Rhodium Group

Clean Products Standard

A New Approach to Industrial Decarbonization

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In the US, there has been growing interest in sector-specific market-based performance standards as pathways to decarbonization, but a major gap in the sectoral standard landscape is industry. The industrial sector is one of the most difficult parts of the economy to decarbonize, and it's on track to becoming the largest source of US greenhouse gas (GHG) emissions within the next ten years. Emissions from manufacturing comprise more than 60% of total industrial emissions in the US. Though manufacturing is a diverse subsector, a majority of emissions come from the production of a small set of GHG-intensive products, including basic chemicals, iron and steel, cement, aluminum, glass, and paper. In this report, we propose a novel market-based standard for manufacturing, a clean products standard (CPS), which could reduce emissions from the manufacture of these GHG-intensive products.

A CPS would establish the maximum amount of GHGs per unit of material produced that can be emitted in the production of covered industrial products sold in the US. In developing and implementing a CPS, policymakers will be faced with a set of key design choices, which we outline in this report. Most of these choices require a balance between the ambition of the policy and the administrative complexity of its implementation. Other design choices can help maintain US manufacturer competitiveness and prevent emissions leakage. Key design elements of a CPS include product coverage, compliance metrics, point of obligation, accounting for imports and exports, use of covered products as intermediate inputs, and flexibility options.

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The policy shift to sectoral standards

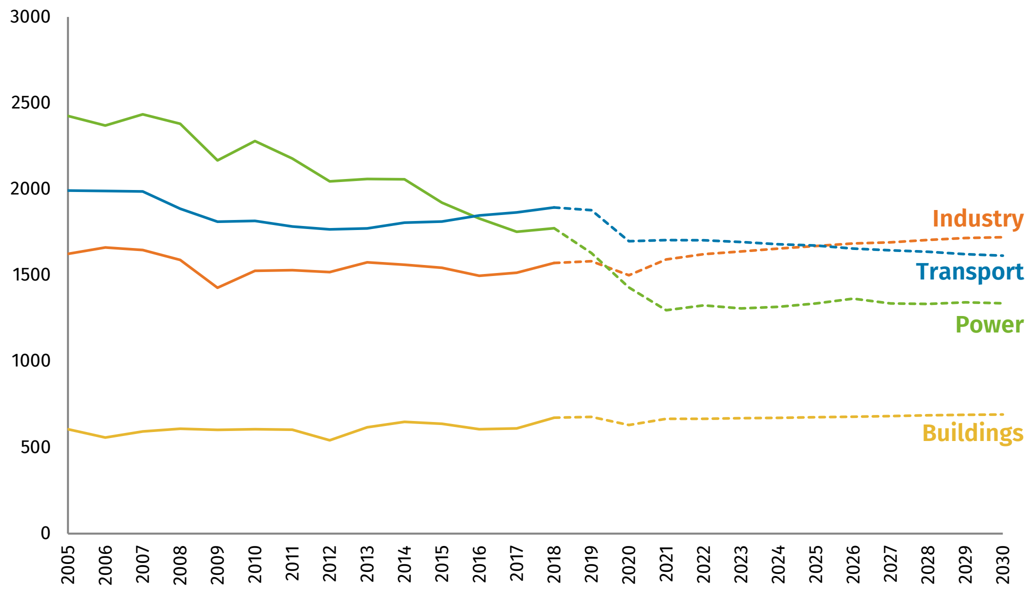
Following the failure of cap-and-trade legislation to pass the US Senate in 2010 and continued challenges in generating legislative support for an economy-wide carbon tax, many in the climate policy community have begun looking for other options. There is growing interest in sectoral market-based performance standards as an alternative to carbon pricing. Performance standards already play a significant role in the transportation and buildings sectors at both the state and federal level. These include federal Corporate Average Fuel Economy (CAFE) and carbon dioxide emissions standards and state-level zero-emission vehicle standards for light-duty vehicles, as well as efficiency standards for appliances. A growing number of states have adopted clean energy standards (CES) for the electric power sector, and a number of CES bills have been introduced in Congress.

A major gap in the sectoral standard landscape is industry. Under current policy, Rhodium estimates industry will surpass transportation and the power sector and become the largest source of US GHG emissions within the next ten years (Figure 1). Under most carbon pricing proposals, industrial decarbonization is achieved by imposing a tax (or allowance purchase requirement) on industrial emitters, but also on importers of GHG-intensive manufactured goods to prevent a decline in US competitiveness or "leakage" of emissions overseas. As focus has shifted from economy-wide carbon pricing to sectoral performance standards, very little work has gone into developing a strategy for industrial decarbonization that could fit within this new framework.

FIGURE 1

US greenhouse gas emissions in key sectors[1], 2005-2030

Million metric tons of CO_2-equivalent (CO_2e)



Source: Rhodium Climate Service

Introducing a clean products standard

A clean products standard (CPS) is a novel proposal to create a technology-neutral, market-based sectoral standard to decarbonize the production of a set of basic manufactured materials. A CPS establishes the maximum amount of greenhouse gases (GHGs) per unit of material produced that can be emitted in the production of covered industrial products sold in the US. Covered products can include steel, cement, glass, and chemicals. Manufacturers can employ any technological or process-based solutions that allow them to meet the emissions limit. These solutions include the use of low-carbon electricity, liquid fuels, and feedstocks, as well as process and efficiency improvements and deployment of carbon capture systems. The stringency of the standard for each product category tightens over time, creating regulatory certainty for an ambitious but achievable path toward deep decarbonization. The breadth of products covered by the standard can also expand over time.

To avoid the potential for adverse competitiveness effects and emissions leakage, a CPS applies to all designated products *sold*—not just produced—in the US. A CPS could also be expanded to encompass final consumer products that rely heavily on CPS-regulated inputs. A CPS allows for trading of CPS compliance credits, similar to other market-based policies like a cap-and-trade policy or a clean energy standard. We discuss important design considerations and trade-offs relating to a number of these factors in greater detail later in this report.

[1] Emissions from Rhodium's Taking Stock 2020 "V"-shaped economic recovery scenario

Product standard precedent

Many products sold in the US are subject to standards and testing to achieve stated goals like consumer safety and environmental outcomes. These policies can help contextualize a CPS within the broader US regulatory context. In this section, we discuss three categories of product standards: consumer goods for children, building materials, and minimum equipment energy performance. These examples just scratch the surface of product regulations in the US, which run the gamut and include food safety, pesticide use, domestic content requirements as part of trade deals, and worker safety and human rights—to name a few.

