STAPPA/ALAPCO

Clean Air and Climate Protection Software Overview

* * * On-Line Training Session* * *

October 5, 2005

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ICLEI – CCP

The Cities for Climate Protection® Campaign

CCP is an international initiative bringing together more than 550 local governments to reduce emissions of greenhouse gases (GHGs) and improve air quality within their communities.

- 168 cities and counties in the US participate.
- Representing over 48+ million people
- 19 percent of U.S. GHG emissions

Cumulative local actions can have a positive impact on global climate change.

Clean Air and Climate Protection Software

Project History

- ICLEI-CCP dedicated to GHG mitigation
- STAPPA/ALAPCO members are air pollution control officials around the country
- CACP Software allows users to design strategies to reduce <u>both</u> traditional (criteria) air pollutants and GHGs
- EPA provided funding to include energy and state utility officials in 2005

Issues Surrounding Global Warming and Air Pollution are Linked
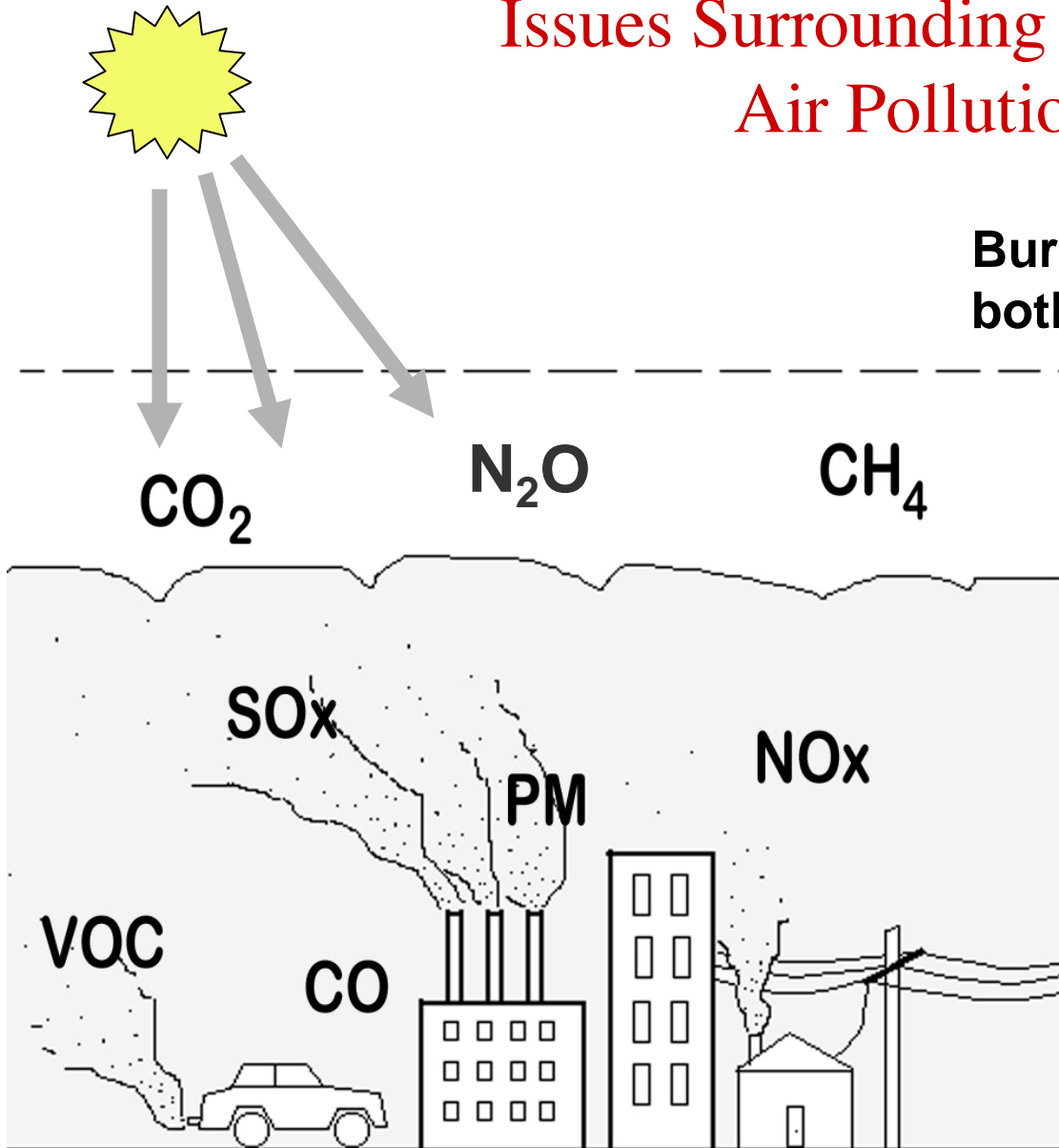
Burning fossil fuels release both:

CO_2

N_2O

CH_4

SO_x

PM

NO_x

VOC

CO

•Heat trapping *greenhouse gases*

•*Air pollutants* responsible for:

  • Smog,

  • Health problems

  • Reduce visibility

  • Diminished quality of life

Key Premises

- A healthy atmosphere cannot be achieved without the active engagement of all levels of government

- Emission reduction strategies bring multiple benefits and complement other objectives:
    - environmental improvement   - public health
    - economic development   - enhanced livability

- Emission sources and mitigation opportunities vary from region to region — STATE and LOCAL action plans are necessary

State and Local Government's Impact Global Warming and Air Quality

State and Local policies affect all the major sources of global warming pollution

Energy Codes, Energy Use, and Electrical Generation

Transportation and Planning

Solid Waste Management

The Importance of Quantification

- Establish a firm baseline against which future action can be evaluated
- Compare the impact of alternatives, before implementation
- Develop analytical evidence to secure political and community support for actions
- Demonstrate and monitor progress towards achieving emission reduction goals
- Facilitate inter-jurisdictional comparisons and information exchanges
- Illustrate the critical role state and local agencies play in reducing emissions

The Software

What is the Clean Air & Climate Protection Software?

