Overview of the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013*

Leif Hockstad
U.S. EPA
OAR – Office of Atmospheric Programs
Climate Change Division

U.S. Greenhouse Gas Inventory Background

- The U.S. Government annually submits a national U.S. 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 189 countries
    - Annex I
      - Industrialized nations and "economies in transition"
    - 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

GHG Inventory Reporting under the UNFCCC

- All Annex I countries (i.e., developed countries) are required to report annual emissions and sinks of greenhouse gases to the UNFCCC Secretariat
  - 41 Annex I countries (+ European Union)
- Anthropogenic sources and sinks
- CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3
  - Weighted using "Global Warming Potential"
    - Include "indirect GHGs" for informational purposes: ozone precursors (CO, NO_x, NMVOCs) & SO_2
- Calculated using consistent and comparable methodologies

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
  - Similar calculation methods used by facilities for EPA's GHRP
  - But where GHGRP focuses on facility-level calculations of emissions from large entities, focus of GHG inventory is to account for all U.S. GHG emissions across all emitting sources
- In order to provide complete coverage, often aggregated national statistics are used
  - 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

IPCC Methodologies

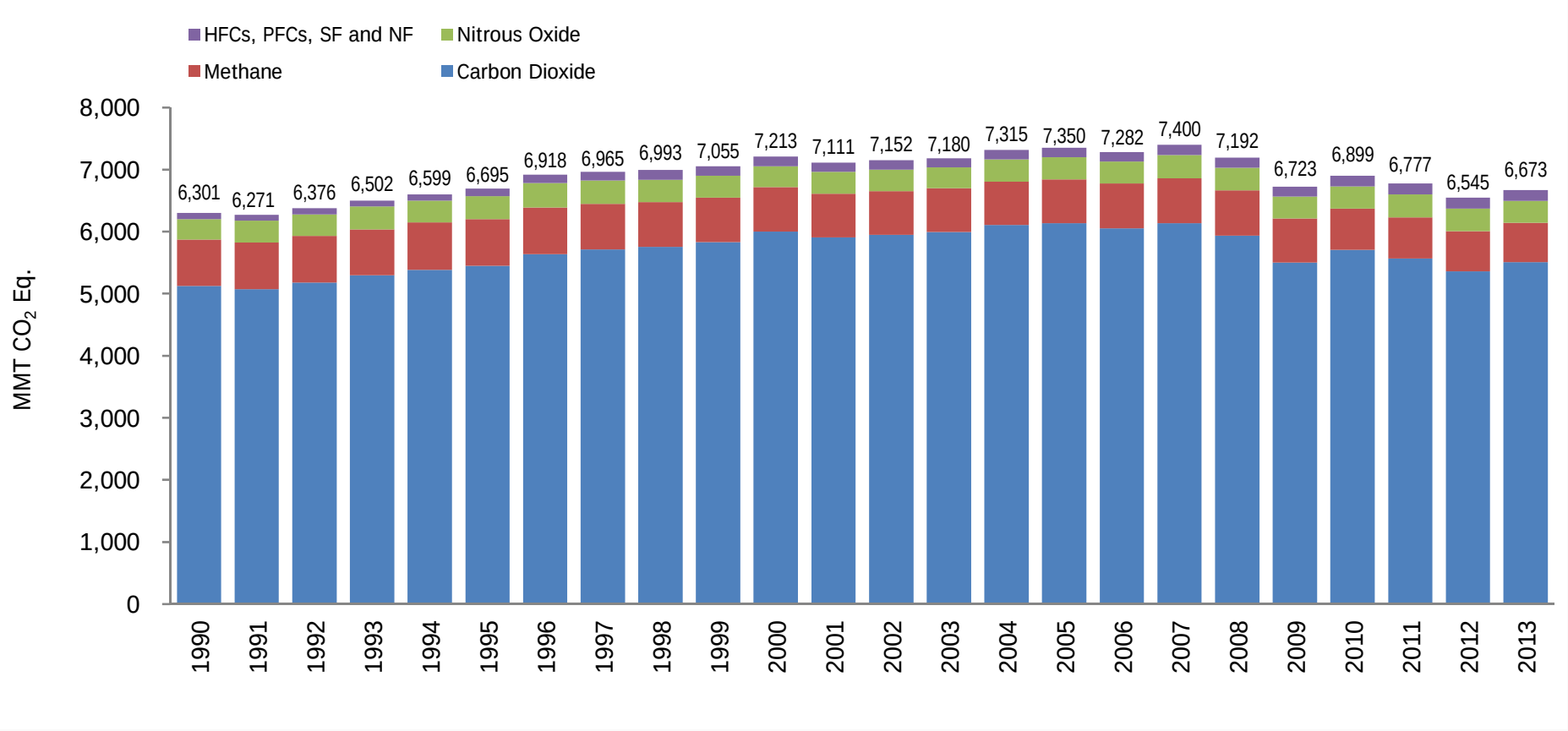
- IPCC guidelines/guidance provide broad international calculation methods:
  - List of emission source types and a compendium of information on methods and factors for the estimation of emissions
  - Step-by-step directions for assembling, documenting and transmitting national inventory data consistently
- Assists development of inventories that are transparently 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 and Product Uses = by-product or fugitive emissions of greenhouse gases from industrial processes or by-product of other product uses not directly related to energy activities (not fuel combustion)
  - Agricultural = anthropogenic emissions from agricultural activities (except fuel combustion)
  - Land Use, Land-Use Change and Forestry = emissions and removals of CO_2 from forest management, other land-use activities, and land-use change
  - Waste = emissions from waste management activities

