

# State Fiscal Implications of Climate Change Legislation to Energy-Dependent States

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## Introduction

In the current political climate federal greenhouse gas legislation has become less likely. However, if scientists are correct the issue will not fade, so some regulatory policy will likely be implemented eventually. States like Wyoming that provide energy for the national economy are particularly concerned about impacts of such regulation. This analysis evaluates Wyoming's State Government Revenue stream if greenhouse gas (GHG) legislation is passed in Congress. Wyoming is among a small group of states whose economies are highly dependent upon supplying energy to the rest of the nation: Montana, Colorado, New Mexico, North Dakota, Kansas, Oklahoma, and Texas. Energy and GHG policy can have a significant impact on the regional economy and on the provision of state and local government services. This study seeks to explore how such legislation may affect Wyoming.

The drive for "energy independence" coupled with a growing demand for reduced GHG emissions has placed the significant energy resources of Wyoming at the forefront of domestic energy policy. Wyoming contains substantial reserves of fossil fuels, including oil, natural gas, and coal, as well as significant renewable energy resources, particularly wind. The state is the nation's leading coal producer, fifth in natural gas production, and seventh in oil production. Wyoming also ranks eighth in available wind energy resource and, as of the end of 2009, is ranked 13th in total wind energy production (DOE EIA, 2009b).

In 2009, Wyoming state and local governments received \$3.571 billion of direct tax revenue from the mining sector, which is comprised mostly of fossil fuel production, 98.2 percent of total mining related revenue (State of Wyoming DAI, 2009). These generate significant impacts in a state of just over 500,000 residents.

The economic benefits to Wyoming from fossil fuel extraction are not without environmental costs, including GHG's. Although Wyoming's individual contribution to global warming is small, the aggregate use of fossil fuels is a primary driver of climate change (UN IPCC, 2007a). The impacts to the environment serve as the impetus to act to stabilize Earth's climate. This requires the reduction of GHG emissions and eventual large-scale carbon sequestration schemes (IPCC, 2007c).

The federal government is engaged in an evolving consideration of limiting the emissions of GHGs. In 2007, the U.S. Supreme Court ruled that the Environmental Protection Agency had the statutory authority to regulate GHG emissions, as the court determined that emissions could lead to detrimental effects on health and welfare. The type and scale of federal regulation ultimately lies with Congress. Legislation considered by Congress, such as the Lieberman-Warner Climate Security Act of 2008 (S.2191) and the McCain-Lieberman Climate Stewardship Act of 2003 (S.139), provided restrictions on the emission of GHGs. Paltsev et. al. (2007) provides a detailed analysis of seven cap-and-trade plans proposed in the U.S. Congress as of early 2007 using a computable general equilibrium model of the world economy incorporating EPA data on GHG emissions. Economic welfare losses range from 0.06 to 0.55 percent by 2020 with CO<sub>2</sub> prices varying \$7-53/ton. By 2050, escalators in the proposed laws could increase carbon prices to \$39-210/ton. At ~\$27/ton CO<sub>2</sub> equivalent, the authors estimate that the added cost to coal will be 207 percent, natural gas will be 28 percent, and oil will be 30 percent based upon base price averages from 2002-2006. Coal prices are predicted to increase from 2030-2050 due to the rise of carbon capture and storage (CCS) technologies. Oil prices are predicted to increase nearly 50 percent, and gas prices double. Electricity prices are expected to increase over 50% in the face of GHG regulation, as consumers substitute lower carbon intensity electricity for fossil fuels. According to the author, energy consumption is reduced at all levels of GHG regulation as compared to the reference case through 2030. Coal consumption decreases markedly, with natural gas filling the majority of the void. The quantity of oil is not as sensitive to less stringent GHG regulations. Renewable energy grows in all scenarios, although growth is the fastest with a

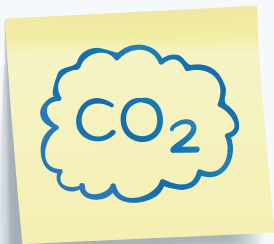
greater price of GHG emissions.

