The Beacon Hill Institute

# *The Economic Effects of Proposed Cap-and-Trade Legislation on the State of Nebraska*

**THE BEACON HILL INSTITUTE AT SUFFOLK UNIVERSITY**
8 Ashburton Place Boston, MA 02108
Tel: 617-573-8750, Fax: 617-994-4279
Email: bhi@beaconhill.org, Web: www.beaconhill.org
**JUNE 2009**

President Obama and several members of Congress have proposed legislation to reduce greenhouse gas (GHG) emissions in the United States. The Waxman-Markey Bill currently before Congress would bring GHG emissions, and hence carbon emissions, below 2005 levels in steps – 3% below those levels by 2012, 20% by 2020, 42% by 2030, and 83% by 2050.

Waxman-Markey would create a "cap-and-trade" system, under which U.S. producers would receive tradable permits to emit greenhouse gasses. Producers buying the permits would, in effect, pay a tax for the privilege of emitting greenhouse gasses currently emitted without charge. The resulting "carbon tax" would have an effect on production and employment similar to an explicit excise tax on production.

In this report, the Beacon Hill Institute (BHI) uses two computer modeling capabilities to estimate the economic effects of this tax on the Nebraska economy. The first of these is the "DICE" (Dynamic Integrated Model of Climate and Economy) model developed by William Nordhaus of Yale University.[1] The second is the Beacon Hill Institute STAMP® (State Tax Analysis Modeling Program). We used the DICE model to estimate the implicit carbon tax that Waxman-Markey would impose on U.S. producers and the STAMP model to estimate the resulting effects on the Nebraska economy.[2] Table 1 displays the results.

**Table 1: The Economic Impact of Waxman-Markey on Nebraska (2009 $)**

| **Cost of Carbon** | **2020** | **2050** |
|---|---|---|
| Equivalent Carbon Tax (current $/metric ton) | 92.66 | 714.00 |
| Total net cost to Nebraska ($ billions) | 1.18 | 9.76 |
| **Economic Variables** | | |
| Total Employment (Jobs) | -8,185 | -98,022 |
| Gross Wage Rate ($/person/year) | -269.55 | -2,235.98 |
| Investment ($ millions) | -90.70 | -752.35 |
| Real Disposable Income ($ millions) | -679.34 | -5,635.37 |
| **Tax Revenues** | | |
| State Funds ($ millions) | -70.61 | -585.73 |
| Local Funds ($ millions) | -51.93 | -430.82 |
| Total Funds ($ millions) | -122.54 | -1,016.54 |

We find that the cap-and-trade system would require an equivalent tax on carbon of $92.66 per metric ton in 2020 in order to reach the 20% emissions reduction goal. The cost of carbon would skyrocket to $714 in 2050 to reduce emissions by 83% below 2005 levels. These carbon prices would cost the

[1] William Nordhaus, 2008, *A Question of Balance*, Yale University Press.

[2] For a description about the model see www.beaconhill.org.

residents of Nebraska $1.18 billion dollars in 2020 and $9.76 billion by 2050 through increased energy prices.

These costs of carbon would produce significant harm to the Nebraska economy. The state economy would shed 8,185 jobs by 2020, increasing to 98,022 jobs by 2050. The decrease in labor demand, as seen in the job losses would cause the gross wage rate to fall by $269 per capita annually by 2020 and $2,235 per capita annually by 2050.

The job losses and price increases would combine to reduce real incomes as firms, households and governments spend more of their budgets on energy and less on other items, such as home goods, entertainment and clothing. As a result, real disposable income would decrease by $679.34 million per year in 2020 and $5.635 billion in 2050. Furthermore, annual investment in the state would fall by $90.7 million and $752.35 million in 2050.

State and local government tax collections would also suffer from the economic damage. By 2020, the state of Nebraska can expect annual tax revenues to fall by $70.61 million, while local governments would lose $51.93 million in tax revenue, for a combined state and local revenue loss of $122.54 million. By 2050, the state and local government tax revenue losses would swell to over $1.016 billion, with the state losing $585.73 million and local governments losing $430.82 million.

