Carbon Policy Impact on Industrial Facilities

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ABSTRACT

Concerns over climate change in the U.S. are prompting actions at the federal, state and corporate levels that will affect how industrial facilities operate now and in the future. Because a comprehensive federal carbon policy is still in its infancy, some states are implementing their own carbon policies and setting their own reduction targets ahead of federal regulations. For example, California's climate change mitigation plan requires a reduction of 80 million metric tons of CO_2 equivalent ($MMTCO_2eq$), or a 16% reduction, from the state's projected 2020 business-as-usual emissions. A significant share of the required reduction will come from a cap-and-trade program, a program that directly affects industrial operation in the state.

This article discusses the impact of federal and state policies on the operation of industrial facilities. It addresses the three primary steps that industrial facilities are currently taking to address or prepare for carbon policies: monitoring and reporting of greenhouse gas (GHG) emissions, managing GHG emissions, and preparing for participation in cap-and-trade programs. The article begins with an analysis of the industrial sector's contribution to total U.S. GHG emissions in the last 20 years. This is then followed by an overview of federal and state climate policies affecting industrial operations. Recent regulations on mandatory GHG emission reporting and permitting at the federal level are discussed. The comprehensive statewide cap-and-trade program in California is also described, as it will greatly affect industrial operation in the state. Finally, the article concludes with examples of GHG strategies and actions taken by industrial subsectors and individual companies to better position themselves for carbon policies at home and abroad.

INTRODUCTION

Data from the most recent inventory of U.S. GHG emissions indicate that 6,708.3 million metric tons of CO_2 equivalet $MMTCO_2eq$ were released to the atmosphere in 2011.[i] This is an increase of 8.7% since 1990, but a decrease of 6.7% since 2005. The decrease in U.S. total GHG emissions that has been experienced since 2008, however, is primarily a result of the economic downturn; total GHG emissions are expected to increase once again when the economic turn-around comes into full force. Therefore, much needs to be done if the U.S. seriously wants to lower its GHG emissions to the 2005 level by 2020, a 17% reduction that the Obama administration put forward as a target in the Copenhagen Accord of the United Nations Framework Convention on Climate Change in December of 2011.[ii] Because there is no single emission source that represents a sufficiently large share of total GHG emissions to become the primary target for emission reductions, reductions must come from numerous sectors including electric power generation, transportation, industrial, commercial, and residential sectors. As a large contributor to overall GHG emissions, the U.S. industrial sector will play a critical role in achieving reduction targets by 2020.

INDUSTRIAL SECTOR'S CONTRIBUTION TO U.S. GREENHOUSE GAS EMISSIONS IS SIGNIFICANT

To achieve significant emission reductions, it is critical to fully understand what sources and activities contribute to GHG emissions. Fortunately, the U.S. Environmental Protection Agency (EPA) has tracked the national trend in GHG emissions and removals in the U.S. since 1990. In its analysis, the EPA uses national energy data, data on national agricultural activities, and other national statistics to determine total GHG emissions for all man-made sources in the U.S. Each year the EPA publishes a report, "Inventory of U.S. Greenhouse Gas Emissions and Sinks." Inventory data reveal that three economic sectors account for approximately 80% of total U.S. GHG emissions.[iii] The three sectors include the electric power industry (33%), transportation (27%) and industrial sectors (20%) as illustrated in Figure 1.

If GHG emissions for the electric power industry are distributed among the end-use sectors ultimately using the electricity, the indus-

trial sector accounts for the greatest share (29%) of total GHG emissions.[iv] Figure 2 demonstrates that the industrial sector is followed closely by the transportation sector (27%). The residential (17%) and

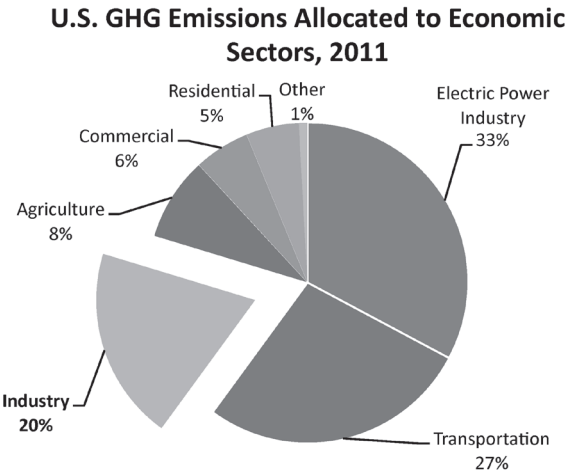

Figure 1. U.S. Greenhouse Gas Emissions Allocated to Economic Sectors, 2011—*Data source: U.S. EPA, Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010, February 11, 2013.*

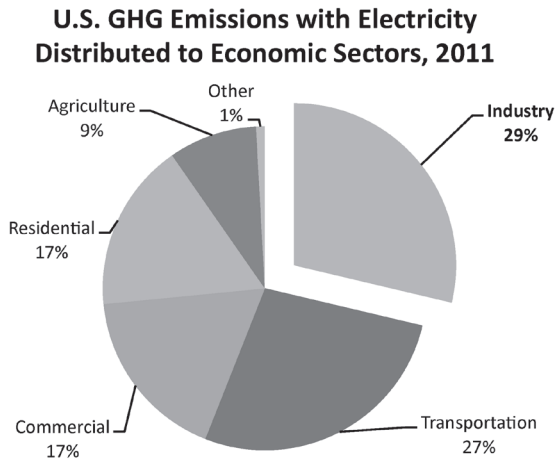

Figure 2. U.S. Greenhouse Gas Emissions with Electricity Distributed to Economic Sectors, 2011—*Data source: U.S. EPA, Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010, February 11, 2013.*

commercial sectors (17%) are also significant contributors to total U.S. GHG emissions.

