Development of North Carolina's Greenhouse Gas Emissions Inventory

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North Carolina Greenhouse Gas (GHG) Emissions Inventory

- Purpose
  - Executive Order 80
  - Starting Point for Planning
- Last Inventory Effort in 2007
- Comprehensive/Economy-Wide
- 1990 - 2030
- Identifies Key Sectors/Potential for Reductions
- GHG Pollutants
  - Carbon Dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous Oxide (N_2O)
  - Sulfur Hexafluoride (SF_6)
  - Perfluorocarbons (PFCs)
  - Hydrofluorocarbons (HFCs)

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EPA's State Inventory and Projection Tool (SIT)

- SIT
  - Comprehensive
  - State-Level
  - Updated Annually
- NC DAQ Application
  - Completed in 9 Months with Existing DAQ Staff
  - October 2017 version of SIT
  - All Modules except Coal
  - Transparency/Password Protection
  - Potential Future Inventory Refinements
  - Uncertainty
  - Public Comment Process

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Deviations from SIT Defaults

Module	Deviation
Fossil Fuel Combustion CO_2	• Computed CO_2 emissions from wood and biofuels combustion
Natural Gas & Oil (no default data)	• NC Utilities Commission where available, • CH_4 emissions factor for natural gas transmission compressor stations reflects NC station emissions in EPA's GHG Reporting Program • Data from DOT's Pipeline and Hazardous Materials Safety Administration
Imported Electricity Use (not in SIT)	• Applied regional emissions factors to "net interstate flow" of electricity into NC from Energy Information Administration (EIA's) State Energy Data System (SEDS)
Agriculture	• Default livestock counts updated to reflect most recent set from USDA
Municipal Solid Waste	• Default landfill disposal data replaced with data from NC Division of Waste Management

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Deviations from SIT Defaults (cont'd)

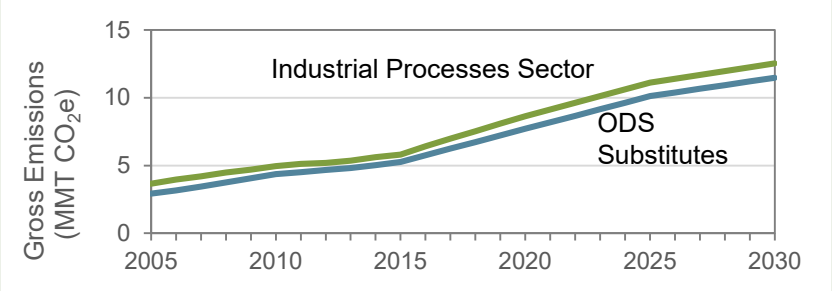
Module	Deviation
Wastewater	• Pulp and paper emissions based on DAQ database of permitted pulp and paper facilities. • Poultry sector emissions based on poultry data from NC Department of Agriculture and Consumer Services (NC DACS).
Industrial Processes	• Iron and Steel production data based on DAQ database of permitted facilities • Phosphoric acid production from EPA's GHG Reporting Program, and pre-2010 data from DAQ database
Land Use, Land Use Change and Forestry (LULUCF)	• The USDA Forest Inventory Analysis carbon flux data replaced SIT defaults • No SIT defaults for wildfires and prescribed burning -- used National Interagency Fire Center (NIFC) data for 2002 to 2015; NC Division of Forestry data used for 1990 - 2001

Deviations from SIT Defaults (cont'd)

Module	Deviation

Projections	• Population and gross state product projections
	  • Replaced SIT defaults with NC Office of State Budget and Management projections
	• Electricity
	  • Duke Energy 2017-2028 forecast of fuel used by Duke Energy power plants
	  • Duke plants forecast for 2029-2030 use latest Annual Energy Outlook (AEO) projections
	  • All other power plants use average 2014-2016 fuel use (EIA Form 923 data)
	• RCI Combustion – update to latest AEO forecast
	• Transportation
	  • Gas/Diesel Vehicles - growth factors derived from GHG emissions output from EPA MOVES model runs for North Carolina
	  • Aircraft - FAA's Terminal Area Forecast, Summary Report annual growth factors derived from total Itinerant operations in NC airports for each forecast year
	• Livestock – replaced outdated emission factors with 2015 year values from SIT

