

MINUTES OF THE MEETING
TAXATION COMMITTEE
MONTANA STATE SENATE

January 9, 1985

The second meeting of the Taxation Committee was called to order at 8:07 am, Wednesday, January 9, by Senator Thomas Towe, in Room 415 of the Capitol Building.

ROLL CALL: All members of the committee were present.

Chairman Towe relinquished the chair to Vice Chairman Mazurek for purposes of hearing SB 21.

CONSIDERATION OF SB 21: Senator Tom Towe, chief sponsor of the bill, was recognized. He explained that the bill would earmark a portion of the coal tax trust fund for coal research. Currently there is no coal tax revenue being spent on coal research. Other states and provinces are doing research in some areas, but there is no coal lab for subbituminous coal which is the kind extracted in Montana. The bill proposes a coal lab and research program related specifically to Montana needs.

Senator Towe then presented a chart explaining how the coal tax trust funds are currently being allocated and how this bill would change that (Exhibit 1). He then addressed how the portion of coal tax trust money for this bill would be allocated (Exhibit 2). Projections from the Governor's budget office of the total amount available in the coal tax trust were presented as follows:

FY 84	\$19 million
FY 85	24.5 million
FY 86	28.8 million
FY 87	33.5 million

Senator Towe estimated the following projections beyond FY 87:

FY 88	\$38 million
FY 89	43 million
FY 90	48 million

Senator Towe then addressed the nature of the research contemplated by the bill assigning it to four main categories: location and characteristics of the coal itself, marketing of Montana coal, alternatives to the traditional use of coal and coal by-products and reclamation of natural resources (land, water and air) disturbed by coal mining (Exhibits 3 and 4).

He suggested that it be left to the Board of Regents to select a lead institution for the research which would involve

the other institutions. He did not feel that designation should come from this bill.

Senator Towe said that coal is currently being mined entirely in Eastern Montana. Eastern Montana College, however, is not equipped as well as other units of the university system to handle coal research. EMC would, however, be an appropriate location for a center of future studies looking at concerns for Montana's future. This designation would then remove EMC from consideration for the "lead institution" designation.

PROPONENTS

Dr. Irving Dayton, Commissioner of Higher Education, was then recognized. He discussed the university system's established pattern of cooperation with state government and among the various units of the system itself. Research for the developmentally disabled and for gerontology have already been handled in this way. He addressed the methodology of developing these cooperative efforts among branches of the university system.

Representative Tom Asay, House District 27, was recognized and stated that he strongly supports coal research. He believes that combustion will cease to be a major use of coal. He noted that the state should be willing to support research that could be joined by private funding. He strongly supported the bill.

Edward Bingler, the state geologist from Montana Tech, addressed the committee from a prepared statement (Exhibit 5).

Fred De Money, President of Montana Tech was recognized and commended Senator Towe's effort. In an effort to make Montana coal marketable he stated his support for SB 21, agreeing that the specific designation of the money should be made by the Board of Regents.

Henry McClernan, Acting Director of the Montana Bureau of Mines and Geology, also presented written testimony (Exhibit 6).

Ronald M. Hays, Dean of Engineering at Montana Tech, also presented written testimony (Exhibit 7).

Senator Chris Christiaens, District 17, was recognized in support of SB 21. He stated that as a member of the Coal Tax Oversight Committee he understood the need for research and development of coal resources as essential to the future of Montana.

Dr. Neil Bucklew, President of the University of Montana, said in support of SB 21, that research is needed in the areas of coal chemistry, properties of different coals, alternate use of coal and by-products, reclamation including reestablishment of trees, brush, etc. UM worked with the

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Montana Power Company in Colstrip reclamation and is currently involved in a successful project at Yellow Bay station looking at the potential of water impacts from the Cabin Creek project upstream. He also supported the bill's look at the futures study saying that UM has done a major study on the impact of coal industries on Montana.

John Jutila, Vice President for Research at MSU, also supported SB 21 saying that coal deserves attention from the private sector and the University system. He submitted written testimony (Exhibit 8). Page one discusses program areas for coal research. The second page notes results of the Old West Regional Commission Task Force. The third page shows the university's record in successfully competing for grant monies and notes faculty resources available. He noted that reclamation research and MHD programs have steadily declined in funding. His conclusions followed.

Dave Gibson, Dean of Engineering at MSU, stated support for SB 21 and said that coal consumption and sale of western coal were both increasing. Therefore, he felt it important that some monies be reinvested as proposed in this bill.

Lloyd Berg, Professor of Chemical Engineering at MSU, submitted written testimony (Exhibit 9) in support of SB 21. He addressed orally the high water content of Montana coal, which makes transportation costs prohibitive. Tech already has found a way to remove water and MSU has been working on the process of adding a binder. He said he holds two patents in coal research.

Frank ^{Munshower}, Reclamation Research Unit at MSU, said that all the research done has been privately paid for and that funding is decreasing because of the coal crunch and also because the private concerns don't want to bear the burden alone. Reclamation is a long way from fulfilling the requirements of the law, he noted. He also said that while acid soil has not been found in Montana, it would be found in time. He said nothing has been done about reclaiming water, that the work to date is diagnostic and not prescriptive. The graduate academic program at MSU is currently placing all of its students. He said part of the reason is the research opportunity in the only program of its kind in the country, but state funding must be added to keep up that effort.

Dr. Bruce Carpenter, President of Eastern Montana College, presented written testimony (Exhibit 10).

Mike Fitzgerald of the Montana Trade Commission supported the bill stating that it is important for Montana to look for markets for coal in the shrinking national and international markets. We need research to improve the quality of Montana's product, he said. He also addressed the future

studies portion of the bill saying that it is a legitimate need and should not be viewed as a tacked on item. He urged the committee to recognize the new spirit of working cooperation among the university system, private industry and state government and to take advantage of that to implement SB 21.

Dr. Bill Tietz, President of MSU, spoke in favor of SB 21.

Pat Wilson, Montco/Thermal Energy, said they have looked for a long time at the need to earmark coal tax revenue for coal research instead of always using the money for unrelated research efforts.

OPPONENTS

Jeanne Sourgney representing Northern Plains Resource Council spoke against SB 21. Ms. Sourgney addressed two concerns: First, she questioned the removal of money from the general fund to benefit a single industry. Second, she said NPRC has philosophical problems with support of a bill which would serve to increase the coal mined in Montana.

Senator Pat Goodover, Senate District 20, also spoke in opposition. He felt the severance tax should be reduced to reduce the cost of Montana coal and make it competitive right now rather than used to do more research.

Questions from the committee were called for.

Senator McCallum asked for the percentage of moisture content in Montana coal. Dr. Berg said that it is about 15%, which is significantly increasing the cost of transportation of Montana coal.

Senator Severson asked why drying coal was difficult. Dr. Hays said that it is difficult to dry a combustible product and pointed out that coal changes structurally when dried. Dr. Berg said that dried coal has the consistency of talcum powder and cannot be shipped, plus the large surface area causes quick reabsorption of moisture. The briquet developed at MSU has apparently solved some of those problems.

Senator Towe asked about the cost of briquets and Dr. Berg said that the increased BTU content of the briquet offset the cost of making it.

Senator Halligan asked if the Governor's office had any input on the bill. Senator Towe said that coal research is supported by the Governor, who is looking for \$800,000 to spend in this bienium for coal research. He did not know if the Governor supported this particular bill.

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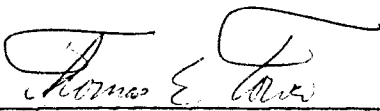
Senator Hirsch asked if the bill addresses the type of research discussed in committee, citing page 4, lines 5-8 in the bill. Senator Towe agreed that some things may need to be specifically amended into the bill.

Senator McCallum asked about the use of powdered coal in gasoline. Dr. Berg answered that it had been done, but that coal was tough in an internal combustion engine.

Senator Eck asked about the relationship between research funding and specific research directions given by the legislature. Commissioner Dayton said that to grant research dollars for study of a particular area seemed to be a proper for the legislature. He said the specific need of the university system is for continuity of research funding.

Senator Towe closed the hearing on SB 21 by saying that there were many other names that would be added to the bill and that for years he had hoped there was another way to get this job done; but that, seeing none, he encouraged passage of SB 21.

Vice Chairman Mazurek adjourned the meeting at 10 am.



Chairman

ROLL CALL

SENATE TAXATION COMMITTEE

49th Legislative Session -- 1985

Date 9 January 85 8:07 am

Location -- Room 413-415

Name	Present	Absent	Excused
Senator Brown	✓		
Senator Eck	✓		
Senator Goodover	✓		
Senator Hager	✓		
Senator Halligan	✓		
Senator Hirsch	✓		
Senator Lybeck	✓		
Senator Mazurek	✓		
Senator McCallum	✓		
Senator Neuman	✓		
Senator Severson	✓		
Senator Towe	✓		

Senator Brown	✓		
Senator Eck	✓		
Senator Goodover	✓		
Senator Hager	✓		
Senator Halligan	✓		
Senator Hirsch	✓		
Senator Lybeck	✓		
Senator Mazurek	✓		
Senator McCallum	✓		
Senator Neuman	✓		
Senator Severson	✓		
Senator Towe	✓		

NAME Ed Brinker, H Galt BILL NO. SB21
ADDRESS MT Tech Research Center DATE 1/9/85
WHOM DO YOU REPRESENT Butte MT Tech
SUPPORT ✓ OPPOSE _____ AMEND _____

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Fred W. De Money BILL NO. S-21
ADDRESS Montana Tech DATE 1/9/85
WHOM DO YOU REPRESENT Montana Tech
SUPPORT X OPPOSE _____ AMEND X

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Rowell M. Hays BILL NO. 5-21
ADDRESS Montana Tech DATE 1/9/85
WHOM DO YOU REPRESENT Montana Tech
SUPPORT X OPPOSE _____ AMEND X

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Henry McClerman BILL NO. SB21
ADDRESS Montana Tech DATE 1/9/84
WHOM DO YOU REPRESENT MT. Bureau of Mines & Geology
SUPPORT X OPPOSE _____ AMEND _____

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME B F Christians BILL NO. SB 21
ADDRESS 210 36 St No MF DATE 1/9/85
WHOM DO YOU REPRESENT Coal Tax Oversight & Self
SUPPORT ✓ OPPOSE _____ AMEND _____

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Bruce H Carpenter BILL NO. SB 21

ADDRESS Southern Montana College DATE 1/9/84

WHOM DO YOU REPRESENT SN

SUPPORT ✓ OPPOSE _____ AMEND _____

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Pat Wilson BILL NO. SB21

ADDRESS Billings DATE _____

WHOM DO YOU REPRESENT Montco / Thermal Energy

SUPPORT X OPPOSE _____ AMEND _____

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

NAME Jeanne-Marie Sompuy BILL NO. SB 21

ADDRESS _____ DATE 1/9

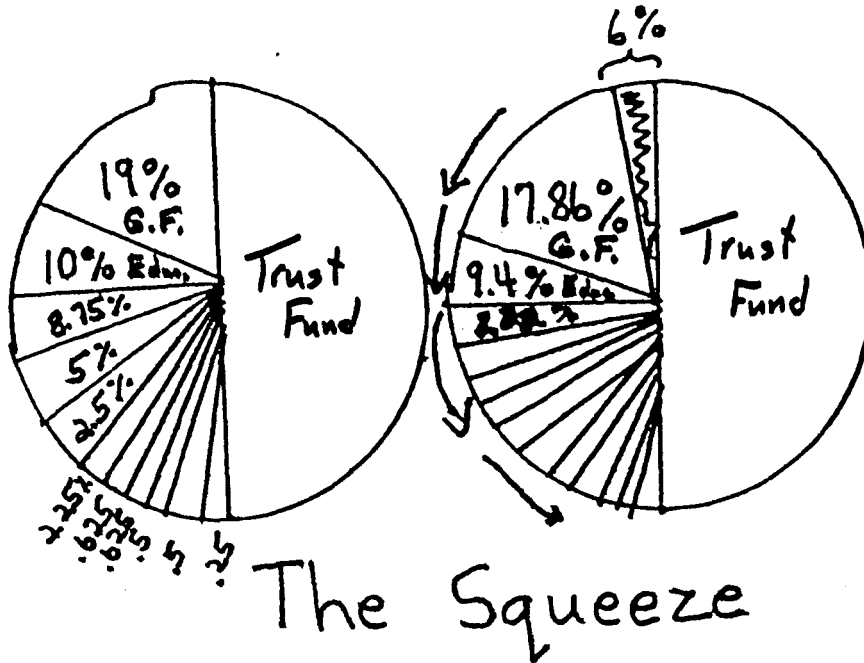
WHOM DO YOU REPRESENT NPRC

SUPPORT _____ OPPOSE X AMEND _____

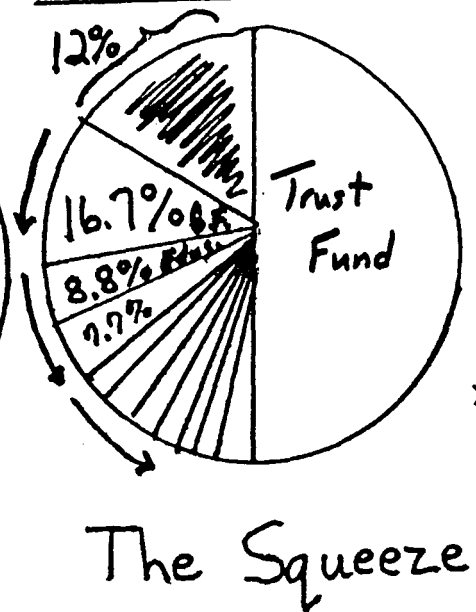
PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

1986 - 87



1988
and
after



Highways = 6% (1986-87) • ■
= 12% (1988 + after)

<u>Current</u>	<u>Fund</u>	<u>'86-'87 Squeeze</u>	<u>88 + after Squeeze</u>
19%	General Fund	17.86%	16.7%
10%	Educational Trust	9.4%	8.8%
8.75%	Local Impact	8.22%	7.7%
5.0%	Foundation Program	4.7%	4.4%
2.5%	Park & Culture Trust	2.35%	2.2%
2.25%	Alternative Energy	2.11%	1.2%
.5%	Libraries	.47%	.44%
125	CONSERVATION DISTRICTS	.235%	.22%

Amounts credited to the Coal Research and Development Account

in the State Special Revenue Fund - from the general fund of
Coal Severance Tax collections. (All amounts in millions of \$)

<u>1987-1988</u>	<u>1990</u>
1.9734999	3.9469999

Coal Research and Development Account Breakdowns

	<u>1987-1988</u>	<u>1990</u>
2/5 to Science and Technology Development Board	.7893998	1.5787998
2/5 to Montana Coal Laboratory	.7893998	1.5787998
1/5 to Center for Future Studies at Eastern Montana College within the Montana University System	.3946999	.7893999

Montana needs coal market research plan

Funding from coal severance tax fund

Montana has nearly 25 percent of the nation's coal supply and nearly 10 percent of the world's coal supply.

