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Climate Change and U.S. Competitiveness

We need to move to a low-carbon, energy-efficient economy, but we also need to be sure that we don't lose critical manufacturing sectors in the process.

The Obama administration and Congress have been grappling with how to craft legislation that addresses the looming threat of global warming while reducing U.S. dependence on foreign energy sources. In June 2009, the House passed a climate change bill that would establish an economy-wide cap-and-trade system, aimed at reducing the amount of greenhouse gas emissions produced by economic activity in the United States. The Senate is now working on its own bill.

Naysayers about the threat of climate change aside, the House legislation faced opposition from a number of Democrats, not just Republicans, worried about its potentially harmful economic effects on U.S. businesses, workers, and communities. Similar concerns are being expressed in the Senate debate. A climate bill that places a charge on carbon-based greenhouse gas emissions would drive up fossil fuel energy prices, with most of the increase being passed along to energy users. In theory, this would encourage a shift to lower carbon-based energy generation and greater energy efficiency throughout the economy. But many in Congress fear that these higher energy costs could impose new economic burdens on their constituents and hurt the competitiveness of U.S. businesses, resulting in the loss of jobs in their states and districts. These concerns particularly resonate in the wake of the current financial crisis and recession.

On the other hand, climate policy supporters cite studies that project very modest effects on the overall economy from the enactment of cap-and-trade legislation: perhaps a couple of percent slower economic growth and smaller industrial output and employment levels as compared to a no-policy, business-as-usual baseline. More significantly, according to supporters, there could be substantial economic gains that ultimately accrue from making the transition to a highly energy-efficient, low-carbon industrial base, not to mention the benefits of reducing U.S. dependence on foreign energy sources and mitigating global warming.

Environmentalists and other "green" economy proponents have long touted new business opportunities and jobs that could be created by investing in renewable energy and energy-efficiency technologies. By sending a strong price signal that would significantly ramp up demand for these technologies—and diminish the economic advantages of fossil fuels—a climate policy would hasten the growth of these emerging industries. According to the American Council for an Energy-Efficient Economy, investments in energy productivity gains would yield both the largest and most cost-effective mitigation of greenhouse gas emissions and strengthen the competitiveness of the U.S. economy.

Recognizing the opportunity to revitalize the U.S. manufacturing base and strengthen the middle class that could be created by such investments, the Obama administration made simulating growth in clean energy development and infrastructure repair and modernization a key goal of the American Recovery and Reinvestment Act (ARRA), enacted in February 2009. The White House estimated that the act would generate 541,000 jobs. The Apollo Alliance—a coalition of labor, environmental, and community leaders—is more optimistic, estimating that the act could create or retain more than one million green-collar jobs.

Nevertheless, there remain unresolved questions about the pending climate change legislation, especially the full extent of the effects on the U.S. industrial base and whether measures in the bill can sufficiently mitigate these effects or foster the gains hoped for by climate policy proponents. A key question is how a climate policy would affect the competitiveness of critical manufacturing industries and what policy and technology options might be needed to mitigate these effects. A recent study that we conducted shows that U.S. trade-sensitive, energy-intensive manufacturers could experience substantial cost pressures from energy prices driven upward by a climate policy, ultimately threatening their mid- to long-term economic viability. The study finds that there are options that could mitigate these effects but that additional policy measures will also be needed to preserve the competitiveness of primary manufacturing industries in the United States, while also reducing greenhouse emissions.

Climate and competitiveness

The potential effect of climate policy on U.S. manufacturing has become an important concern in the climate debate. The discussion is taking place against the backdrop of a long-term decline in manufacturing capacity and jobs, accompanied by a ballooning trade deficit, a situation made worse by the recession and financial meltdown. Since 1998, the manufacturing sector has shed well over 5 million jobs, or one-quarter of its workforce. Foreign competition has been a major factor in the shrinking and restructuring of U.S. manufacturing during the past few decades. U.S. firms across the manufacturing spectrum have lost significant market shares to cheaper foreign imports. As a result, the United States has for many years experienced a substantial and growing trade deficit, rising to more than $700 billion in 2007.

