STANDARD & POOR'S

How U.S. Federal Climate Policy Could Affect Chemicals' Credit Risk

WORLD RESOURCES INSTITUTE

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This article has been written by Standard & Poor's Ratings Services and the World Resources Institute (WRI), and brings together the independent perspectives of a rating agency and an environmental think tank. APG, which seeks to integrate environmental, social, and governance issues across all asset classes, including fixed income, provided funding for WRI's contributions to this report. Standard & Poor's did not receive funding from APG or any other party for its contributions. Standard & Poor's views and commentary in this article, though based on certain analysis and assumptions by WRI, have been arrived at independently.

Standard & Poor's and WRI have based their respective contributions on WRI's analysis of future policy determinants and the U.S. Energy Information Administration's policy forecasts, among other public data sources. As with any scenario-based exercise, this analysis uses several assumptions to examine a range of possible outcomes. Our respective findings are illustrative and do not represent WRI's or Standard & Poor's predictions of policies and related effects. An accompanying technical document which details WRI's analytical approach is available at http://www.wri.org/publication/federal-climate-policy-and-us-chemicals-credit-risk.

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Credit Commentary

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Editor's Note: Standard & Poor's and WRI contributed to this article in an effort to examine how potential U.S. climate change policy scenarios could have credit implications for the U.S. chemicals manufacturing industry. In both Standard & Poor's and WRI's view, their respective findings indicate that environmental policy issues could play a role in the evaluation of credit quality.

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Any significant federal action to address climate change would likely be most relevant for subsectors of the U.S. chemicals industry that have significant greenhouse gas (GHG) emissions or a high dependence on natural gas- or oil-derived raw materials. Almost half of the 2007 value of shipments of the $724 billion[i] U.S. chemicals manufacturing industry—mostly commodity chemicals—fit this description.

These include the following 13 manufacturing subsectors, which comprised more than 90% of the U.S. chemicals industry's direct GHG emissions in 2006[ii]:

- Alkalies and chlorine,
- Carbon black,
- Cyclic crude and intermediates,
- Ethyl alcohol,
- Industrial gas,
- Nitrogenous fertilizer,
- Noncellulosic organic fiber,
- Other basic inorganic,
- Other basic organic,
- Petrochemical,
- Phosphatic fertilizer,
- Plastic material and resin, and
- Synthetic rubber.

In the first part of the analysis, WRI describes scenarios under two types of potential federal climate policy—an economy-wide market-based system (specifically, cap-and-trade legislation) and Environmental Protection Agency (EPA) regulation of GHGs (see "U.S. Climate Policy Scenarios," below). In the second part, WRI and, in certain discrete issues, Standard & Poor's look at how these policy scenarios could influence credit risk factors in 13 greenhouse gas-intensive[iii] chemicals subsectors (see "Subsector Analysis," below). In the final, third part, Standard & Poor's applies these findings with a view to assessing the potential credit impact on two hypothetical companies—one carbon black manufacturer and one industrial gas manufacturer (see "Company Case Studies," below).

This analysis does not cover most U.S. specialty chemicals companies because they tend to be less GHG-intensive and have strong competitive positions. As a result, any future climate policy is less likely, in Standard & Poor's view, to significantly affect their credit quality.

In Standard & Poor's and WRI's opinion, key indicators of credit impact under any U.S. policy to significantly reduce GHG emissions would likely include factors such as:

- Macroeconomic and energy-related factors including:
  - Industrial growth forecasts and the effects on demand for chemicals products;
  - Prices of fuel, feedstock, and electricity and their effects on input costs;
- Compliance-related factors, including:
  - Costs, or in some cases, revenues, related to climate policy provisions;
  - Capital expenditures or other spending to reduce/meet compliance obligations; and
- Competitive factors, including:
  - Effective management of the above factors, including the ability to pass along costs to customers, and/or in a few cases, to take advantage of new market opportunities.

The effects of these factors on creditworthiness would likely vary by policy design and implementation. To illustrate, rather than predict, WRI created scenarios based on two types of policy. The first type of policy envisions U.S. Congress using a market-based system—such as cap-and-trade policy—to reduce GHG emissions across the economy. Here, WRI uses the American Power Act (APA)—the most recently proposed economy-wide cap-and-trade bill in the Senate (May 2010)—as a proxy, since any future market-based policy would likely draw from APA. The second type of policy examines how the EPA would regulate chemicals-related GHGs using its existing authority under the Clean Air Act. As the EPA's GHG regulatory form, timeline, and scope are currently unclear, WRI only examined which of the 13 subsectors are most likely to face GHG regulations rather than analytically examine credit impact on the 13 subsectors. While WRI and Standard & Poor's considered these policy types separately in their respective analyses, they are not mutually exclusive because Congress and the EPA (as well as state governments and other federal agencies) could simultaneously establish policies to address climate change.

Standard & Poor's and WRI decided to examine potential credit effects after an anticipated five-year phase-in period. We used 2016 as a proxy because it is the first year that the chemicals industry would have been required to hold permits under the APA, and, in WRI's view, it is unlikely that future EPA regulation would cover GHGs from existing chemical facilities before 2016. Although not explicitly analyzed, chemicals companies could feel a credit impact before 2016—particularly those with older, less efficient facilities—as they expend capital to prepare for policy.

Standard & Poor's and WRI also do not consider new market opportunities under a GHG-constrained economy as part of this analysis. These opportunities may be significant for some companies. For example, companies manufacturing products for use in industries like building insulation, electric vehicles, and agriculture could see greater demand for their products because of policy.

Key Findings

Credit impact under cap-and-trade scenarios

If passed, the APA would require companies to hold permits to emit GHGs for all emissions from facilities emitting more than 25,000 tons of carbon dioxide (CO2) or equivalent greenhouse gas. Most large U.S. chemical facilities would meet this threshold.[iv] By limiting the supply of these permits—

known as emissions allowances—in the market, the government would be able to cap economy-wide emissions. The APA also includes provisions that would rebate free emissions allowances to facilities in select subsectors. Eligibility for these free allowance rebates is at the subsector level, and depends on a subsector's energy intensity and trade exposure.[v]

WRI has calculated that the APA provides enough free allowances to energy intensive, trade exposed manufacturing industries that any eligible subsector—as a whole—will receive enough free permits to cover all emissions in that subsector for 2016 and several years beyond (see WRI's accompanying technical document). However, the risk remains that the supply of free permits relative to demand may decline over time and at a faster rate than originally envisaged.

Predicting how the APA would affect the economy is challenging. For their analysis, Standard & Poor's and WRI have each relied on the U.S. Government's Energy Information Administration's (EIA) projections of APA's impact on GDP, energy prices, and GHG emissions permit prices.[vi] As with any forecasting, these projections indicate what could happen, rather than what would happen.

Subsector-level evaluation

Standard & Poor's and WRI based their respective analyses on EIA projections using three GHG permit price scenarios—low, medium, and high—under the APA. Based on these projections, most of the chemicals subsectors we examined would only see modest energy and compliance effects in the first year of assumed compliance (2016).

The EIA projects only modest changes relative to no policy for most natural gas and oil-derived energy inputs in 2016 under the APA. Only well-head natural gas prices increase significantly—from 4% to 25% higher relative to no policy in the three scenarios Standard & Poor's and WRI considered—while petroleum and coal prices decrease modestly—from 1% to 9% lower relative to no policy. These projections are premised on the assumption that users across the economy will likely switch away from emissions-intensive fuel/feedstock sources (i.e., petroleum and coal) and demand lower emissions fuel/feedstock sources (including natural gas) because of the price signal cap-and-trade policy creates.

APA provisions require utilities to pass any free allowances they receive to industrial consumers, including chemicals manufacturers, in the form of lower electricity prices, which mutes electricity price changes.

WRI estimates that facilities in 10 of the 13 chemicals subsectors (as a whole) would be eligible to receive free allowance rebates under the APA. For these eligible subsectors, WRI expects no net compliance obligations—at the subsector level—in 2016 and through as far as 2033 (see WRI's accompanying technical document). WRI expects only facilities in three of the 13 subsectors examined—the industrial gas, ethyl alcohol, and phosphatic fertilizer— would not be eligible to receive free allowances since these subsectors don't meet the legislation's threshold for trade exposure and/or energy-intensity.

WRI compared the 13 GHG-intensive subsectors' relative policy-related energy and compliance costs (based on EIA projections in 2016) against Standard & Poor's ranking of relative competitive risks for each subsector *(see Figure 1)*. WRI assumed that the ratio of these subsectors' emissions and their energy-related fuel/feedstock purchases to their size, as measured by value of shipments, is the same in 2016 as in 2006 (the most recent data available for emissions estimates). This comparison appears to indicate the following:

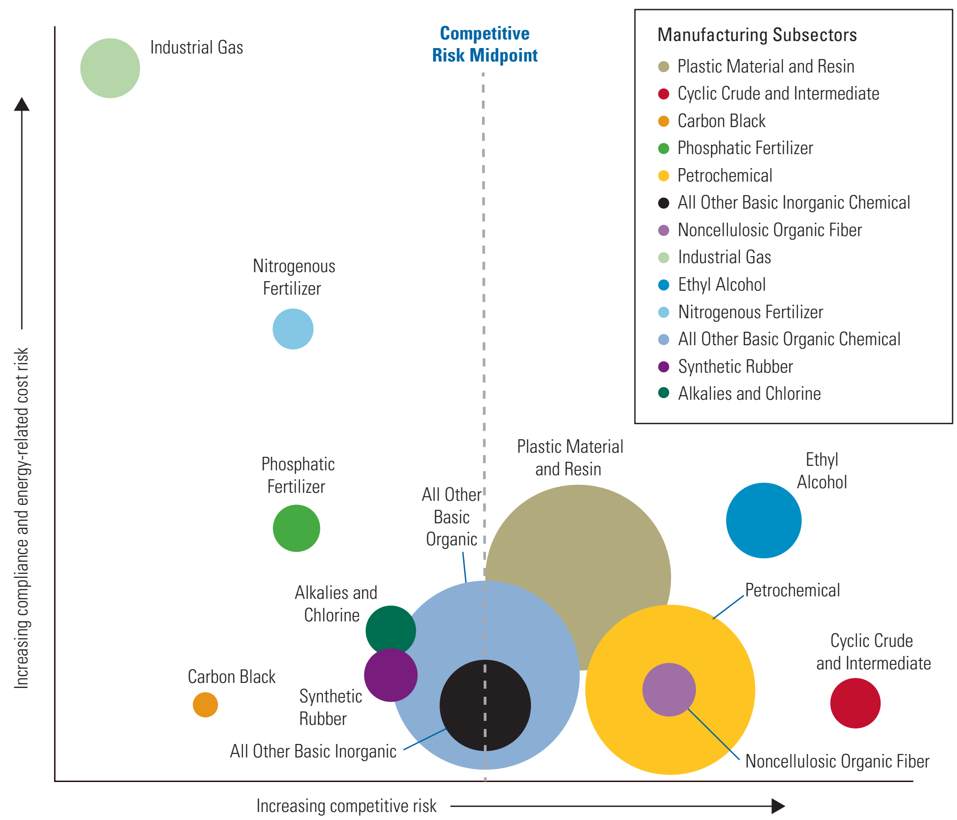
- While large energy-intensive commodity chemical subsectors (like the petrochemical, plastic material and resin, and other basic organic chemical subsectors) may have limited ability to pass along costs depending on market conditions, WRI doesn't expect these subsectors to face significant compliance costs because of their eligibility for free allowances. At the same time, these subsectors also depend heavily on natural gas-derived feedstocks so they could face higher production costs. Standard & Poor's expects higher production costs could make some of these subsectors less competitive in their markets, lower their export opportunities, and ultimately weaken their credit metrics.

- The nitrogenous fertilizer subsector is likely to face moderate energy-related risks because of their natural gas purchases.
- The industrial gas subsector may have the greatest compliance costs relative to its size, but it should also be in the best competitive position to pass along these costs to customers.

Company-level evaluation

Under the APA, companies in eligible subsectors receive free allowances based on their market share (by output) in a subsector, multiplied by the whole subsectors' GHG emissions. As a result, companies with a lower ratio of GHG emissions to output than those of their peers would receive more free allowances than required to cover their facilities' compliance requirements. These companies can sell their extra free allowances for cash or bank them for future use. Companies with a higher ratio of

Figure 1 **Estimated *Relative* Impacts on Select Manufacturing Subsectors under the American Power Act—Average of Three EIA Projection Scenarios (2016)**



Notes: Analytical approach and assumptions are described later in this report and WRI's accompanying technical document.
(1) Bubble size indicates each subsector's value of shipments as of 2006/2007.
(2) Values on the X axis and Y axis are ranked relative to the subsectors examined; each subsector is examined in isolation so any inter-subsector impacts due to policy are not considered.
(3) Energy-related impacts are primarily based on direct purchases of natural gas, fuel oils, LPG, NGL, coal and electricity. Two exceptions are the bubbles for two subsectors—Plastic Material and Resin, and Synthetic Rubber—which were adjusted (to reflect greater *indirect* energy-related costs) based on their dependence on certain natural gas-derived feedstocks which were not fully accounted for in the public data used in this analysis.

