Economic Impacts of Potential Montana Climate Change Initiatives: Evidence from MIT and Penn State Analyses

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Introduction

Montana and other western states are actively pursuing a variety of policy initiatives to address global climate change. This paper examines results from two recent studies by MIT and Penn State on the potential costs of carbon dioxide cap-and-trade and other climate policies. It concludes that a state or regional cap-and-trade policy imposed in Montana potentially could reduce annual state economic output by hundreds of millions of dollars, with more than ten thousand job losses.

Montana is a major coal producing and consuming state, with more than one-quarter of the nation's estimated recoverable coal reserves. Montana ranked 47th in GDP by state in 2006, and 46th in per capita personal income. In 2005, Montana produced 40.3 million tons of coal, 3.6% of total U.S. coal production. In 2007, coal will supply roughly two-thirds of Montana's electric generation. Montana's electric rates are currently below the U.S. average due the availability of relatively low-cost coal and hydroelectric generation. In August 2007, Montana's residential customers paid 9.1 cents per kWh, compared to the national average rate of 11 cents/kWh.

Executive Summary

A state or regional greenhouse gas control program could harm the competitiveness of Montana's industrial base by raising energy costs above those of competing states, and penalizing new clean energy development. Economic research indicates that Montana's economy would suffer as a consequence of higher prices for energy and other consumer goods, and reduced employment and economic growth. Most of these impacts would result from the reduced utilization of coal for electric generation.

This paper uses two recent studies of the economic impacts of greenhouse gas controls – one prepared by MIT[1] and one by Penn State

[1] S. Paltsev *et al.*, "Assessment of U.S. Cap-and-Trade Proposals," (MIT Joint Program on the Science and Policy of Global Change, Report No. 146, April 2007). Available on the web at: web.mit.edu/globalchange/www/MITJPSPGC_Rpt146.pdf

University[2] – to estimate the economic impacts on the Montana economy of potential greenhouse gas control policies.

These two studies used different approaches to estimate the costs of climate change initiatives. Penn State used an input-output model to measure the direct and indirect impacts on individual state economies of reducing coal use – a principal means to achieve near-term reductions of carbon dioxide emissions. Penn State took into account the positive offsetting employment and output benefits of investments in alternative energy supplies such as renewables and natural gas.

The April 2007 MIT analysis employed a general equilibrium model of the U.S. economy to estimate the costs of achieving economy-wide greenhouse gas reductions based on several climate bills before the U.S. Congress. The emission reduction targets MIT analyzed include proposals similar to those under consideration by various western states.

Penn State found that states such as Montana that rely on coal for a substantial portion of electric generation, and that also produce major quantities of coal, obtain significant benefits from the availability of low-cost and reliable electricity. In 2015, coal mining and coal-based electric generation are projected to account for $4.5 billion of Montana's economic output, while creating $1.4 billion in personal income and adding 44,000 direct and indirect jobs.

Penn State's findings for the net economic impacts of reducing the use of coal for electric generation in Montana by -33% and -66% in 2015 are summarized below. A 33% displacement of coal generation could be expected with an aggressive emission reduction target taking effect after 2015, due to the likelihood that generators would reduce CO2 emissions early in order to "bank" reductions for use in later years. The Penn State estimates shown here are based on the average of alternative low and high-energy price projections.

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[2] Adam Z. Rose, Ph.D. and Dan Wei, "The Economic Impacts of Coal Utilization and Displacement in the Continental United States, 2015" (The Pennsylvania State University, July 2006.)

Potential Impacts of Electric Utility Carbon Dioxide Limitations on Montana Output, Household Income and Jobs, 2015

	-33% Coal Displacement	-66% Coal Displacement
State output ($2005 Bil.)	-$0.4	-$1.3
H'hold income ($2005 Bil.)	-$0.2	-$0.5
Jobs	-6,200	-16,600

Source: Penn State University (see fn. 2).

MIT's macroeconomic study for the U.S. economy examined the impacts of alternative climate change bills before Congress, assuming a nationwide emissions trading program. MIT's findings for Montana are summarized below, based on a conservative arithmetic average allocation of Montana's GDP as a fraction of U.S. GDP in 2005 (0.24%) and Montana's share of national coal-based electric generation through July 2007 (0.85%).

