ICF INTERNATIONAL

Draft Inventory of Greenhouse Gas Emissions and Sinks in Hawaii: 1990 and 2007

January 15, 2009

Presentation Overview

- Act 234 Mandate
- Background on Inventories
- Updated Inventory Approach
- 1990 and 2007 Results
- Emissions in Context

Hawaii GHG Emissions Reduction Act 234: Inventory Requirement

"By December 31, 2008, the Department of Business, Economic Development, and Tourism and the Department of Health shall complete an updated inventory of emission sources or categories of sources from the past report prepared by the Department of Business, Economic Development, and Tourism and the Department of Health, entitled, "Inventory of Hawaii Greenhouse Gas Emissions Estimates for 1990", dated July 1997; provided that at least one public hearing shall be held prior to the completion of the updated inventory." – Act 234

Background

- What is a GHG inventory?
- Why prepare an inventory?
- Inventory scope
- Data considerations

What is a GHG Inventory?

- Estimate of GHGs emitted and removed from the atmosphere
  - Specific timeframe
  - Specific geographic scale (e.g., country, state, county)
- Transparent and easily reproducible
- Follows established accounting guidelines (e.g., IPCC, EIIP, WRI/WBCSD)
- More than 45 states have completed inventories for 1990

Why Prepare an Inventory?

- To identify the greatest sources of GHG emissions within your geographic region
- To understand emission trends
- To quantify the benefits of specific activities that result in GHG emissions
- To provide a basis for identifying mitigation actions
- To track progress at reducing emissions
- To set goals and targets for future reductions

Inventory Scope: Sources and Gases

- Sources (sectors)
  - Energy
  - Industrial Processes
  - Waste
  - Agriculture, Forestry, and Other Land Use

- Gases

	National (IPCC)	States (EIIP)	Cities for Climate Protection (CCP)
CO_2	✓	✓	✓
N_2O	✓	✓	✓
CH_4	✓	✓	✓
PFCs	✓	✓	
HFCs	✓	✓	
SF_6	✓	✓	

Data Considerations

- Availability
  - 1990 data is difficult to obtain in 2008
- Collection Method
  - Top-down
    - Data compiled by an agency or office that attempts to provide information (e.g., fuel consumption) for specific geographic areas (e.g., EIA's State Energy Data Report)
  - Bottom-up
    - Data representing end use information, pulled from utility bills or other locally provided sources of information
- Quality
  - Is the data verifiable?
- Scale
  - Entity-level, county-level, state-level, national-level

Updated Inventory Approach

- Methods
- Data
- Sources

Updating Hawaii's GHG Inventory

- Methods
  - What methods, assumptions, and data were used in the 1997 Report?
  - Are improved methods and assumptions available?
  - Are more up-to-date carbon contents, global warming potentials, emission factors, and other factors available?
- Data
  - What data were used in the 1997 Report?
  - Where proxy data were used, is actual historical information available?
- Sources of Emissions
  - Were the appropriate emissions sources included in the 1997 Report?
  - Were any key sources omitted in the 1997 Report?
  - What gases were covered in the estimates?
  - Should any sources be allocated differently (e.g., fuel used for military purposes and international transport)?

Methodological Improvements

- Consulted international and state guidelines
  - Intergovernmental Panel on Climate Change (IPCC) Guidelines, including:
    - *Revised IPCC Guidelines for National Greenhouse Gas Inventories (1996)*
    - *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003)*
    - *2006 IPCC Guidelines for National Greenhouse Gas Inventories*
  - Emission Inventory Improvement Program, Volume VII, Estimating State GHG Emissions and Sinks

Methodological Improvements (cont.)

- Consulted recent inventories/state-of-the-art methods
  - U.S. EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks*
  - *Inventory of California Greenhouse Gas Emissions and Sinks*
  - Draft GHG inventory for the Delaware Valley Regional Planning Commission (DVRPC) under development by ICF
  - EPA's *State Greenhouse Gas Inventory Tools* (SITs)

Collection and Verification of Data

- Data availability drives methodological choices within the flexible IPCC framework
- Where possible, data cited in the 1997 Report was recollected and verified before being used to develop updated inventory estimates
- As available, Hawaii-specific data was collected for all sources

Collection and Verification of Energy Data

- As with most state GHG inventories, energy consumption data drives emission profile and trends
- Detailed fuel consumption data only available as of mid-October
- DBEDT Records dataset was compiled from a number of data sources and reports of fuel consumption to DBEDT:
  - AES; Chevron; Hawaii Department of Taxation; the Energy Information Administration of the U.S. Department of Energy; Gay & Robinson; Hawaiian Commercial & Sugar Company (HC&S); the Petroleum Industry Monitoring, Analysis, and Reporting Program (PIMAR), Hawaiian Electric Company (HECO), Hawaii Electric Light Company (HELCO), Maui Electric Company (MECO), and Kauai Island Utility Cooperative (KIUC)

Collection and Verification of Energy Data

- ICF evaluated the DBEDT Records dataset
  - Assessing data for each year and comparing against other sources
  - The July 1997 report, EIA, and PIMAR (Hawaii's Petroleum Industry Monitoring, Analysis, and Reporting Program)
- Concluded DBEDT Records represent the best available data for both 1990 and 2007
  - Data available at a detailed level: fuel provider, activity, and county
  - Compiled from thousands of data points reported to or compiled by DBEDT
  - Matches up well with EIA overall, though some differences for individual fuel types

Categorization of Emission Sources

- Implemented the IPCC 2006 guidelines for categorization of sources
  - Updated Inventory presents the 4 IPCC sectors: Energy, Industrial Processes, Waste, and AFOLU
  - July 1997 report presented emissions for 2 main areas, “Energy Use” and “Non-Energy Sources” (Industrial Processes, Municipal Waste Management, and Agricultural Activities)
- Source categories moved between sectors
  - Fugitive emissions from oil and gas activities moved to the Energy sector
  - Emissions from MSW combustion moved to the waste sector

New Emission Sources and Sinks in the Updated Inventory

- Energy
  - Military fuel consumption (now included in totals)
  - Domestic interstate travel
  - International travel (NOT included in totals)
- Industrial Processes
  - Electricity transmission and distribution
  - Substitutes of ozone depleting substances (ODS)
- Waste
  - N_2O from wastewater
- AFOLU
  - N_2O from manure management
  - Direct emissions from crop residue and manure inputs
  - Indirect emissions from fertilizer, crop residues, and manure
  - Urea application
  - Landfilled yard trimmings and food scraps
  - Urban trees
  - Forest fires

1990 and 2007 Draft Results

- Summary of emissions and sinks
- Estimates by island
- Estimates by gas
- Estimates by sector
- Changes in emissions from 1990 to 2007

