Climate Policy and Energy-Intensive Manufacturing: Impacts and Options

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HIGH ROAD STRATEGIES

Joel Yudken, Ph.D.
Principal, High Road Strategies, LLC
104 N. Columbus Street, Arlington, VA 22203
(703) 528-7896 • jyudken@highroadstrategies.com
www.highroadstrategies.com

POLICY CONTEXT

Economy vs. Environment

Economic Development Policy

- Economic Growth
- Jobs
- Competitiveness
- Profitability

Environmental Sustainability Policy

- Clean Environment
- Reduce GHG Emissions
- Green Energy
- Resource Conservation

Addiction or in our industrial DNA?

Not just an environmental problem—

- It's a trade, competitiveness and economic development issue
- It's a national security issue

Obama Administration Policy

- Climate change high on Obama administration agenda, reversing Bush's policy
  - American Recovery and Reinvestment Act of 2009—$80 billion in clean energy investments
  - Raised fuel economy standards for vehicles
  - Worked with House of Representatives to pass comprehensive clean energy and climate change bill
- U.S. reengaged in UN climate negotiations
  - Obama announced pledge to reduce US emissions 17% below 2005 by 2020; 83 % by 2030
  - Supports binding agreement for developed and developing nations
  - Major Economies Forum, bilateral meetings (China, India) and declarations
  - Helps broker and supports Copenhagen Accord

Legislative State-of-Play

- American Clean Energy and Security Act (Waxman-Markey bill, HR 2454) passed by U.S. House June 2009
- Kerry-Boxer (S. 1733)
  - Similar to ACESA; BA, but no specifics
- Cantwell-Collins (S. 2877)
  - Regulates entry point (first seller) of fossil-based carbon; auction of allowances to first sellers; "price collar" $7-$21; output-based rebate to EITEs; BA starting 2013
- Kerry (D-MA), Lieberman (I-CT), Graham (R-SC) bill was to be introduced April 2010 (fate uncertain)
  - Sector-specific emissions limits, power plants; manufacturing; revenue recycling to consumers; price collar
- Fall-out from health care fight; finance reform, immigration reform, 2010 elections create uncertainty about climate bill prospects

ENERGY-INTENSIVE MANUFACTURING

Climate-Manufacturing Challenge

- **Crisis in U.S. manufacturing**
  - Loss of capacity, jobs
  - Foreign competition, offshoring
- **Energy-intensive trade-exposed (EITE) industries especially affected**
  - Consolidation, restructuring, import penetration, offshoring
  - Sensitive to fossil-fuel energy/emissions prices, foreign competition

Columbia Falls Aluminum Plant

- **Why protect EITE industries?**
  - EI industries cornerstone of manufacturing—beginning of supply chains for all manufacturing
  - Industrial retention and competitiveness (labor/industry, politicians)
    - Concerned about offshoring, competitive disadvantage impacts
  - Carbon leakage; encourage foreign compliance (environmentalists)

Energy-Intensive Industries, 2006

[Industries in bold are examined in the study]

NAICS Code	Industry Sector	Energy Intensity* [Percent]
31-33	Manufacturing	2.9
322	Paper Manufacturing	7.3
32212,3	**Paper and Paperboard Mills**	**14.5**
32212	**Paper Mills**	***13.0***
32213	**Paperboard Mills**	***18.0***
325	Chemicals Manufacturing	5.6
3251	Basic Chemicals	10.2
32511	**Petrochemicals**	**8.0**
325181	**Alkalies and Chlorine**	**38.9**
331	Primary Metals	6.4
3311	**Iron & Steel & Ferroalloy Products**	**8.8**
3313	Alumina and Aluminum Production and Processing	7.5
331312,4	Primary and Secondary Aluminum Production	14.8
331312	**Primary Aluminum Production**	***26.5***
331314	**Secondary Aluminum Production**	***6.2***

*Energy intensity is calculated as the share of total energy expenditures (fuel and electricity) as a share of total operating expenditures (roughly equal to sum of materials costs, labor compensation and new capital expenditures in the Census Bureau's *Annual Survey of Manufactures*, for 2006)

†Does not include expenditures on energy fuels used as manufacturing feedstock (e.g., natural gas used in petrochemical production; coke used in steel production).

