



Size Thresholds for Greenhouse Gas Regulation Who Would Be Affected by a 25,000-ton CO₂ Emissions Rule?¹

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Introduction

One of the first questions posed when new regulations of any kind are being considered is, who is regulated? Lack of clarity on the point of regulation can lead to incorrect assumptions and policy decisions. Opponents of action on climate change have warned that jobs might be lost to a cap-and-trade system that encompasses small businesses. This concern is especially prevalent in the manufacturing sector, where most facilities currently do not measure emissions, and are unsure how they would be affected by a cap-and-trade system. It is critical, therefore, to understand what type and size of business entities might be subject to regulation, both to allay concerns and to design policy that can assist those most affected.

Various legislative proposals have sought to target only “large emitters,” commonly measured as those facilities whose annual emissions exceed a certain threshold. The presumption is that this threshold essentially defines a large emitter, and that it may represent the optimal balance between the scope of a cap-and-trade system and the potential burden such a system may place on business owners. In Washington, a range of policies have been proposed, including regulations that would affect only those facilities with annual emissions at threshold levels of 10,000 or 25,000 metric tons per year of carbon dioxide or its greenhouse gas equivalent.²

This is not only a matter of conceiving efficient public policy; opponents of action on climate change have warned that jobs might be lost to a cap-and-trade system that regulates small businesses. Therefore, it is critical to understand what type and size of business entities might be affected, both to allay concerns and design policy to assist those who would experience the most impact. This policy brief explores the effects of a 25,000-ton requirement.

Data on fuel consumption per employee used in this policy brief to derive total annual CO₂ emissions per employee are from the most recent Manufacturing Energy Consumption Survey (MECS) from the Energy Information Administration (EIA). Data on the number of facilities and employees in each industry, used with fuel consumption data to estimate total annual emissions per facility, are from the U.S. Census Bureau’s Economic Census.

¹ This Policy Brief was made possible by a grant from Environmental Defense Fund. It serves as an abbreviated update to the Nicholas Institute Policy Brief, “Size Thresholds for Greenhouse Gas Regulation: Who Would Be Affected by a 10,000-ton CO₂ Emissions Rule?” first published in 2007, which was intended to identify the impact of a potential 10,000-ton-per-year CO₂ reporting threshold on three sectors of the U.S. economy, with particular attention given to the manufacturing sector. To extend our previous analysis, this Policy Brief uses a 25,000-ton requirement to identify at a national level who is in, and who is out, of regulation in three U.S. sectors: electric power plants, commercial buildings, and manufacturing industries. A complete update of the 2007 report, with state-specific examples and additional analysis, will be forthcoming over the next several weeks. The author can be reached at freys@comcast.net.

² “Ton” and “metric ton” are used interchangeably in this report (1 metric ton = 1,000 kg = 2,204.62 lbs.).

Summary of Results

Electric power plants

One-half of power plants that use fossil fuels to generate electricity would emit more than 25,000 tons of CO₂ per year. Power plants are concentrated on the high end of the spectrum of CO₂ emissions per facility. For example, a small coal-fired unit with a generating capacity of 25 megawatts (MW) would exceed 25,000 tons of CO₂ emissions in 45 days at full output.³ However, there is a large number of even smaller generating units around the country, often used only intermittently, that are not likely to emit more than 25,000 tons of CO₂. Data gathered by the U.S. Department of Energy and the Environmental Protection Agency indicate that in 2005, some 2,834 generating plants in the country used fossil fuels (coal, gas, or oil) as their primary fuel.⁴ Almost 52% of these plants emitted more than 25,000 metric tons of CO₂ in that year. The emissions were so concentrated among the larger power plants that these 1,468 plants accounted for 99.78% of CO₂ emissions from the fossil fuel power sector.⁵

Table 1. The scope of a 25,000-ton reporting threshold in power generation.

Total number of fossil fuel-generating plants in 2005	Total annual CO ₂ emissions (million tons)	Number of plants above 25,000 tons	Percentage of plants above 25,000 tons	CO ₂ reported from threshold plants (million tons)	Percentage of generation CO ₂ emissions from threshold plants
2,834	2,667	1,468	51.8%	2,661	99.78%

Source: U.S. EPA, 2005 data from eGRID2007, Version 1.1, Plant File.

Farms and commercial buildings

On the other end of the spectrum we find most farms and commercial buildings, which generally have no large boilers or other large sources of fossil fuel combustion. The exceptions are some large universities and hospitals that run large boilers for central heat. A 25,000-ton threshold would not affect the vast majority of farms, and the same is true for commercial buildings that are not centers of large-scale manufacturing.

