



Executive Summary

On August 22, 2003, Wyoming Governor Dave Freudenthal and Utah Governor Michael Leavitt announced the formation of the Rocky Mountain Area Transmission Study (RMATS). They did so because the electric power industry has been reluctant to invest in new transmission infrastructure due to protracted regulatory uncertainties. Without such investment, the region¹ may not be able to tap lower cost coal and wind generation for Rocky Mountain load growth, or to export generation to other parts of the Western Interconnection. Making greater use of the region's coal and wind resources can lower power costs to consumers and reduce the volatility of electricity prices.

The Governors created a charter that established the guiding principles for the RMATS effort, which are:

- Include all interested stakeholder individuals and groups;
- Work together for effective solutions in a balanced, open and inclusive public process;
- Conduct analysis of generation and transmission alternatives based on data, assumptions, and scenarios developed by participating stakeholders;
- Consider every need, generation technology and location option that is appropriate for the region;
- Evaluate all potential transmission alternatives within the region;
- Identify the costs and benefits of generation and transmission options for serving the electricity needs of consumers that make operational, economic, and environmental sense for the region; and,
- Cooperate and coordinate with the west-wide Seams Steering Group-Western Interconnection (SSG-WI) planning effort and other sub-regional planning efforts and with WECC in order to ensure maintaining or improving system reliability.

The RMATS footprint covers the States of Colorado, Idaho, Montana, Utah and Wyoming.

In the first phase of the RMATS process, stakeholders joined in work groups on load forecasting, resource additions, and transmission additions which developed assumptions that were input into a production cost model to examine the value of potential transmission expansion under different generation scenarios. The information used in the modeling effort is publicly available. A steering committee guided the integration of the activities of the work groups and the RMATS modeling team to: (1) evaluate the overall economics of transmission expansion under four generation scenarios; and, (2) identify transmission projects that may be economic and feasible because of the savings they provide Rocky Mountain region and elsewhere in the West. The analysis tested the sensitivity of the results under a variety of assumptions, such as high and low hydroelectric generation, high and low natural gas prices, significant improvements in energy efficiency, and potential imposition of constraints on carbon dioxide emissions.

¹ In this Report the term "region" will refer to the Rocky Mountain area of the states of Idaho, Montana, Wyoming, Utah and Colorado except where there are references to the Seams Steering Group-Western Interconnection (SSG-WI) planning effort where the Rocky Mountain area will be referred to as a sub-region.

The most feasible transmission additions are recommended to proceed to Phase II. The purpose of Phase II is to conduct transmission technical studies, address siting and cost assignment and recovery issues, identify project sponsors, and arrange project financing. To jumpstart Phase II work, RMATS formed a cost allocation and cost recovery team to begin identifying promising approaches to financing the recommended transmission additions. The team also recommended process improvements that would (1) make it more likely that economic transmission expansion projects would be implemented; and, (2) set the stage for continuing improvements in transmission planning.

Because of the potential for significant new wind generation in the Rocky Mountain region in the near term and the unique characteristics of wind development and operation, RMATS also formed a work group to explore ways in which the existing transmission system could be used more efficiently to enable the development of additional wind generation. The work group found, after comparing wind output and existing flow data on three specific transmission paths in the region, that there is substantial physical capacity available at most times of the year that current operational practices and tariff requirements do not make available to wind on a long-term basis. Additional study work will be required to take into account the scheduled use of the transmission system as well as the actual power flows. There is potential for wind to make better use of the existing system through innovative tariff products. A “conditional firm” product would offer firm service except for certain defined periods, and a long term “priority non-firm” product would offer a high priority non-firm service on a long-term contractual basis. Other resources may find this product attractive also.

Contractual, tariff and operating practices limit the use of existing transmission assets. Such institutional impediments also limit transmission access and raise the cost of operating and expanding the grid. Removing or reducing these impediments would enable the existing system to be used more fully and optimally, and potentially allow some capital investment in grid expansion to be deferred. The RMATS simulation includes the benefits of a regionally operated system that avoids rate pancaking, consolidates control areas, and removes other institutional impediments to fuller use of the existing system.

Recommended Projects

The RMATS process identified two projects that are needed to serve load in the near-term, involve limited investment and provide significant benefits:

- A transformer replacement at Flaming Gorge to increase transfer capacity on existing lines in southwest Wyoming and northeast Utah; and
- A phase shifter on the line between Montana and Idaho to increase the control of actual flow and usability of the path from Montana.