In a similar study the economic impacts of the proposed Lieberman-Warner Climate Security Act of 2007 (S.2191) (EIA, 2008a) were analyzed. The cap-and-trade proposal would commence in 2012 with a cap 7 percent below 2006 levels and progress to 39 percent below 2006 levels in 2030. The Reference case represents energy growth with no GHG emissions regulation. The "Core" Case "represents an environment where key low-emissions technologies, including nuclear, fossil with carbon capture and sequestration (CCS), and various renewables, are developed and deployed in a timeframe consistent with the emissions reduction requirements without encountering any major obstacles, even with rapidly growing use on a very large scale, and the use of offsets, both domestic and international, is not significantly limited by cost or regulation". The rate of growth of energy use is expected to decline under the Lieberman-Warner legislation, especially coal, as much as 4.6 quadrillion Btu. The escalating price of GHG emissions reduces coal further over time. Liquid fuel consumption is universally reduced, although the impact is limited. Natural gas is not impacted as significantly as coal because of the lower carbon intensity. Renewable energy benefits over the reference case in all GHG regulation cases.

The EIA forecasts strong growth in renewable energy, but also sees growth for the coal, oil, and natural gas industries through 2030. The manner in which fossil fuels are utilized is forecasted to change with carbon regulation, but overall consumption is predicted to increase. Demand for Powder River Basin Coal is expected to grow through 2030, as is demand for Western natural gas production. Overall, the EIA forecasts strong demand for Wyoming's energy production through 2030.

The existing literature contains little information regarding the ramifications of federal climate change legislation on energy-dependent states. The complex regulation-driven interaction between different fossil fuels and renewable energy, particularly wind energy, can have profound impacts on the fiscal well-being of energy producing states. Ford (2008) explored the impacts of an explicit price for GHG emissions in the western electricity system. The author simulates the impact of the adoption of Senate Bill 139 (McCain-Lieberman Bill) with a base price of \$22/ton of CO<sub>2</sub>-e (CO<sub>2</sub> equivalent) in 2010 and escalating to \$60/ton in 2025. Using a simulation model, Ford determined that the source of electricity in the Western Electricity Co-ordination Council (WECC), which includes Wyoming, would move away from coal towards renewables, primar-

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ily wind, and combined cycle gas turbines.

The model used in this study simulates market responses within a system dynamics state tax revenue framework (Geiger et al., 2010). Two scenarios are considered: The reference scenario where no Federal action occurs, and a scenario modeling the Lieberman-Warner (S.2191) bill. The Reference Scenario considers production, prices, and tax revenue at \$0/ton CO<sub>2</sub>-e. In the GHG Policy Scenario a carbon tax is applied to all fossil fuels based upon the fuels carbon intensity. Both production and real prices increase in the Reference Scenario through 2030, tax revenue is also predicted to increase to nearly \$6 billion annually.

In the Reference Scenario both natural gas and oil revenues experience the greatest expansion (Figure 1). Coal revenues increase more gradually, and wind energy revenues remain small (undetectable at the scale of Figure 1). With no federal action regarding climate change, Wyoming's real energy derived tax revenues are expected to increase 78 percent from 2007-2030. Total tax revenue from energy over the time period is over \$107 billion. Natural gas provides 53 percent of total revenue over the time period and wind provides 0.31 percent of revenue.

Following the steep decline through 2010 with the current recession, tax revenues are expected to grow steadily, which concurs with independent

forecasts (CREG, 2009). If EIA forecasts of price and production are assumed, the only source of error is the proportion of national/regional production provided by Wyoming. As previously discussed, the proportion of production is held constant at 2007 levels; this may not accurately reflect future production in Wyoming. For example, with heightened interest in Wyoming's wind resource, limited current development, and new interstate transmission infrastructure, wind energy in Wyoming may experience more rapid growth than the country as a whole. Therefore, wind energy may be underreported in the model. Wyoming's oil industry has generally been in decline since the 1970's, although enhanced oil recovery has recently led to a slight increase. Therefore, oil production and revenues could be overstated.

