

Evaluating Climate Policy Impacts on U.S. Manufacturing Competitiveness



Transatlantic Research on Policy Modeling Workshop

Session 5: Energy & Environmental Policy Analysis: Applications

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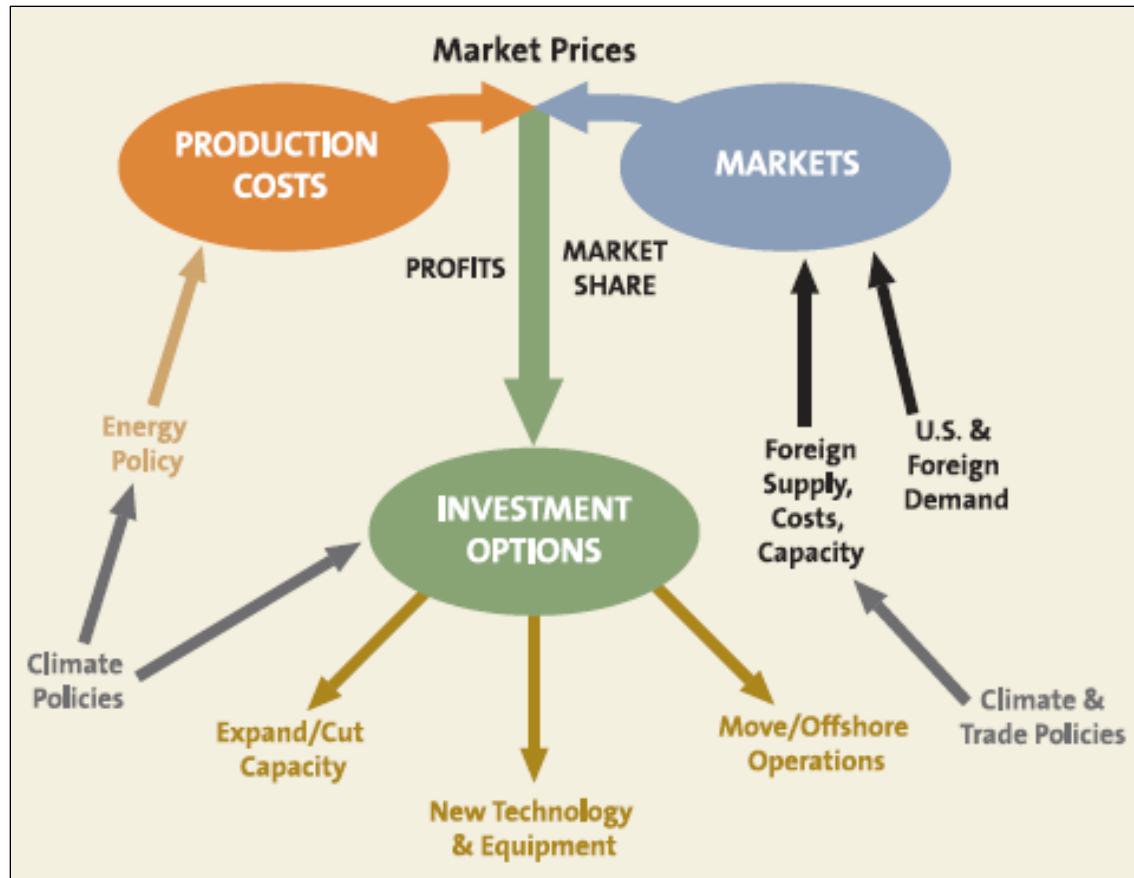
EVALUATING FEDERAL CLIMATE POLICIES



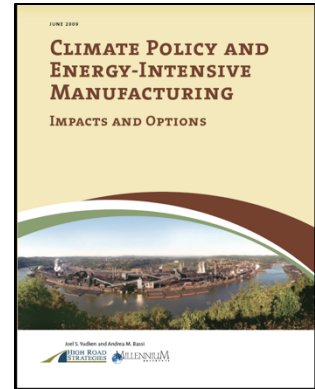
HRS-MI Climate Policy & EITE Manufacturing “Trilogy”

- **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** (November 24, 2010)
 - NCEP, AFL-CIO WAI-sponsored; HRS-MI performed
 - Evaluates alternative scenarios, output-rebates, border-adjustment measures

Study Framework



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, chlorine-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



L-W Study 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-CO₂ Price Case

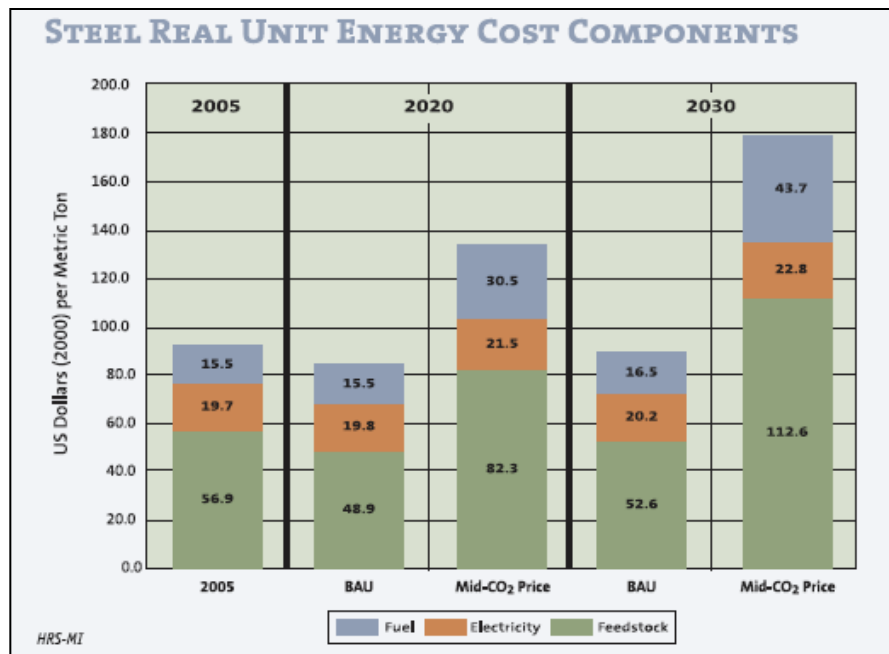
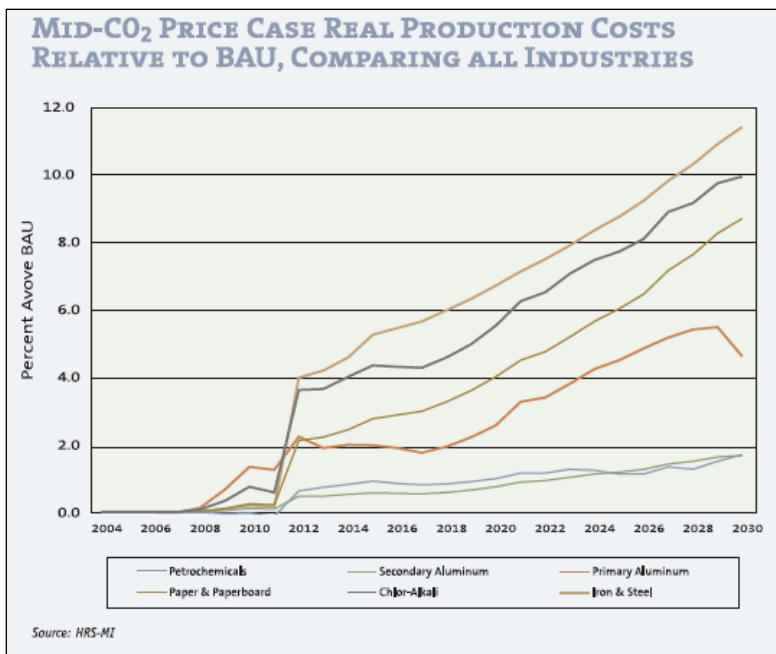
- Based on Lieberman-Warner Climate Security Act (S. 2191)
- Emissions allowance price: 2020-2030, \$30-\$61/mt CO₂-equivalent
 - 30% emissions below 2005 by 2030; 70% below by 2050

