

Greenhouse Gases 101

Kristina Alexander



Credit: Gerald Simmons

Arguments over greenhouse gas emissions show up in published court opinions beginning in 1990 and continue to the present, including a Supreme Court case issued June 30, 2022. This article gives a summary overview of the regulation of greenhouse gases in the United States and encourages the exploration of the issue in depth from the myriad reputable sources.

Initial Greenhouse Gas Legislation

In 1978 the U.S. Congress enacted the “National Climate Program Act,” in part because Congress found “an ability to anticipate natural and man-induced changes in climate would contribute to the soundness of policy decision.”¹ The act directed studies and agency attention, and set up

5-year program to assess “the effect of climate on the natural environment, agricultural production, energy supply and demand, [and] land and water resources” among other things. While Congress was concerned about changes in the climate, greenhouse gases were not mentioned.

A search of a database of U.S. statutes found the term *greenhouse gas* was first used in U.S. public laws in 1987 in a State Department appropriations act finding U.S. policy should seek to “increase worldwide understanding of the greenhouse effect and its environmental and health consequences” which would include “slowing the rate of increase of concentrations of greenhouse gases in the atmosphere in the near term; and stabilizing or reducing atmospheric concentrations of greenhouse gases over the long term.”²

What Gases Are Greenhouse Gases?

While many gases are identified as Greenhouse Gases (GHGs), the most important ones are: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These gases are emitted by natural and manmade sources, albeit not in equal quantities. Some artificially-developed gases, or synthetic gases, also are identified as GHGs. These include fluorinated gases (F-gases) such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.³ Also, synthetic gases identified as Ozone-Depleting Substances (ODS), such as chlorofluorocarbons (CFCs) which were common in aerosols, also act as greenhouse gases.⁴

When ODS were banned in the late 1980s, fluorinated gases frequently took their place in products. While F-gases have not been found to deplete the ozone layer, they still act as greenhouse gases. According to the Environmental Protection Agency (EPA), the federal agency with the primary role in regulating GHGs in the United States, in 2009, six gases, including three F-gases, when combined are “the root cause of human-induced climate change,” and it identified these six as “well-mixed greenhouse gases.”⁵

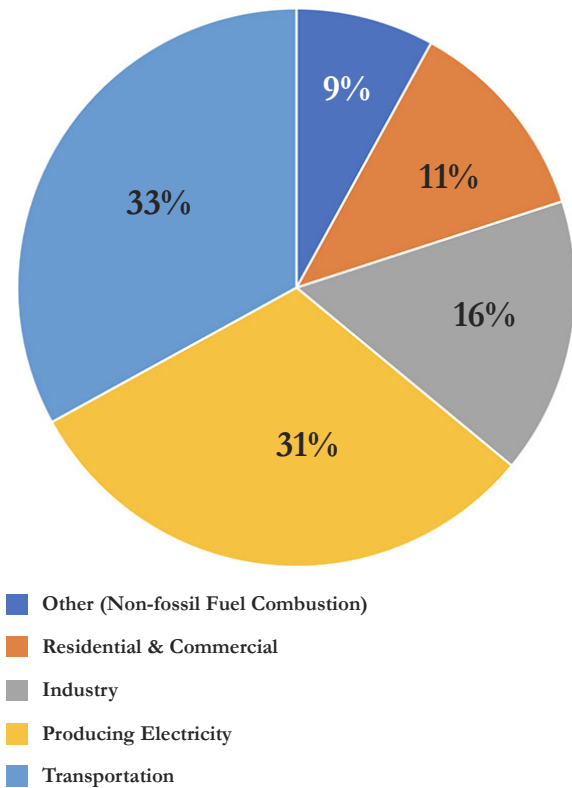
How Did They Get the Name?

They are called greenhouse gases because once released into the atmosphere they act to insulate the earth. Instead of infrared energy escaping from earth into space, it is absorbed by GHGs, leading to a phenomenon first known as *global warming*, but now more generally termed *climate change*.⁶

The impact of a GHG varies. According to the European Union’s European Environment Agency, F-gases can have a greenhouse effect up to 23,000 times more powerful than the same amount of CO₂. However, F-gases are emitted in far smaller quantities than is CO₂. One reason GHGs have different impacts is that GHGs stay in the atmosphere for different durations – from 10 years to 1,000s of years depending on the gas.

