ALASKA LEGISLATURE COMMITTEE FILES 1991-1992 8672
7047 HOUSE LABOR & COMMERCE

FISCAL NOTE

STATE OF ALASKA
1991 LEGISLATIVE SESSION

BILL NO. CS HB 131

Revision Date:
Title: "An Act relating to energy efficienty and security...."
Sponsor: Rep. Brown
Requestor:

Department Affected: Community & Regional Affairs
BRU: Energy Programs
Component: Energy Conservation
COMPONENT SERIAL NO. 677

Expenditures/Revenues: (Thousands of Dollars)

OPERATING	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
PERSONAL SERVICES	11.2	-0-	-0-	-0-	-0-	-0-
TRAVEL	6.0	-0-	-0-	-0-	-0-	-0-
CONTRACTUAL	61.8	-0-	-0-	-0-	-0-	-0-
SUPPLIES	1.0	-0-	-0-	-0-	-0-	-0-
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	80.0	-0-	-0-	-0-	-0-	-0-

CAPITAL						

REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND	80.0	-0-	-0-	-0-	-0-	-0-
FEDERAL FUNDS						
OTHER						
TOTAL	80.0	-0-	-0-	-0-	-0-	-0-

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

Estimate of current year Impact: None

ANALYSIS: (Attach a separate page if necessary.)
These monies will fund 20 percent of an Energy Specialist and provide the necessary travel, contractual, and supply funds to prepare the report on the implications of a major energy supply disruption to the State.

Prepared By: Remond Henderson, Director Remond Henderson
Phone: 465-4708
Division: Administrative Services
Date: 3/21/91
Approved by Commissioner: Remond Henderson for EDGAR BLATCHFORD
Agency: Community & Regional Affairs
Date: 3/21/91

Distribution (by preparer): Legislative Finance, Legislative Sponsor, Requestor, OMB, & Impacted Agency(ies).

Rev 10/90

STATE OF ALASKA

OFFICE OF THE GOVERNOR

BILL ANALYSIS

DEPARTMENT: DCRA

DIVISION: RDD

BILL NUMBER: CSHB 121

SPONSOR: Representative Kay Brown

SHORT TITLE OF BILL: "Energy Efficiency and Security Act"

DEPARTMENT POSITION: Neutral

PREPARED BY: Steve Baden

DATE: 3/26/91

COMMISSIONER'S SIGNATURE: /Dep. Comm

DATE: 3/26/91

SUMMARY

OTHER AGENCIES AFFECTED BY BILL

Alaska Public Utilities Commission
Alaska Energy Authority

CONSTITUENT GROUP(S) AFFECTED BY BILL

Utility consumers, utilities, energy efficiency advocates, building and electrical supply companies, small businesses.

ORGANIZATIONAL SUPPORT FOR BILL

Consumer and energy advocacy groups.

ORGANIZATIONAL OPPOSITION TO BILL

None have emerged at this time.

FISCAL IMPACT: ☐ NONE ☐ FISCAL NOTE ATTACHED

BACKGROUND/LEGISLATIVE INTENT

This legislation would require the state's largest utilities served by state-owned or financed power facilities to prepare integrated resource plans. Large portions of Alaska are vulnerable to supply or price disruptions beyond the state's control. A vivid example of this is the fact that events in the Middle East have resulted in the price of heating oil in many Alaskan communities increasing by 40 percent since August. (See additional comments attached.)

ANALYSIS OF BILL/PROGRAM EFFECTS

Requires utilities served by state-owned or financed power facilities with an annual sale of over 300 million kilowatt hours to prepare integrated resource plans. The plans would evaluate supply and demand side power options and identify lowest cost options. The Alaska Public Utilities Commission would review and approve the integrated resource plan. Beginning on January 15, 1993, the State of Alaska would not participate in the finance or construction of a power project with a utility covered under the bill unless the project is consistent with the utility's integrated resource plan.

The Department of Community and Regional Affairs would be directed to prepare a report to the Legislature by January 15, 1992, that examines the implications of a major disruption of energy to Alaskans. This would include the effects of drastic price increases. (Please see additional comments attached.)

AMENDMENTS PROPOSED

PLEASE ATTACH A SEPARATE SHEET FOR ADDITIONAL COMMENTS OR ANALYSIS.

01-009 (Rev. 12/83)

[redacted] [redacted]

ADDITIONAL COMMENTS ON CS FOR HOUSE BILL 121

Over the past ten years, the State of Alaska has invested hundreds of millions of dollars on power development and distribution projects. Not all of these projects proved to be economical. A planning process must be adopted to ensure that, in the future, all alternatives are equally considered and that consumer energy needs are met at the least cost.

Across the nations, states and utilities are taking advantage of a new way of looking at utility planning. This process is called integrated resource planning, or least cost planning. While there are many variants of the process, the common goal is that the utility allow supply and demand reductions to compete economically on a level playing field and that the utility invest in the option that best ensures system reliability and least cost to consumers. The utility-funded Electrical Power Research Institute reported in 1988 that at least 43 states had functioning integrated resource plans or were adopting one. While this planning process may cost a little more, it has saved utilities and consumers hundreds of millions of dollars. In most of the states, the state government spearheaded the adoption of the planning process.

In 1988, the Department of Community and Regional Affairs conducted a successful conference that explored the potential of integrated resource planning in Alaska. The conference was co-sponsored by the Alaska Public Utilities Commission, the Alaska Rural Electric Cooperative Association, and energy and consumer interest groups. It brought together experts from across the nation to meet with representatives of the state's utilities, consumers, state officials, and legislators. The conference demonstrated there was considerable interest across the state in this new approach to utility planning.

Utilities across the nation have discovered that in many instances saving a kilowatt is a much better investment than producing a kilowatt. This could also be the case in Alaska. This potential is illustrated to the Railbelt energy alternatives study conducted by Alaska Energy Authority. The study found there were a number of energy efficient strategies that had highly favorable benefit-cost ratios under all fuel price and energy load forecasts.

In order to foster a sustainable economic future for Alaska, the state needs to have reliable and least cost energy. With the concern over declining state revenues, it is essential that all energy alternatives be reviewed through a consistent analysis and that the state only invest in the most cost effective options. An integrated resource planning process will present such a framework. The state's leadership on this issue is essential to ensure a sustainable energy future for Alaskans.

FISCAL NOTE

STATE OF ALASKA
1991 LEGISLATIVE SESSION

BILL NO. HB 121

Revision Date:

Department Affected: Community & Regional Affairs

Title: "An Act relating to energy efficiency and security..."

BRU: Energy Programs

Component: Energy Conservation

Sponsor: Brown

Requestor:

COMPONENT SERIAL NO. 6 7 7

Expenditures/Revenues: (Thousands of Dollars)

OPERATING	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
PERSONAL SERVICES	11.2	-0-	-0-	-0-	-0-	-0-
TRAVEL	6.0	-0-	-0-	-0-	-0-	-0-
CONTRACTUAL	61.8	-0-	-0-	-0-	-0-	-0-
SUPPLIES	1.0	-0-	-0-	-0-	-0-	-0-
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	80.0	-0-	-0-	-0-	-0-	-0-

CAPITAL						

REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND	80.0	-0-	-0-	-0-	-0-	-0-
FEDERAL FUNDS						
OTHER						
TOTAL	80.0	-0-	-0-	-0-	-0-	-0-

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

Estimate of current year impact: None

ANALYSIS: (Attach a separate page if necessary.)

These monies will fund 20 percent of an Energy Specialist and provide the necessary travel, contractual, and supply funds to prepare the report on the implications of a major energy supply disruption to the state.

Remond Henderson

Prepared By: Remond Henderson, Director

Phone: 465-4708

Division: Administrative Services

Date: 3/11/91

Approved by Commissioner: Edgar Blatchford

Agency: Community and Regional Affairs

Date: 3/11/91

Distribution (by preparer): Legislative Finance, Legislative Sponsor, Requestor, OMB, & Impacted Agency(ies).

Rev 10/90

CORRECTION

THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY

ADDITIONAL COMMENTS ON CS FOR HOUSE BILL 121

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In order to foster a sustainable economic future for Alaska, the state needs to have reliable and least cost energy. With the concern over declining state revenues, it is essential that all energy alternatives be reviewed through a consistent analysis and that the state only invest in the most cost effective options. An integrated resource planning process will present such a framework. The state's leadership on this issue is essential to ensure a sustainable energy future for Alaskans.

CS for House Bill 121 would affect only those large utilities (Chugach Electric Association, Golden Valley Electric Association, Homer Electric Association, Matanuska Electric Association and Municipal Light and Power) that are served by state-owned or financed power projects. It will guide future state investments in power projects for these utilities and ensure the state and the consumer get the wisest return on these investments.

While Alaska is the leading oil producer in the nation, most areas of the state are dependent upon energy sources that are imported from outside of the state. Most areas of Alaska are vulnerable to events outside the state that can affect the availability and affordability of energy needed to stay warm. Events in the Middle East have illustrated how vulnerable the nations's energy foundation is. Alaskans are at risk with this vulnerability. The federal government has shifted the responsibility of preparing for an energy disruption to the states. A study of the implications of a major energy supply disruption will provide state, local, and private sector decision makers a framework in developing plans to prepare for such a contingency. Such a study would complement the state's disaster resource network. This report could be strengthened by including options to mitigate a major energy disruption.

FISCAL NOTE

STATE OF ALASKA
1991 LEGISLATIVE SESSION

BILL NO. HB 121

Revision Date:
Title: "An Act relating to energy efficiency and security..."
Sponsor: Brown
Requestor:

Department Affected: Community & Regional Affairs
BRU: Energy Programs
Component: Energy Conservation
COMPONENT SERIAL NO. | | 6 | 7 | 7 |

Expenditures/Revenues: (Thousands of Dollars)

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SUPPLIES	1.0	-0-	-0-	-0-	-0-	-0-
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	80.0	-0-	-0-	-0-	-0-	-0-

CAPITAL						

REVENUE						

FUNDING: (Thousands of Dollars)

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FEDERAL FUNDS						
OTHER						
TOTAL	80.0	-0-	-0-	-0-	-0-	-0-

POSITIONS

FULL-TIME						
PART-TIME						
TEMPORARY						

Estimate of current year Impact: None

ANALYSIS: (Attach a separate page if necessary.)

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Remond Henderson

Prepared By: Remond Henderson, Director
Phone: 465-4708
Division: Administrative Services
Date: 3/11/91

Approved by Commissioner: Edgar Blatchford
Agency: Community and Regional Affairs
Date: 3/11/91

Distribution (by preparer): Legislative Finance, Legislative Sponsor, Requestor, OMB, & Impacted Agency(ies).

Rev 10/90

Page 1 of 1

STATE OF ALASKA

OFFICE OF THE GOVERNOR

BILL ANALYSIS

DEPARTMENT	DIVISION	BILL NUMBER	SPONSOR
DCRA	RDD	HB 121	Representative Kay Brown

SHORT TITLE OF BILL
"Energy Efficiency and Security Act"

DEPARTMENT POSITION

PREPARED BY	DATE	COMMISSIONER'S SIGNATURE	DATE
Steve Baden			3/11/91

SUMMARY

OTHER AGENCIES AFFECTED BY BILL	CONSTITUENT GROUP(S) AFFECTED BY BILL
Alaska Public Utilities Commission Alaska Energy Authority	Utility consumers, utilities, energy efficiency advocates, building and electrical supply companies, and small businesses

ORGANIZATIONAL SUPPORT FOR BILL	ORGANIZATIONAL OPPOSITION TO BILL
Consumer and energy advocacy groups	None have emerged at this time

FISCAL IMPACT: ☐ NONE ☒ FISCAL NOTE ATTACHED

BACKGROUND/LEGISLATIVE INTENT

This legislation would require the state's largest utilities served by state-owned or financed power facilities to prepare integrated resource plans. Large portions of Alaska are vulnerable to supply or price disruptions beyond the state's control. A vivid example of this is the fact that events in the Middle East, have resulted in the price of heating oil in many Alaskan communities increasing by 40% since August. (Please see additional comments attached.)

ANALYSIS OF BILL/PROGRAM EFFECTS

Requires utilities served by state-owned or financed power facilities with an annual sale of over 300 million kilowatt hours to prepare integrated resource plans. The plans would evaluate supply and demand side power options and identify lowest cost options. The Alaska Public Utilities Commission would review and approve the integrated resource plan. Beginning on January 15, 1993, the State of Alaska would not participate in the finance or construction of a power project with a utility covered under the bill unless the project is consistent with the utility's integrated resource plan.

The Department of Community and Regional Affairs would be directed to prepare a report to the Legislature by January 15, 1992, that examines the implications of a major disruption of energy to Alaskans. This would include the effects of drastic price increases. (Please see additional comments attached.)

AMENDMENTS PROPOSED

Amend Section 5 to include options for mitigating the effects of a major disruption of energy supply as part of the report to the Legislature. (Please see additional comments attached.)

PLEASE ATTACH A SEPARATE SHEET FOR ADDITIONAL COMMENTS OR ANALYSIS.

ADDITIONAL COMMENTS ON HOUSE BILL 121

Over the past ten years, the State of Alaska has invested hundreds of millions of dollars on power development and distribution projects. Not all of these projects proved to be economical. A planning process must be adopted to insure that, in future, all alternatives are equally considered and that consumer energy needs are met at the least cost.

Across the nation, states and utilities are taking advantage of a new way of looking at utility planning. This process is called integrated resource planning, or least cost planning. While there are many variants of the process, the common goal is that the utility allow supply and demand reductions to compete economically on a level playing field and that the utility invest in the option that best ensures system reliability and least cost to consumers. The utility-funded Electrical Power Research Institute reported in 1988 that at least 43 states had functioning integrated resource plans or were adopting one. While this planning process may cost a little more, it has saved utilities and consumers hundreds of millions of dollars. In most of the states, the state government spearheaded the adoption of the planning process.

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House Bill 121 would affect only those large utilities (Chugach Electric Association, Golden Valley Electric Association, Homer Electric Association, Matanuska Electric Association and Municipal Light and Power) that are served by state-owned or financed power projects. It will guide future state investments in power projects for these utilities and ensure the state and the consumer get the wisest return on these investments.

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Alaska State Legislature

HOUSE OF REPRESENTATIVES

Official Business

P.O. Box V
State Capitol
Juneau, Alaska 99811

TO: Representative David Finkelstein, Chair
House Labor and Commerce Committee

FROM: Representative Kay Brown

DATE: March 24, 1991

SUBJ: CS HB 121 (C&RA) — Energy Efficiency and Security Act

In anticipation of the House Labor and Commerce Committee hearing on CS HB 121 (C&RA), please find attached the following materials:

1. Sponsor Statement
2. Sectional Analysis
3. Copy of CS HB 121 (C&RA)
4. Department Position Statements/Fiscal Notes
    Alaska Public Utilities Commission
    Department of Community and Regional Affairs
5. *Railbelt Intertie Reconnaissance Study* (excerpt)
    Alaska Energy Authority (June 1989)
6. *Conservation Supply Curve: Railbelt Electrical Efficiency Programs*
    Institute of Social and Economic Research (April 1988)
7. *Impact of Electrical End Use Efficiency Programs for the Railbelt*
    Analysis North (February 25, 1991)
8. *Benefit-Cost Comparison of Eight Railbelt Energy Projects*
    Legislative Research Agency (Research Request 91.025)
9. *Status of Least Cost Planning in the United States* (excerpt)
    Electric Power Research Institute, Project 2982-2 (December 1988)
10. Additional Material:
    — "Seeing the Light on Energy" (article)
    Los Angeles Times October 14, 1990
    — "Utilities Rush to Profit From Selling Less" (article)
    Wall Street Journal, November 5, 1990
    — Payback on the Conservation Investment (table)
    Backgrounder "How Conservation Measures Up"
    Bonneville Power Administration (March 1990)

If you have any questions concerning this legislation, please let me know or contact Eric Myers of my staff at 465-4998.