Some of the most stringent product standards pertain to consumer goods intended for use by children. The Consumer Product Safety Act, passed by Congress in 1972, established the framework for such regulations and the corresponding Consumer Product Safety Commission (CPSC), the responsible federal entity. The CPSC generally defers to voluntary industry standards, as prescribed by the Act, and most of the mandatory rules they have adopted have related to children's products. The CPSC has enshrined in federal code safety standards developed by ASTM International, a voluntary code-setting body, for products like cribs, high chairs, and bunk beds. These products may not be sold in unless they meet exacting design standards and pass a battery of specific, technical tests (e.g., "apply a cyclical horizontal load of 27 ± 2 lbf (120 ± 9 N) to the geometric center of the top of each side/end assembly at a point no more than 1 inch from the top of the rail on the assembly being tested"). Violations of these rules can be punished by civil and criminal penalties.

Like consumer product safety standards, building materials like concrete, masonry, and steel are also subject to safety standards and testing protocols. Unlike consumer products, building materials are governed by state building codes instead of federal regulations. Most of the codes are either direct adoptions or minor modifications of the International Building Code and International Residential Code developed by the International Code Council, another voluntary code-setting organization. These codes, in turn, adopt product-specific standards developed by industry groups like the American Institute of Steel Construction or the American Concrete Institute. Much like consumer products, the safety standards for building products are quite detailed—often running to hundreds of pages—and include technical specifications and testing procedures. Violations of building codes can also be punished by both civil and criminal penalties. Notably, though these codes often govern downstream products from the basic manufactured products we propose to cover through the CPS, those basic materials generally aren't subject to building code requirements.

Returning to federal standards, the US Department of Energy establishes minimum equipment performance standards, commonly called appliance and equipment standards, that mandate a minimum level of energy efficiency for a set of consumer and commercial products. As with the other standards discussed, the specifications that a product must meet to be legally sold in the US are quite detailed, as are the testing procedures used to assess product compliance. These regulations and test procedures are often based on industry-developed guidelines developed by groups like the American National Standards Institute, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, and the Association of Home Appliance Manufacturers.

Existing GHG tracking efforts

Though a CPS is a new policy, there are existing GHG tracking efforts that policymakers can leverage in implementing a CPS. Most notable are the EPA's Greenhouse Gas Reporting Program (GHGRP) and corporate emissions tracking.

In 2009 the Environmental Protection Agency (EPA) established the Greenhouse Gas Reporting Program (GHGRP), which requires large emitters of GHGs (defined as having emissions greater than 25,000 metric tons of CO_2e per year for most categories) to report their annual GHG emissions. EPA reviews these submissions and subjects them to a rigorous verification process before publishing the data on a publicly available web platform. In 2018, facilities reported nearly 3 billion metric tons of CO_2e emissions, covering nearly all power plant emissions and 80% of industrial emissions. Many of the entities that could be obligated to comply with a CPS already report their GHG emissions through the GHGRP.

Separately, many companies are independently tracking their GHG emissions and using those emissions inventories to establish climate goals. Though large companies have been tracking GHG emissions from their direct combustion of fossil fuels and use of electricity (i.e. scope 1 and scope 2 emissions) for years, they are increasingly focusing on their indirect, or scope 3, emissions as well. This is particularly relevant in a CPS context as many of the basic manufactured materials covered by the policy would fall within a company's supply chain scope 3 emissions. These supply chain emissions are often an order of magnitude or more greater than a company's scope 1 and 2 emissions. Dozens of American companies have set scope 3 GHG goals, with some of those goals specifically focused on decarbonizing supply chains.

Clean product standard design elements

Policymakers will be faced with a set of key design choices in developing and implementing a CPS. Most of these choices require a balance between the ambition of the policy and the administrative complexity of its implementation. Other design choices can help maintain US manufacturer competitiveness and prevent emissions leakage. Key design elements of a CPS include product coverage, compliance metrics, point of obligation, accounting for imports and exports, use of covered products as intermediate inputs, and flexibility options.

Covered products

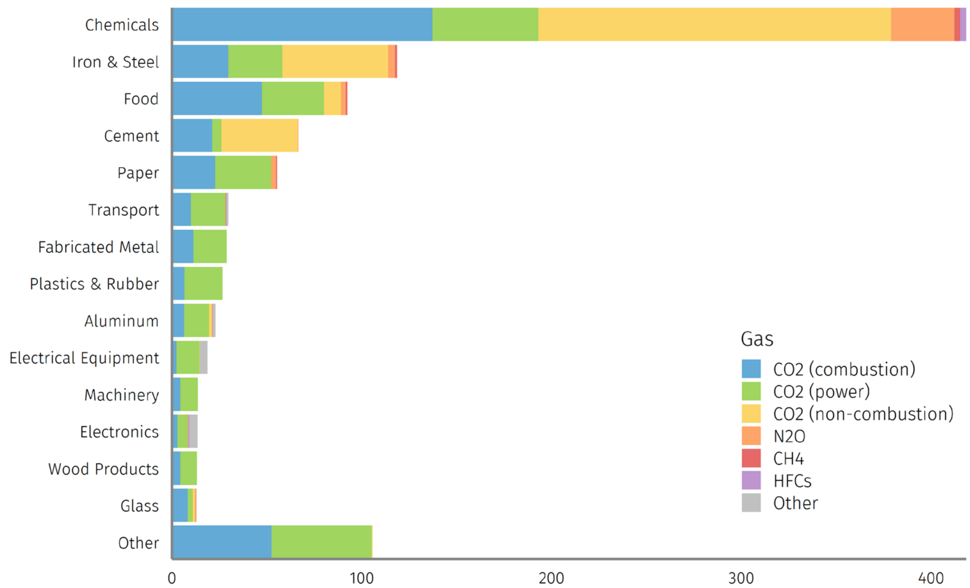
One of the most important decisions to make in the design of a CPS is selecting which products must comply with the standard. The most stringent CPS would cover all manufactured products. Though such a policy would yield the most substantial emission reductions benefits, it would be exceedingly difficult to implement. The manufacturing sector is highly diverse, representing about $6 trillion in output each year, $2.6 trillion of GDP, 250,000 individual firms, and 11.7 million employees paid just under $700 billion annually. Establishing an emissions standard for each type of product coming out of every manufacturing sector would be a monumental undertaking.