- A harmonized tool for quantifying emissions of GHGs and criteria air pollutants from *combustion, energy use and waste disposal*

- Assesses the effectiveness of existing and proposed emission reduction and control strategies

- Important policy planning tool
  - Compare the impact of different measures
  - Scenario building,
  - Emissions reduction planning

- Takes a flexible, reproducible, standardized, integrated approach to tracking emissions

What is Tracked?

- Greenhouse Gases
  - Carbon Dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous Oxide (N_2O)

Reported in carbon dioxide equivalencies (eCO_2)

- Criteria Air Pollutants
  - NO_X
  - SO_X
  - CO
  - Volatile Organic Compounds (VOC)
  - Particulate Matter (PM10)

- "Indicators" standardize results for ease of comparisons
  - per capita, per household, per unit of floor area, etc.

Capability of the CACP Software

Stand-alone functionality or use modules together to create an Emissions Reduction Plan

- Create an emissions inventory
- Set a target for emissions reduction
- Forecast predicted emissions in future years under a "business-as-usual" scenario (i.e. the target year)
- Quantify the impact of reduction measures on emissions, energy use and cost
- Create custom reports
- Track changes over time and progress towards meeting targets

Organization of the Software (Main Divisions)

The software takes a sector based approach to account for all activities taking place within the jurisdiction.

Clean Air and Climate Protection Software®			_ □ ✕
File Settings Help			
Community Analysis	**Community Measures**	**Government Analysis**	**Government Measures**

–*Community:* The emission and reduction from the jurisdiction as a whole.

–*Government:* The emissions and reductions associated with the government's own operations.

–*Analysis:* Creates an inventory of all emission sources.

–*Measures:* Allows you to quantify all existing or proposed emission reduction activities.

Organization of the Software (Sectors)

- Community
  - Residential
  - Commercial
  - Industrial
  - Transportation
  - Waste
  - Other

- Government
  - Buildings
  - Vehicle Fleet
  - Employee Commute
  - Water / Sewage
  - Waste
  - Streetlights
  - Other

Organization of the Software
(Individual Records)

- Within each sector, data is entered into individual records
  - There is no limit to the number of records created
  - Data can be as aggregated as you would like
  - To avoid double counting, make sure that each record contains a discrete data set
- Using this sectoral approach to emissions quantification helps identify which sectors and operations are generating the most emissions – and thus the greatest opportunities for reductions.

Analysis (Inventory) Parameters

- By calculating emissions on an "end use" basis, the software is designed to allow users to create demand side management strategies

- An assessment is made of all emissions that the jurisdiction is either:
  - Directly Generating…
    - Transportation Fuels
    - Gas Heating
  - Indirectly Responsible For…
    - Upstream electricity generation
    - Landfilling of waste

Analysis Data Requirements

- Activity data (e.g., fuel or electricity used, vehicle miles traveled (VMT), etc.)
- Waste generated, disposal method, and efficiency of emissions capture

− OR −

- Direct entry of absolute emissions levels (e.g., for a state that is using the EPA's State Inventory Tool)

− Optional Information −

- Indicators
  - employees, floor space, etc
- Cost information (Government Module Only)

Sample Inventory Data Input Screen

Clean Air and Climate Protection Software®

File   Year   Record   Report   Settings   Assistants   Help

| Community Analysis | Community Measures | Government Analysis | Government Measures |

Community Analysis for Year 2000

Residential | Commercial | Industrial | Transportation | Waste | Other

Sector Tabs

Name of Residential Building or Group

Test Group

Group Name

Record Controls

| Insert | Select | Delete |

| ◄◄ | ◄ | ► | ►◄ |

Report   ? Help

Assistants | Categories | Indicators | Coefficients

Forecast Builder

Accessories Tabs

Record Navigation Controls

Fuel Type	Units	Energy Use
Electricity (Grid Average)	(kWh)	100,000,000
Coal	(tons)	0
Light Fuel Oil	(US gal)	0
Natural Gas	(thousand cu ft)	0
Propane	(US gal)	0
Biomethane	(thousand cu ft)	0
Fuelwood	(cords)	0
Solar	(MMBtu)	0
Green	(kWh)	0

Energy Inputs Table

Notes Regarding Residential Building or Group Data

Enter notes here

Notes Box

Outputs Fields

Energy Consumption	(MMBtu)	Equivalent CO_2 Production	(tons)	NOx Production	(lbs)
	341,297		74,958		296,170

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Emissions Reduction Measures

- Quantifies the emission reductions from existing and proposed actions.

- Calculates the energy and cost savings associated with these activities.

- Calculates simple payback periods

- Compares the emissions reductions quantified to what is needed to reach the reduction target.