Sources: WRI and S&P, based on data from EIA, EPA, and Census Bureau.

GHG emissions to output than their peers still receive free allowances, but these free allowances would only offset a portion of their compliance requirements and may put them at a cost disadvantage.

WRI and Standard & Poor's expect that the credit impact at a company-level would likely vary within each subsector based on the following:

- **Current and projected emissions and the ability to reduce emissions.** For companies eligible to receive free allowances, emissions data should be compared with the subsector average, since net compliance costs would depend on emissions intensity relative to the subsector average.
- **Current and projected fuel and feedstock mix.** Dependence on GHG-intensive fuels like petroleum products and coal (and to a lesser extent, natural gas) increase compliance costs because GHG emissions are released upon combustion. Natural gas dependence, whether through direct purchases or natural gas-derived feedstocks, may result in higher energy purchase costs.
- **Competitive position,** both domestic and international, including the ability to pass along costs.

Standard & Poor's examined the potential credit impact on two hypothetical companies in energy-intensive subsectors in 2016, using EIA projections of the APA and WRI's analysis of free allowances:

- Company A is a large carbon black producer with lower GHG emissions than most of its peers. WRI estimates that the value of free allowances Company A would receive under the APA would be greater than the costs of its compliance obligations, resulting in net revenue of $0.01 to $0.03 per dollar of U.S. sales in the first year of regulation—a negligible positive impact. Standard & Poor's also expects the implications of raw material costs to be manageable for Company A because it focuses its energy purchases on refined crude oil products, which are expected to decline in cost relative to the no-policy case. Even in the downside case, where its energy outlays increase more than what the EIA projects, energy costs appear manageable because of the company's geographic diversity and the expectation that Company A would retain sufficient pricing power due to the value-added-nature of its products and favorable industry structure. Thus, under the EIA projections, Standard & Poor's would not expect Company A's profitability and leverage metrics to deteriorate.
- Company B, as a large industrial gas producer, would not be eligible to receive compliance-related subsidies. As a result, WRI estimates Company B would face $0.06 to $0.17 in compliance costs per dollar of U.S. sales. The substantial costs of compliance could raise some uncertainty on future capital spending, and the EIA's projection for slightly lower economic growth could affect demand growth. But we expect Company B to be able to pass through some costs to downstream customers as a result of the strength of its business model and lack of lower-cost substitutes. Here, Standard & Poor's expects Company B's profitability and leverage metrics to deteriorate modestly under the EIA projections.

The subsectors that are most likely to face EPA regulation

WRI believes that 2016 is likely the earliest year that future EPA regulation would cover GHGs from existing chemical facilities. The form of regulation is unclear. Previously, the EPA has used both market-based and command-and-control regulation to limit pollutants.[vii]

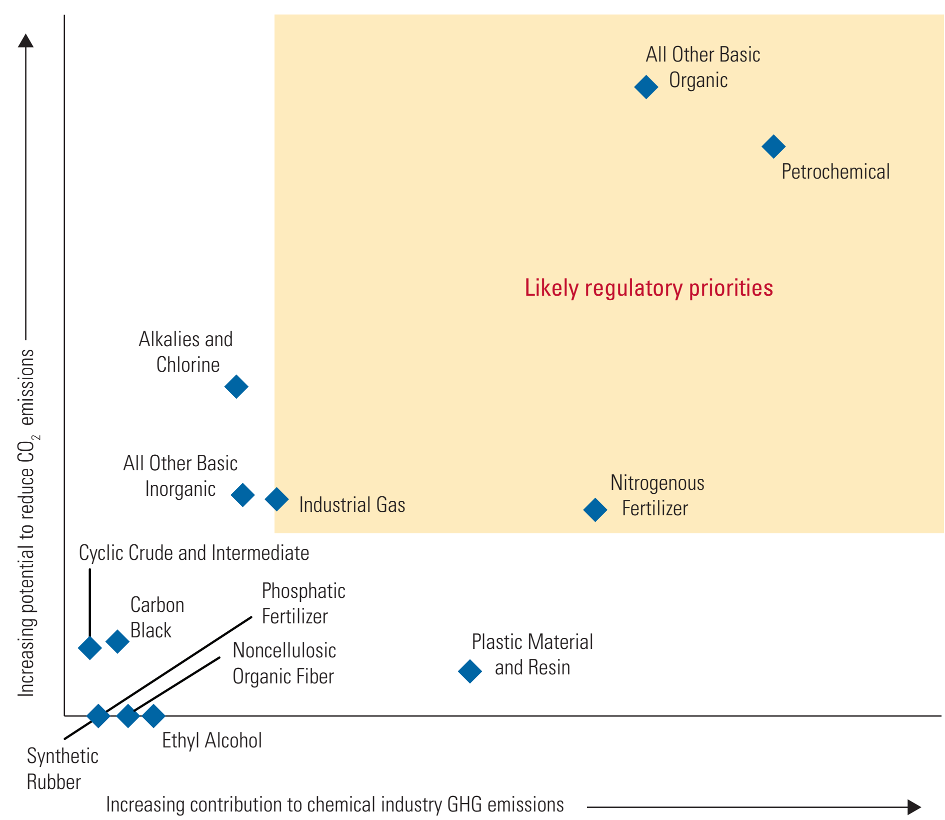
WRI believes that absolute emissions and emissions reduction potential are among the factors that the EPA will consider when regulating GHG emissions; other key criteria include cost feasibility and the remaining useful life of facilities *(see Figure 2)*. Nitric acid and adipic acid production—part of the nitrogenous fertilizer and all other basic organic subsectors, and an input into fiber manufacturing—are also likely to come under regulation as a significant source of nitrous oxide (N2O) emissions (a potent GHG). (Because of data limitations, Figure 2 does not reflect cost feasibility, the remaining useful life of facilities, and nitric acid and adipic acid production.)

The credit differences between policy scenarios

Assuming the EPA does not use market-based mechanisms, WRI and Standard & Poor's believe the key credit-related differences between the cap-and-trade and EPA regulatory scenarios include:

- **Cash flow flexibility.** Cap-and-trade legislation provides companies with greater flexibility to choose between up-front capital expenditure and the purchase of emissions allowances, allowing companies to more easily manage cash flows in a given year.
- **Compliance-related revenue.** Under the APA, companies that are both eligible for rebates and emit less GHGs than their peers (per unit of output) would presumptively receive more free allowances than required, and could bank or sell these allowances for cash. A non-market-based EPA regulatory approach would not provide a similar opportunity to gain compliance-related revenue.
- **Management strategy.** Implementing an effective management strategy to comply with climate policy becomes more important in a cap-and-trade scenario. Benchmarking emissions reductions against peers and participating in GHG permit trading ("carbon") markets will likely be a complex undertaking for any company, requiring input and coordination from all business segments. In contrast, meeting EPA regulatory standards is likely to be easier to manage within existing company operations.

Figure 2 ***Relative*** **Likelihood of Future EPA Regulation for Select Chemical Manufacturing Subsectors**



Note: Y-axis does not consider the potential to reduce GHGs other than CO_2.

Sources: WRI, based on data from the Department of Energy and the EIA/EPA, and assumptions in WRI's accompanying technical document.

As climate policy evolves, key policy variables to watch for include:

- **Stringency.** How aggressively do policies target greenhouse gas emissions reductions?
- **Coverage.** Which subsectors in the chemicals value chain do the regulations cover? And how and when do those regulations apply?
- **Transition provisions.** What provisions are available to ease the economy and companies into reducing GHG emissions and minimize competitive pressures (for example, free allowances)?

U.S. Climate Policy Scenarios

The chemicals industry accounted for a significant portion of the U.S. economy's greenhouse gas emissions in 2006, at 21% of U.S. manufacturing GHG emissions and around 5% of total U.S. emissions.[viii] The cost base of many commodity chemicals producers depends on the price of oil or natural gas-related raw materials. Thus, any future U.S. government action to significantly limit GHG emissions is relevant for these companies' credit quality either directly because of compliance-related costs and revenues or indirectly through changes in fuel and feedstock costs. Here, WRI describes possible paths for U.S. federal climate policy as context for this article's analysis of credit impact.

U.S. climate policy: the current state of play

In 2009 and early 2010, an economy-wide cap-and-trade policy structure—where the U.S. government would sell a limited number of GHG emissions permits to companies—gained significant political traction. In June 2009, the U.S. House of Representatives passed a landmark economy-wide cap-and-trade bill, commonly called "Waxman-Markey." And in May 2010, Senators Kerry and Lieberman followed by proposing a similar bill, the APA, in the Senate. But political winds changed by mid-2010; the Senate has not voted on the APA, and Congress has done little to address climate change.

Meanwhile, in 2009 and 2010, the EPA proposed and/or passed several rules designed to limit GHG emissions from sources such as passenger vehicles. In September 2010, President Obama stated that "passing an energy policy that begins to address all facets of [U.S.] over-reliance on fossil fuels" was one of his "top priorities" for 2011.[ix] The EPA has indicated it plans to continue taking actions to regulate GHG emissions. The EPA's specific ambitions and its timeline are unclear, but it is likely that among non-transportation-related sectors, utilities would be the first to be regulated, followed by industrials. Depending on future political will, Congress could reconsider the APA cap-and-trade bill, or at least parts of it, sometime in the next five years. Finally, several states and regional state partnerships have pursued their own GHG emissions reduction targets *(see sidebar 1)*.

State Action

Many states—Arizona, California, Connecticut, Florida, Hawaii, Illinois, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New Mexico, New York, Oregon, Utah, Washington, and Wisconsin—have already announced legislative and executive orders to reduce GHG emissions or are part of regional GHG reduction programs. There are varying emissions reduction targets and scopes for each of these states' programs. For example, some only consider the power sectors while others also consider industrial sources. See the 2010 WRI publication "Reducing Greenhouse Gas Emissions in the United States Using Existing Federal Authorities and State Action," for additional information.

Since the form and implementation of future climate policy are uncertain, WRI used recent political developments and its policy expertise to create two sets of hypothetical policy scenarios: one based on a cap-and-trade legislative scenario, and one based on EPA regulation of chemicals subsectors. Although WRI considers these two sets of policy scenarios separately, they are not necessarily mutually-exclusive because the EPA and Congress could simultaneously pursue emissions reductions. In addition, no specific policy scenario is assumed to be more likely than another. Other policy scenarios could play out, or there could be no policy at all.

Our analysis only looks at U.S. federal climate policy, but U.S. state and regional policies are also relevant. For example, California is in the process of implementing its own cap-and-trade system to limit the state's GHG emissions, including emissions from its industrial sector *(see sidebar 1)*. Other countries' climate policies would affect global industry dynamics, regardless of U.S. action on climate policy. In addition, companies may suffer the physical impact of climate change and the opportunity costs of no climate policy. For example, higher frequency of extreme weather events can disrupt manufacturing operations.

WRI's policy scenarios use the following key assumptions *(also see table 1)*:

- **Cap-and-trade policy scenarios are based specifically on the APA.** The APA has not passed in the U.S. Senate, but any future economy-wide cap-and-trade proposal would likely draw from APA's provisions because it is the most recent economy-wide bill proposed in Congress.
- **EPA analysis focuses on identifying subsectors most likely to face GHG regulations.** It does not analyze the credit impact on subsectors because the EPA's GHG regulatory timeline and scope are unclear.
- **2016 is used as a proxy for the first year of direct compliance for the chemicals industry,** which is in line with the expected phase-in of the APA (had it passed) and likely the earliest year EPA regulation would cover GHGs from existing chemical manufacturing facilities.

Federal cap-and-trade scenarios

Economy-wide cap-and-trade legislation would affect about 85% of U.S. emissions. It would require companies with significant emissions to hold permits—known as emissions allowances—to emit GHGs. By limiting the supply of GHG emissions allowances, the government is able to cap overall U.S. GHG emissions. Demand for these allowances then sets the market price for emissions—also known as a "carbon price". In addition to establishing a "carbon" market, recent cap-and-trade bills proposed in Congress have also included several provisions aimed at limiting any negative economic effects and maximizing GHG reductions.

