

# Energy and Greenhouse Gas Emissions

## Why is this important?

Global climate change is an increasingly acknowledged environmental problem. There is scientific consensus that it is caused by greenhouse gases being released into the atmosphere faster than the earth's natural systems can re-absorb them. Besides a small portion of emissions resulting from waste decomposition, soil disruption, or the release of industrial chemicals, energy use (in buildings, transportation, or elsewhere) is the primary source of greenhouse gas emissions in most U.S. cities, including Redwood City. Both decreased energy consumption and increased renewable energy production are key components to reducing greenhouse gas emissions, and one without the other is unlikely to achieve a sustainable energy economy.

Models predict world temperatures will rise by between 1.4 and 5.8 °C (2.5 and 10.4 °F) during the 21<sup>st</sup> century, depending on how much atmospheric concentrations of greenhouse gases rise and on the eventual effect of such rises.<sup>27</sup> These global changes would affect residents of Redwood City in a variety of ways, including:

- More frequent heat waves.
- Rising sea levels, which would threaten coastal infrastructure such as the Port of Redwood City, residential, industrial, or other development near sea level, and coastal ecosystems such as Bair Island and Redwood City's many other wetland areas.
- A decrease in the Sierra snowpack, which will reduce fresh water availability through the Hetch Hetchy water system that supplies Redwood City, and could reduce the availability of hydro-electric electricity, a major power source for Redwood City.
- The potential arrival of tropical insect-borne diseases.

Besides Redwood City's obvious stake in contributing to efforts to address this global problem, there is increasing market, regulatory, and public support for action to combat climate change. In June 2005, Governor Schwarzenegger signed California executive order S-3-05, which called for the state to reduce its greenhouse gas emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050. This was followed by State Assembly Bill 32, which requires California to reduce its greenhouse gas emissions levels to 1990 levels by 2020. The California Air Resources Board (CARB), which is required by law to implement and enforce AB 32, released a draft implementation framework in July 2008 and will release a final implementation framework in January 2009. CARB's power to enforce AB 32 will start in 2012. State Bill 375, signed into law in September 2008, clarifies that CARB will set regional greenhouse gas targets by 2010, that transportation funding will be contingent on meeting these targets, and that certain kinds of transit-oriented and compact development will be exempt from assessing greenhouse gas impacts under CEQA.

California residents and institutions have many years of experience implementing energy conservation efforts. While per capita energy consumption has increased nationally by 50% over the past 30 years, per capita consumption in California has not increased over the same period,

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<sup>27</sup> Intergovernmental Panel on Climate Change, Working Group III Report: Climate Change 2007: Mitigation of Climate Change, p. 133.

due to many factors including efficiency and conservation campaigns by governments, private citizens and some utility companies.

## Defining Sustainability

A sustainable level of global greenhouse gas emissions could be re-absorbed by the earth's natural processes, and a sustainable local level of greenhouse gas emissions would contribute proportionally to this goal. A sustainable energy economy would have stable or decreasing levels of consumption combined with indefinitely renewable energy sources.

## Indicator Results

### City-wide Greenhouse Gas Emissions and Energy Use

Table 13 shows the Redwood City Community Greenhouse inventory by sector. Highlights are as follows:

- Transportation uses the most energy and emits the most greenhouse gas emissions (51% of total greenhouse gas emissions) of any sector in the city-wide inventory. Residential, commercial and industrial buildings account for another 43% of greenhouse emissions, and waste accounts for 6% of emissions.
- Redwood City's 6.71 metric tons<sup>28</sup> of CO<sub>2</sub> equivalent emitted per capita is similar to the 6.75 metric tons of CO<sub>2</sub> equivalent emitted per capita in the City of San Mateo. Total per capita emissions inventoried in other Bay Area cities vary widely (for instance, 5.23 metric tons of CO<sub>2</sub> Equivalent per capita in El Cerrito and 7.91 metric tons of CO<sub>2</sub> Equivalent per capita in Hercules). However, some differences between cities may have as much to do with unstandardized inventory protocols (particularly around measuring transportation emissions, waste emissions, and "embodied" emissions) and regional forces like miles of through-cutting regional highways as with extremely different consumption patterns.

