

**SAN DIEGO ASSOCIATION OF
GOVERNMENTS**

**CLIMATE
ACTION
STRATEGY**

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1. INTRODUCTION

Overview of the Climate Action Strategy

The SANDAG Climate Action Strategy (Strategy) serves as a guide to help policymakers address climate change as they make decisions to meet the needs of our growing population, maintain and enhance our quality of life, and promote economic stability. It does so in the context of the significant action on climate change happening in California, and the need for national and international attention to address what is ultimately a global problem.

Despite its global nature, many climate change solutions and especially its impacts will occur at the regional and local levels. There are many actions our region could take to prepare for the projected impacts and do our part to reduce greenhouse gases that contribute to climate change. While these actions are most directly focused on reducing our greenhouse gas emissions and preparing for impacts, the success of climate action will ultimately be determined by our ability to do so in ways that also create jobs, improve social equity, and protect our environment – in short, promote sustainable, livable communities and a high quality of life in our region.

The State of California is taking a strong approach to address climate change, and has jurisdiction over important sources of greenhouse gas emissions like passenger vehicle tailpipe greenhouse gas emissions and power plants. In addition, the U.S. Congress has recently become more active in climate change, and as of this writing, federal legislation to reduce greenhouse gas emissions is pending before Congress. Federal agencies have been involved in climate change and related issues for many years. Nevertheless, there are roles for local and regional governments. SANDAG, local governments, and other regional entities have authority and influence over three essential areas that contribute to climate change:

1. Land use patterns, transportation infrastructure and related public investments
2. Building construction and energy use
3. Government operations

As a result, this Strategy focuses on these areas where regional and local agencies have the authority or opportunity to influence emissions and make our region more resilient to the changing climate. The opportunity and ability to reduce the three largest sources of greenhouse gas emissions in our region are in the following areas:

- On-road transportation (i.e., passenger vehicles, light-, medium- and heavy-duty vehicles, and motorcycles),
- Electricity generation, and
- Natural gas end uses (e.g., space heating, cooking, etc.).

When combined, these three sources account for about 80 percent of emissions in the San Diego region, with on-road transportation alone responsible for about 46 percent of the total. Just as important, our transportation and energy infrastructure systems also are threatened by climate change impacts.

Responding to climate change will require us to mitigate our greenhouse gas emissions and adapt to the changes coming to our region. Regional and local government efforts to reduce our greenhouse gas emissions will require a foundation of improved land use and transportation planning, and changes in the amounts and types of energy we use. A major purpose of the Strategy is to identify land use and transportation policy measures that could help SANDAG meet or exceed its Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008) targets for reducing greenhouse gas emissions from passenger cars and light-duty trucks.

The Strategy identifies goals, objectives, and policy measures in the areas of transportation, land use, buildings, and energy use. Also addressed are measures and resources to help local governments reduce emissions from their operations and in their communities. While a small fraction of our total climate change contribution, reducing greenhouse gas emissions from local government operations can save taxpayer dollars and set an example for the greater community.

Development and implementation of adaptation measures will be critical to protecting the region from the impacts of climate change. This Strategy does not identify adaptation measures for all of the potential wide-ranging impacts. Many agencies with jurisdiction in the San Diego region are likely to have a role in adaptation planning, with SANDAG being just one of several agencies. Due to SANDAG's core function as the regional transportation planning agency and its long involvement in regional energy issues, the Strategy focuses on adaptation measures to consider when addressing impacts to transportation and energy infrastructure.

Decisions on which adaptation measures to pursue, responsible entities, and opportunities for coordination are best debated among regional and local officials and the general public during updates to SANDAG plans like the Regional Transportation Plan and Regional Comprehensive Plan, and during updates to local government General Plans and other community plans (and related regulatory mechanisms).

Policy Measures of the Climate Action Strategy

The policy measures contained in this document are intended to be a list of potential options – “tools in the toolbox” – for consideration as SANDAG updates its Regional Transportation Plan and Regional Comprehensive Plan, and as local governments update their General Plans and other community plans. The policy measures are not requirements for SANDAG, local governments, or any other entity. Moreover, it is the discretion of each agency to decide whether and how to best implement the various policy measures listed in this plan. For example, a policy measure at the local government level could be implemented through a local government regulation, incentive, program, public-private collaboration or by a variety of entities such as a local government, private developer, business, non-profit, quasi-government entity, or even some combination thereof. Many actions at the local government level also could benefit by supportive regional actions from entities like SANDAG.

The range of potential measures results from a comprehensive review of other agencies and various authorities working on measures to address climate change and published research on the topic of reducing greenhouse gas emissions. While some measures may not ultimately prove viable for the San Diego region, they are presented in the Strategy to provide decision-makers with a broad range of options for considerations. In most, if not all cases, more detailed study and analysis of the measures would be required prior to implementation.

Decisions on which climate action measures to pursue are best debated among regional and local officials and the general public during the development of these subsequent public policy documents (and related regulatory mechanisms). Moreover, as important as climate change action is, it is not the only important issue facing the region. This Strategy does not prioritize greenhouse gas reduction over other public policy efforts, and climate action planning should not be done in isolation. Rather, our challenge will be to develop public policies that simultaneously and holistically address the many issues we face: greenhouse gas reduction, constrained budgets, access to adequate drinking water supplies, job creation, social equity, energy security, and more.

Climate Change and SANDAG Regional Planning

The SANDAG Regional Comprehensive Plan provides the long-term strategic planning framework for our region to address the many issues affecting our quality of life and move us toward a more sustainable future. The Regional Comprehensive Plan, which was adopted in 2004, does not include a discussion of climate change and its effects on the region. At the time the Regional Comprehensive Plan was prepared, climate change was not a significant public policy issue at the regional and state levels. When the issue of climate change is integrated within the broader Regional Comprehensive Plan framework, it is expected that certain regional strategies for promoting our quality of life may contribute to climate change. For example, different transportation infrastructure investment strategies may affect greenhouse gas emissions in the region to varying degrees. In addition, some investments called for in the Regional Comprehensive Plan, such as investments in low lying coastal areas, may face threats from climate change.

The quality of life experienced by future generations in the San Diego region is influenced by the decisions we make today, and the Regional Comprehensive Plan's vision for the region will be dependent on effective climate action.

Fortunately, many strategies discussed in the Regional Comprehensive Plan provide a foundation for addressing climate change: smart growth land use planning and compact urban form, providing transportation alternatives like walking, bicycling, ridesharing, and public transit, and reducing energy consumption all contribute to lower greenhouse gas

Regional Comprehensive Plan Vision

"To preserve and enhance the San Diego region's unique features – its vibrant and culturally diverse communities, its beaches, deserts, mountains, lagoons, bluffs, and canyons, and its international setting – and promote sustainability, economic prosperity, and an outstanding quality of life for everyone."

emissions and a healthier climate. In addition, the types of changes required to address climate change reinforce the Regional Comprehensive Plan's principles of smart growth and sustainability.

In many cases responding to climate change will provide benefits in other areas related to our quality of life such as job creation, social equity, public health, biodiversity and air quality protection, and financial savings. Many of the available measures to reduce greenhouse gas emissions also help promote sound energy policy and reduce our dependence on volatile energy sources and supplies. The interdependent nature of these issues means that climate action also could have unintended adverse impacts on other important quality of life indicators. For example, the interaction among climate action and issues like job creation and implementation costs will require careful examination in light of the high unemployment, budget cuts and other economic factors. In any event, integrating climate action planning into the broader planning framework of the Regional Comprehensive Plan and other local and regional planning processes will allow us to make climate change related decisions based on evaluation and understanding of the potential effects on a comprehensive set of quality of life indicators important to the region.

Taking climate change action requires building on the foundation of smart growth and sustainability established in the Regional Comprehensive Plan and integrating important considerations like greenhouse gas emissions and climate impacts into existing planning processes at the regional and local level. This Strategy provides a basis for addressing climate change in the context of regional and local decision making that affects our transportation system, land use patterns, building stock, and energy infrastructure.

SANDAG Transportation and Land Use Planning Integration

As the consolidated agency for transportation, SANDAG serves as the forum for regional decision-making among the 18 cities and county government. SANDAG builds consensus, makes strategic plans, obtains and allocates resources, plans, engineers, and builds public transportation, and provides information on a broad range of topics pertinent to the region's quality of life. In its federal and state roles, SANDAG develops the Regional Transportation Plan to implement a long-range vision for transportation in the region. SANDAG provides the regional framework to connect our land use to our transportation systems through the Regional Comprehensive Plan. Integrated land use and transportation planning is a core element to successfully reduce greenhouse gas emissions. The Climate Action Strategy can serve as a foundation for addressing climate change when these plans, summarized below, are updated.

SANDAG Regional Comprehensive Plan

Adopted in 2004, the Regional Comprehensive Plan serves as the foundation for integrating land use, transportation, infrastructure needs, and public investment strategies in the San Diego region. It connects local and regional policy decisions that support our shared vision of the future, balancing regional population, housing, and employment growth with habitat preservation, agriculture, open space, energy, and other infrastructure needs in a way that moves us toward a sustainable future with more choices and opportunities for all residents.

SANDAG adopted the goals and policy direction of the Regional Comprehensive Plan as the strategic planning framework for our region, in conjunction with other plans and strategies. To implement these goals, the Regional Comprehensive Plan calls for the application of principles of "smart growth" and "sustainability." Smart growth in the San Diego region means developing the region in a way that creates livable communities by connecting land use and transportation and improving the quality of travel by focusing on better urban design and walkability. The principles of sustainability are based on achieving goals and objectives in three broad areas: a prosperous economy, a healthy environment, and social equity. These "three Es" together provide the foundation for achieving sustainable and livable communities in the San Diego region.

2030 San Diego Regional Transportation Plan

The Regional Transportation Plan, most recently updated in 2007, serves as the primary transportation element of the Regional Comprehensive Plan, and helps position the region to achieve smarter, more sustainable growth that meets the transportation needs of the growing population and changing region. The Regional Comprehensive Plan calls upon SANDAG to update the regional transportation plan and related programming documents in a way that both maximizes opportunities for local governments to implement smart growth and ensures that the design and implementation of regional transportation facilities support local smart growth. The adopted regional transportation plan calls for more than \$42 billion for transportation investments through 2030. The types of transportation investments and their relationship with local smart growth will greatly influence the transportation choices people make to reach jobs and services, including driving alone, walking, bicycling, taking public transit, vanpooling, and carpooling. Transportation-related GHG emissions are in large part determined by the sum of individual travel choices, as well as other important factors like vehicle fuel efficiency. Work on development of the 2050 regional transportation plan, scheduled for adoption in 2011, is now underway.

Overview of Climate Change

Climate change is happening now and its impacts are readily apparent, with temperatures increasing, Arctic sea ice disappearing, glaciers melting at historic rates, and sea levels rising beyond climate scientists' worst-case estimates. Recently it was reported that January 2000 to December 2009 was the warmest decade on record.¹ Recent atmospheric measurements of carbon dioxide and methane (two important greenhouse gases) exceed the natural range over the last 650,000 years.² The predicted rate of temperature change by 2050 as a result of these greenhouse gas levels is 10-50 times faster than the temperature changes that occurred when the ice ages receded.³

Our changing climate is the result of greenhouse gases produced by the fossil fuel energy we burn to power our society and vegetation cleared in order to develop and use land. We are largely dependent on fossil fuels to generate electricity, drive our vehicles, transport goods, heat and cool our homes, produce and deliver food, convey and treat water, and provide power to our businesses and industries. When too many greenhouse gas emissions are released into the air, they act like a blanket, trapping heat in the atmosphere and altering weather patterns throughout the world. A shift in global temperature threatens the favorable ecological conditions in which human beings have thrived for thousands of years, such as ample water supplies, increasing food production, and constant sea levels.

Climate change is expected to affect the San Diego region. Over the next several decades, if no action is taken to reduce or minimize climate change and its impacts, we face the prospect of water shortages, rising sea levels along our coast, more frequent and intense wildfires, longer and more severe heat waves, loss of native plants and animals, worsening air quality, and difficulty meeting peak energy needs.

Many citizens currently lack the resources to respond to these impacts and the resulting economic losses. A report cited in the [2009 California Climate Adaptation Strategy](#) estimates that the cost of no action in California would be on the order of "tens of billions of dollars in direct costs" and would "expose trillions of dollars of assets to collateral risk."⁴

While our region needs to reduce its share of global greenhouse gas emissions, the speed and severity of the impacts to the San Diego region will ultimately be determined by the outcome of worldwide efforts to reduce the amount of emissions in the atmosphere to a safe level. If global emissions stopped tomorrow, some level of further warming and related impacts are inevitable as a result of the emissions already in the atmosphere.

The current climate we are experiencing now is the result of much lower levels of greenhouse gas emissions that occurred several decades ago. Several decades from now, future generations will experience the impacts of higher levels of greenhouse gas concentrations occurring today.

¹ National Aeronautics and Space Administration. 2010. *NASA Research Finds Last Decade was Warmest on Record, 2009 One of Warmest Years*. Available at: http://www.nasa.gov/home/hqnews/2010/jan/HQ_10-017_Warmest_temps.html.

² Intergovernmental Panel on Climate Change. 2007. *IPCC Fourth Assessment Report: Climate Change 2007. Working Group I: The Physical Science Basis*. Available at: <http://www.ipcc-wg1.unibe.ch/publications/wg1-ar4/wg1-ar4.html>

³ The San Diego Foundation. 2008. *Summary of The San Diego Foundation Regional Focus 2050 Study: San Diego, California*. Available at: <http://www.sdfoundation.org/communityimpact/environment/Initiative-Climate2050.html>

⁴ California Natural Resources Agency. 2009. *2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008*. Available at: <http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF>

Global emissions are unlikely to cease anytime soon, and the outcome of international efforts to reduce emissions remains uncertain. Worldwide emissions have been increasing year-after-year, and the rate of annual increase has been going up. The longer the trend of greater emissions and temperature increases continues, the greater the risk of triggering “tipping elements” that can rapidly bring about abrupt changes. Tipping elements refer to thresholds where temperature increases cause a chain reaction of mutually reinforcing physical processes that lead to accelerating and possible irreversible climate change.⁵

While per-capita emissions in the San Diego region are on average lower than the nation as whole, they are among the highest in the world. The United States is currently the world’s second greatest climate change contributor, and historically has been one of the largest contributors to greenhouse gas emissions. Climate science tells us that all nations must find ways to decrease their emissions by 50 to 95 percent below today’s levels by the middle of the century, with high-emitting developed nations like ours needing to make the steepest cuts. Efforts are underway in many countries, for example, China recently unveiled its goal to reduce the amount of greenhouse gasses emitted per unit of gross domestic product (GDP) by 40-45% by 2020, relative to 2005 levels.⁶

The San Diego region’s emissions primarily result from our reliance on and inefficient use of fossil fuel-based electricity, natural gas, and transportation fuels like gasoline and diesel to support the region’s existing three million residents, one million housing units, and one and a half million jobs. Improving energy efficiency and other actions and advances will help reduce the amount of fossil fuels used to support our region’s population, thereby lowering greenhouse gas emissions.

Long-term population and economic growth will complicate efforts to reduce greenhouse gas emissions. According to the SANDAG regional growth forecast, the San Diego region is expected to grow by almost one million people (32 percent), housing units will increase by four hundred thousand (26 percent), and the region will add nearly half a million jobs (32 percent) by 2030. Historically, growth in population, the economy, energy use, and greenhouse gas emissions have gone hand-in-hand.

The general trend of increasing population, economic output, energy use and greenhouse gas emissions is expected to continue unless deliberate, systematic changes are made in the areas of public policy, private sector decisions, and individual behavior. Fortunately, these trends are already changing in the right direction -- we are driving more efficient vehicles, building walkable communities, using cleaner electricity, creating clean energy jobs, and diversifying our water supply.

How the Strategy is Organized

Where appropriate, the policy measures included in the Strategy are divided into two main categories of authority or influence: (1) SANDAG and (2) local governments. Regional and local coordination will be essential to the success of many of the policy measures identified. In certain cases where authority is lacking at the regional or local level, the Strategy identifies policy measures for which our region may want to consider pursuing legislation or similar actions to enable regional or local action. The policy measures for local governments are not prescriptive and only intended as guidance to help them in their consideration of measures to address climate change through planning and permitting processes, local ordinances, outreach and education efforts, and their government operations.

⁵ Lenton, T.M., et al. 2008. *Tipping Points in the Earth’s Climate System*. Proceedings of the National Academy of Sciences 105 (6) 1786-1793.

⁶ *Energy and Climate Policy Action in China*. Available at: <http://www.chinafaqs.org/policy-actions>.

Considerations for evaluating policy measures include: (1) their effectiveness in helping to achieve short-term (2020) and longer-term (2035 and 2050) goals for greenhouse gas emission reduction and (2) their costs, not just to government budgets and the economy, but also social and environmental costs important to our quality of life. Toward this end, SANDAG is overseeing the preparation of a study estimating the greenhouse gas reductions and costs of several transportation and energy-related policy measures. The study, which is expected to be completed in spring 2010, will serve as one of many resources to help policy-makers evaluate greenhouse gas reduction measures during development of the 2050 Regional Transportation Plan.

Mitigation and Adaptation

Mitigation is defined as actions to reduce greenhouse gas emissions, while adaptation refers to actions to avoid, withstand, or take advantage of climate change effects.

Mitigation alone will not prevent climate change from having serious impacts on the San Diego region. The current concentration of greenhouse gasses in our atmosphere – without considering continued and accelerated pace of emissions – will continue to change the climate for the next several hundred years. Adaptation to the changes that have already been set in motion is essential to maintain the region’s economy, ecosystems, and public health health.

While adaptation and mitigation measures can be complementary and overlapping, they also can conflict. For example, increased air conditioning use is one adaptation strategy to extreme heat events, but would complicate mitigation efforts to reduce energy usage during peak demand periods. Likewise, the energy-intensive nature of seawater desalination could simultaneously help the region adapt to climate-related impacts to our water-supply and impede efforts to reduce greenhouse gas emissions from electricity generation and energy consumption. Because of this, an integrated approach that coordinates efforts to manage impending climate risks (adaptation) while avoiding climate extremes through reductions of greenhouse gas emissions (mitigation) is critical.

2. CLIMATE ACTION STRATEGY GUIDING PRINCIPLES

GENERAL

TAKE IMMEDIATE ACTION

Climate change is a serious global challenge to public health, the environment, and the economy requiring all levels of government, including SANDAG and its member agencies, to engage in immediate and sustained actions to reduce greenhouse gas emissions and prepare for the impacts of a changing climate.

