Greenhouse Gas Inventory 101:
What to Consider When Starting an Inventory

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Inventory 101 Overview

State and Local Climate and Energy Program

- Background on EPA State and Local Climate and Energy Program
- Topics to Consider when Initiating an Inventory
- Putting Your Inventory into Context
- Tools and Resources

State and Local Climate and Energy Program

EPA's State and Local Climate and Energy Program assists state and local governments in their clean energy efforts by providing technical assistance, analytical tools, and outreach support.

Specific assistance includes:

- Identifying and documenting cost-effective policies and initiatives that promote renewable energy, energy efficiency, and related clean technologies.
- Measuring and evaluating the environmental, economic, and public health benefits of clean energy initiatives.
- Offering a suite of national voluntary programs that provide partners with assistance and recognition for their clean energy actions.
- Fostering peer exchange opportunities for state and local officials to share information on best practices and innovative policies.

http://www.epa.gov/statelocalclimate

State and Local GHG Resources

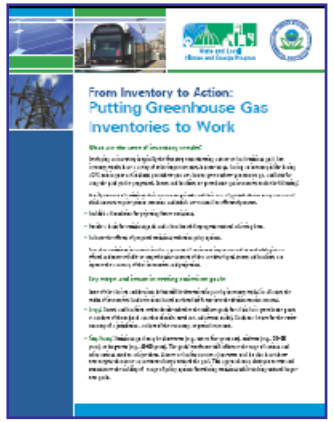
State and Local Climate and Energy Program

State Resources:

- Background Information
- Energy CO_2 Emissions by State
- State GHG Inventories/Maps
- Tools and Guidance
- Training
- http://www.epa.gov/statelocalclimate/state/activities/ghg-inventory.html

Local Resources

- Background Information
- Local GHG Inventory Examples
- Tools and Guidance
- Training
- Local Actions
- http://www.epa.gov/statelocalclimate/local/activities/ghg-inventory.html



Topics to Consider

State and Local Climate and Energy Program

- Purpose of inventory
- Inventory vs. registry
- Setting boundaries
- Sources and Gases
- Direct and Indirect Emissions
- Quantification approach
- Setting a baseline
- Timelines and level of effort
- Engaging stakeholders
- Certification

Why prepare an inventory?

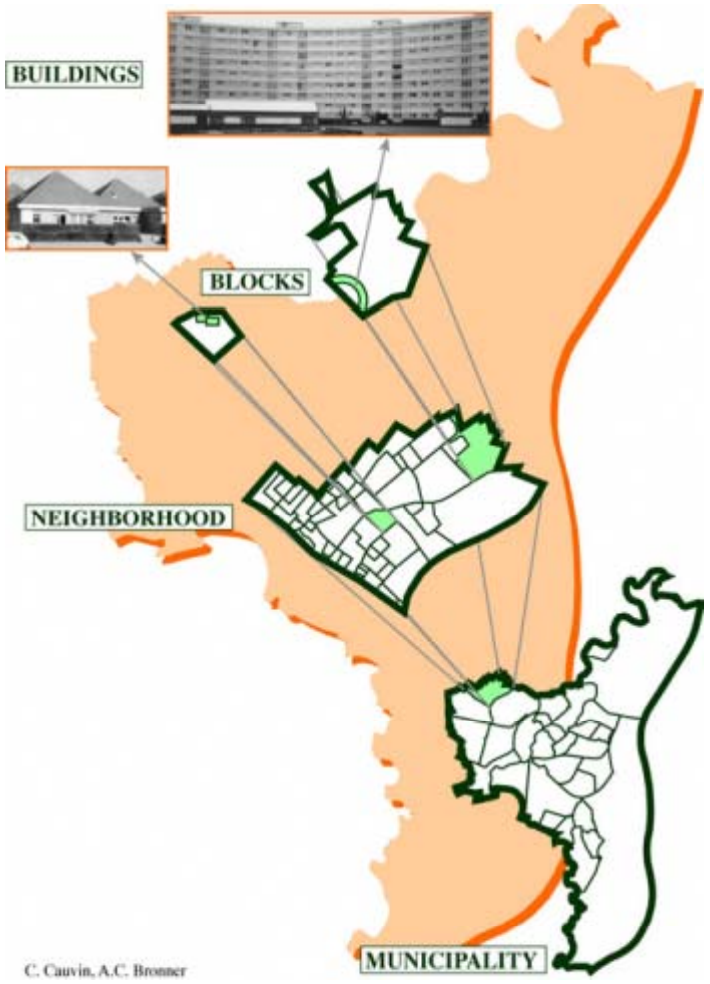
State and Local Climate and Energy Program