■ 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)

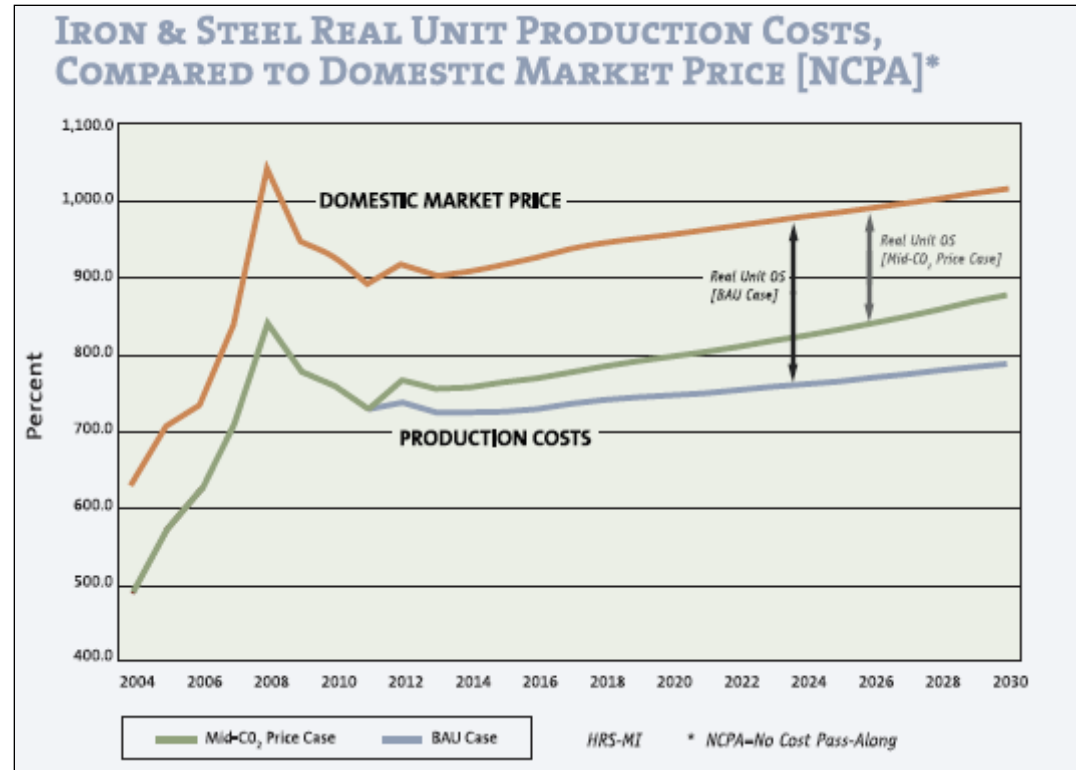


Operating Surplus Defined

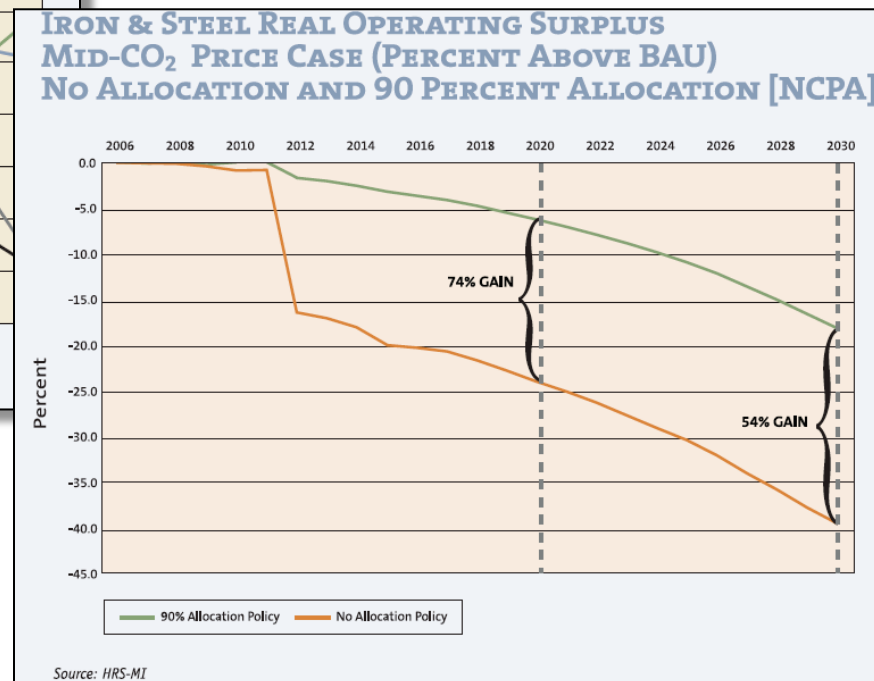
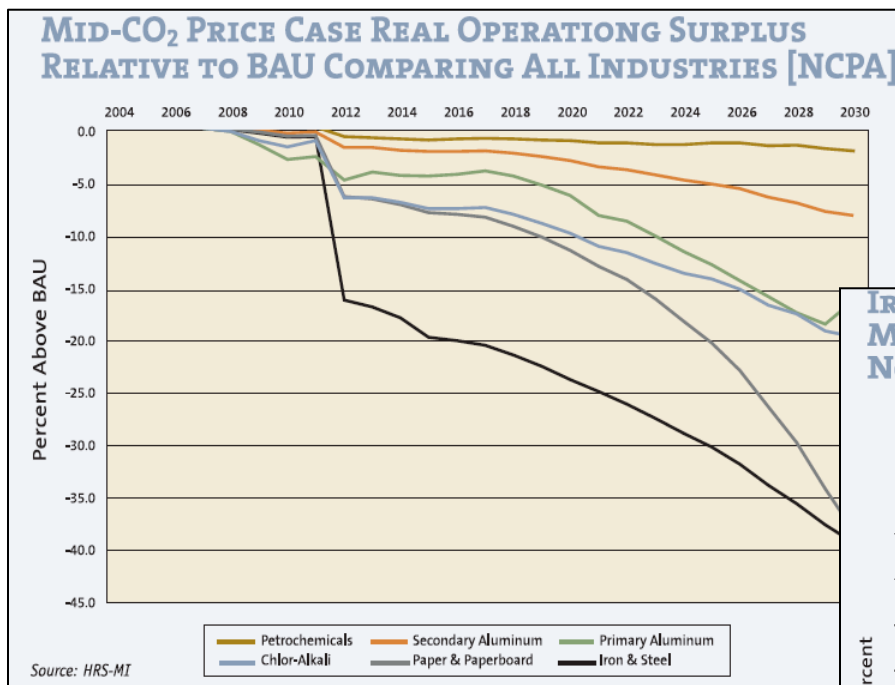
- **Operating Surplus:**
Domestic Market Price
Minus Unit Production
Cost (Revenues-PCs)