The method scientists use to compare how much of a threat each GHG poses is known as the Global Warming Potential (GWP). One court described the GWP as “the tool preferred by leading scientists for analyzing the effects of greenhouse gases.”⁷ That method uses carbon dioxide – the biggest player among GHGs – as a baseline for the comparison. According to the EPA, carbon dioxide makes up to 79% of GHGs emitted from human activities. The EPA describes the GWP as “a measure of how much

2020 U.S. Carbon Dioxide Emissions, By Source



energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide.”⁸ That given period of time is 100 years. For example, methane over 100 years has a GWP of between 27 and 30, according to the EPA. According to other sources, methane’s GWP is 34 which means a ton of methane during 100 years “trap[s] 34 times more heat than 1 [ton] of CO₂.”⁹ The GWP for nitrous oxide (yes, that is laughing gas) is 273, according to the EPA, and the agency says that F-gases and ODS can have GWPs in the “thousands or tens of thousands.”

Laws About GHGs

In 1990, Congress amended the Clean Air Act to address the problem of ODSs, but was silent on GHGs.¹⁰ In 1992, Congress directed the Secretary of the Department of Energy to produce a report comparing “alternative policy mechanisms for reducing the generation of greenhouse gases” including caps on GHG generation and “federal standards for energy efficiency for major sources of greenhouse gases, including ... power plants, industrial processes, automobile fuel economy, appliances, and buildings, and for emissions of methane.”¹¹

Thus, GHGs eventually were recognized by Congress which used its authority to set objectives such as in the Biomass Research and Development Act of 2000, which had a goal of converting biomass into biofuel to offer “near-zero net greenhouse gas emissions.”¹² However, Congress did not set emission limits on GHGs, despite the unanimous ratification by Senate in 1992 of the international treaty signed by President George H.W. Bush committing to reduce GHGs.¹³

Science and the Courts

Just as Congress has not directly required GHG reduction, the regulatory path for controlling GHGs is not a straight line. Consider, for example, the story of hydrofluorocarbons, an F-gas. Hydrofluorocarbons were developed to replace CFCs because they did not damage the ozone layer. The EPA put them on a regulatory list of safe substitutes for CFCs in 1994. However, hydrofluorocarbons were found to have such high GWPs that in 2015 the EPA placed them on the list of ozone depleting substances, identifying them as unsafe substances. This change did not go over well with manufacturers of hydrofluorocarbons, who sued. The manufacturers succeeded in getting a federal judge (now-Supreme Court Justice Brett Kavanaugh) to reject that the EPA had the authority to make manufacturers replace those gases with safer gases.¹⁴ However, then-Judge Kavanaugh upheld the EPA decision to place hydrofluorocarbons on the list of ODS.

GHGs eventually all mix together in the atmosphere, regardless of whether the source is cow or coal-fired power plant. When it comes to CO₂, the EPA says the primary source of that pollutant is transportation, which accounts for 33% of all CO₂ emissions. Close second is electricity production, which accounts for 31%. A general category the EPA describes as “industry” contributes 16%, and the remaining emissions arise from residential and commercial (11%) and other (9%). It is a complicated mix. (See chart, p. 4.)

The fact that GHGs are ubiquitous has proved troublesome for plaintiffs seeking to limit GHG emissions. In order to bring a claim before a court, a plaintiff must be able to establish “standing,” which generally speaking, means showing there is an actual or imminent injury, that the injury is traceable to the defendant, and that the court case could fix the injury. This can be difficult when alleging that specific emissions from a specific source caused a

specific injury to the plaintiff when those gases are known as “well-mixed” and the harm is to the entire world. But the link to injury is an important legal standard. As put by one judge, a causal link between the injury and the ability of a court to fix the injury is necessary when asserting harm from GHGs, otherwise lawsuits could come from “anyone with the wit to shout ‘global warming’ in a crowded courthouse.”¹⁵