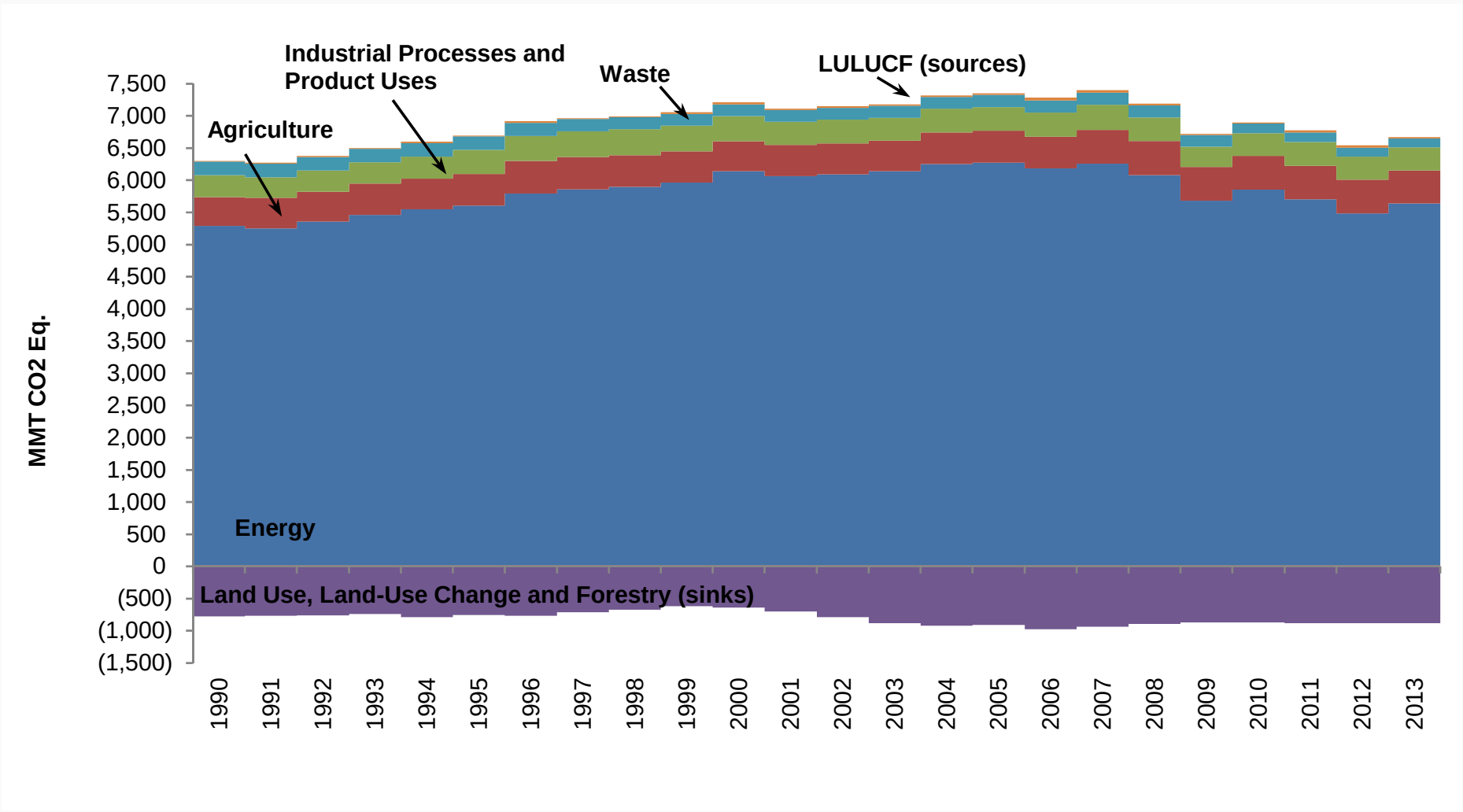
U.S. GHG Emissions by Gas

- U.S. greenhouse gas emissions increased by 2.0% from 2012 to 2013



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013* (April 2015)

U.S. GHG Emissions by Sector



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Key Findings from 1990-2013 Inventory Report

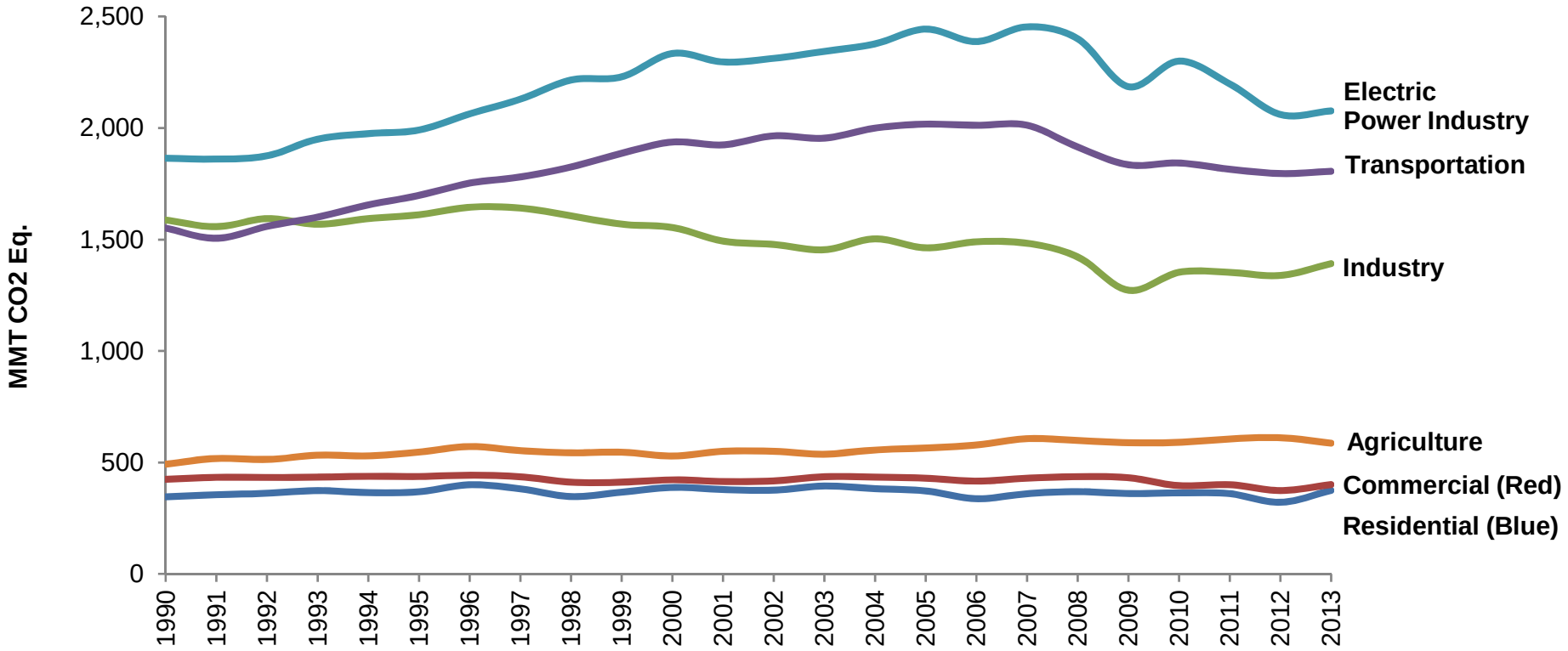
- CO_2 emissions from fossil fuel combustion dominate total emissions and trends
  - The major contributor to the increase in overall GHG emissions was the increased combustion of fossil fuels in 2013, compared to 2012
  - Increase in all sectors (electricity generation, transportation, industrial, residential and commercial)
    - Increased carbon intensity for electricity generation due to increased coal use in 2013
    - Also increased energy consumption in residential and commercial sectors due to weather
- In 2013, 31% of U.S. GHG emissions come from the electric power industry

