

US EPA ARCHIVE DOCUMENT



# Greenhouse Gas Inventory 101

## Session 3: State Inventory Tool (SIT) Training Session

You will hear music until the webcast begins.

Slides will be e-mailed to all participants.





# Greenhouse Gas Inventory 101

## Session 3: State Inventory Tool (SIT) Training Session

December 5, 2007

Andrea Denny, EPA & Lauren Pederson, ICF





# Welcome and background

- Clean Energy Environment Programs
    - Promote cost-effective clean energy strategies that achieve environmental, energy, public health and economic benefits
      - Clean Energy Environment State Program
      - Clean Energy Environment Municipal Network
- [www.epa.gov/cleanenergy/stateandlocal](http://www.epa.gov/cleanenergy/stateandlocal)





# Logistics

- Phone lines are muted to control background noise.
- Please use question/comment box to submit your questions, we will consolidate questions and ask them during the Q&A session at the end of the presentation.
- Please use color indicators to show if you are confused or need the presenter to slow down. We will keep an eye on this during the presentation.
- We will notify participants of where the recording will be online once it is available.
- Feedback after the training is welcomed, please email [denny.andrea@epa.gov](mailto:denny.andrea@epa.gov) with questions or comments.





## Session 3

- Audience:
  - Recommended for state officials as the tool is designed to incorporate state-level data.
- Goal:
  - This detailed training for the SIT modules includes implementation of state data to assess GHG emissions by source and sector.



# Outline

- Background
- Lessons Learned
- State Inventory Tool
- State Inventory Tool Demonstration
  - CO<sub>2</sub> from Fossil Fuel Combustion module
  - Natural Gas and Oil module
  - Synthesis module
- Projection Tool





## Background

- The State and Local 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
  - 42 states and Puerto Rico have developed inventories







## Lessons Learned

- Inventories are time-intensive
  - Collecting the data
  - Identifying the appropriate emission factors
  - Setting up the infrastructure to calculate emissions
- Inventories for a single year in the 1990s are insufficient for mitigation planning in 2007
- Emission trends are necessary for:
  - projecting emissions, identifying mitigation activities, setting targets, and creating action plans



## Lessons Learned (continued)

- Updating methodology is difficult
  - Creation of User's Guide to update methodology and provide guidance for modules
- States need tools
  - To facilitate updates
  - To project emissions
  - To analyze trends
  - To provide a standardized methodology
  - To track progress from year to year
  - To gain perspective on major sources and sinks



# State Inventory Tool Goals

- Leverage EPA's extensive inventory experience
  - Development of the National Inventory
  - Contributing to the IPCC Good Practice Guidance
- Provide default state activity data and emission factors, but allow customization
- Maximize transparency
- Provide estimates for the most recent year where data is available
- Enable sector experts to work simultaneously on different parts of the inventory
- Utilize a user-friendly interface





# 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
- A companion Projection Tool



## Sector Modules

- CO<sub>2</sub> from Fossil Fuel Combustion
- CH<sub>4</sub> and N<sub>2</sub>O from Stationary Combustion
- CH<sub>4</sub> and N<sub>2</sub>O from Mobile Combustion
- Natural Gas and Oil Systems
- Coal Mining
- Industrial Processes
- Agriculture
- Municipal Solid Waste
- Wastewater
- Land-Use Change and Forestry



## Using the Tool

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



## Completing a Source Module...

- On the control worksheet: select the state, select the parameters of the inventory (where necessary), and fill in the emission factors (or utilize default parameters)
- On the calculation worksheet: enter activity data or select default data
- On the summary worksheet: view the summary of emissions
- On the control worksheet: export the summary data to a separate file





# Control Worksheet

State Inventory Tool - CO<sub>2</sub> Emissions from Combustion of Fossil Fuel

File Edit Module Options

**State Inventory Tool - CO<sub>2</sub> Emissions from Combustion of Fossil Fuels**

1. Choose a State: Colorado Consult EIIP Guidance

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

2. Fill In the Variables that are used throughout the module for:  
 Either Type in the value/percentage or Click the Default Box