PREPARE FOR THE IMPACTS OF A CHANGING CLIMATE

The region will be prepared for projected impacts of climate change, including increased threats to public health, higher sea level, warmer average temperature, more frequent and longer heat waves, increased peak demand for electricity, more vulnerable water supply, more frequent wildfires, and loss of native plant and animal species.

LEAD BY EXAMPLE

SANDAG and its member agencies lead by example and increase public awareness of climate change with our actions to reduce greenhouse gas emissions from internal operations. By preparing for the impacts of climate change, we encourage residents and the private sector to follow our lead.

ENSURE SOCIAL EQUITY AND ENVIRONMENTAL JUSTICE

Climate protection policies and actions promote the principles of opportunity, inclusion, and equal access for disadvantaged populations and ensure fair treatment and meaningful involvement for all people regardless of race, ethnicity, gender, income, national origin or geography.

LAND USE AND TRANSPORTATION

BUILD COMMUNITIES FOR WALKING, BICYCLING AND PUBLIC TRANSIT

Regional transportation planning is integrated with improved land use planning and community design to significantly lower demand for vehicle travel by making walking, bicycling, and public transportation practical choices for everyday travel.

MINIMIZE GREENHOUSE GASES RELEASED FROM VEHICLES

Programs to reduce demand for single-occupancy vehicle trips, such as carpools, vanpools, pricing of vehicle trips and parking, and telecommuting, and to promote efficient travel conditions are an emphasis in regional transportation planning.

FUND THE REGIONAL TRANSIT NETWORK

Increasing and securing funding for public transportation planning and operation is recognized as critical to the success of the region's efforts to reduce greenhouse gas emissions.

PRICE TRANSPORTATION MODES TO REFLECT THEIR CLIMATE IMPACTS

Transportation pricing signals lead to travel behavior that supports regional greenhouse gas emissions reductions.

INCREASE USE OF ALTERNATIVE FUELS AND VEHICLES

Infrastructure and policy promote the transition away from petroleum to vehicles and fuels with lower greenhouse gas emissions on a full fuel-cycle basis.

REDUCE EMISSIONS FROM THE INTERREGIONAL AND BINATIONAL MOVEMENT OF PEOPLE AND GOODS

Infrastructure, policy, and technology are deployed as necessary to significantly lower greenhouse gas emissions associated with the interregional movement of people and goods.

ENERGY AND BUILDINGS

IMPLEMENT THE STATE'S PREFERRED LOADING ORDER

Following the state's preferred loading order, new energy resources come first from energy efficiency, and then demand response, renewable energy, and distributed generation, all before new transmission and natural gas generation are sought.

PURSUE ENERGY REDUCTIONS IN EXISTING RESIDENTIAL AND COMMERCIAL BUILDINGS

Net energy usage and costs from the region's existing building stock are significantly reduced through targeted policies, programs and financing options to promote energy efficiency and clean distributed generation.

PROMOTE STATE POLICY FOR ZERO NET ENERGY RESIDENTIAL AND COMMERCIAL BUILDINGS

Consistent with the policy direction of state agencies like the California Public Utility Commission, aggressive strategies, including regulations and incentives, are employed to achieve zero net energy usage in new residential and commercial buildings.

3. FRAMEWORK FOR CLIMATE ACTION

California has responded to the challenge of climate change in many ways. These state efforts are driving climate change action at the regional and local level. In developing regional and local responses, it is important and helpful to differentiate among international, state, regional, and local authorities, responsibilities, and opportunities. Key efforts are described below.

International Efforts

United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty that sets an overall framework for intergovernmental efforts to address the challenge posed by climate change. The UNFCCC entered into force in March 1994, with ratification by 192 countries (both the United States and Mexico signed the Convention in 1992).

Kyoto Protocol

Linked to the UNFCCC, the Kyoto Protocol sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas emissions. Mexico signed the Kyoto Protocol in 1998 and enacted the legislation in 2005. The United States signed the Protocol in 1998, but has not ratified or enforced it. The Kyoto Protocol expires in 2012, and negotiations to develop a new protocol are ongoing as of this writing.

State Efforts

California Global Warming Solutions Act of 2006 (Assembly Bill 32)

The California Global Warming Solutions Act of 2006 (Assembly Bill 32, Nunez, Chapter 488, Statutes of 2006) establishes the 1990 emissions level as the statewide limit for 2020, which is approximately a 15 percent reduction from the baseline 2006 level. AB 32 calls for regulatory and consideration of market mechanisms to achieve the greenhouse gas emissions reduction target. Many of the State's policies and programs are now significantly shaped, at least in part, by the requirements of AB 32 and its intent to limit and reduce the total amount of greenhouse emissions generated in California.

Climate Change Scoping Plan

The California Air Resources Board *Climate Change Scoping Plan (Scoping Plan)* outlines the main strategies for meeting the AB 32 greenhouse gas reduction target, which include a range of actions including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, market-based mechanisms like a cap-and-trade system, and a cost-of-implementation fee to fund the program. The Air Resources Board and other state agencies must adopt these reduction measures by the start of 2011, and already a number of "early action" measures required by the *Scoping Plan* have been adopted, such as the Low Carbon Fuel Standard. In addition, the *Scoping Plan* emphasizes the need to better connect land use and transportation planning to help the state achieve its greenhouse gas emissions reduction target for 2020.

Governor's Executive Order S-13-08

Governor Schwarzenegger's Executive Order S-13-08 recognizes that mitigation efforts in California may slow but will not stop all long-term climate impacts to California. Adapting and creating resiliency to climate change also is needed. Executive Order S-13-08 directs the California Natural Resources Agency to develop a state Climate Adaptation Strategy through coordination with local, regional, state, and federal public and private entities. It also emphasizes the need for statewide consistency in planning for sea level rise, and calls on the National Academy of Sciences to complete the first California Sea Level Rise Assessment Report.

Senate Bill 375

As described in the introduction, Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008) requires metropolitan planning organizations like SANDAG to create a Sustainable Communities Strategy that integrates the transportation network with development patterns in a way that achieves greenhouse gas emissions reduction targets from passenger cars and light-duty trucks while meeting housing needs and other regional planning objectives. The Sustainable Communities Strategy must demonstrate how changes to land use patterns, transportation infrastructure investments, funding allocations, policies, or any other measures will achieve the targets to be established through the SB 375 process in the next update of the Regional Transportation Plan. Local government land use planning and coordination with regional transportation planning will be critical to the ultimate success of the Sustainable Communities Strategy. Local governments retain their land use planning authority under this legislation.

Governor's Executive Order S-3-05

Governor Schwarzenegger's Executive Order S-3-05 establishes a long-term climate goal for the state of reducing emissions 80 percent below the 1990 level by 2050 (an approximately 95 percent reduction from the baseline 2006 level of AB 32). Although not required by statute, the 2050 reduction goal is based on the scientifically-supported level of emissions reduction needed to avoid significant disruption of the climate and is used as the long-term driver for state climate change policy development.

California's Preferred Loading Order

The California Public Utilities Commission and California Energy Commission adopted a preferred loading order to meet goals for satisfying the state's growing demand for electricity while reducing greenhouse gas emissions. The preferred loading order for new energy resources places top priority on increasing energy efficiency and demand response, then new generation from renewable and distributed generation resources, and finally with clean, fossil-fueled generation and infrastructure improvements. This is described further in the SANDAG Regional Energy Strategy.

The California Preferred Loading Order

1. Increase energy efficiency and demand response.
2. Meet generation needs with renewable and distributed generation resources.
3. Meet new generation needs with clean fossil-fueled generation and infrastructure improvements.

California Attorney General Guidance on Climate Change, CEQA, and General Plan Updates

The Office of the Attorney General has encouraged local governments to take a programmatic approach to climate change planning, particularly through General Plan updates and accompanying California Environmental Quality Act (CEQA) documents.⁷ Guidance addressing CEQA, climate change, and general planning is emerging in pending CEQA Guidelines amendments, comments on General Plan updates and Regional Transportation Plans, and ensuing settlements by the Office of the Attorney General.

⁷ California Attorney General's Office. September 2009. *Climate Change, the California Environmental Quality Act, and General Plan Updates: Straightforward Answers to Some Frequently Asked Questions*. Available at: http://ag.ca.gov/globalwarming/pdf/CEQA_GP_FAQs.pdf

The Office of the Attorney General suggests that a city or county General Plan update should, if feasible, evaluate at least one alternative that would contribute to state goals for lower greenhouse gas emissions. Such an alternative might include one or more of the following options, but the selection of measures is subject to the discretion of each local government:

- Higher density development that focuses growth within existing urban areas;
- Policies and programs to facilitate and increase biking, walking, and public transportation to reduce vehicle miles traveled;
- The creation of “complete neighborhoods” where local services, schools, and parks are within walking distance of residences;
- Incentives for mixed-use development;
- In rural communities, creation of regional service centers to reduce vehicle miles traveled;
- Energy efficiency and renewable energy financing (e.g., AB 811 or PACE programs);
- Policies for preservation of agricultural and forested land serving as carbon sinks;
- Requirements and ordinances that mandate energy and water conservation and green building practices; and
- Requirements for carbon and nitrogen-efficient agricultural practices.

Targets and Goals for Reducing Greenhouse Gases in the San Diego Region

Achieving the near-term goal of reducing statewide greenhouse gas emissions to the 1990 level by the year 2020 is ambitious but likely achievable with available policy measures and technology options. However, the long-term goal of reducing statewide greenhouse gas emissions to 80 percent below the 1990 level by the year 2050 will require fundamental changes in policy, technology, and behavior.

Although California does not set economy-wide reduction targets for specific geographic regions of the state, projections showing the theoretical emissions reductions necessary to reach the 2020 and 2050 targets illustrate the magnitude of change the region needs to make during the next four decades (Figure 3-1).⁸

Figure 3-1. Theoretical Greenhouse Gas Emissions Reduction Targets for the San Diego Region



Source: Energy Policy Initiatives Center, University of San Diego, 2008.

⁸ SB 375 will lead to the establishment of regional greenhouse gas emission reduction targets; however, the targets are limited to passenger cars and light-duty trucks.

By 2030, the region must have met and gone below the 1990 level and be well on its way to doing its share for achieving the 2050 greenhouse gas reduction level. It should be noted that deep cuts in greenhouse gas emissions required for climate stabilization also must occur during a period of projected growth in regional population and economic output.

SANDAG Energy and Climate Change Planning

Under a partnership with the California Energy Commission, SANDAG prepared the 2009 Regional Energy Strategy and a Regional Alternative Fuels, Vehicles, and Infrastructure Report. This Strategy also is being prepared as part of this partnership. Where applicable, this strategy incorporates the energy policy guidance of the Regional Energy Strategy and recommendations from the Alternative Fuels report, which are summarized below.

Regional Energy Strategy

Approved in December 2009, the updated Regional Energy Strategy (RES) provides information, goals and policy measures for a comprehensive set of energy issues. With its intent to save energy and promote the use of clean and renewable energy sources, many of the measures identified in the following areas also would reduce greenhouse gases: (1) Energy efficiency and conservation, (2) Renewable energy, (3) Distributed generation, (4) Energy and water, (5) Peak demand, (6) The "smart grid," (7) Natural gas power plants, (8) Transportation fuels, (9) Land use and transportation planning, (10) Border energy, (11) Clean energy economy.

Although there is overlap between the energy policy guidance provided in the Regional Energy Strategy and the types of policy measures that would reduce greenhouse gas emissions addressed in this Strategy, energy and climate change are not synonymous issues. As a result, SANDAG is preparing this Strategy to accompany the Regional Energy Strategy to provide regional policy guidance on climate change and energy issues, respectively.

In light of significant state control over certain energy policy areas like electricity and natural gas, the Regional Energy Strategy focuses on the multiple opportunities and authorities that SANDAG and its member agencies could take advantage of to address energy issues and achieve both local and regional goals related to energy and climate change. SANDAG can address energy considerations through future updates of the Regional Comprehensive Plan and Regional Transportation Plan, while local governments can use mechanisms like their General Plans and by participating in the SANDAG Energy Roadmap program. The Regional Energy Strategy identifies six core strategies that, if implemented, would go a long way toward helping the region meet its energy and climate change mitigation goals. The following strategies are ones that SANDAG and local governments could play an integral role in implementing.

1. Pursue a comprehensive building retrofit program to improve efficiency and install renewable energy systems.
2. Create financing programs to pay for projects and improvements that save energy.
3. Utilize the SANDAG-San Diego Gas & Electric Local Government Partnership funding to help local government identify opportunities and implement energy savings at government facilities and throughout their communities.
4. Support land use and transportation planning strategies that reduce energy use and greenhouse gas emissions.
5. Support planning of electric charging and alternative fueling infrastructure.
6. Support use of existing unused reclaimed water to decrease the amount of energy needed to meet the water needs of the San Diego region.

Regional Alternative Fuels, Vehicles, and Infrastructure Report

SANDAG developed a regional assessment of alternative transportation fuels, vehicles, and infrastructure that recommends regional and local government level actions that could increase the use of alternative fuels and vehicles in the fleets of local governments and their franchisees. While primarily focused on opportunities for local government fleets, the report also provides analysis, tools, and recommendations to facilitate a regional rollout of alternative fuels, vehicles, and infrastructure to the general public.

The report concludes with four sets of recommendations to help local government fleets and the region as a whole increase the use of alternative fuels and vehicles and develop supporting infrastructure. The SANDAG Board of Directors accepted the final report in September 2009.

Climate Change and SANDAG Borders Planning and Coordination

The SANDAG Borders Planning program addresses planning issues from three perspectives: the [binational perspective](#) with relation to our international border with the Republic of Mexico; the [interregional perspective](#) regarding issues with our Orange, Riverside, and Imperial County neighbors; and collaboration with [tribal governments](#) within San Diego County.

Climate change mitigation and adaptation planning are increasingly receiving attention in at least one of these perspectives: binational and crossborder collaboration with Baja California, Mexico. The 2009 topic of the annual SANDAG binational event was "Challenges and Opportunities for Crossborder Climate Change Collaboration." Stakeholders attending from both sides of the international border received several presentations and participated in discussions on both climate change mitigation and adaptation planning. The 2009 binational event led to development of the following recommendations later approved by the SANDAG Board of Directors:

1. Recognize the importance of encouraging all levels of agencies and stakeholders in our San Diego – Baja California region to mutually agree on priority aspects of climate change collaboration, including mitigation, adaptation, and education strategies.
2. Encourage the inclusion of strategies for collaboration and sharing information on regional climate change action plans in San Diego and Baja California.
3. The FY 2010 binational event should follow up on topics related to climate change planning.
4. In FY 2010, produce a progress report on development and actions taken in climate change planning as a result of the 2009 seminar recommendations.

4. THE SAN DIEGO REGION'S CONTRIBUTION TO CLIMATE CHANGE

Existing Greenhouse Gas Emissions in the San Diego Region

Energy use is the largest source of our greenhouse gas emissions. Table 4-1 shows emissions in the four principal categories established by the United Nations Intergovernmental Panel on Climate Change (IPCC). As it shows, 91 percent of all greenhouse gas emissions in the region are related to the production and consumption of energy.

Table 4-1. San Diego County Greenhouse Gas Emissions by IPCC Category

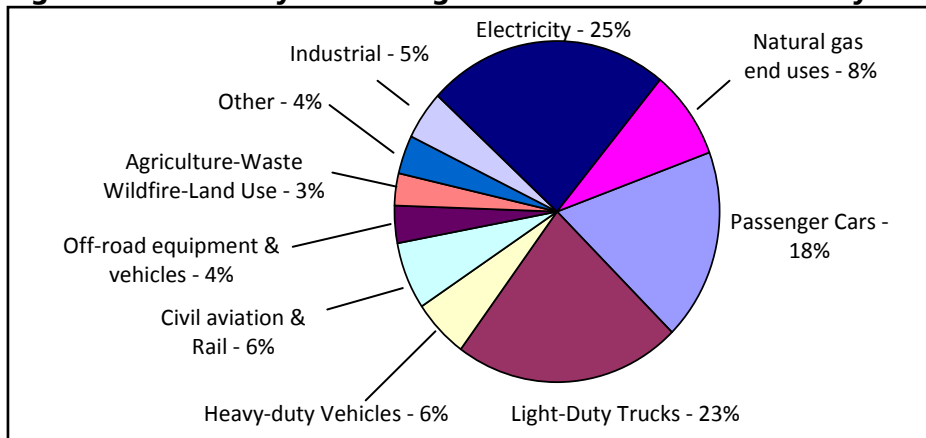
Intergovernmental Panel on Climate Change Category	Percentage of Total Greenhouse Gas Emissions
Energy	91%
Industrial (non-fuel)	5%
Waste	2%
Agriculture, Forestry, Land Use	2%

Source: Energy Policy Initiatives Center, University of San Diego, 2008.

Existing Greenhouse Gas Emissions by End-Use Category

Although many activities consume energy, most of the region's energy consumption and related greenhouse gas emissions are caused by three categories of energy consumption: the movement of people and goods in the on-road transportation sector, electricity generation that provides power to homes and businesses, and natural gas for end-uses like space heating and cooking (Figure 4-1).

Figure 4-1. Summary of Existing Greenhouse Gas Emissions by End-Use Category



Source: Energy Policy Initiatives Center, University of San Diego, 2008.

On-Road Transportation

The largest emissions category is on-road transportation, which accounts for nearly half (46 percent) of greenhouse gas emissions in the San Diego region. Moreover, energy consumed by passenger cars and light-duty vehicles (such as pick-up trucks, sport utility vehicles, and similar automobiles), primarily gasoline for personal automobile transportation, accounts for about 89 percent of on-road transportation emissions, and about 41 percent of total emissions in the region.

The high level of greenhouse gas emissions from on-road transportation is due to the region's near total dependence on petroleum-based gasoline and diesel fuel, average vehicle efficiency, and levels of driving. On-road transportation also comprises a significant proportion of greenhouse gas emissions statewide. In response, the state has enacted several transportation-related laws and regulations calling for petroleum reduction, the development of low-carbon and alternative fuels, increased vehicle fuel efficiency, and coordinated land use and transportation planning that reduces greenhouse gas emissions from passenger cars and light-duty trucks.