- 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



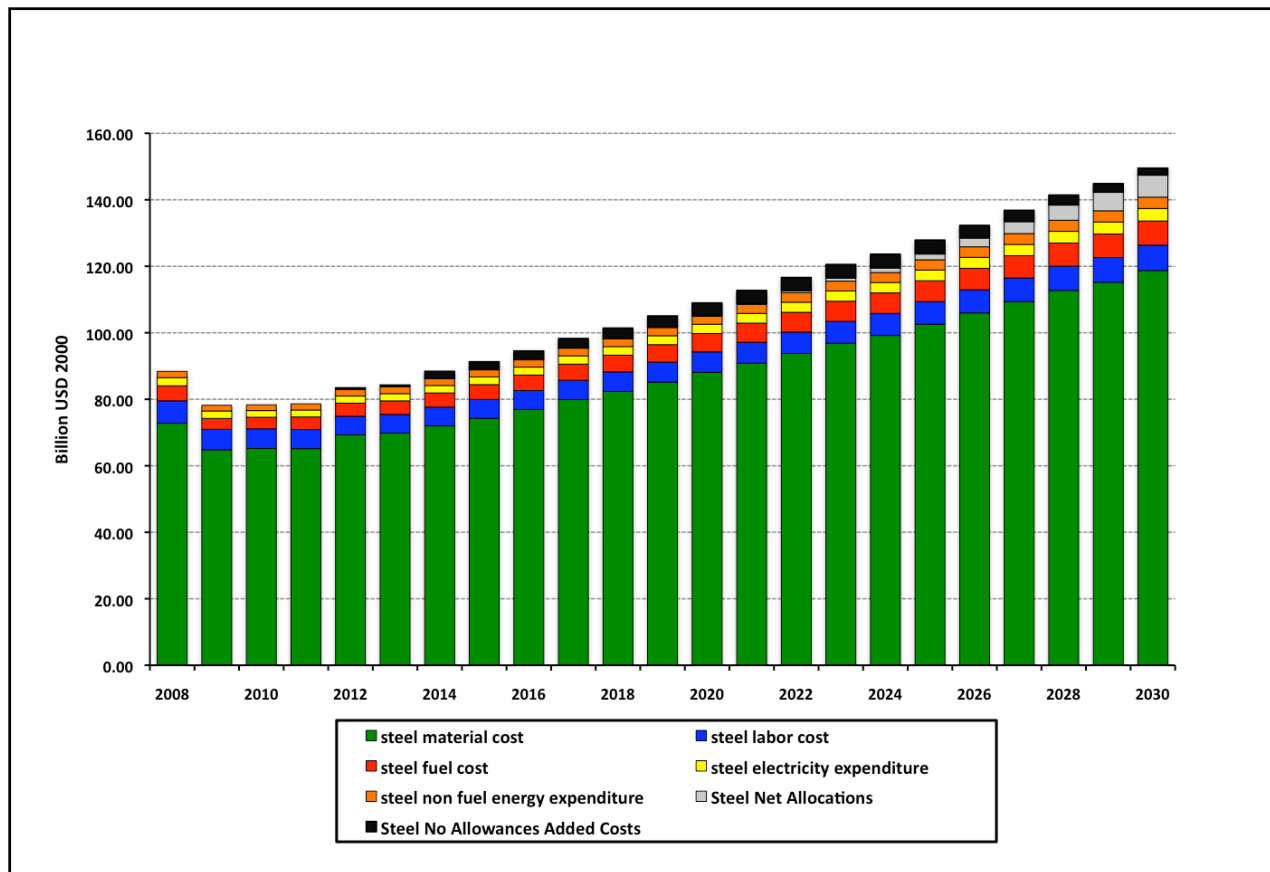


EDF ACESA-EITE Industry Study

- 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

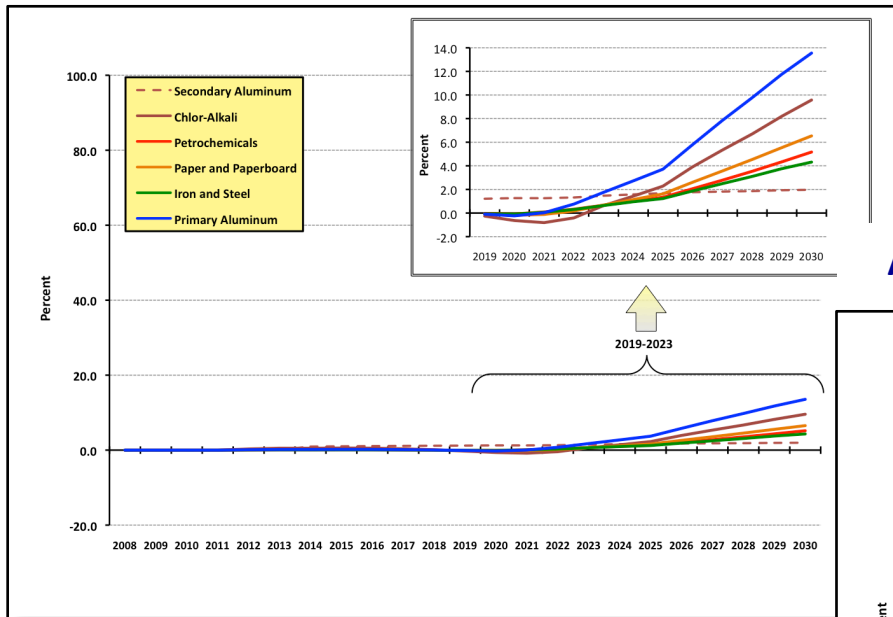
Production Cost Structure

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

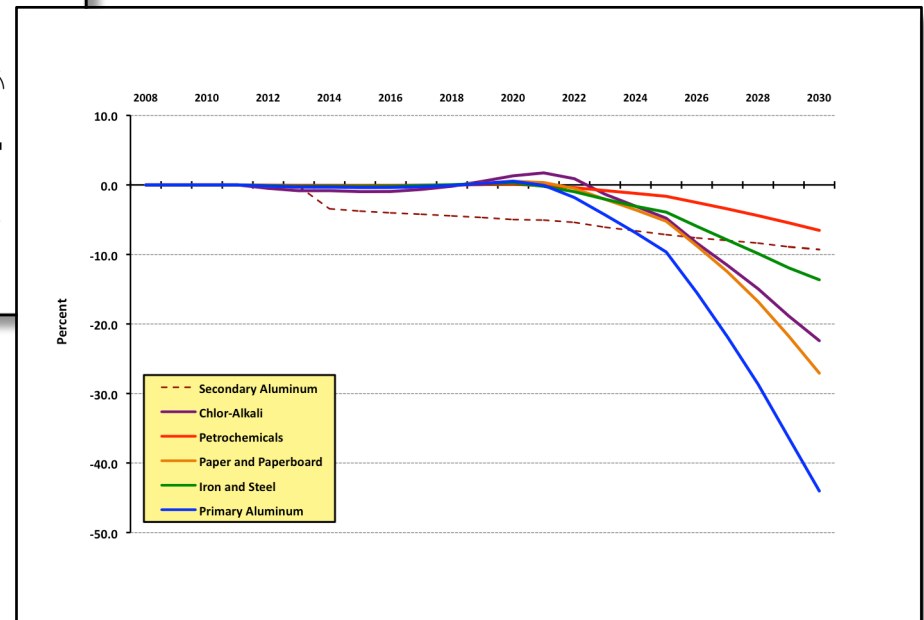


Allowance Rebate Effectiveness

ACESA Basic–Production Costs With Rebates



ACESA Basic–Operating Surplus With Rebates



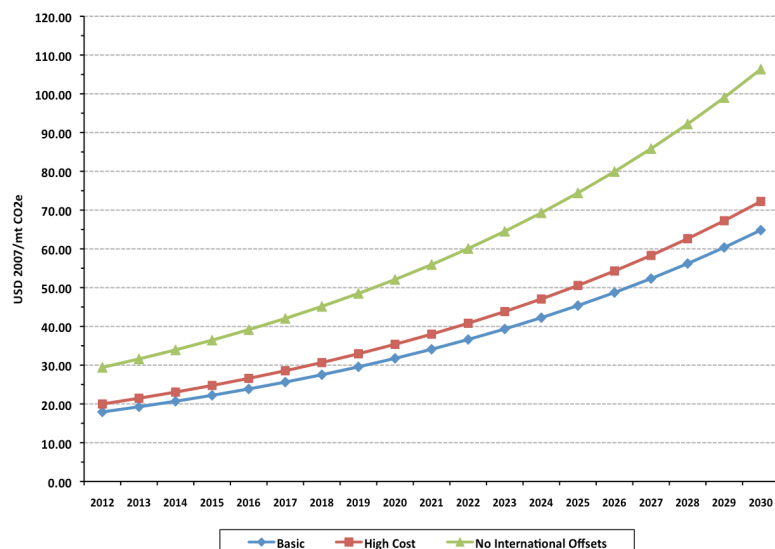


ACESA-EITE Industry Study (II)

- 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 it encourage other nations’ comparability? Will it adequately mitigate costs? Will it encourage low-carbon technology investments?