WRI based its cap-and-trade legislation analysis on the APA. Relevant provisions include:

- **Emissions compliance obligations.** Facilities that directly emit more than 25,000 tons of CO2 or equivalent GHGs are considered to be "covered." That is, these facilities must hold emissions allowances equivalent to their GHG emissions to be compliant. In addition, any chemical facilities producing certain types of chemicals—such as adipic acid, ammonia, nitric acid, phosphoric acid, soda ash, carbon black, ethylene, fluorinated gases, and hydrogen—would have to hold emissions allowances even if they emitted less than the 25,000-ton threshold. Since this analysis focuses on GHG intensive chemicals subsectors, WRI assumes that all chemical facilities would meet this criteria, and therefore, be required to hold emissions allowances.[x] Some small facilities, particularly in the industrial gas subsector, may not reach the 25,000 ton threshold, but may come under regulation anyway as fluorinated gas, hydrogen, or hydrofluorocarbons (HFCs) producers.

- **Free emissions permits.** The APA would provide free emissions allowances to select energy-intensive and trade-exposed manufacturing subsectors. Subsectors deemed to have both high energy use relative to output and trade exposure[xi] are eligible to receive these free allowances (also known as direct output-based rebates). According to WRI's analysis of the APA, these free allowances would be adequate to cover the emissions compliance costs in 2016 of each eligible chemicals subsector. *(See Figure 7 for a summary of eligible chemicals subsectors, and WRI's technical document for analysis.)*
- **International project offsets.** Companies may choose to offset a portion of their emissions by undertaking emissions-reducing projects in certain developing countries without climate policies. This mechanism offers the potential to reduce compliance costs and/or earn revenue. However, it's uncertain how smoothly the international offset program would function in early years due to the complexity of administering such a program, among other factors.

Table 1 | **WRI's Assumptions In Policy Scenarios**

	Economy-Wide Cap-and-Trade Legislation	EPA Regulation
Description	Congress caps total U.S. emissions by requiring facilities to buy tradable GHG emissions permits. The supply of GHG permits is limited by the total cap on U.S. emissions. APA (which was proposed in May 2010, but not passed) is used as a proxy for economy-wide cap-and-trade legislation.	The EPA regulates sources of GHG emissions using existing authority under the Clean Air Act. Likely to roll out by industry, rather than economy-wide. Scenarios in this analysis focus on a small set of possible EPA actions to regulate GHGs from chemical manufacturing and coal-fired utilities.
Form	Market-based	Form is unclear; this analysis assumes command-and-control, but the EPA has previously used both command-and-control and market-based systems to control pollutants.
Coverage	Assumes facilities emitting over 25,000 tons of CO2 annually, plus additional industrial producers listed in the APA, are required to hold GHG emissions allowances starting in 2016	This analysis only considers the likelihood of regulation for the 13 chemicals subsectors examined.
Timeline	Assumes that it takes two years for utilities (2013) and five years for industrials, including chemicals (2016), to be regulated	Assumes it takes five years for industrials (including chemicals) to be regulated
Stringency	The APA targets a 17% reduction in total U.S. emissions by 2020	This analysis does not consider economy-wide EPA stringency, but assumes that the EPA targets a 22% reduction in carbon dioxide equivalent (CO2e) emissions for the chemicals industry by 2020 (which will affect both existing and new chemicals facilities).
Precedent	An economy-wide cap-and-trade bill was passed in the House of Representatives in 2009, but a companion bill did not pass in the Senate.	The EPA currently uses a market-based system to limit sulfur dioxide and nitrogen oxide emissions. In May 2010, the EPA required new/modified facilities with significant emissions to use best available control technologies to reduce GHGs.
Status	The APA was never voted on; a future economy-wide cap-and-trade bill will depend on future political will.	The EPA has indicated it will take action to regulate GHGs—though the form/timeline/reach is unclear. Congress could limit the EPA's ability to regulate, particularly if it passes comprehensive climate legislation.

Source: WRI.

- **Electricity price subsidies.** Local distribution companies (LDCs) are also eligible for free allowances, but are required to pass along the value of these allowances to their consumers. In particular, LDCs must distribute allowance value in direct proportion to the amount of electricity each industrial customer uses, thus muting increases—and in some cases reducing—electricity prices. The free allowance subsidies to electricity LDCs would be highest during the first years of the program and then phased out by 2030.
- **Additional costs.** HFC emissions fall under a separate emissions cap due to their extremely high global warming potential. Producers and importers of HFCs need to hold HFC-specific emissions permits. Chemicals companies with HFC production, such as those involved in the value chains of refrigerants and some types of plastics, could see compliance costs and/or changes in market structure.
- **Opportunities.** Cap-and-trade legislation favors emerging low-carbon technologies and markets like energy-efficient buildings and related systems, renewable energy production, and clean/low emissions vehicles. Chemicals companies creating products within the production value chain of these industries are likely to see their markets expand. WRI and Standard & Poor's did not consider climate policy-related market opportunities, though they are likely to be relevant to credit quality for some companies and, therefore, merit further analysis.

To understand the broad impact of the APA on the economy, WRI relied on the EIA's analysis of the APA. As with any economic forecast, there are inherent uncertainties in the projected data, but WRI believes it is an appropriate set of economic projections (based on the factors it analyzed) to use in this analysis. The EIA's projections assume, per APA provisions, that utilities are regulated starting in 2013, and industrial sectors including the chemicals industry, are regulated starting in 2016.

The EIA modeled several different policy scenarios. They vary by how well different components of the APA legislation function in practice and the availability and cost of low/no carbon electricity technologies (such as nuclear power, and carbon capture and storage) to displace conventional coal-fired generation. WRI used three of the EIA's scenarios, which, for simplicity, it renamed as low, medium, and high carbon price scenarios *(see table 2)*.

EPA regulatory scenario

In 2007, the U.S. Supreme Court determined that the EPA had the authority to regulate GHGs under the Clean Air Act. Since then, the EPA has taken several actions to address U.S. GHG emissions. Those relevant for the chemicals industry include requiring companies to report GHG emissions over a specified threshold to the EPA, and requiring large new construction/major retrofitting of facilities to apply for emissions permits starting in 2011 and to use "best available control technologies."

The EPA has yet to state how and when it will act to reduce GHG emissions for industrial sources, including which sectors it will target, the form of regulation (for example, whether it will consider market-based approaches to help companies reach minimum standards), and how stringent the regulation will be.

To reduce industrial emissions, the EPA could establish emissions performance standards for new facilities and require major retrofitting of existing industrial facilities. It could then mandate states to establish similar, but likely less stringent, performance standards for existing industrial facilities considering factors like cost feasibility and the remaining useful life of facilities.

For purposes of this analysis, WRI assumes the EPA[xii]:

- **Creates regulation to achieve a 22% reduction in U.S. chemicals industry emissions by 2020;** this regulation would cover both old and new facilities, but a large portion of the 22% reduction would occur in 2016, and in existing facilities.

- **Does not use cost-containment provisions or market-based approaches in its regulation.** In reality, the EPA does have the legal authority to use market-based approaches, and some states are likely to use a market-based system to help companies transition to new standards.
- **Requires efficiency improvements for coal-fired power plants,** but not for gas-fired or other types of power plants. It is unclear whether this requirement could lead to higher electricity costs for chemical facilities purchasing from coal-fired power plants, but it is a potential risk.
- **Requires adipic and nitric acid manufacturers to reduce nitrous oxide emissions** by 96% and 89%, respectively, by 2030, though WRI expects the cost to achieve these reductions to be relatively low.[xiii]
- **Targets an 85% reduction in HFC emissions by 2030,** which affects chemical companies involved in refrigerants value chains and certain plastics products. The resulting financial impact could be positive or negative depending on whether products/processes that reduce or contribute to HFC emissions use a chemicals product. In April 2010, U.S., Canada, and Mexico submitted an updated proposal to reduce HFC emissions by developed countries under the Montreal Protocol. So even in the absence of EPA regulation, chemicals companies involved in related products are likely to face compliance costs tied to HFCs.
- **Creates (indirectly, through regulation) potential opportunities** for chemical products contributing to vehicle fuel efficiency, biomass-based fuels, and building energy efficiency. This article does not

Table 2 | **Summary Of EIA Projections Of The American Power Act**

(In year 2016, in 2008 dollars)		—Cap-And-Trade Scenarios: First Year Of Direct Chemicals Compliance—		
	No Policy Reference	**Low Carbon Price**	**Medium Carbon Price**	**High Carbon Price**
Key variable of policy uncertainty	Based on the EIA's 2010 Annual Energy Outlook; reflects laws, regulations, and technology trends as of July 2010	Key low-emissions technologies are widely available. The international offset market functions smoothly.	Same as Low, but international offsets are unavailable.	Same as Medium, but only limited key low emissions technologies are available.
GHG permit cost	None	$26/ton of CO2e	$48/ton of CO2e	$73/ton of CO2e
GDP (2000 dollars)	$13.67 trillion	0.15% lower than reference	0.23% lower than reference	0.57% lower than reference
Natural gas (well-head) price	$5.63/MMBtu	4.17% higher than reference	7.52% higher than reference	24.97% higher than reference
Industrial residual fuel oil price	$15.37/MMBtu	1.25% lower than reference	2.08% lower than reference	2.23% lower than reference
Industrial LPG price	$23.29/MMBtu	1.24% lower than reference	2.07% lower than reference	3.26% lower than reference
Industrial coal price	$2.68/MMBtu	3.42% lower than reference	6.63% lower than reference	8.88% lower than reference
Industrial electricity price	$17.59/MMBtu	0.40% lower than reference	1.25% lower than reference	5.36% higher than reference

Source/Notes: These scenarios are the "Basic," "No International," and "No International/Limited Technology" scenarios in the EIA's analysis of the American Power Act. More information on these scenarios and related assumptions is available in Section 1, the Methodology Document, and at http://www.eia.doe.gov/oiaf/servicerpt/kgl/index.html. These projections do not include an attached carbon cost since we assume this would only be attached at the point of combustion based on the APA's provisions. It is possible that natural gas/oil/coal product sellers could pass along some of their processing-related compliance costs; this would likely be a minor cost in most instances, and thus, not considered in this analysis. CO2e denotes carbon dioxide or equivalent of another greenhouse gas, where equivalence is determined by global warming potential.

consider policy-driven market opportunities, though it would likely be relevant to credit quality for some companies.

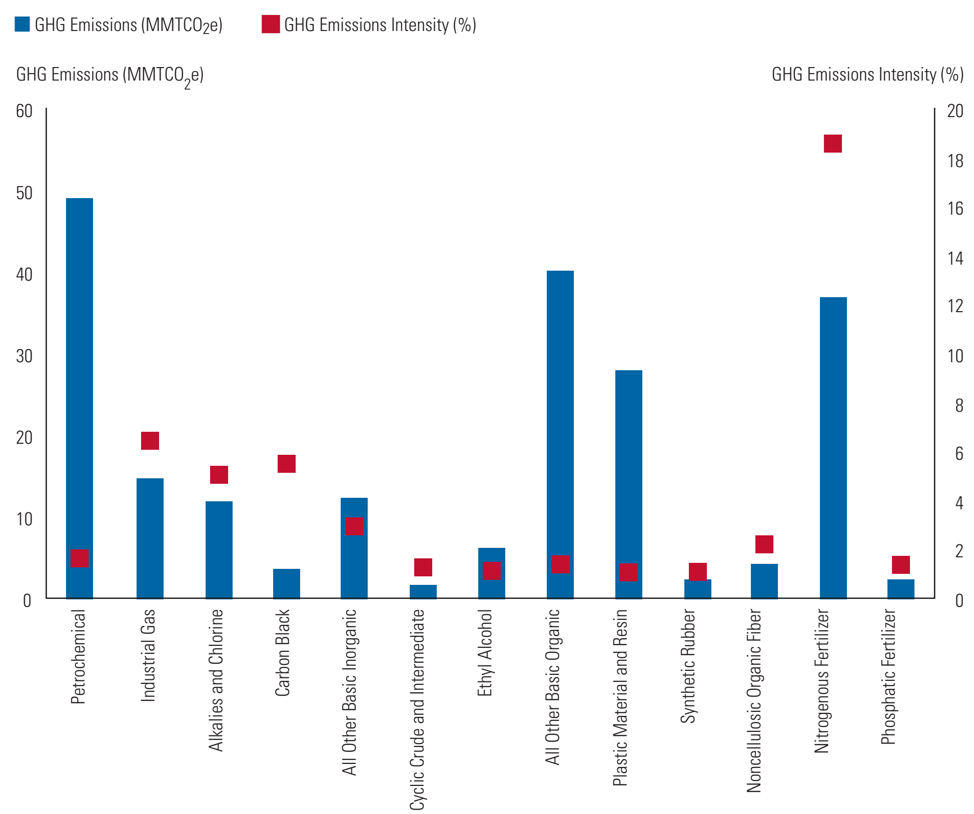
Subsector Analysis

WRI and Standard & Poor's examined the possible credit implications of the policy scenarios for 13 of the most GHG-intensive chemicals manufacturing subsectors.[ii]

Analytical approach and scope of analysis

WRI and Standard & Poor's analysis covers 13 chemicals subsectors as defined by the government's North American Industry Classification System (NAICS)[xiv]. These subsectors make up less than half ($332 billion) of the $724 billion [xv] U.S. chemicals industry's value of shipments in 2007, but contributed to more than 90% of the chemicals industry's overall direct GHG emissions in 2006[xvi] *(see table 3)*. Standard & Poor's and WRI chose these subsectors because they exhibited relatively high GHG intensity per unit of product compared with that of the entire chemicals industry and, thus, are most vulnerable to policies aiming to reduce GHGs[xvii] *(see Figure 3)*.

