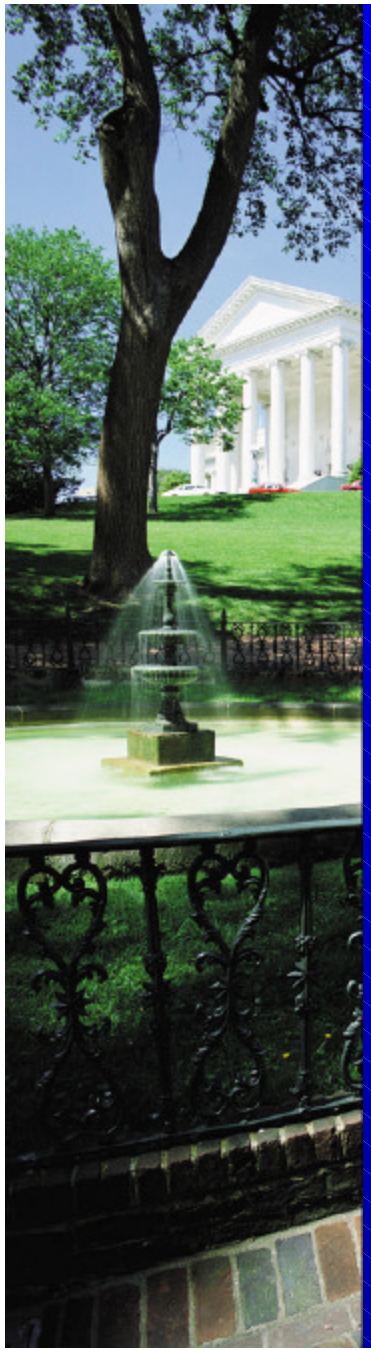
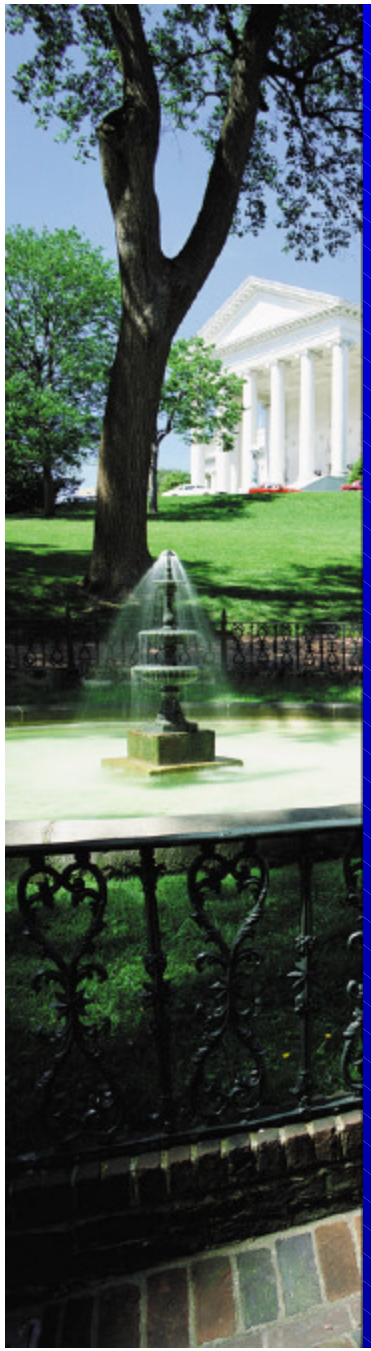


Greenhouse Gas Inventory Guidance and Tools for States

Philip Groth, ICF Consulting

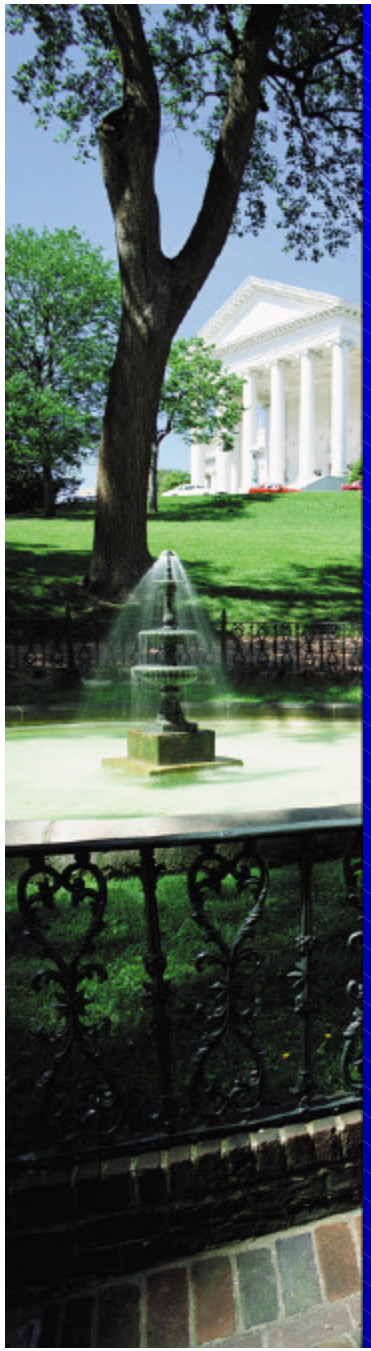
October 14, 2003

State & Local Climate Change Program
EPA



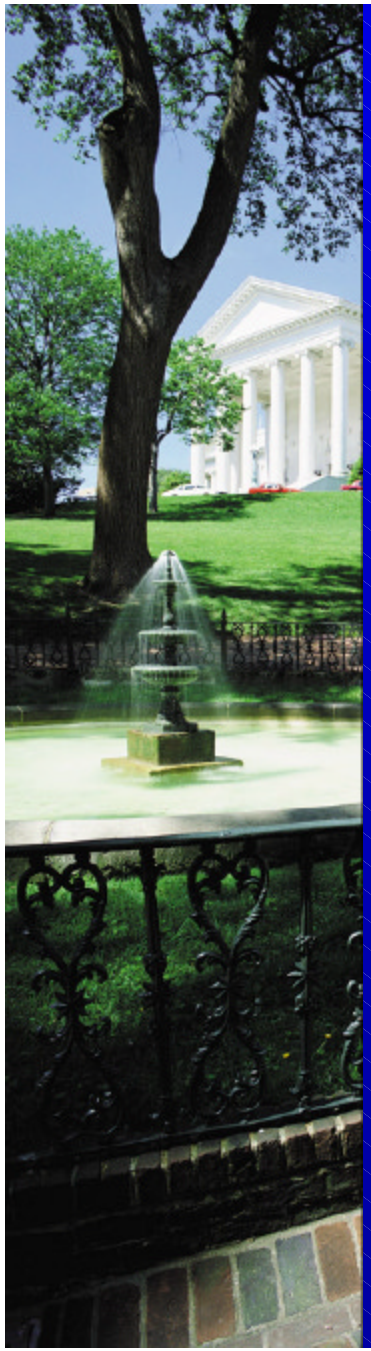
Overview

- History of state GHG inventories
- Lessons learned
- Revisions to EIIP State Guidance
- State Inventory Tool
- Tool demonstration
- Moving forward



