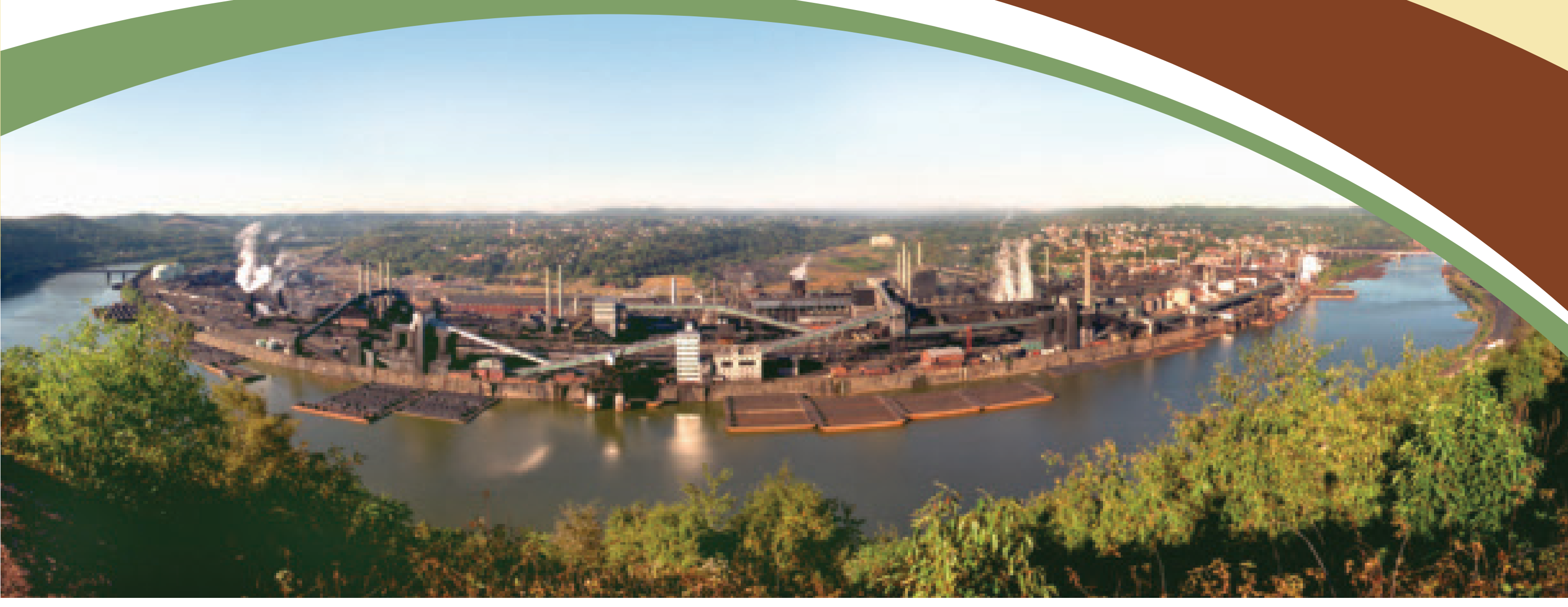
JUNE 2009

EXECUTIVE SUMMARY

Climate Policy and Energy-Intensive Manufacturing

Impacts and Options



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Executive Summary

Introduction

The Obama administration and Congress have begun to grapple with crafting legislation that addresses the looming threat of global warming while reducing America's dependency on foreign sources of energy. As attention turns to this debate, however, policymakers are confronting the challenge of how to design policies that maintain and enhance the competitiveness of America's manufacturing industries by promoting improvements in energy efficiency, while also reducing greenhouse gas emissions. Meeting this challenge is especially important if the United States is going to preserve its capacity in critical energy-intensive industries—such as iron and steel, aluminum, paper, and chemicals—which form the cornerstone of the nation's industrial base. These basic industries supply the materials used in almost every sector of the economy, from construction and transportation to a myriad of industrial and consumer products. They are also among the most sensitive industries to rising energy costs and international competition.

A climate policy that puts on a price on carbon dioxide (CO_2) and other greenhouse gas emissions could promote energy efficiency gains throughout economy.

The story of the Flambeau Rivers Paper, a paper mill located in the heart of a Northern Wisconsin forest, both exemplifies this challenge and illustrates the real potential for successfully addressing it. 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, closed, costing 300 workers their 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 the owners of this mill to declare 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 is moving towards becoming the first modern U.S.-based pulp mill biorefinery to produce cellulosic ethanol. Not only would the new biorefinery have a positive carbon impact of about 140,000 tons per year, it would create an additional 100 new jobs in the Park Falls area.[1]

Like many other American manufacturers, the Flambeau River mill faced volatile energy prices, intense international competition, a lack of capital, and aging equipment. Nevertheless, its success in turning itself into an energy-efficient, carbon-free competitive enterprise illustrates that new opportunities are being created as well. This suggests that policies requiring mandatory reductions in greenhouse gas (GHG) emissions, such as a cap-and-trade program, need not have devastating effects on American manufacturing, as some fear.

