

### **3 2020 BUSINESS AS USUAL AND ADJUSTED GREENHOUSE GAS EMISSIONS INVENTORY**

This chapter forecasts the greenhouse gas (GHG) emissions in Vacaville in the year 2020. The year 2020 was selected to be consistent with the statewide target established by Assembly Bill (AB) 32, which, as explained in Chapter 1, is to limit California's GHG emissions to 1990 levels by the year 2020.

As described in the inventory of existing emissions in Chapter 2, this forecast looks at GHGs emissions from:

- Transportation
- Residential energy use
- Non-residential energy use
- Moving and treating water/wastewater
- Solid waste disposal
- Other off-road emissions (e.g. from lawnmowers and construction equipment)

This chapter discusses two scenarios for the year 2020:

1. A "business as usual" (BAU) forecast, if no steps were taken to reduce emissions.
2. An "adjusted" forecast, which takes into account State and federal regulations and standards to reduce emissions that will be in effect by the year 2020.

#### **BUSINESS AS USUAL FORECAST**

The BAU forecast refers to a scenario in which neither California nor the US government adopts any measures to reduce GHG emissions.

For Vacaville's BAU forecast, the projected GHG emissions in 2020 were based on the communitywide GHG emissions inventory for the year 2008, which as identified in Chapter 2 is 949,340 metric tons of carbon dioxide equivalent (MTCO<sub>2e</sub>). These 2020 GHG emission projections assume that future growth in Vacaville will produce the same carbon intensities as the buildings and cars in 2008 produced. Table 3-1 shows Vacaville's projected population, housing, non-residential building square footage, and employment in 2020, based on the amount and type of development that is reasonably foreseen. These 2020 projections were based on the differences between 2008 conditions and the proposed General Plan 2035 land use map and policies. Table 3-1 totals the number of residents and number of employees working in Vacaville to arrive at the "service population." Since both residents and workers in a community drive, use energy, flush toilets, and throw away trash,

GHG emissions analyses frequently refer to a “service population” of both workers and residents, rather than the standard population, which refers only to residents.

**TABLE 3-1 EXISTING AND 2020 POPULATION, EMPLOYMENT, AND HOUSING PROJECTIONS**

	2008 Baseline	2020 Forecast <sup>e</sup>	Percent Change from Existing
Population	87,340 <sup>a</sup>	98,300	12.6%
Housing	32,550 <sup>b</sup>	37,060	13.9%
Employment	30,250 <sup>c</sup>	33,740	11.5%
Service Population <sup>d</sup>	117,590 <sup>e</sup>	132,040	12.3%

<sup>a</sup> State of California, Department of Finance, May 2010, E-5 Population and Housing Estimates for Cities, Counties, and the State, 2001-2010, with 2000 Benchmark. Excludes prison population, based on: State of California, Department of Corrections and Rehabilitation, Data Analysis Unit, January 7, 2008, Weekly Report of Population as of midnight January 2, 2008.

<sup>b</sup> State of California, Department of Finance, May 2010, E-5 Population and Housing Estimates for Cities, Counties, and the State, 2001-2010, with 2000 Benchmark.

<sup>c</sup> 2009 ABAG Projections.

<sup>d</sup> Population plus employment.

<sup>e</sup> Estimated by The Planning Center | DC&E based on the land use map in the General Plan Update.

Table 3-2 identifies the 2008 baseline communitywide GHG emissions inventory (from Chapter 2) and the 2020 BAU communitywide GHG emissions projection for Vacaville.

Technical documentation for the BAU and adjusted forecasts are provided in Appendix B.

## ADJUSTED FORECAST

The “adjusted” forecast refers to a scenario that assumes federal- and State-mandated GHG emission reduction measures would be implemented. As described in Chapter 1, federal and State regulations have already been adopted that will require reductions in GHG emissions from a wide range of activities, including how energy is generated and how vehicle fuels are formulated. These federal- and State-mandated GHG emission reductions will occur regardless of any reduction measures that the City of Vacaville does or does not implement in this Energy and Conservation Action Strategy, so they are included in the adjusted forecast.