Combustion Efficiencies			
Fuel	Default Efficiency	Efficiency Used	Use the Default? (Check for Yes)
Coal	100.0%	100.0%	<input checked="" type="checkbox"/>
Natural Gas	100.0%	100.0%	<input checked="" type="checkbox"/>
Petroleum	100.0%	100.0%	<input checked="" type="checkbox"/>
LPG	100.0%	100.0%	<input checked="" type="checkbox"/>

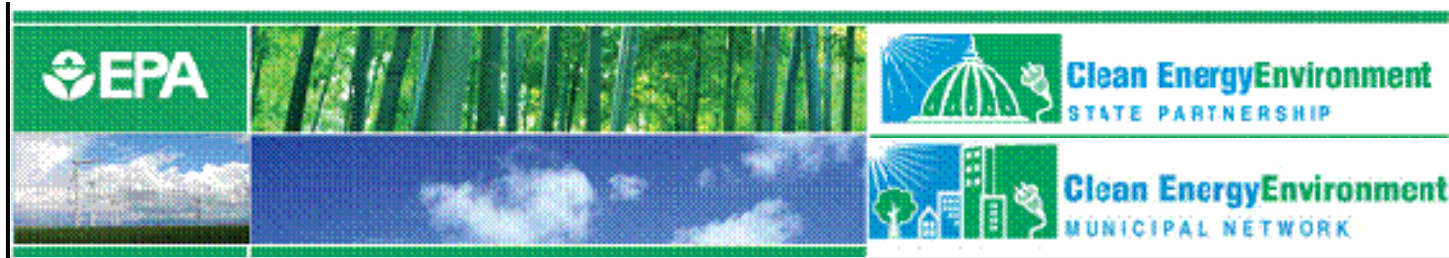
Clear/Select All Defaults

Carbon Contents (lbs Carbon/million Btu)			
Fuel	Default Carbon Content	Carbon Content Used	Use the Default? (Check for Yes)
Asphalt and Road Oil	45.42	45.4	<input checked="" type="checkbox"/>
Aviation Gasoline	41.56	41.6	<input checked="" type="checkbox"/>
Distillate Fuel	43.94	43.9	<input checked="" type="checkbox"/>
Jet Fuel, Kerosene	variable by year	variable by year	<input checked="" type="checkbox"/>
Jet Fuel, Naphtha	43.50	43.5	<input checked="" type="checkbox"/>
Kerosene	43.44	43.4	<input checked="" type="checkbox"/>
LPG (industrial)	variable by year	variable by year	<input checked="" type="checkbox"/>
LPG (energy only)	variable by year	variable by year	<input checked="" type="checkbox"/>
Lubricants	44.58	44.6	<input checked="" type="checkbox"/>
Motor Gasoline	variable by year	variable by year	<input checked="" type="checkbox"/>
Residual Fuel	47.33	47.3	<input checked="" type="checkbox"/>
Misc. Petro Products	variable by year	variable by year	<input checked="" type="checkbox"/>
Feedstocks, Naphtha	39.96	40.0	<input checked="" type="checkbox"/>
Feedstocks, Other Oils	43.94	43.9	<input checked="" type="checkbox"/>
Pentanes Plus	40.18	40.2	<input checked="" type="checkbox"/>
Petroleum Coke	61.34	61.3	<input checked="" type="checkbox"/>
Still Gas	38.57	38.6	<input checked="" type="checkbox"/>
Special Naphthas	43.74	43.7	<input checked="" type="checkbox"/>
Unfinished Oils	variable by year	variable by year	<input checked="" type="checkbox"/>
Waxes	43.63	43.6	<input checked="" type="checkbox"/>
Residential Coal	variable by year	variable by year	<input checked="" type="checkbox"/>

Control / Residential / Commercial / Transportation / Electric Power / Bunker Fuels / Industrial / Summary-MMTCO<sub>2</sub>E / Summary







# Calculation Worksheet

State Inventory Tool - CO2 Emissions from Combustion of Fossil Fuel

3. Residential Consumption and CO2 Emissions in Colorado

Click here for possible data sources.

CO<sub>2</sub> 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), then to million metric tons of carbon dioxide equivalent (MMTCO<sub>2</sub>E), and summed. For further detail on this method, refer to the CO<sub>2</sub>-FFC Chapter in the User's Guide.

