

Staff Report

November 4, 2008

TO: City Council

FROM: Donna Silva, Director Parks and General Services Department
Mitch Sears, Sustainability Program Manager

SUBJECT: Greenhouse gas emissions: Inventory update, Davis greenhouse gas emission reduction targets, and carbon allowances for residential development

Recommendations

1. Receive update on the Davis GHG inventory.
2. Approve the attached resolution establishing GHG emissions reduction targets for Davis City operations and the Davis community.
3. Consider and provide comments on conceptual guidelines for Carbon Allowances for new Residential Development (CARD).

Overview

This report provides analysis and recommendations on three interrelated greenhouse gas emissions topics: (1) an updated GHG emissions inventory, (2) the establishment of GHG emissions reduction targets for City operations and the Davis community, and (3) the creation of a new methodology to assist the City in evaluating the GHG emissions impacts of new residential development projects.

Staff and the City's consultant, Deb Niemeier (Ph.D., P.E, Director John Muir Institute of the Environment, UCD), developed the following strategy to address these three interrelated topics:

1. Resolve known (significant) gaps in the City's existing local GHG inventory.
2. Link statewide GHG inventory to local GHG inventory.
3. Establish a link between State GHG reduction targets (AB 32 and Executive Order S-3-05) and local GHG reduction targets.
4. Establish a per-capita carbon allowance for new and existing Davis residents (assuming an absolute reduction target), to meet statewide GHG reduction mandates and apply to new housing developments.

The Consultant's report is included as Attachment 1 and provides detailed analysis of the issues summarized in this report.

To Staff's knowledge, Davis is the only City in the state that has attempted to link statewide GHG inventory/targets with local inventory/targets and apply the results.

Council Goals

The set of recommended actions address the Council goal of conserving natural resources and protecting the environment. Specifically, the actions partially implement the Council objective of addressing global warming and reducing the carbon footprint of Davis.

Fiscal Impact

No direct costs associated with this report. Implementation of the actions associated with achieving GHG emissions reduction goals recommended in this report will be determined as the final Climate Action Plan is being considered in Spring of 2009. The action plan will include cost estimates for actions.

The fiscal impact of implementing the proposed draft residential Carbon Development Allowance guidelines would be determined on a project by project basis. Staff is developing a methodology that will allow developers to seek out the lowest cost options to meet a portion of project targets. Additional detail is provided in the analysis section below.

Natural Resources Commission

In its advisory role to the Council on local GHG emission reduction strategies, the Natural Resources Commission (NRC) considered the updated inventory, local reduction targets, and the Carbon Allowance for Residential Development at its October 27, 2008 meeting. Following its discussion, the Commission made the following recommendations to the City Council:

1. Accept the updated GHG inventory that includes estimates for out of town travel to and from Davis.
2. Approve local GHG emission reduction targets that establish a range and are linked with state mandated targets.
3. Continue to develop the carbon allowance concept for new and existing residences.

The Commission recommended minor changes to the reduction targets to clarify priorities and include additional milestones. Staff believes these recommended changes are helpful and has incorporated them into Table 2 below and the associated resolution (Attachment 2).

Staff supports the Commission's recommendations.

Background and Analysis

In April 2007, the City Council adopted a strategy to reduce local GHG emissions. To achieve this objective, the City joined the Cities for Climate Protection (CCP) program along with hundreds of other communities across the globe working to reduce greenhouse gas emissions at the local level. The CCP is a performance-oriented campaign that offers a framework for local governments to reduce greenhouse gas emissions and improve livability within their municipalities. The framework includes the following 5 steps:

1. Conduct a baseline emissions inventory and forecast.
2. Adopt an emissions reduction target for the forecast year.
3. Develop a Local Action Plan.
4. Implement policies and measures.

5. Monitor and verify results.

As noted in the overview section above, this report addresses steps 1 and 2 (emissions inventory and reduction targets), and offers guidance on one implementation measure (Carbon Allowances for New Development). Staff, the Climate Action Team, and the Science Advisory Team continue to work on the development of a local action plan (Step 3).

1. GHG emissions inventory.

The City has measured local GHG emissions using the ICLEI Clean Air and Climate Protection software (CACP). Based on staff research, the ICLEI model is the standard approach used by communities measuring local GHG emissions. Put simply, it is the best tool available at this time. However, as noted when it was presented to the NRC and the City Council earlier this year, the inventory is considered a continuing work in progress and will be improved when better data (or methodology) that significantly improves the reliability of the results becomes available.

Resolving significant gaps

As part of the original effort to assemble the ICLEI inventory, staff recognized that there were gaps in the software that had the potential to significantly affect results. Specifically, the model did not capture vehicle (commute or other) miles occurring outside Davis. In order to improve the local GHG inventory and address this gap, the City's consultant worked with SACOG staff and traffic models to estimate commute miles associated with Davis residents and businesses. To calculate the approximate adjustment that should be made to include trips that may have some portion of their travel outside Davis, staff and the consultant determined that half of each commute trip (into and out of Davis) should be included in the Davis GHG inventory. As the consultant's report notes, this is a fairly speculative approach but it is based on the notion that the destination community "owns" half of the miles traveled (see Attachment 1, Appendix B).

When the travel that occurs outside of Davis (but begins or ends within Davis), is accounted for, the estimated Davis transportation related GHG emissions for both the base year (1990) and target years (2020, etc.) is approximately 75% of the per capita transportation emissions estimated from the state inventory.

Link with State GHG inventory

As noted above, the City has used the standard model for establishing a local GHG emissions inventory. However, the California Air Resources Board (ARB) has also conducted a statewide inventory that is the basis for moving forward on State mandated reduction targets and will be required to set regional targets under SB 375. To the knowledge of staff and the City's consultant, no local jurisdiction has attempted to directly link these two types of inventories. Staff and the consultant believe this is an important step if Davis (or any local jurisdiction) is to show how its actions contribute to state (or regional) GHG reduction targets. Given the uncertain regulatory environment surrounding GHG reduction and the possible establishment of a GHG cap and trade system, staff believes it is prudent for the City to establish a link between the state and local GHG inventory.

In order to link the two inventories, the consultant first helped the City identify the state inventory emissions sectors that occur in Davis (e.g. transportation, residential, commercial, etc.). Next, state emissions were calculated on a per capita basis and allocated to Yolo County and finally to Davis based on proportion of population. As noted in the consultant’s report, disaggregating to the county level first provides a logical political and geographic boundary to conduct future quality assurance checks. Additionally, based on recent legislation (SB 375), it appears likely that future state GHG targets will be established at the regional level (SACOG) which tends to conduct analysis at the county level.

Based on the results of the exercise to link the two inventories, the per capita GHG emissions in Davis are approximately 30% lower than what the state inventory would predict. After accounting for the gap in the Davis inventory for travel outside the City (but begins or ends in the City), as noted above, the difference is approximately 25%. Staff and the consultant believe that a portion of the difference is due to the policies the City has pursued for the past several decades that serve to reduce local GHG emissions. However, staff and the consultant also concur that some of the difference is associated with the differences in the assumptions that are built into the state and ICLEI models. Staff and the consultant are exploring options for how to investigate these differences and reconcile the two methodologies. Lacking resources and time, staff is recommending that the City proceed with the best available information in setting GHG guidelines for new residential development projects. Therefore, the guidelines proposed in section three of this report use the statewide inventory to establish a per dwelling unit GHG “allowance” for Davis projects.

2. Revised GHG emissions reduction targets.

As part of the overall effort to establish a Climate Action Plan for the City, staff concurred with the recommended GHG reduction targets originally considered and passed by the NRC in April 2008. Because the work with the consultant had just begun, staff postponed its report to the Council on the NRC action until the additional analysis by the consultant had been completed. The GHG reduction targets recommended by the NRC in April are shown in Table 1:

Table 1: GHG reduction targets recommended by Natural Resources Commission 4/28/08

Year	Target	Notes
2012	7% below 1990 levels	Consistent with Kyoto – Mayors Climate Protection Agreement Pledge – City of Davis Reso 2006.
2015	15% below 1990 levels	Consistent with current ICLEI modeling conducted by the City. Due to residency time of GHG gasses in the atmosphere, early GHG reduction is more beneficial for mitigation of most severe impacts.
2015-2040	Ave of 2.6% reduction/yr to achieve 80% below 1990 levels	Reduction level adopted by the state based on climate stabilization levels of 3-5.5 degree increase in temp. Average reduction encourages monitoring of progress and some flexibility in implementation.
2050	Carbon neutral	Combination of actions at the local, regional, national, and international levels and carbon offsets. Similar to targets for the UC system, City of Berkeley, and Norway.