In addition to being diverse in terms of its output, the manufacturing sector is also heterogeneous in its GHG intensity. Six major product classes—chemical manufacturing, iron and steel production, cement and concrete production, paper manufacturing, aluminum manufacturing, and glass manufacturing—account for more than 60% of total manufacturing emissions and about 40% of industrial emissions overall (Figure 2). The majority of these emissions come from the combustion of fossil fuels, either on-site at manufacturing facilities or at power plants to generate electricity. But in key manufacturing subsectors, non-combustion or process emissions—emissions that result from chemical reactions in the manufacture of a material—can account for half or more of total emissions.

FIGURE 2

US manufacturing greenhouse gas emissions, 2018[2]

Million metric tons of CO_2e



Source: Rhodium Group analysis

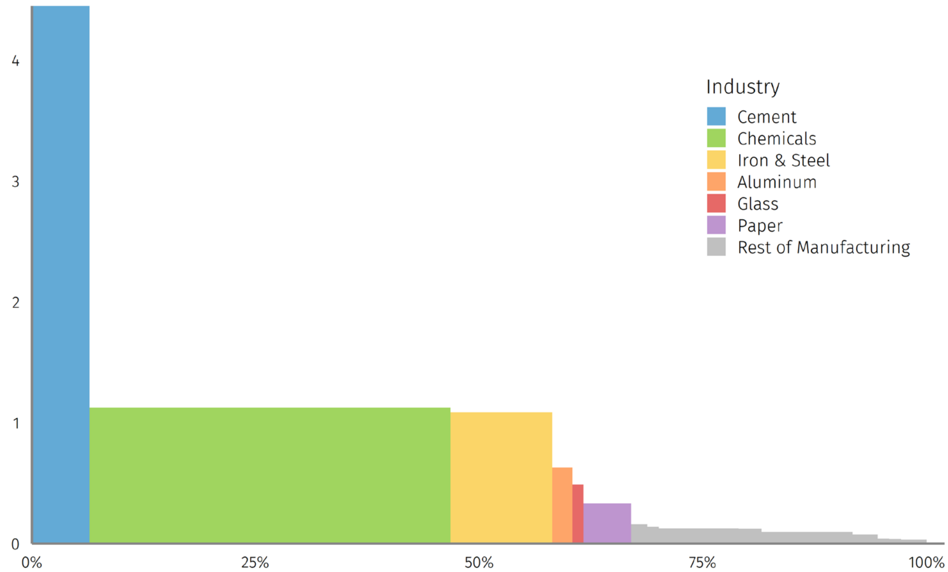
An important concept when considering CPS design is GHG emissions intensity, which normalizes a subsector's GHG emissions by some measure of its production output. GHG intensity can be calculated as a function of physical units (e.g., GHG emitted per tons of steel produced or gallons of petrochemicals produced), but to compare across subsectors with diverse outputs, GHG intensity can also be calculated as a function of the dollar value of output. We calculate subsectoral GHG intensity using this dollar-value basis and arrange subsectors in order of GHG intensity (Figure 3). Cement production is the most GHG-intensive subsector; every billion dollars of cement produced in the US results in more than 4.75 million metric tons of CO_2e emitted into the atmosphere. And, as represented by the x-axis, cement emissions are 6.7% of total manufacturing emissions. Chemical manufacturing is the next most-intensive subsector.

[2] Our definition of manufacturing sectors starts with total industrial emissions and excludes oil and gas systems, petroleum refining, mining, agriculture, construction, substitution of ozone-depleting substances, and liquified natural gas exports.

FIGURE 3

GHG emissions and GHG intensity of manufacturing, 2018

X-axis is percent of total manufacturing emissions by subsector, y-axis is GHG intensity of subsector on a per dollar of output basis



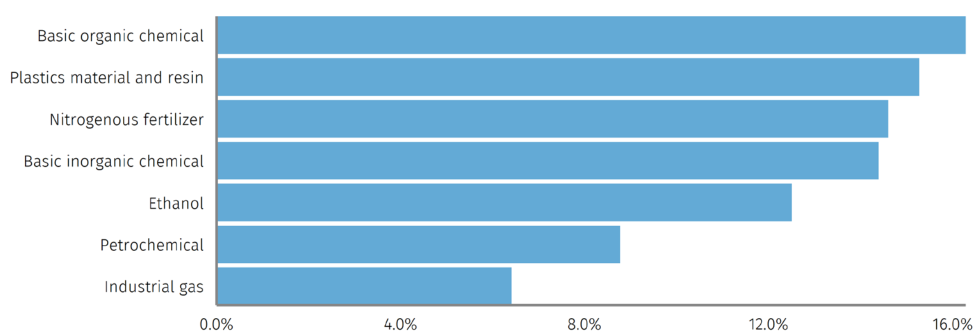
Source: Rhodium Group analysis

The chemical manufacturing subsector represents just under 40% of total manufacturing emissions and is itself quite diverse.[3] Basic organic chemical production,[4] plastic material and resin manufacturing, nitrogenous fertilizer production, and basic inorganic chemical manufacturing[5] each made up about 15-16% of the subsector's emissions in 2012 (Figure 4). Among these producers, nitrogenous fertilizer production, industrial gas production, and basic inorganic chemical production were the most GHG-intensive. By narrowing in on a subset of GHG-intensive products, policymakers can maximize emissions coverage while minimizing how difficult the policy is to implement.

FIGURE 4

GHG emissions shares in the chemical manufacturing subsector, 2012

Share of total chemical manufacturing emissions



Source: Rhodium Group analysis

[3] Our base dataset does not provide subsectoral granularity to examine which specific chemical production processes are contributing to those chemical emissions, but we can use an older dataset to get a rough approximation of production to determine which basic chemicals are driving the most GHG emissions.

[4] Excluding ethanol, cyclic crude, intermediate, and gum and wood chemical manufacturing.

[5] Excluding industrial gases and synthetic dyes and pigments

Compliance metrics

Once policymakers decide which subsectors are covered by a CPS, the next critical decisions are what metric will be used to assess these products and to what entity will they report.