Indeed, a climate policy that puts on a price on carbon dioxide (CO_2) and other greenhouse gas emissions could promote energy efficiency gains throughout economy, as well spawn new industries and generate new jobs. However, making the transition to a low-carbon economy will not be without costs. Moreover, it would require the right kinds of supporting public policies and serious industry commitments to invest in such transformations.

[1] Glenn Ostle, "Reopened Flambeau River Papers targets energy independence," *Paper360°,* December 1, 2006, 12-16; "Flambeau River BioFuels Gets OK for Biorefinery Project," *PaperAge,* July 15, 2008, http://www.paperage.com/2008news/07_15_2008flambeau_river.html.

Climate Policy and Manufacturing Study

The study presented in this report, conducted by High Road Strategies, LLC in collaboration with the Millennium Institute (referred to as the "HRS-MI study"), was undertaken to better understand the implications of enacting a climate policy for the energy-intensive manufacturing sector. Specifically, our objective was to examine the impacts of energy price changes resulting from CO_2-pricing policies on the competitiveness of five energy-intensive industries—iron and steel, aluminum, paper and paperboard, chlor-alkali, and petrochemicals—that are among the largest industrial consumers of fossil fuels in the American economy. We also did a preliminary evaluation of potential options to mitigate these impacts, including energy-saving and low-carbon technology investments and cost-mitigating policy measures.

Employing the *Integrated Industry-Climate Policy Model* (II-CPM), a computer-based system dynamics model developed by the HRS-MI team—supplemented by econometric and qualitative analyses—we investigated 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 industry's competitiveness (i.e., profitability and market share)?
- How will manufacturers respond to the energy price increases and possible threats to their competitiveness? For example, would firms adopt new energy-saving practices and technologies, expand or reduce production capacity, or move operations or plants offshore?

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A number of proposals aimed at reducing GHG emissions in the U.S. have been debated in Congress over the past few years.

Climate Change and Competitiveness

A number of proposals aimed at reducing GHG emissions in the U.S. have been introduced and debated in Congress over the past few years. Under these proposals, a mandatory cap would be placed on the total amount of greenhouse gases that could be emitted, generally tightening over time to meet long-term emission reduction goals.

The resulting increase in fossil fuels prices would prompt a shift towards the use of lower-carbon fuels, especially in electricity generation and in industrial processes. It would also encourage energy-efficiency gains in all sectors of the economy, thereby lowering GHG emissions.

But these gains would not come without transitional costs, especially in the sectors most heavily reliant on carbon-based fuels. Of particular concern are what impacts these policies would have on the U.S. manufacturing base, which has undergone significant capacity and job losses for well over a decade, accompanied by a growing trade deficit.

Industry groups and labor unions have raised concerns about the competitive disadvantages a climate policy might impose on U.S. manufacturing–especially energy intensive sectors. For example, iron and steel industry groups have argued that American manufacturing is at "a distinct disadvantage in global competition… due to dramatically rising costs associated with energy."[2] They warn that a mandatory cap-and-trade program would consequently hurt the competitiveness and viability of the domestic steel industry. Some worry that their industry is approaching the physical limits of energy efficiency for the processes it operates today. To adjust to rising energy prices, it would need to adopt costly "new and transformational steelmaking technologies to achieve major additional reductions."[3]

Similarly, although most labor unions today favor enacting a comprehensive climate policy, industry impacts and international competition remain under scrutiny. Labor leaders have longstanding concerns about the impacts of policies on the competitiveness of our economy and especially on workers involved in the manufacturing of energy-intensive industry products. They argue that climate policies should not encourage off-shoring of manufacturing or the sale of assets, and warn against "carbon leakage", which results when companies move their production to regions of the world without comparable GHG emissions reduction commitments. As Robert Baugh, executive director of the American Federation of Labor-Congress of Industrial Organizations (AFL-CIO) Industrial Union Council (IUC) and co-chair of the AFL-CIO Energy Task Force, testified before the U.S. Senate Environment and Public Works Committee in 2007, "it is not in our national interest to see our efforts to reduce carbon emissions become yet another advantage that a developing nation uses to attract business."[4]

In recent years the attention devoted to climate change and its impacts, as well as the consequences of the financial and economic crisis currently underway, have contributed to change the way labor unions, industries, and policymakers approach climate policies. They all are concerned about reviving the U.S. manufacturing sector and keeping domestic jobs. But they now see an opportunity to modernize and make U.S. industries more energy efficient under a set of comprehensive and fair domestic and international climate policies.

THE ATTENTION DEVOTED TO CLIMATE CHANGE AND ITS IMPACTS HAVE CONTRIBUTED TO CHANGE THE WAY LABOR UNIONS, INDUSTRIES, AND POLICYMAKERS APPROACH CLIMATE POLICIES.

Research Approach

To carry out the HRS-MI study, we developed detailed economic and energy profiles of several manufacturing industries, entailing the collection and processing of historical economic data. We then constructed system dynamics models, supported by stakeholder group modeling sessions, to simulate the impacts of a climate policy on these sectors.