Potential Impacts on Montana GDP of Greenhouse Gas Emission Limitations Analyzed by MIT (Billions of 2005 $)

MIT Case	2015	2025	2050
1 ("Bingaman")	-$0.2	-$0.7	-$0.7
2 ("Lieberman-McCain")	-$0.5	-$0.9	-$1.2
3 ("Sanders-Boxer")	-$0.6	-$0.5	-$2.2

Source: Derived from MIT (see fn. 1).

MIT's GDP estimates cover a range of increasingly stringent greenhouse gas control proposals. The "Bingaman" case imposes a growth cap on greenhouse emissions, but does not include Bingaman's proposed emission allowance safety valve price cap. The "Lieberman-McCain" and "Sanders-Boxer" proposals each require U.S. emissions to return to 1990 levels by 2020, and then to achieve 60% and 80% reductions below 1990 levels by 2050, respectively.

The MIT and Penn State findings for the potential loss of Montana GDP are generally consistent. The lower-bound Penn State estimate of a $0.4 billion GDP loss corresponds well with MIT's $0.5 billion impact in Case 2 in 2015. Penn State's 66% displacement finding of a $1.3 billion GDP loss is consistent with MIT's Case 2 findings in later years.

The MIT and Penn State findings underscore the importance to Montana of engaging the climate change issue through national legislation, rather than state or regional policies. Montana competes both domestically and internationally, and its electric sector is a key source of low-cost energy production in the Rockies. Montana's political leaders should insist upon a level playing field for all states, in the framework of national legislation that includes significant incentives for the participation of major developing nations.

The impact of higher electric generation costs on Montana's ability to compete in interstate electric markets is a major uncertainty requiring careful evaluation by Montana policymakers. Imposing major new regulatory costs on Montana generators, such as through emission allowance auction requirements, may reduce Montana's generation and exports, likely leading to additional new rate burdens for Montana consumers. The impacts of state or regional carbon allowance auction requirements on the development of new clean power generation assets also need to be evaluated, because carbon capture and storage technologies are not likely to be commercially available in the short planning timeframe proposed by current state and regional climate initiatives. These constraints may cause a major shift away from coal toward higher-cost natural gas generation, with adverse electric rate implications for all consumers.

Penn State Research

A July 2006 study by Professor Adam Rose and Dan Wei of Penn State University, "The Economic Impacts of Coal Utilization and Displacement in the Continental United States," estimates the state-specific costs of displacing coal-based electric generation through climate change or similar state legislation. The Penn State study estimates specific economic and job impacts for Montana if state climate policies required utilities to reduce their utilization of coal in favor of renewable energy or natural gas generation.

Coal-generated electricity is among the lowest-cost power produced in Montana. In 2005, Montana produced 40.3 million tons of coal, or 3.6% of U.S. coal production. Electric utilities in Montana relied on coal to supply two-thirds of their total generation in August 2007.[3] Industrial electric rates, a critical attraction to energy-intensive manufacturing and processing industries in Montana, averaged 6.1 cents per kilowatt-hour in August 2007, or 11% below the national average rate of 6.8 cents/kwh.

Penn State found that states such as Montana that rely on coal for a substantial portion of electric generation, and that also produce major quantities of coal, obtain significant benefits from the availability of low-cost and reliable electricity. In 2015, coal generation is projected to increase Montana's economic output by $4.5 billion, while creating $1.4 billion in personal income and adding 44,000 direct and indirect jobs.

Penn State simulated cases where alternative energy supplies (including natural gas, nuclear, and a 10 percent mix of renewables) displace coal-based electricity generation at levels of 66 percent and 33 percent. The two displacement scenarios were calculated using low, high, and average projections for the costs of alternative energy supplies. These levels of coal displacement could be anticipated if Montana adopted carbon dioxide restrictions, such as a cap-and-trade program, on Montana electric utilities. The findings take into account the positive offsetting benefits of alternative investments in natural gas and renewable energy sources, such as wind and biomass.

The following table estimates the economic and job impacts of reducing Montana's coal-based electric generation by 33% and 66% by the year 2015. These estimates are based on the average of Penn State's results for its low and high energy price scenarios.

[3] Energy Information Administration, State Energy Profile – Montana (November 2007).

Potential Impacts of Electric Utility Carbon Dioxide Limitations on Montana Output, Household Income and Jobs, 2015

	-33% Coal Displacement	-66% Coal Displacement
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The magnitude of these estimates reflects the importance of coal-based generation to Montana's economy. Some $1.3 billion of annual state economic output could be lost as a consequence of shifting two-thirds of coal-based generation to higher-cost forms of electric generation. Household income loss estimates for the two displacement scenarios range from $0.2 billion to $0.5 billion, with potential direct and indirect employment losses ranging from 6,200 to 16,600 jobs.

