

<b>Santa Rosa Measure Number</b>	<b>Similar to CA2020 Measure Number</b>	<b>Santa Rosa Measure Name</b>	<b>2020 GHG Reductions MTCO2e</b>
3.3.1	4-L4	Provide affordable housing near transit	
3.3.2	4-L4	Implement the Housing Allocation Plan	
<b>3.4</b>	<b>5-L6</b>	<b>Limit free parking in high traffic areas</b>	12,030
3.4.1	5-L6	Price on street parking relative to congestion	
3.4.2	5-L6	Implement residential permit program	
3.4.3	5-L6	Evaluate the zoning code to reduce parking where appropriate	
<b>3.5</b>	<b>5-L6</b>	<b>Unbundle price of parking from property costs</b>	940
3.5.1	5-L6	Investigate mechanisms to unbundle parking from property cost	
3.5.2	5-L6	Implement policy to encourage unbundled parking	
<b>3.6</b>	<b>5-L4, 5-L5</b>	<b>Provide traffic calming to encourage walking and biking</b>	800
3.6.1	5-L4, 5-L5	Install calming features to improve ped/bike experience	
<b>4</b>	<b>Goal 5, Goal 7</b>	<b>Increase safe, reliable alternatives to vehicle travel</b>	
<b>4.1</b>	<b>5-R7, 5-R8, 5-R10, 5-L4, 5-L5</b>	<b>Improve the bicycle and pedestrian network</b>	1,880
4.1.1	5-R8, 5-R10, 5-L4	Implement the Bicycle and Pedestrian Master Plan	
4.1.2	5-L4	Update bicycle parking regulations	
4.1.3	5-L4	Provide bicycle safety training to residents and employees	
4.1.4	5-R8, 5-L4	Continue to support Safe Routes to School and transit programs	
4.1.5	5-R10, 5-L4	Implement a bike-share program	
<b>4.2</b>	<b>5-R1, 5-R2, 5-R3, 5-R4, 5-R5, 5-R6, 5-R7</b>	<b>Improve transit to and within Santa Rosa</b>	6,410
4.2.1	5-R1, 5-R7	Provide real time arrival and departure information	
4.2.2	5-R1	Provide safe spaces to wait for bus arrival	
4.2.3	5-R3	Support establishment of SMART rail service	
4.2.4	5-R3	Explore high frequency/rapid bus along major transit corridors	
4.2.5	7-R2	Replace bus fleet with GHG reducing vehicles	

<b>Santa Rosa Measure Number</b>	<b>Similar to CA2020 Measure Number</b>	<b>Santa Rosa Measure Name</b>	<b>2020 GHG Reductions MTCO2e</b>
4.2.6	5-R1, 5-R2	Evaluate system performance to maximize transit trips provided	
4.2.7	5-R1, 5-R2	Evaluate measures to increase transit ridership	
<b>4.3</b>	<b>5-R1, 5-R2, 5-R3, 5-R4, 5-R5, 5-R6, 5-R7, 5-R9, 5-L1, 5-L2, 5-L3, 5-L6, 5-L7</b>	<b>Increase shared vehicle and transit trips</b>	4,010
4.3.1	5-R9	Work to establish a car-sharing operation in Santa Rosa	
4.3.2	5-R4, 5-R5, 5-L1, 5-L2, 5-L7	Work with large employers to provide rideshare programs	
4.3.3	5-R4, 5-R5, 5-R6, 5-L2, 5-L3, 5-L7	Consider expanding employee programs promoting transit use	
4.3.4	5-R5, 5-L2, 5-L7,	Provide awards for employee use of alternative commute options	
4.3.5	5-R4, 5-R5	Encourage new employers of 50+ provide subsidized transit passes	
4.3.6	5-R6	Work with local school districts, SRJC to provide subsidized passes	
4.3.7	5-L6, 5-L7	Identify locations for additional park-and-ride lots	
<b>4.4</b>	<b>5-L4</b>	<b>Consider Car-Free Sunday demonstration for use of streets</b>	Supportive
4.4.1	5-L4	Designate some Sundays as car-free in different neighborhoods	
<b>4.5</b>	<b>5-R5, 5-L1</b>	<b>Encourage remote work centers and telecommuting</b>	830
4.5.1	5-R5, 5-L1	Promote workplace alternatives including telecommuting	
<b>5</b>	<b>Goal 6, Goal 7, Goal 8</b>	<b>Increase use of alternatively fueled vehicles</b>	
<b>5.1</b>	<b>7-R1, 7-R2, 7-L1</b>	<b>Facilitate use of electric and hybrid vehicles</b>	2,600
5.1.1	7-R1, 7-L1	Provide electric recharging stations in City facilities/lots	
5.1.2	7-R1, 7-L1	Require new parking lots to include electric vehicle recharging	
5.1.3	7-R1, 7-L1	Allow EV charging stations as permitted uses in larger parking lots	

<b>Santa Rosa Measure Number</b>	<b>Similar to CA2020 Measure Number</b>	<b>Santa Rosa Measure Name</b>	<b>2020 GHG Reductions MTCO2e</b>
5.1.4	7-R1, 7-L1	Provide priority parking for electric hybrid vehicles in city lots	
5.1.5	7-R1	Consider rebates for employee purchase of electric vehicles	
5.1.6	7-R1, 7-L1	Expand electric vehicle charging network	
<b>5.2</b>	<b>7-R2, 7-L2, 7-L3</b>	<b>Support Low Carbon Fuel Standard &amp; alternative fuels</b>	52,480
5.2.1	6-S1	Require new fueling stations to provide alternative fuels	
5.2.2	6-S1	Offer guidance about diesel-to-biodiesel conversions	
5.2.3	6-S1, 7-R2	Develop tri-generation fuel cell for City/public vehicles	
5.2.4	6-S1	Develop alternative fueling stations in Santa Rosa	
5.2.5	6-S1	Increase participation in SRJC alternative fuel classes	
<b>5.3</b>	<b>8-L1, 8-L2</b>	<b>Limit vehicle idling</b>	2,140
5.3.1	8-L1	Work with law enforcement to enforce state idling rules	
5.3.2	8-L1	Shut off cars when waiting to pick up children at school	
5.3.3	8-L1	Consider amending zoning code to prohibit new drive-through facilities	
<b>5.4</b>	<b>7-R1</b>	<b>Facilitate use of neighborhood electric vehicles (NEV)</b>	2,630
5.4.1	7-R1	Identify streets appropriate for NEV	
5.4.2	7-R1	Create a NEV street network	
5.4.3	7-R1	Explore rebates for purchases of NEV	
5.4.4	7-R1	Develop a map and signage for NEV network	
<b>6</b>	<b>Goal 9</b>	<b>Reduce solid waste sent to landfill from Santa Rosa</b>	
<b>6.1</b>	<b>9-R1, 9-L1</b>	<b>Increase recycling and composting of waste</b>	64,370
6.1.1	9-R1	Increase waste accepted for curbside recycling	
6.1.2	9-R1	Work with Waste Management to encourage composting/recyclable containers	
6.1.3	9-L1	Increase diversion of construction waste	
<b>6.2</b>	<b>9-R1</b>	<b>Reduce use of non-recyclable materials</b>	Supportive
6.2.1	9-R1	Discourage use of Styrofoam and plastic bags	
6.2.2	9-R1	Reduce amounts of packaging used	
6.2.3	9-R1	Discourage bottled water at City events	

<b>Santa Rosa Measure Number</b>	<b>Similar to CA2020 Measure Number</b>	<b>Santa Rosa Measure Name</b>	<b>2020 GHG Reductions MTCO2e</b>
6.2.4	9-R1	Divert 75% of waste by 2020	
<b>7</b>	<b>Goal 11, Goal 12, Goal 13, Goal 14</b>	<b>Improve water &amp; wastewater efficiency</b>	
<b>7.1</b>	<b>11-R1, 11-L1, 11-L2, 11-L3, 12-L1</b>	<b>Conserve water</b>	1,700
7.1.1	11-L2	Require reduction in potable water for new development	
7.1.2	11-L1, 11-L2, 11-L3	Expand water conservation efforts	
7.1.3	11-L1	Use water meters which track real-time water use	
7.1.4	N/A	Utilize smart water meters to save water and costs	
<b>7.2</b>	<b>13-R1, 13-R2</b>	<b>Improve efficiency of water/wastewater facilities</b>	2,050
7.2.1	2-R1, 12-R1	Provide recycled water to Geysers to generate clean energy	
7.2.2	14-L1	Install innovative renewable energy projects at treatment plant	
<b>7.3</b>	<b>12-R1</b>	<b>Increase use of recycled water in Santa Rosa</b>	
7.3.1	12-R1	Expand infrastructure network to deliver recycled water	
7.3.2	12-R1	Install dual plumbing in some new development	
<b>8</b>	<b>Goal 18</b>	<b>Improve efficiency of agricultural operations/food consumption</b>	
<b>8.1</b>	<b>18-R1, 18-R2, 18-R3</b>	<b>Increase amount of food grown and consumed locally</b>	Supportive
8.1.1	18-R3	Incentivize residential agriculture	
8.1.2	18-R3	Promote growing of fruits/vegetables in front yards	
8.1.3	18-R3	Establish community gardens and urban farms	
8.1.4	18-R3	Revise zoning code to allow small animals, chickens, bees	
8.1.5	18-R2	Promote Slow Food campaign for restaurants/wineries	
<b>9</b>	<b>Goal 7, Goal 8, Goal 11</b>	<b>Reduce emissions from construction &amp; lawn/garden activities</b>	
<b>9.1</b>	<b>7-L2</b>	<b>Encourage use of electric lawn and garden equipment</b>	20
9.1.1	7-L2	Re-establish voluntary exchange of gas mowers/blowers	

<b>Santa Rosa Measure Number</b>	<b>Similar to CA2020 Measure Number</b>	<b>Santa Rosa Measure Name</b>	<b>2020 GHG Reductions MTCO2e</b>
9.1.2	7-L2	Encourage provision of outside outlets	
9.1.3	11-L2, 11-L3	Replace high water use landscapes	
<b>9.2</b>	<b>8-L2</b>	<b>Reduce construction equipment emissions</b>	<b>360</b>
9.2.1	8-L2	Minimize idling time to 5 minutes or less	
9.2.2	8-L2	Maintain construction equipment per manufacturer's specs	
9.2.3	8-L2	Limit GHG construction equipment emissions with measures	
<b>Grand Total Emissions Reductions in Santa Rosa<sup>2</sup></b>			<b>368,680</b>

Notes:

- <sup>1</sup> GHG reductions from CalGreen requirements are included in existing activities. For more information, see the Santa Rosa CAP.
- <sup>2</sup> Does not include state measures reductions (161,760 MTCO2e), or existing measure reductions (27,640 MTCO2e)

# Sebastopol

Commitments to meeting  
community greenhouse  
gas reduction goals.



## 5.7 Sebastopol

This section presents the community greenhouse gas (GHG) emissions profile specific to Sebastopol and the measures that the City of Sebastopol will implement, with the support of the RCPA and other regional entities, as part of the regional approach to reducing GHG emissions.

### 5.7.1 Community Summary

Sebastopol has a unique and highly valued small-town character. Sebastopol is the hub of West Sonoma County. While the incorporated area is small, Sebastopol serves a much larger unincorporated area stretching to the Pacific Ocean and the Russian River. The City's "market area" comprises a population of approximately 30,000 to 50,000 people, who, to varying degrees, use Sebastopol as their "town" for goods, services, and recreational and cultural activities. Thus, the town has far more economic activity, traffic, and recreational and cultural services than would be apparent based simply on the incorporated population.

The City is surrounded by vineyards, orchards, rural residential, and wetlands, located minutes from the Sonoma Coast and the Russian River area, and just 52 miles north of San Francisco. Sebastopol is at the crossroads of two State Highways, Highways 116 and 12, and is just 8 miles from the county's largest city, Santa Rosa. Sebastopol has a typical Mediterranean climate, with summertime highs above 83 degrees and wintertime lows near 35 degrees.

### Demographics

Sebastopol spans 1.9 square miles and has largely residential and commercial land uses. The City had a population of 7,379 as of the 2010 census. In 2020 the population of Sebastopol is expected to be 7,613, an increase of 3% over 2010. Employment in the area is expected to increase by 20%. Sebastopol's demographic composition in 2010 was 88% White, 1% African American, 0.8% Native American, 1.6% Asian, 0.3% Pacific Islander, 4% from other races, and 4% from two or more races. Persons of Hispanic or Latino origin were 12%.

As shown in Table 5.7-1, the City is expected to experience modest but steady growth in population, housing, and jobs in the future.

**Table 5.7-1. Sebastopol Socioeconomic Data**

	Actual		Projected			
	1990	2010	2015	2020	2040	2050
Population	7,004	7,379	7,497	7,613	8,188	8,608
Housing (# of Houses)	2,842	3,345	3,431	3,521	3,803	3,994
Employment	4,301	5,102	5,507	6,147	6,668	6,827

Socioeconomic data were derived from the SCTA travel demand model and incorporate input from the City based on its internal planning forecasts.

According to the 2010 Census data, Sebastopol is majority owner-occupied with 53% of all houses owner-occupied and 47% renter-occupied.

### Energy and Water Use

Compared to households in the county as a whole, Sebastopol households use less electricity and water but more natural gas. They also use less electricity, natural gas, and water than households statewide.

**Table 5.7-2. Sebastopol, County, and State 2010 Average Energy and Water Use (per household, per year)**

	Sebastopol	County	State
Electricity (kWh)	5,606	7,042	9,320
Natural Gas (Therms)	468	413	512
Water Use (Gallons)	64,833	75,810	107,869

Sources:

City Data: provided by PG&E (energy) and by the City of Sebastopol (water).

County Data: provided by PG&E (energy) and the cities or their Urban Water Management Plans (water).

State Data: U.S. Energy Information Administration 2009, U.S. Geological Survey 2014, California Department of Finance 2015.

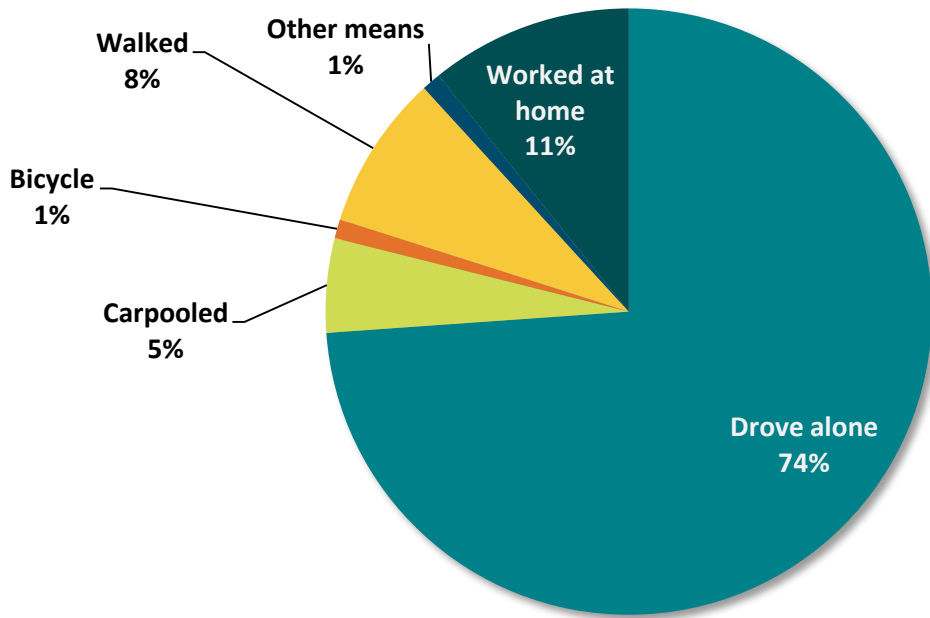
kWh = kilowatt hours

### Transportation Commute Modes

In the inventory year 2010, most Sebastopol residents (74%) drove to work alone, with about 5% carpooling. It takes a Sebastopol resident on average 24 minutes to get to work (U.S. Census Bureau 2014).



**Figure 5.7-1. Modes to Work in Sebastopol in 2010**



Source: U.S. Census Bureau 2014: American Community Survey 2006–2010

### 5.7.2 Sebastopol’s Existing Actions to Reduce GHG Emissions

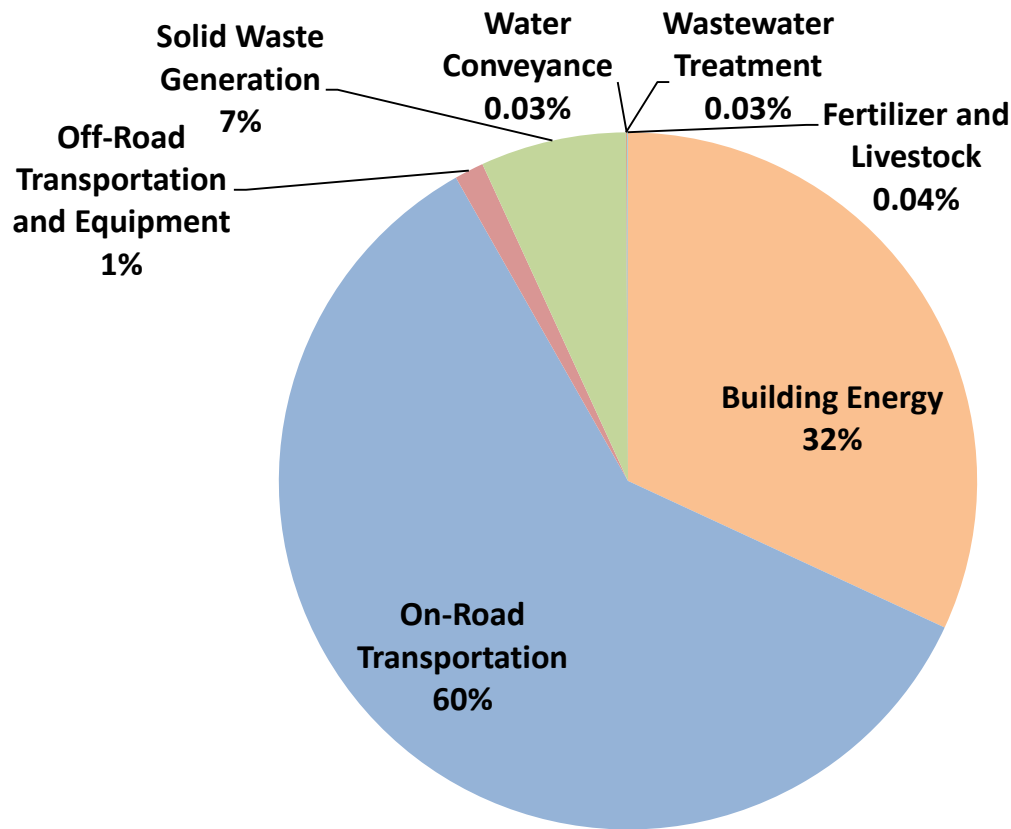
Sebastopol has already taken a number of steps to reduce energy use, promote renewable energy use, and other actions that have been helping to reduce GHG emissions. The City has adopted the following ordinances and General Plan policies that help to reduce GHG emissions and will support the implementation of the formal GHG reduction measures in this CAP.

- Building Energy
  - Residential Retrofits: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Residential Appliance Upgrades: Programs through PG&E and other agencies.
  - Solar Installations at Residences: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Solar Sonoma County program (Resolution No. 5696).
  - LED Light Bulbs program (Resolution No. 5816).
  - Green Building Ordinance: Adoption of Tier 1 Voluntary measures for residential and non-residential structures adopted as mandatory requirements (Municipal Code Chapter 15.04.140).
- Land Use and Transportation
  - Bicycle and Pedestrian Master Plan.

- Urban Growth Boundary: General Plan Policy – Chapter 1: Goal 2: P.9.
- Measure O: Urban Growth Boundary Initiative.
- Zero Emission Dedicated Electric Vehicles Program (Resolution No. 5729).
- Plug-In Electric Vehicles or Hybrids – Plug In Partners (Resolution 5674).
- Promote measures to reduce travel demand: General Plan Policy – Chapter 2: Goal 10: P.27 Continue to implement the Trip Reduction Ordinance.
- Encourage transit use: General Plan Policy – Chapter 2: Goal 6: P.19 Continue to support and expand the Sebastopol Transit Service.
- Reduce regional traffic growth: General Plan Policy – Chapter 2: Goal 1: P.2 Coordinate with the Sonoma County Congestion Management Plan.
- Support regional alternatives to single-occupant vehicle: General Plan Policy – Chapter 2: Goal 1: P.3 Support policies and programs which increase the use of transit, carpools, bicycles, etc.
- Water and Wastewater Efficiency
  - Grey Water: two multifamily developments have installed systems.
  - Water and Sewerage System Conservation Requirements: Municipal Code Chapter 13.04.
  - Urban Runoff Reduction Requirements: Municipal Code Chapter 15.77.
  - Water Fixture Retrofits Water Conservation Rebate Program: Resolution No. 5621 Resolution to amend incentives for water conservation.
  - Water and Energy Conservation Requirements: Municipal Code Chapter 15.74.
  - Water Efficient Landscaping Requirements: Municipal Code Chapter 15.36.
- Urban Forestry and Natural Areas
  - Open Space Conservation Tree Planting: planted thousands of trees in Laguna de Santa Rosa Wetlands Preserve.
  - Street Tree Program.
  - Adopt a Landscape Program.
  - Tree Protection Ordinance: Municipal Code Chapter 8.12.
- Waste Minimization and Recycling
  - Food Waste: Sebastopol residents may put all vegetative food waste in their yard debris.

### 5.7.3 Greenhouse Gas Inventory and Forecast

Figure 5.7-2. Sebastopol 2010 Community GHG Inventory by Source



Sebastopol's inventory is similar to other cities in the county and state. The majority of the emissions are from on-road transportation due to fossil fuel combustion in personal and light-duty vehicles. The next largest source is building energy, which includes emissions related to energy used to heat the homes, and business in Sebastopol. Residential uses account for most (52%) of the building energy emissions in Sebastopol. Commercial uses account for 48% of building energy emissions. The other categories of emissions are much smaller in comparison to building energy and on-road transportation.

In Sebastopol, total GHG emissions generated by community activities in 2010 were 76,330 MTCO<sub>2</sub>e, which is approximately 2% of countywide GHG emissions in the same year. This is a 4% increase from estimated 1990 emissions, which were 73,230 MTCO<sub>2</sub>e. Table 5.7-3 shows the 1990 backcast, the 2010 inventory and business-as-usual (BAU) forecasts for 2015, 2020, 2040 and 2050 for the City of Sebastopol.