In contrast to the other end-use sectors, GHG emissions from the industrial sector have steadily declined during the last 20 years. The decline of GHG emissions from U.S. industry is illustrated in Figure 3. Since 1990, overall U.S. GHG emissions have increased at an annual average rate of 0.4%. This can be compared to an annual average rate decrease of 0.6% for the industrial sector for the same time period. Though the decline over the last two decades in GHG emissions for the industrial sector is primarily a result of a shift from a manufacturing-based to a service-based U.S. economy, it is also due to the decreasing carbon intensity of the fuel mix consumed to meet industrial demand and because industrial facilities are operating with greater energy efficiency. The slight increase in industrial GHG emissions in 2010 is due to the recovery from the most recent economic downturn. Preliminary data just released from EPA indicate a renewed downward trend in GHG emissions from the industrial sector for 2011.[v]

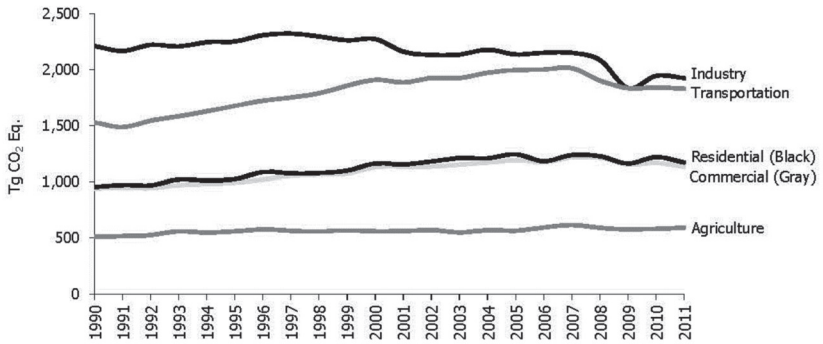

Figure 3. U.S. Greenhouse Gas Emissions with Electricity Distributed to Economic Sectors, 1990-2011—*Source: U.S. EPA, Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010, February 11, 2013.*

Though the industrial sector has already achieved significant energy efficiency gains, prime opportunities still exist in industrial operations for additional energy and thus GHG emission reductions. As a result, many federal and state GHG emission reduction efforts are targeting industrial facilities. This, in turn, greatly affects how industrial facilities operate now and in the future.

OVERVIEW OF FEDERAL, STATE AND COMPANY CARBON POLICIES

Carbon policies can be implemented at the federal or state level. Individual companies may also develop and adhere to their own carbon policies. This section provides an overview of existing and emerging federal and state carbon policies. It also provides a few examples of actions that industrial companies and industrial subsectors are taking to address GHG emissions associated with their operations. In some instances, corporations have been forced to set quantitative GHG reduction goals and developing strategies for reducing GHG emissions by disgruntled shareholders and consumers.

Federal Carbon Policies Slowly Emerging

Beginning in 2010, the EPA has issued a series of rules that put the framework in place for regulating GHG emissions under the Clean Air Act.[vi] Two important rules affecting industrial facilities include the Mandatory Greenhouse Gas Reporting Rule and the GHG Tailoring Rule. The Mandatory Greenhouse Gas Reporting Rule, which came into effect in 2010, requires the largest GHG emitters in the country to submit GHG emission data to EPA annually. These data are subsequently used by the government to form federal climate policy. Since 2011, the EPA also requires all sources emitting GHGs above a certain threshold to obtain permits under the Clean Air Act. Because the threshold used for GHG pollutants is much greater than that typically used for other air pollutants (tens of thousands of metric tons versus hundreds of metric tons), EPA had to issue the GHG Tailoring Rule; thus the name.

Mandatory Greenhouse Gas Reporting Rule

The Mandatory Greenhouse Gas Reporting Rule was published in 2009 ("40 CFR Part 98"), requiring industrial facilities to start annual reporting in 2010.[vii] Through the Greenhouse Gas Reporting Program, the EPA collects facility-level GHG emission data from all electric power plants, fossil fuel suppliers and specific types of industrial facilities, as well as facilities that emit 25,000 $MTCO_2eq$ or more per year from stationary combustion. The types of industrial facilities required to report include cement production, lime manufacturing, nitric acid production, petroleum refineries, and facilities with "Part 75/Acid Rain Program" units. (Part 75/Acid Rain Programs are existing and mandatory EPA reporting programs.)

In 2011, about 7,900 facilities reported direct GHG emissions of 3,294 $MMTCO_2eq$ to the EPA using an electronic GHG reporting tool called e-GGRT.[viii] This was an increase from 6,200 facilities reporting in 2010. Most reporting facilities are electric power plants, but many industrial facilities also reported, including chemical manufacturers (548 facilities), oil and gas producers (547), natural gas processors (372), minerals manufacturers (362), metals manufacturers (297), food processors (299), pulp and paper manufacturers (230), ethanol producers (162), refineries (145), and other manufacturing (338).[ix] The 295 largest-emitting facilities, which consist primarily of power plants, refineries, metals manufacturers, and chemicals manufacturers, accounted for 57% of total GHG emissions reported in 2011.[x] EPA's GHG data publication tool—FLIGHT (Facility Level Information on Greenhouse Gases Tool)—allows easy access to GHG emission data by facility, industry, location, or GHG gas.[xi] A screenshot of the GHG data publication tool is displayed in Figure 4.

Figure 4. EPA GHG Data Publication Tool

Largest-emitting facilities are those emitting in excess of 2.5 $MMTCO_2eq$ per year.

GHG Tailoring Rule Establishes Clean Air Act Permitting for GHG Emissions

Starting in 2011 and under the Clean Air Act, EPA also requires all sources, including industrial sources, to obtain Prevention of Significant Deterioration (PSD) and Title V Operating Permits—typically referred

to as New Source Review ("NSR") and "Part 70" permits, respectively—if they emit GHG emissions above a certain threshold.[xii] For most regulated criteria air pollutants, the permitting NSR thresholds are 100 or 250 tons per year. However, a threshold of 100-250 tons per year would be impractical to use for GHG emissions because basically all facilities would have had to report their emissions. Therefore, EPA issued the GHG Tailoring Rule in 2010 to increase the thresholds for GHG emissions.