3/20/91 Rep. Kay Brown

SPONSOR STATEMENT

CSHB 121 (C&RA) — Integrated Resource Planning & Energy Efficiency

CS House Bill 121 (C&RA)

The recent war in the Middle East has once again focused worldwide attention on the vulnerabiliy of our non-renewable energy supplies and the need to aggressively pursue energy policies that emphasize energy efficiency and conservation in concert with the development of additional energy supplies.

CS House Bill 121 (C&RA) has two basic elements. This legislation would,

1) establish an Integrated Resource Planning (IRP) requirement for the state's largest Railbelt utilities (ie, yearly sales in excess of 300 million kilowatt hours); and

2) direct the Department of Community and Regional Affairs (DCRA) to prepare a report for the legislature concerning the implications of a major energy supply disruption.

Integrated Resource Planning

Integrated resource planning, also popularly referred to as "least-cost planning," is a planning process that ensures that utilities develop the most cost-effective energy system by integrating the analysis of "demand-side" energy service options with "supply-side" options.

Integrated Resource Planning enables utilities to evaluate "demand side" conservation options (so-called "end-use" technologies that conserve electricity) on an equal basis with the development of new power generation facilities. A 1988 House Research Agency (HRA) report, indicates that integrated resource planning is long overdue in Alaska. As noted by the House Research Agency, in urban areas of the state, $1.3 billion was appropriated between FY 77 and FY 88. Over 99 percent of these appropriations were spent on "supply-side" projects and less than one percent on demand-side investments. If a true integrated resource planning process had been in place during this period, the study concluded, "a comprehensive analysis would have revealed residential and commercial building standards, commercial ventilation and lighting technical improvements, energy efficient appliances, and load management as feasible or more cost effective alternatives to new generating capacity." (See *Energy Planning in Alaska: Past Efforts and A Future Direction* , February 1988).

The National Energy Strategy & Integrated Resource Planning

The value of the Integrated Resource Planning approach is widely recognized throughout the nation. A 1988 report by the Electric Power Research Institute found that at least "43 states have functioning LCP [least cost planning] strategies or are considering, developing or implementing a planning process that will ensure the most cost-effective mix of new generating facilities and demand-side management (DSM)." (*Status of Least Cost Planning in the United States*, EPRI Project 2982-2, December 1988).

The recently released National Energy Strategy also recognizes the critical role that Integrated Resource Planning will play in meeting a substantial portion of our nation's future electrical energy needs:

> The National Energy Strategy is based on the premise that investments in electricity conservation and efficiency should be allowed to compete fairly with electricity supply options. An efficient electricity market is a National Energy Strategy goal. ... Federal support and State implementation of IRP activities are expected to reduce electricity demand by about 45,000 megawatts (MW) of generating capacity in 2010 and 90,000 MW in 2030. This represents a 7-percent reduction in necessary generating capacity compared with the current policy reference case. The net economic benefit is estimated to be about $35 billion for the 1990-2030 period.

Energy efficiency and demand-side investments are a big part of the solution to additional power needs for some of the nation's largest utilities. In San Francisco, for example, Pacific Gas and Electric (PG&E) recently unveiled a 10-year program to promote energy efficiency as an alternative to the development of more expensive supply-side power resources. PG&E expects to spend $1.5 - 2 *billion* on about 30 programs that will promote hundreds of energy efficiency technologies that will deliver energy savings to consumers. PG&E expects to meet 75% of its anticipated increases in power demand through energy efficiency instead of looking to costly new power plants to provide additional power to its customers.

Integrated Resource Planning in Alaska

As part of the Railbelt Intertie Reconnaissance Study, the Alaska Energy Authority (AEA) identified a substantial number of cost-effective energy efficiency and conservation investments. In fact, the AEA reconnaisance study documented that conservation (demand-side) investments have a significantly *higher* cost-benefit ratio than virtually any of the new power project (supply-side) or intertie development options evaluated. (See *Railbelt Intertie Reconnaissance Study* , Alaska Energy Authority, June 1989.)

As noted in materials provided by Analysis North (the state's utility consumer advocate) demand-side energy efficiency and conservation investments could significantly offset the need for additional Railbelt power capacity investments. **Conservation program investments could reduce the need for additional capacity investments in the year 2010 by 73 megawatts.** (By comparison, the proposed Healy Coal Project would provide 50 megawatts of generation capacity.) **Moreover, the AEA studies have concluded that energy efficiency investments are very *cost-effective* when compared to supply-side alternatives on a cost-benefit basis. The top three conservation program investments would produce a benefit of $1.65 for each $1 invested while a number of the supply side alternatives have benefits lower than costs.**

Need for CS House Bill 121 (C&RA)

A recent report prepared by the Legislative Research Agency (Research Request 91.025) identified the need for a true Integrated Resource Planning process in Alaska:

> Alaska state government should initiate a planning process that incorporates several key elements. ... The emphasis needs to change from studying and approving specific capital power projects to determining the best (least-cost) combination of supply and demand side power programs that meet energy requirements. ... the state should expend no funds that assist energy projects that are not consistent with the energy plan developed jointly between the state, industry and other groups.

The state has invested hundreds of millions of dollars in the Railbelt's electrical energy generating and distribution facilities and there is a compelling public interest in the efficient and cost-effective utilization of these state-financed facilities. CSHB 121 (C&RA) would ensure a much needed planning process to provide on-going evaluation of cost-effective energy efficiency and conservation investments as a condition of using state subsidized power facilities and access to future state subsidies or financing.

The planning requirements proposed in CSHB 121 (C&RA) would only apply to the state's larger Railbelt electric utilities (ie, utilities served by state-owned or financed power facilities and having sales in excess of 300,000,000 kwh). These are utilities with the administrative and financial resources to undertake the required planning efforts. CSHB 121 (C&RA) would ensure that future development of Railbelt utility systems proceeds in a balanced fashion with appropriate consideration given to both supply-side and demand-side alternatives.

2/20/91
Rep. Kay Brown

Sectional Analysis

CSHB 121 (C&RA) — Energy Efficiency and Security Act

Section 1

Findings.

Section 2

Short Title: "Energy Efficiency and Security Act"

Section 3

Requires utilities served by state-owned or financed power facilities with annual sales greater than 300 million kilowatt hours (kwh) to prepare 20-year integrated resource plans. The plans would evaluate "demand-side" and "supply-side" energy alternatives available to the utility to meet forecasted power requirements. The first plan would be prepared on or before January 15, 1993, and every 4 years thereafter.

Plans would approved by the Alaska Public Utilities Commission (APUC), in consultation with the Alaska Energy Authority (AEA). Major elements of the integrated resource plans would:

- identify a utility's current facilities and forecasted retirement schedule;
- document energy end-use in the service area;
- provide 20-year power demand forecasts (base, high, low);
- evaluate alternative development options with consideration given to availability, reliability, flexibility and cost effectiveness;
- identify the system option with the lowest cost ;
- evaluate demand-side and supply-side alternatives; and
- recommend a specific system development option.

The APUC is directed to develop a consistent reporting methodology in consultation with the Alaska Energy Authority, including coordinated filing of plans by closely integrated utilities. The APUC shall establish by regulation a public process for the review and approval of integrated resource plans. The APUC is directed to approve a plan upon a finding that the plan would:

- ensure system reliability;
- provide consumers with the lowest reasonable cost of power;
- adequately address the conservation of electrical energy;

- documents a reasonable expectation of future power requirements;
- uses appropriate methodology for the evaluation of options;
- adequately evaluates resource alternatives currently available or reliably anticipated to exist in the forecast period; and
- describes the utility's data collection activities and on-going data collection efforts.

The Commission is directed to adopt regulations and policies that set rates and revenue requirements at a level sufficient to recover costs incurred by a utility in preparing and implementing an approved plan.

Effective January 15, 1993, state agencies or corporations of the state may not participate in the financing, acquisition or construction of an electrical generation or transmission system project or improvement intended to provide electricity to a utility subject to the integrated resource planning requirements unless the project or improvement is consistent with a utility's approved integrated resource plan.

Section 4

Establishes authority for the Alaska Energy Authority to make grants to utilities for the purpose of preparing integrated resource plans.

Section 5

The Department of Community and Regional Affairs, in consultation with the Alaska Energy Authority and Department of Military and Veterans Affairs, shall prepare a report investigating the implications of a major energy supply disruption to the State of Alaska. The report shall be submitted to the Alaska Legislature by January 15, 1992.

STATE OF ALASKA

ALASKA PUBLIC UTILITIES COMMISSION
DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

WALTER J. HICKEL, GOVERNO

1016 WEST 6TH AVENUE
SUITE 400
ANCHORAGE, ALASKA 99501
PHONE: (907) 276-6222

ALASKA PUBLIC UTILITIES COMMISSION COMMENTS ON CSHB 121

March 21, 1991

The Commission strongly supports CSHB 121 which requires the large Railbelt electric utilities to prepare and implement integrated resource plans (least cost plans) which have been coordinated and approved by the Commission.

The purpose of integrated resource plans is to evaluate all of the electricity-producing and electricity-saving options available to a utility in order to select the most cost-effective means of providing adequate and reliable power to consumers. This planning process has become the established business practice for electric utilities across the country. Approximately 17 states have implemented programs similar to this legislation, and, indeed, four of the five Railbelt utilities covered by CSHB 121 have adopted resolutions endorsing least cost planning. In particular, this information is fundamental to electric utilities' investment and rate decisions which is why GVEA developed an integrated resource plan in conjunction with its evaluation of the Healy coal project. Given the state's historical involvement in financing energy projects and its decreasing resources, the plans will be a critical tool in deciding policy and appropriations issues affecting these utilities.

In addition to mandating that the Railbelt electric utilities perform this planning exercise, CSHB 121 provides for the Commission to review and approve the plans. By using common assumptions and examining the individual utility plans from a Railbelt-wide perspective, the Commission is in a position to assist the utilities to work together to find win-win alternatives which will result in lower bills for all Railbelt consumers. Otherwise, individual utility actions may benefit one utility's consumers at the expense of others. Such consistent, coordinated approval is essential if the full benefits of integrated resource planning are to be realized.

In summary, the Commission believes that it is good, perhaps essential, public policy to require the large Railbelt electric utilities to prepare and implement approved integrated resource plans. Therefore, the Commission endorses CSHB 121 and urges its adoption by the Legislature.

March 26, 1991

POSITION PAPER

RE: CSHB 121

SPONSOR:

Program Effects of Bill

This bill would require the Department of Community and Regional Affairs to prepare a report to the Legislature by January 15, 1992, that examines the implications of a major disruption of energy to Alaskans. This would include the effects of drastic price increases.

Comments

This bill requires utilities served by state-owned or financed power facilities with an annual sale of over 300 million kilowatt hours to prepare integrated resource plans. The plans would evaluate supply and demand side power options and identify lowest cost options. The Alaska Public Utilities Commission would review and approve the integrated resource plan. Beginning on January 15, 1993, the State of Alaska would not participate in the finance or construction of a power project with a utility covered under the bill unless the project is consistent with the utility's integrated resource plan.

Over the past ten years, the State of Alaska has invested hundreds of millions of dollars on power development and distribution projects. Not all of these projects proved to be economical. A planning process must be adopted to ensure that, in the future, all alternatives are equally considered and that consumer energy needs are met at the least cost.

Across the nations, states and utilities are taking advantage of a new way of looking at utility planning. This process is called integrated resource planning, or least cost planning. While there are many variants of the process, the common goal is that the utility allow supply and demand reductions to compete economically on a level playing field and that the utility invest in the option that best ensures system reliability and least cost to consumers. The utility-funded

Electrical Power Research Institute reported in 1988 that at least 43 states had functioning integrated resource plans or were adopting one. While this planning process may cost a little more, it has saved utilities and consumers hundreds of millions of dollars. In most of the states, the state government spearheaded the adoption of the planning process.

In 1988, the Department of Community and Regional Affairs conducted a successful conference that explored the potential of integrated resource planning in Alaska. The conference was co-sponsored by the Alaska Public Utilities Commission, the Alaska Rural Electric Cooperative Association, and energy and consumer interest groups. It brought together experts from across the nation to meet with representatives of the state's utilities, consumers, state officials, and legislators. The conference demonstrated there was considerable interest across the state in this new approach to utility planning.

Utilities across the nation have discovered that in many instances saving a kilowatt is a much better investment than producing a kilowatt. This could also be the case in Alaska. This potential is illustrated to the Railbelt energy alternatives study conducted by Alaska Energy Authority. The study found there were a number of energy efficient strategies that had highly favorable benefit-cost ratios under all fuel price and energy load forecasts.

In order to foster a sustainable economic future for Alaska, the state needs to have reliable and least cost energy. With the concern over declining state revenues, it is essential that all energy alternatives be reviewed through a consistent analysis and that the state only invest in the most cost effective options. An integrated resource planning process will present such a framework. The state's leadership on this issue is essential to ensure a sustainable energy future for Alaskans.

CS for House Bill 121 would affect only those large utilities (Chugach Electric Association, Golden Valley Electric Association, Homer Electric Association, Matanuska Electric Association and Municipal Light and Power) that are served by state-owned or financed power projects. It will guide future state investments in power projects for these utilities and ensure the state and the consumer get the wisest return on these investments.

While Alaska is the leading oil producer in the nation, most areas of the state are dependent upon energy sources that are imported from outside of the state. Most areas of Alaska are vulnerable to events outside the state that can affect the availability and affordability of energy needed to stay warm. Events in the Middle East have illustrated how vulnerable the nations's energy foundation is. Alaskans are at risk with this vulnerability. The federal government has shifted the responsibility of preparing for an energy disruption to the states. A study of the implications of a major energy supply disruption will provide state, local, and private sector decision makers a framework in developing plans to prepare for such a contingency. Such a study would complement the state's disaster resource network. This report could be strengthened by including options to mitigate a major energy disruption.

Remond Henderson for
Edgar Blatchford, Commissioner

RAILBELT INTERTIE
RECONNAISSANCE STUDY

Benefit/Cost Analysis

Prepared for

Alaska Power Authority
P.O. Box 190869
Anchorage, Alaska 99519-0869

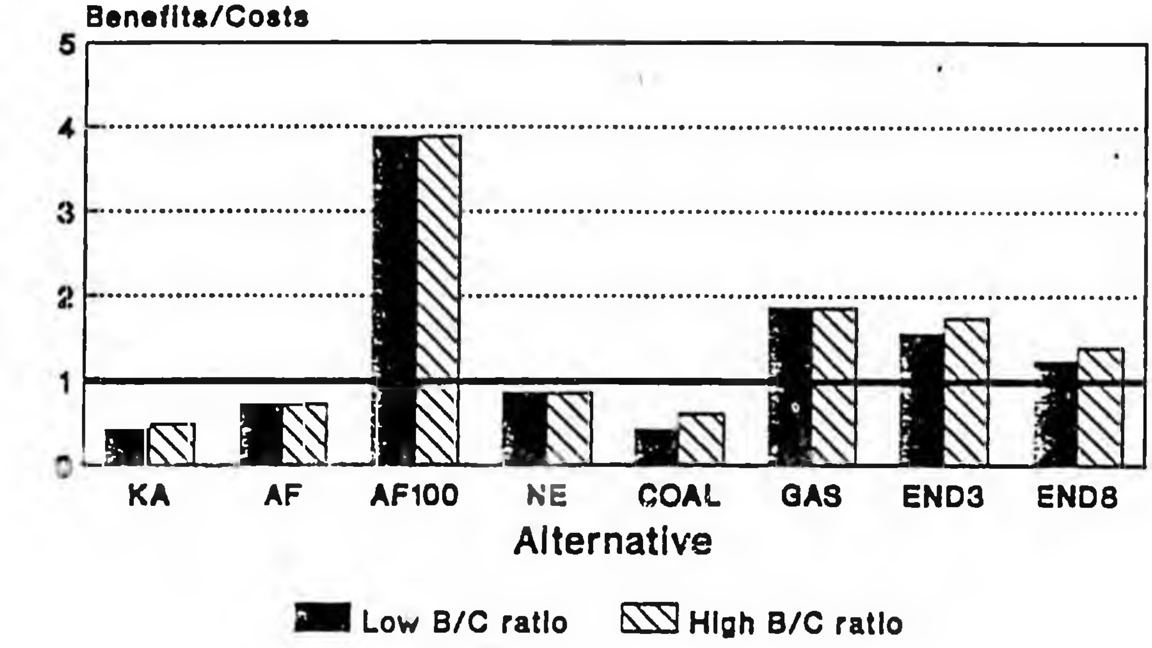
Project Manager: Richard Emerman

Prepared by

Salim J. Jabbour, Principal Investigator
Richard B. Fancher
Michael S. Gordon
Jennie S. Rice
Peter G. Borocz
N. Bruce Ashby

Decision Focus Incorporated
4984 El Camino Real
Los Altos, California 94022

June 1989



Based on expected net benefits for nine base case scenarios.