The key alternative energy price variable underlying Penn State's calculations is the price of natural gas used in lieu of coal. Penn State used low and high estimates for the price of natural gas. In the 33% displacement scenario, Penn State assumed that the delivered price of natural gas in 2015 would range from $5 per mcf (low case) to $9 per mcf (high case). In the 66% displacement case, natural gas prices were projected to range from $6 to $10 per mcf. The current wellhead price of natural gas is nearly $8 per mcf. Penn State's estimates, using an average of the low and high energy price cases, are likely conservative.

MIT's 2007 Cap-and-Trade Analysis

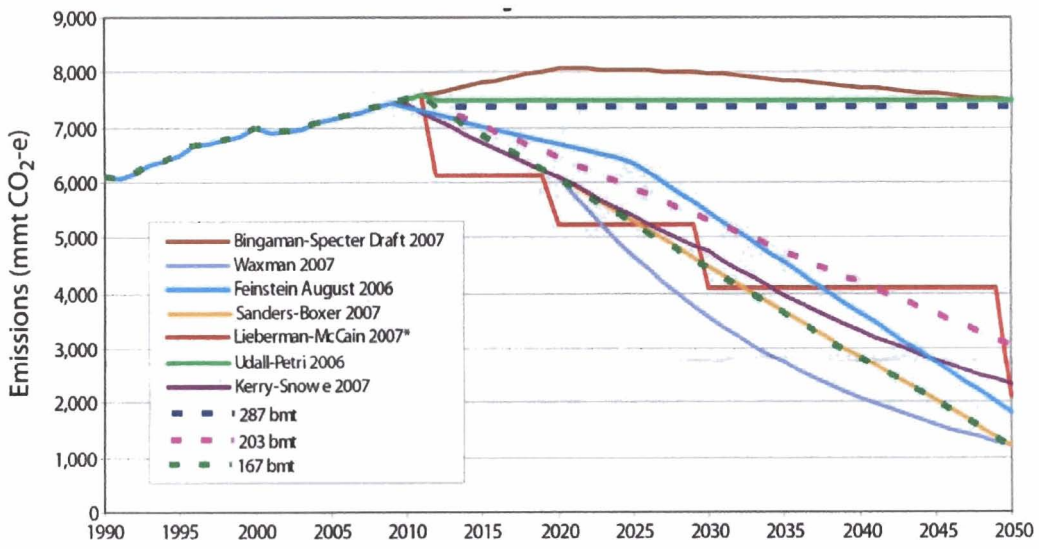
An April 2007 report from the MIT Joint Program on the Science and Policy of Global Change analyzes the economic impacts of all major greenhouse gas cap-and-trade bills before the U.S. Congress. The MIT study groups these bills into three cases, based on the cumulative number of carbon dioxide-equivalent (CO2e) emission allowances issued from 2010 to 2050. An emission allowance confers the right to emit one ton of CO2. The

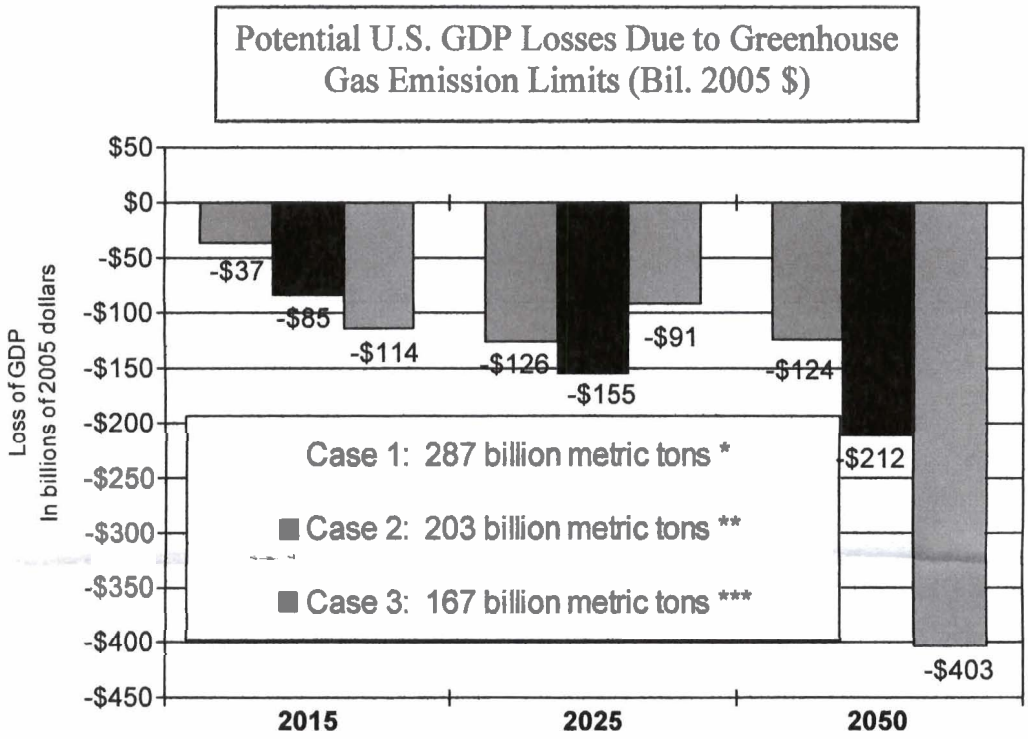
cumulative emissions allowed by MIT's three cases are 167, 203 and 287 billion metric tons.