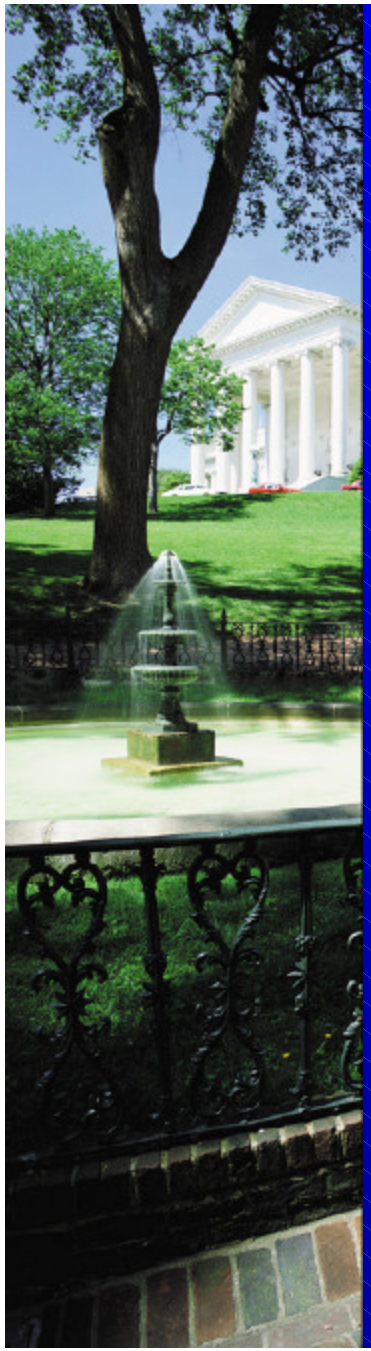
Historical Perspective

- The State and Local Climate Change Program began in 1990
  - Mission: to build capacity in the states
- Developed the *State Guidance* for estimating state GHG emissions
- Gave grants to states to develop GHG inventories
  - 39 states and Puerto Rico have developed inventories for 1990
  - WV inventory underway



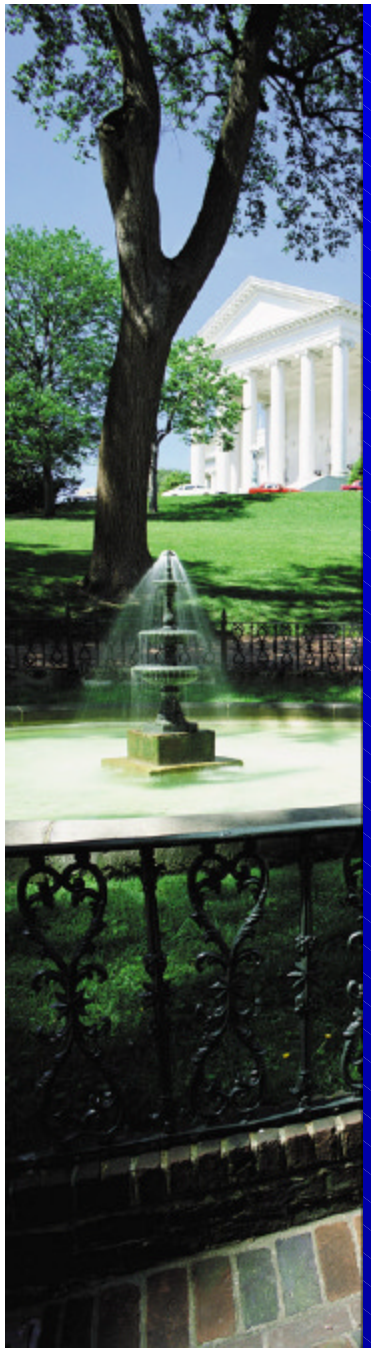
Rationale for SLCCP Inventory Support

- Help states develop targeted action plans
- Share EPA's extensive inventory experience
  - Development of the National Inventory
  - Contributing to the Good Practice Guidance
- Help states overcome monetary, knowledge, and data constraints
- Facilitate comparisons across states by providing standardized inventory methodologies

