

Regional Energy Strategy

for the
San Diego Region



December 2009



Regional Energy Strategy



for the San Diego Region

Table of Contents

■	ACKNOWLEDGEMENTS AND DISCLOSURES	v-vii
■	1 INTRODUCTION	1
	1.1 SANDAG’s History of Regional Energy Planning	2
	1.2 The SANDAG Regional Comprehensive Plan	2
	1.3 Relationship with other SANDAG Planning Efforts	3
	1.3.1 Regional Transportation Plan	3
	1.3.2 SANDAG Climate Action Strategy	5
	1.3.3 Regional Alternative Fuels, Vehicles and Infrastructure Report	5
	1.4 Updating the Regional Energy Strategy	5
	1.4.1 New California Energy Policy Direction	5
	1.4.2 Focus of the Regional Energy Strategy	6
	1.4.3 Structure of the Regional Energy Strategy	6
■	2 GUIDING PRINCIPLES FOR SANDAG REGIONAL ENERGY PLANNING	9
■	3 KEY POLICY DRIVERS	11
	3.1 California Preferred Loading Order	11
	3.2 Global Climate Change	11
	3.2.1 Overview	11
	3.2.2 Key State Climate Change Policy and Legislation	12
	3.2.3 Greenhouse Gas Emissions Reduction Targets	13
	3.2.4 The Effect of Climate Change on Energy Consumption	14
	3.3 The RES Approach to Climate Change	14
■	4 EXISTING CONDITIONS AND FUTURE PROJECTS	17
	4.1 Electricity	17
	4.1.1 Current Statewide and Regional Electricity Supply	17
	4.1.2 Regional Electricity Consumption Forecast	18
	4.2 Natural Gas	21
	4.3 Transportation	21

4.3.1	On-Road Transportation	21
4.3.2	Other Transportation: Aviation, Rail, Watercraft, and Off-Road Equipment	22
4.4	Greenhouse Gas Emissions	23
4.4.1	Existing Greenhouse Gas Emissions in the San Diego Region	23
4.4.2	Future Projections for Greenhouse Gas Emissions	27
5	REGIONAL ENERGY GOALS	29
5.1	Energy Efficiency and Conservation	31
5.1.1	California Energy Efficiency Policy	31
5.1.2	California Energy Efficiency Programs	33
5.1.3	Electricity Consumption Overview	34
5.1.4	Pursuing Energy Efficiency in Existing Buildings	36
5.1.5	SANDAG Sustainable Regional Program: Energy Roadmap Initiative	39
5.1.6	Recommended Actions to Promote Energy Efficiency and Conservation	40
5.2	Renewable Energy	42
5.2.1	Renewable Energy Credits	44
5.2.2	Renewable Energy in the San Diego Region	44
5.2.3	Renewable Energy Transmission Initiative (RETI)	47
5.2.4	Barriers to Renewable Energy Development	48
5.2.5	Recommended Actions to Support Renewable Energy	49
5.3	Distributed Generation	50
5.3.1	Feed-in Tariff	53
5.3.2	Net Metering	53
5.3.3	Interconnection Policies	54
5.3.4	Distributed Generation in the San Diego Region	54
5.3.5	Solar Photovoltaic Systems	55
5.3.6	Combined Heat and Power Systems	56
5.3.7	Distributed Generation System Costs	56
5.3.8	Recommended Actions to Support Distributed Generation	57
5.4	Energy and Water	59
5.4.1	Energy and Water in the San Diego Region	61
5.4.2	Energy and Water End Uses	61
5.4.3	Water Efficiency and Conservation	64

5.4.4	Reclamation	65
5.4.5	Desalination	67
5.4.6	Water for Electricity Generation	67
5.4.7	Recommended Actions for Energy and Water	68
5.5	Peak Demand	69
5.5.1	Demand and Response	72
5.5.2	Distributed Generation	73
5.5.3	Advanced Metering Information	73
5.5.4	Recommended Actions to Support Peak Demand Reduction	74
5.6	Smart Grid	76
5.6.1	Recommended Actions to Support the Smart Grid	79
5.7	Natural Gas Power Plants	80
5.7.1	RES Approach to Natural Gas for Transportation, End-Uses, and Electricity	80
5.7.2	California Policies Related to Natural Gas Power Plants	81
5.7.3	Natural Gas Power Plants and Once Through Cooling	82
5.7.4	Natural Gas Prices	83
5.7.5	Recommended Actions for Supporting Replacement of Inefficient Natural Gas Power Plants	84
5.8	Transportation Fuels	86
5.8.1	Passenger Cars and Light-Duty Trucks	88
5.8.2	Heavy-Duty Trucks and Buses	89
5.8.3	Regional Planning for Alternative Fuels and Vehicles	90
5.8.4	Recommended Actions to Support Use of Alternative Transportation Fuels	91
5.9	Land Use and Transportation Planning	92
5.9.1	Energy and the Built Environment	92
5.9.2	Government Influence Over the Built Environment	93
5.9.3	Existing Smart Growth and Transportation Planning Efforts	95
5.9.4	Business-As-Usual Fuel Consumption and GHG Emissions Projections	97
5.9.5	State Legislation related to Land Use and Transportation Planning: SB 375	97
5.9.6	Land Use and Transportation Strategies	98
5.9.7	Non-Transportation Strategies	99

5.9.8	Recommended Actions for Land Use and Transportation Planning	101
5.10	Energy and Borders	103
5.10.1	Tribal Governments	103
5.10.2	Interregional Coordination	104
5.10.3	Binational Coordination	104
5.10.4	Recommended Actions for Energy and Borders	105
5.11	Clean Energy Economy	106
5.11.1	Growing Investment in the Clean Energy Sector	108
5.11.2	Job Creation by Clean Energy Sector	108
5.11.3	Regional Clean Energy Job Development Opportunities	110
5.11.4	Recommended Actions for Clean Energy Economy	111
	6 FINDINGS	113
6.1	Priority Early Actions from the RES	113
6.2	Broad Strategies to Implement Multiple RES Goals	114
	7 CONCLUSION	115

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1

Introduction

Energy is fundamental to the regional economy and the quality of life of San Diego residents. Energy lights, heats, and cools our homes and offices, runs our businesses and industrial machines, moves people and goods, delivers and heats our water, and impacts nearly every facet of daily life. Abundant amounts of electricity, natural gas, and transportation fuels like gasoline and diesel are required to support the region's existing three million residents, one million housing units, and one and a half million jobs. According to the San Diego Association of Governments (SANDAG) regional growth forecast, regional population is expected to increase by almost one million people (32 percent), four hundred thousand housing units (26 percent), and add nearly half a million jobs (32 percent) by 2030, which will increase demand for energy.

The Regional Energy Strategy (RES) builds on and updates past SANDAG energy strategies adopted in 2003 and 1994. The RES serves as an energy policy guide to support decision-making by SANDAG and its member agencies as the region strives to meet the energy needs of a growing population, housing stock, and number of workers while maintaining and enhancing regional quality of life and economic stability.

Benefits of developing a regional energy strategy include:

- Identifying region-specific energy issues, such as increasing the diversity of energy supply in the region or reducing energy intensity of water and wastewater processes;
- Identifying commonly held principles or unique aspects about the region that may differ from those of state policymakers and utility planners;
- Prioritizing regional energy issues, guiding future actions and decisions in the region;
- Establishing a mechanism to implement regional goals;
- Representing shared regional interests at appropriate proceedings, such as a utility's long-term procurement plan or state regulatory and legislative activities;
- Helping local governments represent their interests in the energy arena and increase energy-efficiency; and

- Realizing potential co-benefits of energy policies, such as improved air quality, public health, job creation, and financial savings.

1.1 SANDAG's History of Regional Energy Planning

SANDAG decided to undertake an update its 2003 Regional Energy Strategy in response to the increasing scientific and policy focus on global climate change and in light of the significant policy changes and implementation programs affecting the electricity, natural gas, and transportation sectors. These issues will significantly affect energy-related issues in the San Diego region.

The San Diego region has a history of developing energy strategies dating back to 1979, with updates occurring through the 1980s and 1990s. The most recent updates were adopted by the SANDAG Board of Directors in 2003 and 1994. With adoption of the 2003 RES, the SANDAG Board established the Regional Energy Working Group to advise SANDAG on issues related to the coordination and implementation of the RES.

The 2003 RES focused primarily on electricity and natural gas issues and developed a vision for how energy would be produced and consumed in the region. The 2003 RES proposed a series of goals and implementation steps to achieve the goals addressing issues such as: regional consensus, peak demand, renewable energy, distributed generation, transmission, per capita electricity and natural gas consumption, and natural gas supply.

The 2003 RES helped the region develop programs for energy efficiency and renewables, set legislative priorities, make recommendations to state regulatory and policy proceedings and the local utility San Diego Gas and Electric (SDG&E), obtain funding, and implement the SANDAG Sustainable Region Program, which helps local governments improve energy efficiency of their operations and throughout their communities.

The 2003 RES is a component of the SANDAG Regional Comprehensive Plan (RCP), which provides a long-term strategic planning framework for the region to address the many issues affecting regional quality of life, including energy.

1.2 The SANDAG Regional Comprehensive Plan

The RCP, adopted in 2004, integrates the array of local and regional plans in land use, transportation, and supporting infrastructure like energy that influence the region's quality of life. The RCP creates a regional vision and provides a broad context in which local and regional decisions can be made that foster a healthy environment, a vibrant economy, and a high quality of life for all residents.

The vision balances regional population, housing, and employment growth with habitat preservation, agriculture, open space, energy, and other infrastructure needs. The intent of the vision is to move San Diego toward a sustainable future with more choices and opportunities for all residents. The vision also looks beyond our borders and considers the planning and growth underway in Imperial, Orange, and Riverside Counties as well as in Baja California, Mexico.

SANDAG

Regional Comprehensive Plan Vision
“To preserve and enhance the San Diego region’s unique features – its vibrant and culturally diverse communities, its beaches, deserts, lagoons, bluffs and canyons, and its international setting – and promote sustainability, economic prosperity, and an outstanding quality of life for everyone.”

The SANDAG Board adopted the goals and policy direction of the RCP as the strategic planning framework for the region, in conjunction with other plans and strategies. To implement these goals, the RCP calls for the application of principles of “smart growth” and “sustainability.” Smart growth 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. The strategy’s approach to energy issues has been developed to fit within the larger regional vision and strategic planning framework of the adopted RCP.

1.3 Relationship with other SANDAG Planning Efforts

1.3.1 Regional Transportation Plan

The Regional Transportation Plan (RTP), most recently updated in 2007, serves as the primary transportation element of the RCP, and helps position the region to achieve smarter, more sustainable growth that meets the transportation needs of the growing population and changing region. The RCP calls upon SANDAG to update the RTP 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 RTP calls for more than \$42 billion for transportation investments through 2030. The types of transportation investments identified in the RTP 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, and carpooling. Transportation energy consumption and related greenhouse gas (GHG) emissions are in large part determined by the sum of individual travel choices, as well as other important factors like vehicle fuel efficiency.

Senate Bill 375

Federal and state laws require that SANDAG prepare a long-range transportation plan and make an air quality conformity determination every four years, and the next RTP update (2050 RTP) is scheduled for adoption in 2011. In the next update, SANDAG will be the first major metropolitan planning organization (MPO) in the state to prepare an RTP that will include the provisions of Senate Bill (SB) 375 (Statutes of 2008). In effect, SB 375 requires the next RTP update to achieve

GHG emissions reduction targets from passenger cars and light-duty trucks for 2020 and 2035. The legislation requires a new element of the RTP called a Sustainable Communities Strategy (SCS) that shows how regional GHG reduction targets, to be established by the California Air Resources Board (CARB), would be achieved through development patterns, transportation infrastructure investments, and/or transportation measures or policies that are determined to be feasible. The SCS also must address housing needs and protection of sensitive resource areas. If the SCS does not meet regional GHG reduction targets, an Alternative Planning Strategy (APS) must be developed to demonstrate how the targets could be achieved.

The adopted SANDAG Smart Growth Concept Map, which identifies existing, planned, and potential smart growth areas linked to existing and planned public transit, along with habitat conservation areas and major employment areas, will serve as a basis for the SCS. The RES sections dealing with Transportation Fuels and Land Use and Transportation Planning provide policy guidance related to saving energy and reducing GHG emissions from the transportation sector generally, and passenger cars and light-duty trucks, specifically. SANDAG's climate strategy will provide more in-depth analysis of land use and transportation policy measures that could reduce GHG emissions and help achieve the SB 375 targets. SB 375 is also discussed in Section 3 - Key Policy Drivers, and Section 5.9, Land Use and Transportation Planning.

SB 375 implementation will ultimately be addressed in the next update of the SANDAG RTP, which is currently under preparation and scheduled for adoption in 2011, and the next update of the SANDAG RCP, which is slated for preparation after the adoption of the RTP.

1.3.2 SANDAG Climate Action Strategy

Although there is overlap between the energy policy guidance provided in the RES and types of policy measures that can reduce GHG emissions, energy and climate change are not synonymous issues. As a result, SANDAG is preparing a Climate Action Strategy to accompany the RES that will provide regional policy guidance related to climate change. Where applicable, the Climate Action Strategy will reference the energy policy guidance of the RES.

The primary purpose of the Climate Action Strategy is to provide more in-depth analysis of land use and transportation policy measures that could reduce GHG emissions and help achieve SB 375 targets. With a focus on identifying measures to achieve SB 375 targets for passenger cars and light-duty trucks, it will examine potential GHG emissions reductions from land use and transportation policy measures. In addition, it will identify climate change policy measures that SANDAG and its member agencies could implement and support to reduce GHG emissions from other major sectors and activities and adapt to the projected impacts of climate change. The Climate Action Strategy is expected to be available by April 2010.

1.3.3 Regional Alternative Fuels, Vehicles, and Infrastructure Report

As part of a partnership with the California Energy Commission (Energy Commission), SANDAG developed a regional assessment of alternative transportation fuels, vehicles, and infrastructure. The report identifies and recommends regional and local government actions to 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 the supportive infrastructure. The SANDAG Board accepted the final report for distribution at its September 25, 2009, meeting.

1.4 Updating the Regional Energy Strategy

1.4.1 New California Energy Policy Direction

Deregulation of the electricity market and its implications were a major focus RES 2003. Since then, the state has established new regulations for utilities like SDG&E, specifically requiring them to resume their role in long term resource planning. Preparation of the

2003 strategy occurred while a void existed in this area. California has also implemented comprehensive energy policies affecting residents, the economy, and the environment, including landmark legislation to address global climate change, adoption of a preferred loading order for meeting new energy needs and addressing climate change, and recommendations from the state to integrate energy considerations into land use and transportation planning.

As a result, the state, through agencies like the California Public Utility Commission (CPUC) and Energy Commission and utilities like SDG&E has significant authority over electricity and natural gas end uses (e.g., space and water heating) in the San Diego region. In addition, SANDAG and local governments have significant energy-related authorities through their role in areas like land use planning, transportation planning and funding, and building permitting.

1.4.2 Focus of the Regional Energy Strategy

In light of significant state control over certain energy policy areas like electricity and natural gas, the updated RES 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. This includes opportunities for SANDAG to address energy climate change considerations through RCP implementation and the next RTP update, as well as options for local governments through mechanisms like the General Plan. This update looks out to 2030, the horizon year for current adopted regional growth projections.

Although the RES does not make recommendations for specific energy projects (e.g., power plants or transmission projects), it does assess regional need for energy resources and infrastructure. Furthermore, the RES does not replace the long-term electricity plan (i.e., procurement plan) that SDG&E is required to develop by the CPUC, but it can inform decisions made by SDG&E and Public Utilities Commission.

1.4.3 Structure of the Regional Energy Strategy

The strategy provides analysis of existing conditions and projections in the region related to energy, as well as guiding principles, goals, and recommended actions.

2. Guiding Principles for Regional Energy Planning

For the update of the RES, guiding principles were developed with the involvement of the Regional Energy Working Group, Regional Planning Technical Working Group, SANDAG Board and policy advisory committees, and members of the public. These principles helped to identify a vision for the region that guides regional decision-making

on energy-related items in response to key policy drivers and future projections. They also informed the development of goals and recommended actions for the RES.

