CLIMATE POLICY AND ENERGY-INTENSIVE MANUFACTURING: ALTERNATIVE POLICIES AND EFFECTIVENESS OF COST MITIGATION PROVISIONS IN THE AMERICAN ENERGY AND SECURITY ACT OF 2009

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SUMMARY

In June 2009, the U.S. House of Representatives passed H.R. 2454, the American Clean Energy and Energy Security Act (*ACESA*). The *ACESA,* and a similar bill introduced in the Senate, include cost containment and cost mitigation measures to either directly limit or offset after-the-fact the cost impacts of carbon-pricing to ease the transition for certain segments of the economy. Energy-intensive trade-exposed (EITE) manufacturing industries especially are vulnerable because of their heavy fossil-fuel reliance and their sensitivity to foreign competition.

This study—the last of a trilogy of studies High Road Strategies, LLC (HRS) and the Millennium Institute (MI), of Arlington, VA, (the "HRS-MI team") were commissioned to conduct[1]—first focused on examining the output-based rebate measure in the *ACESA*, for alternative policy assumptions that directly or indirectly affect the economic impacts of emissions allowances in the economy—i.e., testing the effectiveness of cost containment in the bill:

- a *High Cost* (*HC*) case which assumes the costs of nuclear, fossil with CCS and biomass generation would be 50 percent higher than the *Basic* case in the *ACESA* examined in the second of the three HRS-MI studies;[2] and
- a *No International Offsets* (*NIO*) case that assumes the use of international offsets is severely limited by cost, regulation, and/or slow progress in reaching international agreements on offsets.

It then examined the effectiveness of the border adjustment measure (the International Reserve Allowance program) to mitigate EITE industry costs, as the rebates decline and emissions allowance costs grow.

Overall, the study confirmed that regardless of the policy case or industrial sector, the output-based rebates would be an effective means for mitigating the costs of carbon-pricing for EITE industries, from the short-to-medium term, through 2020-2022. But as the rebates start phase to out after 2020, if low-carbon electric power alternatives (*HC* case) or international offsets (*NIO* case) were not readily available—which might be more realistic assumptions—the economic impacts on EITE industries would be greater, perhaps significantly for some industries, especially after 2025. In short, the predicted economic impacts in the *Basic* case analyses could underestimate the actual impacts that EITE industries would experience if the *ACESA* were actually enacted.

At the same time, the study's findings were mixed concerning the effectiveness of the border adjustment (BA) measure in reducing cost impacts after 2020. The results of the modeling of the BA measure reflect uncertainties about how the measure would be designed and applied. For example, because countries that have complied with carbon reduction agreements account for the overwhelming largest share of U.S. imports, the BA measure would not be especially effective in offsetting the rising allowance costs of U.S. EITE manufacturers after the rebates start to fade.

The iron and steel industry, whose imports include a large proportion from non-compliant countries compared to the other industries would be the only sector with any observable benefit from the BA measure, assuming no cost-pass through.

On the other hand, the BA measure could make it less risky for U.S. firms to pass through their emissions costs to their U.S. customers. The prices of compliant country imports would not be affected, however, and they would increasingly replace both U.S. and non-compliant country EITE goods in domestic markets. Eventually the U.S. gains from BAs would diminish as allowance costs grow and compliant country imports increase their inroads in U.S. markets. The BA measure also would not alleviate the higher production costs of U.S. EITE exports sold in international markets, and could force U.S. downstream industrial consumers to bear higher U.S. and non-compliant import prices, putting U.S. manufacturers at a competitive disadvantage with foreign producers of downstream products.

Given these limitations and potential trade and legal issues that remain unresolved—e.g., WTO compliance, BAs may not be the most effective means for mitigating EITE industry costs from carbon-pricing, and limiting carbon leakage.[3] Instead, a continuation of the output-based rebates—an option available under Presidential discretion—might be an easier, less encumbered and more effective mechanism for offsetting adverse impacts on U.S. EITE industrial competitiveness.

The only true, long-term solution, however, is for U.S. EITE manufacturers to invest in energy-saving and next generation low-carbon production and process technologies. The rebate and BA measures only buy time for manufacturers, over the short-to-medium term. While the rebates might encourage some companies to make energy-saving investments,[4] these inducements would not be enough -alone- to encourage the large-scale investments in the low-carbon technologies they would need to remain competitive in the face of high emissions costs incurred by 2030.

The first HRS-MI report illustrated that technology options exist for EITE industries,[5] but it also identified barriers (capital availability, technical feasibility, equipment vintage) to making such investments.[6] So far, there have been few measures considered in the climate debate that encourage the innovation and adoption of advanced low-carbon technologies by the EITE industries.[7] Yet such investments would substantially and permanently reduce GHG emissions produced by industry and eliminate the threat of carbon leakage, while also strengthening the competitiveness of a critical manufacturing sector in the United States.

ENDNOTES

1 The first two's reports include Joel S. Yudken and Andrea M. Bassi, *Climate Policy and Energy-Intensive Manufacturing: Impacts and Options*, Arlington, VA: High Road Strategies and Millennium Institute, June 2009; and —, *Climate Policy and Energy-Intensive Manufacturing: The Competitiveness Impacts of the American Energy and Security Act of 2009.* Report to the Environmental Defense Fund. Arlington, VA: High Road Strategies and Millennium Institute,

February 26, 2010. The both can be downloaded from the High Road Strategies website, www.highroadstrategies.com.

[2] I.e., Yudken and Bassi (2010).

[3] Moreover, there is significant doubt whether the BA measure would be an effective inducement for non-compliant countries to adopt policies that include binding emission reduction commitments, a rationale used in arguing for BA measures. Werksman et al (2009), 6.

[4] For example, rebates are averaged over a whole industry sector (6-digit NAICS), which could provide the more efficient producers a small windfall—rebates may exceed their costs—while less efficient firms receive rebates less than their costs. This subsequently could induce the latter to invest in incremental reductions in their emissions and energy use.

[5] Yudken and Bassi (2009). The Environmental Defense Fund also has recently identified a range of potential energy-efficiency opportunities available to U.S. energy-intensive industrial sectors. See www.LessCarbonMoreInnovation.org. The industries for which technology options were examined include petroleum refining, iron and steel, pulp and paper, chemicals, and cement.

[6] See Yudken and Bassi (2009), especially the Technology Policy and Investment Options subsections in the industry chapters.

[7] Exceptions include U.S. Senator Sherrod Brown's (D-OH) Invest in Manufacturing and Clean Technology Act (IMPACT) whose main provisions were incorporated into H.R. 2454, and proposal for a National Industrial Transformation Institute.

OVERVIEW

Despite the oil spill in the Gulf of Mexico, it seems unlikely that Congress will take action on a strong climate and energy bill in the current session, as some have hoped. Nevertheless, debate over the potential economic impacts policies aimed at limiting the use of carbon-based fuels, especially on manufacturing, is likely to continue. In June 2009, the U.S. House of Representatives passed H.R. 2454, the American Clean Energy and Energy Security Act (*ACESA*), first introduced by U.S. Representatives Henry Waxman (D-CA) and Edward Markey (D-MA) ("Waxman-Markey"). On May 12, 2010, Senators John Kerry (D-MA) and Joseph Lieberman (I-CT) released details of the American Power Act (*APA*, or "Kerry-Lieberman").[8] Whether Congress eventually will be able to produce a bill acceptable to both chambers and ultimately signed by the president however remains uncertain.

Both the House and Senate bills include cost containment features (banking and borrowing, domestic and international offsets, allowance "price collar"(Kerry-Lieberman)), to slow the cost impacts from carbon allowance prices over time, and cost mitigation measures (rebates, border adjustments), to offset costs from carbon-emissions pricing. The intent is either to directly limit or to offset after-the-fact the cost impacts of carbon-pricing, at least over the short-to-medium term, to ease the transition for certain segments of the economy, including consumers (especially low-income households) and energy producing and using industries, among others.

The "banking" and "borrowing" of carbon allowances would allow "covered entities" to hold allowances for use during future compliance years or borrow future allowances to satisfy current year compliance obligations. Domestic and international offset credits would allow covered entities to obtain credits for domestic (and international emissions reduction or sequestration projects, representing an equivalent to the emissions covered by an emission allowance. The Kerry-Lieberman bill has an additional built-in cost containment feature not in Waxman-Markey. It would establish a hard "price collar" that creates a predictable systems for greenhouse (GHG) gas prices to rise at a fixed rate over inflation.[9]

Protecting EITE industries. Each bill includes very similar cost mitigation provisions—with a few important variations—that explicitly benefit energy-intensive trade-exposed (EITE) manufacturing industries. These provisions were incorporated in response to industry and labor groups, concerned that a climate bill that drove up fossil-fuel energy costs (including electricity) for energy reliant industries could drive production plants to close or move offshore, causing job dislocations and hurting regional economies, especially in the industrial "heartland."

EITE industries are especially vulnerable compared to other manufacturing industries because they depend heavily on fossil-fuel energy sources for process heating electric power and some for production feedstock. These industries also are highly sensitive to foreign competition, especially from countries with low-cost

labor without comparable GHG mitigation policies. Under the cap-and-trade climate proposals, industrial facilities would be required to submit permits to cover the costs of their "direct" carbon-based emissions and would incur "indirect emissions" costs from purchased electricity, passed-through by fossil-fuel generators. The intent of cost mitigation measures for EITE industries therefore would be to:

- Protect U.S. manufacturers from potential competitive disadvantages resulting from carbon-pricing
- Provide a temporary respite from carbon-pricing cost impacts, to better enable EITE industries to make the transition to low-carbon production
- Prevent the "carbon leakage" resulting from GHG-intensive production moving to countries with less stringent emissions limits, which would undermine the environmental effectiveness of domestic climate policy.[10]

A fourth objective, used to argue for trade-related measures in the bills, is to encourage other countries to adopt climate policies and join climate agreements.[11]

Industry leaders, labor unions, Congressional representatives from regions with concentrations of EITE industries, primarily have been concerned about the first two objectives. The debate over the climate bill and its economic impacts is taking place against a backdrop of both the recent recession and crisis in the financial system, and the long-term erosion in the American manufacturing competitiveness in the global marketplace. U.S. manufacturing has lost more than 6 million workers and 57,000 establishments of all sizes since 1998, and the U.S. continues to have record trade deficits in goods and manufacturing.

For this reason, political support has grown for measures like output-based rebates and border adjustments to protect EITE industries, such as iron and steel, aluminum, chemicals, paper, and cement, among others. These industries form the cornerstone of the manufacturing base; they at are the beginning of the supply chain for all downstream product fabrication industries. Over several decades, however, they have undergone significant shrinkage, restructuring and consolidation, with many plants closing or moving offshore to lower cost foreign locations. Although U.S. EITE industries' primary trade competitors are developed countries, such as European Union nations and Japan, in the last decade they have lost markets to emerging industrial nations such as China, Brazil and India, which have been building up their capacity in these sectors as part of their industrial strategies.

Environmental groups also have supported EITE cost mitigation, but mostly because of their concerns about "carbon leakage." They recognize that if a U.S. climate policy prompts energy-intensive plants to go offshore to countries without a comparable GHG-emissions mitigation program, then all that would have been accomplished is to shift greenhouse emissions to other parts of the world. Many also recognize that mitigating the economic costs to manufacturing industries would make it easier to obtain both industry and labor political support for passing climate legislation.

Three studies. Motivated by these concerns, High Road Strategies, LLC (HRS) and the Millennium Institute (MI), of Arlington, VA, (the "HRS-MI team") were commissioned to conduct a series of studies to examine the costs impacts of climate policies and evaluate mechanisms for mitigating these costs on EITE industries:

1. *Climate Policy and EITE Industries* ("L-W EITE"). The National Commission on Energy Policy (NCEP)/Bipartisan Policy Center, in Washington, DC commissioned the HRS-MI team to analyze the impacts of the *Lieberman-Warner Climate Security Act of 2007* (S. 2191) on energy-intensive manufacturing industries—in particular, the iron and steel and ferroalloy products (33111), primary aluminum (331312) and secondary smelting of aluminum (331314),[12] paper and paperboard mills (32212,3), petrochemicals (325110) and alkalies and chlorine (or chlor-alkalies, 325181). S. 2191 was introduced but not passed in the Senate in the 110th Congress. The results of the study were presented in the report, *Climate Policy and Energy-Intensive Manufacturing: Impacts and Options* (June 2009), by Joel S. Yudken, Ph.D. (HRS) and Andrea M. Bassi, Ph.D. (MI).[13]

2. *Output-Base Rebates and the EITE Sector* ("ACESA I"). The Environmental Defense Fund (EDF) commissioned the HRS-MI team to evaluate the costs of the Waxman-Markey bill on the six EITE industries in the first study, and the potential effectiveness of the output-based allowance rebate measure in the *ACESA* to mitigate these costs. The study built upon the models developed in the prior study, but used a different methodology to measure impacts. The prior study's impact estimates were based on energy price differences between a core climate case and a business-as-usual or *BAU* case.[14] The new study directly calculated the costs that industries would incur from the purchase of carbon-emissions allowances, and then the cost mitigation impacts of the output-based allowance rebates, closely following the rules to calculate allowances and rebates stipulated in the *ACESA.* The methodology and results of this study were presented in the report, *Climate Change and Energy-Intensive Manufacturing: The Competitiveness Impacts of the American Clean Energy and Security Act of 2009* (February 26, 2010), by Yudken and Bassi.[15]

3. *Alternative Policy Scenarios and Border Adjustments* ("ACESA II"). NCEP, the AFL-CIO Working for America Institute (WAI), and EDF jointly supported a third study to examine alternative *ACESA* policy scenarios and a border adjustment mechanism as specified in Waxman-Markey and its cost mitigation impacts on the selected industries, under different market assumptions. Its methodology is based on the modified models for the selected industries, developed and employed in the prior EDF-sponsored study, estimating the cost impacts of the Waxman-Markey bill (*ACESA*) on the EITE industries and the effectiveness of measures in *ACESA* to mitigate these impacts. The two alternative policy scenarios, which are compared to the *ACESA Basic* case, includes one that assumes that non-carbon sources (nuclear, CCS, biomass) that substitute for carbon fuels in electricity generation would have higher costs than in the *Basic* case (the *High Cost (HC)* case), and a second which assumes that use of international offsets *ACESA*—important for cost containment—would be severely limited (*No International Offsets (NIO)* case).