**Table 13: City-wide ("Community") Greenhouse Gas Emissions and Energy Use in 2005**

	CO <sub>2</sub> Equivalent (Total Metric Tons)	CO <sub>2</sub> Equivalent (Metric Tons Per Capita)	CO <sub>2</sub> Equivalent (%)	Total Energy Used (MMBtu <sup>29</sup> )
Residential	98,802	1.26	18.9	1,738,288
Commercial	58,866	0.75	11.2	1,075,303
Industrial	67,865	0.87	13.0	1,264,244
Transportation	266,867	3.42	50.9	3,653,965
Waste	31,646	0.41	6.0	N/A
<b>TOTAL</b>	<b>524,046</b>	<b>6.71</b>	<b>100.0</b>	<b>7,731,801</b>

Source: Redwood City Inventory of 2005 Community Greenhouse Gas Emissions, 2008

<sup>28</sup> "Metric tons" are a metric unit of measurement, equal to 1,000 kilograms, or about 2,200 pounds. Metric tons are the standard unit of measurement for emissions of CO<sub>2</sub> equivalent.

<sup>29</sup> "MMBtu" is one million British Thermal Units.

## Building Sector Greenhouse Gas Emissions by Selected City

Comparisons to surrounding cities can give Redwood City a relative sense of its own greenhouse gas emissions performance. The cities listed in this indicator have calculated building greenhouse gas emissions using the ICLEI protocol, which is endorsed by CARB and used by cities across the country. In this protocol, building emissions figures are based on fairly standardized energy bill data and therefore provide a meaningful comparison, with a smaller margin of error, between cities. (Calculations of transportation or waste sector emissions, on the other hand, tend to use less standard data sources and therefore are less meaningful to compare from city to city.) Emissions inventories across all sectors are likely to be more comparable in the future as they are standardized by the state. Highlights of selected cities' buildings emissions are as follows:

- Redwood City's residential buildings emit 1.26 metric tons of CO<sub>2</sub> equivalent per capita. As with many cities in California and the rest of the United States, the residential sector is the single building sector with the most emissions.
- Redwood City reports somewhat lower levels of residential emissions than other selected cities.
- Redwood City's commercial and industrial building emissions, which combine to 1.62 metric tons of CO<sub>2</sub> equivalent per capita, are higher than other selected cities.
- San Mateo's overall profile is the most similar to Redwood City in terms of total emissions from both residential and industrial or commercial buildings, perhaps because of a similar land use make-up and regional location.

**Table 14: Per Capita Building Sector Emissions in Selected Bay Area Cities, in Metric tons of CO<sub>2</sub> Equivalent**

	Residential	Industrial	Commercial	Commercial and Industrial Combined
Redwood City	1.26	0.75	0.87	1.62
San Mateo	1.46	N/A	N/A	1.38
El Cerrito	1.62	N/A	N/A	0.92
Hercules	1.43	N/A	N/A	0.83

Source: Cities of Redwood City, San Mateo, El Cerrito, and Hercules, 2005 Greenhouse Gas Inventories

## Watts of Solar Energy Capacity Installed Annually in Redwood City

Redwood City's well-known sunny climate makes it a good location for use of solar energy. Solar energy capacity is defined as the amount of energy able to be produced from solar sources like photovoltaic panels and passive water-heating solar panels. It can be measured in terms of watts installed. Highlights of solar capacity installed in Redwood City include:

- Redwood City has installed a total of 555,877 watts of solar capacity and an average of 61,764 watts of solar capacity per year since 1999.
- Installation of solar energy production capacity has increased in the past nine years, highlighted by 207,347 Watts (37% of the nine year total) of capacity installed in 2006 and 442,843 Watts (80% of the nine year total) of capacity installed from 2004-2007.

- Despite increasing installation, solar energy accounts for an extremely small percentage of overall energy consumed in Redwood City. The 555,877 watts of solar capacity installed since 1999 remains less than one one-millionth of the 1,195 billion watts of energy consumed by residential, commercial, and industrial uses in Redwood City in 2005.