According to the U.S. Energy Information Administration (EIA), the industrial sector (all of the materials-processing and goods-processing industries, inclusive of manufacturing) consumes about one-third of the total delivered energy in the U.S. economy and produces about 28% of total carbon dioxide (CO_2) emissions. Manufacturing accounts for an estimated 90% of the energy consumed and 80% of the emissions generated in the industrial sector. Among the nation's 21 major manufacturing sectors, five (petroleum and coal products, chemicals, paper, primary metals, and nonmetallic mineral products) use most of the energy consumed by U.S. manufacturing. These five sectors contain almost all of the most energy-intensive industries in the economy.

Although manufacturing is a major consumer of energy and emitter of greenhouse gases, most analyses have shown that climate policies would have only modest effects on manufacturing costs, profits, and outputs. This reflects the sector's low energy intensity on aggregate: Only about 3% of operating expenditures are for energy. But among the energy-intensive industries (steel, aluminum, chemicals, paper, and cement), the percentage is much higher: for example, 9% for iron and steel and 27% for primary aluminum.

A CLIMATE POLICY THAT PUTS A PRICE ON CARBON-BASED GREENHOUSE GASES IN THE ECONOMY COULD SUBSTANTIALLY AFFECT THE COMPETITIVENESS OF THE U.S. ENERGY-INTENSIVE INDUSTRIES DURING THE NEXT TWO DECADES.

Consequently, the concern of many business, labor, and political leaders that climate policies may contribute to the continued erosion of U.S. manufacturing competitiveness is particularly acute for the energy-intensive, basic materials manufacturing industries, which are especially vulnerable to rising energy prices and highly sensitive to global competition. U.S. energy-intensive manufacturers have struggled for many years to remain competitive in domestic and international markets against foreign producers advantaged by low-cost labor and poor labor standards; lax environmental regulations; government subsidies; and, some would argue, unfair trade practices. These include manufacturers from major developing nations, especially the so-called BRIC nations (Brazil, Russia, India, and China). Although the European Union and Japan remain major producers and trade partners with the United States, the BRIC nations have been rapidly building up their capacities in these industries to support their own industrial development, but also as export platforms.

The main fear is that the added energy costs from a climate policy would drive many firms out of business or offshore to lower-cost locations. Consequently, as climate legislation has been drafted, industrial and labor groups have lobbied Congress hard for policies to mitigate the cost effects of increased energy prices from a cap-and-trade program and to level the playing field for U.S. producers competing against foreign manufacturers in these sectors that are currently unburdened by comparable measures to limit carbon emissions in their countries. Their concern is to preserve and strengthen the capacity of these critical industries and maintain their competitiveness in global markets.

Despite waves of restructuring, consolidations, plant closures, offshore movements, and large-scale job losses during the past three decades, the United States remains one of the world's largest producers in all these industries. Energy-intensive manufacturing forms the cornerstone of the nation's manufacturing base. It is the beginning of the supply chain for all other manufacturing industries, supplying the primary materials used in tens of thousands of intermediate industrial goods and end-use consumer products throughout the economy. It therefore would be sadly ironic that even if the climate bill were to live up to its potential of fostering the creation of new domestic manufacturing jobs producing renewable energy products, windmills made in Ohio or other heartland states, for example, were made from steel produced in China!

Some environmentalists also acknowledge the importance of keeping these industries healthy and onshore to prevent "carbon leakage." Because the energy-intensive sector accounts for the bulk of energy consumption and greenhouse emissions in the U.S. industrial sector, if U.S. climate policies encourage energy-intensive plants to move offshore, they would succeed only in shifting the generation of greenhouse gases to other locations in the world that may have few if any carbon-constraining regulations. The United States therefore might still record gains in cutting emissions, but emissions levels for the world as a whole—where it really matters—would not improve, and U.S. manufacturing would suffer further losses.