Specifically, the study compared the *Lieberman-Warner America's Climate Security Act of 2008* (S. 2192), referred to in the report as the "Mid-CO_2 Price Policy," to a Business As Usual (BAU) case that assumed

[2] The American Iron and Steel Institute (AISI), the Steel Manufacturers Association (SMA) and the Specialty Steel Industry of North America (SSINA), "Submission On behalf of Our U.S. Member Companies, To The U.S. Department of Commerce (DOC), In Connection with The DOC's Review of U.S. Manufacturing and The Need to Develop and Implement A Pro-Manufacturing Policy Agenda," Washington, D.C., August 15, 2003.

[3] American Iron and Steel Institute (AISI), "Climate Change Priorities" *2007 Public Policy Agenda,* Washington, DC, February 22, 2007, 8-10.

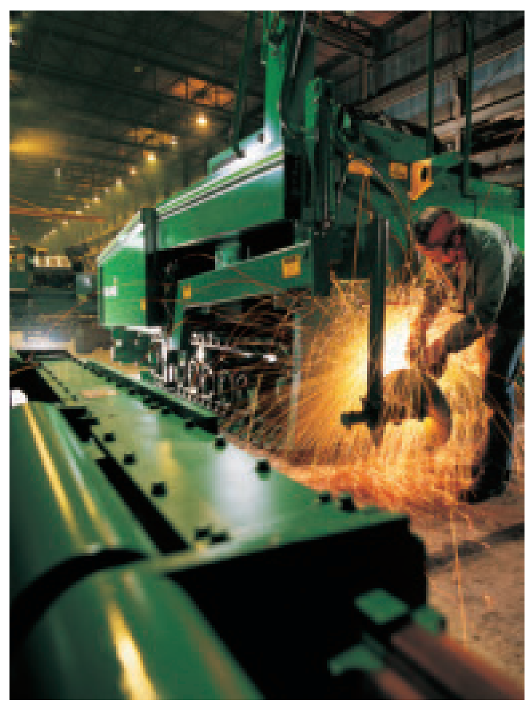
[4] Robert C. Baugh, "A 21st Century Energy Policy for Environmental and Economic Progress, Testimony Before the Environment and Public Works Committee for the U.S. Senate," July 25, 2007.

no climate policies are enacted into law throughout the study period (1992-2030). The EIA's analysis of the Lieberman-Warner bill projects the inflation-adjusted (USD 2006) allowance price to be $30 per metric ton of CO_2-equivalent by 2020 and $61 by 2030.[5] The policy case was assumed not to go into effect until 2012. The energy price projections used in this study—for electricity and five fuel types, (metallurgical coal, natural gas, liquid petroleum gas, residual fuel and distillate fuel)—correspond to the EIA's Lieberman-Warner analysis (see Table ES-A).

According to economic studies and industry experts, the ability of these industries to pass along policy-driven costs is generally constrained, especially in the short-to-medium run, depending on economic conditions.

Core Scenarios. Using the II-CPM, we conducted simulations estimating the impacts of the Mid-CO_2 Price Policy relative to BAU on six industries (primary and secondary aluminum, iron and steel and ferroalloy products, paper and paperboard, petrochemicals, and chlor-alkali), with the assumption that the industries did not pass additional energy costs along to their customers (the "no cost pass-along" scenario, or NCPA). In addition to measuring energy and production cost impacts in the simulations, we defined two new variables: the *operating surplus,* to serve as a proxy for an industry's profits, and the *operating margin,* as a proxy for its profit margin, and therefore are indicators of an industry's profitability (see Box ES-I).

Cost Pass-Along Scenarios. According to economic studies and industry experts, the ability of these industries to pass along policy-driven costs is generally constrained, especially in the short-to-medium run, depending on economic conditions and the strength of market demand. Indeed, the evidence suggests that the no cost pass along scenarios would more realistically represent the energy-intensive industries' market situation under a climate policy. Nevetheless, to provide a full spectrum of possible industry responses to energy costs increases, we simulated the Mid-CO_2 Price Policy relative to BAU assuming that the 100 percent of the additional energy costs are passed along by industries (the "cost-pass-along" scenario, or CPA). The model outputs included production costs, operating surpluses and margins, and domestic and import market shares and production outputs.



[5] U.S Department of Energy, Energy Information Administration (EIA), *Energy Market and Economic Impacts of S. 2191, the Lieberman-Warner Climate Security Act of 2007* [SR/OIAF/2008-01] (Washington, DC, April 2008), xii, table ES3.

