



Overview of the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008*

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U.S. Greenhouse Gas Inventory Background

- The U.S. Government annually submits a national GHG Inventory Report
 - This is the official U.S. government GHG Inventory
 - Meets U.S. commitments under the UNFCCC
 - Impartial and policy-neutral
- Interagency effort led by EPA
 - Data and input provided by DOE, USDA, DOT, DOD, the State Department, and others
- Open for 30 day public review and comment period
 - As well as “peer review” targeted at technical audience
 - International peer review through the UNFCCC



United Nations Framework Convention on Climate Change

- The UN Framework Convention on Climate Change “sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change”
 - Adopted in 1992
 - Signed and ratified by the U.S. in 1992
 - Ratified by 192 countries
 - Annex I
 - Industrialized nations (and EIT)
 - Non-Annex I
 - Developing countries
- Under the UNFCCC, governments:
 - “Gather and share information on greenhouse gas emissions, national policies and best practices”
 - GHG inventories are considered mechanisms to compare relative contributions



Inventory Reporting under the UNFCCC

- All Annex I countries are required to report annual emissions and sinks of greenhouse gases to the UNFCCC Secretariat
 - 40 Annex I countries (+ European Commission)
 - Annual inventory required under the UNFCCC since 1994
- Anthropogenic sources and sinks
- CO₂, CH₄, N₂O, HFCs, PFCs, SF₆
 - Weighted using “Global Warming Potential”
 - Include “indirect GHGs” for informational purposes: ozone precursors (CO, NO_x, NMVOCs) & SO₂
- Calculated using consistent and comparable methodologies

IPCC Methodologies

- IPCC guidelines/guidance provide broad international calculation methods:
 - List of emission source types and a compendium of information on methods and factors for the estimation of emissions
 - Step-by-step directions for assembling, documenting and transmitting national inventory data consistently
- Assists development of inventories that are transparent, documented, consistent over time, complete, comparable, assessed for uncertainties, subject to quality control and quality assurance, and efficient in the use of resources



IPCC Methodologies (II)

- IPCC guidelines divided into sectors:
 - Energy = emissions of all greenhouse gases resulting from stationary and mobile energy activities including fuel combustion and fugitive fuel emissions
 - Industrial Processes = by-product or fugitive emissions of greenhouse gases from industrial processes not directly related to energy activities (not fuel combustion)
 - Solvent and Other Product Use = emissions that are produced as a by-product of various solvent and other product uses
 - Agricultural = anthropogenic emissions from agricultural activities (except fuel combustion)
 - Land Use, Land-Use Change and Forestry = emissions and removals of CO₂ from forest management, other land-use activities, and land-use change
 - Waste = emissions from waste management activities



General, Basic Methodologies

$$\text{Emissions} = \text{Activity Data} \times \text{Emission Factor}$$

- Activity data is generally from national level statistics
 - e.g., CO₂ from Fossil Fuel Combustion: based on fuel consumed
 - Fuel consumption collected and aggregated to national level by EIA
 - Based on EIA surveys and EIA definitions of sectors
 - e.g., CO₂ from Iron & Steel Production: based on national production statistics
 - Coal and coke consumption from EIA; coke consumed for pig iron production and scrap steel consumption from AISI; iron ore consumption in sinter production from USGS
- Emission factors can be mix of IPCC default and country-specific
 - e.g., CO₂ from Fossil Fuel Combustion: based on fuel-specific carbon content analyses conducted by EIA (coal, petroleum, natural gas)
 - Non-CO₂ from IPCC
 - e.g., CO₂ from Iron & Steel Production: based on mix of factors
 - Pig iron and crude steel carbon contents from IPCC
 - Electric arc furnace carbon anodes from DOE

“Basic” Methodology Improvements

- Improvement over IPCC methods by using country-specific information known about a source
 - e.g., CH₄ from Coal: IPCC method combines separate calculations from underground mines, surface mines, and post-mining emissions
 - EPA-industry voluntary partnership to reduce emissions from mine methane venting
 - Data provided by partnerships combined with IPCC method for final estimate
 - e.g., SF₆ from Electrical Transmission: combines IPCC method with detailed partnership information
 - EPA-industry voluntary partnership to reduce emissions
 - Industry partners provide usage data since 1999
 - Developed proxy methodology as data missing from 1990 to 1998