### GHG Policy Scenario

The GHG Policy scenario is based upon the Lieberman-Warner proposal in Congress, which was the leading proposed legislation. An explicit price for GHG emissions commences in 2012 at \$10/ton CO<sub>2</sub>-e. From 2012 to 2020, the price increases incrementally at a constant rate to \$30/ton. From 2021 to 2030, prices increase evenly to \$61/ton. This scenario receives the most analysis, due to the likelihood of GHG emissions regulation taking a form similar to this legislation.

The level of production, and total tax revenue are presented in Figures 2 and 3 and as expected,

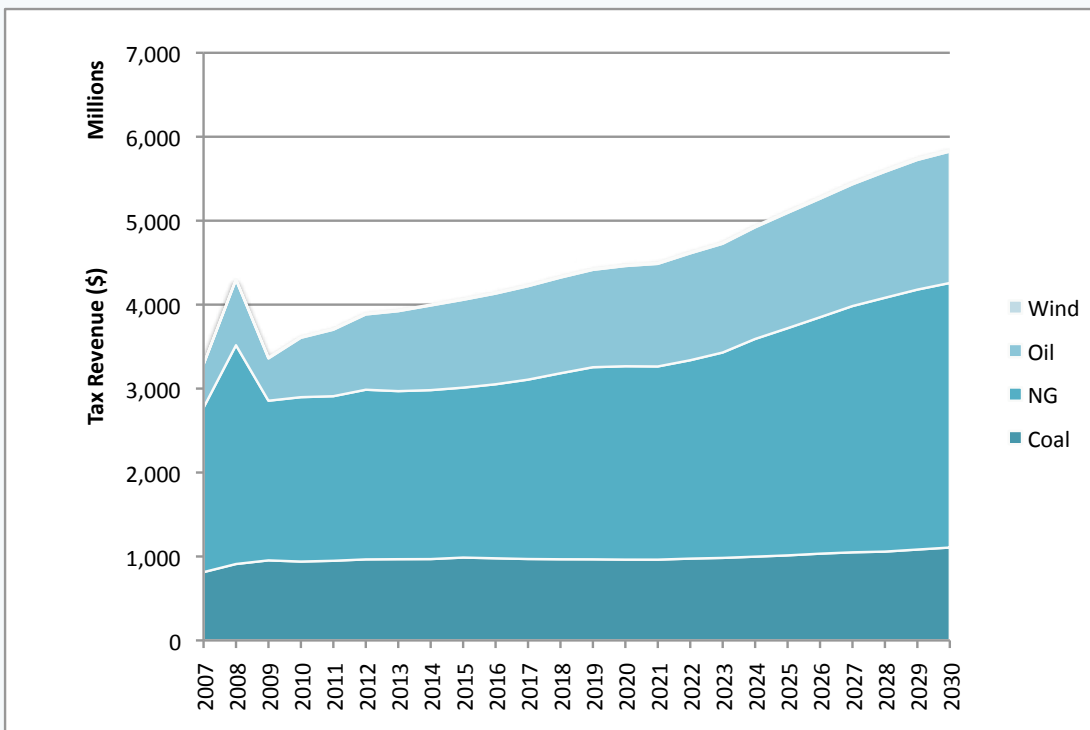


Figure 1. Tax Revenue in the Reference Scenario.

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the imposition of a price for GHG emissions leads to a decline in high carbon intensity coal. The increased price overwhelms the relative inelasticity of coal and the EIA estimated increase in production. Due to coal providing such a large share of total energy production (78 percent of energy in 2007), overall energy production also declines markedly. Natural gas production, the second largest source of energy, increases, but the elevated level of production does not offset losses in coal. Oil is not drastically impacted due to its very low price elasticity and the general EIA trend for increased production. Wind remains a very small portion of primary energy production in Wyoming.