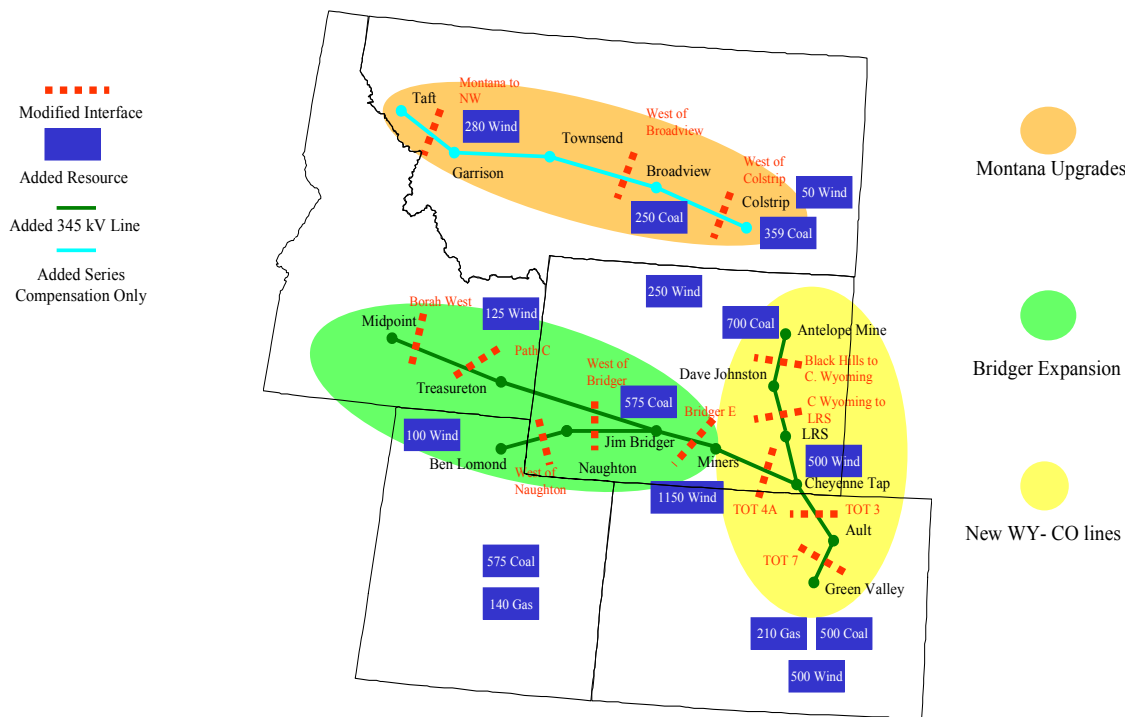
The Western Area Power Administration will replace the transformers at Flaming Gorge in 2006; and Northwestern Energy, Idaho Power Company and PacifiCorp are examining the addition of the phase shifter.

Recommendation 1: Expansion Projects within the Rocky Mountain Footprint

RMATS identified projects that would provide significant economic benefit over the longer term. There are three discreet transmission projects within the RMATS footprint included in Recommendation 1, and several options in Recommendation 2 for longer-term development. Figure E-1 shows the three discrete projects included in Recommendation 1: Montana Upgrades

(tan oval), Bridger Expansion (green oval), and Wyoming to Colorado Project (yellow oval). The capital cost for these three transmission expansion projects is estimated to be \$970 million. An economic comparison of Recommendation 1 with the two Reference Cases indicates these three transmission expansion projects are cost justified and capable of producing annual net savings of \$61 million to \$531 million per year. While each project is discrete, the three projects together provide the greatest benefit to the region.

Figure E- 1: Recommendation 1 Projects



Recommendation 1 is predicated on the new wind capacity and coal-fired generation additions shown on the map. The new capacity will meet expected load growth in the Rocky Mountain region for the 2013 timeframe.

Montana System Upgrade Project

This project upgrades the existing Montana 500 kV transmission system to enable exports from the Rocky Mountain region to the Pacific Northwest and does not require new transmission lines. By installing series compensation in the 500 kV lines from Colstrip to Taft, adding a 500/230 kV autotransformer at Colstrip, and adding two new substations on the 500 kV transmission system near Ringling and Missoula, transfer capacity can be increased by an estimated 500 MW. The capital cost for the Montana System Upgrade project is estimated to be \$72 million. The resource additions assumed include 330 MW of nameplate capacity wind generation and 609 MW of coal-fired generation in Montana.

