# UNINCORPORATED SHASTA COUNTY

# GREENHOUSE GAS REDUCTION MEASURE QUANTIFICATION METHODOLOGY

This appendix summarizes the methodology for quantifying greenhouse gas (GHG) reductions resulting from implementing the Climate Action Plan (CAP) measures. Calculations and/or background information are only shown for horizon year 2020. Energy emissions factors based on an RPS-compliant energy source mix were used to quantify emissions reductions for all measures resulting in electricity savings to avoid double counting.

## Measure BE-1: Existing Buildings

This measure estimates the reduction in energy-related emissions (i.e., electricity and natural gas) resulting from retrofitting existing residential units and commercial properties. The measure includes retrofitting both single- and multi-family units based on a pre-defined package of energy efficiency retrofits that include installation of programmable thermostats, gas water heater upgrades, installation of high-efficiency light bulbs, gas furnace upgrades, duct sealing, foundation insulation, and building envelope sealing/ weatherization.

Baseline electricity and natural gas consumption levels per unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3, which covers 85 to 95 percent of Shasta County. Mitigated energy savings estimates were based on outputs from Lawrence Berkeley Laboratory's Home Energy Saver $^{TM}$ building energy modeling software. The model-derived energy savings estimates were downscaled in order to be conservative in emissions reduction calculations. Total energy savings were calculated by subtracting the mitigated electricity and natural gas consumption levels from baseline levels. See Table B-1 for data used to calculate emissions reductions.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 2% of existing residential buildings implement energy efficiency retrofits<br><br>10% of existing non-residential buildings implement energy efficiency retrofits | 201 MT $CO_2e$/yr | *Building Data: Shasta County Assessor's Office parcel data*<br><br>*Baseline Energy Consumption: Commercial End Use Survey, CEC, 2006*<br><br>*Energy Savings from Retrofit Packages: AECOM SSIME$^{TM}$ Building Energy Analysis*<br><br>*Baseline Energy Consumption: Residential Appliance Saturation Survey, CEC, 2010*<br><br>*Energy Savings from Retrofit Packages: SSIMe Building Energy Model, AECOM 2011*<br><br>*Participation Rates: Shasta County, 2012* |

## Measure BE-2: New Construction

Reductions associated with this measure are described in Statewide Measures Reductions on page B-24.

**Table B-1**
**Residential Retrofits**

| **Baseline Energy Consumption** | | | | | | |
|---|---|---|---|---|---|---|
| | **Total Units** | **Participation Rate** | **kWh/unit/year** | **therms/unit/year** | **Total kWhr/year** | **Total therms/year** |
| Single Family | 19,196 | 2% | 8,836 | 562 | 3,392,317 | 215,624 |
| Townhome | 244 | 2% | 5,762 | 327 | 28,119 | 1,595 |
| 2-4 unit apartment | 373 | 2% | 4,595 | 305 | 34,279 | 2,279 |
| 5+ unit apartment | 176 | 2% | 5,248 | 199 | 18,473 | 700 |
| Mobile Home | 7,165 | 0% | na | na | na | na |
| **Total** | **27,154** | | | | **3,473,187** | **220,198** |
| **Mitigated Energy Consumption** | | | | | | |
| | **Total Units** | **Participation Rate** | **kWh/unit/year** | **therms/unit/year** | **Total kWhr/year** | **Total therms/year** |
| Single Family | 19,196 | 2% | 8,598 | 489 | 3,300,825 | 187,893 |
| Townhome | 244 | 2% | 5,565 | 305 | 27,155 | 1,491 |
| 2-4 unit apartment | 373 | 2% | 4,483 | 290 | 33,445 | 2,161 |
| 5+ unit apartment | 176 | 2% | 5,115 | 192 | 18,006 | 675 |
| Mobile Home | 7,165 | 0% | na | na | na | na |
| **Total** | **27,154** | | | | **3,379,432** | **192,220** |
| **Energy Savings** | | | | | **93,755** | **27,978** |

**Table B-2**
**Commercial Retrofits**

**Baseline Energy Consumption**

| | Total SQFT | Participation Rate | kWh/sqft/year | kBTU/sqft/year | Total kWhr/year | Total kBTU/year |
|---|---|---|---|---|---|---|
| All Office | 140,620 | 10% | 11.1 | 16.1 | 155,684 | 225,796 |
| All Warehouse | 265,576 | 10% | 22.7 | 0.0 | 601,954 | 0.0 |
| Grocery | 26,915 | 10% | 36.3 | 0.0 | 97,617 | 0.0 |
| Health | 29,879 | 10% | 15.0 | 46.6 | 44,936 | 139,237 |
| Large Office | 12,606 | 10% | 14.2 | 27.6 | 17,901 | 34,804 |
| Restaurant | 29,021 | 10% | 33.2 | 214.0 | 96,483 | 621,172 |
| Retail | 191,508 | 10% | 10.1 | 12.8 | 192,587 | 244,903 |
| **Total** | **696,125** | **-** | **-** | **-** | **1,207,161** | **1,265,912** |

**Mitigated Energy Consumption**

| | Total SQFT | Participation Rate | kWh/sqft/year | kBTU/sqft/year | Total kWhr/year | Total kBTU/year |
|---|---|---|---|---|---|---|
| All Office | 140,620 | 10% | 9.9 | 13.3 | 139,051 | 186,789 |
| All Warehouse | 265,576 | 10% | 22.5 | 0.0 | 598,734 | 0.0 |
| Grocery | 26,915 | 10% | 35.2 | 0.0 | 94,725 | 0.0 |
| Health | 29,879 | 10% | 13.2 | 40.5 | 39,468 | 121,059 |
| Large Office | 12,606 | 10% | 12.6 | 22.9 | 15,879 | 28,865 |
| Restaurant | 29,021 | 10% | 30.8 | 211.9 | 89,481 | 614,936 |
| Retail | 191,508 | 10% | 8.9 | 10.9 | 170,317 | 208,933 |
| **Total** | **696,125** | **-** | **-** | **-** | **1,147,654** | **1,160,582** |
| **Energy Savings (Baseline minus Mitigated)** | | | | | **59,507** | **105,331** |

## Measure BE-3: Commercial Indoor Lighting

This measure estimates the reduction in electricity-related emissions resulting from indoor and outdoor light retrofits within commercial land uses. Baseline lighting electricity loads per square foot per non-residential use type were identified using CEC's Commercial End Use Survey data for Forecast Climate Zone 3 (see Table B-3).