**Table 2: Effects of Waxman-Markey on Energy Prices in Nebraska**

| Energy Source | 2008 Retail Price | Energy Price Increases | |
|---|---|---|---|
| | | 2020 | 2050 |
| Gasoline retail price ($/gal) | 2.67 | 0.29 | 1.94 |
| Natural gas residential price ($/'000 cu ft) | 11.15 | 1.75 | 10.66 |
| Electricity retail price : natural gas (¢/kWh) | 5.84 | 1.11 | 7.64 |
| Electricity retail price : coal (¢/kWh) | 5.84 | 2.48 | 16.93 |
| Coal, bituminous, market price ($/ton) | 40.8* | 40.63 | 277.89 |
| Coal, lignite, market price ($/ton) | 14.89* | 71.69 | 490.29 |

*2007 national price

Table 2 shows how cap-and-trade would affect energy prices in Nebraska. The policy would push up the price of gasoline by 29 cents/gallon by 2020 and by $1.94/gallon by 2050, and would raise the retail price of electricity produced from natural gas by 1.11 cents/kWh by 2020 and 7.64 cents/kWh by 2050. Electricity produced from coal would experience a 2.48 cent/kWh increase by 2020 and a 16.93 cent/kWh increase by 2050. Additionally, bituminous coal would increase in cost by $40.63 /ton by 2020 and $277.89 /ton by 2050, while lignite coal would increase by $71.96 /ton by 2020 and $490.29 /ton by 2050.

## Conclusion

Cap-and-trade is aimed at reducing the consumption of fossil fuels by increasing their prices and thus, in turn, the prices of energy and of all goods and services. A cap-and-trade proposal such as Waxman-Markey would therefore inflict large negative impacts on the economy of Nebraska. The state would experience significant declines in employment, wages, disposable income and investment upon implementation of the policy.

There is, moreover, no offsetting benefit to the other states that would offset the harm suffered by Nebraska. In other analyses, we have shown that Waxman-Markey would inflict harm on the U.S. economy as a whole equivalent to what it would inflict just on the state of Nebraska.[3] No proposal to institute cap-and-trade should go forward without regard to these findings.

## Methodology

To reduce GHG emissions, a cap-and-trade system seeks to change the behavior of economic agents, such as producers, consumers and governments. It does so by changing the incentives, both negative and positive, faced by all three when consuming GHG producing energy.

BHI deployed the DICE model developed by William Nordhaus of Yale University to derive its own estimate of an equivalant carbon tax, or cost of carbon, needed to achieve the GHG reduction outlined below. We then used these results to calculate the effects on fossil fuel prices that would result from reducing GHG emissions and to measure the effects on the economy of Nebraska. Although full details of the DICE model are set out clearly in Nordhaus (2008), and the computer code is freely available, it is useful to sketch the essential components here.

The model consists of 19 dynamic equations, and rests on 44 non-trivial parameters. The objective is to maximize the present value of the utility that consumers get over time from consumption. Emissions of CO2 accumulate in the atmosphere and the oceans, and these accumulations reduce output via a damage function. Spending on emissions abatement is costly, and so there is a tradeoff: more abatement eats into consumption directly but limits damage by avoiding further warming that would indirectly have cut consumption. In principle there is a level and time pattern of emissions reductions that maximizes utility, which is referred to below at the optimal path. This may be compared to the "baseline" case of no emissions controls for 250 years.

The model allows one to specify abatement targets – for example, a maximum allowable rise in global temperature, or a maximum atmospheric concentration of CO2, or a given proportionate reduction in emissions. The model then determines how much to save and invest, and how much to spend on abatement. It also generates the carbon prices (sometimes referred to as carbon taxes) that would be needed to yield these outcomes efficiently.

[3] We will provide the results on request.

