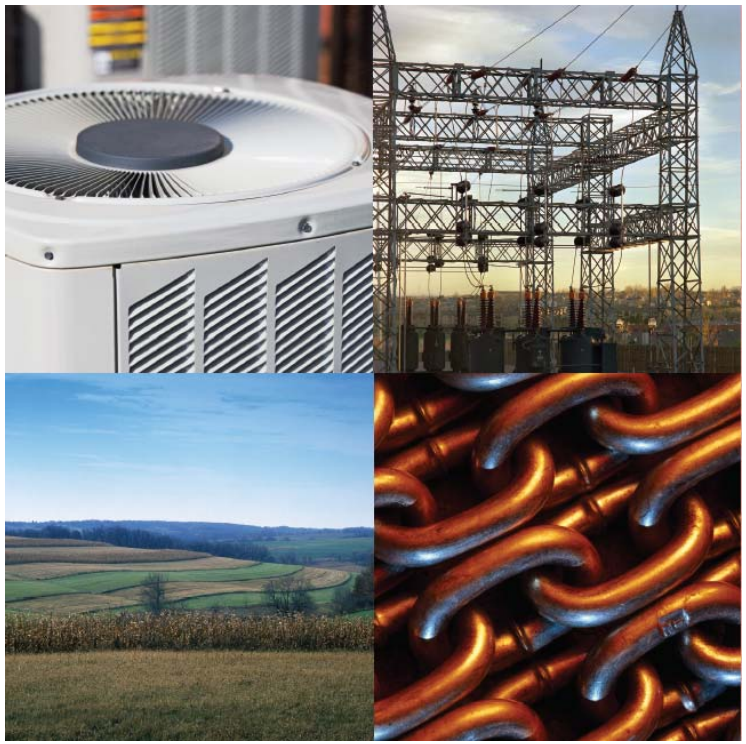

Overview of the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*

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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

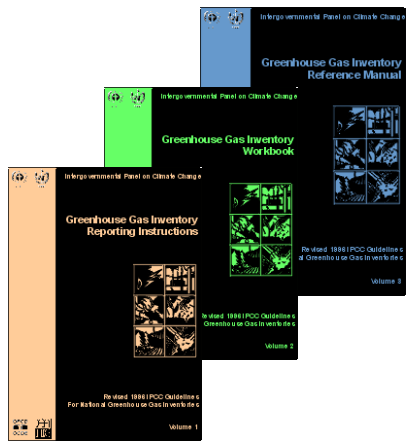
- The UN Framework Convention on Climate Change "sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change"
  - Adopted in 1992
    - Signed and ratified by the U.S. in 1992
  - Ratified by 189 countries
    - Annex I
      - Industrialized nations (and EIT)
    - 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
- CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
  - 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

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 CO_2 from forest management, other land-use activities, and land-use change
  - Waste = emissions from waste management activities

General, Basic Methodologies

Emissions = Activity Data × Emission Factor

- Activity data is generally from national level statistics
  - e.g., CO_2 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., CO_2 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., CO_2 from Fossil Fuel Combustion: based on fuel-specific carbon content analyses conducted by EIA (coal, petroleum, natural gas)
    - Non-CO_2 from IPCC
  - e.g., CO_2 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