3. Key Policy Drivers

This section provides more detailed discussion of the main two drivers of this strategy: (1) global climate change and its policy implications, and (2) the state’s preferred loading order for meeting new energy needs.

4. Existing Conditions and Future Projections

This section provides existing conditions and future projections to 2030 related to consumption of electricity, natural gas, and transportation fuel, as well as the resulting GHG emissions.

5. Regional Energy Strategy Goals

The RES is structured around 11 major energy topics identified during its development. For each topic, the document identifies an overarching goal, a summary of relevant facts and issues, and a set of recommended actions that contribute to the goal. The recommended actions represent options for SANDAG, local governments, other regional entities, or potentially combinations thereof, to contribute to regional energy goals. Achieving many, if not most, of the goals will require actions that go above and beyond existing requirements or would require funding amounts or types not provided through existing programs. Achieving the goals will also require regional and local governments to take active and innovative approaches, not the least of which is securing needed funding.

Major Topic Areas with Goals in the Regional Energy Strategy

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

6. Findings

This section identifies priority early actions to implement the Strategy. Six actions emerged as priorities, or core strategies, essential to meeting the region's energy goals. The Energy Working Group will pursue these actions upon completion of the updated RES: some of these actions are already underway. Broad strategies have been identified to implement several RES goals. By implementing these broad strategies, SANDAG and local governments will contribute to achieving these goals.

Priority Early Actions from the RES

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-SDG&E Local Government Partnership to help local governments 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 GHG 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

Broad Strategies to Implement Multiple RES Goals

1. Identify, secure, or develop funding mechanisms to pay for energy-related projects and programs
2. Educate and engage the general public or other stakeholders
3. Support enabling legislation or policy changes from state or federal government
4. Take early actions that set examples for residents and businesses
5. Develop standardized approaches and programs that can be implemented by all member agencies

2

Guiding Principles for SANDAG Regional Energy Planning

For the update of the RES, guiding principles were developed with the involvement of the Regional Energy Working Group, Regional Planning Technical Working Group, SANDAG Board and policy advisory committees, and members of the public. These principles helped to identify a vision for the region that guides regional decision-making on energy-related items in response to key policy drivers and future projections. They also informed the development of goals and recommended actions for the updated RES.

Regional Energy Strategy Guiding Principles

Sustainably Meet Future Energy Needs	The region's energy needs are met while maintaining environmental quality by employing resources efficiently, diversifying our fuel mix, and utilizing supplies that minimize cost.
Reduce Greenhouse Gas Emissions from Energy Use	All levels of government are engaged in immediate and sustained cost-effective actions to reduce and mitigate GHG emissions and to prepare for the serious impacts of climate change to public health, the environment and the economy.
Promote Education and Consensus-Building	An open, transparent and inclusive planning process including community and business stakeholders and education programs combine to increase public awareness and responsible energy decision-making in the region.
Foster the Clean Energy Sector	Economic development initiatives and workforce training programs position the region to supply a growing demand for energy efficient and renewable energy products and services.
Ensure Social Equity and Environmental Justice	Energy planning and programs 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.
Implement the State's Preferred Loading Order	Following the state's preferred loading order, new resources come first from energy efficiency, demand response, renewable energy, and distributed generation, all before new transmission and natural gas generation are sought.
Implement the Smart Grid	The deployment of smart devices, controls, and communications modernize our electricity grid to improve reliability, power quality, and detect problems before service is affected.
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 energy policies, programs and financing options.

<p>Reduce Energy Demand and Renewable Energy System Cost</p>	<p>Policies and programs promote the integration of energy efficiency at a structure prior to the installation of a renewable energy system in order to reduce the size and cost of the renewable energy system.</p>
<p>Promote State Policy for Zero Net Energy Residential and Commercial Buildings</p>	<p>Consistent with the policy direction of state agencies like the CPUC, aggressive strategies, including regulations and incentives, are employed to achieve zero net energy usage in new residential and commercial buildings and communities, and reduce energy usage in existing residential and commercial buildings and communities, through energy efficiency, clean distributed generation, and community planning efforts.</p>
<p>Reduce the Energy Intensity of the Built Environment</p>	<p>The energy intensity of community design, including buildings and travel options, is an integral consideration in land use and transportation planning.</p>
<p>Ready the Region for Wide-Scale Deployment of Alternative Fuel Vehicles</p>	<p>The region has convenient access to alternative transportation fuels that reduce our dependence on foreign oil supply, reduce local economic impacts from oil price volatility and reduce GHG emissions.</p>

Key Policy Drivers

3.1 California Preferred Loading Order

The CPUC and Energy Commission adopted a preferred loading order to meet goals for satisfying the state’s growing demand for electricity and significantly reducing the level of GHG emissions responsible for global climate change. The loading order calls for achieving these goals by placing top priority on first increasing energy efficiency and demand response, then with new generation from renewable and distributed generation resources, and finally with clean fossil-fueled generation and infrastructure improvements.

The California Preferred Loading Order

1. Increase energy efficiency.
2. Increase demand response – temporary reduction or shift in energy use during peak hours.
3. Meet generation needs with renewable and distributed generation resources.
4. Meet new generation needs with clean fossil-fueled generation and infrastructure improvements.

The components of the preferred loading order are addressed throughout the RES: Section 5.1 - Energy Efficiency and Conservation; Section 5.2 - Renewable Energy, including transmission issues; Section 5.3 - Distributed Generation; Section 5.5 - Peak Demand (i.e., demand response); and Section 5.7 - Natural Gas Power Plants.

3.2 Global Climate Change

3.2.1 Overview

Global climate change has emerged as the defining challenge of the 21st century, with the Intergovernmental Panel on Climate Change (IPCC) reporting that GHG emissions from human activities have begun to destabilize the Earth’s climate. The IPCC is the leading international scientific body for the assessment of climate change, established by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic

consequences. The changing climate threatens the public health, economy, and environment of the San Diego region, California, and the entire world. Projected adverse climate change impacts to the San Diego region include hotter temperatures, sea level rise, water shortages, more frequent and intense wildfires, increased risks to public health, loss of native plant and animal species, increased demand for electricity, and subsequent economic losses. Significant actions are needed to both reduce the region's contribution to climate change and adapt to the impacts of climate change.

A more detailed and up-to-date discussion of global climate change and its impacts will be provided in the SANDAG Climate Action Strategy, which is anticipated for completion in March 2010. For discussion of the projected impacts of climate change on the San Diego region, please see San Diego's Changing Climate: A Regional Wake-Up Call – A Summary of the Focus 2050 Study by the San Diego Foundation.

3.2.2 Key State Climate Change Policy and Legislation

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

California has responded to the challenge of climate change in many ways, including passage of the California Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32, Chapter 488, Statutes of 2006). This legislation establishes the 1990 emissions level as the statewide limit for 2020; an approximately 15 percent reduction from the baseline 2006 level. AB 32 calls for regulatory market mechanisms to achieve the GHG emissions reduction target. Many of the state's energy policies and programs are now significantly shaped, at least in part, by the requirements and spirit of AB 32.

Climate Change Scoping Plan

The CARB Climate Change Scoping Plan report outlines the main strategies for meeting the AB 32 GHG 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. CARB and other state agencies must adopt these reduction measures by the start of 2011, and already a number of "early action" measures required by Scoping Plan have been adopted, such as the Low Carbon Fuel Standard (LCFS). In addition, the Scoping Plan emphasizes the need to better connect land use and transportation planning to help the state achieve its GHG emissions reduction target for 2020.

Senate Bill 375

As described in the introduction, Senate Bill (SB) 375 (Statutes of 2008) requires MPOs like SANDAG to create a Sustainable Communities Strategy (SCS) that integrates the

transportation network with development patterns in a way that achieves GHG emissions reduction targets from passenger cars and light-duty trucks while meeting housing needs and other regional planning objectives. The SCS 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 RTP.

Governor's Executive Order S-3-05

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

3.2.3 Greenhouse Gas Emissions Reduction Targets

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

Although the state does not set economy-wide reduction targets for specific geographic regions of the state¹, projections showing the theoretical emissions reductions necessary to reach the 2020 and 2050 targets illustrate the magnitude of change the region needs to make over the next four decades (Figure II-1). It should be noted that deep cuts in GHG emissions required for climate stabilization must also occur during a period of projected growth in population and economic output.

¹ Except for SB 375, which will lead to the establishment of regional GHG emission reduction targets for passenger cars and light-duty trucks.

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



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

3.2.4 The Effect of Climate Change on Energy Consumption

Environmental changes caused by climate change also will impact energy production. In the San Diego region and statewide, climate change is projected to increase the risk of drought or water shortages during summer months. In addition, winter runoff may increase and increase the risk of flooding. As a result, hydroelectric power generation may be adversely affected. Lower runoff flows would decrease hydropower generation while higher flows often must be spilled past dams without generating any electricity. Lost hydropower generation would have to be replaced with electricity generated from renewable sources, or else GHG emissions from electricity generation would increase.

In addition, increased average temperatures and longer and more extreme heat events associated with climate change are expected to increase peak demand for electricity. In many cases, relatively inefficient and high cost “peaker plants” are utilized to meet peak demand. As a result, demand response strategies will become an even more important part of the region’s energy strategy as a result of climate change.

More discussion of the connection between how we use energy, the deep GHG reductions required to address climate change, and the regional impacts of climate change will be provided in the forthcoming SANDAG Climate Action Strategy.

3.3 The RES Approach to Climate Change

Achieving the near-term 2020 target for GHG emissions reduction will likely focus on increasing energy efficiency and the use of renewable energy and clean distributed energy systems. By contrast, reaching the 2050 target for GHG emission reductions will require more fundamental changes in how we use energy through technology and

behavior change. The recommended actions of the RES start the region on a long-term path to do its part for climate stabilization. Consistent with the state's policy framework, the RES focuses primarily on strategies for reducing GHG emissions from electricity generation and natural gas end use by increasing energy efficiency and reducing the carbon intensity of electricity supplies.

The three primary strategies for reducing GHG emissions from fuel use in the on-road transportation sector are to: (1) improve vehicle fuel efficiency, (2) reduce the carbon content of transportation fuels, and (3) better integrate land use patterns and transportation infrastructure through improved planning. The RES focuses on reducing GHG emissions from transportation fuel consumption by transitioning the region away from petroleum-based fuels and reducing automobile dependence through a variety of policy measures, including improved integration of land use and transportation planning, smart growth development patterns, promoting walking, bicycling, and public transit as viable travel options, managing transportation demand, pricing vehicle trips and parking, and improving transportation system efficiency.

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4

Existing Conditions and Future Projections

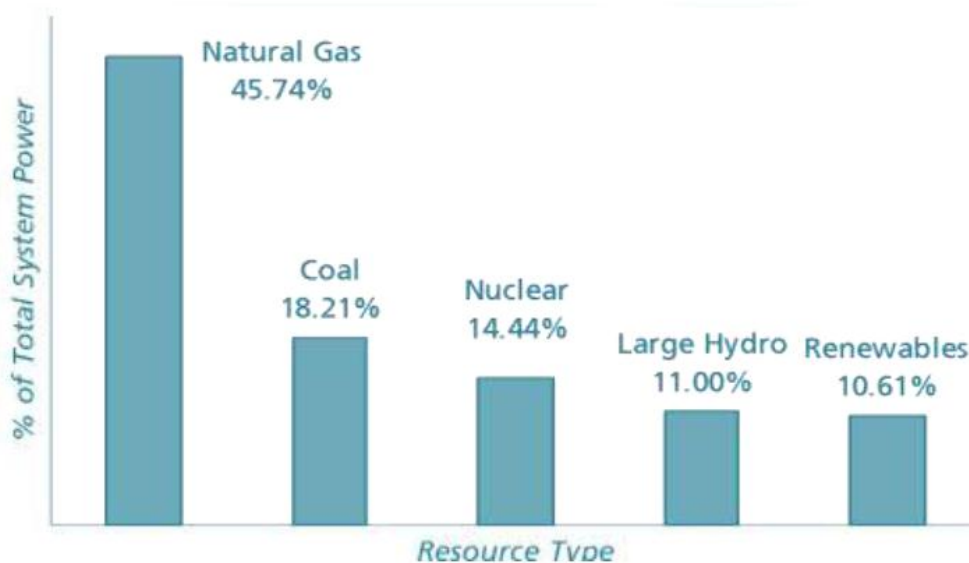
This section presents existing conditions and future projections for transportation fuel, electricity, and natural gas use, as well as resulting GHG emissions.

4.1 Electricity

4.1.1 Current Statewide and Regional Electricity Supply

Figures 4-1 and 4-2 illustrate the types of resources that make up the total electricity production (measured in GWh) for California. Statewide, natural gas is the predominant fuel type, followed by coal, nuclear, and large hydroelectric. Renewable sources, which are used to generate about 10 percent of total system power, are largely geothermal, followed by wind, biomass, small hydroelectric, and solar.

Figure 4-1: 2008 Statewide Total Electricity System Power Mix (GWh)



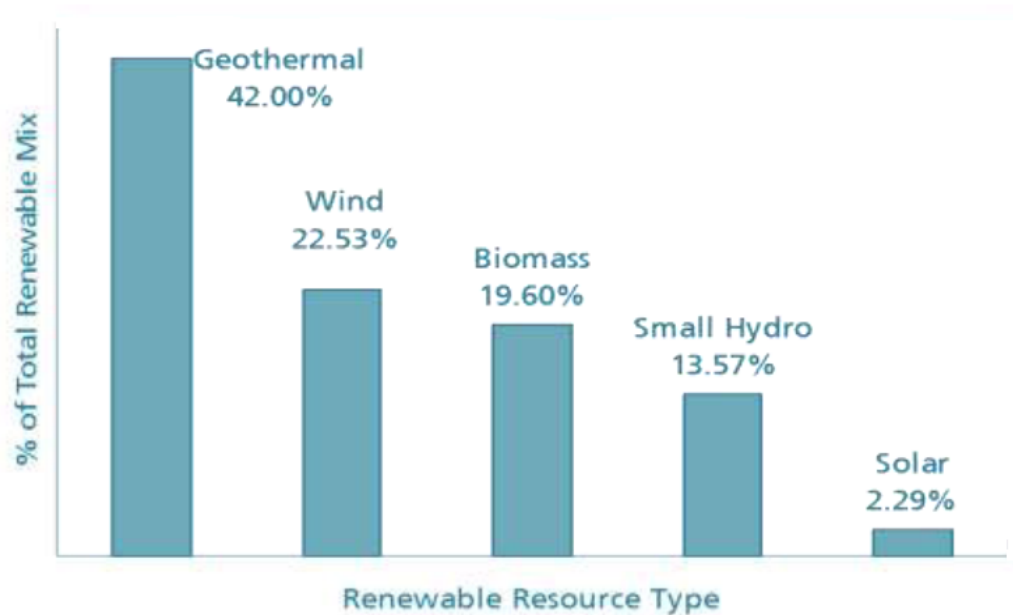
Source: California Energy Commission

Figure 4-4 shows projected 2009 electricity production for the SDG&E service area, which includes all of San Diego County and a small portion of southern Orange County. Much like statewide figures, the SDG&E power mix is dominated by natural gas. Renewable resources are close to the state total at about nine percent, with wind as the largest component of the renewable portfolio.

4.1.2 Regional Electricity Consumption Forecast

Under a business-as-usual scenario (i.e., no change in existing policy, programs, or behavior), the region's total electricity consumption from 2007² (18,648 GWh) is expected to increase by about 10 percent in 2020 (to 20,555 GWh) and 21 percent in 2030 (to 22,647 GWh). This increase in total consumption assumes that existing levels of funding for energy efficiency programs administered by the utility continue.