Figure 3 **GHG Emissions and Intensity by Chemical Manufacturing Subsector (2006)**



Note: GHG intensity is calculated as the product of a subsector's GHG emissions and a carbon price of $20/ton of CO_2, all divided by each subsector's value of shipments. The American Power Act uses $20/ton of CO_2 as the baseline price to calculate greenhouse gas intensity when determining eligibility for free allowances.

Source: WRI using the data file of the US government's Interagency Report on International Competitiveness and Emissions Leakage.

Most specialty chemicals companies are not covered because they tend to be less GHG-intensive. Standard & Poor's also expects the credit quality of specialty players to be less affected by climate policy because these businesses typically benefit from meaningful barriers to entry—in the form of proprietary technology, high value content, and strong customer relationships—which may allow them to pass along costs with less risk of price competition. Industrial gas is the one subsector our analysis covers that has many of the positive characteristics of the specialty chemicals industry.

WRI assumed that the ratios of value of shipments to GHG emissions and to energy purchases, as well as the energy (fuel and feedstock) mix are the same in 2016 as they were in 2006 (the latest year public data is available by subsector). Both Standard & Poor's and WRI examined each subsector in

Table 3 | **Description And Value Of Shipments Of 13 Subsectors Analyzed**

Title (NAICS Code)	Products Manufactured	2007 Value Of Shipments ($ 000s)
Petrochemical (325110)	(1) acyclic (i.e., aliphatic) hydrocarbons such as ethylene, propylene, and butylene and/or (2) cyclic aromatic hydrocarbons such as benzene, toluene, styrene, xylene, ethyl benzene, and cumene.	77,661,772
Industrial gas (325120)	Industrial organic and inorganic gases in compressed, liquid, and solid forms.	9,543,443
Alkalies and chlorine (325181)	Chlorine, sodium hydroxide (i.e., caustic soda), and other alkalies often using an electrolysis process.	6,370,780
Carbon black (325182)	Carbon black, bone black, and lamp black.	1,487,557
All other basic inorganic (325188)	Basic inorganic chemicals (except industrial gases, inorganic dyes and pigments, alkalies and chlorine, and carbon black).	22,828,592
Cyclic crude and intermediate (325192)	Establishments primarily engaged in (1) distilling coal tars and/or (2) manufacturing cyclic crudes or cyclic intermediates (i.e., hydrocarbons, except aromatic petrochemicals) from refined petroleum or natural gas.	5,947,517
Ethyl alcohol (325193)	Nonpotable ethyl alcohol.	13,604,052
All other basic organic (325199)	Basic organic chemical products (except aromatic petrochemicals, industrial gases, synthetic organic dyes and pigments, gum and wood chemicals, cyclic crudes and intermediates, and ethyl alcohol).	80,464,324
Plastic material and resin (325211)	(1) resins, plastics materials, and nonvulcanizable thermoplastic elastomers and mixing and blending resins on a custom basis and/or (2) noncustomized synthetic resins.	85,231,585
Synthetic rubber (032521)	Synthetic rubber.	8,253,660
Non-cellulosic organic fiber (325222)	(1) noncellulosic (i.e., nylon, polyolefin, and polyester) fibers and filaments in the form of monofilament, filament yarn, staple, or tow, or (2) texturizing noncellulosic fibers and filaments.	6,963,293
Nitrogenous fertilizer (325311)	(1) nitrogenous fertilizer materials and mixing ingredients into fertilizers; (2) fertilizers from sewage or animal waste; or (3) nitrogenous materials and mixing them into fertilizers.	5,524,151
Phosphatic fertilizer (325312)	(1) phosphatic fertilizer materials or (2) phosphatic materials and mixing them into fertilizers.	6,476,832

Source: WRI. Based on U.S. Census Bureau definitions and value of shipments from the 2007 U.S. Economic Census. Note: The analysis in this article is mainly based on the U.S. annual survey of manufacturers' 2006 value of shipments (to be comparable with 2006 emissions data), though 2007 U.S. Economic Census was used in certain instances where data were not available at the six-digits NAICS code level.

isolation and, therefore, did not consider climate policy-related outcomes passed through from one subsector to another within the chemicals industry.

Potential effects under federal cap-and-trade scenarios

Using the EIA policy scenarios and projections of the APA, WRI analyzed the potential additional costs or savings as a result of climate policy. WRI's analysis covers the potential impact on GDP, and on prices of natural gas, fuel oils, liquefied petroleum gas (LPG), natural gas liquids (NGLs), coal, and electricity. It also explores compliance costs related to GHG emissions and prevailing GHG permit prices. Separately, these outcomes were then compared by Standard & Poor's to its determination of subsectors' and companies' ability to pass along any related costs or preserve related savings (see "Competitive factors," below).

Overall, most subsectors face only modest compliance and direct energy purchase costs under the EIA scenarios and projections ***(see figure 4)*****.** However, the overall energy-related impact will also depend on a subsector's indirect energy purchases—that is, the purchase of feedstocks that are produced using energy-related raw materials like natural gas, petroleum products, coal, and electricity. The price of these feedstocks typically moves with the price of the underlying fuel or electricity

Figure 4 **Summary of *Relative* Subsector-Level Vulnerability under the APA (Average of Three EIA Projection Scenarios 2016)**

	Relative **Macroeconomic/Energy Impacts**			
Manufacturing Subsector	GDP Impacts on Shipment Value	Impacts Related to *Direct* Purchase of Natural Gas, Fuel Oils, LPG, NGL, Coal, and Electricity	***Relative*** **Compliance-Related Impacts 1&2**	***Relative*** **Competitive Position (Not Related To Policy) (S&P)**
Petrochemical	MED	LOW/MED	LOW/NONE	MED/HIGH
Industrial Gas	LOW/MED	LOW/MED	HIGH	LOW
Alkalies and Chlorine	LOW/MED	MED	LOW/NONE	MED
Carbon Black	LOW/MED	LOW/MED	LOW/NONE	LOW
All Other Basic Inorganic	LOW/MED	LOW/MED	LOW/NONE	MED
Cyclic Crude and Intermediate	MED	LOW	LOW/NONE	HIGH
Ethyl Alcohol	MED	LOW/MED	MED	HIGH
All Other Basic Organic	MED	MED	LOW/NONE	MED
Plastic Material and Resin*	MED/HIGH	MED*	LOW/NONE	MED
Synthetic Rubber*	MED/HIGH	LOW*	LOW/NONE	MED
Noncellulosic Organic Fiber	MED/HIGH	LOW/MED	LOW/NONE	MED/HIGH
Nitrogenous Fertilizer	LOW	HIGH	LOW/NONE	LOW/MED
Phosphatic Fertilizer	LOW	LOW	MED	LOW/MED

Notes: All rankings are (1) relative to each of the 13 subsectors, *not* the entire chemicals industry, (2) based on the average of the three EIA scenario projections used in this analysis, and (3) based on subsector-level vulnerabilities, not company-level vulnerabilities. **Input costs other than *direct* natural gas, fuel oils, coal, LPG, NGL and electricity are not considered, with the following exceptions:**

* Plastic Material and Resin, and Synthetic Rubber, are two subsectors where *indirect* energy-related impacts could be significant. Roughly, these *indirect* impacts could increase total energy-related risk ranking up a notch, to MED/HIGH for Plastic Material and Resin, and to LOW/MED for Synthetic Rubber due to these subsectors' dependence on natural gas-derived feedstocks like ethylene.

(1) Small industrial gas facilities may not face compliance costs if they (a) emit fewer than 25,000 tons of CO_2e per year and (b) do not produce fluorinated gases, HFCs, and hydrogen. Any facilities producing HFC's may face additional compliance costs not considered in this study.

(2) WRI expects each *eligible* subsector as a whole would receive adequate free rebates to cover any compliance obligations in 2016, resulting in no net permit costs (see WRI's accompanying technical document). But because there may be other *indirect* costs associated with compliance provisions in 2016 (for example, administrative requirements relating to compliance, company-level capital expenditures, or changes in a subsectors' metrics which could change eligibility for free allowances) the ranking is described as Low/None.

Source: WRI for GDP, Direct Energy, and Compliance; S&P for Competitive Risk. See WRI's accompanying technical document at http://www.wri.org/publication/federal-climate-policy-and-us-chemicals-credit-risk.

used to produce the feedstocks. Based on EIA projections, for subsectors that depend on natural gas-derived raw materials, the cost risk is higher (since natural gas prices are projected to be higher relative to no policy), while for petroleum, coal, and electricity-derived raw materials, there is limited energy-related cost risk (since prices are mostly projected to be lower relative to no policy). There is also a relationship between energy-related costs and compliance related-costs because GHGs may be released during the combustion of energy-derived raw materials, especially in the case of materials derived from coal and petroleum products.

Macroeconomic effects (GDP and energy prices)

- GDP Impact*s*

  Demand for chemicals is typically correlated with a country's GDP growth, its industrial production levels, and consumer spending. Under the APA, according to EIA projections, U.S. GDP is $13.66 trillion (in 2000 dollars) in the reference case, and 0.15% ($13.65 trillion) lower in the low scenario, 0.23% ($13.64 trillion) lower in the medium scenario, and 0.57% ($13.59 trillion) lower in the high scenario relative to no policy in 2016.

  Based on the EIA's 2010 projections of the APA, chemicals subsectors like plastic material and resin, synthetic rubbers, and organic fibers, where demand is tightly correlated to GDP, will see a minor negative impact on demand. However, fertilizer producers could see an increase in value of shipments under some scenarios *(see table 4)*. This is because fertilizer producers' business prospects correlate more directly with trends and cycles in the agricultural industry, and demand for agricultural products is projected to increase.

- Direct Energy Purchase Impacts

  In Standard & Poor's view, the profitability of commodity chemicals production is highly correlated to energy and raw materials prices because these costs often make up the majority of a chemical company's production cost base, and competitive advantage is largely based on a company's ability to maintain low costs of production. Under each of the EIA's scenarios, WRI notes that energy price changes due to policy vary—in some cases substantially *(see figure 5)*. EIA's modeling of cap-and-trade legislation projects higher demand for natural gas and lower demand for petroleum products and coal as the economy responds to the price on GHG emissions and shifts away from GHG-intensive fuels.

