



## 2 – SCIENTIFIC AND REGULATORY FRAMEWORK



## CLIMATE CHANGE SCIENCE OVERVIEW

Since the early 1990s, scientific consensus holds that the world's population is releasing greenhouse gases faster than the earth's natural systems can absorb them. These gases are released as by-products of fossil fuel combustion, waste disposal, energy use, land-use changes, and other human activities.

While often used interchangeably, there is a difference between the terms "climate change" and "global warming." According to the National Academy of Sciences, climate change refers to any significant, measurable change of climate lasting for an extended period of time that can be caused by both natural factors and human activities.<sup>1</sup> Global warming, on the other hand, is an average increase in the temperature of the atmosphere caused by increased greenhouse gas emissions. The use of the term climate change is becoming more prevalent because it encompasses all changes to the climate, not just temperature.

### The Greenhouse Effect

Our planet is reliant on the greenhouse effect, which results when the atmosphere captures the heat that radiates away from the earth toward space. Several gases in the atmosphere function as barriers and trap heat within the planet's atmosphere, including water vapor, carbon dioxide, methane, nitrous oxides, and chlorofluorocarbons.

This release of gases, such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), creates a blanket around the earth that allows light to pass through but traps heat at the surface preventing its escape into space (Figure 2-1). While this is a naturally occurring process known as the greenhouse effect, human activities have accelerated the generation of greenhouse gases beyond natural levels. The overabundance of greenhouse gases in the atmosphere has led to an unexpected warming of the earth and has the potential to severely impact the earth's climate system.

<sup>1</sup> National Academy of Sciences 2008.



The six internationally recognized greenhouse gases include:

Carbon dioxide (CO<sub>2</sub>)

Methane (CH<sub>4</sub>)

Nitrous Oxide (N<sub>2</sub>O)

Sulfur Hexafluoride (SF<sub>6</sub>)

Chlorofluorocarbon (CFC)

Hydro-Chlorofluorocarbon (HCFC).

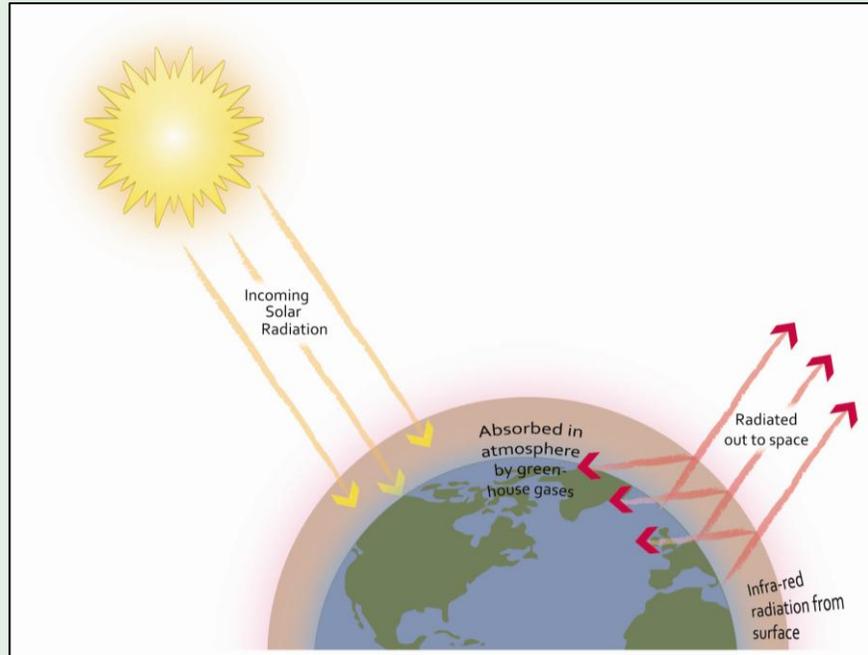


Without the greenhouse effect, the average global temperature would be zero degrees Fahrenheit, and life on earth would not be possible (National Oceanic and Atmospheric Administration, National Climatic Data Center 2008).