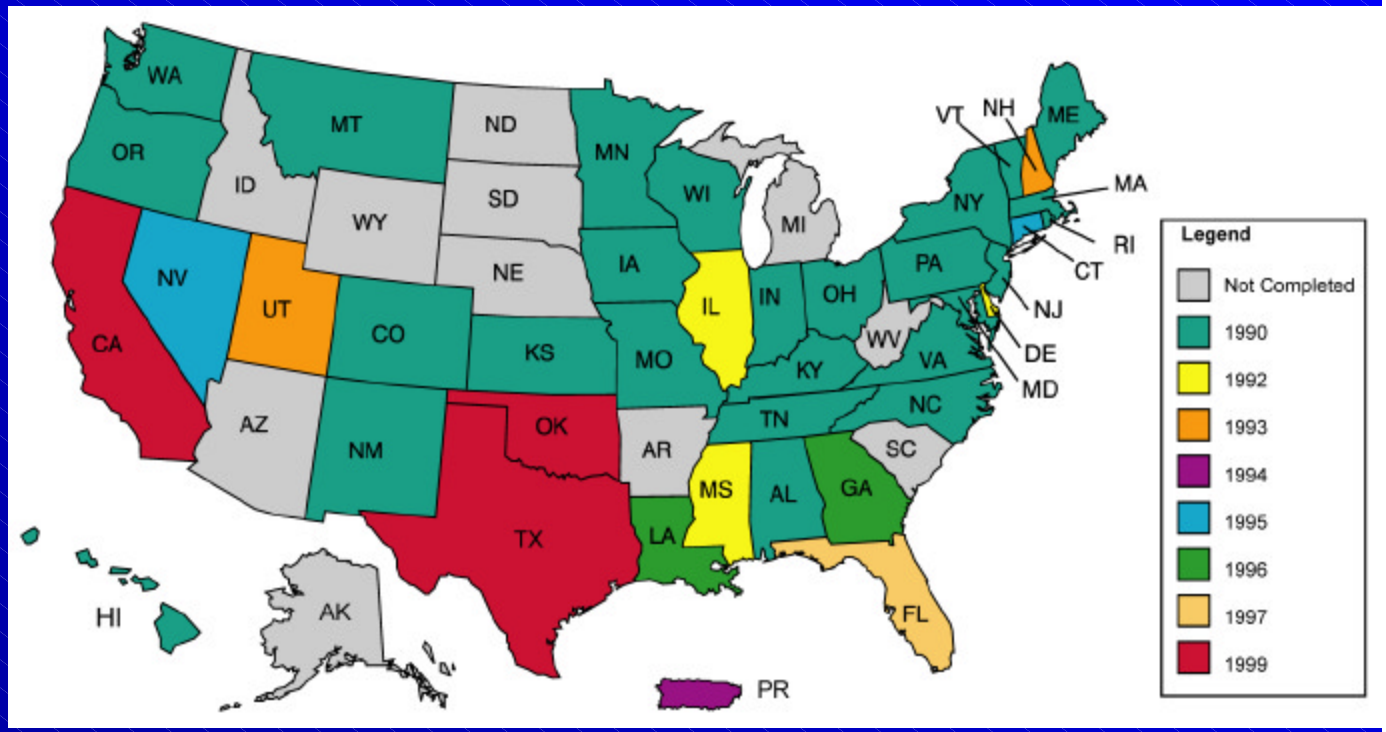


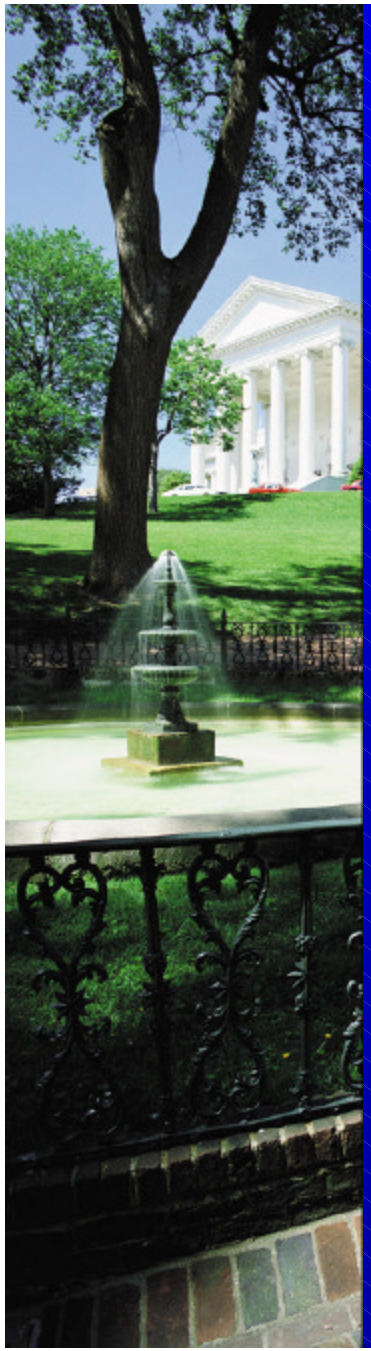
Lessons Learned

- Inventories are time-intensive
  - Collecting the data
  - Identifying the correct emission factors
  - Setting up the infrastructure to calculate emissions
- Inventories for 1990 are not very useful in 2003
- Emission trends are necessary for projecting emissions, identifying mitigation activities, and setting targets



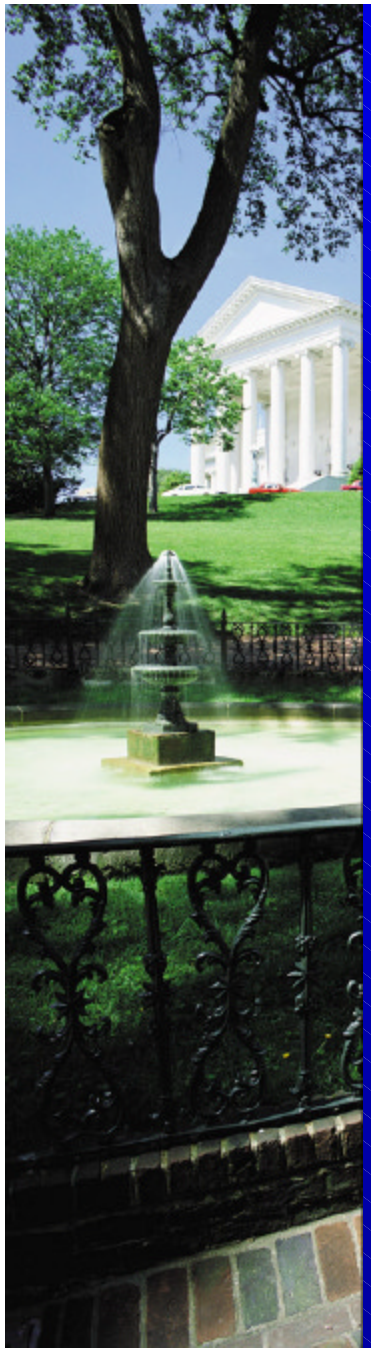
Most Recent Year of State GHG Inventory Completion





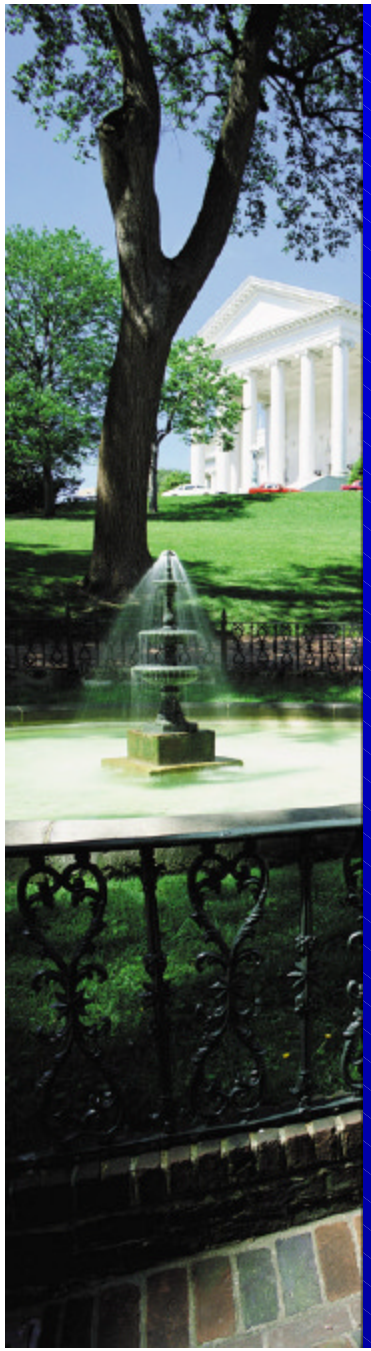
Lessons Learned (cont.)

- Methods in 1998 EIIP Guidance are outdated
- States need tools
  - To facilitate updates
  - To project emissions
  - To analyze trends



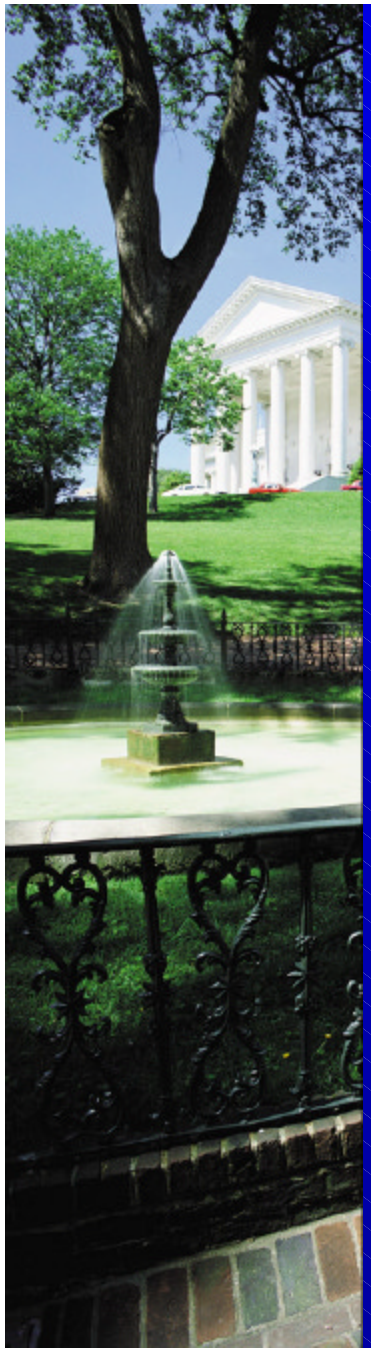
Revisions to EIIP Guidance

- Streamline the guidance
- Improve consistency with U.S. Inventory data sources, emission factors, and methods
- Incorporate updated state-level data sources, methods, and emission factors where possible
- Include references to the State Tool