The GHG Tailoring Rule requires new facilities with GHG emissions of at least 100,000 $MTCO_2eq$ per year and existing facilities with emissions of at least 100,000 $MTCO_2eq$ per year which are making changes that will increase emissions by 75,000 $MTCO_2eq$ or more to obtain NSR permits.[xiii] Facilities that are already required to obtain NSR permits to cover other regulated air pollutants must also address GHG emission increases of 75,000 $MTCO_2eq$ or more per year, even if they do not meet the threshold new source review requirements for other pollutants. New and existing facilities with GHG emissions above 100,000 $MTCO_2eq$ per year must also obtain operating (or "Part 70") permits.

The EPA's NSR permit regulations require the use of Best Available Control Technology (BACT) for new or modified major sources of air pollution to minimize pollution. BACT is an emissions limitation which is based on the maximum degree of control that can be achieved, taking energy, environmental, and economic impacts into consideration. BACT can be add-on control equipment or modification of the production processes or methods. For example, BACT may include fuel cleaning or treatment and innovative fuel combustion techniques. BACT may also be a design, equipment, work practice, or operational standard if imposition of an emissions standard is infeasible. In most states, the environmental agency, rather than the EPA, will be issuing the permits.

EPA's regulation of GHG emissions under the Clean Air Act has been challenged numerous times in the courts. For example, several lawsuits were consolidated and brought jointly by 15 states, including Texas and Virginia, as well as coal, oil and gas, manufacturing, and other industry groups against EPA (Coalition for Responsible Regulations v. EPA).[xiv] Siding on the EPA's side were automakers, environmental groups and 14 states, including New York, New Mexico and Oregon. On June 26, 2012, a federal appeals court panel dismissed all challenges to EPA's GHG regulations. The ruling upheld the endangerment finding

rule, the tailpipe rule, the tailoring rule, and the timing rule. In layman's terms, the ruling upheld that EPA can regulate GHG emissions under the Clean Air Act. A few days after the court ruling, the EPA issued a final rule that reiterated the GHG permitting thresholds.

Recently, EPA has also proposed promulgating New Source Performance Standards (NSPS) for GHGs from new electric power plants. [xv] NSPS are technology-based minimum performance standards which apply to specific categories of stationary sources designated by EPA. Though the EPA cannot prescribe a particular technology, it must set the limit in the form of a standard. The EPA is expected to propose promulgating NSPS for GHGs from petroleum refineries soon. There is also pressure from environmentalists and certain states that the EPA must move forward with rules for existing electric power plants.

State Carbon Policies Ahead of Federal Regulations

Because the federal government has been slow at regulating GHG emissions, numerous states have developed carbon policies ahead of federal regulation. Indeed, roughly half of the U.S. states have established GHG emission reduction targets as illustrated in Figure 5.

The first states to establish GHG emission reduction targets include Maine, Rhode Island, and Vermont. They signed onto the Climate Change Action Plan developed by the New England Governors and the Eastern Canadian Premiers in 2001. By signing the agreement, they agreed to reduce their statewide GHG emissions to 10% below 1990 levels by 2020 and 75-85% below 2001 levels in the long term.[xvi] Maine made its targets a little bit more stringent in 2003. In 2002, the state of New York established goals to reduce statewide GHG emissions to 10% below 1990 levels by 2020. Not only has the Northeast led the way for setting state GHG emission reduction targets, the northeastern states were also instrumental in creating the Regional Greenhouse Gas Initiative (RGGI), a regional cap-and-trade program covering electric power plants.

In 2006, California enacted the Global Warming Solutions Act, commonly referred to as AB 32, which set into law the goal of reducing GHG emissions statewide to 1990 levels by 2020. California is the first state in the country to mandate an economy-wide emissions cap on covered sectors that includes enforceable penalties. The impact of California's carbon policy on industrial facilities is discussed next.

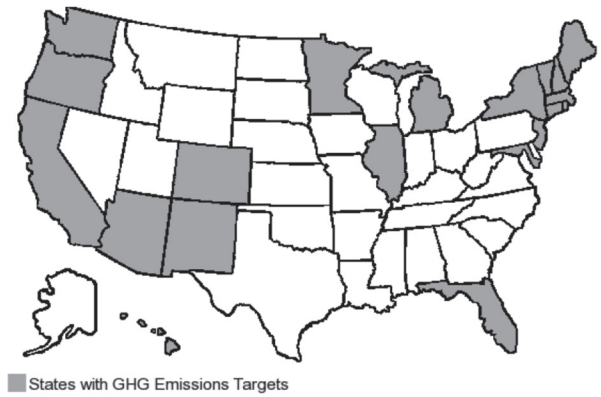

Figure 5. U.S. States with Greenhouse Gas Emission Reduction Targets— Source: Center for Climate and Energy Solutions

California's Economy-wide Carbon Policy Offers Risks and Opportunities to Industrial Facilities

When AB 32 was adopted in 2006, the California Air Resources Board (ARB) was directed to develop a climate change plan to identify actions required to achieve the statewide 2020 GHG emission limit. The climate change plan—the "AB 32 Scoping Plan"—was approved by the ARB Board in December of 2008 and subsequently finally approved by the Board's Executive Officer in May of 2009. The AB 32 Scoping Plan was updated and re-approved in 2011.[xvii]

At the time of the first approval, the AB 32 Scoping Plan outlined actions required for reducing emissions by 169 $MMTCO_2eq$ by 2020, a 28% reduction from the state's projected 2020 business-as-usual emissions.[xviii] Because of the recent economic recession as well as revised future fuel and energy demand estimates, the projected 2020 business-as-usual emissions were adjusted downwards in 2010. This, in turn, has resulted in the lowering of the required reduction of GHG emissions from 169 $MMTCO_2eq$ to 80 $MMTCO_2eq$, a 16% reduction below the estimated 2020 business-as-usual emission levels. Figure 6 illustrates this adjustment. Despite the reduction, drastic changes are required to reach the 2020 target of 427 $MMTCO_2eq$.

