Revegetation Techniques on Successional Trends on Mine Spoils 30/	USDA	6	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Performance of Species in Mixtures Growing on Alpine Mine Spoils	USDA	5	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Species Adaptability to Alpine Mine Spoils Assessed by Bioassay Techniques	USDA	3	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Nitrogen Fixation in Non-Leguminous Plants Used for Surface Mine Revegetation 31/	USDA	1	R. Brown, Intermountain Forest and Research Station, Logan, Utah
Identify Plant Species Adapted for Growth and Establishment on Alpine Mine Spoils 32/	USDA	2	R. Brown, Intermountain Forest and Research Station, Logan, Utah

28/ Total project funded at $4K.
29/ Total project funded at $5K.
30/ Total project funded at $11K.
31/ Total project funded at $3K.

Table 11 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Reclamation Potential of Energy Disturbed Lands 33/	USDI/EPA	5/6	P. Packer, Intermountain Forest and Research Station, Logan, Utah

33/ Total project funded at $36K/$40K.

Table 12

OIL, GAS, ELECTRICITY & URANIUM

Project Title	Sponsoring Agency	$(K)	Investigator
Test of Oil "Wash" Method, Bell Creek Fields, Montana	ERDA	37	R. Branish, Gary Operating Company, Colorado
Uranium Water & Sediment Geochemistry of Boulder Batholith, Western Montana	ERDA	14	A. Silverman, University of Montana
Western Energy Expansion Study	USDI	290	J. Davies, Bureau of Reclamation, Billings, Montana
Northern Tier Crude Oil Study	FEA	14	J. Nybo, Montana Energy Advisory Council, Helena, Montana

Table 13

POPULATION/DEMOGRAPHIC

Project Title	Sponsoring Agency	$(K)	Investigator
Montana Futures Process	OWRC	39	G. Hoven, Mt. Department of Community Affairs, Helena, Montana

Table 14

RESOURCE ALLOCATION

Project Title	Sponsoring Agency	$(K)	Investigator
Yellowstone River Basin and Adjacent Coal Area Level "B" Study -- Energy Analyses 34/	U.S. Water Resources Council	767	K. Corrigall, Missouri River Basin Commission

34/ Total project funded at $2,300K.

Table 15

SOCIOLOGICAL STUDIES

Project Title	Sponsoring Agency	$(K)	Investigator
Bridging Resource and Social Variables: A Project to Learn How to Plan for and Manage 'People Problems' Associated With Resource-Related Development	USDA	18	R. Gold, University of Montana
The Socioeconomic Impact of Energy Development of the Crow and Northern Cheyenne Indian Tribes	OWRC	258	J. Nordstrom, Northern Cheyenne Research Project

Table 16

WATER QUALITY

Project Title	Sponsoring Agency	$(K)	Investigator
Potential Impacts to Groundwater and Surface-water Quality and Quantity From Proposed Energy Development on the Northern Cheyenne Reservation, Montana	EPA	275	W. Woessner, Northern Cheyenne Reservation, Busby, Montana
Water Quality Effects of Coal Development on the Tongue River Reservoir	EPA	24	J. Keiser, Montana Water Quality Bureau, Billings, Montana
Water Quality Effects of Canadian Coal Development on the East Poplar River, Montana	EPA	24	J.Keiser, Montana Water Quality Bureau, Billings, Montana
Study and Monitoring of Fort Union Basin -- Water Quality	EPA	58	D. Willems, Montana Water Quality Bureau, Helena, Montana
Ground Water Analyses of Shallow Aquifers in the Tongue, Yellowstone and Missouri Drainage	EPA	38	G. Pike, USGS, Helena, Montana
Water Quality and Biological Monitoring Program for Energy Resource Areas -- Montana	EPA	28	G. Pike, USGS, Helena, Montana
Effects of Surface Configuration in Water Pollution Control on Semi-Arid Mined Lands	EPA	259	W. VanVoast, Montana State University
A Model for Predicting Ion Concentration in the Yellowstone River Basin Between Miles City and Billings, Montana: A Management Tool	EPA	6	R. Karp, Montana State University
Water Resources Aspects of Coal Transportation by Slurry Pipeline 35/	USDI	18	J. Moore, Water Resources Res. Center, Fayetteville, Arkansas

35/ Total project funded at $55K.