Examples of Potential Future Refinements

Module	Refinement
Natural Gas & Oil	• Update CH4 emission factor for NG transmission compressor stations • EPA update to national GHG emissions inventory methods for Natural Gas Systems • Review information for estimating indirect emissions for natural gas consumption
Industrial Processes	• For ozone depleting substance (ODS) substitutes, investigate use of U.S. Climate Alliance's Short-Lived Climate Pollutant Emissions Tool 

Projections	• Revise to reflect updates in Federal and State Policies
	  • Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule
	  • NC Clean Energy Plan

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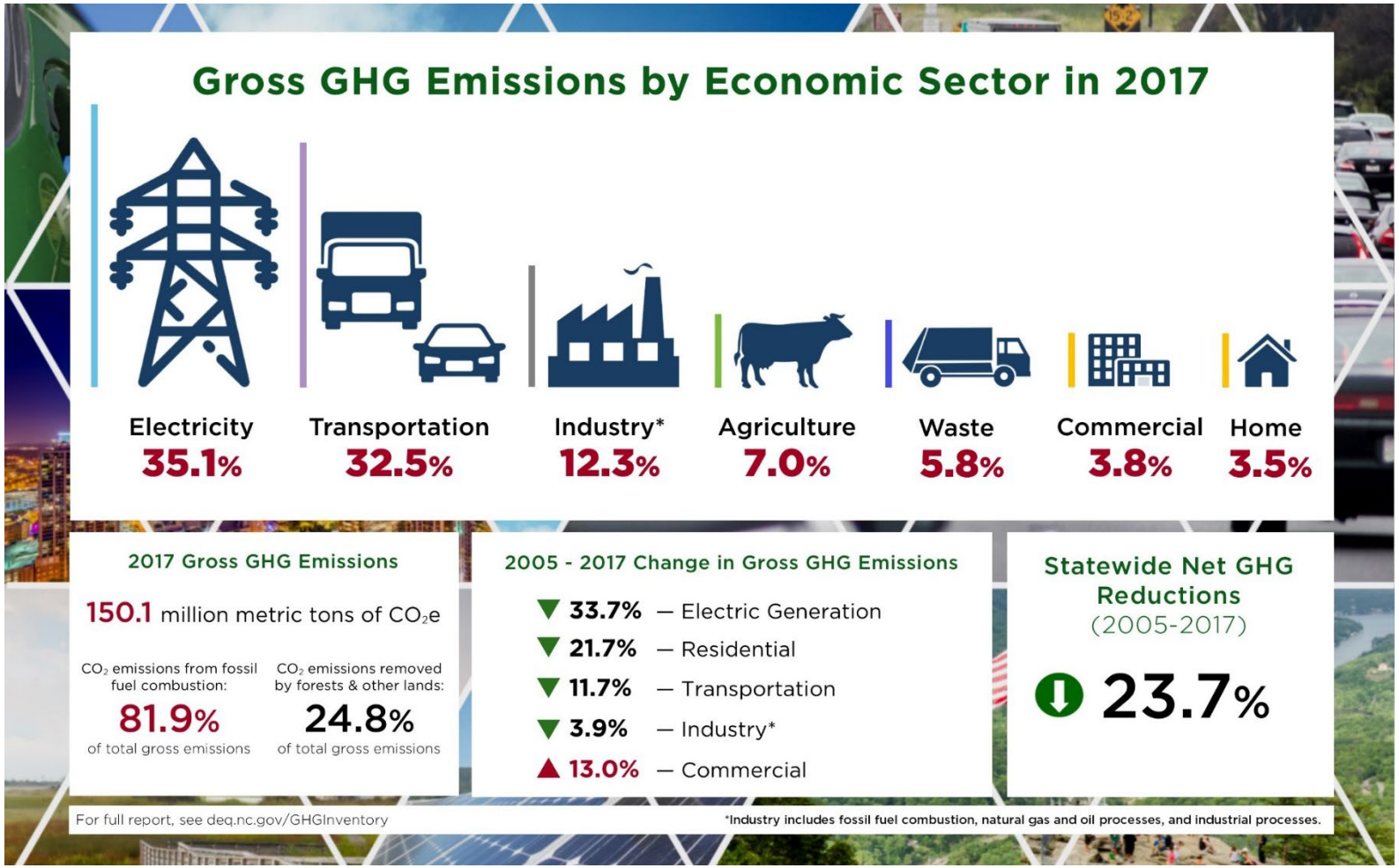
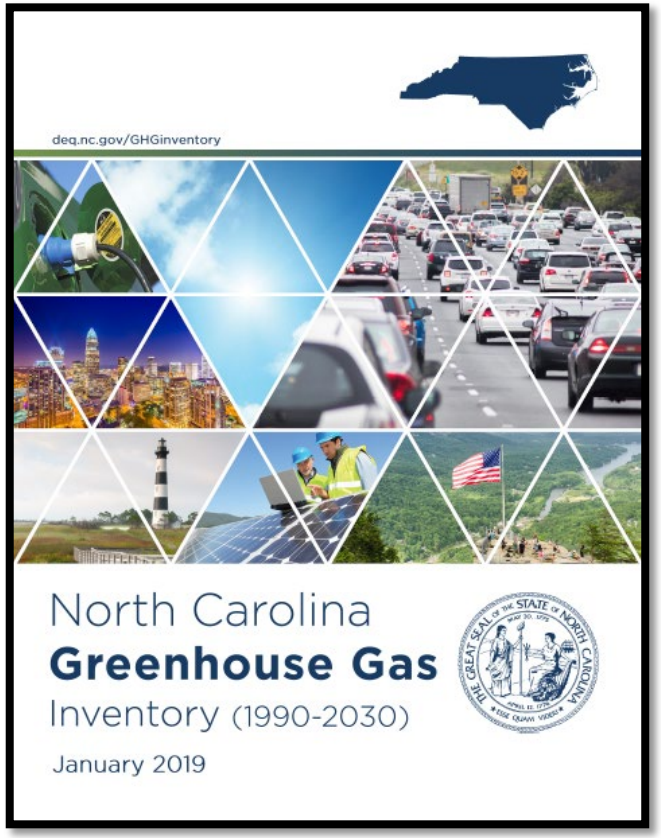
GHG Inventory Overview