We propose GHG emissions intensity (as previously introduced) as the appropriate method for assessing a product's emissions profile. This is different than traditional point source pollution standards (such as those prescribed in the Clean Air Act) because point source pollution standards set absolute limits on the amount of a pollutant that a facility can emit, which can provide a disincentive for production. By using an intensity metric instead, facilities aren't punished for making more of a material as long as they abide by the established per-unit emissions limit.

Above we discussed GHG intensity as normalized by a dollar-value of output to easily compare and contrast emissions intensity across sectors. For the purposes of a CPS, the intensity limit should be set on a physical unit basis—a set amount of emissions per ton of material produced, for instance. Using monetary units as the basis for the standard could lead to gaming, which using a physical unit avoids.

We suggest calculating GHG intensity on the basis of scope 1 and scope 2 emissions—all direct emissions at the facility plus emissions from electricity used at the facility. This is a narrower scope than a full lifecycle assessment (LCA) of GHG intensity, but it significantly improves the policy's administrative simplicity. Moreover, on a per-ton basis, scope 3 emissions represent a relatively small share of total emissions for basic materials, and complementary policies like a clean fuels standard can help in driving down these emissions.

Policymakers should designate a federal agency to lead the development and implementation of a CPS. The EPA is a natural choice given its experience with the Greenhouse Gas Reporting Program. Each obligated entity reports on an annual basis several pieces of data to the designated federal agency for each class of covered product that it sells:

- Direct emissions (i.e., combustion and process) associated with the production of the basic manufactured material from the manufacturing facility
- Grid electricity purchased by the manufacturing facility associated with the production of the material
- Total amount of material sold, in physical units as designated by the federal agency

The accuracy of these reported data is paramount to the effectiveness of the CPS. Obligated entities must follow established GHG accounting protocols, as promulgated through regulation by the designated federal agency. These reports must be subject to verification checks, and the designated agency should conduct regular facility audits to ensure the validity of the data.

Once the designated federal agency confirms the accuracy of the reported data, the agency can then assess an obligated entity's performance against the established GHG intensity standard. Entities that have lower emissions than the standard receive compliance credits (denominated in tons of CO_2e) that can be banked for future use (i.e., retired in future years to demonstrate compliance). Entities that have higher emissions than the standard face a compliance credit deficit and must secure additional compliance credits to demonstrate adherence to the standard—either by trading with facilities with excess compliance credits or pursuing other compliance pathways. We discuss these mechanics in greater detail later in this report.

Setting standards

The designated federal agency should conduct a baseline assessment to determine current emissions intensities for covered products. Using this baseline, they can establish a path to net-zero GHG intensity for each product by 2050. Interim annual targets should be set on the basis of achievable reductions, and these targets should be subject to regular review and revision.

To establish intensity reduction pathways, the agency should assess a range of emissions mitigation options:

- Industrial electrification
- Fuel switching to low-carbon fuels (e.g., biofuels or electrofuels) for use as a fuel and/or as a feedstock
- Switching to novel, low-carbon production processes to produce the substantially same product with fewer or no process emissions (e.g., low-carbon cement)
- Paired deployment of carbon capture technologies
- Energy and process efficiency improvements

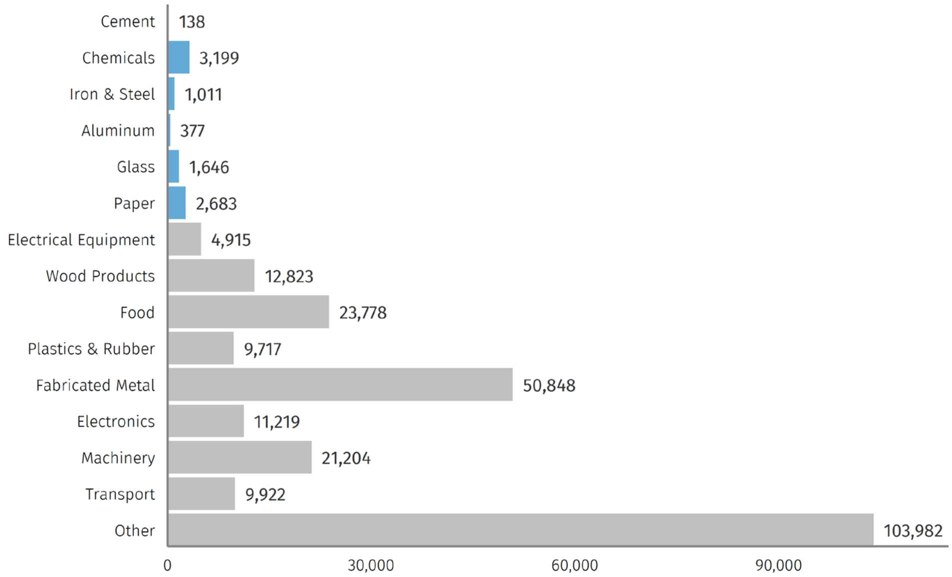
Product demand-side changes like material use efficiency fall outside the scope of a CPS (but could be encouraged by other policies).

In regular review of these targets, the agency should pay special attention to a CPS's interaction with other climate policies. In particular, the agency should review progress on and forecasts of power sector decarbonization (from policies like a clean electricity standard) and ensure industrial reduction pathways are adjusted appropriately. If the power sector is decarbonizing quickly over the near term, GHG intensity reduction requirements could in some cases be met simply by using the cleaner grid electricity. However, this will require a much steeper intensity decline in the later years of the path to net-zero, which is likely not optimal for firms' investment decisions.

Point of obligation

The design goal of a CPS is to cover a substantial share of GHG emissions with relatively low administrative complexity. To achieve this goal, the point of obligation should be as far upstream (that is, as close to the original point of manufacture) of basic materials as is practical. A relatively small number of firms are producing the most GHG-intensive basic materials, especially as compared to less GHG-intensive manufacturing like production of food, machinery, and fabricated metals (Figure 5).

FIGURE 5
Number of firms per manufacturing subsector, 2017
Number of firms in order from greatest to least GHG emissions intensity



Source: Rhodium Group analysis

To achieve the most administratively straightforward approach to a CPS, the point of obligation should be set at the first domestic sale of a basic manufactured good. In most cases, this first sale will be from the material manufacturer to another intermediate manufacturer in a longer supply chain. For steel producers, this may be to another manufacturer that stamps sheets of steel into auto bodies and bumpers; for cement manufacturers, it's likely to be ready-mix concrete makers. A small number of basic manufactured materials may be sold directly to final end users, either from manufacturers or via wholesalers and retailers.