Key questions. This report presents the methodology, results and analysis for the third study. It was concerned, in particular, with two questions:

- How effective would the output-based rebate measures be in mitigating the costs incurred by EITE industries under the alternative policy cases?
- How effective will border adjustment fees be in mitigating the costs incurred by EITE industries from a climate policy, especially after the rebates begin to fade?

The first question concerns evaluating the impacts of *ACESA* on the EITE industries, with and without an output-based rebate measure, under alternative policy cases that would produce somewhat higher emissions costs than in the *Basic* case: namely, a higher share of fossil-fuel generated electricity than projected in the *Basic* case, in the *HC* case, and the limited use of international offsets, in the *NIO* case.

The second question is more controversial. Starting in 2018, the Waxman-Markey would allow the President to establish an "international reserve allowance program," that could impose a border adjustment fee on imported goods in eligible EITE industry sectors, based on the emissions content of these imports, from countries without a GHG emissions reduction commitment as stringent as that of the United States. The provision would go into effect as the output-based allowance rebates begin to decline, and the "President determines" that further cost mitigation is required to "address the competitive imbalances that lead to carbon leakage."[16] The border adjustment measure has attracted criticisms from within and outside the United States. Some doubt whether the measure is WTO compliant or meets other legal standards. These concerns are not directly addressed here, though they will be weighed along with the measure's effectiveness at cost mitigation in any consideration of inclusion in a climate bill.

Other important questions not directly addressed here, which nevertheless can be informed by the study, will be touched on at the end of the report:

- To what extent will cost containment and cost mitigation measures be sufficient to encourage EITE firms to invest in low-carbon technologies to the extent needed to limit cost effects while maintaining their competitiveness?
- What are implications of these measures for downstream manufacturing industries supplied by EITE industries that may experience higher costs?

ANALYTICAL ISSUES AND METHODOLOGIES

Output-Based Rebate Analysis

The models and methodology employed in the ACESA I study of the Waxman-Markey bill's impact on EITE industries, reported in Yudken and Bassi (2010), were the baseline for the models employed in the current study. The steps included:

- Updating of the financial, energy, industry and other data used in the original *Integrated Industry-Climate Policy Models* (II-CPM) in the L-M EITE study.[17]
- Characterization of the reference (*BAU*) case, based on the *EIA Annual Energy Outlook for 2009* (*AEO2009*).[18]
- Characterization of the *ACESA Basic* case (see table I), which entailed estimating the costs incurred by the selected EITE industries from the purchase of GHG allowances, and the cost mitigation impacts of the output-based allowance rebates, following the method to calculate allowances and rebates stipulated in *ACESA*.[19] This included the following steps for each industry:
  - Calculation of industry (GHG (CO_2-equivalent)) emissions.[20]
  - Calculation of production-based allowance costs.[21]
  - Calculation of output-based rebate allocations.[22]
- Industry simulations of *ACESA Basic* case impacts on key economic variables (production costs, operating surplus), assuming no cost pass-along (NCPA).[23]
- Estimates of energy-efficiency requirements to offset cost impacts.[24]

Only the *ACESA Basic* case was simulated in the second study, and the model projected results only through 2025. *ACESA* was designed to cover 100 percent of the production-based emissions allowance costs for each EITE industry in the early years starting in 2014, and later fall off, covering a diminishing share of costs over time. It would provide a limited amount of free allowances each year to the EITE industries—up to 15 percent of all allowance permits in the economy. This number would begin to decline in 2021, and fall sharply after 2025 to zero by 2035, unless a Presidential discretionary measure is put into effect to continue providing rebates, to address potential carbon leakage in these industries.

Alternative Policy Scenarios

The current ACESA II study, which assumed that a Presidential measure would not be taken—and the industries do not make substantial energy-savings investments—made projections out to 2030 for the *Basic* case and for alternative policy cases. Recognizing that the complex interaction of various policy instruments in *ACESA* can results in substantial uncertainty, the EIA analyzed a large number of alternative cases, along with the *Basic* case.[25] Key areas of uncertainty include the availability and cost of low- and no-carbon electricity technologies and the role of offsets:

- The timing, cost, and public acceptance of low- and no-carbon baseload electricity technologies (nuclear power and coal and natural gas with CCS) are areas of great uncertainty in assessing the energy systems and economic impacts of *ACESA*. It is very difficult to estimate the costs of these technologies and the feasibility of rapidly introducing them on a large scale. The EIA notes that their actual costs will not become clearer until a number of full-scale projects are constructed and brought on line.[26] The limitations on the availability and cost-

effective deployment of these technologies that can potentially displace conventional coal-fired generation are therefore a key concern.[27]

Table I—Summary of the ACESA (H.R. 2454)

American Clean Energy and Security Act of 2009 (ACESA; H.R. 2454)*
Reference Case (AEO2009)†:
• Reflects impact of American Recovery and Reinvestment Act, Energy Improvement and Extension Act of 2008, Energy Independence and Security Act of 2007, Energy Policy Act of 2005
• Long-term economic growth 2.4 % 2008-2030
• Short-term growth substantially lower than *AEO2008* due to current recession
ACESA—all EIA analysis cases:
• GHG cap-and-trade program for gases other than HFCs
— ~84% of total US GHG emissions covered by 2016
— 17% reduction by 2020, 58% in 2030, 83% by 2050, relative to 2005
• Provisions for allocation of allowances to electricity and natural gas distribution utilities, low-income consumers, State efficiency programs, rebate programs, energy-intensive industries, other purposes
• CCS demonstration and early deployment program
• Federal building code updates
• Federal lighting and appliances efficiency standards
• Technology improvements driven by Centers for Energy and Environmental Knowledge and Outreach
• Smart grid peak savings program
ACESA Basic Case:
• Also assumes use of domestic and international offsets, not severely constrained by cost, regulation, pace of negotiations with key countries covering key sectors
• Assumes covered entities will bank total of approx. 13 BMT by 2030 through offset usage, emissions reduction that exceeds level required under emissions ca
• Allowance price ($2007/mt CO2-equivalent): $31.7 in 2020, $64.8 in 2030
Provisions of ACESA not addressed:
• Clean Energy Deployment Administration
• Strategic allowance reserves
• Separate cap-and-trade program for HFCs
• GHG performance standards for activities not covered by cap-and-trade
• Distribution of allowances to coal merchant plants
• Effects of increased investment in energy R&D

* Energy Information Administration, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009,* SR/OIAF/2009-05 (Washington, DC, August 2009).

† Energy Information Administration, *An Updated Annual Energy Outlook of 2009 Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook,* SR/OIAF/2009-03 (Washington, DC, April 2009).

- Even though the ceiling on offset use is clearly specified in *ACESA*, there are great uncertainties related to their actual use. Offset use will depend on yet to be made regulatory decisions by the EPA and on the timing and scope negotiations on international agreements or arrangements between the United States and countries where offset opportunities may exist, and on GHG emissions reduction commitments of other nations.[28]

The availability of no- or low-carbon electric power options and of offsets would greatly influence GHG allowance prices, which in turn would affect the economic costs of the *ACESA*. Since the vast majority of reductions in energy-related emissions would occur in the electric power sector, if new nuclear, renewable, and fossil plants with CCS cannot be deployed in the *ACESA* timeframe (2012-2030), the

EIA predicts "covered entities" would increase their use of offsets, if available, and substitute to natural gas for coal-based electricity generation. In any event, fossil-based electricity generation (coal and natural gas) would be higher than in the *ACESA Basic* case.[29] Similarly, if offset use is limited or not possible, the cost containment effect of this measure would be greatly impeded, driving up allowance prices and costs incurred by covered entities required to submit emission permits.

To examine the implications of these different assumptions, the HRS-MI team selected two alternative policy scenarios specified in the EIA analysis, to assess the potential impacts of *ACESA* on the EITE sector:

- *The ACESA High Cost* case is similar to the *Basic* case except that the costs of nuclear, fossil with CCS, and biomass generating technologies are assumed to be 50 percent higher.[30]
- The *ACESA No International Offsets* case is similar to the *Basic* case but assumes the use of international offsets is severely limited by cost, regulation, and/or slow progress in reaching international agreements covering offsets in key countries and sectors. That is, a large portion of international offsets might not meet the requirements specified in *ACESA*, or are not economical.[31]

To assess the impacts on EITE industries of the two alternative policy cases, the HRS-MI team employed the models and methodology, with small modifications,[32] it employed in the ACESA I study and compared the results to those of the *ACESA Basic* case analysis. As shown in figure 1, based on the EIA analyses, the *HC* case would result in modestly higher emission allowance costs than the *Basic* case—11 percent higher in 2030. The *NIO* case would result in substantially higher allowance costs relative to the *HC* and *Basic* cases—57 percent higher than the latter case.

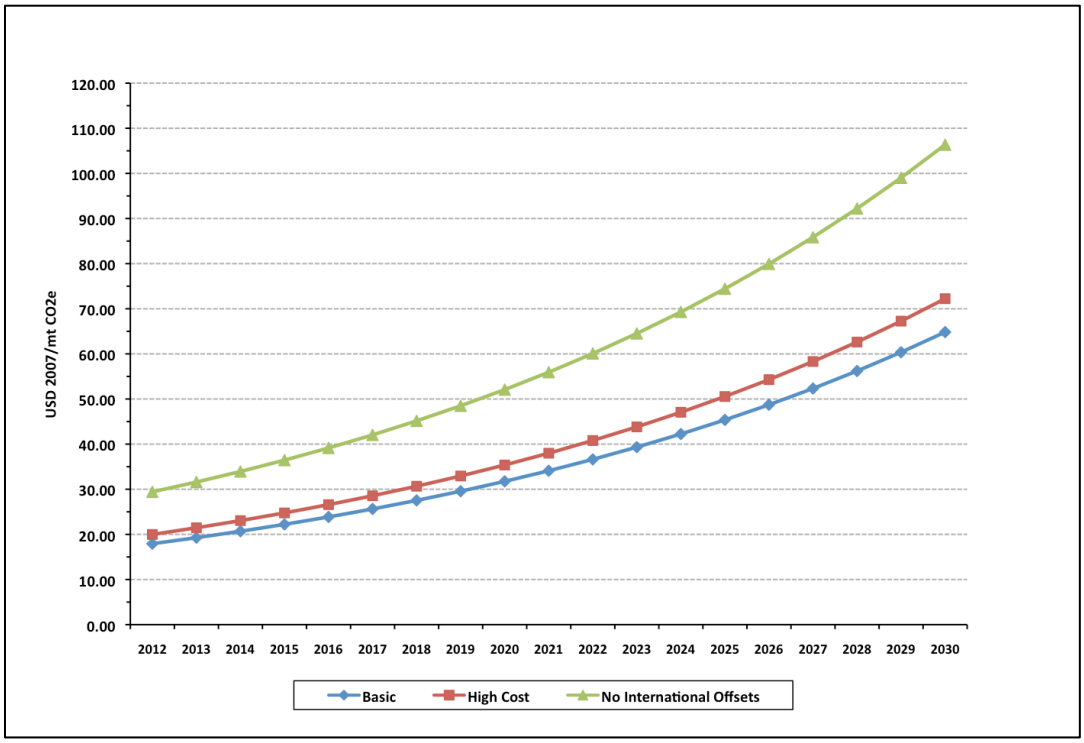
Figure 2 shows the EIA projections of resulting electricity generation mixes for the different cases, comparing to the *BAU* case in 2008, and to *BAU* and each other in 2020 and 2030. In the *Basic* case, coal-based generation would drop dramatically by 2030, to 41 percent less than *BAU*, and natural gas generation would be 28 percent less.[33] The difference would be made up by a substantial growth, absolutely and as a share of total generation, by nuclear power and renewable sources.[34]

In contrast, in the *HC* case there would be a more modest reduction (32 percent) in coal use compared to *BAU*, which would be made up for by a modest rise in renewables (22 percent), a very small increase in nuclear power (4 percent) and small growth in natural gas use (7 percent) by 2030.[35] This mix of electric power sources probably reflects a more realistic scenario. Nuclear power in particular may not be able to grow nearly as fast as projected in the *Basic* case, given substantial economic, technical, environmental and perhaps political obstacles that could slow construction and licensing of new nuclear plants.

At the same time, although the *NIO* case might represent more reasonable assumptions about offsets, it would require an even greater—and probably a more

unrealistic—substitution by nuclear power for coal in electricity generation. The former would more than double, and renewables use also would nearly double, while coal generation would shrink to less than one-quarter of *BAU*, by 2030.[36]

Figure 1—Emissions Allowance Prices for Alternative Policy Cases



The HRS-MI team therefore expected to see a range of different impacts on the EITE industries' production costs and operating surpluses—with and without the output-based rebate measure—for the alternative cases, reflecting variations in the industries' electric power use and emissions-intensities associated with the use of fossil-fuels in their manufacturing facilities and production processes.

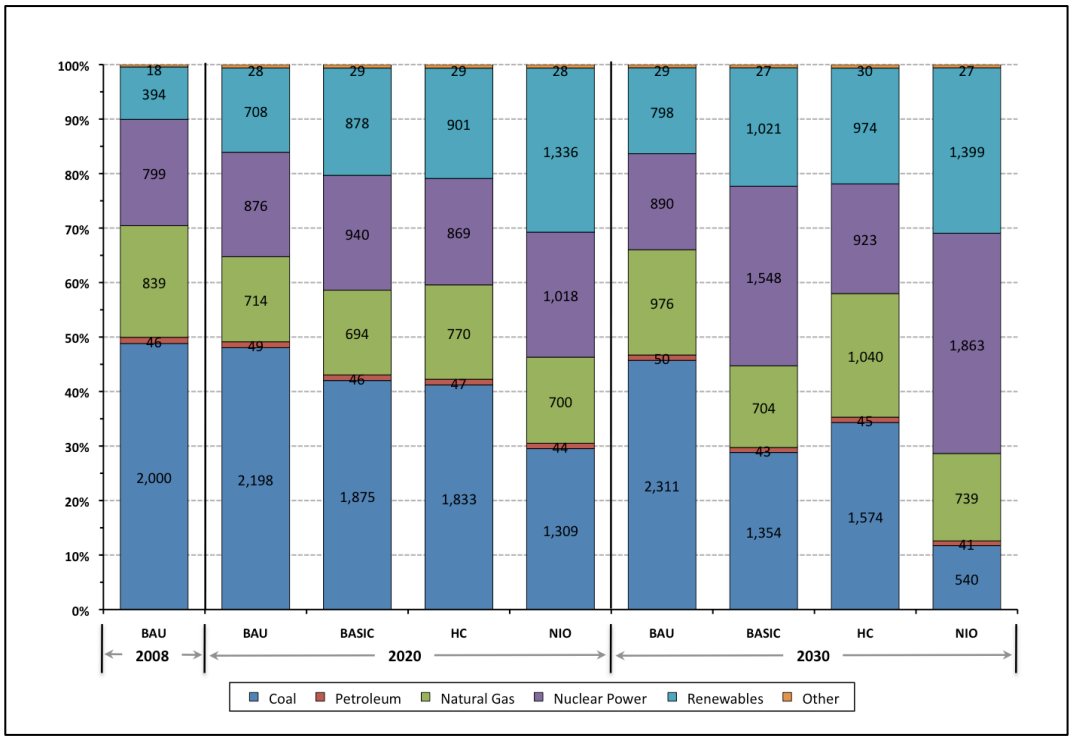
Border Adjustment Measure

The *ACESA* allows the use of a border adjustment (BA) measure—the "international reserve allowance program" in H.R. 2454 (Sec. 768)—starting in 2020, if it appears that a risk of carbon leakage remains after application of the output-based rebates measure. Specifically, the BA measure would require importers of energy-intensive products from countries that have not enacted emissions reduction policies comparable to that of the United States to submit a specified amount of "international reserve allowances" to gain entry to U.S. markets.