Because no single sector in California has a sufficiently large share of total GHG emissions to become the primary target for emission reductions, reductions must come from many sectors including the trans-

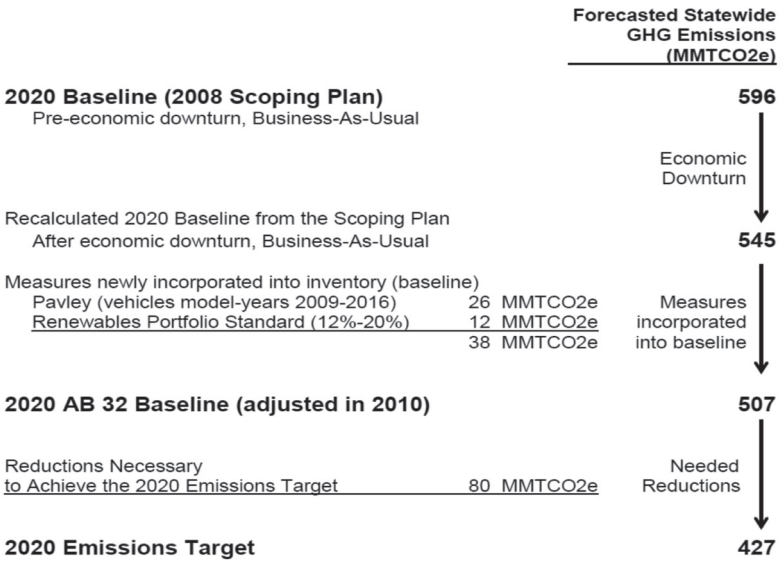

Figure 6. California 2020 GHG Emissions and 2020 Reduction Target—Source: California Environmental Protection Agency, Air Resources Board

portation, electricity, industrial, and commercial and residential sectors. Indeed, the AB 32 Scoping Plan outlines a combination of numerous command-and-control measures and a market-based cap-and-trade program required to achieve the 2020 GHG emission limit. Examples of command-and-control measures include building efficiency, renewable portfolio, vehicle, and low carbon fuel standards. For the purpose of this article, regulations and measures that target industrial facilities are of primary interest. For example, the AB 32 Scoping Plan recommends specific measures to control fugitive emissions from refineries, oil and gas extraction operations, and gas transmission. ARB is currently developing these industrial measures. Other examples of regulations and measures affecting industrial operation include mandatory energy efficiency audits for larger industrial facilities and a cap-and-trade program.

Mandatory Reporting of GHG Emissions Helps Pinpoint Targeted Measures

Similar to the U.S. EPA's GHG reporting requirement for larger industrial facilities, ARB requires California's larger industrial sources to report GHG emissions each year. California's Regulation for the

Mandatory Reporting of GHG emissions, however, preceded the EPA Greenhouse Gas Reporting Program by two years, with the state's largest emitters beginning to report annual GHG emissions in 2008. California's reporting requirements were recently revised, and proposed changes are currently under consideration (as of September of 2012.) The primary purpose of these revisions and changes is to incorporate elements of the federal Mandatory Greenhouse Gas Reporting Rule (40 CFR Part 98) and to better align with the cap-and-trade regulation.

In accordance with U.S. EPA reporting requirements, all petroleum refineries and cement, lime, and nitric acid production plants must report GHG emissions annually regardless of amounts. Other types of industrial facilities must report if the facility's total annual emissions are equal to or greater than 25,000 $MTCO_2eq$.[xix] Total emissions include emissions from stationary combustion of fossil fuels and biomass-derived fuels, as well as process, vented, and fugitive emissions. If a facility's total annual emissions are less than 25,000 $MTCO_2eq$ but it has combustion emissions equal to or greater than 10,000 $MTCO_2eq$ per year, the facility is subject to the abbreviated reporting requirement. The abbreviated reporting requirement helps reduce the costs of compliance for smaller industrial facilities. Industrial facilities with a compliance obligation under the cap-and-trade regulation are not allowed to use abbreviated reporting.

Collectively, about 180 California industrial facilities reported GHG emissions of 154 $MMTCO_2eq$ in 2011, accounting for about 37% of all reported emissions that year.[xx,xxi] These emissions account for roughly 33% of estimated total statewide GHG emissions.[xxii] The top 15 industrial facilities with greatest GHG emissions include 12 refineries and three oil and gas operations as illustrated in Table 1.[xxiii] They account for 80% of total industrial GHG emissions. Because refineries and oil and gas extraction operations account for such a great share, ARB is currently developing specific GHG emission reduction measures for these industrial subsectors.

Mandatory Energy Efficiency and Co-Benefits Assessments of Large Industrial Facilities

The Energy Efficiency and Co-Benefits Assessments of Large Industrial Facilities Regulation requires all facilities that emitted 0.5 $MMTCO_2eq$ or more in 2009 and all cement manufacturing plants and refineries that emitted at least 0.25 $MMTCO_2eq$ in 2009 to conduct a one-

Table 1. California Industrial Facilities with Greatest GHG Emissions, 2011

Data source: California Air Resources Board, Mandatory GHG Reporting, http://www.arb.ca.gov/cc/reporting/ghg-rep/reported_data/ghg-reports.htm

Industrial Facility	2011 GHG Emission (MTCO2eq)	Type of Industrial facility
Chevron Products Company - El Segundo	22,191,761	Refinery
Chevron Products Company – Richmond	20,384,231	Refinery
Conoco Philips Company	20,958,626	Refinery
Ultramar Inc – Valero	15,230,294	Refinery
ExxonMobil - Torrance	12,927,716	Refinery
BP West Coast Products	5,190,278	Refinery
Valero Refining Company – Benicia	4,906,194	Refinery
Shell Oil Products US - Martinez	4,747,678	Refinery
Occidental of Elk Hills, Inc. - San Joaquin Valley Basin	3,282,671	Natural Gas Liquid Extraction
Aera Energy –San Joaquin Basin	3,204,897	Crude Petroleum and Natural Gas Extraction
Kern Oil	2,626,598	Refinery
Tesoro – Martinez	2,400,813	Refinery
Chevron AAPG 745 - San Joaquin Basin	2,158,500	Crude Petroleum and Natural Gas Extraction
Conoco Philips – Wilmington	1,996,264	Refinery
Conoco Philips – San Francisco	1,502,353	Refinery

time assessment of their facility's fuel and energy uses. Based on 2009 GHG emission data, 45 industrial facilities are subject to the regulation and had to file an assessment report with ARB in 2011. ARB staff is currently preparing the public versions of the assessments. As part of the assessment, each facility had to identify potential energy efficiency improvements as well as determine improvements. Furthermore, the regulation requires each facility to identify energy efficiency improvement reductions in GHG emissions, criteria pollutants, and toxic air contaminants associated with those projects that affect 95% of the equipment, processes, or systems emitting GHG emissions.