The Montana System Upgrade is expected to have limited siting requirements. All the impacts are local in nature and a new transmission corridor is not required. The additions at the Colstrip and Broadview buses constitute upgrades to existing substation sites and will have little if any

environmental impact. The new substation sites will have minimal siting requirements. Acquisition of sufficient land for the substations may be the most serious issue. Local opposition may be reduced if future ties to the lower voltage systems at these two locations reduce the requirements for new transmission in these areas as loads grow.

Bridger Expansion Project

Expansion of the Bridger 345 kV transmission system involves the addition of 345 kV transmission facilities from Miners to Bridger in Wyoming and from Bridger to Ben Lomond in Utah and to Midpoint in Idaho. These additions would increase transfer capacity by an estimated 1,350 MW. Resource additions are assumed to include 1,375 MW of wind and 575 MW of coal-fired generation in southwest Wyoming and southern Idaho. The capital cost of the Bridger Expansion project is estimated to be \$580 million.

A new transmission corridor may be required between Naughton and northern Utah, and a new transmission corridor will be required between Bridger and Midpoint (potentially traversing an environmentally sensitive area north of Bear Lake in southern Idaho). New substation sites could have siting requirements. Siting issues may be reduced through use of existing lower voltage transmission corridors.

Wyoming to Colorado Transmission Project

This project involves the addition of a 345 kV line from northeastern Wyoming across the constrained path between Wyoming and Colorado to Denver. The new line is estimated to increase capacity by 500 MW. The addition of series compensation to this new line (and potentially other lines) is estimated to increase capacity by an additional 250 MW. Assumed resource additions are 500 MW of wind capacity and 700 MW of coal-fired generation capacity. The capital requirements for the Wyoming to Colorado project are an estimated \$318 million.

The new 345 kV line would have substation interconnections in Wyoming potentially in the Dave Johnston, Laramie River Station and Cheyenne areas. It would also require an interconnection in northern Colorado, perhaps at the Ault substation, with a final destination near the Green Valley substation northeast of Denver. Congestion resulting from the generation additions would be reduced from an estimated high of 73 percent to below 30 percent with these line additions. Substantial siting work is expected. Siting issues may be reduced through use of existing lower voltage transmission corridors.

Recommendation 2: Export Projects beyond the Rocky Mountain Footprint

In addition to the projects in Recommendation 1, RMATS recommends transmission expansions that extend beyond the Rocky Mountain States to enable exports of generation. This is a longer-term export proposal that: (1) includes the generation assumed for the projects in Recommendation 1; (2) assumes construction of an additional 3,900 MW of coal generation and remote wind generation; and, (3) builds two export paths to the West Coast, Nevada and Arizona markets. The viability of Recommendation 2 depends on the fuel preferences of load-serving entities outside the Rocky Mountain region.

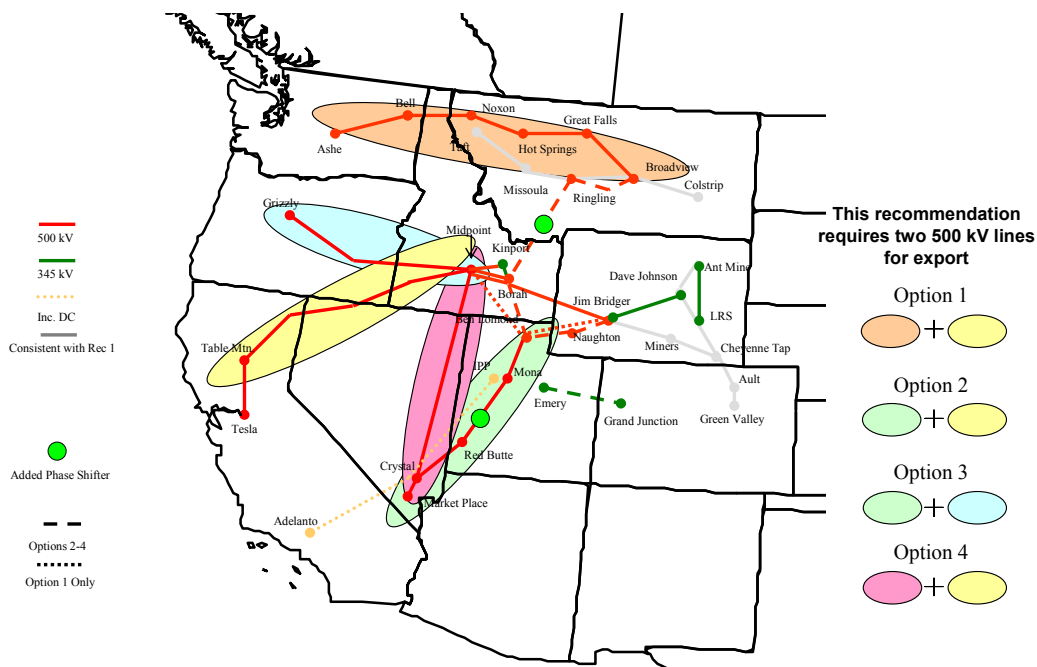
Recommendation 2 includes two of five optional 500 kV paths shown in the colored ovals in Figure E-2. Additional transmission upgrades in the Rocky Mountain region are also part of