Part of the Presidential determination about whether the BA measure would go into effect is (i) an assessment of the effectiveness of emission allowance rebates in mitigating the allowance costs incurred by eligible EITE industries; and (ii) whether more than 85 percent of the imports of covered goods (for a given eligible EITE

industry) are manufactured in countries that meet one of three criteria concerning the importing countries' compliance to GHG emissions reductions commitments or has an energy or GHG-intensity equal or less for the given EITE industry.[37]

Figure 2—Electricity Generation Fuel Mixes for Alternative Policy Cases



Although the BA measure in H.R. 2454 is actually somewhat constrained in scope and, as will be seen, in its impacts, BA tariffs called for by the United States and the European Union are highly controversial, both within the United States and abroad. While properly designed trade measures are not prohibited by the World Trade Organization (WTO) and the United Nations Framework Convention on Climate Change (UNFCCC), some analysts have expressed concerns about the uncertainty over whether the BA measure would be WTO-compliant.[38]

This report however does not address claims that BA fees are protectionist or violates WTO rules, or even that their effectiveness in preventing carbon leakage may be limited. It is mostly concerned with the primary motivation of the measures, to maintain the competitiveness of domestic industries vulnerable to carbon-constraining policies because they are both carbon-intensive and highly sensitive to international trade competition. As a World Resources Institute (WRI) report concluded, "the most defensible use of border measures would be to impose comparable costs on importers as imposed on domestic producers."[39]

Key features and assumptions. Depending upon how they are interpreted, a few features in the measure—how the BA "tariffs" are calculated, and the

eligibility criteria for determining the products, industries and countries covered by the measure—could affect how the BA measures would be implemented and their effects on competitiveness and carbon leakage. However, because specification of the design and implementation of the BA measure in *ACESA* was somewhat vague, the HRS-MI team had to make several assumptions regarding these features:

1. *The BA fees added to non-climate compliant country imports would be based on the carbon content of domestic products of covered industries.* The *ACESA* specifies that the price for foreign imports purchasing an "international reserve allowance" (BA fee) from the United States be equivalent to the auction clearing price for emission allowances on a given day. However, it does not provide a methodology for calculating the quantity of allowances that a U.S. importer of a covered good must submit; it only requires that such a methodology be established.

Hence, it is not clear whether the BA fees should be calculated based on the carbon content of domestic production or on the carbon content embodied in the eligible imports. Some have argued that it could matter a great deal which of these methods of calculation are used in imposing a BA "tariff" on an imported good. Although the method of imposing BA fees based on the carbon content of imports would address the domestic producers' competitiveness concerns, especially if foreign goods have higher carbon-intensity than domestic goods, it would have far more serious trade consequences than if the fees were based on the carbon content of U.S. goods.[40] Domestic producers would probably prefer this approach, though it could also raise strong complaints of protectionism and WTO violation from importing countries.

At the same time, a serious practical problem may preclude calculating BA fees based on the carbon content of imports. This would require having data on the carbon content for all industrial products from all the importing countries, which could be extremely difficult if not impossible to collect. For this reason, the HRS-MI team based its calculation of BA fees on the allowance costs incurred by the U.S. EITE industries and on the emission intensities of their production.[41] On the other hand, the potential effectiveness of BA measures in mitigating costs could be understated if the import-based carbon-content approach were actually employed. To simulate the most optimistic scenario from the U.S. manufacturing perspective, therefore, the HRS-MI models assumed that the BA fees applied to imports would equal the total production-based emissions costs of U.S. producers, not the net allowances that take into account the output-based rebates.[42]

2. *Only U.S. EITE industries will be eligible for the protection of BAs applied to importing countries that fail to meet criteria specified in ACESA.* The ACESA states that only EITE industries that meet certain criteria would be eligible to receive free allowance rebates and benefit from the IRA program.[43] Accordingly, the HRS-MI team applied its BA models only to (six-digit NAICS) EITE industries, represented by the six industries examined in its earlier studies. Some analyses, however, assume that all industrial sectors across the economy in the developed countries could be eligible for BA protection. That is, BA tariffs would be imposed on all merchandise imports,[44] and some in the developing world express similar concerns,[45] even

though the U.S. and European Union (EU) climate policies clearly restrict application of their BA measures to EITE industries.

The criteria determining which importing countries would be subject to BA fees are similarly limiting. The *ACESA* states that if *more* than 85 percent of U.S. imports of covered goods with respect to a given industry sector are produced in countries that have met one or more of three criteria specified in the bill—i.e., the country has an equally stringent GHG emissions mitigation policy as the United States—then the IRA program would not apply (or continued to apply) to that sector.[46] Applying these criteria in the modified II-CPM models used in the ACESA II, required making simplifying assumptions, for analytical purposes, especially because of the difficulties of determining the comparability between the United States emissions reduction commitments and other nations' commitments, as defined in *ACESA*. In the study, for a any eligible EITE industrial sector:

- *Compliant countries* refer to importing countries that are assumed to meet one or more of the comparability criteria in *ACESA.* For analytical purposes all Annex II countries were deemed comparable and Non-Annex II countries were deemed non-comparable, though it was recognized that the actual breakdown might be different.[47]
- *Non-compliant countries* refer to importing countries that are assumed not to meet these criteria[48]
- *Rest of the World* (*ROW) countries* include those countries exempted from the IRA requirements, aside from the compliant countries, that according to *ACESA* qualify as least developed countries as identified by the United Nations.[49]

Table II shows, for each EITE industry, the main importing countries grouped into compliant and non-compliant countries, and the shares of the imports associated with each of these groups and the ROW countries, based on *ACESA* criteria, the definitions above, and criteria and import data from the U.S. International Trade Commission (USITC). Both the compliant and ROW country groups would be exempted form IRA requirements for a given eligible industry. Based on cumulative imports values for 2004-2008, all the industries except paper and paperboard meet the criteria of less than 85 percent of imports coming from compliant countries.

For analytical purposes, the HRS-MI team modeled the BA measure for the paper and paperboard industry, even though it wouldn't technically meet the 85 percent eligibility criteria—over 90 percent of the industry's imports are from compliant countries. The iron and steel industry has the lowest share of compliant country imports—indeed, over half its imports coming from non-compliant countries—followed by primary aluminum and chlor-alkalies. Petrochemical manufacturing however would come close to not meeting the eligibility criteria.

An important caveat is that the models assumed that the lists of importing countries for a given industry remains constant throughout the time period (2012-2030) examined in this study. However, it is possible that some of the major non-

compliant countries—India, China, Russia, and Brazil in particular—could adopt GHG emissions reduction targets comparable to those of the United States and other developed nations before 2030, and perhaps before the BA measure might be applied. Thus, in this case, the modeling results represent a *best case* for the cost mitigation benefits of the BA measure. That is, the lower the share of non-compliant country imports, the lower the BA fees importers would pay, and the smaller the extent the BA measure might mitigate industries' carbon-costs.

Table II—Compliant and Non-Compliant Country Shares of Imports for Selected EITE Industries

Industry	Primary Aluminum	Iron & Steel	Paper & Paperboard	Petro-chemicals	Chlor-Alkalies
Percent of Imports [General Imports-Custom Value ($) Cumulative 2004-08]					
Compliant Countries	63.7%	39.5%	90.5%	81.5%	63.1%
Non-Compliant Countries	*35.1%*	*52.9%*	*8.6%*	*14.4%*	*32.8%*
ROW	1.2%	7.6%	0.9%	4.1%	4.1%
Top Importing Countries					
Compliant Countries	Australia, Canada, EU-15, New Zealand	Australia, Canada, EU-15, Japan	Australia, Canada, EU-15, Japan, Norway, Switzerland	Canada, EU-15, Norway,	Canada, EU-15, Japan
Non-Compliant Countries	Argentina, Bahrain, Brazil, China, Mexico, Russia, South Africa, UAE, Venezuela	Argentina, Brazil, China, India, Kazakhstan, Korea, Mexico, Russia, South Africa, Taiwan, Turkey, Ukraine, Venezuela	Brazil, China, Indonesia, Korea, Mexico	South Africa, Venezuela, Libya, Turkey, Nigeria, Brazil	China, Korea, Mexico, Romania, Taiwan

Data source: USITC

3. *The study modeled scenarios assuming the BAs would first be applied either in 2020 or in 2025*. The *ACESA* would require the President to make a determination starting in 2018, and every 4 years thereafter, based on the effectiveness of the output-based rebates in mitigating carbon-emissions allowance costs to implement the BA program. The HRS-MI study assumed that the BAs would begin either in 2020 or 2025.[50] An industry's output-based rebates would first begin to be surpassed by the emissions allowance costs incurred in 2020, though the net added costs due to *ACESA* would remain small, but steadily rise, until 2025. After 2025, the rebates would drop off rapidly, and the eligible industries' emissions costs would grow rapidly. This assumes that the industries would not invest in energy-saving technologies that substantially reduce cost impacts. The BA scenarios that start in

2025 show the potential cost mitigation effects of the BA measure after the emission allowance costs start to rise significantly for a sector, as the rebates wear off.

4. *The study examined two scenarios based on behavioral assumptions about U.S. EITE industries passing-along their emissions allowance costs to their output market prices in response to imposition of BA fees on non-compliant importers.* In the ACESA I study, only the no cost pass-along (NCPA) scenarios were simulated in the output-based rebate assessments. It was assumed that these reflect a most likely case that most EITE industries would experience with passage of carbon-pricing climate policy such as *ACESA* (or Lieberman-Warner, in the first HRS-MI report (Yudken and Bassi, 2009)). The prior HRS-MI studies assumed that since EITE industries are trade-sensitive and market prices for their goods are generally set in global markets, they typically would have difficulty passing along higher costs arising from a geographically limited carbon-pricing policy, since foreign competitors would not be subject to these cost pressures.

EITE manufacturers would not only hesitate to pass-through their costs in fear of losing market share to lower cost imports in their domestic markets. They may be even more fearful of losing *export* sales in foreign markets if they increase prices to offset added emissions costs, which foreign manufacturers from non-compliant countries would not incur. It is precisely these impacts that the rebate and BA measures were designed to offset, delaying the potential impacts on manufacturers' bottom-lines. They would enable U.S. manufacturers to maintain prices at the prevailing market levels and not lose competitive advantage to lower-cost foreign manufacturers. At the same time, with a BA measure in place, U.S. EITE producers may feel freer to pass through their costs to their U.S. marketed goods, whose price increases would still be smaller than those of non-compliant importing countries.

In any event, the HRS-MI models examined the BA measures applied in addition to the output-based rebates, for two different assumptions about the cost pass-along behavior of U.S. EITE manufacturers to the imposition of the BAs on non-compliant importers, for each assumed starting year, 2020 and 2025.[51]

- *No Cost Pass-Along (NCPA BA) Scenario*: Assumes that BA fees would be added to the prices of non-compliant countries' imports in the U.S. market for an industry's products, but U.S., compliant country and ROW manufacturers do not raise their prices above the prevailing domestic market price in a given year.[52]
- *Cost Pass-Along (CPA USA BA) Scenario*: Assumes that BA fees based on the full production-based emissions allowance costs would be added to non-compliant countries' import prices, while U.S. manufacturers raise their prices an equal amount *less* output-based rebates received in a given year.[53]

SUMMARY OF FINDINGS

Output-Based Rebate Analysis

The ACESA I study's main finding was that the output-based allowance rebates would be effective in limiting the cost impacts of a carbon-pricing policy on EITE industries for the short-to-mid term—reducing the additional costs to near zero until about 2020. Cost mitigation, however, would diminish as the allowance rebates start phasing out after 2020, paralleled by modestly rising economic costs until 2025, though the extent and nature of these impacts would vary by industry. After 2025, industry costs would accelerate as the rebates fall off, unless the Presidential discretionary cost mitigation measures are put into effect—border adjustments or an extension of the rebates—or the industries have made sufficient energy-saving investments to avoid the additional costs from carbon pricing.