Energy efficiency improvement projects can generate significant GHG emission reductions. Indeed, EnerNOC assisted four oil and gas extraction operations with energy efficiency and co-benefits assessments in 2011 where the team identified 110 select energy efficiency projects that collectively generate close to 1.1 MMTCO_2eq in reductions per year.

Cap-and-Trade Program Serves as a Backstop

California's cap-and-trade program is a central and critical element of the state's GHG reduction strategy because it serves as a backstop to achieving the GHG emission target by 2020. A cap-and-trade program is a market-based mechanism that places a hard and declining "cap" on GHG emissions from covered sectors. Though it provides the "covered entities" flexibility in achieving GHG emission reductions, the cap ensures that they do not emit more than allowed. Because the compliance instruments for GHG emissions can be traded, the market price of GHG emissions yields an enduring price signal across the economy. This price signal, in turn, provides incentives for the market to find new and cost-effective ways to reduce emissions.

The California cap-and-trade program was adopted on October 20, 2011, and took effect on January 1, 2012. The California cap (334 MMT-CO_2eq) covers approximately 80% of the state's total GHG emissions. [xxiv,xxv,xxvi] The emission reduction currently required from the cap-and-program's covered entities is 18 MMTCO_2eq, or 20% of total emission reductions required by 2020. The covered sectors include power plants, transportation fuels, refineries, cement manufacturing plants, and large industrial combustion sources. When the program is fully implemented, about 350 of California's largest GHG emitters will be participating.[xxvii] The cap-and-trade program has two compliance periods.

First Compliance Period

Starting in 2012, stationary sources emitting at or above 25,000 MT-CO_2eq per year are covered in the cap-and-trade program. Such sources include in-state electricity generating facilities, importers of electricity, and large industrial facilities.

Second Compliance Period

Starting in 2015, the upstream treatment of industrial fuel combustion at facilities with emissions at or below the 25,000 MTCO_2eq per year, and commercial and residential fuel combustion regulated where the fuel enters into commerce, will be phased into the cap-and-trade program. Additionally, transportation fuel combustion regulated where the fuel enters into commerce will be added to the cap in 2015.

Participants in the cap-and-trade program must surrender one compliance instrument for each covered MTCO_2eq at the end of each compliance period. Consequently, a covered entity must determine if it is more cost-effective to purchase a compliance instrument or reduce GHG emissions. The compliance instrument is either an allowance or an offset credit, and both may be traded. An allowance allows its owner the right to emit one MTCO_2eq. An offset credit can be used in lieu of a one MTCO_2eq direct emission reduction by sources subject to the cap. For example, a refinery may pay a dairy (which is not otherwise regulated) for offset credits. The refinery would then be credited for the GHG emissions reductions achieved by the dairy. (Both types of compliance instruments are discussed in greater detail below.)

Over time, the amount of aggregate GHG emissions from the covered entities will gradually decline. As the cap declines, the number of allowances available will decline proportionately. Figure 7 illustrates how the cap is reduced each year, except for 2015, when it jumps significantly because of the phasing in of additional sectors. Because a certain number of emissions allowances are put in circulation in each compliance period, this approach provides a measure of certainty about the total quantity of emissions that will be released from entities covered under the program. The narrow and broad scope historical emissions correspond to the different groups of entities covered in the two compliance periods.

ARB has set up an account and transaction registry—the Compliance Instrument Tracking System Service (CITSS)—to accommodate account management for compliance and non-compliance entities as

well as tracking and managing allowances and offset credits. The CITSS is a key component of a multi-jurisdiction administrative system being developed to support the implementation of state and provincial GHG emissions trading programs such as the Western Climate Initiative (WCI). The WCI is a consortium of western U.S. States, Canadian Provinces, and Mexican states. Because many WCI members have postponed or are behind in the regulatory development process, ARB is currently focusing on linking to Quebec only. A decision on the linking of the California and Quebec cap-and-trade programs was expected in the fall of 2012. Some experts and industrial companies have also urged ARB to consider linking to the European Emissions Trading System (ETS), which is the world's largest cap-and-trade program. However, differences in the use of protocols for offsets have made linking of the California and European cap-and-trade programs unlikely in the short term.

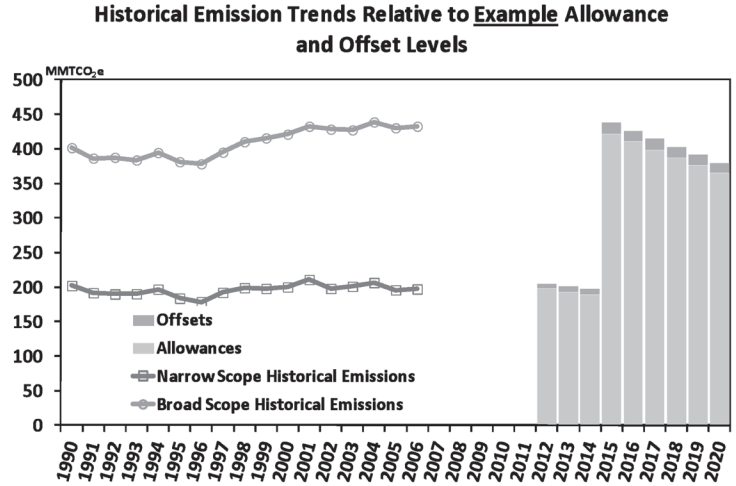

Figure 7. Covered Entities Will Use Allowances and Offsets to Comply with GHG Emissions—Source: California Air Resources Board

Some Emission Allowances Freely Allocated, Some Auctioned

Emission allowances can be freely allocated, sold through auction, or some portion freely allocated while another portion is auctioned. A combination of auction and free allocation of allowances and auction will be used in California. ARB will hold quarterly auctions of a set number of allowances. In total, ARB will distribute roughly 2.5 billion allowances, with 50% auctioned and 50% given away freely between

2012 and 2020.[xxviii] A majority of allowances will initially be given away to reduce transition costs and prevent economic leakage. Economic leakage refers to the decision by plants to relocate to other states or countries where they are not subject to a perceived competitive disadvantage imposed by the cap-and-trade program. Therefore, to reduce transition costs and prevent leakage, ARB distributed about 150 million free allowances to electrical utilities and large GHG-emitting industrial sectors such as oil and gas extraction and cardboard manufacturing that were at high risk of competitive disadvantage in 2012-2013.