Figure 4-2: 2008 Statewide Renewables Mix (GWh)

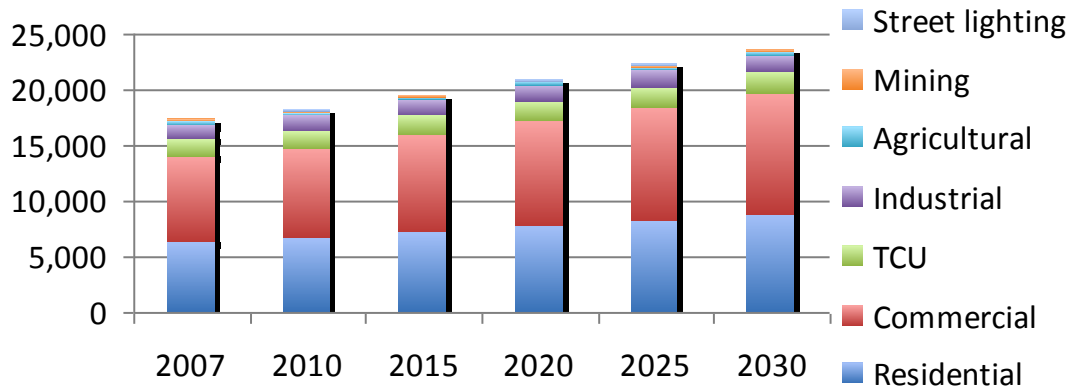


Source: California Energy Commission

The RES uses the Energy Commission June 2009 electricity consumption forecast to determine energy efficiency targets. SDG&E also relies on the Energy Commission forecast for resource planning. Figure 4-5 depicts regional electricity consumption if current business-as-usual trends continue.

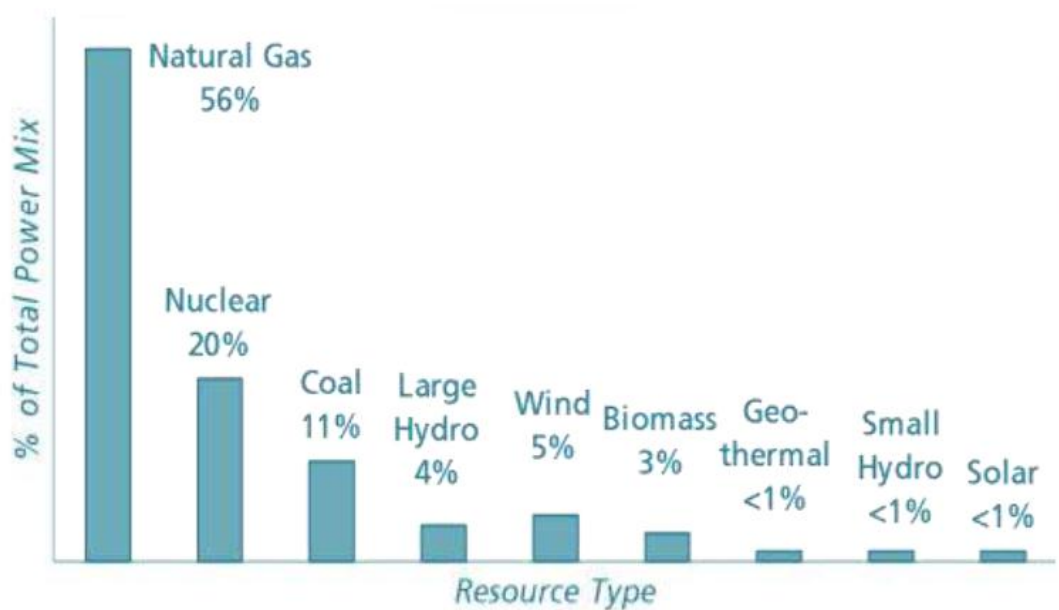
² 2007 data was the most recent available at the time the RES update was initiated.

Figure 4-3: Projected Electricity Consumption (Gigawatt-hours), 2007-2030



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

Figure 4-4: Projected 2009 SDG&E Power Mix (GWh)



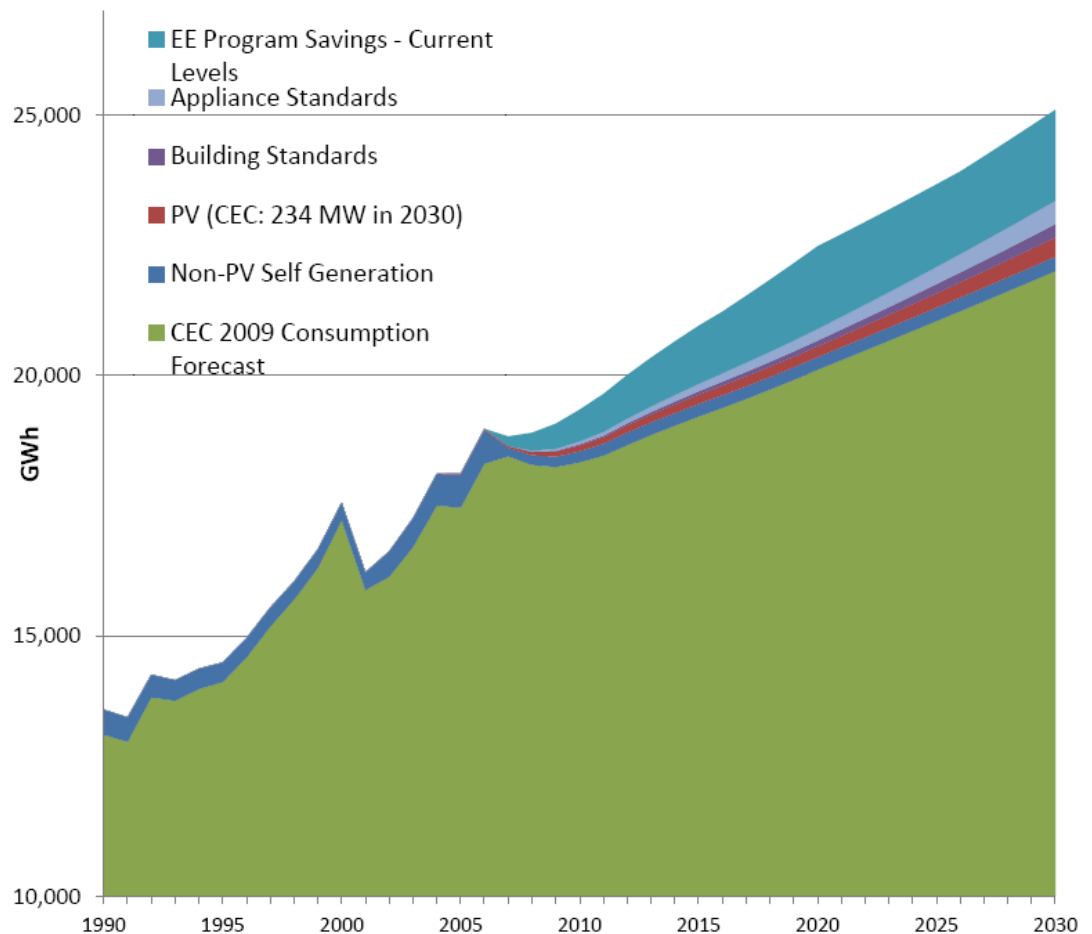
Source: San Diego Gas and Electric

The June 2009 forecast for regional electricity consumption is about 10 percent lower than the previous forecast, attributed primarily to the economic recession. Despite this projected decrease, aggressive actions are needed to reduce electricity use are needed to meet long-term greenhouse gas emissions reduction targets.

Residential and commercial sectors use the most electricity in the San Diego region, as depicted in Figure 4-3. Consumption in these sectors could continue to grow due to regional population and job growth.

Though current trends indicate that total regional electricity consumption will continue to grow, per capita consumption is projected to remain flat through 2030. Consumers are using more electronic products and appliances today, but energy-saving measures like conservation and energy efficiency standards have been effective in maintaining per capita consumption. The main reason for overall growth in electricity consumption is population growth, anticipated to be on the order of nearly one million additional people between now and 2030 according to the SANDAG regional growth forecast. The region will need sufficient energy supply resources to accommodate this future growth.

Figure 4-5: Business as Usual Electricity Forecast for the San Diego Region 2010-2030 (Measures and their impacts shown)



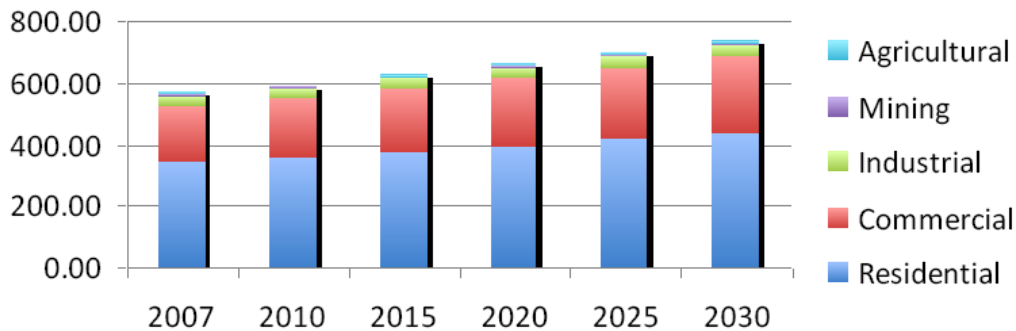
Source: California Center for Sustainable Energy, 2009.

4.2 Natural Gas

As shown in Figure 4-6, the San Diego region currently consumes approximately 581 million therms (MMTh) of natural gas per year (not including gas used for electricity generation, which is accounted for in the previous section above). As the figure also shows, the majority of natural gas end-uses are in the residential and commercial sectors. At present, California imports 87 percent of its natural gas needs from out state, and at the same time in-state production is decreasing. Over the last decade, natural gas prices have been volatile; therefore, it is difficult to reliably predict future prices.

Under a business-as-usual scenario, regional natural gas consumption is expected to grow to 660 MMTh in 2020 and 730 MMTh in 2030 as shown below. With increase in demand expected to coincide with continued price volatility, natural gas must be utilized in the most energy efficient manner and replaced with renewable or other options where feasible.

Figure 4-6: Existing and Projected Natural Gas Consumption, 2007-2030



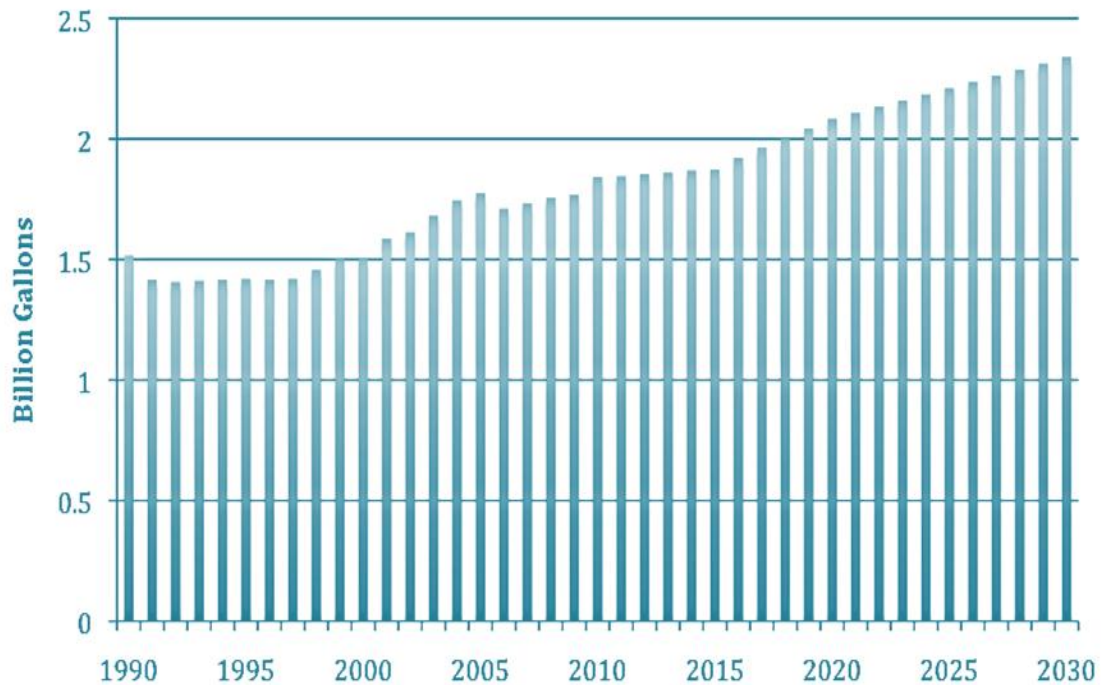
Source: Energy Policy Initiatives Center, University of San Diego, 2008.

4.3 Transportation

4.3.1 On-Road Transportation

The on-road transportation sector is a large consumer of energy, and is almost entirely dependent on petroleum-based fuels (gasoline and diesel). As shown in Figure 4-7, passenger cars and light-duty trucks are by far the largest consumers of transportation fuel, accounting for about 1.6 billion gallons of gasoline and diesel per year, or 85 percent of total consumption by on-road vehicles.

Figure 4-7: Projected On-road Fuel Consumption 2007-2030



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

Light-duty trucks represent only about 35 percent of total miles traveled, but due to their relatively low efficiency, account for about half of fuel consumption.

Heavy-duty trucks and buses account for most of the remaining consumption by on-road vehicles, about 170 million gallons or about 11 percent of total on-road fuel consumption. While heavy-duty trucks mostly use diesel fuel, the region's transit agencies operate a substantial number of CNG buses, including CNG-electric hybrids. Passenger cars and light-duty trucks are the largest contributors, generating about 89 percent of emissions from on-road vehicles, while heavy-duty vehicles account for the remainder. Without changes in policy or behavior, on-road consumption of petroleum-based fuels is expected to increase sizably by 2020, with the trend continuing to 2030.

4.3.2 Other Transportation: Aviation, Rail, Watercraft, and Off-Road Equipment

Although small relative to fuel use by passenger cars and heavy-duty vehicles, energy consumed by the civil aviation, rail transportation, water-borne equipment, and off-road sectors is significant. Fuel consumption in these sectors accounts for about 10 percent of GHG emissions in the San Diego region and is primarily petroleum-based.

In 2007, the civil aviation sector, which comprises commercial flights and ground operations at San Diego International Airport (SDIA), consumed about 210 million gallons of jet fuel, 28,000 gallons of aviation gasoline, and 53 million cubic feet of natural gas. International flights and aviation at other airports and military facilities are not included in this analysis because data could not be obtained. Fuel use in this sector combined to account for about five percent of total GHG emissions in the region. The off-road vehicle and equipment category is the next largest consumer of fuel in this sector (primarily gasoline and diesel), accounting for about 4 percent of total GHG emissions. The largest fuel users in this category are construction and mining, industrial, pleasure craft, and agricultural.

The rail transportation category consumes diesel fuel for freight and goods movement, the Coaster commuter rail line, and the Sprinter light-rail line. The light-rail San Diego Trolley is powered by electricity. The diesel consumption accounts for about one percent of the region's carbon footprint, while electricity to power the Trolley accounts for a very small amount of GHG emissions from the region's electricity consumption.

There are many types of water-borne navigation in the San Diego region, but the largest sources of fuel consumption are ocean going vessels (OGVs) and harbor operating within San Diego Harbor. It should be noted that like rail, OGVs are among the most efficient mode of goods movement. The majority of fuel use from OGVs is due to automobile shipments, refrigerated vessels, and passenger cruise ships. The majority of harbor craft fuel use is due to commercial and charter fishing boats. Water-borne navigation accounts for less than one percent of total GHG emissions.

New CARB fuel regulations effective July 2009 and January 2012 will require the use of clean marine distillate fuels in OGVs that visit California seaports and operate within 24 nautical miles of the coast. In addition new CARB shore power regulations effective in 2014 will reduce emissions from cruise ships and refrigerated container ships while at berth.

4.4 Greenhouse Gas Emissions

4.4.1 Existing Greenhouse Gas Emissions in the San Diego Region

Energy use in the San Diego region is the largest source of 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 GHG emissions in the region are related to the production and consumption of energy.