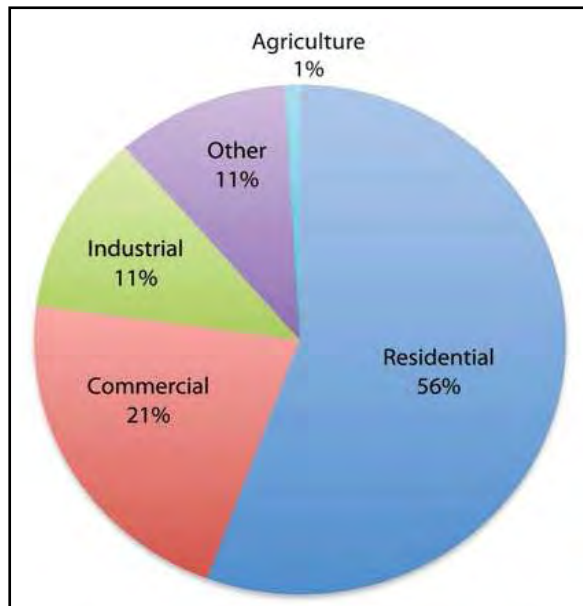
Electricity Generation and Natural Gas End-Use Sectors

Electricity generation and natural gas end-uses (such as space and water heating, cooking, and similar uses.) account for about one-third (33 percent) of greenhouse gas emissions in the region. Total consumption levels, efficiency of use, and fuel sources contribute to the level of greenhouse gas emissions from electricity generation. About two-thirds (67 percent) of the fuel used to generate the electricity consumed in the region comes from natural gas and out-of-state coal.⁹ Both of these energy sources release greenhouse gas emissions when combusted, although natural gas produces fewer greenhouse gas emissions than coal and other fossil fuels. The level of efficiency of power plants, buildings, and end-use equipment also are factors that contribute to the level of emissions from electricity generation and natural gas end-uses.

Existing Greenhouse Gas Emissions by Economic Sector

Greenhouse gas emissions also can be analyzed by economic sector. As shown in Figure 4-2, the residential sector, which includes passenger cars, light-duty trucks, electricity and natural gas consumption, accounts for more than half (56 percent) of all greenhouse gas emissions. This indicates that energy used by residents for personal travel and home use contribute significantly to regional greenhouse gas emissions.

Figure 4-2. Greenhouse Gas Emissions by Economic Sector



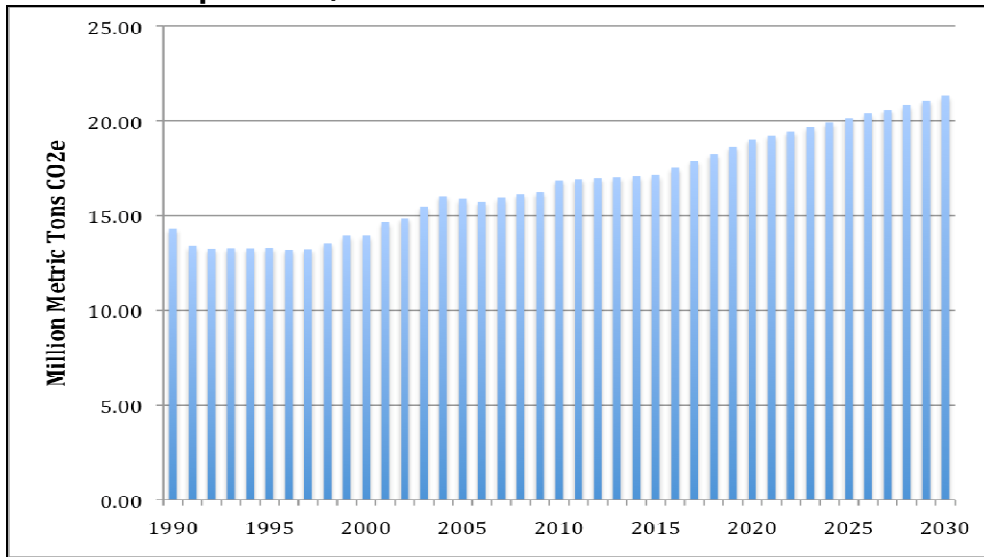
Source: Energy Policy Initiatives Center, University of San Diego, 2008.

⁹ San Diego Gas & Electric. 2009. *Power Content Label*. Available at: http://www.sdge.com/documents/billinserts/myAccount/090909/FINAL%200930042%20PowerLabel_3.pdf

Future Projections for Greenhouse Gas Emissions

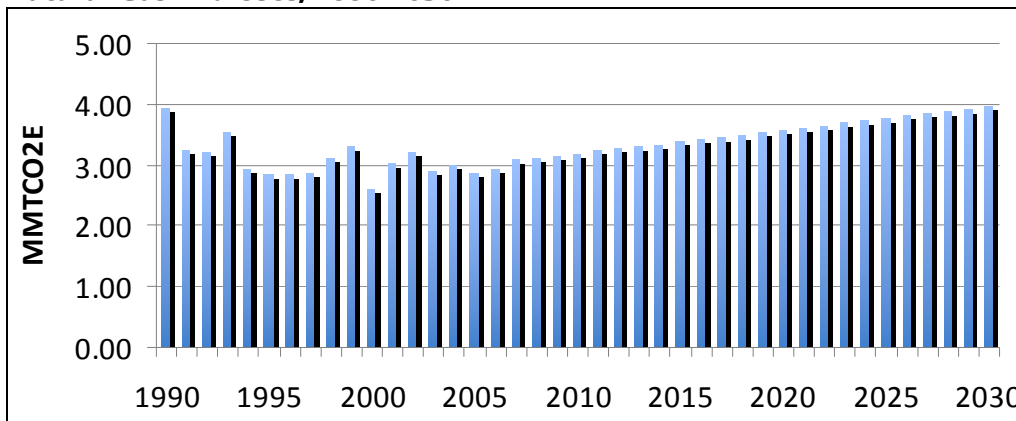
Under a “business-as-usual” scenario in which current energy use trends and policies do not change, greenhouse gas emissions in the region will be approximately 43 million metric tons of carbon dioxide equivalent in 2020, approximately 26 percent greater than the 2006 level, and 48 percent higher than the 1990 level.¹⁰ Emissions would be even greater in 2030 under a business-as-usual scenario. The projected increases in greenhouse gas emissions for on-road transportation, natural gas, and electricity under business-as-usual scenarios are shown in Figures 4-3 to 4-5 below. Because the following figures are business-as-usual projections depicting the consequences of not taking action, the effect of new federal, state, and local policies is not shown.

Figure 4-3. Projected Business-as-Usual Greenhouse Gas Emissions from On-road Transportation, 1990-2030



Source: Energy Policy Initiatives Center, University of San Diego, 2008.

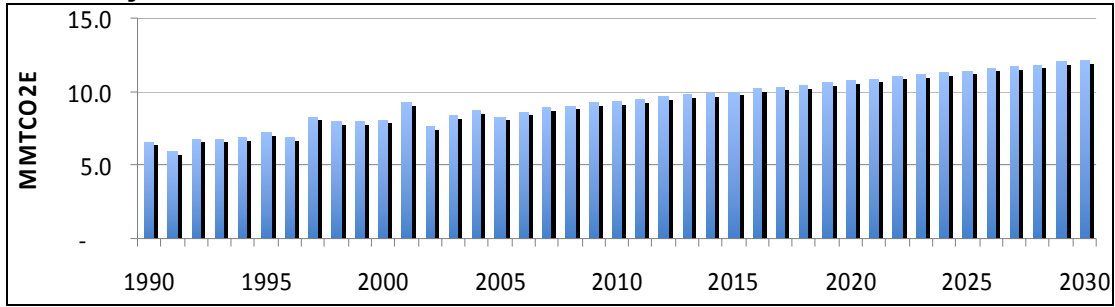
Figure 4-4. Projected Business-as-Usual Greenhouse Gas Emissions from Natural Gas End-Uses, 1990-2030



Source: Energy Policy Initiatives Center, University of San Diego, 2008.

¹⁰ Energy Policy Initiatives Center. September 2008. *San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets*. Available at: <http://www.sandiego.edu/epic/ghginventory/>

Figure 4-5. Projected Business-as-Usual Greenhouse Gas Emissions from Electricity Generation, 1990-2030



Source: Energy Policy Initiatives Center, University of San Diego, 2008.

5. THE SAN DIEGO REGION'S CHANGING CLIMATE

Except where otherwise noted, information presented in this section is based on the reports listed below, each of which presents a range of climate change impacts on California or the San Diego region using climate models and emissions scenarios from the Intergovernmental Panel on Climate Change (IPCC), the world's leading scientific body for the assessment of climate change. Established by the United Nations Environment Program and World Meteorological Organization, the IPCC provides the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

- San Diego Foundation's *Regional Focus 2050 Study*. Summary and full versions of the report are available online at: <http://www.sdfoundation.org/communityimpact/environment/Initiative-Climate2050.html>
- California Climate Change Center's *Climate Change-Related Impacts in the San Diego Region by 2050*. A draft version of the report is available online at: <http://www.energy.ca.gov/2009publications/CEC-500-2009-027/CEC-500-2009-027-D.PDF>
- California Natural Resources Agency 2009 *California Climate Adaptation Strategy*. Summary and full versions of the report are available online at : <http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF>

Introduction

The climate of the San Diego region is certain to change under even the most optimistic and aggressive scenarios to reduce global greenhouse gas emissions. Substantial emission reductions are essential for avoiding the worst impacts of climate change, but mitigation alone is not enough. Even if global emissions were immediately reduced to zero, the existing concentration of greenhouse gas emissions in the atmosphere would continue to cause the climate to change for the next several hundred years.¹¹ Compounded with projected population and economic growth, climatic changes are expected to become significantly more rapid and severe unless global greenhouse gas emissions are leveled off in the next few years and then significantly reduced over the coming decades.

According to the San Diego Foundation's Focus 2050 Study, average annual temperatures in our region are projected to increase between 1.5 and 4.5 degrees Fahrenheit by 2050. Greater increases will occur in summer, with peak temperatures consistently reaching the upper 80s and low 90s. Larger temperature increases are expected in inland areas as compared to the coastal zone (the area within about 30 miles of the ocean). Though precipitation is expected to maintain the existing Mediterranean pattern with dry summers and most rainfall happening in the winter months, rainfall amounts are expected to vary widely from year to year, leaving the region highly vulnerable to drought.

Adaptation planning can minimize the damage caused by climate change. According to the California Climate Adaptation Strategy adaptation refers to efforts that respond to the impacts of climate change. Adaptation planning also can be described as adjustments in natural or human systems in response to actual or expected climate changes that minimize harm or take advantage of beneficial opportunities.

¹¹ Pew Center on Global Climate Change. 2009. *Climate Change 101: Adaptation*. Available at: http://www.pewclimate.org/global-warming-basics/climate_change_101

Climate changes and their associated impacts vary greatly from location to location. Although national and international action is essential, many important decisions about how best to manage systems affected by climate change are made at the local and regional levels.¹² Regional and local planning should reinforce and complement the recommendations given at the state and federal levels. In an effort to begin a process of collaborative adaptation planning in California, the Governor issued Executive Order S-13-08 (2008), which led to completion of the State's first comprehensive Climate Adaptation Strategy in 2009. The Climate Adaptation Strategy summarizes the best known science on climate change impacts in seven specific sectors and provides recommendations on how to manage against those threats.

This section describes the impacts climate change is expected to have on the San Diego region by 2050. Because greenhouse gases have a very long-lasting effect on the climate, impacts are likely to worsen after 2050, unless global greenhouse gas concentrations are significantly reduced during the coming years and decades.

Adaptation Planning and Responsibilities

Development and implementation of adaptation measures will be critical to protecting the region from the impacts of climate change. However, this Strategy does not identify adaptation measures for all of the potential wide-ranging impacts. Many agencies with jurisdiction in the San Diego region are likely to have a role in adaptation planning, with SANDAG being just one of several agencies. Decisions on which adaptation measures to pursue, responsible entities, and opportunities for coordination are best debated among regional and local officials and the general public during updates to SANDAG plans like the Regional Transportation Plan and Regional Comprehensive Plan, and during updates to local government General Plans and other community plans (and related regulatory mechanisms).

Due to SANDAG's core function as the regional transportation planning agency and its long involvement in regional energy issues, the Strategy focuses on adaptation measures available for SANDAG and local governments to consider when addressing impacts to transportation and energy infrastructure, which are described in the Smart Growth Land Use and Low Carbon Transportation and Clean Energy and Efficient Buildings sections, respectively.

Impacts on Public Health

Extreme Temperature Events

Heat waves will be more common, last longer, and reach higher temperatures. According to the California Climate Change Center's Climate Change-Related Impacts in the San Diego Region by 2050, heat waves are already a major public health concern. Potential health impacts from these extreme heat events include heat stroke, heat exhaustion, and the exacerbation of existing medical conditions. Those at highest risk are the elderly, infants, and socially-isolated people with pre-existing illnesses. Extreme temperature events can be exacerbated in urban areas due to the [urban heat island effect](#). Exposed surfaces like building roofs and pavement absorb heat and cause surface and air temperature in surrounding areas to be hotter than less developed or undeveloped areas. Urban heat islands increase demand for air conditioning, particularly during periods of peak electricity demand.

¹² Pew Center on Global Climate Change. 2009. *Climate Change 101: Adaptation*. Available at: http://www.pewclimate.org/global-warming-basics/climate_change_101

Wildfires

The existing habitat and climate conditions make the region vulnerable to extreme fire events. According to the California Climate Adaptation Strategy, wildfire frequency and intensity is expected to grow as temperatures increase and vegetation dries due to longer dry seasons. Larger, more frequent, and longer-lasting wildfires are expected to result in loss of human life, up to billions of dollars in property damage, business closures, increased fire-fighting and emergency services costs, expensive recovery and restoration efforts, and release of stored or sequestered carbon in vegetation.

Air Quality

Studies have shown a link between heat and the formation of ground-level ozone, the primary component of "smog." In the San Diego region, days over 90 degrees Fahrenheit exceed the state ozone standard 16 percent of the time.¹³ Ozone is not emitted directly but forms when nitrogen oxide emissions and volatile organic compounds react with heat and sunlight. By 2050, the San Diego region is expected to experience greater exposure to ground-level ozone due to a climate change-induced increase in number of hot and sunny days. Increased ground-level ozone tends to aggravate asthma and increase airway inflammation.

Infectious Disease

The likelihood of changes in temperature, humidity, and rainfall in San Diego will affect the geographic distribution and quantity of arthropod vectors (such as mosquitoes and ticks). As a result, the risk of contracting infectious disease from vectors will also be altered by climate change. Climate change may also affect ranges and population densities of animal hosts (such as rodents and rabbits). For the most part, further research is needed to fully understand the impacts of climate change on infectious disease. Listed below are some trends that have been studied or predicted for infectious disease as a result of climate change.

- *West Nile Virus (vector: mosquito)*. Increased variability in precipitation may impact the incidence of West Nile Virus, though the use of municipal water systems by mosquitoes as breeding sites may reduce the impacts of changing precipitation patterns. Higher temperature, on the other hand, is linked to increased dispersal and transmission of West Nile Virus.¹⁴
- *Hantavirus (vector: rodent)*. Increased variability in precipitation is likely to increase the food supply of rodents during years with higher rainfall and more flooding. Humans contract Hantavirus cardiopulmonary syndrome when they come into contact with infected rodents or their excrement. Increased development and recreational activities within the unincorporated areas of San Diego County in years where host populations are elevated will increase the potential for contact between humans and disease hosts and vectors.
- *Plague (vector: flea; host: rodent)*. Increased variability in precipitation is likely to increase the food supply of rodents during years with higher rainfall and more flooding. Increased development and recreational activities within areas like unincorporated San Diego County due to population growth will increase the potential for contact between humans and disease hosts and vectors.
- *Malaria and Dengue Fever (vector: mosquito)*. Higher temperatures for the San Diego region could facilitate the local establishment of these historically tropical diseases.

¹³ Environment California. 2007. *Hot and Smoggy: The Ozone – Hot Weather Connection in Eight California Cities*. Available at: <http://www.environmentamerica.org/home/reports/report-archives/clean-air/clean-air/hot-and-smoggy-the-ozone-hot-weather-connection-in-eight-california-cities>

¹⁴ Reisen, W.K., Fang, Y., and Martinez, V.M. 2006. *Effects of Temperature on the Transmission of West Nile Virus by Culex tarsalis (Diptera: Culicidae)*. *Journal of Medical Entomology* 34(2): 309-317.

Impacts on Water Supply

Demand for Water

Based on the San Diego Foundation's Focus 2050 Study, demand for water is expected to increase by around 37% by 2050 as a result of population and economic growth. Extended and more frequent drought conditions would reduce local groundwater supplies about seven percent per year on average and increase our dependence on imported water from distant sources like the Colorado River and the Sacramento-San Joaquin River Delta. Higher temperatures also will increase water demand by increasing the rate of evapotranspiration for outdoor water uses like landscaping.

Water Supply

Climate change is projected to reduce the amount of water available from the imported sources upon which our region relies. For example, recent projections for the Colorado River range from a 6 to 45 percent decline by 2050 as a result of the changing climate. The amount of water imported to the San Diego region from the Sacramento-San Joaquin River Delta is dependent on several factors. Projections of warmer temperatures and more precipitation falling as rain instead of snow will lead to flooding and increased stress on the already strained Delta levee system.¹⁵

Spring snowmelt, which historically provided a reliable supply of water after winter storms, will likely be lower due to an expected 25 percent snowpack reduction in the Sierra Nevada by 2050. Other environmental factors may limit the amount of water available for export to our region. For example, efforts such as the CALFED Bay-Delta Program are trying to balance water supply needs with environmental goals supporting freshwater habitat for fish and other wildlife in the Delta. Furthermore, rising sea level threatens the freshwater Delta with saltwater intrusion and puts increased stress on the area's already fragile levee system. Overall, our region faces a possible water supply shortfall of 18 percent by 2050, and quite possibly sooner.

Impacts on Agriculture

San Diego's unique topography creates a wide variety of microclimates supporting over 200 different agricultural commodities.¹⁶ Between now and 2050, climate change could negatively impact agriculture in our region, and in turn exacerbate our water supply situation, by increasing demand for irrigation to meet higher evaporative rates associated with warmer and drier conditions. The cost of water is already a concern for many in the agriculture industry, and climate change along with other impacts to water supply could contribute to higher costs in the future. Climate change also will change the geographic distribution of crop pests, though understanding the potential for crop loss from pests requires further research.¹⁷

¹⁵ Hayhoe, K., Cayan, D. Field, C.B., Frumhoff, P.C., Maurer, E.P., Miller, N.L., Moser, S.C., Schneider, S.H., Cahill, K.N., Cleland, E.E., Dale, L., Drapek, R., Manemann, R.M., Kalkstein, L.S., Lenihan, J., Lunch, C.K., Neilson R.P., Sheridan, S.C., and Verville, J.H. 2004. *Emissions Pathways, Climate Change, and Impacts on California*. Proceedings of the National Academy of Sciences 101(34): 12422-12477.