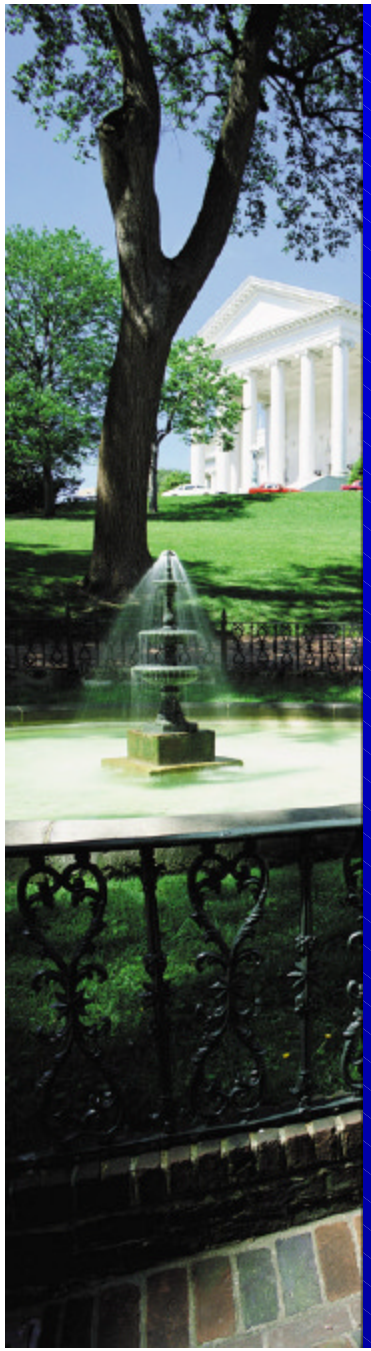
State Inventory Tool Goals

- Provide maximum transparency
- Include default state activity data and emission factors, but allow states to override this information
- Cover the 1990-2000 timeline
- Enable sector experts to work simultaneously on different parts of the inventory
- Create a user-friendly framework



State Inventory Tool Design

- Eleven Excel® modules comprise the State Inventory Tool
  - Ten modules cover the emission source categories
  - One Synthesis Module compiles data from the source modules into a complete inventory



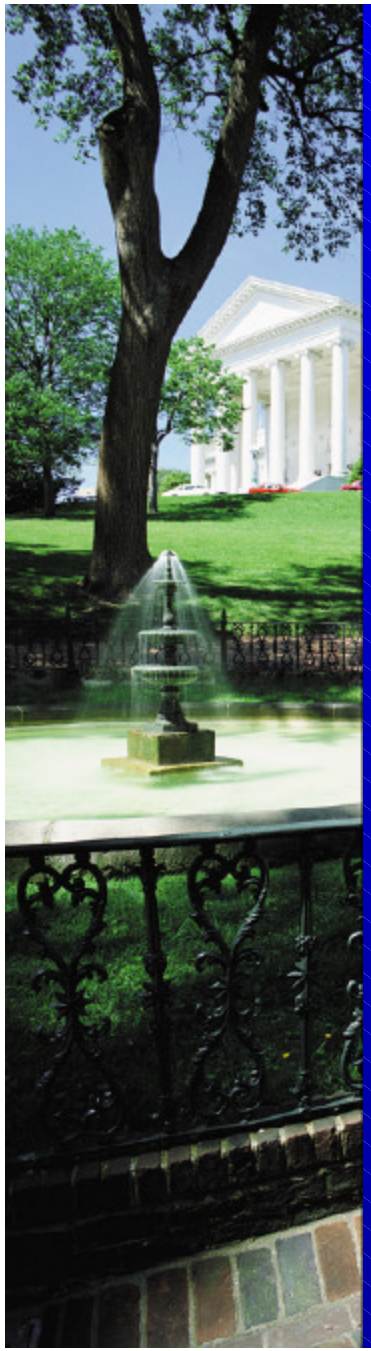
Sector Modules

Energy Modules

- CO_2 from Fossil Fuel Combustion
- CH_4 and N_2O from Stationary Combustion
- CH_4 and N_2O from Mobile Combustion
- Natural Gas and Oil Systems
- Coal Mining

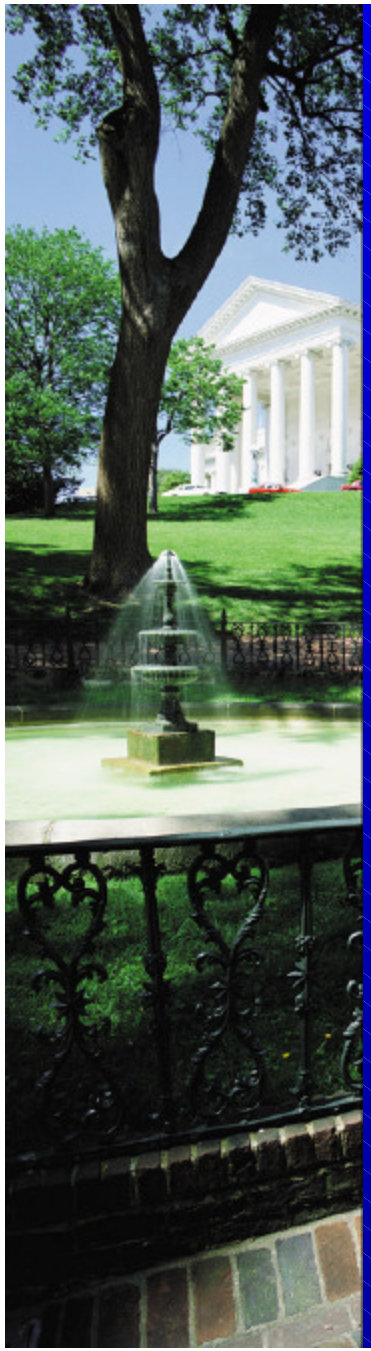
Other Modules

- Industrial Processes
- Agriculture
- Municipal Solid Waste
- Wastewater
- Forest Management and Land-Use Change