Staff believes that these aggressive reduction goals are important to frame the local discussion and to set an example for other communities to consider. In addition, staff recognizes that early GHG reduction is beneficial in addressing climate change due to residency times of GHG's in the atmosphere. However, after considering the implications of the revised inventory, staff believes it will be very difficult to reach these local targets and that consideration of a revised target set aligned with state targets is warranted. This approach would affect the near-term targets and the acceleration of the long-term target of 80% reduction below 1990 levels.

Rather than abandon the more aggressive targets, staff is proposing a target range using the state targets as the minimum and the targets shown above as the desired reductions. This serves to remind the City of its leadership role while also providing a higher likelihood that it will achieve at least a minimum target. This approach also serves to link the state inventory and targets with the local inventory and targets and recognizes the current debate over whether the state's targets will achieve climate stabilization levels in the lower range of predicted temperature increases.

The revised recommended GHG reduction targets are shown in Table 2 below:

Table 2: Recommended Davis GHG Reduction Targets: Community and City Operations

Year	Target Range*		Notes
	State	Davis**	
2010	2000 levels	1990 levels	<u>Minimum:</u> State target. <u>Desired:</u> Provides baseline for subsequent average annual reductions.
2012	1998 levels	7% below 1990 levels	<u>Minimum:</u> State does not establish target for this year; linear interpolation from 2010 target. <u>Desired:</u> Consistent with Kyoto – Mayors Climate Protection Agreement Pledge – City of Davis Reso. 2006.
2015	1995 levels	15% below 1990 levels	<u>Minimum:</u> State does not establish target for this year; linear interpolation from 2010 target. <u>Desired:</u> Consistent with initial ICLEI modeling conducted by the City.
2015 to 2020	Average annual reduction	Ave of 2.6% reduction/yr to achieve 80% below 1990 levels by 2040	<u>Minimum:</u> State does not establish target for these years. <u>Desired:</u> Average reduction encourages monitoring of progress and some flexibility in implementation.
2020	1990 levels	28% below 1990 levels	<u>Minimum:</u> State target. <u>Desired:</u> Average reduction encourages monitoring of progress and some flexibility in implementation.
2020-2040	No formal target, but must reduce an ave. of	Average of 2.6% reduction/yr to achieve 80% below 1990	<u>Minimum:</u> State does not establish target for these years. <u>Desired:</u> Reduction level adopted by the state based on climate stabilization levels of 3-5.5 degree increase in temp. Average reduction encourages monitoring of progress and some

	2.66%/yr to achieve 80% below 1990 levels by 2050	levels	flexibility in implementation.
2050	80% below 1990 levels	Carbon neutral	<p><u>Minimum:</u> State target. Reduction level adopted by the state based on climate stabilization levels of 3-5.5 degree increase in temp. Average reduction encourages monitoring of progress and some flexibility in implementation.</p> <p><u>Desired:</u> Combination of actions at the local, regional, national, and international levels and carbon offsets. Similar to UC system, City of Berkeley, and Norway.</p>

* It is anticipated that Davis will achieve reductions within the range of the state targets (minimum) and local targets (desired).

**Due to residency time of GHG gasses in the atmosphere, early GHG reduction is generally more beneficial for mitigation of the most severe impacts of climate change.

As the inventory was examined and refined as described in section 1 of this report, staff reconsidered the likelihood that the desired near-term targets could be achieved. Based on this analysis, staff concluded that: (1) the state targets presented considerable challenges for a local jurisdiction to achieve, and (2) that the desired reduction levels shown in Table 2 above would be very difficult to achieve without fundamental advances in technology and shifts in society that are outside the influence of the Davis community. Therefore, staff is recommending a range of targets that set a floor but aim much higher.

Analysis of potential GHG reduction actions currently underway by staff, the Climate Action Team, and the Science Advisory Team will provide additional information on the practicality of the recommended targets. As expressed to the NRC in April (and as with the GHG inventory), staff expects that these targets will be reexamined as part of an adaptive management approach that takes updated information, changing policy, and advancements in technology into consideration.

3. Residential carbon allowances.

The City’s GHG inventory shows that more than three-quarters (3/4) of the total GHG emissions generated in Davis are associated with the energy used in Davis’ homes and personal transportation associated with residential land uses; residential energy use (33%) and transportation (53%) (Source: City of Davis GHG Inventory and Forecast Report, May 2008). Though some of the transportation GHG emissions are associated with the movement of goods, the majority are associated with personal transportation and are therefore linked with residential activities.

Due to the importance of the residential sector relative to GHG emissions, staff asked the consultant to develop a methodology establishing a GHG target (or “allowance”) for individuals and, by extension, dwelling units. Establishing this allowance informs the City’s efforts to cut local GHG emissions in two ways: (1) with a simple calculation, it allows the City to link GHG emissions from new residential development projects directly to local and state GHG reduction targets, and (2) it provides targets for existing residents. In short, this information allows the

City to set GHG performance standards for new residential projects and helps educate existing residents about what role they play in reducing local GHG emissions.

The remainder of this section of the staff report addresses the establishment of GHG allowances for these two residential sectors – new housing projects and existing residents. As staff noted in the report overview, Davis is at the forefront in utilizing an approach linking state and local GHG emission inventories and targets and applying the results to local GHG emission reduction efforts. Staff believes that the methodology developed and applied by the consultant to establish the residential GHG allowances is sound and that the resulting per-capita GHG reduction targets shown in Table 3 below are based on the best available GHG inventory information. See Attachment 1, pg 9 for additional information.

In order to meet the GHG emissions reduction targets shown in Table 2 above, it is clear that the energy used in Davis’ existing housing stock and newly constructed residential units must be addressed. As noted above, more than three-quarters (3/4) of the total GHG emissions generated in Davis is directly related to residential energy use and transportation. Working from the assumptions that every home built in Davis today will still be in existence in 2050 and that energy use associated with residential activities will continue to be the primary source of local direct and indirect GHG emissions, new residential units built in Davis must perform to meet future GHG reduction targets.

Working from these assumptions, the adjusted GHG inventory, and the proposed Davis GHG reduction targets, the consultant showed how new (and existing) residential units must perform for the City to meet the community reduction targets (Attachment 1, pg 9). The carbon “allowance” for new and existing residential units for sample reduction targets is summarized in Table 3 below:

Table 3: Carbon Allowances

Target year Minimum/Desired	Target	Carbon allowance to meet GHG reduction target* (annual metric tonnes per dwelling unit and per person)**	
		Residential Type	
		New	Existing
Existing/Base year (2010)	N/A	20.25 per unit/ 8.1 per person	20.25 per unit/ 8.1 per person
2012 (Min.)	1998 level	18.6 / 7.4	18.75 / 7.5
2012 (Desired)	7% below 1990	11.25 / 4.5	11.75 / 4.7
2020 (Min.)	1990 level	12 / 4.8	12.75 / 5.1
2020 (Desired)	28% below 1990	8.75 / 3.5	9.25 / 3.7
2030 (Min)	28% below 1990	8.75 / 3.5	9.25 / 3.7
2030 (Desired)	53% below 1990	5.75 / 2.3	6 / 2.4
2040 (Min.)	53% below 1990	5.75 / 2.3	6 / 2.4
2040 (Desired)	80% below 1990	2.5 / 1.0	2.5 / 1.0
2050 (Min.)	80% below 1990	2.5 / 1.0	2.5 / 1.0
2050 (Desired)	Carbon Neutral	Net 0	Net 0

* Source: Carbon Development Allowances, Final Report, September 2008.

** Assumes 2.5 persons/dwelling unit and an annual growth rate of 1%/yr (Source: City of Davis GHG Inventory and Forecast Report, May 2008).

By establishing these allowances, the City has the information necessary to develop standards, incentives, and tools to help the residential sector achieve its share of local (and State) GHG emission reductions. As noted below, the City has initiated action to address GHG emissions in both the existing and new residential sectors.

Existing residential dwelling units. As a first step in achieving these long-term per-capita reduction goals, the City has initiated a public engagement program to raise citizen awareness and give existing residents a tool to achieve measurable GHG reduction savings at the household level. The voluntary Davis Low Carbon Diet Challenge pilot program was launched on October 12th with the goal of 100 households losing 5,000 lbs of carbon each over the course of a year.

The City's goal is to learn from this pilot program and scale it up in coming years to cover thousands of Davis households. If the 100 households involved in the pilot program are successful, they will lose an average of 2.25 metric tonnes per household, which is approximately 25% of the way to the desired reduction for Davis residents by 2012 and 27% of the State's 2020 target.

As part of its planning process to develop a long-term climate action plan for the community, consideration is also being given to other incentive based programs to assist existing residents (e.g. financing programs for energy efficiency upgrades and solar power). In addition, improvements to the transit system and changed land-use patterns are being considered with the objective of reducing automobile use which would lead to reductions in GHG emissions at the community level.