Key Findings from 1990-2013 Inventory (II)

- Emissions trends across 1990 to 2013 time series fluctuate with trends in the economy, energy sources, population and weather
- Overall, since 1990;
  - GHG emissions have increased by 5.9%
  - CO_2 emissions have increased by 7%
  - CH_4 emissions have decreased by 15%
  - N_2O emissions have decreased by 8%
  - HFCs, PFCs and SF_6 emissions increased by 73%
- Over the same period;
  - GDP has grown by 75%
  - U.S. Population has increased by 26%
  - Energy consumption has increased by 15%

2013 U.S. Economic Sectors

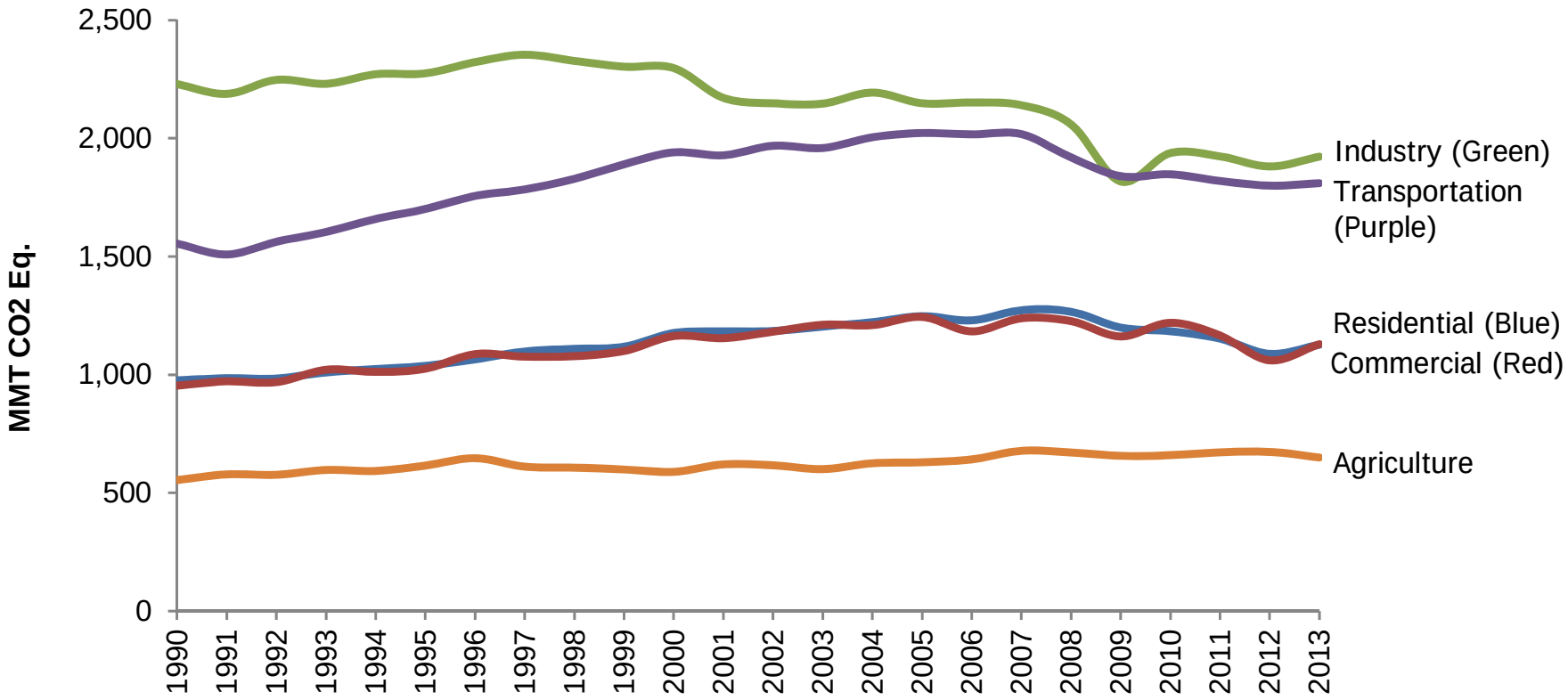
Emissions distributed to Economic Sectors