Setting the point of compliance at the first domestic sale is important from an international trade perspective as well. The CPS applies to all covered products sold in the US, not just those produced domestically. We discuss the trade dynamics of GHG-intensive products in greater detail in the next section. In order to be governed by the most permissive World Trade Organization (WTO) rules, which can allow for maximum flexibility in the design of the CPS, the point of obligation needs to be set at the point of first domestic sale for both domestic and imported goods. The act of importing the covered good on its own should not cause a product to come under CPS regulation.[6]

Imports of covered products

Two of the most common issues policymakers encounter when designing policies to decarbonize the industrial sector are concerns about US manufacturing competitiveness and emissions leakage. A US manufacturer of a basic material faces a competitive disadvantage if they must increase the price of their product to cover additional costs of decarbonization while their foreign competitors are permitted to keep using dirtier, cheaper production processes. When faced with a more expensive domestic product and a cheaper foreign option, buyers of these basic materials will opt for the cheaper alternative, all else equal. This dynamic leads to emissions that were once generated in the US instead being emitted by foreign producers—the emissions "leak" across international borders. Facing this situation, domestic producers may opt to move their production facilities to a

[6] Memo from Kyle Danish and A.J. Singletary, Van Ness Feldman, "International Trade Law Implications of the Clean Product Standard"

country with more permissive environmental laws. Both relatively higher prices for materials and this incentive to offshore production harm US manufacturing competitiveness.

A CPS already has some design elements in place to avoid these outcomes. By using a technology-neutral emissions standard rather than mandating that facilities install specific pollution mitigation technologies, a CPS leverages market forces to achieve the emissions standard at the least cost to producers. Moreover, this technology neutrality provides an incentive for manufacturers to innovate and seek ever-cheaper methods of compliance.

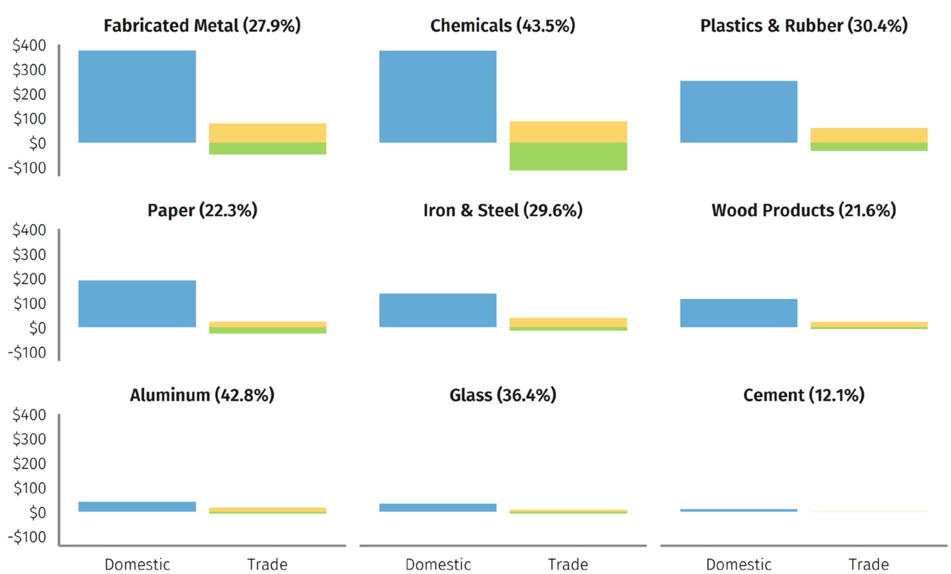
Despite these advantages, a CPS will still increase the cost of production of basic materials in the near term. To avoid competitiveness and leakage issues, the CPS's emission standard should apply to any basic material imported and sold in this country. The OECD estimates that US demand for imports of all intermediate manufactured goods (a more expansive set of materials than discussed for the CPS) resulted in 569 million metric tons of energy-related CO_2 emissions outside the US in 2015 (the most recent data available)—around 45% of total domestic manufacturing emissions. Applying a CPS to some portion of these imports can have a material impact on global GHG emissions and avoid emissions leakage.

Competitiveness and leakage concerns are only meaningful if there is robust foreign trade of the materials under consideration. Though the products vary in degree, all of the GHG-intensive materials discussed feature some dimension of trade exposure, a function of domestic production of materials (in blue) and imports into and exports out of the US (in yellow and green) of these materials (Figure 6). We also calculate a trade exposure metric, which was originally developed as part of the Waxman-Markey climate bill in 2009; higher percentages indicate a product is more trade exposed. Cement faces the least trade exposure of these subsectors, and chemicals faces the most.

FIGURE 6

Domestic production (left) and imports and exports (right) of key subsectors, 2018

Billions of dollars; trade exposure metric labeled in header



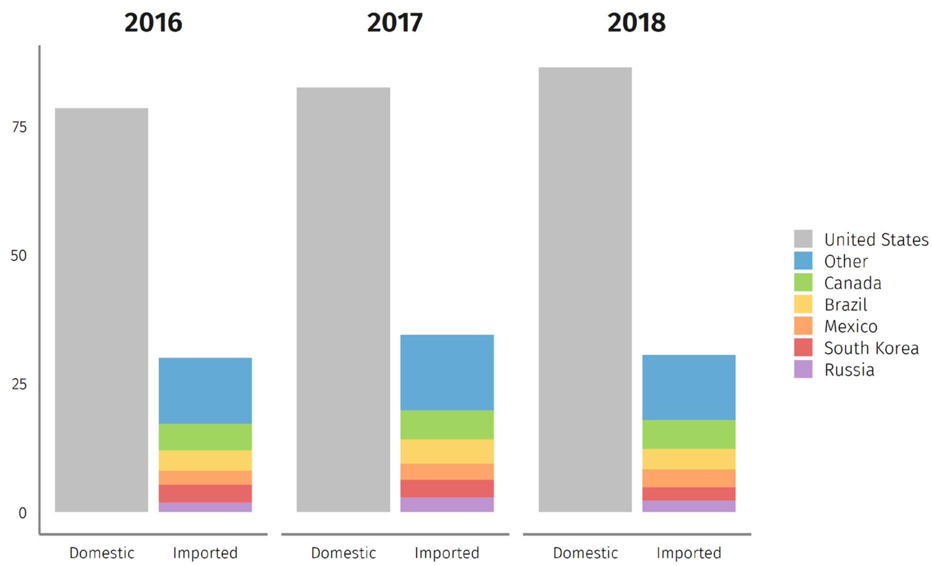
Source: Rhodium Group analysis

Consider US consumption of iron and steel. The US produced 79-86 million metric tons of raw steel annually in 2016-2018 and imported 30-34 million metric tons annually over the same period. These imports were chiefly sourced from Canada and Mexico, our largest trade partners, as well as South Korea and Russia (Figure 7).

