Integrating Climate and Air Emissions Action Planning

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ABSTRACT

Worldwide, local governments are undertaking climate change action planning. To create an effective strategy for reducing greenhouse gas (GHG) emission, a jurisdiction needs to balance costs, local air quality, and other environmental concerns. The Clean Air Climate Protection (CACP) Software uses energy, waste, and transportation data to inventory the GHGs and criteria air pollutants (CAP) a community produces and quantifies the effects of measures implemented to reduce those emissions.

To quantify the link between GHG and air emissions planning, ICLEI analyzed the climate action plan of Durham, NC, using the CACP Software. This plan was designed to curb rapidly growing GHG emissions from the region, but this study shows that their GHG reduction target of 5% below a 1998 baseline by 2025 may also reduce NO_x, SO_x, and PM_{10} by 30-60%. This large reduction in air pollutant emissions is based on the plan's non-technological emphasis on demand side management and assumed control technology improvements. This study shows how a harmonized climate and air quality analysis can suggest alternative emission reduction strategies other than those identified in the straight climate action plan. It also provides an overview of the CACP Software tool, examines how harmonizing GHG and CAP analyses might influence local governments' decisions about which reduction strategies to implement, and looks at how the tool can be used for future scenario building. The cases highlight the software's value in making these connections and assisting local governments in developing comprehensive emissions reduction plans.

INTRODUCTION

Local governments throughout the world are undertaking steps to reduce their emissions of the greenhouse gasses responsible for global climate. Around the world, ICLEI's Cities for Climate Protection (CCP) Campaign works with over 550 local jurisdictions (150 in the US), assisting them in the development and implementation of Local Action Plans (LAPs) for emission reduction. In order to create an effective plan and ensure that it leads to tangible reductions, jurisdictions involved with the CCP follow a five-milestone methodology. These milestones include:

1) Conducting a **baseline emissions inventory** of the sources and quantity of greenhouse gases, and forecasting the future growth in those emissions;
2) Adopting a **local emissions reduction target** expressed in terms of percent reduction in emissions below the base year's level;
3) Developing a **local action plan** outlining the activities that will be pursued to achieve the emissions reduction target;
4) **Implementation** of emissions reduction policies
5) **Monitoring** progress of measures to reduce greenhouse gases

In following this methodology, local governments quantify their current emission level and forecast the impacts of various measures they would like to implement on their overall GHG emissions. This procedure allows the local authority to assess and compare alternative emission reduction strategies before implementing them. This allows the jurisdiction to choose the most cost effective and politically viable measures, helping to ensure that they will be able to meet their reduction targets.

To assist local governments in completing these milestones, ICLEI created the original *CCP Greenhouse Gas Emissions Analysis Tool*. This tool applied state-based emission coefficients to information on end-use energy consumption, waste production, and transportation data to create an inventory of the GHGs produced by a community as a whole and from the local government's internal operations. This software also quantifies the effect of emission reduction measures being planned or that have already been implemented to gauge progress towards meeting the jurisdiction's target.

In recent years it became apparent that this approach was limiting in that greenhouse gases are only one of the many emissions that local governments had to take into consideration when working to achieve cleaner, healthier, more sustainable communities. Many local governments suffer from dirty air and are in regions out of compliance with the guidelines set by the EPA. The emissions of air pollutants other than the greenhouse gasses are often of more concern to local authorities, since they have immediate impacts on health, perceived environmental quality, and are regulated by the Clean Air Act.

As many activities designed to reduce GHG emissions also impact air emission levels, and vice versa, it is logical to integrate climate protection and air emissions planning in a coordinated process. In order to assist local authorities in creating an effective strategy for reducing both emission types, ICLEI partnered with STAPPA/ALAPCO, with the support of the EPA, to develop the *Clean Air Climate Protection (CACP) Software*. This software package is built on the earlier *CCP Greenhouse Gas Emissions Analysis Tool* but was greatly expanded to include specific technologies and coefficients for five criteria air pollutants (CAP). Like its predecessor, this tool relies on input information concerning energy consumption, waste, and transportation, but also allows users to assess, in a harmonized fashion, their emissions and potential impact on both GHGs – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) – and CAPs – nitrogen compounds (NO_x), sulfur compounds (SO_x), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter under 10 microns in size (PM_{10}).