Hawaii GHG Emissions Summary

Hawaii GHG Emissions Summary By Sector & Source, 1990 & 2007 (MMTCO2Eq)		
Sector/Source	**1990**	**2007**
Energy	**21.12**	**21.83**
Residential	0.03	0.05
Commercial	0.38	0.26
Industrial	0.70	0.18
Transportation	13.21	12.58
Ground	3.23	4.47
Marine	1.65	2.16
Aviation	6.80	4.83
Other	1.53	1.13
Electric Power	6.79	8.76
Oil and Gas	+	+
International Bunker Fuels	*1.01*	*1.32*
Industrial Processes	**0.18**	**0.54**
Cement Manufacture	0.10	-
Electricity T&D	0.08	0.04
Substitutes of ODS	-	0.50
Waste	**0.85**	**1.07**
Municipal Solid Waste - Landfills	0.54	0.77
Municipal Solid Waste - Combustion	0.18	0.15
Wastewater	0.13	0.15

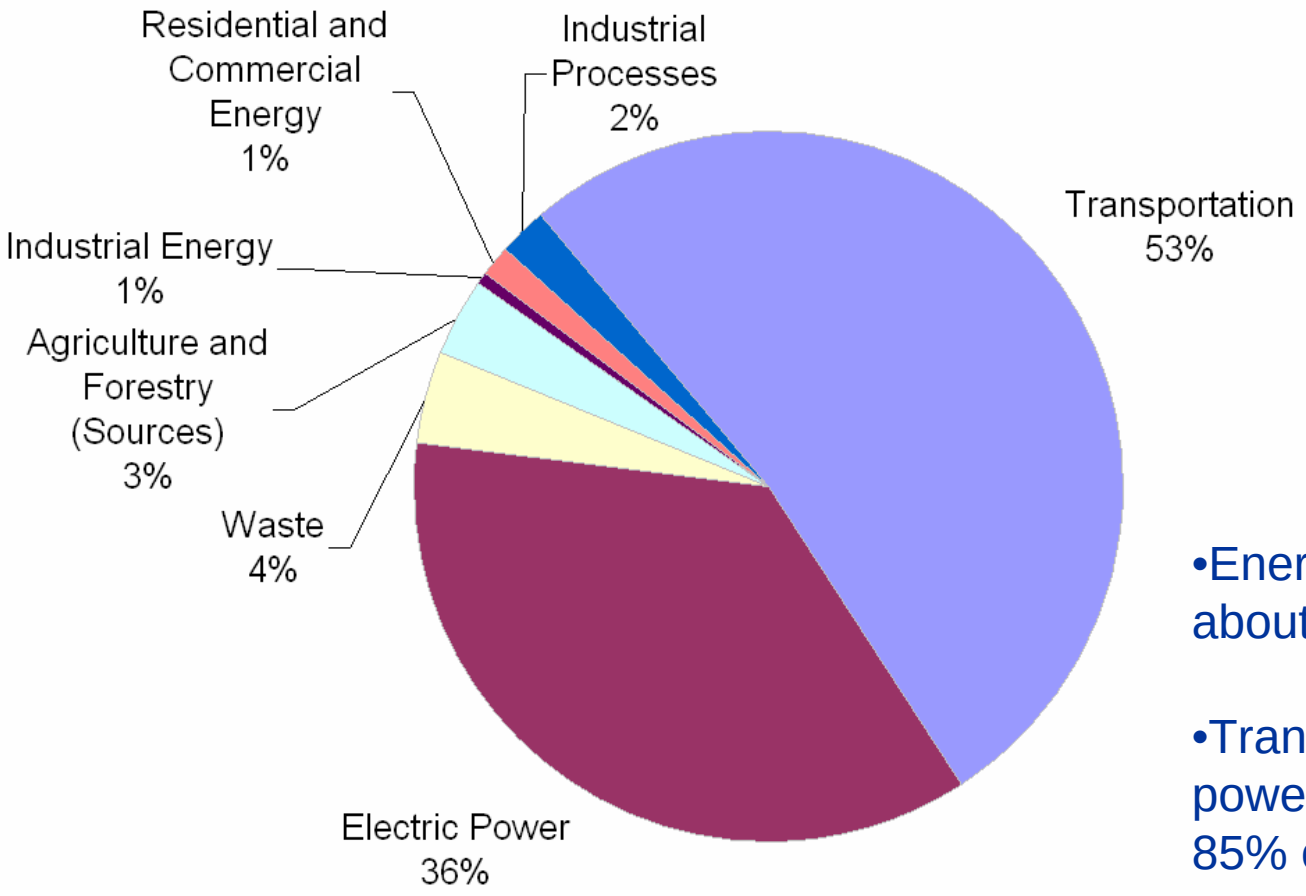
While aviation emissions are counted in Inventory totals, Act 234 specifies that they cannot be regulated as part of the emissions reduction effort

Hawaii GHG Emissions Summary (cont.)

Hawaii GHG Emissions Summary By Sector & Source, 1990 & 2007 (MMTCO2Eq)		
Sector/Source	**1990**	**2007**
Agriculture, Forestry and Other Land Use (AFOLU Sources)	**0.98**	**0.83**
Agriculture, Forestry and Other Land Use (AFOLU Sinks)	***-2.67***	***-2.75***
Enteric Fermentation	0.27	0.25
Manure Management	0.12	0.05
Agricultural Soil Management	0.19	0.17
Field Burning of Agricultural Residues	0.03	0.01
Urea Application	+	+
Agricultural Soil C	0.22	0.24
Landfilled Yard Trimmings and Food Scraps	-0.11	-0.03
Urban Trees	-0.11	-0.13
Forest C	-2.45	-2.59
Forest Fires	0.16	0.12
TOTAL Emissions (Excluding Sinks)	**23.13**	**24.27**
TOTAL Net Emissions (Including Sinks)	**20.46**	**21.52**
TOTAL Emissions (Excluding Sinks, Excluding Aviation)	**16.33**	**19.44**
TOTAL Net Emissions (Including Sinks, Excluding Aviation)	**13.66**	**16.69**