Montana collects nearly \$100 million in severance taxes and \$13 million in gross proceeds taxes each year on coal.

Montana does not, however, fund any research on the improvement or use of coal and almost nothing on the location and characterization of coal.

Other states do.

Illinois recently appropriated \$55 million for coal research. The Alberta Research Council has one of the best mineral research programs in the world. After the federal coal research centers in Grand Forks, N.D., and Laramie, Wyo., are turned over to those two states, even our neighboring states will have significant research programs in coal.

All of the research — primarily in locating and characterizing the coal — that has been done in Montana has been funded by the federal government. The feds require a 5 percent match for this research, and once a \$55,000 grant for location and characterization of coal on state lands was made. Now, however, the grant has been completed, and the federal funds have all but dried up, and Montana has virtually no coal research.

I suggest the time has come to set aside some coal tax money for coal research. Further, I suggest 5 percent or about \$5 million per year be earmarked for this purpose out of the General Fund portion of the coal tax pie, reducing the General Fund portion to 14 percent (this



**Thomas
Towe**

Guest Columnist

amount will be more than made up by the increase in the interest income from the Coal Tax Trust). Also, we could obtain some additional funds (1) from the interest income of the Resource Indemnity Trust Fund and (2) from the Economic Development Fund (a portion of the interest income from the Coal Tax Trust as established by Initiative 95).

This research should be of several different types. First, we should continue the discovery and characterization research commenced by federal funding. Although the coal in the Fort Union formation is fairly well mapped, much remains to be done in the rest of the state.

Second, much can be accomplished by research into the processing of coal — coal beneficiation. Vic De Jong, assistant general manager, Mountain States Energy, said that if we are serious about marketing coal, improving the quality of the coal is the best long-term approach to making the coal more desirable and saleable. Decreasing

the price such as by reducing the production costs or the coal tax is only a short-term solution, according to De Jong.

Much can be done to improve the quality of the coal, if it can be made economically feasible. The coal could be cleaned, the ash content reduced, the sodium removed or other impurities removed. Also, the moisture content could be reduced. If the coal could be dried, the BTU content and quality of coal would be greatly enhanced because the moisture is very heavy.

Third, a tremendous potential for discovery of other uses of coal exists. Coal has many of the same chemical properties as petroleum which has produced products ranging from plastics and polyester clothing to pharmaceuticals. There is also the possibility of gasification and liquification, although we probably should leave this research to others.

Finally, we should devote some research funds to the continuation of research on coal reclamation, the effects of mining on ground water and the further perfecting of air pollution control. Sustained reclamation sufficient to warrant bond release has not yet been established.

There is enough coal. Unless production in Montana increases substantially, it should last for 1,000 years. We have excellent state laws protecting the environment, the workers and the collection of an adequate tax. So long as these laws are not compromised, we should not fear greater mining. If the research encourages greater use of coal to benefit mankind and provided the coal is not mined just for the sake of mining, it could be very beneficial to the state. Not only would it provide employment in mining, but it would also likely bring a great number of additional small industries that need to locate near where the research is taking place.

It also would give the mining companies a feeling that they are receiving something more for the several taxes they pay. Perhaps then they would not be so quick to advocate reducing the level of the tax.

Thomas Towe, who serves in the state Senate, is practicing attorney in Billings. This is the first of two articles he has written on his proposal. The next addresses the question of what role Eastern Montana College should play in the plan — the editor.

EMC research center would study future Seeking clues as to what lies ahead

Coal tax research, research into where to find the coal, how to improve the quality of the coal, how to develop other coal products and how to improve coal mine reclamation, is appropriate from coal tax revenue. In fact, in view of what is being done in Illinois, North Dakota, Wyoming and other states, it is long overdue.

If we take 5 percent from the coal tax allocation, we would have approximately \$5 million per year. This could be very beneficial to the Montana economy and would not require us to compromise our environmental protections, labor laws or coal tax.

What role would EMC play in all this? A single center would probably not be as efficient or as appropriate as a number of independent research projects in cooperation with existing personnel and programs. Some coal research has been done in the past at Montana Tech in Butte, and therefore to avoid duplication, all but the more scientific aspects of alternative products development, reclamation research and pollution control research should be done at Butte. The rest should be done at Montana State University in Bozeman which already has some of the scientific activity.

Thus, even though the coal is in eastern Montana, EMC appears to be left out.

I suggest that another type of research is needed. One thing we have established with the coal tax is the need to look to the future. We set 50 percent of the tax aside in a trust fund for the future. Another 10 percent goes into an education trust fund for the future; 2½ percent goes into a Parks and Cultural Trust Fund for the future. The Coal Board is charged with taking care of



Guest Columnist

Thomas
Towe

tail end impacts that will occur after the coal is gone as well as front end impacts. County land planning, alternative energy research and library support also suggests a concern about the future. Indeed, we should be planning for whatever is necessary to take care of the future problems caused by coal development.

We should set aside a portion — I suggest one-fifth — of our coal research funds for study and research about the future. There is a fairly well developed area of study and research called Futures Studies. A center for Future Studies should be created at Eastern Montana College.

There are some persons who have devoted their life's work to studying what we can expect life to be like 10, 20 or 50 years in the future. Because of their work, others are able to better plan for the future. People like Kenneth Boulding of the University of Colorado are in great demand by industry as a speaker and consultant

on what to expect in the future. Obviously, when making a decision to invest large sums of money in a building, plant improvements or plant equipment that will last for 30 to 50 years, knowing what life will be like 30 years from now will be very helpful. Such information is also very important to government officials in charge of building roads, municipal improvements and community centers. While no one can be certain what the future will bring, ideas and suggestions from those who have spent more time on the subject than the rest of us could definitely be beneficial.

One doesn't have to look very far to see the need for more information about the future. If the Montana Power Company had had better information about the electrical demands for the mid-'80s when they planned Colstrip 3 and 4 in the mid-'70s, they undoubtedly would have cancelled both units before they were built. Not having better information and forecasting has cost MPC dearly. The same could be true for many other businesses.

I would like to see a Center for Future Studies, funded by the coal tax at EMC, attracting some of the best futures experts in the country. The center could hold conferences, symposiums and seminars that would be available to the business community and the public, as well as other academic people. In this regard, it would fit in well with the business school at EMC.

Further, there is room for a great deal of cross-fertilization of thinking. For example, those in the other disciplines like education, science, business and the arts could take part in the conferences, seminars and research.

A Center for Futures Studies in Billings could be the most important place to go for such information in Montana and the Pacific Northwest, maybe even in the entire country. With such a center in Billings, other businesses and firms may be more attracted to settling here where they could be near the research.

It could lift up the sights of the whole community — encouraging everyone to better plan for the future. It is an exciting concept which could benefit not only EMC, but Billings and eastern Montana as well.

Thomas Towe, who practices law in Billings, is a state Senator. He was one of the prime architects of the state's new income tax.

9/1/85



Montana Mining and Mineral Resources Research Institute
Montana College of Mineral Science and Technology
Butte, Montana 59701
(406) 792-8321

Testimony Presented To The
TAXATION COMMITTEE
in Support of S.B. 21
January 9, 1985
Helena, Montana

SUMMARY

Mr. Chairman:

The coal industry is an important part of the economic framework of the state.

Our ability to market coal in the future can be positively influenced by research to upgrade the chemical and thermal quality of our low-rank coal resources.

Coal research can lead to expanded marketing of an improved product, more economical production, and improved mine-land reclamation practice.

Research helps diversify our coal products and lends stability to a major mineral industry subject to cyclic supply and demand. Stability lessens socioeconomic impacts from coal production and contributes to a more predictable revenue base.

Montana must recognize and should be prepared to meet the technological challenge being mounted in other coal-producing regions in North America. Technology applied to improving coal quality can generate major dislocations in coal marketing patterns for western coal-producing states.

I respectfully ask your support in developing an effective and continuing coal research program which will benefit all Montanans.

Edward C. Bingler
State Geologist

EXHIBIT 5 -- SB 21

9 January 1985

A COAL RESEARCH AND DEVELOPMENT
PROGRAM FOR MONTANA

A coal science and engineering research program that supports long-term stability and reasonable growth of this major mineral-fuels industry in Montana must have as its primary goal the improvement of our competitive position in coal characterization and coal preparation.

Coal characterization refers to the distribution and quality factors of our coal resources. It includes the systematic determination of chemical and physical characteristics of major Montana coal resources, and results in the identification and inventory of regional and local trends in primary coal properties, such as rank, Btu content, ash constituents, oxides of sulfur and nitrogen, and trace metals.

The technology required to advance our knowledge of coal characterization includes:

- High quality and specialized chemical and microscopic analysis of representative coal samples from the Montana resource base.
- Delineation of the distribution of mineable coal geographically and geologically in our major coal fields and coal regions.
- Generate an automated data processing system for selective storage and retrieval of identified and inventoried coal characteristics.

A modern inventory of coal characteristics would provide a readily available and much needed data base for the development of processing technology and the identification of potential production or use problems related to coal contaminants. The development of modern processing research requires detailed and well-documented quantitative information on the physical and chemical properties of coal. An effective inventory reduces the time required to develop new processing technology. Also, Montana has already recorded lost coal production because of contamination problems related to metals, such as sodium. Trace metal distribution and oxides of sulfur and nitrogen are of critical importance in determining the end use of Montana coal, and thereby its marketability.

A coal characterization program requires staffing by coal petrologists, coal geologists, and stratigraphers plus operational support in the form of analytical data and drilling for effective sample gathering. A comparable program, previously supported in Montana by the federal government, was funded at approximately \$500,000 per year. An effective base program should be funded at approximately \$600,000 per year to support all of the elements

described above and should be predicated upon a continuing effort that develops an expanding and effective data base.

Coal processing converts or upgrades mined coal in order to improve its chemical and/or thermal quality. Such beneficiation refers to low-cost physical and chemical conversion of coal that results in substantial quality improvements. It does not include coal conversion technologies, such as coal gasification and coal liquification. New improved processing technology will preserve and expand coal markets by decreasing already relatively low levels of chemically deleterious materials generated during coal burning and by improving the thermal content of very large, low-grade lignite deposits in Montana.

Because the nature of western coal is fundamentally different from eastern coal resources (geologic age, chemistry, mode of origin, physical makeup, and so forth), Montana research initiatives should focus on the specific economic opportunities for upgrading western coal and lignite, such as:

- Improve and expand the technology of separating physically bound mineral ash constituents in subbituminous coal and lignite.
- Develop new technologies specifically aimed at economically removing organically-bound sulfur species from subbituminous coal and lignite.
- Expand our knowledge and develop innovative technologies for thermal upgrading of low-rank coal resources, such as eastern Montana lignite, through a program that goes beyond conventional drying technology.

Research projects funded at from \$150,000 to \$250,000 per year would support basic research for engineering development in coal processing. Engineering projects at \$500,000 to \$1,000,000 per year can lead directly to industrial development and pilot plant demonstration projects. State support in this area would encourage investment by the private sector and a contribution of applicable federal funds to demonstration projects in coal cleaning and thermal upgrading.

THE TECHNOLOGICAL WAR FOR SUPREMACY IN COAL MARKETING

Future coal marketing will be strongly influenced by coal research and technology development.

The state of Illinois has launched a massive, multi-million dollar research effort in coal characterization, coal preparation, coal conversion, and coal utilization aimed at removing impurities and developing new uses for high-sulfur bituminous coal. In 1983, the state of Illinois appropriated \$1.6 million from utility revenues

to the University of Southern Illinois at Carbondale and the Illinois Geological Survey for coal research. In the same year, the University of Southern Illinois received \$1.5 million for coal research and to operate DOE's coal technology laboratory at Carterville, Illinois.

Continuing concern over acid precipitation has prompted congressional interest in massive technology programs like those proposed in Senate Bill 1925 introduced by Senator Byrd of West Virginia. That bill proposed a national coal science, technology, and engineering development program that will result in "increased coal use.....consistent with the nation's environmental goals." This massive five-year program, with a recommended appropriation of \$775 million, will focus on supporting coal research and engineering development for processing and improving the quality of eastern high-sulfur coal. This program would be administered by the Department of Energy and would support research at universities and DOE's Energy Technology Centers. These federal research centers have had a long history of research programs in cleaning, conversion, and utilization of high-sulfur coal from the eastern United States.

The Province of Alberta has long been committed to a comprehensive coal research program. The Province has enormous reserves of bituminous and subbituminous coal and lignite; recoverable reserves have recently been estimated at 819 billion tons, much of which is low-rank coal and lignite. These large reserves have prompted intensive efforts by the staff of the Alberta Coal Mining Research Center to develop coal drying and processing technology for application to Plains coals. This year that agency will move into a new \$20 million facility dedicated to coal research. Alberta's aim is to develop an improved product and expand their share of the thermal coal market in Europe, the Pacific Rim, and within Canada.

FUNDING A MAJOR MONTANA COAL RESEARCH PROGRAM

Montana can develop a successful and continuing coal research and technology development program if the legislature is able to provide significant levels of funding through a constructive and sustaining appropriation formula. This funding mechanism should reflect the essential ingredients cited below for building and maintaining a responsive and effective research enterprise.

- Initial funding levels should be at relatively high levels to provide necessary research equipment, full-time salaries for investigators, and to meet the relatively high acquisition costs for field sampling and analytical data.

- Continuing support should be at levels sufficient to maintain staff size adequate for substantial progress in scientific programs. This requires groups large enough to interact on research projects and achieve "critical mass" interaction and enhanced research productivity.
- Continuing funds should be at levels adequate to insure significant support to attract funds from the private sector or from the federal research agencies with the proviso that matching should never become an exercise that drives the research groups to near total dependence on non-state funds for effective coal research.
- The funding source or sources should be related to state revenue directly derived from coal production. Research support that is in some way directly related to mineral production for a commodity like coal is a rational and logical relationship that motivates the research community to perform relevant applied research through increased private sector interest.



MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

BUTTE, MONTANA 59701
406/496-4180

Office of the Director

TESTIMONY PRESENTED TO THE
SENATE TAXATION COMMITTEE
IN SUPPORT OF SENATE BILL 21
JANUARY 9, 1985
HELENA, MONTANA

HENRY MCCLERNAN
ACTING DIRECTOR
MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

I want to thank you for the opportunity to comment on Senate Bill 21, particularly that part addressing coal research by the proposed Montana Coal Laboratory within the Montana University System.

The Bureau of Mines and Geology, a department of Montana Tech, has been involved in coal studies since 1966 primarily in carrying out contracts with the Federal Government to determine both the quantity and quality of Montana coal. The Bureau is the public agency within the University System with a legislative charge to study the economic mineral resources of the State.

As I mentioned above, most of the coal research carried out by the Bureau of Mines and Geology was supported by the Federal Government. Much of this work dealt with determining how much coal is in Eastern Montana, how thick and how many seams there are, and how deep the coal is below the surface. The Bureau's early work also focused on the character of the coal - that is answering the question: How good is Montana's coal compared to the then traditional coal sources of the Eastern United States? Although the coal characterization aspect of the work was relatively scanty, that research determined the thermal quality was acceptable and the ash and sulfur content was low enough to also be acceptable for use in coal fired generators.

Montana's coal is presently being mined because of an increase in electrical demand primarily in the Eastern and Midwestern United States and also because using Montana coal enables the utilities to comply with state and federal emission regulations. In effect, Montana coal captured a segment of the coal market away from the traditional coal producers of twenty years ago. In recent years, states that have traditionally produced coal and have seen their markets eroded by western coal producers are aggressively pursuing recapture of those

EXHIBIT 6 -- SB 21

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markets through research efforts aimed at determining which of their coal seams are of the highest quality, that is, they are doing coal characterization. These states are also actively engaged in processing research aimed at removing the deleterious components, mainly sulfur, contained within their coal and also are examining alternative uses and derivative products.

I would encourage passage of this bill as a means for Montana to both protect and potentially expand its coal markets and thus protect the jobs and the tax revenue generated by coal mining.

The Bureau of Mines and Geology, as I said, was established as a department of the College to conduct studies aimed at furthering the economic development of Montana's mineral resources and has been doing so at a scale dictated by available financial resources. Consistent with this, both the Bureau of Mines and Geology and the College have recognized the need for coal research studies and most recently have pursued additional resources to address this need. For the 1985 Legislative Session, the Board of Regents concurred with this perceived need by approved budget modification requests for both the Bureau and the College. A copy of the Bureau request is attached.

Montana Tech has within its role and scope the responsibility for conducting research in mineral resource development in addition to its educational role. It is important to note the language of the bill specifying duties of the laboratory: To "sponsor research" concerned with characterization, production, processing, marketing, and use of Montana coal. It is my impression that this language provides for research to be performed by any entity with demonstrated expertise and capability.

The Bureau of Mines and Geology is actively pursuing coal research, albeit on a small scale, at the present time. One cooperative agreement with the U.S. Geological Survey has recently been completed; another on coal characterization will start in February at a much reduced scale than originally anticipated. Still another cooperative program, also with the U.S. Geological Survey, aimed at collecting existing data on Montana coal resources is in progress despite cutbacks at the Federal level. With these cutbacks in research funding at the Federal level, it becomes more important to initiate coal research at the State level.

I believe that research focused on the economic development of Montana coal should be implemented and I see Senate Bill Number 21 as a means of doing this work. Thank you.

Agency Program Identification	Agency Code	Program Code	Program Name
	5105	08	Montana Bureau of Mines and Geology
Type of Request	Expanded Services		
Title of Request	Coal Geology		

JUSTIFICATION:

Since the mid-1970's, the Montana coal industry has been a significant element in the state's mineral-based economy. Average annual production of nearly 30 million tons per year of low sulfur, subbituminous coal provides nearly \$90 million annually in severance taxes, several thousand jobs, and significant capital investment.

Increased concern over coal use as a factor in acid precipitation, and the intensifying research and technology development programs in eastern coal-producing states, are increasing demand for information on the quality and distribution of Montana coal resources. Coal quality investigations provide quantitative measures of thermal quality, ash and sulfur content, presence of metal species, identity and distribution of maceral components and other measures critical to assessing end use or appropriate beneficiation processes. If Montana coal producers are to meet the technological challenge posed by intensive research and development programs in other coal-producing states, and avoid further market erosion of current production, it is essential that critical research in coal characterization be expanded. A modern inventory of the quality characteristics of coal resources in each of our major coal basins can pave the way for realizing new market advantages and expanding existing markets for coal sales.

This program modification would provide two staff coal geologists to begin systematic coal quality investigations. Operating funds would support the collection of subsurface coal samples by core drilling and the completion of diagnostic coal chemical analyses. Results of these investigations will be published as definitive profiles of coal characteristics including the distribution, by coal seam and area, of critical quality factors essential to any effort to expand use through technological innovation.

BUDGET REQUEST

	<u>FY 86</u>	<u>FY 87</u>	<u>TOTAL</u>
<u>Personal Services</u>			
FTE	2.0	2.0	2.0
Salaries & Benefits	\$71,700	\$71,700	\$143,400
<u>Operations</u>	35,500	35,500	71,000
<u>Capital</u>	6,500	---	6,500
TOTALS	\$113,700	\$107,200	\$220,900



MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

BUTTE, MONTANA 59701

406/496-4101

Dean of Engineering

Testimony Presented To The SENATE TAXATION COMMITTEE

January 9, 1985

Helena, Montana

**Ronald M. Hays
Dean of Engineering
Montana College of Mineral Science and Technology**

I want to thank the Chairman and Committee members for the opportunity to comment on Senate Bill Number 21. My comments are related to the portion of the Bill which provides funding for a Montana coal laboratory within the Montana University System.

It is proposed that the Montana coal laboratory sponsor research in the characterization, production, processing, marketing, and use of Montana coal and derivative products. Montana Tech favors the creation of a Montana coal laboratory and expanded coal research with a portion of the funds provided by the State of Montana. Montana Tech also believes the Montana coal laboratory should be within the University System and the University System has facilities, expertise, and research capabilities for a coal laboratory.

The importance of the coal industry to Montana can not be overstated. It is important to our social welfare, as well as our economic well being. Power generated using coal provides electricity for our schools, hospitals, street lights, and homes; for our ranches, farms, factories, mines, stores, offices, and other places of employment. Our social welfare, as well as our economic well being, is greatly enhanced because of Montana coal. Economically, coal mining provides jobs in mining companies and related service companies. Coal taxes provided \$83 million annually or 16% of all State of Montana taxes in 1984. I do not claim that there are no adverse effects because of coal mining, but, in balance, I believe coal mining has been and is good for Montana. I believe that the social and economic benefits to the people of Montana greatly exceed the adverse impacts. It is important that Montana maintains a viable coal industry which provides for the needs of the people of Montana.

EXHIBIT 7 -- SB 21

9 January 1985

Coal research has received considerable attention before Montana legislative committees. On August 10, 1984, Dr. Edward C. Bingler, Director of the Montana Bureau of Mines and Geology, made a comprehensive presentation on coal research (attached). Representatives from other units within the University System have provided testimony at previous hearings, as well as today. All these attest to the need for coal research for Montana to maintain a viable and competitive coal industry.

Coal research facilities and expertise exist at three units of the Montana University System: Montana State University, University of Montana, and Montana Tech. All three of these institutions are engaged in coal research.

I would like to briefly describe some of the coal research capabilities and programs at Montana Tech. Montana Tech was established in 1893 as the Montana School of Mines. Although the name has changed, Montana Tech's role and scope is still to educate professionals of highest quality for outstanding professional attainment in the mineral and energy industries and to conduct research in the mineral and energy fields. Presently, Montana Tech is conducting research under contracts that total \$2.4 million.

Dr. Henry McClernan has just commented on coal research at the Montana Bureau of Mines and Geology, a department of Montana Tech. Coal research began at the Bureau in 1966 and is still continuing today.

In 1984, the Board of Regents of the Montana University System approved the establishment of the Center for Energy and Mineral Research at Montana Tech. The purpose of the Center is to develop new knowledge that supports the discovery, extraction, and utilization of Montana's mineral resources and provides educational and training opportunities for students, scientists, and engineers. The primary objective of the Center is to serve as a centralizing entity for diverse research programs in energy and mineral technology.

The Center for Energy and Mineral Research presently includes several coal research related facilities and programs, principally the federally designated Title III Mining and Mineral Resources Research Institute, Montana Tech Research Center, and the Fast Neutron Activation Analysis Laboratory. The Montana Tech Research Center is a comprehensive research facility located in the Butte Industrial Park which was constructed by the Montana Tech Foundation with private funds and given as a gift to Montana Tech by the Foundation in 1983.

Montana Tech has a long history of coal research. From 1974 until 1982, MHD (Magnetohydrodynamics) research provided funding for coal characterization, drying, and preparation. This research was sponsored by the U.S. Department of Energy with funding of about \$300,000 per year. Coal research currently being conducted at the Montana Tech Research Center includes an approximate \$300,000 project to investigate processing technology for upgrading Eastern Montana lignite. This project is solely supported by private funds and utilizes the facilities, faculty, and staff at Montana Tech. The Fast Neutron Activation Analysis Laboratory has received federal funding for the direct determination of oxygen in coals which is a means of determining coal rank. Another interesting small project is the evaluation of coal bricks for household heating.

With academic departments in Geophysical, Geological, Mining, Mineral Processing, Metallurgical, and Environmental Engineering and Engineering Science, Montana Tech has outstanding facilities and experienced faculty for coal research. This available expertise relates to coal characterization, production, processing, marketing, and uses, as well as other areas of the coal industry. The State of Montana needs to take advantage of this expertise.

Is there a need for coal research? You bet there is. Montana coal has to be produced and delivered to the customer at a lower cost. Coal mapping and characterization is needed. Mining techniques need continuous evaluation and improvement. Montana coals need to be processed to improve their coal quality before shipment. New potential coal uses, including non-burning gas, need to be evaluated. Coal mineland reclamation needs continued study. The effects of coal mining and subsequent reclamation on ground water hydrology need to be better understood. There is much more needed research.

The Montana University System, through program modified requests as approved by the Board of Regents, will propose that the State of Montana strengthen coal research capabilities. These requests for Montana Tech include \$220,900 for coal geology and characterization and \$224,494 for coal processing research (attached).

Next week, Dr. John Brower, Associate Professor of Mineral Economics, and I will be in Minnesota to present a paper titled "Minnesota Market for Montana Coal." Minnesota is the largest out-of-state market for Montana coal. We hope Montana coal can keep that market and possibly even expand that market. We believe increasing markets for Montana coal is in the best interest of the people of Montana. We need your help by supporting coal research.



MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
BUTTE, MONTANA 59701
(406) 496-4180

Testimony Presented To The
COAL-TAX OVERSIGHT COMMITTEE
On Current Status And Recommendations For A
Montana Program In Coal Research
August 10, 1984
Helena, Montana

Mr. Chairman:

I want to thank you and the Sub-Committee for inviting me to present this brief review of the status of coal research in Montana. As part of my general review, I will also describe the research program initiatives in coal technology that will be presented to the 1985 Legislature by the Montana College of Mineral Science and Technology and the Montana Bureau of Mines and Geology.

In my remarks today, I will:

- 1) briefly describe what is included in the field of coal research,
- 2) provide an historical perspective on coal research activity in Montana including the current level of research at Montana Tech/MBMG,
- 3) present the key program elements of a new research initiative, and
- 4) describe three policy issues which put Montana in a national perspective in coal research, highlight the loss of intellectual resources for such programs, and suggest funding sources and their relationship to a viable research program.

The Fields Of Coal Research

Research programs that lead to technological innovation related to coal are broad and many-faceted. So that we may have a basis for discussing significant research initiatives in Montana, I have outlined the various coal research fields where significant research is being done nationally or internationally and which might place Montana at an economic disadvantage if we do not meet the technology challenge.

Likewise, the cost of research also tends to be higher in fields of engineering development because of the necessity for proof-of-process experiments from bench-scale through pilot plant development.

Coal characterization, the detailed determination of the physical and chemical constituents and properties of coal, is emerging as a fundamental tool for successful research in many aspects of coal preparation and conversion.

In light of the growing interest and demand for coal with low levels of impurities, potential market advantage and economic stability will hinge upon technological innovation in coal preparation.

HISTORICAL PERSPECTIVE ON COAL RESEARCH IN MONTANA

Early coal studies in Montana described the general distribution and rank of coal seams exposed at the surface in our major coal basins. These early field surveys were conducted by geologists of the United States Geological Survey, were reconnaissance in nature, and were generally completed by 1920. The state of Montana did not contribute to this work except in a very minor and indirect way through support of those few University faculty who had a passing interest in coal as a part of their individual research and as they could obtain time away from their teaching responsibilities.

In 1969, the first federal contract was awarded to the Montana Bureau of Mines and Geology to systematically investigate the quality and quantity of the state's coal resources on public lands. This program, which subsequently involved considerable drilling to identify and assess the value of subsurface coal seams, was supported annually by federal contracts until 1982 when a major policy change by the Department of Interior resulted in cancellation of all Department of Interior contracts for field investigations involving drilling of coal in the western United States. In the last year of its operation, this program was funded at an average level of \$500,000 per fiscal year. Because of a 5% state matching commitment, the Bureau of Mines and Geology provided \$25,000 annually in state funds for program support. Over the 13 year life of this program, the Bureau of Mines and Geology completed 1,750 shallow stratigraphic testholes and 900 chemical analyses of coal. Project staff maintained systematic files of well logs, drafted the best available coal resource maps, provided a sound data base for reclamation research, provided information to the Department of State Lands on selected tracts for state-owned coal, and supplied about 90% of the scientific data for pre-lease evaluation of federal coal in the Fort Union area and the Powder River Basin. Project staff maintained proprietary files of private-sector drilling information and incorporated that data in their geologic assessments of coal resources.

Similar geologic investigations based on field mapping without drilling were conducted by Bureau of Mines and Geology staff in southeastern Montana under a cooperative program negotiated with the United States Geological Survey at an average annual level of about \$80,000 per year. We have been notified that that program will be discontinued for all western states on September 30, 1984.