Using the new Clean Air and Climate Protection (CACP) tool, ICLEI has reanalyzed local climate protection plans to illustrate the link between greenhouse gas reduction activities and emissions of criteria air pollutants. This paper presents these findings and makes the case for approaching emission reduction programs in a more harmonized fashion. We also provide an overview of the CACP Software, illustrating its value in assisting local jurisdictions in their planning processes.

OVERVIEW OF THE CLEAN AIR CLIMATE PROTECTION SOFTWARE

The CACP Software calculates, on an end-use basis, the greenhouse gases and criteria air pollutants produced and avoided based on energy use, fuel use, and waste production. The software takes data provided on energy use and converts it to emissions using coefficients that relate the amount of a particular pollutant (e.g. carbon dioxide) to the quantity of the fuel used (e.g. kilograms of coal). The software allows the user to:

- Create an inventory of greenhouse gas and criteria air pollutant emissions for a base year.
- Forecast emissions growth to create a inventory of predicted emissions levels for a future year
- Evaluate measures to reduce emissions of these pollutants, and
- Prepare emission reduction action plans.

These components can be used independently to evaluate a single activity or measure, semi-autonomously to develop various emissions scenarios, or together to develop a comprehensive action plans. The software also generates reports that show the anticipated emission reductions of GHGs and CAPs from individual measures and the action plan as a whole, as well as cost savings and expected payback periods. The GHGs (CO_2, N_2O, and CH_4) are aggregated and reported as carbon dioxide equivalents (eCO_2), a commonly used unit that combines greenhouse gases of differing impact on the earth's climate into one weighted unit. Each of the CAPs is reported individually.

As the emission of CO_2 is affected only by the amount of fuel used, there is only one set of coefficients for CO_2 emissions. These factors have been taken from the Department of Energy's 1605b guidelines and the International Panel on Climate Change's (IPCC) reporting procedures. On the other hand, as the release of the other (non-CO_2) greenhouse gases and the criteria air pollutants are dependent on the technology being used, the software contains thousands of technology and sector specific and emission coefficients. The user can decide whether to use the emission factors for a specific technology or apply the generic emission factors for each sector. These emission factors for the non-electric fuel types have been taken from the EPA's AP-42.

The electricity emission factors (both GHG and CAP) were derived by running the National Emission Modeling System (NEMS) for each of the interconnected grid regions, as defined by the North American Energy Reliability Council (NERC). Therefore, these emission factors create a demand side emissions profile that considers all generation sources within the grid region to which the user is connected.

THE CASE OF DURHAM

In 1999, the City of Durham used the original *CCP Greenhouse Gas Emissions Analysis Tool* to create a climate action plan that outlined the city's program to combat the growth of community and government-based GHG emissions. The plan establishes a 1998 baseline inventory, forecasts emissions levels in the target year of 2025, sets a reduction target of 5% below the baseline, and lays out a set of quantified measures designed to meet that emission reduction target.

Re-Analysis of the Inventory and Forecast

To evaluate air emissions implications of Durham's plan, ICLEI reanalyzed the community emissions portion of the plan using the new CACP Software. A summary of the City's original Climate Action Plan (DCAP) and how it compares with the CACP Software re-analysis are shown in Table 1.

Table 1: Comparison of Original and Re-analyzed Climate Action Plans.

	DCAP[1]	**CACP Software**
1998 Baseline Emissions	2.61 million tons eCO2	3.8 million tons eCO2
2025 Forecast Emissions	4.31 million tons eCO2	4.91 million tons eCO2
Reduction Target below baseline	5%	5%
Emission reductions required	1.83 million tons eCO2	1.86 million tons eCO2

The CACP Software's baseline and forecasted eCO_2 emission levels are higher than those in the original DCAP. This difference is explained by differences in the electricity emission coefficients used. The DCAP used a fuel mix of 45% coal and 55% zero emission electricity (presumably based on statistics from Duke Power, the regional utility), whereas CACP Software used a mix based on the southeastern NERC grid region that is 30-40% more coal intensive. The decision was made to switch to a NERC region based set of coefficients as this better reflects the emissions being produced from a demand-side point of view. The purpose of this report is not to advocate for a specific emission factor set, but rather to show the impact of the GHG action plan on air emissions. As the target is based on the difference in base and target year emissions levels, the overall reductions required end up being similar in both cases. Therefore, it was felt that this was an appropriate example to test the impact of a GHG emission reduction plan on the emission of air pollutants.