¹⁶ County of San Diego, Department of Agriculture, Weights, and Measures. 2008. *Crop Status and Annual Report*. Available at: http://www.sdcounty.ca.gov/awm/crop_statistics.html.

¹⁷ Intergovernmental Panel on Climate Change. 1995. *Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. Available at: <http://www.ipcc-wg2.gov/publications/SAR/index.html>.

Impacts on Biodiversity and Habitats

Along with one other county, the San Diego region has the most plants and animals at risk of extinction in the continental United States. While in many cases human population growth and development have fragmented critical habitat areas, the impacts of climate change will compound the threats facing already vulnerable plant and animal species. Though most species are often able to adapt to changing conditions, unnaturally rapid shifts in temperature, sea level rise, and drought due to climate change are expected to outpace the ability of some species to adapt and survive if no action is taken to protect them.

Forests

Extended drought can stress individual trees, increasing their susceptibility to insect attack by species like the bark beetle. Warmer winter temperatures can also facilitate insect attack by increasing the insect survival rate and the size of their populations. Temperature increases will minimize the extent of the cooler-climate forests. Reduced forest habitat can impact forest-dependent fish and wildlife species. Changes in fire regimes can impact the ability of a forest to recover after wildfire.

Southern California Shrublands

Due to rising temperatures and changes in precipitation, chaparral and coastal sage scrub are expected to move to higher elevations where temperatures are cooler and precipitation is greater. Associated animal species will adjust their ranges, oftentimes not concurrently with the vegetation, potentially resulting in a new mix of species and ecosystems. Projected increases in non-native grasses and fire frequency could substantially reduce the range and extent of future shrublands.

Deserts

Desert plant and animal species are adapted to extreme conditions of aridity and heat. With climate change, most deserts are expected to become hotter and drier,¹⁸ and in California models are predicting the expansion of deserts, though at a slow rate and probably not apparent before 2050.¹⁹

Freshwater Ecosystems and Vernal Pools

Climate change is predicted to directly and indirectly impact the hydrology and ecology of freshwater systems in our region. Freshwater ecosystems, particularly vernal pools, are dependent on annual rainfall and are extremely sensitive to pollution, habitat degradation, and invasive species. To date, there has not been extensive study on the effects of climate change on vernal pools.²⁰

¹⁸ Intergovernmental Panel on Climate Change. 1995. *Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. Available at: <http://www.ipcc-wg2.gov/publications/SAR/index.html>.

¹⁹ Hayhoe, K., Cayan, D., Field, C.B., Frumhoff, P.C., Maurer, E.P., Miller, N.L., Moser, S.C., Schneider, S.H., Cahill, K.N., Cleland, E.E., Dale, L., Drapek, R., Manemann, R.M., Kalkstein, L.S., Lenihan, J., Lunch, C.K., Neilson R.P., Sheridan, S.C., and Verville, J.H. 2004. *Emissions pathways, climate change, and impacts on California*. Proceedings of the National Academy of Sciences 101(34): 12422-12477.

²⁰ City of San Diego. 2008. Draft Vernal Pool Management Plan. Available at: <http://www.sandiego.gov/planning/mscp/>.

Impacts on Ocean and Coastal Resources

Climate change threatens the coastal resources such as beaches, harbors, lagoons, wetlands, and seaside cliffs that comprise our 70 miles of coastline and represent a fundamental element of our region's beauty, economy, unique identity, and quality of life.

Sea Level Rise

There are three climate change-related causes for the accelerated pace of global sea level rise: increased sea surface temperature creating thermal expansion of the water, melting and other changes in continental ice sheets in Greenland and Antarctica, and melting of alpine glaciers²¹. By 2050, average sea level in San Diego is projected to be 1 to 1.5 feet higher than today, making lasting changes to the coastline and threatening one of our greatest environmental and economic assets.

As ocean water levels rise relative to land, coastal sediments are sequestered offshore.²² Without action, beaches will shrink and some could disappear entirely. Streets, homes, recreation areas, businesses, and boardwalks near the shoreline will experience flooding more often, causing increased risk of damage to property and infrastructure. Other low-lying places like San Diego International Airport will likely be vulnerable to large-scale emergency and evacuation situations, especially during high surf and winter storm periods.

Coastal habitats such as salt marshes and rocky intertidal areas will be exposed to more sea water. When natural or manmade barriers like cliffs, seawalls, or buildings impede the ability of those habitats to retreat landward, their range is reduced until they are completely underwater. Places in the San Diego region like the Cabrillo National Monument and Scripps Coastal Reserve are bordered by steep cliffs and likely to lose much of their intertidal habitats to sea level rise. In all of Southern California, where 91 percent of wetlands have already been lost and many remaining wetlands are stressed by pollution, invasive species, and altered hydrology, sea level rise poses yet another threat to coastal wetland habitats.²³

Ocean Acidification

Oceans absorb and are significantly affected by the carbon dioxide increasingly released into the atmosphere. To date, oceans have absorbed about one-third of all anthropogenic carbon dioxide emissions, resulting in a significant acidification of seawater.²⁴ Ocean acidification causes problems similar to those experienced in freshwater lakes from acid rain. In particular, acidification impedes the formation of protective skeletons of crabs, sea urchins, abalones, oysters, and plankton species, potentially having profound impacts on the entire marine food chain. As the oceans become more acidic, the fertilization, development, and metabolic function of many marine species such as kelp, a commercially harvested species, will be increasingly impacted.

²¹ WBGU. 2006. *The Future Oceans – Warming Up, Rising High, and Turning Sour*. Available at: http://www.wbgu.de/wbgu_sn2006_voll_en.html.

²² SANDAG. 2009. *Coastal Regional Sediment Management Plan for the San Diego Region*. Available at: <http://www.sandag.org/index.asp?projectid=330&fuseaction=projects.detail>.

²³ Zedler. J. B. 1996. *Coastal Mitigation in Southern California: the Need for a Regional Restoration Strategy*. *Ecological Applications* 6(1): 84-937.

²⁴ WBGU. 2006. *The Future Oceans – Warming Up, Rising High, and Turning Sour*. Available at: http://www.wbgu.de/wbgu_sn2006_voll_en.html.

6. SMART GROWTH LAND USE AND LOW-CARBON TRANSPORTATION

On-road transportation of people and goods is the single largest source of greenhouse gas emissions in our region (46 percent of the total), with passenger cars and light-duty trucks alone responsible for 41 percent of all greenhouse gases. The three primary strategies for reducing greenhouse gas emissions in the on-road transportation sector are to: (1) increase vehicle fuel efficiency, (2) reduce the carbon content of transportation fuels, and (3) better coordinate land use and transportation planning, and related measures, policies, and investments. While the majority of needed reductions are expected to come from fuel substitution and vehicle fuel efficiency standards, local and regional actions related to the design and development of our communities and cities also are needed for California to meet its greenhouse gas reduction goals.

State agencies like the California Air Resources Board and California Energy Commission are responsible for and are actively implementing regulations and programs related to the first two strategies, although regional and local actions also can contribute to increased use of low-carbon alternative fuels and technologies. These standards and programs at the State level are expected to achieve the majority of the greenhouse gas reductions needed in the transportation sector to achieve the statewide 2020 target under Assembly Bill 32. The California Light-Duty Vehicle Greenhouse Gas Standards and the Low Carbon Fuel Standard are expected to account for about 90 percent of the reductions needed from the transportation sector. Additional transportation-related greenhouse gas reductions will need to come from changes in transportation planning and land use patterns at the regional and local levels.

Local governments and SANDAG have the ability and authority to regulate, provide incentives, collaboratively plan, and make infrastructure investments that affect land use patterns, the transportation system, and other public infrastructure investments. The form and function of our communities and cities can either reduce or increase demand for energy, and also can influence how energy is produced, distributed, and used. As population and economic activity increase, the design of our communities and cities may play as important a role as fuel efficiency and technology in reducing our contribution to climate change.

In order to help meet the statewide 2020 greenhouse gas reduction target under Assembly Bill 32, the State is requiring Metropolitan Planning Organizations like SANDAG to reduce greenhouse gas emissions from passenger cars and light-duty trucks through coordinated land use and transportation planning, and related measures, policies, and investments per the requirements of Senate Bill 375 (as explained in the box below, SANDAG will be assigned a target for greenhouse gas reduction from passenger cars and light-duty trucks by the California Air Resources Board). Coordination of local land use planning, including the identification of sites for affordable housing with regional transportation planning are essential to the successful implementation of SB 375.

Senate Bill 375 and the Regional Transportation Plan

Federal and state laws require that SANDAG prepare a long-range transportation plan and make an air quality conformity determination every four years – the next regional transportation plan update is scheduled for adoption in 2011. SANDAG will be the first major metropolitan planning organization in the state to prepare a regional transportation plan that complies with the provisions of SB 375. In effect, SB 375 requires the next regional transportation plan update to achieve targets for greenhouse gas reductions from passenger cars and light-duty trucks for 2020 and 2035. The statute also requires a new element of the regional transportation plan called a Sustainable Communities Strategy, which must show how regional greenhouse gas reduction targets, to be established by the California Air Resources Board, would be achieved through development patterns, transportation infrastructure investments, and/or transportation measures or policies that are determined to be feasible. The sustainable communities strategy also must address housing needs and protection of sensitive resource areas. If the sustainable communities strategy does not meet regional greenhouse gas reduction targets, an Alternative Planning Strategy must be developed to demonstrate how the targets could be achieved.

Land use and transportation planning seek to identify land, infrastructure and other resources needed to accommodate our growing population and economy while maintaining and enhancing quality of life. Such planning influences the design of our communities and cities. In the past, the design of our cities and communities has increased vehicle miles traveled and greenhouse gas emissions. Since 1980, national vehicle miles traveled has increased about three times faster than population growth and nearly twice as fast as vehicle registrations.²⁵ Continued growth in the rate of driving would likely cancel out the greenhouse gas savings of standards for cleaner cars and fuels.²⁶

While there are many reasons for the vehicle miles traveled increase, factors like land use segregation, long trip distances, and transportation systems, policies and urban design that favor vehicle travel over walking, bicycling and public transit are critical, and are a direct result of past land use planning decisions and transportation investments. In general, segregated, low-density land use patterns and automobile-oriented transportation investments and urban design are not conducive to reducing greenhouse gas emissions.

According to its Environmental Impact Report,²⁷ the transportation projects, funding allocations, policies, and adopted local land use plans identified in the adopted SANDAG Regional Transportation Plan would increase annual transportation-related greenhouse gas emissions by 30 percent by 2030, relative to 2006 baseline conditions. Transportation-related greenhouse gas emissions need to be lower than they are today by 2030, although the California Air Resources Board will not establish final targets for greenhouse gas reduction from passenger cars and light-duty trucks until September 2010. The land use plans and transportation investments and policies identified in the adopted Regional Transportation Plan collectively do not contribute to lower transportation-related greenhouse gas emissions.

According to the 2030 Regional Growth Forecast,²⁸ our population is expected to increase by about 32 percent by 2030 relative to 2006. The environmental impact report for the 2030 Regional Transportation Plan reports that total daily on-road gasoline and diesel fuel consumption per capita are projected to increase by about 4 percent, and daily vehicle miles traveled per capita is expected to increase by about 3 percent by 2030. This indicates that vehicle miles traveled and transportation-related greenhouse gas emissions are projected to increase slightly faster than population growth under adopted regional transportation and local land use plans. Meeting transportation-related greenhouse gas reduction targets will require decreases in per capita emissions.

Past investments and decisions that shaped the region's land use patterns and transportation systems are major determinants of current greenhouse gas emissions and will continue to be into the future. Once in place, land use patterns and transportation infrastructure typically remain part of the built environment and influence travel behavior and greenhouse gas emissions for several decades, perhaps longer. As a result, it is imperative that future planning take into account the climate change implications of transportation infrastructure and land use investments for the duration of their useful lives. This is important because transportation and land use choices made today will affect our greenhouse gas emissions for several decades into the future.

²⁵ Ewing, R., Bartholomew, K., Winkelman, S., Walters, J., and Chen, D. 2007. *Growing Cooler: the Evidence on Urban Development and Climate Change*. Urban Land Institute. Available at:

<http://www.smartgrowthamerica.org/documents/growingcoolerCH1.pdf>

²⁶ Ewing et al 2007.

²⁷ SANDAG. 2007. *Final Environmental Impact Report for the 2030 San Diego Regional Transportation Plan: Pathways for the Future*. San Diego County, California. Available at:

http://www.sandag.org/programs/transportation/comprehensive_transportation_projects/2030rtp/2007eir_final.pdf

²⁸ SANDAG. 2006. *2030 Regional Growth Forecast Update*.

<http://www.sandag.org/index.asp?projectid=356&fuseaction=projects.detail>

Approach for Addressing Climate Change in the Transportation Sector

Acknowledging the critical role of State standards to improve vehicle technology and increase the use of low-carbon alternative fuels, this section focuses on available policy measures SANDAG, local governments, or other regional entities could choose to implement or influence to reduce greenhouse gas emissions through coordinated land use and transportation planning and related measures, policies and investments.

The remainder of this section describes and identifies the many types of land use and transportation-related policy options available to help SANDAG and local governments achieve greenhouse gas reductions from the on-road transportation sector, with a focus on helping SANDAG identify measures to reduce greenhouse gas emissions from passenger cars and light-duty trucks as required in future updates of the Regional Transportation Plan. While some policy measure options to reduce greenhouse gas emissions have not historically been a part of transportation and land use planning in our region, many of the available options to address climate change involve continuing and expanding investments the region has already made and actions we already take for other reasons related to our quality of life. Our efforts to build walkable, smart growth communities, expand and improve public transportation network, promote bicycling, vanpooling and carpooling all contribute to lower greenhouse gas emissions and create a foundation on which the region can build to further reduce its greenhouse gas emissions over the coming years and decades.

The discussion is organized around goals that will reduce transportation-related greenhouse gas emissions at the regional and local levels and help the region prepare for potential impacts to the transportation system:

- (1) Reduce Total Miles of Vehicle Travel**
- (2) Minimize Greenhouse Gas Emissions When Vehicles Are Used**
- (3) Support Increased Use of Low Carbon Alternative Fuels**
- (4) Protect Transportation Infrastructure from Climate Change Impacts**

Purpose of the Transportation-Related Policy Measures

The information provided in this section can help inform SANDAG decision-making during the development of the 2050 Regional Transportation Plan. It identifies objectives for each of the goals, and available policy measures that, if implemented, would achieve the goals and objectives. The goals, objectives and policy measures are intended to serve as a guide for integrating transportation-related climate change considerations into existing plans as they are updated. Since preparing the Regional Transportation Plan is one of the primary responsibilities of SANDAG, the primary focus of this section is in identifying measures that could help to reduce greenhouse gas emissions from passenger cars and light-duty trucks and comply with Senate Bill 375.

The goals, objectives or policy measures listed herein are not given priority over any other; they are solely intended to inform decision-makers of available options for addressing climate change and complying with new requirements like Senate Bill 375. It is likely that a variety of policy measures from each of the goal areas will need to be considered and implemented if the region is to be successful in reducing greenhouse gases from the transportation sector. The actual mix of measures implemented by SANDAG to reduce greenhouse gas emissions from on-road transportation will be determined through the development of the 2050 Regional Transportation Plan. Further analysis of land use and transportation policy measures will be performed as part of the 2050 Regional Transportation Plan development process to understand a variety of issues associated with their implementation including greenhouse gas reduction estimates, possible barriers to regional or local implementation, cost implications, and their impact on important regional quality of life indicators related to economic, environmental, and social issues.

GOAL 1. REDUCE TOTAL MILES OF VEHICLE TRAVEL

State-level efforts to reduce greenhouse gas emissions from on-road transportation through fuel efficient vehicles and low carbon fuels are critical but will not succeed if the amount of driving – also known as vehicle miles traveled – continues to follow past trends and rates of increase. Statewide forecasts of fuel used for personal transportation indicate that significant increases in vehicle fuel efficiency and use of alternative fuels will not achieve the long-term 2050 goal for greenhouse gas reduction unless per capita vehicle miles traveled in the state is reduced about five percent below the baseline 2005 level.²⁹ The statewide 2050 forecast for per capita vehicle miles traveled is approximately 17 percent lower than projected per capita vehicle miles traveled in the San Diego region in 2030 under the adopted Regional Transportation Plan.^{30, 31}

Along with standards to reduce greenhouse gases from passenger vehicles and transportation fuels, the California Climate Change Scoping Plan notes that reductions in total miles vehicles travel are needed to help achieve the goals of AB 32.³² The Scoping Plan and other studies in a growing body of evidence strongly suggest that the trend of vehicle miles traveled growth needs to be slowed, stopped, and soon reversed in order to successfully lower greenhouse gas emissions from the on-road transportation sector.

Lowering vehicle miles traveled means providing high-quality opportunities to make trips by alternative means to driving alone such as walking, bicycling, ridesharing, and public transit, and by shortening vehicle trips that are made. This can be accomplished through improved land use and transportation planning and related measures, policies and investments that increase the options people have when they travel.

The following objectives can help the region lower the amount of vehicle travel: design of neighborhoods and communities in accordance with our region's adopted smart growth principles, expansion and new development of transportation systems to support low-carbon mobility options like public transit, vanpooling, carpooling, walking and bicycling, and reducing demand for single occupancy vehicle travel.

Since existing land use patterns and transportation infrastructure are the result of several decades of investments, the effects of smart growth will likely be incremental in the near term. But over the long term, smart growth neighborhoods and communities will provide more significant greenhouse gas reductions.³³

²⁹ California Energy Commission. 2007. *State Alternative Fuels Plan*. CEC-600-2007-011-CMF. Available at: <http://www.energy.ca.gov/ab1007/index.html>.

³⁰ The State Alternative Fuels Plan 2050 forecast for per capita vehicle miles traveled is 8,200 miles per year on average.

³¹ 2030 per capita vehicle miles traveled in the San Diego region is projected to be 28.54 miles per day according to the 2030 Regional Transportation Plan, or about 9,900 miles per capita per year. Available at: http://www.sandag.org/programs/transportation/comprehensive_transportation_projects/2030rtp/2007rtp_final.pdf

³² California Air Resources Board. 2008. *Climate Change Scoping Plan: A Framework for Change*. Available at: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

³³ Cambridge Systematics, Inc. 2009. *Moving Cooler: An Analysis of Transportation Strategies for Reduction Greenhouse Gas Emissions*.