Alternative Policy Cases

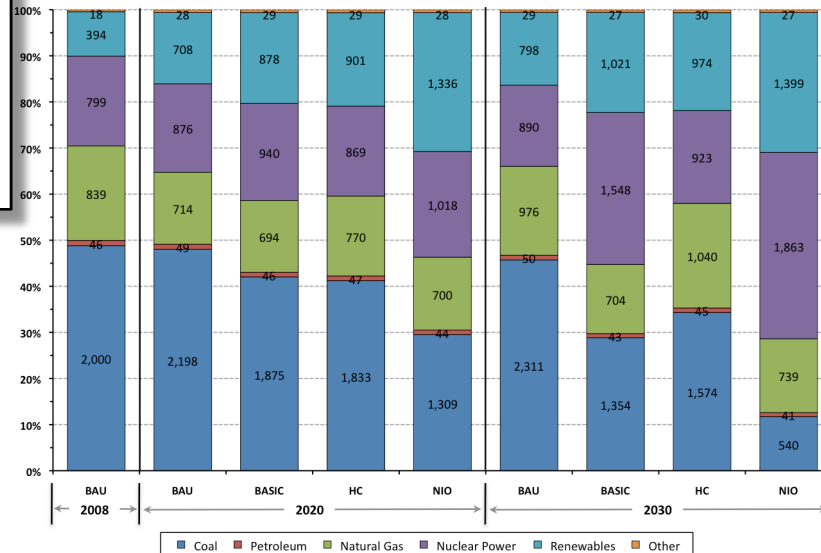
Emission Allowance Prices—Alternative Cases



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

Electric Power Fuel Mixes—Alternative Cases

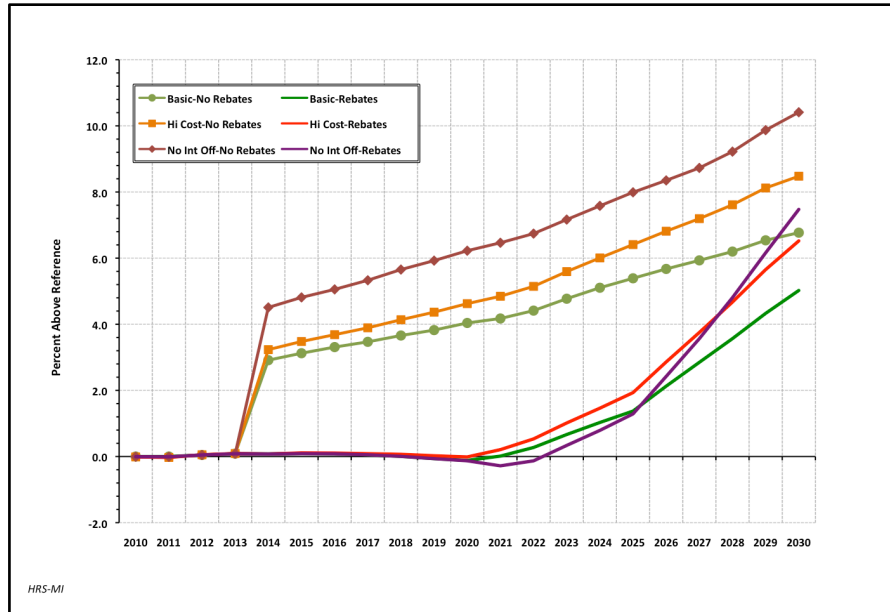


ACESA No International Case

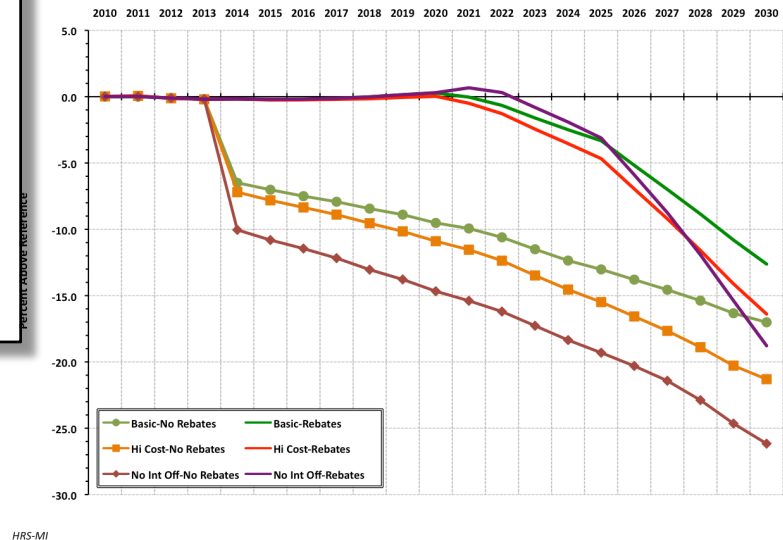
- International offsets severely limited by cost, regulation, slow progress reaching international agreements re offsets
- Significant portion of international offsets might not meet all requirements