+ Less than .01 MMTCO2Eq; - No emissions occurring/estimated

Composition of 2007 Emissions

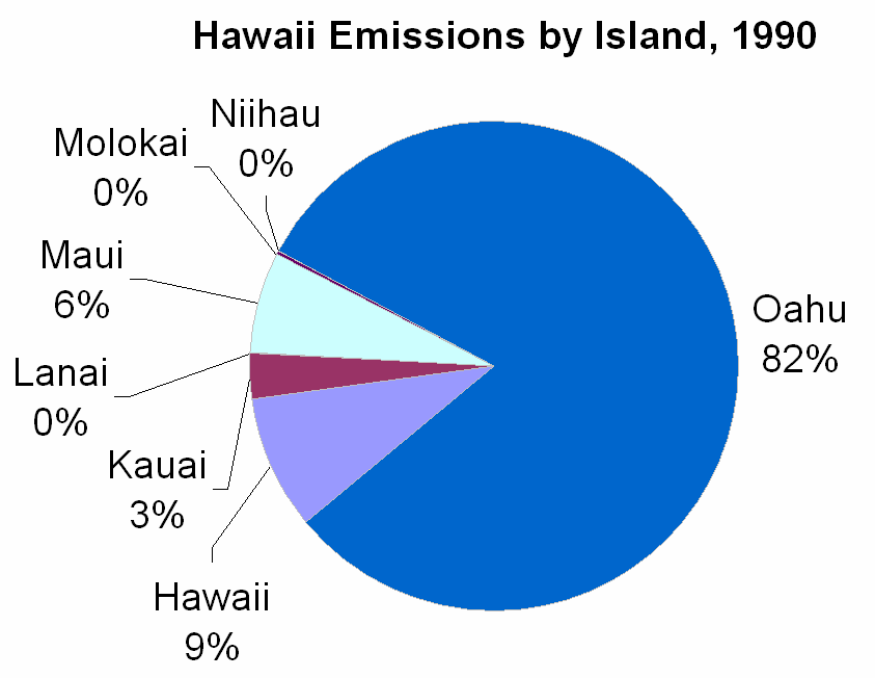


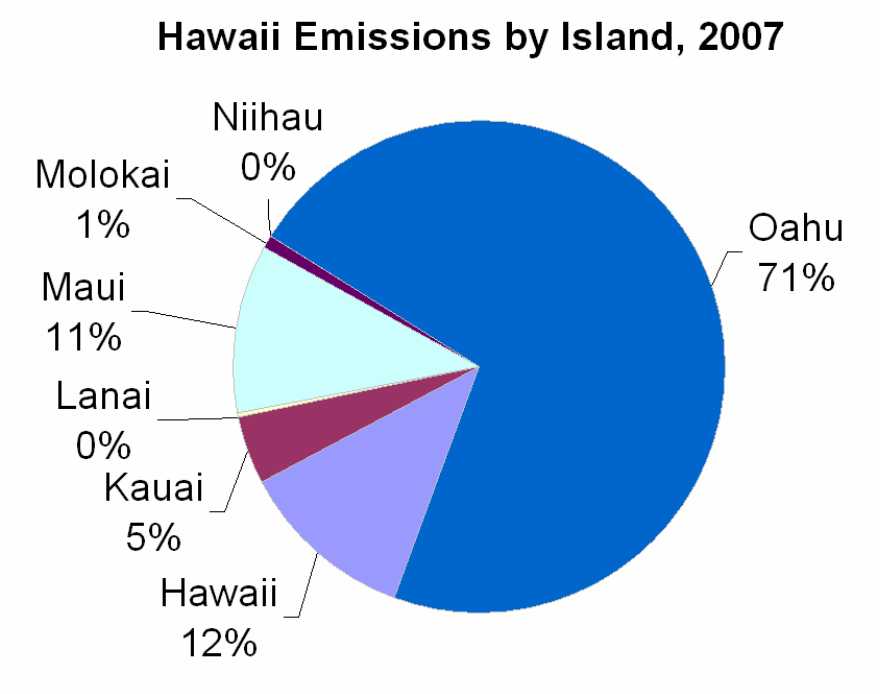
- Energy sector responsible for about 90% of all emissions
- Transportation and electric power account for more than 85% of total emissions in Hawaii

Total Emissions (*including aviation*) = 24.27 MMTCO2E

Total Emissions (*excluding aviation*) = 19.44 MMTCO2E

Hawaii GHG Emissions by Island





Total Emissions (*including aviation*)
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Total Emissions (*excluding aviation*)
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Total Emissions (*including aviation*)
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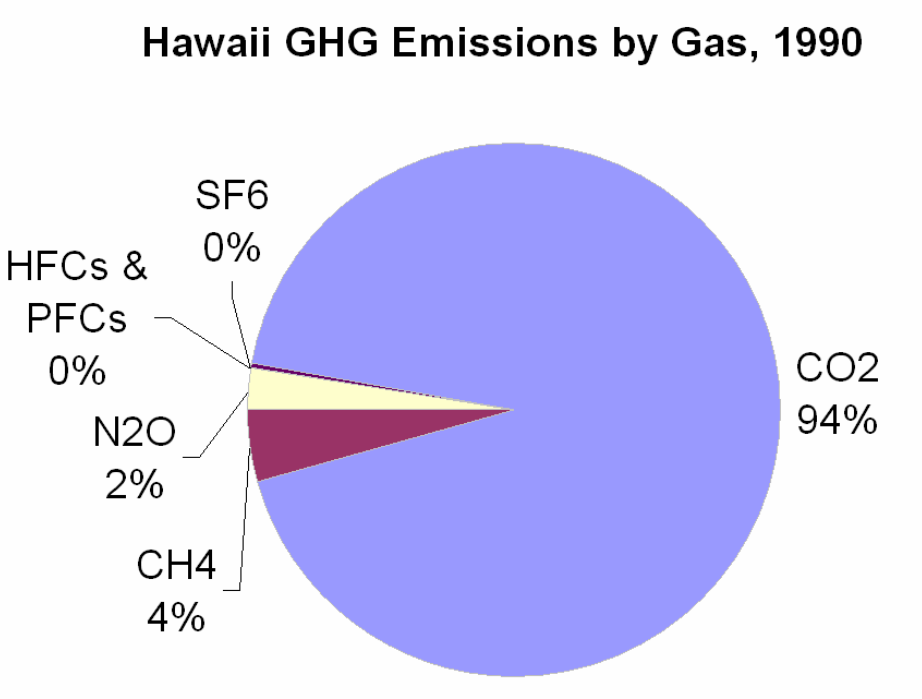
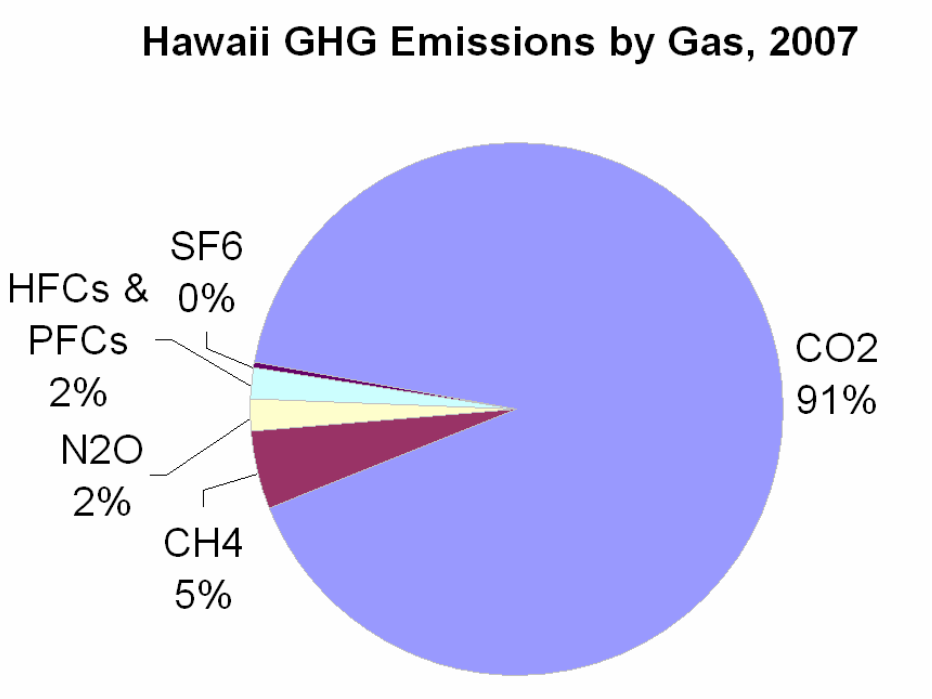
Total Emissions (*excluding aviation*)
= 19.44 MMTCO2E