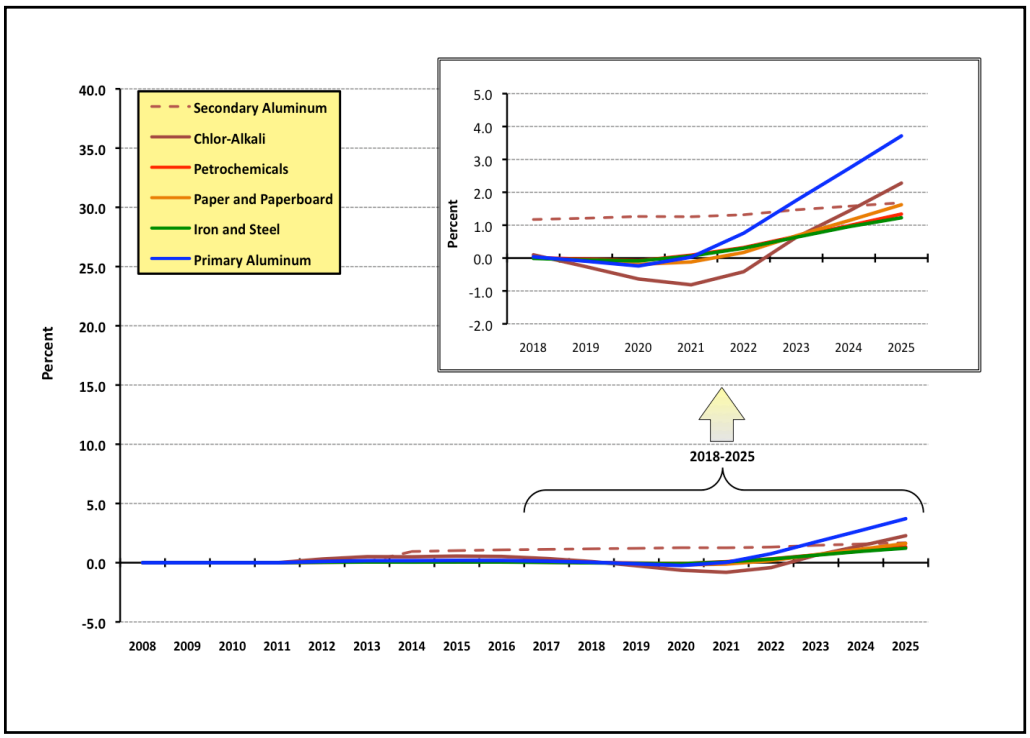
Figure 3 compares potential production cost impacts relative to *BAU* for the EITE industries, from H.R. 2454 with the allocation. The models projected 7 years of almost no impacts—the rebates would completely cover emission costs—and then a steady rise in costs beginning in 2021, as production-based emissions allowance costs outpace the rebates.[54] Table III also summarizes the impacts (production costs, operating surplus) of *ACESA* on the industries—reflecting different factors that influence market prices, input costs, and market demand, and different patterns of energy consumption (fuels, electricity, and feedstock) and associated emissions. Primary aluminum would have the largest impacts, followed by chlor-alkalies, and paper and paperboard. Iron and steel and petrochemicals would experience more modest impacts relative to *BAU*, according to the model projections.

Figure 4 shows the energy efficiency gains required for a given year, to offset the added costs of *ACESA* from 2012-2025 for each industry aggregating across all energy fuels consumed by an industry (heat and power, electricity, feedstock), comparing the no-allocation rebates and allocation cases. The method of calculation used estimates the energy-efficiency gains (percent of Btus reduced relative to BAU) required for a given year, for the energy types, assuming only minor yearly efficiency gains of 0.5 percent are made in prior years.[55]

Alternative Policy Scenarios

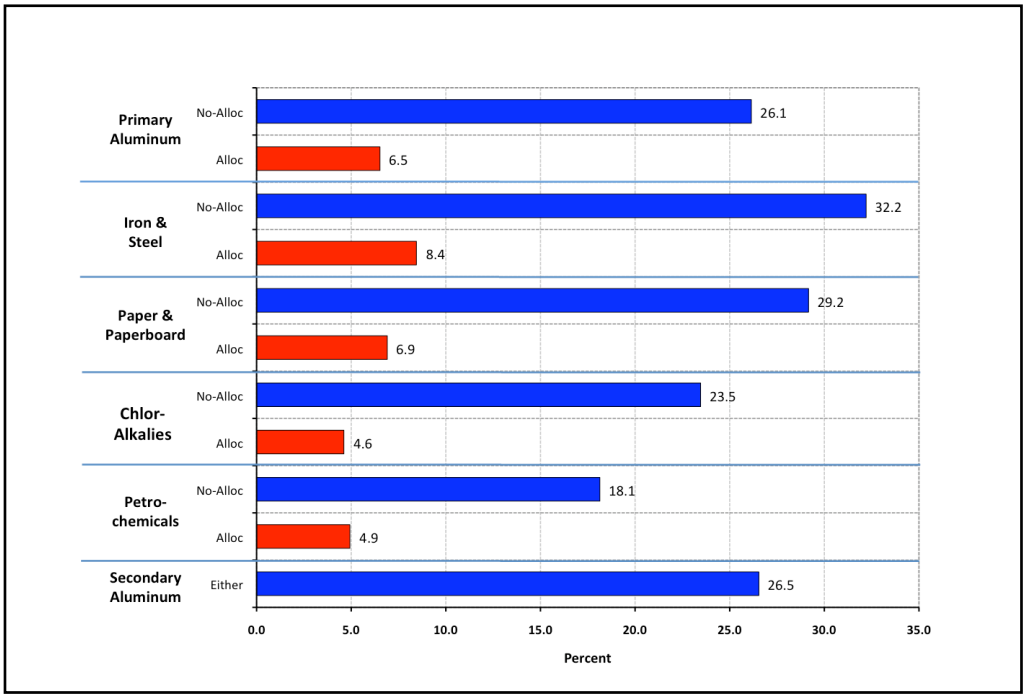
The findings for the *ACESA High Cost* and *No International Offsets* policy cases are similar to those for the ACESA I study of the output-based rebate provision. As shown in table IV and figures 5 and 6, which present the results for a weighted average for the industries,[56] the economic impacts of the alternative cases would begin to deviate from the *Basic* case and each other starting around 2020 as the rebates decline and cover less of the industries' emissions costs. Generally, the results show that if low-carbon electric power alternatives or international offsets were not readily available, the impacts on EITE industries would be greater than in the *Basic* case, especially after 2025. Specifically, the key findings include:

Figure 3—Production Costs Above BAU—All Industries Allocation Scenario



Source: Yudken and Bassi (2010), fig. 3

Figure 4— Total Energy Efficiency Gains Required (Percent)—2025



Source: Yudken and Bassi (2010), fig. 6b.

Table III: Summary of Results—ACESA I Study

Industry [NAICS]	Energy Cost Share* (2008)	Primary Energy Sources	Emissions Characteristics		Production Costs (% Above BAU)				Operating Surplus (% Above BAU)			
			Energy Type	% of Industry Emissions (2012)	No Allocation		Allocation		No Allocation		Allocation	
					2020	2025	2020	2025	2020	2025	2020	2025
Primary Aluminum [331312]	36.0%	NG, Petro Coke, RFO, Elect	Fuel	4.3	10.8	14.9	-0.2	3.7	-23.8	-38.7	0.5	-9.7
			Feedstock	44.3								
			Electricity	51.4								
Secondary Aluminum [331314]	4.4%	NG, Elect	Fuel	38.2	1.3	1.7	—	—	-5.0	-7.2	—	—
			Electricity	61.8								
Iron & Steel [33111]	10.0%	Coal, Coke, NG, RFO, Elec	Fuel	35.8	3.6	4.7	-0.1	1.2	-11.6	-14.9	0.3	-3.9
			Feedstock	35.4								
			Electricity	28.7								
Paper & Paperboard [32212,3]	13.1%	Coal, NG, RFO, Elect	Fuel	58.3	4.8	6.9	-0.2	1.6	-13.4	-22.1	0.5	-5.2
			Electricity	41.7								
Petro-chemicals [325110]	19.0%	NG, LPG, RFO	Fuel	15.5	3.5	4.9	-0.1	1.3	-4.2	-6.0	0.1	-1.6
			Feedstock	76.7								
			Electricity	7.9								
Chlor-Alkalies [325181]	45.9%	NG, Coal, LPG, Elect	Fuel	57.3	9.2	11.6	-0.6	2.3	-18.9	-24.4	1.3	-4.8
			Electricity	42.7								

NG= Natural Gas; RFO = Residual Fuel Oil; LPG = Liquefied Petroleum Gas; Elect = Electricity; Petrocoke = Petroleum Coke
** Energy share of production costs*
Source: Yudken and Bassi (2010), 15, table B.

- Regardless of the policy case and EITE industry, *without a rebate provision*, production costs would start growing in 2014, the first year the industries would be subject to a carbon price, and grow substantially—and operating surpluses would decline and continue to fall— by 2030, relative to *BAU*. The greatest impacts would occur in the *NIO* case, followed by the *HC* and *Basic* cases.
- *With rebates*, although the EITE industries would be protected from significant emissions allowances costs until around 2020-2022, for all the cases:
  - the *HC* impacts would start growing, surpassing those of the *Basic* case, around 2020 and rise at an even faster rate after 2025

– the *NIO* case impacts would fall below the *HC* and *Basic* cases between 2020-2025—production costs would dip below and operating surpluses would rise above *BAU*, 2020-2022—before surpassing and growing beyond the *Basic* case and *HC* case impacts in 2025 or after.

Table IV: Summary of Results—Alternative Policy Scenarios

Industry	Real Production Costs Above BAU (%)						Real Operating Surplus Above BAU (%)					
	No Rebates			With Rebates			No Rebates			With Rebates		
	Basic	HC	NIO	Basic	HC	NIO	Basic	HC	NIO	Basic	HC	NIO
2020												
Primary Aluminum	10.7	12.2	15.4	-0.2	0.0	-0.2	-24.1	-27.4	-34.5	0.5	0.1	0.5
Secondary Aluminum	1.3	1.5	1.8	1.3	1.5	1.8	-5.0	-5.9	-7.2	-5.0	-5.9	-7.2
Iron & Steel	3.6	4.1	5.5	-0.1	0.0	-0.1	-11.6	-13.2	-18.1	0.3	0.0	0.2
Paper & Paperboard	4.8	5.5	7.2	-0.2	0.0	-0.1	-13.4	-15.4	-20.2	0.5	0.1	0.3
Petro-chemicals	3.5	4.0	5.7	-0.1	0.0	-0.1	-4.2	-4.8	-6.9	0.1	0.0	0.1
Chlor-Alkalies	9.2	10.9	14.0	-0.6	-0.1	-0.4	-18.9	-22.4	-28.8	1.3	0.2	0.9
2025												
Primary Aluminum	14.8	17.8	19.0	3.7	5.2	2.8	-39.2	-47.1	-50.4	-9.8	-13.7	-7.3
Secondary Aluminum	1.7	2.2	2.1	1.7	2.2	2.1	-7.2	-9.3	-9.1	-7.2	-9.3	-9.1
Iron & Steel	4.7	5.5	7.1	1.2	1.7	1.2	-14.9	-17.6	-22.5	-3.9	-5.4	-4.0
Paper & Paperboard	6.9	8.3	9.7	1.6	2.5	1.5	-22.1	-26.9	-31.2	-5.2	-7.9	-4.8
Petro-chemicals	4.9	5.7	8.1	1.3	1.7	1.5	-6.0	-7.0	-10.0	-1.6	-2.1	-1.9
Chlor-Alkalies	11.6	14.8	16.7	2.3	4.3	2.2	-24.4	-31.0	-35.1	-4.8	-9.0	-4.7
2030												
Primary Aluminum	18.2	24.1	24.1	13.5	18.4	17.2	-60.7	-80.2	-80.4	-44.9	-61.4	-57.4
Secondary Aluminum	2.0	3.0	2.5	2.0	3.0	2.5	-9.3	-13.9	-11.8	-9.3	-13.9	-11.8
Iron & Steel	5.8	7.2	9.0	4.3	5.6	6.5	-18.4	-22.8	-28.6	-13.6	-17.6	-20.6
Paper & Paperboard	8.9	11.8	12.9	6.5	9.0	9.2	-36.9	-48.7	-53.5	-27.0	-37.4	-38.2
Petro-chemicals	6.9	8.0	11.5	5.2	6.2	8.3	-8.7	-10.2	-14.5	-6.5	-7.9	-10.5
Chlor-Alkalies	13.4	18.6	19.8	9.6	14.2	13.8	-31.3	-43.6	-46.3	-22.4	-33.2	-32.4

Figure 5— EITE Industries (Weighted Ave.) Production Costs, Percent Above BAU, All Policy Cases