The measure assumes that indoor lighting retrofits would occur at a performance level identified within the State's *Database for Energy Efficient Resources*. For 2020, the County assumes that 10% of total community-wide nonresidential square footage would implement a 40% indoor lighting load reduction. All non-residential uses (office, retail, and warehouse) are included in these calculations. Participation rates also reflect the assumption that State and federal light bulb efficiency standards (i.e. Energy Independence and Security Act of 2007) will assist in the implementation of this measure.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 10% of non-residential buildings reduce indoor lighting load by 40% | 24 MT $CO_2e$/yr | *Baseline Energy Consumption: Commercial End Use Survey, CEC, 2006*<br>*Energy Savings from Retrofit Packages: CEC/CPCU Database for Energy Efficient Resources, 2005*<br>*Participation Rates: Shasta County, 2011* |

**Table B-3**
**Indoor and Exterior Lighting Energy**

| Commercial Use Type | Baseline (kWh/SF/Year) | Mitigated (kWh/SF/Year) |
|---|---|---|
| Grocery | 36.27 | 33.31 |
| Health | 15.04 | 13.54 |
| Lodging | 10.07 | 9.44 |
| Large Office | 14.20 | 12.62 |
| Restaurant | 33.25 | 30.81 |
| Retail | 10.06 | 8.43 |
| School | 8.82 | 7.63 |
| Small Office | 9.40 | 8.26 |
| Warehouse (All) | 22.67 | 21.55 |

Source: CEC 2006

## Measure BE-4: Energy Efficient Appliances

This measure estimates the reduction in electricity-related emissions resulting from installing energy-efficient appliances in new and existing residential units. This measure focuses on installation of energy-efficient refrigerators, clothes washers, and dishwashers. The CAPCOA report "*Quantifying Greenhouse Gas Mitigation Measures*" provides a methodology for calculating the electricity reductions associated with the installation of energy-efficient refrigerators, clothes washers, and dishwashers. Participation rates were selected on the assumption that State and utility outreach programs will increase the market share of ENERGY STAR appliances above current levels. Baseline market share values from a *Northwestern Energy Alliance* study indicate that approximately 33% of consumers purchase ENERGY STAR refrigerators, 83% purchase ENERGY STAR dishwashers, and 36% purchase ENERGY STAR clothes washers. The study shows a strong trend of increasing ENERGY STAR appliance market share over the past decade. For 2020, the County assumes that additional outreach and rebates will further increase the ENERGY STAR appliance market share in the unincorporated county. For new residential units, the measure assumes use of energy-efficient refrigerators and clothes washers will increase to a market share of 40% and use of energy-efficient dishwashers will increase to a market share of 70%. The County assumes that 20% of existing residential units will install energy-efficient refrigerators, clothes washers, and dishwashers.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | New homes install ENERGY STAR appliances at the following rates: 40% refrigerators, 40% clothes washers, and 70% dishwashers | 1,443 MT $CO_2e$/yr | *Quantification Methodology: Energy Efficient Appliance Reduction: CAPCOA. 2010 (August). Quantifying Greenhouse Gas Mitigation Measures. Available: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.*<br><br>*Participation Rates: ENERGY STAR Consumer Products Program: Market Progress Evaluation Report. Prepared by KEMA, Inc. July 24, 2007. Prepared for Northwestern Energy Efficiency Alliance.* |
| | Existing homes replace ENERGY STAR appliances at the following rates: 20% refrigerators, 20% clothes washers, and 20% dishwashers | | |

## Measure BE-5: Smart Grid Integration

This measure estimates the reduction in electricity-related emissions resulting from integration of Smart Grid technologies in new and existing residential and commercial land uses. Literature indicates that integration of Smart Grid technologies reduces electricity use by more than 5% in existing residential and commercial buildings and 6% in new residential and commercial buildings. For 2020, the measure assumes that 30% of all new residential buildings and 10% of existing residential and commercial buildings will integrate Smart Grid technologies.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 10% of existing residential and commercial customers adopt smart-grid technology<br><br>30% of new residential and commercial customers adopt smart-grid technology | 1,214 MT $CO_2e$/yr | *Smart Grid Reduction: SMART 2020: Enabling the low carbon economy in the information age, The Climate Group on behalf of the Global Sustainability Initiative (GeSI)*<br><br>*Estimating the Benefits of the GridWise Initiative Phase I Report Walter S. Baer, Brent Fulton, Sergej Mahnovski TR-160-PNNL, May 2004 Prepared for the Pacific Northwest National Laboratory*<br><br>*Participation Rates: Pacific Northwest National Laboratory , Estimating the Benefits of the GridWise Initiative Phase I Report Walter S. Baer, Brent Fulton, Sergej Mahnovski TR-160-PNNL, May 2004* |

## Measure BE-6: Solar Water Heaters

This measure quantifies natural gas and electricity-related emissions reductions resulting from the installation of solar hot water heaters in residential units and commercial buildings. Baseline water heating-related natural gas consumption levels per residential unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3. In addition, CEC data identifies the energy savings potential of solar hot water heaters for specific climates in California. The measure assumes that 40-67% of water-heating natural gas can be reduced through the use of solar hot water heaters. The measure assumes that 5% of all residential units (i.e., single family and multi-family) and 5% of all commercial buildings will install solar hot water heaters to meet their hot water demands. Care should be taken to avoid double-counting between a solar hot water heater installed to help new residential units achieve the building code-mandated energy efficiency performance and solar hot water heaters installed in excess of that requirement. Table B-4 provides the assumptions used to quantify reductions from solar water heaters.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 5% each of single-family residential buildings, multi-family residential buildings, and non-residential buildings install a solar hot water system | 886 MT $CO_2e$/yr | *Baseline Hot Water Natural Gas Consumption: Residential Appliance Saturation Survey, CEC, 2010*<br><br>*Solar Fraction: Solar Water Heating CEC 2013 Title 24 Pre-rulemaking Workshop, California Energy Commission, June 9, 2011*<br><br>*Solar Insolation: National Renewable Energy Laboratory Renewable Resource Data Center, 2011*<br><br>*PV Participation Rates: Shasta County, 2012* |

**Table B-4**
**Solar Water Heaters – 2020**

**Residential Units**

| | Units (2020) | Hot Water Heater Energy per Unit (therms/year) | Solar Water Heater Effectiveness | Energy Savings per Unit (therms/year) | Participation Rate (% of units) | Total Savings (therms/year) |
|---|---|---|---|---|---|---|
| Single Family | 20,361 | 196 | 67% | 131.54 | 5% | 133,907 |
| Townhouse | 259 | 170 | 67% | 114.15 | 5% | 1,477 |
| 2-4 unit apartment | 396 | 135 | 59% | 79.65 | 5% | 1,576 |
| 5+ unit apartment | 187 | 84 | 59% | 49.30 | 5% | 460 |
| **Total** | **21,202** | **-** | **-** | **-** | **-** | **137,419** |

**Commercial Buildings**

| | SQFT (2020) | Hot Water Heater Energy per SQFT (kBTU/year) | Solar Water Heater Effectiveness | Energy Savings per SQFT (kBTU/year) | Participation Rate (% of sqft) | Total Savings (kBTU/year) |
|---|---|---|---|---|---|---|
| All Office | 165,122 | 3.22 | 50% | 1.58 | 5% | 13,014 |
| All Warehouse | 311,850 | 0.00 | 50% | 0.00 | 5% | 0.0 |
| Grocery | 31,605 | 0.00 | 50% | 0.00 | 5% | 0.0 |
| Health | 35,085 | 17.34 | 50% | 8.49 | 5% | 14,902 |
| Large Office | 14,802 | 6.94 | 50% | 3.40 | 5% | 2,518 |
| Restaurant | 34,078 | 29.95 | 50% | 14.67 | 5% | 25,001 |
| Retail | 224,876 | 1.91 | 50% | 0.94 | 5% | 10,549 |
| **Total** | **817,417** | **-** | **-** | **-** | **-** | **65,985** |