Objective 1a. Build Smart Growth Neighborhoods and Communities in which Basic Daily Needs and Public Transit Service are Safely Accessible on Foot or by Bicycle

Using our region's smart growth principles to create neighborhoods and communities in which most, if not all, daily needs and public transit service are accessible on foot or by bicycle will be critical to reducing our greenhouse gas emissions. Accommodating population growth through smart growth lowers vehicle miles traveled by creating neighborhoods and communities in which walking, bicycling, and public transit are viable travel options and vehicle trips are relatively short.³⁴

Research shows that miles driven can be 20 to 40 percent lower in compact urban developments compared to miles driven in automobile-oriented developments typical of the last several decades.³⁵ The greenhouse gas reduction potential of smart growth can be maximized by combining it with other strategies such as investments in public transit, walking, and bicycling, pricing techniques, and parking strategies.

The ongoing SANDAG study *Trip Generation for Smart Growth: Guidelines for the San Diego Region* (2010) indicates that existing smart growth areas in the San Diego region have fewer vehicle trips and miles traveled and a greater number of walking, bicycling and public transit trips than conventional, non-smart growth development due to characteristics like mixture of uses and activities, variety of nearby destinations, transportation infrastructure and urban design conducive to walking and bicycling, and high quality access to public transit.

Neighborhoods and communities in which people walk, bike, and ride public transit are typically characterized by a more concentrated, diverse mix of land uses and a sense of place, complemented by sidewalks, bike paths and lanes, buildings that front directly onto public streets, a variety of housing types and choices, and an interconnected and rich street grid that slows and disperses vehicle traffic. In addition to promoting transportation choices (other than the private vehicle), smart growth land use patterns help protect open space, wildlife habitat, watersheds, and agricultural land. Smart growth also leads to lower water consumption and related household and infrastructure costs than conventional development patterns,³⁶ and reduces water-related energy use and greenhouse gas emissions (see further discussion of the relationship among water, energy, and greenhouse gases in the Clean Energy and Efficient Buildings section).

The affordability of housing and transportation and access to employment play a critical role in determining where people live and how much they travel, directly affecting transportation-related greenhouse gas emissions. Integrating social equity considerations like affordability, displacement, and gentrification, while providing affordable housing that matches well with wage levels of nearby jobs (jobs-housing fit) can lower vehicle miles traveled and contribute to greenhouse gas reductions. Such planning allows groups with moderate and lower incomes to live affordably in areas closer to their jobs, with improved access to services and affordable travel options like public transit. Failure to consider social equity factors may lead to exclusion, limited employment opportunities, dispersed development, and therefore higher vehicle miles traveled.

³⁴ Rodier, Caroline. 2008. *A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions*. U.C. Berkeley, Transportation Sustainability Research Center. Available at: http://www.arb.ca.gov/planning/tsaq/docs/rodier_8-1-08_trb_paper.pdf

³⁵ Ewing, R., Bartholomew, K., Winkelmann, S., Walters, J., and Chen, D. 2007. *Growing Cooler: the Evidence on Urban Development and Climate Change*. Urban Land Institute. Available at: <http://www.smartgrowthamerica.org/documents/growingcoolerCH1.pdf>

³⁶ United States Environmental Protection Agency. Available at: http://www.epa.gov/dced/pdf/growing_water_use_efficiency.pdf

Under SB 375, the areas identified to house all economic segments of the population through the Regional Housing Needs Assessment process must be consistent with the land use pattern of the sustainable communities strategy. Planning that integrates the siting of affordable housing (in addition to market rate housing) into pedestrian and bicycle-friendly smart growth areas with access to public transit will help reduce greenhouse gas emissions in a way that complies with the sustainable communities strategy.

Through an ongoing collaborative process among SANDAG and local jurisdictions, Smart Growth Opportunity Areas are identified as places that can accommodate higher residential and employment densities within pedestrian-friendly activity centers connected to other activity centers by public transit. The SANDAG [Smart Growth Concept Map](#) (Figure 6-1) illustrates these nearly 200 locations of existing, planned, and potential smart growth opportunity areas in seven categories, reflecting the notion that smart growth is not a “one-size-fits-all” concept. The Map shows the relationship among smart growth areas, existing major employment areas, existing, planned, and potential public transit service, and habitat planning preserve areas. These elements make it a logical basis for the sustainable communities strategy that will be prepared for the 2050 Regional Transportation Plan.

SANDAG uses the Map to fund transportation and transportation-related infrastructure improvements and planning efforts that support smart growth development through the [TransNet Smart Growth Incentive Program](#). Two percent of annual *TransNet* revenues are allocated to this program, for a total of \$280 million over the life of the 40-year measure. SANDAG’s Smart Growth Design Guidelines includes the greenhouse gas reduction benefits of smart growth land use and alternative transportation choices like walking, bicycling, and public transportation.

Habitat protection and similar efforts to safeguard sensitive resources facilitates smart growth and greenhouse gas reductions by limiting development in certain areas and contributing to more compact urban form. Protection of sensitive resources areas, such as land protected under Habitat Conservation Plans like the Multi-Species Conservation Plan and Multi-Habitat Conservation Program and the *TransNet* Environmental Mitigation Program to mitigate habitat impacts for regional transportation projects, must be integrated into and consistent with other components of the sustainable communities strategy. Integration of habitat planning and protection of other sensitive resource areas with smart growth planning can help promote more compact urban form and related transportation alternatives that contribute to lower transportation-related greenhouse gas emissions.

Expanding on the Smart Growth Concept Map and building more smart growth development in our region will be critical to lowering the amount of vehicle travel and reducing our greenhouse gas emissions. In addition, designing neighborhoods in accordance with smart growth principles is essential to the success of the next objective: developing systems to promote low carbon transportation options like walking, bicycling, and public transit.

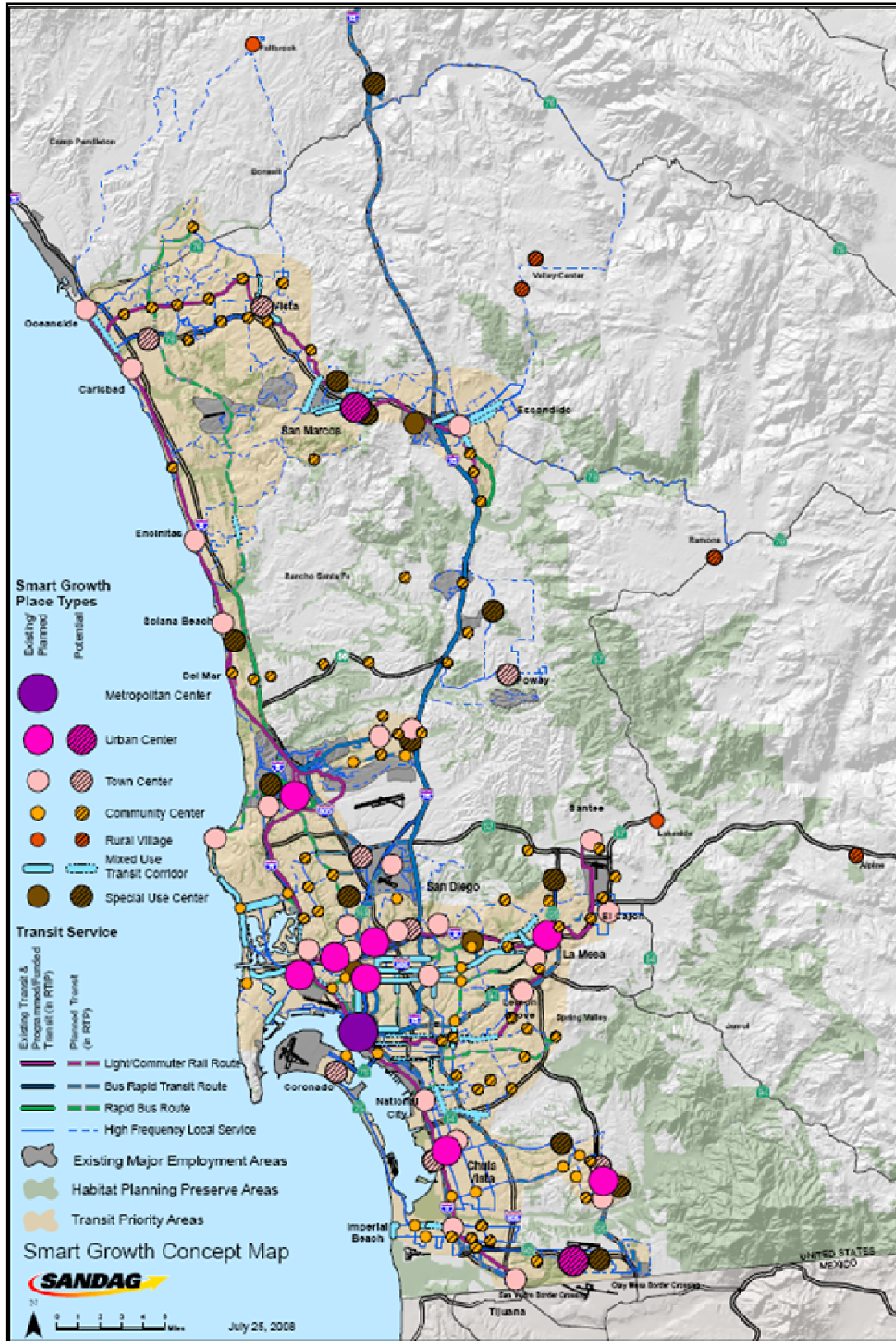
Policy Measures

Available measures to create smart growth neighborhoods and communities in which basic daily needs and public transit service are safely accessible on foot or by bicycle include:

- Continue to encourage and assist local governments in implementing planned and potential smart growth areas as identified on the Smart Growth Concept Map (SANDAG)
- Give strong consideration to existing and planned smart growth areas in the prioritization of transportation projects and related investments and decisions to reduce greenhouse gas emissions (SANDAG)
- Identify additional ways SANDAG can support the planning and development of smart growth areas through its transportation investments and other funding decisions (SANDAG)

- Identify additional sources of funding for the *TransNet* Smart Growth Incentive Program (SANDAG)
- Offer incentives for transit-oriented developments in smart growth areas (SANDAG and local governments)
- Use the Smart Growth Concept Map as a starting point for the land use component of the Sustainable Communities Strategy (SANDAG)
- Support smart growth development along Coaster, Sprinter, and Trolley stations (SANDAG and local governments)
- Locate larger retail, employment, medical, educational and government land uses near arterial and major collector streets served by public transit (local governments)
- Integrate supporting retail uses into residential and employment developments to help minimize dependence on automobile use (local governments)
- Prioritize pedestrian access to public transit (SANDAG and local governments)
- Integrate sensitive resource area protection activities with efforts to promote compact smart growth development patterns and reduce transportation-related greenhouse gas emissions (SANDAG and local government)
- Implement transportation infrastructure that increases transit connectivity and walking and biking as alternative modes in smart growth areas (SANDAG and local governments)
- Implement supportive policies that promote infill development, higher densities, affordable housing, jobs-housing fit, mixed uses, improved pedestrian and bicycle connections, and open space preservation (SANDAG and local governments)
- Coordinate public investments for transportation, energy, water supply, parks, open space, and others in a manner that supports smart growth development (SANDAG and local governments)
- Inform planners, developers, businesses, residents and other stakeholders of the climate change benefits, among others, that can result from smart growth development (SANDAG)
- Provide tools, data and analytical capacity to facilitate analysis of opportunities and feasibility of implementing smart growth development (SANDAG)

Figure 6-1. SANDAG Smart Growth Concept Map



Objective 1b. Expand and Develop New Systems for Low Carbon Modes of Transportation

Reducing miles of vehicle travel will require expanding existing systems and developing new ones that provide transportation alternatives with low or even zero greenhouse gas emissions. These “low carbon” transportation systems will provide options to driving that serve pedestrians, bicycles, and public transit. Other investments may be needed to promote low carbon travel, such as high occupancy vehicle lanes to facilitate vanpooling and carpooling and public transit service. Infrastructure for low carbon modes of transportation should be integrated with smart growth neighborhoods to create areas in which a resident’s basic daily needs and access to public transit are safely accessible on foot or by bicycle. Integrating smart growth land uses and low carbon transportation systems will be essential to lowering miles of vehicle travel and achieving significant greenhouse gas reductions, particularly over the long-term.

The region continues to take steps to expand and develop new systems that promote low carbon alternatives to driving. For example, SANDAG is developing an Urban Area Transit Strategy to evaluate strategies that could significantly increase the attractiveness and use of transit in the urban area and maximize peak-period trips on transit, bicycle, and foot. The results will be incorporated into the next update of the Regional Transportation Plan. This transit strategy will examine short-term action plans and implementation strategies to increase the use of transit. SANDAG also is developing bicycle and pedestrian infrastructure projects, a regional Safe Routes to School strategy, bicycle master plans, community active transportation studies, neighborhood safety and traffic calming projects, bicycle parking, and education, marketing, and awareness programs. More information on bicycle education programs, public awareness and marketing programs, encouragement and enforcement programs can be found in Chapter 4 of the preliminary draft of the San Diego Regional Bicycle Plan. The Regional Bicycle Plan can be viewed at www.sandag.org/bicycle.

Building on these existing efforts and identifying new measures to promote widespread use of low carbon alternatives to driving like walking, bicycling, and public transit and linking them with smart growth land use efforts would significantly contribute to lower transportation-related greenhouse gases. While many factors are important, having secure funding sources, particularly for public transit operations, will be critical to our region’s success in developing low carbon transportation systems.

Policy Measures

Available measures to expand and develop new systems for low carbon modes of transportation include:

- Give greater consideration to transportation modes and related investments that contribute to short- and long-term greenhouse gas reductions in future Regional Transportation Plan updates (SANDAG)
- Increase and prioritize funding and system investments for public transit (including stable and secure funding for transit operations) (SANDAG and local governments)
- Increase level of service on existing routes and improve travel through reduced headways, limited stop service, and similar techniques (SANDAG and transit agencies)
- Provide new public transit service through expanded investments such as commuter rail, light rail, bus rapid transit, and local bus service (SANDAG and transit agencies)
- Improve the performance of transit with infrastructure upgrades like queue jumps, signal prioritization, and dedicated transit-only lanes (SANDAG and local governments)
- Encourage the use of transit by increasing its safety and cleanliness, providing real-time information, and making other quality improvements (SANDAG and transit agencies)

- Improve the performance of public transit to attract single-occupancy drivers, for example by making transit trip times competitive with vehicle trips (SANDAG)
- Support expanding existing interregional public transit service and adding new routes, like high speed rail (SANDAG)
- Coordinate the funding of low carbon transportation like walking, bicycling and public transit with smart growth development (SANDAG and local governments)
- Encourage the use of neighborhood electric vehicles and similar low-carbon mobility options as alternatives to the private automobile (SANDAG and local governments)
- Improve regional bicycle corridors and their supportive infrastructure (SANDAG and local governments)
- Implement the Regional Bicycle Master Plan (SANDAG)
- Support bicycle education and marketing efforts that promote bicycling, such as Bike-to-Work Day (SANDAG)
- Implement the regional Safe Routes to School strategy (SANDAG)
- Establish “complete streets” policies that help make roadways safe, attractive, and comfortable for all users, including pedestrians and bicyclists, as well as drivers (local governments)
- Provide sidewalks with pedestrian amenities such as curb cuts, good lighting, and well-marked pedestrian crossings at key intersections (local governments)

Objective 1c. Reduce Demand for Single Occupancy Vehicle Travel

Vehicles will continue to be the first choice for many individual trips for the foreseeable future. A primary reason is the automobile orientation of existing neighborhoods and communities and transportation systems. In addition, smart growth and low carbon transportation infrastructure are longer-term strategies to reduce greenhouse gas emissions.

Because of the need to achieve greenhouse gas emissions reductions in the near term (SB 375 identifies 2020 as the near term target year), it is necessary to examine policy measures that can relatively quickly reduce vehicle miles traveled and greenhouse gas emissions while our region creates the smart growth communities, builds low carbon transportation systems, and makes other long-term investments critical to systematically lowering our emissions. Reducing demand for single occupancy vehicle travel will be an important strategy for achieving short-term vehicle miles traveled and greenhouse gas reductions.

The region continues to reduce demand for drive alone trips. The SANDAG Transportation Demand Management Program known as iCommute provides free assistance to San Diego regional businesses and agencies in establishing and implementing customized transportation demand management programs that reduce traffic congestion and greenhouse gas emissions. Services offered through iCommute include:

- A regional vanpool program that provides a \$400-a-month subsidy per van.
- On-line ridematching services for carpools, vanpools, and schoolpools via RideMatcher.
- Measurement of transportation demand management benefits to the environment via the TripTracker tool.
- Information on other commuting options including transit, bicycling, and teleworking.

Additional measures to reduce demand include teleworking, carpooling and vanpooling, alternative work schedules, certain vehicle pricing measures as well as parking pricing, and parking management and reform.

Parking management and parking pricing strategies are additional options to reduce the amount of driving. They can primarily be implemented at the local government level. In contrast to other greenhouse gas reduction measures, most parking policies could achieve greenhouse gas savings relatively quickly. Parking strategies are particularly effective in and complement smart growth areas with compact land use patterns and alternative travel options. Improved management and pricing of parking promotes the alternative travel choices, urban form, urban design and land use patterns that contribute to lower greenhouse gases. It is important to note that parking strategies are likely to achieve wide-ranging outcomes depending on the community or type of development project, and therefore should not be uniformly applied throughout the region. Instead, parking strategies should be evaluated on a case-by-case basis to reflect the unique nature and local characteristics of the many communities and types of development projects throughout the region.

In addition, these parking policies can lower traffic congestion, reduce the cost of housing and development, and improve social equity. In some cases existing parking requirements contribute to more dispersed development patterns, longer travel distances, and urban design that are more conducive to driving and automobile oriented development patterns than to the alternative travel options and land use patterns needed to address climate change.

Potential parking policy reforms that would contribute to lower greenhouse gases include using variable pricing for on-street parking that leaves one or two vacant spaces on each block (or about 85 percent maximum occupancy rate), allowing shared parking, using parking revenue in the communities that generate it, reducing or removing requirements for off-street parking on order to facilitate higher-density development (for example by decreasing development costs and potentially freeing up existing surface parking lots for development), encouraging businesses to provide employees cash in exchange for parking spaces, and unbundling parking costs from residential and commercial purchase, rental and lease costs.