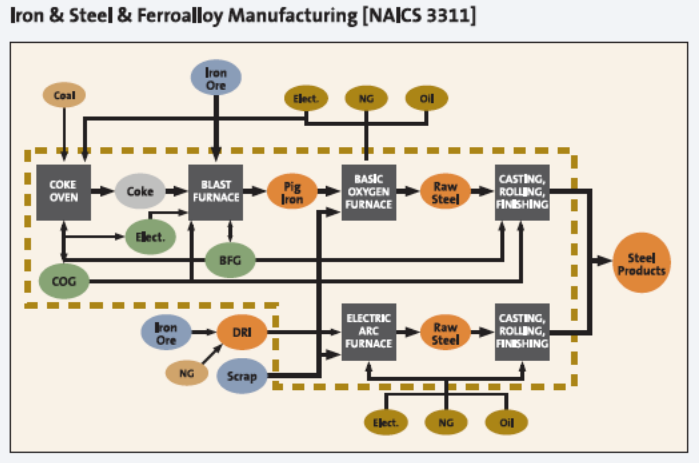
- **Waxman-Markey Definition of EITE Industry**
  - 5% greenhouse gas intensity (tons CO2e/$ value of shipments, or
  - 5% energy intensity (cost of purchased electricity & fuel costs/$VS)
  - Trade intensity—at least 15 (M+X)/(VS+M)

Selected Financial Characteristics

NAICS Code	Industry Sector	Total VS	Total EC	PF & E	PE	PE (billion kWh)
		Billions of US Dollars				
31-33	Manufacturing	5,020.0	758.5	103.7	49.7	892.2
32212,3	Paper and paperboard mills	75.7	10.2	7.1	2.7	55.9
32511	Petrochemicals	60.8	1.0	2.8	0.4	7.5
325181	Chlor-alkali manufacturing	6.4	0.7	1.6	0.6	12.9
3311	Iron & steel mills & ferroalloys	93.3	9.4	6.2	2.6	57.1
331312	Primary aluminum	6.2	0.7	1.2	1.1	28.4
331314	Secondary aluminum	7.0	0.5	0.4	0.1	3.3

VS=Value of Shipments; EC=Employee Compensation; PF&E=Purchased Fuel & Electricity; PE=Purchased Energy
Source: Census Bureau, Annual Survey of Manufactures, 2006

Steel Production and Energy Flows



EVALUATING CLIMATE POLICIES

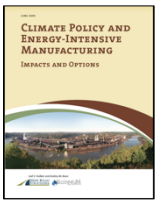
Key Policy Design Issues

- **Point of regulation, timing**
  - Electricity generators, fuel producers and distributors (natural gas, petroleum)
  - Industrial stationary sources (energy-intensive manufacturers)
- **Allowance distribution**
  - Auctioning, free allowances
  - Industry, consumers, states, agriculture, etc.
- **Cost mitigation**
  - Banking, offsets (domestic and international)
  - "Price collar," "safety valve"
  - Energy Intensive, Trade Exposed (EITE) industries, (output-based), consumer, agricultural allowance rebates
  - International Reserve Fund ("border adjustment fees")
- **Auction Revenue Investments**
  - CCS, advanced fuel vehicles, renewables, energy efficiency
  - Transition assistance for workers, communities, small manufacturers

HRS-MI Climate Policy & EITE Industry Studies

- **Climate Policy and Energy Intensive Manufacturing: Impacts and Options** (June 2009)
  - National Commission on Energy Policy (NCEP)/Bipartisan Policy Center-sponsored
  - High Road Strategies (HRS)-Millennium Institute (MI) performed work
  - Examined impacts of Lieberman-Warner Climate Security Act of 2007 (S. 2191)
- **Competitiveness Impacts of American Energy & Security Act (ACESA) of 2009** (February 26, 2010)
  - Environmental Defense Fund (EDF)-sponsored; HRS-MI performed
  - Examined impacts of ACESA (Waxman-Markey bill; H.R. 2454), focus on output-based rebate measure
- **Evaluation of ACESA Cost Mitigation Measures** (forthcoming)
  - EDF, NCEP, AFL-CIO WAI-sponsored; HRS-MI performed
  - Evaluates alternative scenarios, output-rebates, border-adjustment measures