- 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 developing an action plan
- To track progress at reducing emissions
- To set goals and targets for future reductions

What level of inventory?

State and Local Climate and Energy Program

- Multi-state
- State
- Regional (e.g., MPO, COG, RPA)
- Local (e.g., cities participating in the Mayor's Climate Protection Agreement)
- Corporate
  - Entity-level
  - Project-level



Inventory vs. Registry-What's the Difference?

State and Local Climate and Energy Program

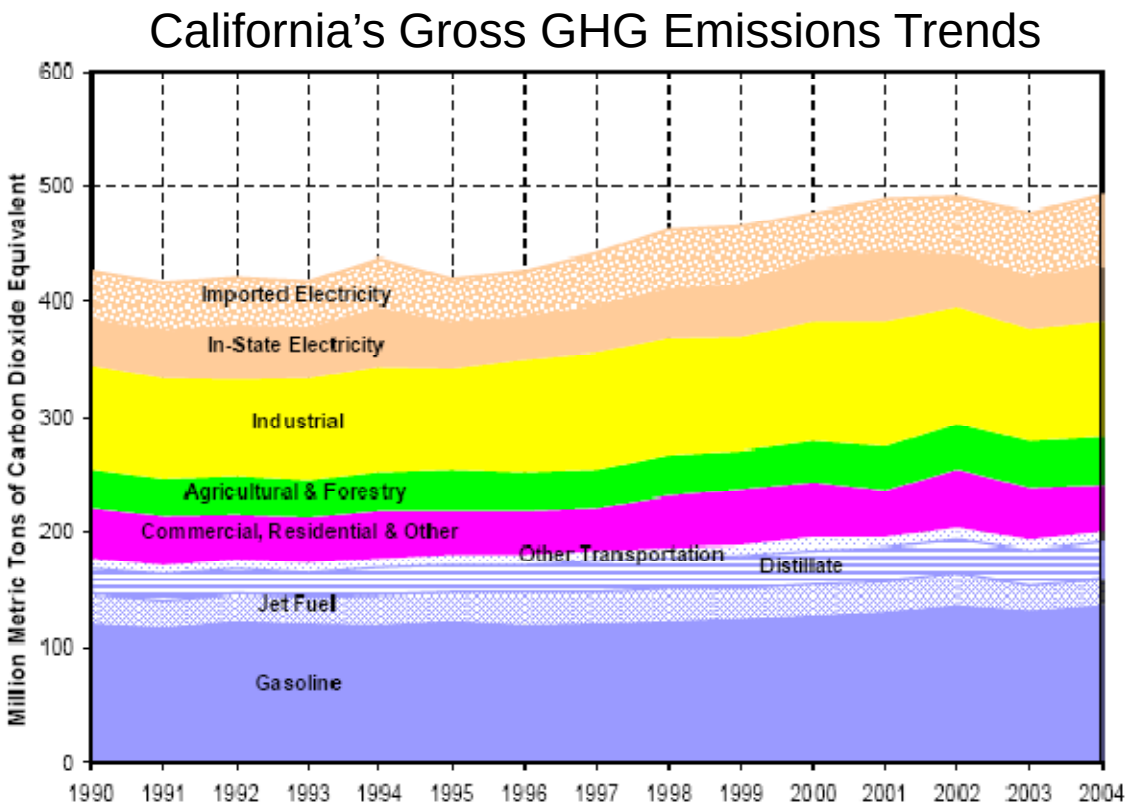
- Inventory
  - Accounts for GHG's emitted and removed from the atmosphere over a specific timeframe
  - Gives a snapshot of emissions from within a defined boundary
  - Follows established accounting guidance (e.g., IPCC, EIIP, WRI/WBCSD)