Recommendation 2, including:

- Upgrading the Bridger Expansion project from 345 kV to 500 kV west of Bridger. Specifically, new 500 kV lines would be added between Bridger and Ben Lomond, Ben Lomond and Midpoint, Ben Lomond and Kinport, Borah and Midpoint, Borah and Ringling (including a phase shifter), and Ringling and Broadview;
- In lieu of a line from Broadview to Ringling to Borah, a 500 kV line from Broadview to Hot Springs may be considered; and,
- Adding new 345 kV lines between Grand Junction and Emery, Antelope and Laramie River Station, and Dave Johnson to Bridger.

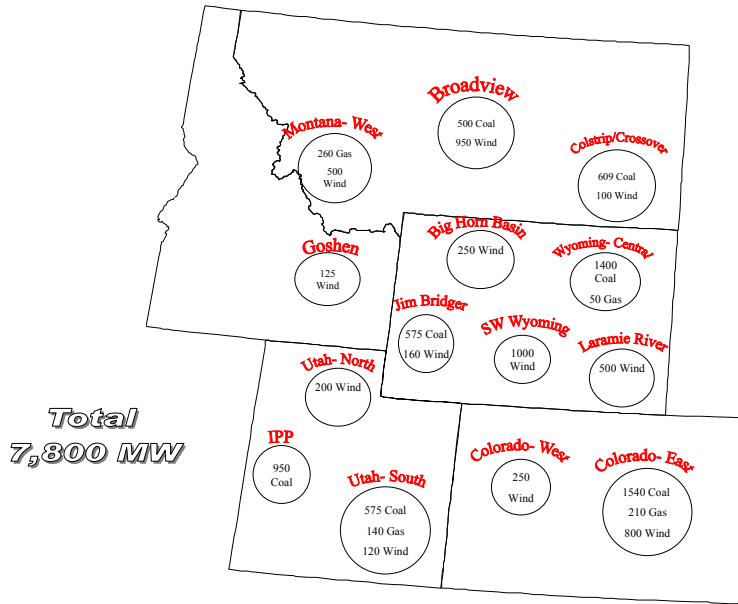
In addition, the existing IPP-Adelanto DC line would be upgraded. The capital cost for the Recommendation 2 transmission expansion is estimated to be \$4,265 million.

Figure E- 2: Transmission Expansion Extending Beyond the Rocky Mountain Region



The economic analysis for these transmission export options was based on the assumed generation additions shown in Figure E-3.

Figure E- 3: Generation Additions Assumed in Recommendation 2



Economic Analysis of Recommendations

To determine the benefits from transmission expansion, annual electricity production costs were simulated using the generation additions outlined above. The production costs were then added to the annualized capital and other fixed costs for the resource and transmission additions. These project cost totals were then compared with the project cost totals from two reference cases, an “all gas” case and an “IRP case”². Table E-1 summarizes the annual savings from Recommendations 1 and 2 compared with the two reference cases.