Figure 1-2. Railbelt Alternatives: Benefit/Cost Ratios

1.4.1 New Kenai-Anchorage Intertie

This alternative consists of a new 230-KV transmission line between Anchorage and the Kenai Peninsula with a transfer capacity of 250 MW. The capital cost of the proposed Kenai-Anchorage intertie is $81.7 million for the "Enstar" route and $99.4 million for the "Tesoro" route[2]. This analysis of benefits and costs is based on the lower of these two capital cost estimates. Operations and maintenance cost is estimated at $1.2 million per year. The present value of total costs is estimated at $103.1 million.

The expected value of benefits is estimated between $43.1 million and $49.1 million. This consists of benefits in the following six categories:

1. *Stability*: The new intertie would allow the avoidance of $2.8 million in costs to provide stability with Bradley Lake at peak output.

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[2] Unless otherwise noted, these and all other costs and benefits are presented in terms of 1987 dollars.

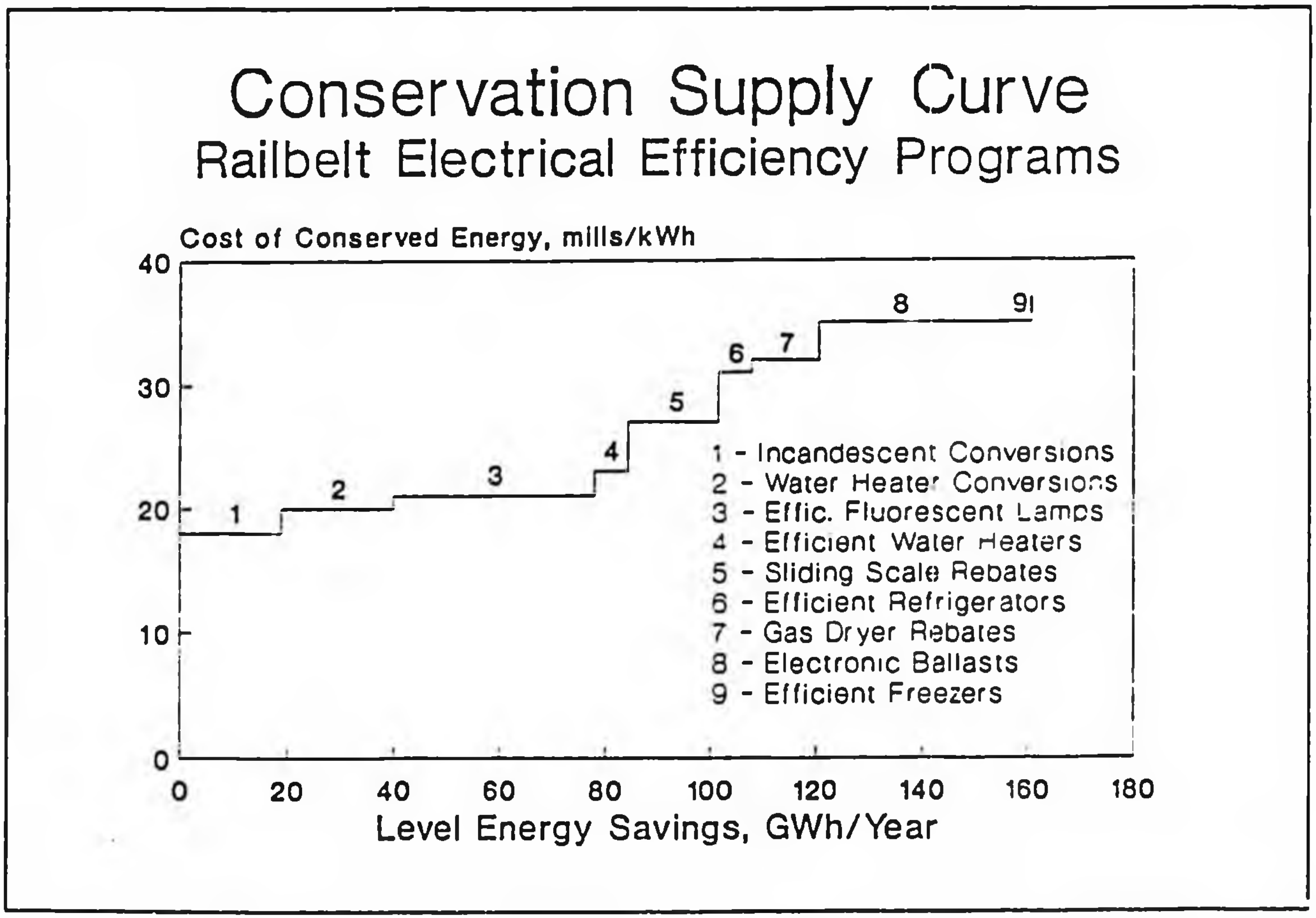

Figure ES-2 - Conservation Supply Curve. The savings are level values for the 1991 through 2010 period. The savings are net savings over and above market-driven efficiency investment.

Source: *Analysis of Electrical End Use Efficiency Programs for the Alaskan Railbelt*
Institute of Social and Economic Research (April 1988)

Analysis North

Alaska's Utility Consumer Advocate

911 West 8th Avenue, Suite 204 Anchorage, Alaska 99501 907-272-3425

FEB 28 1991

February 25, 1991

Representative Kay Brown
Alaska State Legislature
P.O. Box V
Juneau, AK 99811

Dear Representative Brown:

In response to your request for a summary of the potential impacts of implementing aggressive electrical conservation programs in the Railbelt, I have prepared the attached table. The figures in the table are derived from the "Analysis of Electrical End Use Efficiency Programs for the Alaskan Railbelt". I wrote that report while employed by the Institute of Social and Economic Research (ISER), University of Alaska, Anchorage. The report was part of the Alaska Energy Authority Railbelt Intertie Reconnaissance Study completed in 1989.

The report addresses the potential impact of offering financial rebates for the implementation of a number of different electrical conservation measures in Railbelt residential and commercial buildings. Such rebates would be targeted at cost-effective energy conservation measures that consumers might normally bypass because of poor information, lack of capital, or other market failures. An example includes the use of energy-efficient fluorescent lamps and ballasts[1] in commercial lighting fixtures. Conservation rebates similar to these have been implemented by numerous electric utilities in the lower 48, including New England Electric System, Boston Edison, and Pacific Gas and Electric.

The first column of the table, *Peak Demand Reduction, MW* (megawatts), indicates the amount that the Railbelt peak electrical demand will be reduced by implementation of the programs. The next column, *Equivalent Generation Capacity, MW*, equals 1.3 times the Peak Demand Reduction. In order to reliably supply 1 MW of peak demand, about 1.3 megawatts of generation (power plant) capacity is required because generation capacity is not 100% reliable. This column therefore represents how much generation capacity is potentially avoided by the implementation of the conservation programs. The third column, *Energy Savings, MWh* (megawatt-hours), gives the annual energy savings from the conservation programs. Reducing electrical demand by 1 MW continuously for the entire year results in an energy savings of 8,766 megawatt-hours, because there are 8,766 hours in a year. However, the electrical demand

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[1] A fluorescent lamp ballast is the device that starts and provides proper operating conditions for fluorescent lamps.

reductions caused by conservation programs typically vary across the hours of the year. A conservation measure that reduces demand by 1 MW during the peak demand period of the year typically saves only 4,500 megawatt-hours over the course of the year.

The last column, *Program Budgetary Cost*, indicates the annual expenditures required to fund the conservation programs. This includes the cost of the rebates and the general cost of administering the conservation programs. The costs are expressed in nominal or actual dollars so include the effects of general price inflation. That is one reason why the dollar figures rise in later program years. The present value of program costs is about $66 million; i.e., an appropriation equal to $66 million would fund the programs over their 20 year life if that appropriation could be invested at an interest rate 4.5% more than inflation. The programs could be reduced in scope for funding levels less than $66 million.

The table shows that the conservation programs are expected to reduce the need for generation capacity in the year 2010 by 73 megawatts and reduce annual energy generation by 260,000 megawatt-hours. This energy savings amounts to approximately 7% of the expected Railbelt electrical load in the year 2010. Savings in all other years are less. For comparison purposes, the Bradley Lake hydroelectric project will be able to provide 120 MW of peak generation capacity and produce 370,000 megawatt-hours of electricity. The proposed Healy Clean Coal plant will provide 50 megawatts of generation capacity and also about 370,000 megawatt-hours of electricity.

My work at ISER involved estimating the costs of the conservation programs and the MW and MWh savings from the programs. Decision Focus Inc. determined how much generation costs would be reduced by those MW and MWh savings. They then compared the generation cost savings to the costs of the conservation programs. As well as the program budgetary costs described above, DFI's benefit/cost analysis included the costs paid by consumers (the rebates are *not* assumed to pay 100% of the conservation costs). Their analysis concluded that 8 of the 9 conservation programs analyzed were cost-effective, and those programs are expected to deliver $1.31 of benefits for each $1 of cost. The best 3 programs in that package of 8 programs produced $1.65 of benefit per $1 of cost. The next five programs had a benefit-to-cost ratio of 1.12.

Please call if you have any questions concerning this information.

Sincerely yours,

Alan Mitchell

Alan Mitchell

Impact of Electrical End Use Efficiency Programs for the Alaskan Railbelt

Year	Peak Demand Reduction. MW	Equivalent Generation Capacity. MW	Energy Savings MWh	Program Budgetary Cost Nominal $
1991	4.5	5.9	20.240	$4,464,000
1992	9.6	12.5	42,610	$4,791,000
1993	15.1	19.7	66,720	$5,712.000
1994	20.8	27.0	91,640	$5,957,000
1995	26.2	34.0	115.600	$6.046,000
1996	29.1	37.8	129,150	$6,679,000
1997	32.2	41.8	143,630	$7,408.000
1998	35.7	46.4	159,740	$8,841,000
1999	38.8	50.4	174,440	$9,055,000
2000	41.1	53.5	186,330	$9,196,000
2001	42.4	55.1	193,230	$7,735,000
2002	44.2	57.4	202,100	$9,737,000
2003	46.0	59.7	210,450	$9,958,000
2004	47.9	62.3	219,780	$11,395,000
2005	49.7	64.6	228,410	$11,114,000
2006	51.4	66.8	236,630	$10,965,000
2007	53.3	69.3	245,370	$11,917,000
2008	55.0	71.4	253,400	$12,038,000
2009	55.7	72.4	257,330	$12,769,000
2010	56.2	73.0	260,000	$14,943,000
2011	51.6	67.1	240,030	$0
2012	47.2	61.4	220,860	$0
2013	43.2	56.2	203.250	$0
2014	38.5	50.0	182,290	$0
2015	33.5	43.6	160,290	$0
2016	30.3	39.4	145,350	$0
2017	27.4	35.7	132,030	$0
2018	24.7	32.1	119,380	$0
2019	22.0	28.6	106,940	$0
2020	19.7	25.5	95,140	$0
2021	17.7	23.0	85.610	$0
2022	15.5	20.1	75,070	$0
2023	13.4	17.4	64.950	$0

Impact of Electrical End Use Efficiency Programs for the Alaskan Railbelt

Year	Peak Demand Reduction, MW	Equivalent Generation Capacity, MW	Energy Savings MWh	Program Budgetary Cost Nominal $
2024	11.0	14.3	53,970	$0
2025	8.6	11.2	42,460	$0
2026	6.4	8.3	32,110	$0
2027	4.6	6.0	22,960	$0
2028	2.6	3.4	13,320	$0
2029	1.5	1.9	7,900	$0
2030	0.8	1.0	4,400	$0
2031	0.6	0.8	3,200	$0
2032	0.4	0.5	2,200	$0
2033	0.2	0.3	1,100	$0
2034	0.2	0.3	900	$0
2035	0.1	[illegible]	700	$0
2036	0.1	0.1	500	$0
2037	0.1	0.1	400	$0
2038	0.0	0.0	300	$0
2039	0.0	0.0	100	$0
2040	0.0	0.0	0	$0

Alaska State Legislature

Legislative Research Agency

P.O. Box Y
Juneau, AK 99811-3100
Phone: (907) 465-3991
Fax: (907) 465-3351

November 20, 1990

MEMORANDUM

TO: Representative Mike Davis

FROM: Tom Chester T
Legislative Analyst

RE: **Benefit-Cost Comparison of Eight Railbelt Energy Projects**
Research Request 91.025

You requested a comparison of economic benefits and costs of the Healy Clean Coal Project and other proposed Railbelt projects such as the Energy Conservation project.

To answer your question the first section of this memorandum (page 5) summarizes results of the benefit-cost analysis[1] section of the *Railbelt Intertie Reconnaissance Study*,[2] conducted under the auspices of the Alaska Power Authority (APA).[3] We then begin an analysis of the Healy Clean Coal Project and discuss the effects of different energy load and fuel price scenarios on APA conclusions with regard to the Healy Clean Coal Project and the Energy Conservation Projects (page 15).

Section three (page 16) recalculates the Healy project's benefit-cost results to accommodate three modifications to APA assumptions. The fourth section (page 21 modifies the APA conclusions by limiting the analysis to costs and beneftis born by Golden Valley Electric Association [GVEA] of Fairbanks).

Finally, we make recommendations for future studies, based on the assumption that the state will continue to have rising energy demands but will most likely have decreasing ability to subsidize energy projects (page 22).

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[1] Benefit-Cost analysis is a method of evaluating the relative merits of alternative public investment projects in order to achieve efficient allocation of resources. In principle, it entails little more than adjusting conventional business profit-and-loss calculations for construction projects to reflect social instead of private objectives, criteria, and constraints.

[2] Decision Focus, Inc., *Railbelt Intertie Reconnaissance Study: Benefit/Cost Analysis*, prepared for the Alaska Power Authority, June 1989.

[3] On July 1, 1989 the Alaska Power Authority was reorganized as the Alaska Energy Authority under Executive Order 75.

The APA study describes the economic costs and benefits of eight alternative Railbelt energy projects--including the Healy Clean Coal Power and Energy Conservation projects.[4] In the APA study it was determined that only four projects resulted in expected benefits exceeding expected costs (providing favorable economic benefit-cost ratios and representing net increases in wealth). The four projects having favorable economic benefit-cost ratios were:

Limited upgrade of the Anchorage-Fairbanks intertie:

> The existing intertie is limited to 70,000 watt (70 MW) input at Anchorage. The proposed upgrade to the intertie consists of electrical equipment (static var unit, one transformer, and six capacitors) which would increase the Anchorage input to 100 MW. Potential power that could be transmitted from Anchorage to Fairbanks across the intertie would increase from 61.6 MW to 84.2 MW. The cost of this project is approximately $10 million (198^{7} dollars).

Construction of a natural gas pipeline linking Fairbanks with the Cook Inlet area:

> A natural gas line to be constructed linking the Cook Inlet area with the Fairbanks area. The estimated capital cost of the project is $183 million (1987 dollars) for the main pipeline and $32.5 million (1987 dollars) for a Fairbanks distribution system.

Electric end-use conservation programs (components of the Energy Conservation Project). This is considered to be two projects since analysis was conducted on two distinct sets of conservation programs.

> The APA analyzed eight energy conservation programs divided into two groups. In the first group were electric-to-gas water heat conversion, fluorescent lamp rebate, and incandescent to fluorescent lamp conversion programs. These programs netted about half the benefits and a third of the cost of the top eight conservation programs. The second set of programs, although not as efficient as the top three, included efficient electric water heaters, electric-to-gas clothes dryer conversions, electronic ballasts for fluorescent lights, efficient refrigerators, and sliding-scale rebates for efficient new construction of commercial buildings.