NCEP Climate Policy-EITE Manufacturing Study: Impacts & Options

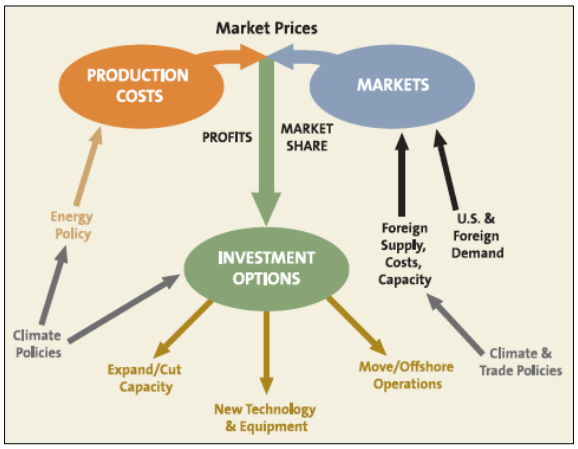


- What are climate policy impacts on the competitiveness of energy-intensive manufacturing industries
  - Iron & steel, primary & secondary aluminum, paper & paperboard, petrochemicals, chorine-alkalies manufacturing
- What policies are needed to maintain manufacturing competitiveness and retain jobs, while cutting emissions?
  - To mitigate cost impacts and level the playing field in international trade
  - Enable and encourage industry investments in new technology

Climate Policy Comparison

Lieberman-Warner Climate Security Act of 2007 (S. 2191)	American Clean Energy & Security Act of 2009 (ACES; H.R. 2454)
GHG cap-and-trade program • 39% reduction–2030; 72%–2050 relative to 2006 • Allowance prices: $31.7–2020; $64.8–2030 (USD 2007)	GHG cap-and-trade program • 17% reduction–2020; 58%–2030; 83%–2050 relative to 2005 • ACES Basic–allowance prices: $31.7–2020; $64.8–2030 (USD 2007)
Auction allowances used for low-carbon technology programs; transition assistance; states; etc.	Allowances to electricity, NG distributors; low-income consumers; **energy-intensive industries;** states; etc.
Low-emissions technologies—nuclear, coal, CCS; incentives for CCS, biogenic carbon sequestration; building, appliance standards	CCS demonstration, early deployment; building, appliance standards; other technology improvements
Domestic and international offsets each capped at 15%;	Domestic and international offsets; banking
BAU: AEO2008 • 2.5% long-term growth; includes 2007 energy bill; current legislation, regulations	BAU: AEO2009 • 2.4% long-term growth; short-term growth <AEO2008; reflects ARRA, current leg. & regs.

Study Framework



Methodology

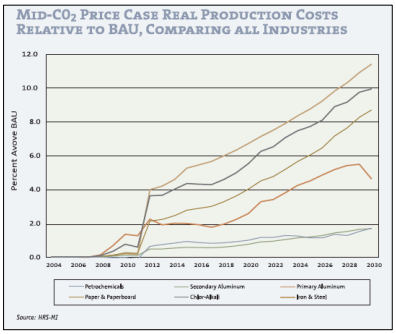
- Data collection
  - ASM, MECS, USGS, USITC
  - AISI, Aluminum Association, AF&PA, ACC
- System Dynamics modeling
  - Computer-based SW platform: Vensim®
  - Integrated Industry-Climate Policy Model (II-CPM)
- Group modeling sessions
  - Industry groups (AISI, Aluminum Assoc., ACC, AF&PA); Labor unions (USW, AFL-CIO IUC)
- Characterize policy cases
  - EIA/NEMS, GI
- Model runs
  - Cost pass-along scenarios (NCPA, CPA)
  - Sensitivity and alternative scenarios