New residential projects

Staff is in the process of drafting initial guidelines for GHG reduction standards for new residential projects. The guidelines use the GHG inventory and allowances to set standards for new residential projects. The intent of the guidelines is to ensure that new residential projects move Davis toward its long-term GHG reduction targets. The draft guidelines are in the early development stages and will be presented to the Council as part of the staff presentation on November 18th. Staff will be seeking feedback from the Council to assist in the development of the guidelines.

Conclusion

Staff recognizes that implementation of programs to reduce residential GHG emissions will require development of a set of standards, measures and tools to educate and guide existing residents and developers of new residential projects. Establishment of the allowances is a critical first step, but it must be followed by programs that provide certainty and adequate flexibility to give developers and residents a viable chance of achieving the per-capita targets.

Attachments

1. Carbon Development Allowances – Final Report, Sept., 2008
2. Resolution: Davis GHG reduction Targets

CARBON DEVELOPMENT ALLOWANCES

FINAL REPORT

Prepared By

Deb Niemeier, Ph.D., P.E.

Prepared For

Mitch Sears
City of Davis
Davis, CA

September, 2008

Introduction

California has several climate change related initiatives currently in play most notably that of AB32 and Executive Order S-3-05, both of which establish climate change emissions reduction targets for the state. AB32 requires greenhouse gas emissions (GHG) to be reduced to 1990 levels by 2020 and S-3-05 establishes a year 2000 target for greenhouse gas emissions by 2010; 1990 by 2020, and 80% below 1990 by 2050. In 2007, Yolo County's Board of Supervisors passed Resolution 07-109 adopting the Cool Counties Climate Stabilization Declaration. The Declaration commits the county to developing an inventory of its operational GHG emissions and achieving a target rate of 10% reduction every 5 years, beginning in year 2010.

The City of Davis is also focused on establishing energy as a key factor in planning for future growth. The City has endorsed the US Conference of Mayors Climate Protection Agreement, and in spring of 2007 the City passed a resolution establishing the reduction of greenhouse gas emissions as a key priority. A greenhouse gas emissions inventory was recently completed and the City is currently in the process of identifying an emissions reduction target and actions to reduce greenhouse gas emissions (GHG).

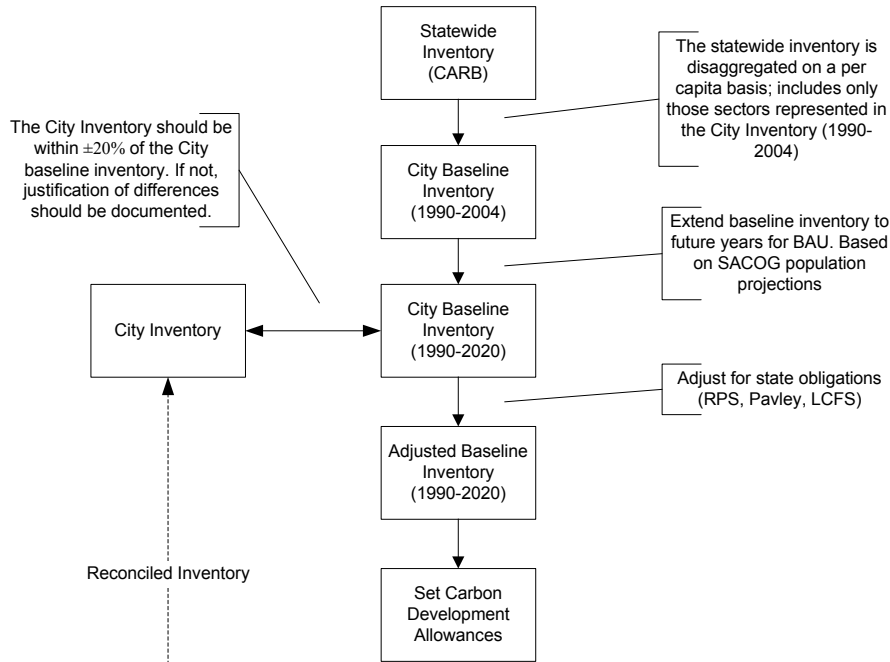
As part of this effort, this study has been commissioned to develop (GHG) emissions goals for proposed and existing residential and multi-family dwellings. The study is motivated by the City's desire to reduce its GHG emissions and to be able to show progress toward achieving local, and with the possibility of SB 375, eventually state and regional targets. The purpose of this memo is to outline possible approaches to setting greenhouse gas reduction (GHG) targets for new and existing residential development and transportation (combined). Establishing the targets requires two types of inventories: a top-down inventory that reflects the statewide targets and a bottom-up inventory that reflects the city's best estimate of its GHG emissions. In this report, each of the inventories is discussed and GHG reductions targets are developed in the context of the inventories.

A COMMUNITY-BASED GHG INVENTORY PROTOCOL

In absence of state guidance, two approaches are available for building community inventories: top-down using the state's inventory and bottom-up using methods like ICLEI. As Figure 1 illustrates, both inventories are actually needed. In order for the city to compare its progress toward state (or regional) GHG goals, any inventory built from the bottom-up must be linked to the state (and eventually regional) inventories. That is, there must be some way to show how the City contributes to reductions in a statewide target. As a result, a top-down inventory is constructed from the estimated statewide inventory using sectors represented within Davis (e.g., refineries are filtered out of the total GHG emissions) and historical and projected per capita trends. This top-down inventory can be compared to the bottom-up inventory already estimated by the City.

Since the two inventories are unlikely to match, an adjustment (or reconciliation) process is also required in which acceptable differences are documented and a tolerance level (or difference between inventory totals) is established. After the initial process of preparing and comparing inventories is completed, the bottom-up inventory can be used to track year by year progress toward state (and regional) goals. Each of these steps: preparing the bottom-up and top-down inventories, and reconciling differences are described in greater detail in the next few sections.

Initial Preparation



Yearly Updates

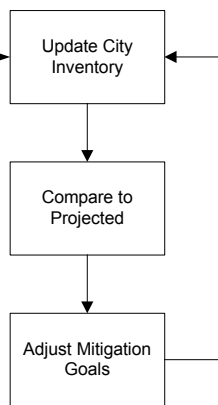


Figure 1. Process for establishing and maintaining inventories

Bottom-up Inventory

The City’s recently completed inventory included four sectors of energy consumption (Table 1): commercial/industrial, residential, transportation and waste. The City used the ICLEI local government framework for calculating its emissions.¹ Inventories were calculated for 1990 and 2015, and in both inventories transportation constitutes the majority (more than 55%) of the estimated GHGs. The respective years were chosen because the 1990 inventory matches the regulatory baseline while the 2015 establishes a potential target.

¹ <http://www.iclei.org/>

Table 1. City of Davis GHG Inventory²

Sources	1990 CO2e (MT)	2006 CO2e (MT)	2015 (BAU) CO2e (MT)
Commercial/Industrial	76,225 (11.8%)	87,498 (11.8%)	95,498 (17.6%)
Residential	27,119 (33.1%)	40,593 (33.1%)	56,280 (29.9%)
Transportation	121,353 (52.7%)	151,059 (53.1%)	162,046 (50.7%)
Waste	5,660 (2.5%)	5,468 (2.5%)	3,220 (1.9%)
Total	230,356	284,618	317,044

Source: City of Davis, Greenhouse Gas Inventory and Forecast Report (May, 2008)

Top-down Inventory

In AB 32, CARB is formally charged with developing a 1990 greenhouse gas inventory and approving the statewide 1990 emissions level, which in turn establishes the 2020 emissions target. The CARB completed the inventory in fall of 2007.³ In addition, under SB 375 CARB is also charged with setting regional GHG targets.⁴ As a result, those communities moving quicker than the state in setting regional or local goals and implementing planning guidance for reducing GHGs must develop their own methods for ensuring that local achievements can be mapped and then standardized against regional and state goals.⁵ There are several ways to think about establishing a target, but ultimately any target that is selected should be sufficient to ensure that the City is on track to meeting AB32, SP-06-03, and ultimately SB 375 requirements.

The GHG inventories have to be nominally computed for a number of years, at the minimum 1990, 2010, 2020 and 2050 because each of these years has a formal mandated state target or reference. These inventories, based on historical and current trends in energy consumption, are typically referred to as business-as-usual (BAU) scenarios. For past years, the BAU inventory represents a best estimate of the actual inventory in that year.

Consistent with the City’s baseline inventory which includes four primary sectors (see Table 1): commercial/industry, residential, transportation, and waste, the state’s inventory was filtered to match the sectors and activities represented in the City’s inventory (Figure 2; see Appendix A for additional details). From this baseline inventory, first, county and then city totals were calculated on per capita basis. Although there are a number of different ways in which the statewide inventory can be disaggregated to the county level, a per capita basis represents the most straightforward method, and in the absence of state guidance, a reasonable approach. The rationale for going from state to county to city rather state to city is that the county provides a logical political and geographic boundary to conduct quality assurance checks (both now and in the future).