The Intergovernmental Panel on Climate Change is an organization created by the United Nations Environmental Programme and the World Meteorological Organization to provide a global scientific view on the current state of climate change and its potential environmental and socio-economic impacts.

These gases function similarly to glass on a greenhouse; the glass panes of a greenhouse allow sunlight to pass into the building but trap heat within it, preventing the heat from escaping.<sup>2</sup>

**Figure 2-1. The Greenhouse Effect**



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center. 2008. *NOAA Satellite and Information Service*.

## GLOBAL CLIMATE CHANGE IMPACTS

The Intergovernmental Panel on Climate Change’s (IPCC) Fourth Assessment Report’s Working Group I Summary for Policymakers summarizes current scientific understanding of global climate change and projects future climate change using the most comprehensive set of recognized global climate models.<sup>3</sup> The report incorporates the current effects of global climate change and includes an increase in tropical cyclone intensity, a loss in seasonally frozen ground, and an increase in drought intensity.

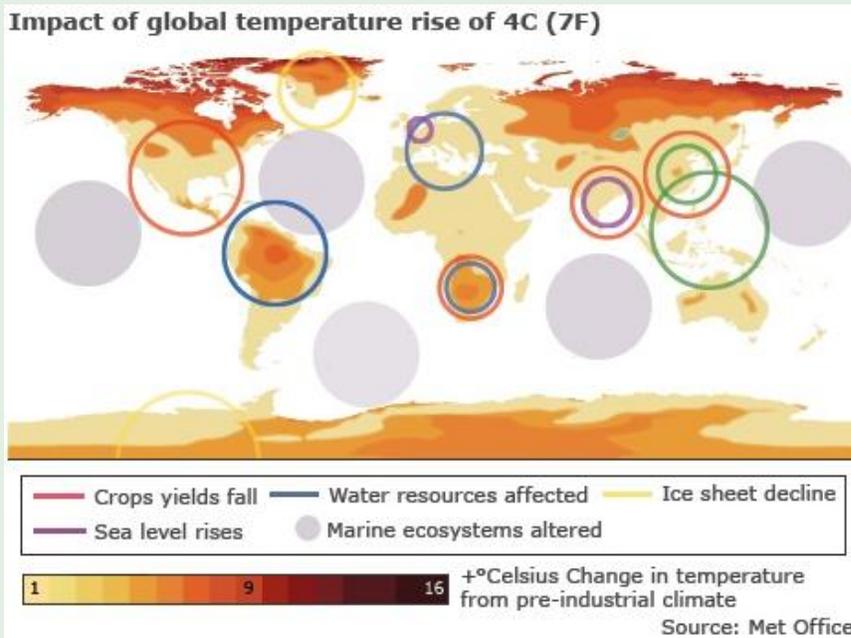
<sup>2</sup> National Oceanic and Atmospheric Administration, National Climatic Data Center 2008.

<sup>3</sup> IPCC 2007.

As asserted in the IPCC Fourth Assessment Report, if trends remain unchanged, continued GHG emissions above current rates will induce further warming changes in the global climate system and pose even greater risks than those currently witnessed. The impact of additional warming on the global climate is shown in Figure 2-2.

Given the scientific basis of climate change facts and expected trends, the challenge remains to prepare for and mitigate climate change through deliberate global and local action.

**Figure 2-2. Potential Global Climate Change Impacts**



Source: Met Office, Hadley Centre. 2009. *Mapping Climate Impacts*.

## CLIMATE CHANGE IMPACTS TO CALIFORNIA

Research suggests that California will experience hotter and drier conditions, reductions in winter snow and increases in winter rains, sea level rise, significant changes to the water cycle, and an increased occurrence of extreme weather events. Such compounded impacts will affect economic systems throughout the state. To refrain from action is costly and risky; the California