Hawaii GHG Emissions by Gas





Total Emissions (*including aviation*)
= 23.13 MMTCO2E

Total Emissions (*excluding aviation*)
= 16.33 MMTCO2E

Total Emissions (*including aviation*)
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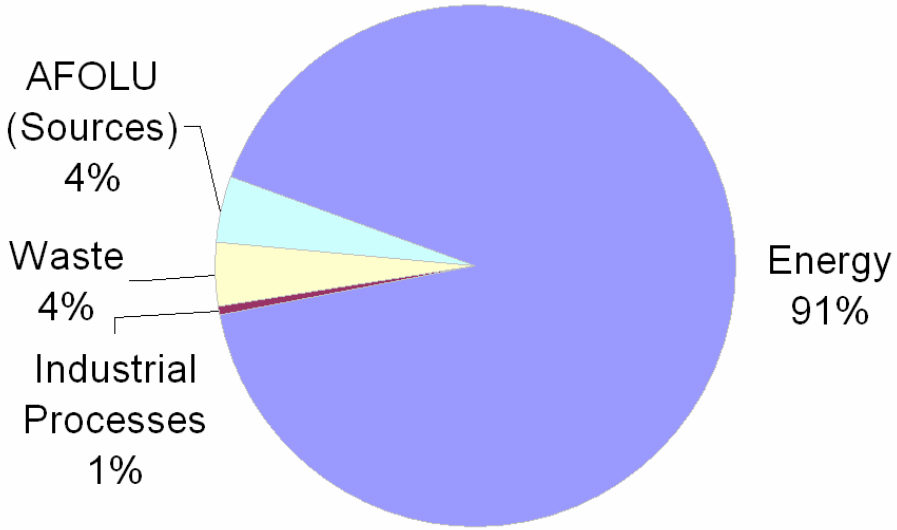
Total Emissions (*excluding aviation*)
= 19.44 MMTCO2E