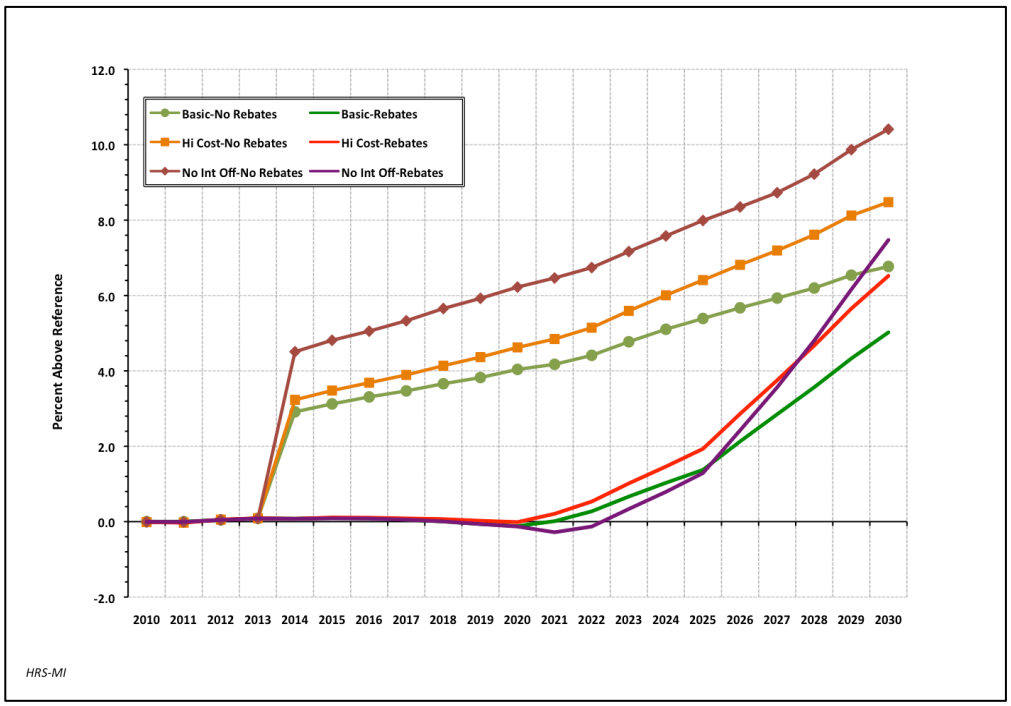
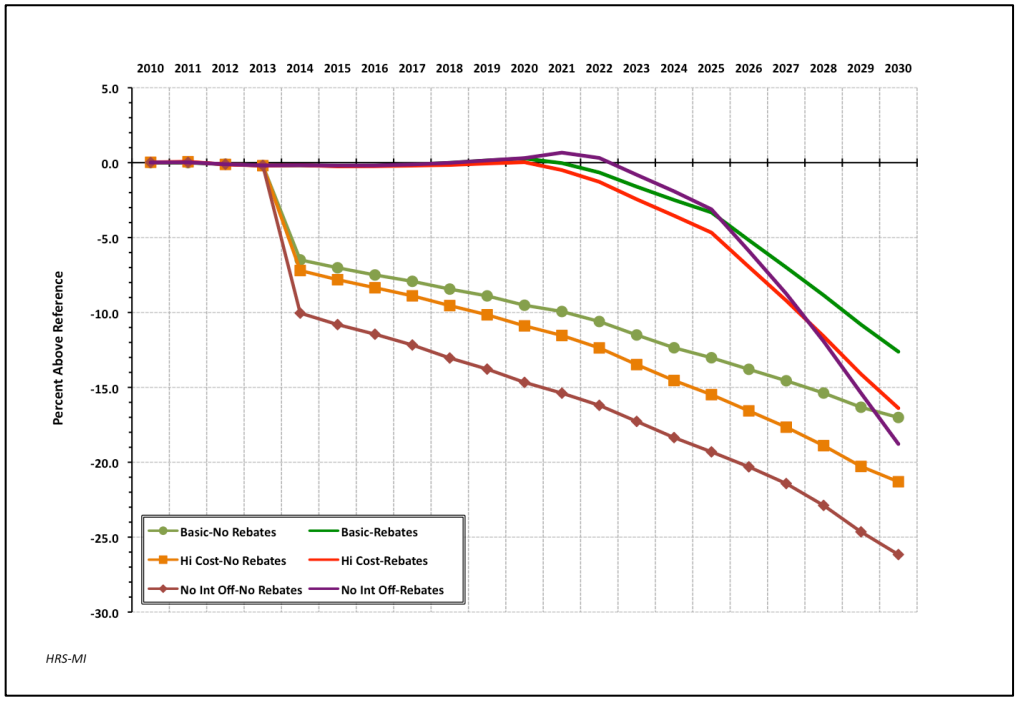
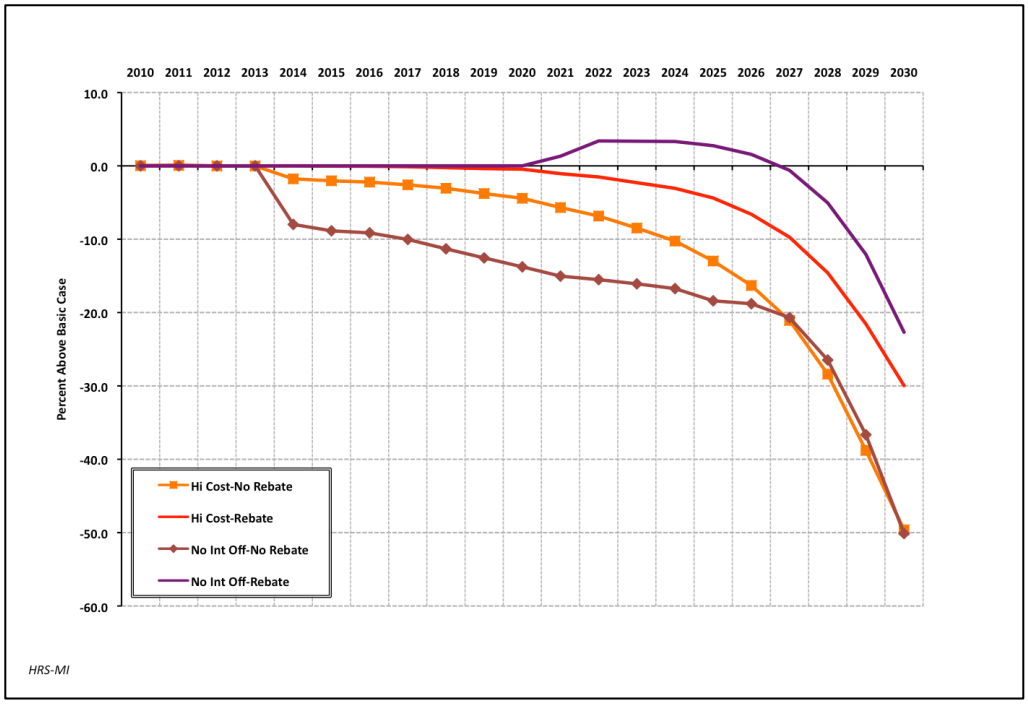


Figure 6— EITE Industries (Weighted Ave.) Operating Surplus, Percent Above BAU, All Policy Cases



- The impacts on the individual industries would follow a similar pattern, but with important exceptions:
  - the *NIO* case impacts would remain lower than the *HC* impacts on the paper and paperboard industry until 2029 and never exceed the *HC* impacts on the primary aluminum (figure 7) and chlor-alkalies industries
  - the *NIO* case impacts on petrochemicals would surpass the *HC* impacts a little earlier (2026) and grow much larger than the *Basic* and *HC* cases.

Figure 7— Primary Aluminum Operating Surplus, Percent Above Basic Case, HC and NIO Cases



All the modeling results assume that neither the federal government nor the industries would take actions after 2020 to mitigate the cost impacts of the climate policies—continued rebates, border adjustments by government or energy-saving investments by industry. They also assume that none of the costs are passed through to the industries' customers—i.e., the no cost-along (NCPA) scenario.[57]

These results primarily reflect three factors: the allowance prices associated with the different cases, the emissions produced and the energy costs associated with the fuels consumed by each industry. The latter, in turn, are affected by projected fossil-fuel prices, especially those of coal and natural gas.

Allowance price impacts. For the weighted mean of the selected *EITE* industries, *NIO* production costs would grow at a faster rate—and *NIO* operating surpluses would rapidly fall—compared to the *Basic* and *HC* cases after 2025,

reflecting the relatively higher allowance price trend for the *NIO* case relative to those of the other cases (figure 1). Similarly, the *HC* impacts would start to grow relative to the *Basic* case in 2020, and spike upwards from 2025 on—though, for some industries, faster than the *NIO* case as well—*because* of high allowance prices.

Emission cost impacts. The amount and sources of emissions from each industry's production naturally influences the modeling results, especially after 2025. The emissions—and related allowance costs—associated with electricity generation for example, would diminish under any of the climate policies, as fossil fuel (coal, natural gas, oil)-generated electric power are replaced by non-carbon sources (renewables, nuclear power). In the *NIO* case, coal use for electricity would be dramatically reduced (see figure 2) compared to the other cases, and *BAU*. This would be true, to a lesser extent, for the *Basic* case, as well. For all the industries, coal-generated electricity emissions therefore would be higher in the *HC* case relative to the *Basic* case, which in turn would be higher relative to the *NIO* case.

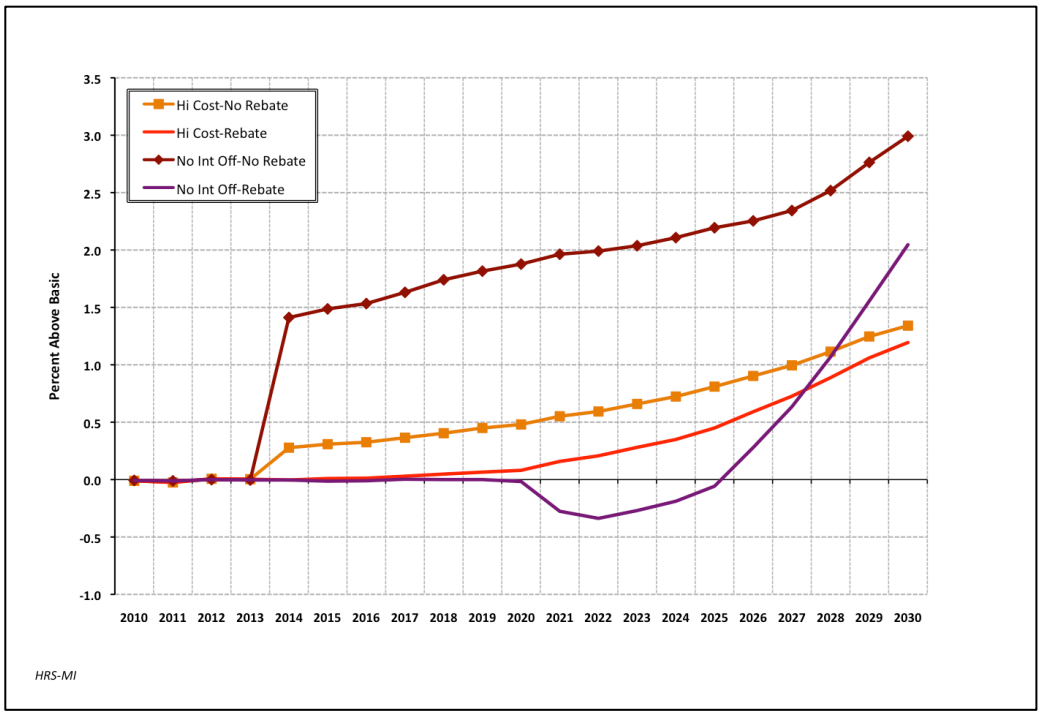
The biggest changes would be apparent in the electricity-reliant primary aluminum and chlor-alkalies industries, whose indirect emissions—generated by the electricity consumed in their production (for smelting and electrolysis, respectively)—represent the major portion of their total emissions—55 percent and 44 percent, respectively, in 2008. By 2030, however, electricity emissions in the *NIO* case would fall to only 14 percent and 11 percent of total emissions, respectively, substantially lower than *BAU* in both industries.

In the *HC* cases, by contrast, the electric power share of emissions for the two industries would be 41 percent and 33 percent, respectively. As a result, *total* emissions for the two industries in the *NIO* case would be 56 percent and 36 percent *less* than *BAU,* respectively, in 2030, but in the *HC* case, *total* emissions would fall by only 18 percent and 15 percent, respectively, relative to *BAU*. The same pattern would be replicated for all the industries, though not to the same degree.

In short, the production costs and operating surpluses after 2025, for each industry, would depend on the combined effects of the relative allowance prices and emissions levels of the different cases. Allowance prices would be substantially higher and rise with time in the *NIO* case relative to the *HC* case, whose prices in turn are greater than for the *Basic* case. However, emissions levels would move in the opposite direction across the cases, falling substantially in the *NIO* case relative to the *Basic* case, which in turn would be lower than those in the *HC* case.

For example, in primary aluminum, production impacts in the *NIO* case would not catch up with those in the *HC* case (at least by 2030) reflecting the large reduction in coal-generated electricity emissions in the former case compared to the latter, which would not be offset by the higher allowance prices of the *NIO* case. In the iron and steel industry, on the other hand, the drop in coal-based emissions associated with electric power would not be as great, and high allowance prices would push the *NIO* impacts higher than the *HC* impacts in 2027 (figure 8).

Figure 8— Iron and Steel Production Costs, Percent Above Basic Case, HC and NIO Cases



Fuel mix and energy price impacts. Between 2020 and 2025, the fuel mix and fuel prices would strongly influence the relative impacts of the policy cases. Both coal and natural gas prices would vary with the demand and supply fluctuations of the two fuels across the economy. Over time, both sets of prices would decline in the policy cases, as coal and natural gas consumption for electric power generation, in particular, would fall due to substitution by non-carbon fuel sources—the extent of which, however, would vary by policy case (figure 2). As a result, energy costs in each of the policy cases would *fall* relative to *BAU* especially after 2020, which when combined with the allowance costs would produce a small negative blip between 2020-2023 in the *NIO* case. The smaller energy costs for the policy cases relative to *BAU*, especially in the *NIO* and *Basic* cases, bring down the costs curves relative to the *HC* case, and to *BAU*, though the large, growing net allocation costs (as the rebates shrink) swamp energy price affects after 2025.

Border Adjustment Measure

While the HRS-MI analysis of the output-based rebate provision in the ACESA showed that the economic impacts on the EITE sector would be effectively mitigated through at least 2020 in all the policy cases, the study's findings are decidedly mixed concerning the effectiveness of the border adjustment (BA) measure (the International Reserve Allowance program) in reducing cost impacts after 2020. The study assumed that the BA measure would be applied to all the EITE industries,

even though at least one industry (paper and paperboard) might not meet the eligibility requirements as specified in the ACESA legislation.

Not surprisingly, the results show different cost mitigation impacts from starting the BA program in 2020, as rebates would begin to scale-down, and in 2025 when rebates would start to decline rapidly and allowance costs accelerate for the industries. However, cost-pass along behavior of U.S. manufacturers in response to the BA measure—U.S. producers do not pass along (*NCPA BA*) or they do pass along their *net* added allowance costs (*CPA USA BA*)—would result in greater differences in cost mitigation impacts for the EITE industries. The principal findings include:

- Regardless of the industry and behavioral assumptions, the cost mitigation effects from the BA measure would be greater if the measure went into effect in 2020 than in 2025 (see table V and figures 9, 10 and 11). That is, operating surplus declines would be smaller and domestic market share gains higher. However, the differences would be noticeably greater for the CPA USA BA scenarios than the NCPA BA scenarios (see figure 12).
- In the NCPA BA scenarios, the mitigation of the cost and operating surplus impacts after 2020 would be very modest, swamped by cost increases after 2025, as rebate offsets diminish and production-based allowance costs grow.
- These impacts only would be noticeable in the NCPA BA scenarios for the iron and steel industry (figure 9-11), and to a lesser extent primary aluminum, reflecting the non-complaint nations' relatively higher share of domestic imports for these industries (53 percent and 35 percent respectively) (see table II).
- In the NCPA BA scenario starting in 2020, the iron and steel industry would enjoy an additional two years of mitigating its cost and operating surplus impacts, essentially an extension of the output-based rebates (figures 9, 10)—though after 2025, its operating surplus would fall to 11.2 percent below BAU by 2030 (table V), or 2.4 percent higher than if the BA were not in effect (NCPA), and it would increase its domestic market share by a little more than 2 percent.
- If the U.S. industries passed along their costs (CPA USA BA), all except primary aluminum would have positive operating surpluses by 2030—chlor-alkalies would see the largest operating surplus gain, of over 5 percent, followed by paper and paperboard, with 2 percent above BAU (table V, figure 12).
- Domestic market share gains in the CPA USA BA scenario would be smaller than in the NCPA BA scenarios—in most instances, the industries (except iron and steel), would see declines after 2025, and by 2030 they would suffer small domestic market shares losses (table V).

Caveats and issues. A number of qualifiers, caveats and issues need to be considered in interpreting these findings, and what they suggest regarding the effectiveness of the BA measure in mitigating EITE emissions cost impacts.