Table ES-A

Carbon-Based Fuels and Electricity Price Scenarios Mid-CO_2 Price and BAU Cases

($2000/MBtu and % above BAU)

Energy Source	Real Energy Prices ($2000)		
	BAU 2006	Mid-CO_2 Price	
		2020	2030
Electricity	15.42	16.09	17.11
Percent above BAU	—	*8.6*	*13.1*
Natural Gas	6.57	6.51	8.69
Percent above BAU	—	*22.2*	*39.0*
Metallurgical Coal	3.04	6.01	8.65
Percent above BAU	—	*104.7*	*180.0*
Liquefied Petroleum Gas	16.91	14.48	15.25
Percent above BAU	—	*0.5*	*-0.1*
Coal Coke	9.11	18.02	25.94
Percent above BAU	—	*104.7*	*180.0*
Residual Fuel	7.77	9.01	11.81
Percent above BAU	—	*26.7*	*43.1*
Distillate Fuel	13.15	*14.31*	17.30
Percent above BAU	—	*14.1*	*24.0*

Source: EIA, HRS-MI

Box ES-I

Operating Surplus and Operating Margin Defined

At the unit of production level, the **operating surplus** is defined as the difference between an industry's aggregate market price and its unit production cost. For each industry, the II-CPM generated operating surplus and margin projections for the climate policy case and the BAU scenario. At the industry output level, the total operating surplus was calculated by subtracting total production costs from total industry revenues for a given year.[6] The **operating margin** is defined as the ratio of an industry's total operating surplus and total revenues.

The operating surplus includes several overhead-related costs (such as sales, general and administrative (SG&A) costs), depreciation, interest on capital, and other expenses that could be considered part of the industry's fixed production costs, and profits and taxes not yet paid out. When a firm's operating surplus and margin is reduced as a result of increased production costs, this generally leads to lower profits, at least over the short-run unless administrative costs are reduced, as well.

[6] Total production costs equals total production output multiplied by unit production costs. Total industry revenues equals production output multiplied by market price.

These results were used to inform preliminary analyses of investment and policy options for the different industries. Although investment options were not directly modeled, we calculated energy-efficiency improvements needed to offset the increasing energy costs from a climate policy. We also modeled an allowance allocation scenario, wherein allowances are distributed to energy-intensive industries to mitigate a portion of the increased energy prices. This work included the following assessments:

Energy-efficiency requirements—for each industry, estimates of the energy efficiency gains required to offset increased energy costs under a climate policy.

Technology investment options—review of the principal near-, mid- and long-term technology options available to reduce energy use, improve efficiency, and offset higher production costs arising from a climate policy.

Ninety percent allocation policy option—simulations of a policy option that would allocate to each of the industries allowances mitigating 90 percent of the additional costs incurred as a result of a climate policy.

Additional scenarios and sensitivity analyses were simulated to examine changes in the II-CPM outputs resulting from variations in key assumptions, under different economic conditions and scenarios.

Summary of Findings

The results of the HRS-MI study show that climate change policies that put a price on CO_2 and other greenhouse gas emissions in the economy, when applied only in the United States and with no relevant energy efficiency investments, could have substantial impacts on the competitiveness of U.S. energy-intensive manufacturing industries over the next two decades. On the other hand, we also found that technology investment and policy options exist that could mitigate the industries' policy-related cost increases, improve their energy-efficiency, and ultimately enhance their economic performance. More research is needed, however, to further explore and analyze these options, as well as other policies that could preserve and strengthen this vital part of the nation's manufacturing base while reducing the threat of global warming.

Our findings support the following general conclusions:

Climate policies that impose a modest to high cost on carbon-based energy sources would increase most of the energy-intensive industries' production costs, reduce their operating surpluses and margins, and shrink their domestic market shares. This assumes that no investments or actions are made to mitigate or offset the additional cost impacts. These results also are contingent on each industry's future energy mix and reliance on fossil fuels.

Since these industries typically are constrained in their ability to pass along domestic policy-driven energy costs (because of international competition, market conditions, the nature of their markets, and other factors), **they likely would feel increasing pressure to take actions to reduce their costs and prevent their profitability from decreasing to undesired levels.**

The adoption of both readily available and more cutting-edge technology, and the achievement of high energy efficiency at a large scale could offset increased costs and generate additional profits. All the industries investigated are exploring a range of energy-saving technologies that could help mitigate these impacts, but face financial, technological, and other limitations (such as the age and sunk costs of their existing equipment) on their ability to successfully invest and adopt these alternatives over the short-to-mid-term.

An allowance allocation policy that substantially offsets energy cost impacts, at least through 2025, could buy time for these industries to make the adjustments and energy-saving technology investments required for maintaining their domestic production capacity and competitiveness. On the other hand, if industries do not invest early enough, making use of the time window provided by the allowance allocation, they could face even harder times toward 2025-2030.

Other policies, nevertheless, will likely be needed to encourage and enable industries to make these investments, as an alternative to cutting production or moving their operations to low-cost, low-regulation locations.

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Production Costs

Energy price increases in the Mid-CO_2 Price Policy would drive up total production costs in the energy-intensive industries. Table ES-B shows, though, that these impacts would vary considerably across the industries. The iron and steel industry would see the largest real production cost increases of all the industries analyzed, growing from 4 percent above BAU by 2012 to over 11 percent by 2030, while secondary aluminum and petrochemicals would experience the most modest cost impacts, rising only to a little under 2 percent by 2030.