The National Coal Resource Data System, a cooperative program between the United States Geological Survey and the Montana Bureau of Mines and Geology for entering all coal resource information into a national automated data system, will be continued. This program is funded at \$90,000 per year.

The MHD (Magnetohydrodynamics) program, sponsored by the Department of Energy beginning in the mid-seventies, supported considerable research in coal characterization (chemical), coal drying, and coal preparation at Montana Tech. The MHD research program extended from 1974 until 1982 and was federally funded at about \$300,000 per year. Five faculty were supported on a part-time basis in addition to a number of graduate students.

Montana State University has been involved in coal research on liquifaction, catalysis, and upgrading of liquid fuel products from coal through sponsored research in their Department of Chemical Engineering. Dr. John Sears is currently conducting liquifaction studies under a \$250,000 grant from the Department of Energy and Dr. Lloyd Berg with Phil McCandless continue to be involved in DOE-sponsored research on upgrading liquid products from coal. Their project has been funded at about \$60,000 per year for the past seven years.

There is no record of past coal research (exclusive of mine reclamation) sponsored by the private sector in Montana at significant levels or over sufficient periods of time to have made a major contribution to new knowledge. One major firm has sponsored research outside of Montana on the liquifaction or gasification potential of eastern Montana lignite, and several firms have sponsored very modest surveys or minor topical studies utilizing consultants.

In 1983, Western Energy Company entered into a contract agreement with Montana Tech, the Bureau of Mines and Geology, and Multitech, Inc. in Butte to investigate processing technology for upgrading eastern Montana lignite. That project, funded at approximately \$300,000 will investigate the organic conversion of low-rank coal at elevated temperatures. This process holds the promise of developing an improved coal product for marketing through a cost-effective, value-added processing technique. This joint venture is solely supported by private funds and utilizes the faculty and staff at Montana Tech, the professional engineering and management staff at Multitech, Inc., the engineering staff at Western Energy Company, and faculty at Montana State University.

To summarize, coal research has existed at low levels in Montana for many years. A flurry of activity during the late seventies and early eighties based on the MHD project and federal coal-leasing interests, resulted in sponsored coal research at support levels of about \$1 million per year for several years until a rapid decline in 1982. Program directions have centered on coal geology for resource determinations, and characterization/beneficiation research on the Rosebud Coal for use as an MHD feedstock. State support in these programs was more incidental, through minor matching commitments, than direct. With the cessation of most federal support, our pool of research faculty and professional staff is at the lowest level of the last 15 years.

PROPOSED PROGRAM STRENGTHENING IN COAL RESEARCH

The University System, through program modified requests submitted to and approved by the Board of Regents, will propose that the 1985 Montana Legislature strengthen research capability in coal research and process engineering at the Montana Bureau of Mines and Geology and the Center for Energy and Mineral Research at Montana Tech. These modified requests will emphasize strengthening our research capability for coal characterization and coal processing.

The Montana Advisory Council on Science and Technology, pending approval by the full Council, will recommend that significant funds be appropriated to support coal research through a program of competitive grants and contracts that will support both the public and the private research process.

I have summarized our proposed research programs in my letter to your committee staff dated July 20, 1984, and with your permission I would like to have that letter made a part of this testimony. In addition I have provided copies of our budget program modified requests which have been approved by the Board of Regents and which provide more information on staffing levels and program content. These requests from Montana Tech and the Bureau of Mines and Geology reflect the response in part to the needs of a total research program that relates to Montana coal.

I would like to turn now to defining the nature of a more comprehensive technology development program.

A COAL RESEARCH AND TECHNOLOGY DEVELOPMENT PROGRAM FOR MONTANA

A coal science and engineering research program that supports long-term stability and reasonable growth of this major mineral-fuels industry in Montana must have as its primary goal the improvement of our competitive position in coal characterization and coal preparation.

Coal Characterization

Refers to the distribution and quality factors of our coal resources. This large and complex research field is primarily geologic, mineralogic, and chemical in terms of applied disciplines: information gained in this field is the basis for assessing minability, value, and ultimate use of coal.

Scope: Includes the systematic determination of chemical and petrographic characteristics of major Montana coal resources. Results in the identification and inventory of regional and local trends in primary coal properties such as rank, BTU content, ash constituents, oxides of sulfur and nitrogen, trace metals and so forth.

Technology: The technology elements required to advance our knowledge of coal characterization include:

- High quality and specialized chemical and microscopic analysis of representative coal samples from the Montana resource base.
- Delineation of the distribution of mineable coal geographically and geologically in our major coal fields and coal regions.
- Generate an automated data processing system for selective storage and retrieval of identified and inventoried coal characteristics.

Benefits: A modern inventory of coal characteristics would provide a readily available and much needed data-base for the development of processing technology and the identification of potential production or use problems related to coal contaminants. The development of modern processing research requires detailed and well documented quantitative information on the physical and chemical properties of coal. An effective inventory reduces the time required to develop new processing technology. Also, Montana has already recorded lost coal production because of contamination problems related to metals such as sodium. Trace metal distribution and oxides of sulfur and nitrogen are of critical importance in determining the end use of Montana coal and thereby its marketability.

Program Duration: Continuing and long-term.

Funding Level Required: This program requires staffing by coal petrologists, coal geologists, and stratigraphers plus operational support in the form of analytical data and drilling for effective sample gathering. A comparable program, previously supported in Montana by the federal government was funded at approximately \$500,000 per year. An effective base program should be funded at approximately \$600,000 per year to support all of the elements described above and should be predicated upon a continuing effort that develops an expanding and effective data base.

Coal Processing

Montana should support the development of technology to convert or upgrade mined coal in order to improve its chemical and/or thermal quality. Such beneficiation refers to low-cost physical and chemical conversions of coal as a fuel that results in substantial quality improvements. It does not include coal conversion technologies such as coal gasification and coal liquification.

Processing technology includes research and engineering development aimed at:

1. Improving the chemical quality of coal resources by reducing noxious compounds formed in the burning process such as sulfur and nitrogen oxides and ash constituents.
2. Thermal upgrading technology that adds value to low-rank resources i.e., increases BTU content in a cost effective manner.

New and improved processing technology will preserve and expand coal markets by decreasing already relatively low levels of chemically deleterious materials generated during coal burning and by improving the thermal content of very large, low-grade lignite deposits in Montana.

Research Initiatives: These are recommended areas of technology development that have specific application to western coal resources. Some, but not all, of these efforts are being supported by the research community in mid-western and eastern states for specific application to high-sulfur coal resources.

Because the nature of western coal is fundamentally different from eastern coal resources (geologic age, chemistry, mode of origin, physical make-up, and so forth) Montana research initiatives should focus on the specific economic opportunities for upgrading western coal.

1. Improve and expand the technology of separating physically bound mineral ash constituents in sub-bituminous coal and lignite.
2. Develop new technologies specifically aimed at economically removing organically-bound sulfur species from subbituminous coal and lignite.
3. Expand our knowledge and develop innovative technologies for thermal upgrading of low-rank coal resources such as eastern Montana lignite through a program that goes beyond conventional drying technology.

Program Duration: Short, middle, and long-term efforts.

Funding Level Required: 1) Research projects: \$150,000 to \$250,000 per year. These projects would support basic research to better define the scientific basis for engineering development in coal processing. 2) Engineering

projects: \$500,000 to \$1,000,000 per year. Engineering support projects can lead directly to industrial development and pilot-plant demonstration projects. State support in this area would encourage investment by the private sector and a contribution of applicable federal funds to demonstration projects in coal cleaning and thermal upgrading.

MONTANA'S CAPACITY TO CONDUCT COAL RESEARCH

Because of dwindling funds from sources outside Montana for coal research, our faculty and staff resources are at record lows. Uncertainty and lack of confidence in the prospect of continued federal funding for coal research projects has resulted in the loss of nearly all professional and technical staff in coal research at Montana Tech.

In 1980, federally sponsored research on coal supported six full-time professional staff, four part-time faculty, four technical staff, and about a dozen half-dozen graduate students.

Today our coal research program consists of two data-base technicians, one part-time staff member, and two students. Our coal geologists were hired by Cities Service Company, Sohio and Utah Power and Light. Our only coal petrologist has returned to graduate school in South Dakota because of a lack of financial support in Montana. Our last half-time coal geologist will be leaving for Akita University in Japan, where he will conduct research on Chinese coal for the Japanese. The program that has supported his work in Montana will be cancelled next month and there will be no support for him when he returns.

Faculty who were employed part-time in coal research now consult for Alberta and Illinois developing technology for those rival coal-producing areas.

Over the past few years, five mineral processing graduate students who specialized in coal processing have left Montana to conduct coal research in Texas and Illinois. Four of these students were native Montanans. One former student, now a staff member for the Illinois Geological Survey, manages a \$300,000 annual coal-processing research budget. Part of those funds support Montana scientists paid to conduct desulfurization research on Illinois bituminous coal. If such research leads to economically feasible beneficiation of Illinois bituminous coal, Montana's midwest markets for low-sulfur coal will be greatly threatened or lost.

THE TECHNOLOGICAL WAR FOR SUPREMACY IN COAL MARKETING

Future coal marketing will be strongly influenced by coal research and technology development.

The state of Illinois has launched a massive multi-million dollar research effort in coal characterization, coal preparation, coal conversion and coal utilization aimed at removing impurities and developing new uses for high-sulfur bituminous coal. In 1983, the state of Illinois appropriated \$1.6 million from utility revenues to the University of Southern Illinois at Carbondale and the Illinois Geological Survey for coal research. In the same year, the University of Southern Illinois received \$1.5 million for coal research and to operate DOE's coal technology laboratory at Carterville, Illinois.

Continuing concern over acid precipitation has prompted congressional interest in massive technology programs like those proposed in Senate Bill 1925, introduced by Senator Byrd of West Virginia. This bill proposes a national coal science, technology, and engineering development program that will result in "increased coal use . . . consistent with the nations environmental goals."

This massive five-year program with a recommended appropriation of \$775 million will likely focus on supporting coal research and engineering development for processing and improving the quality of eastern high-sulfur coal. This program would be administered by the Department of Energy and would support research at universities and DOE's Energy Technology Centers. These federal research centers have had a long history of research programs in cleaning, conversion and utilization of high-sulfur coal from the eastern United States.

The province of Alberta has long been committed to a comprehensive coal research program. The province has enormous reserves of bituminous and sub-bituminous coal and lignite; recoverable reserves have recently been estimated at 819 billion tons, much of which is low-ranked coal and lignite. These large reserves have prompted intensive efforts by the staff of the Alberta Coal Mining Research Center to develop coal drying and processing technology for application to plains coals. This year that agency will move into a new \$20 million facility dedicated to coal research. Alberta's aim is to develop an improved product and expand their share of the thermal coal market in Europe, the Pacific Rim, and within Canada.

FUNDING A MAJOR MONTANA COAL RESEARCH PROGRAM

Montana can develop a successful and continuing coal research and technology development program if the Legislature is able to provide significant levels of funding through a constructive and sustaining appropriation formula. This funding mechanism should reflect the essential ingredients cited below for building and maintaining a responsive and effective research enterprise.

1. Initial funding levels should be at relatively high levels to provide necessary research equipment, full-time salaries for investigators, and to meet the relatively high acquisition costs for field sampling and analytical data.

2. Continuing support should be at levels sufficient to maintain staff size adequate for substantial progress in scientific programs. This requires groups large enough to interact on research projects and achieve "critical mass" interaction and enhanced research productivity.
3. Continuing funds should be at levels adequate to insure significant support to attract funds from the private sector or from the federal research agencies, with the proviso that matching should never become an exercise that drives the research groups to near total dependence upon non-state funds for effective coal research.
4. The funding source or sources should be related to state revenue directly derived from coal production. Research support that is in some way directly related to mineral production for a commodity like coal is a rational and logical relationship that motivates the research community to perform relevant applied research through increased private sector interest.

To conclude,

The coal industry is an important part of the economic framework of the state.

Our ability to market coal in the future can be positively influenced by research to upgrade the chemical and thermal quality of our low-rank coal resources.

Coal research can lead to expanded marketing of an improved product, more economical production, and improved mine-land reclamation practice.

Research helps diversify our coal products and lends stability to a major mineral industry subject to cyclic supply and demand. Stability lessens socio-economic impacts from coal production and contributes to a more predictable revenue base.

Montana must recognize and should be prepared to meet the technological challenge being mounted in other coal-producing regions in North America. Technology applied to improving coal quality can generate major dislocations in coal marketing patterns for western coal-producing states.

I respectfully ask your support in developing an effective and continuing coal research program which will benefit all Montanans.

Thank you.

BUDGET MODIFICATION REQUEST

Priority No. 2

Agency Program Identification	Agency Code	Program Code	Program Name
	5105	08	Montana Bureau of Mines and Geology
Type of Request	Expanded Services		
Title of Request	Coal Geology		

JUSTIFICATION:

Since the mid-1970's, the Montana coal industry has been a significant element in the state's mineral-based economy. Average annual production of nearly 30 million tons per year of low sulfur, subbituminous coal provides nearly \$90 million annually in severance taxes, several thousand jobs, and significant capital investment.

Increased concern over coal use as a factor in acid precipitation, and the intensifying research and technology development programs in eastern coal-producing states, are increasing demand for information on the quality and distribution of Montana coal resources. Coal quality investigations provide quantitative measures of thermal quality, ash and sulfur content, presence of metal species, identity and distribution of maceral components and other measures critical to assessing end use or appropriate beneficiation processes. If Montana coal producers are to meet the technological challenge posed by intensive research and development programs in other coal-producing states, and avoid further market erosion of current production, it is essential that critical research in coal characterization be expanded. A modern inventory of the quality characteristics of coal resources in each of our major coal basins can pave the way for realizing new market advantages and expanding existing markets for coal sales.

This program modification would provide two staff coal geologists to begin systematic coal quality investigations. Operating funds would support the collection of subsurface coal samples by core drilling and the completion of diagnostic coal chemical analyses. Results of these investigations will be published as definitive profiles of coal characteristics including the distribution, by coal seam and area, of critical quality factors essential to any effort to expand use through technological innovation.