## Measure BE-7: Solar Photovoltaic Systems

This measure estimates the reduction in electricity-related emissions resulting from installation of grid connected photovoltaic (PV) systems in residential and commercial uses. The measure uses National Renewable Energy Laboratory solar insolation data specific to Shasta County's geographic location and climate. For 2020, it was assumed that approximately 10% of single-family and town-home units would install 3-kilowatt grid-connected PV systems. It was also assumed that the County would install 6.5 MW of additiaonl PV systems. See Table B-5 for calculations and assumptions associated with this measure.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 10% of single-family residential units install a rooftop PV system<br><br>County government installs 6.5 MW of solar power | 6,315 MT $CO_2e$/yr | *Solar Insolation: National Renewable Energy Laboratory Renewable Resource Data Center, 2011*<br><br>*Participation rates: Shasta County, 2012.*<br><br>*Building Data: Shasta County Assessor's Office parcel data* |

**Table B-5**
**Solar PV Systems – 2020**

| **Single-Family Residential** | | | |
|---|---|---|---|
| Photovoltaic System Size per Unit (kW) | Number of SFR Units | Generation Potential (kWh/sqft/year) | Electricity Generated (kWh/year) |
| 3.2 | 2062 | 166 | 10,940,971 |
| **Multi-Family Residential and Commercial** | | | |
| Total Photovoltaic System Capacity Installed (MW) | Area (sqft) | Generation Potential (kWh/sqft/Year) | Electricity Generated (kWh/Year) |
| 6.5 | 500,000 | 166 | 10,778,169 |
| **Total Electricity Generated (kWh/Year)** | | | **21,719,141** |

## Measure W-1: Residential Fixture and Fittings Retrofit

This measure estimates the reduction in water-related emissions resulting from installation of high efficiency water fixtures and fixture fittings in residential buildings. The measure uses Residential End Uses of Water Study to estimate baseline (pre-retrofit) scenario indoor water demand. The measure then develops a mitigated (post-retrofit) scenario indoor water demand average using data from the Residential Indoor Water Conservation Study and participation rates estimated by Shasta County. The difference between the two scenarios is the amount of water reduced by implementation of the measure. For 2020, it was assumed that approximately 5% of residential units in the County would retrofit to highly efficient fixtures. The amount of water reduce was converted into GHG reduction estimate by multiplying the volume by an appropriate water intensity factor and electricity emissions factor..

See Tables B-6, B-7, B-8 and B-9 for assumptions and calculations used to quantify reductions from this measure.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 5% of residential households install high-efficiency toilets, showerheads, faucets, dishwashers, and clothes washers | 94 MT $CO_2e$/yr | |

**Table B-6**
**Residential Indoor Water Use**

| | End Use (Mgal/year) | | | | | |
|---|---|---|---|---|---|---|
| | **Toilet** | **Clothes Washer** | **Shower** | **Faucet** | **Dishwasher** | **Total** |
| **Residential Indoor Water Use – Unmitigated Scenario** | | | | | | |
| Single-Family | 372 | 273 | 223 | 186 | 25 | 1,079 |
| Multifamily | 123 | 90 | 74 | 62 | 8 | 357 |
| **Total** | **495** | **363** | **297** | **248** | **33** | **1,436** |
| **Residential Indoor Water Use – Mitigated Scenario** | | | | | | |
| Single-Family | 167 | 121 | 167 | 155 | 18 | 628 |
| Multifamily | 55 | 40 | 55 | 51 | 6 | 208 |
| **Total** | **222** | **161** | **223** | **206** | **24** | **836** |
| **Residential Indoor Water Use – Water Conserved** | | | | | | |
| Single-Family | 206 | 152 | 56 | 31 | 7 | 451 |
| Multifamily | 68 | 50 | 18 | 10 | 2 | 149 |
| **Total** | **274** | **203** | **74** | **41** | **9** | **600** |

Source: National Residential End Uses of Water Study, Alliance for Water Efficiency, American Water Works Association, and AWWA Research Foundation

| Table B-7<br>Residential Indoor Water Use – End Uses | | | |
|---|---|---|---|
| **Fixture/Appliance** | **Units** | **Existing Scenario** | **Mitigated Scenario** |
| Toilet | gallons/flush | 3.88 | 1.6 |
| Clothes Washer | gallons/load | 40.7 | 18 |
| Shower | gallons/minute | 2 | 1.5 |
| Dishwasher | gallons/cycle | 8.9 | 6.5 |
| Faucet | gallons/minute | 1.2 | 1 |

| Table B-8<br>Water Energy Intensity (kwh/Mgal) | | | | | | |
|---|---|---|---|---|---|---|
| **Water Supply** | **Supply & Conveyance** | **Treatment** | **Distribution** | **OUTDOOR TOTAL** | **Wastewater Treatment** | **INDOOR TOTAL** |
| North CA - Generic | 2,117 | 111 | 1,272 | 3,500 | 1,911 | 5,411 |

Source: CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC·500·2006·118.

| Table B-9<br>Electricity Emissions Factor | | | | | |
|---|---|---|---|---|---|
| **$CO_2$ (lbs/MWh)** | **$CH_4$ (lbs/MWh)** | **$N_2O$ (lbs/MWh)** | **$CO_2e$ (lbs/MWh)** | **$CO_2e$ lbs/kWh** | **$CO_2e$ MT/kWh** |
| 641.00 | 0.000 | 0.000 | 641 | 0.64100 | 0.00029 |

Source: PGE

## Measure SW-1: Lumber Waste Diversion Ordinance

An inventory of the community's organic waste was created using Cal Recycle waste volume and characterization data. Using the first-order decay methodology from the 2006 IPCC guidelines, fugitive methane emissions from the organic landfill waste were calculated for base-case and mitigated scenarios. This measure assumes that residential and commercial uses will divert 75% of construction/demolition waste (highlighted in blue in Tables B-10 and B-11) from landfills by 2020. This measure would apply to GHG emissions associated with new waste generated and would not apply to waste in place disposed prior to CAP implementation.

Calculations for this measure factored in the advanced methane recovery rate described in Measure SW-2 to avoid double counting emissions reductions.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 100% of residential and commercial projects participate in 75% lumber waste diversion | 1,334 $CO_2e$/yr | *CalRecycle Waste Characterization Data, 2011*<br>*IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Chapter 3.* |