Operating Surplus

The II-CPM projections of the impacts on industries' *operating surpluses*—a proxy for their profits—incorporated the market dynamics associated with international

Table ES-B
Real Unit Production Costs Above BAU, Mid-CO_2 Price Policy

Industry Sector (Unit)	2012		2020		2030	
	$2000	Percent	$2000	Percent	$2000	Percent
Primary Aluminum (mt)	38	*2.2*	40	*2.6*	64	*4.6*
Secondary Aluminum (mt)	7	*0.5*	10	*0.8*	19	*1.7*
Iron & Steel & Ferroalloys (ton)	29	*4.0*	50	*6.7*	90	*11.4*
Paper & Paperboard (ton)	11	*2.1*	17	*4.0*	31	*8.7*
Petrochemicals (ton)	3	*0.6*	5	*1.0*	9	*1.5*
Chlor-Alkali (mt)	4	*3.6*	6	*5.5*	10	*9.9*

mt=metric ton

competition. These results show what might happen if manufacturers make no adjustments to their outputs or invest in new energy-saving technologies to offset cost increases.

Manufacturers have several options when confronted with higher production costs, including investments in energy-saving technologies.

As Figure ES-1 shows, every industry in the study would see an operating surplus decline relative to BAU under the Mid-CO_2 Price Policy, although in absolute terms the operating surplus would still be positive for all industries. As noted above, these scenarios assumed no major new investments are undertaken to improve efficiency, and that no complimentary policies are implemented to mitigate increased energy costs.

Not surprisingly, the industries with the greatest production cost increases associated with higher energy costs, also would suffer the largest operating surplus and operating margin declines. These include iron and steel, paper and paperboard, and chlor-alkali, followed by primary aluminum.

Investment Options

Manufacturers have several options when confronted with higher production costs, including investments in energy-saving technologies. A review of near-, mid-, and long-term energy efficiency opportunities available to the industries suggests that a number of such technology options exist for each industry. The II-CPM enabled estimations of the energy efficiency gains that would be needed in each industry to offset the energy cost impacts from climate policies. These calculations, summarized in Figure ES-2, include the gains that would be required in the use of energy fuels, electricity and energy feedstocks. The estimates first involved calculating the energy equivalent for the incremental cost increases arising from a climate policy. For any given year after the policy went into effect, this amount was divided by the total energy consumption through that year, to give the energy efficiency gains needed to offset the cost increases.

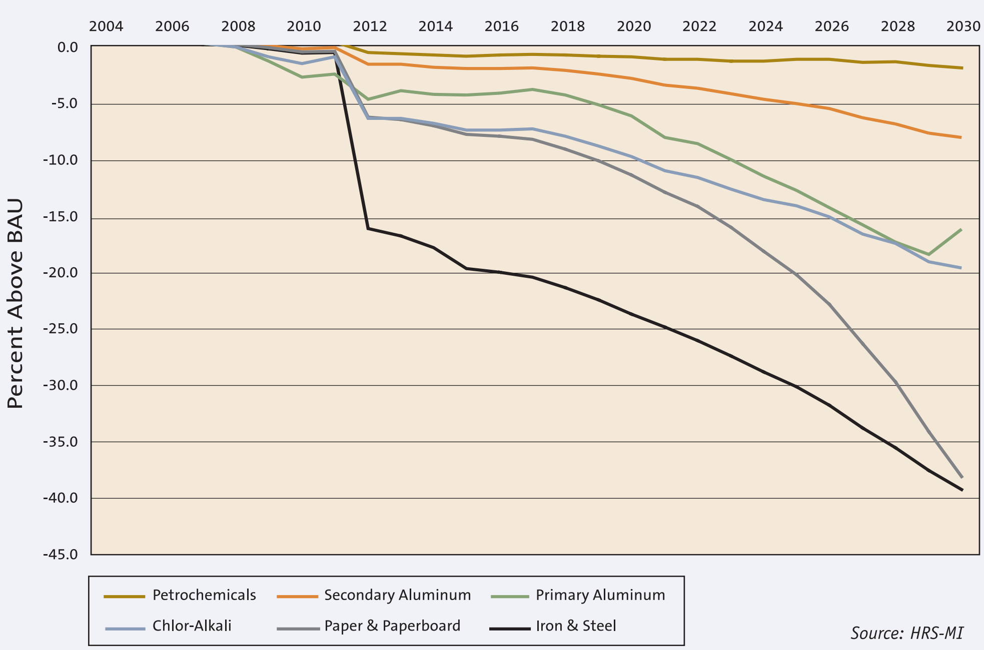
Over the short run, these options might be limited, as many of the industries already have invested over the years in substantial energy-efficiency gains. On the other hand, we found that relatively low-cost incremental improvements in energy efficiency and savings are possible over the near-to-mid term, such as more combined-heat and power (CHP) generation; relined boilers; enhanced heat recovery; improved sensors and process controls; more efficient electric motors, pumping systems and compressed air systems; and improved recycling technologies, among other measures. These improvements could result in small, steady energy-efficiency gains, offsetting some of the added costs from a climate policy. However, the energy-efficiency analysis indicates that much larger gains, requiring substantial investments in advanced low- or no-carbon production processes would be necessary over time.