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013* (April 2015)

2013 U.S. Economic Sectors (II)

Emissions distributed to Economic Sectors,
including emissions from electricity use



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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)
    - GHGRP data incorporation underway for most categories
    - Efforts to produce gridded versions of US GHG Inventory
- Coverage has been determined by Framework Convention
  - Still must use AR4 GWP values (not latest AR5)
  - 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 (II)

- 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 GHGRP which provides 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

- Electronically download
  - → http://www.epa.gov/climatechange/emissions/usinventoryreport.html
  - → http://epa.gov/climatechange/ghgemissions/inventoryexplorer/
- Printed copies of latest GHGH Inventory factsheet
  - → Stand-alone Fast Facts available soon
    - → Emissions and other useful information!
- UNFCCC and IPCC Greenhouse Inventories Programme
  - → unfccc.int
  - → www.ipcc.ch

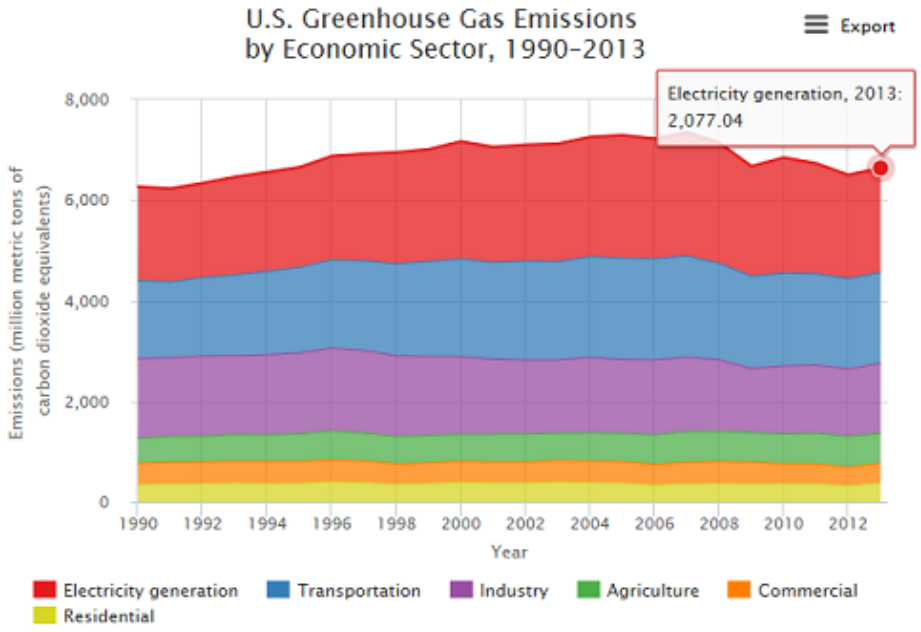
Greenhouse Gas Inventory Data Explorer

→ *http://epa.gov/climatechange/ghgemissions/inventoryexplorer/*

Data Explorer

1. Choose a sector:	2. Choose a greenhouse gas:	3. Break out by:	4. Year(s):
All sectors	All gases	Economic sector	All years