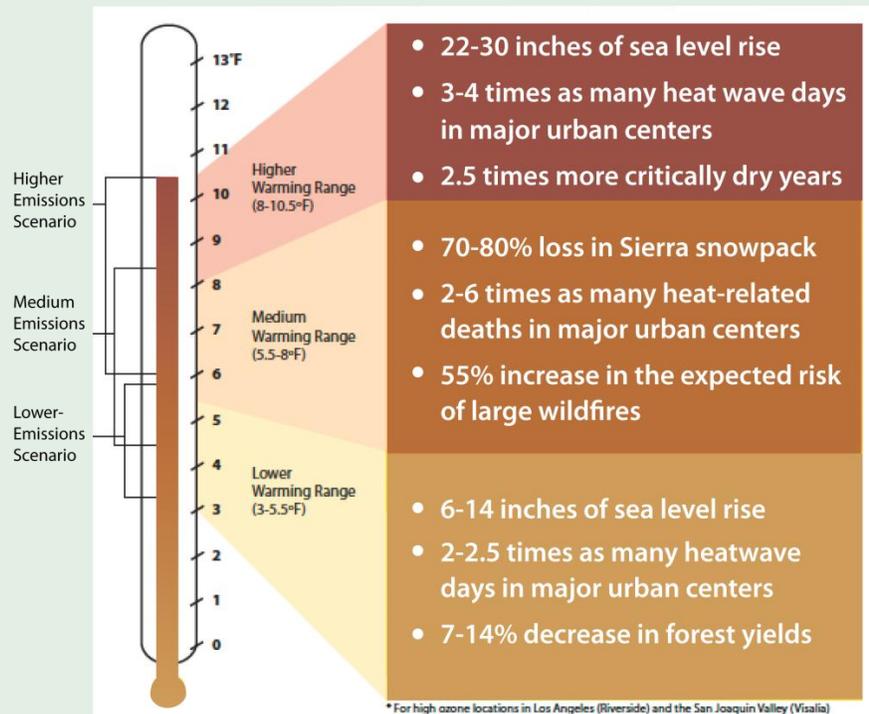
### Climate Change in California

- hotter and drier conditions,
- reductions in winter snow and increases in winter rains,
- sea level rise,
- significant changes to the water cycle, and
- an increased occurrence of extreme weather events



Climate Adaptation Strategy estimates that no action to address the potential impacts of climate change will lead to economic losses of “tens of billions of dollars per year in direct costs” and “expose trillions of dollars of assets to collateral risk.”<sup>4</sup> Potential impacts in California due to climate change are summarized in Figure 2-3.

**Figure 2-3.** California Climate Change Impacts, 2070-2099



Source: California Energy Commission. 2006. *Our Changing Climate: Assessing the Risks to California*. Web Document. Sacramento, CA: California Energy Commission.

**Increased Rate of Wildfires**

Wildfire risk is based on a combination of factors including rainfall, winds, temperature, and vegetation. Wildfires are likely to grow in number and size throughout the state as a result of increased temperatures induced by climate change. Even under the “medium” warming scenario predicted by the Intergovernmental Panel on Climate Change, wildfire risk will likely increase by 55% in

<sup>4</sup> California Natural Resources Agency 2009.

California.<sup>5</sup> Further, as wildfires increase in frequency and size, they will also increase in intensity.<sup>6</sup>

### **Negative Impacts on Wildlife**

As temperatures rise, species are moving north in California or to higher elevations. This migrational change disrupts the food chain and prevents some plant species from being pollinated. Water and food supplies are expected to be more variable and to shift as the seasons change. Those species that are unable to migrate face the danger of extinction: “The amount of future warming expected in California may likely exceed the tolerance of endemic species (i.e., those that are native to a specific location and that only occur there) given their limited distribution and microclimate.”<sup>7</sup>

Reduction in soil moisture will result in early dieback of many plants, potentially leading to conflicts with animal breeding seasons and other natural processes. Many of the potential effects on wildlife are still being studied, but with a limited ability to adapt to new climates, the potential for severe species loss is present.

Several potential hydrological changes associated with global climate change could also specifically influence the ecology of aquatic life in California and have several negative effects on cold-water fish. For example, if a rise in air temperature by just a few degrees Fahrenheit occurs, this change could be enough to raise the water temperatures above the tolerance of salmon and trout in many streams, favoring instead non-native fishes such as sunfish and carp. Unsuitable summer temperatures would be particularly problematic for many of the threatened and endangered fish that spend summers in cold-water streams, either as adults or juveniles or both<sup>8</sup>.