Table E- 1: Annual Savings Compared to Reference Cases
(Savings West-wide for Representative Year, Millions of Dollars)

	Reference Case	
	All-Gas Case	IRP-Based Case
Recommendation 1	(531)	(61)
Recommendation 2	(986)	(516)

These estimated economic benefits are based on critical assumptions, including the future price of natural gas and hydroelectric conditions. These benefits assumed a 2013 gas price of \$6.50/MMBtu (\$5.20 in 2004 dollars). If natural gas prices drop and remain at \$4.50 (\$3.60 in 2004 dollars) over the long term, then the economic benefits of the Recommendations would be largely eliminated. However, if one assumes \$6.50 gas prices and low hydro conditions over time, then the annual

² The All-Gas Reference Case assumes all load growth in the Western Interconnection is met by gas-fired generation. The IRP-based Reference (integrated resource plan) Case is grounded in the resource plans of PacifiCorp, Idaho Power and Xcel Energy and assumes all new generation outside the RMATS footprint is gas-fired.

production cost savings and the net benefit from constructing the projects in Recommendations 1 and 2 are significantly higher than shown in the table. Equally important, but not evaluated in the modeling, are the natural gas price hedging benefits of increasing access to coal and wind resources, through new transmissions. Strategies to hedge against volatile natural gas prices are important to provide greater stability in electricity prices.

Analyses were also performed to test the sensitivity of the findings to increased energy efficiency and potential constraints on carbon emissions. Increased energy efficiency could reduce or eliminate the need for new generation and transmission to meet load growth within the Rocky Mountain region. However, in that event, the transmission expansions in the Recommendation 2 would enable exports that reduce costs outside the Rocky Mountain region. A carbon adder of \$15 per ton would not affect the dispatch of power plants that have been constructed by the time the adder is imposed. However, such a carbon constraint would affect the choice of new generation, an issue addressed in utility resource plans and not in this report.

Understanding where economic benefits will fall helps to identify likely project participants. The distribution of economic benefits from the projects in Recommendations 1 and 2 can be inferred from the modeling data, but not precisely calculated because the model diverges from current conditions by assuming perfect competition and locational marginal pricing. Figures E-4 and E-5 show the estimated distribution of annual economic gains based on fuel and other variables from Recommendations 1 and 2.

*Figure E- 4: Economic Benefits and Losses
(Annual Benefits in Millions of Dollars)
Recommendation 1 Compared to Reference Cases*