- Example: California GHG Inventory
  - All emissions within state borders (electric power, transportation, industrial, ag & forestry, and other)
  - Annual totals for each year, 1990-2008

Inventory vs. Registry

State and Local Climate and Energy Program

Inventory: quantifies the magnitude of emissions by source and by gas



Source: CEC 2006

Inventory vs. Registry

State and Local Climate and Energy Program

- Registry
  - An organized reporting system
  - May record GHG emissions or emission reductions
  - Can be voluntary or mandatory
  - Varying reporting level (project or entity-level)
  - May require verification (none, self, or 3rd party)

- Example: California Climate Action Registry
  - 343 total registry members
  - Each member conducts/submits an inventory
  - Climate Action Reserve: a program of the California Registry which tracks and registers voluntary projects that reduce emissions of GHGs

Inventory vs. Registry

State and Local Climate and Energy Program

Registry: a repository of inventories and reduction actions

Some CA Climate Action Registry Members

Boundaries: Physical or Organizational?

State and Local Climate and Energy Program

- Physical: emissions within a certain geographic region
  - e.g., the state of California
- Organizational: emissions within a certain entity's control
  - e.g., municipal operations in King County
- Project: emissions/reductions associated with a particular project
  - e.g., ghg reductions from installing methane capture technology at a municipal landfill

Which GHGs should be included?

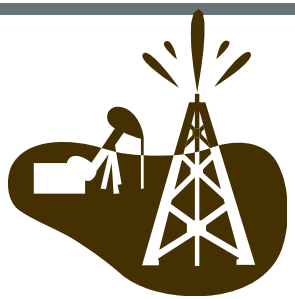
State and Local Climate and Energy Program

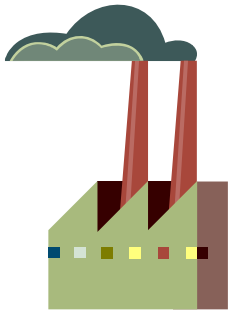
	National (IPCC)	States (EIIP)	Cities for Climate Protection (CCP)
CO_2	✓	✓	✓
N_2O	✓	✓	✓
CH_4	✓	✓	✓
PFCs	✓	✓	
HFCs	✓	✓	
SF_6	✓	✓	

Which sources should be included?

State and Local Climate and Energy Program

- Energy
  - consumption
  - production
  - transportion
- Industrial Processes (non-energy process emissions)
- Solvent and Other Product Use
- Agriculture
  - animal related emissions
  - crop related emissions
- Land-Use Change and Forestry
- Waste
  - Solid waste management
  - wastewater management)





Consider what is practical and useful to include

What are Direct and Indirect Emissions?

State and Local Climate and Energy Program

- Direct Emissions (aka scope 1)
  - Emissions that are released from activities within the inventory boundary
    - Fossil fuel combustion
    - Fertilizer application
    - Landfill operation
- Indirect Emissions (aka scope 2 and 3)
  - Emissions that occur outside the boundary because of activity or demand within the boundary
    - Purchased electricity
    - Off-site waste disposal
    - Lifecycle related emissions

Quiz: Direct or Indirect?

Anycity, USA quantifies emissions from:

Municipal Landfill plant that collects Anycity and Neighborcity's garbage

- Gasoline and diesel used by fleet

Electricity used in municipal buildings

- Natural gas used in municipal buildings

Gasoline used by municipal employee commuting

- Local wastewater treatment plant

Doublecounting Emissions?

State and Local Climate and Energy Program

- Your indirect emissions are someone else's direct emissions, and possibly vice versa
- Neighborcity sent waste to your landfill:
  - they calculate the emissions associated with that waste as indirect emissions
  - your inventory includes all emissions from the landfill as direct emissions
- What happens when Home County adds your inventories together to get total county emissions?
- Always specify emissions as direct or indirect to facilitate comparison and avoid erroneous accounting

What Quantification Approach to Use?