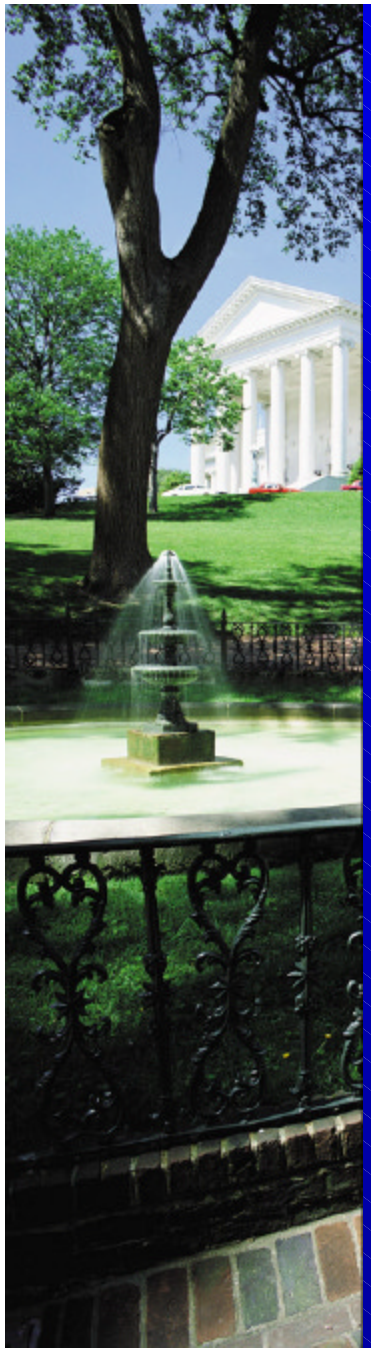
Using the Tool

- Complete one module at a time or farm modules out to sector experts
- When modules are complete, create export files
- Use Synthesis Module to create summary tables and graphs



How to Complete a Source Module

- On the control sheet: select the state and fill in the emission factors or select any available defaults
- On the calculation sheet: enter data or choose to use available defaults
- On the summary sheet: view the resulting summary of emissions
- Once you have reviewed your results, export the summary data to a separate file using the button at the bottom of the control sheet



CO_2 from Fossil Fuel Combustion: Control Sheet

State Inventory Tool - CO2 Emissions from Fossil Fuel Combustion

File Edit Module Options

State Inventory Tool - CO_2 Emissions from Fossil Fuel Combustion

1. Choose a State: Alabama

This is very important - it selects the correct default variables for your state.

2. Fill In the Variables that are used throughout the Worksheet for:

Either Type in the value/percentage or Click the Default Box

RESET ALL!

Combustion Efficiencies

Fuel	Default Efficiency	Efficiency Used	Use the Default? (Check for Yes)
Coal	99.0%		
Natural Gas	99.5%		
Petroleum	99.0%		
LPG	99.5%		

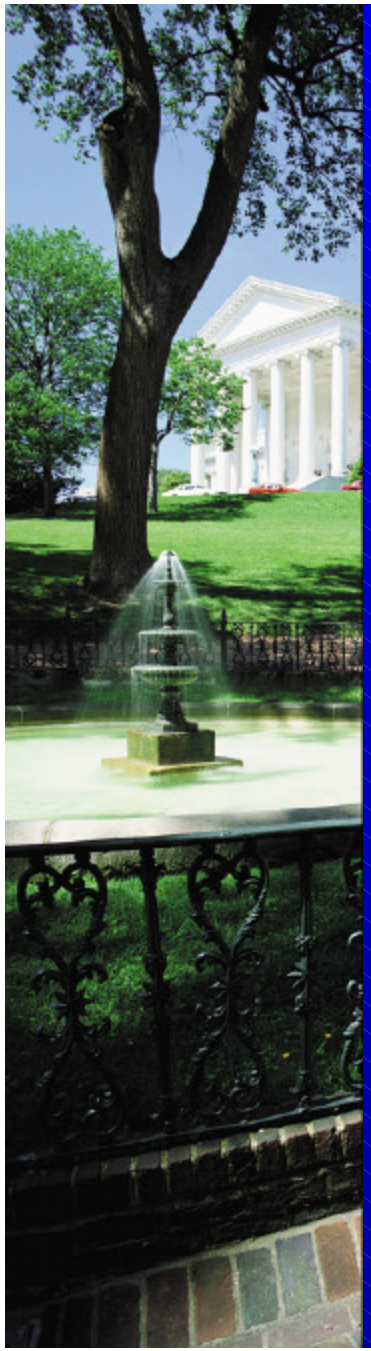
Clear/Select All Defaults

Carbon Contents (lbs Carbon/million Btu)

Fuel	Default Carbon Content	Carbon Content Used	Use the Default? (Check for Yes)
Asphalt and Road Oil	45.46		
Aviation Gasoline	41.60		
Distillate Fuel	43.98		
Jet Fuel, Kerosene	variable by year		
Jet Fuel, Naphtha	43.50		
Kerosene	43.48		
LPG	variable by year		
Lubricants	44.62		
Motor Gasoline	variable by year		
Residual Fuel	47.38		
Misc. Petro Products	variable by year		
Feedstocks, Naphtha	39.99		
Feedstocks, Other Oils	43.98		
Pentanes Plus	40.21		
Petroleum Coke	61.40		
Still Gas	38.60		
Special Naphthas	43.78		

Clear/Select All Defaults

Control | Residential | Commercial | Industrial | Transportation | Utilitie



CO_2 from Fossil Fuel Combustion: Calculation Sheet

State Inventory Tool – CO2 Emissions from Fossil Fuel Combustion

File Edit Module Options

State: Alabama

CO_2 emissions from fossil fuel combustion in the residential sector are calculated by multiplying energy consumption (in the residential sector) by carbon content coefficients for each fuel. These quantities are then multiplied by fuel-specific percentages of carbon oxidized during combustion ("combustion efficiency"). The resulting fuel emission values, in pounds of carbon, are then converted to short tons of carbon and million metric tons of carbon equivalent (MMTCE), and summed. For further detail on this method, refer to Chapter 1 in the EIP Guidance.

Click here for possible data sources.

According to the methods developed by the International Panel on Climate Change, CO_2 emissions from the combustion of biogenic sources (e.g., fuel wood) are not counted in greenhouse gas inventories, provided that those sources are harvested on a sustainable basis. The carbon in wood fuel was originally removed from the atmosphere by photosynthesis, and under natural conditions, it would cycle back to the atmosphere eventually as CO_2 due to degradation processes. For processes with CO_2 emissions, if the emissions are from biogenic materials and the materials are grown on a sustainable basis, then those emissions are considered simply to close the loop in the natural carbon cycle.

Go to the Control Sheet

Check All Boxes

Clear All Data

Residential Sector 1990 ☑ Default Consumption Data?

Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)
Coal	901	56.10	98.0%	25,057	0.023
Distillate Fuel	148	43.36	99.0%	3,233	0.003
Kerosene	28	43.48	99.0%	638	0.001
LPG	3,744	27.45	99.5%	50,593	0.045
Natural Gas	48,221	31.90	99.5%	764,558	0.673
Other				-	0.000

Residential Sector 1991 ☐ Default Consumption Data?