**Table 5.7-3. Sebastopol Community GHG Backcast, Inventory, and Forecasts**

<b>Source</b>	<b>1990 Backcast</b>		<b>2010 Inventory</b>		<b>2015 Forecast</b>		<b>2020 Forecast</b>		<b>2040 Forecast</b>		<b>2050 Forecast</b>	
Building Energy	21,840	30%	24,370	32%	26,980	32%	28,930	31%	31,320	32%	32,450	33%
On-road Transportation	42,030	57%	45,730	60%	51,540	60%	56,550	61%	55,800	58%	54,990	57%
Off-road Transportation and Equipment	970	1%	1,040	1%	1,260	1%	1,570	2%	2,930	3%	3,020	3%
Solid Waste	8,010	11%	5,150	7%	5,450	6%	5,900	6%	6,380	7%	6,590	7%
Wastewater Treatment	20	0%	20	0.0%	20	0%	20	0%	20	0%	20	0%
Water Conveyance	370	1%	30	0.0%	30	0%	30	0%	30	0%	30	0%
<b>Total</b>	<b>73,230</b>	<b>100%</b>	<b>76,330</b>	<b>100%</b>	<b>85,280</b>	<b>100%</b>	<b>92,990</b>	<b>100%</b>	<b>96,480</b>	<b>100%</b>	<b>97,100</b>	<b>100%</b>
<b>Per-Capita Emissions</b>	<b>10.5</b>		<b>10.3</b>		<b>11.4</b>		<b>12.2</b>		<b>11.8</b>		<b>11.3</b>	

#### 5.7.4 Greenhouse Gas Reduction Goal and Measures

The City of Sebastopol joins other Sonoma County communities to support the regional GHG emissions reduction target of 25% below 1990 countywide emissions by 2020 through adoption of 27 local GHG reduction measures. The City’s GHG emissions under 2020 BAU conditions (in absence of state, regional, and local reduction measures) would be approximately 92,990 MTCO<sub>2</sub>e. The City’s local GHG reduction measures, in combination with state and regional measures, would reduce the City’s GHG emissions in 2020 to 63,430 MTCO<sub>2</sub>e, which would be a reduction of approximately 32% compared to 2020 BAU conditions. The City will achieve these reductions through reduction measures that are technologically feasible and cost-effective per AB 32 through a combination of state (64%), regional (26%), and local (10%) efforts. With the reduction measures in CA2020, per-capita emissions in Sebastopol will be 8.3 MTCO<sub>2</sub>e per person, a 20% reduction in per capita emissions compared to 1990.

**Table 5.7-4. Sebastopol 2020 GHG BAU Emissions, Reductions, and CAP Emissions**

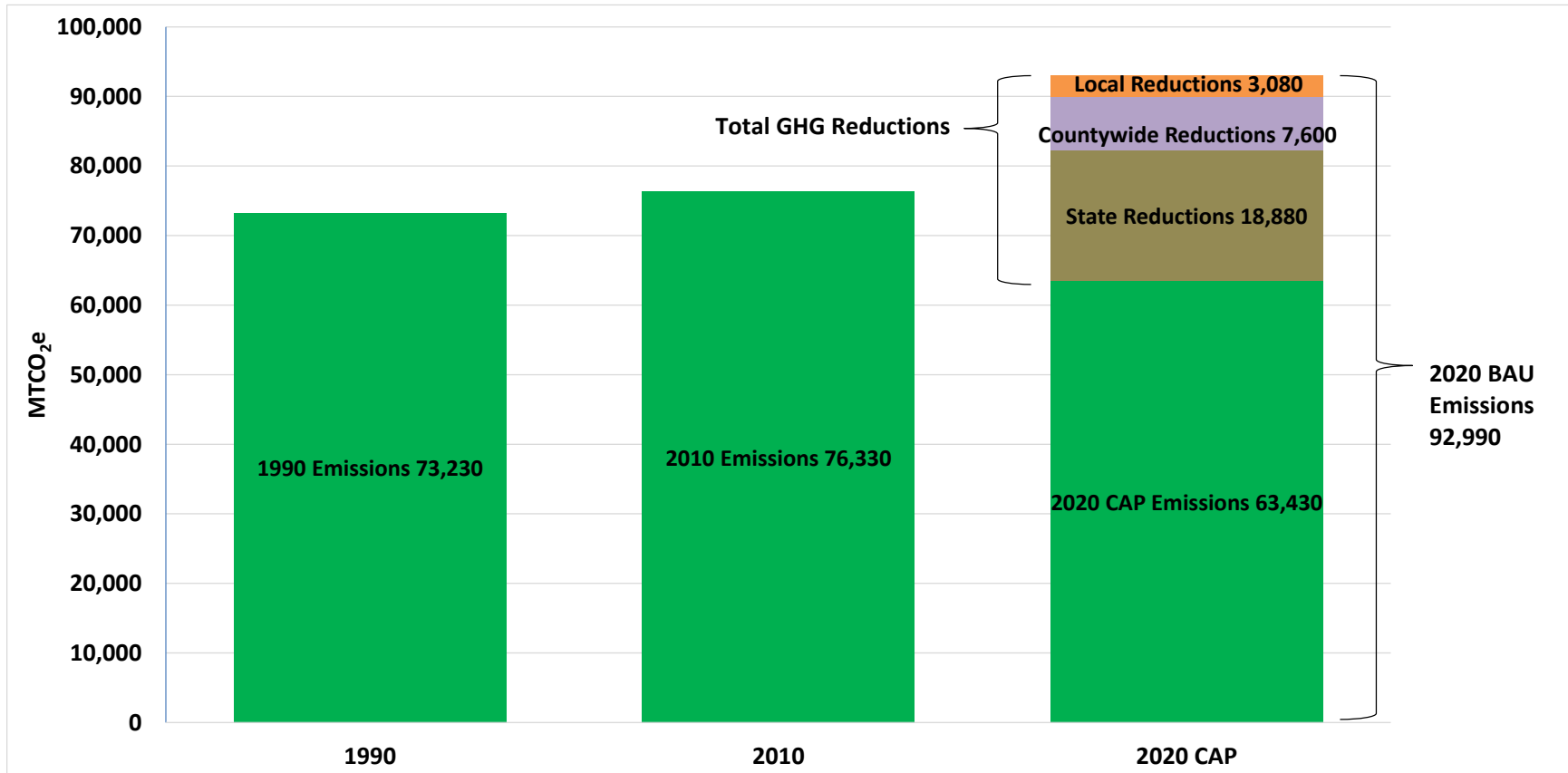
Source	2020 BAU Forecast	Reductions				2020 CAP Emissions	% Reduction From BAU
		State	County-wide	Local	Total		
Building Energy	28,930	6,780	1,770	1,780	10,320	18,600	36%
On-Road Transportation	56,550	11,970	1,360	720	14,050	42,500	25%
Off-Road Transportation and Equipment	1,570	140	-	50	190	1,390	12%
Solid Waste	5,900	-	4,450	-	4,450	1,450	75%
Water Conveyance	30	-	10	530	540	- <sup>1</sup>	100%
Wastewater Treatment	20	-	10	-	10	10	69%
<b>Total Emissions</b>	<b>92,990</b>	<b>18,880</b>	<b>7,600</b>	<b>3,080</b>	<b>29,560</b>	<b>63,430</b>	<b>32%</b>
		<b>64%</b>	<b>26%</b>	<b>10%</b>			

Values may not sum due to rounding.

<sup>1</sup> The CAP reduction for the water conveyance sector is greater than 2020 BAU emissions because it contains emission reductions from multiple sectors. Water conveyance measures reduce improve efficiency, which reduces electricity use within the building energy sector.

Figure 5.7-3 shows Sebastopol’s 1990 and 2010 GHG emissions total, 2020 BAU emissions forecast total, and the total emissions remaining after implementation of the City’s reduction measures. The contribution of state, regional, and local reductions are overlaid on the 2020 BAU emissions forecast total, representing the total emissions reductions achieved in 2020. Like the other communities, Sebastopol benefits greatly from the work the state and regional entities are committed to implementing on climate action. See Chapter 4 for more information on state and regional actions.

**Figure 5.7-3. Sebastopol 1990, 2010, and 2020 GHG Emissions; 2020 State and Local Reductions**



## Greenhouse Gas Reduction Measures

As shown in Table 5.7-5, the City of Sebastopol will achieve its reduction goal through a combination of state, regional, and local measures. State reduction measures are implemented through state law, including some that require action by the City to comply with state mandates (e.g., Title 24 energy efficiency measures). State measure reductions total 18,880 MTCO<sub>2</sub>e, which include the Pavley vehicle

fuel efficiency standards, Title 24 building standards, the state's low carbon fuel standard, and the RPS, which will reduce GHG emissions from Sebastopol's on-road and off-road transportation and building energy use in 2020.

Regional measures will reduce emissions by 7,600 MTCO<sub>2</sub>e and will be implemented by regional entities, including the Regional Climate Protection Authority (RCPA), Sonoma County Water Agency (SCWA), County of Sonoma Energy Independence Office (ESD), Sonoma County Transportation Authority (SCTA), and Sonoma Clean Power (SCP).

An additional reduction of 3,080 MTCO<sub>2</sub>e will be achieved through measures the City of Sebastopol has chosen. The locally adopted measures, although not as high-achieving of GHG reductions as the state and regional measures, are important because they represent the actions that local communities can take directly. The communities have local control over their infrastructure and policies and have selected the local measures that best suit the needs of their community. The City intends to review the suite of measures with an eye towards expedited implementation of selected measures to achieve timely emission reductions.

The three measures that will have the greatest impact in Sebastopol are, in order of importance, Measure 2-L4 (Solar in Existing Non-Residential Buildings), Measure 11-L1 (Senate Bill SB X7-7 - Water Conservation Act of 2009), and Measure 5-L2 (Carpool-Incentives & Ride-Sharing Program). These three measures, in addition to reducing GHG emissions, will save energy, improve air quality and public health in the City, and conserve water and other natural resources. As the county and state continue to experience a historic drought, water conservation will remain an especially important co-benefit.

On the state level, the RPS and the Pavley measures have the greatest potential to reduce emissions in the City. Of the regional measures, the measures with the greatest impact are the Community Choice Aggregation (CCA) measure, the waste-to-energy measure, and the waste diversion measure.

Table 5.7-5 presents the individual GHG reduction measures that Sebastopol has selected for the CAP. For more information on the specifics of each measure, see Appendix C.

### Sustainable Sebastopol

Sebastopol has committed to a diverse range of programs and policies that reduce the emissions of GHGs. The City maintains a list of the programs, policies, and resolutions that it has adopted, and tips for members of the community to take on the City website. One of these resolutions, adopted in 2002, establishes the City's official support for the use of alternatively fueled vehicles for the City's municipal fleet.

**Table 5.7-5. Sebastopol 2020 GHG Emissions Reductions by Measure**

<b>State and Regional Measures</b>	<b>2020 GHG Reductions</b>	<b>Participation Rate</b>
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>1,538</b>	
Measure 1-S1: Title 24 Standards for Commercial and Residential Buildings	531	N/A
Measure 1-S2: Lighting Efficiency and Toxics Reduction Act (AB1109)	603	N/A
Measure 1-S3: Industrial Boiler Efficiency	-	N/A
Measure 1-R1: Community Energy Efficiency Retrofits for Existing Buildings	69	N/A
Measure 1-R2: Expand the Community Energy Efficiency Retrofits Program	335	N/A
<b>Goal 2: Increase Renewable Energy Use</b>	<b>7,007</b>	
Measure 2-S1: Renewables Portfolio Standard	5,619	N/A
Measure 2-S2: Solar Water Heaters	23	N/A
Measure 2-R1: Community Choice Aggregation	1,364	N/A
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>977</b>	
Measure 5-R1: Improve and Increase Transit Service	13	N/A
Measure 5-R2: Supporting Transit Measures	NQ	N/A
Measure 5-R3: Sonoma-Marín Area Rail Transit	NQ	N/A
Measure 5-R4: Trip Reduction Ordinance	195	N/A
Measure 5-R5: Supporting Measures for the Transportation Demand Management Program	NQ	N/A
Measure 5-R6: Reduced Transit Passes	181	N/A
Measure 5-R7: Alternative Travel Marketing & Optimize Online Service	144	N/A
Measure 5-R8: Safe Routes to School	444	N/A
Measure 5-R9: Car-sharing Program	NQ	N/A
Measure 5-R10: Bike Sharing Program	NQ	N/A



State and Regional Measures	2020 GHG Reductions	Participation Rate	
<b>Goal 6: Increase Vehicle and Equipment Fuel Efficiency</b>	<b>11,969</b>		
Measure 6-S1: Pavley Emissions Standards for Passenger Vehicles and the Low Carbon Fuel Standard	11,074	N/A	
Measure 6-S2: Advanced Clean Cars	298	N/A	
Measure 6-S3: Assembly Bill 32 Vehicle Efficiency Measures	597	N/A	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>526</b>		
Measure 7-S1: Low Carbon Fuel Standard: Off-Road	139	N/A	
Measure 7-R1: Shift Sonoma County (Electric Vehicles)	386	N/A	
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>1,722</b>		
Measure 9-R1: Waste Diversion Goal	1,722	N/A	
<b>Goal 10: Increase Capture and Use of Methane from Landfills</b>	<b>2,725</b>		
Measure 10-R1: Increase Landfill Methane Capture and Use for Energy	2,725	N/A	
<b>Goal 11: Reduce Water Consumption</b>			
Measure 11-R1: Countywide Water Conservation Support and Incentives	NQ	N/A	
<b>Goal 12: Increase Recycled Water and Greywater Use</b>	<b>&lt; 1</b>		
Measure 12-R1: Recycled Water*	< 1	N/A	
<b>Goal 13: Increase Water and Wastewater Infrastructure Efficiency</b>	<b>21</b>		
Measure 13-R1: Infrastructure and Water Supply Improvement	7	N/A	
Measure 13-R2: Wastewater Treatment Equipment Efficiency*	14	N/A	
<b>Local Measures</b>			
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>33</b>		
Measure 1-L2: Outdoor Lighting	29	25%	of outdoor lighting to participate

State and Regional Measures	2020 GHG Reductions	Participation Rate	
Measure 1-L3: Shade Tree Planting	4	400	trees planted
<b>Goal 2: Increase Renewable Energy Use</b>	<b>1,712</b>		
Measure 2-L1: Solar in New Residential Development	26	100%	of new houses to participate
Measure 2-L2: Solar in Existing Residential Building	248	15%	of existing homes with solar
Measure 2-L3: Solar in New Non-Residential Developments	221	75%	of new non-residential development to participate
Measure 2-L4: Solar in Existing Non-Residential Buildings	1,217	25%	of existing non-residential development with solar
<b>Goal 3: Switch Equipment from Fossil Fuel to Electricity</b>	<b>32</b>		
Measure 3-L1: Convert to Electric Water Heating	32	10%	of households
<b>Goal 4: Reduce Travel Demand Through Focused Growth</b>	<b>245</b>		
Measure 4-L1: Mixed-Use Development in City Centers and Along Transit Corridors	208	60%	of growth to result in mixed use
Measure 4-L2: Increase Transit Accessibility	24	15%	of growth to be 25+ units
Measure 4-L3: Supporting Land Use Measures	NQ	Yes	
Measure 4-L4: Affordable Housing Linked to Transit	13	20%	of new development to be affordable
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>471</b>		
Measure 5-L1: Local Transportation Demand Management Program	144	38%	of employees eligible
Measure 5-L2: Carpool-Incentives & Ride-Sharing Program	282	78%	of employees eligible
Measure 5-L3: Guaranteed Ride Home	NQ	Yes	
Measure 5-L4: Supporting Bicycle/Pedestrian Measures	NQ	Yes	
Measure 5-L5: Traffic Calming	45	100%	of trips affected
Measure 5-L7: Supporting Parking Policy Measures	NQ	Yes	

State and Regional Measures	2020 GHG Reductions	Participation Rate	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>42</b>		
Measure 7-L1: Electric Vehicle Charging Station Program	3	5	charging stations installed
Measure 7-L2: Electrify Construction Equipment	38	10%	of equipment
Measure 7-L3: Reduce Fossil Fuel Use in Equipment through Efficiency or Fuel Switching	NQ	Yes	
<b>Goal 8: Reduce Idling</b>	<b>9</b>		
Measure 8-L1: Idling Ordinance	NQ	2	minutes below state law
Measure 8-L2: Idling Ordinance for Construction Equipment	9	2	minutes below state law
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>&lt; 1</b>		
Measure 9-L1: Create Construction and Demolition Reuse and Recycling Ordinance	< 1	3%	beyond baseline
<b>Goal 11: Reduce Water Consumption</b>	<b>532</b>		
Measure 11-L1: Senate Bill SB X7-7 - Water Conservation Act of 2009*	418	20%	Reduction in per capita water use
Measure 11-L2: Water Conservation for New Construction*	4	100%/50%	% of new residential/nonresidential development
Measure 11-L3: Water Conservation for Existing Buildings*	110	25%/50%	% of new residential/nonresidential development
<b>Goal 12: Increase Recycled Water and Greywater Use</b>	<b>3</b>		
Measure 12-L1: Greywater Use	3.23	25%	greywater goal
<b>State Measure Reductions in Sebastopol</b>	<b>18,880</b>		
<b>Regional Measure Reductions in Sebastopol</b>	<b>7,600</b>		
<b>Local Measure Reductions in Sebastopol</b>	<b>3,080</b>		
<b>Grand Total Emissions Reductions in Sebastopol</b>	<b>29,560</b>		

\*Measures reduce emissions from multiple sources (i.e. water and energy)  
NQ = not quantified

### **5.7.5 Municipal Greenhouse Gas Reduction Measures**

Like the other cities and the county, Sebastopol has recognized the need to reduce GHG emissions from municipal operations. The City has existing programs in place for green municipal buildings and alternative fuels for its municipal fleet. Although municipal GHG reduction measures are not part of this countywide plan, action by the cities and the County to reduce municipal emissions is still important. Sebastopol and the other local communities will continue to pursue actions that reduce GHG emissions from municipal operations. Descriptions of potential municipal GHG reduction measures are provided in Appendix E as an informational resource.

# Sonoma

Commitments to meeting  
community greenhouse  
gas reduction goals.



## 5.8 Sonoma

This section presents the community greenhouse gas (GHG) emissions profile specific to Sonoma and the measures that the City of Sonoma will implement, with the support of the RCPA and other regional entities, as part of the regional approach to reducing GHG emissions.

### 5.8.1 Community Summary

The City of Sonoma is home to three of the first ten California Historical Landmarks, along with a number of other historic sites. Located in the heart of one of the world’s premier wine producing regions, Sonoma is a working town with a rich cultural heritage. The adjacent scenic hills and agricultural valley provide a setting of unparalleled natural beauty. The San Francisco de Solano mission and other historic buildings that surround the central Plaza complement the area’s viticultural prominence and visual beauty to make Sonoma a distinctive and successful tourism destination. The City serves as the economic hub for the rural Sonoma Valley, which has a population of about 39,000. Sonoma has typical Mediterranean weather with hot, dry summers and cool, wet winters. The City is located in the southeast portion of the county, west of Napa and east of Petaluma.

### Demographics

Sonoma spans 2.7 square miles and has largely residential, commercial, and agricultural land uses. The City had a population of 10,678 as of the 2010 census. In 2020 the population of Sonoma is expected to be 11,165, an increase of 5% over 2010. Employment in the area is expected to increase by 21%. Sonoma’s demographic composition in 2010 was 87% White, 0.5% African American, 0.5% Native American, 3% Asian, 0.2% Pacific Islander, 7% from other races, and 2.5% from two or more races. Persons of Hispanic or Latino origin were 15%.

As shown in Table 5.8-1, the City is expected to experience relatively slow growth in population, housing, and jobs in the future.

**Table 5.8-1. Sonoma Socioeconomic Data**

	Actual			Projected		
	1990	2010	2015	2020	2040	2050
Population	8,121	10,648	11,009	11,165	11,692	11,964
Housing	3,866	5,060	5,123	5,196	5,441	5,568
Employment	4,937	5,746	6,350	6,954	7,978	8,178

Socioeconomic data were derived from the SCTA travel demand model and incorporate input from the City based on its internal planning forecasts.

According to the 2010 Census, City of Sonoma housing is majority owner-occupied with 59% of housing units owner-occupied and 41% rented.

## Energy and Water Use

Compared to households in the county as a whole, Sonoma households use less electricity but more natural gas and water. They also use less electricity, natural gas, and water than households statewide.

**Table 5.8-2. Sonoma, County, and State 2010 Average Energy and Water Use (per household, per year)**

	Sonoma	County	State
Electricity (kWh)	5,997	7,042	9,320
Natural Gas (Therms)	483	413	512
Water Use (Gallons)	84,136	75,810	107,869

Sources:

City Data: provided by PG&E (energy) and by the City of Sonoma Urban Water Management Plan.

County Data: provided by PG&E (energy) and the cities or their Urban Water Management Plans (water).

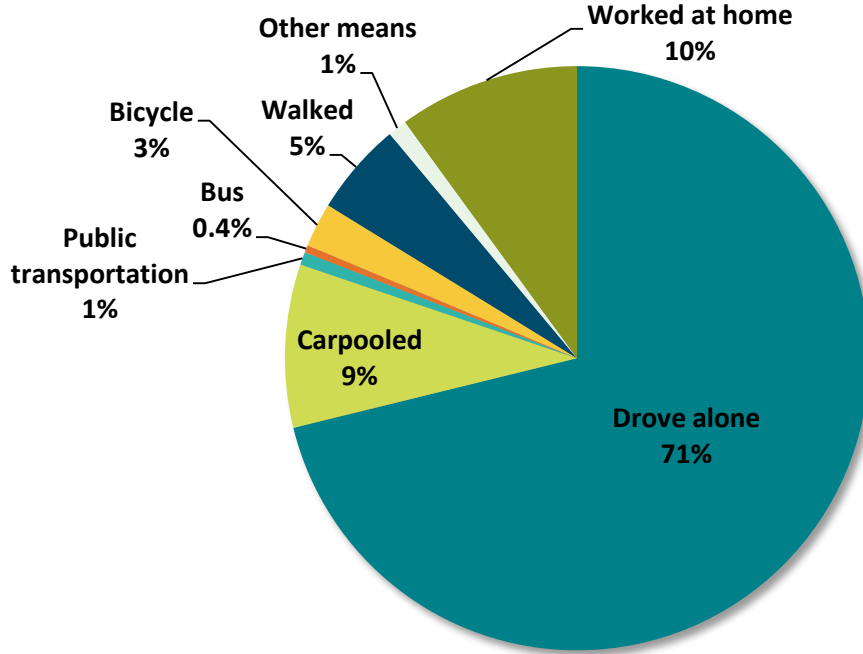
State Data: U.S. Energy Information Administration 2009, U.S. Geological Survey 2014, California Department of Finance 2015.

kWh = kilowatt hours

## Transportation Commute Modes

In the inventory year 2010, most Sonoma residents (71%) drove alone to work, and about 9% carpooled. For many residents of Sonoma, alternative transportation options are not available for their commute trip. With the average trip to work for residents of Sonoma taking 25.5 minutes, and limited bus service, riding a bus is not a viable option for many City residents (U.S. Census Bureau 2014).

**Figure 5.8-1. Modes to Work in Sonoma in 2010**



Source: U.S. Census Bureau 2014: American Community Survey 2006–2010

### 5.8.2 Sonoma’s Existing Actions to Reduce GHG Emissions

Sonoma has already taken a number of steps to reduce energy use, promote renewable energy use, and other actions that have been helping to reduce GHG emissions. Sonoma has adopted the following ordinances and General Plan policies that would also help to reduce GHG emissions and will support the implementation of the formal GHG reduction measures in this CAP.