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<sup>5</sup> California Natural Resources Agency 2009.

<sup>6</sup> California Natural Resources Agency 2009.

<sup>7</sup> California Natural Resources Agency 2009.

<sup>8</sup> California Natural Resources Agency 2009.





### Improving Public Health

This symbol indicates that a GHG reduction measure will have a beneficial impact on public health.

### Deteriorating Public Health

Heat waves are expected to have a major impact on public health, as well as decreasing air quality and increasing mosquito breeding and mosquito-borne diseases. Further, climate change is expected to alter the spread and prevalence of disease carrying insects, organisms, or people, referred to as vectors, in addition to leading to a possible decrease in food quality and security.<sup>9</sup> Vector control districts throughout the state are already evaluating how they will address the expected changes to California's climate.

According to a new report from the Air Resources Board, the warming climate will increase ozone levels in California's major air basins, leading to upwards of 6 to 30 more days per year with ozone concentrations that exceed federal clean-air standards.

Cost-effective measures to reduce greenhouse gas emissions and protect public health are important for local governments. The new Air Resources Board study provides evidence of what is becoming known as the "climate penalty," where rising temperatures increase ground-level ozone and airborne health-damaging particles, despite the reductions achieved by programs targeting smog-forming emissions from cars, trucks, and industrial sources.<sup>10</sup> The elderly, young, and sensitive populations most likely to be impacted by climate change are also those that often lack sufficient resources to adapt. Such vulnerable demographics are likely to need assistance to respond to climate change. Social equity issues related to the unequal distribution of resources and increased costs to address community-wide health risks will need to be addressed proactively to reduce the potential for financial strain on local governments.

### Decreased Supply of Fresh Water

The state's water supply is already under stress and is anticipated to shrink under even the most conservative climate change scenario. Warmer average global temperatures cause more rainfall

<sup>9</sup> California Natural Resources Agency 2009.

<sup>10</sup> California Natural Resources Agency 2009.

than snowfall, making the winter snowfall season shorter and accelerating the rate at which the snowpack melts in the spring. The Sierra snowpack is estimated to experience a 25 to 40% reduction from its average by 2050.<sup>11</sup> With rain and snow events becoming less predictable and more variable, the rate of flooding could increase and California's ability to store and transport fresh water for consumption could decrease. Further, warmer weather will lead to longer growing seasons and increased agricultural demand for water.<sup>12</sup>

### **Increased Severity and Frequency of Flood Events**

Forecasts indicate more intense rainfall events, generating more frequent or extensive runoff, and flooding may result from a changing climate. Localized flood events may increase in periods of heavy rain. As explained by the Climate Adaptation Strategy, California's water system is structured and operated to balance between water storage for dry months and flood protection during rainy seasons.<sup>13</sup> Although climate change is likely to lead to a drier climate overall, risks from regular, more intense rainfall events can generate more frequent and/or more severe flooding that upsets this managed balance between storage and protection. Additionally, erosion may increase and water quality may decrease as a result of increased rainfall amounts.

## **STATE CLIMATE ADAPTATION EFFORTS**

Many state and regional entities are well under way in their effort to address climate change impacts. Existing efforts include detailed vulnerability assessments, risk assessments, adaptation policies, and adaptation policy guides for local governments. Current efforts include the following:

<sup>11</sup> California Natural Resources Agency 2009.

<sup>12</sup> California Natural Resources Agency 2009.

<sup>13</sup> California Natural Resources Agency 2009.



### **CAL Adapt**

[CAL Adapt](#) is a tool created by the California Energy Commission's Public Interest Energy Research Group to provide local governments with tools and resources to address climate change impacts.