State and Local Climate and Energy Program

- Top-down
  - Uses Aggregated Data (often compiled by govt agencies) to provide a big-picture view of total emissions

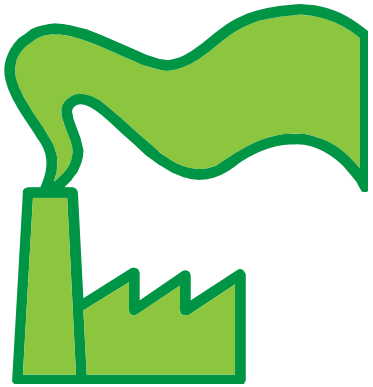
- Bottom-up
  - Uses more detailed data (often representing end use information) to provide more detailed but often less inclusive picture.

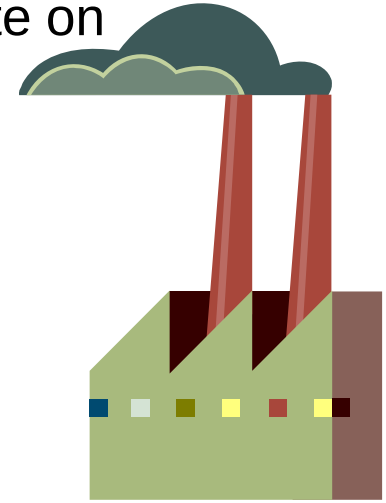
Examples of Quantification Approaches

State and Local Climate and Energy Program

State Level Industrial Energy Use

- Top-down
  - Use DOE's State Energy Data Reports on state-wide industrial fossil fuel consumption
- Bottom-up
  - Request data from each industrial facility in the state on their fossil fuel consumption





Examples of Quantification Approaches

State and Local Climate and Energy Program

Local Government Building Energy Use

- Top-down
  - Acquire total energy consumption data from utility or calculate based on energy expenditures to generate total emissions from local government fossil fuel use
- Bottom-up
  - Track each building's fossil fuel consumption individually and calculate resultant emissions

Pros and Cons of Quantification Approaches

State and Local Climate and Energy Program

- Top-down-Advantages
  - Quick, efficient, and comprehensive estimates
  - Good for tracking large trends over time
  - Keeps data manageable for large sectors
  - Errors tend to average out across sector
- Top-down-Disadvantages
  - Lose ability to compare different facilities/buildings/industries
  - Aggregated data isn't always available or credible—especially at the sub-state level

Pros and Cons of Quantification Approaches

State and Local Climate and Energy Program

- Bottom-up Advantages
  - More detailed analysis is possible
  - May better identify targets for mitigation planning
  - Can be used when high-level data is unavailable
- Bottom-up Disadvantages
  - Requires more data—more time consuming to collect and manage
  - Detailed data isn't always complete or consistent

How do I Choose a Baseline Year?

State and Local Climate and Energy Program

- Think it through!
  - How will baseline data be used?
  - Are there anomalies present in the baseline (uncharacteristically high or low emissions)?
  - How will regulatory or voluntary efforts proposed or in progress affect baseline and/or future emissions?
  - Will the baseline be compatible with baselines being used elsewhere?
  - Is the data available?

Choose a baseline that is realistic and meets your specific needs

It All Comes Down to Data

State and Local Climate and Energy Program

- Availability
  - 1990 data can be difficult to obtain
- Quality
  - Bottom-up v. top-down
  - How is it collected?
  - Is it verified? Is it credible?
- Scale
  - Entity-level, state-level, national-level

How Long Does an Inventory Take?