Table V: Summary of Results—Basic Case With Rebates: Border Adjustment Scenarios

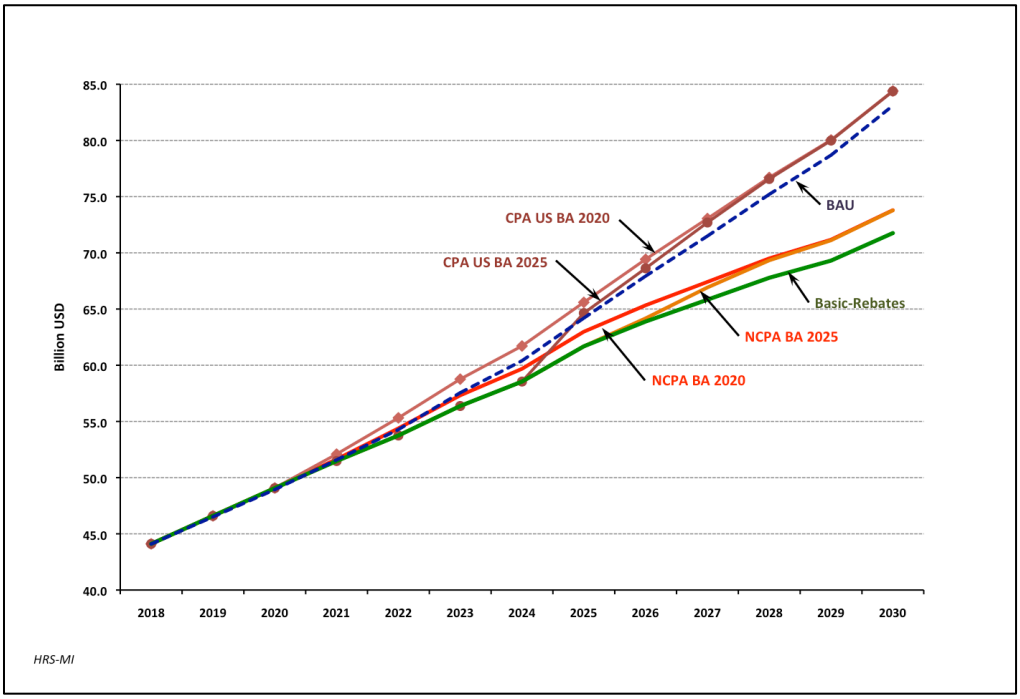
Industry Sector	No BA, NCPA	NCPA BA—Starting:		CPA USA BA—Starting:	
		2020	2025	2020	2025
Operating Surplus (%) Above BAU—2025					
Primary Aluminum	-9.8	-8.2	-9.8	2.2	1.6
Iron & Steel	-3.9	-1.9	-3.9	2.2	0.7
Paper & Paperboard	-5.2	-5.2	-5.2	1.3	1.6
Petrochemicals	-1.6	-1.6	-1.6	0.2	0.2
Chlor-Alkalies	-4.8	-4.7	-4.8	3.2	3.1
Domestic Market Share (%) Above BAU—2025					
Primary Aluminum	0.0	1.3	0.0	0.5	0.0
Iron & Steel	0.0	1.7	0.0	1.2	0.0
Paper & Paperboard	0.0	0.2	0.0	-0.1	0.0
Petrochemicals	0.0	0.1	0.0	0.1	0.0
Chlor-Alkalies	0.0	0.3	0.0	0.2	0.0
Operating Surplus (%) Above BAU—2030					
Primary Aluminum	-44.9	-43.2	-43.3	-0.3	-0.4
Iron & Steel	-13.6	-11.2	-11.2	1.6	1.5
Paper & Paperboard	-27.0	-26.9	-26.9	1.9	2.1
Petrochemicals	-6.5	-6.5	-6.5	0.2	0.2
Chlor-Alkalies	-22.4	-22.1	-22.2	5.4	5.4
Domestic Market Share (%) Above BAU—2030					
Primary Aluminum	0.0	2.0	1.7	-1.9	-1.9
Iron & Steel	0.0	2.2	2.2	0.2	0.2
Paper & Paperboard	0.0	0.4	0.3	-1.5	-1.4
Petrochemicals	0.0	0.1	0.1	-0.2	-0.2
Chlor-Alkalies	0.0	0.5	0.4	-0.1	-0.1

1. *Compliant countries dominate U.S. imports*. The relatively high import shares of compliant countries compared to the non-compliant countries for the U.S. EITE industries would be a major factor limiting the cost mitigation effects of the BA measure in the NCPA scenarios. As already noted, the NCPA assumption is considered the more realistic, typical response of EITE industries that are subject to substantial international trade pressures and whose prices are strongly influenced, if not fully determined (as in the case of primary aluminum), by global markets. As the exception that proves the rule, non-compliant countries account for more than half of the iron and steel industry's imports—the largest for any of the industries, Subsequently, the modeling results show that it would be the only industry benefiting from a relatively large mitigation effect from the BA measure. The others only would see very modest (primary aluminum) or barely perceptible benefits.

2. *Future non-compliant country import shares may grow.* The import shares of non-compliant major developing countries—China, India and Brazil—could grow, perhaps substantially, in the coming years, in several EITE industries. If so, the BA measure could produce greater benefits under the NCPA assumption than projected by the modeling results. At the same time, the results do not take into account the possibility, if not probability, that today's major non-compliant countries may adopt climate mitigation measures by the time the output-based rebates would begin their descent, between 2020-2025. Thus, even if their shares of U.S. imports do increase, the BA measure would not provide any cost mitigating benefits to U.S. EITE manufacturers, whose emissions allowance costs, nevertheless, continue to grow.

3. *Different bases for BA calculations.* In the HRS-MI models, the BA measure would impose tariffs on non-compliant country EITE imports into the United States equal to the *total* amount of U.S. production-based GHG emissions allowance costs, while U.S. manufacturers would incur increases in their costs equal to *net* allowance costs—production-based allowance costs *minus* output-based rebates.

Figure 9— Iron and Steel Operating Surplus
BA Scenarios Compared to Basic Case—No BA



After 2020, the BA tariff could give U.S. manufacturers confidence that they can pass through their costs in U.S. domestic markets—the CPA USA BA cases—without losing market share to large non-compliant developing nations, that already benefit from cost advantages. Since U.S. price increases would be less than those of non-compliant importers, U.S. EITE producers would increase their domestic market share compared to non-compliant country importers.[58]

Figure 10— Iron and Steel Operating Surplus Percent Above BAU, BA Scenarios

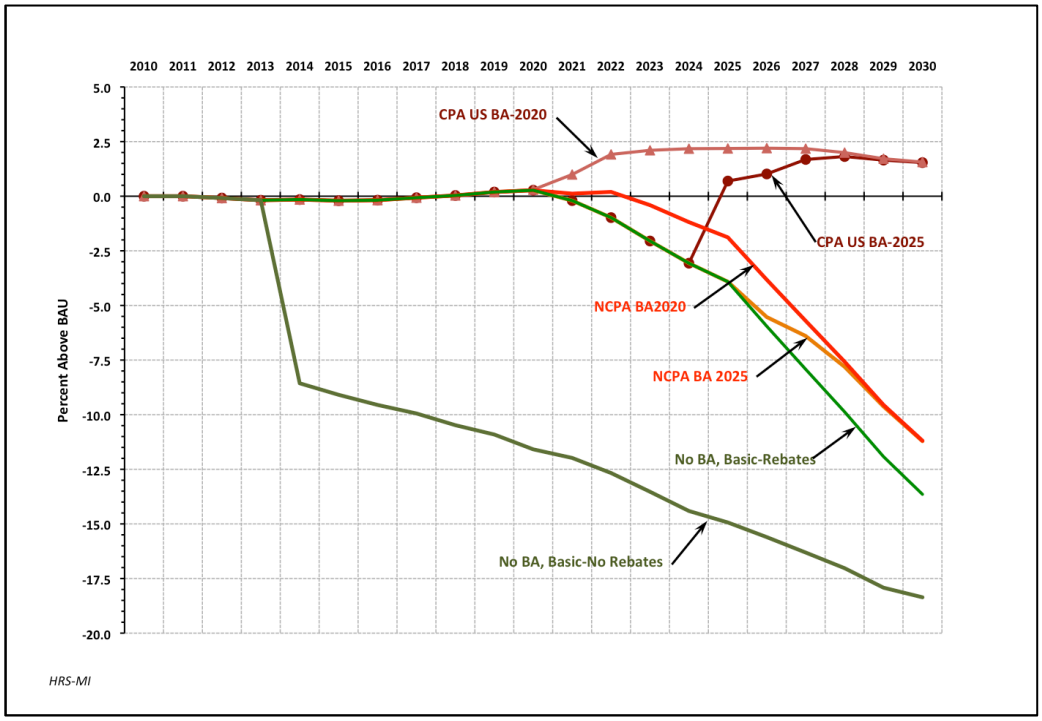
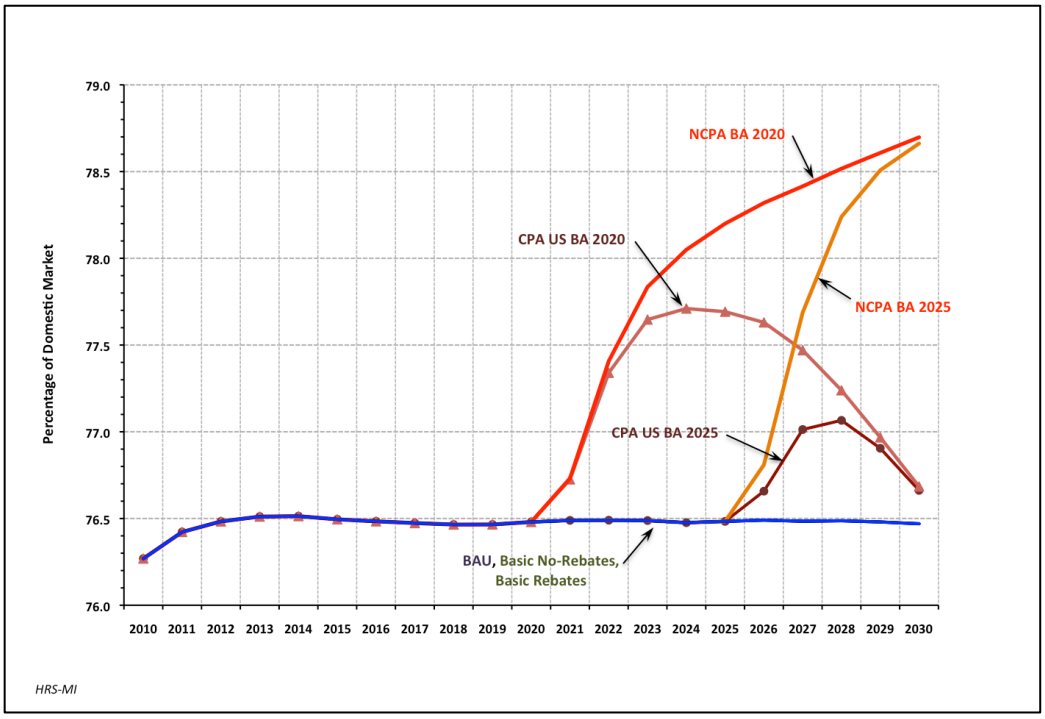
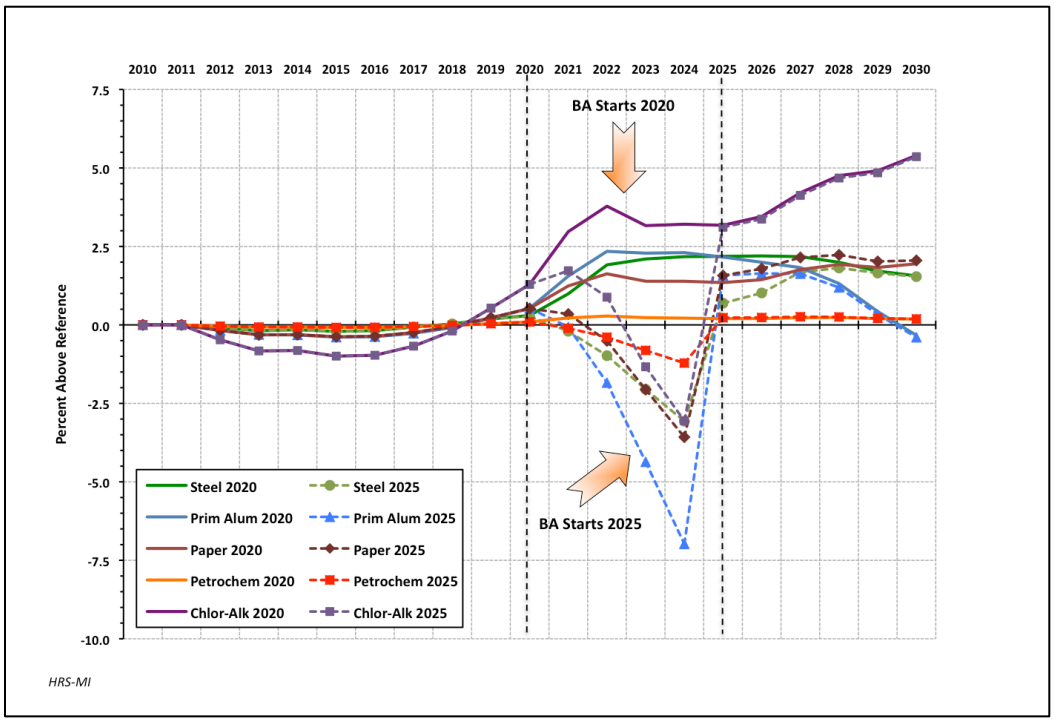


Figure 11— Iron and Steel Domestic Market Share, NCPA and CPA BA Scenarios



On the other hand, if the BA fees incurred by non-complaint countries were equal to only the *net* allowance costs of U.S. EITE producers, then U.S. and non-compliant manufacturers would maintain market shares relative to each other. However, since compliant country importers (Canada, EU, Japan, etc.), that would not need to raise their prices, account for the overwhelming share of U.S. imports in most EITE sectors, they would gain market shares from U.S. *and* non-compliant manufacturers. This accounts for the declines in U.S. market shares that each U.S. EITE industry would see relative to *BAU* in the CPA USA BA scenarios, especially after 2025, when total allowance costs would grow and rebates rapidly shrink. If the net allowance costs were used to calculate non-compliant BA fees, the compliant countries would take an even larger share of the U.S. market from U.S. and non-compliant importers.