To varying degrees, the industries have been supporting research and development on advanced production and process technologies that could result in significant energy savings (Table ES-C). However, several barriers to commercialization and deployment of these and other important technologies remain. First, it may be many years before most of these technologies are proven to be technically and commercially feasible, and cost effective from manufacturers' point of view, even with higher energy costs. Second, these technologies mostly involve installing large, expensive pieces of equipment, requiring fairly substantial infusions of new capital

RELATIVELY LOW-COST INCREMENTAL IMPROVEMENTS IN ENERGY EFFICIENCY AND SAVINGS ARE POSSIBLE OVER THE NEAR-TO-MID TERM, SUCH AS MORE COMBINED-HEAT AND POWER (CHP) GENERATION.

Figure ES-1

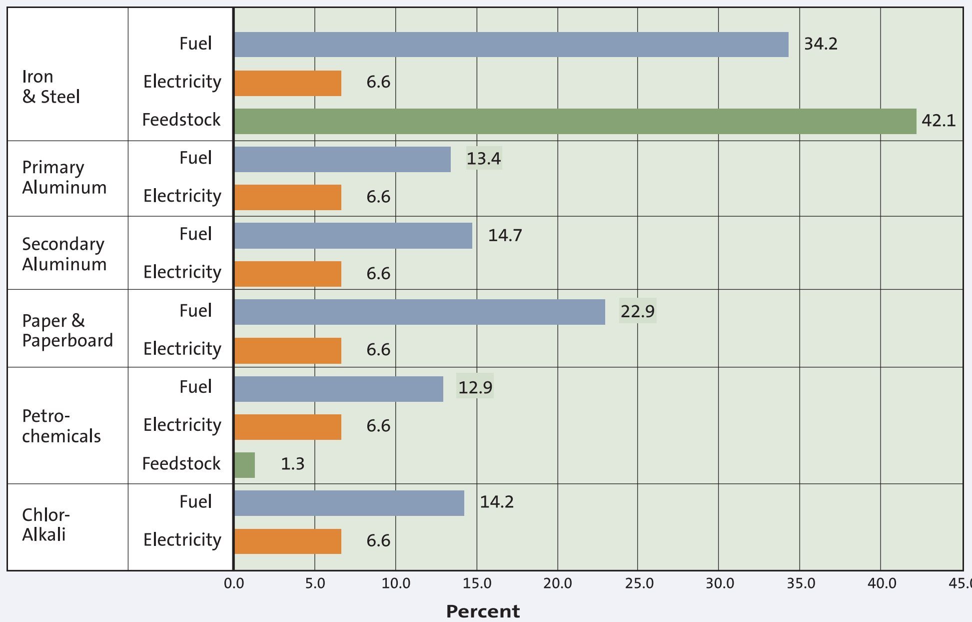
Mid-CO_2 Price Case Real Operationg Surplus Relative to BAU Comparing All Industries [NCPA]



Source: HRS-MI

Figure ES-2

Energy Efficiency Gains Required by 2020 (Cumulative) Mid-CO_2 Price Policy Case [Percent of BAU]



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Additional policies would likely be needed to support timely investment in energy efficiency and retrofitting of less advanced production facilities.

investments, by industries that chronically complain about a lack of capital. Finally, the vintage of existing equipment, machinery and facilities in these industries will dictate when manufacturers will be willing to replace aging production capacity with new, more energy-efficient technologies.

Additional policies would likely be needed to support timely investment in energy efficiency and retrofitting of less advanced production facilities. Also, more research is needed to assess the industries' potential to adopt new energy-savings technologies and whether or not this would be sufficient to offset the impact of higher energy prices for different climate policies. Finally, we need a better understanding of the financial and market conditions—that is, the "business case"—that would motivate and justify manufacturers' investments in advanced low-carbon production technologies.

Allowance Allocation Option

We also conducted a preliminary examination of policies for mitigating the impacts of CO_2-pricing policies on energy-intensive manufacturers. Specifically, we used the II-CPM models to evaluate a policy that would allocate free emission allowances equal to 90 percent of the increase in energy costs. Companies could then sell these allowances to offset their increased energy costs. The number of