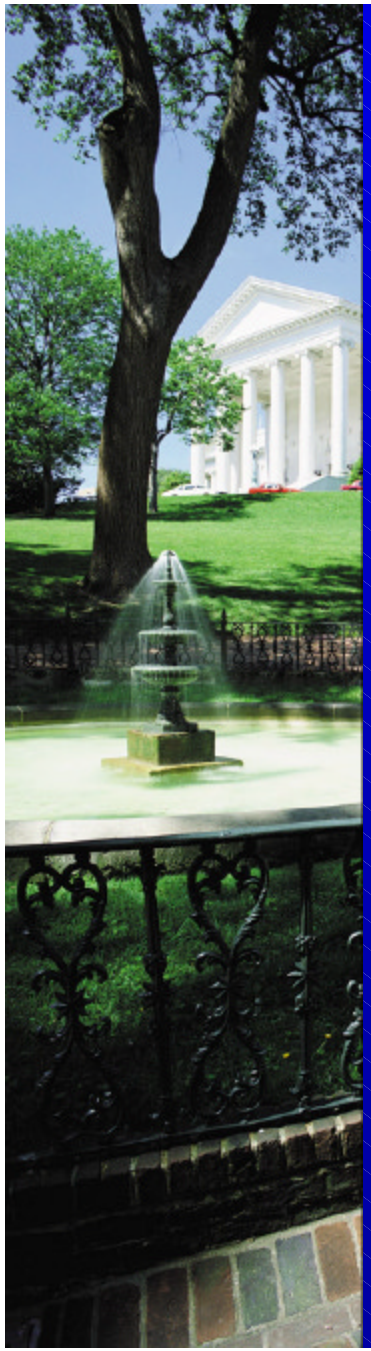
Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)
Coal		56.07	98.0%	-	0.000
Distillate Fuel		43.36	99.0%	-	0.000
Kerosene		43.48	99.0%	-	0.000
LPG		27.44	99.5%	-	0.000
Natural Gas		31.90	99.5%	-	0.000
Other				-	0.000

Residential Sector 1992 ☐ Default Consumption Data?

Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)
Coal		56.05	98.0%	-	0.000
Distillate Fuel		43.36	99.0%	-	0.000
Kerosene		43.48	99.0%	-	0.000
LPG		27.46	99.5%	-	0.000
Natural Gas		31.90	99.5%	-	0.000
Other				-	0.000

Residential Sector 1993 ☐ Default Consumption Data?

Control | Residential | Commercial | Industrial | Transportation | Utilities | Bunker Fuels | Summary-MMTCE



CO_2 from Fossil Fuel Combustion: Summary Sheet

State Inventory Tool - CO2 Emissions from Fossil Fuel Combustion

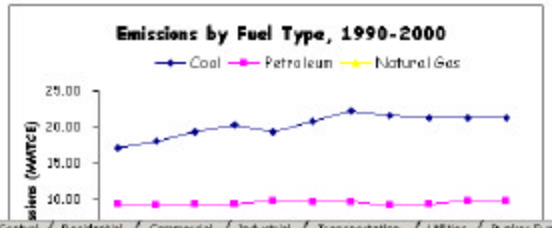
File Edit Module Options

Alabama Emissions Summary (MMTCE)

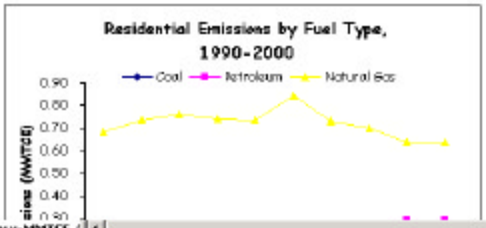
Go to the Control Sheet

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Residential	0.87	0.84	0.89	0.95	0.92	0.92	1.04	0.94	0.86	0.93	0.93
Coal	0.02	0.00	0.02	0.01	0.00	0.00	0.01	0.02	0.00	0.01	0.01
Petroleum	0.17	0.15	0.14	0.18	0.18	0.18	0.19	0.19	0.16	0.29	0.29
Natural Gas	0.67	0.69	0.73	0.76	0.74	0.73	0.84	0.73	0.70	0.64	0.64
Commercial	0.67	0.55	0.57	0.54	0.54	0.49	0.54	0.60	0.47	0.54	0.54
Coal	0.04	0.01	0.04	0.02	0.00	0.00	0.02	0.03	0.00	0.01	0.01
Petroleum	0.26	0.19	0.16	0.14	0.16	0.10	0.09	0.08	0.08	0.12	0.12
Natural Gas	0.36	0.35	0.37	0.38	0.38	0.39	0.43	0.49	0.38	0.41	0.41
Industrial	7.16	7.11	7.91	7.47	7.70	7.73	7.66	7.49	6.96	7.09	7.09
Coal	3.58	3.65	4.10	3.51	3.65	3.56	3.73	3.54	3.19	3.03	3.03
Petroleum	1.36	1.12	1.18	1.13	1.26	1.00	1.04	0.87	0.73	0.88	0.88
Natural Gas	2.24	2.36	2.63	2.83	2.81	3.15	3.12	3.08	3.06	3.18	3.18
Transportation	7.75	7.89	8.10	8.11	8.44	8.73	8.53	8.30	8.58	8.79	8.79
Coal	-	-	-	-	-	-	-	-	-	-	-
Petroleum	7.54	7.64	7.83	7.88	8.22	8.44	8.25	8.07	8.28	8.46	8.46
Natural Gas	0.22	0.24	0.28	0.23	0.22	0.30	0.28	0.31	0.30	0.33	0.33
Electric Utilities	13.45	14.51	15.22	16.82	15.77	17.32	18.68	18.22	18.47	18.56	18.56
Coal	13.37	14.43	15.16	16.74	15.69	17.19	18.56	18.05	18.03	18.22	18.22
Petroleum	0.02	0.02	0.02	0.01	0.03	0.02	0.03	0.03	0.05	0.03	0.03
Natural Gas	0.06	0.06	0.05	0.07	0.06	0.11	0.09	0.15	0.38	0.30	0.30
International Bunker Fuels	-	-	-	-	-	-	-	-	-	-	-
Petroleum	-	-	-	-	-	-	-	-	-	-	-
TOTAL	29.91	30.89	32.69	33.89	33.37	35.19	36.68	35.63	35.36	35.91	35.91
Coal	17.02	18.07	19.31	20.28	19.33	20.78	22.31	21.63	21.23	21.27	21.27
Petroleum	9.34	9.12	9.32	9.35	9.84	9.73	9.60	9.24	9.31	9.76	9.76
Natural Gas	3.55	3.69	4.07	4.27	4.20	4.68	4.76	4.75	4.82	4.86	4.86