There are several categories of allowances, including advance allowances, allowances for investor-owned and publicly owned utilities or co-ops, and remainder allowances for industry. Advanced allowances constitute 10% of all allowances in 2015 and later, and are designated for advance auctions that occur three years prior to the vintage year. The first auction of advanced allowances was initially planned for August, 2012 but got rescheduled for November 14, 2012. At the first auction, CARB sold the 2013-vintage allowances and 2016-vintage allowances at $10.09 and $10.00 per allowance, respectively.[xxix] This can be compared to $13.62 for the 2013-vintage allowances and $10.71 for the 2016-vintage allowances at the second auction on February 23, 2013.[xxx]

The formulas for distributing allowances are quite complicated. For example, some remainder allowances will be given freely to certain industries using a formula that is intended to provide transition and leakage assistance to certain industries. The formula is also intended to reward industries that reduce emissions. As mentioned previously, leakage of industrial economies to other states or countries that have no carbon policies in place is a major concern.[xxxi] As a result, ARB wants to limit the risk of leakage by allocating free allowances to such industries that will have a hard time passing on the increased costs to consumers. To determine leakage risks, ARB will collect facility-level economic indicators such as total value of product shipped, total capital expenditures, cost of material, and numbers of workers. This has met resistance from some industrial companies because of the confidential nature of certain data. The total number of allowances provided freely and auctioned to industry each vintage year is still an unknown. Another unknown is how ARB will use revenues generated from the auction of advance and remainder allowances.[xxxii]

Eligible industries will receive free allowances based on output rather than emissions. Thus, free allowances are decoupled from emis-

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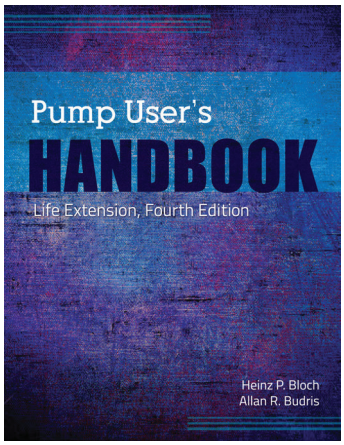

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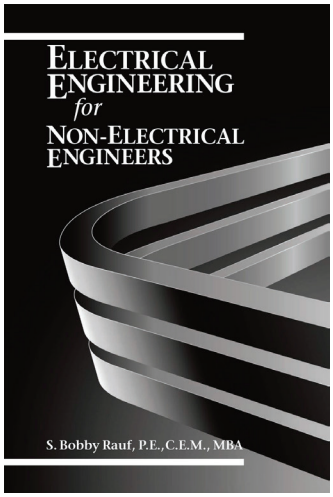

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sion, that, in turn, rewards those industrial facilities which reduce their emissions. An allowance can only be used for emissions on or after its vintage year. To prevent gaming of the market, ARB has adopted strict limits on the number of allowances any trader or company can hold. Most companies which are required to participate in the auctions can hold no more than 15% of the allowances available for sale. Traders can hold no more than 4%. Additionally, all parties planning to trade in the allowance auctions must deposit all of the money needed to pay for their bids 12 days in advance. There is also a market surveillance committee made up of experts from Stanford University, UC Berkeley and UC Davis.

Offset Credits Limited

Capped sector participants are allowed to use offset credits to cover 8% of their GHG emissions. Currently, ARB has approved four compliance protocols for offset projects in California: livestock, ozone-depleting, urban forest, and U.S. forest projects. Only GHG emission reductions associated with these four types of offset projects can get offset credits. Furthermore, only ARB can issue offset credits. There is great concern among cap-and-trade participants that there will not be sufficient offset credits for purchase, especially in the second compliance period. There is also concern from environmental parties about linked jurisdictions' offsets protocols not meeting the requirements of AB 32 offset credits.

SUSTAINABLE CORPORATE CARBON POLICIES

Because governments, customers, consumers and shareholders are increasingly demanding to know how industrial facilities are achieving sustainability and what specific steps are taken to reduce GHG emissions, more companies are forced to take action and implement corporate carbon policies. For example, shareholders recently requested ExxonMobil, Cabot Oil & Gas Corporation, and ConocoPhillips to adopt quantitative goals, based on current technologies, for reducing GHG emissions.[xxxiii] They also demanded reports describing the companies' plans to achieve the GHG reduction goals by the end of the year. Additionally, shareholders of Kraft Foods and Kruger requested the two corporations to take on producer responsibility for

post-consumer product packaging in 2012.[xxxiv] Specifically, shareholders urged the food manufacturers to determine and report the carbon footprint of their product packaging. This includes determining the GHG emissions associated with producing as well as disposing of the packaging. In the first two months of 2013, as many as 20 companies had been asked by shareholders to develop sustainability reports or adopt GHG emission reduction goals.[xxxv] Furthermore, more shareholders are requesting executive compensation to be linked to sustainability criteria.

Results from a recent survey of 630 U.S. industrial facilities conducted by EnerNOC in spring of 2012 indicate that energy management decisions in industry are typically not influenced by the ability to impact carbon reductions.[xxxvi] Indeed, only 5.5% of the respondents selected the "ability to impact carbon reductions" as one of the top three factors influencing their energy management decisions. Instead, most respondents selected pure energy (cost) savings, such as "$ savings on your utility bill" and "kWh savings," as the primary factors. This illustrates that the cost of GHG emissions is still not of great concern to industrial operations in the U.S. However, this is expected to change significantly in the next few years when emerging cap-and-trade programs assign a price to carbon.