**TABLE 3-2 BASELINE YEAR 2008 AND FORECAST YEAR 2020 BUSINESS AS USUAL COMMUNITYWIDE GREENHOUSE GAS EMISSIONS SUMMARY**

	2008 Baseline GHG Emissions (MTCO <sub>2</sub> e/Year)	2020 BAU GHG Emissions (MTCO <sub>2</sub> e/Year)	Increase from Baseline (MTCO <sub>2</sub> e/Year)
Transportation <sup>a</sup>	598,040	808,140	210,100
Residential <sup>b</sup>	153,210	172,440	19,230
Non-Residential <sup>b</sup>	156,390	174,510	18,120
Water/Wastewater <sup>c</sup>	10,680	12,780	2,100
Solid Waste Disposal <sup>d</sup>	19,030	21,370	2,340
Other Off-Road Emissions <sup>e</sup>	11,990	13,470	1,480
<b>Total</b>	<b>949,340</b>	<b>1,202,710</b>	<b>253,370</b>

Note: Emissions are rounded to the nearest tens place.

<sup>a</sup> EMFAC2011 based on vehicle miles traveled (VMT) provided by Kittelson & Associates, as modeled by LSA Associates.

<sup>b</sup> Natural gas and purchased energy provided by PG&E.

<sup>c</sup> LGOP Version 1.1 based on water/wastewater use in the city. Includes wastewater treated at the City’s wastewater treatment plant but generated by land uses outside the city.

<sup>d</sup> US EPA WARM model based on waste disposal obtained from CalRecycle.

<sup>e</sup> Estimate of stationary equipment use for landscaping, light commercial and industrial, and construction equipment, based on Solano Transportation Agency’s (STA) 2011 GHG Inventory.

Source: The Planning Center | DC&E, 2012; LSA Associates, 2012; and STA, 2011.

The adjusted forecast does not include GHG emission reductions from federal or State requirements that must be implemented at the local level. For example, California AB 341, which requires municipalities to achieve 75 percent solid waste diversion by 2020, will be implemented by the City and not by the State. Therefore, the GHG emission reductions from AB 341 are excluded from the adjusted forecast, and instead included in the forecast of GHG emission reductions resulting from the City’s actions under this Energy and Conservation Action Strategy.

Accordingly, by considering an adjusted forecast that reflects GHG emission reductions that federal and State regulations will achieve, the City can more precisely determine what additional GHG emission reductions it needs to reach its local GHG emissions reduction target (discussed further in Chapter 4).

Table 3-3 compares the inventory of existing emissions to the adjusted forecast for year 2020 GHG emissions based on federal and State GHG regulations and programs currently in place. This adjusted forecast accounts for GHG emission reductions from the specific federal and State regulations described below.

**TABLE 3-3 BASELINE YEAR 2008 AND ADJUSTED FORECAST YEAR 2020  
COMMUNITYWIDE GREENHOUSE GAS EMISSIONS SUMMARY**

	2008 Baseline GHG Emissions (MTCO <sub>2</sub> e/Year)	2020 Adjusted GHG Emissions (MTCO <sub>2</sub> e/Year)	Decrease from Baseline (MTCO <sub>2</sub> e/Year)
Transportation <sup>a</sup>	598,040	639,790	-41,750
Residential <sup>b</sup>	153,210	131,940	21,270
Non-Residential <sup>b</sup>	156,390	126,870	29,520
Water/Wastewater <sup>c</sup>	10,680	8,690	1,990
Solid Waste Disposal <sup>d</sup>	19,030	21,370	-2,340
Other Emissions <sup>e</sup>	11,990	12,120	-130
<b>Total</b>	<b>949,340</b>	<b>940,780</b>	<b>8,560</b>

<sup>a</sup> EMFAC2011 based on VMT provided by Kittelson & Associates, as modeled by LSA Associates.

<sup>b</sup> Natural gas and purchased energy provided by PG&E.

<sup>c</sup> LGOP Version 1.1 based on water/wastewater use in the city. Includes wastewater treated at the City’s wastewater treatment plant but generated by land uses outside the city.

<sup>d</sup> US EPA WARM model based on waste disposal obtained from CalRecycle.

<sup>e</sup> Estimate of stationary equipment use for landscaping, light commercial and industrial, and construction equipment, based on Solano Transportation Agency’s (STA) 2011 GHG Inventory.

Source: The Planning Center | DC&E, 2012; LSA Associates, 2012; and STA, 2011.