Date range: 1990–2013



Emissions (million metric tons of carbon dioxide equivalents) Search

Economic Sector	1990	1991	1992	1993	1994	1995	1996	1997
Total	6,301.05	6,270.83	6,375.51	6,501.53	6,599.45	6,694.61	6,917.91	6,965.20
Electricity generation	1,864.79	1,860.72	1,875.62	1,950.62	1,975.06	1,991.43	2,063.88	2,129.66
Transportation	1,551.25	1,505.56	1,559.11	1,600.92	1,655.65	1,698.07	1,753.14	1,780.76

Create a graph by choosing options from the four dropdown menus above. **Within each graph, you can click the legend to turn layers on or off, and you can hover your mouse over the display to reveal data.** See "How to Use this Tool" above to learn more.

Percent change:
1990–2013

↑ 11.4%
↑ 16.4%
↓ 12.3%
↑ 19.1%
↓ 5.6%
↑ 8.3%

Total: ↑ 5.9%

Inventory of U.S. Greenhouse Gas Emissions and Sinks

For more information on sources, data, and methods, visit EPA's greenhouse gas inventory page.

→ *http://epa.gov/climatechange/ghgemissions/inventoryexplorer/*

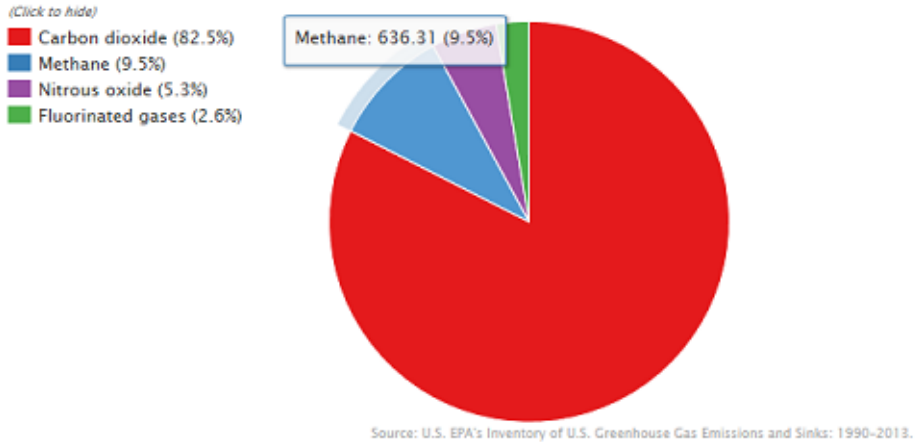
Data Explorer

1. Choose a sector:	2. Choose a greenhouse gas:	3. Break out by:	4. Year(s):
All sectors	All gases	Gas	Most recent year

U.S. Greenhouse Gas Emissions by Gas, 2013

Export

Emissions in million metric tons of carbon dioxide equivalents



Source: U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013.
http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

Emissions (million metric tons of carbon dioxide equivalents) Search

Gas	1990	1991	1992	1993	1994	1995	199
Total	6,301.05	6,270.83	6,375.51	6,501.53	6,599.45	6,694.61	6,
Carbon dioxide	5,123.70	5,074.08	5,178.99	5,293.14	5,386.18	5,450.54	5,
Methane	745.49	748.96	753.47	743.82	758.48	750.17	
Nitrous oxide	329.90	354.88	345.57	366.55	352.81	371.46	
Fluorinated gases	101.97	92.91	97.48	98.03	101.98	122.44	

Download the data (.csv format)

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Percent change: 2012–2013

Carbon dioxide: ↑ 2.7%
Methane: ↓ 1.7%
Nitrous oxide: ↓ 2.8%
Fluorinated gases: ↑ 1.5%

