

New Jersey Clean Air Council Primer on Highly Warming Gases and Related Topics

Air Quality, Energy and Sustainability

New Jersey Department of Environmental Protection

December 12, 2018

Commissioner's Ask

- A review of highly warming gases (HWGs) in New Jersey
 - What are the sources?
 - Are they already regulated? If not, should they be regulated?
 - Are there best practices strategies that can be expanded?
 - How can they be effectively addressed in the absence of a strong federal government?
- Possible expansion to short-lived climate pollutants?

Terminology

- **Greenhouse Gases (GHGs)** -- Any gas that absorbs infrared radiation in the atmosphere, slowing the rate at which that energy escapes to space.
- **Global Warming Potential (GWP)** -- A measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide.
- **Highly Warming Gases (HWGs) or High-GWP Gases** – Gases that, for a given amount of mass, trap substantially more heat than carbon dioxide (CO₂)
- **Carbon dioxide equivalent (CO₂e)** -- The basic metric used to summarize the relative contribution of various GHGs to climate change. Carbon dioxide (CO₂) is the reference gas against which other greenhouse gases are measured, with a GWP of 1.
- **Short-Lived Climate Pollutants (SLCPs)** – A set of gases and particles that act as powerful climate forcers and remain in the atmosphere for a much shorter period of time (> 20 years) than longer-lived climate pollutants such as CO₂. These are sometimes called “super pollutants.”

Terminology (cont.)

- **Ozone Depleting Substances (ODS)** – Chemicals that destroy the earth's protective stratospheric ozone layer. Most of these chemicals, including chlorofluorocarbons (CFCs), carbon tetrachloride (CCl_4), methyl chloroform (CH_3CCl_3), halons, methyl bromide (CH_3Br) and hydrochlorofluorocarbons (HCFCs) are also greenhouse gases, but have been widely banned and replaced under the Montreal Protocol.
- **Hydrofluorocarbons (HFCs)** -- A group of chemicals manufactured for as replacements in refrigeration, insulation foam, and aerosols for CFCs and HCFCs under the Montreal Protocol. There are many varieties of HFCs, each with a different atmospheric lifetime and warming impact.

International Protocols and Accords

- **Montreal Protocol** – A global agreement finalized in 1987 to protect the earth's stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances.
- **Kyoto Protocol** -- An international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce GHG emissions, based on the scientific consensus that global warming is occurring and human-made CO₂ emissions have predominantly caused it. The Kyoto Protocol was adopted on 11 December 1997 and entered into force on 16 February 2005.
- **Paris Accord** – An agreement within the UNFCCC, dealing with GHG emissions mitigation, adaptation and finance, starting in the year 2020. In June 2017, President Trump announced his intention to withdraw the US from the agreement.

Which GHGs are included National and State Inventories?

Gas	Global Warming Potential (GWP)	Gas	Global Warming Potential (GWP)
CO ₂	1	HFC-227ea	3,220
CH ₄	25	HFC-236fa	9,810
N ₂ O	298	HFC-4310mee	1,640
HFC-23	14,800	CF ₄	7,390
HFC-32	675	C ₂ F ₆	12,200
HFC-125	3,500	C ₄ F ₁₀	8,860
HFC-134a	1,430	C ₆ F ₁₄	9,300
HFC-143a	4,470	SF ₆	22,800
HFC-152a	124	NF ₃	17,200
Source: IPCC (2007)			

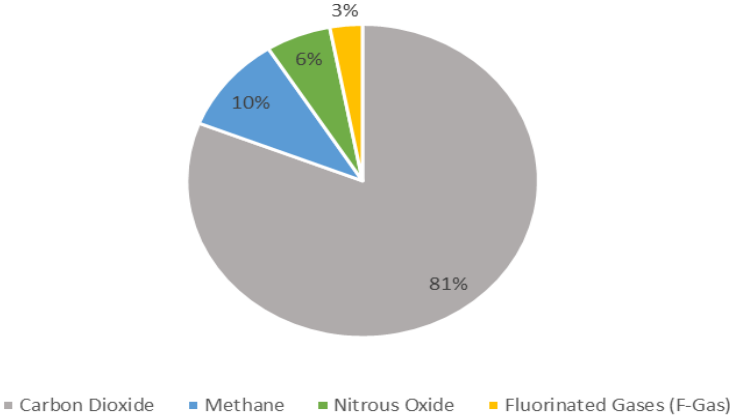
	Kyoto Protocol	ICPP GHGs	GWRA GHGs	HWGs	SLCPs
CO2	X	X	X		
CH4	X	X	X	X	X
N2O	X	X	X	X	
HFC-23	X	X	X	X	
HFC-32	X	X	X	X	X
HFC-125	X	X	X	X	
HFC-134a	X	X	X	X	X
HFC-143a	X	X	X	X	X
HFC-152a	X	X	X	X	X
HFC-227ea	X	X	X	X	
HFC-236fa	X	X	X	X	
HFC-4310mee	X	X	X	X	X
CF4	X	X	X	X	
C2F6	X	X	X	X	
C4F10	X	X	X	X	
C6F14	X	X	X	X	
SF6	X	X	X	X	
NF3	X	X	X	X	
Black Carbon					X
tropospheric O3					X
CFCs	X				