Type of Measures

- Residential/Commercial/Industrial, Buildings, Streetlights, Water / Sewage Sectors:
  - Energy efficiency measures
  - Change in energy source or fuel type

- Transportation, Vehicle Fleet, & Employee Commute Sectors:
  - Change in vehicle type, mode, occupancy, fuel used, and miles traveled

- Waste Sector
  - Waste reduction, recycling and composting measures
  - Changes in disposal technologies

Emissions Reduction Measures Data Needs

- General Information
  - Fuel, technology, or waste type affected
  - Before and after data
  - Implementation year

- Optional Information
  - Energy cost
  - Ramp-in schedule
  - Cost of implementation

Sample Data Input Screen for Energy Reduction Measures

Government Measures [Target Year 2010]

| Buildings | Vehicle Fleet | Employee Commute | Streetlights | Water/Sewage | Waste | Other |

Measure Type
Energy Efficiency: Lamp and Ballast

Measure Name
Tombstone Efficient Street Light Program

Measure Description, Notes and Assumptions ⤓ *Expand*
Retrofit the city's streetlights with efficient lamps, and replace existing traffic signals with LEDs

Record Controls

| Insert | Select | Delete |
| ◄ | ◄ | ► | ►◄ |

🗐 **Report**   🖩   ? **Help**
Calculator

| Location | Implementation Data | Coefficients |

Affected Energy Source

- **Nil**
- Grid Electricity
  - **Grid Average**
  - **Grid Marginal**
- Fuel and Electricity Averages
- Specific Technologies

Energy Reduction (kWh)
2,200,000.0

($ per kWh)
0.1

Year Implemented
2003

Implementation Cost ($)
500,000

🖩 **Ramp-In Schedule**

| Equivalent CO_2 Reduction (tons) | Savings ($) | NOx Reduction (lbs) |
| 1,103 | 220,000 | 2,141 |

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Generic Fuel technologies can be used, or…

…specific technologies can be selected, if known

# Creating an Emissions Reduction Plan

What Is a Emissions Reduction Plan?

- Base Year Emissions Inventory
- Emissions Reduction Target
  - % reduction from the base year emission level
  - By a target year
- Forecasted emissions levels in the target year under a "business-as-usual" scenario
- Quantified measures to reach the target

The Software Performs these Calculations for You

The Action Plan
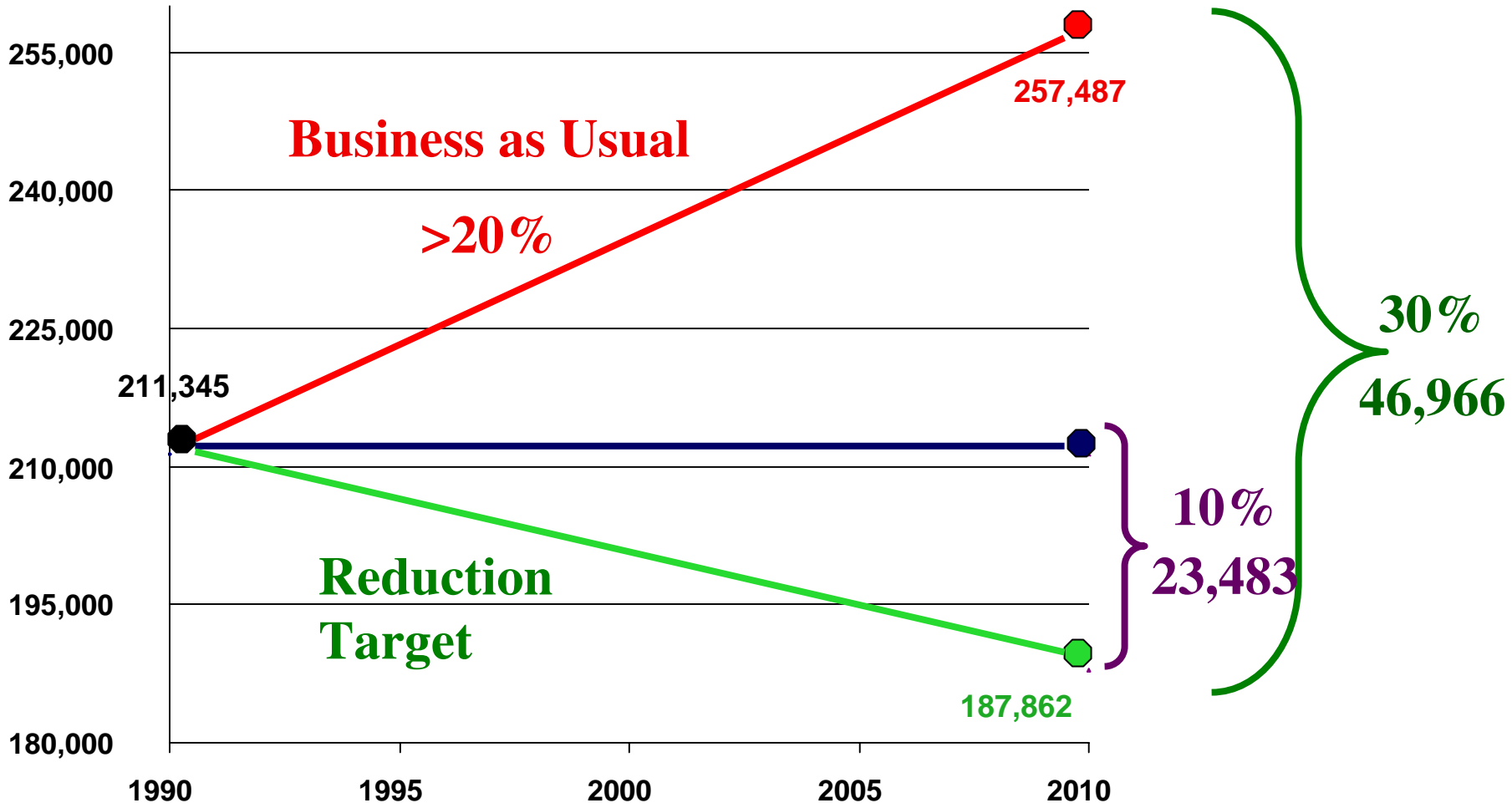
Emission Factors / Coefficients