- Building Energy
  - Residential Retrofits: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Residential Appliance Upgrades: Programs through PG&E and other agencies.
  - Solar Installations at Residences: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Solar Installations at businesses.
  - Standardized Permit Submittal for Residential PV Systems: In an effort to promote a consistent methodology of processing permits by all jurisdictions within the Redwood Empire Chapter of Code Officials, this standardized permit submittal has been developed for residential roof-mounted PV electrical systems of up to 5 kilowatts (kW).
  - Sonoma County Energy Independence Program (SCEIP): Enables residential and commercial property owners to access PACE financing for permanently installed energy or



- water improvements to their property. Under Energy Upgrade California, rebates are available for homeowners interested in doing energy retrofit improvements.
- Sustainability Program – General Plan Implementation Measure: Chapter 3 – Measure 3.2.1 General Plan Goal: ER-3: Conserve natural resources to ensure their long-term sustainability. CAL Green Building Standards Code: Municipal Code Chapter 14.10.050. City adopts Tier 1 as mandatory for all new residential and non-residential buildings.
  - General Plan Policy 6.2: Implement Sonoma’s Green Building Ordinance to ensure new development is energy and water efficient, and consider establishing additional incentives to achieve energy and water conservation efficiencies higher than those required by the Ordinance. Revise and/or revisit the ordinance as necessary to reflect the introduction of a State-wide green building code.
  - General Plan Policy 6.4: Promote the use of alternative energy sources such as solar energy, cogeneration, and non-fossil fuels.
  - The City offers a Business Improvement Matching Funds Loan Program for improvements to commercial buildings, including lighting retrofits, insulation and weatherization, energy management systems, HVAC system upgrades, water heating systems, irrigation efficiency systems, rainwater harvesting systems, low-flow toilets, and similar types of improvements to the building or property that have been identified through a qualified energy and/or water efficiency survey.
- Land Use and Transportation
    - Bicycle and Pedestrian Master Plan.
    - Mixed Use Development – General Plan Policy: Chapter 4 – Policy 3.2 General Plan Goal CE-3: Minimize vehicle trips while ensuring safe and convenient access to activity centers and maintaining Sonoma’s small-town character.
    - General Plan Policy 3.2: Encourage a mixture of uses and higher densities where appropriate to improve the viability of transit and pedestrian and bicycle travel.
    - Increased Transit Service – General Plan Policy 3.3. Promote transit use and improve transit services.
    - General Plan Goal 6.0: Promote environmental sustainability through support of existing and new development which minimizes reliance on natural resources.
    - General Plan Policy 6.1: Preserve open space, watersheds, environmental habitats and agricultural lands, while accommodating new growth in compact forms that de-emphasizes the automobile.
    - General Plan Policy 6.5: Incorporate transportation alternatives such as walking, bicycling and, where possible, transit into the design of new development.
    - Idling Ordinance: Municipal Code 9.56.080 other limitations. A. Limitations on the Idling of Commercial Vehicles. When parked within 100 feet of a residential zoning district, a driver

of a commercial vehicle shall not cause or allow an engine to idle for more than five consecutive minutes, except as necessary for the loading or unloading of cargo within a period not to exceed 30 minutes.

- General Plan Goal CE-2: Establish Sonoma as a place where bicycling is safe and convenient.
  - General Plan Policy 2.1: Promote bicycling as efficient alternative to driving.
  - General Plan Policy 2.2: Extend the bike path system, with a focus on establishing safe routes to popular destinations.
  - General Plan Policy 2.3: Expand availability of sheltered bicycle parking.
  - General Plan Policy 2.5: Incorporate bicycle facilities and amenities in new development.
- General Plan Goal CE-3: Minimize vehicle trips while ensuring safe and convenient access to activity centers and maintaining Sonoma’s small-town character.
  - General Plan Policy 3.2: Encourage a mixture of uses and higher densities where appropriate to improve the viability of transit and pedestrian and bicycle travel.
  - General Plan Policy 3.3: Promote transit use and improve transit services.
  - General Plan Policy 3.4: Encourage shared and “park once” parking arrangements that reduce vehicle use.
- General Plan Goal CD-4: Encourage quality, variety, and innovation in new development.
  - General Plan Policy 4.4: Require pedestrian and bicycle access and amenities in all development.
- Waste Minimization and Recycling
  - Increase Waste Diversion in Municipal Facilities: Recycling is required in all City offices.
  - Compost Your Veggies Program: All vegetative food waste can be added to yard debris bins.
  - Commercial Composting Program. Collects waste from local restaurants and kitchens and converts to high organic soil from local gardens, farms, and vineyards
  - Pharmaceutical Drop-off Program: In partnership with the Sonoma County Water Agency, the City and local pharmacies have instituted a program in which residents may return unused pharmaceutical products as a means of diverting them from the sanitation system.
  - Waste Reduction Goal: General Plan Goal ER-3: Conserve natural resources to ensure their long-term sustainability.
  - General Plan Policy 3.1: Increase the conservation-effectiveness and cost-effectiveness of the solid waste source reduction program through expanded recycling and composting.

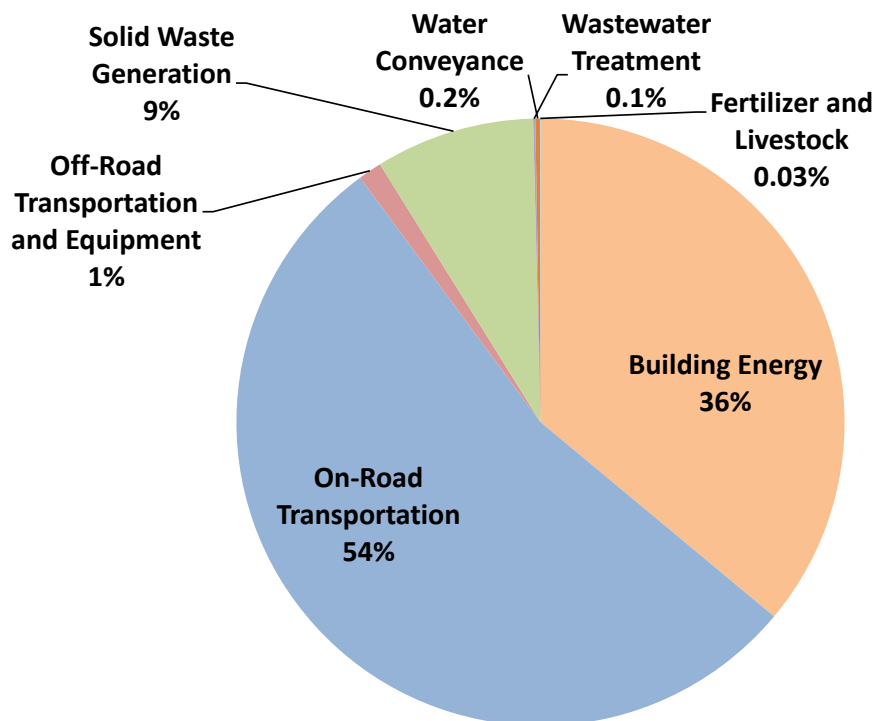
- Polystyrene Food Packaging: Municipal Code Chapter 7.30. The purpose of this chapter is to decrease the use and presence of polystyrene products in order to promote the public health, reduce solid waste disposal and litter, protect air quality and the ozone layer, protect wildlife, livestock and the environment. The City council supports a ban on all uses of polystyrene not deemed absolutely critical.
- Green Purchasing Policy: Municipal Code Chapter 3.04.060: In an effort to comply with the State of California Public Contract Code, the City recognizes the state guidelines referencing purchase of recycled products.
- General Plan Goal ER-3: Conserve natural resources to ensure their long-term sustainability.
- Water and Wastewater Efficiency
  - General Plan Policy 6.3: Promote the use of sustainable construction techniques and environmentally sensitive design for all housing, to include best practices in water conservation. Low-impact drainage, and greenhouse gas reduction.
  - General Plan Implementation Measure 3.2.2: Continue to implement the Xeriscape Ordinance and update it as necessary to achieve water conservation objections.
  - Water Conservation Strategy – General Plan Implementation Measure: Chapter 3 – Measure 2.4.1, General Plan Goal ER-2: Identify, preserve, and enhance important habitat areas and significant environmental resources. Prepare and implement a comprehensive strategy for water conservation and the protection of water quality, including quantified objectives, with the goal of producing a Water Element for the General Plan.
  - General Plan Policy 2.4: Protect Sonoma Valley watershed resources, including surface and ground water supplies and quality.
  - General Plan Policy 6.6: Ensure sufficient water resources to serve existing and future residents provided for under Sonoma’s 2020 General Plan: 1) take proactive steps to improve water conservation; 2) upgrade water supply infrastructure; 3) increase the local supply of water through new wells; 4) protect the quality and sustainability of groundwater resources; 5) investigate alternative water supply options.
  - Prior to the issuance of any building permit for new development, a water demand analysis, accompanied by a water conservation plan that targets CALGreen water standards, shall be submitted by the applicant and shall be subject to the review and approval of the City Engineer.
  - Water-Efficient Landscaping: Municipal Code Chapter 14.32: “This policy protects local water supplies through the implementation of a whole system approach to design, construction, installation and maintenance of the landscape resulting in water-conserving climate-appropriate landscapes, improved water quality and the minimization of natural resource inputs.

- Water Shortage and Conservation Plan: Municipal Code Chapter 13.10: Regulations that enforce the conservation of water for the greatest public benefit with particular regard to public health, fire protection, and domestic use; to conserve water by reducing waste; and to achieve water use reductions in response to water shortages that occur from time to time. Includes voluntary measures and, when applicable by county council, mandatory measures.
- Urban Water Management Plan: Resolution adopting the City of Sonoma 2010 Urban Water Management Plan.
- The City has issued one building permit for a greywater system and one commercial development (Sonoma Valley Oaks) installed a greywater system.
- Sustainability Workshops: The Sonoma Community Center has offered a number of sustainability workshops related to greywater, rainwater harvesting, recycling, gardening with native plants, and water conservation.
- The City’s Business Improvement Matching Funds Loan Program described above under “Building Energy” also supports water efficiency improvements on existing commercial buildings.
- Agriculture, Urban Forestry, and Natural Areas
  - General Plan Goal CD-1: Contain urban land uses within a compact area that preserves surrounding open space and agricultural resources.
  - General Plan Policy 1.4: Coordinate planning efforts with the County to protect adjacent agricultural land and open space.
  - General Plan Goal ER-1: Acquire and protect important open space in and around Sonoma.
  - General Plan Policy 1.3: Support community programs that preserve and promote agriculture.
  - Urban Growth Boundary: An Urban Growth Boundary (UGB) is established at the location shown on this General Plan’s Land Use Plan map. The UGB is a line beyond which urban development will not be allowed, except for public parks, public schools, and uses consistent with the General Plan “Agriculture” land use designation as of February 25, 2000.
  - Tree Ordinance: Municipal Code Chapter 12.08: Regulations prohibiting unnecessary damage, removal, or destruction of trees.
  - Resource Conservation Strategy – General Plan Implementation Measure General Plan Goal ER-2: Conserve natural resources to ensure their long-term sustainability. General Plan Implementation Measure 3.3.1 Develop a sustainable resource conservation strategy for City facilities, services, and projects with quantifiable standards that serves as a model of green building and operation for the community.

- Natural Resource Conservation – General Plan Policy: Chapter 3 – Policy 3.2 General Plan Goal ER-3: Conserve natural resources to ensure their long-term sustainability. General Plan Policy 3.2: Encourage construction, building maintenance, landscaping, and transportation practices that promote energy and water conservation and reduce greenhouse gas emissions.
- General Plan Goal 6.0: Promote environmental sustainability through support of existing and new development which minimizes reliance on natural resources.
- General Plan Policy 3.2: Encourage construction, building maintenance, landscaping, and transportation practices that promote energy and water conservation and reduce greenhouse gas emissions.
- General Plan Implementation Measure 3.2.1: Implement a sustainability program that includes quantified objectives, standards and incentives for green construction and assistance to local businesses and agricultural operations to institute green practices for construction and land, energy, and water conservation.

### 5.8.3 Greenhouse Gas Inventory and Forecast

**Figure 5.8-2. Sonoma 2010 Community GHG Inventory by Source**



Sonoma’s inventory is similar to other cities in the county and state. The majority of the GHG emissions are from transportation due to fossil fuel combustion in personal and light-duty vehicles. The next largest source is building energy, which includes emissions related to energy used to heat the homes and businesses in Sonoma. Residential uses account for most (53%) of the

building energy emissions in Sonoma. Commercial uses account for 47% of building energy emissions. The other categories of emissions are much smaller in comparison to building energy and on-road transportation.

In Sonoma, total GHG emissions generated by community activities in 2010 were 103,370 MTCO<sub>2</sub>e, which is approximately 3% of countywide GHG emissions in the same year. This is a 7% increase from estimated 1990 emissions, which were 96,890 MTCO<sub>2</sub>e. Table 5.8-3 shows the 1990 backcast, the 2010 inventory and business-as-usual (BAU) forecasts for 2015, 2020, 2040 and 2050 for the City of Sonoma.

**Table 5.8-3. Sonoma Community GHG Backcast, Inventory, Forecasts**

Source	1990 Backcast		2010 Inventory		2015 Forecast		2020 Forecast		2040 Forecast		2050 Forecast	
Building Energy	31,750	33%	37,280	36%	41,350	35%	43,620	36%	47,960	36%	49,120	37%
On-road Transportation	50,850	52%	55,670	54%	64,500	55%	65,950	54%	68,870	52%	66,090	50%
Off-road Transportation and Equipment	1,120	1%	1,300	1%	1,600	1%	1,950	2%	3,720	3%	3,810	3%
Solid Waste	10,110	10%	8,750	8%	9,490	8%	10,180	8%	11,410	9%	11,690	9%
Wastewater Treatment	90	0%	120	0.1%	120	0%	120	0%	130	0%	130	0%
Water Conveyance	2,970	3%	250	0.2%	330	0%	340	0%	380	0%	390	0%
<b>Total</b>	<b>96,890</b>	<b>100%</b>	<b>103,370</b>	<b>100%</b>	<b>117,390</b>	<b>100%</b>	<b>122,170</b>	<b>100%</b>	<b>132,470</b>	<b>100%</b>	<b>131,240</b>	<b>100%</b>
<b>Per-Capita Emissions</b>	<b>11.9</b>		<b>9.7</b>		<b>10.7</b>		<b>10.9</b>		<b>11.3</b>		<b>11.0</b>	

### 5.8.4 Greenhouse Gas Reduction Goal and Measures

The City of Sonoma joins the other Sonoma County communities to support the regional GHG emissions reduction target of 25% below 1990 countywide emissions by 2020 through adoption of 20 local GHG reduction measures. The City’s GHG emissions under 2020 BAU conditions (in absence of state, regional, and local reduction measures) would be approximately 122,170 MTCO<sub>2</sub>e. The City’s local GHG reduction measures, in combination with state and regional measures, would reduce the City’s GHG emissions in 2020 to 85,700 MTCO<sub>2</sub>e, which would be a reduction of approximately 30% compared to 2020 BAU conditions. The City will achieve these reductions through reduction measures that are technologically feasible and cost-effective per AB 32 through a combination of state (63%), regional (33%), and local (4%) efforts. Per-capita reductions in Sonoma in 2020 would be 3.3 MTCO<sub>2</sub>e per person. With the reduction measures in CA2020, per-capita emissions in Sonoma will be 7.7 MTCO<sub>2</sub>e per person, a 36% reduction in per capita emissions compared to 1990.

**Table 5.8-4. Sonoma 2020 GHG BAU Emissions, Reductions, and CAP Emissions**

Source	2020 BAU Forecast	Reductions				2020 CAP Emissions	% Reduction From BAU
		State	County-wide	Local	Total		
Building Energy	43,620	9,670	2,950	570	13,190	30,440	30%
On-Road Transportation	65,950	13,140	1,640	50	14,820	51,120	22%
Off-Road Transportation and Equipment	1,950	170	-	20	190	1,760	10%
Solid Waste	10,180	-	7,200	-	7,200	2,980	71%
Water Conveyance	340	-	310	730	1,040	- <sup>1</sup>	100%
Wastewater Treatment	120	-	10	-	10	110	11%
<b>Total Emissions</b>	<b>122,170</b>	<b>22,990</b>	<b>12,110</b>	<b>1,360</b>	<b>36,460</b>	<b>85,700</b>	<b>30%</b>
		<b>63%</b>	<b>33%</b>	<b>4%</b>			

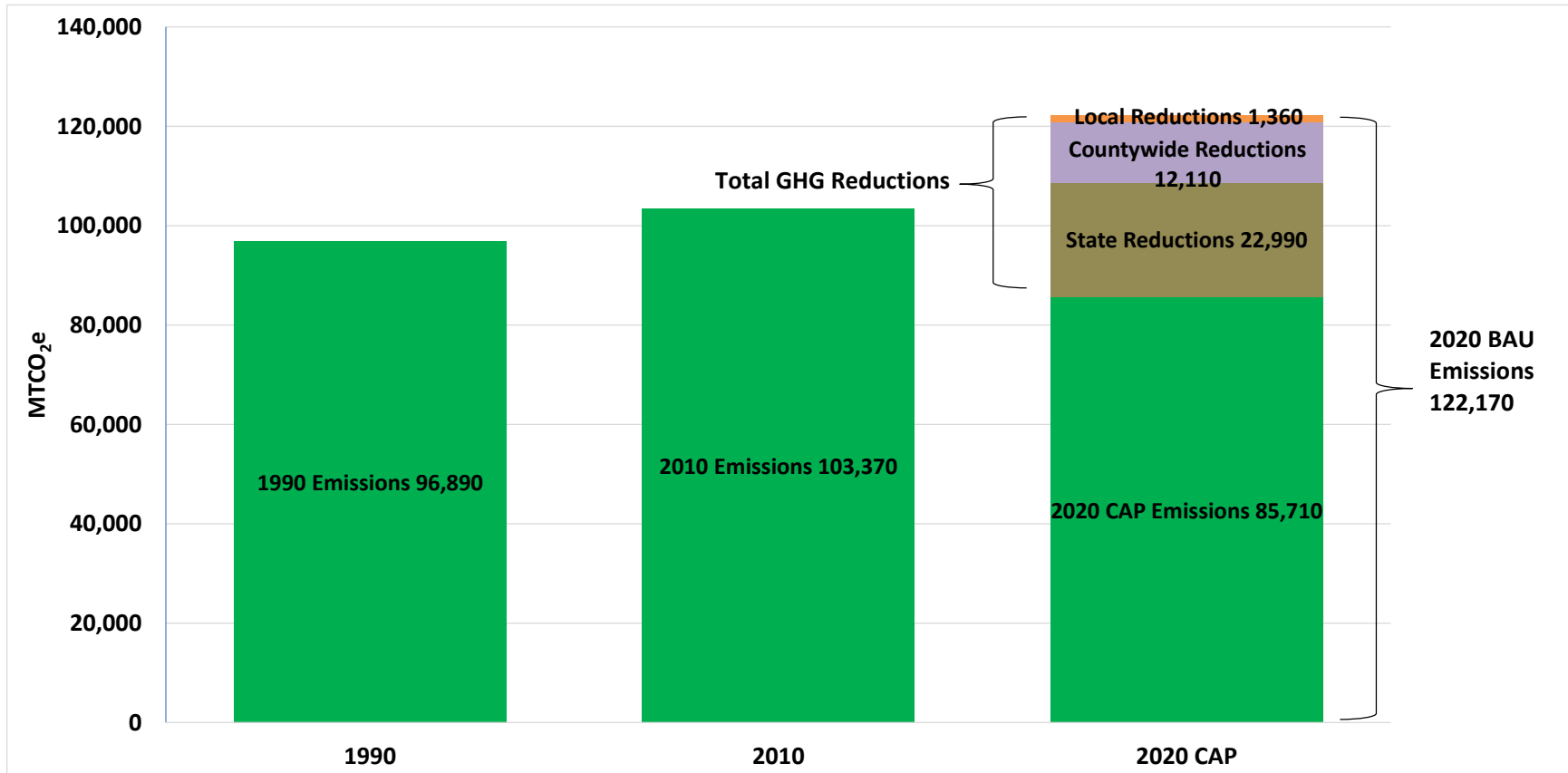
Values may not sum due to rounding.

<sup>1</sup> The CAP reduction for the water conveyance sector is greater than 2020 BAU emissions because it contains emission reductions from multiple sectors. Water conveyance measures reduce improve efficiency, which reduces electricity use within the building energy sector.

Figure 5.8-3 shows Sonoma’s 1990 and 2010 GHG emissions total, 2020 BAU emissions forecast total, and the total emissions remaining after implementation of the City’s reduction measures. The contribution of state, regional, and local reductions are overlaid on the 2020 BAU emissions forecast total, representing the total emissions reductions achieved in 2020. Like the other communities, Sonoma benefits greatly from the work the state and regional entities are committed to implementing on climate action. See Chapter 4 for more information on state and regional actions.



**Figure 5.8-3. Sonoma 1990, 2010, and 2020 GHG Emissions; 2020 State and Local Reductions**



## Greenhouse Gas Reduction Measures

As shown in Table 5.8-5, the City of Sonoma will achieve its reduction goal through a combination of state, regional, and local measures. State reduction measures are implemented through state law, including some that require action by the City to comply with state mandates (e.g. Title 24 energy efficiency measures). State measure reductions total 22,990 MTCO<sub>2</sub>e, which include the Pavley vehicle fuel efficiency standards, Title 24 building standards, the state's low carbon fuel standard, and the RPS, which will reduce GHG emissions from Sonoma's on-road and off-road transportation, and building energy use in 2020.

Regional measures will reduce emissions by 12,110 MTCO<sub>2</sub>e and will be implemented by regional entities, including the Regional Climate Protection Authority (RCPA), Sonoma County Water Agency (SCWA), County of Sonoma Energy Independence Office (ESD), Sonoma County Transportation Authority (SCTA), and Sonoma Clean Power (SCP).

An additional reduction of 1,360 MTCO<sub>2</sub>e will be achieved through local measures. The locally adopted measures, although not as high-achieving of GHG reductions as the state and regional measures, are important because they represent the actions that local communities can take directly. The communities have local control over their infrastructure and policies and have selected the local measures that best suit the needs of their community.

The three measures that will have the greatest impact in Sonoma are, in order of importance, Measure 11-L1 (Senate Bill SB X7-7 - Water Conservation Act of 2009), and Measure 11-L3 (Water Conservation for Existing Buildings), Measure 2-L2 (Solar in Existing Residential Buildings). These three measures, in addition to reducing GHG emissions, will save energy, improve air quality and public health in the region, and conserve water and other natural resources. As the county and state continue to experience a historic drought, water conservation will remain an especially important co-benefit.

On the state level, the RPS and the Pavley measures have the greatest potential to reduce emissions in the City. Of the regional measures, the measures with the greatest impact are the Community Choice Aggregation (CCA) measure, the waste-to-energy measure, and the waste diversion measure.

Table 5.8-5 presents the individual GHG reduction measures that Sonoma has selected for the CAP.