The climate-manufacturing study

In response to concerns about manufacturing competitiveness and also carbon leakage, legislators have attempted to incorporate measures in cap-and-trade bills that aim to reduce greenhouse gas emissions while also mitigating economic effects on vulnerable industries. These include cost containment features such as "safety valve" prices (caps on emission allowance prices), carbon offsets (allowance credits for investments in domestic or international emissions reduction projects by regulated entities), and allowance banking (covered entities holding onto unused allowances for future sales at higher prices); and economic mitigation measures such as free allowance allocations, border adjustment mechanisms, and international compliance provisions (see below).

Because of the strong interest of labor and industry stakeholders, the Washington, DC–based National Commission on Energy Policy of the Bipartisan Policy Center sponsored

Study Overview and Approach

The HRS-MI study used qualitative, econometric, and modeling methods to analyze the effects of a cap-and-trade climate policy—the Lieberman-Warner Climate Security Act of 2007 (S. 2191)—on six energy-intensive industries: iron and steel, primary and secondary aluminum, paper and paperboard, petrochemicals, and alkalis and chlorine (or chlor-alkali), which are among the largest energy consumers in the U.S. economy. The U.S. EIA projected the inflation-adjusted (in 2006 U.S. dollars) greenhouse emissions allowance price for S. 2191 to be $30 per metric ton of CO_2 equivalent by 2020, rising to $61 by 2030.

The study examined three questions:

- How will climate policy–driven energy price increases affect the production costs of manufacturers in energy-intensive manufacturing sectors?
- In the face of energy-driven cost increases and constraints on manufacturers' ability to pass these costs along to consumers, how will international competition affect the industries' competitiveness?
- How will manufacturers respond to energy price increases and possible threats to their competitiveness? Will they adopt new energy-saving practices and technologies, reduce production capacity, or move operations or plants offshore?

This investigation included:

- Detailed economic and energy profiles of the six industries, entailing the processing of extensive historical economic and technical data from federal databases, domestic and international industry sources, academic research, and the professional literature
- Construction of a computer-based system dynamics model, the Integrated Industry-Climate Policy Model (II-CPM) to simulate the effects of a climate policy on these sectors
- Use of the II-CPM to simulate the impacts of the core provisions of S. 2191 compared to a no-policy, business-as-usual case. To characterize the climate policy and the business-as-usual cases, the II-CPM used energy price projections based on data from an EIA analysis of S. 2191 and its *Annual Energy Outlook 2008*, respectively.

The core simulations assumed that the industries would not be able to pass additional costs along to their customers. According to economic studies and industry experts, the ability of these industries to pass along policy-driven costs is typically constrained, depending on economic conditions and market demand. (To provide a full spectrum of possible industry responses, the study also simulated 100% cost pass-through scenarios.)

The study assessed the effects on an industry's competitiveness by measuring changes in its energy and production costs, operating surplus (a proxy for profits) and operating margin (a proxy for its profit margin), domestic market share, and in some cases, production output. The operating surplus is defined as the difference between an industry's revenues and its production costs, which encompass profits; depreciation; interest on capital and other fixed production costs; and sales, general, and administrative costs.

The modeling results were used to inform preliminary analyses of investment and policy options for the different industries, including:

- A detailed review of near-, mid-, and long-term technology options available in each industry to reduce energy use, improve efficiency, and offset higher production costs arising from a climate policy
- For each industry, estimates of the energy efficiency gains required to offset increased energy costs under a climate policy
- Simulations of a policy option that would allocate to each industry allowances initially mitigating 90% of the additional costs from higher energy prices—diminishing by 2% per year—incurred as a result of climate policy

a two-year study to examine these issues. The study was conducted by High Road Strategies (HRS) and the Millennium Institute (MI), both in Arlington, Virginia, culminating in the report, *Climate Policy and Energy-Intensive Manufacturing: Impacts and Options*. National labor organizations and several large industrial associations (from the iron and steel, aluminum, chemicals, and paper sectors) participated throughout the study.