Table 16 Cont'd.

Project Title	Sponsoring Agency	$(K)	Investigator
Compilation of Hydro-geological Data for Southeastern Montana	EPA	20	M. Miller, Montana Bureau of Mines and Geology, Butte, Montana
Nonpoint Source Water Quality Project	EPA	58	R. Choriki, Montana Testing Lab., Great Falls, Montana
A Cooperative Program to Evaluate Surface and Ground Water Problems Associated with Potential Strip Mine Sites 36/	EPA	276	R. Koob, P. Rechard, T. Williams, North Dakota State, University of Wyoming, Montana State University, and Montana College of Mineral Sciences and Technology
Hydrological Reconnaissance of the Fort Union Formation	USDI	9	W. VanVoast, Montana State University
Chanel Changes in the Powder River 37/	USDI	20	R. Meade, USGS, Lakewood, Colorado
Hydrology of the Madison Limestone and Associated Rocks in Parts of Montana, Nebraska, North Dakota, South Dakota and Wyoming 38/	USDI	35	E. Cushing, USGS, Lakewood, Colorado

36/ Total project funded at $629K.
37/ Total project funded at $28K.
38/ Total project funded at $1,300K.

Table 17

WATER USE / SUPPLY

Project Title	Sponsoring Agency	$(K)	Investigator
Effects of Mining and Related Activities on the Shallow Ground-Water System	USDI	187	G. Pike, USGS, Helena, Montana
Collection of Surface-Water, Ground-Water and Quality of Water Data in Southeastern Montana	USDI	750	G. Pike, USGS, Helena, Montana
Hydrologic Effects of Surface Mining, Land Rehabilitation and Land Use as Defined by Rainfall Simulation 39/	USDI	7	G. Lusby, USGS, Denver, Colorado
Evaluation and Monitoring of the Hydrologic Impact of Cabin Creek, B.C., Coal Pit Mining Upon the North Fork of the Flathead River	USDI	8	W. Weber, University of Montana
Investigation of the Implications of Yellow-stone River Flow Reserva-tion in Montana	USDI	33	H. Boeker, U.S. Fish and Wildlife Service, Washington, D.C.
Water Conservation on Rangelands and Mine Spoils of the Northern Plains 40/	USDI	2	G. Schuman, US ARS, Cheyenne, Wyoming
Regionwide Evaluation of Available Hydrologic Data, Water Resource Consider-ations for the Proposed Eastern Montana Coal Development	NSF	34	R. Curry, University of Montana

39/ Total project funded at $75K.
40/ Total project funded at $6K.

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11. U.S. Federal Energy Administration, supra note 258, p. XXIV.

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15 SUPPLEMENTARY NOTES

This project is part of the EPA-planned and coordinated Federal Interagency Energy/Environment R&D Program.

16 ABSTRACT

In August 1976, the U.S. Environmental Protection Agency, in cooperation with the State of Montana, established the EPA Montana Energy Operations Office. The challenge of this office is to develop an effective mechanism for transferring energy research results from the laboratory to the decision-makers. As a way to fulfill part of this challenge, a survey was initiated in the Fall of 1976 to summarize the federal energy effort in the State of Montana. This report is a summary of the information obtained from numerous state and federal publications. Recommendations regarding further actions on various aspects of energy research are included. The report serves primarily as an informative document to inform researchers, state and federal government officials, and decision-makers at all government levels how and where the federal energy research dollar is being directed in Montana.

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a DESCRIPTORS			b IDENTIFIERS/OPEN ENDED TERMS	c COSATI Field/Group
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