Policy Measures

Available measures to reduce demand for single occupancy vehicle travel include:

- Provide financial incentives to support increased vanpooling (SANDAG)
- New or expanded policies, programs, and incentives to promote carpooling (SANDAG and local governments)
- Encourage employers to institute telework programs (SANDAG and local governments)
- Encourage employers to institute alternative work schedules (SANDAG and local governments)
- Encourage employers to institute programs that provide financial incentives for commuters to reduce their vehicle trips and use alternative transportation modes like walking, bicycling, public transit, vanpooling, and carpooling, often as an alternative to subsidized employee parking (SANDAG and local governments). Examples include:
 - Parking Cash Out: commuters offered subsidized parking are offered the cash equivalent if they use alternative travel modes.
 - Travel Allowances: financial payments are provided to employees in lieu of parking subsidies. Commuters could use the travel allowance to pay for parking or for another travel mode.
 - Transit and Rideshare Benefits: free or discounted fares provided to employees.
 - Reduced Employee Parking Subsidies: commuters who drive would pay a portion or all of their parking costs.
- Reduce parking requirements and/or initiate parking maximums in smart growth areas (local governments)
- Establish on-street parking fees in smart growth areas (local governments)

- Enact policies that de-couple the cost of parking spaces from residential units (local governments)
- Encourage and use paid parking, shared parking, and other parking management and design measures that promote more walking and transit use in smart growth areas (SANDAG local governments)
- Support investments to provide high-performance broadband connectivity to every business, government agency, non-profit organization, and residence to enable widespread e-commerce and telecommuting (SANDAG and local governments)
- Evaluate and support or implement vehicle pricing measures such as cordon (area) tolls, a fuel or carbon tax, a per mile fee for vehicle travel, and pay-as-you-drive insurance (SANDAG and local governments)
- Implement strategies that prioritize high-occupancy vehicles – carpools, vanpools, and public transit vehicles – on the road and for parking (SANDAG and local governments)
- Support or implement car and bicycle sharing programs (SANDAG and local governments)

GOAL 2. MINIMIZE GREENHOUSE GASES WHEN VEHICLES ARE USED

Minimizing greenhouse gas emissions when vehicles are used means encouraging efficient vehicle travel and operations. Vehicles operating in congested traffic conditions or at higher speeds inefficiently consume fuel and generate a higher level of greenhouse gas emissions relative to vehicles operating under more efficient conditions. Creating efficient traffic conditions also is important to promote efficient travel by public transit services and high occupancy vehicles using our arterial and highway systems.

SANDAG can promote operation of vehicles at more efficient speeds through efforts to reduce traffic congestion, limit vehicle speeds, and promote overall fuel efficient driving practices. Pricing policies are an option for managing the use of transportation facilities, particularly when there is limited capacity, such as during rush hours. Conversion of existing high occupancy vehicles facilities to high occupancy toll lanes, or general purpose facilities to toll facilities, are ways in which pricing could be used to manage demand. In the San Diego region, development of new high occupancy toll lanes and new toll lanes – rather than the conversion of existing facilities – has been the adopted approach to pricing.

Objective 2a. Reduce Traffic Congestion

Characteristics of traffic congestion like idling, slow vehicle speeds, and repetitive braking and accelerating lead to inefficient vehicle operation and consumption of fuel, and therefore higher greenhouse gas emissions relative to vehicles operating in more efficient conditions. Eliminating or reducing congestion can lead to more efficient travel conditions for vehicles and greenhouse gas savings. Options to relieve congestion may include increasing roadway or highway capacity, relieving highway bottlenecks, or systems management techniques such as ramp metering, active traffic management based on traffic conditions, or temporarily converting shoulders to travel lanes.

Measures to relieve congestion also may induce additional vehicle travel during uncongested periods, particularly over the long-term, which can partially or fully offset the greenhouse gas reductions achieved in the short-term from congestion relief.^{37,38} Induced demand (sometimes called the rebound effect) in transportation refers to the increase in travel that can occur when the level of service on a roadway or other facility improves. Travelers sometimes respond to faster travel times and decreased costs of travel by traveling more, resulting in increased vehicle miles traveled.

³⁷ Victoria Transport Policy Institute. *Smart Congestion Reductions: Evaluating Highway Expansion Benefits*. Provides a summary of research on vehicle travel generated and induced by roadway expansion. Available at: http://www.vtpi.org/cong_relief.pdf

³⁸ Cambridge Systematics, Inc. 2009. *Moving Cooler: An Analysis of Transportation Strategies for Reduction Greenhouse Gas Emissions*.

When evaluating the impacts of congestion reduction measures on greenhouse gas emissions, it is necessary to examine both the fuel efficiency benefits of less traffic congestion and the increased fuel consumption associated with the potential for induced vehicle miles traveled. Since the level of congestion reduction and demand inducement will likely vary by the type of congestion relief measure, careful study of these factors will be needed to determine a more complete understanding of the relationship between congestion relief measures and greenhouse gas emissions.

Policy Measures

Available measures to reduce traffic congestion include:

- Make improvements to relieve congestion and bottlenecks (SANDAG and Caltrans)
- Conduct education campaigns to promote efficient driving (eco-driving) habits (SANDAG and local governments)
- Evaluate the implementation of congestion pricing programs on congested highways and regionally significant arterial roadways (SANDAG)
- Implement traffic calming measures such as replacing stop-controlled intersections with roundabouts (local governments)
- Continue to coordinate traffic signals to facilitate efficient traffic conditions (SANDAG and local governments)
- Promote transportation alternatives for special events such as professional sporting events and concerts (SANDAG, Caltrans, transit agencies and local governments)
- Convert general purpose lanes to toll lanes on highways and arterials (SANDAG and local governments)

Objective 2b. Promote Efficient Driving Practices

Similar to vehicles operating in congested conditions, inefficient driving practices such as rapid acceleration and braking lead to higher fuel consumption relative to vehicles operating at lower, more fuel efficient speeds. Greenhouse gas reductions could be achieved by training drivers in techniques that reduce gasoline consumption, such as avoiding rapid acceleration and braking, reducing speeds, properly changing gears, and using cruise control.³⁹ These efficient driving or “eco-driving” techniques could be promoted through education and awareness programs.

There also may be a link among pavement characteristics such as material type and roughness and vehicle fuel efficiency. While some research indicates that concrete pavement could result in modest fuel efficiency improvements relative to asphalt, particularly for heavy-duty vehicles,⁴⁰ other research reports that the fuel economy differences between concrete and asphalt are not statistically significant.⁴¹ Pavement smoothness appears to have a stronger correlation with fuel efficiency than pavement type, although the fuel economy improvements are modest.⁴²

³⁹ United States Environmental Protection Agency. *Driving More Efficiently*. Available at:

<http://www.fueleconomy.gov/feg/driveHabits.shtml>

⁴⁰ Cement Association of Canada. *Hard Facts on How Concrete Pavement Helps the Environment*. Available at:

http://www.cement.ca/index.php/en/Highways/Fuel_Savings_and_Reductions_in_Emissions_Major_Canadian_Urban_Arterial_Highways_and_Freeways_.html

⁴¹ European Asphalt Pavement Association. 2004. *Environmental Impacts and Fuel Efficiency of Road Pavements*. Available at:

http://www.eapa.org/START/positionprs_publications/papers/Fuel%20Efficiency%20Report.pdf

⁴² Missouri Department of Transportation. 2006. *Pavement Smoothness and Fuel Efficiency*. Available at:

<http://library.modot.mo.gov/RDT/reports/Ri05040/or07005.pdf>

Policy Measures

Available measures to promote efficient driving practices include:

- Promote fuel-efficient, “eco-driving” practices such as reducing idling, slower driving speeds, gently accelerating, and proper tire inflation, as a new driver education program or as part of existing programs (SANDAG and local governments)
- Use changeable message signs to encourage fuel-efficient, eco-driving practices (SANDAG)

GOAL 3. PROMOTE USE OF LOW CARBON ALTERNATIVE FUELS

In addition to coordinated land use and transportation planning, the San Diego region can reduce greenhouse gas emissions by promoting the use of low carbon alternative transportation fuels. While efforts to encourage low carbon fuels are primarily happening at the state and federal levels and in the private sector, the region can promote their implementation by facilitating the siting and streamlining permitting for the needed infrastructure installation.

SANDAG is a logical entity for helping to coordinate, plan and identify suitable locations for alternative fuel infrastructure. As a regional planning agency, SANDAG can ensure that alternative fuel considerations are integrated with development of the regional transportation network. It can recommend specific alternative fuel and vehicle technologies for different transportation sectors that are tailored to the unique characteristics of the region. In general, local governments have jurisdiction over siting and permitting of alternative fuel vehicle infrastructure, while state and federal agencies establish standards for vehicles and fuels.

With funding and tax credits, state and federal government can help the region increase the deployment of alternative fuel vehicles and infrastructure. A variety of alternative fuel vehicles in multiple vehicle classes are available now or will be in the near future, including factory-made and commercially available vehicles from major automobile manufacturers and after-market vehicle conversions and retrofits. Much government funding, research, and private sector investment is focused on the development of plug-in hybrids, electric vehicles, and biofuels. In addition, hydrogen,⁴³ natural gas, and propane are the focus of public and private sector research and dollars.

The promotion of low carbon, alternative fuels provides the added benefit of reducing regional reliance on imported petroleum. The federal Energy Independence and Security Act of 2007 identified increased vehicle efficiency and increased supply of alternative fuels as two measures to enhance national energy security and reduce the nation’s reliance on petroleum imports. By coordinating a regional alternative transportation infrastructure effort and supporting local alternative fuel developers, SANDAG and local governments can help the San Diego region become more energy independent.

SANDAG has developed relationships with a variety of regional stakeholders regarding alternative fuels, including the San Diego Regional Clean Fuels Coalition and the Clean Transportation Program at San Diego Gas & Electric. SANDAG will partner in the American Recovery and Reinvestment Act funded project between eTec and Nissan North America (eTec Nissan project) to deploy up to 1,000 all-electric vehicles and establish up to 2,250 private and publicly accessible charging points in the San Diego region as part of the largest transportation electrification project in U.S. history.

⁴³ Hydrogen is an energy carrier, not an energy source.
<http://www1.eere.energy.gov/hydrogenandfuelcells/production/basics.html>

Policy Measures

Available measures to promote the use of alternative fuel vehicles include:

- Create an action plan that incorporates alternative fuel and technology vehicles into SANDAG and local government-owned vehicle fleets, and the fleets of contractors and funding recipients, such as the vehicle fleet for the SANDAG Regional Vanpool Program or for local government trash haulers (SANDAG and local governments)
- Develop a regional approach to infrastructure planning for alternative fuels and technologies by continuing to develop a public-private strategic alliance (SANDAG)
- Support electricity and natural gas tariffs that encourage their use as transportation fuels (SANDAG and local governments)
- Develop streamlined permitting requirements and standardized design guidelines and siting criteria for all types of electric charging stations (such as single- and multi-family residential, commercial, public access, fast-charge, etc.) (SANDAG and local governments)
- Accelerate the transition to plug-in hybrid electric and battery electric vehicles by developing a regional plan to install a public access electric car charging network, as recommended in the *Regional Alternative Fuels, Vehicles, and Infrastructure Report* (SANDAG)
- Work with San Diego Gas & Electric to understand the potential impacts of widespread plug-in hybrid and electric vehicle deployment on the electricity grid (SANDAG)

GOAL 4. PROTECT TRANSPORTATION INFRASTRUCTURE FROM CLIMATE CHANGE IMPACTS

In addition to being the number one source of climate change emissions in our region, the transportation sector is threatened by the impacts of climate change. More frequent extreme hot days and prolonged extreme heat periods would increase the risk of buckling of highways and railroad tracks, and premature deterioration or failure of transportation infrastructure.⁴⁴ More frequent and severe wildfires followed by rainfall can increase the risk of mudslides, which can disrupt major infrastructure like roadways and rail lines. Accelerated sea level rise and stronger storm surges are likely to impact densely developed urban areas, ports, airports, and other vital lines of coastal transportation.

Preparing transportation infrastructure for climate change is a new concern as future projects are designed and our current system is maintained. The tools and methodologies for evaluating and adapting to such impacts are still in the early stages of development.

Objective 4a. Protect Transportation Infrastructure from Damage Due to Extreme Heat

Policy Measures

- Direct research at developing materials for transportation infrastructure that are better suited to withstand high temperatures (SANDAG and local governments)
- Accelerate inspection schedules and prepare for increased maintenance and costs (SANDAG and local governments)
- Identify adaptive management and monitoring to incorporate into regional transportation planning (SANDAG)

⁴⁴ California Natural Resources Agency. 2009. *2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008*. Available at: <http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF>

- Address adaptation issues in the design and location of new projects and when improvements are made to existing infrastructure (SANDAG and local governments)
- Partner with government, academic, and other agencies and stakeholders to develop adaptation strategies (SANDAG and local governments)

Objective 4b. Protect Transportation Infrastructure from Sea Level Rise and Higher Storm Surges

Policy Measures

- Develop a climate vulnerability plan that will identify areas in the San Diego region at risk of damage from sea level rise and storm surges.
- Modify standards for the design, location, and construction of infrastructure to account for areas potentially subject to storm surge, sea level rise, and more frequent flooding events.
- Reduce building in floodplains and areas subject to storm surge or sea level rise
- Engage a multi-disciplinary team of climate change and coastal experts along with hydraulics and bridge design specialists during the scoping process of coastal bridge projects.
- Identify adaptive management and monitoring to incorporate into regional transportation planning (SANDAG)
- Address adaptation issues in the design and location of new projects and when improvements are made to existing infrastructure.

Objective 4c. Protect Transportation Infrastructure from Wildfire-Associated Mudslides

Policy Measure

- Improve bank stabilization and erosion control measures near important transportation infrastructure after wildfires.
- Replant wildfire landscapes to sequester carbon and stabilize soils within vulnerable watersheds that could put transportation (and other) infrastructure at risk.
- Address adaptation issues in the design and location of new projects and when improvements are made to existing infrastructure.

7. CLEAN ENERGY AND EFFICIENT BUILDINGS

Conservation, energy efficiency, and clean on-site generation reduce greenhouse gas emissions. The easiest ton of greenhouse gases to remove from the atmosphere is one that is not emitted in the first place. State agency and regional utility actions are responsible for the majority of reductions in the energy sector, but there are actions that regional and local governments can take to leverage existing policies and programs to achieve additional greenhouse gas savings.

Electricity generation and natural gas end-uses such as space and water heating account for about 33 percent of greenhouse gas emissions in the San Diego region.⁴⁵ Factors contributing to the level of emissions from electricity include total consumption, fuel sources, and technologies in the electricity generation sector. About 67 percent of the fuel used to generate electricity that is consumed in the region is from fossil fuels like natural gas and coal.⁴⁶ Factors contributing to greenhouse gas emissions from energy include:

- The carbon intensity and location of energy supplies.
- The efficiency of power plants and the transmission network.
- The efficiency of buildings.
- The efficiency of end-use equipment.

Recommended regional and local government energy policies focus on the following:

- Improving energy planning.
- Reducing energy consumption.
- Expanding clean energy supply.

The State's Climate Change Scoping Plan identifies local government measures to reduce inefficient energy use from municipal operations and the community-at-large. Local governments have authority to adopt mandatory and voluntary codes that require higher degrees of energy efficiency and lower greenhouse gas emissions than state codes require. According to a 2009 greenhouse gas analysis performed by the Energy Policy Initiatives Center at the University of San Diego, significant greenhouse gas savings can be found in our region by improving the efficiency of existing buildings and new construction (reducing energy consumption), and by installing more distributed energy systems like solar photovoltaics, combined heat and power, and solar water heating.⁴⁷

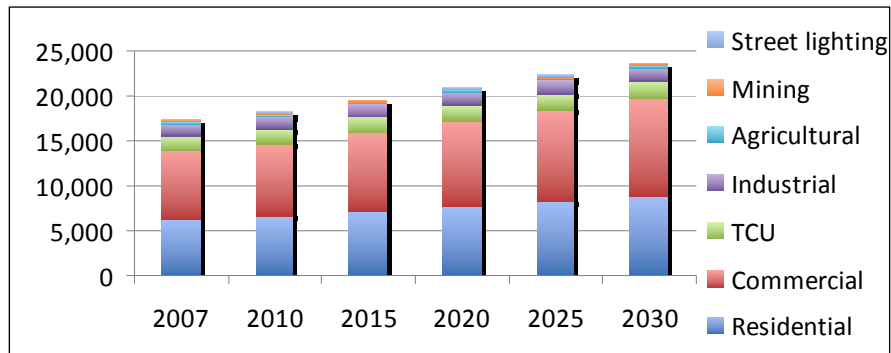
Figures 7-1 and 7-2 show projected regional electricity and natural gas consumption by end-use sector under business-as-usual conditions in which current energy use trends and policies do not change. Commercial and residential sectors consume the most energy and are forecasted to produce the most greenhouse gas emissions from electricity and natural gas end uses. Because the following figures are business-as-usual projections depicting the consequences of not taking action, the effect of new federal, state, and local policies is not shown.

⁴⁵ Energy Policy Initiatives Center. 2008. *San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets*. Available at: <http://www.sandiego.edu/epic/ghginventory/>

⁴⁶ San Diego Gas & Electric. 2009. *Power Content Label*. Available at: http://www.sdge.com/documents/billinserts/myAccount/090909/FINAL%200930042%20PowerLabel_3.pdf

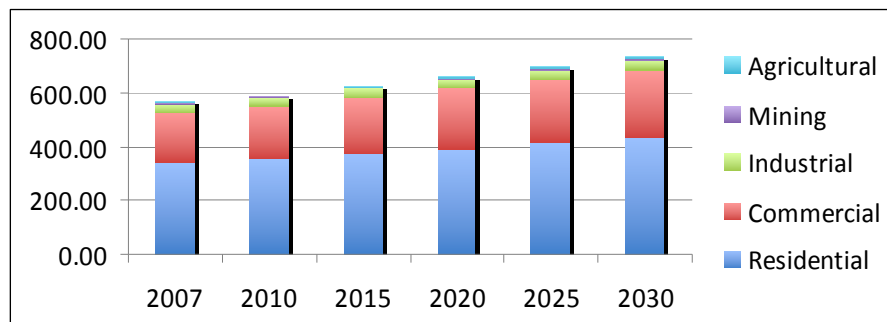
⁴⁷ Energy Policy Initiatives Center, 2009. *Reducing Greenhouse Gases from Electricity and Natural Gas Use in San Diego County Buildings: An Analysis of Local Government Policy Options*. Available at: http://www.sandiego.edu/epic/ghgpolicy/documents/GHGPolicy_Buildings_FINAL_000.pdf

Figure 7-1. Projected Electricity Consumption under a Business-as-Usual Scenario (Gigawatt-hours), 2007-2030



Source: Energy Policy Initiatives Center, University of San Diego, 2008. SANDAG *Regional Energy Strategy*, Figure 4-3, 2009.