Prices change through the demand and supply relationships. Coal prices slowly decline until reaching zero in 2026. The model then predicts a negative price for coal, which is reflected as zero in calculations for tax revenue. (Tax revenue cannot be negative.) Natural gas price increases through 2030, reflecting EIA forecasted price increases and an increase in quantity demanded for the relatively low carbon intensity energy source (demand response). Oil prices increase drastically reflecting higher demand for the moderate carbon intensity fuel. The reference case also predicted a significant increase in oil prices. The price of wind energy also responds positively, as demand for wind increases with the large decline in coal production.

Overall tax revenue increases in the GHG Policy Scenario by 14.07 percent over the Reference Scenario. The increase comes despite the significant decline in coal revenues and is driven by growth in natural gas and oil tax revenues due to both increased production and prices. Wind energy tax revenue also grows drastically (418 percent) over the duration of the simulation, but the amount contributed is still very minor compared with fossil fuels.

**Implications**

These results have several important implications for Wyoming’s energy dependent economy. The potential for climate change legislation to be beneficial is likely despite our coal dominance. Climate change legislation devalues this resource if utilized with existing technologies. The price of oil and natural gas will also increase with an explicit price for carbon, exerting downward pressure on demand. Loss of demand would theoretically depress prices received by producers. However, without considering market substitution responses, wind energy appears to be the only clear winner under federal action. However, this fails to consider the interrelationship between energy resources. The growth in demand for higher value natural gas overwhelms the loss of coal and growth in wind.

Regional and local impacts of a rapidly declining coal industry could be devastating to parts of this state. However, some coal producing areas are

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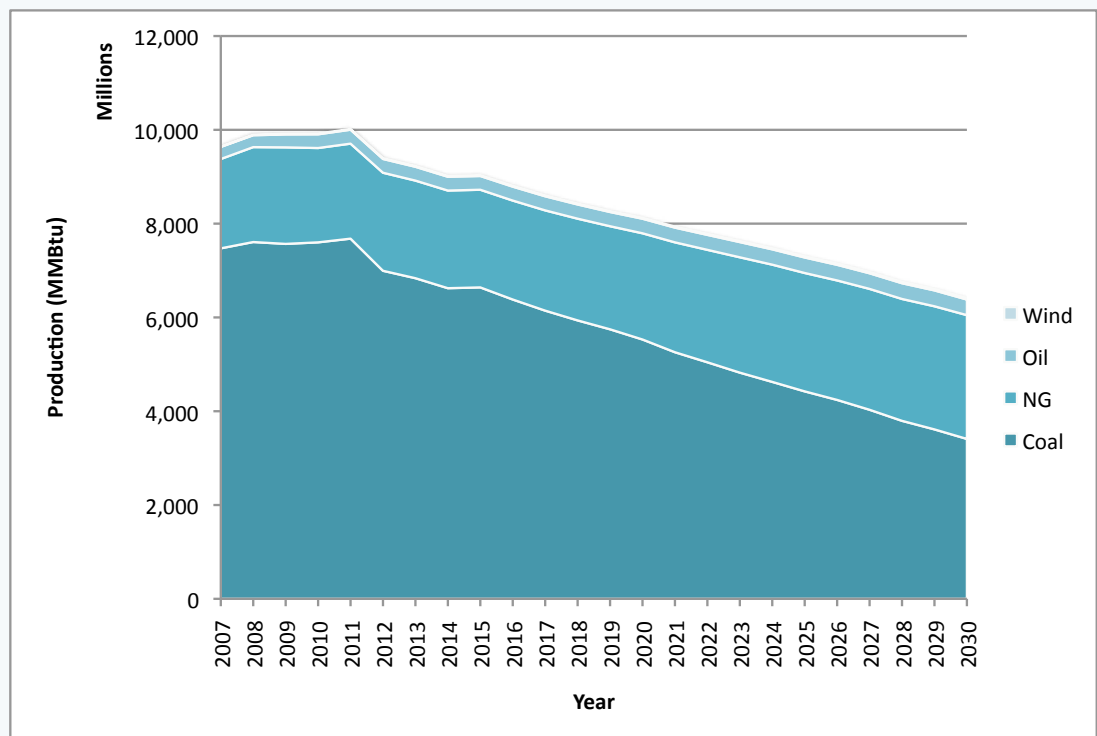
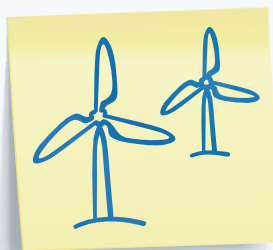