FIGURE 7

Iron and steel domestic production and imports by country of origin

Million metric tons of steel products



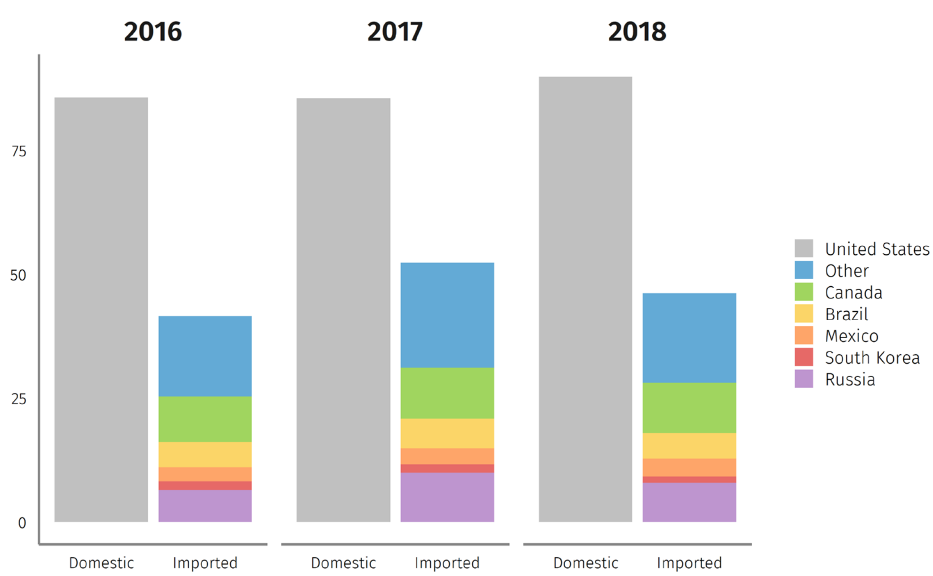
Source: Rhodium Group analysis

The GHGs embodied in this imported steel represented as much as 61% of total GHGs emitted in domestic steelmaking in recent years (Figure 8). By requiring imported materials to adhere to the same standards as domestically produced materials, a CPS can ensure US manufacturers are competing on a level playing field with foreign firms while also reducing the potential for emissions leakage.

FIGURE 8

GHG emissions from domestic steel production and embedded emissions in imports

Million metric tons of CO_2e



Source: Rhodium Group analysis

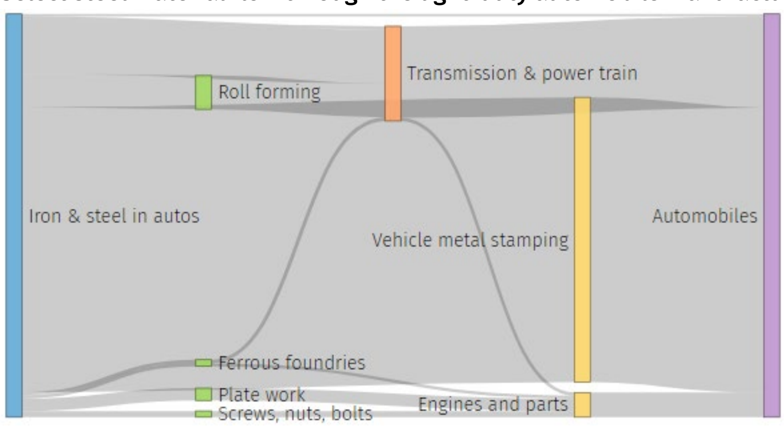
Covered products in final goods

If a CPS covers sales of imported basic manufactured materials, domestic manufacturers with lengthy supply chains could also seek to avoid the higher price of CPS-compliant basic materials by importing products downstream from the basic materials.

For example, the auto industry and its supply chains are highly globalized. Basic materials like steel, plastic, aluminum, and glass can cross borders multiple times from production of those materials through assembly into finished vehicles. Basic materials usually undergo multiple transformations as intermediate inputs before being assembled into a final product that is sold to consumers. Raw steel that is used in auto manufacturing can be first further processed at ferrous metal foundries, roll forming facilities, and plate work facilities. The output from these facilities is subsequently assembled into engines, transmissions, and powertrains. Steel is also stamped into auto bodies, fenders, and bumpers. These components are then assembled into a final product sold to consumers. A fairly modest amount of raw steel flows directly from steel mills to automobile manufacturers; the vast majority proceeds through this supply chain (Figure 9).

FIGURE 9

Select steel material flow through the light-duty automobile manufacturing industry



Source: Rhodium Group analysis

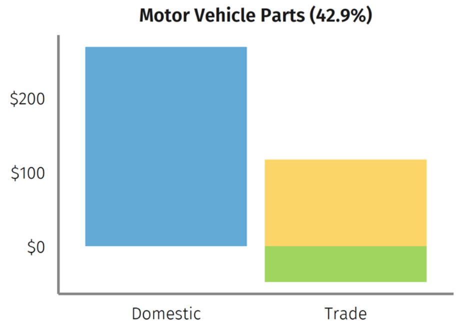
All told, total demand for raw steel in the light-duty car industry and its supply chain equates to about $4.5 billion a year. Similarly, the larger and more steel-intensive light truck and utility vehicles industry demands just over $10 billion in raw steel annually. Given that steel comprises a material portion of vehicle manufacturing costs, these industries would face economic pressure to procure both raw steel as well as steel-intensive components from countries that have relatively cheaper steel production due to the lack of steel emissions standards.

The US produced about $270 billion in motor vehicle parts in 2018, and it imported another $117 billion from foreign manufacturers (Figure 10). Absent a component of the CPS accounting for the raw steel in these imports, the import figure (and associated embedded emissions) could well increase.