Figure 7-2. Existing and Projected Natural Gas Consumption under a Business-as-Usual Scenario, 2007-2030



Source: Energy Policy Initiatives Center, University of San Diego, 2008. SANDAG *Regional Energy Strategy*, Figure 4-6, 2009.

GOAL 5. REDUCE ENERGY USE IN RESIDENTIAL AND COMMERCIAL BUILDINGS

Reducing energy use through efficiency is the first priority in the state’s preferred loading order for new energy resources. Energy efficiency provides direct and measurable benefits like potential cost savings for the end user and reduced greenhouse gas emissions for a community. One way local governments can increase efficiency is through their ability to regulate existing buildings and new construction. Analysis by the Energy Policy Initiatives Center shows that 89 percent of energy savings opportunities lie in the region’s existing building stock, with only 11 percent of the savings potential available through new construction.⁴⁸

Existing state and utility programs to reduce electricity and natural gas consumption include the routine strengthening of building and appliance standards, wide-ranging energy efficiency and renewable energy programs, and the purchase of renewable energy supplies to meet future electricity demand.

The goals and actions outlined here complement the measures identified in the SANDAG Regional Energy Strategy, which was approved by the Board of Directors in December 2009. The Regional Energy Strategy includes more expanded discussions of these topics.

⁴⁸ EPIC 2009.

Green Building Practices

Green buildings reduce energy consumption, use water more efficiently and utilize materials with recycled content, thus saving money, natural resources, and greenhouse gas emissions. Many local governments have adopted voluntary or mandatory codes equivalent to the Leadership in Energy and Environmental Design (LEED) green building standards. To ensure the greatest reductions in greenhouse gas emissions, green building programs should include minimum standards for energy efficiency, in addition to other standards for other resources like water, indoor air quality, and recycled materials.

In 2004, Governor Schwarzenegger signed Executive Order S-20-04 regarding Green Buildings, which sets a goal of reducing energy use in state-owned buildings by 20 percent by 2015 (from a 2003 baseline) and encourages the private commercial sector to set the same goal. The state's [Green Building Action Plan](#) provides policy guidance and strategies for how the state will meet this goal.

In January 2010, California became the first state in the nation to adopt a mandatory Green Building Standards Code (CALGREEN) requiring all new buildings in the state to be more energy efficient and environmentally responsible. CALGREEN is part of Title 24, California's building energy code. It will become effective January 1, 2011.

CALGREEN requires every new building constructed in California to reduce water consumption by 20 percent, divert 50 percent of construction waste from landfills, and install low pollutant-emitting materials. These provisions are part of the State's strategy to reduce greenhouse gas emissions to the 1990 level by 2020. The [California Green Building Directory](#) is an online informational tool providing details about state-owned green buildings that are energy-efficient and environmentally friendly.

Objective 5a. Retrofit Existing Buildings to Reduce Energy Use

Six actions were identified in the Regional Energy Strategy that local and regional government should address as top energy priorities. One is to develop a regional building retrofit program to reduce inefficient electricity and natural gas use in our existing building stock. Analysis by the Energy Policy Initiatives Center identified the residential sector as having the greatest potential for total energy savings at 48 percent, and the commercial sector representing 24 percent.⁴⁹

A large proportion of the region's existing buildings were constructed prior to full implementation of the state's minimum building energy code (Title 24): 60 percent of residential buildings and 40 percent of the commercial buildings.⁵⁰ Because the useful life of buildings typically spans decades, a significant number of existing buildings will still be in use in 2030.

Comprehensive programs that integrate all potential energy-saving aspects for a building, creating prioritized packages of measures, achieve larger greenhouse gas reductions than singular programs. Financing programs need to be identified that address the upfront costs of retrofits. In California, financing to undertake building retrofits is becoming more available through Property Assessed Clean Energy (PACE) programs, also known as AB 811 (Levine, Chapter 159, Statutes of 2008) programs. PACE programs allow local governments to offer energy project loans to eligible property owners. The City of San Diego is expected to begin a financing program called *San Diego Clean Generation* in summer 2010. [CaliforniaFIRST](#), sponsored by the California Statewide Communities Development Authority (California Communities) in partnership with Renewable Funding and the Royal Bank of Canada Capital Markets, offers a financing program that local governments across the state can join. The City of San Diego and CaliforniaFIRST are both using the [California Center for Sustainable Energy](#) (based in San Diego) for program implementation.

⁴⁹ EPIC, 2009.

⁵⁰ EPIC, 2009.

Policy Measures

Available policy measure to reduce energy through existing building retrofits include:

- Provide energy efficiency planning assistance to local governments through the Sustainable Region Program with San Diego Gas & Electric (SANDAG)
- Establish or support building energy rating and disclosure policies that inform building owners of their energy usage (SANDAG or local governments)
- Promote policies that lead to energy efficiency retrofits in existing buildings (SANDAG and local governments)
- Support increased use of solar water heating in residential, pool, and commercial uses to reduce natural gas demand (SANDAG or local governments)
- Create or join financing programs (e.g. PACE programs) to pay for energy projects and improvements that reduce greenhouse gas emissions (local governments)
- Increase energy code training for building code officials and builders to improve implementation and enforcement of energy codes (local governments)

Objective 5b. Maximize Efficiency in New Residential and Commercial Construction

Analysis by the Energy Policy Initiatives Center of local government policy options to reduce greenhouse gas emissions found that energy efficiency beyond Title 24 requirements (called reach codes) could achieve moderate emissions reductions at a low cost in the commercial sector, and much lower greenhouse gas savings at a higher cost in the residential sector. Voluntary and mandatory reach codes for new commercial and residential construction yield less greenhouse gas savings due to the small amount of new construction as a proportion of the total building stock and the fact that California's building energy code is already stringent and updated regularly.

A bold strategy of the state's Long-term Energy Efficiency Strategic Plan calls for zero net energy buildings. Through a combination of energy efficient design features and on-site clean distributed generation, zero net energy buildings result in no net purchases from the electricity or natural gas grid, thereby avoiding the associated greenhouse gas emissions from power plants and the grid. Increased installation of high-efficiency technologies like solar hot water heaters and combined heat and power systems are strategies to reduce natural gas use and meet energy needs more efficiently.

Policy Measures

Available policy measures to maximize efficiency in new residential and commercial construction include:

- Develop a policy to include energy star appliances in new construction (local governments)
- Exceed Title 24 energy requirements for new construction through regulations or incentives that work toward the state's goal of zero net energy new homes by 2020 and zero net energy new commercial buildings by 2030 (local governments)
- Increase enforcement of building energy requirements to reduce the rate of noncompliance in new construction (local governments)

GOAL 6. INCREASE USE OF RENEWABLE ENERGY

Increasing the use of renewables and distributed energy systems is the state's second priority for meeting our resource needs. Clean, nonrenewable on-site energy sources like combined heat and power systems also are needed to reduce the greenhouse gas intensity of energy consumed in the region. Local governments have the opportunity to supplement ongoing state and utility efforts to increase the use of renewable energy and help the region reduce greenhouse gas emissions by encouraging or requiring installation of on-site renewable and combined heat and power systems.

Objective 6a. Promote Installation of Clean, On-site Energy Systems

Distributed energy systems like rooftop solar photovoltaics, fuel cells, and combined heat and power systems can produce electricity during peak times and reduce demand on the electricity grid. Distributed energy systems are small-scale power generation technologies located close to the load being served. These decentralized systems are complementary to traditional electric power systems, can increase grid reliability and reduce the need for additional central peaking units.

Policy Measures

Available measures to promote the installation of clean, on-site energy systems include:

- Revise, or support revision of, local zoning policies, homeowner association codes, and other codes to remove hindrances and promote installation of photovoltaic (PV) or other distributed renewable energy systems (for example, require or provide incentives for new construction to pre-wire for PV installation) (SANDAG or local governments)
- Explore opportunities to demonstrate advanced energy storage technologies at local government-owned or controlled sites (local governments)
- Combine energy assessments and energy efficiency improvements with the installation of distributed energy systems to reduce system costs and maximize energy savings (SANDAG or local governments)
- Establish financing programs (using public or private sources) that residents and businesses can access to install distributed energy systems, conduct energy assessments, and make energy efficiency retrofits to existing buildings (SANDAG or local governments)
- Monitor and support a feed-in-tariff or other policies that will facilitate increased, cost-effective installation of small-scale renewable energy systems like solar photovoltaics (SANDAG or local governments)
- Identify local barriers to installing distributed generation, including combined heat and power systems, and identify potential solutions that could be consistently applied across jurisdictional boundaries (SANDAG or local governments)
- Encourage local home builders to participate in the [New Solar Homes Partnership](#) to install solar photovoltaics on new homes in the region (SANDAG or local governments)

Objective 6b. Promote Large-Scale Renewable Energy Projects

Analysis from the Energy Policy Initiatives Center identifies increases in large-scale renewable energy as the top greenhouse gas reduction strategy for the energy sector (the state's Pavley Standard for passenger vehicles is the first), consistent with analysis of the California Air Resources Board.⁵¹ The primary way to encourage large-scale renewable energy is through utility-scale systems like wind farms and solar power arrays.

⁵¹ EPIC, 2008.

California's Renewable Portfolio Standard (RPS) originally required retail sellers of electricity to procure 20 percent of retail sales from renewable energy by 2017.⁵² The 20 percent requirement was later moved to the end of 2010,⁵³ and a 33 percent goal for 2020,⁵⁴ recommended by multiple state agencies, is in the process of being implemented. SANDAG and local governments can support increased large-scale renewable energy use as described below. More detail on supporting large-scale renewable energy is provided in the *Regional Energy Strategy*.

Policy Measures

Available measures to promote large-scale renewable energy projects include:

- Identify potential locations in the region that could accommodate utility-scale renewable energy infrastructure (SANDAG or local governments)
- Explore options to pre-permit zones of appropriate land for renewable energy development (SANDAG or local governments)
- Support cost-effective access to transmission and related infrastructure that will help the region meet or exceed requirements for procuring renewable resources while protecting environmental and other resources (SANDAG or local governments)

GOAL 7. REDUCE WATER-RELATED ENERGY USE AND GREENHOUSE GASES

In the San Diego region, water and energy resources are closely connected. Large amounts of energy are needed to pump, treat, deliver, and recycle water, in addition to the energy expended for customer end-uses like heating and cooling water. Power plants primarily use water for cooling, which can impact local water supplies. The preceding section, Smart Growth Land Use and Low Carbon Transportation, describing the relationships among land development patterns, transportation planning, and greenhouse gas emissions, also notes the correlation between land development patterns and water use.

California's water systems use much more energy than the national average. The state's major conveyance systems move water to end users over hundreds of miles and thousands of feet in elevation. The State Water Project (SWP) consumes energy by pumping water 2,000 feet over the Tehachapi Mountains -- the highest lift of any water system in the world.

The San Diego region currently imports more than 80 percent of its water and is at the farthest, most energy intensive, end of the State Water Project and Colorado River Aqueduct.⁵⁵ Imported water from the State Water Project and the Colorado River will likely be constrained by various factors including enforcement of the Colorado River Compact, environmental restrictions on water from the SWP, and the impacts of climate change such as reduced snowpack levels in the Sierra Nevada.

The California Water Plan prepared by the Department of Water Resources, provides a framework for water managers, legislators, and the public to consider options and make decisions regarding California's water future. The Plan, which is updated every five years, presents basic data and information on California's water resources including water supply evaluations and assessments of agricultural, urban, and environmental water uses to quantify the gap between water supplies and uses. It also identifies and evaluates existing and proposed statewide demand management and water supply augmentation programs and projects to address the State's water needs.⁵⁶

⁵² Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002).

⁵³ Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006).

⁵⁴ Governor Schwarzenegger Executive Orders S-14-08 and S-21-09.

⁵⁵ Presentation by Paul Lanspery, Deputy General Manager, San Diego County Water Authority to SANDAG Board of Directors Meeting, May 8, 2009.

⁵⁶ Department of Water Resources. Available at: <http://www.waterplan.water.ca.gov/>

For the San Diego region, there are various strategies for satisfying additional water demand as we continues to grow, each of which is embedded with different amounts of energy use and greenhouse gas emissions. These strategies include conservation, recycling, additional imports, and desalination. The estimated energy intensity of each strategy should be included in the consideration of various water choices. In 2005, the California Energy Commission estimated energy intensity of water strategies provided below, expressed in kilowatt hours of electricity per acre foot of water (kWh/af).⁵⁷

- Conservation: 6,030 kWh/af
- Recycling: 6,620 kWh/af
- Status quo: 6,900 kWh/af
- Imperial Irrigation District Transfer: 6,940 kWh/af
- Additional State Water Project: 7,100 kWh/af
- Seawater desalination: 7,260 kWh/af

Recycled water is wastewater purified through treatment processes to be used again. It is treated to regulatory requirements for non-potable use, and then distributed through a separate system of pipes. Indirect potable reuse involves taking recycled water that meets all regulatory requirements for non-potable use, treating it further with several advanced treatment processes to meet potable water standards, and then adding it to an untreated potable water supply like a surface reservoir or a groundwater aquifer.

The highly treated indirect potable reuse water blends with the source water, which is often imported water and local runoff, and is treated to regulatory requirements for potable water use and distributed to customers. Since indirect potable reuse involves treatment to potable water standards, it would have higher energy intensity than recycled water used for non-potable purposes. However, indirect potable reuse, and recycled water in general, is the least energy intensive water supply option in California, after conservation and efficiency.

Objective 7a. Integrate Measures that Save Water and Energy into Building Retrofit Programs

As of 2005, water-related energy use annually accounts for 20 percent of the state's electricity consumption, 30 percent of non-power plant natural gas consumption, and use of 88 million gallons of diesel fuel.⁵⁸ Peak demand for water generally coincides with peak demand for electricity. The California Energy Commission identifies water conservation and efficiency as the best, most energy efficient way to serve future demand.

Policy Measures

Available measures to integrate water- and energy-saving measures into building retrofit programs include:

- Coordinate efforts to reduce water and energy use with the San Diego County Water Authority, local water districts and other agencies including the US Environmental Protection Agency's WaterSense program (SANDAG or local governments)
- Increase energy conservation and the efficient use of water in the residential and commercial sectors, with priority on the largest end uses such as landscape irrigation, toilets, and showers and the water end-uses with the most embedded energy like dishwashers, residential clothes washers, and commercial laundries (local government)

⁵⁷ California Energy Commission. 2005. *Integrated Energy Policy Report*. CEC-100-2005-007CMF.

⁵⁸ California Energy Commission. 2005. *Integrated Energy Policy Report*. CEC-100-2005-007CMF.

- Identify existing and new financing mechanisms such as on-bill financing for property taxes or utilities, or low interest loans that end users can utilize to reduce water-related energy consumption (SANDAG or local governments)
- Promote energy efficiency, demand response and clean on-site generation to local governments that own or operate water pumping stations and water or wastewater treatment facilities (SANDAG or local governments)

Objective 7b. Use Reclaimed Water to Decrease the Amount of Greenhouse Gases Attributed to Meeting Water Needs

Water reclamation is the fastest growing source of new supplies in the state. After treatment to stringent health and quality standards, recycled water can displace use of fresh water for power plant cooling, industrial processes, landscape irrigation, and groundwater replenishment. The San Diego region has made substantial investment in water reclamation.

The City of San Diego has constructed two reclamation facilities – North City Water Reclamation Plant and South Bay Water Reclamation Plant. The cities of Encinitas and Solana Beach, acting as the San Elijo Joint Powers Authority, operate the San Elijo Water Reclamation Facility, a wastewater treatment and water reclamation plant. In addition, two recycled water reservoirs provide operational storage for the water reclamation program.

Indirect potable reuse is another method for using reclaimed water. For example, Orange County has operated a facility since January 2008. As of this writing, the City of San Diego is undertaking a pilot project to determine the viability and cost-effectiveness of treating existing city-owned wastewater to potable standards and distributing it via the existing potable water system. Reuse of processed reclaimed water can reduce greenhouse gas emissions to the extent it displaces more energy intensive water supply options in the region.

Reclaimed water can be derived from gray water at the individual building level. Gray water is wastewater generated from domestic activities such as laundry, dishwashing, and bathing, which can be recycled on-site for uses such as landscape irrigation.

Policy Measures

Available measures to promote the increased use of reclaimed water include:

- Support or identify uses for existing unused reclaimed water to decrease the amount of water imported to the San Diego region (SANDAG or local governments)
- Support projects to meet water demand by treating and reusing processed reclaimed water to potable water standards, such as the City of San Diego Indirect Potable Reuse project (SANDAG and local governments)
- Identify and support programs for residential re-use of gray water to decrease the amount of energy needed to meet residential water needs (SANDAG or local governments)
- Support landscape design educational programs to help residential and commercial customers install low water use landscaping, thereby reducing water-related energy use (SANDAG or local governments)

GOAL 8. PROTECT ENERGY INFRASTRUCTURE FROM CLIMATE CHANGE IMPACTS

For the San Diego region, climate change will impact energy infrastructure with hotter temperatures, longer and more extreme heat waves, and sea level rise. Electricity and natural gas demand is highest when the temperature is high. Hot temperatures increase peak demand for electricity and make the electricity grid less efficient. By 2050, peak electricity demand is expected to increase by 60 percent to 75 percent under business-as-usual conditions,⁵⁹ particularly during summer months when air conditioners are running. Because much of San Diego's population growth is projected to occur in hotter inland areas over the next few decades,⁶⁰ total electricity demand could strain the existing system and potentially lead to power outages.

By 2050, average sea level is projected to rise one to one and one half feet,⁶¹ which would cause lasting changes to the coastline. Substations, natural gas distribution lines and power lines in low-lying places could face loss or damage. Although the study of adaptation needs for electricity and natural gas infrastructure is not covered in this strategy, SANDAG and local governments should routinely reach out to San Diego Gas & Electric, the California Public Utilities Commission, California Energy Commission and others to understand how to respond to issues affecting the energy infrastructure that is critical to our region.

Objective 8a. Support Modernization of the Electricity Grid

Climate change impacts on the electricity system can be reduced by implementing the "smart grid," modernizing the electricity grid with smart meters, smart end-use devices, and interactive communication technologies. Smart grid technologies can provide basic information about grid system performance that is not currently available, including problems with power lines and blackouts. Modern technologies will provide better infrastructure monitoring capabilities. In addition, pilot smart metering projects in the San Diego region and across the state have shown that consumers provided with information about their energy use and the actual cost of electricity based on the time of use, modified their consumption and reduced peak demand. The smart grid is one of the energy goals in the Regional Energy Strategy and is discussed in detail there.