The DCAP reported top-down energy use data for the Residential, Commercial, Industrial, and Transportation sectors. CACP Software translated this data (typically electricity, coal, heating oil, propane, and natural gas consumption) into GHG and air emissions. Tables 2 and 3 summarize the re-analyzed emission inventory and forecast, called the "CACP Software," and compares the results to the original analysis done for the DCAP.

Note: The discrepancy between the total eCO_2 *numbers presented in Table 1 and other tables in this report is due to the fact that the waste sector's influence was only considered in Table 1. The other tables focus on the CAP emissions and, due to the lack of commonly agreed upon emission coefficients, the CACP software only calculates the GHG emissions from the waste sector.*

Table 2: The CACP Software's analysis of Durham's 1998 baseline emission level.

Sector	Emissions (tons)					
	eCO_2	NO_x	SO_x	CO	VOC	PM_{10}
Residential	1,072,000	2,542	5,683	180	28	112
Commercial	794,000	2,067	5,063	128	19	87
Industrial	551,000	1,217	2,702	592	107	91
Transportation	867,000	3,434	169	22,903	2,494	120
Total	**3,284,000**	**9,260**	**13,618**	**23,804**	**2,648**	**410**

The data presented in Table 2 illustrates one benefit of looking at both the CAPs as well as the GHGs emissions when creating a local emission reduction action plan. Taken from a strict eCO_2 perspective, a local authority would want to focus to its efforts on the residential sector. But communities have many competing environmental issues that they have to deal with. Governments suffering from poor air quality may want to focus their first efforts on the transportation or commercial sectors, as these areas are responsible for larger emissions of nitrogen, sulfur, and volatile organic compounds.

Table 3 indicates similar trends in the target year. Between 1998 and 2025, NO_x and SO_x are forecasted to change very little despite rising vehicle miles traveled (VMT) and energy demand. Predicted improvements in control technologies and fuel quality will reduce emission per unit energy of these pollutants, particularly from electricity generation. NO_x emissions from transportation grow moderately, whereas NO_x emissions from electricity decline at a rate that nearly offsets the growth in the transportation sector. Emission controls for CO and VOCs are less likely to improve significantly and so their emissions grow at a more rapid rate, in proportion to the rising VMT.

Table 3: 2025 Durham Emission Forecast, as generated by the CACP Software.

Sector	Emissions (tons)					
	eCO_2	NO_x	SO_x	CO	VOC	PM_{10}
Residential	1,400,000	2,014	4,597	280	42	135
Commercial	1,076,000	1,546	4,161	203	29	103
Industrial	930,000	1,609	3,593	1,027	185	150
Transportation	1,538,000	4,089	244	41,519	3,927	99
Total	4,944,000	92,584	12,595	43,029	4,183	487

Direct vs. Indirect emissions

Direct emissions are those that occur directly within a jurisdiction and are commonly thought of as point and areas sources. "Indirect" emissions are those that are not emitted locally but are directly caused by local activity. In both the original DCAP and the CACP Software analyses, Durham took responsibility for emissions from electricity consumption, a common source of indirect emissions that are produced at power plants scattered throughout the state and the southeast electricity grid region.

Accounting for these emissions is important in GHG planning, as the location of the emissions are irrelevant in terms of their climate impact. When reporting the air emissions, however, it is important to report direct and indirect emissions separately because physical location of emissions is important for developing air management strategies and for modeling.

In the Durham area, indirect emissions from electricity consumption in the residential, commercial, and industrial sectors are indeed a significant portion of overall emissions of all pollutants except VOC and CO. More than 80% of SO_x emissions are estimated to be indirect from electricity consumption. See Table 4 for a complete breakdown of emissions.

Table 4: Direct vs. Indirect (electricity related) Emissions 1998 Baseline (tons)

	Total	% Emissions that are Indirect	Indirect Emissions	Direct Emissions
eCO_2 (CACP Software)	3,284,000	48%	1,582,000	1,702,000
NO_x	9,260	49%	4539	4,721
SO_x	13,618	87%	11,882	1,736
CO	2,648	7%	195	2,453
VOC	23,804	0%	23	23,781
PM_{10}	410	45%	185	225

Note: To fully account for the emissions associated with local electricity demand it is important to survey the local utility. While this study assumes the electricity grid is regionally integrated, there are cases where a jurisdiction's electricity could come from a small subset of the plants in the region (i.e. in the case of municipal utilities, or local "peak load plants" specifically designed to meet local demand. In these cases it would be inappropriate to use regional emission coefficients. The choice of coefficients must be evaluated on a case-by-case basis.