Manufacturing

In the manufacturing sector, the bulk of CO₂ emissions come from a very small portion of all manufacturing facilities, but due to the large number of facilities and differences across subsectors of industry, there is reason to take a closer look. The manufacturing sector spans the entire spectrum from very low to very high emissions per facility, and it is the area with the greatest need for clarification on who is, and who is not, affected by a 25,000-ton threshold for regulation.

The analysis presented here confirms that a 25,000-ton threshold for inclusion in an emissions cap would cover approximately 83% of manufacturing sector emissions while affecting only 1.3% of manufacturing facilities, mostly large factories and facilities with a large number of employees (Table 2).

³ Assuming heat rate of 10,000 Btu per kWh: (250 mill. Btu/hour) x (25.74 kg carbon per mill. Btu) x (44/12 mass ratio CO₂/C) = 23.6 metric tons/hour. 10,000 tons/23.6 tons per hour/24 hours per day = 17.7 days.

⁴ Here, a power plant refers to a single plant that may be, and often is, made up of several boilers and several generators of varying capacity. A plant as a whole may exceed the 25,000-ton threshold while some, or all, generating units of the plant may remain within the threshold individually.

⁵ Many of the plants emitting less than 25,000 tons of CO₂ were either not operating in 2005 or operating at an uncharacteristically low level. The results shown here represent actual unit emissions in the year 2005, and not necessarily typical emissions for each unit.

Table 2. The scope of a 25,000-ton reporting threshold in manufacturing.

Total number of facilities in 2002	Annual CO ₂ emissions (1,000 tons)	Number of facilities above threshold	Percentage of facilities above threshold	CO ₂ reported (1,000 tons) by threshold facilities	Percentage of industry CO ₂ emissions from threshold facilities
350,075	851,677	4,724	1.3%	702,907	82.5%

Industry Summaries

Using information from MECS, which organizes fuel consumption data by industry according to the North American Industry Classification System (NAICS), Table 3 provides an overview of results for all manufacturing industries covered in this report, listing industry designations, the number of facilities and total CO₂ emissions in each industry, size thresholds for reporting, percentages of facilities reporting, and the share of total emissions reported for each industry. Thresholds are based on the number of employees at facilities. Facilities larger than the threshold estimated for each industry are assumed to be included in the cap.

Table 3. All available results for a 25,000-ton threshold.

NAICS Code	Industry	Total number of facilities	Annual CO ₂ emissions (1,000 tons)	Threshold size of firms reporting (employees)	Percentage of facilities reporting	Percentage emissions reported
311	Food	27,898	50,890	>1,000	0.9%	45%
311221	Wet corn milling	61	14,656	>50	54.1%	99%
[31131x]	"Sugar"	87	4,984	>100	50.6%	92%
311421	Fruit & vegetable canning	782	2,062	>1,000	0.4%	11%
312	Beverage and tobacco	3,017	4,571	>500	1.9%	59%
[3121xx]	"Beverages"	2,903	3,336	>500	1.3%	51%
[3122xx]	"Tobacco"	114	1,235	>250	18.4%	87%
313	Textile mills	3,919	6,590	>500	2.1%	38%
314	Textile product mills	7,270	1,759	>1,000	0.1%	13%
315	Apparel	13,041	913	none	0.0%	0%
316	Leather and allied products	1,530	212	none	0.0%	0%
321	Wood products	17,178	4,244	none	0.0%	0%
321113	Sawmills	3,807	959	none	0.0%	0%
[32121x]	"Veneer, plywood, etc."	1,916	2,260	none	0.0%	0%
[3219xx]	"Other wood products"	10,940	793	none	0.0%	0%
322	Paper	5,501	58,475	>250	7.0%	86%
322110	Pulp mills	32	1,703	>100	68.8%	99%
323	Printing and related activities	37,532	2,504	none	0.0%	0%
324	Petroleum	2,262	280,200	>50	18.7%	98%
324110	Petroleum refineries	198	254,600	All	100.0%	100%
325	Chemicals	13,189	211,600	>100	14.6%	87%
325182	Carbon black mfg	25	4,900	>50	80.0%	100%
325188	All other basic inorganic chemicals	617	7,200	>50	22.0%	88%
325192	Cyclic crude & intermediate mfg	39	2,800	>100	33.3%	93%
325199	All other basic organic chemical	688	65,700	>50	42.3%	98%
325211	Plastics material & resin mfg	688	49,400	>100	23.1%	94%
325212	Synthetic rubber mfg	157	2,400	>100	17.2%	91%
325311	Nitrogenous fertilizer mfg	143	10,156	>50	18.9%	98%