Existing Greenhouse Gas Emissions by End-Use Category

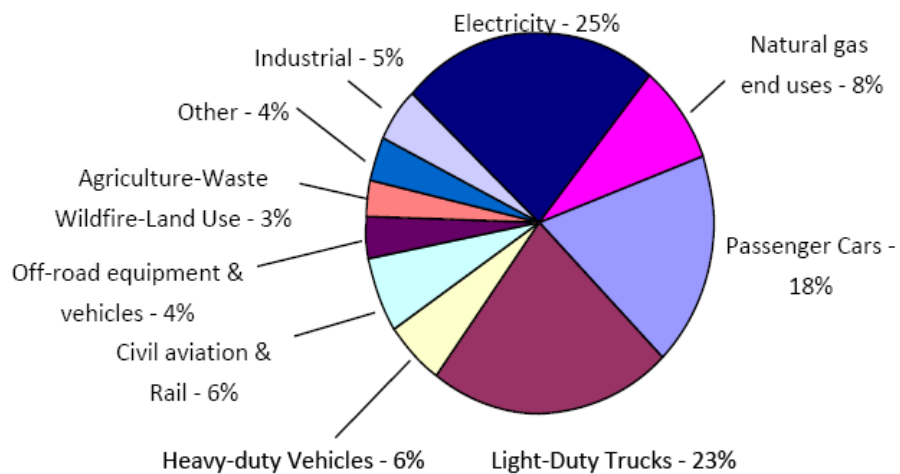
Although many activities consume energy, most of the region’s energy consumption and related GHG emissions are caused by three end-use categories of energy consumption: the movement of people and goods in the on-road transportation sector, electricity generation that provides power to homes and businesses, and natural gas for end uses like space heating and cooking (Figure 4-8).

Table 4-1: San Diego County GHG Emissions by IPCC Category

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

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

Figure 4-8: Summary of Existing Greenhouse Gas Emissions by End-Use Category



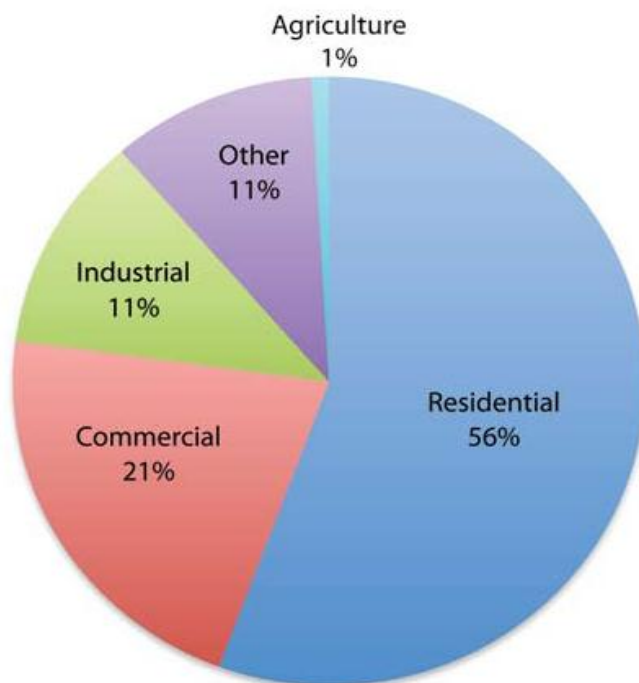
Source: Energy Policy Initiatives Center, University of San Diego, 2008.

On-Road Transportation

The largest emissions category is on-road transportation, which accounts for nearly half of emissions (46 percent). Moreover, energy consumed by passenger cars and light-duty vehicles (pick-up trucks, sport utility vehicles), 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 GHG 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 GHG emissions statewide. In response, the state has enacted several transportation-related laws and regulations calling for petroleum reduction, development of low-carbon and alternative fuels, increased vehicle fuel efficiency, and improved land use and transportation planning.

Figure 4-9: Greenhouse Gas Emissions by Economic Sector



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

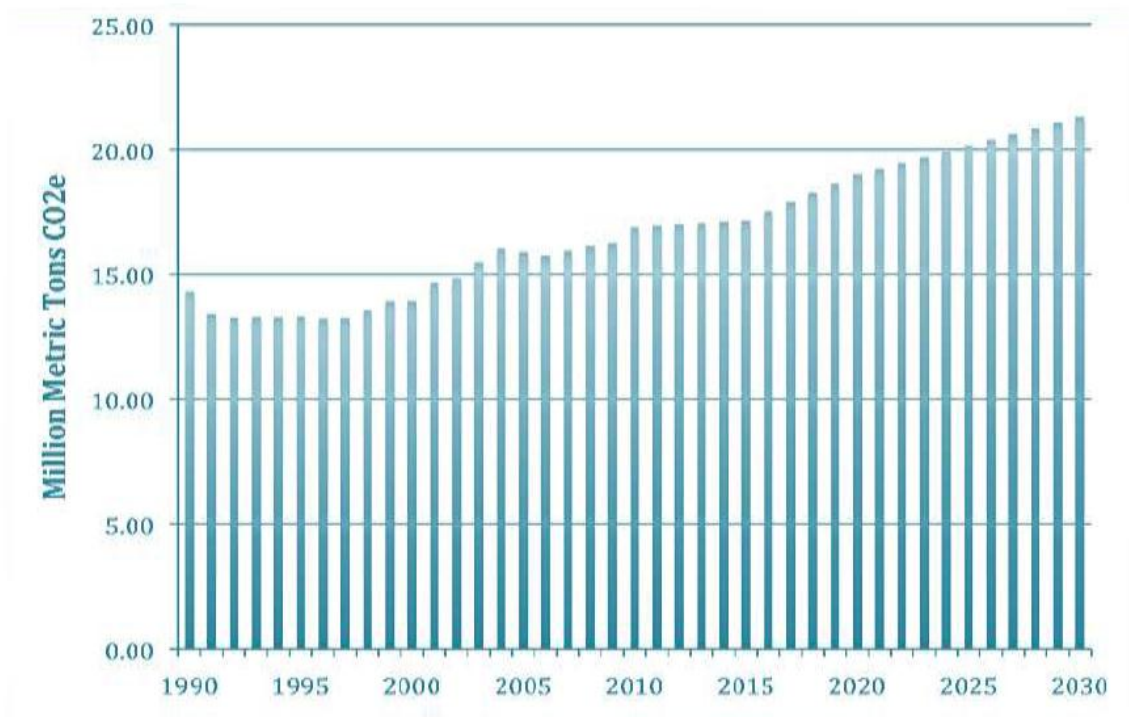
Electricity and Natural Gas End-Use Sectors

Electricity and natural gas end-uses account for about one-third (33 percent) of GHG emissions in the region. Total consumption levels and fuel sources contribute to the level of GHG emissions from electricity generation. About two-thirds (67 percent) of the fuel used to generate the electricity consumed in the region is natural gas and out-of-state coal. Older and relatively inefficient natural gas power plants, buildings, and end-use equipment are also factors that contribute to the level of emissions from electricity and natural gas.

Existing Greenhouse Gas Emissions by Economic Sector

GHG emissions can also be analyzed by economic sector. As shown in Figure 4-9, the residential sector (i.e., passenger cars, light-duty trucks, electricity and natural gas consumption) accounts for more than half (56 percent) of all regional emissions. This indicates that energy used by residents for personal transport and home use contribute significantly to regional GHG emissions.

Figure 4-10: Projected Greenhouse Gas Emissions from On-road Transportation, 1990-2030

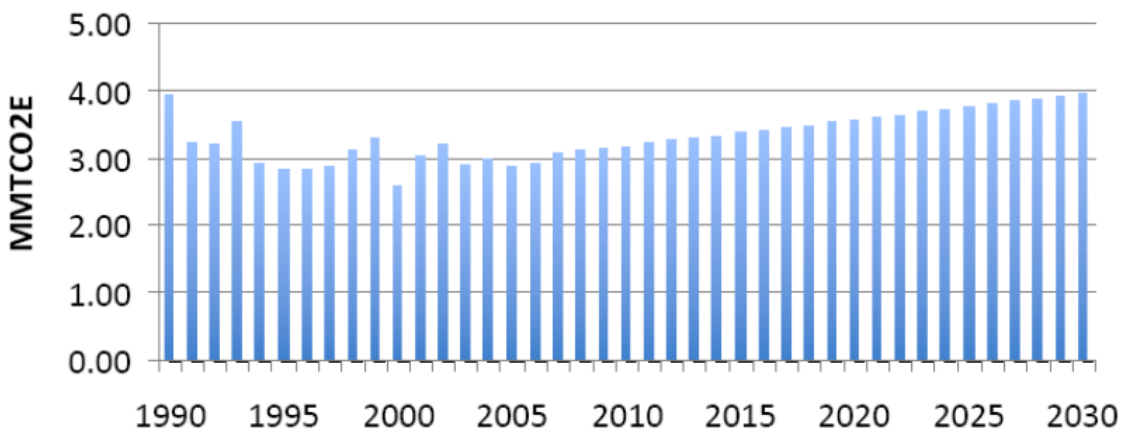


Source: Energy Policy Initiatives Center, University of San Diego, 2008.

4.4.2 Future Projections for Greenhouse Gas Emissions

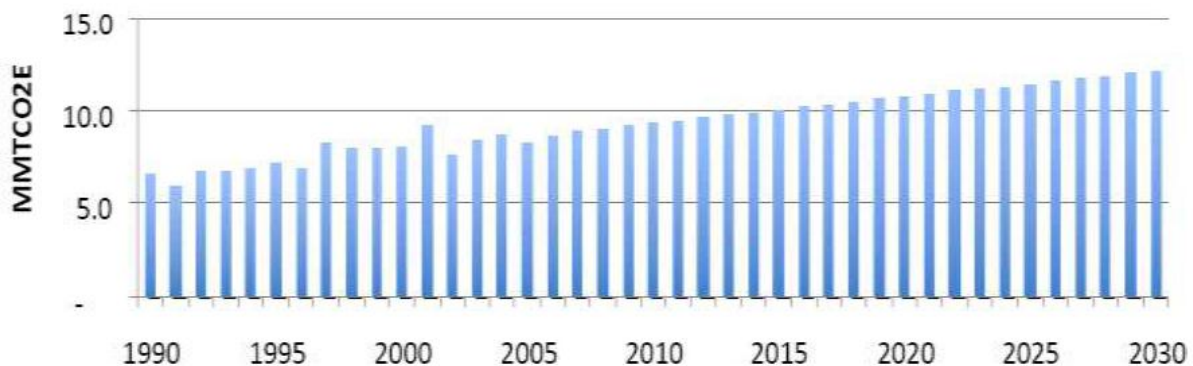
Under a business-as-usual scenario in which current energy use trends and policies do not change, GHG emissions in the region will be approximately 43 MMT CO₂E in 2020, approximately 26 percent greater than the 2006 level and 48 percent higher than the 1990 level. Emissions would be even greater in 2030 under a business-as-usual scenario. The projected increases in GHG emissions for on-road transportation, natural gas, and electricity are shown in Figures 4-10, 4-11, and 4-12. 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 4-11: Projected Greenhouse Gas Emissions from Natural Gas End-Uses, 1990-2030



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

Figure 4-12: Projected Greenhouse Gas Emissions from Electricity Generation, 1990-2030



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

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5

Regional Energy Goals

The RES is structured around eleven major energy topics identified during its development. For each topic, it identifies an overarching goal, a summary of relevant facts and issues, and a set of recommended actions that contribute to the goal. The recommended actions represent options for SANDAG, local governments, other regional entities, or potentially combinations thereof, to contribute to regional energy goals. Achieving many of the goals will require actions that go above and beyond existing requirements or would require funding amounts or types not provided through existing programs. Achieving the goals also will require regional and local governments to take active and innovative approaches, including securing needed funding.

Major Topic Areas with Goals in the Regional Energy Strategy

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

Priority Early Actions

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-SDG&E Local Government Partnership funding award 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 GHG 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.

Broad Strategies to Implement Multiple Goals

1. Identify, secure, or develop funding mechanisms to pay for energy-related projects and programs.
2. Educate and engage the general public or other stakeholders.
3. Support enabling legislation or policy changes from state or federal government.
4. Take early actions that set examples for residents and businesses.
5. Develop standardized approaches and programs that can be implemented by all member agencies.

5.1 Energy Efficiency and Conservation

Introduction

Reducing energy use is the first priority in the state’s preferred loading order for meeting new energy needs because it can help meet future energy needs and reduce GHG emissions without significant investment in infrastructure and with little or no

Energy Efficiency and Conservation Goal:
Reduce per capita electricity consumption in the residential and commercial sectors by 20 percent by 2030 in order to keep total electricity consumption flat between now and 2030.

environmental impact. From a customer perspective, reducing energy use has direct and measurable benefits including cost savings. 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, provide 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, replacing incandescent lamps with compact fluorescent (CFL) or light-emitting diode (LED) lamps, or tuning up building systems to improve their energy performance. Efficiency and conservation are necessary and complimentary.

California has promoted energy efficiency through policies and programs that require buildings and appliances to be constructed in a manner that uses less energy, provide incentives for purchasing energy efficiency equipment, and provide information to encourage people to save energy. Since the 1970s, these programs have helped keep per capita electricity consumption flat.

Energy efficiency measures for both electricity and natural gas can significantly reduce GHG emissions. Given the region’s relatively low level of industrial activity, the primary focus is on improving energy efficiency, in both the existing building stock and new construction. In particular, the existing building stock presents a significant opportunity to achieve major improvements in energy efficiency. Because buildings typically have a lifespan of several decades, it is important to build in as much efficiency as possible.

5.1.1 California Energy Efficiency Policy

Key state energy efficiency policies include:

- California’s Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 and are regularly updated as relevant cost-

effective improvements become available. The next update will take effect on January 1, 2010. Local government building departments are responsible for enforcing these mandatory energy efficiency standards for buildings at the time of construction.

- The California “Green Building Action Plan” was developed in conjunction with the signing of Executive Order S-20-04, the “Green Building Initiative,” in which the governor calls for state buildings to be 20 percent more energy efficient by 2015 and encourages similar private sector efforts.
- Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006), which requires an estimate of all potentially achievable cost-effective electricity and natural gas efficiency savings and establishment of annual statewide targets for energy efficiency savings and demand reduction over 10 years. AB 2021 is a key legislative mechanism for utilities to expand their energy efficiency programs.
- The Climate Change Scoping Plan, which outlines GHG reduction measures in the electricity and natural gas sectors through building and appliance standards, implementing additional conservation and efficiency programs, increasing combined heat and power (CHP), solar water heating systems, and the like.
- The California Public Utility Commission (CPUC) Long-Term Energy Efficiency Strategic Plan, which provides a roadmap to achieve maximum energy savings across all sectors in the state including local government, and identified four “Big Bold Energy Efficiency Strategies”³:
 1. All new residential construction in California will be zero net energy by 2020³ ;
 2. All new commercial construction in California will be zero net energy by 2030;
 3. Heating, ventilation, and air conditioning will be transformed to ensure that its energy performance is optimal for California’s climate; and
 4. All eligible low-income customers will be given the opportunity to participate in the low income energy efficiency program by 2020.

The Strategic Plan also specifically calls upon local governments to do the following⁴:

- At least 5 percent of California’s local governments (representing at least 5 percent of CA total population) each year adopt “reach” (enhanced energy efficiency) codes.
- By 2020, the majority of local governments have adopted incentives or mandates to achieve above-code levels of energy efficiency in their communities, or have led statewide adoption of these higher codes.

³ A zero net energy building combines building energy efficiency design features and clean onsite or near-site distributed generation of sufficient quantity on an annual basis to offset any residual purchases of electricity or natural gas from utility suppliers.

⁴ The CPUC is working with investor-owned utilities like SDG&E to develop a menu of strategies that local governments could implement through local government partnerships to contribute to the Strategic Plan goals.