Analysis of the GHG Emission Reduction Plan

In order to achieve the 1.8 million tons/year reduction required to meet the city's reduction target, Durham designed a plan comprised of 15 quantified measures. The CACP Software analysis suggests that Durham's climate action plan will have a significant impact on emissions of air pollutants in the region (see Table 5).

Table 5: Summary of annual emission reductions (in lbs) included in Durham's Plan[1]

Community Measures	Emission Reductions for each Measure (tons) *Note: negative numbers indicate increases in emissions*					
	eCO_2 (tons)	NO_x (lbs.)	SO_x (lbs.)	VOC (lbs.)	CO (lbs.)	PM_{10} (lbs.)
Transportation Measures						
Regional Rail System	69,270	-135,000	-96,837	453,000	5,018,000	-8,521
Expand Mass Transit Bus System	54,000	74,334	6,655	310,558	4,034,000	1,904
Increased Use of Alternative Fuels in Motor Vehicles	33,991	191,293	8,349	295,003	2,378,000	540
Land Use Planning	327,469	1,211,000	86,564	1,809,000	19,284,000	28,024
Decrease motor vehicle	1,166	4,314	308	6,443	68,680	100

traffic (walking and biking)						
Decrease motor vehicle traffic (telecommuting)	12,245	45,299	3,237	67,647	721,000	1,048
Decrease motor vehicle traffic (car and vanpooling)	11,692	70,158	5,026	132,516	1,316,000	1,433
Decrease Idle time of Motor Vehicles	10,014	6,921	0	13,983	208,000	13,801
Residential, Commercial, Industrial Measures						
Residential Fuel Switching	19,000	80,097	127,079	-204	9,204	23,835
Residential Energy Efficiency	514,000	1,479,000	3,624,000	28,000	196,000	99,000
Residential Renewable Energy	17,000	50,054	155,271	588	5,372	3,465
Commercial/Industrial Fuel Switching	125,038	582,267	4,907,205	-1,354	61,030	158,045
Commercial/Industrial Energy Efficiency	524,000	1,647,000	4,099,000	108,800	630,000	134,000
Commercial/Industrial Renewable Energy	52,888	152,703	473,699	1,794	16,389	10,570
Reduce Heat Island Effect	35,349	102,000	316,000	1,199	10,954	7,065
Total	**1,807,122**	**5,561,440**	**13,715,556**	**3,226,973**	**33,956,629**	**474,309**

Overall, the measures included in the GHG action plan vary widely in their impact on air emissions. In the commercial and industrial sectors, the energy efficiency measures (which reduce coal and fuel oil use) are most effective at reducing GHGs, NO_x and SO_x emissions, followed by encouraging switching to alternative fuels and natural gas. In the transportation sector, land use planning to encourage mixed-use and high-density development is the most effective measure, providing NO_x and SO_x emissions reductions that are an order of magnitude larger than the other transportation measures. Other measures, such as vanpooling, are also effective but are limited by the amount of VMT they impact.

It is important to note that, as envisioned now, a plan to expand the diesel rail will reduce GHG emissions but may actually increase NO_x and SO_x emissions (assuming current diesel technology is used and using current predictions about ridership levels). This situation has also been observed in other emission reduction measures ICLEI has quantified in the past. For example, as Table 6 indicates, switching from traditional diesel to biodiesel can lead to significant reductions in GHGs but also cause increases in NO_x, making this alternative less appealing in regions where air quality and ozone are a concern. Similarly, encouraging a shift from single occupancy vehicles to <u>new</u> bus routes has negative air quality implications unless those new routes have high numbers of passengers per bus. *(Note: this is not the case if riders switch to existing bus routes, since there is no increase in emission, as the buses are already on the roads.)* Conversely, common CAP emission reduction measures may not have an impact on greenhouse gas emissions (catalytic converters, emission standards, scrubbers, etc). This highlights the importance of looking at the full range of air pollutants together. Focusing on only one type of emissions (GHGs or CAPs) may lead to a community choosing to implement a measure that is less effective overall, or one that may negatively impact other emission levels.