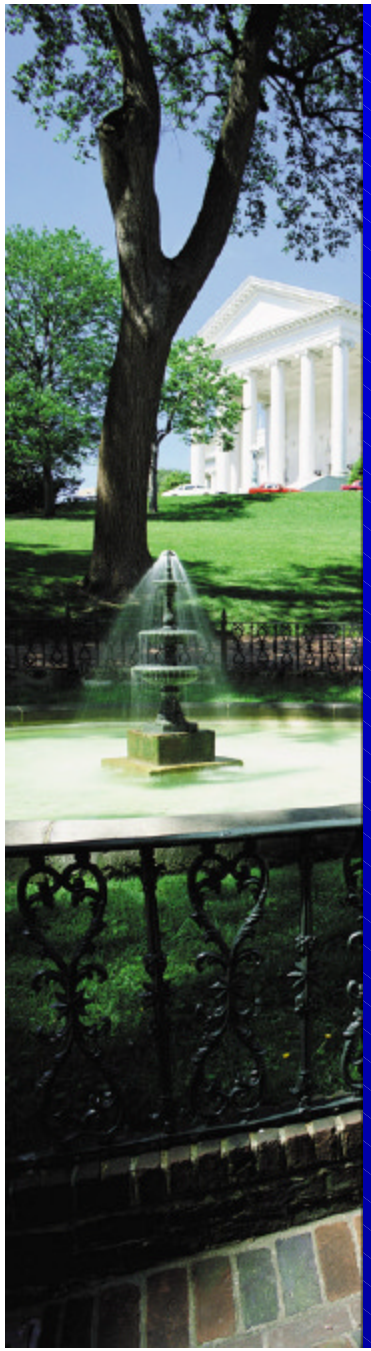
Multi-Sector Charts



Individual Sector Charts

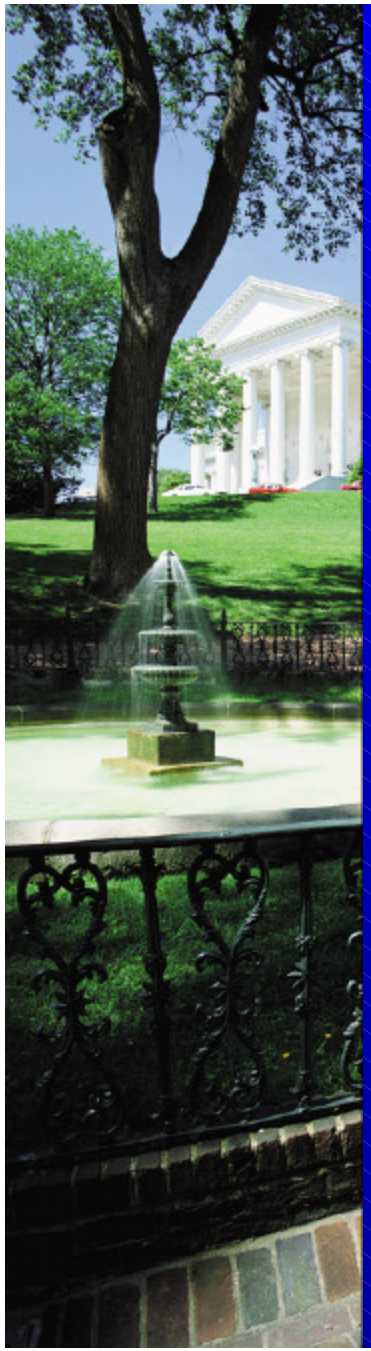


Control / Residential / Commercial / Industrial / Transportation / Utilities / Bunker Fuels / Summary-MMTCE /



How to Complete the Synthesis Module

- On the control sheet: select the state, import and review the data, and select the units for the final results
- On the summary sheet: review the inventory results



Synthesis Tool

State Inventory Tool - Synthesis Module

File Edit Module Options

State Inventory Tool - Synthesis

This tool will collect data from the individual sector modules and combine them, the final step in conducting a GHG inventory for your state.

Before using this module, the user should conduct greenhouse gas inventories for all applicable sources using the individual sector modules. After completing each sector inventory, the user should export the data using the button provided in the final step of each sector module. The modules will then create an output file using a default file name. Please do not change the file names or alter the output files in any way. Once all nine output files have been generated and placed in a common directory, the user of this Synthesis module should then begin here by choosing a state. In step 2, when the user clicks on the buttons to get the data, the user will be prompted to locate the output files. This module will then open the specified file and copy the necessary data. In order to attain correct results, please be sure to choose the proper files when prompted.

1. Choose a State: Alabama — Reset All

2. Locate Output Files for the Following Sectors:

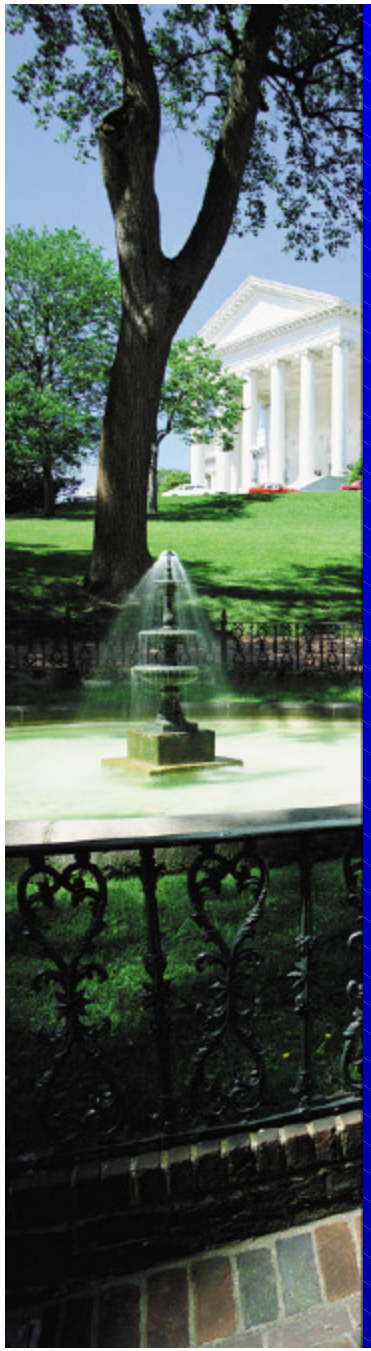
CO_2 from Fossil Fuel Combustion	Get CO2 from FF Consumption Data	Review Data
Stationary Combustion	Get Stationary Combustion Data	Review Data
Mobile Combustion	Get Mobile Combustion Data	Review Data
Coal Mining	Get Coal Data	Review Data
Natural Gas and Oil Systems	Natural Gas and Oil Data	Review Data
Industrial Processes	Get Industrial Processes Data	Review Data
Agriculture	Get Agriculture Data	Review Data
Land-Use Change and Forestry	Get LUCF Data	Review Data
Municipal Solid Waste	Get Waste Data	Review Data
Wastewater	Get Wastewater Data	Review Data

3. Select Units and Go to the Summary Sheets:

What units would you like to use for the final summary?