EPA Source-Specific Model

- “Vintaging Model”
 - Tracks turnover in equipment containing ODSs based on estimates of historical equipment and material (e.g., foams) stocks
 - Simulates replacement of ODSs in equipment over time with substitute chemicals including HCFCs, HFCs, PFCs, and SF₆
- “Landfill Model”
 - First order decay model with CH₄ generation coefficients, based on empirical measurements, are applied to waste in place data
 - CH₄ emissions are adjusted for gas recovery for energy, additional CH₄ generation in industrial landfills, and CH₄ oxidation
- Enteric Fermentation
 - Model of livestock populations by animal type and age group applied to CH₄ conversion factors
- Agricultural Soil Management
 - Model uses fertilizer consumption data combined with N₂O emission factors for fertilizer use on agricultural soils

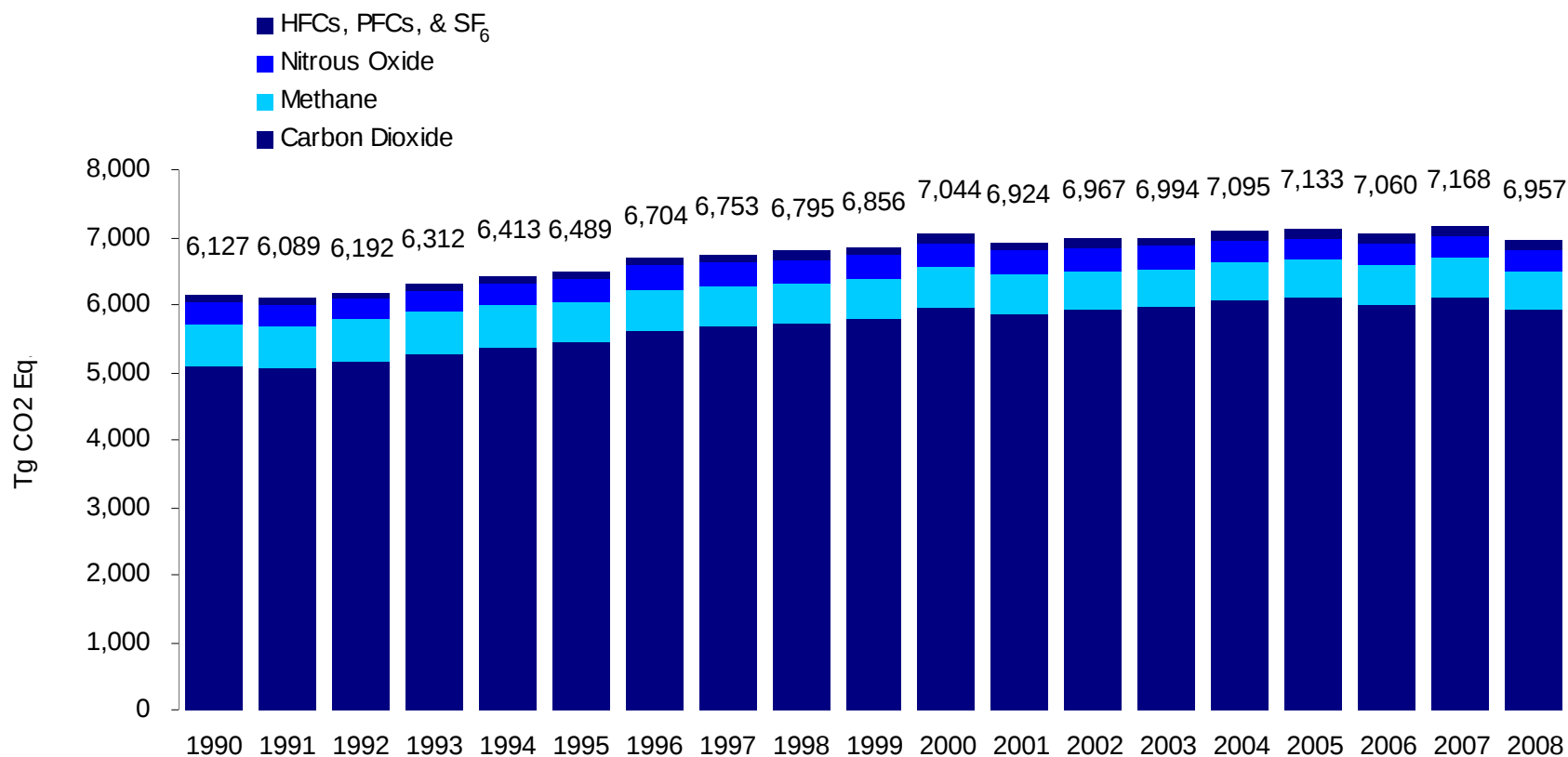
GHG Inventory Compilation Process

- Unlike criteria pollutant inventory (i.e., NEI), GHG emissions are not collected from States for use in national GHG inventory
- U.S. GHG emissions calculated using internationally-accepted methods and appropriate statistics and data for national-level GHG estimates
 - Calculation methods have also served as basis for mandatory GHG reporting rule for facility-level calculations of emissions from large entities
- In order to provide complete coverage, often aggregated national statistics are used
 - Focus of GHG inventory is to account for all U.S. GHG emissions across all emitting sources
 - Example: Total fuel use in U.S. economy provided by DOE's Energy Information Administration, which is utilized to estimate total U.S. GHG emissions from fuel combustion