- **Executive Order S-13-08** – Signed in 2008, the executive order requires the preparation of a California Sea Level Rise Assessment Report and requires state agencies consider and address a range of sea level scenarios for 2050 and 2100 inundation. Lastly, the order requires development of the Climate Adaptation Strategy (CAS).
- **California Climate Adaptation Strategy** – The CAS summarizes the best-known science on climate change impacts and provides recommendations on how to manage the risks.
- **Managing an Uncertain Future: Climate Change Adaptation Strategies for California’s Water** – A report by the Natural Resources Agency on climate change impacts to California’s water system.

## CLIMATE CHANGE PROJECTIONS AND IMPACTS TO SAN LUIS OBISPO COUNTY

Potential Climate Change projections and impacts are summarized in Chapter 7 of this Plan and are accompanied by the County’s existing efforts and new measures to prepare for the potentially negative impacts that climate change may occur in San Luis Obispo County.

## LEGISLATIVE BACKGROUND & REGULATORY FRAMEWORK

While the federal government has yet to enact legislative targets for reducing greenhouse gas emissions, California was the first state in the nation to adopt GHG emissions reduction targets in 2006 under Assembly Bill 32 (AB 32). This section highlights the federal, state, and local legislative framework guiding the preparation and implementation of this Plan.

### **Federal Framework**

Though current federal government regulations lack strict emissions reduction targets, there are a variety of ways that the federal government is supporting emissions reduction efforts of state and local governments. Numerous proposals are currently under way at the federal level to limit emissions from power plants, impose pricing on carbon emissions, and provide federal energy legislation.

Although federal agencies do not have regulatory control over GHG emissions, there is an effort to assist state and local governments, businesses, and residents with efforts related to energy, climate action planning, and smart growth. The Environmental Protection Agency (EPA) also provides educational resources and analytical tools in support of GHG analysis and climate action planning.

### **Clean Air Act**

Under the Clean Air Act (CAA), the EPA is required to regulate and set emissions standards for “any air pollutant” from motor vehicles which have the potential to endanger public health or welfare. In 2003, the EPA made the determination that it lacked the authority to regulate carbon dioxide and other greenhouse gas emissions for the purpose of climate change.<sup>14</sup> Following this determination, a group of 12 states (including California), three cities, and one American Territory, along with more than a dozen individual organizations appealed the EPA’s decision to the U.S. Court of Appeals in the case of *Massachusetts v. Environmental Protection Agency*. The decision was upheld by the lower courts and appealed up to the Supreme Court, where the 5–4 decision was made to force the EPA to treat and regulate carbon dioxide and other greenhouse gases as pollutants under the Clean Air Act.<sup>15</sup>

Beginning in 2011, the EPA will regulate GHG emissions from new power plants and refineries through a set of New Source



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<sup>14</sup> United States Environmental Protection Agency 2003.

<sup>15</sup> Massachusetts et al. v. Environmental Protection Agency et al. 2007.



Performance Standards (NSPS). These regulations will be finalized and applied to all new stationary sources by 2012.

### ***American Reinvestment and Recovery Act – Energy Efficiency and Conservation Block Grants***

In addition to the EPA's regulatory authority to manage greenhouse gas emissions, the 2009 American Reinvestment and Recovery Act (ARRA) package has supported state and local government investment in greenhouse gas reduction activities through Energy Efficiency and Conservation Block Grant (EECBG) funding. The EECBG program, managed under the U.S. Department of Energy, has provided a total of \$3.2 billion to cities and counties across the U.S. to invest in energy efficiency and reduce fossil fuel use from the building and transportation sectors, thereby reducing greenhouse gas emissions.

### **California Legislative Framework**

The State of California is the 15<sup>th</sup> largest emitter of greenhouse gases in the world, ultimately accounting for 2% of global greenhouse gas emissions.<sup>16</sup> However, the State has been proactive in working to reduce emissions and has a long history of proven leadership in addressing energy and climate issues spanning the last 40 years. In 1988, Assembly Bill 4420 (Sher, Chapter 1506, Statutes of 1988) designated the California Energy Commission (CEC) as the lead agency for climate change issues in California.<sup>17</sup> Since that time, there have been numerous initiatives in California to address climate change and energy efficiency, the majority of legislation passed between 2000 and now. These initiatives have strengthened the ability of entities in California to engage in accurate data collection and have created ambitious targets and regulations that will directly lead to reductions in greenhouse gas GHG emissions. Not only have California's efforts earned it a role as the leader in the United States for climate

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<sup>16</sup> California Air Resources Board, California Climate Action Registry, and ICLEI 2008.