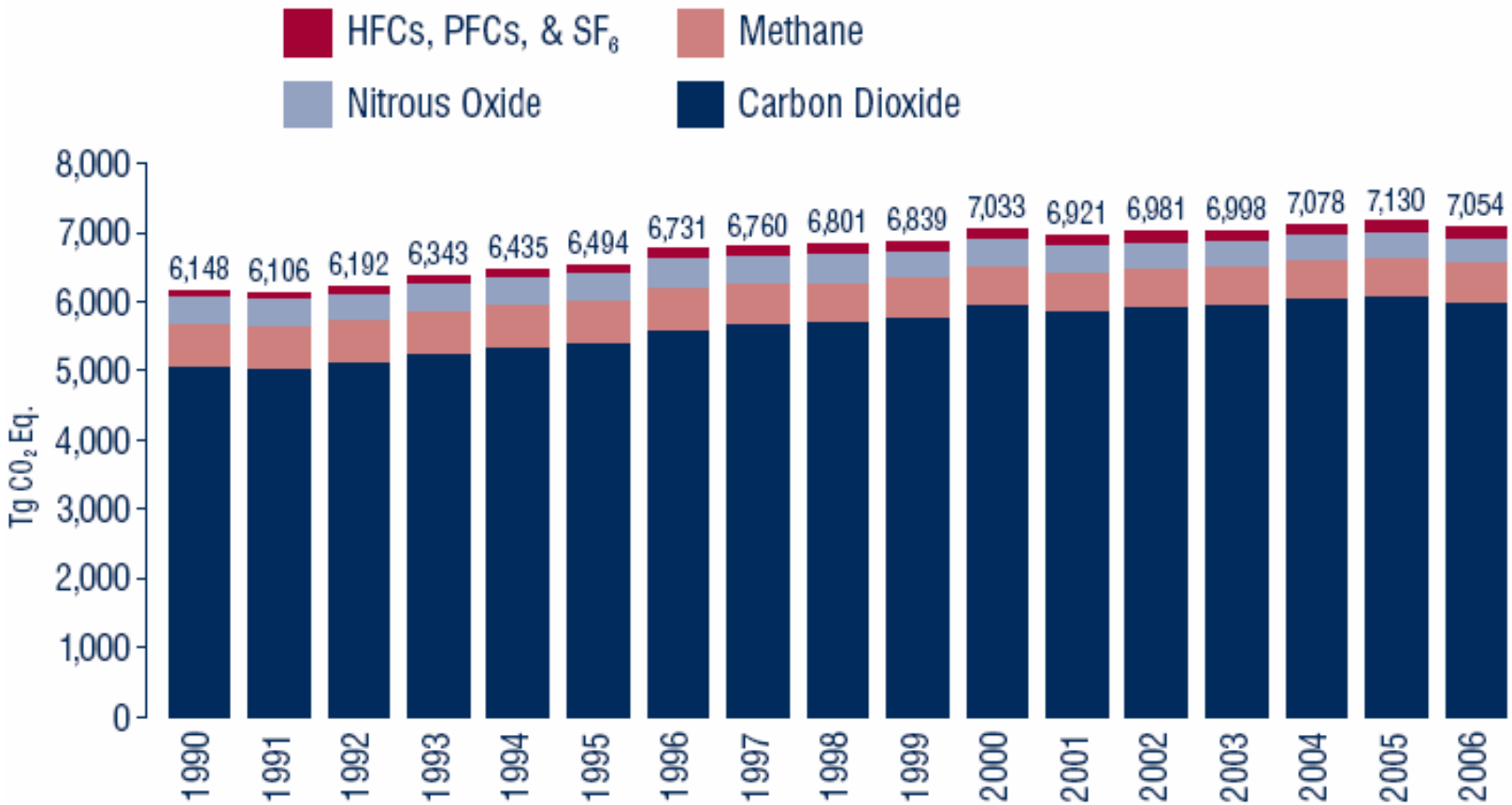
“Basic” Methodology Improvements

- Improvement over IPCC methods by using country-specific information known about a source
  - e.g., CH_4 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., SF_6 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 SF_6
- "Landfill Model"
  - First order decay model with CH_4 generation coefficients, based on empirical measurements, are applied to waste in place data
  - CH_4 emissions are adjusted for gas recovery for energy, additional CH_4 generation in industrial landfills, and CH_4 oxidation
- Enteric Fermentation
  - Model of livestock populations by animal type and age group applied to CH_4 conversion factors
- Agricultural Soil Management
  - Model uses fertilizer consumption data combined with N_2O emission factors for fertilizer use on agricultural soils