### City of Sonoma Electric Municipal Vehicle Fleet

Along with the other communities in the county, the City of Sonoma joined the Sonoma County Local Government Electric Vehicle (EV) Partnership to collaborate as a region on the implementation of EVs and EV charging infrastructure. Purchasing electric vehicles for the City's municipal vehicle fleet, and constructing vehicle charging infrastructure will help the City reduce its municipal operations GHG emissions.

**Table 5.8-5. Sonoma 2020 GHG Emissions Reductions by Measure**

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate
<b>State and Regional Measures</b>		
<b>Goal 1: Increase Building Energy Efficiency</b>		
Measure 1-S1: Title 24 Standards for Commercial and Residential Buildings	741	N/A
Measure 1-S2: Lighting Efficiency and Toxics Reduction Act (AB1109)	901	N/A
Measure 1-S3: Industrial Boiler Efficiency	-	N/A
Measure 1-R1: Community Energy Efficiency Retrofits for Existing Buildings	39	N/A
Measure 1-R2: Expand the Community Energy Efficiency Retrofits Program	493	N/A
<b>Goal 2: Increase Renewable Energy Use</b>		
Measure 2-S1: Renewables Portfolio Standard	7,998	N/A
Measure 2-S2: Solar Water Heaters	34	N/A
Measure 2-R1: Community Choice Aggregation	2,415	N/A
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>		
Measure 5-R1: Improve and Increase Transit Service	< 1	N/A
Measure 5-R2: Supporting Transit Measures	NQ	N/A
Measure 5-R3: Sonoma-Marin Area Rail Transit	NQ	N/A
Measure 5-R4: Trip Reduction Ordinance	239	N/A
Measure 5-R5: Supporting Measures for the Transportation Demand Management Program	NQ	N/A
Measure 5-R6: Reduced Transit Passes	221	N/A
Measure 5-R7: Alternative Travel Marketing & Optimize Online Service	177	N/A
Measure 5-R8: Safe Routes to School	572	N/A
Measure 5-R9: Car-sharing Program	NQ	N/A
Measure 5-R10: Bike Sharing Program	NQ	N/A
<b>Goal 6: Increase Vehicle and Equipment Fuel Efficiency</b>		

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
Measure 6-S1: Pavley Emissions Standards for Passenger Vehicles and the Low Carbon Fuel Standard	12,097	N/A	
Measure 6-S2: Advanced Clean Cars	288	N/A	
Measure 6-S3: Assembly Bill 32 Vehicle Efficiency Measures	755	N/A	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>604</b>		
Measure 7-S1: Low Carbon Fuel Standard: Off-Road	173	N/A	
Measure 7-R1: Shift Sonoma County (Electric Vehicles)	431	N/A	
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>3,012</b>		
Measure 9-R1: Waste Diversion Goal	3,012	N/A	
<b>Goal 10: Increase Capture and Use of Methane from Landfills</b>	<b>4,190</b>		
Measure 10-R1: Increase Landfill Methane Capture and Use for Energy	4,190	N/A	
<b>Goal 11: Reduce Water Consumption</b>			
Measure 11-R1: Countywide Water Conservation Support and Incentives	NQ	N/A	
<b>Goal 13: Increase Water and Wastewater Infrastructure Efficiency</b>	<b>16</b>		
Measure 13-R1: Infrastructure and Water Supply Improvement	2	N/A	
Measure 13-R2: Wastewater Treatment Equipment Efficiency*	14	N/A	
<b>Goal 14: Increase Use of Renewable Energy in Water and Wastewater Systems</b>	<b>310</b>		
Measure 14-R1: Sonoma County Water Agency Carbon Free Water by 2015	310	N/A	
<b>Local Measures</b>			
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>173</b>		
Measure 1-L2: Outdoor Lighting	172	80%	of outdoor lighting to participate
Measure 1-L3: Shade Tree Planting	1	50	trees planted

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
<b>Goal 2: Increase Renewable Energy Use</b>	<b>394</b>		
Measure 2-L1: Solar in New Residential Development	2	8%	of new houses to participate
Measure 2-L2: Solar in Existing Residential Building	245	11%	of existing homes with solar
Measure 2-L3: Solar in New Non-Residential Developments	7	2%	of new non-residential development to participate
Measure 2-L4: Solar in Existing Non-Residential Buildings	141	2%	of existing non-residential development with solar
<b>Goal 4: Reduce Travel Demand Through Focused Growth</b>	<b>18</b>		
Measure 4-L1: Mixed-Use Development in City Centers and Along Transit Corridors	16	50%	of growth to result in mixed use
Measure 4-L2: Increase Transit Accessibility	2	15%	of growth to be 25+ units
Measure 4-L3: Supporting Land Use Measures	NQ	Yes	
Measure 4-L4: Affordable Housing Linked to Transit	1	20%	of new development to be affordable
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>26</b>		
Measure 5-L4: Supporting Bicycle/Pedestrian Measures	NQ	Yes	
Measure 5-L5: Traffic Calming	26	80%	of trips affected
Measure 5-L7: Supporting Parking Policy Measures	NQ	Yes	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>24</b>		
Measure 7-L1: Electric Vehicle Charging Station Program	2	3	charging stations installed
Measure 7-L2: Electrify Construction Equipment	22	5%	of equipment
Measure 7-L3: Reduce Fossil Fuel Use in Equipment through Efficiency or Fuel Switching	NQ	Yes	
<b>Goal 8: Reduce Idling</b>			
Measure 8-L1: Idling Ordinance	NQ	2	minutes below state law
<b>Goal 11: Reduce Water Consumption</b>	<b>729</b>		

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
Measure 11-L1: Senate Bill SB X7-7 - Water Conservation Act of 2009*	436	10%	Reduction in per capita water use
Measure 11-L2: Water Conservation for New Construction*	16	50%/50%	% of new residential/nonresidential development
Measure 11-L3: Water Conservation for Existing Buildings*	278	25%/10%	% of new residential/nonresidential development
<b>Goal 12: Increase Recycled Water and Greywater Use</b>	<b>&lt; 1</b>		
Measure 12-L1: Greywater Use	< 1	2%	greywater goal
<b>State Measure Reductions in Sonoma</b>	<b>22,990</b>		
<b>Regional Measure Reductions in Sonoma</b>	<b>12,110</b>		
<b>Local Measure Reductions in Sonoma</b>	<b>1,360</b>		
<b>Grand Total Emissions Reductions in Sonoma</b>	<b>36,460</b>		

\*Measures reduce emissions from multiple sources (i.e. water and energy)  
NQ = not quantified

### 5.8.5 Municipal Greenhouse Gas Reduction Measures

Like the other cities and the county, Sonoma has recognized the need to reduce GHG emissions from municipal operations. The City has an existing program for using alternative fuels for its municipal fleet. Although municipal GHG reduction measures are not part of this countywide plan, action by the cities and the County to reduce municipal emissions is still important. Sonoma and the other local communities will continue to pursue actions that reduce GHG emissions from municipal operations. Descriptions of potential municipal GHG reduction measures are provided in Appendix E as an informational resource.

# Windsor

Commitments to meeting  
community greenhouse  
gas reduction goals.



## 5.9 Windsor

This section presents the community greenhouse gas (GHG) emissions profile specific to Windsor and the measures that the Town of Windsor will implement, with the support of the RCPA and other regional entities, as part of the regional approach to reducing GHG emissions.

### 5.9.1 Community Summary

The Town of Windsor is a family-oriented community with a diverse population, a robust economy, and strong ties to the surrounding Sonoma County wine country and nearby Russian River recreation areas. Windsor follows the “Smart Growth” model for development that favors a mix of land uses, walkable neighborhoods, compact building design, transportation choices, distinctive architecture, and a strong sense of community. Visitors to Windsor appreciate its small-town character, comfortable and welcoming pace, downhome atmosphere, and quality shopping, restaurants, summer concerts, special events, and public spaces. Windsor residents enjoy excellent educational, recreational, civic, and cultural facilities and services, including the award-winning Town Green, Keiser Community Park, and Foothill Regional Park. The Town values its cultural diversity and promotes opportunities for all residents to share their unique heritage and engage in the life of the community.

Windsor embraces the concept of sustainability and supports efforts to increase the resilience of its residents and businesses in response to the environmental, social, and economic effects of changing climate conditions. The Town promotes energy efficiency and the use of renewable energy and is recognized as a leader in water conservation and the use of recycled water. The Town consistently follows prudent fiscal policies and practices to ensure sufficient resources in times of economic downturn or other challenges. The location and timing of new development in Windsor is carefully managed in order to maximize community benefits and minimize the impact of development on existing infrastructure, public services, and the Town’s fiscal well-being. The Town’s voter-approved Urban Growth Boundary is intended to retain the Town’s small size, manage new growth and development, and maintain its rural surroundings.

### Demographics

Windsor spans 7.3 square miles and has largely residential and commercial land uses. The Town had a population of 26,801 as of the 2010 census. In 2020 the population is expected to be 28,190, an increase of 5% over 2010. Employment in the area is expected to increase by 15%. Windsor’s demographic composition in 2010 was 74% White, 0.8% African American, 2% Native American, 3% Asian, 0.2% Pacific Islander, 15% from other races, and 5% from two or more races. Persons of Hispanic or Latino origin were 32%. According to the 2010 Census data, the Town of Windsor is majority owner-occupied with only 24% of all housing units occupied by renters. This is the lowest percentage of renters in the county. Windsor’s current average household income is the highest in the county, and in terms of age demographics, its population is the youngest.



As shown in Table 5.9-1, the Town is expected to experience steady growth in population, housing, and jobs in the future.

**Table 5.9-1. Windsor Socioeconomic Data**

	Actual			Projected		
	1990	2010	2015	2020	2040	2050
Population	13,371	26,801	27,295	28,190	32,663	34,167
Housing	4,912	8,970	9,418	9,828	11,435	11,949
Employment	4,898	8,963	9,609	10,283	11,280	11,626

Socioeconomic data were derived from the SCTA travel demand model and incorporate input from the Town based on its internal planning forecasts.

### Energy and Water Use

Compared to households in the county as a whole, Windsor households use more electricity, natural gas, and water. This may be due to larger household sizes and a greater percentage of households with children. However, Windsor households use less electricity, natural gas, and water than households statewide.

**Table 5.9-2. Windsor, County, and State 2010 Average Energy and Water Use (per household, per year)**

	Windsor	County	State
Electricity (kWh)	7,145	7,042	9,320
Natural Gas (Therms)	503	413	512
Water Use (Gallons)	86,862	75,810	107,869

Sources:

Town Data: provided by PG&E (energy) and by the Town of Windsor Urban Water Management Plan.

County Data: provided by PG&E (energy) and the cities or their Urban Water Management Plans (water).

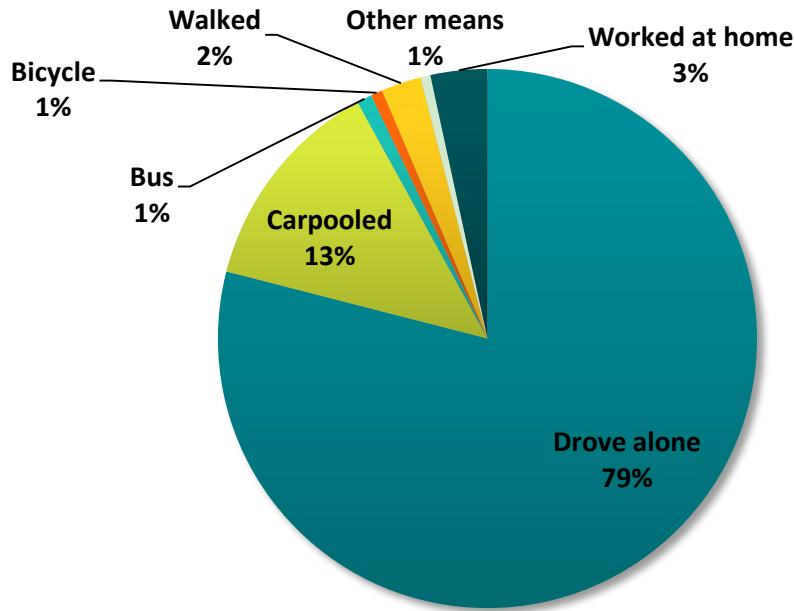
State Data: U.S. Energy Information Administration 2009, U.S. Geological Survey 2014, California Department of Finance 2015.

kWh = kilowatt hours

### Transportation Commute Modes

In inventory year 2010, most Windsor residents (79%) drove alone to work, with 13% carpooling. With the average trip to work for residents of Windsor taking 23.5 minutes and limited bus service, riding a bus is not a viable option for many Windsor residents (U.S. Census Bureau 2014).

**Figure 5.9-1. Modes to Work in Windsor in 2010**



Source: U.S. Census Bureau 2014: American Community Survey 2006–2010

### 5.9.2 Windsor’s Existing Actions to Reduce GHG Emissions

Windsor has already taken a number of steps to reduce energy use, promote renewable energy use, and other actions that have been helping to reduce GHG emissions. The Town has adopted the following ordinances and General Plan policies that also help to reduce GHG emissions and will support the implementation of the formal GHG reduction measures in this CAP.

- Building Energy
  - Residential Retrofits: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Residential Appliance Upgrades: Windsor Efficiency Pay-As-You-Save (PAYS®) program for water saving retrofit projects and appliances replacement. Also included as an implementation program in the Town’s 2015 General Plan Housing Element.
  - Solar Installations at Residences: Energy Upgrade California in Sonoma County – Whole House Upgrade Program.
  - Energy Conservation Measures – General Plan Policy: Chapter 6 (Energy) - H.1.6. Energy conservation measures such as insulation and weather stripping should be encouraged in existing structures through public education and financial assistance to low- and moderate-income families. General Plan Housing Element Policy 8.3 provides similar encouragement for residential buildings.

- Solar Access – General Plan Policy: Chapter 6 (Energy) – Policy H.1.2. New residential and non-residential development should provide for solar access and encourage the use of solar easements.
- Passive Heating and Cooling – General Plan Policy: Chapter 6 (Energy) – Policy H.1.4. New residential and subdivision developments should be required to consider opportunities for passive heating and cooling.
- CALGreen Building Standards Code: Title VII, Chapter 2, Article 11. Tier 1 measures for residential and non-residential structures adopted as mandatory. General Plan Housing Element Policy 8.1 contains similar policy language and also refers to the Town’s Green Building Ordinance.
- Energy Conservation Promotion – General Plan Policy: Chapter 6 (Air Quality) – Policy G.2.6. Promote energy conservation/efficiency programs.
- Resolution authorizing the Town’s participation in the Sonoma County Energy Independence Program and other PACE financing programs.
- Ordinance No. 2013-279: Authorization of the Implementation of a Community Choice Aggregation Program, Sonoma Clean Power (SCP).
- Land Use and Transportation
  - Bicycle and Pedestrian Master Plan.
  - Urban Growth Boundary – General Plan Policy: Chapter 4 (Community Development Pattern) – Policy B.1. Establish and Urban Growth Boundary with sufficient land to accommodate the Town’s growth for the next 20 years.
  - Transit Oriented Development: The Town adopted the Station Area/Downtown Specific Plan in 2012. The plan increases densities within a 1/4 of the intermodal center.
  - Transit Oriented Development – General Plan Housing Element Policy 8.5. The Town shall encourage residential development in proximity to the Sonoma-Marin Area Rail Transit (SMART) Station, consistent with the Windsor Station/Downtown Specific Plan, to reduce vehicle miles traveled and promote transit ridership.
  - Complete Streets - General Plan: Chapter 4 (Transportation) – Policy D.3.2. The Town shall consider the needs of transit riders, pedestrians, people in wheelchairs, cyclists, and others in long-range planning and street design.
  - Mixed Land Use – General Plan: Chapter 4 (Transportation) - Policy D.5.2. The Town should encourage higher density mixed land uses within walking distances of existing and future transit stops.
  - Land Use and Circulation – General Plan Policy: Chapter 6 (Energy) – Policy H.1.1. The Town should promote land use patterns that reduce operational energy requirements especially for transportation purposes.

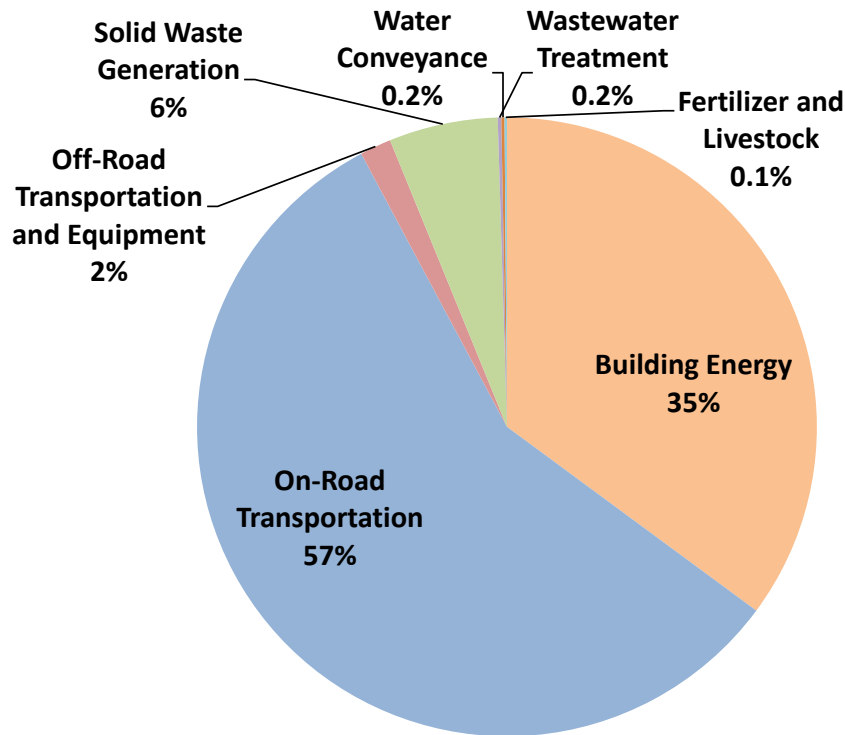
- Housing Element – General Plan Housing Element (Opportunities for Water Conservation) - Policy 8.1. The Town shall establish a development pattern that helps reduce vehicle miles traveled and promotes transit ridership, and pedestrian and bicycle access.
- Increased Transit Infrastructure – General Plan: Chapter 4 (Transportation) - Policy D.5.4. The Town shall require developers to construct, when appropriate, transit facilities including bus turnouts shelters and benches.
- Commitment to Increased Transit Service – General Plan Policy D.5.3. The Town should support expansion of local bus service, and should continue to provide paratransit services to qualified users.
- Carpooling – General Plan Policy: Chapter 6 (Air Quality) – Policy G.2.5. The Town should support and participate in regional carpooling, vanpooling, and other high occupancy vehicle efforts.
- Trip Reduction Ordinance: Municipal Code Title IV – Chapter 4. Employers within the Town with one hundred (100) or more employees at an individual job site shall disseminate trip reduction information regarding transportation alternatives including carpools, vanpools, transit and bicycling and other methods of reducing trips such as telecommuting, compressed work week and flexible work hours annually to each employee and to all new employees as they are hired.
- Energy Conservation Development Incentives – General Plan Program: Chapter 6 (Energy) – Implementation Program H.1. The Town shall consider reducing automobile parking area requirements for new developments in exchange for owner-supplied transit, in-lieu fee payments for public transit, vegetation that shades bike routes and parking lots in the summer, and other amenities.
- Installed public electric vehicle (EV) charging stations.
- Green Purchasing – General Plan Program: Chapter 6 – Implementation Program H.6. The Town should purchase energy-efficient automobiles and other equipment.
- Water and Wastewater Efficiency
  - Wastewater Methane Capture: The Town’s ongoing Modernization Study is evaluating a number of aspects of the treatment plant processes, including solids handling, and a review of potential methane capture may be included as part of the Study.
  - Water Fixture Retrofits (Windsor Pay-As-You-Save Program). On-bill water financing and retrofits.
  - Increase Waste Diversion in Municipal Facilities: The minimum required diversion rate in the Exclusive Franchise agreement is 45%. The minimum diversion rates in the Non-exclusive Franchise agreements (C&D debris) is 60% to 65%, depending on the franchisee.
  - Recycled Water: The Town has an extensive system of recycled water use, concentrated in the west side of Windsor.

- Water Conservation Techniques – General Plan Policy: Chapter 6 (Water Resources and Quality) – Policy C.1.2. Encourage water conservation through measures such as low-flow and low-flush toilets and showers, drought resistant landscaping, and using recycled water.
- Water Efficient Landscape Ordinance: Municipal Code Title XII, Chapter 3, Article 9. Creates provisions for the design, construction, installation and maintenance of the landscape resulting in water conserving climate-appropriate landscapes, improved water quality and the minimization of natural resource inputs.
- Conservation of Water Supply: Municipal Code Title XII, Chapter 3, Article 8. Ordinance relates to the suspension of new connections to the Town’s water system, waste of water prohibited, prohibition of non-essential use of water, and conditional use of sprinklers.
- Water Resources and Quality – General Plan: Chapter 6 (Water Resources and Quality) – Policy C.1. Protect and manage the Town’s surface water and groundwater resources to meet the needs of Windsor.
- Agriculture, Urban Forestry and Natural Areas
  - Open Space Preservation – General Plan Policy: Chapter 6 (Open Space) – Policy A.1. Preserve open space land for commercial agricultural and productive uses, the protection and use of natural resources, the enjoyment of scenic beauty and recreation, and protection from natural hazards.
  - Agricultural Perpetuity – General Plan Policy: Chapter 6 (Agricultural Lands) – Policy B.1.1. The Town shall encourage the County to preserve agricultural activities on state-designated important farmlands and on prime soils outside the Urban Growth Boundary in recognition that prime agricultural land (defined as Class I and II soils by the U.S. Soil Conservation Service) is an irreplaceable natural resource. Town’s Zoning Ordinance (Chapter 27.24: Agricultural Preservation) requires agricultural buffers.
  - Legal Mechanisms for Open Space Protection – General Plan Policy: Chapter 6 (Open Space) – Policy A.1.7. Employ actions such as land acquisition, conservation easements, dedications and property owner/developer exactions, and impact mitigations to protect open space.
  - Resource Preservation – General Plan Policy: Chapter 6 (Open Space) – Policy A.1.2. Encourage the preservation of oak woodlands, productive farmlands, riparian corridors, and visually prominent hillsides and ridgelines.
  - Clustering Development – General Plan: Chapter 6 (Open Space) Policy A.1.2: The Town shall encourage the preservation of sensitive environmental resource areas, such as oak woodlands, productive farmlands, riparian (creekside) corridors, and visually prominent hillsides and ridgelines through measures such as clustering development and conservation easements. Town’s Zoning Ordinance (Section 27.20.040: Creekside Development) requires setbacks and regulates development along creeks.

- Trees – General Plan Program: Chapter 6 (Biological Resources) – Implementation Program D.3. Develop regulations to define and protect oaks and heritage trees to be incorporated into the existing regulations. The Town has adopted Zoning Ordinance Chapter 27.36: Tree Preservation and Protection to implement this policy.