State and Local Climate and Energy Program

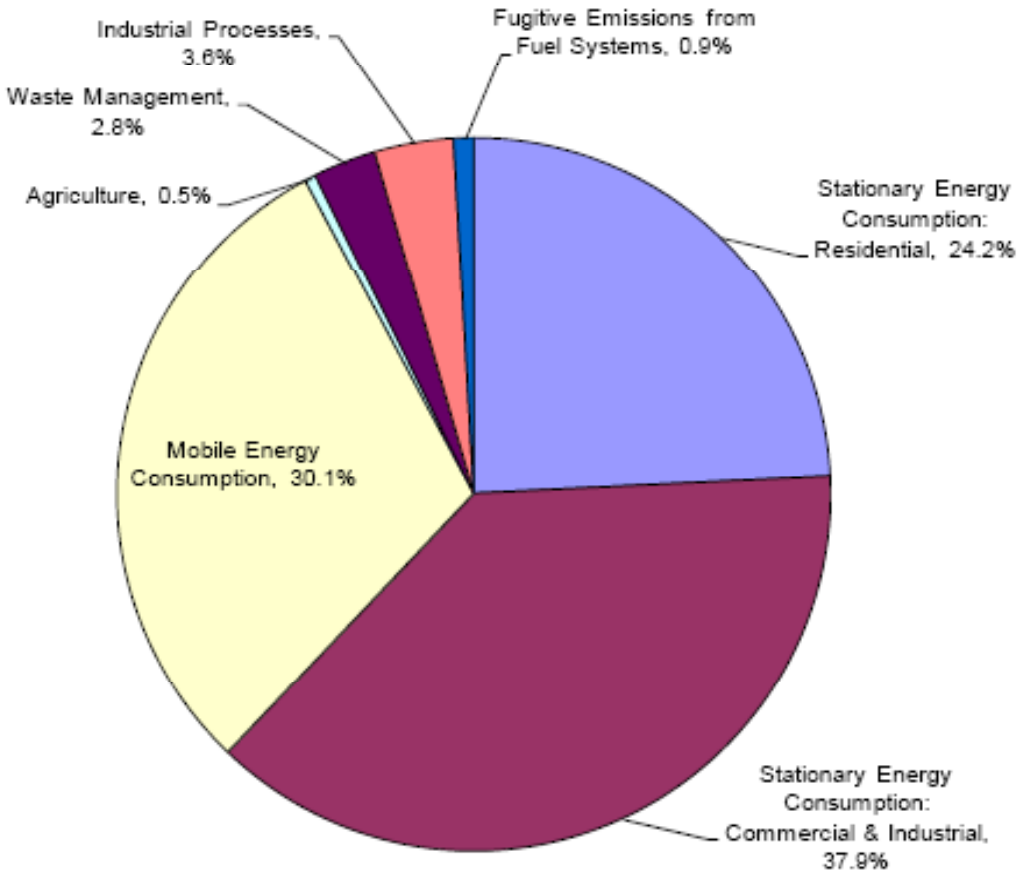
- Timeline dependent on:
  - Data availability and vintage
  - Reporting requirements
  - Reduction commitments

- Level of effort dependant on:
  - Resources (human, and economic)
  - Data availability and access
  - Level of detail (number of gases, number of sources, level of disaggregation)
  - Top-down vs bottom-up

- Keep the 80/20 rule in mind

What is the 80/20 rule?

- Focus efforts on the "most important" sources
- Sometimes only 20% of the effort is needed to quantify 80% of emissions
- Focus on:
  - Energy use: Stationary and Transportation
  - 92%+ of emissions



Delaware Valley Regional Planning Commission GHG Inventory

Why Engage Stakeholders?

State and Local Climate and Energy Program

- How can they contribute?
  - Data, resources, outreach, public support

- Who to Engage?
  - NGOs
  - Community groups
  - Schools and Universities
  - Other Government Agencies

Does an Inventory Need Certification?

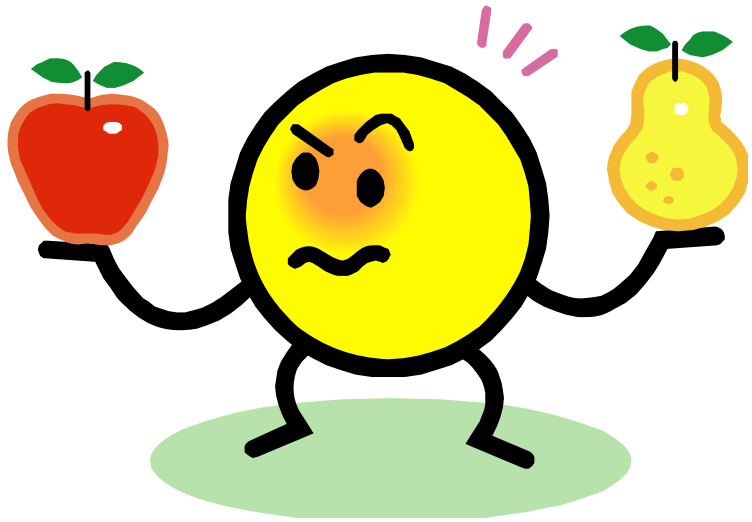
State and Local Climate and Energy Program