According to the methods developed by the International Panel on Climate Change, CO<sub>2</sub> 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<sub>2</sub> due to degradation processes. For processes with CO<sub>2</sub> emissions, if the emissions are from biogenic materials and the materials are grown on a sustainable basis, then those emissions are considered to close the loop in the natural carbon cycle.

Go to the Control Sheet

Check All Boxes

Clear All Data

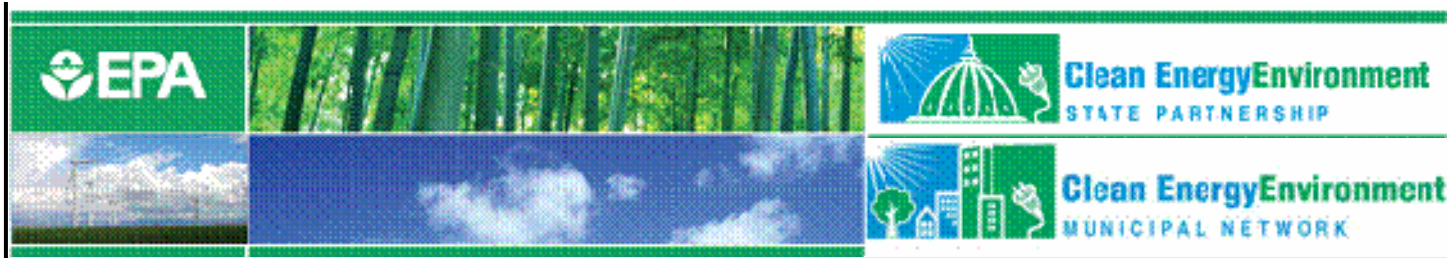
Residential Sector 1990						
Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)	Emissions (MMTCO <sub>2</sub> E)
Coal	248	57.93	100.0%	7,180	0.007	0.024
Distillate Fuel	160	43.94	100.0%	3,519	0.003	0.012
Kerosene	127	43.44	100.0%	2,759	0.003	0.009
LPG	6,150	37.96	100.0%	116,725	0.106	0.388
Natural Gas	92,191	31.87	100.0%	1,469,161	1.333	4.887
Other					0.000	0.000

Residential Sector 1991						
Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)	Emissions (MMTCO <sub>2</sub> E)
Coal	251	57.93	100.0%	7,269	0.007	0.024
Distillate Fuel	127	43.94	100.0%	2,780	0.003	0.009
Kerosene	136	43.44	100.0%	2,963	0.003	0.010
LPG	6,865	37.95	100.0%	130,251	0.118	0.433
Natural Gas	100,304	31.87	100.0%	1,598,462	1.450	5.317
Other					0.000	0.000

Residential Sector 1992						
Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)	Emissions (MMTCO <sub>2</sub> E)
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Other					0.000	0.000

Control \ Residential \ Commercial \ Transportation \ Electric Power \ Bunker Fuels \ Industrial \ Summary-MMTCO<sub>2</sub>E \ Summary-MMTCE





# Summary Worksheet

State Inventory Tool - CO2 Emissions from Combustion of Fossil Fuel

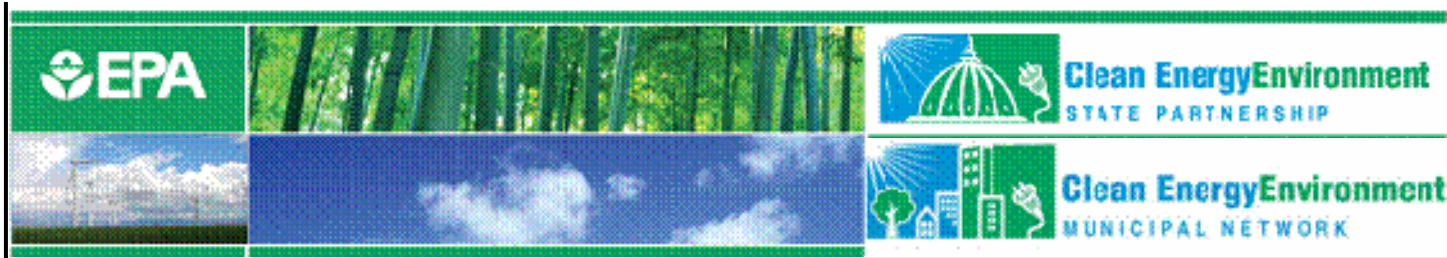
9. Colorado Emissions Summary (MMTCO2E)

Emissions were not calculated for the following sector: International Bunker Fuels.