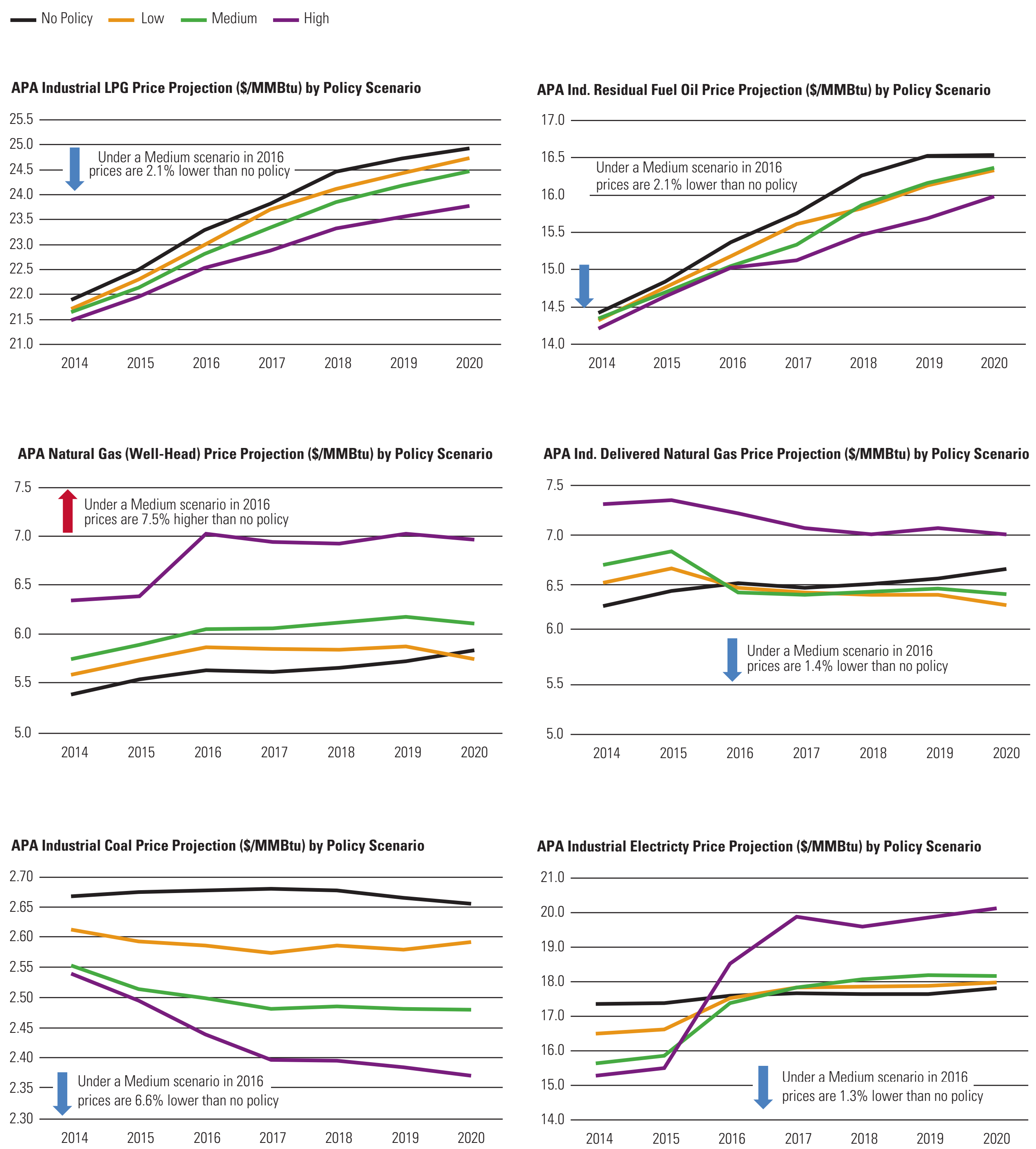
  Under the three EIA scenarios, natural gas prices drive energy-related costs for the 13 subsectors. In the three scenarios, natural gas well-head prices are 4% to 25% higher relative to no policy,

Table 4 | **EIA Projections Of Percentage Change In Value Of Chemical Manufacturing Shipments Relative To No Policy In 2016**

Policy Scenario	Low	Medium	High
Total chemical manufacturing industry	-0.30%	-0.64%	-1.44%
Inorganic (includes industrial gas, all other basic inorganic, alkalies and chlorine, and carbon black)	-0.40%	-0.75%	-1.38%
Organic (includes petrochemicals, cyclic crude and intermediates, ethyl alcohol, and all other basic organic)	-0.62%	-1.15%	-2.48%
Resin, synthetic rubber, and fibers (includes plastic material and resins, synthetic rubber, and non-cellulosic organic fiber)	-0.73%	-1.61%	-3.72%
Agricultural chemicals (includes nitrogenous fertilizer and phosphatic fertilizer)	0.65%	0.96%	-1.00%

Source: WRI. Based on data from the Energy Information Administration's analysis of the American Power Act.

Figure 5 **EIA Price Projections of Industrial LPG, Residual Fuel Oil, Well-Head Natural Gas, Delivered Natural Gas, Coal, and Electricity Prices ($2008/MMBtu) by Policy Scenario (2014–2020)**



Notes for those familiar with EIA's APA Modeling: Prices assume no carbon price is embedded at the point of purchase, except for delivered natural gas and electricity where it is likely that chemicals companies would see an embedded carbon price/subsidies related to policy. Using energy prices with a carbon price attached would have double counted compliance costs for companies in this analysis.
Source: WRI, based on EIA forecast data.

while coal, LPG, and residual fuel oil prices are lower relative to no policy in 2016 (2% to 8% lower; *see figure 5)*. This increase/decrease is magnified depending on carbon price projections in each of the scenarios. Companies with fundamental dependencies on natural gas for feedstock and fuel, such as nitrogenous fertilizer companies, and companies that use basic chemicals derived from natural gas (such as commodity petrochemical companies) are likely to see cost increases under the EIA's scenarios. Across the economy, companies dependent on coal and petroleum products are likely to switch (depending on the nature of products and ability to deploy capital) to natural gas to reduce compliance costs, so it is also likely that natural gas will feature more prominently in many chemicals companies' cost structures.

Standard & Poor's views higher natural gas prices, relative to no policy, as a potential meaningful risk factor for companies that compete on price, such as commodity petrochemical and plastics producers. The credit implications of higher natural gas costs, however, will vary depending on chemical industry conditions, such as the cost position of producers in other regions, the balance of supply and demand, and other cyclical factors that can influence profitability.

WRI notes that these EIA projections do not consider the potential for substantially larger shale gas resources in the U.S., which could dampen natural gas price increases, and that companies may have lower fuel requirements as they reduce emissions through energy efficiency improvements.

Delivered industrial electricity prices vary under the three EIA scenarios, because of demand for less GHG-intensive fuels as well as variation in how utilities pass down their free allowances to industrial customers. For example, in the low and medium scenarios, industrial electricity prices are lower, or only slightly higher relative to no policy from 2016-2020, whereas in the high scenario, industrial electricity prices are consistently, and substantially, higher than with no policy from 2016-2020. The APA also includes a provision that allows eligible facilities to apply for additional free allowances—called "indirect" rebates—intended to defray a portion of higher electricity costs. This provides an additional backstop for companies.

The impact of energy-related costs varies under the three EIA scenarios *(see figure 6)*. Direct energy purchases are limited to less than 1% of the value of shipments for all subsectors except nitrogenous fertilizers in the medium scenario. In the high scenario, energy-related purchases are less than 4% of shipments, except for nitrogenous fertilizers, where it is more than 12% of shipments. WRI assumed that the fuel mix for each of these subsectors remains constant, and only quantified changes in costs due to policy, and relative to no policy. In addition, our assessment only includes costs from direct natural gas, fuel oil, LPG, LNG, coal, and electricity purchases and does not consider the potentially higher costs of raw materials, which are derived from natural gas or oil products, because of data limitations. As such, these results may not be representative of the costs for chemicals subsectors that are large purchasers of select raw materials. For example, producers in the plastic material and resin subsector rely on natural gas-based feedstocks. The results don't capture the price increases of these feedstocks passed along to these subsectors. Thus, the energy and emissions intensity and ability to pass along costs of suppliers within the chemicals industry are also key factors in determining the credit effects of climate policy.

Compliance costs and revenues

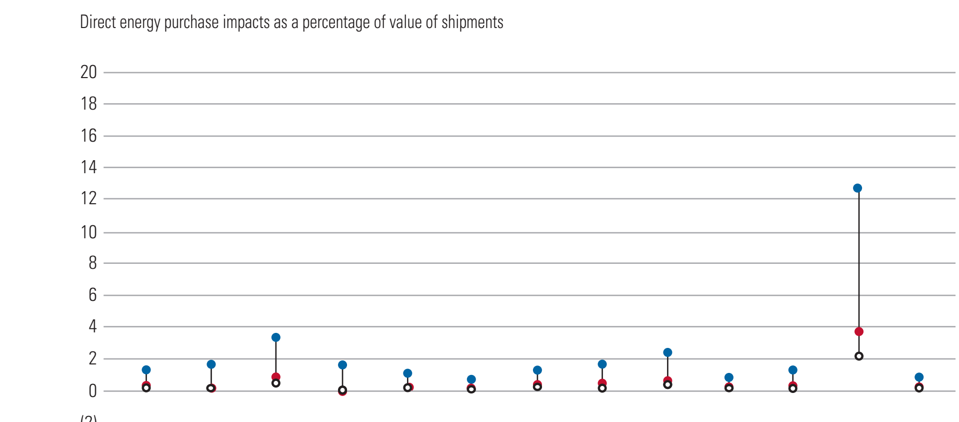
GHG emissions compliance costs should be minimal for 10 of the 13 subsectors eligible for free emissions allowances in 2016, in WRI's view. Eligibility for free GHG emissions permits is determined by a combination of trade, energy, and emissions intensity criteria (see "U.S. Climate Policy Scenarios," above). WRI believes that the APA provides enough free allowances to energy intensive, trade exposed manufacturing industries that any eligible subsector—as a whole—will receive enough free permits to cover all emissions in that subsector for 2016 and several years beyond (see WRI's accompanying technical document and Figure 8).

Of the 13 subsectors WRI analyzed, only industrial gas, ethyl alcohol, and phosphatic fertilizers would not be eligible for rebates because of their relatively low-trade intensity and/or low-energy intensity *(see figure 7)*. The cellulosic organic fiber and the inorganic dye and pigment manufacturing subsectors are eligible, but WRI did not include them in this analysis because of data limitations.

The APA provides free allowances to companies in eligible subsectors based on the company's output multiplied by the sector's average emissions per output. So a company that is less GHG-intensive than the sector average gets more free permits than it needs, and vice versa. Companies can sell excess permits on the domestic carbon market for financial gain or keep them for future use. As a result, low-emitting companies can receive cash or use the permits to cover future compliance liabilities. For high-emitting companies, the free rebates may not be enough to cover compliance obligations, but would still help reduce costs.

Depending on the usability of the international offset market, companies may also undertake emissions reduction projects abroad and sell the generated credits. A case study from the EU—which enacted cap-and-trade-style climate policy in January 2005—on the chemicals fiber manufacturer, Rhodia S.A., provides an example of a positive financial impact from international emissions reduction projects *(see sidebar 2)*.

Figure 6 — Estimated *Direct* Energy Purchase Costs as a Percentage of Shipment Value under Three EIA Projection Scenarios of the APA (2016)



	Petrochemical	Industrial Gas	Alkalies and Chlorine	Carbon Black	All Other Basic Inorganic Chemical	Cyclic Crude and Intermediate	Ethyl Alcohol	All Other Basic Organic Chemical	Plastic Material and Resin	Synthetic Rubber	Noncellulosic Organic Fiber	Nitrogenous Fertilizer	Phosphatic Fertilizer
Low	0.2%	0.1%	0.5%	(0.1%)	0.1%	0.1%	0.2%	0.2%	0.3%	0.1%	0.2%	2.1%	0.1%
Medium	0.3%	0.2%	0.8%	(0.1%)	0.2%	0.1%	0.3%	0.4%	0.6%	0.2%	0.3%	3.7%	0.2%
High	1.2%	1.7%	3.3%	1.5%	1.0%	0.7%	1.2%	1.7%	2.3%	0.8%	1.3%	12.7%	0.8%

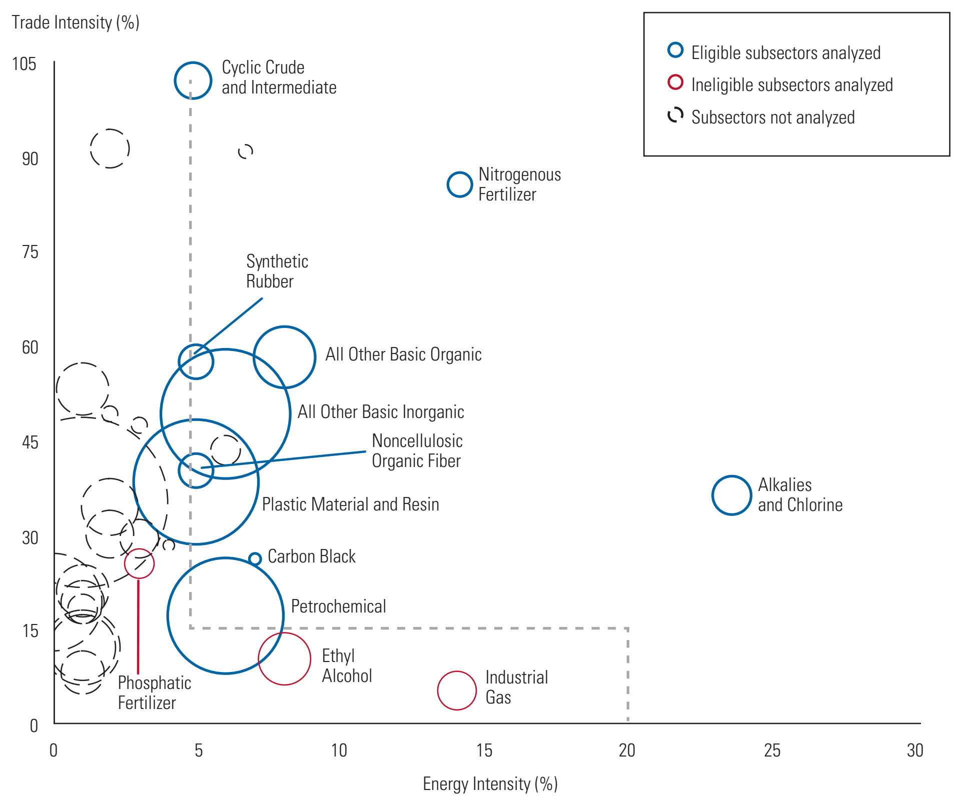
Notes: Range represent low, medium, and high impact scenarios as defined in Section 1. See notes in Figure 5 regarding why a carbon price is not attached to these calculations.
Sources: WRI based on 2006 Manufacturing Energy Consumption Survey, EIA; 2006 Annual Survey of Manufacturers; 2007 US Economic Census; and EIA analysis of the American Power Act.