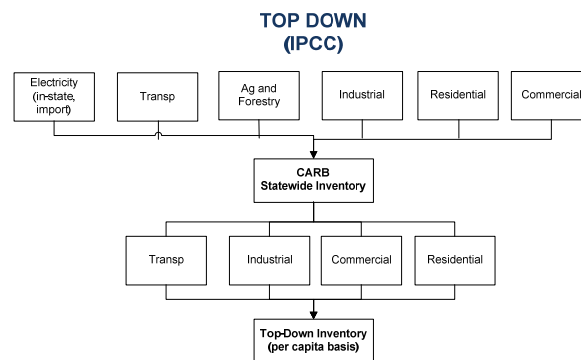


Figure 2. Top-down Inventory

² Tons have been converted to metric tonnes

³ California Air Resources Board (CARB) (2007). California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Level. Sacramento, Air Resources Board.

⁴ SB 375 as approved requires CARB to set regional MPO targets by Sept 2010

⁵ Presumably, if and when the state established regional or local targets, planning guidance will be provided.

Based on population data assembled from 1990 to 2005 (Department of Finance), Yolo County's population as a proportion of the state population has been fairly steady over the past 15 years, ranging from 0.5% in 1990, the baseline year, to 0.6% from 2004 forward. Yet, Davis has grown significantly more than the overall state, on average, since 1990. The state population grew by approximately 11% between 1990 and 2004, while Davis increased by approximately 40%. Using the proportion of the county population, a per capita county level GHG inventory was computed from the statewide total. The county inventory was then disaggregated to the town level, again on a per capita basis. As a percent of the county's population, Davis' population has ranged from 33% (1990) to approximately 35% in 2004. Yet, according to the census, Yolo County ranked 10th in terms of county population change (8.5%) between 2000 and 2003. And despite strong overall growth in population, GHG emissions increased even faster.

Table 2. Top down Inventory Comparison (MTCO₂e)

	1990	1995	2000	2004	2006
State Inventory	230,143,863	225,240,866	249,142,452	255,378,155	--
<i>Per capita</i>	7.7	7.1	7.3	7.0	
Yolo County	1,089,516	1,157,487	1,402,775	1,590,125	--
<i>Per capita</i>	7.7	7.6	8.4	8.6	
City of Davis (top-down)	357,401	397,548	500,626	555,713	--
<i>Per capita</i>	7.7	7.6	8.4	8.6	
City Inventory (bottom-up)	230,356	--	--	--	284,618
<i>Per capita</i>	5.0				6.1

* Note that units are CO₂e in metric tonnes

To establish the future year BAU based on the statewide inventory, population projections were used. Because of a difference in the projections between the Dept. of Finance and SACOG, although population projections from both sources were computed, only SACOG estimates are presented in this report. The current per capita consumption was used to estimate the business-as-usual consumption for future years. Per capita energy consumption has been steadily increasing over time so it is possible that BAU estimated levels would actually be higher if per capita use rates continued to steadily increase. However, for the purposes of this analysis, the future year BAU per capita rate of consumption was set equal to current use rates. This is a reasonable assumption given the City's generally progressive stance toward managing environmental resources.

COMPARISON BETWEEN TOP DOWN AND BOTTOM UP INVENTORIES

Figure 3 shows the estimated BAU scenarios, from 1990 through 2030, on a per capita basis. The estimated 1990 levels differ between the top down city inventory and the bottom-up inventory by approximately 30%. This difference is likely the result of both limitations in the basic framework of the ICLEI inventory method and possibly differences in the underlying emissions rates used between the statewide inventory created by CARB and the City inventory. These differences are currently being evaluated, but it is worth noting the transportation sector appears to be, at least partially, underestimated using the ICLEI method. One important aspect to Figure 3 is that future BAU rates from top-down inventory calculation assume that per capita rates continue as observed in 2007. Per capita rates could increase, but here the assumption is that city residents will maintain current rates.

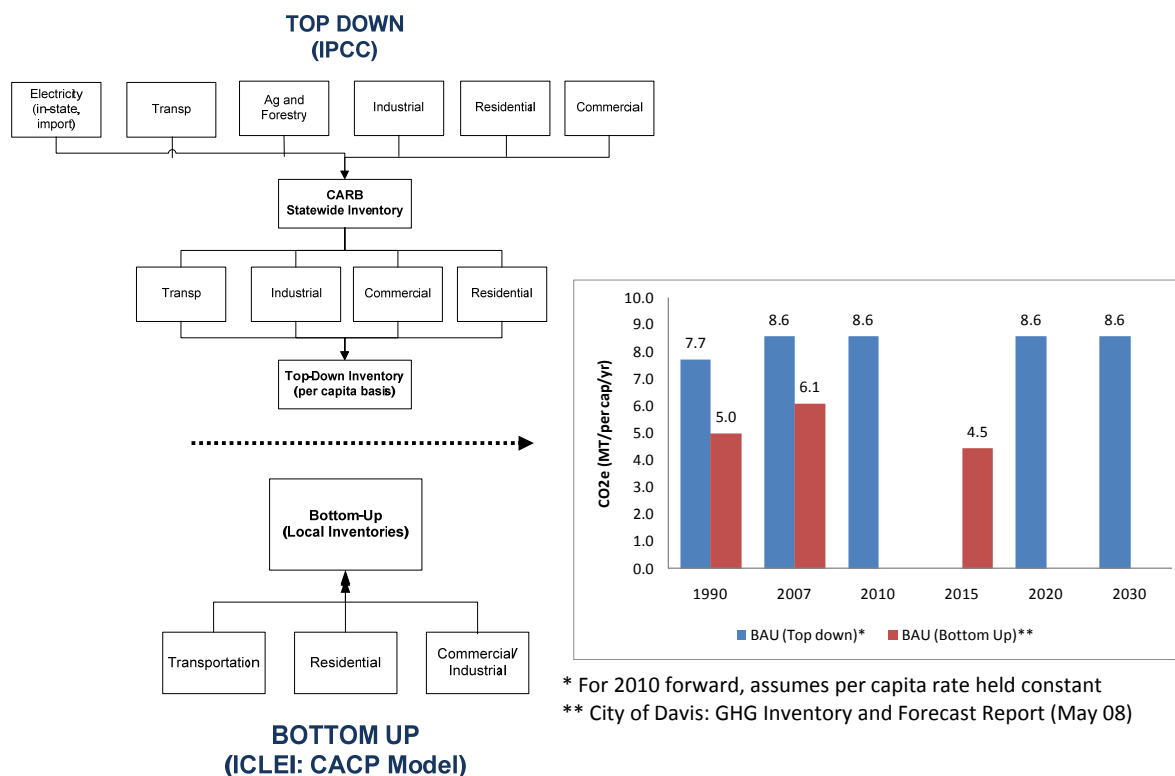


Figure 3. Comparison between top-down and bottom-up inventories

As more detailed comparisons are conducted between the bottom-up and top-down inventories, the differences between the two should become smaller or at least better documented as to why the difference appears. For example, an approximate adjustment to the bottom-up inventory was computed for transportation just to gauge the potential impact of refining the transportation numbers. In the ICLEI method, transportation GHG emissions are calculated for vehicles traveling only *within* Davis. In reality, total travel associated with the City also comprises some portion of trips beginning within Davis and ending outside Davis (e.g., a work commute from Davis to downtown Sacramento) and some portion of trips that begin outside Davis and end within Davis (e.g., a work commute trip from Sacramento to Davis). Making some general assumptions and using travel model data provided by SACOG, the potential adjustment to the bottom-up inventory due to missed travel was calculated (see Appendix B). Assuming the adjustment for missing trips also applies to the 1990 inventory, after the adjustment the difference between the top-down and bottom-up 1990 inventory is reduced to about 25%.

Figure 4 shows the business-as-usual bottom-up and top-down inventories, along with the estimated targets. The markers identified in Figure 3 as “BAU – TranspAdj Davis Inv” represent the adjusted BAU bottom-up inventory after the missed travel is incorporated. Although completely reconciling differences between the two inventories is not critical for the purposes of establishing city carbon allowances, it is important that differences ultimately be reconciled or fully documented so that yearly updates to the bottom-up inventory are robust with respect to estimated reductions in GHGs. As more detailed analysis is conducted the bottom-up inventory will be refined.