The Brains Behind the Software

Emission Factors / Coefficients

(energy use) X (coefficient) = emissions

- The CACP Software contains thousands of default coefficients

- Coefficients and algorithms created by
  - Tellus Institute, Torrie Smith Associates, ICLEI
  - U.S. Environmental Protection Agency
  - U.S. Department of Transportation
  - U.S. Department of Energy

Electricity Emission Factors

Based upon energy end use

•Select the appropriate electricity region (NERC region) for where your operations are located. Each NERC region has a different electricity supply profile – and thus a different emissions profile

•Option to select grid average or grid marginal

•Can also override default electricity factors if have more precise information about electricity being used.

NERC Electricity Regions
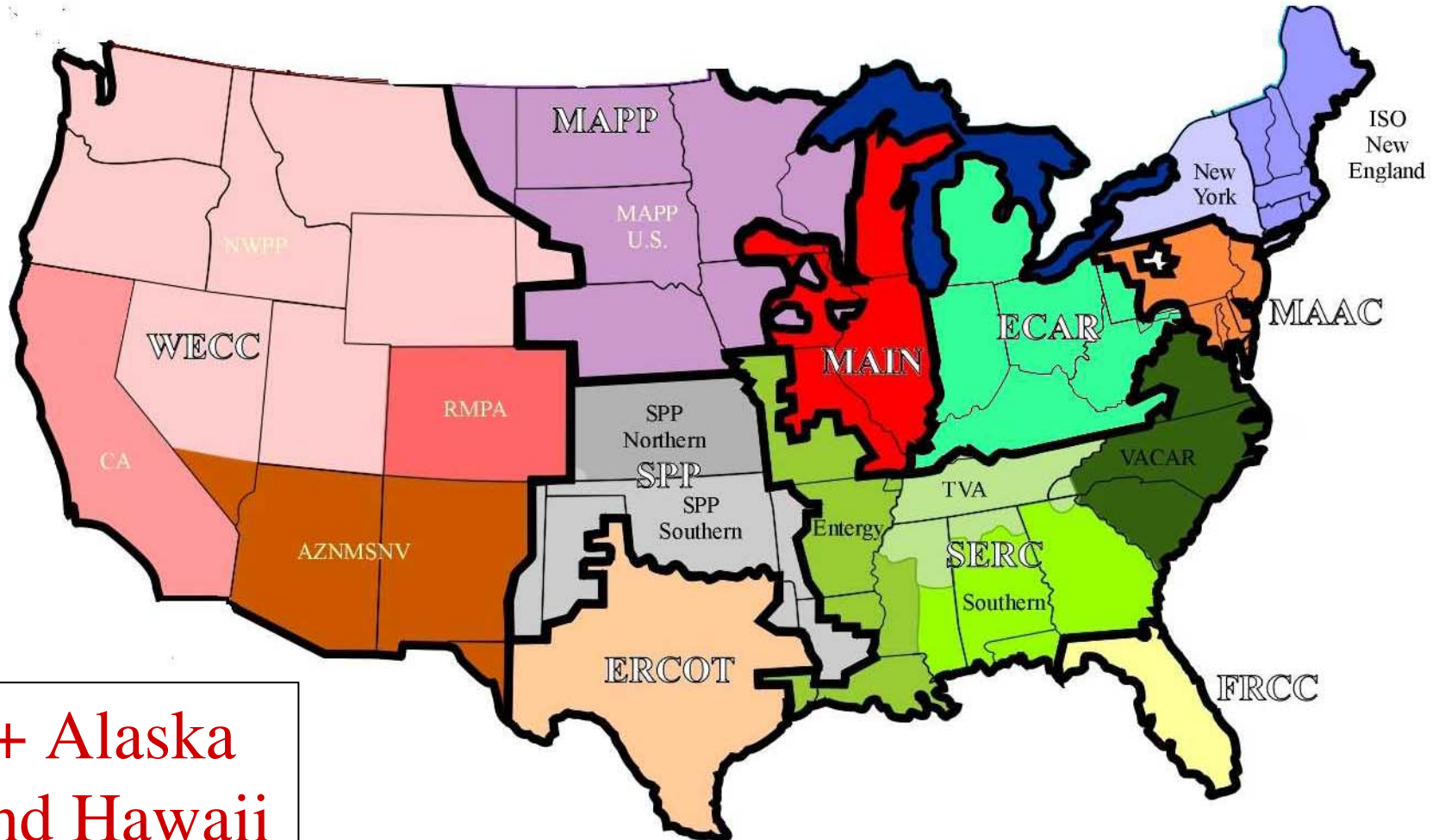
+ Alaska and Hawaii

Example of the Emission Factors Database for Electricity Emissions

Region

10 - Southwest Power Pool	Add Region
11 - Western Systems Coordinating Council/NWP	
12 - Western Systems Coordinating Council/RA	Delete Region
13 - Western Systems oordinating Council/CNV	
USA total	Restore Defaults