Table 6: CACP Software analysis of the potential emission impact of Minneapolis's commute transit ridership (313.04 million annual passenger miles[2]) assuming that trips avoided are taken in passenger vehicles with an average occupancy of 1.6 persons.

	eCO_2 (tons)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)
	Note: negative numbers indicate increases in emissions					
Transportation Mode Shift						
Switch to new routes: High occupancy – 27 pass/bus)	325,521	325,521	26,838	6,946,419	716,399	436
Switch to new routes - Medium occupancy – 10.6 pass/bus	-235,569	235,569	5,661	6,530,849	663,077	-22,940
Switch to utilizing existing routes	655,574	655,574	39,296	7,190,871	747,766	14,186
Fuel Shift						
Switch from traditional diesel to biodiesel in the bus fleet	56,591	-109,291	26,654	292,651	54,329	16,461
Switch from traditional to Ultra Low Sulfur diesel in the bus fleet	0	0	30,715	0	0	1,751

Analyzing the DCAP measures in CACP Software reproduces the GHG reduction target of nearly 5% below baseline as expected (see Table 7). Furthermore, this analysis also suggests that the DCAP reduces NO_x, SO_x, and PM_{10} against their respective baselines by amounts much greater than 5% (e.g., 30%, 57%, and 39% respectively). The reason is that, unlike for GHG emissions, improvements in control technologies for electricity generation and vehicles are expected to limit overall growth of NO_x, SO_x, and PM_{10} even without demand side measures being implemented. Therefore, curbing GHG emissions may result in proportionally much greater reductions in other air pollutants than what was intended for the GHG target.

Table 7: Impact of Durham's Plan (CACP Software Analysis) on emissions (tons)

	1998 Baseline Emissions Level[1]	2025 Business-as-Usual forecast	Reductions Included in the Plan	Predicted 2025 Emissions After Plan	% Below Baseline	% Below Forecast
eCO2	3,284,000	4,944,000	1,807,122	3,136,878	4.5%	37%
NOx	9,260	9,258	2781	6,477	30.1	30
SOx	13,618	12,595	6858	5,737	57.9	54
CO	23,804	43,029	16978	26,051	-9.4	39
VOC	2,648	4,183	1613	2,570	3.0	39
PM10	410	487	237	250	39.0	49

Because many of the DCAP measures focus on controlling electricity demand, more than half of NO_x and SO_x emissions, and roughly a third PM10 reductions, are indirect emission reductions at thermal power plants and therefore not necessarily accountable in local air emissions planning. As discussed earlier, this analysis presumes that these emission savings would be distributed over the southeast NERC region. This would still have an impact on local air quality, but one would have to contact Duke power to ascertain more accurately how the impact of reducing local energy demand impacts production from local power plants. On the other hand, the VOC and CO emissions are primarily associated with transportation and therefore estimated reductions are nearly all local.

SCENARIO ANALYSIS USING CACP SOFTWARE

CACP Software can also be used to compare a variety of emission reduction scenarios and programs. For example, one could consider the implementation of SULEV (super ultra low emitting vehicle) emissions standards for passenger vehicles in the Durham area. While this may or may not happen, this type of analysis demonstrates the relative impact of alternate possibilities as compared to the actions posed in the original action plan. In the original DCAP, the Municipal Planning Organizations assumes that, in 2025, passenger vehicles will account for 60% of the total projected 2500 million VMT, or roughly 1500 million miles traveled.

Table 8: Annual reductions due to SULEV and LEV passenger vehicles (in lbs.).

	eCO_2	NO_x	SO_x	CO	VOC	PM_{10}
All VMT at SULEV standard	314,000	3,085,000	134,000	38,367,000	4,758,000	8,170
50% VMT at SULEV standard	157,000	1,542,000	67,000	19,184,000	2,379,000	4,085
50% VMT hybrid SULEV	274,000	1,542,000	67,000	19,184,000	2,379,000	4,357
All VMT at LEV standards	314,000	1,724,000	134,000	35,800,000	4,200,000	8,170

The study suggests that SULEV standards for all on-road passenger vehicles by 2025 would reduce NO_x emissions by roughly 60% of the total reductions achieved cumulatively in the DCAP (3 million lbs for the SULEV measure vs. for 5 million for the DCAP). Introducing SULEV hybrid gasoline-electric vehicles, (assuming fuel economy increases similar to the 2003 Prius), offers the biggest gains for both GHGs and NO_x emissions. At 50% Hybrid SULEV VMT share, emission reductions of both GHGs and NO_x would be the same as the reductions achieved by the comprehensive land use planning initiative in the DCAP. Therefore, combined implementation of better vehicle standards plus effective land use and transportation planning would have a dramatic impact on air pollution emissions in Durham.