MMTCO <sub>2</sub> E	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>Residential</b>	5.32	5.79	5.54	6.12	5.71	6.14	6.48	6.30	5.97	6.42	6.85	7.30	7.53	7.56	-	-
Coal	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.03	0.02	0.07	0.06	0.08	-	-
Petroleum	0.41	0.45	0.41	0.43	0.43	0.52	0.51	0.10	0.06	0.47	0.68	0.63	0.63	0.91	-	-
Natural Gas	4.89	5.32	5.11	5.68	5.27	5.61	5.97	6.18	5.91	5.93	6.16	6.60	6.85	6.58	-	-
<b>Commercial</b>	3.98	4.28	4.11	4.27	4.06	4.03	4.23	4.21	3.80	3.83	3.79	4.41	4.32	4.13	-	-
Coal	0.10	0.11	0.10	0.06	0.04	0.04	0.02	0.10	0.03	0.19	0.14	0.54	0.42	0.51	-	-
Petroleum	0.36	0.41	0.42	0.37	0.53	0.41	0.50	0.41	0.40	0.49	0.42	0.39	0.34	0.31	-	-
Natural Gas	3.52	3.76	3.59	3.83	3.49	3.58	3.71	3.70	3.37	3.15	3.22	3.47	3.56	3.32	-	-
<b>Industrial</b>	7.03	7.94	8.17	8.89	8.38	8.24	8.50	8.84	9.30	9.09	9.64	13.02	12.43	11.81	-	-
Coal	1.48	1.50	1.42	1.58	1.79	1.53	0.77	1.52	0.78	0.85	0.87	0.63	0.44	0.61	-	-
Petroleum	2.10	2.16	2.57	2.39	2.22	2.22	2.55	2.60	2.60	2.45	2.73	3.15	3.00	2.90	-	-
Natural Gas	3.45	4.28	4.18	4.93	4.38	4.49	5.18	4.72	5.93	5.79	6.04	9.24	8.99	8.30	-	-
<b>Transportation</b>	19.11	19.28	19.51	21.46	21.75	22.39	22.81	22.65	23.75	25.32	25.59	26.89	26.71	26.10	-	-
Coal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum	18.62	18.83	19.06	21.05	21.21	21.77	22.22	21.97	23.24	24.85	25.07	26.32	26.09	25.55	-	-
Natural Gas	0.49	0.46	0.45	0.41	0.54	0.62	0.60	0.68	0.51	0.47	0.52	0.58	0.61	0.55	-	-
<b>Electric Power</b>	31.27	30.60	31.55	32.13	33.47	32.50	34.20	34.40	34.83	35.09	38.64	40.80	39.60	39.73	-	-
Coal	30.54	29.85	30.80	31.43	32.38	31.21	32.64	32.90	32.96	32.78	35.01	35.93	35.36	35.44	-	-
Petroleum	0.02	0.04	0.04	0.01	0.01	0.02	0.02	0.02	0.04	0.03	0.08	0.14	0.02	0.03	-	-
Natural Gas	0.71	0.71	0.71	0.69	1.08	1.28	1.54	1.48	1.84	2.29	3.54	4.73	4.22	4.27	-	-
<b>International Bunker Fuels</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>	66.71	67.90	68.89	72.87	73.38	73.30	76.22	76.40	77.66	79.75	84.51	92.42	90.58	89.32	-	-
Coal	32.14	31.48	32.34	33.08	34.21	32.78	33.43	34.53	33.77	33.85	36.04	37.17	36.28	36.63	-	-
Petroleum	21.51	21.89	22.50	24.25	24.40	24.94	25.79	25.10	26.32	28.29	28.99	30.64	30.08	29.69	-	-
Natural Gas	13.06	14.53	14.05	15.54	14.76	15.58	16.99	16.76	17.56	17.61	19.48	24.61	24.22	23.01	-	-