### 5.9.3 Greenhouse Gas Inventory and Forecast

**Figure 5.9-2. Windsor 2010 Community GHG Inventory by Source**



Windsor’s inventory is similar to other cities in the county and state. The majority of the GHG emissions are from transportation due to fossil fuel combustion in personal and light-duty vehicles. The next largest source is building energy, which includes emissions related to energy used to heat the homes and business in Windsor. Residential uses account for most (69%) of the building energy emissions in Windsor. Commercial uses account for 31% of building energy emissions. The other categories of emissions are much smaller in comparison to building energy and on-road transportation.

Total GHG emissions generated by community activities in 2010 were 157,830 MTCO<sub>2</sub>e, which is approximately 4% of countywide GHG emissions in the same year. This is a 19% increase from estimated 1990 emissions, which were 133,000 MTCO<sub>2</sub>e. This is due to the socioeconomic growth experienced in the Town. Between 1990 and 2010, the Town experienced substantial growth. Population in the Town doubled, and the number of houses and jobs nearly doubled. Table 5.9-3 shows the 1990 backcast, the 2010 inventory and business-as-usual (BAU) forecasts for 2015, 2020, 2040 and 2050 for the Town of Windsor.

**Table 5.9-3. Windsor Community GHG Backcast, Inventory, and BAU Forecasts**

Source	1990 Backcast		2010 Inventory		2015 Forecast		2020 Forecast		2040 Forecast		2050 Forecast	
Building Energy	34,600	26%	55,500	35%	61,450	34%	64,640	34%	73,760	35%	76,740	35%
On-Road Transportation	77,700	58%	90,210	57%	103,730	58%	109,250	58%	119,140	56%	119,910	55%
Off-Road Transportation and Equipment	1,400	1%	2,580	2%	3,060	2%	3,660	2%	7,100	3%	7,380	3%
Solid Waste	17,150	13%	8,980	6%	9,330	5%	9,780	5%	11,080	5%	11,520	5%
Wastewater Treatment	150	0%	290	0.2%	300	0%	310	0%	360	0%	370	0%
Water Conveyance	1,990	1%	260	0.2%	440	0%	470	0%	570	0%	590	0%
<b>Total</b>	<b>133,000</b>	<b>100%</b>	<b>157,830</b>	<b>100%</b>	<b>178,300</b>	<b>100%</b>	<b>188,120</b>	<b>100%</b>	<b>212,010</b>	<b>100%</b>	<b>216,520</b>	<b>100%</b>
<b>Per-Capita Emissions</b>	<b>9.9</b>		<b>5.9</b>		<b>6.5</b>		<b>6.7</b>		<b>6.5</b>		<b>6.3</b>	

#### 5.9.4 Greenhouse Gas Reduction Goal and Measures

The Town of Windsor joins the other Sonoma County communities to support the regional GHG emissions reduction target of 25% below 1990 countywide emissions by 2020 through adoption of 21 local GHG reduction measures. The Town’s GHG emissions under 2020 BAU conditions (in absence of state, regional, and local reduction measures) would be approximately 188,120 MTCO<sub>2</sub>e. The Town’s local GHG reduction measures, in combination with state and regional measures, would reduce the Town’s GHG emissions in 2020 to 127,720 MTCO<sub>2</sub>e, which would be a reduction of approximately 32% compared to 2020 BAU conditions. The Town will achieve these reductions through reduction measures that are technologically feasible and cost-effective per AB 32 through a combination of state (66%), regional (26%), and local (8%) efforts. With the reduction measures in CA2020, per-capita emissions in Windsor will be 4.5 MTCO<sub>2</sub>e per person, a 54% reduction in per capita emissions compared to 1990.

**Table 5.9-4. Windsor 2020 GHG BAU Emissions, Reductions, and CAP Emissions**

Source	2020 BAU Forecast	Reductions				2020 CAP Emissions	% Reduction from BAU
		State	County-wide	Local	Total		
Building Energy	64,640	14,160	4,270	3,010	21,440	43,200	33%
On-Road Transportation	109,250	25,530	2,950	430	28,900	80,350	26%
Off-Road Transportation and Equipment	3,660	320	-	30	360	3,310	10%
Solid Waste	9,780	-	7,830	-	7,830	1,950	80%
Water Conveyance	470	-	440	1,370	1,810	- <sup>1</sup>	100%
Wastewater Treatment	310	-	60	-	60	250	19%
<b>Total Emissions</b>	<b>188,120</b>	<b>40,020</b>	<b>15,540</b>	<b>4,840</b>	<b>60,390</b>	<b>127,720</b>	<b>32%</b>
		<b>66%</b>	<b>26%</b>	<b>8%</b>			

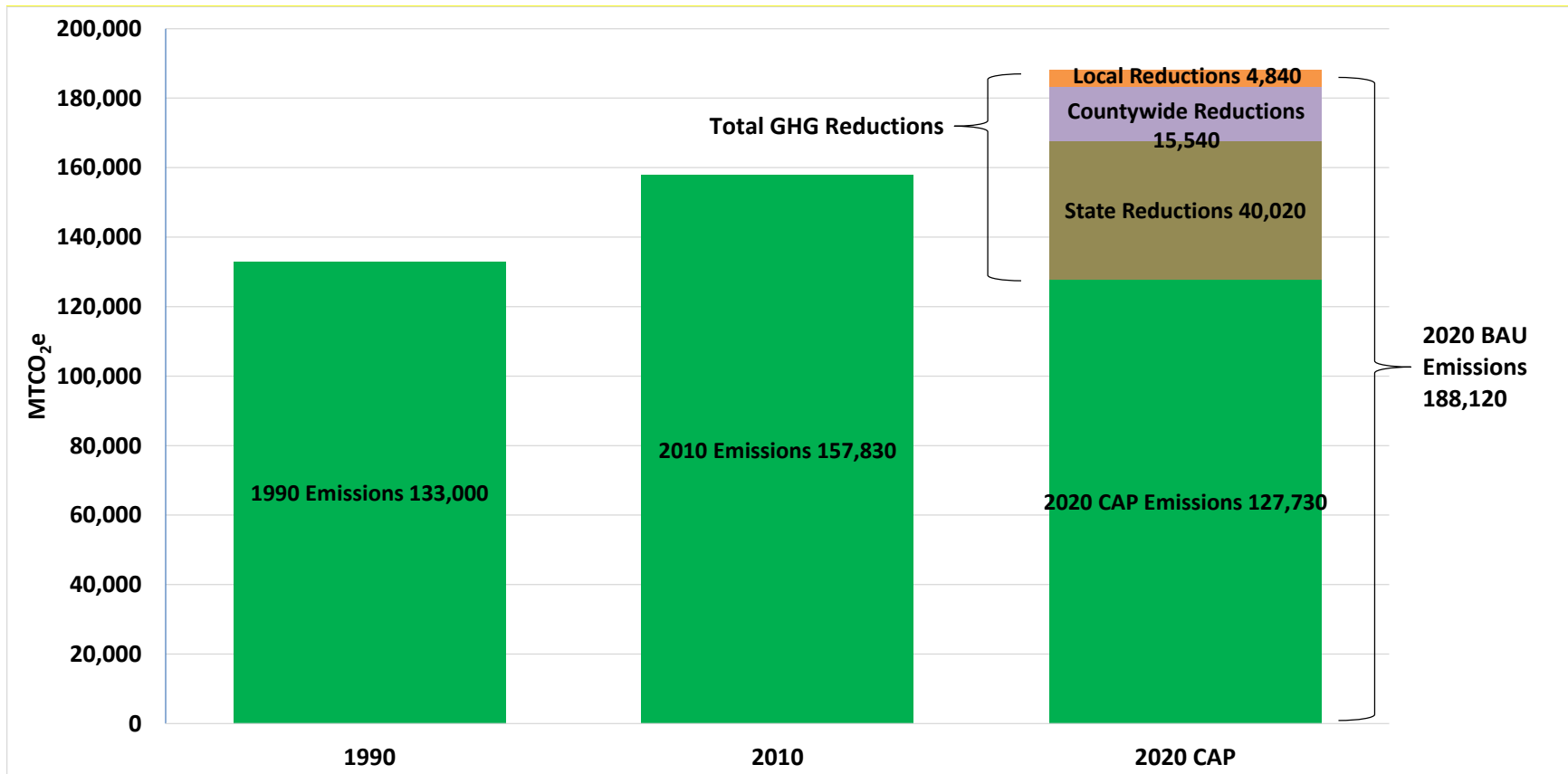
Values may not sum due to rounding.

<sup>1</sup> The CAP reduction for the water conveyance sector is greater than 2020 BAU emissions because it contains emission reductions from multiple sectors. Water conveyance measures reduce improve efficiency, which reduces electricity use within the building energy sector.

Figure 5.9-3 shows Windsor’s 1990 and 2010 GHG emissions total, 2020 BAU emissions forecast total, and the total emissions remaining after implementation of the Town’s reduction measures. The contribution of state, regional, and local reductions are overlaid on the 2020 BAU emissions forecast total, representing the total emissions reductions achieved in 2020. Like the other communities, Windsor benefits greatly from the work the state and regional entities are committed to implementing on climate action See Chapter 3 for more information on state and regional actions.



**Figure 5.9-3. Windsor 1990, 2010, and 2020 GHG Emissions; 2020 State, Regional, and Local Reductions**



## Greenhouse Gas Reduction Measures by Source

As shown in Table 5.9-5, the Town of Windsor will achieve its reduction goal through a combination of state, regional, and local measures. State reduction measures are implemented through state law, including some that require action by the Town to comply with state mandates (e.g., Title 24 energy efficiency measures). State measure reductions total 40,020 MTCO<sub>2</sub>e, which include the Pavley vehicle fuel efficiency standards, Title 24 building standards, the state's low carbon fuel standard, and the RPS, which will reduce GHG emissions from Windsor's on-road and off-road transportation, and building energy use in 2020.

Regional measures will reduce emissions by 15,540 MTCO<sub>2</sub>e and will be implemented by regional entities, including the Regional Climate Protection Authority (RCPA), Sonoma County Water Agency (SCWA), County of Sonoma Energy Independence Office (ESD), Sonoma County Transportation Authority (SCTA), and Sonoma Clean Power (SCP).

An additional reduction of 4,840 MTCO<sub>2</sub>e will be achieved through local measures. The locally adopted measures, although not as high-achieving of GHG reductions as the state and regional measures, are important because they represent the actions that local communities can take directly. The communities have local control over their infrastructure and policies and have selected the local measures that best suit the needs of their community.

The three measures that will have the greatest impact in Windsor are, in order of importance, Measure 2-L4 (Solar in Existing Non-Residential Buildings), Measure 2-L2 (Solar in Existing Residential Buildings), and Measure 11-L1 (Senate Bill SB X7-7 - Water Conservation Act of 2009). These three measures, in addition to reducing GHG emissions, will provide co-benefits that save energy, reduce utility costs, improve air quality and public health in the region, and conserve water and other natural resources. As the county and state continue to experience a historic drought, water conservation will remain an especially important co-benefit.

On the state level, the RPS and the Pavley measures have the greatest potential to reduce emissions in the Town. Of the regional measures, the measures with the greatest impact include the Community Choice Aggregation (CCA) measure, the waste-to-energy measure, and the waste diversion measure.

Table 5.9-5 presents the individual GHG reduction measures that Windsor has selected for the CAP. For more information on the specifics of each measure, see Appendix C.

### Windsor High School Sustainability

Windsor High School has become a model of sustainability, with significant help from the Town. The high school practices aggressive recycling, water conservation, energy efficiency, and uses alternative fuels in school buses. The Town has helped and encouraged the high school to adopt these practices by offering free waste disposal in exchange for the school strongly emphasizing recycling to students, and by providing recycled water at no cost to the school for landscape irrigation and toilet flushing.

**Table 5.9-5. Windsor 2020 GHG Emissions Reductions by Measure**

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate
<b>State and Regional Measures</b>		
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>3,699</b>	
Measure 1-S1: Title 24 Standards for Commercial and Residential Buildings	1,086	N/A
Measure 1-S2: Lighting Efficiency and Toxics Reduction Act (AB1109)	1,357	N/A
Measure 1-S3: Industrial Boiler Efficiency	-	N/A
Measure 1-R1: Community Energy Efficiency Retrofits for Existing Buildings	347	N/A
Measure 1-R2: Expand the Community Energy Efficiency Retrofits Program	909	N/A
<b>Goal 2: Increase Renewable Energy Use</b>	<b>14,729</b>	
Measure 2-S1: Renewables Portfolio Standard	11,656	N/A
Measure 2-S2: Solar Water Heaters	64	N/A
Measure 2-R1: Community Choice Aggregation	3,010	N/A
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>2,158</b>	
Measure 5-R1: Improve and Increase Transit Service	19	N/A
Measure 5-R2: Supporting Transit Measures	NQ	N/A
Measure 5-R3: Sonoma-Marín Area Rail Transit	NQ	N/A
Measure 5-R4: Trip Reduction Ordinance	412	N/A
Measure 5-R5: Supporting Measures for the Transportation Demand Management Program	NQ	N/A
Measure 5-R6: Reduced Transit Passes	381	N/A
Measure 5-R7: Alternative Travel Marketing & Optimize Online Service	305	N/A
Measure 5-R8: Safe Routes to School	1,041	N/A

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate
Measure 5-R9: Car-sharing Program	NQ	N/A
Measure 5-R10: Bike Sharing Program	NQ	N/A
<b>Goal 6: Increase Vehicle and Equipment Fuel Efficiency</b>	<b>25,532</b>	
Measure 6-S1: Pavley Emissions Standards for Passenger Vehicles and the Low Carbon Fuel Standard	23,793	N/A
Measure 6-S2: Advanced Clean Cars	756	N/A
Measure 6-S3: Assembly Bill 32 Vehicle Efficiency Measures	982	N/A
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>1,111</b>	
Measure 7-S1: Low Carbon Fuel Standard: Off-Road	324	N/A
Measure 7-R1: Shift Sonoma County (Electric Vehicles)	787	N/A
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>2,893</b>	
Measure 9-R1: Waste Diversion Goal	2,893	N/A
<b>Goal 10: Increase Capture and Use of Methane from Landfills</b>	<b>4,935</b>	
Measure 10-R1: Increase Landfill Methane Capture and Use for Energy	4,935	N/A
<b>Goal 11: Reduce Water Consumption</b>		
Measure 11-R1: Countywide Water Conservation Support and Incentives	NQ	N/A
<b>Goal 13: Increase Water and Wastewater Infrastructure Efficiency</b>	<b>59</b>	
Measure 13-R1: Infrastructure and Water Supply Improvement	1	N/A
Measure 13-R2: Wastewater Treatment Equipment Efficiency*	58	N/A
<b>Goal 14: Increase Use of Renewable Energy in Water and Wastewater Systems</b>	<b>438</b>	
Measure 14-R1: Sonoma County Water Agency Carbon Free Water by 2015	438	N/A

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
<b>Local Measures</b>			
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>135</b>		
Measure 1-L1: Expand the Green Building Ordinance Energy Code	62	10	points beyond Title 24
Measure 1-L2: Outdoor Lighting	68	25%	of outdoor lighting to participate
Measure 1-L3: Shade Tree Planting	5	500	trees planted
<b>Goal 2: Increase Renewable Energy Use</b>	<b>2,715</b>		
Measure 2-L1: Solar in New Residential Development	37	25%	of new houses to participate
Measure 2-L2: Solar in Existing Residential Building	868	15%	of existing homes with solar
Measure 2-L3: Solar in New Non-Residential Developments	13	5%	of new non-residential development to participate
Measure 2-L4: Solar in Existing Non-Residential Buildings	1,798	25%	of existing non-residential development with solar
<b>Goal 3: Switch Equipment from Fossil Fuel to Electricity</b>	<b>162</b>		
Measure 3-L1: Convert to Electric Water Heating	162	10%	of households
<b>Goal 4: Reduce Travel Demand Through Focused Growth</b>	<b>311</b>		
Measure 4-L1: Mixed-Use Development in City Centers and Along Transit Corridors	282	50%	of growth to result in mixed use
Measure 4-L2: Increase Transit Accessibility	23	15%	of growth to be 25+ units
Measure 4-L3: Supporting Land Use Measures	NQ	Yes	
Measure 4-L4: Affordable Housing Linked to Transit	6	15%	of new development to be affordable
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>83</b>		
Measure 5-L4: Supporting Bicycle/Pedestrian Measures	NQ	Yes	
Measure 5-L5: Traffic Calming	83	100%	of trips affected

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
Measure 5-L7: Supporting Parking Policy Measures	NQ	Yes	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>63</b>		
Measure 7-L1: Electric Vehicle Charging Station Program	31	50	charging stations installed
Measure 7-L2: Electrify Construction Equipment	32	5%	of equipment
Measure 7-L3: Reduce Fossil Fuel Use in Equipment through Efficiency or Fuel Switching	NQ	Yes	
<b>Goal 11: Reduce Water Consumption</b>	<b>1,368</b>		
Measure 11-L1: Senate Bill SB X7-7 - Water Conservation Act of 2009*	788	15%	Reduction in per capita water use
Measure 11-L2: Water Conservation for New Construction*	103	100%/50%	% of new residential/nonresidential development
Measure 11-L3: Water Conservation for Existing Buildings*	478	25%/10%	% of new residential/nonresidential development
<b>State Measure Reductions in Windsor</b>	<b>40,020</b>		
<b>Regional Measure Reductions in Windsor</b>	<b>15,540</b>		
<b>Local Measure Reductions in Windsor</b>	<b>4,840</b>		
<b>Grand Total Emissions Reductions in Windsor</b>	<b>60,390</b>		

\*Measures reduce emissions from multiple sources (i.e. water and energy)  
NQ = not quantified

### 5.9.5 Municipal Greenhouse Gas Reduction Measures

Like the other cities and the county, Windsor has recognized the need to reduce GHG emissions from municipal operations. The Town of Windsor completed an assessment of GHG emissions for municipal facilities in 2003, thereby establishing a baseline for year 2000. The Town Council demonstrated leadership on this issue by adopting a GHG Emission Reduction Action Plan in 2008, documenting a path to a 26.2% reduction in GHG emissions by 2020. Progress toward the Town goal is reviewed by the Town Council every 2 years. The most recent review, in April 2015, showed that the Town is on track to meet and perhaps even exceed its GHG reduction goal. (Gilliran Energy Management, Inc., 2015)

Over the last decade, the Town has implemented a number of energy reduction projects that will also result in GHG reductions. These include lighting upgrades, street lighting conversions to LED, a PV system atop the municipal gymnasium, cool roofs to reflect sunlight to avoid overheating buildings, water supply pump retrofits, and the purchase of energy-efficient vehicles including hybrids. The Town also purchases diesel fuel with 5% biodiesel, reducing emissions from diesel-fueled vehicles. The Town estimates that the combination of all these actions will result in a projected 35% reduction (below 2,000 levels) of GHG emissions from Town-owned and -operated equipment and facilities by 2020.

Although municipal GHG reduction measures are not part of this countywide plan, action by the cities and the County to reduce municipal emissions is still important. Windsor and the other local communities will continue to pursue actions that reduce GHG emissions from municipal operations. Descriptions of potential municipal GHG reduction measures are provided in Appendix E as an informational resource.

# Unincorporated Sonoma County

Commitments to meeting  
community greenhouse  
gas reduction goals.





## 5.10 Unincorporated Sonoma County

This section presents the community greenhouse gas (GHG) emissions profile specific to the unincorporated county and the measures that the County of Sonoma will implement, with the support of the RCPA and other regional entities, as part of the regional approach to reducing GHG emissions.

### 5.10.1 Community Summary

The unincorporated portion of Sonoma County includes all areas not within the jurisdictional limits of Cloverdale, Cotati, Healdsburg, Petaluma, Rohnert Park, Santa Rosa, Sebastopol, Sonoma, or Windsor. Located in Northern California in the heart of Wine Country, Sonoma County has a unique position near the Pacific Ocean and the San Francisco Bay Area. Sonoma County is renowned for its scenic landscapes—from open hillsides, plentiful valleys, celebrated vineyards, and agricultural lands to the Russian River and the picturesque Sonoma Coast. The geographic features and climatic variation of Sonoma County contributes to its success in wine production and other agricultural activities. Sonoma County's land uses reflect the residential and rural values of the county while supporting strong local industries.

### Demographics

The unincorporated county covers approximately 1,684 square miles (the entire county is 1,768 square miles) and has largely residential, commercial, and agricultural land uses. The unincorporated county had a population of 121,281 as of the 2010 census. In 2020, the population is expected to be 124,100, an increase of 2% compared to 2010. Employment in the area is expected to increase by 14%.

The countywide demographic composition in 2010 was 87% White, 0.5% African American, 0.5% Native American, 3% Asian, 0.2% Pacific Islander, 7% from other races, and 2.5% from two or more races (demographic composition data for the unincorporated county is not available). Persons of Hispanic or Latino origin were 15%.

As shown in Table 5.10-1, the unincorporated portion of the county is expected to experience steady growth in population, housing, and jobs in the future.

**Table 5.10-1. Unincorporated County Socioeconomic Data**

	Actual			Projected		
	1990	2010	2015	2020	2040	2050
Population	146,796	121,281	123,025	124,100	134,121	140,390
Housing	54,633	49,049	49,933	50,894	55,234	57,755
Employment	45,413	41,486	44,367	47,257	49,852	51,579

Socioeconomic data were derived from the SCTA travel demand model and incorporate input from the County based on its internal planning forecasts.

According to the 2010 Census, housing in the unincorporated areas of the county is majority owner-occupied with 63% of all housing units owned and 37% rented.

### Energy and Water Use

Compared to households in the county as a whole, households in the unincorporated areas use less natural gas but more electricity and water. Households in the unincorporated county are, overall, located in more rural areas, which are generally less efficient than households located in more urbanized areas. Larger, more rural houses typically have a higher water footprint because of increased landscaping needs. Unincorporated county households use less electricity, natural gas, and water than households statewide, however.

**Table 5.10-2. Unincorporated County, Total County, and State 2010 Average Energy and Water Use (per household, per year)**

	Unincorporated Sonoma County	All County	State
Electricity (kWh)	9,207	7,042	9,320
Natural Gas (Therms)	375	413	512
Water Use (Gallons)	93,365	75,810	107,869

Sources:

City Data: provided by PG&E (energy) and by the SCWA Urban Water Management Plan.

County Data: provided by PG&E (energy) and the cities or their Urban Water Management Plans (water).

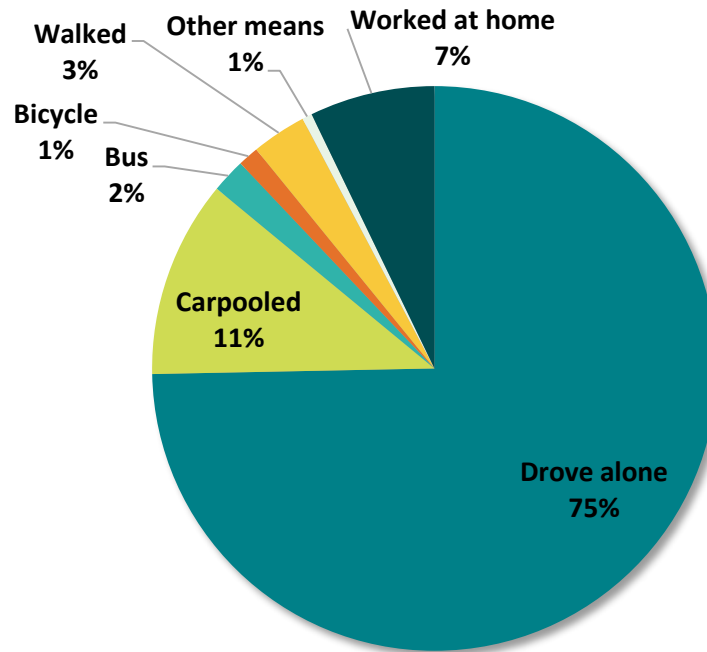
State Data: U.S. Energy Information Administration 2009, U.S. Geological Survey 2014, California Department of Finance 2015.

kWh = kilowatt hours

### Transportation Commute Modes

In the inventory year 2010, most unincorporated area residents (75%) drove alone to work and about 11% carpooled, which is similar to other Sonoma County communities. The average trip to work for the total county, including unincorporated and incorporated areas, is 25.3 minutes (U.S. Census Bureau 2014).