U.S. GHG Emissions by Gas

- U.S. greenhouse gas emissions decreased by 2.9% from 2007 to 2008



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008* (April 2010)



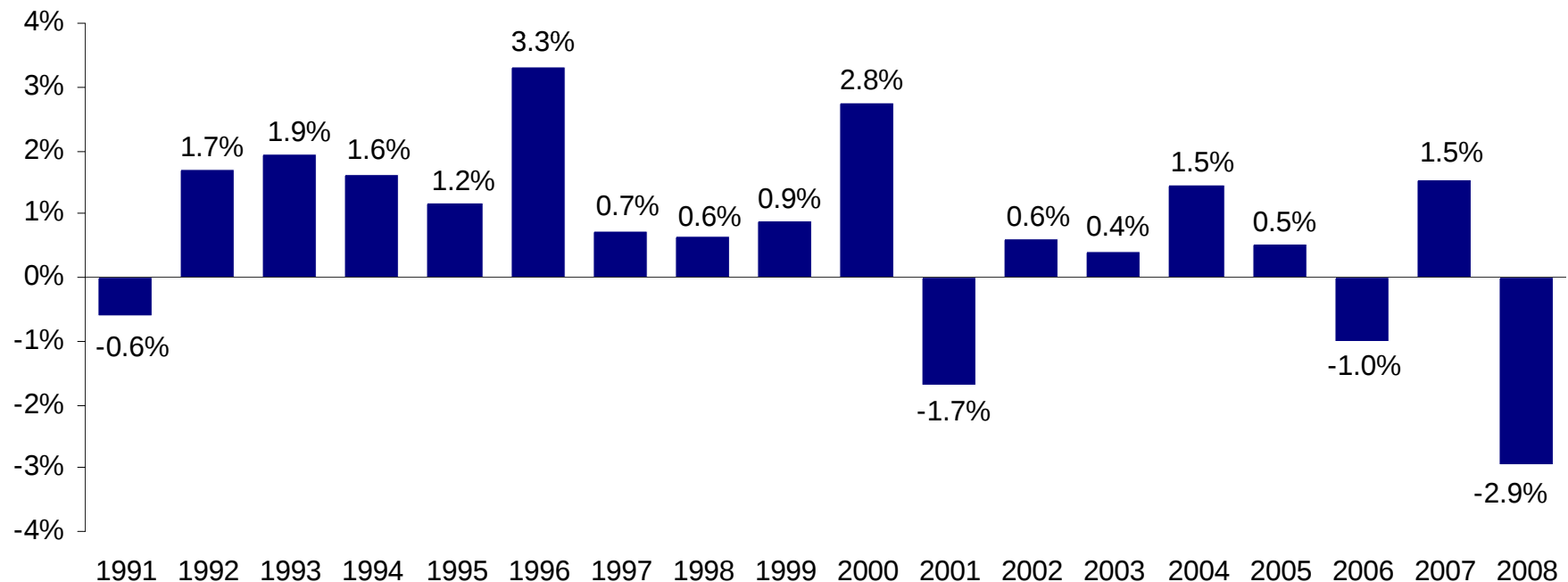
Key Findings from 1990-2008 Report

- CO₂ emissions from fossil fuel combustion dominate total emissions and trends
 - The major contributor to the decrease in emissions was the increased cost of fossil fuels in 2008, compared to 2007
 - A significant increase in the cost of petroleum led to decreased demand for energy, particularly in the transportation sector
 - Decreased electricity use in 2008, partially due to cooler summer conditions compared to 2007 (though temperatures in the summer of 2008 were warmer than normal), led to decreased emissions from the electric power industry
- In 2008, 35% of U.S. GHG emissions come from the electric power industry