Alternative Case Impacts

5-EITE Industries Production Costs



5-EITE Industries Operating Surplus



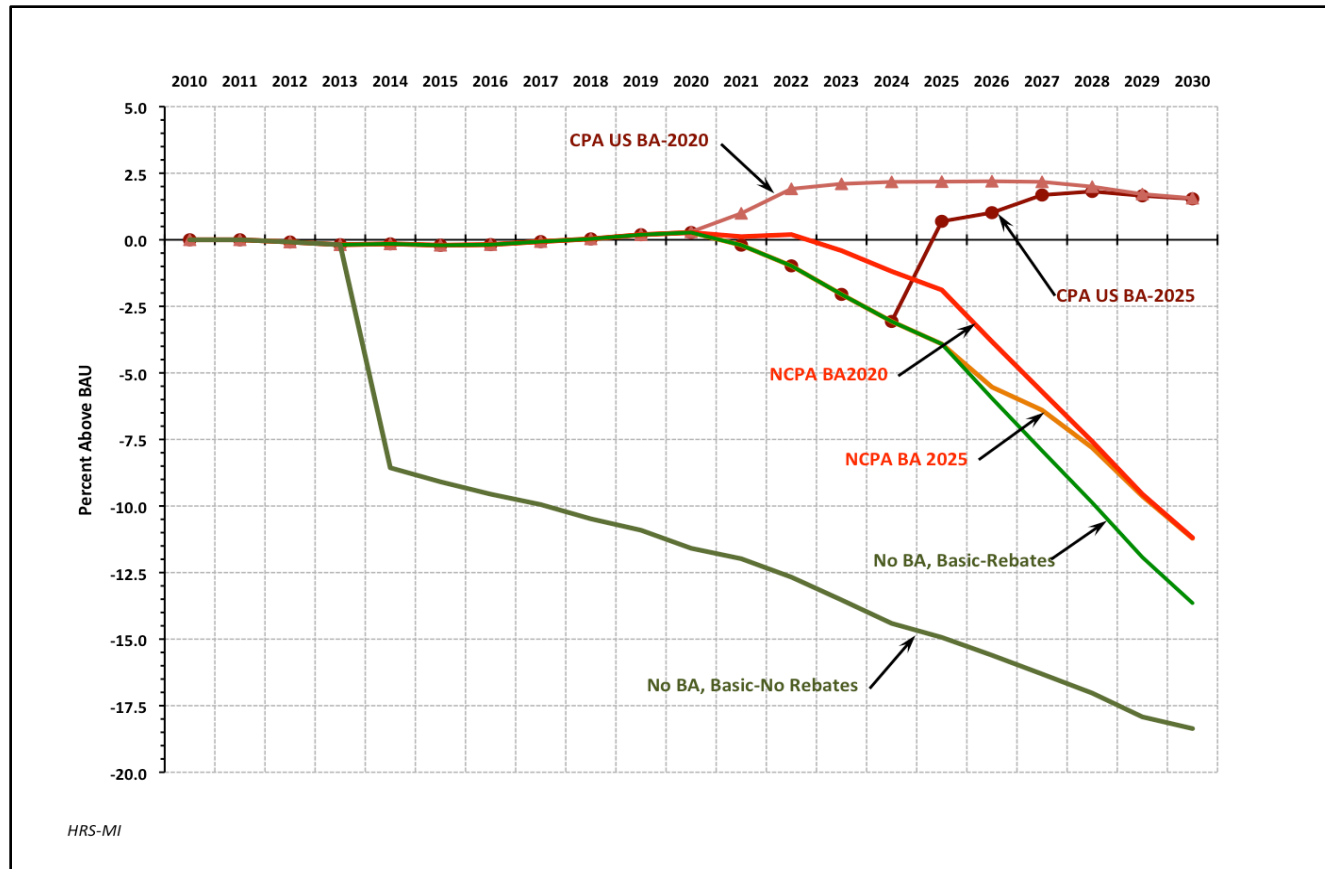


Border Adjustment Scenarios

- **Different Start Dates: 2020 & 2025**
- **Cost Pass-Along Scenarios**
 - **No Cost Pass-Along (NCPA BA)**
 - **BA Fees on Non-Compliant Countries**
 - Fees based on total emissions costs of U.S. industries
 - **Cost Pass-Along (CPA US BA)**
 - **BA Fees on Non-Compliant Countries**
 - **U.S. Manufacturers Pass Along Costs**
 - Total emissions costs less rebates