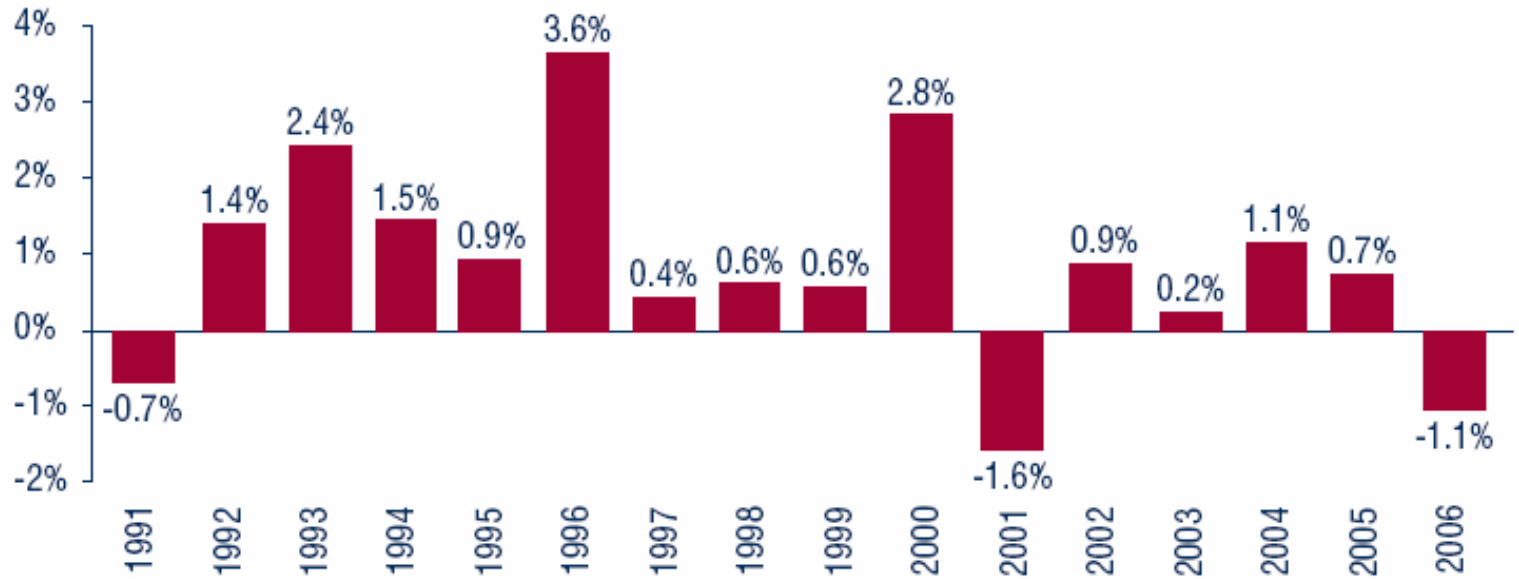
U.S. GHG Emissions by Gas



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006* (April 2008)