Annual percent change in U.S. GHG Emissions Since 1990

In total, emissions increased by 13.5% from 1990 to 2008



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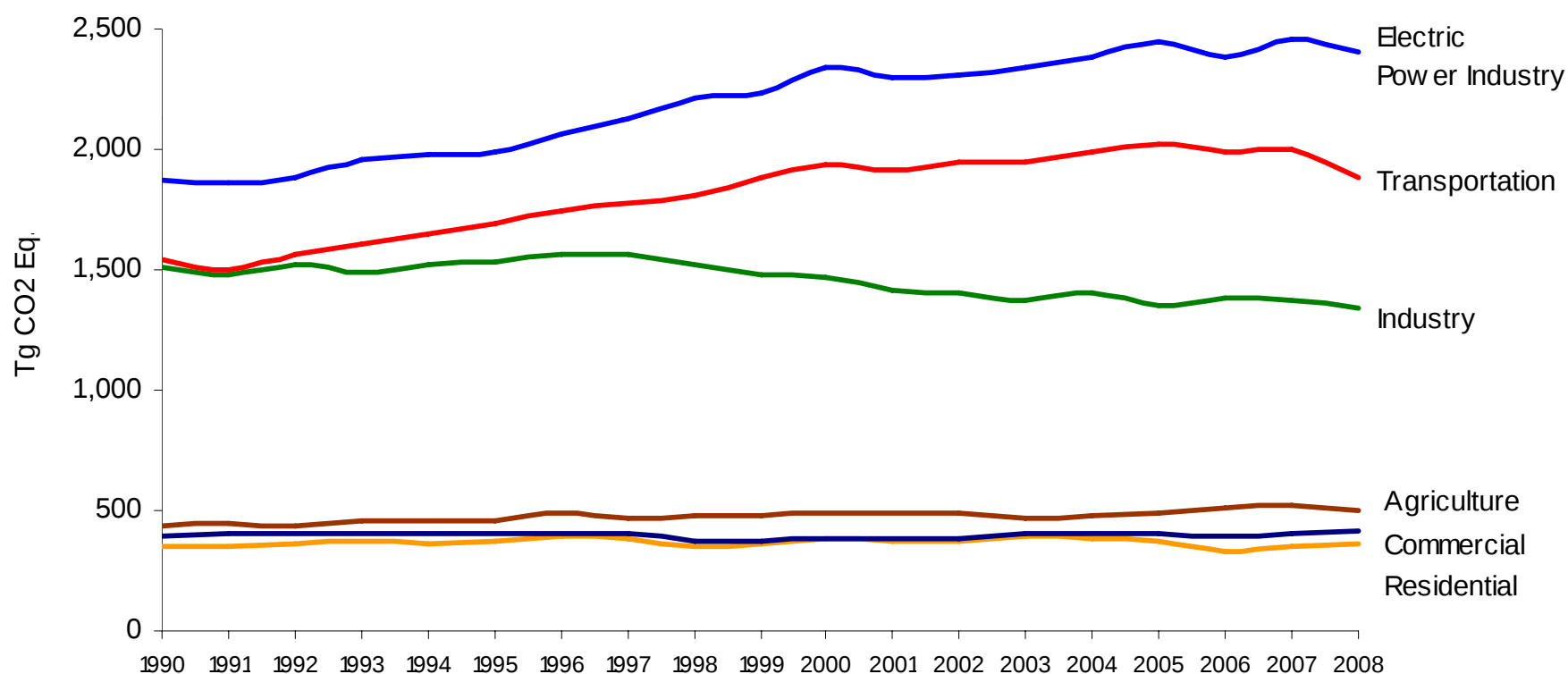
Key Findings from 1990-2008 Report (II)

- Emissions trends across 1990 to 2008 time series fluctuate with trends in the economy, energy sources, population and weather
- Overall, since 1990;
 - GHG emissions have increased by 13.5%
 - CO₂ emissions have increased by 16%
 - CH₄ emissions have decreased by 7%
 - N₂O emissions have decreased by 1%
 - HFCs, PFCs and SF₆ emissions increased by 66%
- Over the same period;
 - GDP has grown by 66%
 - U.S. Population has increased by 21%
 - Energy consumption has increased by 36%