FIGURE 10

Domestic production (left) and imports and exports (right) of motor vehicle parts manufacturing, 2018

Billions of dollars; trade exposure metric labeled in header



Source: Rhodium Group analysis

The CPS could be expanded to include a requirement that manufacturers and assemblers of final products be required to demonstrate compliance with CPS emissions standards for any basic materials used throughout their supply chains. As discussed above, many companies are already tracking and setting goals for their scope 3 supply chain emissions; this addition to a CPS is an extension of that approach.

As is often the case with CPS design choices, deciding how to account these upstream materials is a balance between breadth of coverage and administrative complexity. We propose a two-prong test to determine whether a final product should be subject to upstream accounting requirements:

Substantive input

It is only important to cover upstream basic materials when they comprise a substantive share of the overall cost of inputs to the production of a product. An auto manufacturer is unlikely to retool their entire production line because the cost of reflective paint used on a dashboard goes up. But if the cost of raw steel increases, it may make economic sense to change production to take advantage of cheaper steel parts that can be imported from overseas.

To assess the substantiveness of basic materials to a given product, we propose using the Bureau of Economic Analysis's (BEA) industry-by-industry total requirements table. If an industry has a total requirement coefficient of greater than 0.05 for a CPS-covered basic material, that basic material should be designated substantive to production. A coefficient of 0.05 means that the industry requires at least $50 million of a given basic material to produce $1 billion worth of finished products.

Consumer facing

To ease administrative burden, this requirement should be applied to industries whose input is largely final products (i.e., products bought by consumers or the government) instead of those whose input is largely intermediate products (i.e., products bought by other manufacturers to be further transformed or assembled). This test limits the number of firms obligated to track and report supply chain emissions.[7]

[7] An alternative approach is a GHG-added tracking system, akin to a value-added tax, would track incremental GHG emissions embedded in a product at each production stage. This approach is likely to be more administratively complex than the consumer-facing test we propose here.

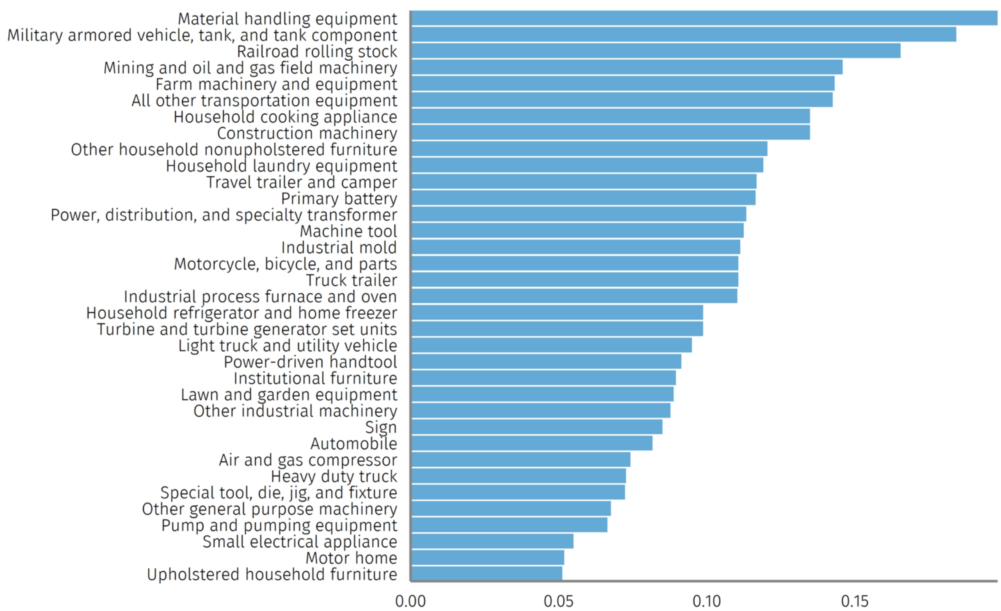
To assess whether a product is consumer facing, we propose using the BEA use of commodities by industry table. If 75% or more of demand for a product comes from final uses and only 25% or less comes from use as an intermediate, a product should be designated as consumer facing.

If a product is both substantively comprised by basic materials and is consumer facing, then the use of basic materials anywhere in the supply chain of that product should be subject to CPS emissions requirements. For example, 35 manufacturing industries would be obligated to demonstrate compliance for any raw steel used throughout their supply chain under these definitions (Figure 11), and five industries would be obligated to demonstrate compliance for any basic organic chemicals used in their supply chains (Figure 12).

FIGURE 11

Downstream industries demonstrating CPS compliance for steel

Total requirement coefficient

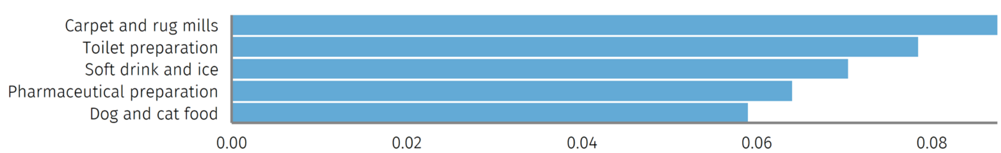


Source: Rhodium Group analysis

FIGURE 12

Downstream industries demonstrating CPS compliance for basic organic chemicals

Total requirement coefficient

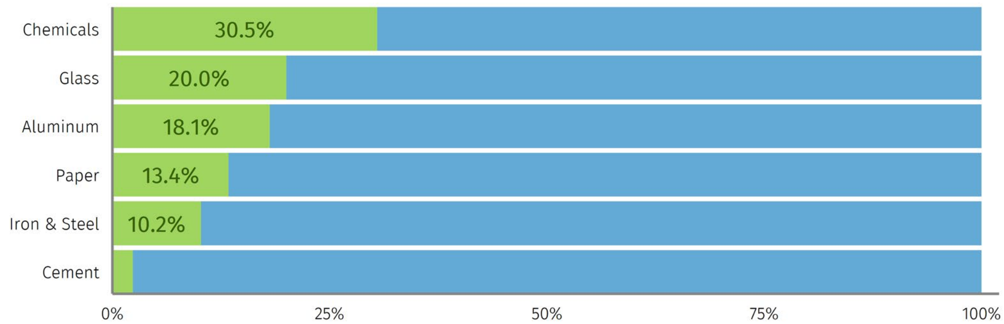


Source: Rhodium Group analysis

Exported products

US manufacturers also produce some basic materials for export to foreign markets. In the six most GHG-intensive subsectors, between 2 and 31% of domestic production is exported (Figure 13). Under a CPS that applies at the first point of domestic sale, basic materials would be subject to emissions limits if they were sold by a producer to a US-based exporter, while materials that are exported directly by the producer would not be subject to emissions limits. This uneven treatment of exports is not optimal; as such, policymakers should choose to either completely include or exclude all exported basic materials from CPS compliance.