Hawaii GHG Emissions by Sector

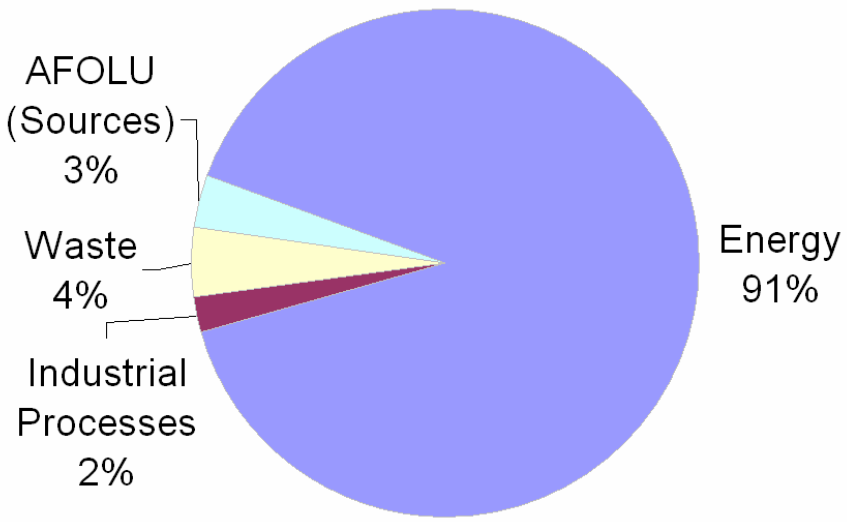
Hawaii Emissions by Sector, 1990



Total Emissions (*including aviation*) = 23.13 MMTCO2E

Total Emissions (*excluding aviation*) = 16.33 MMTCO2E

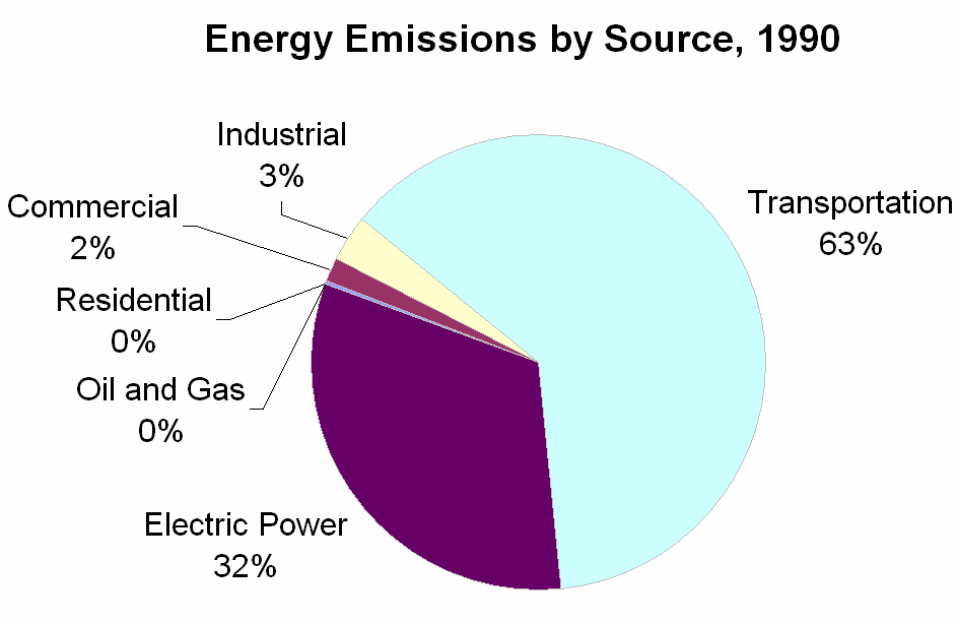
Hawaii Emissions by Sector, 2007

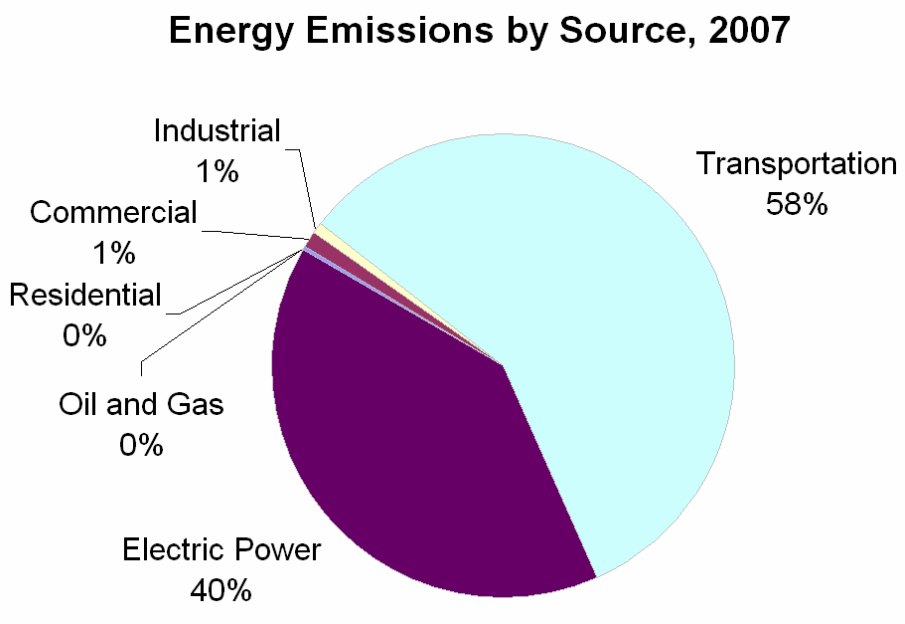


Total Emissions (*including aviation*) = 24.27 MMTCO2E

Total Emissions (*excluding aviation*) = 19.44 MMTCO2E

Energy Emissions by Source





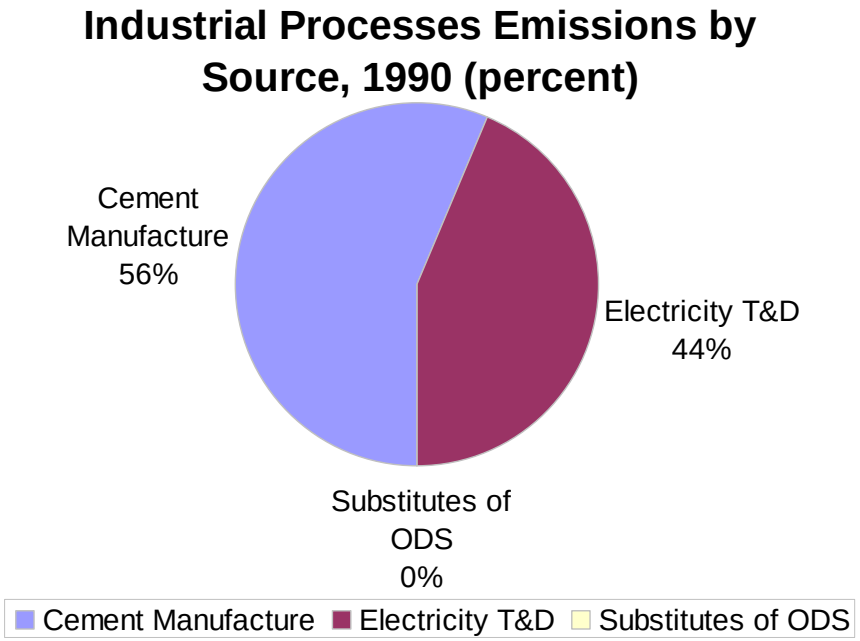
Total Energy Emissions (*including aviation*)
= 21.12 MMTCO2E

Total Energy Emissions (*excluding aviation*)
= 14.32 MMTCO2E

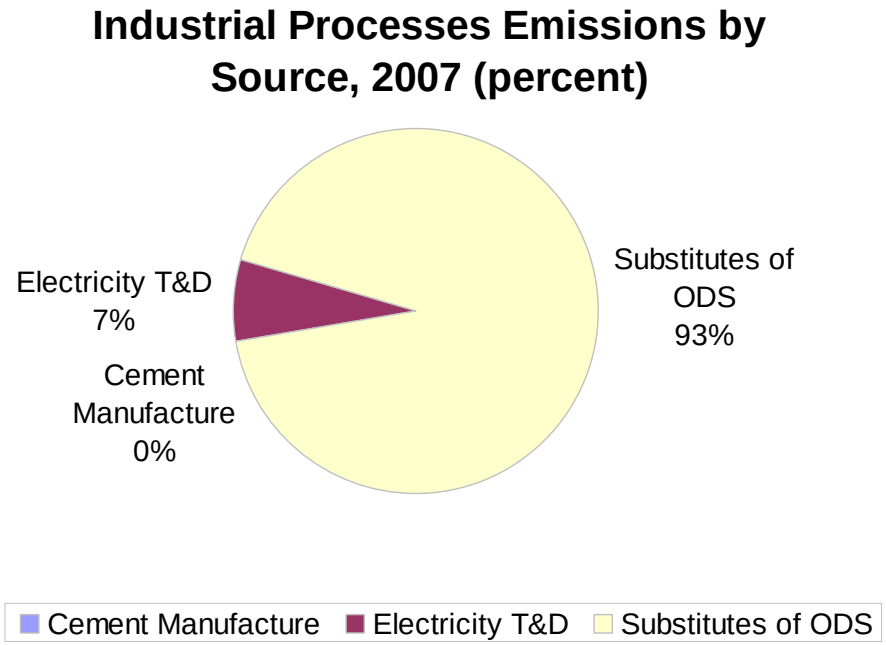
Total Energy Emissions (*including aviation*)
= 21.83 MMTCO2E