## Table B-10
## Baseline Degradable Organic Carbon Disposed

**Commercial Waste – Baseline Mass of Degradable Organic Carbon Disposed (DDOC mdt)**

| Year | Newspaper | Office Paper | Corrugated Boxes | Coated Paper | Food | Grass | Leaves | Branches | Lumber | Textiles | Diapers | Construction/ Demolition | Sludge/ Manure | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 26.0 | 202.5 | 377.1 | 207.0 | 484.7 | 20.4 | 79.7 | 76.8 | 569.9 | 191.2 | 100.7 | 42.3 | 0.0 | 2378.2 |
| 2009 | 26.2 | 203.8 | 379.5 | 208.3 | 487.8 | 20.5 | 80.2 | 77.3 | 573.5 | 192.4 | 101.3 | 42.6 | 0.0 | 2393.3 |
| 2010 | 26.3 | 205.1 | 381.9 | 209.6 | 490.9 | 20.6 | 80.7 | 77.7 | 577.1 | 193.6 | 102.0 | 42.9 | 0.0 | 2408.4 |
| 2011 | 26.5 | 206.4 | 384.3 | 211.0 | 494.0 | 20.8 | 81.2 | 78.2 | 580.7 | 194.9 | 102.6 | 43.2 | 0.0 | 2423.7 |
| 2012 | 26.7 | 207.7 | 386.7 | 212.3 | 497.1 | 20.9 | 81.7 | 78.7 | 584.4 | 196.1 | 103.3 | 43.4 | 0.0 | 2439.0 |
| 2013 | 26.8 | 209.0 | 389.2 | 213.6 | 500.3 | 21.0 | 82.2 | 79.2 | 588.1 | 197.3 | 103.9 | 43.7 | 0.0 | 2454.4 |
| 2014 | 27.0 | 210.3 | 391.6 | 215.0 | 503.4 | 21.2 | 82.7 | 79.7 | 591.8 | 198.6 | 104.6 | 44.0 | 0.0 | 2470.0 |
| 2015 | 27.2 | 211.7 | 394.1 | 216.3 | 506.6 | 21.3 | 83.2 | 80.2 | 595.6 | 199.8 | 105.2 | 44.3 | 0.0 | 2485.6 |
| 2016 | 27.3 | 213.0 | 396.6 | 217.7 | 509.8 | 21.4 | 83.8 | 80.7 | 599.3 | 201.1 | 105.9 | 44.5 | 0.0 | 2501.3 |
| 2017 | 27.5 | 214.4 | 399.1 | 219.1 | 513.0 | 21.6 | 84.3 | 81.2 | 603.1 | 202.4 | 106.6 | 44.8 | 0.0 | 2517.1 |
| 2018 | 27.7 | 215.7 | 401.7 | 220.5 | 516.3 | 21.7 | 84.8 | 81.8 | 606.9 | 203.6 | 107.2 | 45.1 | 0.0 | 2533.1 |
| 2019 | 27.9 | 217.1 | 404.2 | 221.9 | 519.6 | 21.8 | 85.4 | 82.3 | 610.8 | 204.9 | 107.9 | 45.4 | 0.0 | 2549.1 |
| 2020 | 28.0 | 218.5 | 406.8 | 223.3 | 522.8 | 22.0 | 85.9 | 82.8 | 614.7 | 206.2 | 108.6 | 45.7 | 0.0 | 2565.2 |

**Residential Waste – Baseline Mass of Degradable Organic Carbon Disposed (DDOC mdt)**

| Year | Newspaper | Office Paper | Corrugated Boxes | Coated Paper | Food | Grass | Leaves | Branches | Lumber | Textiles | Diapers | Construction/ Demolition | Sludge/ Manure | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 66.3 | 237.5 | 191.3 | 302.6 | 1021.6 | 39.4 | 95.4 | 40.1 | 295.4 | 279.3 | 326.7 | 24.0 | 1.0 | 2920.6 |
| 2009 | 66.7 | 239.0 | 192.5 | 304.5 | 1028.1 | 39.6 | 96.0 | 40.3 | 297.2 | 281.1 | 328.7 | 24.1 | 1.0 | 2939.1 |
| 2010 | 67.1 | 240.5 | 193.7 | 306.5 | 1034.6 | 39.9 | 96.7 | 40.6 | 299.1 | 282.9 | 330.8 | 24.3 | 1.1 | 2957.7 |
| 2011 | 67.6 | 242.1 | 194.9 | 308.4 | 1041.1 | 40.1 | 97.3 | 40.8 | 301.0 | 284.6 | 332.9 | 24.4 | 1.1 | 2976.4 |
| 2012 | 68.0 | 243.6 | 196.1 | 310.4 | 1047.7 | 40.4 | 97.9 | 41.1 | 302.9 | 286.4 | 335.0 | 24.6 | 1.1 | 2995.2 |
| 2013 | 68.4 | 245.1 | 197.4 | 312.3 | 1054.4 | 40.6 | 98.5 | 41.4 | 304.8 | 288.3 | 337.1 | 24.8 | 1.1 | 3014.2 |
| 2014 | 68.9 | 246.7 | 198.6 | 314.3 | 1061.0 | 40.9 | 99.1 | 41.6 | 306.8 | 290.1 | 339.3 | 24.9 | 1.1 | 3033.2 |
| 2015 | 69.3 | 248.3 | 199.9 | 316.3 | 1067.7 | 41.2 | 99.7 | 41.9 | 308.7 | 291.9 | 341.4 | 25.1 | 1.1 | 3052.4 |
| 2016 | 69.7 | 249.8 | 201.1 | 318.3 | 1074.5 | 41.4 | 100.4 | 42.2 | 310.7 | 293.8 | 343.6 | 25.2 | 1.1 | 3071.8 |
| 2017 | 70.2 | 251.4 | 202.4 | 320.3 | 1081.3 | 41.7 | 101.0 | 42.4 | 312.6 | 295.6 | 345.7 | 25.4 | 1.1 | 3091.2 |
| 2018 | 70.6 | 253.0 | 203.7 | 322.3 | 1088.1 | 41.9 | 101.7 | 42.7 | 314.6 | 297.5 | 347.9 | 25.5 | 1.1 | 3110.7 |
| 2019 | 71.1 | 254.6 | 205.0 | 324.4 | 1095.0 | 42.2 | 102.3 | 43.0 | 316.6 | 299.4 | 350.1 | 25.7 | 1.1 | 3130.4 |
| 2020 | 71.5 | 256.2 | 206.3 | 326.4 | 1102.0 | 42.5 | 102.9 | 43.2 | 318.6 | 301.3 | 352.3 | 25.9 | 1.1 | 3150.2 |