Quick Facts: 2005 - 2017

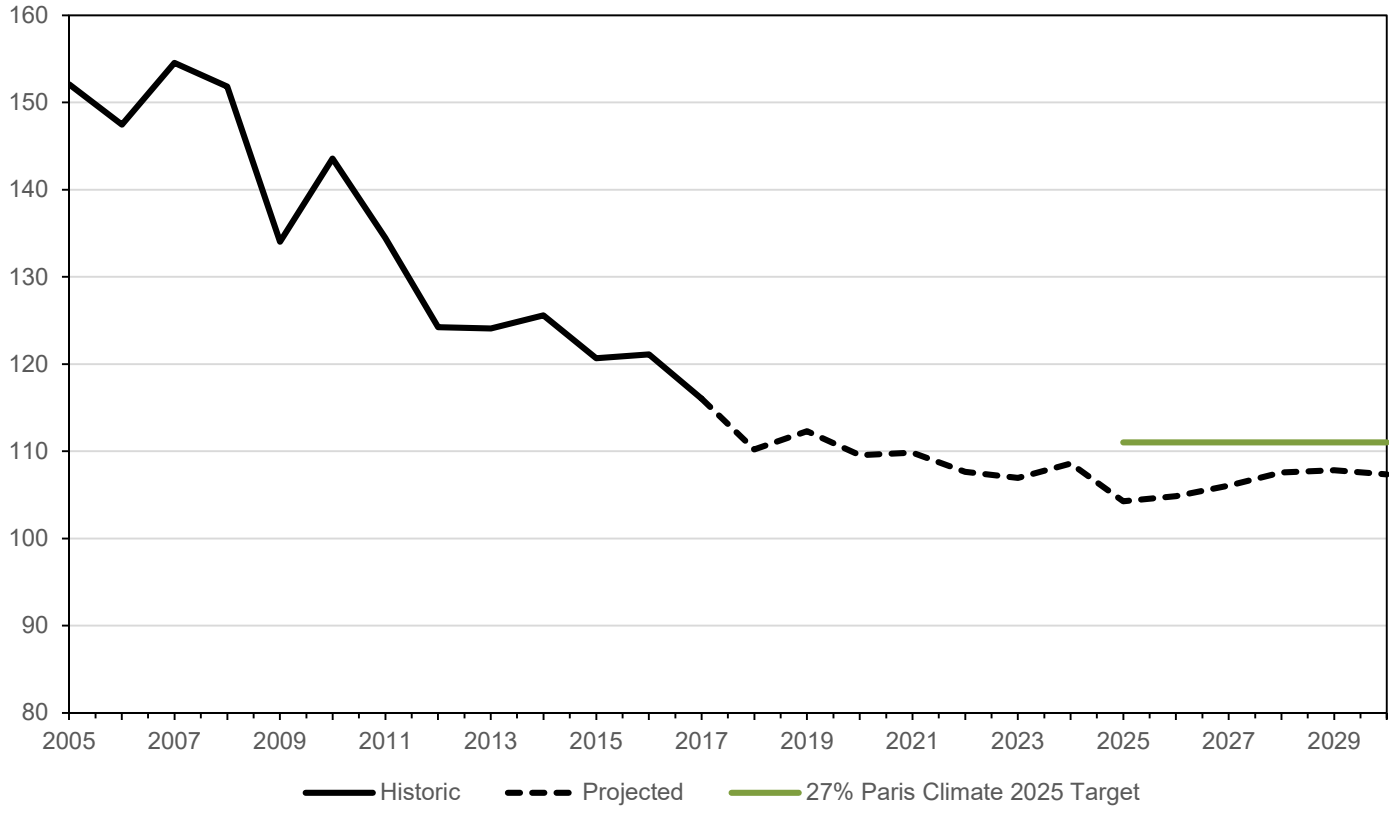




Full Report

https://files.nc.gov/ncdeq/climate-change/ghg-inventory/GHG-Inventory-Report-FINAL.pdf

Net GHG Emissions Trends in North Carolina, 2005-2030



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North Carolina's GHG Emissions

million metric tons carbon dioxide equivalent ($MMTCO_2e$)

Sector	2005	2017	2025
Electricity Use	79.37	52.60	40.59
Transportation	55.19	48.72	41.00
Residential/Commercial/Industrial Combustion*	26.02	20.92	23.26
Agriculture	10.65	10.53	10.47
Waste Management	8.52	8.77	10.17
Industrial Processes	3.83	7.18	11.31
Natural Gas and Oil Systems	1.17	1.35	1.47
Gross Emissions	**184.74**	**150.08**	**138.28**
Net Carbon Sinks - LULUCF**	-32.66	-34.03	-34.03
Net Emissions	**152.08**	**116.06**	**104.25**
Estimated Reduction in Net Emissions from 2005		23.7%	31.4%

Note: Totals may not equal exact sum of subtotals shown in this table due to independent rounding.
* Emissions associated with on-site fuel combustion activities in the Residential, Commercial, and Industrial sectors.
** Land Use, Land Use Change and Forestry