Total Energy Emissions (*excluding aviation*)
= 17.01 MMTCO2E

Industrial Processes

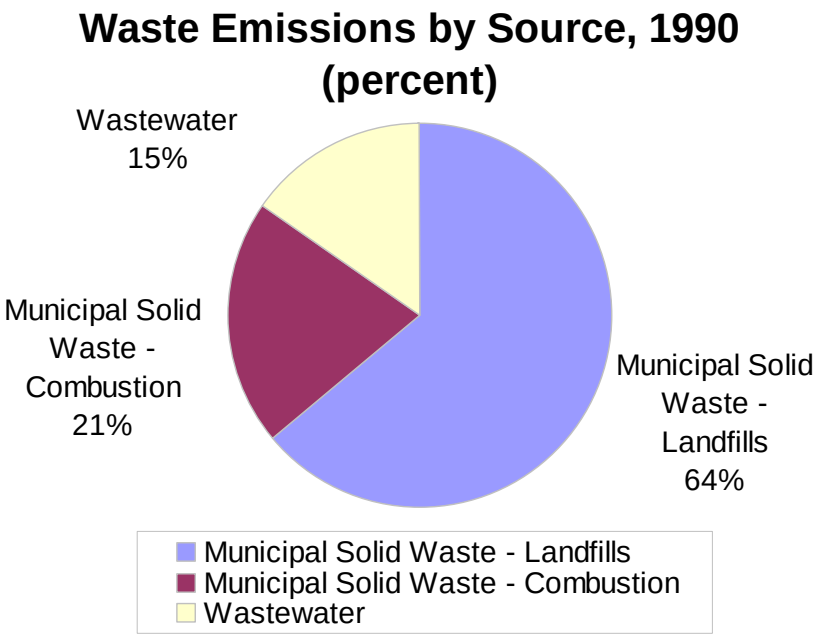


Total Emissions = 0.18 MMTCO2E

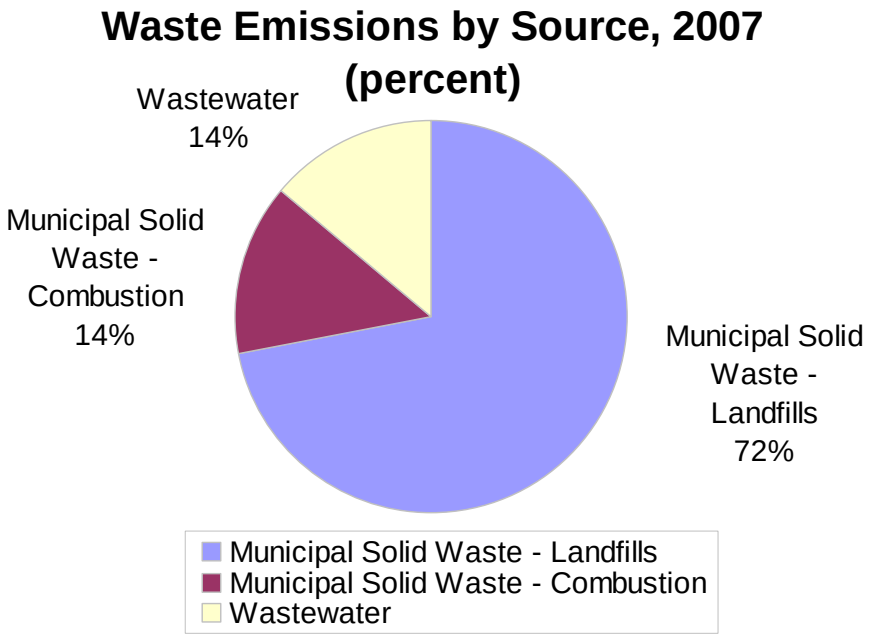


Total Emissions = 0.54 MMTCO2E

Waste



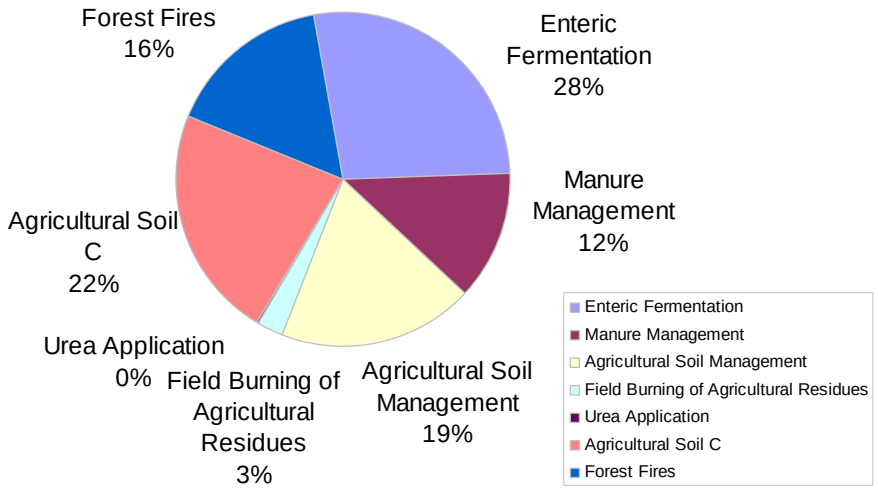
Total Emissions = 0.85 MMTCO2E



Total Emissions = 1.07 MMTCO2E

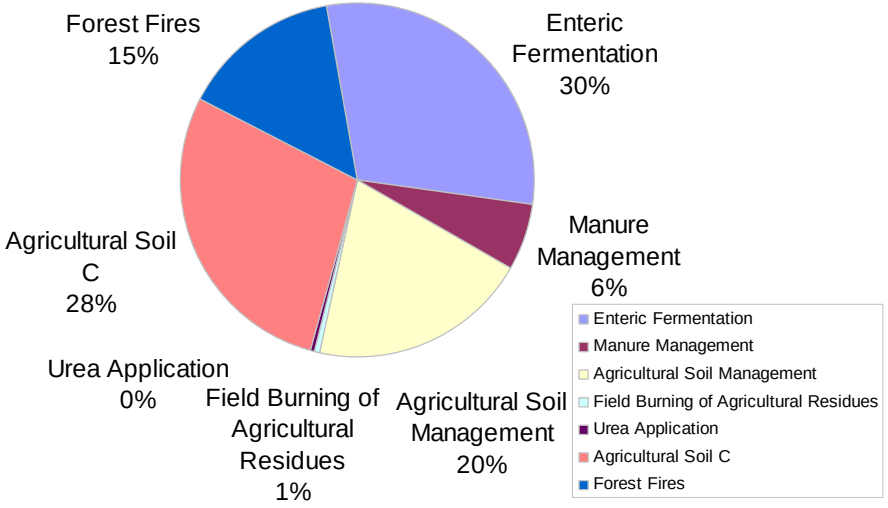
Agriculture, Forestry, and Other Land Use Emissions

Agriculture, Forestry, and Other Land Use: Emission Sources, 1990 (percent)