All four projects were found to have favorable benefit-cost ratios under all nine fuel price and energy load forecasts used by the APA as their base case scenarios. Although the natural gas pipeline is an expensive project, the

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[4] Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, Volume 11, June 1989, prepared for the Alaska Power Authority. Chapter 2 of this volume is provided as Attachment A. It provides a brief overview of the eight projects covered in this memorandum.

other two projects investigated are low cost. The four projects found economically inefficient in the APA study were the following: Healy Clean Coal project, new intertie between Anchorage and Kenai, full upgrade of the existing Anchorage-Fairbanks intertie, and the Northeast intertie.

Of the economically inefficient projects only the Healy Clean Coal project is described in this memorandum. The Healy project would be a 55 MW power plant (50 MW available to customers) to be constructed near Healy, Alaska. The project would be funded from three sources: a $93.2 million dollar Department of Energy grant under the Clean Coal Technology III demonstration Program; a $30 million dollar state appropriation; and approximately $60 million in revenue bonds.

Several construction cost estimates for this project exist. In the first two sections of this memorandum an estimate prepared by project proponents is used to estimate benefits and costs, and is one of two construction estimates used by the APA in its study. This construction estimate is the lowest of those prepared for use in the APA study. Use of this estimate in calculations results in a high measure of net benefits since net benefits increase as construction costs decrease (other things being equal). In section three an estimate prepared for use in the Alaska Industrial Development and Export Authority's (AIDEA) financial feasibility study of this project is used to determine benefits and costs. This estimate is the most recent, and is approximately 50 percent larger than that developed by project proponents. Calculation of net benefits using AIDEA's estimate may well provide the most reliable measure of benefits and costs since it takes into consideration specific site and technology information.

We begin our analysis of the Healy Clean Coal Project in section two of this memorandum, where we discuss the effects of different energy load and fuel price scenarios on APA conclusions with regard to the Healy Clean Coal and the Energy Conservation projects. The scenarios were devised by the APA to determine the sensitivity of the study conclusions to various prices of fuel and levels of demand for energy. Net benefits for the Healy project are negative under all APA price of fuel and load scenarios, while net benefits for the conservation projects are positive for all fuel price and load scenarios.

In section [illegible]lculate the Healy project's benefit-cost results to accommodate three modifications to APA assumptions. The first change calculates net benefits from moving the project's proposed site from the Usibelli coal mine mouth to a site four miles to the south. This places the project near the existing Healy power plant and is a cost savings recommendation of project promoters. The second change drops the federal subsidy from cost calculations. This change reduces the scope of the analysis to costs borne directly by Alaska residents. The final change is to substitute the plant construction estimates submitted by R.W. Beck for those of the plant proponents.[5] The R.W. Beck estimate was recently prepared for use by the Alaska Industrial Development and Export Authority (AIDEA) in their financial feasibility study of the project. The Beck estimate is approximately half-way between the low cost estimate of the plant proponents and the high cost estimate prepared by the firm of Stone and Webster for the APA's reconnaissance study.

Net benefits are positive for the Healy project if 1) the federal subsidy is dropped from the cost base, 2) the plant is built at the south site (near the existing power plant), and 3) the plant construction cost estimate of plant backers is substituted for that of Stone and Webster or Beck.

The fourth section modifies the APA conclusions by limiting the analysis to costs and benefits born by Golden Valley Electric Association (GVEA) of Fairbanks. This change allows the analysis to more closely represent costs as they are perceived by the operators of the proposed facility. In this analysis we show the rationale for the project despite its overall unfavorable project benefit-cost ratio.

In the final section we make recommendations for future studies. Our recommendations are based on the assumption that the state will continue to have rising energy demands but will most likely have decreasing ability to subsidize energy projects. Fortunately, the state will have several years before existing power sources fall short of supplying Railbelt energy demands.[6] We recommend that the state use this period of excess railbelt energy supply to assure that a consistent, affordable plan is put into place for meeting future energy demands.

Developing such a plan requires that several things occur.[7] First, the legislature should direct the APA to focus on developing a plan to meet the power requirements of the population at least cost. The emphasis needs to change from studying and approving specific capital power projects to

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[5] R.W. and Associates, "Healy Coal Project Financial Plan and Feasibility Study", for Alaska Industrial Development and Export Authority (AIDEA), March 30, 1990.

[6] The Railbelt is not expected to need additional generating capacity until 2006.

[7] Governor's Energy Policy Task Force, "Recommended Guiding Principles for Alaska's Overall Energy Policy," January 20, 1988. The stated objectives of the task force and those outlined here are not exactly the same. Attachment B contains the recommendations of the task force.

determining the best (least-cost) combination of supply and demand side power programs that will meet energy requirements.[8]

Second, power projects should be evaluated strictly for their ability to meet energy requirements. Accordingly, employment, income, and other distribution goals should be met through programs specifically designed for those purposes.

Third, the Alaska Energy Authority (AEA) and the Alaska Public Utilities Commission (APUC) should be directed to develop an integrated power plan and to work with the private sector to see that the plan is implemented. Successful planning would require the state to work with industry to devise a rate structure and other incentives that assure planning consistent with the best interests of the state, the utilities, and users.

Fourth, the state should expend no funds on energy projects that are not consistent with the energy plan developed jointly between the state, industry, and other groups.

Finally, the existing tax structure and state-subsidized financing schemes should be evaluated to assure that no group unfairly prospers from state subsidized projects. This recommendation is especially important when private firms directly benefit from the expenditure of state funds.

SUMMARY OF BENEFIT-COST ANALYSIS FOR EIGHT POSSIBLE RAILBELT PROJECTS AS PRESENTED IN THE *RAILBELT INTERTIE RECONNAISSANCE STUDY*

The APA study summarized in this section was authorized by the legislature in the capital budget passed during the 1987 special legislative session. In the legislation the Alaska Power Authority was directed to conduct studies required under AS 44.83.177-185. The purpose of those authorized studies was to complete reconnaissance studies of Railbelt electrical interties. During the 1988 legislative session, the legislature modified the budget for the studies and included study of a gas pipeline between Cook Inlet and Fairbanks. The APA also later added studies for a Railbelt coal-fired power plant and electric end-use conservation programs.

In this section are provided APA's fuel and load scenarios, a description of the probability of occurrence assigned by the APA to each of the scenarios, an outline of the benefits that were evaluated by the APA in its study, a list of items not considered in the APA study but which may be considered important, a summary of the net benefit results as determined by the APA for the eight projects they investigated, and a brief description of the projects having positive expected net benefits.

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[8] Attachment C contains definitions of demand-side management programs.

For purposes of modeling the costs and benefits of the various projects, a set of three oil price and three load forecasts for the years 1994 - 2028 was developed for the APA study. These forecasts resulted in nine distinct combinations of price and load forecasts. The likelihood that a price and load forecast combination would occur (a single probability of joint forecast occurrence) was established based on fuel price probabilities adopted by the APA and load forecast probabilities adopted by the APA and the University of Alaska Institute of Social and Economic Research (ISER).

Each of the eight projects was modeled nine times--each time using a different price and load forecast combination. The outcomes (costs and benefits) for each distinct modeling exercise were assumed to be as likely as the price and load forecast on which they were based. The expected costs or benefits presented below, for any project, result from weighing (multiplying) each cost or benefit by its probability of occurrence (the joint load and price probability) and then adding the weighted outcomes (outcome multiplied by probability) for all nine possible combinations together.

Tables 1 through 4 provide key modeling assumptions used by the APA in developing a benefit-cost analysis. Table 1 provides the low, middle, and high oil price scenarios through the year 2010. Table 2 does the same thing for electric demand. Table 3 provides the price of coal which was assumed to remain constant in 1987 dollars.

In Tables 1 and 2 the annual real growth rate (the rate of growth beyond inflation) between reported years is in parenthesis. For example, in Table 2 the growth rate of 0.02 percent reported for the year 2000 in the low case is the annual growth rate between the year 2000 and the previous reported year 1995.

TABLE 1
CRUDE OIL PRICE SCENARIOS
PRICE OF NORTH SLOPE OIL DELIVERED TO U.S. GULF
(in 1987 Dollars)

	Scenario					
	Low		Middle		High	
Year	$	%	$	%	$	%
1990	13		17		19	
2000	17	(2.72)	23	(3.07)	29	(4 .2)
2010	19	(1.12)	24	(2.35)	39	(3.01)

Source: Alaska Power Authority, *Railbelt Intertie Reconnaissance Study*, June 1989, page B1.

Adapted by: Legislature Research Agency. The original APA numbers were for Saudi Light delivered to the U.S. Gulf. The numbers have been converted to reflect Alaska North Slope crude using data provided by the APA.

Note: The percentage growth rates are derived using the formula ending year price = (1 + percentage growth rate)*$^{\text{number of years}}$ * beginning year price.

TABLE 2
RAILBELT ELECTRIC DEMAND FORECASTS
(total energy GWh)

	Scenario					
	Low		Middle		High	
Year	GWh	%	GWh	%	GWh	%
1987	3305		3305		3305	
1990	3273	(-0.69)	3225	(-0.81)	3269	(-0.36)
1995	3153	(-0.52)	3271	(0.28)	3432	(0.98)
2000	3156	(0.02)	3395	(0.75)	3675	(1.38)
2005	3289	(0.83)	3641	(1.41)	4058	(2.00)
2010	3495	(1.22)	4053	(2.17)	4427	(1.76)

Source: Alaska Power Authority, *Railbelt Intertie Reconnaissance Study*, June 1989, page C5.

TABLE 3
PRICE of HEALY COAL
(in 1987 Dollars)

Waste Coal	$0.50/MBtu
Quality Coal	$1.20/MBtu

Source: Alaska Power Authority, *Railbelt Intertie Reconnaissance Study*, page 8-3.

Note: Coal is priced by its energy content and not by weight. MBtu is Thousand British Thermal Units

TABLE 4
BASE CASE PROBABILITIES

Fuel Price	Load Forecast	Joint Probability %
Low	Low	0.30
Low	Middle	0.23
Low	High	0.06
Middle	Low	0.03
Middle	Middle	0.08
Middle	High	0.19
High	Low	0.00
High	Middle	0.02
High	High	0.08

Source: Alaska Power Authority, *Railbelt Intertie Reconnaissance Study*, page 5-4.

Note: Due to rounding errors the probabilities do not add up to one as expected.

Interpretation of the probabilities in Table 4 is straight forward. For example, Table 4 shows the APA assumed that the low fuel price and low load forecast had a 30 percent chance of occurring. Also the APA assumed that the high fuel price and low load forecast had no chance of occurring.

Other price/load scenarios were also evaluated by the APA. These other cases were referred to as sensitivity scenarios by the APA. They included a load forecast from the Railbelt utilities; no additional military or University of Alaska - Fairbanks load; the Alaska Department of Revenue middle fuel price forecast; two scenarios of hydro power availability; and a high natural gas price escalation between 2011 and 2028. These cases were not assigned probabilities of occurrence and are not discussed in this memorandum.

Source of Benefits

Project effects were broken down into the following categories by the APA when determining benefits:

1. System Stability

   Electrical systems are stable when generators are "in-step" with each other. When the generators are not operating "in-step" and protective back-up devices fail, the result is power outages or damaged equipment. The value of increases in system stability was quantified and added in as project benefits.

2. Reliability

   Projects can affect the number, duration, and magnitude of customer outages. Improvements in reliability were quantified and added in as project benefits.

3. Reduced Energy Cost

   The savings in the cost of energy that a project allowed were evaluated as benefits.

4. Transmission Efficiency

   Typically ten percent or more of energy transferred over interties is consumed during the transmission process. Reductions in transmission losses were quantified and added in as project benefits.

5. Capacity

   Generating capacity expenditures avoided because of a project were quantified and added in as project benefits.

6. Operat[redacted]ing

   Operating reserves is excess capacity that is maintained to accommodate changes in customer demand and equipment failures. Reductions in required operating reserves stemming from a project increase that project's net benefits.

Omitted Issues

Some of the issues that may be considered significant but which are not covered in the APA analysis or benefit-cost analysis in general are as follows:

Employment

Employment consequences of the various projects are generally not mentioned. Although computing the effects of a project on total employment might appear to be straight forward, it is not. The employment computations depend upon economic concepts such as elasticities, capital/labor ratios, and regional leakages and multipliers. Determining values for such economic quantities requires original research and the imposition of assumptions for which no consensus can be developed.

Employment has many facets including quantity and duration. We mentioned above some of the issues involved in determining the quantity of employment. Equally as significant, however, is the length of employment. Policy, not economics, determines whether a project that creates 50 jobs for two years is more or less important than a project that creates five jobs for 50 years.

Income

Income and employment are closely related. Meaningful impacts of a project on income cannot be determined without reliable employment estimates. As mentioned under "employment," no such employment measurements are made.

Regional Stability

A region's ability to deal with a project's effects varies and depends upon such things as the state of the local economy. No discussion on these matters exists.

Leverage and Risk

The economic cost of various projects in the APA study varies from $9 million to $284 million (1987 dollars). The consequence of a project being an economic failure varies with the cost of the project. Not incorporated into the analysis is the increasing "risk" associated with large projects or analysis of who bears the cost of failure.

Environmental Issues

Environmental costs are captured in the APA study only to the extent that projects must meet existing environmental standards. Many less tangible, yet important, environmental costs may be associated with various projects. Some possible side effects of projects include increased haze (for the Healy plant), the possibility of increased ice fog (from natural gas emissions in Fairbanks during winter), or loss of aesthetic beauty (additional intertie hardware). Although these issues are mentioned, no attempt was made to quantify changes in

> property value, employment, or tourism that might result from a given project's implementation.

Consistency

> Although it is possible to argue that the state does not have an energy plan, discussion could be provided on how the projects "fit in" with prior projects. Many such issues could be raised. For example: Does the state wish to support a project that does not make best use of existing hydro power? Does the state wish to support a project that seems to contradict the purpose of the intertie? Exactly what environmental risks is the state willing to undertake?

These omitted factors, plus others, can be made part of benefit-cost studies. Their inclusion would make possible a more focused discussion of the relevant issues. As it is now, such considerations are dismissed by decision makers because they leave too much unanalyzed, too much unsaid.[9]

Expected Benefits

Projects with favorable benefit-cost ratios may not necessarily make everyone better off. Indeed, there may be many who are made worse off by any given project. A project is acceptable on economic efficiency grounds when it would be possible, in principle, to fully compensate those who lose by transferring to them a part of the gain from those who have been made better. (This compensation principal is known as the Hick-Kaldor compensation principal.) The process of effecting the transfer, if it occurs, typically involves political intervention.[10,11]

The APA's expected results for the eight projects are presented in Table 5. The data in Table 5 shows that only four of the projects are economically efficient: a limited upgrade to the Anchorage-Fairbanks intertie, a natural gas line between Cook Inlet and Fairbanks, and various components of the Energy Conservation project. The last two columns of Table 5 are explained the following table.

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[9] Methods exist for assigning shadow prices and thus quantifying many of these apparently qualitative factors.

[10] Lee Anderson, and R. Settle, *Benefit-Cost Analysis: A Practical Guide*, Lexington Books, 1979, p. 13. The Hicks-Kaldor compensation rule described is named after its authors.

[11] Identifying and estimating the benefits of "winners" can be difficult. The legislative intervention mentioned typically involves some combination of taxation and social programs such as job retraining.