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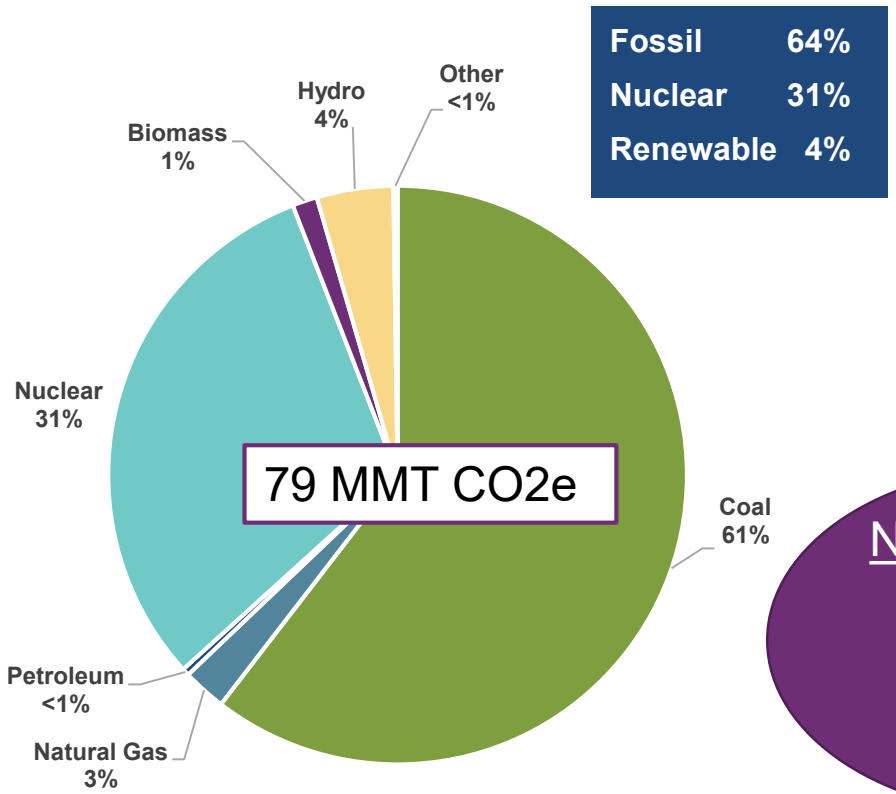
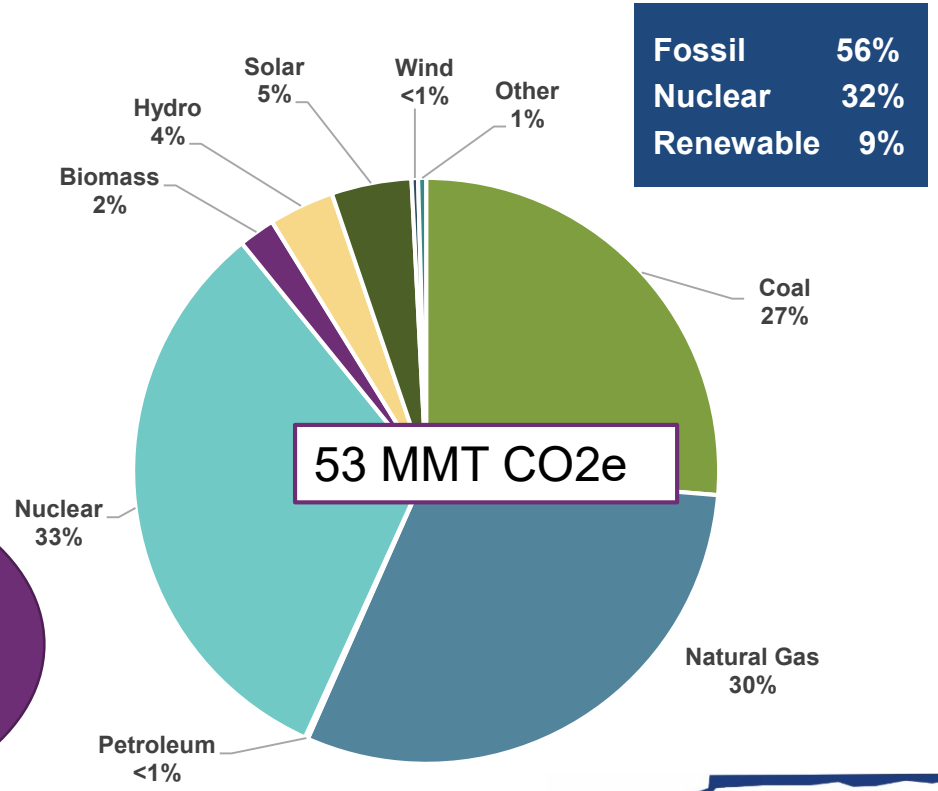
North Carolina Electricity Generation By Source Type (2005 & 2017)