BUDGET REQUEST			
	FY 86	FY 87	TOTAL
<u>Personal Services</u>			
FTE	2.0	2.0	2.0
Salaries & Benefits	\$71,700	\$71,700	\$143,400
<u>Operations</u>	35,500	35,500	71,000
<u>Capital</u>	6,500	---	6,500
TOTALS	\$113,700	\$107,200	\$220,900

PROGRAM MODIFIED REQUEST

Montana College of Mineral Science and Technology

Innovative technology development that supports and strengthens Montana's economy through improved opportunities to prudently expand use of our natural resources is a high priority goal of both state government and the private sector. Increased extraction and use of our primary energy and mineral resources --- oil and gas, coal, precious metals, strategic and critical minerals, and industrial minerals --- provides significant economic gains because of the high average annual earnings in these industries, heightened transportation use, and increased level of activity for processing/manufacturing industries.

Meeting these economic goals will depend upon our ability to foster technological innovation through competent, responsive and integrated research programs in mineral technology. Developing and sustaining high quality research programs requires consistent and long-range funding adequate to the maintenance of an effective pool of research faculty and support staff.

State government and the private sector in Montana look to the University System to mobilize it's resource to meet the need for modern technology development. In order to fulfill our role as a leader in mineral technology development, we must expand our basic research establishment to a level sufficient to conduct meaningful, goal-oriented research in mineral science and engineering.

Funding requested here for expanded program support in organized research will specifically strengthen three technology areas: 1.) Coal research including chemical characterization, processing for sulfur and ash removal, thermal upgrading and alternative coal use; 2.) Petroleum research including enhanced-oil-recovery (EQR) technology, stratigraphic and physical analysis of petroleum source and reservoir rocks, tectonic analysis of the Overthrust Belt, development of deep crustal models; and 3.) Hard-rock mined-land reclamation including geotechnical research for reclaiming surface and subsurface abandoned-mine lands, ground-water impacts and constraints on reclamation, biological impacts from mine reclamation, microbiological technology for mine-waste detoxification and revegetation scenarios for hard-rock mined land.

These program modified funds will provide significant new opportunities to develop innovative technology relevant to the Montana mineral industry. This support, in addition to directly strengthening our research productivity, will provide direct state matching support for the Montana Mining and Mineral Resources Research Institute and will make Montana much more competitive in attracting private capital for mineral technology development.

COST DETAILFY 1986FY 1987TOTAL

1. Coal Processing Research

Personal services (2 FTE) \$39,331 \$ 78,663 \$117,994

Operations 30,000 60,000 90,000

Capital 7500 9,000 16,500

Program Subtotal . \$76,831 \$147,663 \$224,494

BUDGET MODIFICATION REQUEST

Priority No. 3

Agency Program Identification	Agency Code	Program Code	Program Name
	5105	02	Organized Research
Type of Request	New Space		
Title of Request	Energy and Mineral Technology Research Expansion		

JUSTIFICATION:

Innovative technology development that supports and strengthens Montana's economy through improved opportunities to prudently expand use of our natural resources is a high priority goal of both state government and the private sector. Increased extraction and use of our primary energy and mineral resources --- oil and gas, coal, precious metals, strategic and critical minerals, the industrial minerals --- provides significant economic gains because of the high average annual earnings in these industries, heightened transportation use, and increased level of activity for processing/manufacturing industries.

Meeting these economic goals will depend upon our ability to foster technological innovation through competent, responsive and integrated research programs in mineral technology. Developing and sustaining high quality research programs requires consistent and long-range funding adequate to the maintenance of an effective pool of research faculty and support staff.

State government and the private sector in Montana look to the University System to mobilize its resources to meet the need for modern technology development. In order to fulfill our role as a leader in mineral technology development, we must expand our basic research establishment to a level sufficient to conduct meaningful, goal-oriented research in mineral science and engineering.

Funding requested here for expanded program support in organized research will specifically strengthen three technology areas: 1) Coal research including chemical characterization, processing for sulfur and ash removal, thermal upgrading and alternative coal use; 2) Petroleum research including enhanced-oil-recovery (EOR) technology, stratigraphic and physical analysis of petroleum source and reservoir rocks, tectonic analysis of the Overthrust Belt, development of deep crustal models; and 3) Hard-rock mined-land reclamation including geotechnical research for reclaiming surface and subsurface abandoned-mine lands, ground-water impacts and constraints on reclamation, biological impacts from mine reclamation, microbiological technology for mine-waste detoxification and revegetation scenarios for hard-rock mined land.

BUDGET REQUEST

	<u>FY 86</u>	<u>FY 87</u>	<u>TOTAL</u>
<u>Personal Services</u>			
FTE	3.0	6.0	4.5
Salaries & Benefits	\$117,947	\$235,895	\$353,842
<u>Operations</u>	46,250	93,500	139,750
<u>Capital</u>	17,500	22,000	39,500
<u>TOTALS</u>	<u>\$181,697</u>	<u>\$351,395</u>	<u>\$533,092</u>

BUDGET MODIFICATION REQUEST

Priority No. 3

Agency Program Identification	Agency Code	Program Code	Program Name
	5105	02	Organized Research
Type of Request	New Services		
Title of Request	Energy and Mineral Technology Research Expansion continued...		

JUSTIFICATION:

These program modified funds will provide significant new opportunities to develop innovative technology relevant to the Montana mineral industry. This support, in addition to directly strengthening our research productivity, will provide direct state matching support for the Montana Mining and Mineral Resources Research Institute and will make Montana much more competitive in attracting private capital for mineral technology development.

COST DETAIL	FY 1986	FY 1987	TOTAL
1. Coal Research			
FTE	1.0	2.0	1.5
Personal Services	\$ 39,331	\$ 78,663	\$117,994
Operations	30,000	60,000	90,000
Capital	7,500	9,000	16,500
Program Subtotal	\$ 76,831	\$147,663	\$224,494
2. Petroleum Research			
FTE	1.25	2.5	1.875
Personal Services	\$ 49,135	\$ 98,270	\$147,405
Operations	8,500	17,000	25,500
Capital	6,000	8,000	14,000
Program Subtotal	\$ 63,635	\$123,270	\$186,905
3. Hard-rock Mined-Land Reclamation			
FTE	0.75	1.5	1.125
Personal Services	\$ 29,481	\$ 58,962	\$ 88,443
Operations	7,750	16,500	24,250
Capital	4,000	5,000	9,000
Program Subtotal	\$ 41,231	\$ 80,462	\$121,693
PROGRAM TOTAL	\$181,697	\$351,395	\$533,092

BUDGET REQUEST

	FY 86	FY 87	TOTAL
Personal Services			
FTE			
Salaries & Benefits			
Operations			
Capital			
TOTALS			

MAJOR RESEARCH AREAS OF A COMPREHENSIVE COAL RESEARCH PROGRAM

COAL RESOURCES, EXTRACTION AND PROCESSING

COAL UTILIZATION AND CONVERSION

LAND RECLAMATION

ENVIRONMENTAL STUDIES

TRANSPORTATION ISSUES

SOCIO-ECONOMIC IMPACTS

INFORMATION SYSTEMS AND COMPUTER PROGRAMS

PROGRAMS REVIEWED AND RATED BY
OLD WEST REGIONAL COMMISSION TASK FORCE

PROGRAM AREA

COAL CONVERSION AND ENERGY
PRODUCTION

COAL RESOURCES, EXTRACTION
AND PROCESSING

RECLAMATION

ENVIRONMENTAL STUDIES

SOCIOECONOMICS

DECLINE IN FUNDING OF
COAL RESEARCH AT MSU IN KEY AREAS
 (1974-84)

<u>Yr</u>	<u>RECLAMATION RESEARCH</u>	<u>MHD</u>	<u>TOTAL FUNDING</u>
84	\$ 336,434	\$51,206	\$19,500,000
83	313,040	56,744	18,300,000
82	409,103	325,790	15,900,000
81	432,342	547,315	15,500,000
80	554,692	667,035	13,700,000
79	535,576	729,699	12,500,000
78	795,613	753,345	12,700,000
77	792,037	852,361	10,300,000
76	222,450	823,786	9,600,000
75	<u>190,000</u>	<u>53,943</u>	<u>8,900,000</u>
	\$4,581,282	\$4,861,225	\$136,900,000

CONCLUSION REMARKS

ASSUMPTION

1. THERE IS NO MAJOR RESEARCH EFFORT DIRECTED TOWARD SUB-BITUMINOUS COAL WHICH IS ABUNDANT IN MONTANA.
2. BECAUSE COAL IS NOT A HIGH PRIORITY ENERGY PROGRAM IN THE U.S. THERE HAS BEEN A MAJOR DECLINE IN FEDERAL FUNDING OF MOST COAL RESEARCH PROGRAMS.
3. THE STATE OF MONTANA HAS PLAYED A MINOR ROLE IN THE DEVELOPMENT AND SUPPORT OF COAL RESEARCH IN THE PAST DECADE.
4. THERE IS SUBSTANTIAL RESEARCH CAPABILITY IN THE UNIVERSITY SYSTEM.

CONCLUSION

THE STATE SHOULD FUND A MAJOR COAL RESEARCH PROGRAM WITH EMPHASIS GIVEN TO THE:

1. USE OF EXISTING HIGH QUALITY RESEARCH FACULTY AT ALL UNITS OF THE UNIVERSITY SYSTEM.
2. USE OF EXISTING FACILITIES AND EQUIPMENT.
3. INTEGRATION AND COORDINATION OF COAL RESEARCH ACTIVITIES IN THE UNIVERSITY SYSTEM TO AVOID DUPLICATION.
4. RAPID MOVE OF INFORMATION AND TECHNOLOGIES INTO INDUSTRY AND GOVERNMENT.

TECHNOLOGICAL FRONTIERS FOR WESTERN COAL RESEARCH, by Lloyd Berg, MT. St. UN
LUTTE, SEPT. 21, 1984.

COAL: What is it? Water, Volatile Matter, Fixed Carbon, Ash

Fig.1 Chemical precursors of coal

Fig.2 Partial structures of coal

Fig.3 Theoretical Coal Molecule

Actually, it is chicken wire. No volatile compounds in it.

To drive off volatile matter, we are using heat to break up the large molecule.

Fig. 4 Anthracene, Naphthene, Benzene, Ethylene, Methane.

Pyrolysis tends to break up coal in the reverse order of boiling point of the molecules. Highest b.p first, lowest last.

What interest in Montana?

Fig. 5 Coal fields of Montana

Montana has the largest coal reserves in the U.S. & U.S has 1/3 of the world's coal. Eastern quarter is lignite, 2nd 1/4 is sub-bit., western half is bituminous.

Lignite & sub-bit. can be strip mined @ cost \$12-20/ton.

Bituminous is underground, cost is \$35 - 50/ton.

Roundup, Red Lodge, Livingston, Emigrant, Trail Creek, Belt, Sand Coulee have been exploited.

How to develop Montana coal for the future? Four general areas:

Solid fuels, Gaseous fuels, Liquid fuels, Chemicals.

Must be economically attractive before it can be commercially viable.

	<u>Btu/lb.</u>
Lignite	6800
Sub-bituminous	8600
Bituminous	11000

Must be shipped long distances to any market. Therefore heat content is vital. Additionally, some applications require a combustion temperature of 2500 °F. which cannot be attained unless the fuel has 10,000 Btu/lb.

Currently lignite is used only for mine-mouth generating plants

Sub-bituminous coal reaches Minn. & Wisc. but only because of its low sulfur content. SO₂ scrubbers on midwestern coal are the competition.

Western Energy Co. has a research project currently underway to dry lignite

and/or sub-bit. This raises the Btu content to 10,000 - 11,000 but makes a dusty product. Briquetting of the dried lignite seems to overcome this objection.

Gaseous and liquid fuels invariably contain a higher ratio of H_2 to C than coal.

Fig. 6 Natural gas is CH_4 . Gasoline is C_8H_{18} ($C_1H_{2.2}$)

Coal is $C_{1000}H_{850}$ ($C_1H_{0.85}$)

How are we going to change this ratio? in coal?

Three possible ways:

Subtract carbon, Add hydrogen, Break it up & reassemble.

DOE has extensively supported all of these.

Figure 7

1. FMC Process: Coal + heat = C (char) + Oils & gases

Source	Char, #/T	Liquids, gal/T	Gas, SCF/T
Red Lodge, Bituminous	1060	20	6500
Colstrip, Sub-bit.	1000	14	7500
Savage, Lignite	1000	5	300
Value	\$10/T	50¢/gal	\$1.50/1000 scf

2. Add Hydrogen

Coals are the lowest, petroleum distillates the highest.

Bergius (1912), 10,000 $\#/in^2$, 400°C. Poor quality oil. Used by Germany in World Wars I & II. see Figure 8, SYNTHOIL process.

(a) Gulf Oil: SRC process. Uses anthracene oil as the solvent. 2000 psi, 400°C.. \$6MM plant, \$1MM/month. see Figures 9 & 10.

(b) EXXON Donor Solvent. Tetralin is the solvent. 2000psi, 400°C. \$250MM plant, \$5MM/month

(c) HRI, H-Coal process. 2000psi, 400°C. Solid catalyst in an ebulliated bed. Zoned fluidized bed

All three yield a "liquified coal" costing \$50 - 80/bbl.

Fig. 11- Rate of Return calculation of H-Coal plant at Colstrip.

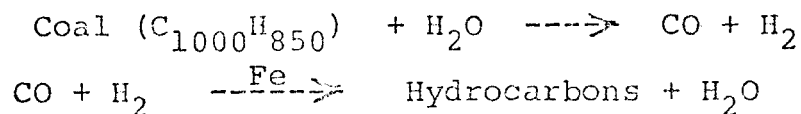
Support for all of the above except H-Coal has ceased.

One demonstration plant under construction at Breckenridge, KY.

3.

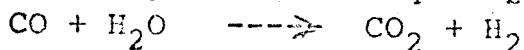
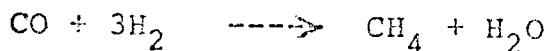
SU developed for DOE a catalytic up-grading process which converts liquified coal into an acceptable substitute for crude oil in a conventional petroleum refinery. Adds about \$5/bbl to cost. That is probably why I am on this program.

3. Reassemble the molecules.

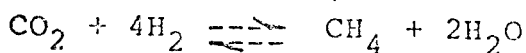
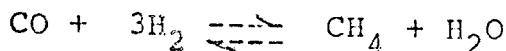


This is the Fischer-Tropsch process. Used in World War II by Germany
 Problem: Step 1 loses 50% of the energy in the coal, Step 2 loses another 10% so you get 40% of the energy originally in the coal
 SASOL is the major Fischer-Tropsch plant in the world. Cost: \$70/bbl.