Customizable Coefficients

13 - Western Systems oordinating Council/CNV   (tons/GWh)

Year	CO2	N2O	CH4	NOx	SOx	CO	VOC	PM10
1990	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1991	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1992	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1993	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1994	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1995	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1996	334.3	0.037	0.028	0.439	0.348	0.270	0.031	0.256
1997	334.3					0.270	0.031	0.256
1998	334.3					0.270	0.031	0.256
1999	334.3					0.270	0.031	0.256
2000	352.2					0.276	0.031	0.262
2001	344.0	0.036	0.026	0.425	0.287	0.280	0.032	0.262

Emission factors from 1990 through 2020 are based on historical and simulated data

Copy Row   Paste Row

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Emissions Factors for Fuels

- CO_2 emissions from direct fuel combustion is only dependent on fuel type (not combustion technology).
  - Derived from the IPCC and the EPA

- Non-CO_2 greenhouse gases and criteria air pollutants are influenced by the combustion technology used.
  - In the analysis the emission factors are based on average technologies for each sector
  - In the measures, users can choose between emission factors for the
    - Average technology used in that sector
    - An emission factor for a specific fuel, combustion and control technologies being used
  - Based on Tellus Institute research, and upon AP-42 (*a database of emission factors maintained by EPA*)
  - Over 1500 combinations fuels and technologies are included

Example of the Emission Factors Database for Non-CO$_2$ Emissions from Directly Combusted Fuels

Waste Emission Factors

Two methodologies for calculating waste sector emissions

- The "Methane Commitment Method" applies all future emissions impacts of waste disposed of in the base or target year to the year in question
  - The Analysis emission factors include: methane generation, on-site sequestration, and the methane
  - The Measures emissions factors include methane generation and sequestration as well as: forest sequestration, upstream energy, and non-energy upstream emissions
  - These emissions factors come from the EPA's WARM Model

- The "Waste in Place" calculator quantifies the emissions generated by a landfill in the year open in the software
  - Data requirements: Year of landfill opening and closing and the methane recovery factor.

Example of the Emission Factors Database applied in the Waste Sector

Waste Coefficients

SetName
USA Default

Add Coefficient Set

Delete Coefficient Set

Restore Defaults

Manage sets: choose, modify, add, and delete them.

Click here to view either Analysis or Measures coefficient sets

USA Default

Choose Waste Disposal Practice

○ **Analysis Waste Types**   ◉ **Measures Waste Types**

Disposal Method	Reduction	Recycling	Compost	Controlled Incineration	Managed Landfill	Open Burning	Open Dump	Uncollected

Waste Type	Emissions Unit	Waste Unit	Methane	Sequestration at Site	Forest Sequestration	Upstream Energy	Upstream Non-energy
Aluminum	(tonnes)	(tonnes)	0	0	0	7.677	2.393
Cardboard	(tonnes)	(tonnes)	1.234	-0.906	0	0.956	0.003
Food Waste	(tonnes)	(tonnes)	0.769	-0.088	0	0	0
Glass	(tonnes)	(tonnes)	0	0	0	0.419	0.141
Mixed MSW	(tonnes)	(tonnes)	0.657	-0.402	0	0	0
Mixed Recyclables	(tonnes)	(tonnes)	1.049	-0.813	0	1.374	0.099
MSW	(tonnes)	(tonnes)	0.382	-0.838	0	0	0
Paper - Household	(tonnes)	(tonnes)	1.247	-0.955	0	1.508	0.006

Waste Type

Choose Units

Copy Row   Paste Row

Coefficient Sets A through E

✓ OK   ✗ Cancel   ? Help

Output and Reports

Reports, summarize the emission reductions and savings from all measures in the emissions reduction plan

Remember: an analysis is only as good as the data entered!!!

Although some assumptions will need to be made, it is important to fully document them and use only the best available information

Measures Summary Reports:

Show greenhouse gas and energy use reductions and costs savings by sector, and…

Sample Community

Community Greenhouse Gas Emissions Reductions in 2010
Target Year Measures Summary

Measures Summary	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (million Btu)	Energy Cost Savings ($)
Residential Sector	60,270	51.1	436,102	7,650,000
Commercial Sector	7,257	6.2	22,526	660,000
Industrial Sector	19,883	16.9	34,130	2,000,000
Transportation Sector	30,473	25.8	355,070	4,240,394
Total	117,884	100.0	847,827	14,550,394

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Sample Community

Community Criteria Air Pollutant Reductions in 2010
Target Year Measures Summary

Measures Summary	NOx (lbs)	SOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs)
Residential Sector	185,462	351,706	23,992	4,033	9,945
Commercial Sector	23,531	61,537	1,870	208	1,472
Industrial Sector	65,571	186,248	4,186	315	4,285
Transportation Sector	200,592	9,397	1,937,610	204,885	4,173
Total	475,155	608,889	1,967,659	209,441	19,875

Climate Action Plan Summary Report:

Sample Community

Community Greenhouse Gas Emissions Reductions in 2010
Target Year Measures Summary Report

Measures Summary	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (GJ)	Energy Cost Savings ($)
Residential Sector	370,529	21.9	3,934,500	28,849,875
Commercial Sector	605,537	35.8	8,692,000	45,000,000
Industrial Sector	191,270	11.3	900,000	17,500,000
Transportation Sector	326,386	19.3	4,789,619	76,003,767
Waste Sector	198,000	11.7		3,000,000
Total	1,691,722	100.0	18	

Local Action Plan	(tonnes)
Base Year Emissions	6,129,846
Target Year Emissions Forecast	7,279,122
Target Emissions Level	4,903,877
Emissions Reductions Required to Meet Target	2,375,245

Measures Summaries compare:
- **the base year emissions,**
- **predicted emissions,**
- **target emissions level,**

With the impact of the actions taken.