## Table B-11
## Mitigated Degradable Organic Carbon Disposed

**Commercial Waste – Mitigated Mass of Degradable Organic Carbon Disposed (DDOC mdt)**

| Year | Newspaper | Office Paper | Corrugated Boxes | Coated Paper | Food | Grass | Leaves | Branches | Lumber | Textiles | Diapers | Construction/ Demolition | Sludge/ Manure | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | **26.0** | **202.5** | **377.1** | **207.0** | **484.7** | **20.4** | **79.7** | **76.8** | **142.5** | **191.2** | **100.7** | **42.3** | **0.0** | **1950.8** |
| 2009 | **26.2** | **203.8** | **379.5** | **208.3** | **487.8** | **20.5** | **80.2** | **77.3** | **143.4** | **192.4** | **101.3** | **42.6** | **0.0** | **1963.2** |
| 2010 | 26.3 | 205.1 | 381.9 | 209.6 | 490.9 | 20.6 | 80.7 | 77.7 | 144.3 | 193.6 | 102.0 | 42.9 | 0.0 | **1975.6** |
| 2011 | 26.5 | 206.4 | 384.3 | 211.0 | 494.0 | 20.8 | 81.2 | 78.2 | 145.2 | 194.9 | 102.6 | 43.2 | 0.0 | **1988.1** |
| 2012 | 26.7 | 207.7 | 386.7 | 212.3 | 497.1 | 20.9 | 81.7 | 78.7 | 146.1 | 196.1 | 103.3 | 43.4 | 0.0 | **2000.7** |
| 2013 | 26.8 | 209.0 | 389.2 | 213.6 | 500.3 | 21.0 | 82.2 | 79.2 | 147.0 | 197.3 | 103.9 | 43.7 | 0.0 | **2013.3** |
| 2014 | 27.0 | 210.3 | 391.6 | 215.0 | 503.4 | 21.2 | 82.7 | 79.7 | 148.0 | 198.6 | 104.6 | 44.0 | 0.0 | **2026.1** |
| 2015 | 27.2 | 211.7 | 394.1 | 216.3 | 506.6 | 21.3 | 83.2 | 80.2 | 148.9 | 199.8 | 105.2 | 44.3 | 0.0 | **2038.9** |
| 2016 | 27.3 | 213.0 | 396.6 | 217.7 | 509.8 | 21.4 | 83.8 | 80.7 | 149.8 | 201.1 | 105.9 | 44.5 | 0.0 | **2051.8** |
| 2017 | 27.5 | 214.4 | 399.1 | 219.1 | 513.0 | 21.6 | 84.3 | 81.2 | 150.8 | 202.4 | 106.6 | 44.8 | 0.0 | **2064.8** |
| 2018 | 27.7 | 215.7 | 401.7 | 220.5 | 516.3 | 21.7 | 84.8 | 81.8 | 151.7 | 203.6 | 107.2 | 45.1 | 0.0 | **2077.9** |
| 2019 | 27.9 | 217.1 | 404.2 | 221.9 | 519.6 | 21.8 | 85.4 | 82.3 | 152.7 | 204.9 | 107.9 | 45.4 | 0.0 | **2091.0** |
| 2020 | 28.0 | 218.5 | 406.8 | 223.3 | 522.8 | 22.0 | 85.9 | 82.8 | 153.7 | 206.2 | 108.6 | 45.7 | 0.0 | **2104.2** |

**Residential Waste – Mitigated Mass of Degradable Organic Carbon Disposed (DDOC mdt)**

| Year | Newspaper | Office Paper | Corrugated Boxes | Coated Paper | Food | Grass | Leaves | Branches | Lumber | Textiles | Diapers | Construction/ Demolition | Sludge/ Manure | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | **66.3** | **237.5** | **191.3** | **302.6** | **1021.6** | **39.4** | **95.4** | **40.1** | **73.8** | **279.3** | **326.7** | **24.0** | **1.0** | **2699.1** |
| 2009 | **66.7** | **239.0** | **192.5** | **304.5** | **1028.1** | **39.6** | **96.0** | **40.3** | **74.3** | **281.1** | **328.7** | **24.1** | **1.0** | **2716.2** |
| 2010 | **67.1** | **240.5** | **193.7** | **306.5** | **1034.6** | **39.9** | **96.7** | **40.6** | **74.8** | **282.9** | **330.8** | **24.3** | **1.1** | **2733.3** |
| 2011 | **67.6** | **242.1** | **194.9** | **308.4** | **1041.1** | **40.1** | **97.3** | **40.8** | **75.3** | **284.6** | **332.9** | **24.4** | **1.1** | **2750.6** |
| 2012 | **68.0** | **243.6** | **196.1** | **310.4** | **1047.7** | **40.4** | **97.9** | **41.1** | **75.7** | **286.4** | **335.0** | **24.6** | **1.1** | **2768.0** |
| 2013 | **68.4** | **245.1** | **197.4** | **312.3** | **1054.4** | **40.6** | **98.5** | **41.4** | **76.2** | **288.3** | **337.1** | **24.8** | **1.1** | **2785.6** |
| 2014 | **68.9** | **246.7** | **198.6** | **314.3** | **1061.0** | **40.9** | **99.1** | **41.6** | **76.7** | **290.1** | **339.3** | **24.9** | **1.1** | **2803.2** |
| 2015 | **69.3** | **248.3** | **199.9** | **316.3** | **1067.7** | **41.2** | **99.7** | **41.9** | **77.2** | **291.9** | **341.4** | **25.1** | **1.1** | **2820.9** |
| 2016 | **69.7** | **249.8** | **201.1** | **318.3** | **1074.5** | **41.4** | **100.4** | **42.2** | **77.7** | **293.8** | **343.6** | **25.2** | **1.1** | **2838.8** |
| 2017 | **70.2** | **251.4** | **202.4** | **320.3** | **1081.3** | **41.7** | **101.0** | **42.4** | **78.2** | **295.6** | **345.7** | **25.4** | **1.1** | **2856.7** |
| 2018 | **70.6** | **253.0** | **203.7** | **322.3** | **1088.1** | **41.9** | **101.7** | **42.7** | **78.6** | **297.5** | **347.9** | **25.5** | **1.1** | **2874.8** |
| 2019 | **71.1** | **254.6** | **205.0** | **324.4** | **1095.0** | **42.2** | **102.3** | **43.0** | **79.1** | **299.4** | **350.1** | **25.7** | **1.1** | **2893.0** |
| 2020 | **71.5** | **256.2** | **206.3** | **326.4** | **1102.0** | **42.5** | **102.9** | **43.2** | **79.6** | **301.3** | **352.3** | **25.9** | **1.1** | **2911.3** |

## Measure SW-2: Methane Recovery

This measure estimates the reductions resulting from installation of a landfill gas recovery system at the West Central Landfill in order to comply with an adopted ARB regulation described as a discrete early action GHG emissions reduction measure in the AB 32 *Climate Change Scoping Plan.* Two landfills currently accept municipal solid waste (MSW) in Shasta County. The Anderson Landfill already has a landfill gas recovery system in place, and no efficiency upgrades are anticipated at this time. Table B-12 shows the percentage of total waste sent to each landfill that is attributed to unincorporated Shasta County. It also shows the baseline and mitigated methane capture rate scenarios upon which emissions reductions were calculated.

This measure would apply to GHG emissions associated with new waste generated and waste-in-place disposed prior to GGRP implementation.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | Methane recovery efficiency at West Central Landfill improved from 0% to 75% | 16,360 MT $CO_2e$/yr | *CalRecycle Waste Characterization Data, 2011*<br>*IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Chapter 3.* |

**Table B-12**
**Waste Contributions per Landfill and Methane Capture Rates**

| Landfill | Proportion of Total Refuse Received at Landfill from Unincorporated Shasta County | BAU Scenario – Methane Capture Rates | Mitigated Scenario – Methane Capture Rates |
|---|---|---|---|
| West Central Landfill | 24.00% | 0% | 75% |
| Anderson Landfill | 22.00% | 80% | 80% |
| Benton Landfill | 0.00% | 90% | 90% |

Source: Ascent Environmental, 2012

## Measure T-1: Bicycle Lane Expansion

This measure quantifies reductions resulting from increasing Shasta Lake's bicycle mode share through expansion of its bicycle infrastructure, primarily Class I and II bicycle facilities. This measure assumes the construction of 20.0 miles of new Class I and II facilities by 2020. Emissions reductions come from VMT differences between a BAU scenario and a mitigated scenario (see Table B-13). The CAPCOA methodology was used to help quantify VMT reductions based on the proposed bicycle infrastructure improvements. A mode share study conducted by Dill and Carr was used to help define assumptions regarding how additional bicycle lanes translate into increased bicycle mode share (see Table B-14). The methodology assumes that the ratio of additional bicycle lane mileage per community area correlates to increased bicycle mode share, above levels reported in the 2010 US Census.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 43.0 miles of bicycle paths constructed | 127 MT $CO_2e$/yr | *CAPCOA. Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emissions Reductions from Greenhouse Gas Mitigation Measures. August, 2010.*<br>*Dill, J and Carr, T. Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them. 2003.* |