### PAVLEY I – CLEAN CAR STANDARDS

The “Pavley” standards, or AB 1493, are named for their author, Assemblywoman Fran Pavley. These standards, originally passed in 2002, required automakers to limit carbon dioxide and pollutants from new cars and light trucks, starting with the 2009 model year. In 2009, CARB adopted amendments to the “Pavley” standards that require manufacturers to achieve higher fuel efficiency standards. The Pavley regulation is anticipated to reduce GHG emissions from new passenger vehicles by 31.4 percent for the 2016 model year.<sup>1</sup>

<sup>1</sup> Based on a California fleet mix of 70 percent passenger cars and light duty trucks (LDT1) and 30 percent light duty trucks (LDT2) as stated in CARB’s 2008 *Comparison of Greenhouse Gas Reductions under CAFE Standards and CARB Regulations Adopted Pursuant to AB 1493*.

### FEDERAL CORPORATE AVERAGE FUEL ECONOMY STANDARDS

In 2010, the US Environmental Protection Agency (EPA) adopted federal Corporate Average Fuel Economy (CAFE) standards for model years 2012 through 2016. In 2011, the EPA, the US Department of Transportation, and the State of California announced a single time frame for proposing the fuel economy and GHG standards for model years 2017 to 2025 passenger vehicles. However, the adjusted forecast does not account for these additional reductions because they are not yet adopted by CARB or EPA.



### LOW CARBON FUEL STANDARD

CARB identified the Low Carbon Fuel Standard (LCFS) as an early action item in its Climate Change Scoping Plan, and adopted the LCFS regulation in 2009; it became law in 2010. The LCFS requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020.



### RENEWABLE PORTFOLIO STANDARD

A major component of California's Renewable Energy Program is the renewable portfolio standard (RPS) under Senate Bill (SB) 1078. Under the RPS, certain retail sellers of electricity, like PG&E, were required to increase renewable energy by at least 1 percent each year in order to reach at least 20



percent by December 30, 2010. According to CARB, PG&E served 15.9 percent of their electricity sales with renewable power in 2010.

CARB has now approved an even higher goal of 33 percent by 2020. Renewable sources of electricity include wind, small hydropower, solar, geothermal, biomass, and biogas. Increasing renewable sources of electricity will decrease indirect GHG emissions from buildings that use energy because electricity production from renewable sources is generally considered carbon neutral.

### SMART GRID

The California Public Utilities Commission (CPUC) requires California investor-owned electric utilities to develop a smarter or more efficient electric grid in the State. In July 2011, California utilities, including PG&E, filed ten-year “Smart Grid deployment plans” with the CPUC showing how they will become more efficient.

### CALIFORNIA BUILDING AND ENERGY EFFICIENCY STANDARDS (TITLE 24)

Title 24, Part 6 of the California Code of Regulations (CCR) requires that the design of building shells and building components conserve energy. The standards are updated periodically to consider and incorporate new energy efficiency technologies and methods. The 2013 Building and Energy Efficiency standards, which will go into effect on January 1, 2014, are approximately 24 percent more energy efficient for residential buildings and 30 percent more energy efficient for non-residential buildings compared to the previous 2008 Building and Energy Efficiency Standards.



### CALIFORNIA GREEN BUILDING STANDARDS CODE (TITLE 24)

On July 17, 2008, the California Building Standards Commission adopted the nation’s first green building standards. The California Green Building Standards Code (proposed Part 11, Title 24) was adopted as part of the California Building Standards Code (Title 24, CCR), known as CALGreen. The 2010 edition of the code established voluntary standards on planning and design for sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and

internal air quality. The mandatory provisions of the code became effective January 1, 2011. CALGreen refers to the mandatory Building and Energy Efficiency Standards described above, and also includes voluntary Tier 1 and Tier 2 programs for cities and counties that wish to adopt more stringent energy efficiency requirements that are 15 percent and 30 percent more energy efficient than the current Title 24 standards, respectively. In addition, CALGreen includes mandatory increases in indoor and outdoor water efficiency for new building construction.



#### **CALIFORNIA APPLIANCE EFFICIENCY REGULATIONS**

The 2006 Appliance Efficiency Regulations (Title 20, CCR Sections 1601 through 1608) were adopted by the California Energy Commission on October 11, 2006, and approved by the California Office of Administrative Law on December 14, 2006. The regulations include standards for both federally regulated appliances and non-federally regulated appliances.