**Figure 5.10-1. Modes to Work in the Unincorporated County in 2010**



Source: U.S. Census Bureau 2014: American Community Survey 2006–2010

### 5.10.2 The County’s Existing Actions to Reduce GHG Emissions

The County has already taken a number of steps to reduce energy use, promote renewable energy use, and other actions that have already been helping to reduce GHG emissions. The County has also implemented projects and adopted ordinances and General Plan policies that would also help to reduce GHG emissions and will support the implementation of the formal GHG reduction measures in this CAP. These are summarized below.

- Building Energy
  - CALGreen Building Standards Code: County Code Chapter 7. Tier 1 measures for residential and non-residential structures adopted as mandatory.
  - Comprehensive Energy Project on County Facilities. Conservation measures employed at County facilities: Upgraded lighting technology, thermal energy storage, variable speed controls, and HVAC improvements.
  - Residential Retrofits: CDC retrofitted 1073 homes through housing/mobile home rehabilitation programs.
  - Property Assessed Clean Energy (PACE) Program: Via AB 811 and SB 555 property owners may finance energy and water efficiency and conservation, and renewable generation improvements to existing homes and business properties via a special voluntary property tax assessment.

- Sonoma PACE Financing Marketplace: The offering of multiple PACE financing products to property owners in the county including products such as the County's SCEIP, California FIRST, California HERO, and Figtree Finance.
- PACE Program Permitting and Inspection Procedures: Special permit procedure for energy and water conservation improvements financed through PACE; permitting for building projects not typically requiring permits.
- County of Sonoma Energy Independence Office: Serves as a community clearinghouse of information, tools, services, programs, financing information, and resources for the general public, contractor communities, and other public entities engaged in pursuing energy and water efficiency and renewable energy initiatives. The office operates and administers County programs including the Sonoma PACE Financing Marketplace (including SCEIP), Energy Watch Program, Green Business Program, Windsor Pay-As-You-Save, and the residential rebate program for Healdsburg Electric.
- Sonoma County Energy Watch (SCEW): a local government partnership between the County of Sonoma's Energy and Sustainability Division and PG&E designed to reduce energy usage and expenses. The program provides energy efficiency services to local governments, special districts, nonprofit organizations, and small to medium businesses. These services include: no-cost energy audits, technical assistance, project consultation, enhanced rebates and incentives, and an on bill financing option. Between the program's inception in 2009 and the end of 2014, nearly \$2 million in incentives have been paid to over 470 projects. The resulting energy savings are estimated to be 10,500,000 kWh/year.
- Sonoma County retrofit/renewables program: This program provides residential and commercial property owners with one-stop success to energy analysis, certified vendors, and a financing package for solar and energy efficiency retrofit projects, working in collaboration with SCEIP and leveraging that existing resource.
- Solar photovoltaic electrical generation at County facilities to augment county needs. 750 kW solar energy system plus 706 kW system at the Los Guilicos Juvenile Justice Center. The two PV systems are designed to generate enough clean energy to cover 100% of the campus electricity bills. This represents the average electricity use of 105 homes and is expected to reduce GHG by 324 metric tons over its 25-year life.
- The County's General Services Department has implemented 38 County facility energy efficiency projects on 24 different County-owned buildings. This work will ultimately save \$41.6 million in energy use over the lifetime of the improvements.
- Landfill Gas Power Plant: produces over 7 megawatts (MW) of renewable electrical energy 24 hours/day, 7 days/week, enough to power a community of 17,000 people. The electricity is sold to the Power and Water Resources Pooling Authority, which provides carbon-free electricity to SCWA, among other entities. A BioGas Filtration Plant (also called the CNG plant) was completed in February 2009. CNG produced at the Central

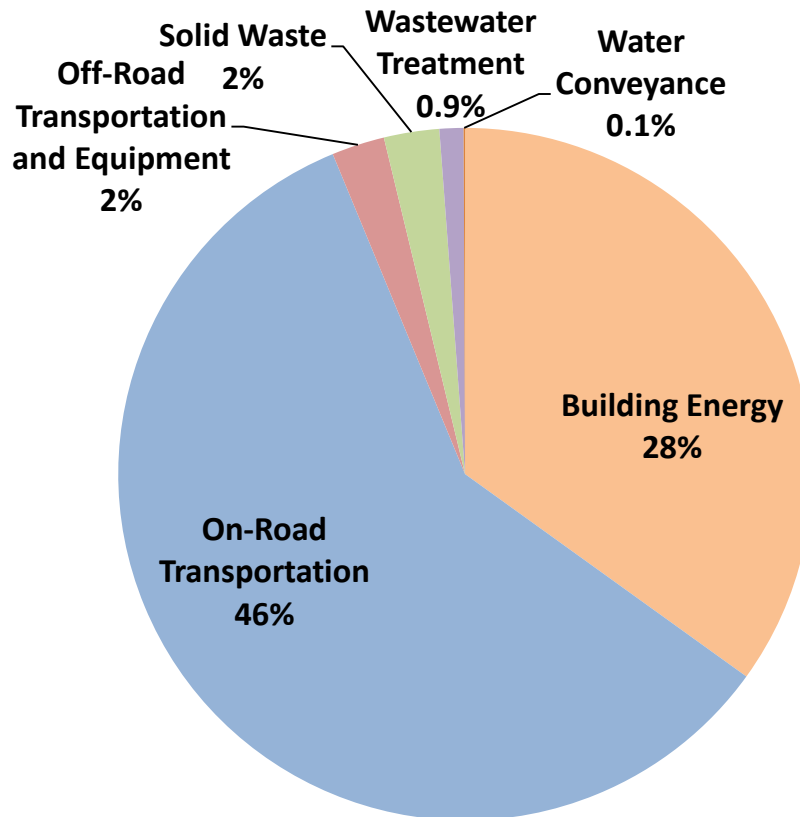
- Disposal Site is currently used to fuel select vehicles in the Sonoma County Transit bus fleet. The plant uses membrane filtration to convert landfill gas to vehicle fuel.
- Sonoma Clean Power Community Choice Aggregation (CCA): Several cities and the County formed SCP to provide electricity with a higher percentage of non-fossil fuel energy sources. Transmission, distribution, customer service and billing remain the same, delivered through the existing utility (PG&E).
  - Hydropower: The Warm Springs Dam was completed in 1984, a hydroelectric turbine was installed a few years later and has been producing electricity since the late 1980s. This turbine has a generation capacity of 2.6 MW. Since energy production is influenced by the flow of water through the dam, actual energy production is usually at about 1.3 MW. Actual annual energy production from 2006 to 2008 was approximately 11,800 to 14,800 megawatt-hours.
  - In 2013 the Sonoma County Zoning Code was amended to enable the construction and use of renewable energy facilities including bioenergy, geothermal, solar, wind, cogeneration, and similar technologies. Uses are now classified into two categories of Accessory systems and Commercial Facilities allowing streamlining with special use standards.
- Land Use and Transportation
    - Fleet Operations Division: Sonoma County was named the #1 2015 Government Green Fleet in North America Award Winner and has been a Government Green Fleet Award Winner in 2010, 2011, 2012, 2013 and 2014. Other designations include a US Environmental Protection Agency (EPA) Clean Air Excellence Award Winner 2015, an Accredited NAFA Sustainable Fleet 2015, a Fleet Technology Top Tier Light & Medium Duty Efficient Fleet Award 2015, California EPA Governor's Environmental and Economic Leadership Award Winner 2013, a Green Fleet 40 Sustainability All Stars Award Winner 2013 and the Bay Area Climate Collaborative "Most EV-Ready Community" Award 2012 and 2011. Sonoma County Transit Fleet changes:
      - In 1990, Sonoma County's transit and paratransit fleets were 100% diesel powered. In 1996, the transition to CNG buses began with the addition of 15–40-foot heavy-duty coaches.
      - In 2000, approximately 31% of the Sonoma County Transit fleet was powered by natural gas and diesel vehicles dropped to 57%. During this period, more gasoline powered minibuses were introduced into the fixed-route fleet, representing approximately 12% of the fleet makeup.
      - By 2010, all of the County's 30- and 40-foot heavy duty coaches had transitioned to CNG, representing 92% of the fleet. The remainder of the fleet comprises small gasoline-powered minibuses. The 2013 fleet composition remains the same as 2010; however, the average vehicle age has decreased. With the delivery of nine new

(replacement) 40-foot CNG buses in 2014, the fleet total will remain the same, but the average vehicle age will again decrease.

- Waste Minimization and Recycling
  - AB 939 compliance for solid waste generation and diversion, which requires California cities, counties, and approved regional solid waste management to divert 25% of their solid waste by 1995 and 50% by year 2000 and afterward.
  - Sonoma Green Business Program: Provides certification and resources for small to medium-sized consumer-oriented businesses that express a desire to contribute to sustainability efforts through resource conservation.
  - Recycling Market Development Zone Program (RMDZ): Businesses that use recycled material in their products, and are located within RMDZs, are eligible for loans, technical assistance, relaxed building permits, and other incentives. The program originated from CalRecycle, but is administered at the local level by zone administrators throughout the state.
- Water and Wastewater Efficiency
  - Reduced size and cost of standard septic systems when low flow plumbing fixtures are installed.
  - Sonoma County Water Efficient Landscape Ordinance: County Code Chapter 7D3. Regulates the design, installation, and maintenance of new and rehabilitated landscapes in terms of plant selection, soil amendments, water features such as recycled water, and irrigation systems.
- Agriculture, Urban Forestry and Natural Areas
  - Open Space Conservation: Over 250,000 protected acres in the County, including 106,000 acres protected by the Sonoma County Agricultural Preservation and Open Space District as well as lands protected through other programs, including agricultural land preservation through the County's ongoing participation in the Williamson Act.

### 5.10.3 Greenhouse Gas Inventory and Forecast

**Figure 5.10-2. Unincorporated Sonoma County 2010 Community GHG Inventory by Source**



The unincorporated area's inventory is similar to cities in the county and state in many respects. The majority of the GHG emissions are from on-road transportation due to fossil fuel combustion in personal and light-duty vehicles. The next largest source is building energy, which includes emissions related to energy used to heat the homes, and business in the county. Most energy consumption in the unincorporated areas of the county is for residential purposes, with 57% of building energy emissions resulting from residential uses. Commercial energy use emissions account for 39% of building energy emissions. Emissions resulting from energy consumed for industrial purposes are a small fraction (4%) of total energy use emissions in the community. The other categories of emissions are much smaller in comparison to building energy and on-road transportation.

In the unincorporated county, total GHG emissions generated by community activities in 2010 were 1,004,510 MTCO<sub>2</sub>e, which is approximately 39% of countywide GHG emissions in the same year. This is a 19% decrease from estimated 1990 emissions, which were 1,244,320 MTCO<sub>2</sub>e. The decrease in emissions from 1990 is partly due to a decrease in population, employment, and housing for the unincorporated county, as the cities annexed unincorporated land into their limits. Therefore, a portion of the reduction in emissions is due to changes in the jurisdictional boundaries of the cities, and not actually due to a decrease in emission-generating activities within the unincorporated areas.

**Table 5.10-3. Unincorporated Sonoma County Community GHG Backcast, Inventory, and Forecasts**

<b>Source</b>	<b>1990 Backcast</b>		<b>2010 Inventory</b>		<b>2015 Forecast</b>		<b>2020 Forecast</b>		<b>2040 Forecast</b>		<b>2050 Forecast</b>	
Building Energy	502,330	40%	350,950	35%	386,270	36%	401,390	36%	430,210	36%	447,780	37%
On-Road Transportation	519,670	42%	590,970	59%	612,650	58%	657,210	58%	688,330	57%	680,920	56%
Off-Road Transportation and Equipment	26,550	2%	24,780	2%	27,010	3%	29,600	3%	43,640	4%	44,380	4%
Solid Waste	170,730	14%	25,900	3%	27,140	3%	28,320	3%	30,140	2%	31,320	3%
Wastewater Treatment	13,610	1%	11,240	1.1%	11,400	1%	11,500	1%	12,430	1%	13,010	1%
Water Conveyance	11,440	1%	660	0.1%	780	0%	790	0%	850	0%	890	0%
<b>Total</b>	<b>1,244,320</b>	<b>100%</b>	<b>1,004,510</b>	<b>100%</b>	<b>1,065,260</b>	<b>100%</b>	<b>1,128,810</b>	<b>100%</b>	<b>1,205,610</b>	<b>100%</b>	<b>1,218,310</b>	<b>100%</b>
<b>Per-Capita Emissions</b>	<b>8.5</b>		<b>8.3</b>		<b>8.7</b>		<b>9.1</b>		<b>9.0</b>		<b>8.7</b>	



#### 5.10.4 Greenhouse Gas Reduction Goal and Measures

The County of Sonoma in representing the unincorporated portion of the county joins the other Sonoma County communities to support the countywide GHG emissions reduction target of 25% below 1990 countywide emissions by 2020 through adoption of 24 local GHG reduction measures. The county’s GHG emissions under 2020 BAU conditions (in absence of state, regional, and local measures) would be approximately 1,128,810 MTCO<sub>2</sub>e. The county’s local GHG reduction measures, in combination with state and regional measures, would reduce the county’s GHG emissions in 2020 to 781,160 MTCO<sub>2</sub>e, which would be a reduction of approximately 31% compared to 2020 BAU conditions. The county will achieve these reductions through reduction measures that are technologically feasible and cost-effective per AB 32 through a combination of state (70%), regional (21%), and local (9%) efforts. Per-capita reductions in the county in 2020 would be 2.8 MTCO<sub>2</sub>e per person.

**Table 5.10-4. Unincorporated Sonoma County 2020 GHG BAU Emissions, Reductions, and CAP Emissions**

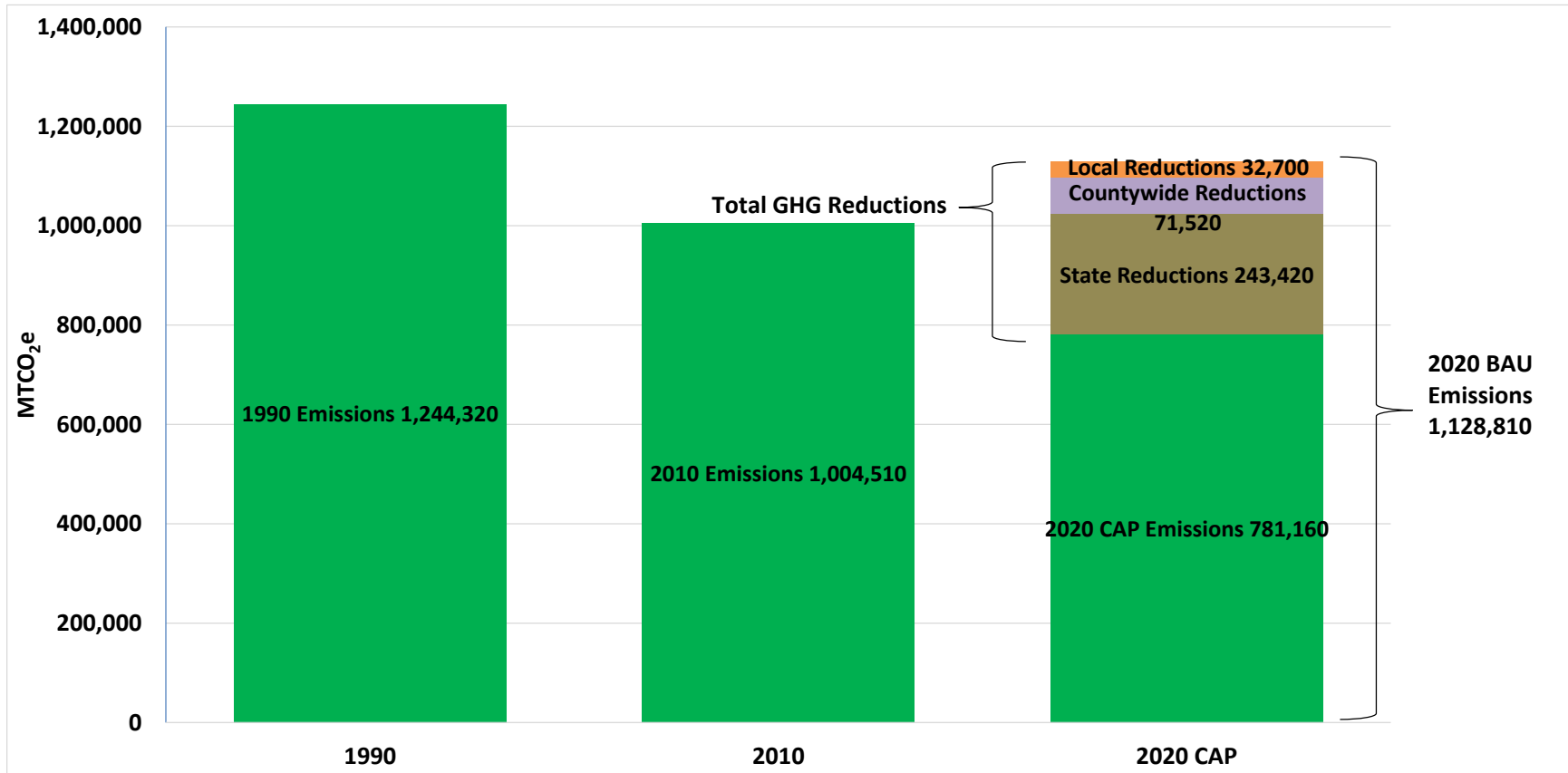
Source	2020 BAU Forecast	Reductions				2020 CAP Emissions	% Reduction From BAU
		State	County-wide	Local	Total		
Building Energy	401,390	100,930	32,800	19,650	153,370	248,020	38%
On-Road Transportation	657,210	139,870	17,450	8,250	165,570	491,640	25%
Off-Road Transportation and Equipment	29,600	2,620	-	70	2,690	26,910	9%
Solid Waste	28,320	-	20,630	-	20,630	7,690	73%
Water Conveyance	790	-	500	4,730	5,230	- <sup>1</sup>	100%
Wastewater Treatment	11,500	-	150	-	150	11,350	1%
<b>Total Emissions</b>	<b>1,128,810</b>	<b>243,420</b>	<b>71,520</b>	<b>32,700</b>	<b>347,650</b>	<b>781,160</b>	<b>31%</b>
		<b>70%</b>	<b>21%</b>	<b>9%</b>			

Values may not sum due to rounding.

<sup>1</sup> The CAP reduction for the water conveyance sector is greater than 2020 BAU emissions because it contains emission reductions from multiple sectors. Water conveyance measures reduce improve efficiency, which reduces electricity use within the building energy sector.

Figure 5.10-3 shows the county’s 1990 and 2010 GHG emissions total, 2020 BAU emissions forecast total, and the total emissions remaining after implementation of the county’s reduction measures. The contribution of state, countywide, and local reductions are overlaid on the 2020 BAU emissions forecast total, representing the total emissions reductions achieved in 2020. As noted above, the decrease in emissions from 1990 is partly due to changes in the jurisdictional boundaries of the cities, and not actually due to a decrease in emission-generating activities within the unincorporated county.

**Figure 5.10-3. Unincorporated Sonoma County 1990, 2010, and 2020 GHG Emissions; 2020 State and Local Reductions**



## Greenhouse Gas Reduction Measures

As shown in Table 5.10-5, the County of Sonoma will achieve its reduction goal through a combination of state, regional, and local measures. State reduction measures are implemented through state law, including some that require action by the County to comply with state mandates (e.g., Title 24 energy efficiency measures). State reductions total 243,420 MTCO<sub>2</sub>e, which include the Pavley vehicle standards, Title 24 building standards, the state's low carbon fuel standard, and the RPS.

Regional measures will reduce emissions by 71,520 MTCO<sub>2</sub>e and will be implemented by countywide entities, including RCPA, SCWA, County of Sonoma Energy Independence Office, SCTA, and SCP.

An additional reduction of 32,700 MTCO<sub>2</sub>e will be achieved through local measures. The locally adopted measures, although not as high-achieving of GHG reductions as the state and regional measures, are important because they represent the actions that local communities can take directly. The communities have local control over their infrastructure and policies and have selected the local measures that best suit the needs of their community.

The three measures that will have the greatest impact in the unincorporated county are, in order of importance, Measure 2-L4 (Solar in Existing Non-Residential Buildings), Measure 2-L2 (Solar in Existing Residential Buildings), and Measure 11-L1 (Senate Bill SB X7-7 - Water Conservation Act of 2009). These three measures, in addition to reducing GHG emissions, will save energy, and conserve natural resources.

On the state level, the RPS and the Pavley measures have the greatest potential to reduce emissions in the unincorporated county. Of the regional measures, those with the greatest impact are the Community Choice Aggregation (CCA) measure, the waste-to-energy measure, and the waste diversion measure.

Table 5.10-5 presents the individual GHG reduction measures that Sonoma County has selected for the CAP. For more information on the specifics of each measure, see Appendix C.

### Sonoma County Green Business Program

Sonoma County Green Business is an award winning program that has been verifying green businesses in the County for many years. The program ensures that businesses who want to be certified meet high standards of environmental performance. The standards that the program sets, in addition to reducing GHG emissions and helping the County meet its goal, ensure water and energy conservation, and reduce air pollutants that can cause health problems for certain populations.