- The current rate of non-compliance with codes and standards is halved by 2012, halved again by 2016, and full compliance is achieved by 2020.
- By 2015, 50 percent of local governments have adopted energy efficiency/sustainability/ climate change action plans for their communities and 100 percent by 2020, with implementation and tracking of achievements.
- The Plan also identifies the following areas where local government authority can reduce energy use in new and existing buildings:
 1. Ensuring compliance and enforcement of the Title 24 energy code for residential and commercial buildings.
 2. Adopting building codes beyond Title 24's energy requirements (and potentially other "green" requirements).
 3. Supporting highly efficient projects that voluntarily exceed minimum energy codes through favorable fee structures, fast-tracked permitting and other innovative and locally appropriate approaches.
 4. Enacting ordinances with point-of-sale or other approaches that spur efficiency actions in existing, privately-owned buildings.
 5. Applying efficiency-related "carrots" and "sticks" using local zoning and development authority.

5.1.2 California Energy Efficiency Programs

In September 2009 the California Public Utilities Commission (CPUC) issued a decision to approve energy efficiency programs for 2010 - 2012, establishing a three-year budget of

\$3.1 billion for Southern California Edison, Pacific Gas and Electric Company, San Diego Gas and Electric Company, and Southern California Gas Company. This is the largest commitment ever made by a state to energy efficiency. Statewide, these programs could create estimated energy savings of almost 7,000 gigawatt hours, 1,500 megawatts, and 150 million metric therms of natural gas, the equivalent of three 500-megawatt power plants and could avoid 3 million tons of GHG emissions. The funding from this decision can create between 15,000 and 18,000 skilled green jobs statewide.

The decision includes the new California statewide program for residential energy efficiency – CalSPREE – the largest and most comprehensive residential retrofit program in the country, aiming to reduce energy consumption by 20 percent for up to 130,000 California homes by 2012. The decision also funds \$175 million for innovative programs to deliver zero net energy homes and commercial buildings, including design assistance, incentives for "above code" construction, and research and demonstration of new technologies and materials.

The decision also provides over \$260 million in funding for 64 cities, counties, and regional agencies for local efforts targeting public sector building retrofits and leading

edge energy efficiency opportunities. Over \$100 million will go to education and training programs at all levels of our educational system to ensure a steady pipeline of skilled blue and white collar energy efficiency professionals.

At the national level, the American Recovery and Reinvestment Act of 2009 (ARRA) is funding the Energy Efficiency and Conservation Block Grant Program, which is providing millions of dollars for local governments in the region to implement projects and programs that reduce total energy use and fossil fuel emissions and improve energy efficiency in multiple sectors. ARRA also is providing \$226 million to the Energy Commission for the State Energy Program (SEP). The SEP provides grants to states to help address energy priorities and program funding to finance renewable energy and energy efficiency improvements in buildings. The SEP is an important component of the overall strategy for making buildings and industrial facilities more energy efficient.

SANDAG, the California Center for Sustainable Energy, several local governments, and other partners are currently collaborating on a SEP proposal to develop a whole building residential retrofit program focused on improving the energy efficiency of existing single family and multifamily residential buildings in the region. If successful, this proposal could bring up to \$8 million to the region, and lay the foundation for a long-term existing building retrofit program.

5.1.3 Electricity Consumption Overview

Within buildings, lighting usually comprises the largest portion of electricity usage, roughly 20-25 percent of the total. Air conditioning is likely to be the largest single energy user for buildings in hotter climate zones in the region. Central, wall-unit, and so-called “split” air-conditioning systems available today are significantly more energy efficient relative to older systems.

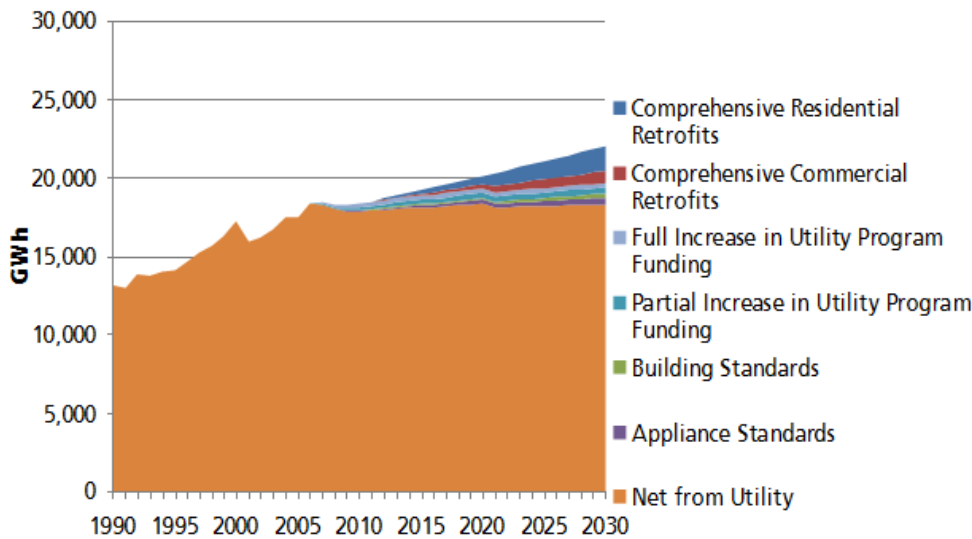
In addition, “plug loads” collectively account for around 25 percent of overall household energy use in California – more than the refrigerator in most homes. Plug loads are smaller electrical devices or appliances that draw power through an electric outlet, such as computers and their peripherals; televisions and entertainment systems; and a wide variety of electronics and rechargeable devices. Further, many electronics and electronic components of appliances use electricity even when the device is not being used. Consumers are often unaware that they are paying higher electricity bills to cover this “phantom” usage (also called “standby” power). Some estimates show standby power to be as much as 10 percent of a home’s electricity consumption. While state and federal governments work with the manufacturing industry to establish and strengthen energy standards for appliances and electronics to reduce demand from plug loads, consumer education about plug loads and efficient appliances in the marketplace can also reduce electricity consumption.

Approach to Meeting the Energy Efficiency Goal

Keeping total electricity consumption in the residential and commercial sectors flat through 2030 will require increased energy conservation and efficiency efforts, above and beyond existing state policy and utility-administered programs described above. As shown in Figure EE-1, additional measures are needed to keep total residential and electricity consumption flat through 2030.

The future electricity projections presented here do not take into account potential growth in electricity consumption due to plug-in electric vehicles. As discussed further in Section 8. Transportation Fuels, plug-in electric vehicles can help the region meet its goals for reducing GHG emissions, improving air quality, and reducing dependence on imported petroleum fuels. While initial market penetration of plug-in electric vehicles likely can be accommodated by the existing electricity grid, conversion of a substantial portion of the vehicle fleet to plug-in vehicles has the potential to increase total electricity consumption, and interfere with the goal of keeping consumption flat, as well as increase peak demand.

Figure EE-1: Projected Impacts of Energy Efficiency Measures in the San Diego Region 2010-2030 (above and beyond business as usual)



Source: California Center for Sustainable Energy, 2009.

Table EE-1 depicts the potential electricity savings from select energy efficiency measures that could be implemented by local governments (except for increased utility program funding and new appliance standards).

Table EE-1: Regional Electricity Savings Targets for Energy Efficiency ^{1,2}

Measures	2030 Reductions (2007 baseline)	
Increased utility energy efficiency program funding	675 GWh	3.0 %
Comprehensive residential building retrofit program	1482 GWh	6.7 %
Comprehensive commercial building retrofit program	572 GWh	2.6 %
New construction building standards (post-2009 updates)	260 GWh	1.2 %
Appliance standards (post-2009 updates)	447 GWh	2.0 %
Total electricity reduction from above measures	3438 GWh	15.6 %
Reduction in total electricity consumption due to energy efficiency	22 GWh	0.1 %
Reduction in per capita electricity consumption due to energy efficiency	N/A	22.2 %

Source: California Center for Sustainable Energy, 2009. Notes: 1) Energy efficiency measures are above and beyond currently funded energy efficiency programs. 2) Table does not include transportation fuels.

Local governments have the opportunity to use their authority and influence to help achieve the needed additional energy efficiency savings to achieve the goal for 2030. Table EE-1 shows that the retrofits of existing residential and commercial buildings, particularly residential buildings, offer the greatest potential for additional energy efficiency savings. However, there are challenges to increasing the efficiency of existing buildings. The upfront costs of an energy audit and energy improvements can be expensive. In addition, there is little incentive for renters in the residential sector or lessees in the commercial sector to pay for energy-saving improvements because they do not own the property. At the same time, there is little incentive for an owner to pay for energy improvements because they do not pay the energy bill. This concept is known as the “split incentive.”

Also, although numerous energy efficiency programs exist for residential and commercial buildings, they generally focus on individual building components. Longer-term and larger energy savings can be achieved through more comprehensive or holistic programs that take an integrated approach to evaluating an entire building and creating prioritized packages of measures. Measures can include lighting, insulation, windows, space and water heating, space cooling, ductwork, weatherization, electronics, appliances, swimming pools, and spas. In general, efficiency upgrades are not required retroactively for existing buildings. As a result, policies and programs, and especially funding mechanisms, are needed to achieve energy efficiency savings in the region’s existing building stock.

5.1.4 Pursuing Energy Efficiency in Existing Buildings

To determine how much energy an existing building uses, including the devices plugged into its electrical outlets, an energy audit serves as an essential first step. The audit can identify both energy usage and opportunities where energy can be saved. The “Home Energy Rating System” program, better known as HERS program, is a nationally recognized system to conduct whole-house energy assessments. HERS raters perform a comprehensive audit for existing homes. Building performance contractors are certified to perform audits for residential and nonresidential buildings as well⁵.

An energy audit can discover inefficiencies and provide solutions for increased efficiency. In addition, the audit is an opportune time to assess potential for installing a distributed generation system, such as rooftop solar photovoltaics (PV) or a fuel cell, along with or after any energy efficiency improvements have been made. This topic is addressed further in Chapter V, Section 3, Distributed Generation.

Potential Funding Mechanisms for Energy Efficiency

Building owners often need financial assistance to implement energy-saving projects due to upfront purchase and installation costs. Energy efficiency financing mechanisms exist but some are new, not well known, not widely used, or only available to certain customers. Mechanisms include utility on-bill financing, property-assessed financing, low interest loans for energy efficiency improvements, rebates, incentives, and federal and state tax credits. A local workforce of trained contractors also is needed to perform building retrofits and other assessments.

Upfront costs can be offset by participating in an on-bill financing (OBF) program, which allows utility customers to pay for energy-efficient improvements through their monthly energy bills. The utility offers an upfront loan used to pay for the cost of the qualifying measure. The energy savings realized from the improvement are used to pay back the loan through monthly utility bills, and once the loan is paid off, monthly bills are permanently lower. SDG&E offers an OBF program for business and government customers participating in demand response programs.

Property Assessed Clean Energy or “PACE” programs, also commonly referred to as AB 811 style programs, can serve as a financing mechanism to implement energy efficiency and renewable energy projects. PACE programs allow local governments to offer sustainable energy project loans to eligible property owners. Through the creation of financing districts, property owners can finance energy efficiency improvements and

⁵ However, there is a significant lack of trained HERS raters in the San Diego region, a void that could be addressed through new training programs. These programs could build from previous programs, like the “Healthy Homes” program funded by the City of San Diego and U.S. Department of Housing and Urban Development, which utilized an integrated approach to remediation issues in existing building stock.

renewable onsite generation installations through a voluntary assessment on their property tax bills.

AB 811 allows local government entities to offer sustainable energy project loans to eligible property owners. With the creation of assessment financing districts, interested property owners can finance energy efficiency projects, solar photovoltaic installations, and possibly other improvements fixed to real property through an assessment on their property tax bills. This mechanism allows property owners to avoid high upfront installation costs and eliminate concern they might sell the property before seeing full return on that high upfront investment. The result is that property owners within AB 811-type financing districts can finance their improvements with reduced financial risk. The AB 811 mechanism does not require investment of general fund dollars and loan repayment becomes a senior lien on the property, ahead of the mortgage itself.

Local governments such as the City of San Diego are actively developing municipal financing programs. Additionally, the California Statewide Community Development Authority (CSCDA, also known as “California Communities”) is developing an AB 811 program, which member jurisdictions (virtually all local governments in the state) could join. California Communities is a statewide joint powers authority (JPA) that can utilize its existing authority to aggregate demand from local governments to relieve them of the burden of establishing financing districts and accessing the bond market for funding.

SANDAG, California Center for Sustainable Energy, several local governments, and other partners are currently collaborating on a State Energy Program (SEP) proposal to develop a whole building residential retrofit program focused on improving the energy efficiency of existing single family and multifamily residential buildings. If successful, this proposal could bring up to \$8 million to the region, and lay the foundation for a long-term existing building retrofit program.

Another example of a financing mechanism is the energy efficient mortgage (EEM). An EEM allows new or current homeowners to finance purchase of a home (or refinance a current mortgage) and include the value of energy saving, cost efficient improvements. EEMs can be used to purchase a new energy efficient home or to finance new improvements to existing homes (also known as an Energy Improvement Mortgage, or EIM). Because cost-effective energy improvements can result in lower utility bills, making more funding available for a mortgage payment, energy efficiency improvements can be directly included in the EEM without the need to qualify for additional financing. By giving borrowers the opportunity to finance improvements as part of a single mortgage, an EEM can also stretch the debt-to-income qualifying ratio and enable homebuyers to qualify for a larger loan amount (and a more energy efficient home).

EEMs are sponsored by federally insured mortgage programs and the conventional secondary mortgage market (Fannie Mae and Freddie Mac). Several types of EEM programs are available. Eligibility for individual EEM programs varies, but in general there is no age limit or income level required. Typically, all programs require that a home energy rating be conducted to provide the lender with an estimate of the “Energy Savings Value”, which includes monthly energy savings and the value of existing/planned energy efficiency measures.

5.1.5 SANDAG Sustainable Regional Program: Energy Roadmap Initiative

As part of CPUC funding for local efforts targeting public sector building retrofits, SANDAG has been awarded about \$1.7 million in funding for a Local Government Partnership with SDG&E. The Partnership will enable SANDAG and SDG&E to make energy planning assistance available to local governments through the Energy Roadmap initiative, which is an expansion of the existing SANDAG Sustainable Region Program (SRP). The SRP began as a pilot program with the City of Carlsbad from 2005-2006. The pilot program identified almost \$200,000 in available energy savings through cost-effective energy efficiency measures and the City was able to save 489,571 kWh in energy consumption through local energy efficiency programs. The SRP was later expanded to the cities of Solana Beach, Poway, and Imperial Beach.

Since the cities of Chula Vista and San Diego and the County, have individual partnerships with SDG&E, the SANDAG-led initiative is primarily targeted at local governments without full-time energy staff and that have minimally participated or not participated in available energy-saving programs. The energy planning assistance is expected to help local governments save money, use less energy, and reduce GHG emissions. The Partnership will fund the Energy Roadmap initiative from January 2010 through December 2012.

The Energy Roadmap initiative will focus on the identification of energy-saving measures for local government operations, as well as policy measures that local governments could implement to realize energy savings for residents, businesses, and throughout their communities. Components of the program will include energy assessments and audits of existing government buildings and facilities, plan review of proposed construction projects, analysis of opportunities to integrate energy-saving policies into the General Plan and other local plans, policies, and regulations, assistance with project development for energy efficiency installations, training of local government staff, public education and engagement tools, identification of rebate and financing programs, and other useful resources for energy management planning. There also will be a focus on clean energy economic development, potential pilot demonstrations of emerging technologies, and opportunities for clean, on-site energy generation.

Strategies to improve building energy efficiency include Zero Net Energy (ZNE) buildings, voluntary and mandatory measures to achieve energy efficiency beyond minimum requirements for new construction, voluntary and mandatory energy-saving retrofits for existing buildings, and improved compliance and enforcement of energy efficiency standards. Increased installation of high efficiency technologies like solar hot water heaters and cogeneration systems are additional strategies to offset natural gas use and meet energy needs more efficiently. And finally, funding and financing strategies are essential to successfully increasing energy efficiency and reducing GHG emissions from the region's building stock.

5.1.6 Recommended Actions to Promote Energy Efficiency and Conservation

SANDAG, local governments, or other regional entities can undertake the following actions to support energy efficiency and conservation. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions also would contribute to other energy goals, and the energy efficiency goal would be enhanced by recommended action identified in other topic areas, as described below.