Sample Community

Community Greenhouse Gas Emissions Reductions in 2010
Target Year Measures Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (million Btu)	Energy Cost Savings ($)
Residential Sector				
Energy Efficiency: Buildings				
Energy Retrofit Program	60,270	51.1	436,102	7,650,000
Subtotal Residential	60,270	51.1	436,102	7,650,000
Commercial Sector				
Energy Efficiency: Equipment and Lighting				
Lighting Retrofit Program	7,257	6.2	22,526	660,000
Subtotal Commercial	7,257	6.2	22,526	660,000
Industrial Sector				
Energy Efficiency: Buildings				
	19,883	16.9	34,130	2,000,000
Subtotal Industrial	19,883	16.9	34,130	2,000,000
Transportation Sector				
Car/Van Pooling				
Van Pooling Program	30,473	25.8	355,070	4,240,394
Subtotal Transportation	30,473	25.8	355,070	4,240,394
Total	117,884	10_._	_____	_____

Greenhouse Gas Detailed Report:

Detailed Reports show the emissions reductions by sector, measure type & record

Criteria Air Pollutant Detailed Report:

Detailed Reports show the emissions reductions by sector, measure type & record

Community Criteria Air Pollutant Reductions in 2010
Target Year Measures Summary

	NOx (lbs)	SOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs)
Residential Sector					
Energy Efficiency: Buildings					
Energy Retrofit Program	185,461.7	351,706.2	23,991.7	4,033.1	9,945.1
Subtotal Residential	185,461.7	351,706.2	23,991.7	4,033.1	9,945.1
Commercial Sector					
Energy Efficiency: Equipment and Lighting					
Lighting Retrofit Program	23,530.6	61,537.3	1,870.1	208.0	1,471.8
Subtotal Commercial		61,537.3	1,870.1	208.0	1,471.8
	23,530.6				
Industrial Sector					
Energy Efficiency: Buildings					
	65,571.0	186,248.3	4,186.5	314.6	4,284.6
Subtotal Industrial		186,248.3	4,186.5	314.6	4,284.6
	65,571.0				
Transportation Sector					
Car/Van Pooling					
Van Pooling Program	200,591.6	9,397.4	1,937,610.2	204,885.0	4,173.1
Subtotal Transportation		9,397.4	1,937,610.2	204,885.0	4,173.1
	200,591.6				
All Measures	475,154.8	608,889.3	1,967,658.5	209,440.8	19,874.6

Measures Listing Reports:

Provide a full analysis of the characteristics and impacts of a measure, including simple payback periods based on energy and implementation costs

...ommunity

...riteria Air Pollutant Reductions in 2010

...Measures Listing

Residential Sector

Location of Measure:

Type of Measure: Energy Efficiency: Buildings

Measure Name

Energy Retrofit Program

Measure Details

Affected Energy Source 1		Affected Energy Source 2	
Electricity		Natural Gas	Commercial
Energy Reduction	37,500,000	Energy Reduction	302,042
Unit	(kWh)	Unit	(thous cu ft)
Price per Unit	$.10	Price per Unit	$12.91
Ramp-In Factor	100%	Energy Reduction (million Btu)	436,102
Year Implemented	1999	Emission Reduction (tons eCO2)	60,270
Implementation Cost	$50,000,000	Savings ($/year)	$7,650,000
		Payback Period (years)	6.5

The emission reduction from this measure as a percentage of total reductions: 51.1%

NOx Reduction	SOx Reduction	CO Reduction	VOC Reduction	PM10 Reduction
(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
185,462	351,706	23,992	4,033	9,945

How Is This Information Used

- Reports provide sector by sector comparisons of emissions and energy use reductions
- Identify potential inefficiencies and areas for improvement
- Bring together data in a central location, and create a permanent record of research and analysis
- Compare the results of alternative measures
- Compare jurisdictions
- Produce analytical support for actions and policies
- Show how your jurisdiction is meeting its emission goals

# Examples of Other Types of Presentational Material the Software Can Create

The CACP Software is compatible with many common spreadsheet and word processing tools, for ease of expanding the analysis and including data in reports and other documents

The following slides show "real world" samples of how data from the CACP Software has been used in reports

Government Operations Emissions Summary

Where are the emissions coming from?