Cumulative change in U.S. GHG Emissions Since 1990

In total, emissions increased by 14.7% from 1990 to 2006



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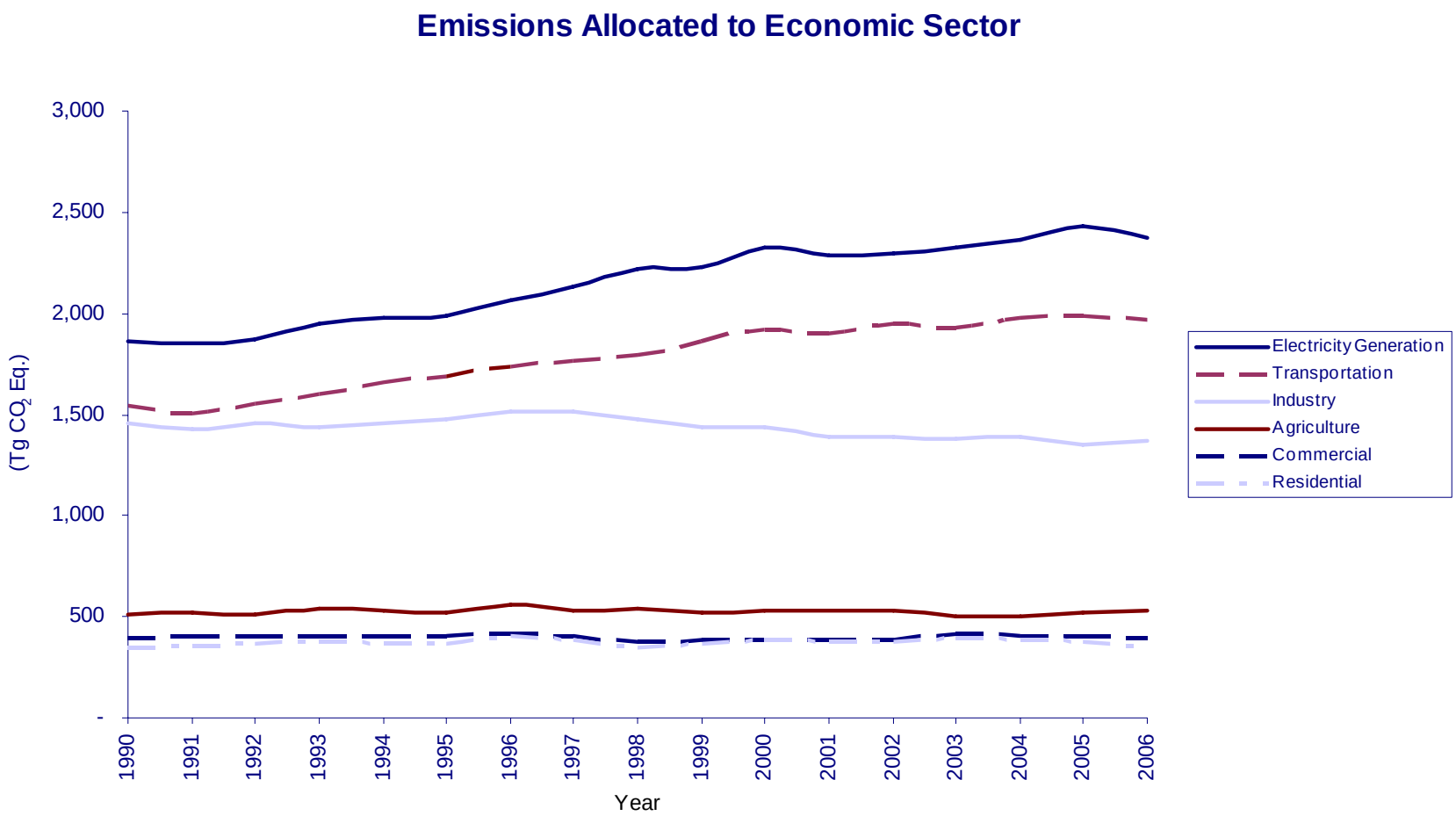
2006 U.S. Economic Sectors