TABLE 5
EXPECTED COSTS AND BENEFITS FOR RAILBELT INTERTIE RECONNAISSANCE STUDY PROJECTS
(in millions of 1987 dollars)

	Est. Expected Costs $	Est. Expected Benefits $	Est. Net Bens. $	Benefit to Cost Ratio	Source of Benefits and Costs	Prob. that Net Benefits are Postive
Projects that are economically efficient						
Limited Upgrade of Anch-Frbks Intertie	10	40	30	4.0	3,5	1.00
Gas Pipeline Between Cook Inlet & Fbks.	284	527	243	1.86	2,3,& 4,5	1.00
Top Three End-Use Conservation Programs	16	28	12	1.75	3,4,5	1.00
Top Eight End-Use Conservation Programs	44	61	17	1.39	3,4,5	1.00
Projects that are economically inefficient						
Northeast Intertie	188	159	-29	.85	2,3,5	0.08
Full Upgrade of Anch-Fbks. Intertie	134	96	-38	.72	2,3,& 4,5	0.00
50-MW Coal-Fired Power Plant	177	108	-69	.61	3,4,5	0.00
New Kenai-Anchorage Intertie	103	49	-54	.48	1,2,& 3,4,5,6	0.00

Notes:

1: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).

2: Estimated Net Benefits = Estimated Expected Benefits - Estimated Expected Costs.

3: Benefit to Cost ratio is a number, rather than a dollar figure, and are always greater than zero.

4: Economically efficient projects are those that lead to a net increase in the value of goods and services produced within the economy. Economically efficient projects have net benefits (benefits - costs) that are positive and benefit-cost ratios greater than one. The term "economically efficient" and "financially feasible" are not the same thing and one does not always imply the other.

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989.

Numbers in the "Source of Benefits," column refer to the six categories of benefits described under the heading "Sources of Benefits" on page 9 of this memorandum. The column in Table 5 entitled "Probability that Net Benefits are Positive," is based on the nine price and load scenarios making up each project's expected value. As described previously, each one of the nine scenarios has a distinct probability of occurrence; these probabilities were given in Table 4. For each, fuel and load scenarios, net benefits were computed and the column "Probability that Net Benefits are Positive" is the sum of all scenario probabilities where the estimated net benefits were positive.[12] (For example, a column value of 1.00 for "Probability that Net Benefits are Positive," as in the case of Energy Conservation projects, implies that in all nine price and load forecast scenarios the net economic benefits were positive: all APA price and load forecasts result in benefits exceeding costs. Values of 0 indicate that there was no fuel price and load scenario which resulted in benefits exceeding costs. A value between 0 and 1 indicates that under some, but not all fuel price and load scenarios, net economic benefits were positive).

Description of Projects Having Positive Expected Net Benefits

Limited Upgrade to Intertie

The existing intertie is limited to 70 MW input at Anchorage. The proposed upgrade to the intertie consists of electrical equipment (static var unit, one transformer, and six capacitors) which increases the Anchorage input to 100 MW. Power received at Fairbanks would increase from 61.6 MW to 84.2 MW.

Energy transfers over the study period are all from Anchorage to Fairbanks. Nearly half of the benefits of this project can be traced to reduced usage of North Pole oil-fired turbines.

The value of this project ranges between $1.2 million per year in 1994 and $3.3 million per year in 2028. This project has little impact on reducing Railbelt capacity shortages due to the limited nature of the project.[13]

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[12] This is standard statistical procedure.

[13] Mr. Thomas Stahr, the general manager of Municipal Light & Power Department of the Municipality of Anchorage has criticized this project as too limited in scope, experimental, and inconsistent with previous state energy expenditures. His testimony to the House Resource Committee is included as Attachment D.

Natural Gas Line

A natural gas pipeline could be constructed to link the Cook Inlet gas fields with the Fairbanks area. The estimated capital cost of the project is $183 million (1987 dollars) for the main pipeline and $32.5 million (1987 dollars) for a Fairbanks distribution system.

Nearly 80 percent of the gas line benefits accrue outside the electric power sector--in commercial and residential heating uses. The cost of this project, which includes the construction of a Fairbanks commercial and residential pipeline distribution system and the discounted present value of unavoidable operating and maintenance charges, is approximately $284 million (in 1987 dollars). Although the costs are high, the net benefits for this program exceed those of any other project examined in the APA study.

The gas line project would most likely result in significant dislocations in the existing Fairbanks energy infrastructure. For example, refiners and distributors of heating oil would be adversely affected. These issues are not dealt with in this memorandum or in the APA study.

The overall effect on employment, however, is unclear since there would be increases in employment in the gas-energy sector and other sectors to the extent that lower cost energy increased disposable income and thus increases demand for other goods and services. None the less, it would be a situation of obvious winners and losers.

Energy Conservation Programs

For APA analysis, the various proposed conservation programs were divided into two groups. The first group consists of electric-to-gas water heat conversion, fluorescent lamp rebate, and the incandescent-to-fluorescent lamp conversion programs. These programs netted about half the benefits and a third of the cost of the top eight conservation programs. The second set of programs, although not as efficient as the top three, include efficient electric water heaters, electric-to-gas clothes dryer conversions, electronic ballasts for fluorescent lights, efficient refrigerators, and sliding-scale rebates for efficient new construction of commercial buildings.

All the programs are designed to encourage the installation of energy-efficient equipment at the time of normal replacement. The programs consist of dealer/contractor rebates designed to lower the relative price of the efficient equipment to nonefficient equipment as an incentive to selection by consumers.

For the top three programs, approximately half of the benefits accrue from the conversion from electric-to-gas water heaters. Consequently most of the reported energy savings result in the Anchorage area.

The advantages of these programs include their low cost and their expected ability to generate benefits exceeding costs (even with low oil price and load projections). The primary disadvantage is that project benefits depend upon consumers adopting and continuing to abide by project guidelines. For example, efficient refrigerators require maintenance of door seals. If this maintenance is not done, the benefits of this particular component of the program gradually disappear.

HEALY CLEAN COAL AND CONSERVATION PROGRAMS

In this section we provide the net benefits and benefit-cost ratios for the Healy Clean Coal and Energy Conservation projects for each fuel price and load scenario.

Using original APA assumptions, the data provided in Table 6 and Table 7 indicate that the Healy Clean Coal power plant is not economically efficient under any oil price and load forecast. The Energy Conservation Projects have benefits exceeding costs for all price and load forecasts.

TABLE 6
ESTIMATED NET BENEFITS FOR HEALY CLEAN COAL AND ENERGY CONSERVATION PROGRAMS
(in millions of 1987 dollars)

			Estimated Net Benefits $	
Price/Load	of Scenario Occurrenace %	Healy Coal	Top 3 Energy Conservation Projects	Top 8 Energy Conservation Projects
Low/Low	0.30	-94.25	9.57	11.51
Low/Mid.	0.23	-91.55	10.07	12.85
Low/High	0.06	-82.95	10.91	15.02
Mid/Low	0.03	-60.75	12.72	18.66
Mid/Mid.	0.08	-49.75	13.49	20.43
Mid/High	0.19	-45.05	14.64	23.50
High/Low	0.00	-20.15	15.73	25.63
High/Mid.	0.02	-6.25	16.60	27.59
High/High	0.08	-0.35	17.89	31.13
EXPECTED VALUES		-69.70	11.95	17.14
Probability that Net Benefits are Positive		0.00	1.00	1.00

Notes:
1: All values are in 1987 dollars (present value for 1994 through 2028 discounted at 4.5 percent per year).
2: Estimated Net Benefits = Estimated Benefits - Estimated Costs.

Source: Decision Focus Inc., "Railbelt Intertie Reconnaissance Study," prepared for the Alaska Power Authority, June 1989.

TABLE 7
BENEFIT-COST RATIOS FOR HEALY CLEAN COAL AND ENERGY REDUCTION PROGRAMS

			Benefit-Cost Ratios	
Scenarios Price/Load	Probability of Scenario $	Healy Coal	Top 3 Energy Conservation Projects	Top 8 Energy Conservation Projects
Low/Low	0.30	0.47	1.62	1.27
Low/Mid.	0.23	0.48	1.65	1.30
Low/High	0.06	0.53	1.71	1.36
Mid/Low	0.03	0.66	1.76	1.42
Mid/Mid.	0.08	0.72	1.80	1.46
Mid/High	0.19	0.75	1.87	1.52
High/Low	0.00	0.89	1.87	1.54
High/Mid.	0.02	0.96	1.92	1.58
High/High	0.08	1.00	1.99	1.66

Notes:
1: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).
2: Estimated Net Benefits = Estimated Benefits - Estimated Costs.
3: Benefit-cost ratios should be greater than 1.0 if the program is to be considered socially efficient.

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989.

MODIFIED BENEFIT-COST ANALYSIS FOR HEALY CLEAN COAL POWER PROJECT

In this section we describe the effect on expected net benefits of changing APA assumptions about the Healy Clean Coal project. The changes are 1) excluding the federal subsidy from cost calculations, 2) moving the plant site to a location near the existing power plant at Healy, and 3) replacing the proponents construction cost estimate with a recent construction cost estimate prepared by R.W. Beck for AIDEA. We also comment on the possibility that the price of coal might be overstated for purposes of the benefit-cost study (reducing expected net benefits).

Cost Reductions Realized by Moving Proposed Plant Site

In the APA study the generating plant is located near the mine mouth. It has been suggested that the plant be located next to the existing facility (referred to as the South site) which is approximately four miles from the mine mouth site. It is claimed by project proponents that placing the new plant near existing facilities will reduce the combined operating costs of the two facilities by approximately $2 million annually. Table 8 presents the net benefits and benefit-cost ratios for this project using the assumption that the facility is built at the South site.[14]

TABLE 8
NET BENEFITS AND BENEFIT-COST RATIOS FOR THE HEALY CLEAN COAL PROJECT BASED UPON LOCATION OF NEW FACILITY AT THE SOUTH SITE
(in millions of 1987 dollars)

	Probability of Scenario	Healy Clean Coal Project	
Scenarios Price/Load	Occurrence %	Net Benefits $	Benefit-Cost Ratio
Low/Low	0.30	$-45.25	0.65
Low/Mid.	0.23	-42.55	0.67
Low/High	0.06	-33.95	0.74
Mid/Low	0.03	-11.75	0.91
Mid/Mid.	0.08	-0.75	0.99
Mid/High	0.19	3.95	1.03
High/Low	0.00	28.85	1.22
High/Mid.	0.02	42.75	1.33
High/High	0.08	48.70	1.38

EXPECTED VALUE..................$-24.31
Probability that Net Benefits are Positive.................... 0.29

Notes:
1: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).
2: Estimated Net Benefits = Estimated Benefits - Estimated Costs.
3: Benefit-cost ratios should be greater than one if the program is to be considered socially efficient.
4: Based upon plant cost assumptions of facility backers.

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989.

Removing Federal Subsidy from Cost Calculations

In the APA study the federal grant of $93.2 million is included as a cost. Costs, however, can be defined in two ways: opportunity costs and financial costs. Benefit-cost studies look at opportunity costs, not financial costs. The opportunity cost of the Healy Clean Coal project is the value of goods and

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[14] The actual amount saved each year by moving the plant site was taken as $2,219,000 for the years 1990 through 2028 discounted back to 1987 dollars at 4.5 percent per year.

services foregone by society as a result of the project. Financial costs are the costs born by facility owners.

Since there appears to be no other use to which these particular federal grant funds could be put within Alaska, it can be argued that there is no opportunity cost to Alaska in using the funds for this specific project. (Obviously there is a cost to the federal government of giving the funds to Alaska for this project.) Table 9 presents the net benefits and benefit-cost ratios for this project excluding the cost of the federal subsidy.[15]

TABLE 9
NET BENEFITS AND BENEFIT-COST RATIOS FOR THE HEALY CLEAN COAL PROJECT BASED UPON DROPPING FEDERAL SUBSIDY FROM COST CALCULATIONS
(in millions of 1987 dollars)

	Probability of Scenario	Healy Clean Coal Project	
Scenarios Price/Load	Occurrence %	Benefits $	Benefit-Cost Ratio
Low/Low	0.30	$-44.25	0.65
Low/Mid.	0.23	-41.55	0.67
Low/High	0.06	-32.95	0.74
Mid/Low	0.03	-10.75	0.92
Mid/Mid.	0.08	0.25	1.00
Mid/High	0.19	4.95	1.04
High/Low	0.00	29.85	1.23
High/Mid.	0.02	43.75	1.34
High/High	0.08	49.70	1.39

EXPECTED VALUE..................$-23.30

Probability that Net Benefits are Positive................... 0.37

Notes:
1: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).
2: Estimated Net Benefits = Estimated Benefits - Estimated Costs.
3: Benefit-cost ratios should be greater than 1.0 if the program is to be considered socially efficient.
4: Based upon plant cost assumptions of facility backers.

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989.

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[15] The federal subsidy used for construction was taken as $75,000,000 discounted back from 1996 to 1987 at 4.5 percent per year.

Locating at South Site *AND* Dropping of Federal Subsidy

Table 10 presents the net benefits and benefit-cost ratios for the Healy project using the South site for the plant and excluding the federal subsidy from the cost calculations (a composite of Table 8 and Table 9).

TABLE 10
NET BENEFITS AND BENEFIT-COST RATIOS FOR THE HEALY CLEAN COAL PROJECT BASED UPON DROPPING FEDERAL SUBSIDY FROM COST CALCULATIONS AND LOCATING PLANT AT THE SOUTH SITE
(in millions of 1987 dollars)

Scenarios Price/Load	Probability of Scenario Occurence %	Healy Clean Coal Project Net Benefits $	Benefit-Cost Ratio
Low/Low	0.30	$4.75	1.06
Low/Mid.	0.23	7.45	1.10
Low/High	0.06	16.05	1.20
Mid/Low	0.03	38.25	1.49
Mid/Mid.	0.08	49.25	1.63
Mid/High	0.19	53.95	1.69
High/Low	0.00	78.85	2.01
High/Mid.	0.02	92.75	2.18
High/High	0.08	98.65	2.26

EXPECTED VALUE...................$29.19
Probability that Net Benefits
are Positive.................... 1.00

Notes:
1: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).
2: Estimated Net Benefits = Estimated Benefits - Estimated Costs.
3: Benefit-cost ratios should be greater than one if the program is to be considered socially efficient.
4: Based upon plant cost assumptions of facility backers.

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989.

Healy Plant Construction Costs Using R.W. Beck Estimates

The cost of construction used in all the foregoing Healy Clean Coal benefit-cost calculations is $80 million (1987 dollars) and is the low cost estimate used in the *Railbelt Intertie Reconnaissance Study* prepared by the APA. In the *Healy Coal Project Financial Plan and Feasibility Study* prepared for AIDEA, R.W. Beck estimates the cost of plant construction to be approximately $120 million (1987 dollars). The R.W. Beck estimate may be the best estimate of plant construction costs since it includes site and technology specific information. If the $120 million estimate of plant construction cost is substituted into the benefit-cost calculations, all cost estimates are increased by $40 million, all net benefits and all expected net benefits are reduced by $40 million. The results are shown in Table 11.

TABLE 11
NET BENEFITS FOR THE HEALY CLEAN COAL PROJECT ASSUMING PLANT CONSTRUCTION COST OF $120 MILLION
(R.W. BECK FEASIBILITY STUDY)

Scenarios Price/Load		Probability of Scenario Occurrence %	Healy Clean Coal Project Based on original APA Assumptions[1] $	Net Benefits Based on Plant Relocation and Exclusion of Federal Subsidy from Cost Calculations[2] $
Low	Low	0.30	$-134.25	$-35.25
Low	Mid.	0.23	-131.55	-32.55
Low	High	0.06	-120.95	-23.95
Mid.	Low	0.03	-100.75	-1.75
Mid.	Mid.	0.08	-89.75	9.25
Mid.	High	0.19	-85.05	13.95
High	Low	0.00	-60.15	38.85
High	Mid.	0.02	-46.25	52.75
High	High	0.08	-40.35	58.65
EXPECTED VALUE			$-108.42	$-10.41
Probability that Net Benefits are Positive			0.00	0.37

Notes:

1: Refers to assumptions underlying creation of Table 5 (except for the cost of construction).

2: Refers to assumptions underlying Table 10 (except for cost of construction). This figure may over state benefits due to possible double counting of benefits derived from building facility near existing plant.

3: All values are in 1987 million (present value for 1994 through 2028 discounted at 4.5 percent per year).

4: Estimated Net Benefits = Estimated Benefits - Estimated Costs.