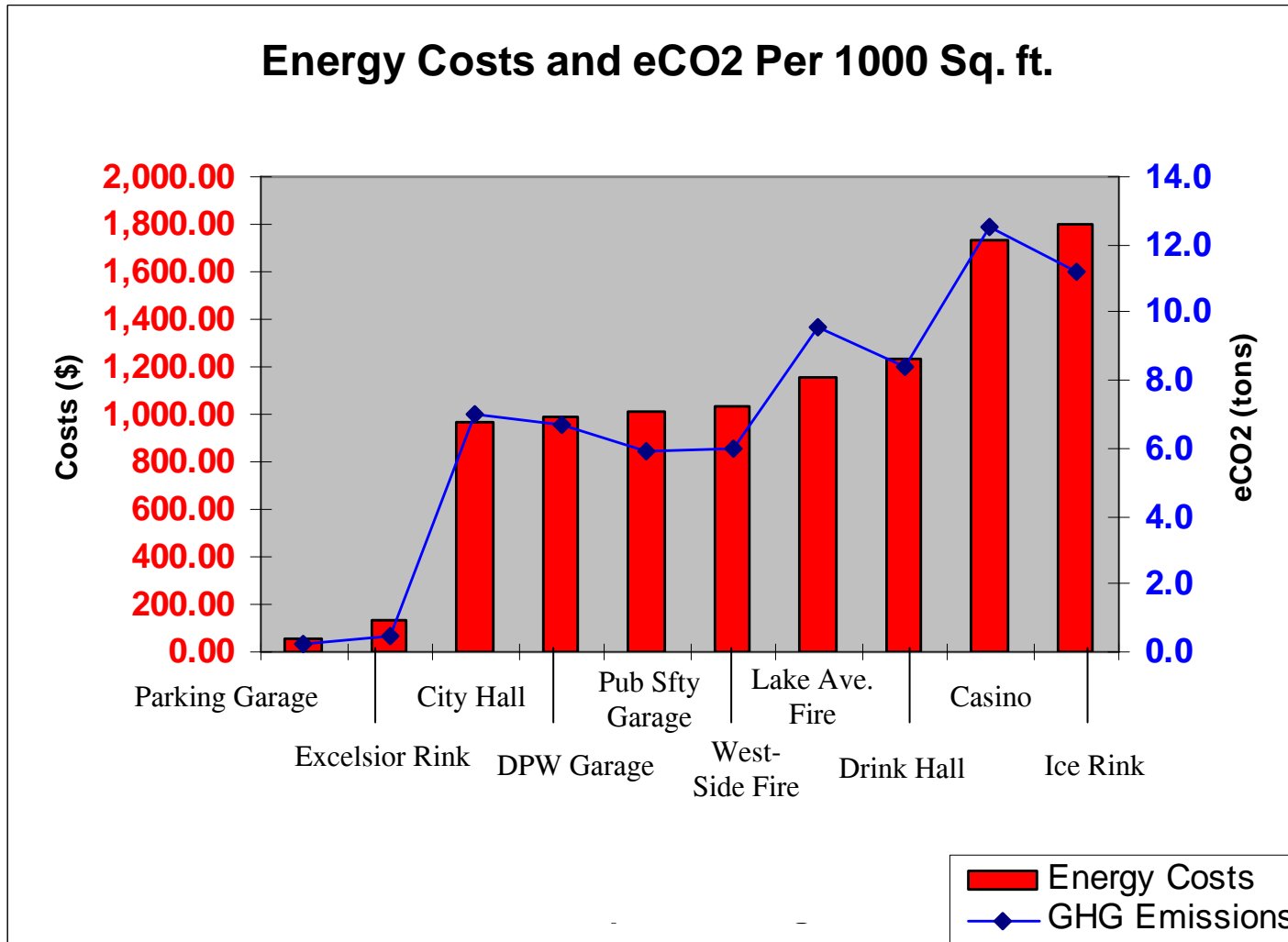**1999 Greenhouse Gas Emissions in a Sample City divided by Sector**
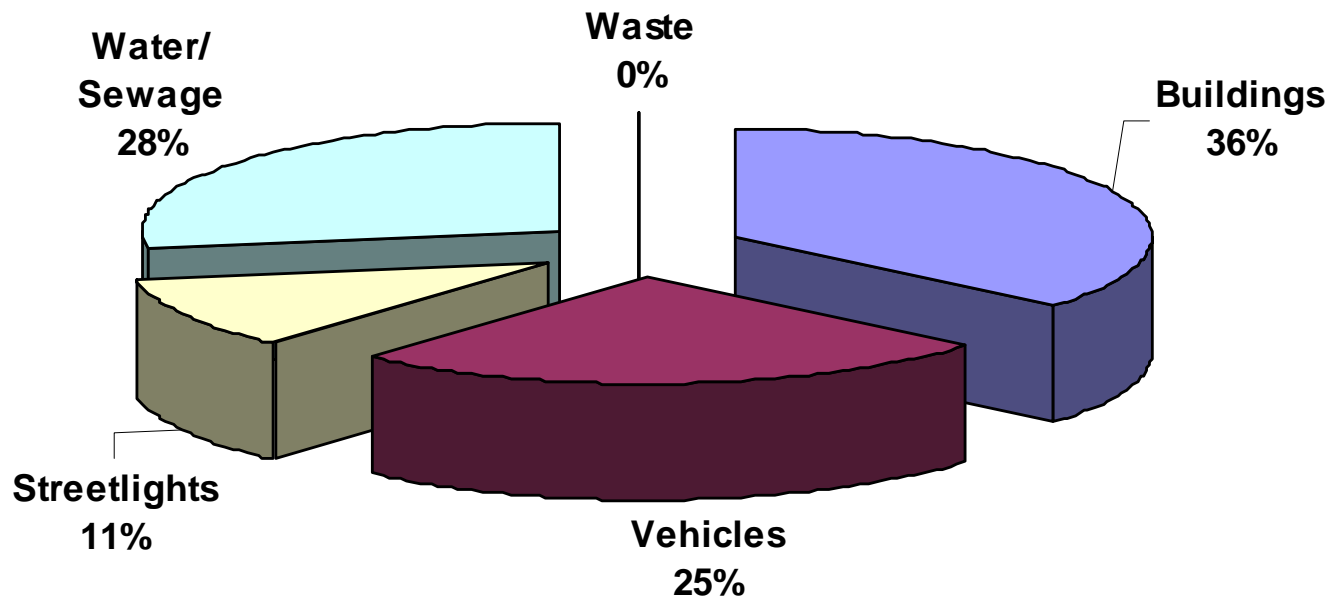
Total Government GHG Emissions:
Base Year: 1999
Total Emissions: 6,070 tons eCO_2

Comparing Costs & Emissions in Government Facilities
How efficient are your buildings?