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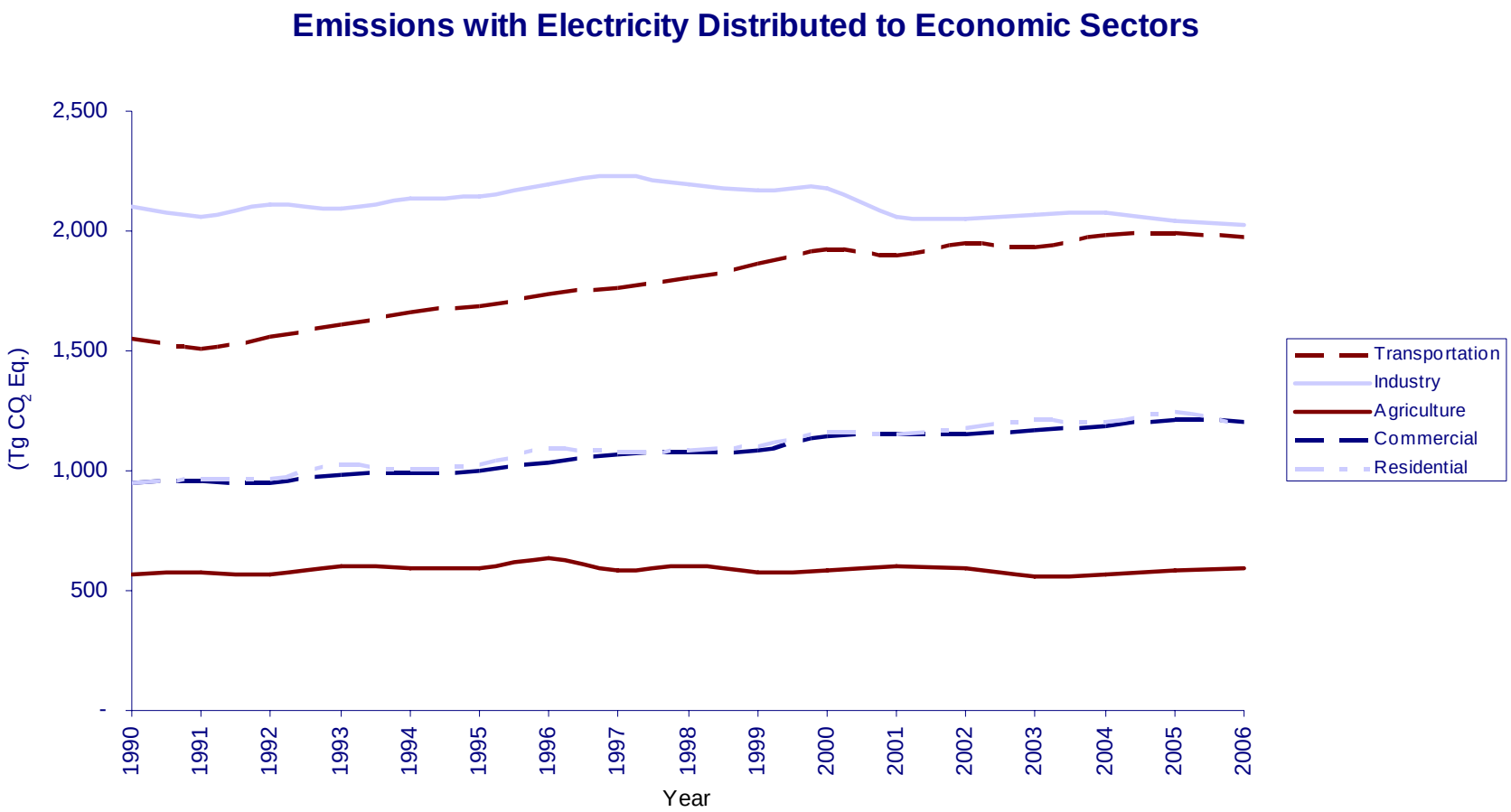
2006 U.S. Economic Sectors (continued)



Taken from: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006* (April 2008)

Key Findings from 1990-2006 Report

- U.S. greenhouse gas emission rose 14.7% from 1990 to 2006; declined by -1.1% from 2005 to 2006
- CO_2 emissions from fossil fuel combustion dominate total emissions and trends
  - Warmer winter and cooler summer in 2006 led to reduction in emissions from heating and air conditioning use in commercial & residential sectors
  - Decreased electricity demand, and more generated in 2006 with natural gas & renewables
  - Lower emissions in transportation sector in 2006 due to higher fuel prices
- 34% of U.S. GHG emissions come from the electric power industry

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

Resources

- Copies of latest Greenhouse Gas Inventory
  - → Full Report available in late summer
  - → Stand-along Executive Summary available in early summer
  - → "Fast Facts" tabular summary available soon
    - → Early printing run copies up front!

- Electronically download
  - → http://www.epa.gov/climatechange/emissions/usinventoryreport.html

- UNFCCC and IPCC Greenhouse Inventories Programme
  - → unfccc.int
  - → www.ipcc.ch