Recommended Actions to Promote Energy Efficiency and Conservation	
SANDAG	Recommended Action
EE-1	Provide energy efficiency planning assistance to local governments through the SANDAG Sustainable Region Program.
Local Governments	Recommended Action
EE-2	Establish building energy rating and disclosure policies that inform building owners of their energy usage.
EE-3	Develop a policy to include energy star appliances in new construction.
EE-4	Exceed Title 24 energy requirements for new construction through regulations 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.
EE-5	Increase enforcement of building energy requirements to reduce the rate of noncompliance.
EE-6	Promote policies that lead to energy efficiency retrofits in existing buildings.
EE-7	Support increased use of solar water heating in residential, pool, and commercial uses to offset natural gas demand (e.g., pre-plumb policies).
SANDAG, Local Governments, or other Regional Entities	Recommended Action
EE-8	Develop model language for a range of policies that seek to reduce energy use in existing buildings and new construction.
EE-9	Develop a whole-building retrofit program to improve energy efficiency in existing residential, commercial, municipal, and other buildings.
EE-10	Establish financing programs (using public or private sources) that residents and businesses can access to conduct energy assessments and make energy efficiency retrofits to existing buildings, as well as other energy-related improvements such as distributed photovoltaic installations.
EE-11	Conduct an assessment of the regional building stock to determine the potential magnitude of energy savings, their contribution to the energy efficiency and conservation goal, and geographical concentrations of retrofit opportunities.
EE-12	Provide information and resources to help residents, businesses, developers, builders and others improve energy efficiency and conservation in new and existing buildings.

5.2 Renewable Energy

Introduction

After energy efficiency and demand response, the state’s preferred loading order calls for meeting electricity needs and reducing GHG emissions with renewable resources, including onsite power systems such as photovoltaic solar panels and utility-scale electricity projects that convert solar and wind resources into electricity.

Renewable Energy Goal:
Support the development of renewable energy resources to meet or exceed a 33 percent renewable portfolio standard (RPS) by 2020 and a 45 percent RPS by 2030.

This section discusses the need to increase utility scale renewable energy projects and the potential challenges that arise, such as impacts to sensitive environmental resources and landscapes. Renewable onsite power systems, and clean, nonrenewable onsite power systems are addressed in Section 3 – Distributed Generation.

In general, renewable energy resources include:

- Wind (produced in windy locations usually at wind farms to generate electricity),
- Solar (systems powered by the sun to provide heat or generate electricity including photovoltaics, concentrated solar power, and solar thermal),
- Geothermal (systems using thermal energy from beneath the earth’s surface to provide heat and generate electricity),
- Biogas (captured from landfills and sewage at wastewater treatment plants),
- Biomass (technologies that burn primarily paper, wood, tree trimming and other similar “green” waste as fuel),
- Hydro power (flowing water that drives a turbine to generate electricity), and
- Offshore wave power (built along shorelines, systems extract energy in breaking waves).

The advantages of utility scale renewable energy can include lower greenhouse gas emissions, energy price stability, and ability to bring large amounts of power online quickly. Many renewables resources such as wind and geothermal are cost-competitive with fossil fuel energy sources and can be carried on existing transmission infrastructure. Renewables can also displace the need for fossil fuel-powered generation.

A mixture of utility scale renewable resources can support a stable and reliable electricity grid. Resources like biomass, geothermal, and small-scale hydroelectric generation can provide baseload power. Some renewables such as solar thermal

technologies have the potential to store energy for an extended period and provide power generation into evening hours (i.e., after the sun goes down). Some renewable technologies like solar thermal may also be able to operate in a hybrid mode as typical natural gas or biomass-fired power plant with characteristics similar to a baseload power plant. Other renewable resources are intermittent such as wind or solar. The integration of large amounts of intermittent generation into the electricity system will require grid improvements to accommodate variation in power availability and improve grid reliability such as improved communications technology, automated demand response, and other modern technologies that would be possible with a smart grid (see Section 6 for further discussion).

Key state policies related to renewable energy production include:

- Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002), which establishes California's Renewables Portfolio Standard (RPS) requiring retail sellers of electricity to procure 20 percent of retail sales from renewable energy by 2017.
- Energy Action Plans I (2003) and II (2005), which recommended accelerating the RPS deadline to 20 percent by 2010, and recommended a further goal of 33 percent renewables by 2020, respectively.
- Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006), which accelerated the 20 percent target to 2010 and authorizes a system of tradable renewable energy credits (RECs).
- Executive Order S-06-06 (2006), which established a biomass target for 20 percent within the RPS goals for 2010 and 2020.
- Executive Order S-14-08 (2008), which established accelerated RPS targets (33 percent by 2020) as recommended in Energy Action Plan II. The order also called for the formation of the Renewable Energy Action Team, comprised of the Energy Commission, Department of Fish and Game, Bureau of Land Management, and U.S. Fish and Wildlife Service. Through the team, the Energy Commission and the Department of Fish and Game are to prepare a plan for renewable development in sensitive desert habitat.
- Executive Order S-21-09 (2009), which directs the ARB to work with the CPUC, the California Independent System Operator (ISO), and the Energy Commission to adopt regulations increasing California's RPS to 33 percent by 2020. ARB must adopt these regulations by July 31, 2010.

Key state policies related to renewable energy and transmission infrastructure include:

- Senate Bill 1565 (Bowen, Chapter 692, Statutes of 2004) addresses the need for an official state role in transmission planning with the passage of this bill. SB 1565 directed the Energy Commission to develop a Strategic Transmission Investment Plan (Strategic Plan), which identifies and recommends actions to

stimulate transmission investments to ensure reliability, relieve congestion, and meet future growth in load and generation, including renewable resources, energy efficiency, and other demand reduction measures.

- Senate Bill 1059 (Escutia and Morrow, Chapter 638, Statutes of 2006), which continued to develop an integrated, statewide approach to electric transmission planning and permitting to address the state’s critical energy and environmental policy goals. This bill provided a bridge between the transmission planning process and the permitting process by designating transmission corridor zones on state and private lands available for future high-voltage electricity transmission projects, consistent with the state’s electricity needs identified in the IEPRs and Strategic Transmission Investment Plans.

Many state strategies and programs have been implemented to increase renewable energy generation consistent with these policies, including Energy Commission’s Renewable Energy Program, the RPS Program jointly administered by the Energy Commission and CPUC, the Renewable Energy Transmission Initiative, the Desert Renewable Energy Conservation Plan, feed-in tariffs for renewable generators, the Bioenergy Action Plan, and multiple RD&D activities.

5.2.1 Renewable Energy Credits

A system of tradable RECs could facilitate goals for increasing the amount of renewable energy. The REC is a certificate representing the environmental benefit of a given unit of renewable energy production. RECs could reward generators of renewable resources by allowing them to earn revenue from the environmental benefit of their renewable energy systems, and could provide purchasers of RECs like utilities with increased flexibility to meet legal mandates such as the RPS. The CPUC may authorize the use of RECs for RPS compliance, but has not done so as of this writing.

5.2.2 Renewable Energy in the San Diego Region

The renewable energy targets developed for the 2003 Regional Energy Strategy were considered aggressive at the time. Since then, state laws and policies have called for more aggressive targets. As discussed above, Executive Order S-21-09 requires multiple state agencies to collaborate and adopt regulations to increase the state RPS to 33 percent by 2020. The RES reflects these changes to be consistent with state policy direction by setting an increased target of 45 percent, which represents a little more than one percent supply increase each year between 2020 and 2030 (roughly consistent with the annual one percent increase required by state policy through 2020). The state does not currently set policy for the RPS beyond 2020.

Table RE-1: Renewable Energy Targets for San Diego County

Targets	2010	2020	2030
RES Targets from 2003 strategy	15%	25%	40 %
RES Targets for 2009 strategy (% of sales)	20%	33%	45 %

Renewable Energy and Electricity Prices

The CPUC, Energy Commission, and other agencies are conducting financial analyses to learn the cost and benefit impacts of meeting the 33 percent renewable energy target by 2020. Initial CPUC analysis shows that electricity costs will increase in 2020, regardless of renewable resource requirements. As shown in Table RE-2, the preliminary analysis indicates that the cost of producing statewide electricity with a 20 percent RPS in 2020 is comparable to the cost of generating the same amount of electricity with all natural gas. Achieving a 33 percent RPS by 2020, is estimated to cost approximately 7 percent more than using all natural gas generation sources.

Table RE-2: Electricity Costs in 2020 under Renewable Portfolio Standard and Natural Gas Scenarios

	2008	All-Natural Gas Scenario in 2020	20% RPS Reference Case in 2020	33% RPS Reference Case in 2020
Total Statewide Electricity Expenditures	\$36.8 billion	\$49.2 billion	\$50.6 billion	\$54.2 billion
Average Statewide Electricity Cost	\$0.132 per kWh	\$0.154 per kWh	\$0.158 per kWh	\$0.169 per kWh

Source: CPUC/E3, June 2009

The all-natural gas scenario may grow more costly with passage of federal climate change laws. A greater demand for natural gas may occur in places reliant on coal. The added competition could raise prices (for example, San Diego natural gas prices are impacted by price spikes in the eastern United States) and reduce available supply. If this scenario occurs, increasing renewable energy supply may help insulate the region from higher-priced finite natural gas resources. Historical average electricity prices by customer class are shown in Table RE-3. However, natural gas prices have been volatile in recent history, and price forecasts have been highly inaccurate. See Section 7. Natural Gas Power Plants, for more discussion of natural gas prices. Renewable energy is expected to provide more price stability than more volatile natural gas.

**Table RE-3: Historical Average Electricity Prices by Customer Class
(in cents per kilowatt-hour)**

Year	Residential		Commercial		Industrial	
	SDG&E	CA	SDG&E	CA	SDG&E	CA
1990	10.7	10.4	9.6	10.6	6.6	7.7
2000	14.1	11.5	14.5	11.5	12.0	7.9
2007	15.7	12.5	17.4	15.3	13.5	10.9
2008	15.5	12.7	16.9	15.5	12.7	11.1

Source: Energy Almanac, Energy Commission, 2009

Potential Impacts of Renewable Energy

Renewable energy can provide environmental benefits to the region by improving air and water quality and reducing GHG emissions. Adding large amounts of renewables can also present challenges. Conflicts could arise between the broader goal of reducing GHG emissions and the specific environmental impacts of additional renewable infrastructure such as power lines to access renewable resources or renewable energy projects that could impact sensitive habitats or communities. While residents are generally supportive of renewable energy and its environmental benefits, many citizens are concerned about renewable energy projects and transmission lines because of their potential for environmental and aesthetic impacts. For example, proposed solar projects located in the California desert may impact sensitive species habitat or may require large amounts of water, while transmission lines could adversely affect sensitive environmental resources or pristine landscapes. Some desert solar technologies such as photovoltaic and dish-Stirling use little water (for cleaning only) while cooling towers could be used for solar thermal power plants to significantly reduce water use. The impacts of solar projects to the landscape can also vary significantly from major grading activity to little-to-no disturbance to the landscape. Wind projects use only a small percentage of the project site for turbines and service roads, leaving most of the site available for compatible uses.

State Initiatives are already underway to facilitate the early identification and resolution or to avoid land use and environmental constraints to promote timely development of renewable generation resources and associated transmission lines.

Even with the 45% renewables goal for 2030, dispatchable power (most likely natural gas power plants) will provide much of the power supply to the grid. This dispatchable

power along with utility scale renewables to the extent they are equipped with energy storage or hybrid operating characteristics will provide stability and reliability to balance power supplied from renewables that are variable in nature, such as wind and solar. Additionally, there may be need for energy storage and other technologies to provide the kinds of services that electricity and transmission systems need to operate reliably. Although new natural gas plants are more efficient and cleaner burning than older gas plants, some of the efficiency and emission benefits may be lost if such plants are frequently ramped up and down to firm up variable renewables. Many factors will influence the mixture of renewables, fossil fuels and other sources providing power to the grid including weather conditions, load characteristics, geographic dispersion of renewables, implementation of smart grid technologies, the extent to which plug-in electric vehicles can feed power to the grid, and others.

5.2.3 Renewable Energy Transmission Initiative (RETI)

To help address potentially significant land use and environmental concerns, the state created the Renewable Energy Transmission Initiative (RETI), a statewide initiative to help identify the transmission projects needed to accommodate state renewable energy goals, support future energy policy, and facilitate transmission corridor designation and transmission and generation siting and permitting. The RETI process, which is open and collaborative so all interested parties can participate, is supervised by a coordinating committee comprised of the Energy Commission, CPUC, California ISO, and publicly owned utilities. In addition to identifying transmission corridors for renewable resources, RETI assesses all competitive renewable energy zones (CREZ) in California, and sometimes zones in neighboring states, that can provide significant electricity to California by 2020. In addition, the federal Department of the Interior and the State of California entered into an agreement to encourage the development of environmentally-appropriate renewable energy on federal lands in the state. Major provisions of the agreement include developing a strategy to identify areas suitable and acceptable for renewable energy development, including renewable energy zones, based on criteria such as renewable energy development potential and wildlife and conservation criteria.

RETI has identified and prioritized preferred renewable resource development areas and associated transmission line links to deliver renewable power to load centers. The RETI Phase 2A Report prioritizes transmission projects to interconnect renewables that are identified as in the state's best interests. It also forms the basis for a draft method for identifying which of the RETI line segments should be considered for corridor designation in the Energy Commission's corridor designation process.

In addition, to help address potential impacts of new renewable power plants and related transmission lines, the Energy Commission and California Department of Fish

and Game are implementing Governor Schwarzenegger's Executive Order S-14-08, which establishes a process to conserve natural resources while expediting the permitting of renewable energy power plants and transmission lines. The primary objectives are to identify and establish areas for potential renewable energy development and conservation areas in the Colorado and Mojave deserts to help reduce the time and uncertainty associated with licensing new renewable projects on state and federal lands.

The criteria used in this process or the RETI process to balance the objectives of renewable energy development and environmental conservation could be used to guide regional decision-making in situations where these objectives may coincide in the San Diego region.

5.2.4 Barriers to Renewable Energy Development

In order to reach the renewable energy targets, certain permitting barriers must be addressed. Renewable generation facilities must receive a site permit in order to construct a project. The California Energy Commission is responsible for approving permits for thermal power plants 50 megawatts and greater. All other projects must receive a county or city permit. Projects on federal land also must receive permits from the appropriate federal agencies, usually the Bureau of Land Management or the United States Forest Service. Most renewable facilities in California require permits from federal and state agencies since renewable resources often are located on lands within federal and state jurisdiction. In recent years, permitting entities have been inundated with applications for new renewable energy facilities, causing project delays. Governor's Executive Order S-14-08, discussed previously, seeks to remove permitting barriers to renewable energy projects. The Energy Commission and Department of Fish and Game also adopted a one-stop permitting process to streamline the process, which has generally reduced application times by half.

Many renewable electrical generation facilities need to be located near the site where geothermal, wind, and solar resources are available, and therefore need new transmission lines to connect to existing transmission infrastructure. New transmission lines often require lengthy permitting processes and, as discussed above, can have the potential to result in significant adverse impacts to conservation areas and landscapes. These factors may impede the development of renewable resources. Potential adverse impacts will need to be weighed against positive impacts such as lower GHG emissions, price stability, and improved air quality.

Connecting to the electricity grid to supply clean power to resource load centers like the San Diego region is generally cost prohibitive for a single renewable energy project. Since multiple renewable projects are often located within a renewable resource area,

California ISO is developing a framework for multiple projects within a transmission constrained renewable resource area to share the costs of connecting to the grid. The magnitude and scale of infrastructure necessary for California to meet the 33 percent target for 2020 has never before been planned, permitted, procured, developed, and integrated in such a short time horizon. The CPUC identified several measures that must be implemented in the near term if achieving a 33 percent RPS by 2020 is to be a top priority, including:

- Planning now for adequate transmission and generation capacity to meet long-term needs for increased generation from renewable energy sources.
- Procuring electricity from resources that are not dependent on new transmission such as distributed solar photovoltaics.
- Concentrating renewable development in pre-permitted land that could be set aside for a renewable energy park.