<sup>17</sup> California Energy Commission 2009.

planning strategies, but the state has received world attention and accolades for its efforts.

### **California Legislation**

California legislation related to climate change includes Executive Order S-3-05, Assembly Bill 32, and Senate Bill 375, which direct the State and other local agencies to reduce GHG emissions. These orders and laws are summarized below:

**Executive Order S-3-05** establishes the California Environmental Protection Agency (CalEPA) as the agency responsible for coordinating the State's effort to achieve the progressive greenhouse gas emissions reduction targets outlined in the executive order for the state:

- By 2010, reduce greenhouse gas emissions to 2000 levels;
- By 2020 reduce greenhouse gas emissions to 1990 levels;
- By 2050, reduce greenhouse gas emissions to 80% below 1990 levels.

**Assembly Bill 32**, known as the California Global Warming Solutions Act, was approved by the legislature and signed by Governor Schwarzenegger in 2006. The landmark legislation requires the California Air Resources Board (CARB) to develop regulatory and market mechanisms that will reduce greenhouse gas emissions to 1990 levels by 2020.<sup>18</sup> Mandatory actions under the legislation to be completed by CARB include:

- Identification of early action items that can be quickly implemented to achieve greenhouse gas reductions. These early action items were adopted by the California Air Resources Board in 2007 and include regulations affecting landfill operations, motor vehicle fuels, car refrigerants, and port operations, among other regulations.

<sup>18</sup> California Air Resources Board 2010.



The County's goal to reduce GHG emissions 15% below 2006 baseline levels by 2020 is consistent with State direction to reduce 2020 emissions to 1990 levels.



- Development of a scoping plan to identify the most technologically feasible and cost-effective measures to achieve the necessary emissions reductions to reach 1990 levels by 2020. The scoping plan employs a variety of GHG reduction measures that include direct regulations, alternative compliance mechanisms, incentives, voluntary actions, and market-based approaches like a cap-and-trade program.
- Creation and adoption of regulations to require the state's largest industrial emitters of greenhouse gases to report and verify their greenhouse gas emissions on an annual basis.

**Senate Bill 375** builds off of AB 32 and aims to reduce GHG emissions by linking transportation funding to land use planning. It requires metropolitan planning organizations (MPOs), like the San Luis Obispo Council of Governments (SLOCOG), to create Sustainable Communities Strategies (SCSs) in their regional transportation plans (RTPs) for the purpose of reducing urban sprawl. The SCS will demonstrate how the region will achieve the greenhouse gas emissions reduction target set by CARB for 2020 and 2035.

In addition to Executive Order S-3-05, AB 32, and SB 375, the State has enacted legislation related to climate change, transportation and vehicle efficiencies, energy, water, and solid waste. A summary of recent state efforts by topic is provided below in Figure 2-4.

**Figure 2-4. California Regulatory Framework**

**Climate Change**



**E.O. S-3-05** 2005 - Establishes the California Environmental Protection Agency (CalEPA) as the agency responsible for coordinating the State's effort to achieve the progressive greenhouse gas emissions reduction targets outlined in the executive order for the state.

**AB 32** 2006 - The landmark legislation requires the California Air Resources Board (CARB) to develop regulatory and market mechanisms that will reduce greenhouse gas emissions to 1990 levels by 2020.

**SB 97** 2008 - Requires lead agencies to analyze GHG emissions and climate change impacts under the California Environmental Quality Act (CEQA).

**Transportation and Vehicles**

**AB 1493** 2002 - Commonly referred to as the Pavley standards, AB 1493 directed CARB to create regulations that would lead to reductions in greenhouse gas emissions from passenger vehicles, light-duty trucks, and noncommercial vehicles sold in California.