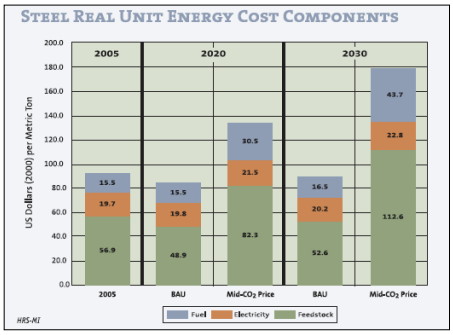
Climate Policy Cases

- **Business As Usual (BAU) Case**
  - No GHG-emissions pricing policies
  - Based on AEO 2008 Reference Case
- **Mid-CO_2 Price Case**
  - Based on Lieberman-Warner Climate Security Act (S. 2191)
  - Emissions allowance price: 2020-2030, \$30-\$61/mt CO_2-equivalent
    - 30% emissions below 2005 by 2030; 70% below by 2050
- **EIA NEMS Fossil-Energy Price Scenarios**
  - Electricity, natural gas, metallurgical coal, coal coke, liquid petroleum gas, residual fuel oil, distillate fuel oil

L-W Production Cost Impacts

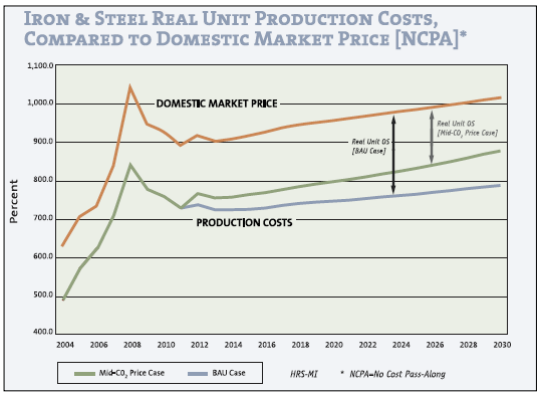
- **Production cost components**
  - Materials and capital + labor + energy costs
  - Energy costs: fuel, electricity, feedstock (EIA, MECS)



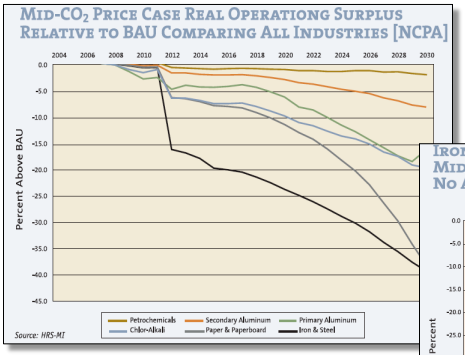


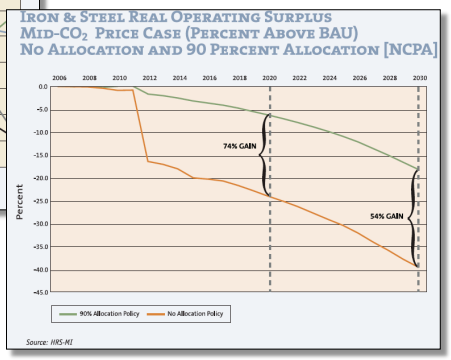
Operating Surplus Defined

- **Operating Surplus:** Domestic Market Price Minus Unit Production Cost (Revenues-PCs)
  - Sales, General and Administrative costs
  - Depreciation, interest on capital
  - Other fixed costs
  - Profits, taxes
  - Reduced OS means lower profits
- **Operating Margin:** Ratio of total OS and total revenues



L-W Operating Surplus Impacts





Summary of Findings

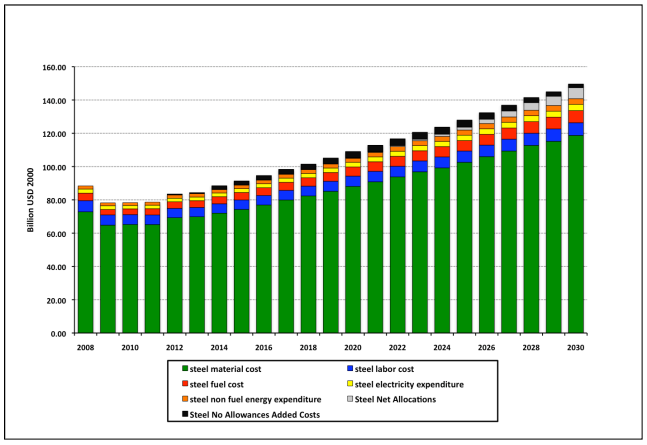
- Modest to high impacts on production costs, operating surplus (profits), market shares from higher energy prices:
  - Contingent on energy mix, cost-pass along assumptions, market conditions
- Pressure on industries to take actions to reduce costs and prevent profits from decreasing to undesired levels
- Technology options available, but timing critical
- Allowance allocation policy would buy time for industry adjustment
- Other policies may be needed to encourage long-term investment in advanced energy-saving technologies