5.2.5 Recommended Actions to Support Renewable Energy

SANDAG, local governments, or other regional entities can undertake the following actions to support the development of renewable energy. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions to Promote Renewable Energy	
SANDAG, Local Governments, or other Regional Entities	Recommended Action
RE-1	Identify potential locations in the region that could accommodate utility-scale renewable energy infrastructure.
RE-2	Explore options to pre-permit zones of appropriate land for renewable energy development.
RE-3	Identify existing barriers to siting large-scale renewable energy installations (e.g., renewable energy parks) in the San Diego region.
RE-4	Support cost-effective transmission access and related infrastructure that will help the region meet or exceed requirements for procuring electricity from renewable resources while protecting environmental and other resources.
RE-5	Monitor the Renewable Energy Transmission Initiative (RETI) and related state efforts and consider its recommendations in future regional planning.

5.3 Distributed Generation

Introduction

After energy efficiency and demand response, increased use of renewables and distributed generation systems is the preferred strategy for meeting the state's GHG reduction goals while satisfying demand for energy.

Distributed energy systems are complementary to traditional electric power systems, and include small-scale power generation technologies such as

photovoltaics, small wind turbines, and cogeneration systems located close to where energy is being used. The advantages of distributed energy systems include increased grid reliability, energy price stability, and reduced GHG emissions. The following state policies encourage the use of distributed generation systems:

Distributed Generation Goal:
Increase the total amount of clean distributed generation (renewable and non-renewable) to reduce peak demand and diversify electricity resources in the San Diego region.

- Assembly Bill 1969 (Yee, Chapter 731, Statutes of 2006) authorized feed-in tariffs for small renewable generators of less than 1 MW at public water and wastewater treatment facilities. In July 2007, the CPUC (D. 07-07-027) implemented AB 1969 and expanded the feed-in tariffs to 1.5 MW and included non-water customers in the PG&E and SCE territories (SDG&E territory was included by later legislation). The power sold to the utilities under feed-in tariffs can be applied towards the state's RPS targets.
- Assembly Bill 2466 (Laird) Government Renewable Energy Producers, which authorizes a city, county (whether general law or chartered), special district, school district, political subdivision, or other local public agency, if authorized by law to generate electricity to receive a bill of credit to a designated benefiting account for electricity exported to the electric grid by an eligible renewable generating facility. Additionally, the bill requires the CA Public Utilities Commission to adopt a rate tariff for the benefiting account.
- Assembly Bill 811 (Levine) Public Financing Districts For Energy Improvements, which authorizes a legislative body of any city to determine that it would be in the public interest to designate an area within which authorized city officials and free and willing property owners may enter into contractual assessments to finance the installation of distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to real property, as specified. The bill would require the resolution of intention to include the kinds of distributed generation renewable energy sources or energy efficiency improvements that may be financed as well as a statement specifying that it is

in the public interest to finance those distributed generation renewable energy sources or energy efficiency improvements.

- Assembly Bill 920 (Huffman) Credit For Net Surplus Electricity From Solar And Wind Distributed Generation, which among other things would: require the ratemaking authority of an electric utility to adopt, by January 1, 2011, a net surplus electricity compensation valuation to compensate a net surplus customer-generator, for the value of net surplus electricity generated by an eligible customer-generator and delivered to the grid that is in excess of the amount of electricity that is delivered from the grid to the eligible customer-generator; require the electric utility to offer a standard contract or tariff to eligible customer-generators that includes compensation for the value of net surplus electricity; require the electric utility, upon an affirmative election by the eligible customer-generator to receive service pursuant to this contract or tariff, to either: (1) provide net surplus electricity compensation for any net surplus electricity generated in the 12-month period, or (2) allow the eligible customer-generator to apply the net surplus electricity as a credit for kilowatt-hours subsequently supplied by the electric utility to the surplus customer-generator; provide that upon adoption of the net surplus electricity compensation rate and the eligible customer-generator electing to receive net surplus electricity compensation, any renewable energy credit, for net surplus electricity belongs to the electric utility purchasing the electricity and that net surplus electricity counts toward the electric utility's renewables portfolio standard purchasing requirements.
- Senate Bill 412 (Kehoe) Self-Generation Incentive Program: Inclusion Of Non-Solar Technologies, which would require the CPUC to require the collection of funding for the self-generation incentive program for non-solar distributed generation resources through December 31, 2011; require that combined heat and power units meet certain efficiency and emissions requirements, including the greenhouse gases emission performance standard, to receive incentives; require the PUC to ensure that distributed generation resources are made available in the program for all ratepayers; prohibit recovery of the costs of the program from ratepayers that participate in the California Alternative Rates for Energy (CARE) program; delete the authorization for the PUC, in administering the program, to include other ultra-clean and low-emission distributed generation technologies; and, delete the current requirement that the CA Energy Commission, by November 1, 2008, and in consultation with the PUC and CA Air Resources Board, to evaluate the costs and benefits of providing ratepayer subsidies for renewable and fossil fuel ultra-clean and low-emission distributed generation.
- Senate Bill 380 (Kehoe, Chapter 544, Statutes of 2008) codified CPUC's expanded feed-in tariff to include all RPS-eligible generators 1.5 MW and below.

The program cap was also expanded from 250 MW to 500 MW. SB 380 expanded the program to include all investor-owned utilities including SDG&E.

- Assembly Bill 1613 (Blakeslee, Chapter 713, Statutes of 2007), also known as the Waste Heat and Carbon Emissions Reduction Act, was designed to encourage the development of new combined heat and power (CHP) systems in California with a generating capacity of up to 20 MW, resulting in more efficient use of natural gas and reduced GHG emissions. The bill requires the CPUC and the Energy Commission to establish policies and procedures for the purchase of electricity from eligible CHP systems.
- The California ARB Climate Change Scoping Plan set a target of 4,000 MW of CHP that would displace 30,000 gigawatt hours of electric energy from other power generation resources with the overall goal of reducing GHG emissions by 6.7 million metric tons of CO₂ equivalent.
- Senate Bill 1 (Murray, Chapter 132, Statutes of 2006) enacted the Governor's "Million Solar Roofs" program with the overall goal of installing 3,000 MW of solar PV systems.

To implement SB 1, the state officially launched Go Solar California in 2007 to bring customer awareness to the CPUC California Solar Initiative (CSI) and the Energy Commission New Solar Homes Partnership (NSHP), and solar incentive programs offered by publicly-owned utilities beginning in 2008. The CSI offers rebates to existing homes and non-residential energy customers installing solar systems in IOU service territories. As of June 2009, 226 MW of new solar systems were installed as a result of the program. When fully implemented in 2016, the CSI program is expected to provide incentives for about 165 MW of photovoltaics in the San Diego region.

The NSHP 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. However, with the recent extreme downturn in new home construction, program activity has been slow and is likely to remain so until if and when the economy recovers. The NSHP does not allocate available funding on a regional basis, so it is not possible to project the amount of photovoltaics that will be installed in the region as a result of the program.

Another customer-side strategy is the Self-Generation Incentive Program, which is administered by the CPUC and implemented through the IOUs and provides rebates for customers who install wind turbines and fuel cells. SB 412 (Statutes of 2009) revises this program to provide incentives for certain non-renewable distributed generation systems. The program originally included microturbines, small gas turbines, wind turbines, solar photovoltaics, fuel cells, and internal combustion engines, but as of

January 1, 2008, only fuel cells and wind energy technologies are eligible. As of December 2008, the IOUs have paid more than \$600 million in rebates for more than 1,200 projects totaling more than 337 MW of generating capacity. The Energy Commission administers a similar program also limited to wind turbines and fuel cells, the Emerging Renewables Program.

5.3.1 Feed-in Tariff

The feed-in tariff is intended to help contribute to the state RPS and encourage customers to install renewable energy systems to help meet the state RPS goals. Some smaller renewable energy systems are able to be counted toward the RPS due to the state feed-in-tariff. Feed-in tariffs are fixed, long-term prices for energy. The law initially supported deployment of renewable resources on publicly owned water and wastewater treatment facilities.

The California feed-in tariff was amended by Senate Bill 32 (Statutes of 2009), and must be implemented through regulations to be developed by the CPUC. SB 32 allows eligible customer-generators in the residential, commercial, and industrial sectors to enter into 10-, 15-, or 20-year standard contracts with their utilities to sell electricity produced by small renewable energy systems, up to 3 megawatts (MW), at time-differentiated market-based prices determined by the CPUC's market price referent (MPR), which is an administratively determined rate based on the cost of natural gas generated electricity. Eligible technologies include solar thermal and photovoltaic, landfill gas, wind, small hydroelectric, among others.

Time-of-use adjustments will be applied by each utility and will reflect the increased value of the electricity to the utility during peak periods and its lesser value during off-peak periods. Power produced during peak demand times earns the highest rate. Power purchased under the feed-in tariff counts toward the utility's RPS obligations, and renewable energy credits (RECs) (discussed below) transfer to the utility under a feed-in tariff contract. The tariff is available until installed generation equals 750 MW, a portion for which each utility is responsible. Any customer-generator who sells power to the utility under this tariff may not participate in other state incentive programs.

5.3.2 Net Metering

Net metering is another strategy to help increase customer-side distributed generation technologies, particularly PV. Customers who install an on-site renewable energy system can apply for net metering, a special billing arrangement with the utility for electric customers who generate their own electricity. Net metering allows for the flow of electricity both to and from the customer – typically through a single, bi-directional meter. When a customer's generation exceeds the customer's use, electricity flows

back to the grid and offsets electricity consumed at a different time. In effect, the customer uses excess generation to offset electricity that the customer otherwise would have to purchase at the utility's full retail rate. Unlike the feed-in tariff, net metering does not involve long-term agreements or prevent the customer from taking advantage of incentives prohibited under the feed-in tariff. The customer's electric meter tracks electricity generated by the renewable system versus electricity consumed, with the customer paying only for the net amount taken from the grid over a 12-month period.

California's net-metering law requires investor-owned utilities like SDG&E to offer net metering to all customers for solar, wind, biogas-electric, and fuel cell systems up to 1 MW. Net excess generation (NEG) is carried forward to a customer's next bill. Previous law granted NEG remaining at the end of each 12-month period accrue to the customer's utility. Assembly Bill 920 (Statutes of 2009) now gives customers the option of rolling over remaining NEG from month-to-month indefinitely or receiving financial compensation from the utility for their remaining NEG. Customers not electing either option will have their NEG granted to the utility at the end of the 12 month period without any compensation. The renewable energy credits (RECs) associated with the electricity produced and used on-site remain with the customer-generator. If, however, the customer chooses to receive financial compensation for the NEG remaining after a 12-month period, the utility will be granted the RECs associated with just the surplus they purchase. The utility can take credit for the surplus purchased under the RPS.

5.3.3 Interconnection Policies

Interconnection policies can be a barrier to increased use of distributed generation (further defined below). California applies a standard practice for interconnecting distributed generation systems to the electric grid (Rule 21). Non-standardized interconnection rules create uncertainty and risk for customers interested in using distributed generation technologies and can make this option cost prohibitive. Rule 21 specifies standard interconnection, operating, and metering requirements for specified distributed generation generators.

5.3.4 Distributed Generation in the San Diego Region

For purposes of this strategy, clean distributed generation is small-scale power generation technologies located close to the load being served, capable of lowering costs, improving reliability, reducing emissions and expanding energy options. Combining energy efficiency measures with distributed generation is the best way to reduce a customer's energy demand, thereby properly sizing the distributed system and generally saving the customer the costs of a larger system.

Table DG-1 presents quantified goals for distributed generation technology penetration through 2030 building on several California mandates and recommendations. These market projections were developed for SANDAG by the California Center for Sustainable Energy.

Table DG-1: Distributed Generation Targets for 2030			
Technology	2008 Level	2030 Base Targets	2030 Stretch Targets
Biogas/Biomass	26 MW	27 MW	31 MW
Solar photovoltaics	49 MW	844 MW	970 MW
Combined heat and power	341 MW	398 MW	458 MW
Other (hydro & steam)	11 MW	11 MW	11 MW
Total Distributed Generation in the Region	427 MW	1,278 MW	1,590 MW
Proportion of Regional Peak Demand			
Targets from 2003 Strategy	12% (2010)	30%	30%
Targets for 2009 Strategy	9% (actual)	21%	24%

Source: California Center for Sustainable Energy, 2009

5.3.5 Solar Photovoltaic Systems

Using the Energy Commission Distributed Generation Roadmap, CCSE projects that the amount of solar photovoltaics could increase from 49 MW in 2008 to a base target of 844 MW in 2030. With additional measures, the region could achieve a stretch target of 970 MW. In the San Diego region, solar PV systems have the greatest growth potential among DG technologies. Several regional resources are available that help enable residents to install solar. The City of San Diego partnered with the California Center for Sustainable Energy (CCSE) to develop an interactive solar mapping tool. The Solar Map identifies solar systems installed in the region and can help a resident determine their own rooftop's viability for solar panels.

Moreover, CCSE manages the California Solar Initiative incentive program for the region and hosts an annual Solar Energy Week including a Solar Homes Tour and Commercial Solar Sites Tour. In the 2009 Environment California report, California's Solar Cities, the City of San Diego was ranked the number one solar city in California, with the most solar roofs and the highest solar capacity kilowatts installed.

5.3.6 Combined Heat and Power Systems

Using the Energy Commission Distributed Generation Roadmap, CCSE projects that the amount of combined heat and power (CHP) (also known as cogeneration) could increase from 341 MW in 2008 to a base target of 398 MW in 2030. With additional measures, the region could achieve a stretch target of 458 MW. CHP efficiently converts natural gas to energy by recycling otherwise wasted heat and reusing it for additional electricity or heating and cooling. These systems also can operate on renewable fuels such as biogas. Technologies typically used on a CHP configuration include microturbines, internal combustion engines and fuel cells.

CHP can provide a variety of benefits to end users. Customers that need greater reliability than what the electric grid can supply can use CHP systems. Biotech firms, data centers, telecommunications, and industrial processes are some of the business types that cannot afford power interruptions. CHP can provide premium power onsite, offering end users a higher level of reliability than the electric grid. CHP is often used in industrial processes that take advantage of the electricity and heat. The relatively small amount of industry and manufacturing in the region limits the potential applications for CHP systems.

5.3.7 Distributed Generation System Costs

Although the lifecycle costs of distributed generation systems make them a good choice for many end users, the upfront capital costs can be a barrier to their increased penetration. California offers many financial incentives (e.g. the California Solar Initiative, New Solar Homes Program, and Self Generation Incentive Program) to help defray the costs for new and existing buildings. Some local governments and large businesses use third party energy providers that can cover the upfront cost of a system through a long-term contract with the jurisdiction.

Since there are a variety of distributed generation systems, customers are able to choose the technology that best serves their needs. Distributed generation also benefits the utility by reducing peak demand on the electric grid and benefits businesses by reducing costs associated with peak demand charges. In power constrained areas where outages are common, distributed generation can serve to provide reliable power.

Advanced energy storage (AES) is a distributed energy system that is expected to perform an integral role in future increased use of renewable energy and in improving grid reliability. AES is a technology that converts electricity into another form of energy, stores it, and then converts it back into electricity at another time. By storing energy that can be used or dispatched at a time when it is more useful to the overall electric grid, AES can help make electricity from intermittent resources such as solar and wind

more usable to the electricity system. Similarly, AES also can reduce peak demand and save money by storing electricity for use when grid-based electricity is most expensive (e.g., during periods of peak demand).