COAL GASIFICATION

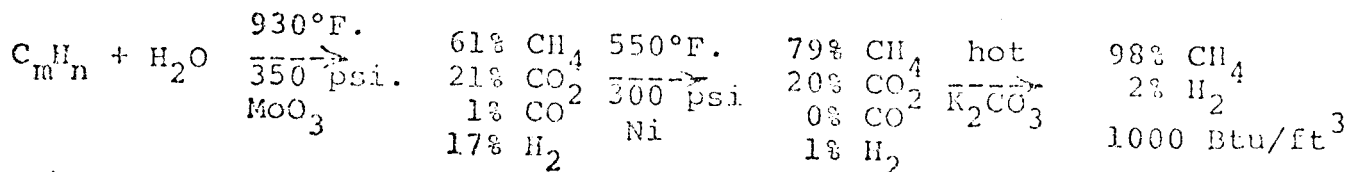


If too much CO, get: $2\text{CO} \xrightarrow{\quad\quad\quad} \text{C} + \text{CO}_2$ carbon on catalyst



To get 1000 Btu/ft³, need almost pure CH₄

Feed: LPG, Naphtha or Coal:



One demonstration plant @ Beulah, ND. Gas cost: \$7-8/1000ft³

Natural gas is \$4.50

What for the future?

DOE funding has been greatly reduced. Current interest of DOE is in novel ways to increase efficiency of liquefaction, unique catalysts. Trying to improve the yield of liquids from Fischer-Tropsch process. DOE effort is mainly on bituminous coals.

What should Montana do?

I recommend process development on sub-bit. coal first and lignite second. DOE has a lignite lab at Grand Forks, ND. and several bituminous coal labs. Would emphasize liquefaction rather than gasification because petroleum will get short again in the 1990's. By then, only Saudi Arabia will have large reserves left. Big new finds from now on will be in very expensive places - Beaufort Sea, Baltimore canyon, Grand Banks.

Methane seems to be much more abundant in nature. Large quantities in:

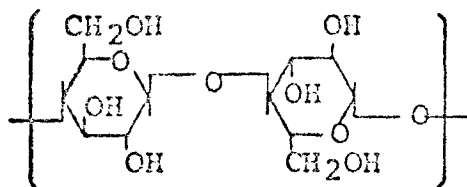
1. Western tight sands - E. slope of Rockies
2. Geopressure zone of Gulf Coast.
3. Deep basins - 15,000-30,000 ft. deep
4. Coal seams
5. Devonian shales
6. Methane hydrates @ 20,000-30,000 ft. down.

Probably at least some of these will be commercial and priced below \$7-8 from coal gasification.

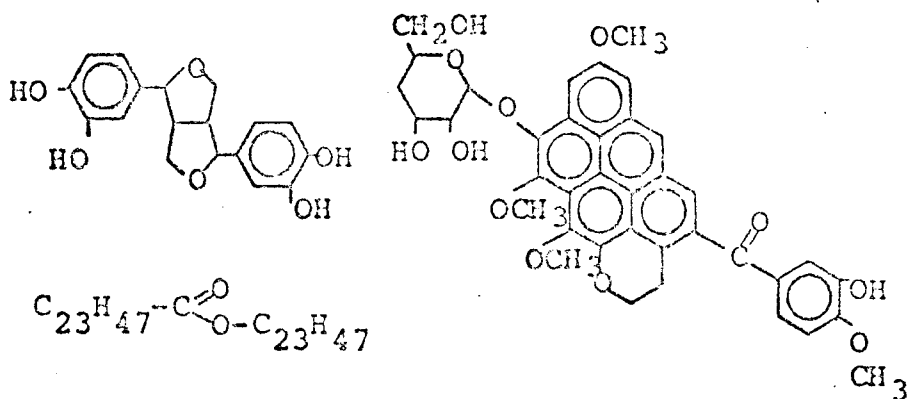
More specifically, how should this effort be supported? The Governor's Build Montana committees on Mineral Tech and Energy will probably recommend a research & development effort funded by the coal severance tax. One proposal that I have seen calls for "no bricks & mortar". Use the facilities & talent currently in Montana. Invite proposals and fund those that appear to meet the goals of developing a viable industry based on Montana sub-bit. & lignite. Start now so that in the 1990's the knowledge will be on hand to supply our refineries with an acceptable feedstock made from sub-bit. and/or lignite as a substitute for petroleum.

For starters, liquify sub-bit. Catalytically treat it to maximize the conversion to benzene, toluene, ethylbenzene, naphthalene & anththracene and market these chemicals. Current price range is \$1.38 - 3.00/gal. Convert sub-bit. coal into synthetic coke. Done by calcining, grinding, briquetting, calcine again. 5% Vol. Matter, Req'd hardness. Stauffer, ASARC are possible customers in Montana.

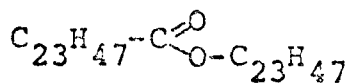
Cellulose



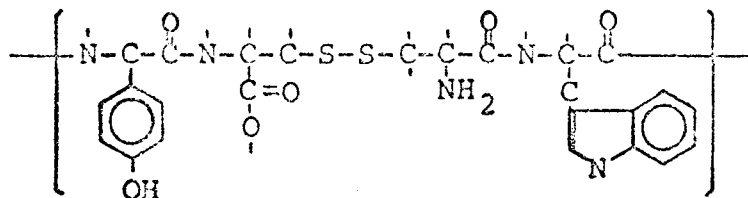
Lignins



Waxes



Protein



Model of a humic acid

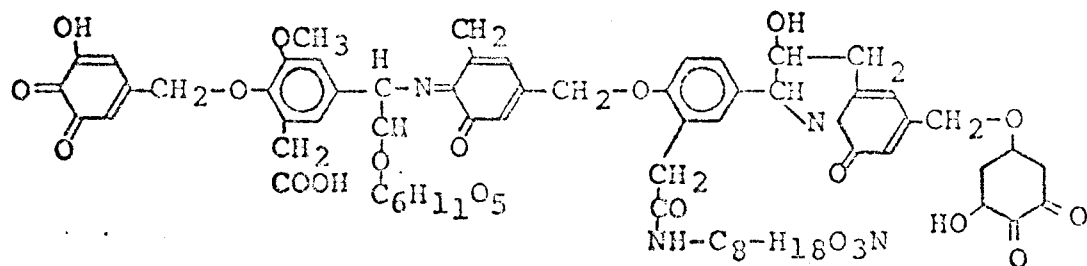
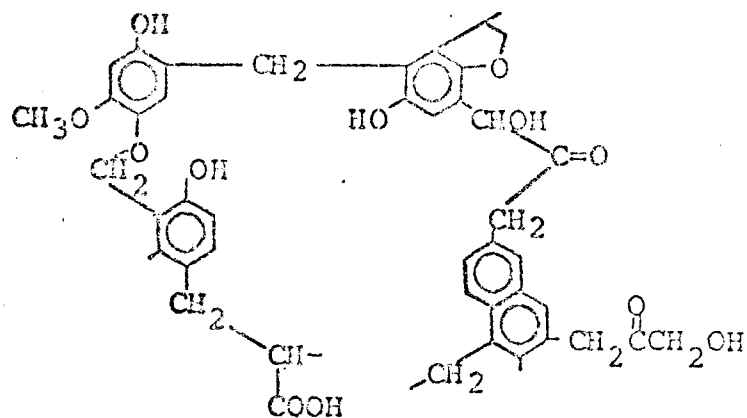
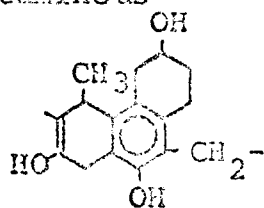


Figure 1. Chemical precursors of coal.

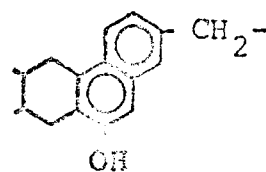
Lignite



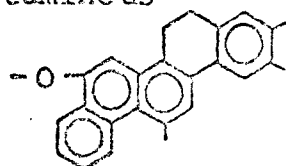
Subbituminous



High-volatile bituminous



Low-volatile bituminous



Anthracite

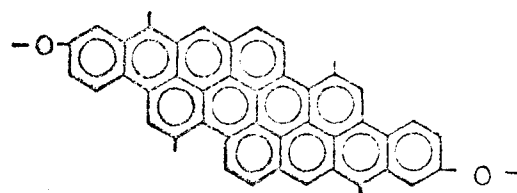


Figure 2. Representative partial structures of coal.

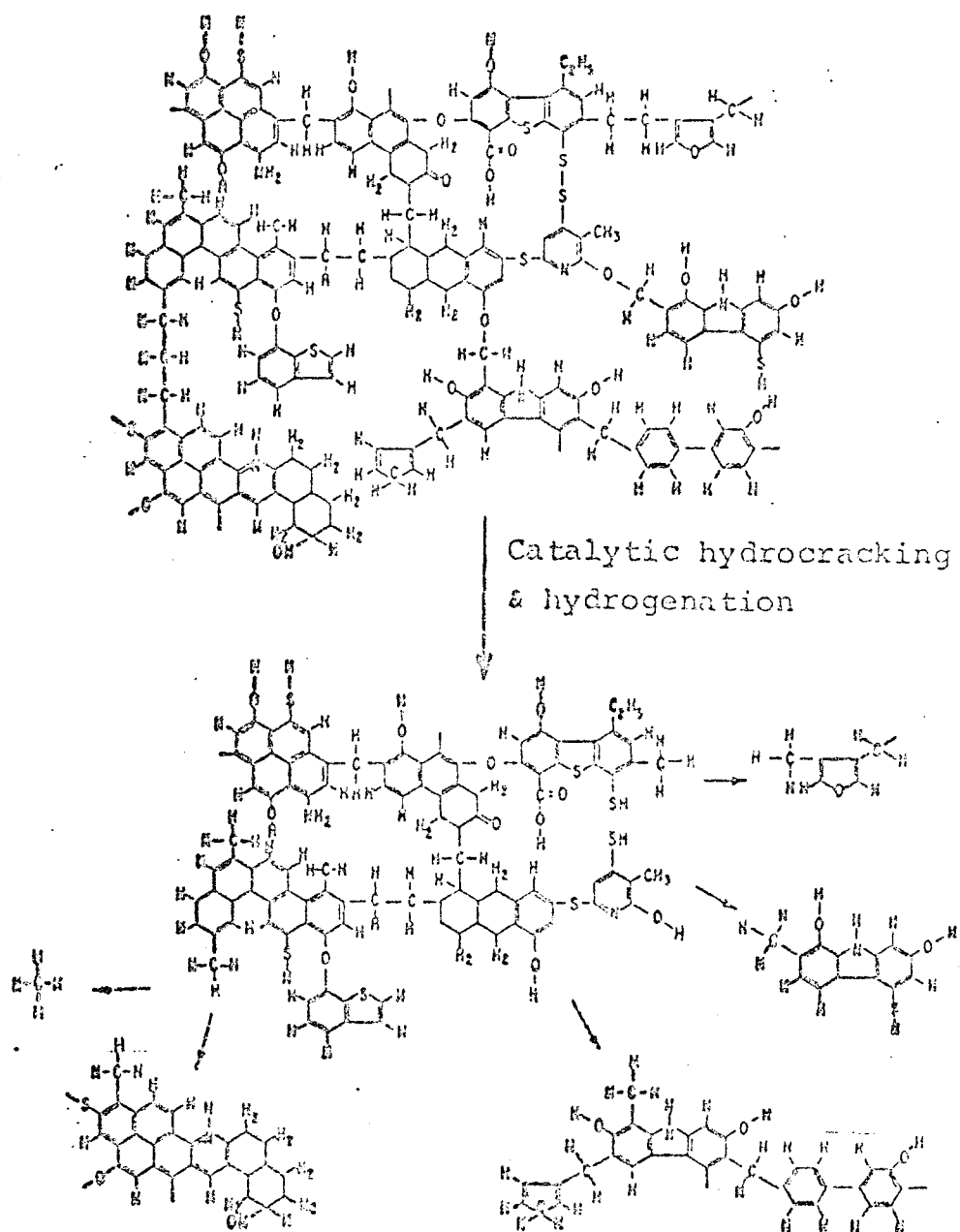
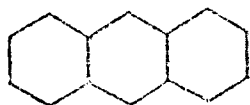


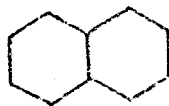
Figure 3. A theoretical molecule and thermal breakup of coal (Wiser).

Anthracene



B.P.°C. 340

Naphthalene



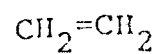
218

Benzene



80

Ethylene



-89

Methane



-162

Figure 4 - Boiling Points of Coal's Decomposition Products.