Scope: Sources Included in the GHG Inventory

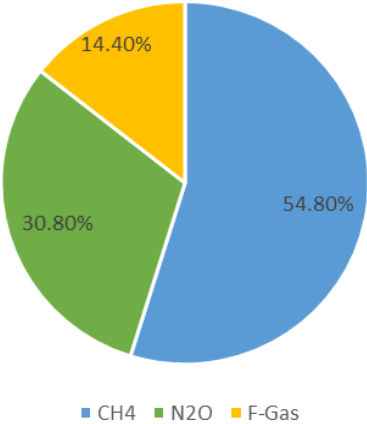
Chapter/IPCC Sector	Activities Included
Energy	Emissions of all GHGs resulting from stationary and mobile energy activities including fuel combustion and fugitive fuel emissions, and non-energy use of fossil fuels
Industrial Processes and Product Use	Emissions resulting from industrial processes and product use of GHGs
Agriculture	Anthropogenic emissions from agricultural activities except fuel combustion, which is addressed under Energy
Land Use, Land-Use Change, and Forestry	Emissions and removals of CO ₂ , CH ₄ , and N ₂ O from forest management, other land-use activities, and land-use change
Waste	Emissions from waste management activities

U.S. and NJ GHG Emissions by Gas (CO₂e)

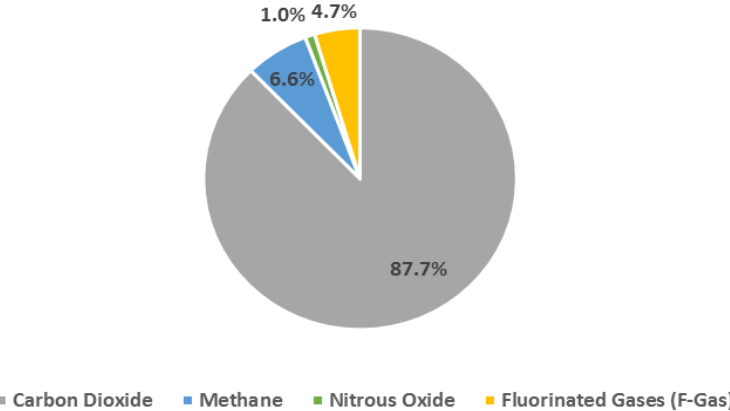
U.S. Total GHG Emissions, 2016



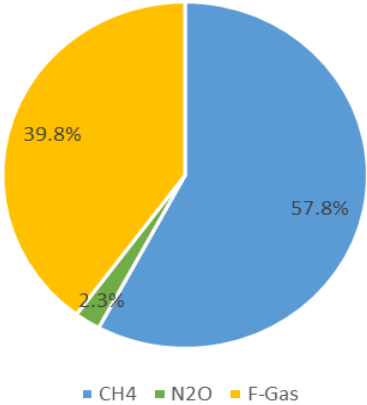
U.S. Non-CO₂ GHG Emissions, 2016



NJ Total GHG Emissions, 2015



NJ Non-CO₂ GHG Emissions, 2015



NJ's Global Warming Response Act

- Greenhouse Gas Monitoring and Reporting Rule
 - Identification, monitoring and reporting for all significant sources of statewide greenhouse gases including those associated with:
 - Fossil fuels (manufacture and distribution) – primarily CO₂ and methane; could have HWGs
 - Electric Generating Units – primarily CO₂ and methane
 - Gas public entities – primarily methane
 - Any other entities determined significant by the DEP -- HWGs

2018 Developments

- In response to the Montreal Protocol, EPA evaluated safe substitutes to ODS through its Significant New Alternatives Policy (SNAP). A number of HFCs were initially identified safe substitutes.
- In 2015-16, EPA made revisions to SNAP by moving certain HFCs from the safe substitutes list to the prohibited list because of the GWP.
 - Two HFC manufacturers sued arguing that the EPA had no authority to require the manufacturers to replace the HFCs with a new safe substitute, because the manufacturers had already replaced their ODSs with the HFCs (previously determined to be safe substitutes).
- Federal Ruling
 - The US Court of Appeals agreed with the manufacturer's argument that the word "replace" unambiguously meant "to take the place of," and referred only to the first replacement of the original ODS, meaning EPA had no authority to phase-out HFC use for the manufacturers that had already replaced their ODS product with that substance.
 - The court further appealed to Congress to enact general climate change legislation to address compounds that have GWP but are not ozone-depleting; emphasizing that EPA may only act as authorized by Congress.

2018 Developments (cont.)

- EPA has proposed revisions to eliminate its entire suite of refrigerant management requirements (e.g. venting, inspections, repair, and maintenance) – even though the Federal Ruling only addressed the phase-out requirement for manufacturers that had already replaced ODS with HFCs.
- State and Environmental Reactions
 - States, led by CA and NY, have committed to adopt state-specific rules to phase-out the use of HFCs in the same manner as the 2015-16 revisions to the SNAP.
 - California is developing an HFC “model rule” based on its existing rule.
 - States, including NJ, and environmental groups have filed lawsuits against EPA for revoking the portions of their rules that were upheld by the Court.
- US Climate Alliance
 - Commits to reducing emissions of SLCPs.
 - Developed SLCP Roadmap outlining options for reducing these emissions.
 - Developing an HFC “model rule” based on California existing rule.

NJ Pending Legislation

- A4775 – Zwicker (D16) -- Establishes Statewide HFC emission limit of 40% of 2018 levels by 2035, and requires DEP to establish HFC emissions monitoring and reporting program.
- S3207 – Smith (D17) – Establishes new timeframes for implementation of certain requirements in the Global Warming Response Act; requires DEP to adopt strategy to reduce SLCPs.