**Table 5.10-5. Unincorporated Sonoma County 2020 GHG Emissions Reductions by Measure**

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate
<b>State and Regional Measures</b>		
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>23,979</b>	
Measure 1-S1: Title 24 Standards for Commercial and Residential Buildings	4,821	N/A
Measure 1-S2: Lighting Efficiency and Toxics Reduction Act (AB1109)	9,945	N/A
Measure 1-S3: Industrial Boiler Efficiency	345	N/A
Measure 1-R1: Community Energy Efficiency Retrofits for Existing Buildings	3,126	N/A
Measure 1-R2: Expand the Community Energy Efficiency Retrofits Program	5,744	N/A
<b>Goal 2: Increase Renewable Energy Use</b>	<b>108,726</b>	
Measure 2-S1: Renewables Portfolio Standard	85,487	N/A
Measure 2-S2: Solar Water Heaters	330	N/A
Measure 2-R1: Community Choice Aggregation	22,909	N/A
<b>Goal 3: Switch Equipment from Fossil Fuel to Electricity</b>	<b>1,022</b>	
Measure 3-R1: Stationary Fuel Switching Incentives	1,022	N/A
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>13,040</b>	
Measure 5-R1: Improve and Increase Transit Service	< 1	N/A
Measure 5-R2: Supporting Transit Measures	NQ	N/A
Measure 5-R3: Sonoma-Marín Area Rail Transit	NQ	N/A
Measure 5-R4: Trip Reduction Ordinance	2,516	N/A
Measure 5-R5: Supporting Measures for the Transportation Demand Management Program	NQ	N/A
Measure 5-R6: Reduced Transit Passes	2,330	N/A
Measure 5-R7: Alternative Travel Marketing & Optimize Online Service	1,864	N/A
Measure 5-R8: Safe Routes to School	6,336	N/A
Measure 5-R9: Car-sharing Program	NQ	N/A
Measure 5-R10: Bike Sharing Program	NQ	N/A

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
<b>Goal 6: Increase Vehicle and Equipment Fuel Efficiency</b>	<b>139,873</b>		
Measure 6-S1: Pavley Emissions Standards for Passenger Vehicles and the Low Carbon Fuel Standard	129,432	N/A	
Measure 6-S2: Advanced Clean Cars	3,545	N/A	
Measure 6-S3: Assembly Bill 32 Vehicle Efficiency Measures	6,896	N/A	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>7,029</b>		
Measure 7-S1: Low Carbon Fuel Standard: Off-Road	2,621	N/A	
Measure 7-R1: Shift Sonoma County (Electric Vehicles)	4,408	N/A	
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>8,303</b>		
Measure 9-R1: Waste Diversion Goal	8,303	N/A	
<b>Goal 10: Increase Capture and Use of Methane from Landfills</b>	<b>12,323</b>		
Measure 10-R1: Increase Landfill Methane Capture and Use for Energy	12,323	N/A	
<b>Goal 11: Reduce Water Consumption</b>			
Measure 11-R1: Countywide Water Conservation Support and Incentives	NQ	N/A	
<b>Goal 13: Increase Water and Wastewater Infrastructure Efficiency</b>	<b>257</b>		
Measure 13-R1: Infrastructure and Water Supply Improvement	104	N/A	
Measure 13-R2: Wastewater Treatment Equipment Efficiency*	153	N/A	
<b>Goal 14: Increase Use of Renewable Energy in Water and Wastewater Systems</b>	<b>391</b>		
Measure 14-R1: Sonoma County Water Agency Carbon Free Water by 2015	391	N/A	
<b>Local Measures</b>			
<b>Goal 1: Increase Building Energy Efficiency</b>	<b>404</b>		
Measure 1-L2: Outdoor Lighting	392	20%	of outdoor lighting to participate

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
Measure 1-L3: Shade Tree Planting	11	1,000	trees planted
Measure 1-L4: Co-Generation Facilities	1	10	MWh of cogeneration
<b>Goal 2: Increase Renewable Energy Use</b>	<b>19,242</b>		
Measure 2-L2: Solar in Existing Residential Building	5,402	15%	of existing homes with solar
Measure 2-L4: Solar in Existing Non-Residential Buildings	13,839	25%	of existing non-residential development with solar
<b>Goal 4: Reduce Travel Demand Through Focused Growth</b>	<b>681</b>		
Measure 4-L1: Mixed-Use Development in City Centers and Along Transit Corridors	681	20%	of growth to result in mixed use
Measure 4-L3: Supporting Land Use Measures	NQ	Yes	
<b>Goal 5: Encourage a Shift Toward Low-Carbon Transportation Options</b>	<b>7,569</b>		
Measure 5-L1: Local Transportation Demand Management Program	1,864	38%	of employees eligible
Measure 5-L2: Carpool-Incentives & Ride-Sharing Program	3,634	78%	of employees eligible
Measure 5-L3: Guaranteed Ride Home	NQ	Yes	
Measure 5-L4: Supporting Bicycle/Pedestrian Measures	NQ	Yes	
Measure 5-L5: Traffic Calming	518	100%	of trips affected
Measure 5-L6: Parking Policies	1,553	10%	of area affected
Measure 5-L7: Supporting Parking Policy Measures	NQ	Yes	
<b>Goal 7: Encourage a Shift Toward Low-Carbon Fuels in Vehicles and Equipment</b>	<b>3</b>		
Measure 7-L1: Electric Vehicle Charging Station Program	3	5	charging stations installed
Measure 7-L3: Reduce Fossil Fuel Use in Equipment through Efficiency or Fuel Switching	NQ	Yes	
<b>Goal 8: Reduce Idling</b>	<b>69</b>		
Measure 8-L1: Idling Ordinance	NQ	2	minutes below state law
Measure 8-L2: Idling Ordinance for Construction Equipment	69	2	minutes below state law

State, Regional, and Local Measures	2020 GHG Reductions	Participation Rate	
<b>Goal 9: Increase Solid Waste Diversion</b>	<b>3</b>		
Measure 9-L1: Create Construction and Demolition Reuse and Recycling Ordinance	3	3%	beyond baseline
<b>Goal 11: Reduce Water Consumption</b>	<b>4,712</b>		
Measure 11-L1: Senate Bill SB X7-7 - Water Conservation Act of 2009*	4,712	12%	Reduction in per capita water use
<b>Goal 12: Increase Recycled Water and Greywater Use</b>	<b>22</b>		
Measure 12-L1: Greywater Use	22	10%	greywater goal
<b>Goal 15: Reduce Emissions from Livestock Operations</b>	<b>NQ</b>		
Measure 15-L1: Encourage voluntary manure management techniques that reduce emissions from the decomposition of manure at dairies	NQ	Yes	
Measure 15-L2: Encourage dairies and livestock operations to explore ways to reduce GHG emissions from enteric fermentation	NQ	Yes	
<b>Goal 16: Reduce Emissions from Fertilizer Use</b>	<b>1,759**</b>		
Measure 16-L1: Encourage voluntary agricultural practices that reduce or eliminate the need for fertilizer (especially synthetic fertilizer)	1,759	Yes	
<b>State Measure Reductions in Unincorporated Sonoma County</b>	<b>243,420</b>		
<b>Regional Measure Reductions in Unincorporated Sonoma County</b>	<b>71,520</b>		
<b>Local Measure Reductions in Unincorporated Sonoma County</b>	<b>32,700</b>		
<b>Grand Total Emissions Reductions in Unincorporated Sonoma County</b>	<b>347,650</b>		

\* Measures reduce emissions from multiple sources (i.e. water and energy)

\*\*Reductions from this measure are included in the countywide accounting of GHG reductions and are not jurisdiction-specific reduction totals.

NQ = not quantified

### 5.10.5 Municipal Greenhouse Gas Reduction Measures

Like the cities in Sonoma County, County government has recognized the need to reduce GHG emissions from municipal operations. In 2006, the County adopted its “Climate Protection Action Plan.” The Plan includes measures to reduce energy and water consumption in County

government buildings and reductions in fleet vehicle fuel consumption and use of lower-carbon fuels, including electric vehicles, and set a target of reducing emissions from County operations by 20% by 2010. Implementation of this plan has been ongoing since adoption and the reduction target has been met and exceeded.

Although municipal GHG reduction measures are not part of this countywide plan, action by the cities and the County to reduce municipal emissions is still important. The County and the other local communities will continue to pursue actions that reduce GHG emissions from municipal operations. Descriptions of potential municipal GHG reduction measures are provided in Appendix E as an informational resource.



# 6. Readiness

## Sonoma County Climate Readiness



# Chapter 6

## Sonoma County Climate Readiness

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### 6.1 Introduction and Background

Sonoma County has long been a leader in addressing greenhouse gas (GHG) emissions and working to reduce the pace of climate change. Much of this work has focused on *climate mitigation*, which refers to reducing the amount of climate change, primarily through measures like those described in Chapter 3, *Reducing Community Emissions*.

However, even with the aggressive climate mitigation measures in Climate Action 2020 (CA2020), climate changes cannot be avoided entirely. Preparing for a changed climate is therefore a fundamental part of Sonoma County's overall climate action program. Reducing vulnerability to climate change hazards and bolstering community readiness to face the unavoidable climate impacts already underway are collectively referred to as *climate adaptation*. While climate mitigation and adaptation have different objectives, many strategies can be used to simultaneously achieve both goals (see Section 6.4.2).

This chapter provides a vulnerability assessment that evaluates potential impacts from anticipated climate change hazards on three key community resource areas. The assessment is not a comprehensive vulnerability analysis, nor does it provide site-specific prescriptions for action. Instead, the analysis provides a starting point for a countywide discussion on climate impacts and vulnerabilities and sets forth goals that the Regional Climate Protection Authority (RCPA) and local communities can use to guide future climate adaptation actions. This chapter also discusses strategies already underway to prepare for climate change, as well as recommendations for further improvement.

Information summarized in this chapter is drawn from the *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities* report prepared by North Bay Climate Adaptation Initiative (NBCAI) for RCPA (Cornwall et al. 2014). NBCAI is a non-governmental organization comprising natural resource managers, policy makers, and scientists committed to working together to create positive solutions to the problem of climate adaptation for the ecosystems and watersheds of Sonoma County.

### 6.2 Climate Change Projections

Climate change projections analyze the likelihood that certain climate conditions will occur in the future. Various climate change models include different assumptions regarding the amount, location, and timing of change, and are thus subject to uncertainty regarding their results. The two primary sources of uncertainty in climate projections are *natural variation* and *climate mechanics*. Natural variation includes numerous independent processes that drive natural

patterns on time scales ranging from minutes to seasons to decades, whereas climate mechanics refers to the complex physical processes that influence climate and how it responds to changing conditions. There is also uncertainty about how quickly and vigorously humanity will reduce GHG emissions. Given this uncertainty, climate change modeling projections are often considered “scenarios” based on long-term trends and estimates of variability (uncertainty is discussed in greater detail in the *Hazards and Vulnerabilities* report).

Despite the uncertainty and complexity inherent in climate change models, there are recurring themes that scientists agree are important to understanding what the future may hold for the region. Sonoma County already benefits from a number of cutting-edge efforts to understand climate trends, in part because local entities are key participants in these efforts. In particular, NBCAI used a set of projections for local temperature, precipitation, and hydrology across Sonoma County derived from the Basin Characterization Model (BCM) prepared by scientists from the U.S. Geological Survey and the University of California, Davis Center for the Environment (Flint et al. 2013). These projections were developed by applying global circulation models at a scaled-down resolution that helps identify watershed-level impacts of climate change here in Sonoma County.

Four of the BCM climate scenarios were selected to inform the vulnerability assessment. The two major variables among the four scenarios are GHG emission levels and precipitation. For example, if humans succeed in significantly reducing global GHG emissions in the near term (“mitigated GHG emissions”) and precipitation levels increase (“more precipitation”), the future will be “warm/wet.” Figure 6-1 identifies the scenarios based on the relationship among the two variables. The scenarios are described in greater detail in the *Hazards and Vulnerabilities* report.

**Figure 6-1. Future Climate Scenarios for Sonoma County**

	Less Precipitation	More Precipitation
High GHG Emissions (greater temperature increase)	Hot/Dry”	Hot/Wet
Mitigated GHG Emissions (less temperature increase)	Warm/Dry	Warm/Wet”

The difference between the “hot” and “warm” scenarios is based on the effects of higher GHG emissions versus lower (more mitigated) GHG emissions. There is uncertainty around precipitation in the global circulation models. Therefore, the difference between the “wet” and “dry” futures reflects the fact that different global climate models produce different rainfall projections.

### 6.3 Vulnerability Assessment

Climate vulnerability consists of the combined effect of exposure, sensitivity, and adaptive capacity, as defined below.

Different areas in Sonoma County will have different exposures to various climate change effects. For example, due to the county’s coastal location, it will not be exposed to flooding from increased and rapid snowmelt. However, portions of Sonoma County will likely be subjected to an increased future risk of sea-level rise. Therefore, *exposure* is how much change a species or system is likely to experience. Section 6.3.1 identifies the climate change exposures that are projected to occur in Sonoma County.

Baseline conditions in communities and natural systems will influence sensitivity to a particular climate exposure. For example, an increase in extreme heat events is likely to disproportionately harm people, plants, and animals not acclimatized to extreme heat. In all locations, extreme heat will do more harm to those with compromised or fragile health. *Sensitivity*, then, is a measure of whether and how much a species or system is likely to be affected by its exposure. Section 6.3.2 evaluates the sensitivity of various community resources to the climate change exposures identified in Section 6.3.1.

An adaptation capacity assessment—an evaluation of the ability to avoid, accommodate, or cope with climate change impacts—is not included in this chapter. However, strategies already underway to prepare for climate change and goals for further improvement are described in Sections 6.4 and 6.5.

### 6.3.1 Climate Change Hazards in Sonoma County

The BCM scenarios and other recent studies indicate that climate change could affect Sonoma County in the following ways.

#### Hotter, Drier Weather with Longer Summers



More extremely hot days



More frequent and intense droughts



More frequent and intense wildfires



Fewer winter nights that freeze

#### More Variable Rain



Greater risk of extreme floods

#### Sea Level Rise



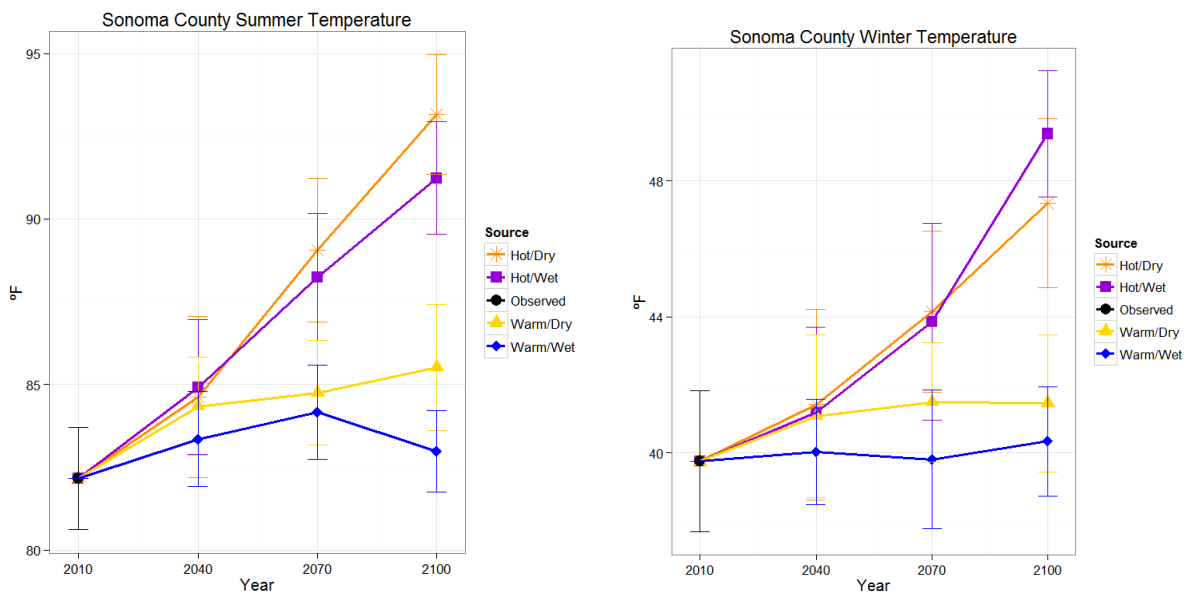
Higher sea level and storm surge

## Hotter, Drier Weather with Longer Summers



**Higher Average Temperatures and More Extreme Heat Events:** Sonoma County is expected to experience more very hot days and overall higher temperatures over a longer warm season. Average monthly maximum temperatures have already risen by 2.7 degrees Fahrenheit (°F) since 1900. Most climate change models project that temperatures will continue to rise, whether they use high or mitigated carbon emissions trends. Figure 6-2 depicts average summer high temperatures projected by the four models chosen for comparison in this report. In the two scenarios with mitigated emissions, summer high temperatures are expected to rise by 1 to 2°F. In the scenarios with uncurbed emissions, average summer high temperatures projected to increase by up to 9 to 11°F by 2100.

**Figure 6-2. Observed (1981–2010) and Projected Future Summer and Winter Temperature for Sonoma County**



Data source: California Basin Characterization Model, Flint et al. (2013).

Table 6-1 shows how these temperature increases can create public health and safety risks, by comparing the increases to the temperature threshold (95° ) for an “extreme heat event” as defined for the Santa Rosa area.

**Table 6-1. Number of Times per Year When Maximum Temperature Is Projected to Exceed 95°F for 3 or More Consecutive Days in the Santa Rosa Plain**

Period	Number
1981–2000	26
2010–2039	39
2040–2069	55
2070–2099	148



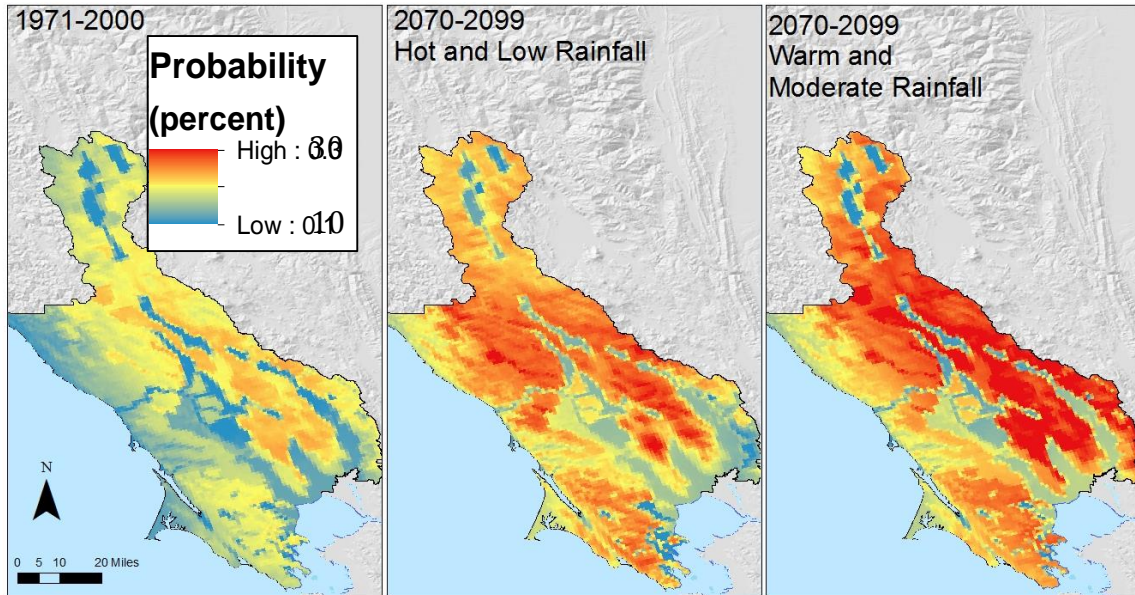
**More Frequent and Intense Droughts:** Whether the North Bay region experiences more or less rainfall overall, the land will likely be drier overall because warmer temperatures increase evapotranspiration (the loss of water from plants and soil into the air) even under the two “wet” scenarios. Climatic water deficit (CWD) is a numeric measure of drought stress that quantifies the extent to which plants’ need for water exceeds moisture available in the soil. Three of the four climate scenarios examined in this report indicate a rising CWD for the 21<sup>st</sup> century while the “Warm/Wet” scenario indicates nearly equivalent CWD to the historic period. The CWD is projected to increase over this century, producing 10 to 20% drier soil conditions in the summer months, leaving less water available for groundwater recharge or runoff into rivers and creeks, increasing irrigation needs, and causing stress to natural vegetation and water-dependent ecosystems. The greatest increases in soil dryness are projected in the south and southeastern portions of the county.



**More Frequent and Intense Wildfire:** Risk of fire is likely to continue to rise due to increased dryness of vegetation, compounded by productivity of plants in the spring (which creates more fuel for dry season wildfires). By the end of this century, the chances of one or more fires during a 30-year period are projected to increase from 15–20% at present to 25–33% in the mountainous areas of the county, a fire regime akin to that experienced today in the Santa Monica Mountains of Southern California. See Figure 6-3.

**Figure 6-3. Changes in Projected Fire Probability for Sonoma County**

### Change in Projected Fire Probability



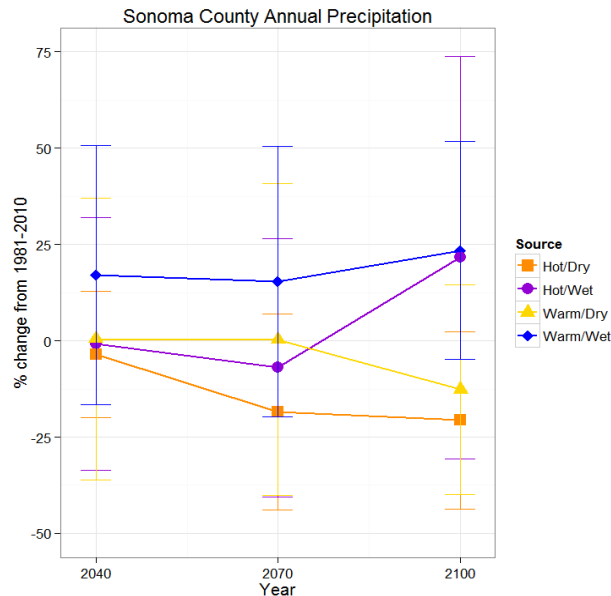
**Fewer Winter Nights that Freeze:** Projected winter low temperatures are also expected to rise in the future. In general, the coast, ridges, and mountain peaks will experience the most significant warming, whereas valley bottoms are projected to warm less dramatically. Figure 6-2 depicts projected winter low temperatures under the four scenarios included in this chapter. In the two models with mitigated emissions, winter low temperatures are expected to rise by 1 to 2°F. In the two models with uncurbed emissions, average winter low temperatures are projected to increase by up to 7 to 9°F by 2100. These increases have potential implications for controlling disease vectors, agricultural pests, and agricultural practices.

### More Variable Rain

While there is a direct link between higher GHG emissions and higher temperatures, there is disagreement about whether the future will be wetter or drier overall. Some models predict less annual rainfall in our region, while others predict more. However, all four climate scenarios evaluated in this chapter include more variation in the timing and amount of precipitation from individual rain events. All of the BCM scenarios indicate that Sonoma County will continue to have some years with precipitation similar to historic averages interspersed with more extreme conditions. The “Warm/Wet” scenario projects some years with an almost 75% increase in mean annual precipitation, while the “Hot/Dry” and “Warm/Dry” scenarios project years with decreases

between 25–50% of historical averages (see Figure 6-4). Overall, the wettest scenario projects almost a 25% increase in precipitation compared to historical (20<sup>th</sup> century) conditions, whereas the driest scenario projects an approximately 20% decrease.

**Figure 6-4. Graph of Annual Precipitation Projected under Four Representative Climate Futures**



Whether the North Bay region experiences more or less total rainfall, the land will likely be drier overall because warmer temperatures increase evapotranspiration. Because most models project a shorter, more condensed wet season, this shift in rainfall timing combined with warmer weather causes soils and plants to dry out more by the end of the summer season compared to current conditions. Even models that project more winter rain also project reduced available soil moisture.