Policy Measures

Available measures to promote the modernization of the electricity grid include:

- Support the installation of smart appliances that interface with smart meters and provide real-time electricity pricing information to consumers (SANDAG or local governments)
- Support the rollout of advanced metering infrastructure that enables electric vehicles, distributed generation systems, and electricity consumption to be accurately monitored by end-users and the utility (SANDAG or local governments)
- Support the distribution of educational information and research on the smart grid and smart meters (SANDAG or local governments)

⁵⁹ San Diego Foundation, 2008.

⁶⁰ San Diego Foundation, 2008.

⁶¹ San Diego Foundation, 2008.

Objective 8b. Utilize Demand Response and Energy Efficiency Measures to Reduce Greenhouse Gases during Peak Periods

Demand response measures entail reducing electricity and natural gas usage during peak demand periods. Shifting energy use away from peak periods can mitigate the need to run less efficient and higher greenhouse gas emitting power plants. Lower peak demand can improve air quality for the region, particularly in areas near peak electricity-producing power plants. Energy efficiency and demand response are each discussed in detail in the Regional Energy Strategy.

Policy Measures

Available measures to better utilize demand response and energy efficiency measures during peak demand periods include:

- Participate in peak demand reduction programs and undertake peak demand reduction measures at local government facilities (local governments)
- Support a regional building retrofit program that can reduce overall and peak energy and water use in older structures (SANDAG and local governments)
- Exceed Title 24 energy requirements for new construction through policy or incentives that work toward an overall goal of zero net energy new homes by 2020 and zero net energy new commercial buildings by 2030 (local governments)
- Support fair and reasonable rate designs and incentives that encourage customers to reduce overall electricity consumption as well as during peak demand periods (SANDAG or local governments)
- Provide information and resources about peak demand and climate change, as well as environmental and monetary costs associated with peak electricity demand (SANDAG or local governments)

Objective 8c. Study the Range of Impacts on Energy Infrastructure

Research is starting to examine the impacts of climate change on the availability of wind power, which in 2009 accounted for about five percent of the total power mix for San Diego.⁶² But the projected climate impacts on wind are highly uncertain at this time. Climate change will likely improve conditions for generating solar energy by increasing the number of warm and sunny days. Changes in precipitation that result in changes to stream flow will impact hydroelectric generating facilities, particularly during the peak summer months when reservoirs are experiencing low water levels. Accelerated sea level rise and stronger storm surges are likely to cause impacts to coastal power plants.

Policy Measures

Available measures to study the range of impacts on energy infrastructure include:

- Request periodic briefings from utilities, the California Public Utilities Commission, and the California Energy Commission on long-term adaptation issues regarding energy infrastructure (SANDAG or local governments)
- Monitor or participate in state agency adaptation efforts (SANDAG or local governments)
- Coordinate adaptation planning with other local and regional entities (SANDAG or local governments)

⁶² San Diego Gas and Electric, 2009.

8. SANDAG AND LOCAL GOVERNMENT OPERATIONS

California's [Climate Change Scoping Plan](#) encourages local governments to voluntarily adopt a greenhouse gas emissions reduction goal consistent with the statewide AB 32 target. The *Scoping Plan* recommends a greenhouse gas reduction target for local government municipal and community-wide emissions of 15 percent from current levels (2006) by 2020. Local governments can set a target using the most current and best available greenhouse gas emissions data for each jurisdiction, or if data is available, a local government can parallel state target-setting by using a 1990 baseline.

City and county governments are essential partners in regional and statewide efforts to reduce greenhouse gases because of their influence over significant local emissions sources, including land use, transportation, and energy. In addition, state agencies like the Attorney General's Office and various stakeholders are increasingly calling for the integration of climate change considerations into local government processes and decision-making. This includes not only city and county operations, but large-scale planning and environmental documents such as General Plan updates, Specific Plans, and CEQA documents. Though small by comparison, emissions produced by local government buildings and facilities, vehicle fleets, employee commutes, and other operations offer an opportunity for local governments to lead by example. This section describes resources and approaches for SANDAG and local governments to reduce greenhouse gas emissions from their operations and in their communities (where applicable). This section also highlights examples of successful local government climate change efforts.

GOAL 9. SANDAG AND LOCAL GOVERNMENTS LEAD BY EXAMPLE

The California Air Resources Board, in partnership with the California Public Utilities Commission, California Energy Commission, and others has developed a [Local Government Toolkit](#) to provide a "one-stop-shop" of guidance and resources to help city and county governments address climate change through local planning and action. The Toolkit's strategies focus on local government actions that reduce emissions both from government operations and communitywide sources. The Air Resources Board also provides other tools to that help local governments, such as [Urban Forest Greenhouse Gas Protocols](#), which provides a wealth of information on urban forestry and climate change, including tools to calculate greenhouse gas savings of urban trees based on factors like tree species, age, and size. The California Energy Commission also has updated its [Energy Aware Planning Guide](#) which provides additional helpful tools for local governments. Table 9-1 lists cities and counties throughout California that have adopted Climate Action Plans and/or prepared inventories of their greenhouse gas emissions.

City of Alameda	City of Fresno	City of Rohnert Park
City of Albany	City of Hayward	City of Sacramento
City of Arcata	City of Huntington Beach	City of San Diego
City of Benicia	City of Los Angeles	City and County of San Francisco
City of Berkeley	City of Manhattan Beach	City of San Jose
City of Burbank	City of Martinez	City of San Rafael
City of Burlingame	City of Menlo Park	City of Santa Barbara
City of Chula Vista	City of Monterey	City of Santa Cruz
City of Davis	City of Palo Alto	City of Santa Monica
City of Emeryville	City of Pasadena	City of Sebastopol
City of Fort Bragg	City of Piedmont	City of Stockton
City of Burlingame	City of Richmond	Town of Windsor
City of Fremont	City of Riverside	
Alameda County	Marin County	San Bernardino County
Contra Costa County	Sacramento County	Sonoma County

Source: Governor's Office of Planning and Research, October 30, 2009

Objective 9a. Local Governments Prepare and Adopt Climate Action Plans

To help identify and prioritize opportunities to reduce greenhouse gas emissions from both municipal operations and the community in general, local governments can consider developing a climate action plan. This process requires a collaborative approach to establish goals and objectives, compare short- and long-term strategies based on a number of factors like costs and benefits, and identifying unique opportunities and circumstances in the community.

ICLEI-Local Governments for Sustainability USA, a membership organization of local governments addressing climate change, identifies five milestones associated with local climate action planning. The five milestones provide a flexible framework that can accommodate varying levels of analysis, effort, and availability of data. Local governments interested in developing an action plan according to the five milestones can receive assistance by joining ICLEI, or by participating in the *Statewide Energy Efficiency Collaborative: A Partnership to Support Local Government*, which is a joint program of ICLEI, the Institute for Local Government, the Local Government Commission, and the state's four investor owned utilities, San Diego Gas & Electric, Pacific Gas & Electric, Southern California Edison and Southern California Gas.

- Milestone 1 – Conduct a Baseline Greenhouse Gas Emissions Inventory.
- Milestone 2 – Adopt an Emissions Reduction Target.
- Milestone 3 – Develop a Local Climate Action Plan.
- Milestone 4 – Implement Policies and Measures.
- Milestone 5 – Monitor and Verify Results.

City of Chula Vista: Climate Action Leader

The City of Chula Vista was one of the first participants in ICLEI's climate change initiatives, joining in 1992, drafting its first climate action plan in 1994, and updating it in 2000. In 2001, the Chula Vista City Council approved an energy plan comprised of eight energy management strategies that advance the interests of residents and businesses in energy conservation, supply, and procurement. The city has worked with ICLEI and the California Climate Action Registry to implement its Climate Action Plan. Chula Vista monitors its progress by performing annual emission inventories. In 2009, Chula Vista was the first public agency in San Diego County to receive the "Climate Action Leader" designation from the California Climate Action Registry.

ICLEI Oceania has developed a [toolkit](#) for local government adaptation planning that can be useful in California. ICLEI states that its adaptation planning toolkit can help local governments:

- Make decisions and plan in the face of complexity and uncertainty.
- Identify, assess, prioritize and manage risks related to climate change.
- Engage their communities in risk management processes.
- Ensure transparency in making and communicating decisions on risk treatment options and implementation plans.
- Foster leadership and culture change in council to ensure the development of a strategic approach to managing high-priority risks/opportunities.

San Diego Regional Climate Protection Initiative

The San Diego Regional Climate Protection Initiative is a partnership between the San Diego Foundation, ICLEI-Local Governments for Sustainability, and local governments in the San Diego Region. The Initiative was established in 2009 to provide a regional platform for local governments to follow ICLEI's Five-Milestone climate planning process.

Through the Initiative, ICLEI worked with the cities of Carlsbad, Encinitas, Imperial Beach, La Mesa, National City, Poway, San Marcos, Solana Beach, Vista, and the County of San Diego to perform greenhouse gas inventories and forecasts; conduct training sessions on mitigation and adaptation planning for climate change; and facilitate an information-sharing regional network. The project also supports workforce development for emerging professionals in the region through its “Climate Fellowship,” in which university students and recent graduates are placed in local government offices to conduct greenhouse gas inventories.

In 2009, 10 local greenhouse gas inventories were completed and were among the first in the state to use the Air Resource Board’s Local Government Operations Protocol. The inventories included greenhouse gas emissions from both government operations emissions and the community at large, and were developed through coordination with various stakeholders in the region, including SANDAG, the Air Pollution Control District, and the Energy Policy Initiatives Center. Several local jurisdictions are now preparing climate action plans based on their greenhouse gas emissions inventories and forecasts.

California Climate Action Network

The Institute for Local Government California Climate Action Network has produced a [Best Practices Framework](#) offering suggested policy actions to reduce greenhouse gas emissions in 10 “Climate Leadership Opportunity Areas,” both in agency operations and the community at large.

Policy Measures

The following policy measures could be evaluated as individual programs or as part of a broader set of local government climate action strategies.

- Establish a cross-department team to address climate change mitigation and adaptation (local governments)
- Identify financing mechanisms to support climate change planning such as low and no cost help from ICLEI, SANDAG’s Sustainable Region Program, and grant opportunities (SANDAG and local governments)
- Complete an inventory of municipal and community-wide greenhouse gas emissions (SANDAG and/or local governments)
- Develop and adopt a local climate action plan (local governments)

Objective 9b. Assess the Energy Use of SANDAG Operations

As detailed through the first half of this Strategy, SANDAG, with its member agencies, must determine how to meet State requirements to reduce greenhouse gas emissions from cars and light trucks. In addition, SANDAG can have its own operations assessed to determine the agency’s energy use and greenhouse gas emissions. With that data, SANDAG can lead by example by setting a greenhouse gas reduction target for its commercial building use, office equipment, vehicles and other operational functions. SANDAG can account for the greenhouse gas emissions generated by its employee commutes and identify opportunities to reduce its impact. SANDAG does not have municipal buildings under its control (e.g., libraries, community centers, police stations and city halls) and does not hold land-use authority to adopt building codes, so these aspects of a local government’s greenhouse gas assessment are not applicable to SANDAG.

Policy Measures

The following policy measures could be evaluated as individual programs or as part of a broader set of regional climate action strategies.

- Establish a cross-department team to address climate change mitigation and adaptation (SANDAG)
- Regularly update a county-wide inventory of municipal and communitywide greenhouse gas emissions (SANDAG and/or local governments)
- Perform an energy assessment of SANDAG operations (SANDAG)
- Based on the assessment, identify opportunities to reduce inefficient use of electricity, natural gas, and petroleum in SANDAG operations (SANDAG)

Objective 9c. Local Governments Use Cleaner Energy Supplies and Reduce Energy Use

Local governments can lead by example by reducing their own energy use and using cleaner supplies like renewable energy and other distributed generation systems. It is easier to approach local businesses and residents about reducing greenhouse gas emissions if the local government has taken on this responsibility first. Reducing energy use also has direct and measurable benefits, including potential cost savings that could be applied to other projects.

Energy use can be reduced by two related strategies: conservation and energy efficiency. Energy conservation refers to behavior changes that decrease energy use, such as turning off lights and changing thermostat settings. Energy efficiency includes programs that require buildings and appliances to be constructed in a manner that uses less energy, offer incentives for purchasing energy efficient equipment, and provide information and education to encourage people to save energy. Energy efficiency refers to structural changes, such as replacing appliances with more efficient models or tuning up building systems to improve their energy performance.

Cleaner energy supplies can come from small-scale power generation technologies such as photovoltaics, small wind turbines, and cogeneration systems located close to where energy is being used. Advantages of such distributed energy systems include increased grid reliability, energy price stability, and reduced greenhouse gas emissions.

Transportation-related measures to reduce greenhouse gas emissions include using alternative transportation options like walking, bicycling and public transit, and low-carbon vehicles and fuels. Additional options to reduce transportation-related greenhouse gases include telecommuting, alternative work schedules, carpooling, and vanpooling.

City of San Diego: Climate Change and the General Plan

In March 2008, the city adopted a [General Plan Update](#) that addressed climate change. The conservation element identified information about climate change and city actions to address it. The conservation element included a table listing how climate change mitigation was addressed in several elements throughout the General Plan: Conservation, Land Use and Community Planning, Mobility [Circulation], Recreation, Public Facilities, Services and Safety, and Urban Design.

Local Resources

SANDAG Sustainable Region Program: “Energy Roadmaps for Local Governments”

Beginning in 2010, SANDAG has undertaken an energy efficiency partnership with San Diego Gas & Electric that assists local governments by providing building energy assessments and energy management plans. SANDAG and San Diego Gas & Electric are calling these energy management plans “Energy Roadmaps” because they benchmark municipal energy usage and identify a framework that local governments can use to improve efficiency while reducing greenhouse gas emissions. The roadmaps identify energy-saving measures that can be integrated into local planning and permitting processes, ordinances, outreach and education efforts, and municipal operations. Additionally, the roadmaps include measures that local governments can implement for residents, businesses, and community-wide. This is a three year expansion of the SANDAG Sustainable Region Program, which began as a pilot with the City of Carlsbad in FY 2005.

During 2005 and 2006, the pilot Sustainable Region Program with the City of Carlsbad identified almost \$200,000 in available energy savings through cost-effective energy efficiency measures, and the City was able to save almost 500,000 kWh in energy consumption through local energy efficiency programs. The City of Carlsbad achieved additional energy savings by implementing additional energy-saving measures after the completing the pilot program.

Additionally, the City of San Diego, County of San Diego, and City of Chula Vista have had energy-saving, greenhouse gas-reducing partnership programs for several years. In 2008, they jointly produced a guidebook for municipal energy efficiency programs: *Best in Class*. SANDAG will be coordinating with these local government partners.

iCommute Program

[*iCommute*](#) provides regional commuters with free carpool and ride matching services, a subsidized vanpool program, transit solutions, the regional bicycle program, Guaranteed Ride Home service, SchoolPool carpooling programs for parents, and information about teleworking. *iCommute* also provides free assistance to local businesses and local governments to help them develop and implement customized employee commuter benefit programs that lower costs, increase productivity, and help the environment.

The goal of *iCommute* is to manage and reduce traffic congestion during peak times, as well as to reduce greenhouse gas emissions and other environmental pollutants that result from commuters driving to work each day alone. The program is managed by SANDAG as part of the regional [511](#) transportation information program.

State Energy Efficiency and Renewable Programs

Since the 1970s, California has promoted energy efficiency by requiring buildings and appliances to be constructed to use less energy. In September 2009, the California Public Utilities Commission approved the newest energy efficiency program cycle spanning 2010 – 2012 that established a three-year budget of \$3.1 billion for Southern California Edison, Pacific Gas and Electric Company, San Diego Gas & Electric, and Southern California Gas Company to implement energy efficiency programs. This was the largest commitment ever made by a state to energy efficiency. The state estimates that this funding can create between 15,000 and 18,000 skilled green jobs statewide.

These energy efficiency programs, including local government partnerships, are funded through a public goods charge on ratepayer utility bills. The funding pays for multiple strategies to promote energy savings including technical assistance, rebates and incentives for various energy efficiency measures, and education and training.

In 2007, the state launched [Go Solar California](#) to bring customer awareness to the California Solar Initiative, the New Solar Homes Partnership, and other solar incentive programs offered by publicly-owned utilities. The California Solar Initiative offers rebates to existing homes and non-residential energy customers installing solar systems in investor-owned utility service areas.

The New Solar Homes Partnership offers incentives for home builders to construct solar homes. The goals of the program are to achieve 400 MW of installed solar capacity by the end of 2016, create a self-sustaining solar market without the need for government incentives, and foster sufficient market penetration in the new residential market so that 50 percent or more of new housing built by 2016 and thereafter will include solar systems.

The Self-Generation Incentive Program provides rebates for customers who install wind turbines and fuel cells. SB 412 (Kehoe, Chapter 182, Statutes of 2009) revises this program to provide incentives for certain non-renewable distributed generation systems. The Self-Generation Incentive program is administered by the California Public Utilities Commission and implemented through the investor-owned utilities and the California Center for Sustainable Energy.

Policy Measures

The following policy measures could be evaluated as individual programs or as part of a broader set of local government climate action strategies.

- Work with other local and regional governments to assess federal and state programs and their impact on greenhouse gas emissions and mitigation efforts (SANDAG or local governments)
- Review major policies and programs in the early stages of development to identify ways to reduce related greenhouse gas emissions (SANDAG or local governments)
- Establish monitoring and annual reporting responsibilities and procedures for performance on sustainability and climate change (SANDAG or local governments)
- Support the integration of alternative transportation fuels and vehicle technologies into local government fleets and the fleets of contractors (SANDAG or local governments)
- Implement programs and provide incentives to encourage reduced emissions from employee commutes, including telecommuting, alternative work schedules, carpooling/vanpooling, walking and bicycling (SANDAG or local governments)
- Utilize all available rebates and incentives for energy efficiency and distributed generation installations, such as the state's public goods programs and solar programs (SANDAG or local governments)
- Solicit site-specific proposals for city facilities and economic development opportunities that include energy efficiency and distributed generation (SANDAG or local governments)
- Convert street lighting, water pumps, water treatment and other energy intensive operations to more efficient technologies (SANDAG or local governments)
- Consider lifecycle greenhouse gas emissions in local government purchasing decisions, include as evaluation criteria in selecting vendors, contractors, service providers and support suppliers that provide accurate information on their supply chain sustainability performance (SANDAG or local governments)