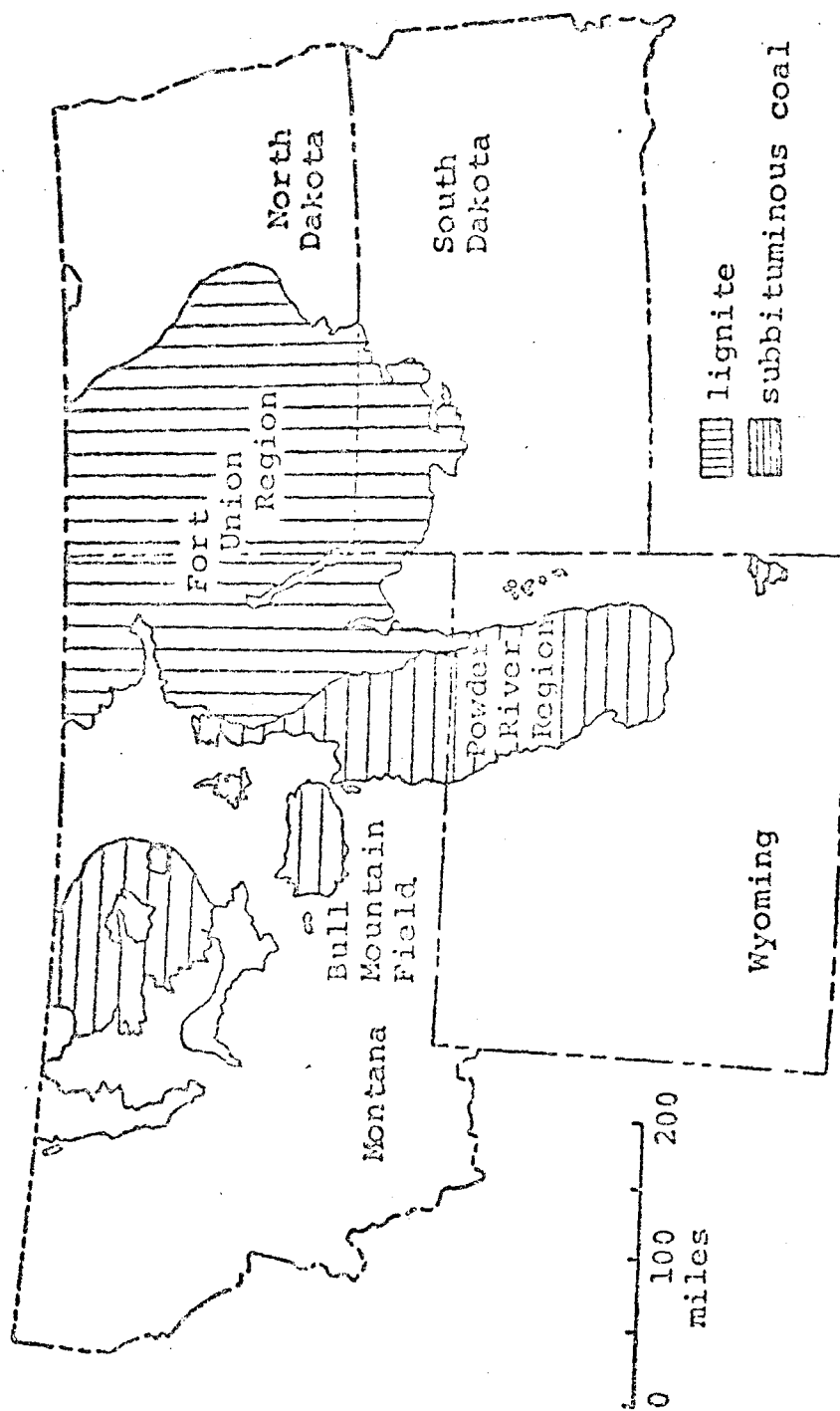


Figure 5. Coal fields in the Northern Great Plains province.

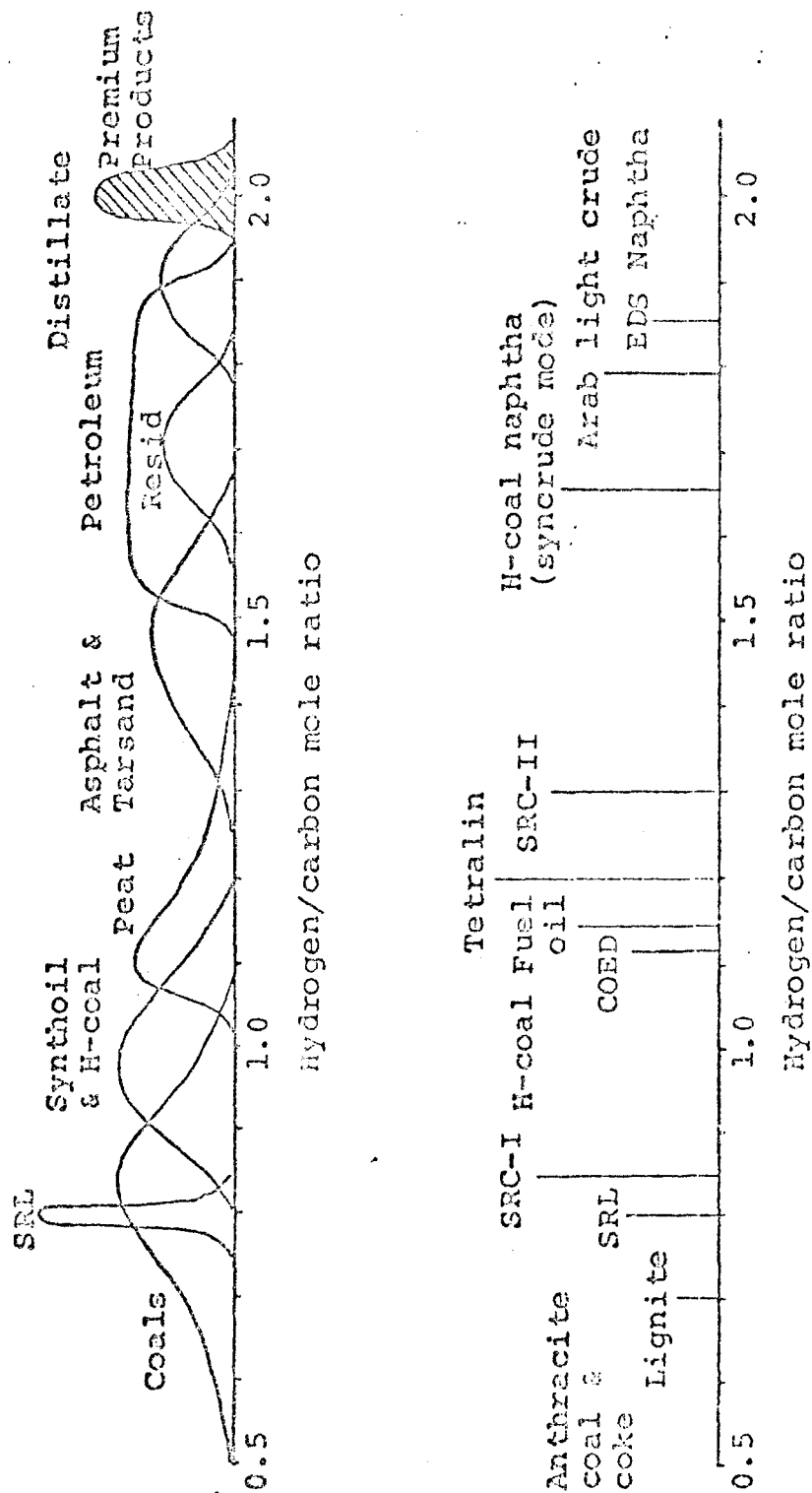
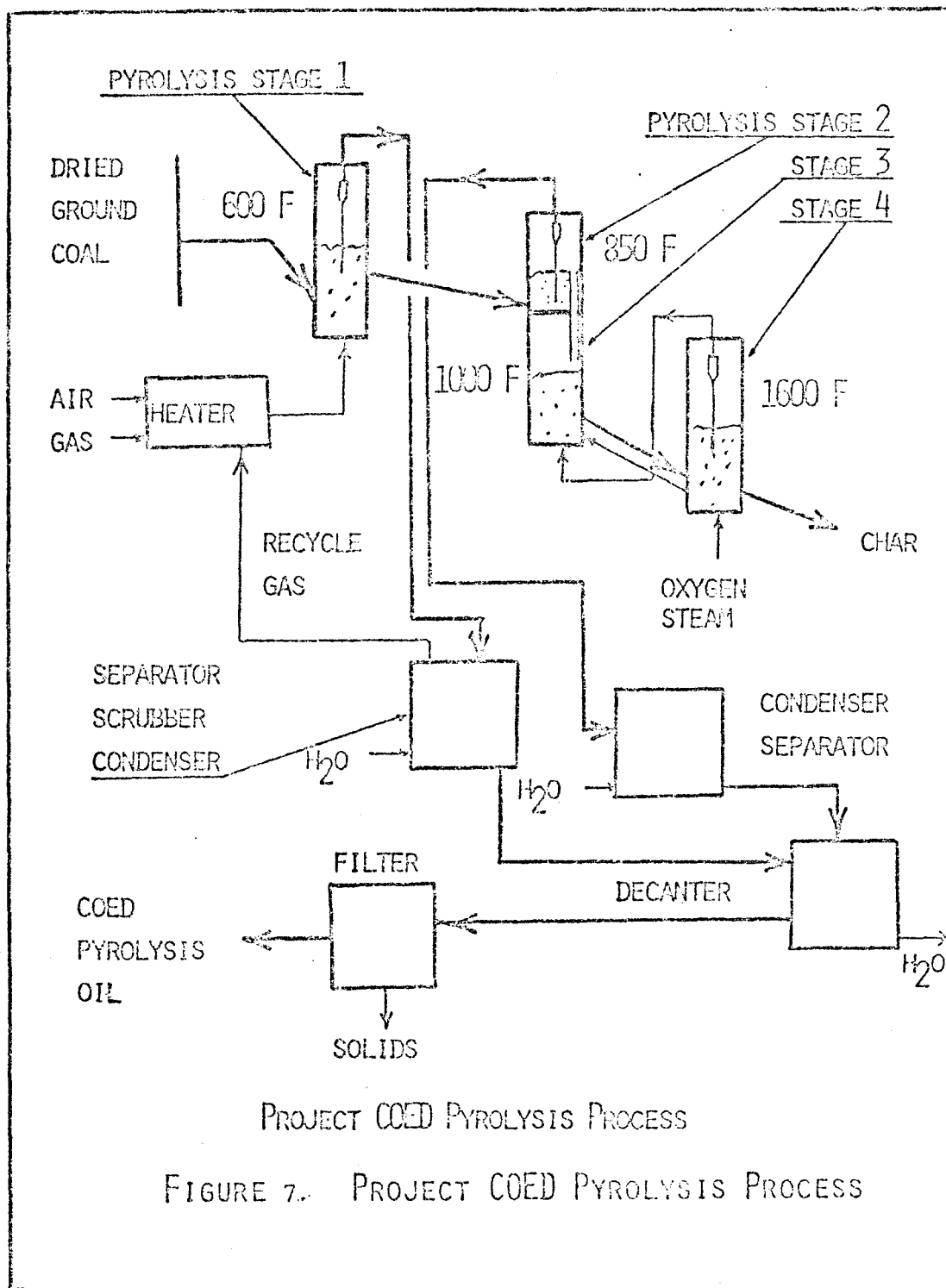


Figure 6. Comparison of lignite with other sources of hydrocarbon.