As sustainability initiatives become more common, management of industrial facilities will increasingly be called upon to develop and report sustainability key performance indicators (KPIs) associated with GHG emissions and carbon foot printing.[xxxvii,xxxviii] KPIs are required not only to effectively manage corporate and facility sustainability programs but also to fulfill disclosure requirements. For example, the Carbon Disclosure Project (CDP), which represents in excess of 720 institutional investors globally, requires disclosure from companies on their GHG emissions and climate change management activities.[xxxix]. In 2011, over 3,000 companies responded to the "Investor CDP" questionnaire.[xl] Furthermore, some 50 purchasing organizations including PepsiCo and Dell use "Supply Chain CDP" to mitigate environmental risk in their supply chains.

Following are three examples of how industrial sectors and individual companies are actively pursuing carbon management. The first example illustrates the chemical industry, an industry that was among the first to address climate change and focus on carbon management, partly as a result of its experience with the phaseout of ozone-depleting chemicals. The second example illustrates how the food and beverage

manufacturing industry, which is less energy-intensive than most, initially was slow to address climate change, but that consumer demand for products with a smaller carbon footprint has forced the sector to engage in carbon management throughout the supply-production-distribution chain. The final example discusses how smaller to medium-sized manufacturing facilities, despite their capital constraint, can reduce their GHG emissions by leveraging existing and subsidized resources that build on the concepts of lean.

Example 1: Chemical Industry

The chemical industry consistently scores near the top in studies evaluating how corporations are positioning themselves to compete in a carbon-constrained world. For example, one assessment conducted by the Investor Responsibility Research Center in 2006 ranked the chemical industry first among the 10 most carbon-intensive industries in America.[xli] The assessment ranked 100 individual corporations within the ten sectors according to a 100-point Climate Governance Checklist of 14 steps associated with Board Oversight ("Board"), Management Execution, Public Disclosure, Emissions Accounting, and Emissions Management and Strategic Opportunities ("Strategies").[xlii] Figure 8 illustrates the ranking of the 10 most carbon-intensive industries. The chemical industry ranked highest with an average industry score of 51.9 points. Chemical companies scored well in all categories, but especially strongly on "Strategies," "Management," and "Emissions." In the category "Strategies," companies are ranked on setting absolute GHG emission reductions targets for facilities; participating in GHG trading programs; and pursuing GHG business strategies. In the "Emissions" category, they are evaluated on calculating GHG emission reductions from projects; conducting annual inventory of GHG emission; setting GHG emissions baseline; and using third-party verifiers.

Similarly, the Carbon Disclosure Project, year after year, ranks numerous chemical companies such as BASF, Air Products & Chemicals, Dow Chemical and Praxair, high on carbon disclosure.[xliii] These chemical companies also rank high on carbon performance, a new ranking component introduced by CDP in 2009. CDP awards performances points for actions considered to contribute to climate change mitigation, adaptation, and transparency.

There are several reasons why the chemical industry and chemical companies typically rank among the top on climate change activi-

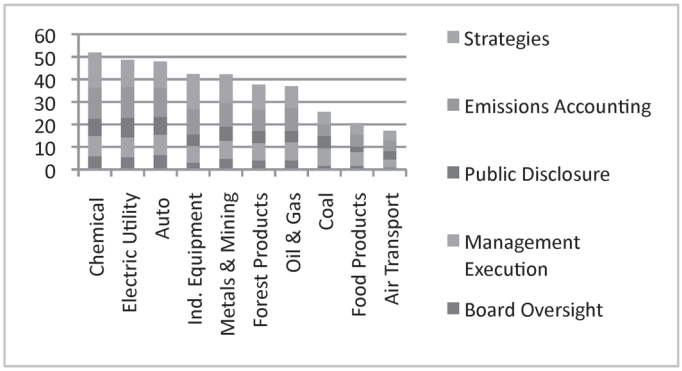

Figure 8. Average Industry Scores for the 10 Most Carbon-intensive Industries in America—Data source: Ceres, Corporate Governance and Climate Change: Making the Connection, March 2006

ties. First, many chemical companies have created a climate change task force to integrate board oversight with executive-level actions on GHG emissions. Indeed, some of the larger chemical corporations, such as DuPont and Dow Chemical, have had their board directors oversee climate change activities for more than 15 years. Second, most chemical companies have committed to absolute GHG emission reduction targets, and they often proactively disclose their climate risks and opportunities in securities filings and other public documents. Indeed, CEOs of chemical companies often embrace climate change and carbon policies publicly by discussing near-term opportunities and risks. Finally, instead of waiting for breakthrough technologies to manage GHG emissions, many chemical companies are actively looking for solutions to mitigate climate changes including energy and water efficiency gains, improved production processes, and chemical products with smaller carbon footprints. For example, chemical companies are the principal suppliers of materials such as next-generation refrigerants, advanced insulation materials, solar panels, lightweight car materials, and carbon sequestration technologies which allow for significant GHG emission reductions.

The chemical industry is energy and carbon intensive and has much to win and lose from emerging carbon regulations and policies. The chemical industry is therefore interested in developing a robust and transparent methodology for GHG abatement options. Towards this end, the chemical industry is working at reducing its GHG emissions through the entire lifecycle of the chemical products and the ap-

plications in which they are used. This requires a cradle-to-grave analysis of GHG emissions associated with the production and disposal of chemical products. For example, chemical companies have committed to "Responsible Care," a voluntary program of the International Council of Chemical Association (ICCA) that promotes continuous improvements in health, safety and environmental performances. A few years ago, the ICCA performed a lifecycle quantification of carbon abatement solutions enabled by the chemical industry.[xliv] Full lifecycle analyses of more than 100 chemical product applications were performed, with GHG emissions from extraction of feedstock and fuel, through the production, in-use and final disposal calculated. The chemical product applications were compared to non-chemical alternatives. Insulation materials and advanced lighting solutions are the biggest levers for GHG emission savings enabled by the chemical industry.