Figure 2. Energy Production in the GHG Policy Scenario.

also blessed with significant natural gas and oil resources, which could mitigate some of the declines in coal production. There would still be large-scale structural changes and unemployment with the loss of the coal industry.

The small contribution of the wind energy created tax revenue is also important. Under its existing tax structure, wind energy cannot readily replace revenues created by fossil fuels. This is not to diminish the potential for growth of revenue created by wind energy. The local taxes, landowner pay-

ments, and job creation could certainly be regionally important and also creates a sustainable revenue base that will not be depleted in the future.

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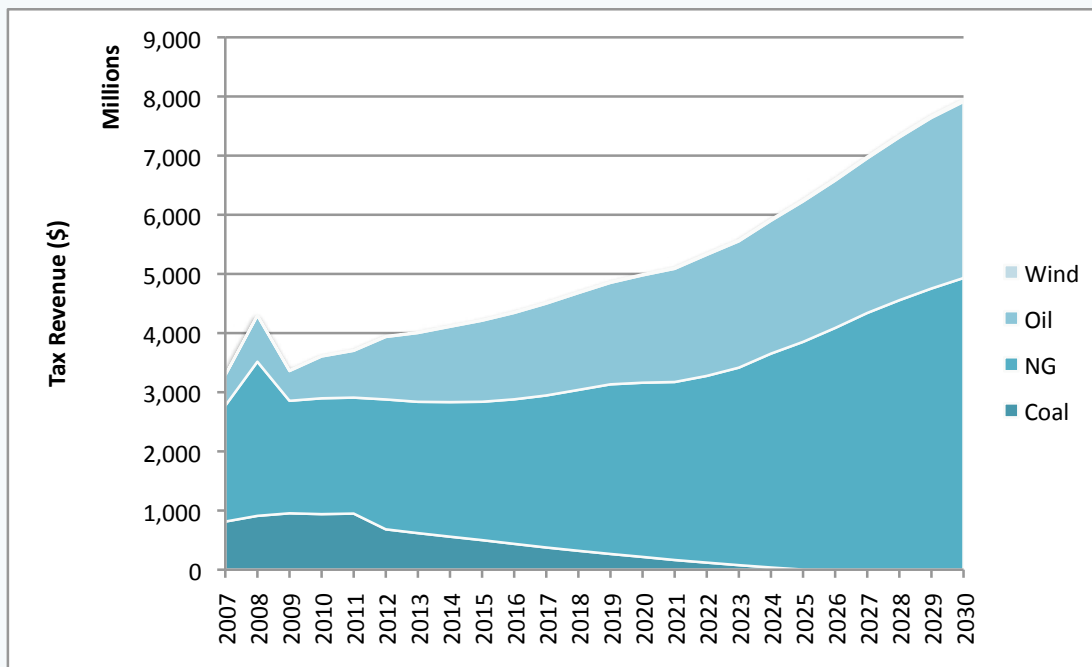


Figure 3. Tax Revenue in the GHG Policy Scenario.

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