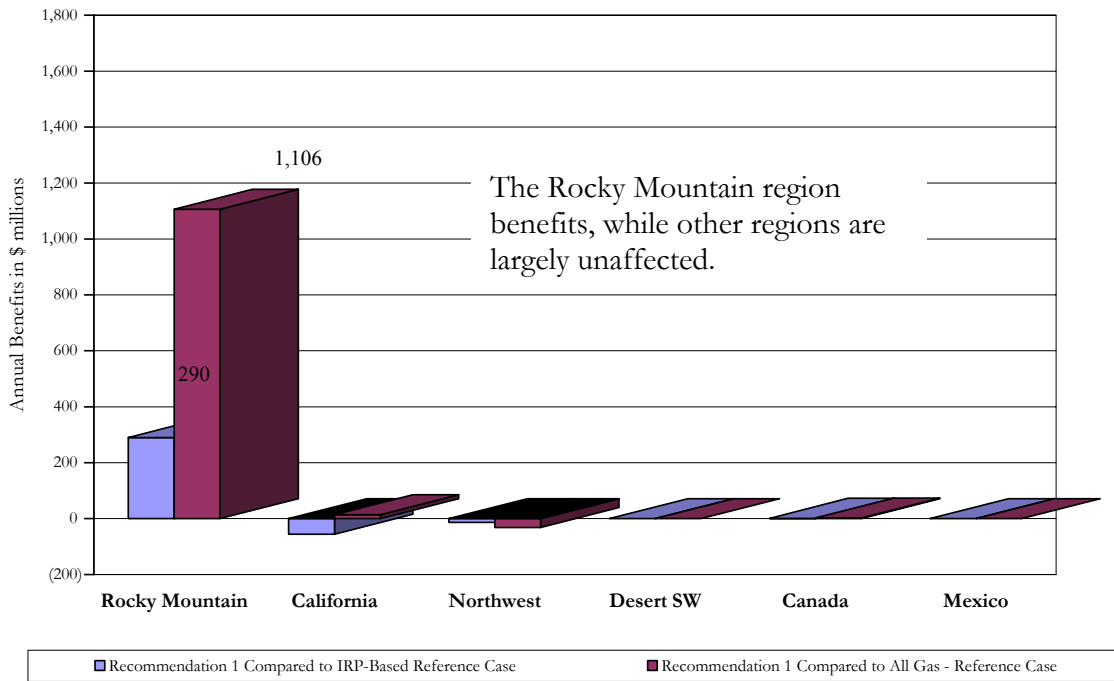
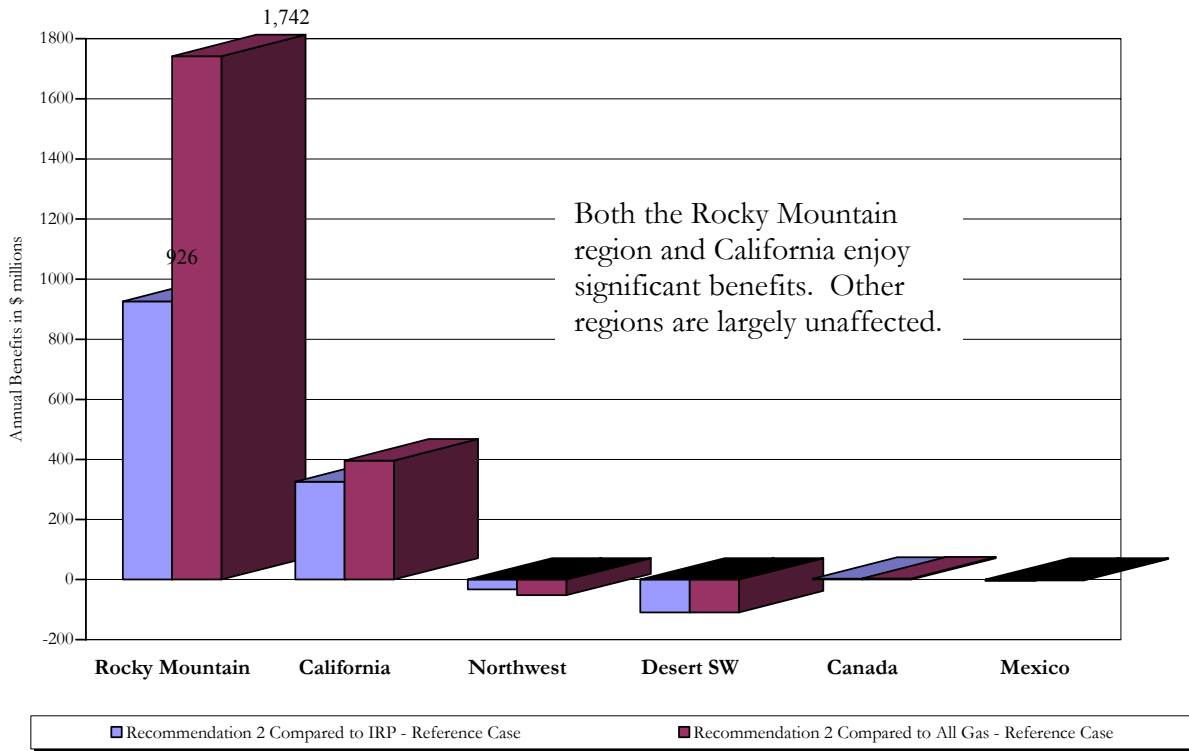


Figure E- 5: Economic Benefits and Losses
 (Annual Benefits in Millions of Dollars)
 Recommendation 2 Compared to Reference Cases



The distribution of economic gains associated with the three projects in Recommendation 1 fall predominantly within the Rocky Mountain region. This makes a compelling case for project beneficiaries to undertake needed technical studies and for entities in the Rocky Mountain region to work together to develop a cost allocation and cost recovery solution to capture this benefit.

Recommendation 2 entails exports from the Rocky Mountain region that would help the West diversify fuels and reduce opportunities to exercise market power by allowing new generators to develop projects that compete with incumbents.

With Recommendation 2, the annual consumer and generator benefits for the Rocky Mountain region increases to between \$926 million to \$1.7 billion. California consumers also stand to benefit from Recommendation 2, by \$325 million to nearly \$400 million annually. These results suggest that RMATS Phase II should coordinate work on Recommendation 2 with California’s transmission planning institutions.