Example 2: Food and Beverage Manufacturing Industry

The food and beverage manufacturing industry has been somewhat slow in addressing climate change and implementing carbon management. In 2006, the food industry was ranked second to last on its carbon management performance among the 10 most carbon-intensive industries in America because of non-existing carbon management strategies and poor GHG emission accounting practices and disclosure, as illustrated in Figure 8.[xlv] Today, an increasing number of food and beverage manufacturers are transitioning to sustainable practices and products, such as locally sourced and low-carbon products and packaging, to meet consumer demand. Perceived climate change performance and its impact on brand value and consumer confidence has caused food and beverage manufactures to not only improve carbon disclosure and GHG emission accounting practices but also support their suppliers to adopt environmentally responsible practices. Indeed, it is widely acknowledged that for many food and beverage manufacturing companies the greatest amount of GHG emissions is not associated with direct manufacturing operations but with the supply chain. They are also greatly concerned about extreme weather patterns and natural disasters and how these can disrupt and adversely affect manufacturing and supply chains.

In 2011, the CDP awarded Nestle, PepsiCo, and Danone the highest scores among food and beverage manufacturing companies reporting.[xlvi] Several food and beverage manufacturers are also CDP Supply Chain member companies, including Coca-Cola Company, PepsiCo,

ConAgra Foods, Kraft Foods, Nestle and Unilever.[xlvii] The CDP Supply Chain member company provides the CDP with a list of its suppliers and encourages these suppliers to respond to CDP's questionnaire on supplier's GHG emissions, energy use, and GHG management activities. The CDP then analyzes the responses and provides the member companies with a detailed report on suppliers' emissions. Several food and beverage corporations have articulated that they expect their suppliers to undertake GHG emission reduction programs and set targets in the near future.

Example 3: Small to Medium-sized Manufacturing Facilities

Small to medium-sized manufacturing facilities have extremely limited resources available for reducing their carbon footprint and energy use. First, smaller manufacturing plants do not have the luxury of having a dedicated person assigned to energy and carbon management. Second, they have very limited capital available for capital projects including energy management and carbon reduction projects. They do, however, offer significant opportunities for energy savings and thus GHG emission reductions. Indeed, it is estimated that small- to medium-sized industrial facilities account for about 42% of total U.S. industrial energy use.[xlviii]

One interesting approach for a cohesive program around sustainability in smaller to mid-sized manufacturing is a bottom-up approach that leverages the concept of lean. Lean production and lean manufacturing focus on the elimination of waste (non-value added activity) while delivering quality products on time and at a low cost.

Several federal and state agencies, utilities, and energy efficiency organizations are currently attempting to build upon the concept of lean to achieve carbon reductions in smaller manufacturing facilities. For example, the E3 Initiative (E3: Economy, Energy, Environment) is a joint effort by federal, state, and local agencies to promote sustainable manufacturing.[xlix] E3 coordinates customized hands-on assessments of manufacturing processes conducted by an experienced team of experts from the NIST Manufacturing Extension Partnership (MEP) Program, the Department of Energy's Industrial Assessment Centers (IACs) and state environmental experts with support from local workforce investment boards and small business development centers. The MEP network comprises over 1,400 technical experts in the 50 states that provide a variety of services for small to mid-sized US manufacturers ranging from innovation strategies to lean process improvements to green manu-

facturing. The IACs have conducted over 15,000 industrial assessments to reduce waste, save energy and improve productivity. During the E3 assessments, manufacturing personnel are also trained on MEP, DOE and EPA tools on lean manufacturing and energy management. For example, the U.S. EPA has developed a Lean, Energy & Climate Toolkit that offers practical strategies and techniques for enhancing lean results while reducing energy use, greenhouse gas emissions, costs, and risk.[l]

Furthermore, energy companies and energy efficiency organizations are increasingly exploring ways to achieve energy and carbon reductions in small and medium-sized manufacturing facilities using lean concepts. For example, a recent collaboration between Northwest Energy Efficiency Alliance (NEEA), a non-profit supported by Bonneville Power Authority, Energy Trust of Oregon, more than 100 Northwest utilities, and the MEP organizations in Oregon, Washington, Idaho and Montana leveraged "right-sized" MEP consultants to assist small and medium-sized manufacturing facilities with energy efficiency opportunities.[li] In 2011, the NEEA-MEP Energy Support Project identified in excess of 4 million kWh in annual savings in 15 smaller manufacturing facilities.[lii]

CONCLUSIONS

Concerns over climate change are prompting actions at federal, state, and corporate levels that will affect how industrial facilities operate. The U.S. EPA has started to put the framework in place for regulating GHG emissions under the Clean Air Act, with several new rules affecting industrial operation. Two new rules require the largest industrial GHG emitters to submit annual GHG emissions data to EPA annually and all sources emitting GHGs above a certain threshold to obtain permits.

In lieu of a federal target for future GHG emissions levels, California is paving the way for a cap-and-trade program to ensure that the state is achieving its 2020 GHG emission target of 427 $MMTCO_2eq$, a target that corresponds to the state's 1990 GHG emission levels. The cap-and-trade program's covered entities will deliver 18 $MMTCO_2eq$, or 20% of total emission reductions required by 2020. The covered entities include several industrial operations such as refineries, cement manufacturing plants, and large industrial combustion sources. When the cap-and-trade program is fully implemented, about 350 of Califor-

nia's largest GHG emitters will be participating.

It is not only carbon policies at the federal and state levels that affect industrial operation. Shareholders and consumers are increasingly demanding that corporations reduce the carbon footprint associated with industrial operation and final products. Therefore, more companies are adopting quantifiable goals for reducing GHG emissions and developing key performance indicators (KPIs) associated with GHG emissions and carbon foot printing. This trend is expected to become stronger in the next few years as the California cap-and-trade program keeps providing a price on carbon. The carbon price settled at $13.69 per $MTCO_2eq$ at the second auction in California, up 36% from the first auction.

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