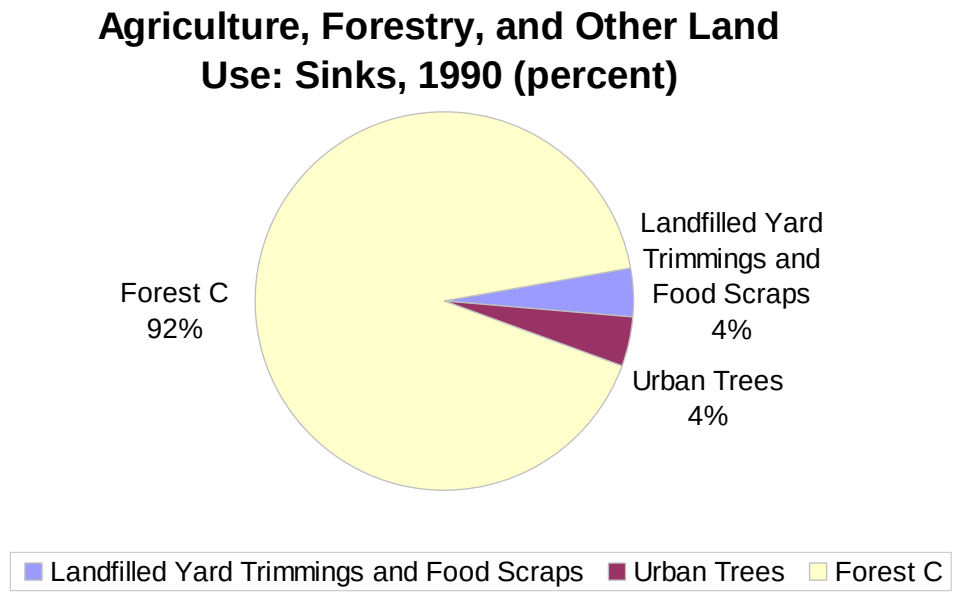
Total Emissions = 0.98 MMTCO2E

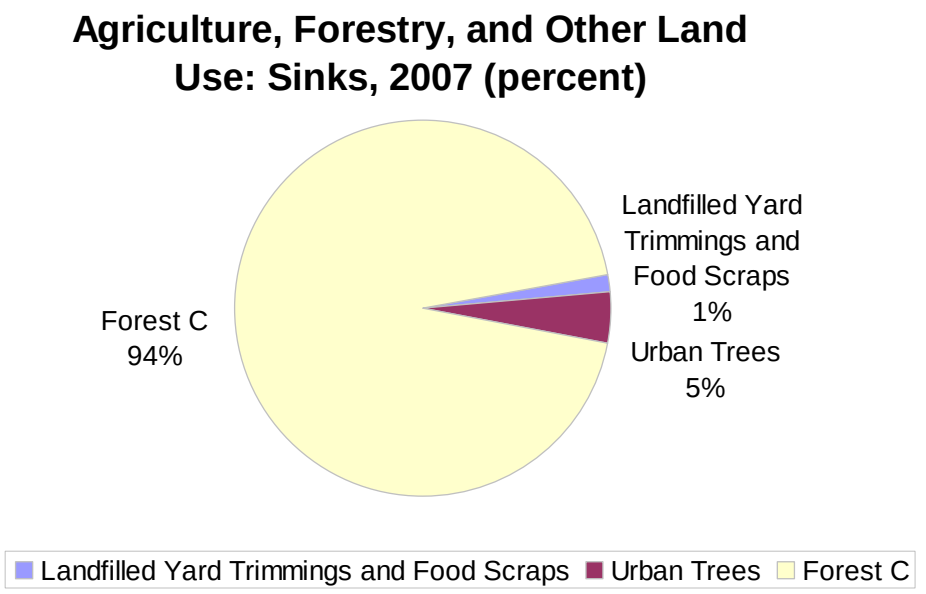
Agriculture, Forestry, and Other Land Use: Emission Sources, 2007 (percent)



Total Emissions = 0.83 MMTCO2E

Agriculture, Forestry, and Other Land Use Sinks





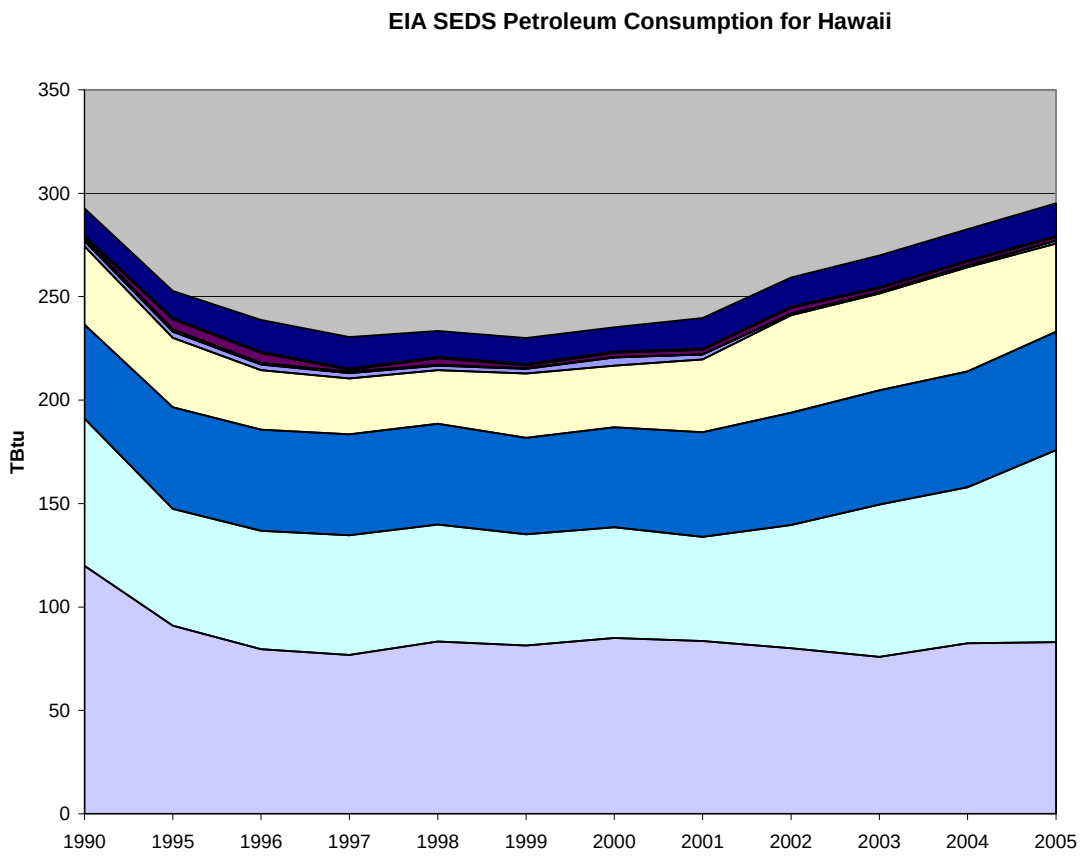
Total Sinks = 2.67 MMTCO2E

Total Sinks = 2.75 MMTCO2E

1990 Emissions Compared to 2007 Emissions

Emissions including aviation	Emissions excluding aviation (per Act 234 requirements)
Total emissions (net and gross) rose about 5%	Total net emissions rose 22%, total gross emissions rose 19%
Energy sector emissions grew about 3%	Energy sector emissions grew about 19%
Emissions from transportation decreased 5%	Emissions from transportation (ground, marine, and other) increased by 21%
Emissions from electric power increased 29%	Emissions from electric power increased 29%