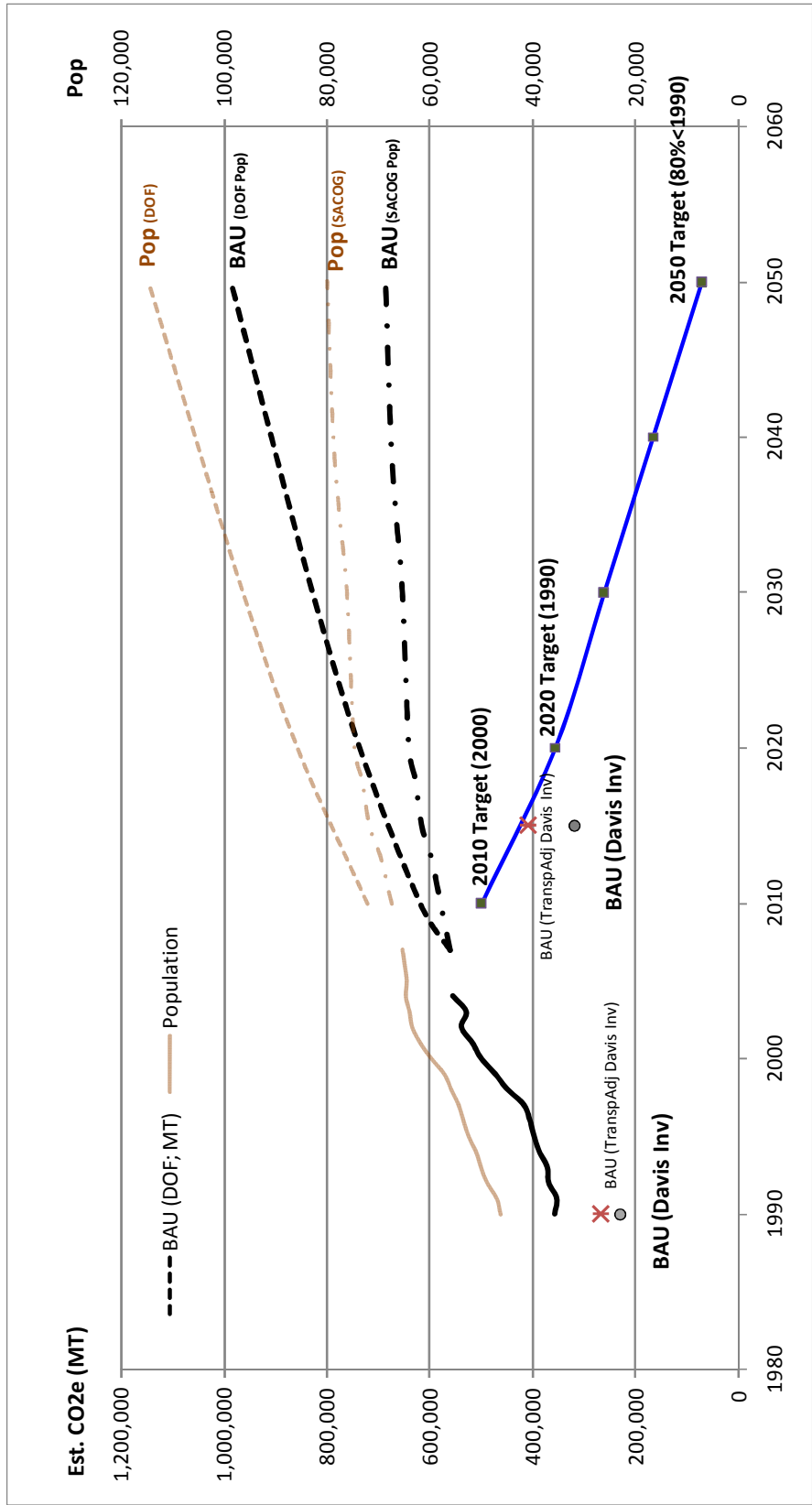


Figure 4. Top-down and Bottom-up Inventories and Targets (solid black: top-down CO2e BAU)

Reflecting State Responsibility

City targets can be set using the per capita top-down inventory, but before setting development allowances specifically for the city, one additional adjustment to the top-down BAU (SACOG) should be calculated. This adjustment should reflect those mandates introduced by the state and designed to specifically reduce energy consumption and GHGs. These reductions are state-wide and the responsibility for the implementation of these measures can be assigned to the state. The City is then responsible for reducing the remaining gap between BAU_{Adj} and the 2020 target. Those emissions assigned to the state include reductions associated with the Renewable Portfolio Standard (RPS) and two transportation-related emissions reductions: the Pavley Law and the Low Carbon Fuel Standard (LCFS). The estimated reduction in GHGs was calculated for all three of these mandates and applied to the BAU_{SACOG}. The results are shown in Figure 5 (additional details are provided in Appendix C).

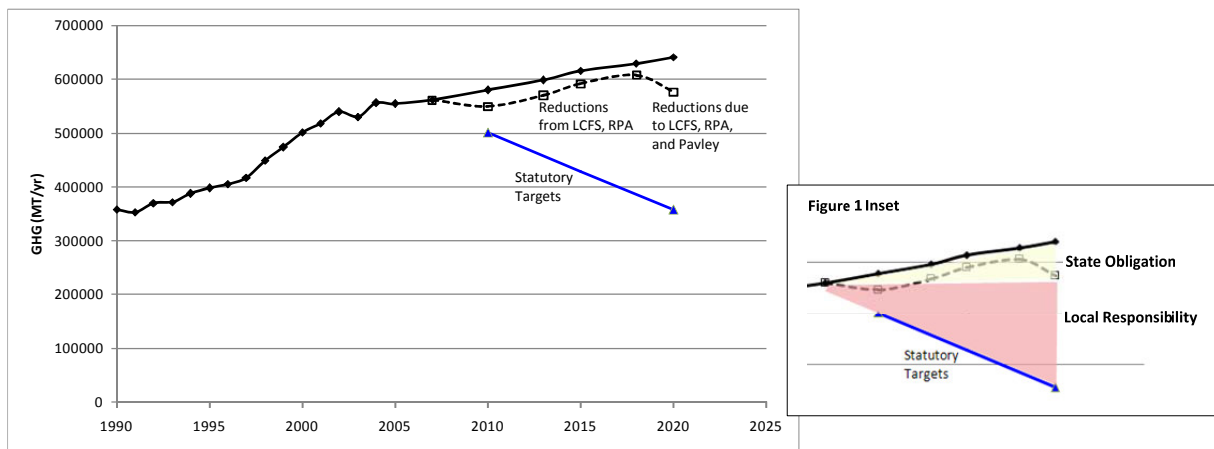


Figure 5. Adjusted baseline inventory (solid black = BAU; dashed black = BAU_{adj})

Figure 6 summarizes the per capita totals for each sector captured by the city inventory. The figure also shows the differences between the baseline inventory and the adjusted baseline inventory. The total effect of the state initiatives is to reduce the 2020 baseline by approximately 10%, which is then proportioned out based on the percentage representation by city sector. It is important to recognize that here the BAU decreases because of the implementation of state-mandated programs, not because there are predicted changes in consumption patterns.

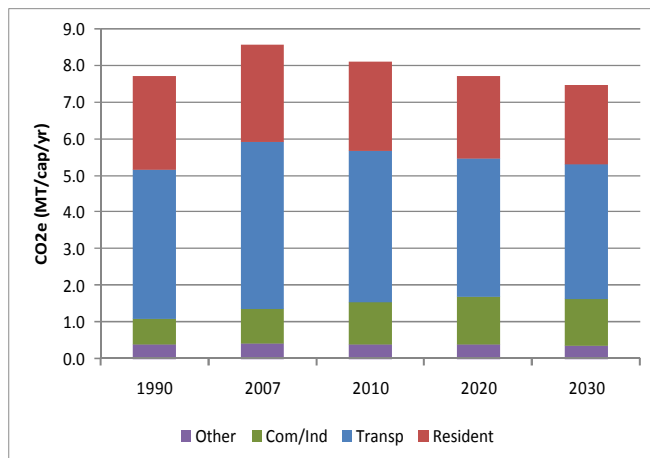


Figure 6 Adjusted per capita (MT/capita/year)

RESIDENTIAL CARBON DEVELOPMENT ALLOWANCES

Potentials methods for calculating carbon development allowances (CDAs) are presented in this section. Before going through each measure, note that several assumptions apply to all the methods. First, it is assumed that the process of implementing CDAs begins in 2010. Thus, the calculation of the marginal increase in energy consumption is the result of population growth between 2010 and 2020. Second, any CDA paradigm must have a rational basis and statutory connection to AB 32 and/or S-3-05 and SB 375. And finally, all of the CDAs are based on a per capita measurement.