The industrial gas, ethyl alcohol, and phosphatic fertilizers subsectors could face significant GHG permit costs. These subsectors do not currently meet the energy intensity and trade exposure thresholds for receiving free emissions allowances in the APA. WRI estimates the maximum compliance costs, as a percentage of shipment value for these ineligible subsectors, range from 4% to 12% for industrial gas, 1% to 3% for ethyl alcohol, and 1% to 4% for phosphatic fertilizers under the three EIA scenarios *(see Figure 8)*. These values assume the ratio of emissions to shipment value stays the same between 2006 and 2016, and use a carbon price of $26 to $73 per ton of CO2 equivalent (CO2e). The carbon price and emissions level determine compliance costs for an ineligible subsector. The total compliance costs for these subsectors are likely to be lower in practice because companies with the capacity and willingness to deploy additional capital can use the following means to reduce compliance obligations:

- Invest in capital expenditure projects to reduce GHG emissions (at a lower price per emissions than the prevailing carbon cost); and/or
- Participate in lower cost international offset projects.

In addition, in Standard & Poor's view, some parts of the industrial gas and phosphatic fertilizers subsectors may experience relatively less competition—and thus, could be more likely to pass along costs to customers—given their current lower trade exposure and industry structure. Finally, in

Figure 7 **Energy Intensity, Trade Intensity, and Size of Chemical Manufacturing Subsectors (2006)**



Notes: Bubble size represents each subsector's value of shipments. Gray dotted line represents rebate eligibility limits.
Sources: WRI, based on the data file of the Interagency Report on International Competitiveness and Emissions Leakage, the 2006 Annual Survey of Manufacturers and the 2007 US Economic Census.

WRI's view, in the case of industrial gas, which consists mostly of small, low-emitting facilities, the regulation may not cover some plants because they do not reach the 25,000 tons per year of CO2e emissions threshold.

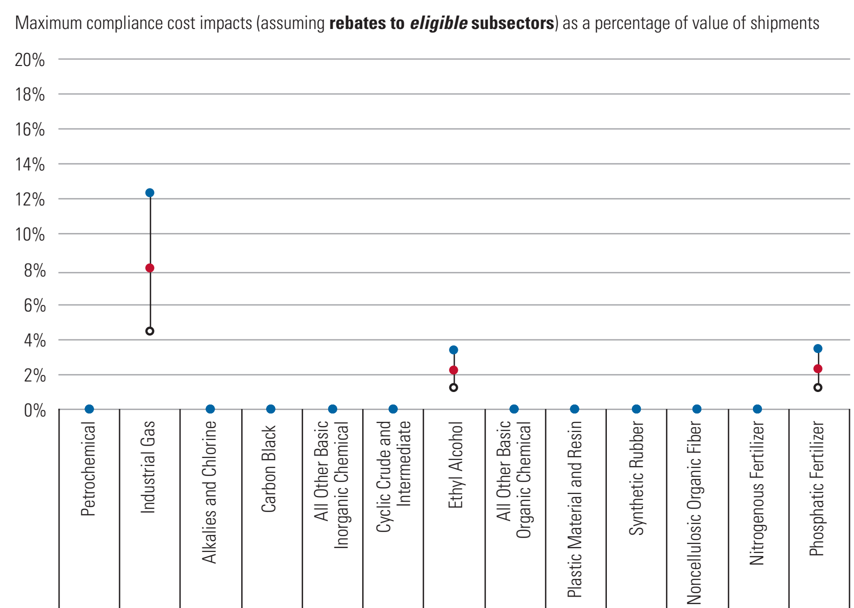
The criteria for determining free allowances may change in future climate policy proposals, including the possibility of not distributing any free allowances to industry. It is also possible (though unlikely based on the current text) that the number of free allowances the legislation sets aside would not be adequate to cover the full quantity of emissions obligations for eligible subsectors *(see figure 9)*. With no rebates, a majority of subsectors would face compliance costs of 1% to 6% as a value of shipments. Subsectors at greatest risk if no rebates were available include nitrogenous fertilizers, carbon black, alkalies and chlorine, and industrial gas.

Competitive factors

In Standard & Poor's view, the ability to effectively manage the effects of the EIA projections largely depends on the strength of a company's competitive positions and factors such as:

- Market structure, including exposure to international competition;
- Diversification;
- Cost position of the companies' plants; and

Figure 8 **Estimated Maximum Compliance Costs under Cap-and-Trade Policy (assuming rebates are provided to eligible subsectors) in 2006**



	Petrochemical	Industrial Gas	Alkalies and Chlorine	Carbon Black	All Other Basic Inorganic Chemical	Cyclic Crude and Intermediate	Ethyl Alcohol	All Other Basic Organic Chemical	Plastic Material and Resin	Synthetic Rubber	Noncellulosic Organic Fiber	Nitrogenous Fertilizer	Phosphatic Fertilizer
With Rebates-low	0.0%	4.4%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
With Rebates-med	0.0%	8.2%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%
With Rebates-high	0.0%	12.3%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%

Note: Subsectors with zero compliance costs per value of shipments are those expected to meet eligibility requirements and receive adequate free allowances to cover all 2016 compliance obligations. Assumes ratio of emissions to value of shipments is the same in 2016 as in 2006. There may be additional compliance-related costs—such as administration and possible additional HFC permit costs—that are not considered here.

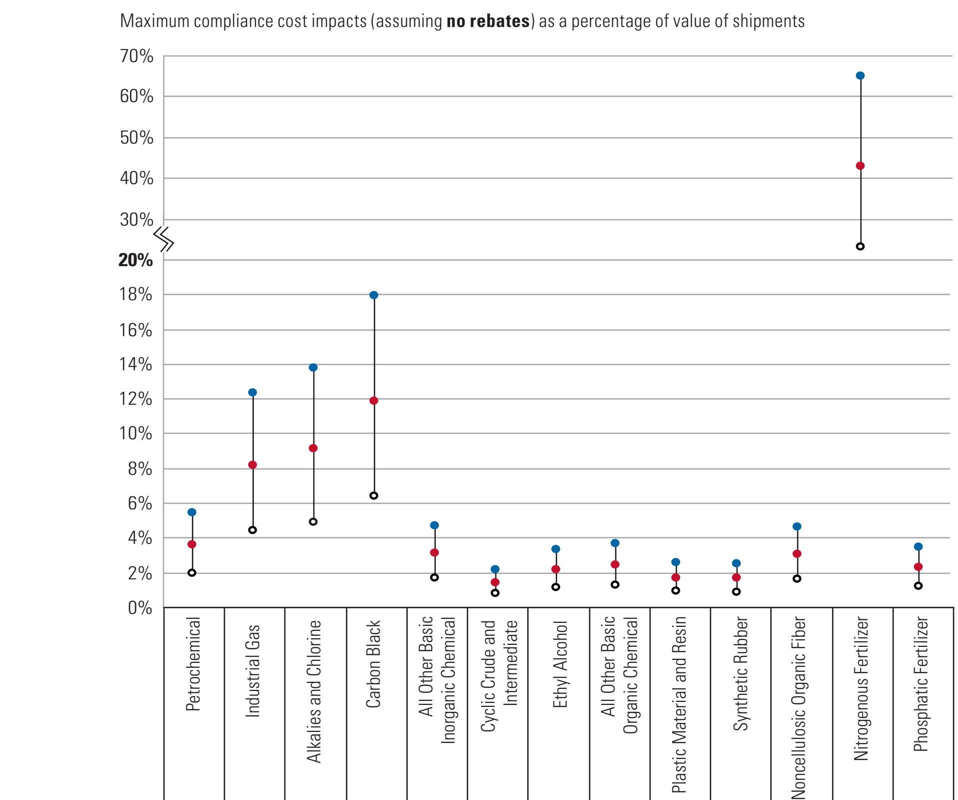
Source: WRI based on data from EIA analysis of the APA and the datafile from the Interagency Report on International Competitiveness.

- Ability to differentiate products through service, quality, or reliability of supply.

These views are illustrative because future climate policy is still unclear, and because the EIA projections used as a basis for this article are indications of what "could" happen rather than "would" happen.

Market structure: Although most of the subsectors WRI reviewed are not likely to face higher compliance or energy costs under the EIA medium case assumptions, Standard & Poor's expects some important chemical subsectors to have higher costs because of their reliance on natural gas or petrochemical products derived from natural gas. Similarly, a few subsectors are likely to face higher compliance costs because they are not eligible for free allowances under the APA. For the subsectors that do face higher costs, the market structure is likely to be key to successfully passing through higher costs to downstream customers. Standard & Poor's expects that participants in favorable market structures that offer barriers to entry in the form of process technology, customer relationships, or logistical hurdles will be able to command sufficient pricing to offset higher costs. In Standard & Poor's view, some commodity segments that benefit include chlorine (somewhat insulated from import

Figure 9 ***Illustrative*** **Compliance Costs by Subsector and by Cap-and-Trade Policy Scenario Assuming No Rebates in 2016**



	Petrochemical	Industrial Gas	Alkalies and Chlorine	Carbon Black	All Other Basic Inorganic Chemical	Cyclic Crude and Intermediate	Ethyl Alcohol	All Other Basic Organic Chemical	Plastic Material and Resin	Synthetic Rubber	Noncellulosic Organic Fiber	Nitrogenous Fertilizer	Phosphatic Fertilizer
○ No rebates-low	2.0%	4.4%	4.9%	6.4%	1.7%	0.8%	1.2%	1.3%	0.9%	0.9%	1.7%	23.2%	1.2%
● No rebates-med	3.6%	8.2%	9.1%	11.9%	3.1%	1.5%	2.2%	2.4%	1.7%	1.7%	3.1%	43.1%	2.3%
● No rebates-high	5.5%	12.3%	13.8%	17.9%	4.7%	2.2%	3.3%	3.7%	2.5%	2.5%	4.6%	65.1%	3.5%

Note: Assumes ratio of emissions to value of shipments is the same in 2016 as in 2006. There may be additional compliance-related costs—such as administration and possible additional HFC permit costs—that are not considered here.
Sources: WRI based on data from EIA analysis of the APA (but assumes no rebates unlike in the APA) and the datafile from the Interagency Report on International Competitiveness.

competition because of the costs of transport), categories such as titanium dioxide (TiO_2), which has the benefit of non-energy-based raw materials, and segments with few global players because of proprietary technology such as acetyls.

Diversification: Diversification, or the lack thereof, can be a significant factor for companies in subsectors Standard & Poor's expects to face higher compliance or energy-related costs under a cap-and-trade framework. Given that many chemical businesses consist of a myriad of products (unlike the simplified case studies in the last part of this article), Standard & Poor's considers that the implications for managing compliance costs or energy costs are likely to differ across diverse products, potentially muting any adverse effects. Most notable is that many chemical companies have broad diversification

The European Experience—Rhodia Emerges As An Early Phase Beneficiary Of Cap And Trade

The EU launched its European Union Trading Scheme (ETS) on Jan. 1, 2005, by setting up an internal market for the exchange of carbon allowances and credits. The first trading period ran for three years to the end of 2007 (Phase I); the second period, which began on Jan. 1, 2008, runs for five years until the end of 2012 (Phase II). Under the new rules (Phase III), industry sectors covered by the ETS must start purchasing at least 20% of their emission permits at auction starting in 2013. That percentage will rise gradually to 70% in 2020, with a view to reaching 100% by 2027. In Phase I and Phase II of the ETS, the cost of procuring allowances has been negligible in most cases as most have been allocated for free to companies.