**Increased Risk of Extreme Floods:** The climate scenarios project increased seasonal variability of precipitation, runoff, and stream flows for Sonoma County, along with increased likelihood of “extreme” precipitation and drought events that were rare or unprecedented in the historic past. The precise risk of flood events is difficult to predict, however. Much of Sonoma County’s wintertime precipitation comes in the form of “atmospheric rivers” from the Pacific Ocean. An atmospheric river is a relatively narrow ribbon of moisture in the atmosphere with ample moisture and strong winds. These atmospheric phenomena can produce very high precipitation in relatively focused areas. The amount and intensity of precipitation therefore depends greatly on where these atmospheric rivers make landfall. Under climate change projections for California, the average intensity of a typical atmospheric river does not increase, but there may be more years with more frequent storm events and occasional events that are much stronger than historical ones. Moreover, the length of the season over which storm events may occur is predicted to increase. These changes to the patterns of storm events may result in more frequent and more severe floods in Sonoma County.

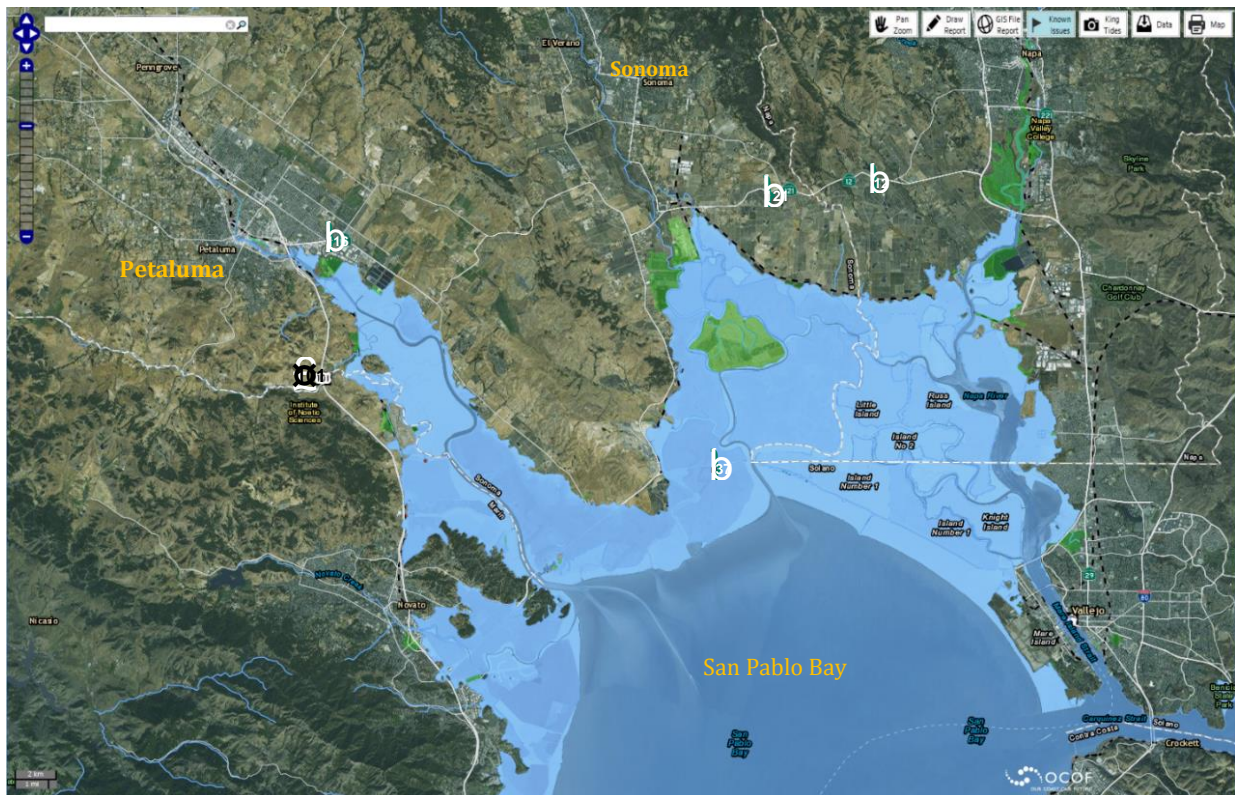


## Sea Level Rise



**More Frequent Coastal Flooding, Increased Erosion, and Saltwater Intrusion:** Sea levels are projected to rise between 16.5 and 65.8 inches by the end of this century. Rising sea levels, combined with increased storm surge, will lead to more frequent inundation of low-lying areas, and flooding of homes, infrastructure, agricultural lands, and natural areas on the shores of San Pablo Bay and the ocean coast, with the greatest impact anticipated during winter storms.

**Figure 6-5. Areas at Risk of Flooding with 39 Inches of Sea-Level Rise in Southern Sonoma County**



The areas at risk of flooding in southern Sonoma County with 39 inches of sea-level rise and a 20-year storm near the cities of Petaluma and Sonoma are shown in light blue. Darker blue is the current extent of the bay. Bright green areas are low enough to flood, but are protected by features such as levees or berms. Source: Our Coast Our Future (2014).

**Figure 6-6. Areas at Risk of Flooding with 39 Inches of Sea Level Rise near Bodega Bay**



Areas at risk of flooding near Bodega Bay with 39 inches of sea-level rise and a 20-year storm are shown in light blue. Darker blue is the current extent of the ocean. Bright green areas are low enough to flood, but are cut off from inundation by features such as levees or road berms. The light green dots show the extent of waves during a 20-year storm; note that waves are projected to pass over Doran Beach and into Bodega Harbor. Source: Our Coast Our Future (2014).

### 6.3.2 Climate Vulnerabilities in Sonoma County

The discussion in Section 6.3.1 shows that Sonoma County will be exposed to a variety of unavoidable climate change effects. However, as noted above, exposure does not necessarily mean that the community will be sensitive to the effect; individuals, property, and the environment may be exposed to a climate change threat but not sensitive to its consequence. For example, most healthy adults will adjust to small increases in average annual temperatures.

This section explores key vulnerabilities for three categories of community resources—people and social systems, built systems, and natural and working lands. A high-level overview of the resource, including essential functions and importance to the community, is presented first. Because climate sensitivity depends, in part, on baseline conditions, existing climate stressors are also briefly described for each resource. Anticipated vulnerabilities to the hazards identified in Section 6.3.1 are subsequently analyzed. Please refer to the *Hazards and Vulnerabilities Report* for summaries of climate exposures and vulnerabilities for each resource.

## People and Social Systems

People and social systems include Sonoma County’s residents and visitors, households, neighborhoods, cities, economic activities, social services, food systems, education, business, emergency services, public safety, and law enforcement. These communities and community systems will exhibit a wide range of abilities to prepare for, respond to, and recover from climate hazards. In particular, disparities in health, education, and income levels will make certain populations and communities more vulnerable to climate change. The social systems that help support basic needs for people—including food, water, shelter, transportation, and healthcare—are also vulnerable to breakdown from climate-related crises, especially those systems that currently suffer from dwindling resources and financial support.

**Table 6-2. Climate Change Effects on People and Social Systems**

<b>Hotter, Drier Weather with Longer Summers</b>	
More extremely hot days	<ul style="list-style-type: none"> <li>• Increased heat-related illness, particularly among those inland, in poor health, working outdoors, in urban heat islands, and/or without air conditioning</li> <li>• Premature death</li> <li>• Added stress on emergency services and health care systems</li> </ul>
More frequent and intense droughts	<ul style="list-style-type: none"> <li>• Higher prices for water and food</li> <li>• Water shortages from reduced surface and groundwater supplies</li> <li>• Food shortages</li> <li>• Potential pressure on housing and social services due to climate migrants</li> <li>• Increase in respiratory problems</li> <li>• Economic loss from decline in water-dependent recreation and tourism activities</li> </ul>
More frequent and intense wildfires	<ul style="list-style-type: none"> <li>• Risk of lost connections to energy, water, and food supplies, especially for isolated populations</li> <li>• Displacement and loss of homes</li> <li>• Injuries and death from burns and smoke inhalation</li> <li>• Lung damage and exacerbation of eye and respiratory illness</li> <li>• Economic loss from decline of recreation and tourism following a major fire</li> </ul>
Fewer winter nights that freeze	<ul style="list-style-type: none"> <li>• Potential increase in disease vectors such as mosquitoes and rodents</li> </ul>
<b>More Variable Rain</b>	
Increased risk of extreme floods	<ul style="list-style-type: none"> <li>• Death from drowning and injuries from flood</li> <li>• Economic losses for people in low-lying areas along rivers and bay lands, especially those without reliable transportation</li> <li>• Public health risks from damage to sanitation, utility, and irrigation systems</li> <li>• Limitations on access to critical services</li> <li>• Economic impacts on businesses, including agricultural operations, affected by flooding</li> </ul>
<b>Sea Level Rise</b>	
Higher sea level and storm surge	<ul style="list-style-type: none"> <li>• Physical danger and economic impact for people living near bay lands or the coast</li> <li>• Disruption in the movement of people and goods</li> <li>• Economic loss from inundation of agricultural land</li> </ul>

## Built Systems

Built systems include residential and non-residential buildings and facilities, and the infrastructure associated with providing water, sanitation, drainage, communications, transportation, and energy. These systems are necessary for maintaining a healthy and well-functioning society, and represent a huge capital investment by both private and public entities. Unfortunately, many built systems and structures are at increased risk of failure due to age and deferred maintenance. For example, Sonoma County’s local road network is also falling into

disrepair at an increasing rate. These existing risks are magnified when multiple systems fail at the same time (as in a flood, fire, or other calamity), resulting in cascading impacts throughout the built environment.

**Table 6-3. Climate Change Effects on Built Systems**

<b>Hotter, Drier Weather with Longer Summers</b>	
More extremely hot days	<ul style="list-style-type: none"> <li>• Damage and disruption to paved roads, rail lines, bridges, electricity transmission lines, and solar and battery facilities</li> <li>• Thermal expansion of bridges</li> <li>• Spikes in energy and water demand; potential stress to supplies</li> <li>• Reduced outputs from thermal power plants, transformers, and other parts of electric systems</li> <li>• Brownouts and blackouts</li> </ul>
More frequent and intense droughts	<ul style="list-style-type: none"> <li>• Increased water demand and reduced supply</li> <li>• Disruption of hydropower operations such as Warm Springs Dam; impacts on power generation facilities that rely on water for cooling</li> <li>• Algae and bacterial growth in water supplies</li> <li>• Increased pumping of groundwater leading to well failure, saltwater intrusion, and degraded water quality</li> <li>• Increased evaporation from reservoirs</li> </ul>
More frequent and intense wildfires	<ul style="list-style-type: none"> <li>• Disruption of electricity transmission lines</li> <li>• Impacts on roadways</li> <li>• Subsequent landslides that close roads and bury infrastructure, including water supply wells</li> </ul>
Fewer winter nights that freeze	<ul style="list-style-type: none"> <li>• None identified</li> </ul>
<b>More Variable Rain</b>	
Increased risk of extreme floods	<ul style="list-style-type: none"> <li>• Less predictable reservoir operation</li> <li>• Road closures, landslides, and loss of infrastructure such as bridges/culverts</li> <li>• Increased potholes and roadway damage from intensity of rainfall</li> <li>• Failure of stormwater and waste water treatment systems</li> <li>• Increased cost and complexity for development and infrastructure projects and for retrofitting existing infrastructure</li> </ul>
<b>Sea Level Rise</b>	
Higher sea level and storm surge	<ul style="list-style-type: none"> <li>• Damage and/or closure of roads crossing former tidal or estuarine areas (Highways 1 and 37)</li> <li>• Increased storm damage to boats and related shoreline infrastructure</li> <li>• Flooding of low-lying infrastructure such as Sonoma Valley County Sanitation District</li> <li>• Saltwater intrusion and reduced water quality</li> <li>• Disruption of transit routes and travel delays</li> </ul>

## Natural and Working Lands

Natural lands include Sonoma County's public and private natural and open space areas and the ecosystems these lands support, including wildlife, streams and wetlands, and sensitive species and habitats. Working lands include Sonoma County's diverse and productive agricultural lands. Sonoma County's vineyards, farms, ranches, and timberlands are the cornerstone of the county's economy and add immeasurably to the area's scenic beauty.

Sonoma County has high biodiversity in many of its landscapes and species, potentially increasing the resilience of natural areas overall. However, the county also has many threatened and endangered species, some of which are found only in very limited areas. Stressors such as pollution, loss of streamflow, and invasive species are already causing numerous plants and animals to decline. Habitat fragmentation and development have also compromised the ecological integrity of some landscapes throughout the county, making them more susceptible to climate change hazards. The county's working lands are subject to these same hazards. Agricultural operations depend heavily on the region's historically moderate climate and are therefore vulnerable to the entire range of climate change hazards.

**Table 6-4. Climate Change Effects on Natural and Working Lands**

<b>Hotter, Drier Weather with Longer Summers</b>	
More extremely hot days	<ul style="list-style-type: none"> <li>• Loss of wine grape quality</li> <li>• Land use pressure to develop vineyards closer to the coast</li> <li>• Changes in yield, types, and cultivars of crops</li> <li>• Increased animal vulnerability to pests, stress, and mortality</li> <li>• Lower production in animals</li> <li>• Reduced chill hours</li> </ul>
More frequent and intense droughts	<ul style="list-style-type: none"> <li>• Increased need for water agricultural land and water-dependent ecosystems</li> <li>• Increased urban water use, at possible expense of agriculture water availability</li> <li>• Shortage of animal feed or rise in cost and access</li> <li>• Increased evapotranspiration from open water sources</li> <li>• Decline or death of water-dependent plants and animals</li> <li>• Potential change in suitable crop varieties, including wine grapes</li> <li>• Increased tree stress and death in timberlands and other forests</li> <li>• Increased off-stream storage of water for agriculture</li> </ul>
More frequent and intense wildfires	<ul style="list-style-type: none"> <li>• Loss of habitat and agricultural lands</li> <li>• Death of wildlife</li> <li>• Loss of recreational lands and commercial forests</li> <li>• Losses from subsequent erosion and landslides, and sedimentation of streams and wetlands</li> </ul>
Fewer winter nights that freeze	<ul style="list-style-type: none"> <li>• Unpredictable, potentially sudden, shifts in populations of disease, pests, or invasive species</li> <li>• Earlier vineyard bud break may lead to increased use of water for frost protection</li> </ul>
<b>More Variable Rain</b>	
Increased risk of extreme floods	<ul style="list-style-type: none"> <li>• Increased erosion and sediment pollution in streams and wetlands</li> <li>• Damage to crops and agricultural lands</li> </ul>
<b>Sea Level Rise</b>	
Higher sea level and storm surge	<ul style="list-style-type: none"> <li>• Loss of prime recreational and natural areas, including marshes, beaches, mudflats, and dunes</li> <li>• Risk of levee breaches and inundation of agricultural land in formerly tidal areas in southern Sonoma County</li> </ul>

## 6.4 Responding to Climate Change Vulnerabilities

The vulnerabilities outlined in Section 6.3 are significant and cut across virtually all of the county’s human and natural systems. Fortunately, many entities in Sonoma County have already begun planning and implementing strategies to increase resilience and readiness for climate change. These strategies target public health and social vulnerability, energy independence, water resource planning, food security, transportation, and conservation. These existing efforts are too

broad to fully capture here, but a sample of critical activities underway is summarized in Table 6-5.

Although impressive and forward-thinking, these current efforts only skim the surface of the effort needed to make our communities truly resilient in the face of climate change. While many entities are increasingly incorporating a climate-changed future into their planning, such as those listed in Table 6-5, a higher-level, more comprehensive approach is also needed to match the scale and variety of climate hazards facing Sonoma County. This broader effort has been led by RCPA and the NBCAI, a collaborative of local organizations. This includes the *Climate Hazards and Vulnerabilities* report that is the basis for this chapter. In 2015, NBCAI and RCPA also sponsored two events with broad participation that clarified the climate readiness challenge and its opportunities for Sonoma County. Section 6.4.1 describes these findings.

#### **6.4.1 Sonoma County Climate Ready Goals**

NBCAI, in conjunction with RCPA and other non-governmental partners, is developing a *Roadmap for Climate Resilience* in Sonoma County based on extensive input from public meetings, workshops, focus groups, and technical experts. Over 230 people participated. Out of these events and extensive discussion with multiple interest groups, NBCAI and RCPA developed the following mission for climate readiness efforts in Sonoma County.

***Increase the health and resilience of social, natural, and built resources to withstand the impacts of climate change.***

The nine goals listed in Table 6-6 are included as part of CA2020 to support this mission. Adoption of these goals by RCPA and local partner agencies (cities and the County) will help set the course for future actions that will increase the adaptive capacity of Sonoma County communities, reduce vulnerability to climate change, and make the county more climate-ready. These goals can also help prioritize the climate mitigation actions identified in Chapter 4 by identifying actions that will increase climate resilience as well as reducing GHG emissions.



**Table 6-5. Sample of Existing Local Efforts that Increase Resilience to Climate Change**

<b>Public Health and Social Vulnerability</b>	
Hazard Mitigation Planning	Every 5 years, the County updates a local Hazard Mitigation Plan that seeks to reduce death, injuries, property loss, and community disruption caused by natural hazards by analyzing those hazards and developing an implementation plan. Climate change is exacerbating hazards that are already prepared for through the Hazard Mitigation Plan.
Health Action	Health Action is the framework for a community engagement effort, backed by the County, to create a healthier Sonoma County for all residents. Pursuit of Health Action goals in education, health care, and economic security will increase the adaptive capacity of the Sonoma County communities that are most vulnerable to climate change.
<b>Energy</b>	
Energy Independence	The County and cities have implemented a countywide renewable energy and energy efficiency retrofit program that provides incentives, financing, tools, and technical assistance to residential and non-residential property owners. Reducing energy use and increasing on-site generation not only lowers GHG emissions, it also reduces energy costs and helps minimize the health and economic impacts of future climate change-related outages.
Sonoma Clean Power	The County and cities have created a community choice aggregation program that allows more local control in obtaining lower-emission, lower-cost, and more distributed power supplies. These distributed and renewable power sources are less vulnerable to climate-related disruption and come back online faster following an emergency.
<b>Water</b>	
Integrated Water Resource Planning	The Sonoma County Water Agency's <i>Water Supply Strategies Action Plan</i> is a framework for regional integrated water management to increase water supply system reliability, resiliency, and efficiency in the face of limited resources, regulatory constraints, and climate change.
Groundwater Management	Sonoma County Water Agency has led development of Groundwater Management Plans in the Sonoma Valley and Santa Rosa Plain that will improve the ability of groundwater-dependent communities, agricultural operations, rural residents, and ecosystems to function during drought periods. Sonoma County cities, SCWA, the County and water districts are currently engaged in early implementation of the state's new Sustainable Groundwater Management Act.
End-use Water Efficiency	Municipal water and sanitation utilities throughout the county have established programs to support property owners in reducing water use while investing in upgrades to their properties.
On-site Water Storage	The Resource Conservation Districts have led projects to develop on-site water storage on rural and agricultural properties to increase drought resiliency
<b>Food</b>	
Sonoma County Healthy and Sustainable Food Action Plan	The County Department of Health Services has partnered with the Food System Alliance to develop a guide to local action on food production, land and natural resource stewardship, job development, public health, and food system equity, all of which help increase the community's climate resilience. It also encourages practices to support the agricultural sector's ability to adapt to climate change.
<b>Transportation</b>	
Transportation Planning and Investment	Many projects to modernize the transportation system and increase the viability of multiple mobility options are underway through implementation of the Comprehensive Transportation Plan adopted by Sonoma County Transportation Authority. The SMART passenger rail will begin operations in 2016. Countywide Bicycle and Pedestrian Master Plan implementation and Safe Routes to Schools projects support expanded use of lower-cost transportation options that are more reliable under projected climate conditions.
Highway 37 Sea Level Rise planning	Due to its proximity to San Pablo Bay, Highway 37 is at significant risk from sea-level rise and storm surge. Local, regional, and state partners are working to address this infrastructure vulnerability while incorporating habitat enhancements that promote resilience to flooding and storm surge.
<b>Natural and Working Lands</b>	
Climate Action through Conservation	The Sonoma County Agricultural Preservation and Open Space District was created in 1990 to protect working farms and ranches, scenic hillsides, and natural areas that make the county special. The District has preserved over 100,000 acres to date. The District is also working on a <i>Climate Action Through Conservation</i> program to incorporate GHG mitigation and sequestration benefits into land use choices, as well as evaluating the ecosystem services provided by landscapes that will be increasingly important under future climate projections.

**Table 6-6. Climate Change Adaptation Goals and Opportunities**

Goals	Opportunities	Climate Hazards Addressed
Promote healthy, safe communities	Invest in measures to increase community knowledge and capacity to respond and adapt to climate hazards, including improving baseline health, well-being, and financial security, especially in vulnerable populations. Link vulnerable populations to services that reduce the safety, health, and financial risks related to climate hazards. Reduce non-climate economic and health stressors.	All hazards, especially those sensitive to demographic and economic changes
Protect water resources	Conserve and reuse water, protect and enhance groundwater recharge areas, capture storm- and flood water, protect streamside areas, invest in natural infrastructure. Reduce non-climate stressors such as hydro-modification, pollution, and overuse of water.	Drought, flooding, and infrastructure failure risks to water quantity and quality
Promote a sustainable, climate-resilient economy	Better define the economic risks of climate change. Communicate to businesses and the broader community about practices that contribute to climate resilience and how to implement them. Reduce non-climate stressors.	All hazards, especially those sensitive to demographic and economic changes
Mainstream the use of climate projections (not just past patterns) in planning, design, and budgeting	Educate and share information among government agencies. Create and promote guidelines for how to use climate information in planning and decision making.	All hazards, especially sea-level rise, drought, wildfire, and flooding
Protect coastal, bayside, and inland buffer zones	Protect, expand, and enhance wetlands, water source areas, fire management zones, and flood zones. Review/revise land management plans, development codes, parks plans, and prevention and response plans for floods and fires. Reduce non-climate stressors in these areas.	Sea-level rise, changing temperature and rain patterns, drought, wildfire
Promote food system security and agricultural climate preparedness	Promote peer-to-peer agricultural adaptation networking, including potential need to cultivate alternative crops or adopt new agricultural land management strategies. Reduce non-climate stressors, such as the high cost of land for food production.	Changing temperature and rain patterns, drought, higher food prices
Protect infrastructure: buildings, energy systems, communications systems, water infrastructure, and transportation systems	Conduct a risk assessment by evaluating potential climate impacts on key infrastructure, buildings, and transit systems. Invest in strategies to ensure the long-term sustainability and reliability of energy resources. Reduce non-climate stressors such as deteriorating infrastructure.	Drought, flooding, wildfire, and extreme heat
Increase emergency preparedness	Support continued interagency emergency planning. Educate the public about climate hazards. Assess and address gaps in vulnerable populations' capacity to respond to extreme events. Reduce non-climate stressors such as forest health problems and provide adequate funding for emergency preparedness and response.	Public health and safety impacts of heat, flooding, and wildfire
Monitor the changing climate and its biophysical effects in real time	Measure actual conditions to validate and/or refine models of climate and climate change effects in order to plan and manage with better information.	All hazards