The first CDA is based on the 2020 AB32 requirements. That is, the per capita energy consumption for the 2020 target is calculated as the 2020 target (year 1990 emissions) divided by the estimated 2020 population. The second CDA is calculated similarly using instead a 2030 target, which can be linearly interpolated from the 2050 mandated target (80% less than 1990 emissions). Obviously, variations on the CDAs could force quicker or slower progress toward local (and eventually regional) goals. It is also important to note that the proportion of commercial/industry GHG emissions and the GHG emissions associated with city operations and waste will be *de facto* capped. That is, future targets have been calculated assuming that the proportion of the city’s total GHG emissions allocated to commercial/industry and city operations/waste is held constant at the estimated 17% and 5%, respectively. With the city emissions being driven downward by the residential/transportation emissions target, the absolute amount that is available to allocate to the remaining sectors also declines.

Figure 7(a) shows how these CDAs on a per capita basis relate to new development and existing development. New development begins at 2010 under the selected CDA, which means total residential/transportation emissions must be below the selected target. For existing development (Figure 7b), at the selected target date, current residents would need to reduce transportation/residential GHG emissions by 2.9 MT/capita/yr for the 2020 target or 3.9 MT/capita/year for 2030.

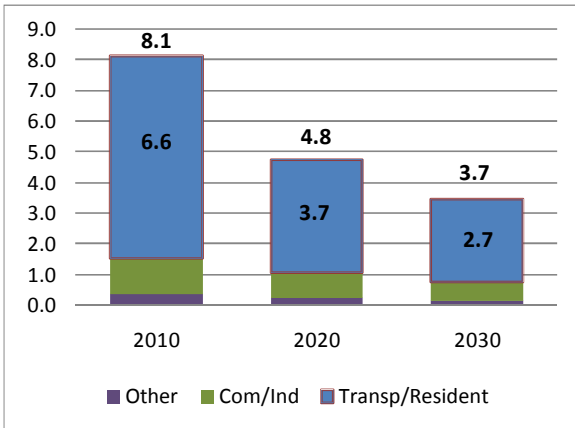
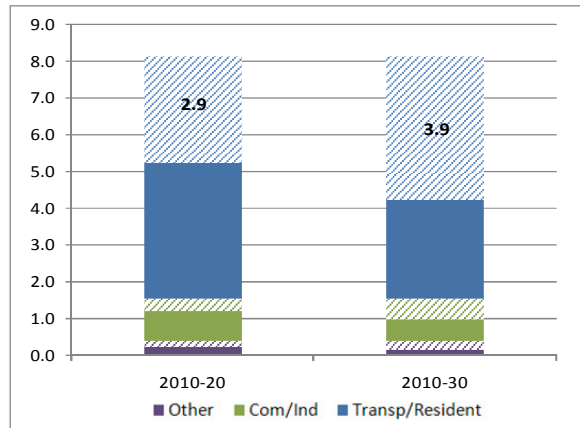


Figure 7 (a). CDA Targets



(b) Reductions by sector (hatched) for existing

The 2020 target represents an overall reduction from 8.1 MT/capita/year of approximately 35%, but within the residential/transportation sector, the reduction is closer to 44%, or about 670 lbs of

CO₂e/capita/year.⁶ That is, each year an additive 670 lbs CO₂e/person reduction has to be achieved for those currently living in Davis. Obviously some existing residents will already be below 4.8 MT/capita/year while others will be significantly higher. The key point is that the City should strive to achieve an average reduction of 2.9 MT/capita/year every year starting at the minimum in 2010. As one final note, although the total estimated growth in square footage (or employee) related to commercial/industrial development is accommodated under the target formula – the proportional increase in GHGs associated with these additions must decline over time as well.

⁶ 2.9MT/capita/yr by year 2020 \approx 0.3MT/capita/year reduction \approx 0.336 tons/capita/person \approx 672 lbs/capita/year

Appendix A.

Consistent with ICLEI recommendations, the City’s baseline inventory includes four primary sectors: commercial/industry, residential, transportation, and waste. These are referred to as level 1 sectors. The state inventory includes all IPCC designated sectors (Figure A1). Some mapping between the CARB statewide inventory and City inventory is required if regional (and state level) contributions made by the City are to be tracked. In order to construct a comparable 1990 community-level inventory from CARB’s statewide level inventory, several adjustments were undertaken. First, the state inventory reflects a number of sectors that are not present within the City of Davis; the City inventory includes only commercial, residential, industrial and transportation, while the state inventory includes additional sectors for agriculture, electricity generation, and unspecified sources. The first step in creating a comparable inventory is to subset the state inventory into the emissions that match the city inventory level 1 sectors. However, even within Level 1 emissions – that is at Level 2 - the City does not have some sources within its jurisdiction. For example, the city doesn’t have petroleum refining or gas/oil extraction sources. In step 2, the statewide emissions sources were further refined to include only those level 2 sources present within the City jurisdiction.

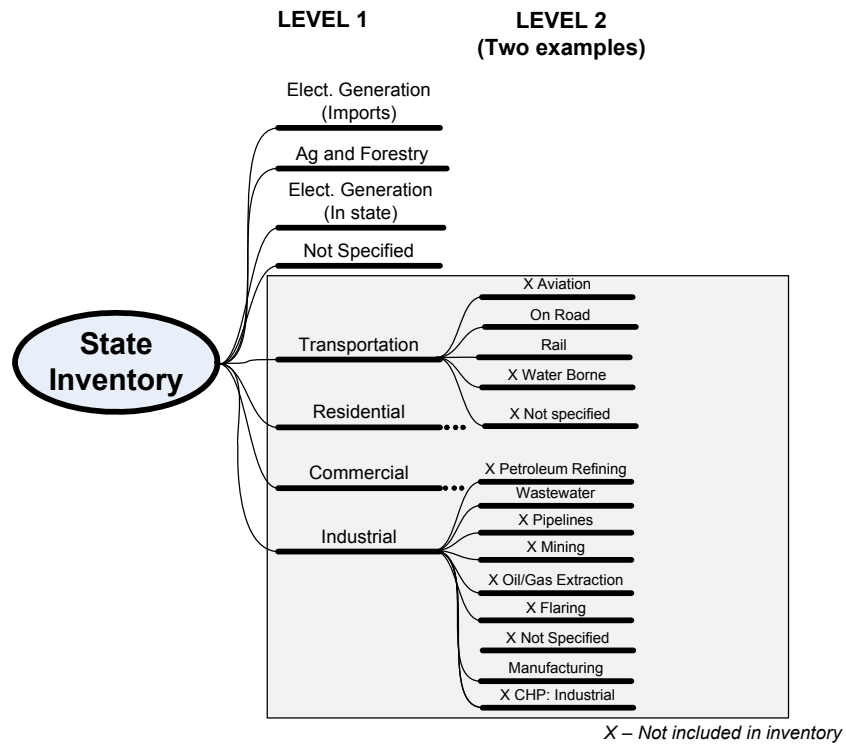


Figure A1. Sector Levels of the State Inventory

An extended list of level 1 and level 2 sectors is shown in Table A1. In Table A2, the comparable statewide emissions for each of the respective are identified. There are a couple of things to notice about the two inventories. First, the full inventory subset includes such sources as refineries, mining, and aviation. These are sources that are obviously not present in the City of Davis, yet it could be argued that everyone within the state (or county) shares some collective responsibility for these sources. The level 2 filtered subset attempts to exclude those sources that are not present directly within the city (e.g., pipelines, refineries, etc); here, it could be argued that the City has no local control over many of

these industries and thus, should not assume the burden of additional emissions. The difference between the two inventories ranges from 20% to 25% across the different years and sectors.

Table A1. Sectors in CARB statewide inventory

Level 1 Sectors	Included	Level 2 Sectors	Included
Ag/Forest		Aviation	
Commercial	•	CHP:Commercial	
Elect. Gen. (imports)		CHP:Industrial	
Elect. Gen. (in-state)		Communication	•
Industrial	•	Domestic Utilities	
Not specified		Education	•
Residential	•	Flaring	
Transportation	•	Food Services	•
		Health Care	•
		Hotels	•
		Household Use	•
		Landfills	•
		Manufacturing	•
		Mining	
		National Security	
		Not Specified	•
		Offices	•
		Oil/Gas Extraction	
		On-road	•
		Petro Marketing	
		Petrol Refining	
		Pipelines	
		Rail	•
		Retail/Wholesale	•
		Transportation Services	•
		Wastewater Treatment	•
		Water-borne	

California Air Resources Board (CARB) (2007). California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Level. Sacramento, Air Resources Board.

After discussion with city staff, the decision was made to use the Level 2 refinement, thus, including only those sources present within the city. It is also important to note that additional filtering on the state inventory could be performed; that is, the state inventory has four levels and two activities that could be used to further refine the replication of only those sources within the City. However, it was deemed that for the purposes of this study, any additional refinement was unnecessary and would likely make only very small changes in the overall inventory total.