NAICS Code	Industry	Total number of facilities	Annual CO ₂ emissions (1,000 tons)	Threshold size of firms reporting (employees)	Percentage of facilities reporting	Percentage emissions reported
325312	Phosphatic fertilizer mfg	44	1,900	>100	40.9%	97%
[32541x]	"Pharmaceuticals and medicines"	1,800	4,516	>1,000	2.5%	37%
325412	Pharmaceutical preparation	901	3,202	>1,000	3.4%	50%
326	Plastics and rubber products	15,487	7,678	none	0.0%	0%
327	Nonmetallic mineral products	16,653	63,907	>100	6.6%	92%
[32721x]	"Glass and glass products"	2,261	8,128	>250	6.5%	74%
327211	Flat glass mfg	36	2,759	>100	86.1%	99%
327310	Cement mfg	246	30,580	>50	48.8%	92%
327410	Lime mfg	77	9,461	All	100.0%	100%
327993	Mineral wool mfg	304	2,139	>100	17.4%	89%
331	Primary metals	5,188	119,000	>250	9.1%	89%
331111	Iron & steel mills	373	91,000	>250	28.4%	98%
331112	Ferrous alloys	24	800	>50	50.0%	89%
[3312xx]	"Steel products from purchased steel"	666	1,273	none	0.0%	0%
[33131x]	"Alumina and aluminum"	592	11,300	>250	13.2%	89%
[3314xx]	"Nonferrous metals, except aluminum"	1,021	4,300	>250	6.3%	59%
[3315xx]	"Foundries"	2,512	7,600	>500	4.1%	51%
331511	Iron foundries	619	4,900	>250	11.1%	68%
331521	Aluminum die-casting foundries	295	849	>1,000	0.7%	25%
331524	Aluminum foundries, except die-casting	542	743	>1,000	0.2%	8%
332	Fabricated metals	62,176	11,811	none	0.0%	0%
333	Machinery	28,239	4,717	none	0.0%	0%
334	Computers and electronics	15,813	3,601	none	0.0%	0%
334413	Semiconductor & related device mfg	1,032	1,114	none	0.0%	0%
335	Electrical equipment, appliances,	6,481	2,948	none	0.0%	0%
336	Transportation equipment	12,579	12,738	none	0.0%	0%
337	Furniture and related products	22,524	1,557	none	0.0%	0%
339	Miscellaneous	32,598	1,761	none	0.0%	0%
	Total manufacturing	350,075	851,677		1.3%	82.5%

Some generalizations can be derived from this manufacturing analysis to highlight which industries are likely to be affected by a 25,000-ton emissions regulation, and which are not. For example, pharmaceutical preparation manufacturers (NAICS Code 325412) are largely unaffected. With over 900 facilities throughout the U.S., only 31 plants would be expected to fall under a 25,000-ton CO₂ regulation requirement. Those 31 facilities represent 50% of that industry's total emissions, but this industry overall is responsible for only about 0.37% of all manufacturing emissions.

Flat glass manufacturing, on the other hand, is a relatively small yet energy-intensive industry which will be affected by a 25,000-ton CO₂ policy. There are 36 flat glass facilities in the United States, and the 31 plants that have more than 100 employees would be expected to exceed 25,000 tons of CO₂ emissions per year. These 31 plants account for 99% of the industry's emissions but only 0.32% of all industrial CO₂ emissions.

Table 4 shows the percentage of each industry that is expected to be affected by a 25,000-ton requirement.

Table 4. Percentage of facilities expected to fall under a 25,000-ton emission regulation.

No facilities	<1% of facilities	1%–5% of facilities	5%–10% of facilities	10%–30% of facilities	30%–60% of facilities	60%–90% of facilities	All facilities
Apparel							
Leather and allied products				Iron foundries			
Wood products				Alumina and aluminum	Cyclic crude & intermediate mfg		
Sawmills	Textile product mills		Nonferrous metals, except aluminum	Synthetic rubber mfg	Phosphatic fertilizer mfg	Pulp mills	
Printing and related activities	Aluminum foundries	Beverages	Glass and glass products other than flat glass	Mineral wool mfg	Basic organic chemical	Carbon black mfg	Petroleum refineries
Plastics and rubber products	Fruit & vegetable canning	Textile mills	Paper, other than pulp mills	Tobacco	Cement mfg	Flat glass mfg	Lime mfg
Steel products from purchased steel	Food	Pharmaceuticals and medicine		Nitrogenous fertilizer mfg	Ferroalloys		
Fabricated metals				Basic inorganic chemicals	Sugar		
Machinery				Plastics material & resin mfg	Wet corn milling		
				Iron & steel mills			