5: Benefit-cost ratios should be greater than one if the program is to be considered socially efficient.

6: In the Financial Feasibility Study the cost of plant construction is given as $136.9 million (1990 dollars). Discounting back to 1987 dollars at 4.5 percent results in a construction cost of $120 million (1987 dollars).

Source: Decision Focus Inc., *Railbelt Intertie Reconnaissance Study*, prepared for the Alaska Power Authority, June 1989, and *Healy Coal Project Financial Plan and Feasibility Study*," prepared for AIDEA by Frank Moolin & Associates, Inc. in association with R.W. Beck and Associates.

Excluding the federal subsidy and relocating the plant adjacent to the existing facility allowed positive net benefits under all fuel price and load forecasts. This case was detailed in Table 10. Raising the cost of construction, however, reduces the probability of positive net benefits from 1.00 to 0.37 while expected net benefits drops from $29 million to $-10 million. For the plant to generate positive net benefits, a fuel price and load scenario at the middle-middle price/load scenario or higher is required (see Tables 1 and 2 for scenario assumptions).

FINANCIAL FEASIBILITY - A PRIVATE SECTOR PERSPECTIVE

In this section we provide a rationale for continued support of the Healy Clean Coal project by project proponents, despite negative net benefits.

In Table 5, $-69.72 million is given as the expected net benefits for the Healy project. Increasing expected net benefits to zero from $-69.72 million (providing benefits equal to costs or a benefit-cost ratio of 1, the minimum point of economic efficiency) requires some combination of increased benefits or reduced costs equal to $69.72 million.

The original construction cost estimate was $80 million. If construction costs could be lowered by $69.72 million, expected costs would equal expected benefits (a benefit-cost ratio of 1). Realizing this type of savings implies a plant construction cost of $10 million ($80 million - $69.72 million). No one argues that the project can be built for so small an amount.

So why would plant proponents, in this case Golden Vally Electirc Association (GVEA) management, be willing to pay more than $10 million for the new facility? The answer has two parts. First, GVEA management does not agree with all the APA assumptions: GVEA assumes a load scenario slightly higher than APA's high scenario. Under the GVEA load scenario, benefits derived from the Healy project increase to $-59 million (from -$69.9 million). This effectively increases the breakeven construction cost from $10 million to $20 million ($80 million - $59 million). Also described elsewhere in this memorandum was the GVEA estimate that moving the plant from the mine mouth to a location near the existing plant could be worth up to $49 million in benefits not reported in the APA study (1987 dollars), raising the construction breakeven point to approximately $69 million ($20 million + $49 million).

A second part to the answer involves the differences between economic and financial studies. In a benefit-cost study, the analytical question is whether a specific project increases society's net wealth. In answering this question, all project costs and benefits occurring anywhere in society are evaluated. In a financial study, a firm asks if a given project is profitable. Here only project costs and benefits accruing to the firm are evaluated. Thus, the results of a benefit-cost study and a financial feasibility study may well be different.

In the case of a financial feasibility study of the Healy project, two significant cost assumptions differ from those used in the benefit-cost study. First, construction of the new Healy plant would reduce intertie charges for the Fairbanks utilities (since less intertie would be used). This reduction in charges is important to GVEA because it represents a true cost savings to their operations. These savings are not realized, however, in the benefit-cost study since they represent ongoing expenses associated with the intertie whether Fairbanks uses the intertie or not. The cost is simply spread over the remaining users (the cost of the intertie to society has not changed--it has only changed for Fairbanks). Secondly, Fairbanks would be purchasing less power from Anchorage and as a result would pay Anchorage less margins (allowed sale profits). Reduction in margin payments by Fairbanks utilities represents a real savings to those utilities. In a benefit-cost study this reduction is merely a shifting of margin payments from Anchorage to Fairbanks. Since this shift does not imply a savings to society, the benefit-cost study does not take them into account. These reductions in charges are worth approximately $40 million to Fairbanks utilities over the project planning period (which ends in 2028).[16]

Reducing costs by this $40 million raises the breakeven point to approximately $109 million ($69 million + $40 million). This is well in excess of the approximate $60 million of revenue bonds that must be issued and constitute the debt obligation that must be incorporated into the rate base.

Although other differences might exist, these show the conceptual difference between the two types of studies and provide a rational for continued interest in the project by its backers despite negative expected net benefits.

RECOMMENDATIONS FOR FUTURE PROJECTS

Despite the current increase in oil prices and state revenues, long-run estimates indicate a steady decline in revenues.[17] At the same time, population estimates indicate a constant or increasing total state population. The state is approaching a time when most likely it will not be able to afford meeting power requirements through the brute force method of building additional, subsidized power projects. In anticipation of that time, the

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[16] The savings to GVEA consists of two parts: first, a savings of $2 million per year in margins to Anchorage producers; and second, a savings of $0.7 million per year in reduced intertie operating and maintenance charges. The stream of savings is discounted back to 1987 using a 4.5 percent discount rate.

[17] State of Alaska, Department of Revenue, *Revenue Sources Book*, Spring 1990. See mid-case scenario, page 34.

Alaska state government should initiate a planning process that incorporates several key elements.[18]

First, the state should turn its attention from evaluating the feasibility of specific projects to determining how to best meet the publics need for a reliable source of energy.[19] The legislature should require the APA to focus on developing a plan to meet the power requirements of the population at least cost. The emphasis needs to change from studying and approving specific capital power projects to determining the best (least-cost) combination of supply and demand side power programs that meet energy requirements.[20,21]

Second, power projects should be evaluated strictly for their ability to help meet energy requirements at least cost. Accordingly, employment, income, and other distribution goals should be met through programs specifically designed for those purposes. Related issues, however, should be adequately addressed to assure rational discussion of the various omitted topics.

Third, the AEA and the APUC should work more closely with the private sector to implement the plan. Successful planning would require the state to work with industry to devise a rate structure and other incentives that assure a plan consistent with the best interests of the state, the utilities, and consumers.

Fourth, the state should expend no funds that assist energy projects that are not consistent with the energy plan developed jointly between the state, industry, and other groups.

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[18] See Governor's Energy Policy Task Force, "Recommended Guiding Principles for Alaska's Overall Energy Policy," January 20, 1988. The stated objectives of the task force and those outlined here are not exactly the same. Attachment B contains the recommendations of the task force.

[19] Attachment E contains relevant sections of *Energy Planning in Alaska: Past Efforts and a Future Direction*, published by the House Research Agency, February 1988, that explain the relevance and importance of demand side planning and the need for an integrated resource plan if a sensible, cost-efficient energy strategy is to be developed in Alaska.

[20] Attachment C contains definitions of demand side management programs.

[21] The APA study did not include analysis to determine the least-cost solution for meeting the power requirements of the Railbelt through the study horizon of 2028. For example, the possibility exists that a combination of two demand side management programs (energy conservation and the limited upgrade to the intertie) at a combined cost of approximately $30 million are the energy equivalent of the Healy Clean Coal project (at around $150 million - 1987 dollars).

Finally, the existing tax structure should be evaluated to assure that no group unfairly prospers from state-subsidized power projects. This recommendation is especially important when private firms directly benefit from the expenditure of state funds.

Ideally a least-cost solution or integrated resource plan for meeting the energy requirements of the Railbelt area during the next quarter century will involve a planning process that includes participation from both the public and private sectors. The state is in an ideal position to garner such cooperation because of its role as the provider of economic subsidies and as the facilitator of debt financing through agencies such as APA and AIDEA.

I hope this information is useful. If you have any questions, please contact this agency.

Attachment

ATTACHMENT A
"Decription and Costs of Alternatives,"
Railbelt Intertie Reconnaissance Study
Section 2, Volume 11, June 1989
Prepared by Decision Focus Incorporated for APA

Section 2

DESCRIPTION AND COSTS OF ALTERNATIVES

2.1 NEW INTERTIE BETWEEN ANCHORAGE AND THE KENAI PENINSULA

The preliminary design and cost estimates for these options were developed by Power Engineers, Incorporated. Two route alternatives were identified:

1. "Enstar" route, which follows an existing natural gas pipeline through the Kenai National Wildlife Refuge, followed by a submarine crossing of Turnagain Arm into Anchorage. The capital cost is estimated at $81.7 million (in 1987 dollars). Annual operations and maintenance cost is estimated at 1.5 percent of capital cost, or $1.2 million per year.

2. "Tesoro" route, which follows an existing oil products pipeline along the west coast of the Kenai Peninsula, followed by a submarine crossing of Turnagain Arm into Anchorage. The capital cost is estimated at $99.4 million (in 1987 dollars). Annual operations and maintenance cost is again estimated at 1.5 percent of capital cost, or $1.5 million per year.

Either line would be constructed at 230 KV and have a transfer capacity of 250 MW. Because the Enstar route crosses land within the Wildlife Refuge that had been proposed (though not yet designated) as "wilderness," it was anticipated that both Congressional and Presidential approval would be required to obtain the necessary right-of-way. Though cost considerations clearly favor the Enstar route, the Tesoro route was developed in case the proposed wilderness designation forced abandonment of the less expensive alternative. However, the Department of Interior has now acted favorably on a request by the State to exclude from wilderness designation a corridor adjacent to the Enstar pipeline for possible future construction of the proposed intertie. If Congress agrees to exclude the intertie corridor from wilderness designation, the two proposed routes would then be roughly equivalent in terms of permitting difficulty.

Preliminary schedules for permitting and construction suggest that completion of the intertie should not be expected prior to 1994, regardless of the route.

2.2 FULL UPGRADE OF THE EXISTING ANCHORAGE-FAIRBANKS INTERTIE

The preliminary design and cost estimate for this proposal was developed by Harza Engineering Company. Presently, the transmission link between the Wasilla area and Fairbanks consists of three segments:

1. Wasilla to Willow—138 KV line owned by Matanuska Electric Association.

2. Willow to Healy—345 KV line owned by the Alaska Power Authority (APA). The line is presently operated at 138 KV, consistent with voltages at either end.

3. Healy to Fairbanks—138 KV line owned by Golden Valley Electric Association (GVEA).

The full upgrade proposal consists primarily of new 345 KV line construction between Willow and the Chugach Electric Association (CEA) transmission system south of Wasilla, and new construction between Healy and Fairbanks. (Existing segments would be supplemented, not replaced, by the new line construction.) This revised link between Anchorage and Fairbanks would initially be operated at 230 KV, raising the transfer capability from the present level of 70 MW to 225 MW.

The capital cost of this upgrade is estimated at $118.2 million in 1987 dollars. The additional operations and maintenance cost of the intertie following this upgrade is estimated at $900,000 per year, again in 1987 dollars.

The main issue with respect to land use involves the new segment from Healy to Fairbanks. The proposed route crosses federal land south of the Tanana River near Fairbanks. Agreement would have to be worked out with the military at Fort Wainwright.

Again, preliminary schedules for permitting and construction suggest that completion of the upgrade should not be expected prior to 1994.

2.3 LIMITED UPGRADE OF THE EXISTING ANCHORAGE-FAIRBANKS INTERTIE

This option was developed by Power Technologies, Incorporated (PTI) at the request of APA and represents an alternative that would provide a small but potentially useful increment of transfer capability over the existing intertie. Presently, Fairbanks can receive an estimated 61.6 MW of power over the intertie when 70 MW is input from Anchorage, assuming the existing 25-MW Healy coal plant is in operation at the time. Most of the losses are incurred on the section of the line between Healy and Fairbanks. The limited upgrade alternative would allow Fairbanks to receive an estimated 84.2 MW over the intertie when 100 MW is input from Anchorage. In other words, an additional 30 MW of power input from Anchorage would allow an additional 22.6 MW to be received in Fairbanks.

The estimated capital cost of this limited upgrade is $8.8 million in 1988 dollars. Its main components consist of one SVS (static var) unit supplementing the three units now in place on the intertie, one additional transformer, and six series capacitors. The additional operations and maintenance cost is estimated at $0.1 million per year.

The present system does not meet the system performance criteria established for the limited upgrade. In order for the present system to meet the same criteria at 70-MW export from Anchorage, the additional SVS unit and one series capacitor would have to be installed. This implies that system performance under the proposed limited upgrade would be improved relative to system performance today.

2.4 NEW INTERTIE FROM PALMER THROUGH GLENNALLEN TO DELTA JUNCTION (NORTHEAST INTERTIE)

The preliminary design and cost estimate for this alternative was developed by Power Engineers, Incorporated. The proposed line would be constructed at 230 KV but operated initially at 138 KV with a transfer capacity of 150 MW. In combination with the existing Anchorage-Fairbanks intertie, the combined transfer capability would therefore be 220 MW, minus whatever intermediate load is served along the Northeast intertie route. For illustration, if the intermediate load served by the intertie in the Glennallen-Valdez area were 10 MW, the combined transfer capability between Anchorage and Fairbanks would be 210 MW.

The capital cost of the Northeast intertie is estimated at $155 million in 1988 dollars. Annual operations and maintenance cost is estimated at 1.5 percent of capital cost, or $2.3 million per year.

Preliminary schedules for permitting and construction suggest that completion of the intertie should not be expected prior to 1994.

2.5 COAL-FIRED POWER PLANTS IN THE RAILBELT

Preliminary design and cost estimates were developed by Stone & Webster Engineering Corporation. Capital cost as well as operations and maintenance cost estimates were developed for coal-fired power plants in three different sizes (50 MW, 100 MW, and 150 MW) and four different Railbelt locations (Healy, Nenana, Beluga, and Matanuska Valley).

Table 2-1 shows a summary of the capital cost estimates and Table 2-2 shows a summary of the operations and maintenance costs.

Table 2-1

CAPITAL COST ESTIMATES
(1988 dollars)

	Healy	Nenana	Beluga	Matanuska
50 MW				
$/kW	3,322	3,378	3,476	3,119
Total ($M)	166.1	168.9	173.8	155.9
100 MW				
$/kW	2,499	2,522	2,610	2,340
Total ($M)	249.9	252.3	261.0	234.0
150 MW				
$/kW	2,143	2,158	2,235	1,952
Total ($M)	321.5	323.7	335.3	292.9

Table 2-2

ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATES*
(millions of 1988 dollars)

	Healy	Nenana	Beluga	Matanuska
50 MW	7.2	7.2	7.2	7.4
100 MW	10.2	10.2	10.2	10.5
150 MW	13.0	13.0	13.0	13.4

* Excludes first year costs for training and commissioning

The combustion technology selected for development of these estimates is atmospheric fluidized bed, based primarily on its expected cost advantage over conventional pulverized coal plants. The cost advantage results from the avoidance of a flue gas desulfurization system.

Organizations proposing to build coal-fired power plants at Healy and at Nenana have thus far maintained that such plants with capacities of approximately 100 MW could be built at an installed cost of about $1,600 per kilowatt, in contrast to the Stone & Webster estimate of about $2,500 per kilowatt. In other words, the Stone & Webster estimate is on the order of 50 percent higher than the estimates suggested by these prospective sponsors.

Because comparable detail has not been made available for the lower estimates, the causes of this substantial difference are not precisely known. However, it appears that the major issue is the estimate of cost differential between Alaska and the lower 48, especially in the area of labor cost.

The power system analysis focused on a single coal-fired power plant proposal: a 50-MW minemouth plant at Healy. Results are presented for two different capital cost estimates: $1600 per kilowatt as previously estimated by potential project sponsors, and $3322 per kilowatt as estimated by Stone & Webster for the 50-MW size. These estimates are applied only to the cost of constructing a single-purpose power plant, and do not include the additional cost that would be incurred for a cogeneration plant that could provide a significant volume of steam to an adjacent facility as well as 50 MW of power.

Stone & Webster also provided an estimate of the additional cost necessary to build and operate a cogeneration plant that could produce not only 50 MW of power, but also sufficient high quality steam for drying an estimated 650,000 tons per year of coal, although very limited resources were available for this estimation task. Their estimate is that the additional capital cost is $368 per kilowatt, and the additional operations and maintenance cost is $400 thousand per year. These factors were used in attempting to assess the impact on coal plant economics of constructing a cogeneration facility as proposed rather than a single-purpose power plant.