Table ES-C

Technology Options for Reducing Energy Use and CO_2 Emissions

Technology Option	Description	Time-frame
Iron & Steel		
Pulverized coal and plaste waste injection	Pulverized coal is already used by more than 50% of U.S. BOFs	ST-MT
New reactor designs	Uses coal and ore fines (COREX, FINEX)	MT
Paired straight hearth furnace	Substitutes coal for coke in blast furnaces, lower costs, uses 2/3 energy	MT-LT
Molten oxide electrolysis	Produces iron and oxygen, no CO_2	LT
Hydrogen flash melting	Uses hydrogen in shaft furnaces, no CO_2	MT
Geological sequestration + steelmaking		MT-LT
Paper and Paperboard		
Black liquor gasification	In demonstration, R&D; commercially available 2030; 15%-23% gain	MT-LT
Efficient drying technology	R&D now; commercial demo, 2015-2030; commercial 2030-->	MT-LT
Primary Aluminum		
Wetted, drained cathode technology		MT
Alternative cell concepts	Combines inert anode, drained cathodes	LT
Carbothermic and kaolinite reduction process on commercial scale	Alternatives to the Hall-Héroult process	LT
Petrochemicals		
High-temperature furnaces	Able to withstand more than 1,100°C	MT-LT
Gas-turbine integration	Higher-temperature CHP for cracking furnace	MT-LT
Advanced distillation columns		MT-LT
Combined refrigeration plants		MT-LT
Biomass-based system options	Feedstock substitution	LT
Chlor-Alkali Manufacturing		
Convert mecury-process and diaphragm-process plants to membrane technology	Combined electrolytic cell with a fuel cell, using hydrogen by-product	MT-LT

ST=Short Term (Current Year-2015); MT=Medium Term (2015-2030); LT=Long Term (2030-2050)
Sources: IEA, DOE, AISI, Aluminum Assocation, Korean Energy Institute

Table ES-D

Real Operating Surplus Above BAU (%) 90 Percent Allocation Policy vs. No Allocation Case, Mid-CO_2 Price Case [NCPA]

Industry Sector	2020		2030	
	No Allocation	90% Allocation	No Allocation	90% Allocation
Primary Aluminum	-6.4	-1.7	-16.5	-7.6
Secondary Aluminum	-3.1	-0.8	-8.3	-3.8
Iron & Steel	-24.0	-6.2	-39.6	-18.2
Paper & Paperboard	-11.7	-3.0	-38.4	-17.7
Petrochemicals	-1.2	-0.3	-2.2	-1.0
Chlor-Alkali	-10.0	-2.6	-19.9	-9.2

PROVIDING FREE ALLOCATIONS, AT LEAST FOR THE NEAR-TO-MID TERM, WOULD GREATLY LESSEN THE COST PRESSURES ON THESE INDUSTRIES THAT MIGHT OTHERWISE LEAD TO PRODUCTION CUTBACKS DOMESTICALLY.

allowances that are distributed would decrease 2 percent annually. The results showed that, for each of the industries, the declines in operating surplus would be reduced by nearly three-quarters under the allocation scenario compared to the non-allocation case by 2020, and by roughly 50 percent by 2030. As Table ES-D shows, every industry would benefit from the same large gains if the allocation allowance measure were enacted. (Note: This scenario assumes no new investments in energy efficiency improvements).

Allocating allowances to firms also substantially decreases the efficiency improvements needed to offset increased energy costs, allowing more time to develop and deploy advanced technologies (see Figure ES-3). By 2020, these requirements for the different energy sources (fuel, electricity, feedstock) with the allocation would be diminished by from 70 to over 80 percent across the industries compared to the no allocation case. Nevertheless, for iron and steel at least, some requirements would still be significant though achievable. For example, by 2020, the required fuel and feedstock efficiency gains would be 9 percent and 12 percent in the 90 percent allocation scenario, compared to 34 percent and 42 percent, respectively, without an allocation. The implication of these findings is that providing free allocations, at least for the near-to-mid term, would greatly lessen the cost pressures on these industries that might otherwise lead to production cutbacks domestically.

Conclusions

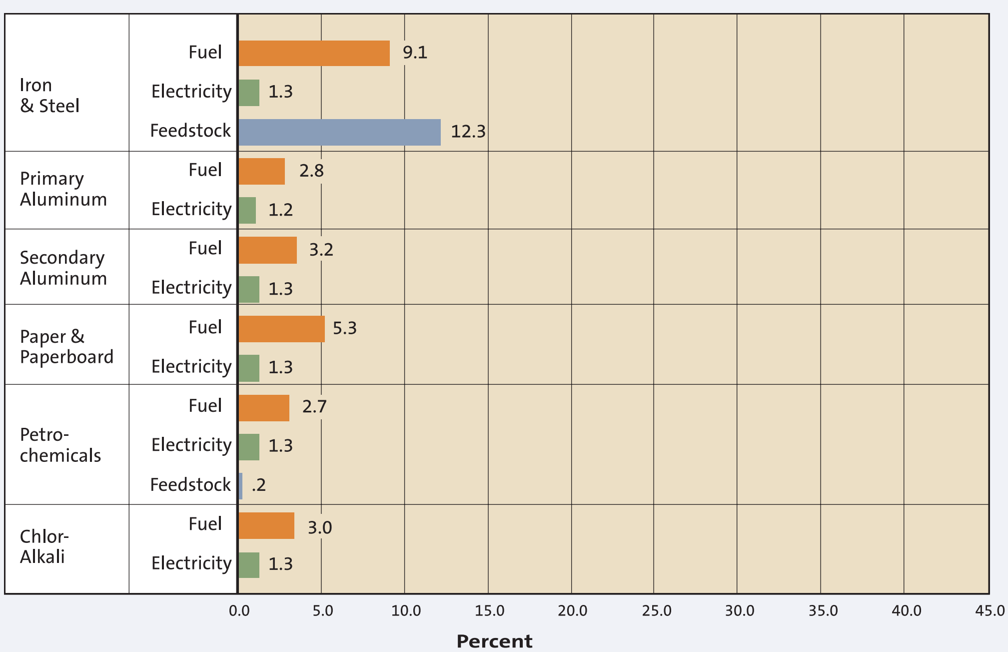
Manufacturing remains a vital part of the American economy. Many business, labor, and political leaders are rightly concerned that climate policies may contribute to the erosion of U.S. manufacturing competitiveness. This challenge is especially acute for energy-intensive basic materials manufacturing industries, which form the cornerstone of the nation's manufacturing base. There is particular concern about climate policy impacts on this sector, which is especially vulnerable to both rising energy costs and global competition. A primary goal of climate policy, therefore, should be to help energy-intensive industries reduce their dependence on fossil-fuels while improving their productivity and competitiveness in global markets.