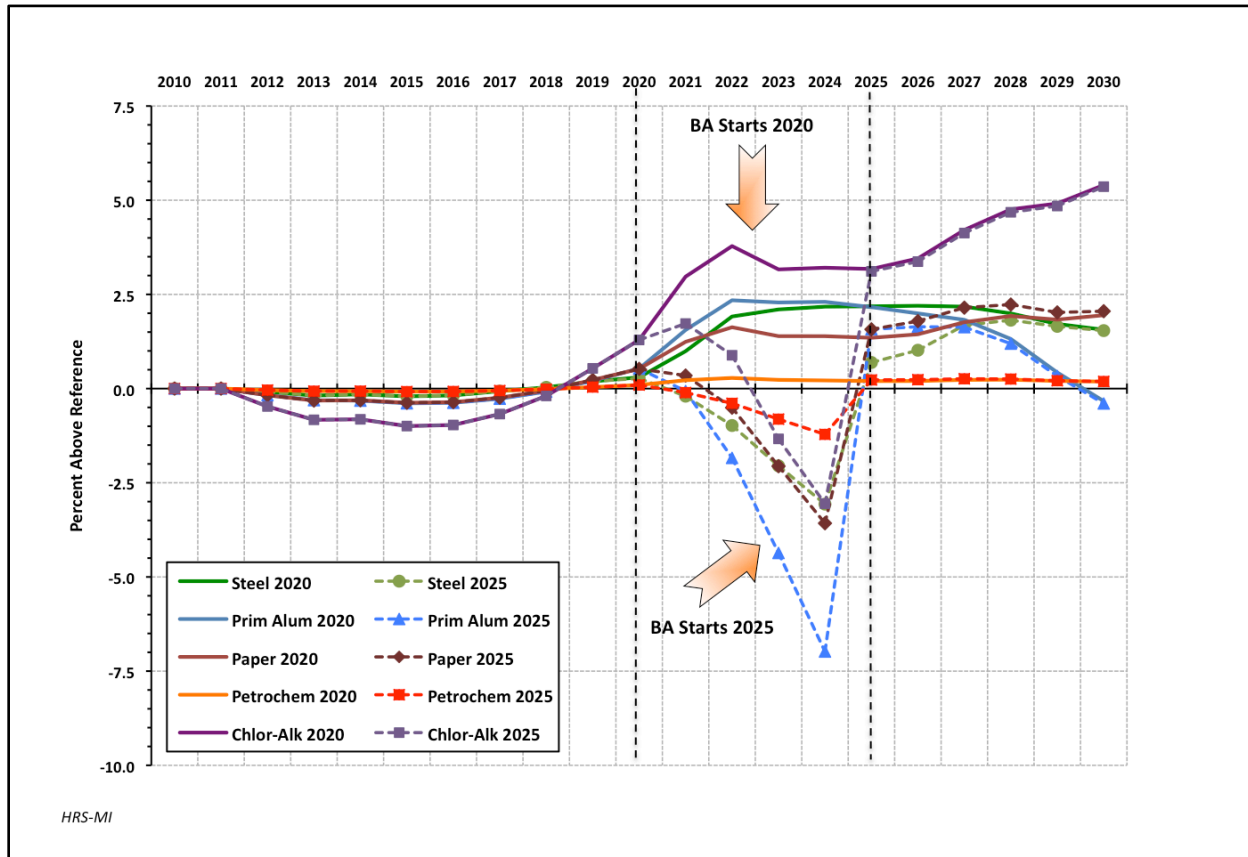
Border Adjustment Findings

Iron & Steel Operating Surplus—Border Adjustment Scenarios



Border Adjustments-Comparisons

EITE Industries Operating Surpluses
CPA BA Scenarios Starting 2020 and 2025





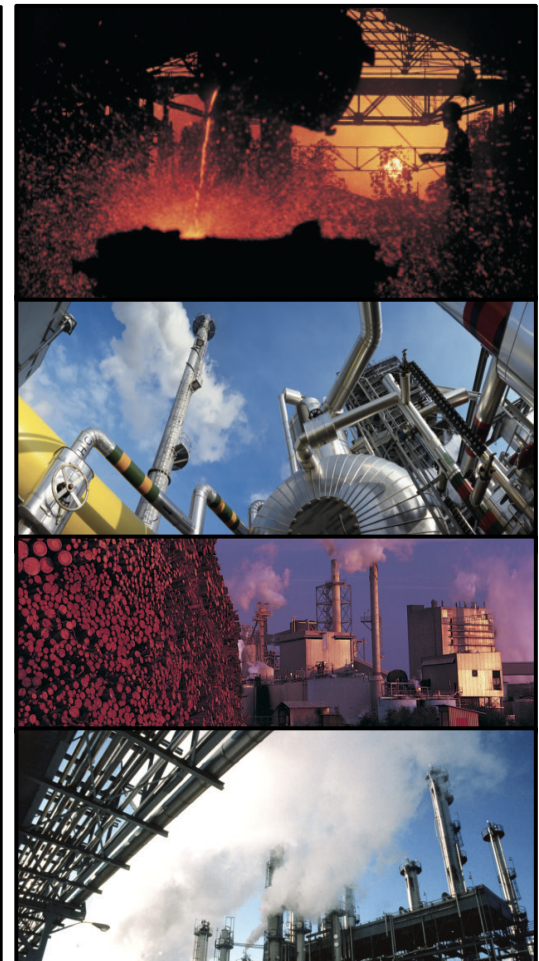
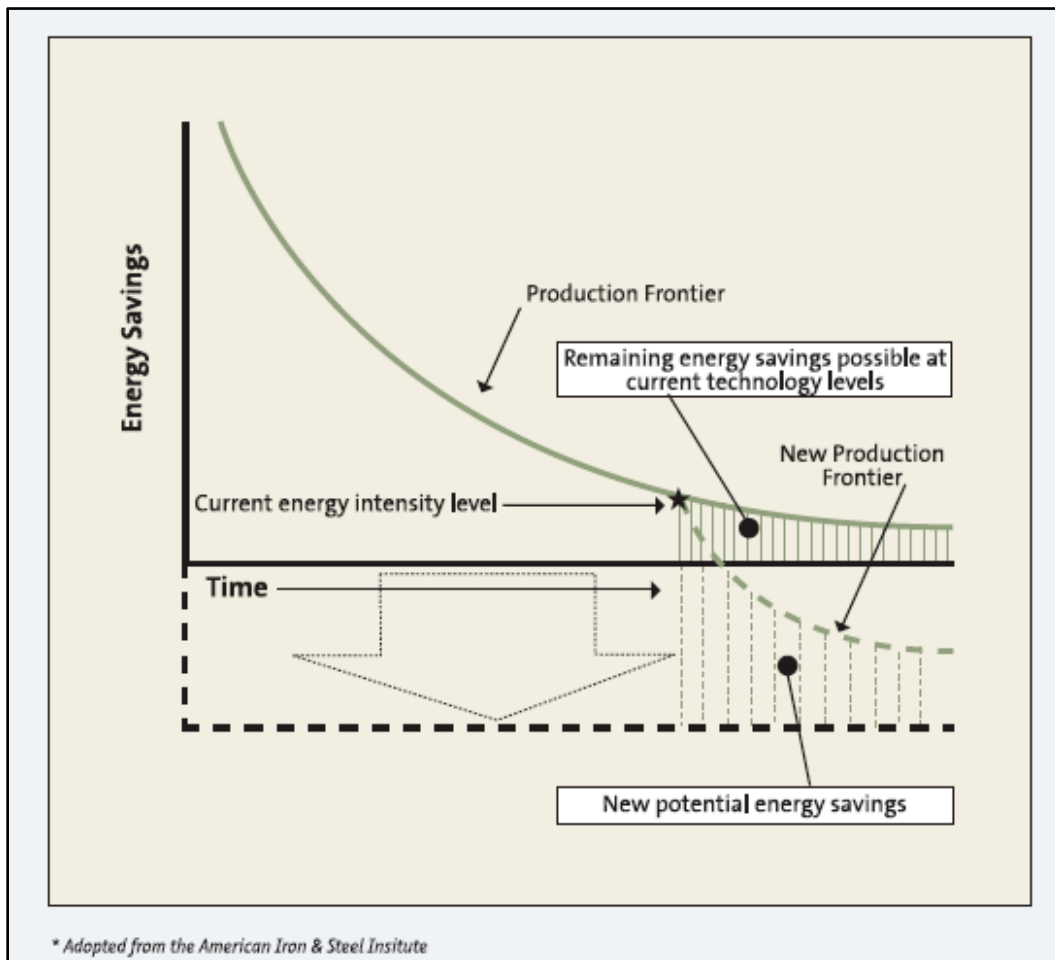
BA Caveats and Issues

- Compliant countries dominate imports
- Future non-compliant import shares may grow
- Different bases for BA calculations
- Export market impacts not assessed
- Downstream industry impacts
- Elasticities of import substitution



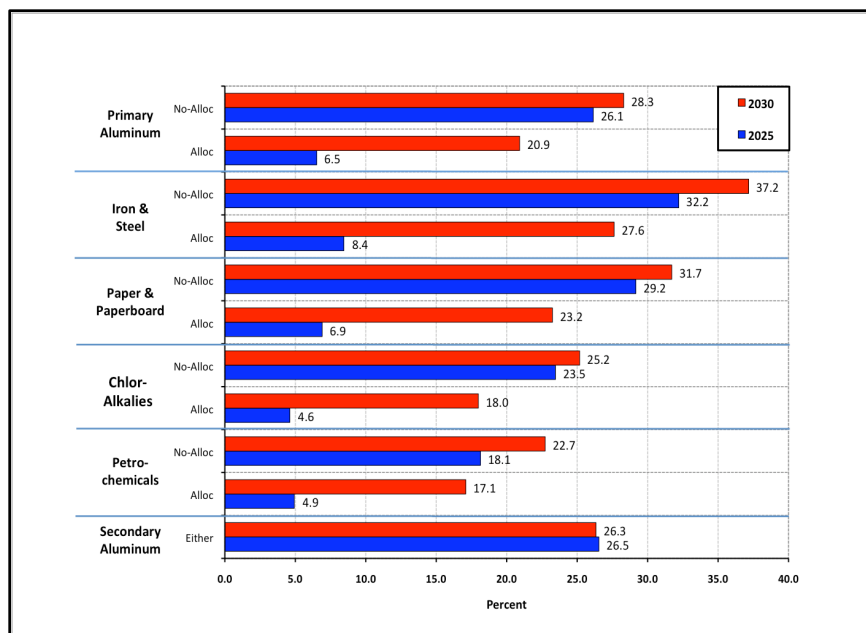
ENERGY EFFICIENCY & INVESTMENT OPTIONS

Energy Savings Potential?

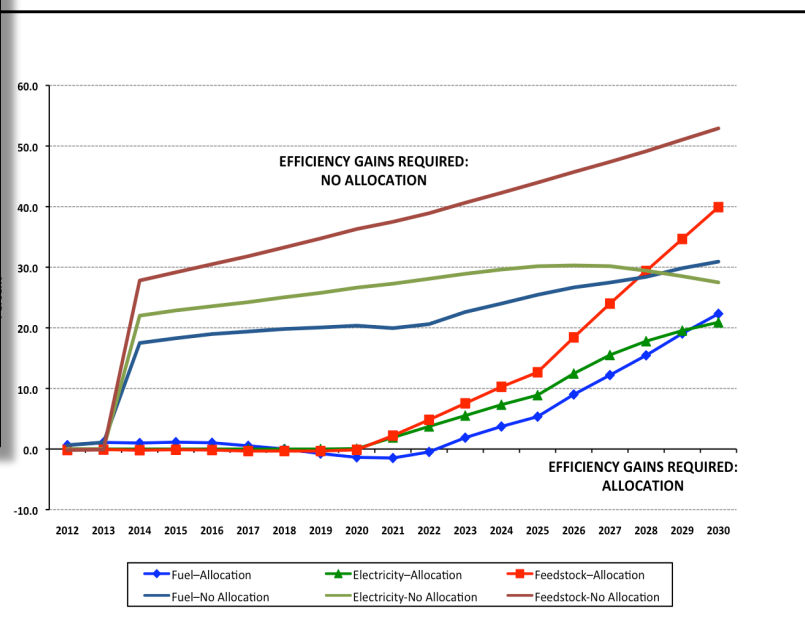


Energy Efficiency Requirements

ACESA—Total Energy Efficiency Gains Required



Iron & Steel Industry Total Energy Efficiency Gains Required



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




Summary of Findings

- With no cost mitigation measures, 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
- Over short-to-mid term, output-based rebates would substantially mitigate the emissions costs on PC and OS
- Cost mitigation would diminish and costs rise as the allowance rebates phases out after 2020, accelerating after 2025— but extent and nature of impacts vary by industry
 - Unless Presidential discretionary measures put in place or industries invest sufficiently in low-carbon, energy-efficient technologies



Summary of Findings (cont'd)

- International offsets have strong cost containment effect—without, cost impacts much higher after 2025 than Basic case
- If non-carbon alternatives are higher cost (nuclear, CCS, biomass), cost impacts after 2025 also higher
- BAs mixed cost mitigation impacts—uncertainties and caveats
- Rebate measure/BAs only buy time for industry adjustment
- Technology investment options necessary and available, but timing, costs critical
- Other policies may be needed to encourage long-term investment in advanced energy-saving technologies