To date, the effects of Phase II of the ETS (2008-2012) on European corporate credit quality are broadly in line with Standard & Poor's expectations. Given the adequacy of the allocations relative to emission caps, there has been no material negative impact on credit quality overall. In some cases, because of overallocation and reduced industrial output arising from the economic downturn, the effect has been positive according to our analysis. The rating on French chemicals company Rhodia S.A. (BB/Stable/—), for example, has benefited from selling emissions allowances. This is because of the company's involvement in generating and trading certified emission reductions (CERs) from its own carbon emission-reduction projects. All rating actions on Rhodia since the beginning of 2007 factor in the material CERs the company was able to receive. Our rating on Rhodia also takes account of the very high margin available from these activities (an EBITDA margin of more than 90%) and their material free cash flows. Standard & Poor's expects carbon credits to remain the group's main source of cash flow in 2009 and 2010, as they were in 2008 and 2007. In the latter two years, Standard & Poor's believes free operating cash flow (FOCF) would have been negative had it not been for the sale of carbon credits.

Notwithstanding the short-term benefits arising from the first two phases, the credit impact of ETS Phase III compliance is far less certain. In our view, the new rules mean that emission levels—along with the price of carbon—will become significantly more important in determining business and financial risk for carbon-intensive sectors such as power generation, oil and gas, steel, cement, and chemicals. Standard & Poor's believes key factors affecting creditworthiness are likely to include:

- The extent to which sectors the scheme covers will be able to pass on additional costs to consumers;
- The competitive disadvantage of having operations and suppliers in Europe versus companies based in developing countries where the carbon compliance regime is less rigorous; and
- The additional costs of a general broadening of the sectors the scheme covers, revised allocations, and stricter caps from 2013 to 2020.

Source: Standard & Poor's.

across geographic lines, which provides obvious benefits in terms of the effects of any expected costs related to climate change legislation in a single region.

Cost position: Competitively priced raw materials, which can account for the majority of cash production costs, are a chief determinant of competitive position for commodity companies. Commodity chemicals companies, which include most of the 13 subsectors examined by Standard & Poor's and WRI, are energy-intensive, operate on a continuous basis, and depend on key raw materials produced from natural gas and oil derivatives. To minimize compliance and energy costs under the different EIA scenarios, Standard & Poor's believes that the ability to optimize the balance between different raw materials through flexible production facilities could be an important consideration.

For commodity subsectors that face competition from foreign producers (like petrochemical and plastic material and resin producers), higher natural gas costs related to climate policy could hurt profits and credit quality, particularly during periods of excess supply. Under the EIA medium case projections, natural gas prices increase by 7% relative to the no-policy case. In Standard & Poor's view, this could be meaningful for companies in the nitrogenous fertilizer, petrochemical, and plastic material and resin subsectors. Other subsectors that use raw materials refined from crude oil may see improvement in costs based on the EIA projections.

Product differentiation: For subsectors facing higher compliance or energy costs, Standard & Poor's views the ability to differentiate products to be a key factor to offset concerns related to competitive position. Standard & Poor's expects that products with high value content, differentiated performance, and a lack of substitutes will be in the best position to pass through higher costs, if any, to customers. Industrial gas producers, for example, may face higher costs under a cap-and-trade framework, but we view these producers as offering sufficient value to customers, which strongly suggests that at least some part of these costs will flow through to customers.

The EPA regulatory scenario analysis

WRI and Standard & Poor's were unable to conduct a full assessment of credit quality per subsector under EPA regulation because of limited information on the EPA's anticipated regulatory approach and stringency.

Instead, using two key characteristics the EPA is likely to prioritize when developing regulations—absolute emissions and the potential to reduce emissions—**WRI determined that likely regulatory priorities among the 13 subsectors include petrochemical, all other basic organic, and nitrogenous fertilizer producers** ***(see figure 10)***. It is important to note that the likelihood of regulation does not necessarily translate to negative credit impact. For example, some companies' facilities may already meet EPA regulatory thresholds. In addition, some emissions reductions may be relatively cheap, such as N2O reductions in nitric acid and adipic acid production, and may not necessarily have a material impact. Finally, the EPA will also consider other key criteria, particularly cost feasibility and the remaining useful life of facilities, which could limit compliance requirements and resulting costs.

Using the assumptions outlined above (see "U.S. Climate Policy Scenarios"), where the EPA mandates states to set performance standards for existing facilities but does not use market-based mechanisms, some of the key credit effects could include:

- **EPA regulation could increase capital spending on existing U.S. chemical plants** as companies retrofit production sites to comply with regulatory requirements. In the absence of any cost defrayment provisions, companies—especially in high-emitting subsectors—would either have to increase capital expenditure or experience higher costs in substituting emissions-intensive practices with low-emissions practices to comply with emissions regulations.

- **Companies that have already implemented emissions reductions strategies may have an advantage** because their capital expenditure requirements would be relatively lower than those of their competitors. Assuming that the EPA creates benchmarks (either at the subsector or product level) to set emissions thresholds, companies already meeting or exceeding these benchmarks will likely become relative winners. For companies yet to invest in emissions reductions, capital expenditures could have a material impact on costs and cash flow, especially in early years.
- **Sensitivity to electricity prices and the type of utility provider can affect electricity costs.** While WRI do not have information about projected energy and electricity prices under EPA regulation, the EPA has already signaled that it will first regulate existing and new electric plants, with a focus on coal-fired power plants. This requirement is likely to affect coal-fired power plants most, but it is not clear if this will necessarily result in higher electricity prices from these providers because these plants might absorb the costs in 2016, or actually achieve energy savings from the requirements after a few years.
- **Competitive position will likely be an important credit quality factor.** As in the cap-and-trade scenarios, the impact of capital expenditures or electricity prices on credit quality will depend on competitive factors including industry structure, product differentiation, and the ability to pass along costs. In general, commodity chemicals companies are likely to face more competitive pressures than specialty chemicals entities. The regulatory approach and stringency of EPA regulation will determine the magnitude of potential costs and the degree to which vulnerable subsectors experience competitive pressures.

Figure 10 **Summary of Select EPA Regulatory Exposure Factors by Chemical Manufacturing Subsector Based on CO_2 Emissions***

	GHG Emissions Profile	Potential to Reduce Emissions
Petrochemical	HIGH	HIGH
Industrial Gas	MED	MED
Alkalies and Chlorine	MED	MED/HIGH
Carbon Black	LOW/MED	LOW/MED
All Other Basic Inorganic	MED	MED
Cyclic Crude and Intermediate	LOW	LOW/MED
Ethyl Alcohol	LOW/MED	LOW
All Other Basic Organic	HIGH	HIGH
Plastic Material and Resin	MED/HIGH	LOW/MED
Synthetic Rubber	LOW	LOW
Noncellulosic Organic Fibers	LOW/MED	LOW
Nitrogenous Fertilizer*	HIGH	HIGH
Phosphatic Fertilizer	LOW	LOW

Petrochemical: Largest GHG emitter in chemicals industry with significant scope for emissions reductions. Ethylene production is identified as one of the largest sources of energy reduction potential in the Chemicals industry.

All Other Basic Organic: The production of adipic acid will likely face more stringent regulation as it is also a large contributor to N_2O emissions—a GHG that is 298 times more potent than CO_2.

Nitrogenous Fertilizer: The production of nitric acid will likely face more stringent regulation as it is also a large contributor to N_2O emissions.

Note: The Chemical Bandwidth Study (DOE 2006), from which data was drawn to create this chart, looks specifically at identifying energy efficiencies for 53 of the industry's most energy-intensive processes. Therefore, this study does not consider potential GHG reductions from non-CO_2 sources, including N_2O and HFCs.
*WRI qualitatively adjusted the ranking of Nitrogenous Fertilizers to reflect the subsector's high potential to reduce N_2O emissions from Nitric Acid production.
Sources: WRI based on data from the Interagency Report on International Competitiveness and Emissions Leakage and the Department of Energy's 2006 Chemical Bandwidth Study. See WRI's accompanying technical document for additional information.

Company Case Studies

Standard & Poor's conducted an analysis of financial risks on key credit factors and ratios for two hypothetical companies in the carbon black and industrial gas subsectors using:

- WRI's estimates of compliance costs and energy price projections under EIA cap-and-trade scenarios, and
- WRI's qualitative evaluation of potential EPA regulation.

Standard & Poor's also examined additional outcomes beyond EIA projections, including what would happen if raw material prices increased more than expected or if companies found it more difficult to pass along costs.

Standard & Poor's looked at two hypothetical chemicals companies: one eligible to receive free allowance rebates, and another ineligible for these free rebates. The analysis focuses on the change in financial metrics during the first year of assumed compliance (2016) under climate policy. Standard & Poor's based its observations related to changes in credit quality in the cap-and-trade scenarios on a comparison of credit metrics under the EIA's projected cap-and-trade scenarios of the APA, versus the same credit metrics in a no-policy scenario in the same period.

Standard & Poor's approach was to determine the influence on company profits using:

- EIA's projected costs related to raw materials and electricity,
- Compliance-related cost or revenue that WRI calculated based on EIA's medium scenario, and
- Assumptions related to the company's ability to pass-on those costs through price increases.

Standard & Poor's further modeled the profit impact to assess the potential implications on cash flow and leverage metrics and to ultimately estimate the implications for credit quality. Other costs, such as selling, general and administrative, and research and development, were held constant to isolate the impact of economy-wide cap-and-trade legislation. Standard & Poor's also did not model any other specific policy effects, such as potential changes to the economic growth rate, the threat of increased import competition, or new market demand for products, though these factors would likely influence the results of this analysis.

Carbon black company: case study A

Standard & Poor's key findings are as follows:

- Company A's profitability and debt leverage metrics improve slightly under the EIA's cap-and-trade medium scenario.
- Company A's core business is involved in the carbon black subsector, which is eligible for free emission allowances, resulting in modest net revenue while raw material costs are slightly lower based on the EIA's projection that crude oil and refined fuel products prices would decline (versus the no-policy case).
- Even if raw material costs increase by more than 20% compared with the no-policy case, Company A's profitability and leverage metrics would likely decline only modestly. In this downside scenario, we deem the higher costs of production manageable given the benefits of geographic diversity and the expectation that Company A would retain sufficient pricing power because of the value-added nature of its products and favorable industry structure.

Description

Company A is a narrowly-focused chemicals company with more than $1.5 billion in adjusted debt. This case study focuses on Company A's carbon black segment. The company's U.S. carbon black manufacturing plants enjoy easy access to petroleum-derived products, which are important raw materials in Company A's production of carbon black. Carbon black production is similar to many commodity petrochemicals in that it is a continuous and energy-intensive process and highly dependent on feedstocks refined from crude oil or natural gas. Carbon black is a black additive that imparts durability and strength to various products including rubbers and plastics used in the auto sector.

Assumptions

To establish a base line, Standard & Poor's assumed that the company has a significant financial risk profile prior to implementation of cap-and-trade legislation, with a ratio of debt to EBITDA of 3.4x and debt to total capitalization of approximately 50%. To determine a base line for profitability, Standard & Poor's assumed operating margins before depreciation and amortization of view, in line with many carbon black and U.S. commodity and basic chemical companies, include:

- Company A is broadly diversified along geographic lines, with about 70% of revenue generated outside the U.S.
- Company A is going through a process of closing older plants in Europe and the U.S., and opening new plants in emerging markets like China and Latin America.

In line with the EIA's medium scenario projections, Standard & Poor's also assumed that Company A's key raw materials in the U.S., such residual heavy oils derived from crude oil refineries, would decrease in cost by 2% in 2016 when the cap-and-trade policy is implemented. At the same time, electricity costs would decline by 1.25% relative to a scenario where there are no policy changes.