The HRS-MI study set out to address two broad questions: What are the effects of a U.S. climate policy on the economic competitiveness of domestic energy-intensive manufacturing industries? What are the best policy options for maintaining manufacturing competitiveness and retaining jobs in these industries, while also cutting greenhouse gas emissions?

The HRS-MI team especially wanted to investigate the policy options that would best mitigate the cost effects of a climate policy, while also enabling and encouraging indus-

try investments in new energy-saving technologies. The ultimate objective was to inform policies that will help U.S. manufacturers move to the next generation of production technologies and to achieve the twin goals of low carbon intensity and global competitiveness. (See box for details on what the study covered and how it was carried out.)

The results of the study suggest that a climate policy that puts a price on carbon-based greenhouse gases in the economy could substantially affect the competitiveness of the U.S. energy-intensive industries during the next two decades. Specifically, enacting a climate policy that imposes a modest to high cost on carbon-based energy sources could increase most of the energy-intensive industries' production costs, reduce operating surpluses and margins, and shrink domestic market shares. These results assume that no investments or actions are made to mitigate or offset the additional cost effects.

Production costs for all industries would be driven upward, but these effects would vary widely, depending on their energy intensities, the mix of energy sources they rely on, and how energy is used in production activities. The iron and steel industry would see the greatest real production cost increases, partly because of its high use of metallurgical coal and coke in production, rising to more than 11% above the business-as-usual case by 2030, driving up the energy cost share of production costs from 15% in 2006 to more than 20% by 2030. Chlor-alkali and paper and paperboard costs would grow at a comparable rate, although primary aluminum costs would grow somewhat more modestly.

The extent to which policy-driven production cost increases translate into profit declines in these industries would depend on the degree to which manufacturers could pass along these costs to customers. Although passing along the costs might be likely for some industry segments under certain market conditions, the study found that these industries typically are constrained in their ability to pass through their costs, especially if the increases apply only to U.S. producers. These industries tend to measure their competitiveness (and preserve profit margins) by their ability to keep their costs low relative to prevailing global market prices.

Assuming the worst case scenario that the industries do not pass along their costs, the study found that every industry would see an operating surplus decline relative to the reference business-as-usual case. Not surprisingly, the industries with the greatest production cost increases would also suffer the largest operating surplus and margin declines. These include iron and steel, paper and paperboard, and chlor-alkali, followed by primary aluminum. Moreover, the model projected that operating surplus reductions for the industries would grow to such an extent, ranging from more than 5 to 25% in 2020 and 20 to 40% by 2030, cutting into profits and even into fixed costs, that some manufacturers probably would feel pressure to take actions to reduce their costs and prevent their profitability from decreasing to undesired levels. Depending on market and other economic conditions, this could include investing in energy-saving processes, although some manufacturers could decide to cut production or, more troubling, move production offshore.

Technology investment and policy options

Despite the potentially troubling economic effects of a climate policy on energy-intensive industries, the study found that technology investments and policy options exist that could mitigate these effects, improve energy efficiency, and ultimately enhance economic performance. The adoption of both readily available and longer-term, cutting-edge technology could offset increased costs and generate additional profits. Over the short run, however, energy-saving technology options might be limited, because many of the industries have invested over the years in substantial energy-efficiency gains. On the other hand, relatively low-cost incremental improvements remain available in the near to medium term that could offset some of the added costs from a climate policy. These include combined heat and power; relined boilers; enhanced heat recovery; improved sensors and process controls; more efficient motors, pumps, and compressed air systems; and improved recycling, among other measures.

However, the study's estimates of energy-efficiency gains required to offset these costs over the longer term suggest

that much larger gains could be necessary over time for most of the industries, requiring investments in advanced low- or no-carbon production processes. The industries have been supporting R&D on advanced production and process technologies that could result in significant energy savings. But several barriers to their commercialization and deployment remain. It may be many years before some of them are technically and commercially feasible and cost effective, even with the incentive of higher energy costs. These technologies mostly involve the installation of large, expensive pieces of equipment, requiring substantial infusions of new capital investments by industries that chronically complain about a lack of capital. Finally, the vintage of existing equipment and facilities in these industries will dictate when manufacturers would be able to replace aging production capacity with new, more energy-efficient technologies—perhaps as much as a decade or more.