Stone & Webster concluded that coal-fired power plants at any of the four sites, and at any of the three sizes, could meet environmental standards including air quality standards, and should be able to obtain all necessary permits.

2.6 NATURAL GAS PIPELINE LINKING FAIRBANKS WITH THE COOK INLET AREA

Preliminary design and cost estimates for this alternative were also prepared by Stone & Webster Engineering Corporation. The capital cost of a 16-inch diameter natural gas pipeline linking Fairbanks with the Cook Inlet area is estimated at $190 million in 1988 dollars. A 16-inch system could accommodate preliminary projections of residential and commercial consumption in the Fairbanks area over the next 30 years and, if required, its capacity could be expanded with compression to accommodate military consumption as well. (For purposes of comparison, the Stone & Webster capital cost estimate for a 20-inch pipeline—the size initially proposed by Enstar Natural Gas Company—is $235 million in 1988 dollars.)

The probability that North Slope natural gas will be available in Fairbanks for transmission to Anchorage at sustained price levels that undercut Cook Inlet gas during the next 30 years was judged by APA to be too low to form a basis for pipeline planning at this time. Though possible future levels of Anchorage demand for natural gas were, as a result, not considered in sizing the pipeline proposal, the selected 16-inch system would be capable of carrying nearly enough gas to satisfy current levels of residential and commercial demand in Anchorage.

The capital cost of the distribution system in Fairbanks is estimated at $33.8 million in 1988 dollars. The annual operations and maintenance expense for the system additions is estimated at $4.0 million ($2.4 million for the distribution system, $1.6 million for the main transmission pipeline).

The major environmental issue with respect to pipeline construction would be the potential cumulative effect on fisheries resources of the numerous instream crossings proposed. However, proper construction techniques can reduce these impacts below significant levels. With respect to air quality impacts, it is expected that widespread conversion to natural gas would reduce pollutants, especially sulfur dioxide and particulates, though increased production of water from natural gas combustion compared with coal or oil may produce increased ice fog during cold weather conditions.

2.7 ELECTRIC END-USE CONSERVATION PROGRAMS

The Institute of Social and Economic Research (ISER) was given the task of identifying the most promising electric end-use conservation programs that could be devised for the Railbelt and estimating their expected costs and load reduction impacts. Because these programs are generally less well understood than the other alternatives presented in this section, they are described below in greater detail.

Based on preliminary screening criteria, nine programs were identified by ISER for further analysis. Eight of the nine programs are structured around dealer/contractor rebates, i.e., rebates to the businesses that sell or install eligible efficiency equipment, thereby reducing the price of efficiency investments faced by consumers. The ninth program would provide rebates to the owners and designers of new or remodeled commercial buildings based on the design efficiency of lighting and ventilation systems.

All the programs are intended to encourage the installation of efficient equipment either initially (in the case of the ninth program) or at the time of normal replacement of standard equipment. No intensive retrofit programs are proposed, primarily because they are more expensive (useful equipment is prematurely replaced) and the present cost of electrical generation in the Railbelt is relatively low. However, though the proposed programs are more cost-effective than accelerated retrofit-type programs, they need more time for their effects to fully register. Because the stock of appliances and equipment takes 10 to 20 years to turn over, programs that encourage efficiency upgrades at the time of normal replacement must be in place for 10 to 20 years to have the potential for affecting the entire appliance stock.

The nine programs are summarized briefly below, with the residential programs listed first, followed by commercial.

1. *Water Heater Conversions*: $500 rebate for the conversion of a residential electric water heater to natural gas.

2. *Efficient Electric Water Heaters*: $40 rebate for the purchase of an electric water heater with an efficiency over 95 percent.

3. *Gas Dryer Rebates*: $170 rebate for installation of gas piping to a clothes dryer within a residence, $50 rebate for purchase of a gas clothes dryer.

4. *Efficient Refrigerator Rebates*: $50 rebate for purchase of refrigerator at least 28 percent more efficient than required by new federal appliance efficiency standards.

5. *Efficient Freezer Rebates*: $50 rebate for purchase of freezer at least 35 percent more efficient than required by new federal appliance efficiency standards.

6. *Fluorescent Lamp Rebates*: Rebates from $0.30 to $1.80 for purchase of energy efficient fluorescent lamps.

7. *Electronic Ballast Rebates*: $13 rebate paid for each electronic fluorescent ballast. (A ballast is the device used to start and provide proper operating conditions for fluorescent lamps.)

8. *Incandescent to Fluorescent Conversions*: $7 to $12 rebates for purchase of compact fluorescent lamps, adapters, and fixtures suitable for replacing incandescent lamps.

9. *Sliding-Scale New Construction Rebates*: $1 per square foot rebate for every one watt per square foot reduction in lighting or ventilation power consumption below a threshold level. This rebate applies in the commercial sector to new construction or remodel projects, and would be divided (85 percent / 15 percent) between the building owner and the architect/engineer project designer.

The commercial lighting programs (#6, #7, and #8 above) generate nearly 60 percent of the expected savings from all nine programs. Within the residential category, the electric water heater conversion program appears to have the most impact and also the lowest cost per kilowatthour saved.

In estimating program impact, care was taken to avoid double counting efficiency measures already assumed to occur within the electric demand forecast (i.e., "market driven" efficiency), and to base projected response rates of consumers to these incentives not only on the available electric end-use data for the Railbelt but also on the program participation rates reported by others. It is estimated by ISER that if the incentive payments for all nine programs were held in place over a period of 20 years, the savings in the 20th year would be approximately 7 percent of estimated load. Load reduction impact builds over the 20-year period up to this 7 percent peak and then declines over the ensuing 20 years due to the termination of incentives, the retirement and replacement of equipment bought earlier with the incentives, and the return to "normal" purchasing behavior. The amount of electricity saved, as well as program cost, is roughly proportional to the length of the program. If the programs were in place for 5 years instead of 20, program impact would peak in year 5 at roughly 2 percent of estimated load, and then decline from there.

The technology screening analysis described in the Interim Report of the Railbelt Intertie Feasibility Study (January 30, 1989) confirmed that the top three programs consisted of two commercial lighting programs (incandescent to fluorescent conversions and rebates for more efficient fluorescent lamps) and the residential electric-to-gas hot water heat conversion program. The one program that was eliminated from further analysis was the residential rebate program for efficient freezers. For the purpose of further analysis, the programs were therefore combined into two groups: the "top three" programs and the "next five" programs.

In addition, it was assumed for subsequent analysis that the programs would remain in place for 10 years. This judgment was based on the idea that program funding over a 20-year period was unrealistic, but that more than a few years of implementation would be necessary for these types of programs to have a significant impact.

Program costs can be presented either as "resource costs" or "budgetary costs." Resource costs are used in the economic analysis and refer to the total resources expended to achieve the electric energy saving. Using the rebate program for efficient fluorescent lamps as an example, the resource costs include the incremental cost of the more efficient lamp, the additional cost of fuel for providing heat to the building (since the reduced heat output of the efficient lamps requires more output from the heating system), and the administrative costs of the rebate program. Budgetary costs include the administrative cost of the program and the cost of the rebates themselves.

For the top three programs implemented over a ten-year period, the discounted present value of resource costs is approximately $15 million. The sum of budgetary costs is estimated at $16.7 million in 1987 dollars, and $24.3 million in nominal dollars assuming incentive payments increase with inflation at 4.5 percent per year.

For the next five programs, the discounted present value of resource costs is approximately $27 million (again assuming a 10-year implementation period). The sum of budgetary costs is estimated at $29.6 million in 1987 dollars, and $43.9 million in nominal dollars assuming incentive payments increase with inflation at 4.5 percent per year.

ATTACHMENT 8
"Recommended Guiding Principles for Alaska's Overall Energy Policy"
Alaska Energy Policy Task Force, Draft, January 20, 1988
pp D-2 to D-4

ALASKA ENERGY POLICY TASK FORCE

January 20, 1988

Draft

RECOMMENDED GUIDING PRINCIPLES FOR ALASKA'S OVERALL ENERGY POLICY

1. The overall goal of Alaska's energy policy should be the long-term availability to all Alaskans of an adequate supply of energy at the lowest total costs to the users, the environment and the State.

2. Recognizing the need to avoid rate-shock--particularly in those rural areas of Alaska where energy costs are very high, it is the policy of the State to avoid actions that in themselves create rate-shock, and also to pursue strategies intended to achieve the lowest combined costs to the State and the consumer.

3. Recognizing the value of free-market forces in bringing about the most effective uses of energy at the least overall cost, State government shall seek to develop a climate that fosters private industry, and in general, the state shall not compete with private enterprise.

4. Recognizing that Alaska's current mix of energy programs may not be the most efficient and cost-effective, and that some programs may work at cross-purposes to others, it is an immediate objective of State energy policy to integrate and modify the various energy programs where necessary to effectively serve the needs of Alaska's citizens, and with the least overall cost.

5. Recognizing that energy conservation is in the best interests of Alaska's citizens, and that efforts directed toward conservation can be more cost-effective than development of additional energy resources, the State's energy policy shall be to promote energy conservation by various means that may include education, technical assistance, development of new technologies, and perhaps direct assistance.

6. Recognizing that state government should take the primary role in necessary energy-related regulatory activities, the state's energy policy shall be to conduct those regulatory activities efficiently and cost-effectively and, as much as is practical, in coordination with other state activities.

7. Recognizing that the federal government has been conducting energy programs in Alaska and that it may continue these or similar programs in future, Alaska's energy policy shall be to coordinate closely with the federal government so that the combined federal and state activities are mutually complimentary and are directed toward the long-term benefit of Alaska's citizens.

8. Recognizing that Alaska has copious energy resources of nearly all forms--including petroleum crude, natural gas, coal, hydropower, geothermal energy, wind energy and biomass--the State's energy policy shall be to make these resources available for development.

9. Recognizing the diversity of Alaska's peoples and the fact that they live in a variety of settings within a land having several distinctly different climatic zones, the State's energy policy shall be to conduct the state's energy activities with a high awareness of the differing regional needs.

10. Recognizing the value of a proper level of planning, it is the policy of the State of Alaska, where expenditure of State funds is involved, to assist as is necessary in such planning activities as are required to accomodate the future energy needs of the State.

11. Recognizing that the state, at no or minimal cost to itself, can sometimes assist local and regional organizations in reducing capital costs of energy-related projects, it is the policy of the State to provide such assistance by either offering at cost (market-rate) loans or by assisting entities to obtain loans from other sources at the lowest cost.

12. Recognizing that it is the proper role of the state to develop information and to provide it to all parties--private industry, publicly owned organizations, and energy users--the State shall promote and participate in the collection, archival, analysis and dissemination of information needed for the conduct of energy activities; and to foster and participate in education and in research and development of energy technologies specifically useful in Alaska.

13. Recognizing that Alaska is highly subject to natural disasters, and also that Alaska is a non-contiguous state which occupies a strategic location in world affairs, thereby possibly making it subject to man-made disasters, the State's energy policy shall be to encourage local and regional energy self-sufficiency so as to mitigate the effects of such events.

14. Recognizing the high cost of energy in rural Alaska and the relative insecurity of rural Alaska economic and energy systems, it is the policy of the State of Alaska to give emphasis to the special energy needs of rural areas.

15. Recognizing that it is in the financial interest of Alaska to so, the State should continue to own the present power production and transmission systems. It should avoid ownership of any new generation facilities if local or regional utilities can plan and build the facilities at lower combined cost to the State and the consumers. The State should continue to be involved in the planning, building and financing of transmission facilities in those cases where it is determined that the utilities or the private sector cannot provide the facilities at lower total cost to the State and the users.

ATTACHMENT C

"Demand-Side Management," Appendix A
Energy Planning in Alaska: Past Efforts and Future Direction,
House Research Agency Report 88-B, February 1988

APPENDIX A

Demand-Side Management[1]

Demand-side management is the planning and implementation of utility activities designed to influence customer use of electricity in ways that will produce desired changes in the utility's load shape--i.e., changes in the time pattern and magnitude of a utility's load. Utility demand-side management programs include: load management, new uses, strategic conservation, electrification, customer generation and adjustments in market share. Demand-side management includes only those activities that involve a deliberate intervention by the utility in the marketplace to alter its load shape. Demand-side management extends beyond conservation and load management to include programs designed specifically to build load in both peak and off-peak periods.

The optimal approach to assessing the viability of demand-side management is to incorporate that assessment into the utility's formal strategic planning process with demand-side alternatives being one of many choices available to meet utility objectives. Using a three step hierarchic process to incorporate demand-side management into the planning process is an effective technique. These three steps are: establish broad utility objectives, set specific operational objectives, and determine desired load shape modifications.

The first level of a utility's formal planning process is to establish overall organizational objectives. These strategic objectives are quite broad and generally include such examples as improving cash flow, increasing earnings, or improving customer and employee relations. While overall organizational objectives are important guidelines for utility long-range planning, there is a need for a second level of the formal planning process in which a utility's objectives are operationalized to determine specific actions. It is at this operational level that demand-side management alternatives should be examined and evaluated. Specific operational objectives are established on the basis of each utility's unique situation. Operational objectives that can be addressed by demand-side management include:

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[1] Unless otherwise noted, this section is based on information from Battelle-Columbus Division and Synergic Resources Corporation, <u>Demand-Side Management</u>, Volume 1: Overview of Key Issues, Prepared for the Edison Electric Institute and Electric Power Research Institute, EA/EM-3597, August 1984.

- Reducing the need for critical fuels;
- Reducing or postponing capital investment in construction programs;
- Avoiding electrical rate increases;
- Increasing revenues or sales;
- Providing customers with options for controlling their monthly utility bills;
- Reducing risks by investing in diverse alternatives;
- Increasing operating flexibility and system reliability;
- Decreasing unit cost through more efficient loading of existing and planned generating facilities;
- Satisfying regulatory constraints or rules;
- Minimizing potential environmental impacts; and
- Improving the image of the utility.

Once established, operational objectives are translated into the desired load shape changes.

Because there are so many demand-side alternatives, the process of identifying potential candidates can be conducted more effectively by considering several aspects of the alternatives in an orderly fashion. Demand-side activities can be categorized in a two-level process in which the second level has three steps:

Level I: · Load Shape Objectives

Level II: · End Use
· Technology Alternatives
· Market Implementation Methods

The first step in the identification of demand-side alternatives is typically the selection of an appropriate load shape objective to ensure that the desired result is consistent with utility goals and constraints. Once the load shape objective has been established, it is necessary to find ways to achieve it. This is the second level in the identification process which involves three steps. The first step is identifying the appropriate end uses whose peak load and energy consumption characteristics generally match the requirements of the load shape objectives. In general, each end use (e.g., residential space heating, commercial lighting) exhibits typical and predictable load patterns. The extent to which a given end use can be used to achieve the desired load shape modification is one factor used to select an end use for demand-side management.

The second step involves choosing appropriate technology alternatives for each target end use. This process considers the suitability of the technology for satisfying the load shape objective. Even though a technology is suitable for a given end use, it may not produce the desired results. For example, although water heater wraps are appropriate for reducing domestic consumption water heater electric consumption (strategic conservation), they are not appropriate for load shifting. If load shifting was the primary objective, an option such as direct load control via receiver/switches would be a better choice. Residential demand-side technologies can be grouped into four general categories:

- Building envelope alternatives;
- Efficient equipment and appliances;
- Thermal storage equipment; and
- Energy and demand control options.

Examples of technologies in these four categories are shown in Table A.1.