Multi-Sector Charts      Individual Sector Charts





# Exporting Data

State Inventory Tool - CO2 Emissions from Combustion of Fossil Fuel

	Default	Storage Factor	Used	Use the Default? (Check for Yes)
49 Fuel				
50 Asphalt and Road Oil	100%		100%	<input checked="" type="checkbox"/>
51 Distillate Fuel	50%		50%	<input checked="" type="checkbox"/>
52 LPG	variable by year		variable by year	<input checked="" type="checkbox"/>
53 Lubricants	9%		9%	<input checked="" type="checkbox"/>
54 Residual Fuel	50%		50%	<input checked="" type="checkbox"/>
55 Feedstocks, Naphtha	variable by year		variable by year	<input checked="" type="checkbox"/>
56 Feedstocks, Other Oils	variable by year		variable by year	<input checked="" type="checkbox"/>
57 Misc. Petro Products	0%		0%	<input checked="" type="checkbox"/>
58 Pentanes Plus	variable by year		variable by year	<input checked="" type="checkbox"/>
59 Petroleum Coke	50%		50%	<input checked="" type="checkbox"/>
60 Still Gas	80%		80%	<input checked="" type="checkbox"/>
61 Special Naphthas	0%		0%	<input checked="" type="checkbox"/>
62 Waxes	58%		58%	<input checked="" type="checkbox"/>
63 Industrial Coking Coal				
64 Natural Gas				

3. through 8. Complete Individual Sheets

Complete the Residential Sheet

9. Review the Summary Information

Go to the MMTCO<sub>2</sub>E Summary Sheet

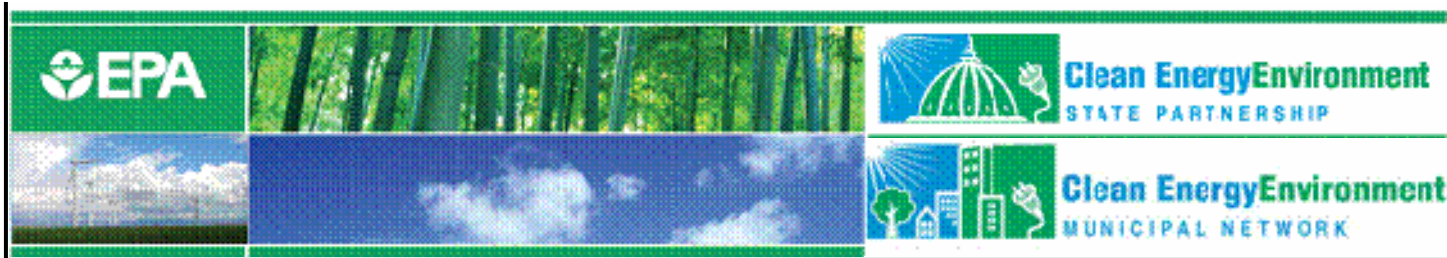
Go to the MMTCE Summary Sheet

10. Export the results for use in the Synthesis Tool.

Export Data

Control / Residential / Commercial / Transportation / Electric Power / Bunker Fuels / Industrial / Summary-MMTCO<sub>2</sub>E / Summary-MMTCE





# Exporting Data (cont. 1)

State Inventory Tool - CO2 Emissions from Combustion of Fossil Fuel

	Default	Storage Factor	
	Storage Factor	Used	Use the Default? (Check for Yes)
49 Fuel			
50 Asphalt and Road Oil	100%	100%	<input checked="" type="checkbox"/>
51 Distillate Fuel	50%	50%	<input checked="" type="checkbox"/>
52 LPG	variable by year	variable by year	<input checked="" type="checkbox"/>
53 Lubricants	9%	9%	<input checked="" type="checkbox"/>
54 Residual Fuel	50%	50%	<input checked="" type="checkbox"/>
55 Feedstocks, Naphtha	variable by year	variable by year	<input checked="" type="checkbox"/>
56 Feedstocks, Other Oils			
57 Misc. Petro Products			
58 Pentanes Plus			
59 Petroleum Coke			
60 Still Gas			
61 Special Naphthas			
62 Waxes			
63 Industrial Coking Coal			
64 Natural Gas			