Total: ↑ 2.0%

Inventory of U.S. Greenhouse Gas Emissions and Sinks

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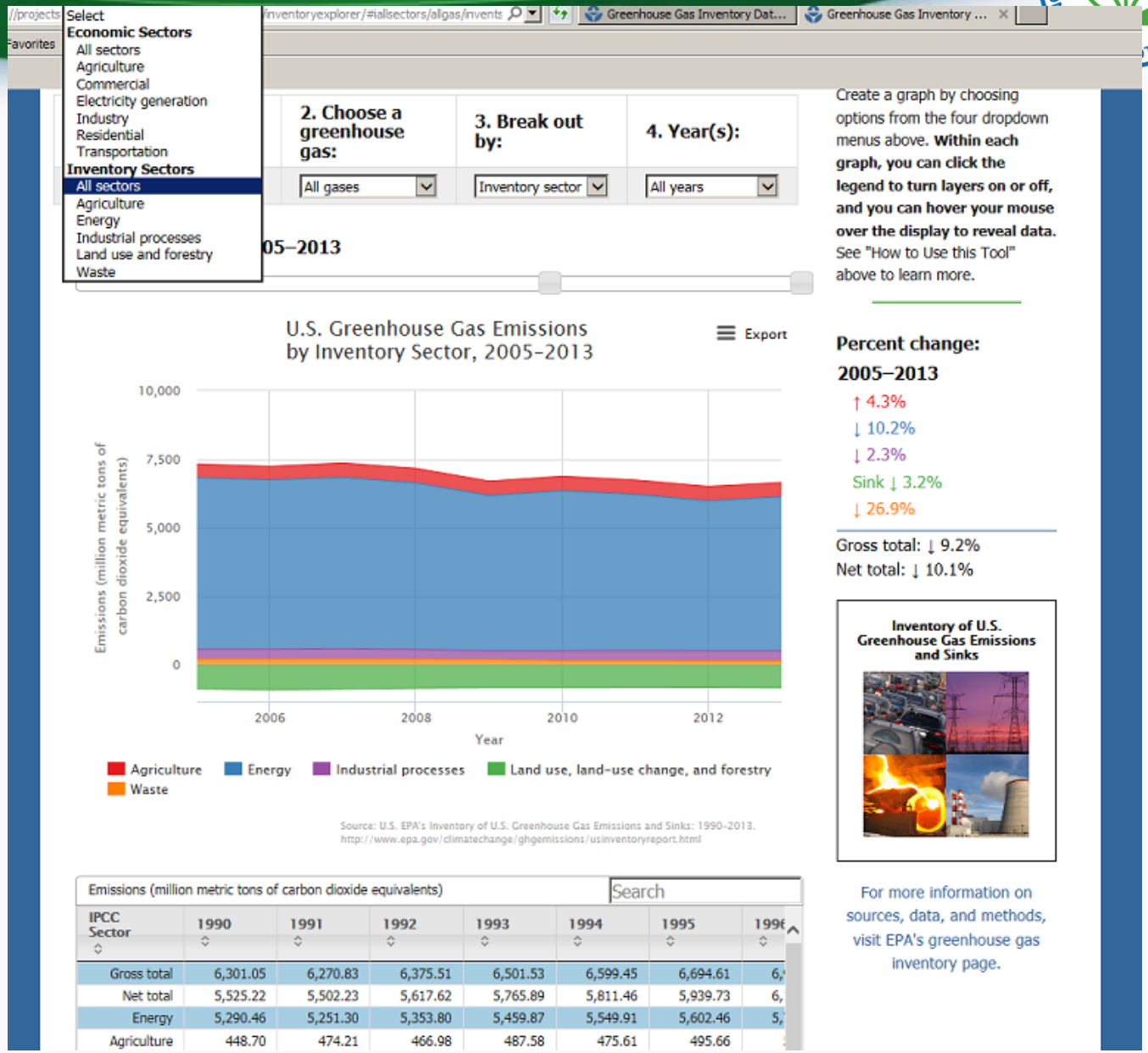
Data Explorer



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