- What is Certification?
  - 3rd party review of methodology and underlying data to ensure inventory is complete, consistent and accurate
- Requirements Depend on Reporting Framework
- A Few Examples of Certification Protocols
  - California Climate Action Registry *General Reporting Protocol*, version 2.2 (March 2007)
  - ISO 14064-1 (inventory) and 14064-3 (verification) standards
  - Environmental Resources Trust, Inc.'s Corporate Greenhouse Gas Verification Guideline (CGVG)

Putting Inventory Results in Context

State and Local Climate and Energy Program

- Comparison to other inventories (many are online)
  - State summaries available on EPA website
  - Representative examples of local inventories on EPA website
  - Climate Analysis Indicator Tool (CAIT)
- Make sure to compare equivalent numbers
- Order of magnitude checks
- Use of Indicators
  - Per capita or per household
  - Per unity of economic activity



What Tools Can I Use?

State and Local Climate and Energy Program

	Source	Tools/Protocols
National	EPA (2006 IPCC Guidelines for National GHG Inventories)	U.S. Inventory Report
State	EPA	EIIP Guidance, EPA State Inventory Tool
Local	ICLEI/NACAA/EPA	Clean Air and Climate Protection Software
		Local Government Protocol (under development)
	ICLEI/CA Registry/Climate Registry	
	EPA/DVRPC	Regional Inventory Protocol (under development)
Corporate	WRI/WBCSD/EPA	worksheets and calculators
	CA Registry/The Climate Registry	Registry worksheets/software

Additional EPA Quantification Tools

State and Local Climate and Energy Program

Tool	Purpose
eGRID and Power Profiler	Database on emissions attributes of all U.S. electric power generation and accompanying tool interface
Portfolio Manager	web tool tracks building energy performance and emissions over time
Waste Reduction Model (WARM) and LandGEM	Calculate emissions from landfill and waste management
Climate CHange Emissions Calculator Kit (Climate CHECK)	Educational school inventory tool for middle and high school students
Personal Emissions Calculator	Estimates household GHG emissions
GHG Equivalencies Calculator	Converts raw emissions data into everyday terms

Additional Resources

State and Local Climate and Energy Program

- Greenhouse Gas Inventory Basic Information:
  - http://epa.gov/climatechange/emissions/index.html#inv
- State Greenhouse Gas Data and Protocols:
  - http://www.epa.gov/statelocalclimate/state/activities/ghg-inventory.html
- Local Greenhouse Gas Data and Protocols:
  - http://www.epa.gov/statelocalclimate/local/activities/ghg-inventory.html
- Climate Analysis Indicators Tool (WRI)
  - http://cait.wri.org/
- California Climate Action Registry and Protocols:
  - http://www.climateregistry.org
- Greenhouse Gas Equivalencies Calculator
  - http://www.epa.gov/cleanenergy/energy-resources/calculator.html
- Personal GHG Emissions Calculator
  - http://www.epa.gov/climatechange/emissions/ind_calculator.html

Additional resources

State and Local Climate and Energy Program

- Portfolio Manager
  - http://www.energystar.gov/benchmark
- Emissions & Generation Resource Integrated Database (eGRID)
  - http://www.epa.gov/egrid
- Power Profiler
  - http://www.epa.gov/powerprofiler
- Climate CHange Emissions Calculator Kit (Climate CHECK)
  - http://www.epa.gov/climatechange/wycd/school.html
- Waste Management Related Tools
  - http://www.epa.gov/climatechange/wycd/waste/tools.html
  - http://www.epa.gov/lmop/res/index.htm#5
- Transportation Related Tools
  - http://www.epa.gov/otaq/stateresources/tools.htm
  - http://www.epa.gov/greenvehicles

For more information:

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