EDF ACESA-EITE Industry Study

- Updated financial, energy, industry, other data
- Characterized Reference and ACES Cases
  - EIA-generated energy prices, allowance costs
  - Calculated industry GHG-emissions
  - Calculated production-based emissions allowance costs
- Calculated output-based rebate allocations
  - Up to 15% total allowances to EITE industries, starting 2014, declining rapidly after 2015 to zero, 2035
  - Industry rebates based on prior 2-year emissions; yearly shares of total (direct, indirect) emissions of all EITE industries
- Industry simulations (NCPA only)
- Energy-efficiency requirements to offset cost impacts
  - Estimates of required gains for a given year, for energy types, assuming 0.5% annual energy efficiency improvements

Production Cost Structure

Iron & Steel Industry
ACESA Basic Case–Production Costs With Allowances



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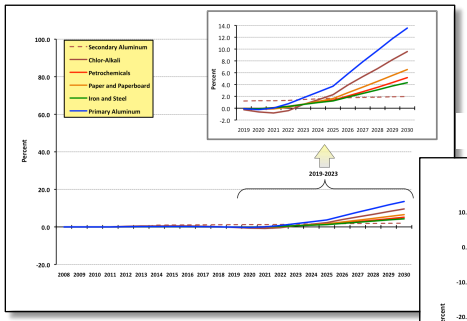
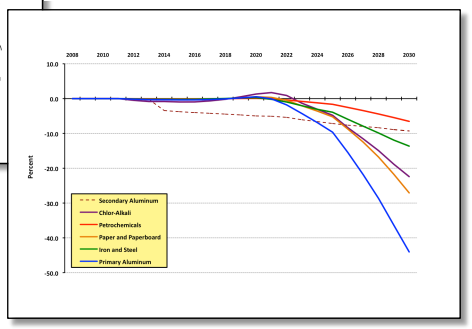
Allowance Rebate Effectiveness

ACESA–Production Costs With Rebates



ACESA–Operating Surplus With Rebates



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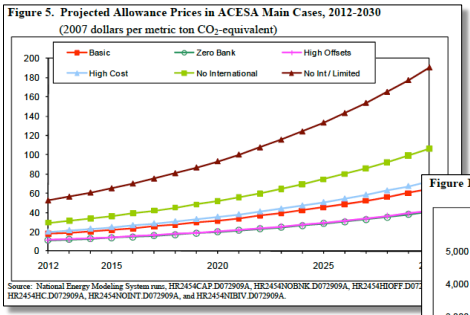
Summary of Findings (ACESA Study)

- Over the short-to-mid term, allowance rebates would substantially mitigate the costs of emissions permits on PC and OS
- Cost mitigation would diminish as the allowance rebates phases out after 2020—paralleled by rising economic cost, but extent and nature of impacts vary by industry
- Cost impacts are modest through 2025, as rebates diminish relative to emissions costs only slowly
- Impacts could accelerate after 2025, as rebates rapidly fall off—unless Presidential discretionary mitigation measures are put into effect, and/or the industries have made sufficient energy-saving investments.