2008 U.S. Economic Sectors

Emissions distributed to Economic Sectors

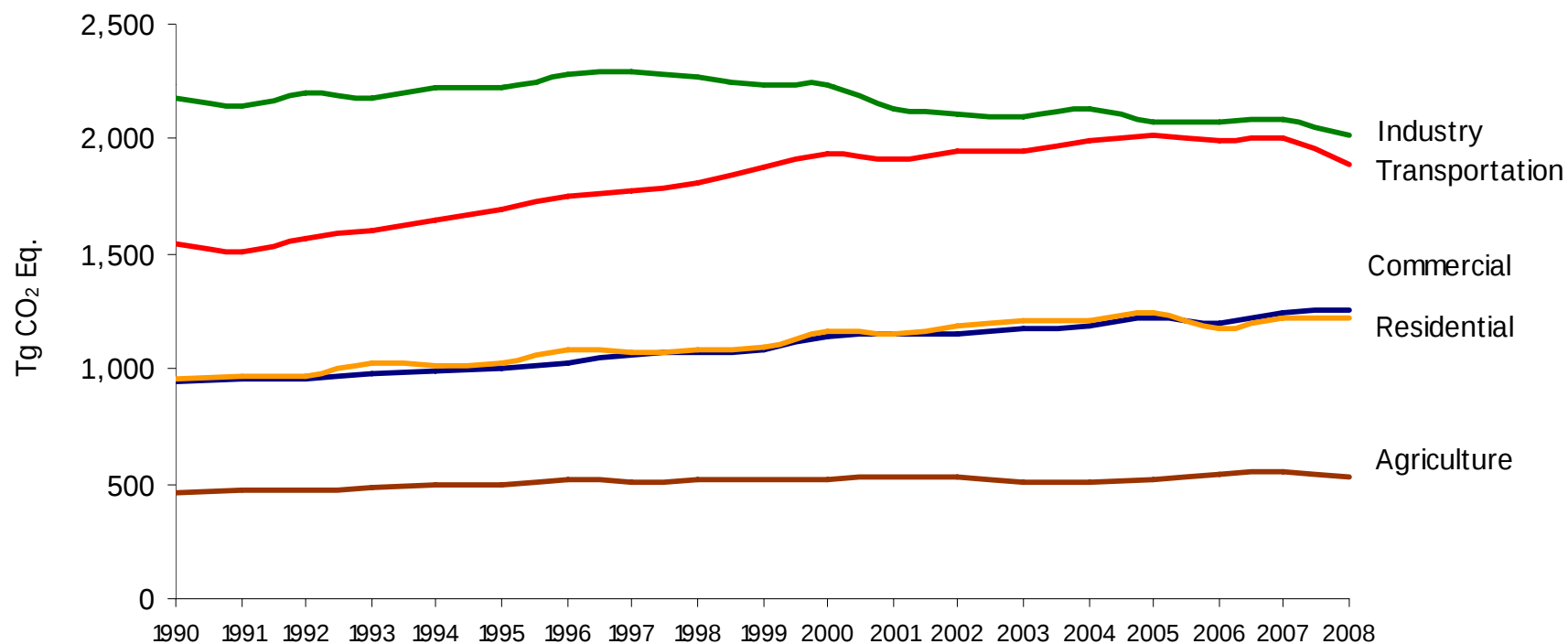


Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008* (April 2010)



2008 U.S. Economic Sectors (continued)

Emissions distributed to Economic Sectors,
including emissions from electricity use



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008* (April 2010)



Limitations of U.S. GHG Inventory

- National-level totals for entire U.S.
 - Data for most sources is very aggregated with little to no geographic scope inside U.S.
 - Difficult to reconcile with criteria pollutant inventories
 - Which include source-specific data necessary to model emissions (e.g., state, county, latitude & longitude)
- Coverage has been determined by Framework Convention
 - Still must use SAR GWP values (not TAR or new AR4)
 - Defers to Montreal Protocol on ODS (which have high GWPs)
 - Impact of “indirect GHGs” and aerosols
 - Contribution of individual countries to world total limited to Annex I vs. Non-Annex I requirements



Limits of U.S. GHG Inventory (continued)

- U.S. GHG Inventory accounts for all GHG emissions in a particular year across the entirety of the United States
 - Needed overview of total U.S. GHG emissions across all sources, in combination with MRR rule which will provide greater detail on individual emitters
- Alternate ways to look at U.S. GHG emissions have been developed
 - EPA
 - OTAQ “Fact Sheet” focusing on detailed analysis of transportation sector; RFS analyses
 - OSWER “Opportunities to Reduce GHG Emissions through Materials and Land Management Practices” - Lifecycle approach to assign emissions to goods and materials
 - USDA focus on agricultural sector; DOT report on transportation sector
 - Interest groups focusing on GHGs from buildings, specific sectors, etc.
- U.S. GHG Inventory remains a transparent way to present overall U.S. emissions
 - Policy-neutral: “Factual, historic snapshot” of U.S. GHG emissions
 - Emissions calculated and presented consistently with other countries

Resources

- Copies of latest Greenhouse Gas Inventory
 - Full Report available in late fall
 - Stand-alone Executive Summary available soon
 - “Fast Facts” tabular summary available
 - Printed copies up front!
- Electronically download
 - <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>
- UNFCCC and IPCC Greenhouse Inventories Programme
 - unfccc.int
 - www.ipcc.ch