**E.O. S-1-07** 2007 - Known as the Low Carbon Fuel Standard, Executive Order S-1-07 establishes a goal to reduce the carbon intensity of California's transportation fuels by 10% by 2020.

**SB 375** 2008 - Requires the California Air Resources Board to establish GHG reduction targets for each metropolitan planning organization (MPO) in California and directs each MPO to develop a Sustainable Communities Strategy.



### Energy

**Title  
24**

Title 24 Standards were first adopted in 1978 and established minimum energy efficiency performance standards for residential and nonresidential buildings. Since then, the standards have been continually updated to reduce California's energy consumption.

**SB  
1078**

2002 - Established Renewable Portfolio Standards for each of the state's investor-owned utilities (IOUs) to acquire 20% of their electricity from renewable resources by 2010 and 33% by 2020.

**SB  
1368**

2006 - Establishes emissions performance standards for new and existing power plants that produce energy that is sold to publicly owned and investor-owned utilities.

**AB  
811**

2008 - Authorized all cities and counties in California to designate areas within which willing property owners could finance the installation of distributed renewable generation, as well as energy efficiency improvements through low-interest loans.

### Water

**SB  
1881**

2006 - Requires cities and counties to adopt a water-efficient landscape ordinance, limiting the amount of water used for landscaping purposes.

**SB  
7**

2009 - Requires the State to achieve a 20% reduction in per capita water use by 2020. Noncompliance by local water providers will make them ineligible for state grant or loan funding from the State.

**SB  
407**

2010 - Targets inefficient plumbing fixtures to be upgraded. Requirements for compliance are phased in depending on the property type, with all single-family, multi-family, and non-residential properties complying by 2019.

**Solid Waste**

**AB  
939**

1989 - Established the goal of achieving a statewide diversion rate of 50% and requires cities and counties to divert a minimum of 50% of their waste stream for reuse or recycling.

**SB  
1016**

2008 - Established per capita disposal rate requirements and goals for local agencies in California. Requirements are expressed in a pounds per person per day measurement.



***State Guidance and Reports on Climate Change***

**AB 32 Scoping Plan** – In 2008, CARB approved the AB 32 Scoping Plan outlining regulatory and market mechanisms to achieve the goal of AB 32. The plan cites local government action as an integral partner to achieving the State’s goals.

**California Climate Adaptation Strategy** – In 2009, the California Natural Resources Agency released the California Climate Adaptation Strategy as a guide to both state and local agencies on appropriate strategies to adapt to climate change impacts that may negatively affect the State’s population and natural resources. The guide includes adaptation strategies for public health, biodiversity, ocean and coastal resources, water management, agriculture, forestry, transportation, and energy infrastructure sectors.

**SB 97-CEQA Guideline Amendments** – The State Resources Agency adopted guidelines developed by the Governor’s Office of Planning and Research (OPR) to address climate change in CEQA documents, per SB 97. The Guidelines outline the approach to structuring plans for reduction GHG emissions to serve as tiering documents.



### **SLO County Existing Efforts**

In 2005, the County adopted Strategic Growth Principles, which serve as guiding principles on how the county's new growth will occur in a more sustainable manner. These Principles have been incorporated as goals, policies, and strategies into the General Plan.

In May 2010, the County Board of Supervisors adopted an update to the Conservation and Open Space Element (COSE) of the County's General Plan. The updated COSE provides the basis and direction for much of this Plan with goals and policies that aim to reduce vehicle miles traveled, conserve water, increase energy efficiency and the use of renewable energy, and reduce greenhouse gas emissions.

Many of the air pollution programs already in place throughout the county were created to reduce ozone-forming pollutants and toxic emissions, but the programs also have the added benefit of reducing greenhouse gas emissions. The County, cities, and the Air Pollution Control District (APCD) implement rules and regulations, clean fuel programs, mitigation programs, grants, ridesharing, pollution prevention activities, energy efficiency and conservation measures, water conservation programs, partnerships, and public outreach that directly or indirectly address climate change and reduce greenhouse gas emissions.

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