**Table B-13**
**Communitywide VMT Reductions – Bicycle Infrastructure Improvements**

| **BAU Scenario – Vehicles Miles Traveled** | | |
|---|---|---|
| | Community Travel (miles) | Fuel Consumption (gallons) |
| Gasoline | 429,894,759 | 22,507,579 |
| Diesel | 45,127,074 | 7,051,105 |
| Total | 475,021,833 | 29,558,684 |
| **Mitigated Scenario – Vehicles Miles Traveled** | | |
| | Community Travel (miles) | Fuel Consumption (gallons) |
| Gasoline | 429,695,818 | 22,497,163 |
| Diesel | 45,106,191 | 7,047,842 |
| Total | 474,802,009 | 29,545,006 |
| **BAU minus Mitigated Scenario** | | |
| | Community Travel (miles) | Fuel Consumption (gallons) |
| Gasoline | 198,941 | 10,416 |
| Diesel | 20,883 | 3,263 |
| **Total** | **219,824** | **13,679** |

| Table B-14<br>Bicycle Infrastructure Assumptions | |
|---|---|
| Land Area of Community (sq miles) | 50 |
| **Existing Scenario** | |
| Bike Lanes (Class I and II) | 4 |
| Bike Lanes/sq mile | 0.08 |
| **Mitigated Scenario** | |
| Bike Lanes (Class I and II) | 43 |
| Bike Lanes/sq mile | 0.86 |
| % Increase in Bicycle Commute Mode Share for each Additional Mile of Bike Lane/sq mile | 1.0% |
| Mitigated Bicycle Commute Mode Share | 2.3% |

## Measure T-2: Commute Trip Reduction

This measure estimates the impact of transportation demand management programs in unincorporated Shasta County, based on the assembled research. The estimated vehicle trip reductions apply to commute trips for employees of those businesses covered by the TDM program. See Table B-15 for calculations and assumptions related to this measure.

**Rideshare promotion** – A study conducted by Reid Ewing concluded that ridesharing programs can reduce daily vehicle commute trips to specific worksites by 5-15%, and up to 20% or more if implemented with parking pricing. In this measure we assume 3% of commute trips shifted from SOV to other modes.

**Telecommuting/alternative work schedule** – A Center for Urban Transportation Research survey found vehicle trips reduced by up to 8% if 50% of employees are participating in alternative work programs, making it among the most effective commute trip reduction strategies considered in that study. A National Association of Regional Councils analysis estimates that compressed work weeks can reduce up to 0.6% of VMT and up to 0.5% of vehicle trips in a region. In this measure we assume telecommuting/compressed work will result in 3% of commute trips shifted from SOV to other modes.

**Subsidized transit fares** – Various studies of the impact of subsidized transit passes indicate reductions in drive-alone mode share of 4% to 42%, with an average reduction of 19%. For Anderson we estimate that a likely percent reduction in vehicle trips from transit pass subsidies would be 6% for those businesses offering passes.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 5% of employees in unincorporated Shasta County commute via carpool or public transit | 70 MT $CO_2e$/yr | *VMT reduction assumptions: AECOM, 2012.* |

**Table B-15**
**TDM Measure Calculations and Assumptions**

**Percent Reduction in VMT from Implementation of TDM Measures**

| | VMT Split by Vehicle Fuel Type | | Reduction in Total VMT by Vehicle Fuel Type | |
|---|---|---|---|---|
| | Gasoline | Diesel | Gasoline | Diesel |
| Reduction in Total VMT | 90.5% | 9.5% | 0.026% | 0.003% |

**2020 Mitigated Scenario – Vehicle Miles Traveled and Emissions**

| | **Community Travel (miles)** | **Weighted Average Fuel Efficiency (mi/gal)** | **Fuel Consumption (gallons)** | **Emission Factors** | | | **Total Emissions (MT $CO_2$e/Year)** |
|---|---|---|---|---|---|---|---|
| | | | | **$CO_2$ (g/gal)** | **$N_2O$ (g/mi)** | **$CH_4$ (g/mi)** | |
| Gasoline VMT (miles) | 380,179,434 | 19.1 | 19,904,682 | 8,599 | 0.0700 | 0.0620 | 179,577 |
| Diesel VMT (miles) | 39,908,338 | 6.4 | 6,235,678 | 10,092 | 0.0500 | 0.0420 | 63,559 |
| **Total** | 420,087,772 | | 26,140,360 | | | | 243,136 |

**Calculation of VMT, Fuel Consumption, and GHG Emission Reduction from TDM Measures**

| | **Community Travel (miles)** | **Fuel Consumption (gallons)** | **Total Emissions (MT CO2e/Year)** |
|---|---|---|---|
| Gasoline VMT (miles) | 109,414.5 | 5,729 | 52 |
| Diesel VMT (miles) | 11,485.5 | 1,795 | 18 |
| **Total** | **120,900** | **7,523** | **70.0** |

## Measure GI-1: Urban Forest

This measure is based on extrapolating the carbon potential of a typical tree planting palette. The City's goal is that 400 new trees will be planted by public and private development by 2020. Carbon sequestration rates specific to the species and age of the planted trees were collected from the Center for Urban Forest Research (CUFR) Tree Carbon Calculator and used to calculate the annual sequestration potential of the trees from 2008 – 2020. For purposes of the calculation it was assumed that an equal number of trees will be planted each year between 2008 and 2020. See Tables B-16 and B-17 for carbon sequestration assumptions used in this measure.

| Year | Progress Indicators | GHG Reduction (MT $CO_2e$/yr) | Sources |
|---|---|---|---|
| **2020** | 400 shade trees are planted. | 30 MT $CO_2e$/yr | The Center for Urban Forest Research (CUFR) Tree Carbon Calculator. |

**Table B-16**
**Carbon Sequestration of Trees Planted 2012-2020 in 2020**

| Year | Trees Planted per Year | Years of Growth | GHG Emissions Reductions (lbs $CO_2e$ in 2020) | Carbon Sequestration (MT $CO_2e$ in 2020) |
|---|---|---|---|---|
| 2012 | 50 | 0 | 17,341 | 7.9 |
| 2013 | 50 | 1 | 14,310 | 6.5 |
| 2014 | 50 | 2 | 11,481 | 5.2 |
| 2015 | 50 | 3 | 8,836 | 4.0 |
| 2016 | 50 | 4 | 6,359 | 2.9 |
| 2017 | 50 | 5 | 4,317 | 2.0 |
| 2018 | 50 | 6 | 2,620 | 1.2 |
| 2019 | 50 | 7 | 1,200 | 0.5 |
| **Cumulative Total in 2020** | **400** | **NA** | **66,463** | **30.1** |