We used the results of the DICE to calculate the effects on fossil fuel prices that would result from reducing GHG emissions and to measure the effects on the economy of Nebraska.

It is easy to understand what might happen if the price increases take effect. The cap-and-trade policy would increase the price of energy, and subsequently goods and services. Standard economic theory shows that price increases of a good or service leads to a decrease in overall consumption, and consequently a decrease in the production of that good or service. This is especially true in periods of economic decline as we are now facing. As producer output falls, the decrease in production results in a lower demand for labor.

The Waxman-Markey proposal would allow a limited amount of offsets – i.e. one could continue to produce more GHG than would otherwise be allowed by providing evidence of offsetting measures (e.g. planting trees) elsewhere. This aspect of cap-and-trade is open to abuse since the verification may prove difficult. We also assume that the federal government opts for the free permit model under its cap-and-trade program thus foregoing a substantial amount of revenue.

To estimate the economic effects of policy changes, BHI utilizes its Computable General Equilibrium (CGE) model. The purpose of the BHI model, called STAMP (State Tax Analysis Modeling Program), is to identify the economic effects and understand how they operate through a state's economy.

STAMP is a five-year dynamic CGE model that has been programmed to simulate changes in taxes, costs (general and sector-specific) and other economic inputs. As such, it provides a mathematical description of the economic relationships among producers, households, governments and the rest of the world. It is general in the sense that it takes all the important markets, such as the capital and labor markets, and flows into account. It is an equilibrium model because it assumes that demand equals supply in every market (goods and services, labor and capital). This equilibrium is achieved by allowing prices to adjust within the model. It is computable because it can be used to generate numeric solutions to concrete policy and tax changes.[4]

BHI calculated impact of the fossil fuel price increases on the price level for each of the (27) sector of the economy within the STAMP model. Using Energy Information Agency's (EIA) national data on GHG emissions by the residential, commercial, industrial and transportation sectors, we allocated the national emissions to the STAMP sectors.[5] We then used data from the U.S. Census Bureau's Economic

---

[4] For a clear introduction to CGE tax models, see John B. Shoven and John Whalley, "Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey," Journal of Economic Literature 22 (September, 1984): 1008. Shoven and Whalley have also written a useful book on the practice of CGE modeling entitled Applying General Equilibrium (Cambridge: Cambridge University Press, 1992).

[5] U.S. Department of Energy, Energy Information Agency, American Energy Outlook 2009, Table 18: Carbon Dioxide Emissions by Sector and Source, Internet, available at www.eia.doe.gov/oiaf/servicerpt/stimulus/excel/aeostimtab_18.xls.

Census as a proxy for the size of each industry in each state relative to the national data.[6] Then we applied the cost of carbon, adjusted to equivalent to 3.67 metric tons of CO2, to each sectors GHG emissions, which gives us our total cost to the economy. We convert these prices increases in dollars into percentage changes based on the annul value of production in each sector.

We simulated these changes in the STAMP model as a percentage price increase on fuel to measure the dynamic effects on the state economy. The model provides estimates of the proposals' impact on employment, wages and income in Nebraska. Each estimate represents the change that would take place in the indicated variable against a "baseline" assumption about the value that variable would be in a specified year.

[6] 2002 Economic Census, Summary Statistics by 2002 NAICS, United States, Internet, available at http://www.census.gov/econ/census02/data/us/US000.HTM.

The Beacon Hill Institute at Suffolk University in Boston focuses on federal, state and local economic policies as they affect citizens and businesses. The institute conducts research and educational programs to provide timely, concise and readable analyses that help voters, policymakers and opinion leaders understand today's leading public policy issues.



**THE BEACON HILL INSTITUTE**
**FOR PUBLIC POLICY RESEARCH**
**Suffolk University**
**8 Ashburton Place**
**Boston, MA 02108**
**Phone: 617-573-8750 Fax: 617-994-4279**
**bhi@beaconhill.org**
**http://www.beaconhill.org**