The HRS-MI study also showed, though, that allocating allowances to offset higher energy prices under a climate policy would substantially mitigate the economic effects on energy-intensive industries, at least through 2025. In its simulation of such a measure, production cost increases and operating surplus reductions would be cut by 90% in 2012, falling gradually to a 54% reduction in these effects by 2030, as compared to not offering the allocation offset. This would buy time for the industries to make adjustments and energy-saving technology investments required for maintaining their domestic production capacity and competitiveness. However, if the industries do not invest early enough, making use of the time window provided by the allowance allocation, they could face even harder adjustments after 2025.

Policy implications

From the point of view of the energy-intensive industries, the main policy concerns associated with a climate bill are cost containment and mitigation measures that help manufacturers adopt more energy-efficient technologies. The HRS-MI study showed that the most serious cost effects of climate policy on these industries could be substantially mitigated by a free allocation allowance that companies can treat as a financial asset, which offsets most of these effects. Of course, these allocation offsets must be designed to diminish over time, so that manufacturers have increasing incentives to invest in energy-saving technologies and practices and replace older, less efficient equipment.

A version of the allowance allocation measure was incorporated into the House-passed climate bill. This measure would compensate eligible trade-exposed energy-intensive facilities with allowance rebates proportional to the costs of their direct and indirect greenhouse emissions. It was designed to preserve incentives to make performance improvements, giving companies more time to prepare for longer-term investments in more advanced, low-carbon, energy-efficient process technologies, even as they introduce incremental improvements, while avoiding undue windfalls. The bill would distribute up to 15% of the total amount of allowance permits to the energy-intensive sector shortly after the cap-and-trade system goes into affect, diminishing steadily every year after.

Despite differences between the free allocation allowance policy to offset higher energy prices evaluated in the HRS-MI study and the House bill's output-based allocation provision (the former is directly tied to energy price increases; the latter is keyed to emissions allowance costs) the end results would be roughly the same: The economic effects on energy-intensive firms would be mitigated, at least in the short to medium term, buying more time for affected manufacturers to adopt low-carbon heat and power and process technologies. More study, though, would be required to examine the relative effectiveness of output-based allowance rebates for the energy-intensive sector under the House bill as compared to other allocation options.

Although the HRS-MI study demonstrated the importance of cost mitigation features such as this, it also concluded that additional policies will probably be needed to support timely investment in energy efficiency and the retrofitting of less advanced production facilities. These

THE STUDY SHOWED THAT ALLOCATING ALLOWANCES TO OFFSET HIGHER ENERGY PRICES UNDER A CLIMATE POLICY WOULD SUBSTANTIALLY MITIGATE THE ECONOMIC EFFECTS ON ENERGY-INTENSIVE INDUSTRIES.

measures might include:

- Tax incentives and credits for installing new equipment
- Accelerated capital stock recovery for encouraging the retirement of older, less efficient equipment
- Support for research, development, and demonstrations of cutting-edge energy-savings process innovations
- Financial support for the adoption of new equipment
- Technical assistance, especially to help medium and smaller manufacturers (under 500 employees) adopt cleaner, leaner energy technologies and practices, such as through the Manufacturing Extension Partnership (MEP).

Some of these measures are being considered and a few have been incorporated in the current legislation. For example, Senator Brown's Investments for Manufacturing Progress and Clean Technology (IMPACT) Act of 2009, which was merged into the House bill, would establish a $30 billion Manufacturing Revolving Loan Fund to help small- and medium-sized manufacturers retool, expand, or establish domestic clean energy manufacturing operations. The fund would also expand and focus the MEP's programs to help manufacturers access clean energy markets and adopt innovative, energy-efficient manufacturing technologies.