3. through 8. Complete Individual...  
 Complete the Residential Sheet

9. Review the Summary Information  
 Go to the MMTCO<sub>2</sub>E Summary Sheet

10. Export the results for use in the Synthesis tool.  
 Export Data

Save Summary Output File As...  
 Save in: SUMMARY FILES  
 CO2FFC\_Summary  
 Wastewater\_Summary  
 Stationary\_Summary  
 Waste\_Summary  
 Gas and Oil\_Summary  
 Mobile Combustion\_Summary  
 Forest Management\_Summary  
 IP\_Summary  
 Coal\_Summary  
 Agriculture\_Summary  
 File name: CO2FFC\_Summary  
 Save as type: Excel Files

Control / Residential / Commercial / Transportation / Electric Power / Bunker Fuels / Industrial / Summary-MMTCO<sub>2</sub>E / Summary-MMTCE





# Exporting Data (cont. 2)

State Inventory Tool - CO2 Emissions from Combustion of Fossil Fuel

Fuel	Default	Storage Factor		Use the Default? (Check for Yes)
	Storage Factor	Used	Used	
Asphalt and Road Oil	100%	100%	100%	<input checked="" type="checkbox"/>
Distillate Fuel	50%	50%	50%	<input checked="" type="checkbox"/>
LPG	variable by year	variable by year	variable by year	<input checked="" type="checkbox"/>
Lubricants	9%	9%	9%	<input checked="" type="checkbox"/>
Residual Fuel	50%	50%	50%	<input checked="" type="checkbox"/>
Feedstocks, Naphtha	variable by year	variable by year	variable by year	<input checked="" type="checkbox"/>
Feedstocks, Other Oils	variable by year	variable by year	variable by year	<input checked="" type="checkbox"/>
Misc. Petro Products	0%	0%	0%	<input checked="" type="checkbox"/>
Pentanes Plus	variable by year	variable by year	variable by year	<input checked="" type="checkbox"/>
Petroleum Coke	50%	50%	50%	<input checked="" type="checkbox"/>
Still Gas	80%	80%	80%	<input checked="" type="checkbox"/>
Special Naphthas	0%	0%	0%	<input checked="" type="checkbox"/>
Waxes	58%	58%	58%	<input checked="" type="checkbox"/>
Industrial Coking Coal	10%	10%	10%	<input checked="" type="checkbox"/>
Natural Gas	variable by year			<input checked="" type="checkbox"/>

3. through 8. Complete Individual Sector Worksheets

Complete the Residential Sheet → Complete the Commercial Sheet → Complete the Transportation Sheet → Complete the Industrial Sheet

9. Review the Summary Information

Go to the MMTCO<sub>2</sub>E Summary Sheet → Go to the MMTCE Summary Sheet

10. Export the results for use in the Synthesis Tool.

Export Data

State Inventory Tool

The summary data were successfully exported!

OK

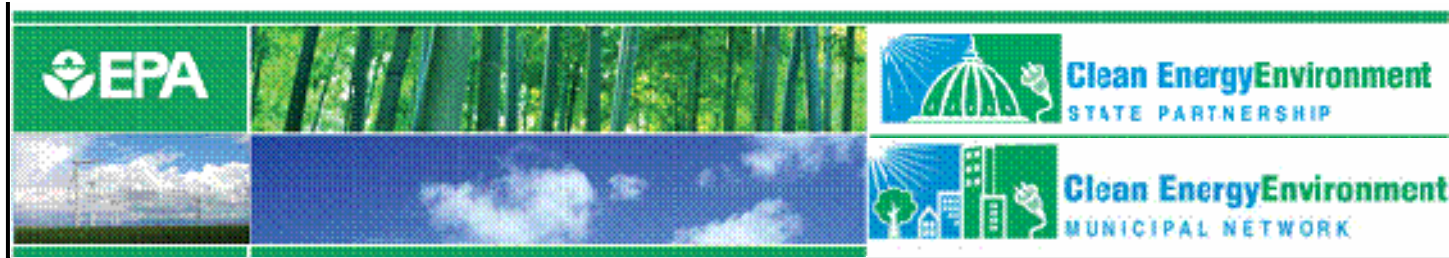
Control / Residential / Commercial / Transportation / Electric Power / Bunker Fuels / Industrial / Summary-MMTCO<sub>2</sub>E / Summary-MMTCE