Figure 12—EITE Industries Operating Surpluses
Percent Above BAU, CPA BA Scenarios Starting 2020 and 2025



4. *Export market impacts not assessed.* Even though, in the CPA scenarios, the operating margins (i.e., profit margins) would be maintained and domestic market share losses on the whole would be modest, the current HRS-MI models cannot estimate the subsequent impacts on U.S. export markets.[59] If allowance costs were passed through resulting in higher U.S. prices for EITE goods, even if non-compliant nations' imported goods are subject to BA tariffs, U.S. manufacturers would be faced with a choice of whether or not to pass through their costs on exports in order to maintain their market shares in international markets, where the competition from low-cost foreign manufacturers are particularly strong.[60]

If they do not pass through their costs in the form of higher export prices, they may in the short run preserve their market shares, but they would suffer from rising emissions costs—and rapidly declining operating surpluses—incurred under the U.S. climate policy. That would put them at a disadvantage relative to low-cost foreign competitors in international markets who are not encumbered by GHG-related costs, or subject to the BA tariffs applied only to U.S. imports. On the other hand, if U.S. EITE producers passed along their added costs to exports, they in the short run would preserve their profit margins, but over time lose their international sales because of higher emissions-related prices relative to foreign competitors.

In short, any gains from the BAs could be offset by losses in export markets. In contrast, the output-based rebates, if continued beyond 2025—an option in the *ACESA*—would enable U.S. manufacturers to export their goods without experiencing losses, if they opted not to pass through their costs. Further research is needed to fully examine the implications for U.S. exports and consequences for U.S. EITE global competitiveness under a cap-and-trade policy.

5. *Downstream industry impacts.* Research is needed to better understand how the climate bill under a CPA assumption might affect producers downstream from EITE industries—i.e., firms that make intermediate and final goods using EITE products. In the CPA USA BA scenarios, U.S. downstream consumers of U.S. EITE products would face higher prices for inputs purchased from U.S. EITE suppliers, including from non-compliant imported goods. As a result, they could opt to purchase EITE goods from compliant nation producers not subject to BA tariffs, if their prices were lower than U.S. or non-compliant imported goods as a result. If U.S. downstream producers, in turn, pass along the emissions costs originating from EITE suppliers, they could find themselves at a significant competitive disadvantage in export markets against low-cost foreign importers, not subject to carbon-pricing policies, encouraging some downstream producers to move offshore to remain competitive.

6. *Elasticities of import substitution*. In the modeling of cost pass-along behavior, there is uncertainty about the elasticities of substitution between domestic and foreign goods in U.S. domestic markets. The HRS-MI models employed an econometric methodology to estimate the industry elasticities, based on historical import trends under different prices.[61] While these may be based on reasonable assumptions about goods substitution under varying prices in normal markets, it may not fully capture the extent such substitution of U.S. produced goods by lower-priced foreign imports might occur if U.S. producers are suddenly subject to policy-induced cost increases that foreign competitors are not. Since, the elasticity numbers used in the analysis could affect product demand and market shares of affected industries, further research examining the climate policy impacts on the EITE sector under different assumptions about elasticities is warranted.

ANALYSIS AND CONCLUSION

Although passage of a comprehensive climate bill in the United States does not look promising, debate over policies to reduce GHG emissions is likely to continue for a

while. Several states and regional bodies have established or are planning to put into place GHG emission mitigation schemes. The U.S. EPA, following the *Massachusetts v. EPA* court decision, has undertaken an effort to develop a domestic regulatory structure based on the Clean Air Act. It also is not entirely unlikely that Congress will once again explore and debate new climate legislation in its next session. Regardless of the policy being considered, concerns about its economic costs, in general, and its impact on manufacturing competitiveness, in particular, will be raised, perhaps ultimately influencing its design and implementation.

Trilogy of studies. The three HRS-MI studies examined EITE manufacturing competitiveness impacts for a small set of proposed climate legislation—the Lieberman-Warner bill (S. 2191) in the L-W EITE study and the Waxman-Markey bill (H.R. 2454) for the ACESA I and current (ACESA II) studies. These studies hopefully shed some illumination on several key issues concerning attempts to mitigate GHG emissions in the U.S. economy and their effects on EITE manufacturing industries: the policies' potential impacts on the industries' costs, bottom-lines and market shares, the effectiveness of cost containment and cost mitigation measures in the proposed legislation, and technology investment options and possibilities to reduce carbon emissions allowance costs (primarily in the L-W EITE study).

The current study first focused on examining the output-based rebate measure, which is designed to mitigate costs incurred by EITE industries under H.R. 2454, for alternative policy assumptions that directly (the *NIO* case) or indirectly (*HC* case) affect the overall costs of emissions allowances in the economy—i.e., testing the effectiveness of cost containment features in the bill. It then examined the effectiveness of the border adjustment (the International Reserve Allowance program) measure in H.R. 2454 in mitigating EITE industry costs, in the long-run, as the output-based rebate measure phases out and production allowance costs grow.

International research and output-based rebates. Interest in carbon pricing policies and provisions aimed at mitigating competitiveness impacts and carbon emissions leakage is not limited to the United States. Discussions and research on rebates and border adjustment measures, and other cost and leakage mitigation in carbon-pricing policies, also are going on in the European Union, Japan and Canada.[62] Comparability is difficult, as most research on these issues employs top-down computable general equilibrium models, which lack the disaggregation of the HRS-MI models and tend to be quite static. In addition, the economic and policy situations of the other nations are quite different than those in the United States.

Nevertheless, the findings of this research are largely compatible with the results of the HRS-MI studies concerning the effectiveness of the output-based rebates in mitigating the cost impacts (and emissions leakage) from carbon-pricing on EITE industries, though the rebate approach in the *ACESA* based on total (direct and indirect) emissions, represents one of several different schemes considered and examined in research.[63] In short, the output-based rebates would appear to be

effective in mitigating the costs of carbon-pricing for EITE industries, from the short-to-medium term—in the HRS-MI studies (ACESA I and II) through 2020-2022.

Alternative policy scenarios. That is, the industries would receive rebates that would just about offset the additional costs they would incur from having to buy permits to cover their direct emissions plus the added costs incurred from purchasing electricity from fossil-fuel electric power generators, who pass-through their emissions allowance costs to their customers. However, the HRS-MI analysis of the *High Cost* and *No International Offsets* policy cases showed that after 2021 and especially after 2025—as the rebates drop off—economic impacts on the EITE industries would escalate more rapidly and to a somewhat higher level by 2030 than those in the *Basic* case. The *NIO* analysis, in particular, illustrated the important role that offsets might play in containing carbon-pricing costs for EITE industries.

As noted, both the *HC* and *NIO* cases reflect assumptions that might be more realistic about carbon-fuel substitution and the availability and effectiveness of international offsets, respectively, than the *Basic* case. In short, care must be taken in interpreting the EIA analysis of the *ACESA*, as the resulting predicted economic impacts reflected in the analyses for the *Basic* case, could underestimate the actual impacts that EITE industries would experience if the *ACESA* were enacted.

Border adjustments. The results of the analysis of the BA measure were much more mixed, which could also reflect a number of uncertainties about how the BA measure would actually be designed and implemented, as well as modeled. Because countries that already have complied with carbon emissions reduction agreements at least as stringent as the U.S. proposal in H.R. 2454 account for the overwhelming largest share of imports into the United States in the EITE industries, the BA measure would not be especially effective in offsetting the rising allowance costs of U.S. EITE manufacturers after the rebates start to fade. The iron and steel industry, whose imports include a large proportion from non-compliant countries compared to the other industries, would be the only EITE sector with any observable benefit from the BA measure, assuming no cost-pass through.

On the other hand, the BA measure could make it less risky for U.S. firms to pass through their emissions costs to their U.S. customers, which would see comparable or greater increases in the prices from non-compliant suppliers (such as from China and India) of EITE products. The prices of compliant country imports would not be affected, however, and they would increasingly replace both U.S. and non-compliant country EITE goods in domestic markets. Hence, eventually of the U.S. gains from the BA would begin to diminish as allowance costs grow and compliant country imports increase their inroads in the U.S. market.

In addition, the BA measure would not alleviate the higher production costs of U.S.-made EITE products that are exported and sold in international markets, facing non-compliant foreign competitors whose goods would not be subject to a BA tariffs. Also, forcing U.S. downstream industrial consumers of EITE products to bear higher

U.S. and non-compliant import prices would put U.S. manufacturers at a competitive disadvantage with foreign producers of higher-carbon downstream products.

Given these limitations and the potential trade and legal issues that remain unresolved—whether or not BA measures would be WTO compliant—BAs may not be the most effective mechanism for mitigating EITE industry costs from carbon-pricing, and limiting carbon leakage. Moreover, there is significant doubt whether the BA measure would be an effective inducement for non-compliant countries to adopt policies that include binding emission reduction commitments, a rationale used in arguing for BA measures.[64]

Instead, a continuation of the output-based rebates—an option available in the *ACESA* under Presidential discretion—might be an easier, less encumbered and more effective mechanism for offsetting adverse impacts on U.S. EITE industries' competitiveness. However, in the medium-to-long run, the only true solution is for U.S. EITE manufacturers to invest in energy-saving and next generation low-carbon production and process technologies. The results of the HRS-MI studies assumed that the EITE industries would make only small improvements in their energy-efficiency (0.5 percent per year). The output-based rebates and BA measures only buy time for manufacturers, by mitigating their costs in the short-to-medium term.

Low-carbon technology options. But they do not necessarily create incentives for companies to make the level of investments needed to permanently reduce their energy and emissions costs. The output rebates might encourage some companies to make some energy-saving investments. Rebates are averaged over a whole industry sector (6-digit NAICS), which could provide the more efficient producers a small windfall—rebates may exceed their costs—while less efficient firms receive rebates less than their costs. This subsequently could induce the latter to invest in incremental reductions in their emissions and energy use. However, these inducements will not be enough to encourage the large scale investments in the low-carbon production technologies they need to remain competitive in the face of the high emissions costs they otherwise would incur by 2030.

The L-W EITE report illustrated that short, medium, and long-term technology options exist for the EITE industries, but it also identified a number of barriers (capital availability, technical feasibility, vintage of existing equipment) to EITE industries making such investments.[65] The Environmental Defense Fund also has identified a range of potential energy-efficiency opportunities available to U.S. energy-intensive industrial sectors.[66] However, there so far have been few measures considered in the climate debate that provide genuine support and incentives for promoting innovation and adoption of advanced low-carbon technologies by the EITE industries.[67] Yet such investments would substantially and permanently reduce GHG emissions produced by industry and eliminate the threat of carbon leakage, while also strengthening and promoting the competitiveness of a critical manufacturing sector in the United States.

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ENDNOTES

[8] Originally drafted with input from Sen. Lindsey Graham (R-SC), who then backed away from it. Senators Kerry and Boxer (D-CA) introduced an earlier bill, the *Clean Energy and American Power Act* (S. 1733) in September 2009. The newer bill introduced by Sen. Kerry superseded that legislation, but neither has moved forward.

[9] It sets an introductory floor ($12 per ton) rising at 3 percent over inflation annually and ceiling price ($25 per ton) increasing at 5 percent over inflation annually.

[10] See Werksman et al (2009).

[11] Ibid.

[12] Secondary aluminum industry is only marginally an energy-intensive industry (only 5% energy footprint of primary aluminum). It uses different processing technologies—based solely on producing aluminum ingot from recovered/recycled aluminum—in different plants and locations, and it is not considered a trade-vulnerable industry. However, its products are chemically and mechanically indistinguishable from aluminum produced by primary aluminum smelters. Its goods are sold in common aluminum markets, also subject to the prices set in the London Metal Exchange (LME) which handles most of the sales and sets prices for aluminum for global markets. It's inclusion in the original study allowed a comparison and counterpoint to its sibling industry and the other energy-intensive industries examined in the study.

[13] The report can be downloaded from the High Road Strategies and Millennium Institute websites: www.highroadstrategies.com and www.millenniuminstitute.net.

[14] The L-W EITE study estimated the impacts the GHG emissions allowances on EITE industries by calculating the potential increase in energy costs under a climate policy relative to a reference or business-as-usual (*BAU*) case. The rise in energy costs would translate into higher production costs and subsequent reductions in operating surpluses depending on the fossil-fuel consumption for heat, power and feedstock in the industries' production processes. The prices used in the HRS-MI teams Integrated Industry-Climate Policy Models were supplied by the EIA's analysis of the S. 2191 (EIA 2008a) for the policy case EIA's *Annual Energy Outlook 2008* (EIA 2008b) for the *BAU* case. The policy case prices represent effective prices calculated by EIA using the National Energy Modeling System (NEMS), which takes into account the costs of emissions allowances incurred by covered entities (e.g., fossil-fuel electricity generators, fossil-fuel consuming manufacturing plants) on an economy-wide basis.

[15] The report can be downloaded from the High Road Strategies website: www.highroadstrategies.com.

[16] H.R. 2454 Sec. 401, "Part F," "Subpart II" "Sec. 766(a)(2)(A): 1115.

[17] See Yudken and Bassi, 2010. The primary data sources for the study included: Census Bureau's Annual Survey of Manufacturers (ASM; financial data); industrial statistical tables from American Iron and Steel Institute; Aluminum Association; American Forest & Paper Association; American Chemistry Council (production supply and other industrial data); EIA's Manufacturing Energy Consumption Survey 2006 (MECS; industrial energy consumption); U.S. International Trade Commission (USITC; industry trade data); IHS-Global Insight (market price projections).

[18] See Yudken and Bassi (2010); and EIA (2009a). Specifically, energy price projections through 2030 from this source were used to characterize the BAU case.

[19] See Yudken and Bassi (2010), n. 8 and Appendix A; and EIA (2009b). Price projections for certain energy fuels—natural gas, coal—from the EIA analysis of the ACES Basic Case were incorporated to partially account for the supply-demand dynamics of fossil fuels that would result from enactment of this policy. In particular, as explained in Appendix A in the ACESA I report, the models used the wholesale price of natural gas, industrial coal and metallurgical coal (and by extrapolation, coal coke) as provided in the EIA analysis of ACES, using NEMS, in calculating the baseline energy and production costs for the industries, before adding the emissions allowance costs and rebates.