2005 Electricity Generation



2017 Electricity Generation



NC Reductions

34% GHG

90% SO2

37% NOx

NC Imports about 10% of its electricity each year

Source: NC GHG Inventory, 2019

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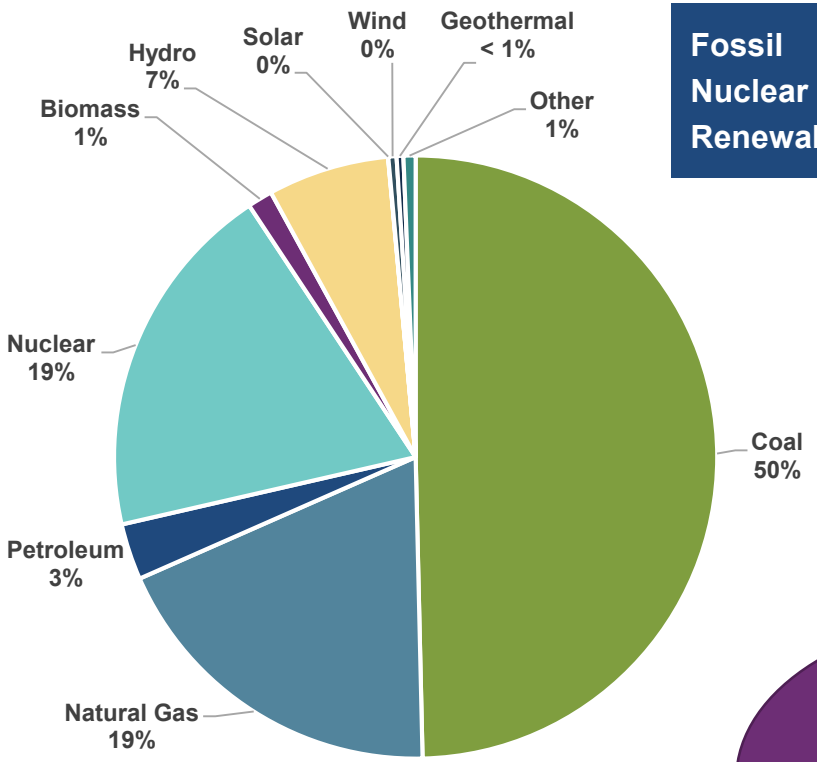
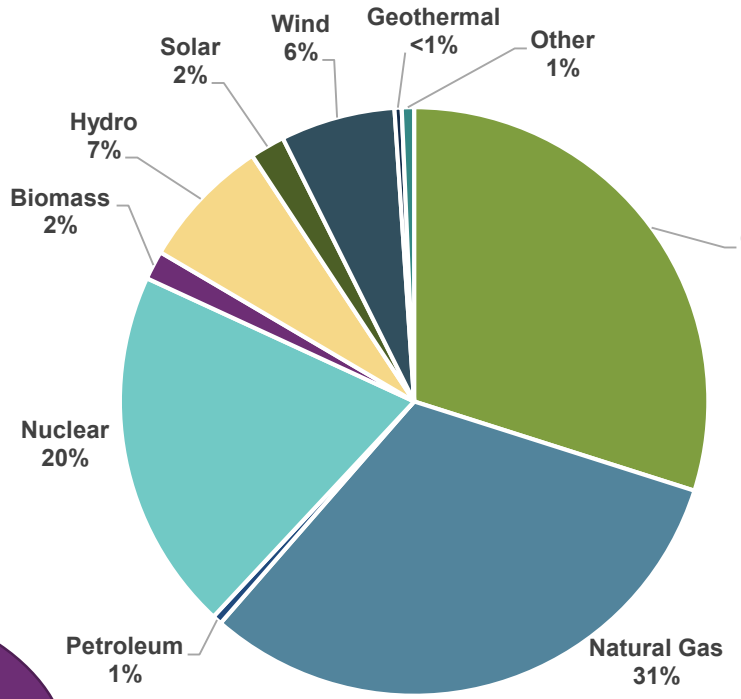
U.S. Electricity Generation By Source Type (2005 & 2017)

U.S. 2005 Electricity Generation



Fossil	71%
Nuclear	19%
Renewable	7%

U.S. 2017 Electricity Generation



Fossil	62%
Nuclear	20%
Renewable	16%

US Reductions

23% GHG

80% SO2

60% NOx

Source: EIA Electricity Data Browser

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Acknowledgements

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