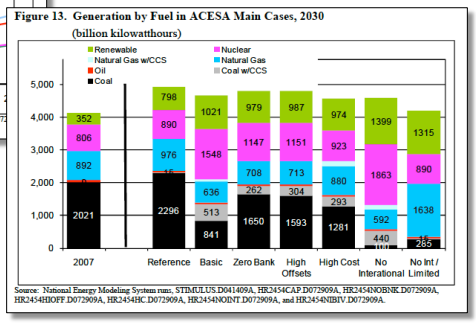
ACESA-EITE Industry Study (II)

- Output-based emission allowance rebates
- Alternative Policy Cases
  - High Cost Case
  - No International Offsets Case
- International reserve allowance program ("border adjustment")
  - Presidential determination if allowance rebates no sufficient to mitigate EITE costs
  - EITE and compliance criteria; start year; fee calculation
    - Countries with 85% or less of imports are compliant or has energy/emissions intensity equal or less than U.S. industry sector
  - Legal and effectiveness issues
    - Is it WTO compliant? Will in encourage other nations' comparability? Will it adequately mitigate costs? Will it encourage low-carbon technology investments?

Alternative Policy Cases



- **ACESA High Offsets Case**
  - Costs of nuclear, fossil with CCS, biomass generating technologies assumed to be 50% higher than Basic Case
  - Great uncertainty about costs, feasibility of rapid introduction on large scale

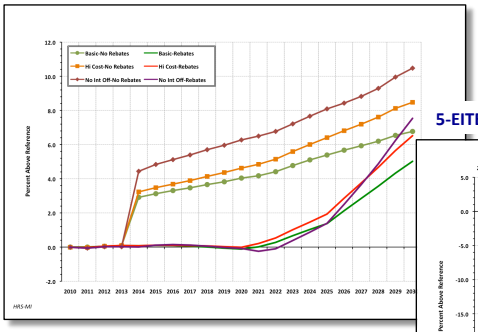


- **ACESA No International Case**
  - International offsets severely limited by cost, regulation, slow progress reaching international agreements re offsets
  - Significant portion of international offsets might not meet all requirements

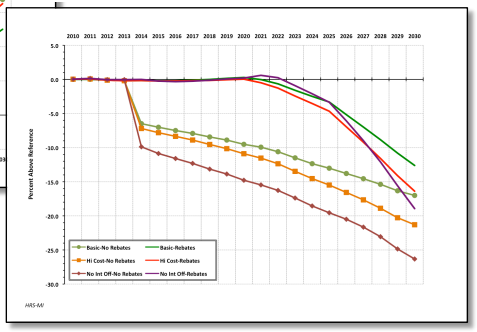
Source: EIA analysis of H.R. 2454

Alternative Case Impacts

5-EITE Industries Production Costs—Alternative Cases



5-EITE Industries Operating Surplus—Alternative Cases



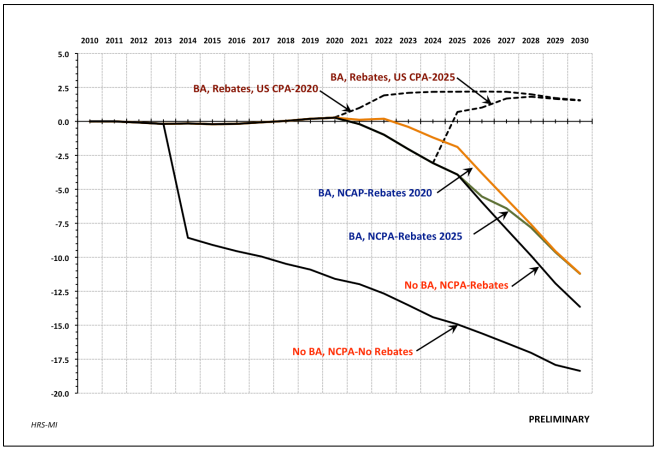
EITE Industry Imports

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 Countfries	*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, Kazahstan, 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