EVALUATING ENERGY & CLIMATE POLICY IMPACTS ON OHIO'S ECONOMY

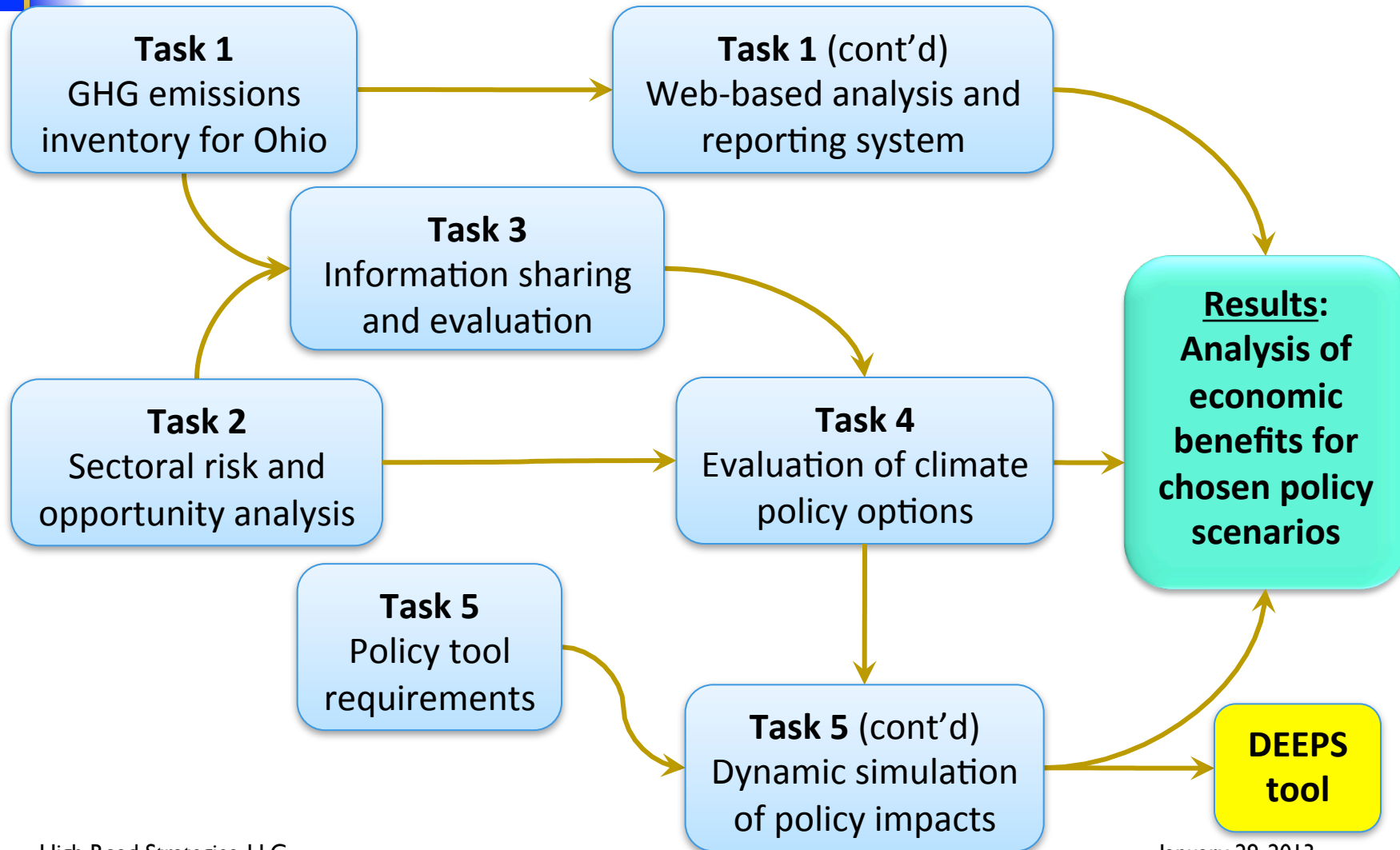


Ohio Energy & Climate Policy Project

- Report to Ohio Department of Development (now JobsOhio): *Assuring Ohio's Competitiveness in a Carbon Constrained World*
- Co-led by *Ohio University Voinovich School of Leadership and Public Affairs* and *The Ohio State University*
- Other Partners: *Millennium Institute* and *High Road Strategies*
- Principal Tasks:
 - Carbon Inventory for the State of Ohio
 - Risk and Opportunity Analysis for Ohio Manufacturing Sector
 - Review of Climate and Energy Policy Options for Ohio
 - Economic Analysis of Climate and Energy Policy Analysis
- See project website: www.ohioenergyresources.com