**Table 15: Watts of Solar Energy Capacity Installed Annually in Redwood City**

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total Since 1999	Average Since 1999
Watts Installed	12,301	1,496	17,425	37,125	44,707	96,334	40,659	207,347	98,483	555,877	61,764

Source: California Energy Commission, 2008

## Mix of the City's Energy Supply

Besides off-the-grid systems or private systems such as rooftop solar panels that feed into the electricity grid, Pacific Gas and Electric Company (PG&E) is Redwood City's sole supplier of electricity for purchase. PG&E assumes that all electricity that flows to individual customers (both inside and outside of Redwood City) has roughly the same ratio of renewable to non-renewable sources, so PG&E's energy supply mix dictates Redwood City's energy supply mix. Redwood City does not have direct control over how PG&E produces energy, but can actively and publicly encourage the company to make its energy portfolio less emissions-intensive. It can also participate in any renewable-purchasing programs PG&E may develop. Relevant features of PG&E's energy production mix, shown in Table 16, are described below:

- Natural gas energy accounted for 40% of power produced in 2006. Per watt of power generated, natural gas produces fewer greenhouse gases than coal but more than any other PG&E source.
- Nuclear energy from the Diablo Canyon power plant accounted for 24% of power produced in 2006. Opinions on the sustainability of nuclear power production are mixed; while it produces few greenhouse gas emissions, it also produces highly toxic waste, and the catastrophic failure of a nuclear plant could cause massive environmental damage.
- Hydroelectric energy accounted for 22% of power produced in 2006. This expanding component of the PG&E energy mix produces no greenhouse gas emissions, but it has impacts on river habitat and is vulnerable to reduced Sierra snowpack that results from climate change.
- Renewable energy sources accounted for 12% of power produced in 2006. This has not increased since 2004, but PG&E recently entered into several major new renewable energy purchasing contracts, and it reports that with the addition of these new contracts, 24% of future power deliveries (3,600 megawatts) will be renewable.<sup>30 31</sup> With the exception of the 0.5 kilowatts (0.0005 megawatts) of solar power installed in Redwood City – most of which is unlikely to feed into the electricity grid and contribute to PG&E's power supply – all PG&E renewable energy is produced outside of Redwood City.

<sup>30</sup> Associated Press, "PG&E to buy power from solar farms on California Coast," cited in *Business Week*, August 14, 2008.

<sup>31</sup> State Senate Bill 1078 requires 20% of a utility's power deliveries to come from renewable sources by 2010.

- Coal energy accounts for 1% of power produced in 2006. This small coal share is a positive feature for environmental sustainability, since coal is the most emissions-intensive (both in terms of greenhouse gases and other air pollutants) of any PG&E energy source.

**Table 16: PG&E Energy Production Mix**

	Natural Gas	Nuclear	Total California Renewable	Large Hydroelectric	Coal	Other	Generic Power Sold
2004	47%	21%	12%	16%	3%	Less than 1%	1%
2005	42%	24%	12%	20%	1%	1%	N/A
2006	40%	24%	12%	22%	1%	1%	N/A

Source: PG&E, 2008

## Summary of Results

Transportation is responsible for the most greenhouse gas emissions in Redwood City, followed closely by buildings and more distantly by waste. Within the building sector, residential are the single sector with the most energy consumption per capita, but industrial and commercial buildings combined use more energy per capita than residential buildings. The city's energy supplier, PG&E, has a relatively low-emitting energy production portfolio, though much of its contracted renewable energy capacity has not yet come on line. The most solar power installed in Redwood City of any year on record were 2006 and 2007, but total installed solar in Redwood City still only accounts for about one one-millionth of energy used in the City.

## Potential Policy Responses

### Cross-Cutting Greenhouse Gas and Energy

- Promote land use decisions that reduce driving and therefore reduce greenhouse gas emissions. Such strategies included Transit-oriented development, mixed-use development, and revitalizing the Downtown and major corridors with higher intensity uses.
- Complete the Redwood City municipal emissions inventory currently underway.
- Continue greenhouse gas inventories into the future, set greenhouse gas reduction targets, and move forward with preparation of a Climate Action Plan.
- Capitalize on the increasing economic benefits of both reduced energy consumption and increased renewable energy production.
- Encourage reductions in energy consumption in tandem with increases in renewable energy production.

### Energy Consumption

- Focus on energy consumption reductions in the transportation and building sectors.
- Seek opportunities to reduce energy consumption in the industrial and commercial sector, where energy use reductions by a single large user could have a large effect.

- Capitalize on the extensive services offered by PG&E and others in the areas of energy efficiency retrofitting and increased energy conservation practices.

## **Energy Production**

- Be an active and vocal PG&E customer, encouraging it to continue introducing new renewable and low-emission power sources into its energy mix.
- Participate in any renewable-purchasing programs PG&E may develop.
- Seek other sources of renewable energy besides PG&E, including city-developed public sources, private sources, or nearby cities that may have public utilities providing extra renewable-sourced power.
- Offer an expedited or low-cost approval process or other incentives to renewable energy projects seeking to locate within the city.