Energy Costs and eCO2 Per 1000 Sq. ft.

Chart showing Energy Costs (red bars) and GHG Emissions (blue line) for government facilities:
Parking Garage, Excelsior Rink, City Hall, DPW Garage, Pub Sfty Garage, West-Side Fire, Lake Ave. Fire, Drink Hall, Casino, Ice Rink

Left axis: Costs ($) from 0.00 to 2,000.00
Right axis: eCO2 (tons) from 0.0 to 14.0

Legend:
- Energy Costs
- GHG Emissions

Comparing the Source of the Total Reductions Included in an Action Plan

Side-by-side measure comparisons allows jurisdictions to assess the relative impact of the actions included in their actions plans or being undertaken by the community

Purchase Energy Star Office Equipment

Energy Efficiency Building Retrofits

City 10% Green Power

Bicycle Patrols

Airport Green Power Purchase

Alternative Fuel Fleet Vehicles

DWP 2000 Integrated Resource Plan

Digester Gas to Energy

Tree Planting

Landfill Gas to Energy

Water Conservation

Energy Efficient Streetlights

Increase Fleet Fuel Efficiency
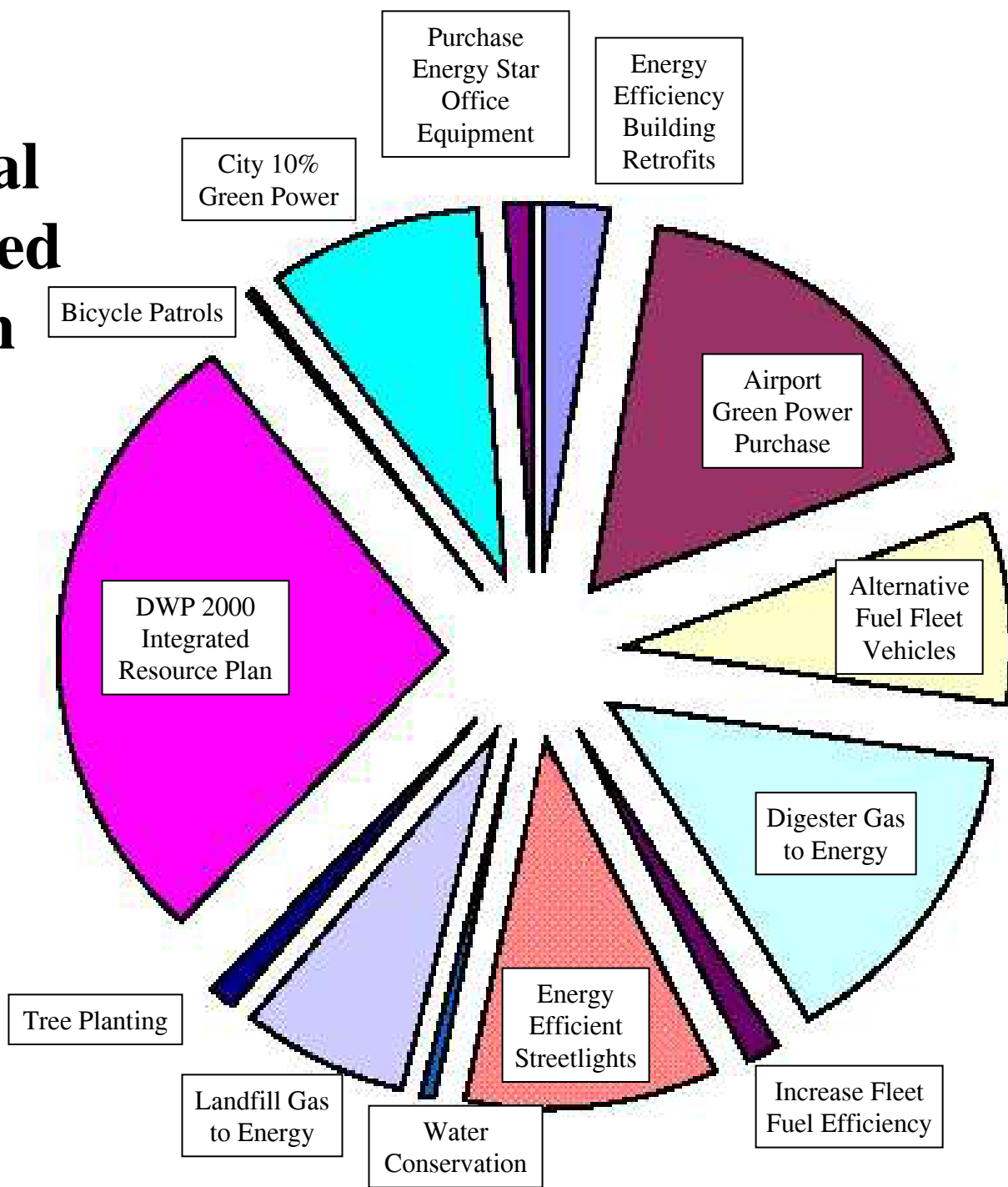
Questions?!?

Contact us at…

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Local Governments for Sustainability
CITIES FOR CLIMATE PROTECTION