Note: Assumes age of tree at planting = 4 years

**Table B-17**
**Carbon Sequestration per Species per Year of growth**

| Species | Camphor Tree *Cinnamomum camphora* | | *Modesto Ash* *Fraxinus vlutina* | | Sweetgum *Liquidambar styraciflua* | | Roble Negro *Quercus ilex* | | Turkish Pine *Pinus brutia* | | ***AVERAGE*** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | **per year** | **Total** | **per year** | **Total** | **per year** | **Total** | **per year** | **Total** | **per year** | **Total** | **per year** | **Total** |
| | **20%** | | **20%** | | **20%** | | **20%** | | **20%** | | | |
| 1 | **0.6** | 0.6 | **1.5** | 1.5 | **0.2** | 0.2 | **0.0** | 0.0 | **0.6** | 0.6 | 0.3 | 0.6 |
| 2 | **0.6** | 1.2 | **13.7** | 15.2 | **0.2** | 0.4 | **0.5** | 0.5 | **0.6** | 1.2 | 1.4 | 3.7 |
| 3 | **2.6** | 3.8 | **30.0** | 45.2 | **0.2** | 0.6 | **3.1** | 3.6 | **4.9** | 6.1 | 3.7 | 11.9 |
| 4 | **6.0** | 9.8 | **43.7** | 88.9 | **0.7** | 1.3 | **8.0** | 11.6 | **12.3** | 18.4 | 6.4 | 26.0 |
| 5 | **10.3** | 20.1 | **54.3** | 143.2 | **1.7** | 3.0 | **14.3** | 25.9 | **21.5** | 39.9 | 9.3 | 46.4 |
| 6 | **13.1** | 33.2 | **58.6** | 201.8 | **2.5** | 5.5 | **18.3** | 44.2 | **27.5** | 67.4 | 10.9 | 70.4 |
| 7 | **16.6** | 49.8 | **63.2** | 265.0 | **3.7** | 9.2 | **23.5** | 67.7 | **35.1** | 102.4 | 12.9 | 98.8 |
| 8 | **21.2** | 71.0 | **68.2** | 333.2 | **5.4** | 14.5 | **30.1** | 97.9 | **44.8** | 147.2 | 15.4 | 132.8 |
| 9 | **26.9** | 97.9 | **73.6** | 406.8 | **7.9** | 22.4 | **38.6** | 136.5 | **57.2** | 204.3 | 18.6 | 173.6 |
| 10 | **34.2** | 132.1 | **79.4** | 486.2 | **11.6** | 34.0 | **49.5** | 186.0 | **73.0** | 277.3 | 22.5 | 223.1 |
| 11 | **37.6** | 169.7 | **80.7** | 566.9 | **13.7** | 47.7 | **54.2** | 240.2 | **78.4** | 355.7 | 24.0 | 276.0 |
| 12 | **41.3** | 211.0 | **81.9** | 648.8 | **16.1** | 63.8 | **59.4** | 299.6 | **84.1** | 439.9 | 25.7 | 332.6 |

Source: Center for Urban Forest Research, CUFR Model, USDA, 2008

## Statewide Measures Reductions

For climate action planning purposes, baseline GHG emissions are projected under a business-as-usual scenario to a future year, assuming that conditions and consumption rates occurring in the baseline year would continue. However, even without local climate action planning, statewide measures and regulations would affect future business-as-usual GHG emissions.

Estimates of the local effect of statewide reduction measures should be conservative to avoid overestimating GHG reductions. In many cases, the regulation may not have the same effectiveness at a particular local level as it does on a statewide level. Furthermore, some regulations that affect certain industries or practices may occur more frequently in one jurisdiction than another and therefore various levels of statewide reductions would be anticipated in each jurisdiction. Therefore, AECOM has selected the following statewide reduction measures that would create reasonably foreseeable emissions reductions attributable to Shasta Lake at a local level.

### Renewable Portfolio Standard

Executive Order S-21-09 established a statewide renewable energy portfolio target of 33% by year 2020. Therefore, California utilities, including PG&E, will increase their renewable portfolio standard (RPS) to at least 33% by year 2020. The GHG reductions associated with the RPS were estimated by evaluating PG&E's RPS increase from baseline year 2008 to year 2020 and 2035. PG&E's year 2008 baseline RPS-eligible electricity sources were determined to be approximately 12%. However, PG&E also maintains other renewable electricity sources that don't qualify for RPS (e.g., large hydroelectric sources); however, would also not generate GHG emissions. These non-RPS eligible sources account for approximately 20% of PG&E's year 2008 baseline electricity portfolio. Therefore, the anticipated change from baseline year 2008 to year 2020 is a 21% increase in RPS sources (i.e., 33% - 12% = 21%). Assuming that PG&E will only focus on RPS-eligible sources, year 2020 renewable portfolio would be approximately 53% (i.e., 33% RPS + 20% non-RPS = 53%). Although it is likely that PG&E would add additional RPS and non-RPS sources between 2020 and 2035, or that new regulations would require an increase in RPS sources, for a conservative analysis, the projections assume the 33% RPS and 20% non-RPS eligible renewable sources remained constant between 2020 and 2035. Table B-18 presents calculations used to estimate GHG emission reductions associated with the RPS.

| Table B-18<br>Communitywide Renewable Portfolio Standard Calculations | | |
|---|---|---|
| **Parameter** | **2020** | **2035** |
| Total Business-As-Usual Electricity Emissions (MT CO2e/yr) | 148,409 | 148,409 |
| Business-As-Usual RPS [1] | 12% | 12% |
| Target RPS | 33% | 33% |
| Additional RPS Percent Increase | 21% | 21% |
| Total Renewable, Non-Carbon Electricity Sources | 53% | 53% |
| Total Electricity Emissions with RPS Target (MT CO2e/yr)<br>(Electricity BAU × (1-Additional RPS)) | 102,577 | 102,577 |
| Emission Reduction (MT CO2e/yr) | 45,832 | 45,832 |

Notes: MT CO2e/yr = metric tons of carbon dioxide equivalent per year; BAU = business as usual; RPS = renewable portfolio standard

[1] Business-as-usual renewable portfolio standard (RPS) (year 2008) and non-RPS eligible resources were obtained from Pacific Gas and Electric.

Source: AECOM 2012

## Scoping Plan Transportation Measures

The AB 32 Climate Change Scoping Plan (Scoping Plan) has established several statewide measures that will contribute to California achieving its GHG reduction goal. Several statewide measures would affect the transportation-related business-as-usual emissions. In order to account for GHG reductions associated with Pavley I and the Low Carbon Fuel Standard (LCFS), the ARB-approved Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0 was used to estimate reductions from EMFAC2007 outputs (ARB 2010b). Table B-19 presents GHG emission reductions associated with Pavley I and the LCFS transportation measures.

The AB 32 Scoping Plan includes other transportation measures that would reduce motor vehicle emissions on a statewide level, which are not estimated in any ARB-approved models. AECOM has selected Heavy-Duty Vehicle Aerodynamic Efficiency, Light-Duty Vehicle Tire Pressure, and Pavley II as measures that can be reasonably assumed to be implemented and affect transportation emissions within Anderson. To estimate the local effect of these reductions, AECOM divided the anticipated transportation emission reductions associated with the Scoping Plan transportation measures by the ARB-projected 2020 transportation emissions to estimate the percent reduction in transportation emissions attributed to implementation of the Scoping Plan. The percent reduction achieved by these measures from the state's total transportation sector was applied to the City's business-as-usual transportation emissions. This method assumes that the City will achieve the same relative level of transportation emission reductions associated with transportation measures as the Scoping Plan assumes at the statewide level. Table B-20 presents calculations used to estimate GHG emission reductions associated with the Heavy-Duty Vehicle Aerodynamic Efficiency, Light-Duty Vehicle Tire Pressure, and Pavley II transportation measures.