Petroleum Consumption Trend, EIA

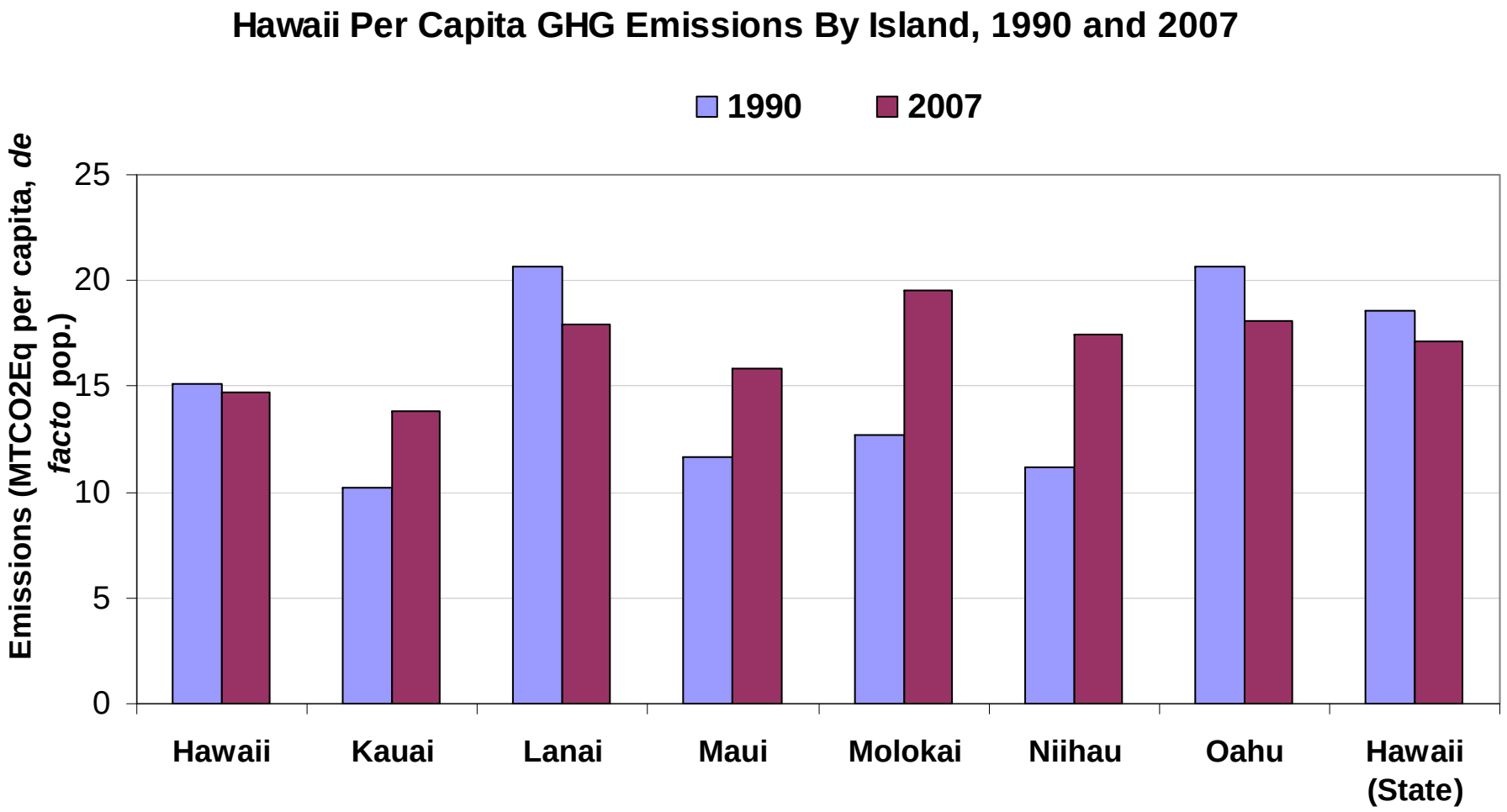


- Energy emissions track fuel consumption trends
  - Compared DBEDT Records against EIA
  - EIA also shows a comparable level of consumption for 1990 and 2005
  - EIA data shows high level of consumption for 1990, then slow decrease through the 1990's, increasing to similar levels by 2005

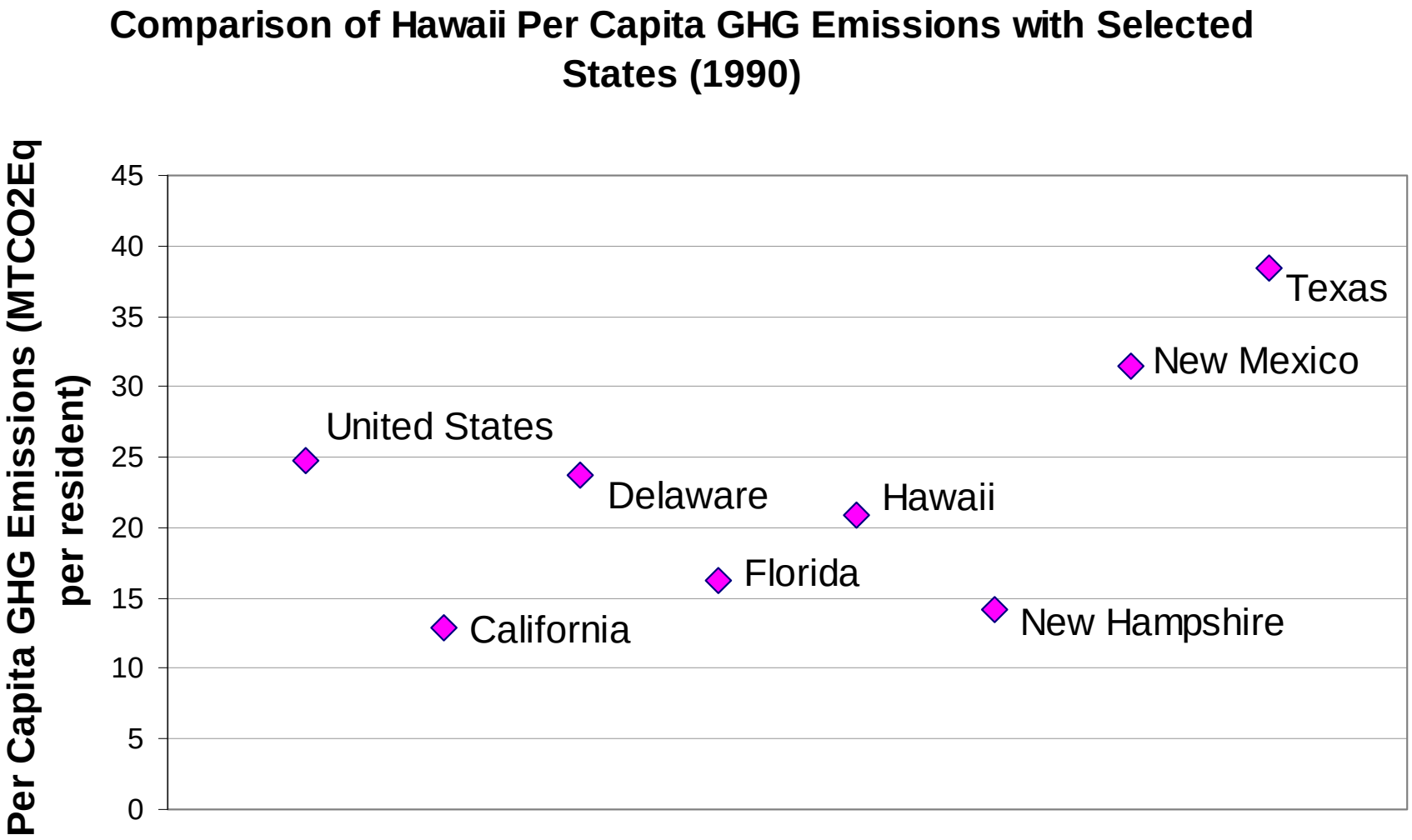
Emissions in Context

- Hawaii per capita emissions by island
- Hawaii per capita emissions compared to other states

Emissions in Context: Per capita, by Island



Emissions in Context: Selected States, Per Capita



Emissions in Context: Selected States, Per GDP