#### **GHG EMISSIONS BY SOURCE**

This section describes the assumptions for the six individual GHG emission-generating sources previously listed. For all sources, 2020 emissions are based on the 2020 population and employment in Vacaville shown in Table 3-1. As Table 3-1 shows, this forecast anticipates a 13.9 percent increase in residential units and an 11.5 percent increase in jobs in Vacaville by 2020, which is equivalent to a total service population increase of 12.3 percent. These numbers are based on the amount and type of development that is reasonably foreseen, and the differences between 2008 conditions and the proposed General Plan 2035 land use map and policies.

#### **TRANSPORTATION AND LAND USE EMISSIONS**

VMT was compiled by Kittelson & Associates for the City of Vacaville for 2008 and 2020. GHG emissions from VMT generated by land uses within the city were compiled using CARB's EMFAC2011 program, as modeled by LSA Associates, and are shown in Table 3-4.

TABLE 3-4 2020 COMMUNITYWIDE GREENHOUSE GAS EMISSIONS FROM TRANSPORTATION SOURCES

Vehicle Miles Traveled		2020 BAU GHG Emissions (MTCO <sub>2</sub> e/Year)	2020 Adjusted GHG Emissions (MTCO <sub>2</sub> e/Year)
Daily	Annual		
3,913,894	1.358 Billion	808,137	639,785

Notes: Daily VMT is multiplied by 347 days/year to account for reduced traffic on weekends and holidays, consistent with the CARB methodology within the *Climate Change Scoping Plan Measure Documentation Supplement*. Emissions are rounded to the nearest tens place.

MTCO<sub>2</sub>e = metric tons of carbon dioxide equivalent.

Source: EMFAC2011.

As explained above, the adjusted scenario includes GHG emissions reductions from the Pavley fuel efficiency standards and the Low Carbon Fuel Standard (LCFS), which are fuel and vehicle efficiency standards required by the State.

## RESIDENTIAL AND NON-RESIDENTIAL EMISSIONS

Energy use and natural gas use from residential and non-residential buildings will grow in proportion to the number of people who live and work in Vacaville. Table 3-5 shows anticipated BAU and adjusted GHG emissions for residential and non-residential uses in 2020. The adjusted scenario includes GHG emissions reductions from the RPS, Smart Grid, and the Title 24 updates.

TABLE 3-5 2020 COMMUNITYWIDE GREENHOUSE GAS EMISSIONS FROM RESIDENTIAL AND NON-RESIDENTIAL LAND USES

Source	2020 BAU GHG Emissions (MTCO <sub>2</sub> e/Year)	2020 Adjusted GHG Emissions (MTCO <sub>2</sub> e/Year) <sup>a</sup>
Residential Buildings	172,440	131,940
Non-Residential Buildings	174,510	126,870
<b>Total</b>	<b>346,950</b>	<b>258,810</b>

Notes: Excludes properties owned by another governmental entity that are outside the land use authority of the City of Vacaville (e.g. County or State jurisdiction). Based on PG&E's third-party verified GHG emission factors. Emissions are rounded to the nearest tens place.

MTCO<sub>2</sub>e = metric tons of carbon dioxide equivalent.

<sup>a</sup> Based on PG&E's forecasted GHG emission rates in 2020.

Source: PG&E, April 2012, Community Wide GHG Inventory Report for Vacaville 2003 to 2010.



## WATER/WASTEWATER EMISSIONS

The increase in water demand and wastewater generation within the City is based on current demand and generation rates applied to expected development in 2020. Table 3-6 shows anticipated BAU and adjusted water demand and wastewater generation and associated GHG emissions in 2020. The adjusted scenario includes GHG emissions reductions from the RPS. The RPS will reduce GHG emissions attributable to water demand and wastewater generation by reducing the GHG emissions from electricity used to treat and transport water and wastewater. The adjusted scenario does not include any reductions from State water efficiency requirements because the City is ultimately responsible for implementing those requirements.