CO₂ Emissions Are Concentrated Among Largest Facilities

The bulk of emissions are generally concentrated with the very largest manufacturing facilities in each industry. To fully explain why emissions are so heavily concentrated, at 83% of emissions among only 1.3% of facilities, it is helpful to look at the relationship among some variables that affect this outcome:

1. The number of employees per facility;
2. Energy use per employee, which is the product of:
 - 2a. Energy use per unit of production (energy productivity);
 - 2b. Unit production per employee (manufacturing productivity);
3. Carbon content of the energy used on-site (not purchased electricity).

Clearly, the consumption of energy in any given industry grows with the size of operations. Greater employee numbers generally mean greater emissions. However, there are more specific reasons for facility emissions to be higher at large facilities. Increased facility size often allows for improved productivity in manufacturing, which means higher economic output per unit of energy (variable 2a declines) and higher economic output per employee (variable 2b rises). If these variables moved proportionately in opposite directions, the energy use per employee would be constant, and a larger facility would not necessarily contribute proportionately more emissions.

Large facilities tend to capitalize on increased efficiency to increase production, however, increasing their total output. The competitive advantage of combined improvements in production efficiency (increased output per worker) and energy efficiency (causing lower cost per unit of output) normally lead to accelerated production. As a result, relative to smaller facilities, emissions per unit of output are lower, but emissions per employee will often be much higher because of the relative acceleration of production. In other words, the additional emissions from

increased output tend to exceed the reductions in emissions from increased unit efficiency. To further augment the contrast, very large manufacturing facilities tend to be few in numbers compared to the large number of smaller facilities. The combined overall effect is the concentration of industry emissions in the hands of a few large facilities.

Another reason for CO₂ emissions to be concentrated on large manufacturing facilities lies in the nature of industries. Most CO₂ emissions in industry come from the combustion of fossil fuels, which is the only source quantified in this report. This relates to the variable of carbon content of energy used on-site (variable 3 above). Most small manufacturers simply do not burn vast amounts of fuel on-site (although electricity consumption can be substantial). By the time a manufacturing facility is using very large amounts of coal, oil, and natural gas, it tends to be a large facility. A simple way to conceive of the difference is as follows: if the facility has a smokestack, it will probably be required to account for its emissions under a 25,000-ton reporting scheme. If the facility has fewer than 50 employees, and no smokestack, it will be virtually guaranteed not to be included in any reporting requirement, regardless of what the industry may be. The vast majority of manufacturing industries are not expected to cross a 25,000-ton reporting threshold until the employee count is in the hundreds, and for a large number of industries, that threshold is never crossed.

Table 5. At what size may a facility reach a 25,000-ton threshold?

Size of facility (employee numbers)	Examples of industries affected	Percentage of facilities affected
No threshold identified	Printing, plastics and rubber products, steel products from purchased steel, fabricated metals, machinery, semiconductors and related devices, computers and electronics, electrical equipment and components, appliances, transportation equipment, furniture, wood products, apparel, and leather goods.	0%
>1,000	Pharmaceuticals and medicine, aluminum foundries, textile product mills, most food manufacture, including fruit and vegetable canning.	Under 5% (ranges from .1% to 3.4%)
>500	Beverages, textile mills.	Under 5% (ranges from 1.3% to 2.1%)
>250	Tobacco, paper (except mills), glass and glass products other than flat glass, iron- and steel mills, non-ferrous metals, and iron foundries.	Under 30% (ranges from 6.3% to 28.4%)
>100	Paper mills, sugar production, various chemicals such as plastics, resins, synthetic rubber, and phosphatic fertilizer, flat glass, and mineral wool.	Under 90% (ranges from 6.6% to 86.1%)
>50	Petroleum (except refineries), various chemicals such as basic organics and inorganics, and nitrogenous fertilizer, cement manufacturing, and ferroalloys.	Under 90% (ranges from 18.7% to 80.0%)
All facilities reporting	Petroleum refineries and lime manufacturing.	100%

Table 5 reveals how a 25,000-ton reporting threshold would primarily target the largest emitters, whether those are energy-intensive industries that are affected regardless of size, such as refineries, or less energy-intensive industries that are only affected once their physical and economic scale has become quite significant, such as transportation manufacturers. These values are broad approximations based on average emissions among facilities within each of the indicated size ranges.



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