The MIT report offers the first systematic evaluation of the potential effects of alternative cap-and-trade programs on the U.S. economy. Using a general equilibrium model, it finds that bills such as those introduced by Senators Sanders and Boxer (equivalent to Case 3, 167 billion tons of CO2) and Lieberman-McCain (equivalent to Case 2, 203 billion tons of CO2) would inflict substantial harm on U.S. GDP and would cause sharp energy price increases across the economy. For example, MIT found that the Boxer bill and similar measures would increase the price of gasoline at the pump by $2 per gallon by 2050.

The national carbon dioxide emission paths of MIT's three cases are shown in dashed lines on the chart below, along with several proposed Congressional climate change bills. The second chart displays the estimated GDP reductions associated with each of the three MIT cases.

MIT CO2 Emission Paths, 2005-2050





*Similar to Bingaman January 2007 proposal (w/o safety valve price cap).
** Similar to Lieberman-McCain bill and to Gov. Blagojevich's proposal.
*** Similar to Sanders-Boxer bill.

In 2005, Montana's Gross Domestic Product was $30 billion, or 0.24% of our national GDP of $12.4 trillion.[4] The state's share of U.S. coal-based electric generation – the sector most affected by carbon cap-and-trade proposals – was 0.85% through July 2007. Assuming an arithmetic average of these values for allocating MIT's national results, the following potential impacts on the Montana economy can be inferred:

Potential Impacts on Montana GDP of Greenhouse Gas Emission Limitations Analyzed by MIT (Billions of 2005 $)

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Source: Derived from MIT (see fn. 1).

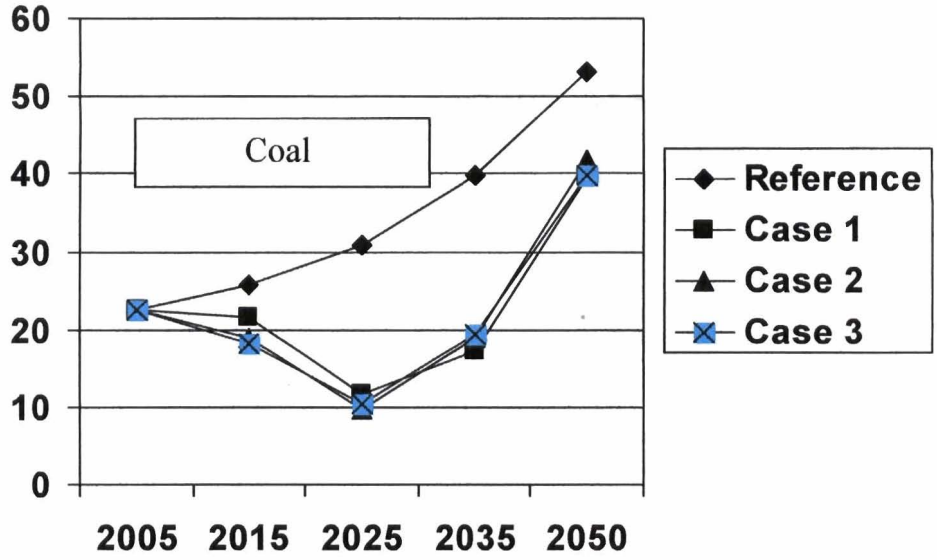
[4] U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product by State 2005 (May 2007).