- ○ Million Metric Tons of Carbon Equivalent (MMTCE)
- ◉ Million Metric Tons of Carbon Dioxide Equivalent (MMTCO2E)

Go to Summary by Sector — Go to Summary by Gas



Synthesis Tool Summary Sheet

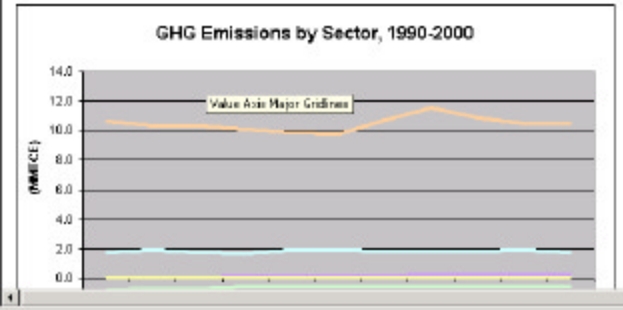
State Inventory Tool - Synthesis Module

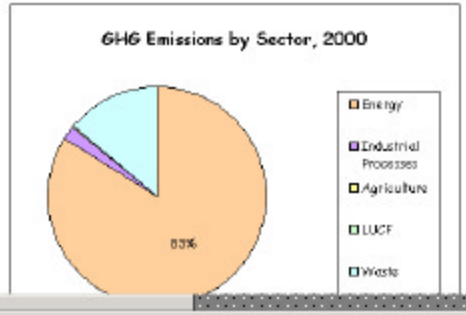
File Edit Module Options

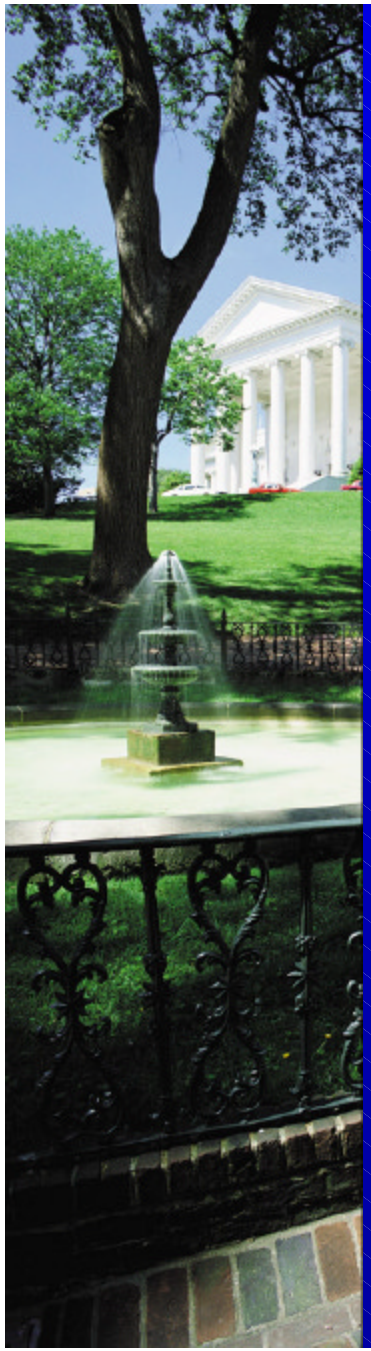
Summary of GHG Emissions by Sector in Connecticut (MMTCE)

Return to Control Sheet | Go to Summary by Gas

Emissions (MMTCE)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	10.635	10.345	10.307	10.069	9.831	9.782	10.726	11.572	10.866	10.511	10.470
CO_2 from Fossil Fuel Combustion	10.282	9.986	9.992	9.698	9.464	9.408	10.354	11.212	10.516	10.166	10.166
Stationary Combustion	0.053	0.054	0.058	0.057	0.056	0.061	0.066	0.060	0.053	0.053	0.053
Mobile Combustion	0.179	0.186	0.189	0.196	0.195	0.197	0.191	0.186	0.183	0.180	0.170
Coal Mining	-	-	-	-	-	-	-	-	-	-	-
Natural Gas and Oil Systems	0.121	0.120	0.069	0.118	0.117	0.116	0.115	0.114	0.113	0.112	0.082
Industrial Processes	0.086	0.089	0.085	0.100	0.114	0.144	0.178	0.191	0.202	0.211	0.229
Agriculture	0.077	0.075	0.077	0.077	0.077	0.074	0.070	0.068	0.069	0.067	0.068
Enteric Fermentation	0.034	0.033	0.034	0.033	0.033	0.033	0.030	0.029	0.030	0.029	0.030
Manure Management	0.012	0.011	0.011	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011
Rice Cultivation	-	-	-	-	-	-	-	-	-	-	-
Agricultural Soil Management	0.032	0.031	0.032	0.032	0.032	0.030	0.029	0.028	0.027	0.027	0.026
Burning of Agricultural Crop Wast	-	-	-	-	-	-	-	-	-	-	-
LUCF	(0.741)	(0.723)	(0.725)	(0.564)	(0.556)	(0.561)	(0.560)	(0.550)	(0.548)	(0.555)	(0.555)
Waste	1.787	1.876	1.745	1.682	1.886	1.886	1.862	1.834	1.843	1.910	1.717
Municipal Solid Waste	1.716	1.804	1.673	1.611	1.815	1.815	1.791	1.762	1.771	1.837	1.642
Wastewater	0.071	0.071	0.071	0.071	0.072	0.071	0.072	0.072	0.072	0.073	0.075
Gross Emissions	**11.843**	**11.442**	**11.408**	**11.372**	**11.353**	**11.325**	**12.272**	**13.115**	**12.431**	**12.144**	**11.930**
Sinks	**(0.741)**	**(0.723)**	**(0.725)**	**(0.564)**	**(0.556)**	**(0.561)**	**(0.560)**	**(0.550)**	**(0.548)**	**(0.555)**	**(0.555)**
Net Emissions	**11.102**	**10.719**	**10.744**	**10.807**	**10.797**	**10.764**	**11.712**	**12.565**	**11.883**	**11.589**	**11.375**

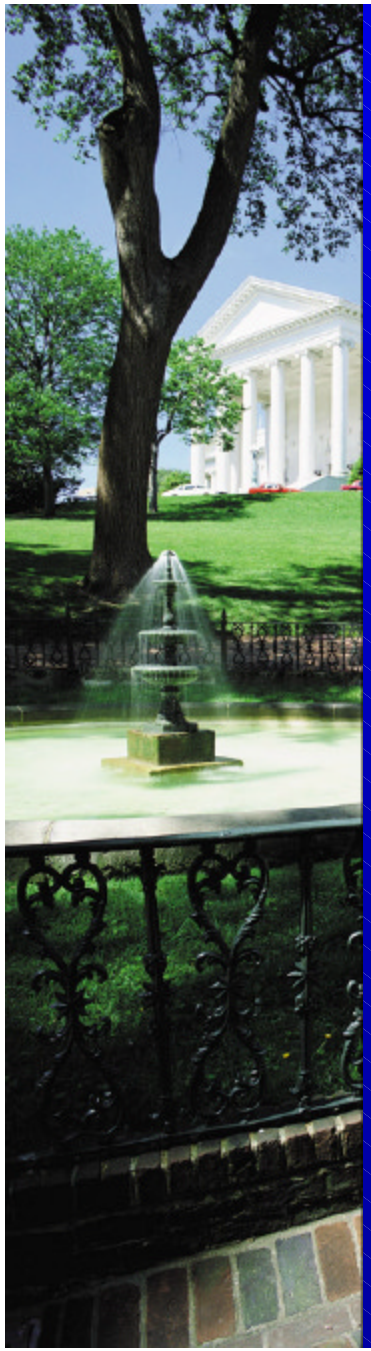






Moving Forward…

- Revise Land-Use Change and Forestry Module
- Develop projection tool
- Release CD and online versions
- Modify tools so that users may install updates periodically to reflect new methods and data



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