In that case from 1990, the plaintiffs argued that in order to avoid catastrophic injury to the planet automobile fuel efficiency requirements should be set higher. The divided court, which included future Supreme Court Justice Ruth Bader Ginsburg, disputed whether harm to the world amounted to standing. While the Notorious RBG and one other judge found standing existed for the environmental plaintiff, a dissenting judge expressed problems finding that slightly less fuel efficient cars – 26.5 mpg rather than 27.5 mpg – could be linked to the injury: “the increase in greenhouse gases that the ... decision can be expected to generate is so small a contribution to the quantum necessary to produce the projected catastrophe.”¹⁶

Almost 20 years later in 2007, the Supreme Court, on which Justice Ginsberg now sat, held the Commonwealth of Massachusetts had standing to bring climate change claims against the EPA, based on the agency’s refusal to regulate vehicle emissions; the fact that the harms were widely shared did not diminish the injury to Massachusetts.¹⁷ In that case, the EPA was sued for denying a petition to restrict vehicular emissions, finding no specific congressional mandate directing the agency to regulate GHGs, as compared to the one for ODSs.¹⁸ The Court held that the EPA should not have denied the petition: the Clean Air Act allowed the EPA to regulate fuel rates for new vehicles if it found that emissions contributed to climate change.

However, the Supreme Court has not found that the EPA may use the Clean Air Act in every situation to restrict GHG releases. For example, the EPA tried to use the act to require permits for stationary sources (i.e. not vehicles) based solely on GHG emissions. In 2014 the Supreme Court found that the Clean Air Act did not stretch to add permittees under that circumstance.¹⁹ However, the Court did approve EPA-required best practices to limit the production of GHGs by sources for which the Clean Air Act already required permits.

On June 30, 2022, the Supreme Court refined that position in *West Virginia v. EPA*. That case challenged an



Credit: Eric Schmuttenmaer

EPA program designed to achieve the “best system of emission reduction” of GHGs from power plants in part by shifting power production away from coal-fired power plants. EPA set GHG limits that the Court described as being so “strict” that existing coal plants could not achieve them. Under the EPA plan, those companies would have to build new facilities, perhaps using different fuel. The Court held EPA’s plan was not backed by clear congressional authority, and therefore, the plan was rejected.

Conclusion

Thus, it took decades to define and identify GHGs. While they are well-defined now, including the harm each gas causes, Congress has yet to put limits on their release. And where the EPA stepped in to regulate GHGs, many of those efforts to limit emissions have been rejected by courts. 🐦

Kristina Alexander is the Sr. Research Counsel at the Mississippi-Alabama Sea Grant Legal Program and is Editor of Water Log.

Endnotes

- 92 Stat. 601 (1978).
- Pub. L. 100-204 (1987).
- EPA, *Overview of Greenhouse Gases*.
- European Union, *Protecting the Ozone While Also Preventing Climate Change* (Aug. 9, 2021).
- 74 Fed. Reg. 66496, at 66516, 66537 (Dec. 15, 2009) (those gases being: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride).
- The Conversation, *Explainer: Hydrofluorocarbons Saved the Ozone Layer so Why Are We Banning Them?* (Nov. 2, 2017).
- Mexichem Fluor, Inc. v. Environmental Protection Agency*, 866 F.3d 451, 463 (D.C. Cir. 2017).
- EPA, *Overview of Greenhouse Gases*.
- Explainer: Hydrofluorocarbons Saved the Ozone Layer so Why Are We Banning Them?*
- Pub. L. 102-486, 106 Stat. 3002 (1992).
- Pub. L. 106-224; 114 Stat. 428 (2000).
- See Massachusetts v. EPA*, 549 U.S. 497, 509 (2007) (referring to the United Nations Framework Convention on Climate Change).
- Mexichem Fluor, Inc. v. Environmental Protection Agency*, 866 F.3d 451 (D.C. Cir. 2017).
- City of Los Angeles v. National Highway Traffic and Safety Association*, 912 F.2d 478, 484 (D.C. Cir. 1990).
- City of Los Angeles v. National Highway Traffic and Safety Association*, 912 F.2d 478, 484 (D.C. Cir. 1990).
- Massachusetts v. EPA*, 549 U.S. 497 (2007).
- 68 Fed. Reg. 52922, 52926 (Sept. 8, 2003) (“Congress has understood the need for specially tailored solutions to global atmospheric issues, and has expressly granted regulatory authority when it has concluded that controls may be needed”).
- Utility Air Regulatory Group v. EPA*, 573 U.S. 302 (2014).