Table A2. Subset of state level inventory for mapping to the Davis inventory (MMTCO₂e)

	1990	1995	2000	2004
Comparable State-Level Inventory (Level 1)				
Com/Ind	117.45	107.37	118.11	109.02
Residential	29.66	27.19	30.61	29.10
Transport	150.67	154.66	169.99	182.37
Total	297.78	289.21	318.71	320.49
Comparable State-Level Inventory (Filtered Level 2)				
Com/Ind	57.16	49.90	54.99	50.33
Residential	29.66	27.19	30.61	29.10
Transport	143.33	148.15	163.54	175.94
Total	230.14	225.24	249.14	255.38

* Note that units are CO₂e in million metric tonnes

Appendix B.

In the ICLEA method, transportation GHG emissions are calculated only for vehicles traveling *within* Davis. In reality, total travel that can be associated with the City is comprises three basic components (Figure 2): internal-external (I-E) represents that portion of total trips beginning within Davis and ending outside Davis (e.g., a work commute from Davis to downtown Sacramento); external-internal (E-I) represents trips that begin outside Davis and end within Davis (e.g., a work commute trip from Sacramento to Davis), and internal-internal represents those trips that both begin and end within Davis. Because it is very difficult to exactly know how far people travel and the origins and destinations for all travelers with some, or all, of their trip occurring with Davis, ICLEA’s accounting method includes only that volume occurring on roadways within Davis. Thus, it is likely that all I-I trips are accounted for in ICLEA’s method, but E-I and I-E trips will be only partially accounted for.

SACOG provided estimated 2005 VMT from the regional travel model for the Davis Regional Analysis District. This VMT, Figure B2 (right side), was disaggregated into the three different types of travel. The Davis ICLEA weekday 2005 VMT⁷ is also plotted beside the SACOG VMT to conceptually show the differences between the two estimates.

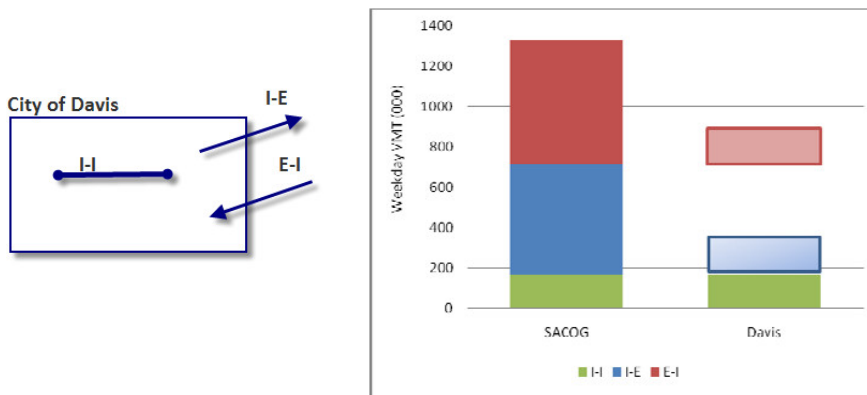


Figure B2. Different components of travel

If we assume that the 2005 GHG estimates from transportation should be approximately similar, the Davis Inventory can be adjusted to reflect the additional GHGs generated from transportation. A decision was made to assign only one-half of the E-I and I-E trips to Davis. This adjustment is obviously fairly speculative, but results from the notion that at least half of the trip would be double-counted if two communities, say Davis and Sacramento, both counted the entire portion of the E-I (or I-E) trip. If we assume the same proportion is missing from the 1990 inventory, the difference between the top-down and the bottom-up inventory reduces to about 25% after adjusting.

Clearly, the Davis inventory results in less GHG emissions than approximated on a per capita basis using the statewide CARB totals. In reviewing the transportation estimates between the two inventories and adjusting Davis to include the travel represented by E-I and I-E yields a transportation sector total roughly 75% that of the state estimate for the transportation sector.

⁷ City of Davis, Greenhouse Gas Inventory and Forecast Report, pg. 41.

Appendix C.

The state has implemented some measures already specifically designed to reduce energy consumption and GHGs. These reductions are state-wide and the responsibility for the implementation of these measures can be assigned to the state. The City would then be responsible for reducing the remaining gap between BAU and the 2020 target. Those emissions assigned to the state include reductions associated with the Renewable Portfolio Standard (RPS) and two transportation-related emissions reductions: the Pavley Law and the Low Carbon Fuel Standard (LCFS).

The Renewable Portfolio Standard. The RPS was established in 2002 (SB 1078; SB 107) and requires electric utility providers to increase renewable energy resources as percent of total generation to 20% by 2010. More recently, the California Public Utilities (CPUC) and the California Energy Commission (CEC) committed to a 33% renewable portfolio by 2020,⁸ which is also echoed in CARB’s recent draft scoping plan.⁹ The reduction in the city CO2e as a result of the RPS was calculated from 2006 forward using the current energy mix linearly transitioned to a 33% RPS in 2020 (Figure C1). The results show that the city GHG emissions will be reduced roughly 24% between 2006 and 2020 (Figure C2) if the 33% RPS target is reached.

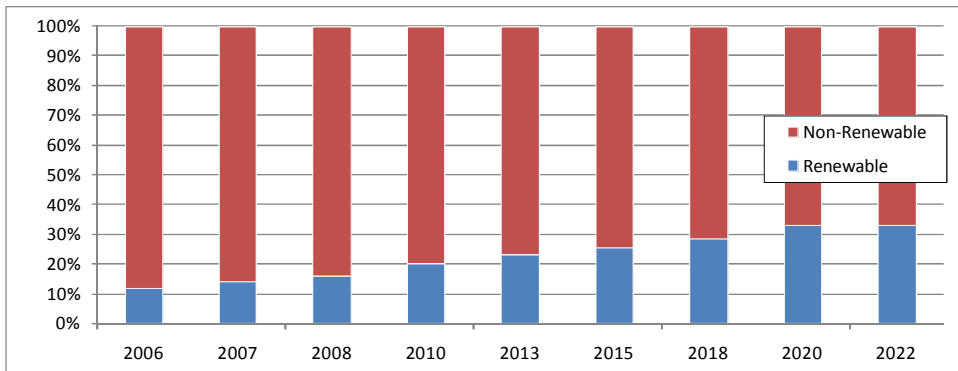


Figure C1. Projected Implementation of the 33% RPS

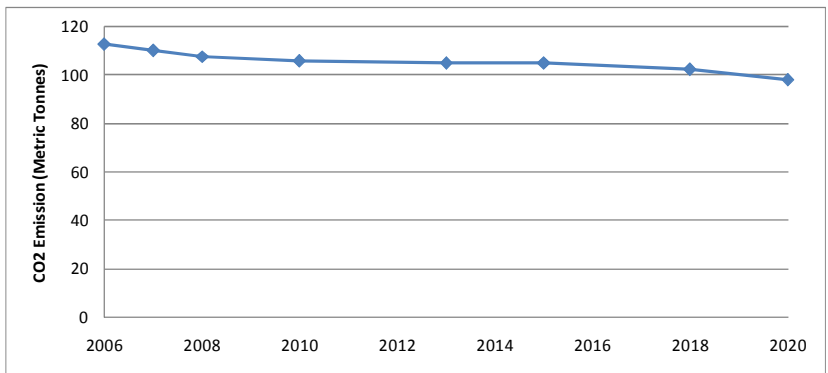


Figure C2. Estimated reduction from PGE renewable mix

⁸ For a recent summary of progress toward 2010 goals and the 33% goal, see CPUC, *Renewables Portfolio Standard Quarterly Report*, July 2008

⁹ Climate Change Draft Scoping Plan a framework for change, June 2008 Discussion Draft, California Air Resources Board.

The Pavley Bill and the Low Carbon Fuel Standard. There are also two state level transportation initiatives aimed at reducing greenhouse gas emissions, the Pavley Bill and the Low Carbon Fuel Standard (LCFS). The Pavley Bill limits greenhouse gas emissions from vehicles sold in California beginning with model year 2009 and Executive Order S-01-07 (The Low Carbon Fuel Standard, LCFS) requires a low-carbon fuel standard that achieves reductions in all greenhouse gases and is scheduled for implementation by January 1, 2010. The estimated impacts for Pavley and the LCFS were calculated using the Yolo County vehicle fleet distribution and EMFAC, and the reductions are shown in Figure C3. The LCFS effects are highest in early years (e.g., 2010, 10% reduction) declining over time as the standard encompasses the vehicle fleet; the Pavley effects are estimated as 15% by 2020. This is slightly lower than the statewide estimate, but consistent with the vehicle fleet for Yolo County.