Next Steps

As an initial step under Phase II, RMATS recommends, for each of the recommended transmission expansion projects, that the Governors of the states where the line would be sited convene a meeting of their public utility commissioners and the CEOs of entities that would benefit for the purpose of: (1) presenting the RMATS findings; (2) urging the beneficiaries to sponsor the projects;

(3) setting in place a process to address siting and cost allocation and recovery issues, (4) assessing financing issues; and, (5) initiating technical studies. The Governors should also consider inviting Governors and public utility commissioners from states outside the geographic scope of the transmission projects that would also benefit.

- For the Montana System Upgrade Project, RMATS recommends that the Governor of Montana convene a meeting of the CEOs of Northwestern Energy, the Bonneville Power Administration, the Montana Public Service Commission, coal and wind power plant developers in Montana, merchant transmission developers, and other potential project sponsors and participants.
- For the Bridger Expansion Project, RMATS recommends that the Governors of Idaho, Utah and Wyoming convene a meeting of the CEOs of Idaho Power, PacifiCorp, the Utah Associated Municipal Power Systems, the Utah Municipal Power Authority, the Wyoming Infrastructure Authority, coal and wind power plant developers in Wyoming, the Idaho Public Utilities Commission, the Utah Public Service Commission, the Wyoming Public Service Commission, merchant transmission developers, and other potential project sponsors and participants.
- For the Wyoming to Colorado Transmission Project, RMATS recommends that the Governors of Colorado and Wyoming convene a meeting of the CEOs of Xcel Energy, PacifiCorp, Black Hills Power, Basin Electric Power Cooperative, Tri-State G&T, the Western Area Power Administration, the City of Colorado Springs, the Platte River Power Authority, the Colorado Public Utilities Commission, the Wyoming Public Service Commission, the Wyoming Infrastructure Authority, coal and wind power plant developers in Wyoming and Colorado, merchant transmission developers, and other potential project sponsors and participants.
- For the export project options included in Recommendation 2, RMATS recommends that, depending on the option under consideration, the Governors of the affected states convene a meeting of the interested utilities, regulatory agencies and others. For example, if an option enhancing exports to California were being considered, we recommend that the Governors of Utah, Idaho and California convene a meeting including PacifiCorp, the Utah Association of Municipal Power Systems, California investor-owned and municipal utilities, the California ISO, the Utah Public Service Commission and the California Public Utility Commission. The Wyoming Infrastructure Authority should also be involved in meetings associated with Recommendation 2 projects.

Following such meetings, technical studies need to be conducted to examine the impact of the recommended projects on transmission system operations.

Needed Institutional Improvements

To improve the process of evaluating and financing transmission expansion and to operate the existing transmission system more efficiently, RMATS recommends that:

- Multi-State transmission expansion pricing principles be developed;

- The Wyoming Infrastructure Authority be engaged in transmission expansion financing discussions;
- The evaluation of transmission expansion to facilitate power exports from the Rocky Mountain region be integrated with regional planning in other parts of the Western Interconnection;
- Governors and regulators consider the formulation of a Regional Transmission Organization (RTO) with features appropriate to the region, including independence and cost-effectiveness; and
- The physical transfer capacity on existing lines be better utilized by requesting that transmission owners develop conditional firm or priority non-firm transmission products that quantify curtailment risks and place curtailment priority for conditional firm ahead of any non-firm transactions and curtailment priority for priority non-firm ahead of any non-firm transactions except secondary network resource service.

Further following specific actions are recommended:

1. To address cost allocation and recovery uncertainties, RMATS recommends that the state public utility commissions and energy agencies in the five states in the RMATS footprint deliver a report to their Governors in six months discussing multi-state transmission expansion cost recovery and pricing principles.
2. RMATS recommends that the regulatory commissions in Colorado, Idaho, Montana, Utah and Wyoming enter into a memorandum of agreement adopting pricing principles, and jointly file the MOA with FERC, requesting its endorsement. These principles would then apply to any applications for transmission cost recovery received by regulatory commissions within the Rocky Mountain region, providing a degree of certainty and consistency in regulatory treatment.
3. RMATS recommends that the RMATS Steering Committee, Load Forecasting Work Group, Resource Additions Work Group, Transmission Additions Work Group, and Cost Allocation/Cost Recovery Team be maintained and be available to conduct additional work as conditions warrant. An agreement among states and the electric power industry to maintain and finance a pro-active transmission planning process in the Rocky Mountain region is needed.
4. RMATS recommends that SSG-WI use RMATS export case analyses in the development of an interconnection-wide “realistic” generation scenario that would be studied in late 2004 and early 2005.