FIGURE 13
Exports (green) as a share of domestic value of shipments



Source: Rhodium Group analysis

By opting to cover all exported basic materials under the CPS, policymakers can enhance the emissions reduction potential of the policy by ensuring any material produced in the US doesn't emit more than a set level of GHGs. However, American producers compete for sales with foreign producers in a global market, and requiring CPS compliance can result in more expensive American goods relative to other countries, thus affecting US competitiveness. By instead choosing to exempt all exported basic materials, policymakers may be able to maintain US competitiveness but weaken the overall emissions impact of the policy. Moreover, the WTO may interpret this exemption as an impermissible subsidy by the US to domestic manufacturers and the WTO could force the removal of this exemption.[8]

Trade law on this topic is very much still evolving. The European Union is currently considering design elements of a border-adjusted carbon tax, which may provide some further guidance on how to implement the export side of a CPS. Ultimately policymakers will need to decide on an approach that balances emissions and economic goals while not running afoul of the WTO.

Compliance flexibility options

Policymakers could consider several design elements to increase the flexibility of a CPS, notably credit trading and the introduction of offset and early compliance credits. Adopting these mechanisms could help minimize compliance costs for obligated entities and drive further innovation in compliance strategies.

Credit trading

One appealing attribute of a market-based standard approach like a cap-and-trade program or a clean electricity standard is the tradability of compliance credits. Obligated entities in a CPS could earn compliance credits by doing better than the established intensity level. Entities that do worse than the established intensity level accrue a deficit of credits. Better performers can keep their credits and bank them for compliance in future years, or they can sell them to worse performers. If it is cheaper to buy a compliance credit than to abate a marginal ton of CO_2e within its own operations, an obligated entity will opt to buy the credit (assuming sufficient volume in the credit market). By allowing obligated entities to trade credits in this manner, a CPS minimizes the

[8] Memo from Kyle Danish and A.J. Singletary, Van Ness Feldman, "International Trade Law Implications of the Clean Product Standard"

systemwide cost of compliance with the standards and/or allows for the establishment of more aggressive emission reduction targets.

Though credit trading is a beneficial feature of the CPS, it is not critical to the success of the policy. Particularly in the early years of compliance when emission reduction obligations are smaller, entities will be more likely to be able to satisfy the requirement through low-cost on-site improvements and intrafirm averaging across multiple sites. Therefore, policymakers should first ensure the accuracy and integrity of the GHG reporting procedure as well as credit and compliance tracking infrastructure. Once this process is running smoothly, policymakers can then roll out a trading platform for compliance credits.

Offset credits

In addition to directly reducing emissions attributable to the manufacturing processes of basic materials, policymakers could also allow for offset credits to be used for compliance. These credits would need to come from sources that are not otherwise subject to decarbonization requirements—e.g., they could come from an independent direct air capture (DAC) facility, but not from a power plant with carbon capture where that captured carbon is already being credited toward clean electricity standard compliance. Offset credits would need to be subject to the same rigorous verification procedures as GHG reports from obligated entities, ensuring additionality and permanence of the GHG reduction used to generate the offset.

Early compliance credits

Policymakers could opt to allow for early compliance credits. Under this approach, obligated entities generate CPS compliance credits prior to being subject to a binding GHG intensity cap. For example, if a CPS comes into force in 2025, obligated entities that reduce their GHG intensity before that year could earn compliance credits for such reductions, bank those credits, and use them to demonstrate compliance with CPS caps once they become mandatory. By allowing for early compliance credits, policymakers would provide an incentive for early adoption of GHG reduction approaches, driving down the costs of such technologies due to technological learning. Making these technologies cheaper earlier would translate into lower total compliance costs. Policymakers would need to account for any early compliance credits when designing and reassessing intensity pathways to net-zero.

Walking before running: government procurement and "Buy Clean" requirements

A CPS is one component of a broader suite of industrial decarbonization policies that focus first on government procurement. The US government is the largest single consumer of goods and services in the world, and this large consumption share extends to markets for basic manufactured materials. Taken as a whole, federal, state, and local governments expenditures comprise 29% of total US output of cement and 9% of domestic steel output. As such, governments are uniquely positioned to be early drivers of demand for the low-GHG versions of these products.

Congress could first adopt a requirement that any basic manufactured materials directly procured by the federal government must meet established GHG intensity standards. This requirement could then be extended to any project receiving federal funding by establishing "Buy Clean" requirements.

In addition to providing early demand for low-GHG products, adopting a government procurement policy can also help pilot data collection and reporting processes that can eventually be used in a CPS. Such government procurement policies require manufacturers and importers to track and report the same data as is needed in a CPS. By introducing these reporting requirements as part of an opt-in policy for manufacturers, the federal government can find best practices and pitfalls prior to rolling requirements out for all market participants.

Tackling industrial decarbonization with a CPS

Reducing GHG emissions in the industrial sector will be increasingly important in any effort to achieve deep decarbonization. If US policymakers continue to favor sectoral performance standards over economy-wide carbon pricing, they will need policies that include industry. A CPS is a technology-neutral, market-based approach to address industrial emissions. It is administratively simple relative to other possible industrial policies, and the tradability of its credits can minimize the total cost of achieving reductions. The policy can also be designed to protect US competitiveness and avoid emissions leakage.

This report introduces the concept of a CPS, but additional work will be critical to moving from theory to practice. Future analysis can inform the appropriate product levels for establishing a CPS as well as potential emission reduction pathways for these products. Additional work can also characterize the expected costs of these reductions. Policymakers will also want to convene diverse sets of stakeholders to pressure-test the key elements of the policy. But the CPS framework outlined here presents a useful starting point for this continued refinement.

Disclosure Appendix

This nonpartisan, independent research was with support from Breakthrough Energy. The results presented in this report reflect the views of the authors and not necessarily those of the supporting organization.

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