The final step in identifying demand-side management alternatives involves the methods for encouraging the customer to participate in the program. Marketing methods vary for different technologies. Frequently, two or more customer adoption strategies are used simultaneously to promote a given program. The different types of customer adoption techniques require differing levels of utility involvement. Direct incentive programs, for example, represent a high degree of utility support in promoting demand-side programs. In contrast, customer awareness strategies require less. Examples of customer adoption techniques are presented in Table A.2

TABLE A.1 RESIDENTIAL DEMAND-SIDE TECHNOLOGY ALTERNATIVES

EFFICIENT EQUIPMENT AND APPLIANCE ALTERNATIVES

- HEAT PUMPS
  - Central Air Source Heat Pump
  - Ground-Water Source Heat Pump
  - Ground-Coupled Heat Pump
  - Multizone Heat Pump
  - Room Heat Pump
- HIGH EFFICIENCY APPLIANCES
  - High-EER Air Conditioner
  - Energy-Efficient Cooking Appliances
  - Energy-Efficient Washers and Dishwashers
  - Energy-Efficient Refrigerators and Freezers
  - Efficient Lighting Fixtures and Lamps
- DUAL FUEL AND ELECTRIC HEATING
  - Dual Fuel Heating Systems
  - Add-On Heat Pump
  - Active Solar Space Heating
  - Task Heating
  - Zoned Resistance Heating
- WATER HEATING EQUIPMENT
  - Heat Pump Water Heater
  - Heat Recovery Water Heater
  - Solar Water Heating

BUILDING ENVELOPE ALTERNATIVES

- THERMAL TREATMENT
  - Insulation (Ceilings, Walls, Floors)
  - Storm and Thermopane Windows, Storm Doors
  - Window Treatments (Shades, Solar Screens)
  - Duct and Pipe Insulation
  - Water Heater Blanket
- INFILTRATION AND INDOOR AIR QUALITY
  - Infiltration and Indoor Air Quality Control
- PASSIVE SOLAR DESIGN AND DAYLIGHTING
  - Passive Solar Design
  - Daylighting

THERMAL STORAGE EQUIPMENT

- HEAT STORAGE
  - Central Ceramic Heat Storage
  - Room Ceramic Heat Storage
  - Slab Heating
- COOL STORAGE
  - Residential Ice Storage Air Conditioning

ENERGY AND DEMAND CONTROL EQUIPMENT

- DIRECT UTILITY CONTROL
  - Receiver Switches
  - Water Heater Cycling Control
  - Air Conditioner Cycling Control
- LOCAL UTILITY OR CUSTOMER CONTROL
  - Variable-Service-Level Devices
  - Timers
  - Appliance Interlocks
  - Programmable Controllers
  - Temperature-Activated Time Switches
  - Load Management Thermostats
  - Swimming Pool Pump Control

SOURCE: Battelle-Columbus Division and Synergic Resources Corporation, Demand-Side Management, Vol. 1: Overview of Key Issues, August 1984.

TABLE A.2 EXAMPLES OF CUSTOMER ADOPTION TECHNIQUES

CUSTOMER ADOPTION TECHNIQUE	OBJECTIVE	SPECIFIC ALTERNATIVES
Customer Education	Increase customer awareness of utility programs.	Bill inserts, brochures, information packets, displays, clearinghouses, direct mailings.
Direct Customer Contact	Through face-to-face communication encourage greater customer response to utility programs.	On-site energy service audits, workshops/energy clinics, store fronts/vendor sales and service.
Trade Ally Cooperation (i.e., architects, engineers, appliance dealers, heating, cooling contractors)	Increase utility capability in marketing and implementing programs.	Cooperative advertising and marketing, training, certification, selected product sales/service.
Advertising and Promotion	Increase public awareness of new programs, influence and control customer response.	Mass media (radio, TV, and newspaper), point-of-purchase advertising.
Alternative Pricing	Provide customers with pricing signals that are reflective of real economic costs and encourage a desired market response.	• Demand rates—rates based on the maximum kilowatt usage of a customer; the rates thus provide an incentive for customers to improve their load factor. • Time-of-use rates—rates where higher costs are incurred by the customer for using during a utility's peak period and lower costs during off-peak periods. • Off-peak rates—rates priced to reflect lower off-peak costs which offer customer service for specific end uses such as storage heating or storage water heating • Seasonal rates—rates where the season in which the utility reaches its peak has a higher flat rate than other seasons. • Inverted rates—rates where consumers pay more for each unit of electric consumed in later tail blocks. The first block may or may not consist of a lifeline rate. • Variable levels of service—rates where customers subscribe to a minimum electric service consistent with their needs—e.g., interruptible rates. • Promotional rates—rates designed to attract targeted groups of customers to a utility service area for the purpose of encouraging economic development. • Conservation rates—reduced rates based on a customer's dwelling meeting minimum energy efficiency standards, including mechanical systems.
Direct Incentives	Reduce up front purchase price and risk of hardware investments to the customer and increase short-term market penetration.	• Low/no interest loans—loans issued to customers below the current lending rate with the length of time for repayment varying. • Cash Grants/Rebates/Buy Back—money paid to customers based on some criteria, usually the efficiency of the device, energy/demand saved, and difference in utility average and marginal costs. • Subsidized installation/modification—utility arranges to have demand-side options installed for a reduced fee or free-of-charge.

SOURCE: Battelle-Columbus Division and Synergic Resources Corporation, Demand-Side Management, Vol. 1: Overview of Key Issues, August 1984.

Taken in sequence, the four steps described above are:

- Establish the load shape objective to be met;
- Determine which end uses can be appropriately modified to meet the load shape objective;
- Select technology options that can produce the desired end use-load shape change; and
- Identify an appropriate market implementation program.

The selection of the most appropriate demand-side management alternatives is probably the most crucial and difficult question a utility faces. This process is difficult because of the number of demand-side alternatives. In addition, because the relative attractiveness of alternatives depends upon specific utility characteristics, such as load shape, summer and winter peaks, generation types, customer characteristics, and load growth, transfer of results from one service area to another may not be appropriate.

Because there are so many different demand-side alternatives available to a utility, they should be analyzed through a hierarchy of evaluation levels, starting with an intuitive selection, continuing with an aggregate analysis, and ending with a detailed and comprehensive evaluation. The first level, intuitive selection, is based on a thorough understanding of the conditions within the service area, of the generating system and any planned expansion, and of the operating characteristics of the demand-side alternatives. The intuitive selection process does not identify those alternatives that are "best" but instead identifies a number of alternatives that are, at least initially, appropriate to achieve stated goals.

The next level in identifying alternatives is a more quantitative analysis that examines costs and benefits to all parties affected by implementation of the specific program over the program's lifetime. Interested parties include the utility, program participants, other customers, and society-at-large. To calculate the costs and benefits requires quantitative information on the impact of the alternative on peak and total energy sales, the expected participation in the program, the costs of implementation, and generating system data (such as costs for existing and planned capacity and fuel costs for base and peaking units). Comparison of the benefit/cost ratios will yield a preliminary ranking of programs.

The final step in the selection of the most appropriate demand-side alternatives is a detailed analysis of the most cost-effective alternatives. In a typical detailed analysis, the performance of the utility system from both an operational and financial viewpoint is simulated over time, with and without the selected demand-side alternative. This analysis estimates changes in the generating system and its operation that will result from the altered load shape produced by the selected demand-side alternatives.

Implicit in the selection process is a definite strategy to reduce the information requirements to manageable levels consistent with the trade-off between the data collection/analysis expense and the resulting level of accuracy in the evaluation. This strategy focuses on quickly and efficiently reducing the number of alternatives appropriate for a given utility. Detailed analyses of demand-side management alternatives are data intensive, requiring information in four major categories:

- Service area specific customer and end-use characteristics (type of equipment in use, stock estimates of equipment, patterns of usage);
- Operating/technical characteristics of the alternatives;
- Characteristics of the supply system (operating costs, reliability, initial cost); and
- Customer acceptance of alternatives.

Once the cost-effectiveness of demand-side management programs has been determined, programs can be implemented. Program implementation involves the many detailed day-to-day decisions that must be made to realize the goals of the program. Developing, installing, and operating a generating plant takes years of planning and scheduling, rigorous analytical modeling, calculations concerning reliability and maintenance, and strict construction scheduling. Similarly, the implementation of a demand-side management program intended to replace the need for all or part of a generating plant requires equally rigorous evaluation. The lack of data, inadequate experience with building models, and problem complexity are challenges to be overcome.

The implementation phase usually occurs in distinct stages. As a result of logistics and uncertainty over customer acceptance and response, a demand-side program can be introduced gradually through pilot projects. If the results from the pilot experiments look promising, the utility may proceed with full-scale implementation and operation.

ATTACHMENT D

Testimony of Thomas R. Starr to the Alaska House Resource Committee

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TESTIMONY OF THOMAS R. STAHR

TO THE HOUSE RESOURCES COMMITTEE

Mr. Chairman, members of the House Resources Committee, my name is Thomas Stahr and I am General Manager of the Municipal Light and Power Department of the Municipality of Anchorage. I am testifying in favor of the funding and construction of new electric transmission interties, both from Anchorage to the Kenai and from Anchorage to Fairbanks.

In its draft study the Alaska Power Authority assumed that certain technological fixes applied to existing old, low capacity transmission lines would result in performance nearly as good as a new transmission line. The result of this assumption was a perceived low benefit to cost ratio for both interties and a anomolously high benefit to cost ratio for the limited upgrade of the northern intertie. I want to explain why, in my professional opinion, these results are illusory and why implementation of the proposed enhancements may result in serious problems.

First, it is necessary to understand that the Bradley Project, as designed, has certain rather unique control features which limit normal operation to operating interconnected with a relatively large power system. Since there is no surge tank or surge chamber in the turbine water supply, operation of the power control valves are restricted to a very slow rate so it is necessary to have other generation units operating in parallel to absorb sudden load variations. There is a device to deflect water away from the turbine runner (wheel) which is normally used to prevent dangerous overspeed on sudden loss of load and it is hoped this device can be used to help govern the unit but there may be no way short of adding the usual surge tank to markedly improve load pick up ability. The braking resistor being proposed as a part of the technological fix is also to help control the tendency toward speed and voltage increase before the deflectors can operate. It is incomprehensible to me why a project would be designed so that strong interconnections are absolutely necessary for successful operation and then the agency ultimately responsible for that design would attempt to argue that the strong interconnection is not cost effective.

The existing Chugach line connecting Anchorage to the Kenai is thirty some years old and in need of major repair. Certainly well within the study period it will have to be replaced. While I have no detailed estimates of what this will cost, location and route alone indicate ths cost will be high compared to the cost of constructing a line on the route proposed for the new line. This old line is also subject to frequent faults and interruptions due to snow slides and other environmental factors. I can personally attest to problems this causes our customers in Anchorage and to the strains the repeated short circuits place on ML&P generators which absorb much of the surge on the Anchorage end. Faults on this old line have frequently caused Providence Hospital and other ML&P customers with sensitive load requirements to be forced to transfer to emergency generation. Supercharging this old line with technological fixes will militate against efforts to isolate Anchorage customers from efforts of faults on this line.

The technical fixes proposed to transform the old line into something approaching a real new transmission line are the addition of power system stabilizers, series capacitors and static var units. All of these devices are used in certain instances to overcome transmission or stability problems when a more conventional approach is inadequate. But to the best of my knowledge, they have not heretofore been considered as a surrogate to a proper transmission line. Each of these devices can cause serious problems if misapplied or if unanticipated operating conditions occur. Series capacitors have, on occasion, engendered sub-synchronous resonance conditions which can be damaging to generators and large industrial motors. Power Technologies, Inc., who proposed the technological fixes, admit they cannot be sure that sub-synchronous problems can be precluded and that other fixes must be used. Unless exhaustive studies are done beforehand we may find out we have a problem the same way most series capacitor problems are found, that is by bitter and expensive experience. Static var units are active devices, hence, subject to failure and miss operation. With the Anchorage/Fairbanks tie line we went through several years of problems before getting the static var units to perform properly. They also create harmonics on the power system which can cause problems for customers' electronic equipment. Certainly the few static var units we now have in service have not caused a problem but with massive additions the situation may be different. The power system stabilizers will help system stability only when they operate as planned but unless all possible situations are modeled, conditions may arise where they destabilize the system. Additionally, the combination of all these devices together means we will be operating a power system in the outer limits of standard utility operating practice. It has long been a fundamental Alaskan power system design principle that this is not the place to experiment with new technology when our customers are the experimental subjects. We should take heed from the recent Ontario Hydro experience where the whole Province was blacked out by Auroral currents and the cause was the saturation of a static var unit used in conjunction with series capacitors, exactly the same combination the Power Authority is suggesting we use. Ontario Hydro had used this combination because they had no alternative in bringing power from remote hydro plants. It is being proposed in our case because it is perceived as a cheap fix. Personally, I doubt that it is a fix or that in the long run that it will be cheap.

If one examines the alleged benefits from the new transmission line one does not find any benefits due to not having to rebuild the old transmission line. I have been told that it is because they expect the utilities to rebuild the old line in any case. To test this hypothesis, one should imagine the case where the new line has been built and the benefits of replacing the old line are being considered. Certainly part of it would be required in any case, to get power to Girdwood and Seward. Much cheaper distribution lines could bring power to Portage and Whittier and for Sunrise and Hope a small automated diesel could be installed at an insignificant fraction of the cost of rebuilding a major transmission line segment. Now, if we accept the Power Authority's silk purse" scenario that a few high tech gadgets will transform the "sows ear" of the old line into something nearly as good as a new line let's examine what it will do for the new line and what the additional benefits of rebuilding the old line are if we have an enhanced new line. Looking at the benefits shown, the major ones are for reduced transmission losses, increased economy energy, capacity sharing and reliability improvements. These constituted 92% of the benefits of building the new line. Starting with losses and assuming the 138Kv new line was in place there would be very minor loss reduction from rebuilding the old line because it is so much longer. There would be little if any reliability improvements. In fact, I believe rebuilding the old line would likely make reliability worse. On capacity sharing, the longer length of the old line makes it of marginal value and finally, it's effect on economy energy would be marginal. Therefore, at least qualitatively, using the study logic, we can see there is very little value in rebuilding the old line so under this premise it would not be done. But the study assumed it would be done so the study impeaches itself.

At this point, I want to make it clear that we have not determined that the old line should or should not be rebuilt. What we have determined is that the cost of rebuilding the old line cannot be ignored and it either must be included in the benefits of the new line or the benefit of the existing line with the high tech fixes are not as great as assumed. Thus, the benefits of a real new line are much greater than represented. I am convinced either of these resolutions to the logical fallacy will result in a benefit to cost ratio well in excess of one.

I urge you to fund the Interties so we can obtain needed transmission lines which will continue to benefit railbelt ratepayers for years to come.

ATTACHMENT E
Energy Planning in Alaska: Past Efforts and A Future Direction,
House Research Agency Report 88-B
pp 20 to 28

Statewide Overview Approach

The statewide overview focuses on a comparison of utility plans with a continuously updated statewide analysis of energy supply and demand. The premise underlying this approach is that utility plans are acceptable if they do not conflict with an independent, integrated statewide overview of demand forecasts, conservation and other demand-management measures, and supply alternatives. This statewide analysis is conducted by the utility regulatory commission or state energy office. The state overview need not include a plan, but must at least provide a general assessment of opportunities for cost reductions and risk management from a statewide societal perspective as opposed to a strictly utility perspective.[26]

The states of Wisconsin, Vermont, New York, Indiana, Kentucky, and Texas have adopted a statewide approach. The need for a statewide approach is described by the Kentucky Public Service Commission as follows:

> "Kentucky's electric utilities have traditionally concerned themselves with meeting the needs of their separate service areas. But given the enormous cost of building new power plants and the uncertainties of a changing economy, the time has come to explore a more cooperative approach in which utilities work together to meet the needs of the entire state. The commission strongly believes that a statewide strategy may generate significant long-term savings for ratepayers, utility companies, and their stockholders. These savings occur through improved long-range planning and better use of the current abundance in Kentucky of electric generating capacity."[27]

Countervailing Recommendation Approach

The countervailing recommendation approach works on the theory that the utilities will present reasonable integrated resource planning options if they face the threat that the commission staff or independent parties will present credible conservation, demand management, and supply-side alternatives in rate cases and other proceedings before the commission. To reply to that threat, the utilities must develop their own credible plans. West Virginia, the District of Columbia, and Maine use aspects of this approach. In addition, the states of Nevada and Pennsylvania have used this approach when the utility planning approach has not been productive.

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[26] Ibid.

[27] Kentucky Public Service Commission, Order, Adm. Case No. 308, p. 2.