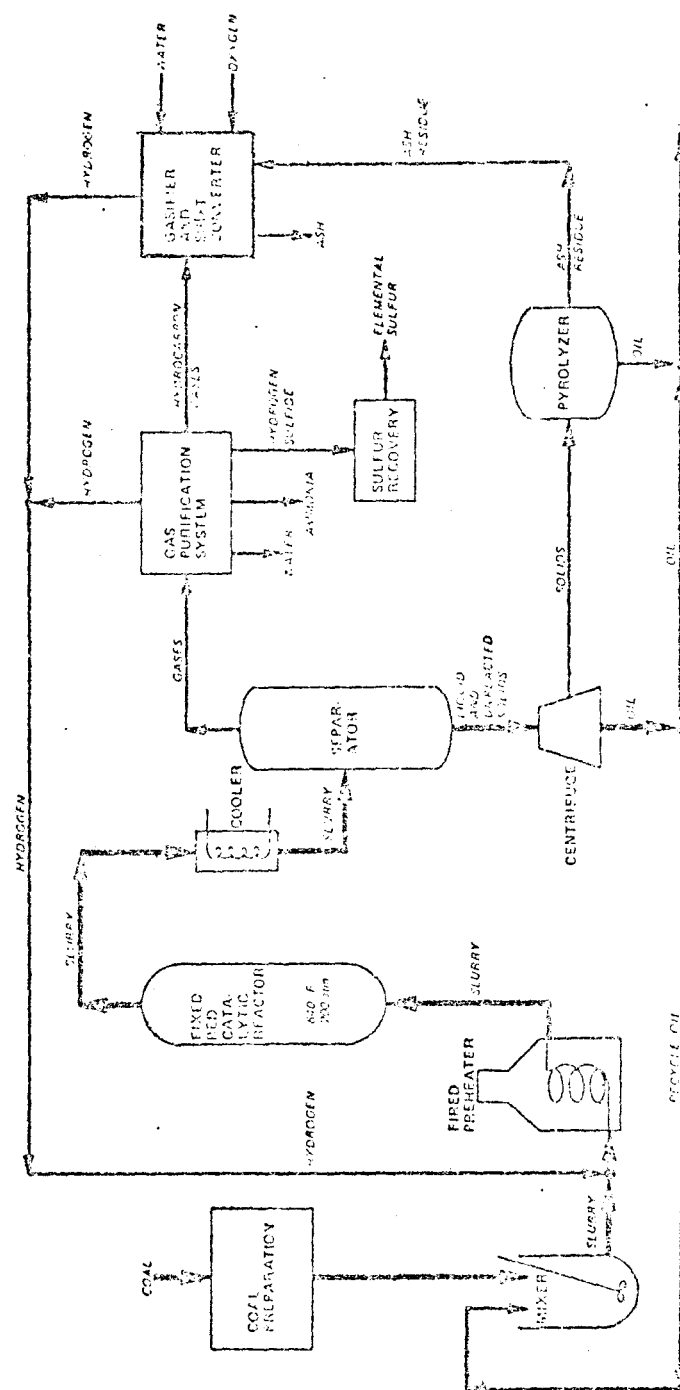


FIGURE 8. SYNTHOIL Process

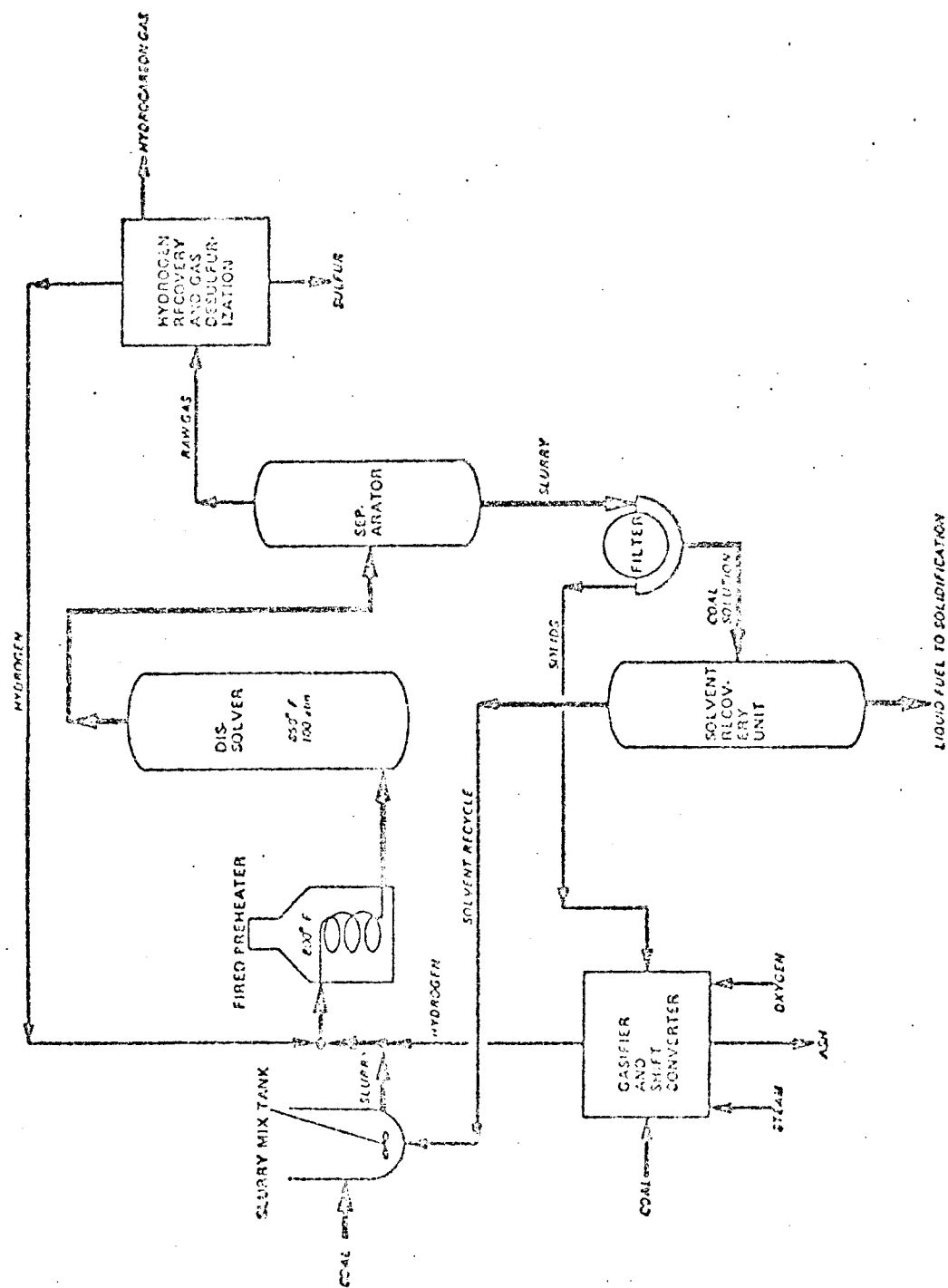


Figure 9. Flow Scheme of SRC-I Process.

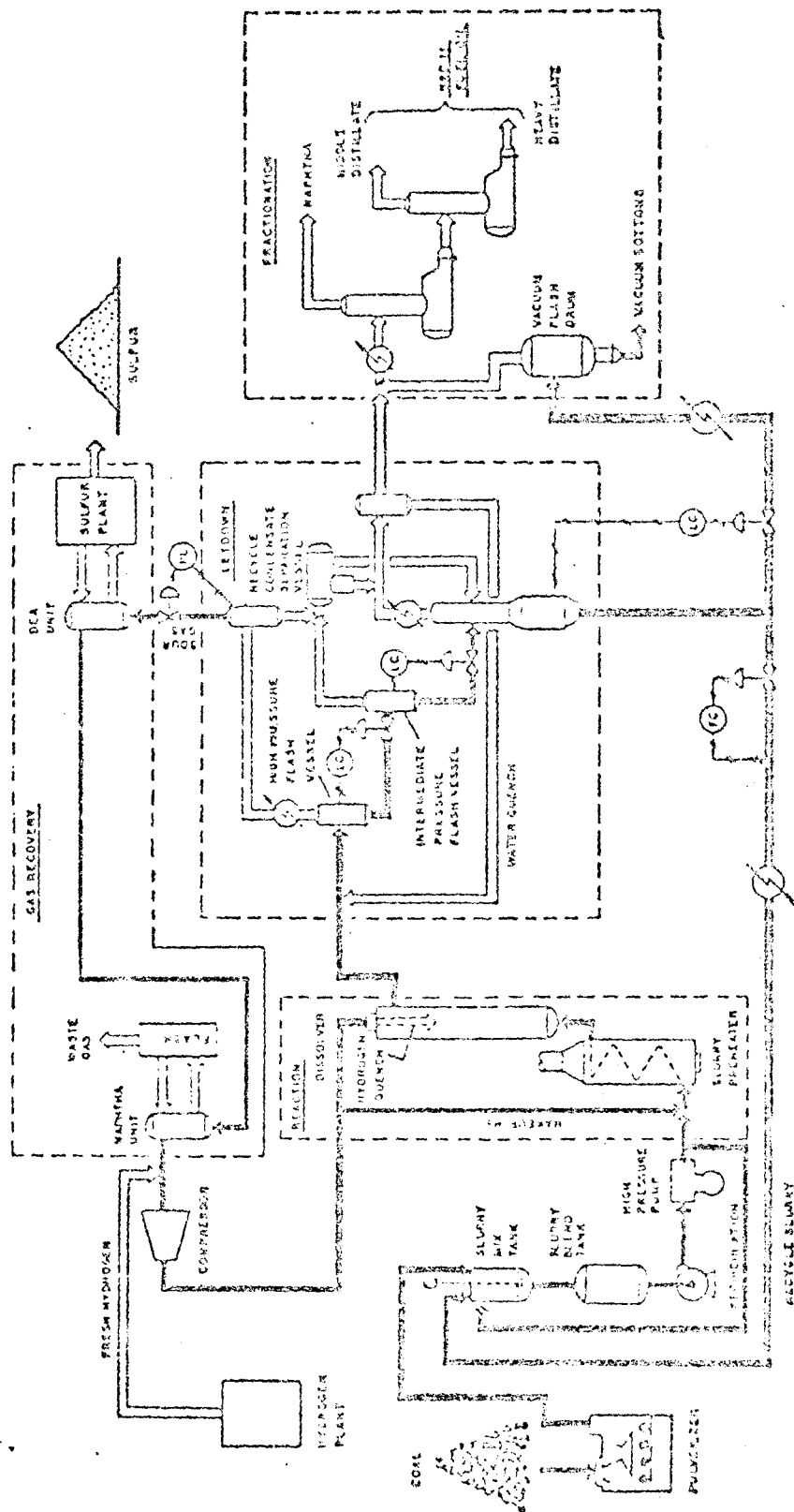
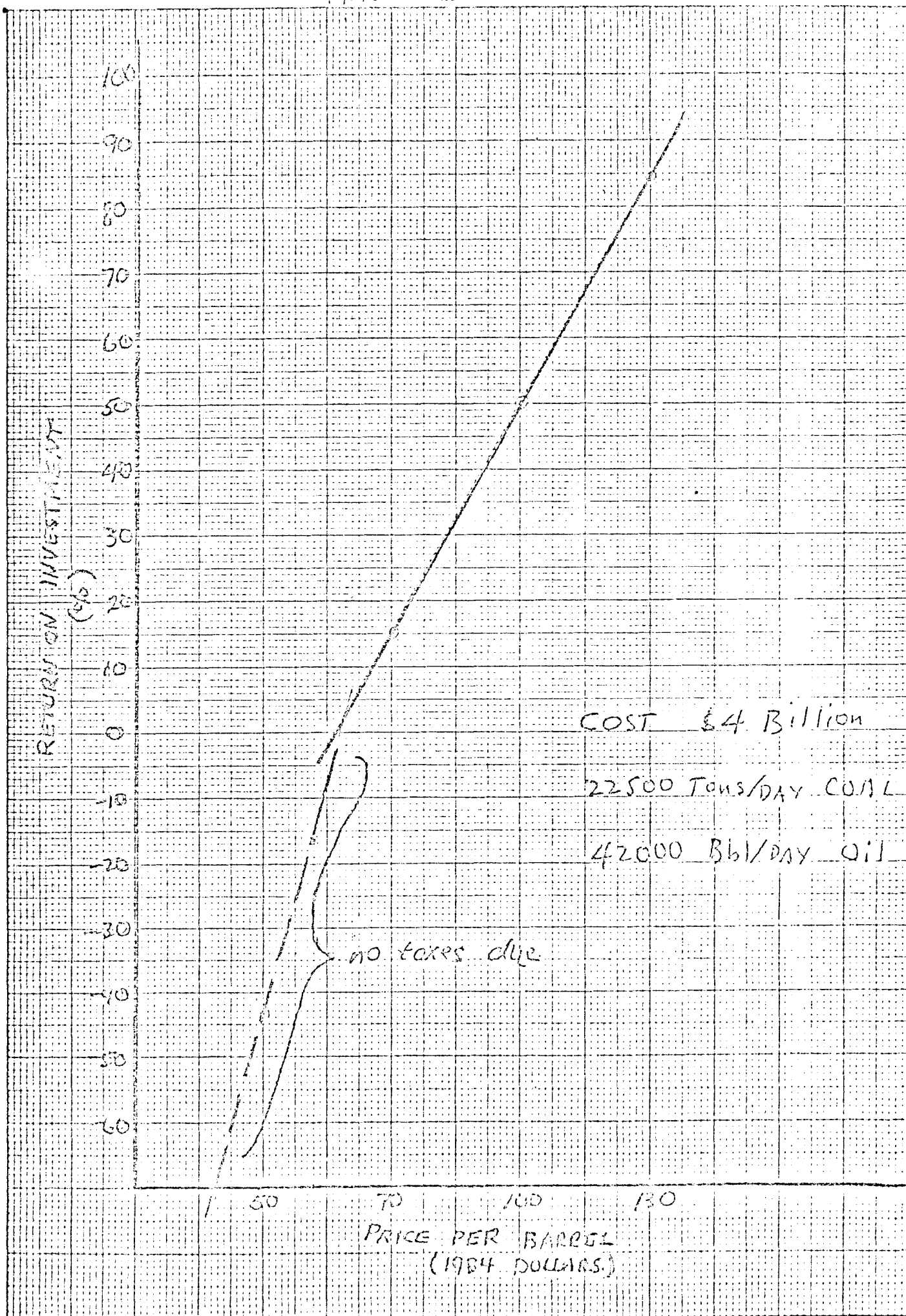


Figure 10. Flow Scheme of SRC-II Process.

FIGURE 11



January 9, 1985

Mr. Chairman, Members of the Committee, for the record I am Bruce H. Carpenter, President of Eastern Montana College, Billings.

I support Senate Bill 21 and the concept of providing funds for the continued investigation on coal research. More particularly, I would like to speak to the concept of a Center for future studies. These funds would support an additional opportunity for the Montana University System to provide a service to the citizens of Montana which is not now available. In the University System there are a number of faculty members who have expertise in this area. They would be here today, however, they are taking care of the present by teaching courses.

Human societies have always had prophets and visionaries whose job it has been to foretell and interpret the future. But it has only been recently that a new form of expertise on this ancient art has emerged. Today's futurist differs from the astrologer and soothsayer of the past as completely as a modern chemist differs from his ancient alchemist precursor. These differences are twofold. First, the futurist is not particularly interested in making predictions, preferring instead to deal in the realm of potentials. And second, the futurist makes use of logical methods as opposed to claiming mystical or super-natural insight.

The field of future's research is based on four assumptions. The future, which actually occurs will be determined partly by history, partly by physical reality, partly by chance, and partly by human choice. The relationships among these factors will vary according to the amount of time one is looking ahead and the nature of the choices to be made. At any given moment, therefore, there exists a range of alternative futures which might come about. History and a physical reality determine which futures are in that range. Chance and human choice will determine which one of those possible futures will happen. True freedom of choice only exists when one understands the full range of options available and the possible consequences of each option. The purpose of future research, therefore, is not to predict the future, but rather to improve our understanding of the range of alternative futures which might come about, and of the role that both chance and deliberate choice might play in either achieving or avoiding any particular future. So the futurist seeks to identify potential options and logically forecast probable alternatives as opposed to predicting or describing the future. These forecasts are of two types, exploratory and normative. Exploratory forecasting largely involves extending past or current practices into the future and responding to the demands which the patterns are suggesting to create. Normative forecasts consist of linking some desirable state in the future with present actions which could be pursued to facilitate the eventual emergence of the desirable future. A major approach used in future's research is the use of trend analysis in

which consistent past and present tendencies are identified, which can be logically and reasonably extrapolated into the future. The report by the National Commission on Excellence in Education - A Nation at Risk - chaired by Dr. David P. Gardner, is a good example of the approach applied to educational policy and practice.

The concept of a future Center in the University System would be focused on service. First, the Center would seek to bring a consulting service directly to the communities. We would, in other words, bridge the gap between problem and expertise. The problems will run the gamut from rather straight forward extrapolations of space required for recreation, housing, or office which a city might need in the year 2000, to others of a much more esoteric nature, such as in what ways will new scientific insights into our nature likely create turmoil in our social institutions. I believe that we, in the University System, have the expertise to provide this valuable service to the citizens of Montana and through the funding proposed in Senate Bill 21 such a possibility could become a reality.

I urge your favorable consideration of the bill.

Thank you.

NORTHERN PLAINS RESOURCE COUNCIL

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NPRC Testimony on S.B. 21

*Jeanne-Marie
Soucy*

January 9, 1984

NPRC's opposition to this proposal is based on two major concerns. One is economic. This bill proposes to take money currently going in to the general fund to pay for research directly benefiting the coal industry.

It commits \$~~2~~-3 million annually during the next biennium, and twice as much in the following two years, for coal industry research. Considering the state's budget position this biennium, and not knowing the state's financial position two years or more down the road, it seems to us irresponsible to divert general fund money benefiting the entire state to research benefiting a single nonrenewable resource industry. We don't think this proposal represents the best use of this money.

Secondly, we oppose the proposal on philosophical grounds. Our Council recognizes that Montana has good coal laws, but these laws do not address all of the negative impacts from coal development. We do not support using coal tax money - money generated because of a recognition of these impacts - to engage in research to promote more coal development and consequently, more development impacts. We have in the past and will continue to support research on impacts from coal mining, such as reclamation research, and research into the effects of coal development on groundwater and surface water. As Sen. Towe has noted, sustained reclamation sufficient to warrant bond release has not yet been established.

Sometimes, research is critical. We feel this proposal, particularly at a time when we are facing severe budget constraints and further decreases for all accounts currently funded from coal tax revenues because of the bill passed last session regarding highway reconstruction funding, does not represent an appropriate and best use of money currently going to the general fund.

EXHIBIT 11 -- SB 21

9 January 1985