**Table B-19**
**Pavley I and Low Carbon Fuel Standard Emission Reductions**

| | Preferred Project ($MT CO_2e/yr$) | |
|---|---|---|
| **Transportation Measure** | **2020** | **2035** |
| Pavley I | 35,421 | 66,274 |
| Low Carbon Fuel Standard | 15,173 | 16,146 |
| **Total** | **50,594** | **82,420** |

Notes: MT $CO_2e/yr$ = metric tons of carbon dioxide equivalents per year.
Source: AECOM 2012, ARB 2010b

**Table B-20**
**Communitywide Scoping Plan Measures Calculations**

| Energy Source and Year | Statewide Total Emissions (MMT $CO_2e/yr$) [1] | AB 32 Scoping Plan Reductions (MMT $CO_2e/yr$) [2] | Percent Reduction | Unincorp. Shasta County Total Emissions (MT $CO_2e/yr$) | Unincorp. Shasta County Total Emissions with Reduction Measure (MT $CO_2e/yr$) | Emission Reductions (MT $CO_2e/yr$) |
|---|---|---|---|---|---|---|
| **Med- and Heavy-Duty Vehicle Efficiency[3]** | | | | | | |
| 2020 | 168.10 | 1.4 | 0.03% | 275,326 | 273,640 | 1,686 |
| 2035 [4] | 168.10 | 1.4 | 0.03% | 335,539 | 333,443 | 2,096 |
| **Pavley II** | | | | | | |
| 2020 | 168.10 | 4.0 | 2.4% | 275,326 | 268,376 | 6,950 |
| 2035 [4] | 168.10 | 4.0 | 2.4% | 335,539 | 327,155 | 8,384 |
| **Total Reductions** | | | | | | |
| 2020 | - | - | - | - | - | 59,230 [5] |
| 2035 [4] | - | - | - | - | - | 92,900 [5] |

Notes: MMT $CO_2e/yr$ = million metric tons of carbon dioxide equivalent per year; MT $CO_2e/yr$ = metric tons of carbon dioxide equivalent per year.

[1] Obtained from the ARB's 2020 projected inventory.

[2] Obtained from ARB's updated AB 32 Scoping Plan implementation schedule.

[3] Combines two AB 32 Scoping Plan action items: Heavy-Duty Vehicle Aerodynamic Efficiency Program and Medium- and Heavy-Duty Vehicle Hybridization Program

[4] ARB has not projected California statewide emissions or emission reductions associated with the AB 32 Scoping Plan out to year 2035. It is anticipated that additional efficiency could increase the measures reductions; however, the same level of reductions was assumed for both 2020 and 2035.

[5] Total reductions equal the sum of emissions reductions from Pavley I and Low Carbon Fuel Standard (see Table B-19) and the transportation measures described and presented above.

Source: AECOM 2012, ARB 2010c, ARB 2011.

## 2008 and 2013 California Title-24 Standards

***Impact of 2008 Title-24***

The first step of this analysis estimates the reduction in energy-related emissions (i.e., electricity and natural gas) associated with new buildings constructed from January 2010 through December 2013. This construction is subject to the current (2008) Title 24 energy code and therefore is more efficient than buildings constructed under the 2005 Title 24 energy code requirements. Business-as-usual electricity and natural gas consumption levels for residential and non-residential construction were established using the CEC's Residential Appliance Saturation Survey data and the Commercial End Use Survey data for Forecast Climate Zone 3. The California Energy Commission's (CEC) report entitled *Impact Analysis - 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings* provides data on the energy savings potential of construction subject to 2008 requirements compared to construction subject to the 2005 baseline requirements. This savings potential was applied to projected levels of residential and non-residential construction for the jurisdiction (see Table B-21).

**Table B-21**
**Impact of 2008 T-24 on Building Energy Use**

| **Residential - Local Climate Zone** | | |
|---|---|---|
| **Title-24 Period** | **kWH/unit/year** | **therms/unit/year** |
| T-24 2005 Residential (SFR) Energy Use | 7,514 | 364 |
| T-24 2008 Residential (SFR) Energy Use | 7,410 | 316 |
| % difference | -1.4% | -13.1% |
| **Non-Residential - Local Climate Zone** | | |
| **Title-24 Period** | **kWH/unit/year** | **kBTU/unit/year** |
| T-24 2005 Residential (SFR) Energy Use | 13.64 | 29.49 |
| T-24 2008 Residential (SFR) Energy Use | 13.04 | 25.45 |
| % difference | -4.4% | -13.7% |

Note:
-Used RASS 'SFR' category for residential.
-Used CEUS 'All Commercial' category for non-residential.

***Impact of 2013 Title-24***

The second step of this analysis estimates the reduction in energy-related emissions (i.e., electricity and natural gas) associated with new buildings constructed from January 2014 forward. The CAPCOA report "*Quantifying Greenhouse Gas Mitigation Measures*" provides a methodology for calculating the reduction in energy-related emissions (i.e., electricity and natural gas) resulting from new construction built to energy efficiency standards above the current (2008) Title 24 energy code. The methodology calculates the reduction in electricity and natural gas consumption for each percent increase over current Title 24 standards per residential and non-residential building type and climate zone.

Baseline electricity and natural gas consumption levels per residential unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3. Mitigated levels of electricity and natural gas consumption levels per building type were calculated using the CAPCOA methodology. The measure assumes that all new buildings constructed after January 2014 will exceed 2008 Title 24 energy standards by 25%. This assumption was based on the following CEC press release. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf

***Building Construction Projections***

Projections of new residential development were developed from SCTPA traffic model inputs. Projections for new non-residential development were developed by using existing non-residential building area data from the County Assessors database and assuming the SCTPA traffic model employment growth rate to estimate growth in non-residential building stock.

## SB 375

SB 375 is designed to align and coordinate a region's transportation planning efforts, GHG emission reduction targets, and land use and housing allocations. The primary tool of SB 375 are Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which are to be developed by the local metropolitan planning organization (MPO) to prescribe land use allocations in the applicable regional transportation plan (RTP). ARB, in coordination with each MPO will set GHG emissions reduction targets for regions. In order to account for the strategies that will be implemented by SB 375, the projections assumed that the SCS and APS developed by Shasta County RTPA would achieve a zero per capita vehicle miles traveled (VMT) growth. In other words, the current year 2008 baseline VMT per capita was assumed to remain constant until 2035 and VMT would only grow proportional to population growth. See Table B-22 for calculations and assumptions used to quantify reductions from SB 375.

**Table B-22**
**Unincorporated County VMT Growth (SB 375)**

| Parameter | 2020 | 2035 |
|---|---|---|
| Total Transportation Emissions (BAU) ($MT CO_2e/yr$) | 275,326 | 335,539 |
| Population Growth from Baseline 2008 | 4.3% | 19.2% |
| Total Transportation Emissions (With SB 375) ($MT CO_2e/yr$) | 254,118 | 290,474 |
| Emission Reductions ($MT CO_2e/yr$) | 21,208 | 45,065 |

Notes: MT CO2e/yr = metric tons of carbon dioxide equivalent per year
Source: AECOM 2012