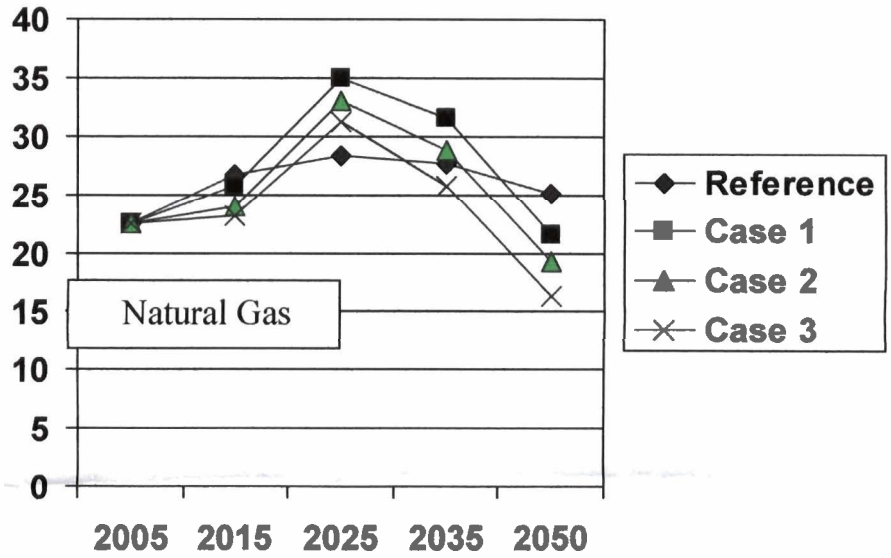
MIT's Case 2 GDP impact estimates, incorporating a national emissions trading program, are generally consistent with Penn State's findings for the 33% coal displacement scenario in 2015, and with the 66% coal displacement scenario in the later projection periods.

In MIT's analysis, significant coal displacements occur in the 2020-2030 timeframe, before carbon capture and sequestration (CCS) technologies are assumed to be deployed on a wide scale. In all three of the carbon cap-and-trade cases, as shown by the charts below, coal utilization declines by more than 50% from 2005 to 2025, and then recovers by 2050 due to the availability of CCS technologies. Initially, natural gas provides most of the alternative energy to replace coal. Later, as both oil and gas supplies dwindle and prices rise dramatically, biomass liquids replace large quantities of natural gas and petroleum.

MIT's energy utilization findings show that the timing of initial emission reductions is the critical factor for maintaining coal use until CCS technologies are available. Short-term targets, such as reducing to 1990 levels by 2020, adversely impact coal use because there are no effective control technologies capable of major emission reductions other than fuel substitution. Energy efficiency and conservation programs, while capable of reducing electric demand, are not sufficiently reliable to support compliance with legally binding emission caps.

U.S. Coal and Natural Gas Utilization, MIT Reference Case and Alternative CO2 Caps, 2005-2050 (In Exajoules/Quadrillion BTUs)





Source: MIT, Appendix C.

Discussion

The Penn State and MIT studies underscore the importance to Montana of engaging the climate change issue through national legislation, rather than stand-alone state or regional policies. Montana's goods compete both domestically and internationally, and its electric sector is a key source of low-cost energy production in the Rockies. Montana's political leaders should insist upon a level playing field for all states, in the framework of national legislation that includes significant incentives for the participation of major developing nations. Participation by India, China and other major developing nations would reduce world energy prices due to reduced oil demand. It also would open up additional low-cost markets for emissions offsets, reducing the costs of U.S. compliance.

The impact of higher electric generation costs on Montana's ability to compete in interstate electric markets is a major uncertainty requiring careful evaluation by Montana policymakers. Imposing major new regulatory costs on Montana generators, such as through emission allowance auction requirements, may reduce Montana's generation and exports, likely leading to additional new rate burdens for Montana consumers.

The impacts of state or regional carbon allowance auction requirements on the development of new clean power generation assets also need to be evaluated, because carbon capture and storage technologies are not likely to be commercially available in the short planning timeframe imposed by current state and regional climate initiatives. These constraints may cause a major shift away from coal toward higher-cost natural gas generation, with adverse electric rate implications for all consumers.