The findings presented in this report show that climate policies that price CO_2 could have significant impacts on the competitiveness of U.S. energy-intensive manufacturing sectors over the next two decades if climate regulations are applied only in the United States, and no action is taken to invest in advanced low- and no-carbon technologies or otherwise mitigate the cost impacts on these industries. The extent of these impacts would vary across industries, depending on their energy-intensities, the mix of energy sources they rely on (electricity, natural gas, coal), and how energy is used in production activities (heat and power, feedstock). An industry's

Many business, labor, and political leaders are rightly concerned that climate policies may contribute to the erosion of U.S. manufacturing competitiveness.

Figure ES-3

Energy Efficiency Gains Required by 2020 (Cumulative) Mid-CO_2 Price Policy Case, 90% Allocation [Percent of BAU]



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sensitivity to foreign imports and its ability to pass through cost increases to its customers in the face of international market competition are also major factors.

Our results also show that the energy efficiency gains required to offset the energy cost impacts from climate policies for energy fuels used for heat an power would range from 14 percent to 34 percent, by 2020. Iron and steel and paper and paperboard, in particular, would require the largest energy fuel efficiency gains. We also estimated that the former would require as much as a 42 percent gain in feedstock consumption. While relatively low-cost incremental improvements in energy use are possible over the near-to-mid term, much larger gains, requiring substantial investments in advanced low- or no-carbon production processes, would be necessary over time.

POLICY MEASURES THAT MITIGATE THE SHORT- TO MID-TERM COST IMPACTS OF CLIMATE POLICY WOULD BUY TIME FOR—AND, IF COUPLED WITH APPROPRIATE POLICIES, ENCOURAGE—ENERGY-INTENSIVE MANUFACTURERS TO MAKE THE TRANSITION TO LOW-CARBON PRODUCTION PROCESSES.

Our findings further suggest that policy measures that mitigate the short- to mid-term cost impacts of climate policy would buy time for—and, if coupled with appropriate policies, encourage—energy-intensive manufacturers to make the transition to low-carbon production processes. In particular, we found that with an allocation of a 90 percent allowance, reduced by 2 percent yearly, a substantial decrease in efficiency improvements would be needed to offset increased energy costs, allowing more time to develop and deploy advanced technologies. Furthermore, with such an allocation, declines in operating surplus for the Mid-CO_2 Price Policy, would be reduced by nearly three-quarters by 2020, and by roughly 50 percent by 2030.

In short, our findings strongly suggest that over the long-run, technologies are available to enable energy-intensive industries to achieve sufficient efficiency gains to offset and manage the additional energy costs arising from a climate policy. However, we also strongly believe that **the industries analyzed will need additional measures that both mitigate these cost impacts in the short-to-medium term, and policies that encourage and facilitate the transition of energy-reliant companies (and their employees) to a low-carbon future, while enhancing their competitiveness in global markets.**

The savings below are achieved when PC recycled fiber is used in place of virgin fiber. Your project uses 955 lbs of paper which has a postconsumer recycled percentage of 25%.

2 trees preserved for the future	6 lbs waterborne waste not created
852 gallons wastewater flow saved	94 lbs solid waste not generated
186 lbs net greenhouse gases prevented	1,420,563 BTUs energy not consumed

In keeping with our environmental initiatives, we engaged a printer that is carbon neutral, FSC certified, and an EPA Climate Leader Partner. This project was printed on FSC certified paper using vegetable-based inks.

CLIMATE LEADERS

FSC
Mixed Sources
Product group from well-managed forests, controlled sources and recycled wood or fiber
Cert no. SW-COC-1689
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Waterless Printing Process

CARBON NEUTRAL

GREEN POWER PARTNER

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