TABLE 3-6 **2020 COMMUNITYWIDE GREENHOUSE GAS EMISSIONS FROM WATER USE AND WASTEWATER GENERATION**

Land Use	2020 BAU			2020 Adjusted		
	Energy (MTCO <sub>2</sub> e/Year) <sup>a</sup>	Fugitive (MTCO <sub>2</sub> e/Year) <sup>b</sup>	Total GHG Emissions (MTCO <sub>2</sub> e/Year)	Energy (MTCO <sub>2</sub> e/Year) <sup>a</sup>	Fugitive (MTCO <sub>2</sub> e/Year) <sup>b</sup>	Total GHG Emissions (MTCO <sub>2</sub> e/Year)
Water Use	6,720	--	6,720	3,440	--	3,440
Wastewater Generation	5,290 <sup>c</sup>	770	6,060	4,480 <sup>c</sup>	770	5,250
<b>Total</b>	<b>12,010</b>	<b>770</b>	<b>12,780</b>	<b>7,920</b>	<b>770</b>	<b>8,690</b>

Notes: Water and wastewater GHG emissions are generated from the energy associated with water conveyance, treatment, and distribution, and wastewater treatment. Emissions are rounded to the nearest tens place. MTCO<sub>2</sub>e = metric tons of carbon dioxide equivalent.

<sup>a</sup> Based on GHG emission factors provided by PG&E.

<sup>b</sup> CARB, May 2010, Local Government Operations Protocol (LGOP), Version 1.1.

<sup>c</sup> Treatment Plant is under City ownership, but also treats waste from outside the city. Specifically, in 2020, there will be 3,638 MTCO<sub>2</sub>e generated from waste from outside of the city, which was added to 1,650 MTCO<sub>2</sub>e from waste originating inside the city under the BAU scenario, and 840 MTCO<sub>2</sub>e from waste originating inside the city under the adjusted scenario.

Source: Based on water demand and wastewater generation estimated in the Vacaville General Plan Update Environmental Impact Report, October 2013, and percent forecast change in service population by 2020.

## SOLID WASTE DISPOSAL EMISSIONS

The amount of trash thrown away in Vacaville will increase in proportion to the number of people that live and work there. The adjusted scenario does not include any reductions from State and federal solid waste diversion requirements because the community is ultimately responsible for the extent of waste reduction. Table 3-7 shows anticipated GHG emissions in 2020.



TABLE 3-7 **2020 COMMUNITYWIDE GREENHOUSE GAS EMISSIONS FROM WASTE DISPOSAL**

	2020 BAU Waste Disposal (Tons)	2020 BAU GHG Emissions (MTCO <sub>2</sub> e/Year)
Total	118,090	21,370

Notes: Assumes a landfill gas control efficiency of 75 percent based on the *International Panel on Climate Change's Local Government Operations Protocol*. Biogenic carbon dioxide is not included. Emissions are rounded to the nearest tens place. MTCO<sub>2</sub>e = metric tons of carbon dioxide equivalent.

Source: US EPA, February 2012, Waste Reduction Model (WARM), Version 12.

## OTHER OFF-ROAD EMISSIONS

Projections for other off-road emission sources in 2020 are based on increases proportional to projected population and employment growth. The BAU and adjusted forecasts for other off-road emissions are summarized in Table 3-8. The adjusted forecast includes reductions from the LCFS.

### LANDSCAPING EQUIPMENT

Landscaping equipment use is assumed to be proportional to population growth.

### LIGHT COMMERCIAL AND INDUSTRIAL EQUIPMENT

Stationary equipment from non-residential land uses, including generators, pressure washers, welders, and pumps, is assumed to be proportional to employment growth.

### CONSTRUCTION EQUIPMENT

The 2020 BAU forecast assumes similar use of construction equipment as baseline conditions.

**TABLE 3-8 2020 COMMUNITYWIDE GREENHOUSE GAS EMISSIONS FROM OTHER OFF-ROAD EMISSIONS**

Source	2020 BAU GHG Emissions (MTCO <sub>2e</sub> /Year)	2020 Adjusted GHG Emissions (MTCO <sub>2e</sub> /Year)
Landscaping Equipment	960	860
Light Commercial and Industrial Equipment	3,420	3,080
Construction Equipment	9,090	8,180
<b>Total</b>	<b>13,470</b>	<b>12,120</b>

Note: Emissions are rounded to the nearest tens place. MTCO<sub>2e</sub> = metric tons of carbon dioxide equivalent.  
 Source: Solano Transportation Authority (STA), 2011. Based on the OFFROAD2007 emissions inventory for the County of Solano, Year 2008, proportioned for the City of Vacaville and projected based on the increase in employment and population growth.

CITY OF VACAVILLE  
ENERGY AND CONSERVATION ACTION STRATEGY  
2020 BAU AND ADJUSTED GREENHOUSE GAS EMISSIONS INVENTORY

*This page intentionally blank*