Other Scenarios

Similar results are seen in other areas. Tables 9 and 10 show emission reduction data from measures implemented or under consideration in Salt Lake City and New York State respectively. These scenarios allow for a comparison of the emission reduction benefits from various measures being considered in these jurisdictions. This information can help inform the decision making process. For example, as Salt Lake has problems with smog and air quality in the region, switching to biodiesel might not be the best option because of potential increased in NO_x. Additionally, state governments can compare the potential impacts of various policy options before implementing them. In all emission categories, New York would achieve the greatest reductions by implementing a renewable portfolio standard, but if GHG and NO_x are the pollutants of concern, it may make more sense to target home heating oil use, as opposed to lighting, which would have a greater impact on the other emission categories.

Table 9: Emission reduction measures being implemented by Salt Lake City[3]

	ECO_2 (tons)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)	Cost Savings
Lighting upgrades	344	795.2	713.1	425	46.9	305.4	$33,571
Wind power	215	497.5	446.1	265.9	29.3	191	
681 LED traffic signals	242	557.7	500.1	298.1	32.9	214.2	$32,962
Biodiesel airport buses	227	-346	112	1,153	118	132	Unknown
TOTAL 2001	**1,028**	**1,504.4**	**1,771.3**	**2,142**	**227.1**	**842.6**	**$66,533**

Table 10: Comparison of emission reduction potentials from the residential sector in New York State

	eCO_2 (tons)	NO_x (tons)	SO_x (tons)	CO (tons)	VOC (tons)	PM_{10} (tons)
25% Renewable portfolio standard	6,862,8690	7,493	23,055	9,924	1,095	7,131
Energy Star Homes, Oil	4,441,344	5,826	3,250	1,181	199	695
Energy Star Lighting	3,173,581	3,465	10,661	4,589	506	3,297
TOTAL Reductions	**15,477,794**	**16,785**	**36,966**	**15,694**	**1,800**	**11,123**

Note: These numbers from New York State are provided as indicators only. They have not been validated, nor should they be taken as official state information.

CONCLUSIONS

The CACP Software provides a harmonized look at the emissions and reductions of GHGs and CAPs. This analysis demonstrates the strong link between climate and air emissions, and the benefits that can come from considering both classes of emissions in local environmental planning. Reanalyzing Durham's climate action plan using the CACP Software tool shows that actions taken to reduce GHG's by 5% below their level in the 1998 baseline year have the potential to cut future NO_x, SO_x, and PM_{10} emissions by 30-40%. This information creates a much stronger case for taking action to reduce GHG emissions as the air quality co-benefits address another area of concern for local governments.

Additionally, looking at both GHG and CAP emissions in the same analysis may lead to a different suite of emission reduction measures being implemented. Some measures that have a high potential for GHG reductions may actually negatively impact air quality and conversely, some air quality measure may have no impact (or worsen) emissions that lead to global climate change. Therefore, it is essential that local governments look carefully at all aspects of any measure that they are considering in order to achieve maximum benefit from the limited dollars available for new projects and programs.

This study suggests that air emissions co-benefits from climate action planning can and should be integrated into regional air management strategies and that local governments could benefit for using tools such as the Clean Air Climate Protection Software.

DISCLAIMER

This report is intended to demonstrate a strategy for evaluating air emissions co-benefits of a typical climate action plan. The results presented from Durham, Salt Lake, and New York have not been validated, nor should the information presented be considered an official document of any of the jurisdictions in question. In cases where needed data was not available in Durham's Climate Action Plan report, ICLEI made assumptions based on the best available information. ICLEI recommends that *a jurisdiction intending to undertake an actual review of their climate action plan thoroughly validate and document all data sources and assumptions. They should pay special attention to documenting the technologies planned for specific measures, as this can have a major impact on air emissions.*

REFFERENCES

[1] *Greenhouse Gas Emissions Local Action Plan for the City of Durham, North Carolina*; Prepared for the City of Durham, NC by CH2MHill, 1999.

[2] Fisher, G. 2004. Environmental Inspector, City of Minneapolis, MN, *personal communication*.

[3] Anderson, R., "Salt Lake City's Local Climate Action Plan – Real actions, real results, no excuses", Presented at the World Summit on Sustainable Development, Johannesburg, South Africa, August 2002.

KEYWORD

Greenhouse Gas
Emissions Inventory
Climate Change
Global Warming
Criteria Air Pollutant
CCP
Cities for Climate Protection
ICLEI
Clean Air and Climate Protection Software
CACP
Harmonized
Emissions
Local Action Plan