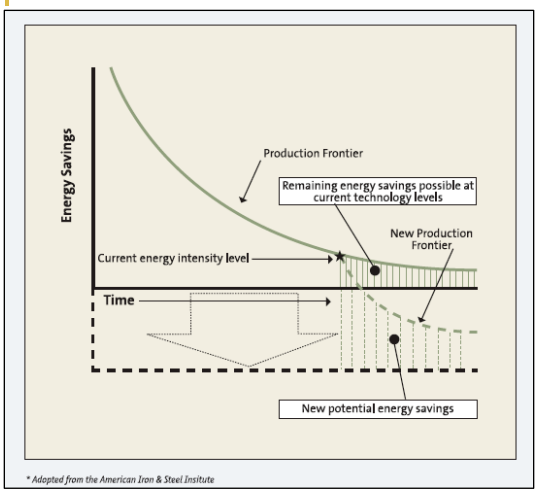
Preliminary BA Findings

ACESA–Iron & Steel Operating Surplus
Border Adjustment Comparison



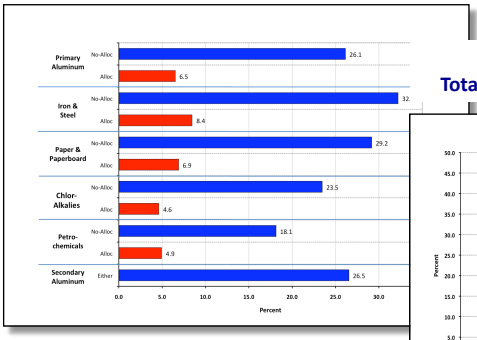
ENERGY EFFICIENCY & INVESTMENT OPTIONS

Energy Savings Potential?

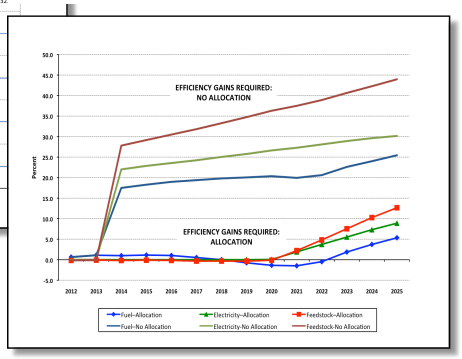


Energy Efficiency Requirements

ACESA–Total Energy Efficiency Gains Required—2025



Iron & Steel Industry
Total Energy Efficiency Gains Required—2025



Technology Investment Options

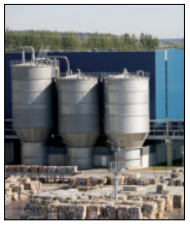
- **"Low-hanging fruit"**
  - Heat recovery, CHP, sensors and process controls, more efficient pumping, motor, compressed air systems, etc.
- **Improved recycling (steel, aluminum, paper)**

- **Advanced and alternative process technologies:**
  - Low-carbon iron-making technology (iron & steel)
  - Wetted drained cathode/inert anodes (aluminum)
  - Black-liquor gasification; efficient drying technology; biorefineries (paper)
  - Shift to membrane technology (chlor-alkali)
  - Advanced furnaces, CHP, biomass-based systems (petrochemicals)
- **Barriers to Adoption:**
  - Costs; timing (technical feasibility, vintage); lack of capital

Success Stories

- **ArcelorMittal (East Chicago, IN)**
  - Partnered with Recycled Energy Development, built onsite energy plant to capture waste heat and gases
  - Cut purchases of coal-fired power by 1/2 at BOF mill; reduced
  - CO2 emissions by 1.3 million tons/yr; saved $100 million/yr
  - Using waste heat recovery at 3 more steel facilities

- **Flambeau River Papers (Park Mill, WI)**
  - Built 1896, 300 employees in town of 3,000, paper mill shut down in 2006
    - High energy costs, foreign competition, aging equipment, outmoded processes
  - Reopened in 2 years with state and private support
    - 1st fossil fuel free, energy independent integrated pulp and paper mill in NA
    - Becoming first modern U.S.-based pulp mill biorefinery
    - Reemployed workers, 100 new jobs, reduced carbon impact



Conversion to Low-Carbon Manufacturing

- **Make a national priority**
  - Presidential task force; interagency working groups; national labs
- **Climate legislation should include:**
  - Cost mitigation; level global market playing field; transition assistance to workers and communities
- **Investment and innovation policies:**
  - RD&D on next generation production technologies; financial assistance (e.g., loan guarantees) and tax credits for new equipment; accelerated capital stock recovery; technical assistance for SMEs.
- **Benefits:**
  - Energy security, reduced GHG emissions, revitalized manufacturing, economic growth and job creation

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