# Tool Demonstration: State Inventory Tools





# Q&A for the State Inventory Tool Modules





# Projection Tool Overview

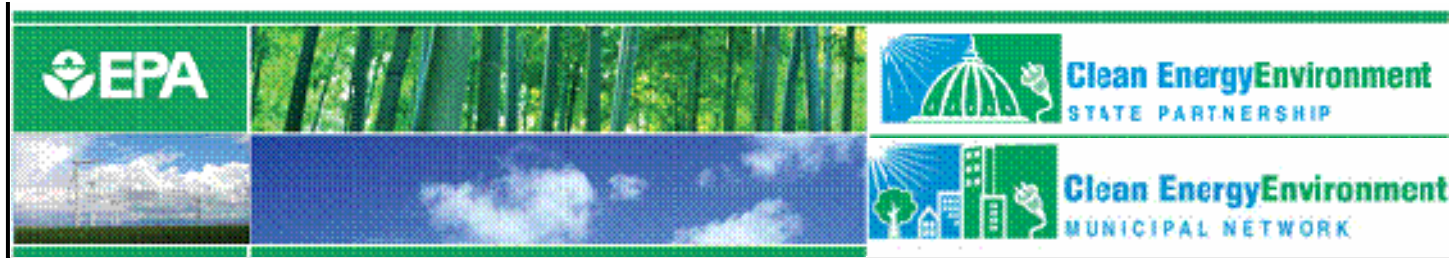
- Project emissions by gas and by sector through 2020
- Import historic emissions from SIT modules (if applicable)
- Project future emissions
  1. Based on historical data
  2. Forecasting using projected activity data





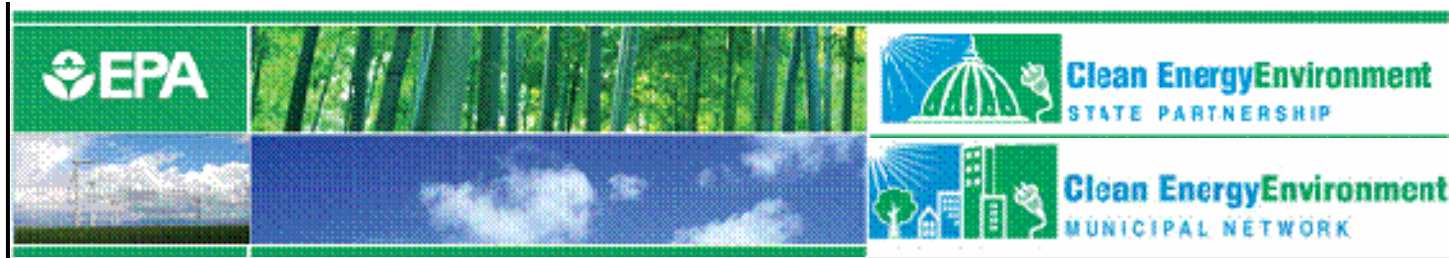
## Projection Example: CO<sub>2</sub>FFC

- Projections based on EIA's regional energy consumption data to 2020
- State specific estimates calculated using historic percentage of energy consumption in the region



# Tool Demonstration: Projection Tool





# Q&A for the Projection Tool





## Additional resources

- Energy CO<sub>2</sub> Emissions by State  
[http://epa.gov/climatechange/emissions/state\\_energyco2inv.html](http://epa.gov/climatechange/emissions/state_energyco2inv.html)
- State Greenhouse Gas Inventories  
[http://epa.gov/climatechange/emissions/state\\_ghginventories.html](http://epa.gov/climatechange/emissions/state_ghginventories.html)
- Inventory of U.S. Greenhouse Gas Emissions and Sinks  
<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>



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