Another more controversial proposal is the climate change border adjustment mechanism. Border adjustment mechanisms would require fees to be added to foreign- made imports from nations that have not adopted a carbon emissions mitigation policy. The border adjustment assessment would be based on the emissions associated with a good produced overseas. The purpose is to level the playing field for U.S. producers who are burdened by higher energy prices imposed by a climate policy and compete in global markets against foreign firms not subject to a comparable emissions regulatory system.

The HRS-MI study did not evaluate this type of policy. However, extrapolating from the study's findings, border mechanisms applied to energy-intensive manufactured goods might enable U.S. producers to more easily pass through additional climate policy-driven energy costs. Meanwhile, a border adjustment provision would require foreign importers to raise their prices to a comparable extent within the U.S. market. A border mechanism provision—the International Reserve Allowance Program—has been incorporated into the House bill. It would kick in some time after 2018, subject to a presidential determination about the effectiveness of the emissions allowance rebate policy mitigating cost effects for primary energy-intensive producers and the extent of foreign competitors' compliance with comparable greenhouse gas limiting polices. It may be necessary, however, to provide rebates of these costs to U.S. exporters of these goods to prevent lower-cost overseas producers from gaining an unfair advantage because of higher U.S. production costs resulting from climate policy.

The low-carbon conversion challenge

The HRS-MI study sought to assess the extent to which an economy-wide cap-and-trade system aimed at reducing greenhouse gas emissions would impose economic costs on critical, trade-sensitive, energy-intensive manufacturing industries. Although it found that such a policy could over time threaten the competitiveness of manufacturing firms in these sectors, creating pressures for some to cut production or move to cheaper offshore locations, it also found that providing free allocation allowances could substantially mitigate these effects.

But this alone will not necessarily be sufficient to make the "business case" for energy-dependent manufacturers to make long-term investments in costly, advanced low-carbon production equipment, which will be required to keep their energy costs low as fossil fuel prices rise. Therefore, other policies incorporated by or supplemental to cap-and-trade climate legislation will be needed to encourage and enable the conversion of energy-reliant companies to next-generation, energy-efficient production technologies.

To achieve this goal, a comprehensive set of policies will be required, including mitigation and various technology policies and perhaps level-the-playing-field measures such as border adjustment. However, attention needs to be paid at the top levels of government to enable this conversion. For

example, the Apollo Alliance has called for a Presidential Task Force on Clean Energy Manufacturing to bring together a range of federal agencies to make the manufacturing of clean energy systems and components a national priority.

The resurrection of Flambeau River Papers, a paper mill located in the heart of a northern Wisconsin forest, both exemplifies and illustrates the potential for meeting this challenge. In 2006, the town of Park Falls, with 3,000 residents, was in trouble. Its major employer, a paper and pulp mill located along the Flambeau River, had closed, costing 300 jobs. Originally built in 1896, the plant's equipment was antiquated, and it used an expensive and outmoded process to make pulp. In recent years, higher energy prices combined with rising international competition and stagnant demand forced owners of this mill into bankruptcy.

Two years later, with the help of state loans and private investors, the mill reopened, its restart enabled by investments in new biomass-energy boilers, making it the first fossil fuel–free, energy-independent, integrated pulp and paper mill in North America. It also reemployed almost all of the workers originally laid off, at the same previous pay and benefits. Moreover, the Flambeau River mill, with help from a U.S. Department of Energy grant, is moving toward becoming the first modern U.S.-based pulp mill biorefinery to produce cellulosic ethanol. Not only would the new biorefinery have a positive carbon effect of about 140,000 tons per year, it would create an additional 100 new jobs in the Park Falls area.

As its name coincidentally implies, Flambeau River Papers is a beacon pointing us in the right direction for making the transition to a prosperous low-carbon, energy-efficient and globally competitive industrial base. It also suggests the critical role government must play in this transition—ideally in partnership with industry, over and above the market signals a climate policy would create. But this conversion will not be easy or cost-free. It will require strong policies that provide necessary supports and incentives for energy-intensive manufacturers to shed their reliance on carbon fuels, while retaining their competitiveness. But in the end, the resulting benefits to our economy and the environment would be very great.

Recommended reading

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