Project Overview

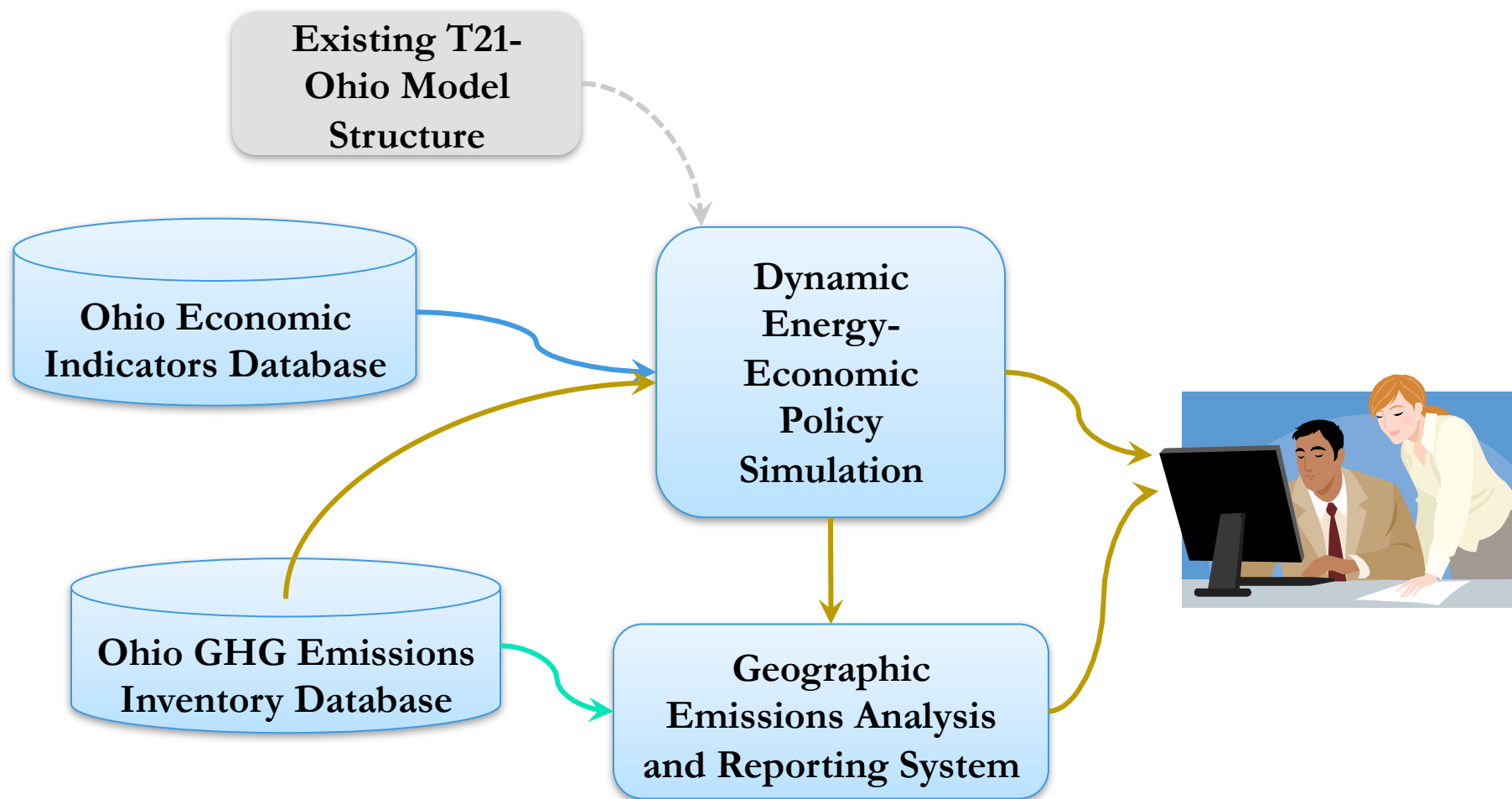


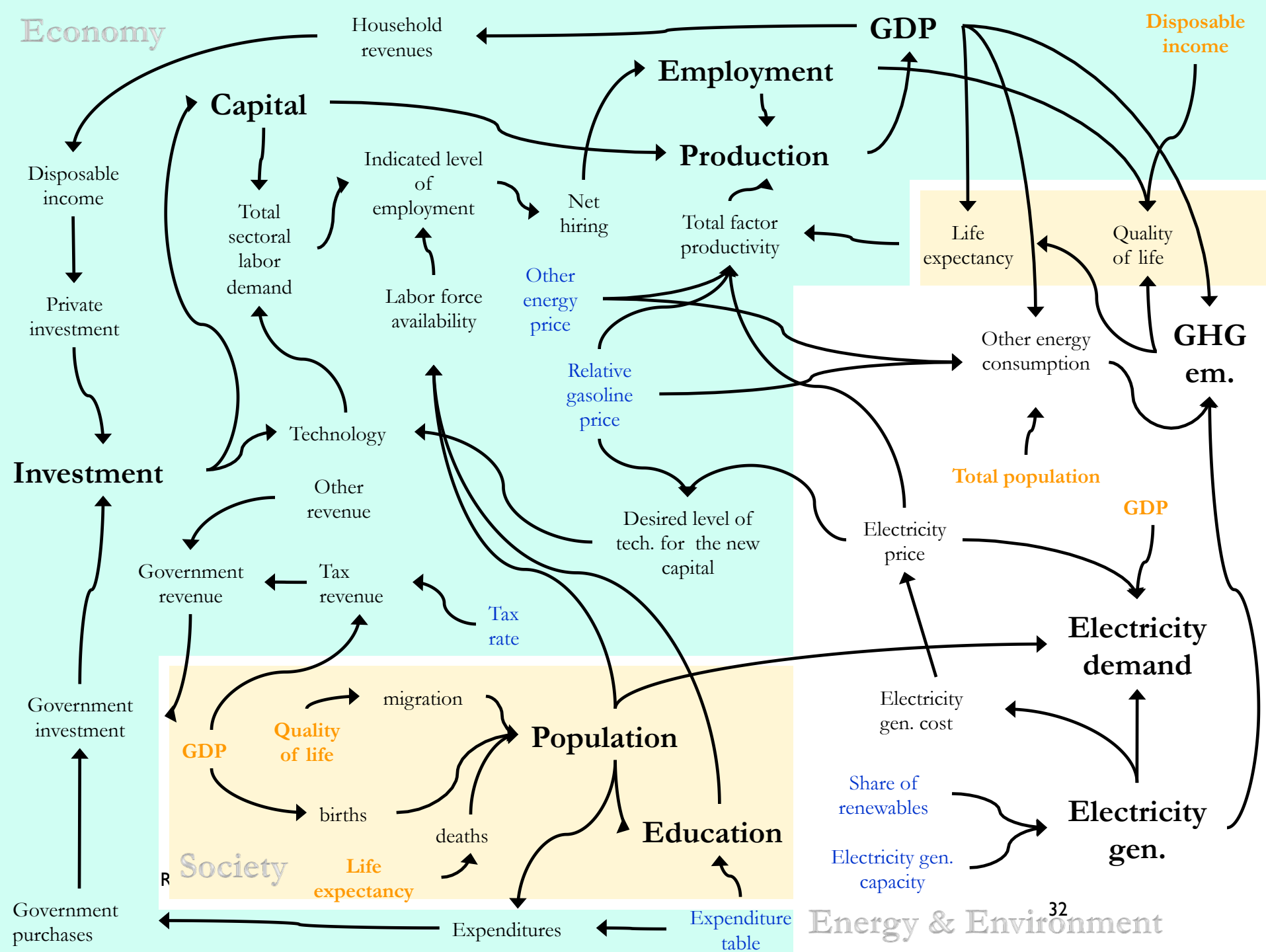


Dynamic Energy-Economic Policy Simulation (DEEPS)

- Designed to help the State of Ohio analyze the economic impacts of possible climate change, energy and GHG emission reduction policy scenarios
- End-user interface designed for ease of use and operability
- Uses System Dynamics (SD) modeling methodology
 - SD=integrated evaluation of policy options related to a variety of issues that arise in complex social, managerial, economic, and ecological systems
- Based on a previous SD model, called T21-Ohio*, which integrates social, economic and environmental factors into one coherent framework
 - * Developed by OSU in collaboration with MI, funded by EPA

Software Capabilities







Range of Policies Considered

Federal Policies

- Renewable portfolio standards
- EPA greenhouse gas standards
- Accelerated coal power plant retirement

State Policies

- Renewable portfolio standards
- Feed-in tariff
- Carbon capture and sequestration
- Smart grid
- Energy efficiency standards (buildings, industry)
- Transportation technologies (biofuels, electric vehicles)
- Non renewable energy investments (nuclear, natural gas)
- Waste utilization
- Forestry



Policy Scenarios

- **Business as usual (BAU) or base case:**
 - Continuation of current policies in Ohio
- **EPA GHG Standards**
 - 2-year U.S. EPA plan establishing GHG emission standards for fossil-fuel power plants and oil refineries
- **Ohio SB 221** (effective 7/30/08)
 - Key energy provisions: RPS; ee portfolio standards; new alternative energy policy; GHG reporting requirements
- **Ohio Energy, Jobs, and Progress Plan** (August 2008)
 - Specifies ee and renewable targets until 2025; larger RPS including clean coal and nuclear



EITE Industry CO₂e Emissions

Manufacturing Sectors (6-digit NAICS)—Top 10 Ranked by Direct Emissions						
Rank	Industry	NAICS	Direct CO ₂ e emissions (MMTCO ₂ e)	% Total Manuf.	No. Establish-ments†	Employeeest
1	Iron and Steel Mills*	331111	8.24	36.8	55	11,903
2	Petroleum Refineries*	324110	4.45	19.9	16	1,653
3	Lime*	327410	1.96	8.8	8	437
4	Paper (except Newsprint)*	322121	1.29	5.8	29	4,423††
5	Nitrogenous Fertilizer*	325311	0.51	2.3	33	1,609
6	Paperboard*	322130	0.40	1.8	††	††
7	Plastics Materials and Resins*	325211	0.32	1.4	63	3,562
8	All Other Misc. Chemical Products	325998	0.27	1.2	92	2,297
9	Turbines and Turbine Generators	333611	0.27	1.2	10	ND
10	Cements*	327310	0.26	1.2	7	391
Top 10 Subtotals			17.98	80.3	313	21,852
TOTALMANUFACTURING		31-33	22.38	100.0	17,413	738,817
* Energy-intensive trade-exposed (EITE) industries as designated by the U.S. EPA ND=NotDisclosable—doesn't meet BLS or State disclosure standards. † Source: BLS Quarterly Census of Employment and Wages (QCEW) †† Combined pulp, paper and paperboard industries <i>Emission Data Source: OU-OSU Ohio Point Source Database</i>						



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