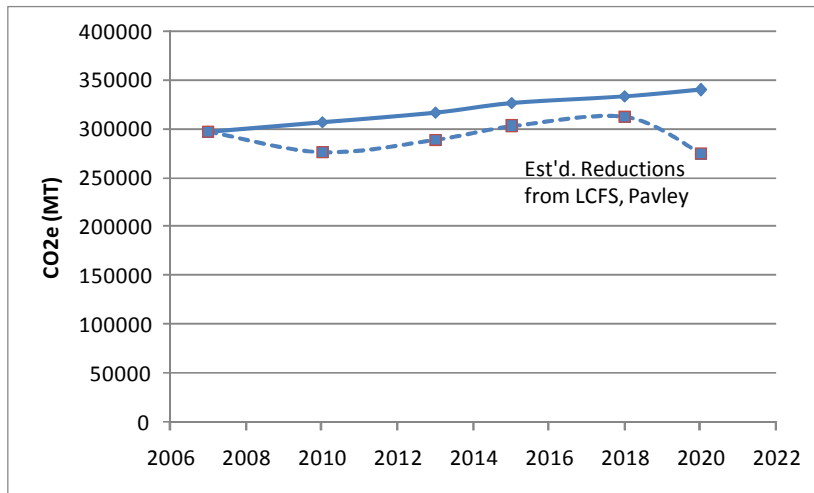


Figure C3. Estimated reductions from state level transport initiatives

After calculating reductions for each of these state-level initiatives, the remaining portion of the reductions is assignable to the City (Figure C4, inset). The total effect of the state initiatives is to reduce the 2020 baseline by approximately 10%, which is then proportioned out based on the representation by city sector.

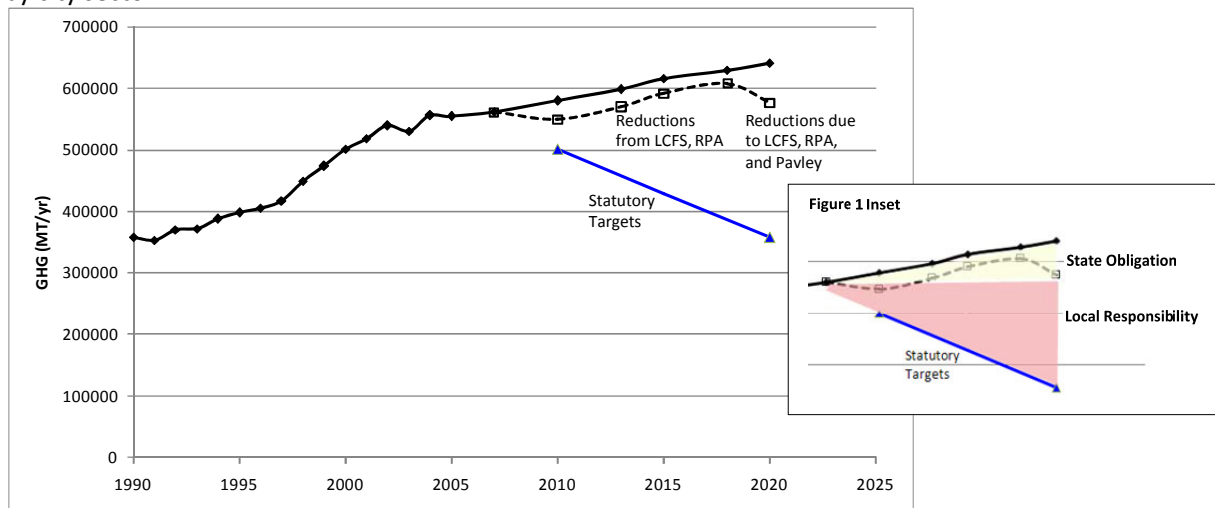


Figure C4. Adjusted baseline inventory (solid black = BAU; dashed black = BAU_{adj})

RESOLUTION NO. _____, SERIES 2009

RESOLUTION ADOPTING GREENHOUSE GAS REDUCTION TARGETS
FOR THE CITY OF DAVIS (CITY OPERATIONS AND COMMUNITY)

WHEREAS, the Davis General Plan establishes visions, goals and policies that guide the community away from impacts on natural systems and toward sustainability; and

WHEREAS, Davis has pursued policies and implemented innovative projects over the past four decades that place it among the leaders in the sustainable communities movement; and

WHEREAS, the adopted City Council goals for 2007/08 provide clear direction that action on climate change and related issues is a City priority; and

WHEREAS, as part of its action in adopting the City of Davis Climate Protection/Community Sustainability Framework Strategy in April 2007, the City Council directed staff to aggressively pursue actions to reduce the City's greenhouse gas emissions; and

WHEREAS, the City has adopted resolutions that outline the emerging global warming threat and encourage cities of all sizes to take preventative steps; and

WHEREAS, there is a scientific consensus, as established by the Intergovernmental Panel on Climate Change and confirmed by the National Academy of Sciences, that the continued buildup of anthropogenic greenhouse gases in the atmosphere threatens the stability of the global climate; and

WHEREAS, there are significant long-term risks to the economy and the environment of the United States, California, and the City of Davis from the temperature increases and climatic disruptions that are projected to result from increased greenhouse gas concentrations; and

WHEREAS, the potential impacts of global climate change, including long-term drought, famine, mass migration, and abrupt climatic shifts, may lead to international tensions and instability in regions affected and thereby have implications for the national security interests of the United States as well as security, economic, and environmental interests of the State of California and the City of Davis; and

WHEREAS, local governments greatly influence their community's energy usage by exercising key powers over land use, transportation, building construction, waste management, and in many cases energy supply and management; and

WHEREAS, local government actions taken to reduce greenhouse gas emissions and increase energy efficiency provide multiple local benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for City government, for its businesses, and for its citizens;

WHEREAS, on September 29, 1999, the City of Davis adopted a resolution to participate in the Cities for Climate Protection Campaign; and

WHEREAS, on April 18, 2006, the City of Davis adopted a resolution endorsing the US Mayor's Climate Protection Agreement and committing to strive to meet the Kyoto emission reduction targets of 7 percent below 1990 levels by 2012;

NOW, THEREFORE, BE IT RESOLVED, the City Council of the City of Davis does hereby adopt the following greenhouse gas emissions targets for the Davis community and its own city operations:

Davis GHG Reduction Targets: Community and City Operations

Year	Target Range*		Notes
	State	Davis**	
2010	2000 levels	1990 levels	<u>Minimum:</u> State target. <u>Desired:</u> Provides baseline for subsequent average annual reductions.
2012	1998 levels	7% below 1990 levels	<u>Minimum:</u> State does not establish target for this year; linear interpolation from 2010 target. <u>Desired:</u> Consistent with Kyoto – Mayors Climate Protection Agreement Pledge – City of Davis Reso. 2006.
2015	1995 levels	15% below 1990 levels	<u>Minimum:</u> State does not establish target for this year; linear interpolation from 2010 target. <u>Desired:</u> Consistent with initial ICLEI modeling conducted by the City.
2015 to 2020	Average annual reduction	Ave of 2.6% reduction/yr to achieve 80% below 1990 levels by 2040	<u>Minimum:</u> State does not establish target for these years. <u>Desired:</u> Average reduction encourages monitoring of progress and some flexibility in implementation.
2020	1990 levels	28% below 1990 levels	<u>Minimum:</u> State target. <u>Desired:</u> Average reduction encourages monitoring of progress and some flexibility in implementation.
2020-2040	No formal target, but must reduce an ave. of 2.66%/yr to achieve 80% below 1990 levels by 2050	Average of 2.6% reduction/yr to achieve 80% below 1990 levels	<u>Minimum:</u> State does not establish target for these years. <u>Desired:</u> Reduction level adopted by the state based on climate stabilization levels of 3-5.5 degree increase in temp. Average reduction encourages monitoring of progress and some flexibility in implementation.
2050	80% below 1990 levels	Carbon neutral	<u>Minimum:</u> State target. Reduction level adopted by the state based on climate stabilization levels of 3-5.5 degree increase in temp. Average reduction encourages monitoring of progress and some flexibility in implementation. <u>Desired:</u> Combination of actions at the local, regional, national, and international levels and carbon offsets. Similar to UC system, City of Berkeley, and Norway.

* It is anticipated that Davis will achieve reductions within the range of the state targets (minimum) and local targets (desired).

**Due to residency time of GHG gasses in the atmosphere, early GHG reduction is generally more beneficial for mitigation of the most severe impacts of climate change.

PASSED AND ADOPTED by the Davis City Council this ____ day of November 2008 by the following vote:

Ayes:

Noes:

Abstain:

H:\Davis - Sustainable Project\GHG Reduction Plan\GHG Reduction Targets 3-08\City Council - GHG Targets 11-08\CC Reso - Davis GHG reduction targets - 11-08 .doc