Company A's production cost structure includes a high level of variable production costs, including logistics, raw materials, and energy. For this analysis, Standard & Poor's assumed that roughly 50% of production costs are for hydrocarbon-related feedstocks and another 10% of production costs are for electricity spending. To model the potential financial impact of these assumptions on Company A, Standard & Poor's considered these changes under two scenarios. In a base case scenario, Company A benefits slightly from excess emissions allowances and slightly lower crude oil and refined products costs versus the no-policy case. In a downside case, Company A benefits slightly from excess emissions allowances but faces over 20% higher raw material costs because crude oil and refined product prices do not decline as fast as the EIA projects. Standard & Poor's considered the implications of these higher costs both with and without the benefit of pass through of higher raw material costs to customers in the U.S. The pass-through scenario is supported by the longstanding favorable profit trend in the carbon black sector, which benefits from a favorable concentrated industry structure and the existence of contracts with pass-through provisions.

The effects under cap-and-trade legislation

All of Company A's carbon black plants would very likely meet the 25,000 ton CO2 emissions threshold and, thus, be required to hold emissions allowances. This company is in an "eligible sector," given its relatively high energy and trade intensity, so Company A would also receive free allowances based on its output and emissions intensity.

The macroeconomic and energy effects: In an economy-wide cap-and-trade scenario, Standard & Poor's views the impact of changes in energy prices on Company A's credit ratios as modest in the context of overall credit risk. Using the base case assumptions above, Company A would face approximately 1% lower costs for raw materials and electricity under a cap-and-trade policy framework.

Under the more pessimistic scenario, whereby raw materials increase by more than 20% in the U.S., Company A would face 5% higher raw material and energy costs. Standard & Poor's calculated the increase in the context of all global raw material and energy costs. Therefore, the effect of higher costs in the U.S. is muted by the international diversification across its production facilities.

Compliance costs: Standard & Poor's and WRI assumed Company A's direct emissions intensity to be less than 1%, which is below the subsector average's emissions. Thus, WRI expects that Company A will receive more emissions allowances than necessary to cover its annual emissions. These credits could be sold on GHG trading markets for extra cash, or rolled over for use in future years. Assuming, conservatively, that Company A does not undertake GHG reduction measures relative to its current state, WRI estimates Company A would net $0.02 per dollar of U.S. carbon black sales under the EIA's medium scenario.

Results: While compliance-related provisions in the APA result in positive earnings for Company A under the EIA's medium projections, the dollar impact is relatively negligible relative to Company A's size. Energy prices then become the key financial metric because of Company A's dependence on crude oil derivatives as a feedstock for its production process.

In a base case scenario, with the benefits of excess emissions allowances and lower energy prices, EBITDA margins increase to 15.8% from 15.1% (compared to the no-policy change case) and the key metric of debt to EBITDA improves slightly to 3.3x from 3.4x on the same basis.

In a downside case scenario, assuming over 20% higher raw material costs and that Company A is not able to raise prices, Standard & Poor's expects that the EBITDA margin would decline to about 13.4% from 15.1%, and that the key ratio of debt to EBITDA would increase slightly to about 3.8x from the 3.4x modeled in the no cap-and-trade policy case. In what Standard & Poor's currently considers to be a more realistic scenario, with the benefit of an assumed 75% pass-through of higher net costs to customers in the auto and tire sector, we believe the ratio effects would be negligible. In this case, EBITDA margins decline only to 14.8% from 15.1% and the ratio of debt to EBITDA remains stable at 3.4x (same as the no cap-and-trade policy case).

Impact under EPA regulation

It's difficult to assess the specific macroeconomic, energy, and compliance effects of EPA regulation because of limited data and information on the potential economy-wide impact. Important factors to consider include the remaining useful life of Company A's facilities, the GHG emissions of these facilities, and the capital costs required to come under compliance. In this case, Company A is in a sector that the EPA is likely to regulate, but since Company A is a leader in emissions reductions, it may well set best practice performance standards for the sector. If this turns out to be the case, EPA regulation would not likely result in significant capital costs to come into compliance.

Conclusion

Under both cap-and-trade policy and EPA regulatory scenarios, Standard & Poor's analysis indicates Company A would not face substantial compliance costs in the first year of implementation, and the financial impact of dealing with changes to raw material and energy costs is likely to be neutral to only modestly negative for credit quality.

Industrial gas company: case study B

Standard & Poor's key findings are as follows:

- As an industrial gas producer, Company B would not be eligible for emissions credits to offset the substantial cost of cap-and-trade legislation compliance.

- The implications of raw material cost increases are less meaningful, given Company B's less raw-material-intensive cost base. However, its raw material mix relies heavily on natural gas, which EIA projects to increase in price relative to the no-policy scenario.
- The substantial costs of compliance would likely be muted by Company B's ability to pass through a portion of its costs to downstream customers. Under this assumption, the impact on credit metrics is modest.
- Although not likely, in a scenario without the benefit of cost pass-through to customers, Company B's profitability and leverage metrics could deteriorate moderately under a cap-and-trade scenario.
- However, the substantial costs of compliance also raise some uncertainty on future capital spending, strategic repositioning of assets, or prospects for lower demand growth.

Description

Company B is a leading industrial gas producer with more than $8.5 billion in reported debt. The company's production assets are broadly dispersed around the world with significant presence in North America, South America, Europe, and Asia. The company's products include atmospheric gases, such as oxygen, nitrogen, and argon, and gases used in industrial processes such as carbon dioxide, helium, and hydrogen. These products are sold through various distribution channels including pipeline, bulk, and individual cylinders, and are often essential inputs to customers in end markets including refining, health care, and electronics. For the purposes of this analysis, Standard & Poor's assumes that 45% of Company B's business is in the U.S.

Assumptions

The company's production facilities are moderately energy-intensive, but the essential nature of the products has resulted in high and steady profits for participants in the industrial gas industry. As a baseline, Standard & Poor's assumed that the company has a significant financial risk profile prior to implementation of cap-and-trade legislation, with a ratio of debt to EBITDA of 3.7x. Standard & Poor's also assumed operating margins before depreciation and amortization of 27%.

The effects under cap-and-trade legislation

For Company B, pricing power reflects a favorable industry structure and formidable barriers to entry such as process technology, existing infrastructure, and capital intensity. Key energy-related raw materials include substantial amounts of natural gas and electricity, and to a lesser extent gasoline and fuel products used in delivery vehicles. To model the potential financial impact of these assumptions on Company B under cap-and-trade legislation, Standard & Poor's considered two scenarios. In a base case scenario, Company B faces significant compliance costs and moderate natural gas price increases relative to no policy. However, Company B is able to pass along 75% of increased costs to customers because of its favorable pricing structure. In a downside case scenario, Company B is not able to pass along policy-related costs. In both, we assume Company B's GHG emissions intensity is modestly higher than the industrial subsector as a whole.

The macroeconomic and energy effects: Electricity and natural gas (used to produce hydrogen and other gases) are by far the most significant raw material costs for this company, with other hydrocarbon-related raw materials representing a smaller proportion of outlays. Given the expectation for natural gas price increases of 7.5% relative to no policy and slightly declining electricity costs in the EIA's medium scenario, the overall effect of cap-and-trade policy on raw material costs is modest. Based on our analysis, and the geographic diversity of Company B, the overall increase to raw materials is less than 2% in 2016, versus expected costs in the same year without cap-and-trade legislation. The impact of this cost increase is limited relative to the compliance costs.

Compliance costs: Since this company is in a subsector ineligible for rebates, the financial impact of cap-and-trade legislation could be significant in Standard & Poor's view. For this company, WRI estimates the maximum range of compliance cost as $0.06 to $0.17 per dollar of U.S. sales; and $0.11 under EIA's medium scenario. That is, these facilities must hold emissions allowances equivalent to their emissions to be compliant. The potential for Company B to undertake significant capital investment to improve emissions efficiency across its major operations or pursue international emissions reductions projects is not considered here due to data limitations.

For the purposes of this analysis, Standard & Poor's also assumes that all U.S. production facilities directly emit more than 25,000 tons of CO2 or equivalent GHGs annually and are, therefore, covered by cap-and-trade policy. In practice, Standard & Poor's believes at least some of the U.S. plants would be below the threshold and, therefore, would not be subject to higher compliance costs.

Results: For Company B, compliance obligations would be a key cost. Conversely, given the mix of raw materials and lower energy-related costs of production for Company B, Standard & Poor's expect the increase to overall production costs to be relatively benign. Taking into account both the compliance costs and raw material assumptions, and assuming Company B was not able to raise prices, Standard & Poor's expects that the EBITDA margin would decline to about 22% from about 27% and the key ratio of debt to EBITDA would increase moderately to about 4.7x from 3.7x. With the benefit of an assumed 75% pass-through of higher net costs to customers in various industries, the ratio effects would be more modest. In this case, EBITDA margins decline only to 24.4% from 27% and the ratio of debt to EBITDA increases to 3.9x versus the 3.7x level assumed for the same year in the no cap-and-trade policy scenario.

Impact under EPA regulation

Since this company is in a subsector which would likely be ineligible for rebates, the EPA regulatory option could turn out to be cheaper in terms of compliance costs. However, EPA regulation provides Company B with less capital flexibility and no ability to sell any project offset allowances from cheap emissions reductions in its international plants.

Conclusions

Under the cap-and-trade scenario, Standard & Poor's analysis indicates that Company B will face substantial compliance costs and modestly higher raw material costs. The financial impact of dealing with increased compliance costs is likely to be moderately negative to credit quality unless Company B achieves substantial pass through of costs. Given the strength of Company B's competitive position, that pass through is likely to have success. Still, even with assumed higher pricing, the substantial costs to be absorbed by industrial customers could decrease demand for some of Company B's products over time.

Endnotes

i. From the 2007 U.S. Economic Census of the Census Bureau.

ii. Categorization is based on U.S. Census Bureau definitions. Subsectors were chosen based on GHG emissions per value of shipments. The inorganic dye and pigment and the cellulosic organic fiber subsectors also exhibit relatively high emissions relative to their size, but are excluded from this analysis due to limited data availability. Emissions are based on data from the Interagency Report on International Competitiveness and Emissions Leakage.

iii. Greenhouse gases commonly refer to the six greenhouse gases covered by the Kyoto Protocol—carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6). Greenhouse gas intensity is generally defined as greenhouse gas emissions per unit of output.

iv. As described in "Subsector Analysis," others types of chemical plants under the APA would also be required to hold permits even if they do not meet the 25,000 ton CO2 equivalent threshold.

v. Energy intensity is calculated as a subsector's total energy purchases divided by its total value of shipments; trade exposure is calculated as the subsector's total sum of exports and imports divided by its total value of shipments.

vi. See table 2 in "U.S. Climate Policy Scenarios" for the EIA projections used.

vii. Command and control policies require all companies to adhere to specific standards and requirements. Market-based policies do not provide specific standards and requirements, but instead create indirect incentives/disincentives—like pricing environmental externalities—to improve business practices.

viii. Based on the Interagency Report on International Competitiveness and Emissions Leakage and includes Scope 1 emissions (emissions from business operations and processes) and Scope 2 emissions (off-site emissions related to electricity purchases).

ix. Eilperin, Juliet. "Policy on energy might change," Washington Post, Sept. 29, 2010.

x. In practice, there may be some small-batch chemicals facilities that do not meet the annual 25,000 ton CO2e threshold.

xi. Subsector energy intensity is calculated as subsector energy expenditures divided by dollar value of shipments of that subsector. The energy intensity threshold for eligibility is 5% in the APA. Trade intensity is calculated as the sum of imports and exports of a subsector divided by dollar value of shipments of that subsector. The trade intensity threshold for eligibility is 15% in the APA.

xii. For additional information on possible EPA and state action to reduce emissions, please refer to a 2010 WRI analysis available at http://www.wri.org/publication/reducing-ghg-emissions-using-existing-federal-authorities-and-state-action.

xiii. The American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (2009). Global Mitigation of Non-CO2 Greenhouse Gases, M. Gallaher, D. Ottinger, D. Godwin, and B. DeAngelo, Rep. no. 430-R-06-005, U.S. Environmental Protection Agency, Office of Atmospheric Programs, June 2006. http://www.epa.gov/climatechange/economics/downloads/GlobalMitigationFullReport.pdf.

xiv. The subsectors are based on the North American Industry Classification System (NAICS), which is the standard used by U.S. federal statistical agencies to classify business establishments: http://www.census.gov/eos/www/naics.

xv. Value of shipments according to the 2007 U.S. Economic Census.

xvi. Ibid iii. This is based on direct and process emissions, and does not include indirect emissions from electricity.

xvii. A threshold GHG intensity of at least 1% was chosen for purposes of this report. Cellulosic organic fiber and inorganic dye and pigment manufacturing sectors also have GHG intensities above the threshold considered for this report. However, they were not included in this report due to limited data availability.

WRI is an environmental think tank that goes beyond research to find practical ways to protect the earth and improve people's lives.

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