[20] The HRS-MI team used an endogenous approach to calculate emissions, which directly converted energy consumed by the industries (from MECS) into GHG emissions from fossil fuels directly combusted or used as feedstock in industrial processes, and the indirect emissions associated with electricity purchased by industrial enterprises. Emissions were calculated by multiplying energy consumption (by source, in Million BTU, with the exception of electricity), by the carbon equivalent emission factor of each energy source (as reported by the Intergovernmental Panel on Climate Change (IPCC 2006). For electricity, emissions calculations entailed multiplying carbon intensity per kWh (calculated by NEMS) by electricity consumption. Since under the climate policy there would a steady shift to lower carbon electricity generation, electricity carbon intensity would fall accordingly. Adjusted carbon intensity data for electricity was provided by Lessly A. Goudarzi, CEO and Managing Director of OnLocation, Inc., Vienna, VA, November, 2009.

[21] The costs incurred by each industry from the purchase of GHG allowance permits to cover their GHG emissions for each year, as required by the ACESA. This entailed multiplying the industries' emissions levels by the emissions allowance prices generated by EIA analysis of the ACESA *Basic Case*, using NEMS. The emissions values for a given year used to calculate production-based allowance costs were the averages of the prior-year emissions, as stipulated in legislation (as they are calculated by multiplying production output and production unit energy consumption levels for each fuel used as fuel or feedstock, or purchased electricity). It was assumed that the costs for combustion fuel and feedstock emissions generated by each industry, and the indirect emissions associated with purchased electricity, would not to be incurred until 2014, as stipulated in the legislation.

[22] The models dynamically simulated the output-based rebates to each industry by calculating the yearly shares each would receive of this overall allocation, based on their shares of total emissions (direct and indirect) generated by EITE industries. The share for each industry for a given year was based on its share of total production-based emissions generated averaged over the two-prior years. The industries in the current study accounted for nearly half of all EITE-eligible industries, averaged over 2004-2006, based on EPA and EIA analyses: See U.S. EPA (2009); Schipper (2006). Because of a lack of data regarding all other EITE industries, it was assumed that this share would remain fixed throughout the time frame examined in the study—that is production levels (and therefore emissions) would grow at a rate comparable to the study's industries.

[23] The updated II-CPM simulated the impacts of the *ACESA Basic* case on key economic variables (production costs, operating surplus) for the six industries. Only no cost pass-along (NCPA) scenarios were simulated. As discussed in the ACESA I report, since these industries are trade-sensitive and market prices tend to be set in global markets, they typically would have difficulty passing along higher energy costs arising from a geographically limited policy, as many foreign competitors would not be subject to these cost impacts. Hence they reflect a worse—but also a more likely—case that these industries would experience with passage of the climate policy.

[24] Based on the simulation results, estimates were made of the energy-efficiency gains required to offset the added costs from *ACESA* relative to *BAU*, for each industry, on top of an assumed baseline 0.5 percent yearly energy efficiency improvement. That is, these are the gains required to offset the added costs of higher prices for fuel, electricity, and feedstock energy for a given year, assuming no substantial gains were made in prior years.

[25] EIA (2009b). The EIA prepared six main analysis cases which focus on two key areas of uncertainty that impact the analysis results: the role of offsets and the timing, cost, and public acceptance of low- and no-carbon baseload electricity technologies. It also included several additional cases that incorporate a range of other policy assumptions.

[26] Ibid., 6.

[27] Ibid., 5.

[28] Ibid., 4.

[29] Ibid., ix.

[30] Ibid., 6.

[31] Ibid.

[32] This includes, for example, using different baseline prices for coal (mine mouth) and natural gas (wellhead) for the alternative policy cases as provided by the EIA in its analyses of these cases in its evaluation of H.R. 2454, i.e., EIA (2009b).

[33] Coal would account for 46 percent of electricity generation in 2030 the *BAU* case, down a little from 48 percent in 2020. It would only account for 29 percent of electric power in the *Basic* case, 34 percent in the HC case and 12 percent in the NIO case.

[34] Nuclear power would increase by 74 percent over its predicted *BAU* level, and grow as a share of total generation from nearly 18 percent for *BAU* to a third in the *Basic* case, by 2030. Renewables use would increase 28 percent over *BAU*, and rise from a 16 percent share of total electricity generation for *BAU*, to 22 percent for the *Basic* case, by 2030.

[35] In the HC case, coal use would fall to a third of total generation, and nuclear power, natural gas, and renewables would each account for about one-fifth, by 2030.

[36] In the *NIO* case coal would only account for 11 percent, while nuclear would rise to 40 percent, renewables to 30 percent, of total electricity generation in 2030. Natural gas use, meanwhile, would decrease by a quarter relative to BAU, and fall from 19 percent of the total to 16 percent, in 2030.

[37] The conditions, criteria and provisions of the International Reserve Allowance program are presented in "Sections 765-769" in H.R. 2454, Sec. 401, "Part F," "Subpart II".

[38] A World Resources Institute (WRI) report, for example, concluded that risk of a WTO dispute over climate-related trade measures is high, which, however, could be lowered by UNFCCC decisions or processes. Werksman et al (2009), 2.

[39] Werksman et al (2009), 6.

[40] See Mattoo et al (2009) for discussion of potential impacts of trade policy actions based on how carbon content is calculated in determining BA tariffs.

[41] In the model, the BA fee calculation was based on the carbon content for the industries' total output rather than on individual products, although the fees in reality would be based the individual product content. Such detailed product-by-product data breakdown was not available or feasible for purposes of this study.

[42] In the latter case, a provision in ACESA requires the EPA to deduct the rebate value to domestic EITE industries from the BA tariff. That is the added costs to foreign imports from having to submit IRAs (the BA tariff) would be equal to the *net* emissions allowance costs incurred by covered domestic manufacturers, which simply equalizes the added costs imposed on domestic and importing firms from the carbon-pricing policy with a BA measure. That is, if U.S. EITE industries' pass-through their additional costs they would equal the added costs to non-complaint prices—U.S. and non-compliant countries would sell the products at the same prices in the domestic market. .In the former case, foreign importers could face somewhat higher additional costs associated with the IRAs they must submit, compared to domestic manufacturers added costs. If the unit production-based allowance cost is x and the output-based unit rebate is y, and only x is added to non-compliant country prices, the non-compliant country competitors would see higher prices (by x-y) than U.S. producers in CPA situation.

[43] Specified in H.R. 2454, Sec. 401, "Part F," "Subpart I" "Sec. 763."

[44] For example, Mattoo et al (2009) makes this assumption, in part, "because the application of border taxes across the board cannot be ruled out either in the United States or European Union." p. 8.

[45] For an interesting treatment from a developing nation perspective of the issues surrounding the BA, especially being considered by the EU, see Dhar and Das (2009). The concern that BA tariffs might be applied to a much larger range of products than currently specified in proposed U.S. legislation or even in proposals to include a BA measure by the EU, was readily apparent to one

of the current ACESA II study author's at a conference in New Delhi, India on March 30-31, 2010. High Road Strategies principal Yudken was a featured speaker at the conference, Trade and *Climate Change in Emerging Economies: The Competitiveness, Technology and Intellectual Property Rights Dimension*, sponsored by the International Centre for Trade and Sustainable Development (ICTSD) and the Research and Information System for Developing Countries (RIS). He observed that a government-sponsored university-based researcher from India studying the potential impacts on the Indian economy from BA tariffs imposed by the United States and the EU, included a very wide range of industries that she assumed would be eligible for the tariffs, including for example toys and aerospace, that in fact would not be subject to the BA measure, at least under the U.S. proposed legislation, such as ACESA. Not surprisingly, her preliminary findings indicated that these impacts, assuming such a large number of industries would be subject to the BA tariff, could be quite large.

[46] These criteria include: (a) the countries are party to an international agreement to which the United States is a part, that includes an economy-wide GHG emissions reduction commitments at least as stringent as that of the United States; (b) the countries are party to a multilateral or bilateral emissions reduction agreement to which the United States is a party; or (c) the countries annual energy or GHG intensities for the given sector are equal or less than the intensity for the given industrial sector in the United States. H.R. 2454, Sec. 401, "Part F," "Subpart I" "Sec. 767"(c), 1120.

[47] Specifically, for purposes of the study, this group (Annex II) was assumed to include the major Annex I countries excluding Russia, Belarus, Hungary, Bulgaria, Poland, Romania, Turkey, and Ukraine. Annex I countries are parties to the United Nations Framework Convention on Climate Change that are industrialized countries and were members of the Organization for Economic Cooperation and Development in 1992, plus countries characterized as economies in transition including Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, and the United States of America. As shown in table II, compliant Annex I countries that also were major producers and importers of goods for one or more of the EITE industries in the study, including Australia, Canada, EU-15, Japan, Norway, New Zealand, and Switzerland. The EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.

[48] Specifically, for analytical purposes, this group was assumed to include major Non-Annex I industrializing nations, such as Brazil, China, India, South Africa, Korea, Taiwan, Mexico, and Indonesia, other non-Annex I countries that have been large importers of covered goods in one or more of the EITE industries in the study, including Argentina, Bahrain, Kazakhstan, Indonesia, Libya, Nigeria, and Venezuela, and Annex I countries considered non-compliant and also major importers of EITE goods in the study, including Russia, Romania, Turkey, and Ukraine.

[49] The ROW group also includes any foreign country determined to be responsible for less than 0.5 percent of total GHG emissions and less than 5 percent of U.S. imports of covered goods with respect to an eligible industrial sector, as specified in ACESA. The EU-15 is considered as one "compliant nation" for purposes of the study, although some EU-15 countries may qualify as exempted according to these criteria for one or more of the EITE industries in the study.

[50] ACESA stipulated that the earliest year the IRA program could be applied was 2020. See H.R. 2454, Sec. 401, "Part F," "Subpart I" "Sec. 768" (c), 1126.

[51] These scenarios were modeled for each of the five EITE industries, that had been examined in studies 1 and 2: iron and steel and ferroalloy products, primary aluminum, paper and paperboard, petrochemicals, and chlor-alkalies. The secondary aluminum industry (was not examined in the scenarios since it would not be eligible to receive either the output-based rebates or subject to the BA tariffs under the ACESA .

[52] The BA fees added to non-compliant country imports for each industry would be equal to the total production-based emissions allowance costs incurred by the industry for a given year=prior year production-based (direct and indirect) emissions multiplied by current year allowance price.

[53] Each U.S. industry would raise its prices equal to the net allowance allocations costs it incurs, which equals total production-based allowance costs *less* output-based rebates calculated for a given year according to ACESA specifications. As noted above, under this CPA scenario, non-compliant country producers would incur tariffs that effectively increase their prices somewhat higher than U.S. producers would raise their prices if they chose to pass-through their allowance costs (see n. 35). Compliant countries and ROW countries would not raise their prices, however, in this scenario.

[54] The modest fluctuations in these costs for each industry relative to their BAU levels are wholly a result of comparable fluctuations in the prices for natural gas, coal, and coke used in the model, based on the projected wholesale prices for these fuels in the EIA analysis of the *ACESA* policy case. As described in appendix A of the ACESA I study, these prices were used to better take into account in the model some of the supply dynamics for these fuels that would result from enactment of the bill, i.e., eventually demand for these fuels would diminish, resulting in lowered prices relative to BAU. For the same reason, a diminishing emissions intensity associated with electricity generation was assumed, as fossil-fuel generated electricity is projected to decline in the policy case.

[55] That is, the energy-efficiency gains would be on top of an assumed annual 0.5 percent energy-efficiency gain in all the simulations.

[56] The weighted average for the cost and operating surplus variables for the five EITE industries was based on the production output for each industry. For example, for a given year, the real market price for the 5-EITE industry weighted aggregate was calculated by summing across the industries the multiplication of each industry's real market price by total production for that industry and dividing that sum by the 5-EITE industry total production (in tons). Total 5-EITE industry total revenues was calculated by multiplying the real market price for the 5-EITE industry aggregated by the 5-EITE industry total production output. The 5-EITE industry real unit production costs for a given year was calculated by multiplying the sum across the industries of real unit production costs for each industry by its respective production output (in tons) and dividing that sum by the 5-EITE industry total output. The 5-EITE industry real total operating surplus was calculated by multiplying total 5-EITE industry production by the difference between the 5-EITE industry real market price and unit production cost.

[57] The results also assumed a yearly 0.5 energy efficiency gain (as noted earlier) and that production output for each industry steadily grows, following projected GDP growth for the economy, as assumed in the EIA analyses of the ACESA policy cases. That is, it assumes that the industries do not cut back their production over the policy period, even though in reality there could be substantial pressures by the last part of that period to cut production because of rising costs and diminishing operating surplus.

[58] Because of the resulting market share gains, the industries' production outputs (and therefore revenues) would also grow relative to BAU. Meanwhile, unit production costs increases (equal to *net* unit emissions allowance costs) would be exactly offset by the cost pass-along on U.S. market prices. Hence, total revenues relative to production costs would increase accordingly, resulting in a total operating surplus gain for each industry.

[59] This would have required obtaining detailed data on the international (outside U.S.) markets for each EITE industry, including the imports and exports of EITE industry goods in these markets from all competing countries. Although this in principal is feasible, the scale of the modeling effort, not to mention the amount of data that would be required, would be extremely daunting—assuming this data is even available (and credible).

[60] In the case of aluminum, this option may not even be available, as most aluminum is sold on the London Metal Exchange and Shanghai Futures Exchange, which would dictate which prices U.S.

aluminum exports would have to be sold at in international markets, regardless of what happens in the U.S. market as a result of BA tariffs.

[61] See Yudken and Bassi (2009), especially Appendix B, 258-261.

[62] See Fischer et al (2010) for summary of conference where research on output-based rebates and border adjustments being conducted in these countries was discussed.

[63] Ibid.

[64] Werksman et al (2009), 6. For example, this report notes that less than one percent of Chinese steel production is exported to the United States, making it unlikely that the border measure would create a sufficiently strong incentive to induce the Chinese government to apply carbon-restricting regulations to the steel sector, let alone to the entire economy.

[65] See Yudken and Bassi (2009), especially the Technology Policy and Investment Options subsections in the industry chapters.

[66] See in particular www.LessCarbonMoreInnovation.org. The industries for which technology options were examined include petroleum refining, iron and steel, pulp and paper, chemicals, and cement.

[67] Exceptions include U.S. Senator Sherrod Brown's (D-OH) Invest in Manufacturing and Clean Technology Act (IMPACT) to provide revolving loans and technical assistance (via the Manufacturing Extension Partnership centers) to small and medium-sized manufacturers, whose main provisions were incorporated into H.R. 2454, and proposal for a National Industrial Transformation Institute.