5.3.8 Recommended Actions to Support Distributed Generation

SANDAG, local governments, or other regional entities can undertake the following actions to encourage an increase in clean distributed generation. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions to Support Distributed Generation	
Local Governments	Recommended Action
DG-1	Revise, or support revision of, local zoning policies, homeowner association codes, and other codes to remove hindrances and promote installation of PV or other distributed renewable energy systems (e.g., require or provide incentives for new construction to pre-wire for PV installation).
DG-2	Explore opportunities and applications for local governments to demonstrate and deploy advanced energy storage with distributed generation technologies.
SANDAG, Local Governments, or other Regional Entities	Recommended Action
DG-3	Combine energy assessments and energy efficiency improvements with installation of distributed energy generation systems to reduce system costs and maximize energy savings.
DG-4	Establish financing programs (using public or private sources) that residents and businesses can access to install distributed energy systems such as PV and combined heat and power systems as well as conduct energy assessments and make energy efficiency retrofits to existing buildings.
DG-5	Continue to 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.
DG-6	Identify local barriers to DG installations and provide supportable and applicable solutions across jurisdictions to reduce confusion for builders, contractors, and officials, about technologies, costs and benefits.
DG-7	Conduct analysis of potential applications for CHP systems in the region (e.g., industrial, hotel, etc.).
DG-8	Promote the use of high efficiency distributed generation technologies like combined heat and power.
DG-9	Encourage local home builders to participate in the New Solar Homes Partnership to install solar photovoltaics on new homes in the region.

5.4 Energy and Water

Introduction

In the San Diego region, water and energy resources – and therefore climate change – are closely connected. The amount and ways water is used in the

Energy and Water Goal:
Reduce water-related energy use.

region require large amounts of energy. Water utilities use large amounts of energy to pump, treat, deliver, and recycle water, while residents and businesses use energy to heat, cool, and use the water. Energy is also used to dispose of wastewater and power the large pumps that move water throughout the state. Power plants use a significant volume of water, primarily for cooling, which can impact local water supplies. Water also provides hydroelectricity generation for the region, while pumped storage facilities provide commercially viable electricity storage on a large scale.

Historically, the energy implications of water decisions were not typically considered. Water sources were chosen without consideration of the energy costs; conversely, energy savings were not associated with water conservation and efficiency measures. However, understanding of the nexus between water and energy is beginning to grow. The region can build from this understanding to take actions that save energy and water resources: reducing the energy intensity of water supply and uses will reduce the region's contribution to climate change while using less water will help the region adapt to the reduction in water supply anticipated from climate change. Integrating energy considerations into water planning also can save money and strengthen the economy. California water and wastewater agencies spend more than \$500 million annually on energy costs.

California's water systems are highly embedded with energy relative to national averages. The state has major conveyance systems that 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 is at the farthest – and therefore most energy intensive – end of the SWP and Colorado River Aqueduct. The amount of energy used to deliver water from the SWP to residential customers in Southern California is almost one-third the total average household electric use in the region. The San Diego region currently imports more than 80 percent of its water from these distant sources that are embedded with large amounts of energy; about 18 percent is supplied from local water sources.

As of 2005, water-related energy use annually consumes 19 percent of the state's electricity consumption, 30 percent of non-power plant natural gas consumption, and

88 million gallons of diesel fuel. Statewide water-related electricity consumption alone costs at least \$2 billion per year. As water demand grows, so does energy demand. Water demand and associated energy costs will continue to grow if current trends continue. Since population growth drives demand for both resources, water and energy demands are growing at roughly the same rate. Water-related electricity use is expected to grow at a faster rate in the future because of increasing and more energy-intensive water treatment requirements such as those under the Safe Drinking Water Act and Clean Water Act, conversion of diesel agricultural pumps to electric, increasing long-distance water transfers, and changes in crop patterns that require more energy intensive irrigation methods.

Table EW-1: Embedded Energy in the Water Cycle			
Water Cycle Segments	Range of Embedded Energy (kilowatt hours/million gallons)		
	Low	High	Typical Southern California Urban Water System
Supply and Conveyance	0	14,000	8,900
Treatment	100	16,000	100
Distribution	700	1,200	1,200
Wastewater Collection and Treatment	1,100	4,600	2,500
Wastewater Discharge	0	400	N/A
Recycled Water Treatment and Distribution	400	1,200	N/A

Source: California Energy Commission, California’s Water-Energy Relationship, final staff report, 2005.

Peak demand for water, and energy required to treat and transport that water, coincides with peak demand for electricity. If not coordinated and managed, water-related electricity demand could affect the reliability of the electric grid during peak load periods. Conversely, reliable and adequate electricity supplies are essential for water and wastewater agencies to meet the needs of their customers need. If electricity infrastructure fails, water system reliability quickly worsens.

5.4.1 Energy and Water in the San Diego Region

The San Diego County Water Authority (CWA) currently supplies about 600,000 acre-feet⁶ of water per year (af/year) to water agencies in the region. Supply sources include 470,000 af/year from the Metropolitan Water District (MWD), 83,000 af/year from the SWP, 30,000 af/year from local groundwater supplies, and 18,000 af/year from recycled wastewater. The average energy intensity of the water-energy cycle in the San Diego region is 6,900 kilowatt-hours per acre-foot (kWh/af). Based on these figures, total water-related energy consumption to satisfy current regional water demand is estimated at 4,140,000 megawatt-hours (mWh) per year. The energy intensities for the five stages of the water life cycle in San Diego region are estimated as follows:

1. Sources and conveyance: 2,040 kWh/af,
2. Water treatment: 60 kWh/af,
3. Distribution: 330 kWh/af,
4. End uses: 3,900 kWh/af, and
5. Wastewater treatment: 570 kWh/af.

5.4.2 Energy and Water End Uses

Despite the energy-intensive process of conveying water over long distances and high elevations to the region, water end use applications are the most energy-intensive stages of the water life cycle, accounting for over half (57 percent) of water-related energy use. The same is true for the state as a whole.

Energy efficiency water programs have traditionally focused on either saving energy in water and wastewater treatment facilities or saving energy in end-use applications including water heating, clothes washing and drying or process heating. Water use efficiency programs have similarly focused on saving water in end-use applications. For the most part these efficiency improvement efforts have occurred separately, although there are some examples of water and energy utility coordination. What appears to be missing is recognition that saving water saves energy throughout the entire water use cycle.

Understanding the embedded energy of water requires distinguishing between cold and hot water. Conserving a unit of cold water avoids using the energy that would have been needed to supply, treat, deliver, consume, treat, and then dispose of it as wastewater. In San Diego, saving cold water, both indoors and outdoors, saves energy (primarily electricity). Saving outdoor water saves the energy needed to extract, convey, treat, and distribute water to customers. Saving indoor water saves the additional energy (mostly electricity), used to collect, treat, and dispose of the waste water. Saving

⁶ An acre-foot is equal to about 325,850 gallons of water, or enough to cover an acre of land to a depth of one foot.

hot water results in additional energy savings needed to heat the water (usually natural gas).

From an energy perspective, saving cold outdoor water is good, saving cold indoor water is better, and saving hot indoor water will save the most energy. Moreover, saving end-use energy can save water and the energy associated with the applicable portion of the water use cycle. For example, saving electricity of any kind also will save water at power plants that use cooling water.

Table EW-2: Estimated Embedded Energy of Water End Uses in the San Diego Region

Water Use Category	Estimated Percent of Total Use in 2010	Estimated Energy Intensity (kWh/af)
Residential	58%	-
Toilets and leaks	14%	0
Dishwashers	1%	27,200
Clothes washers	8%	11,650
Showers, faucets, and bathtubs	12%	6,700
Landscape irrigation	23%	0
Commercial, industrial, and institutional	32%	-
Kitchen dishwashers	50%	27,200
Pre-rinse nozzles	20%	6,700
Other kitchen use	1.2%	Not Estimated
Laundries	0.6%	11,650
On-site wastewater treatment	5.8%	800
Water-cooled chillers	2.4%	67,700
Single pass cooling	2.4%	0
Landscape irrigation	12.1%	0
Other heated water	0.3%	6,700
Other unheated water	6.5%	Not Estimated
Agricultural	10%	Not Estimated
Totals and weighted average	100%	3,900

Source: 2005 Integrated Energy Policy Report, California Energy Commission

As shown in Table EW-2, the residential sector in the San Diego region is estimated to be responsible for 58 percent of water end uses in 2010. The commercial, industrial and institutional sectors are estimated to account for an additional 32 percent, while agriculture will account for about 10 percent. The five largest end use consumers of

water are cold outdoor water for residential landscape irrigation (23 percent), cold indoor water for residential toilets and leaks (14 percent), cold outdoor water for commercial/industrial landscape irrigation (12 percent), hot indoor water for residential showers, faucets and bathtubs (12 percent), and hot and cold indoor water for clothes washers (8 percent). The water end uses with highest embedded energy include water-cooled chillers (67,700 kWh/af), dishwashers (27,200 kWh/af), residential clothes washers and commercial laundries (11,650 kWh/af), showers, faucets, and bathtubs (6,700 kWh/af).

Targeting conservation and efficiency measures toward the largest end use consumers of water and water end uses with the highest embedded energy can reduce the overall energy intensity of water end uses. Renewable or clean distributed energy systems, such as solar hot water heating, also can be used to save energy from the use of hot indoor water.

Energy Considerations for Meeting Future Water Demand

With the population of the San Diego region expected to increase by approximately one million residents by 2030, demand for water will increase. CWA estimates that at least an additional 100,000 af/year will be needed in 2020, and demand for water will continue to grow to 2030 and beyond. CWA must save 80,000 af by 2010, 94,000 af by 2020 and 108,000 af by 2030 to meet the region's water needs, or it must develop or contract additional water supplies. There are various strategies to meet future water demand, including conservation, recycling, and desalination. Imported supplies from the SWP and 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 energy intensity of each potential strategy varies, as shown in Table EW-3.

5.4.3 Water Efficiency and Conservation

The Energy Commission identifies water conservation and efficiency as the best, most energy efficient way to serve future demand using the largest available supply—existing water resources. Investment in conservation and efficiency may forestall or avoid larger public investments for drinking water, clean water infrastructure, or power generation facilities, and it will help stretch available public water funds. For example, total energy savings of meeting the next 100,000 af through conservation instead of additional SWP water could be approximately 767 million kWh, enough to provide electricity for 118,000 households for one year. Waste Not, Want Not, a study published by the Pacific Institute in November 2003, estimated that cost effective urban water conservation

measures could save 22 percent of water end uses in the residential, commercial, and industrial sectors, and without technological chance.

Table EW-3: Energy Intensity for Satisfying Additional Water Demand

	Source and Conveyance	Water Treatment (kWh/af)	Distribution (kWh/af) ²	End Use (kWh/af) ³	Wastewater Treatment (kWh/af) ⁴	Total (kWh/af)
Status quo	2,040	60	330	3,900	570	6,900
Status quo plus scenario⁵						
Conservation	1,780	60	290	3,400	500	6,030
Recycling	1,830	60	330	3,900	500	6,620
Water bag transfer	1,950	60	330	3,900	570	6,810
Imperial Irrigation Direct transfer	60	60	330	3,900	570	6,940
Additional State Water Project	60	60	330	3,900	570	7,100
Seawater desalination	50	60	330	3,900	570	7,260

Source: California Energy Commission. Notes: 1) Conserved water does not need to be distributed, reducing the embedded energy of distribution from 330 to 290 kWh/af delivered. 2) Conservation assumes no energy is conserved when water is conserved, but no energy is expended to conserve water either. 3) Wastewater is not generated by conservation or by recycling if recycled water is used for landscape irrigation, reducing energy intensity from 570 to 500 kWh/af delivered. 4) The scenarios are presented for purposes of comparing energy consumption only. 5) They do not necessarily represent feasible or likely scenarios for satisfying future water demand in the San Diego region.

5.4.4 Reclamation

Water recycling (reclamation) is the next best efficient source of additional water supply. Recycled water is the fastest growing source of new supplies in the state. After treatment to stringent health and quality standards, recycled water can displace offset 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 (NCWRP) and South Bay Water Reclamation Plant (SBWRP). NCWRP has capacity to produce up to 24 million gallons per day (MGD) of recycled water (about 26,880 acre feet per year), but existing beneficial reuse, consisting mostly of irrigation and some industrial purposes, total only about 6 MGD (about 6,700 acre feet per year) (City of San Diego, Water Reuse Study [2006]). Although the region has substantial capacity to produce recycled water with adequate quality, actual demand for recycled water has not matched that capacity. None of the recycled water is currently used as potable water.

The cities of Encinitas and Solana Beach, acting as the San Elijo Joint Powers Authority (SEJPA), operate the San Elijo Water Reclamation Facility (SEWRF), a wastewater treatment and water reclamation plant that treats approximately 5.25 million gallons of raw sewage per day. Approximately 1,200 to 1,300 acre-feet is produced and bought annually, equal to over 400 million gallons per year and serving approximately 32,000 people. Two recycled water reservoirs, one underground, and one above, each with a capacity of 750,000 gallons, provide operational storage for the water reclamation program.

In neighboring Orange County, the City of Huntington Beach and the Orange County Water District (OCWD) developed a Groundwater Replenishment (GWR) System, the world's largest advanced water purification project of its kind. The GWR provides about 70 million gallons per day of near-distilled quality water to central and northern Orange County in an effort to offset the effects of future water shortages. The project takes highly-treated sewer water and put it through a three-step purification process that includes microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide. As of 2008, the water produced cost \$550 per acre-foot, only slightly more expensive than supplies imported from northern California. In the future, GWR water is forecasted to be more cost-effective due to decrease in the availability of imported water and resulting in an increase in cost. The reclamation process uses less electricity than currently used to import the same amount of water through the state aqueduct system.

Currently, a substantial portion of the processed reclaimed water is never utilized. Instead, it is pumped back into the general wastewater lines where it is run through treatment processes again at the Point Loma water treatment facility, and disposed of in the Pacific Ocean. This is an inefficient use of water and the energy used for processing and pumping. Distributing processed reclaimed water to end users via the purple pipe system (i.e., separate system of pipes for transporting reclaimed water) would require investments in water infrastructure such as storage and additional purple pipe system installation. Assessment districts could be established as a means of financing purple pipe system installation.

Another option for the region would be to treat processed reclaimed water to potable standards and distribute via the existing potable water distribution system. Reuse of the processed reclaimed water would save energy to the extent it displaces the embedded energy of water supply that would have otherwise been used to meet water demand.

The City of San Diego is currently undertaking a pilot Indirect Potable Reuse study to examine opportunities to expand its overall water reuse capacity by up to 16 million gallons of highly treated wastewater every day (about 17,900 acre feet per year).

5.4.5 Desalination

Desalination is another option to meet future water demand. The process removes salt from brackish water (a mixture of salt water and fresh water) or seawater to create potable fresh water. Brackish water desalination is considerably less energy intensive than seawater desalination. The Energy Commission reports that desalinated brackish water and seawater can relieve drought conditions, replace and restore groundwater, and provide a source of water for river and stream ecosystem restoration.

The future demand for additional sources of water and constraints on imported supply require the identification of conservation and efficiency options in all stages of the water-energy cycle, as well as potential sources of local supply. It is important to note that many considerations, are relevant to the selection of water sources to meet future demand in the region. Energy is just one of the considerations. Reliability, impacts to environmental resources, cost, and regional control may be other important considerations relevant to the selection of future water sources to meet regional demand.

5.4.6 Water for Electricity Generation

Several opportunities exist to increase energy supplies from water and wastewater utilities, including hydroelectric power in hydroelectric power plants and pumped storage facilities, water storage for peak shifting, in-conduit hydroelectric generation, biogas cogeneration at wastewater treatment plants, and development of local renewable resources on water and wastewater utilities' extensive watersheds and rights-of-way.

Opportunities for construction of new hydroelectric plants are very limited. Pumped storage projects involve the transfer of water between two reservoirs or tanks at varying elevations to generate electricity. Water can be pumped from the lower to the higher reservoir during off-peak electricity periods, and then released to the lower reservoir during peak electricity periods to spin a turbine or power an electricity generating unit. This is considered a method of storing renewable electricity, particularly intermittent sources such as wind and solar power. In-conduit generation utilizes the

flow of water through pipelines, canals, and the like to generate electricity. Additional in-conduit projects could help offset the embedded energy of the water system or be sold back to the grid. In-conduit projects could also help contribute to the region's goals for renewable power generation.

Wastewater treatment plants use anaerobic digestion to clean wastewater, a process that releases biogas (60 to 90 percent methane). Biogas can be captured and used for electricity. The Point Loma Wastewater Treatment Plant in the City of San Diego produces enough biogas to run a 4.5 megawatt (MW) generator, which saves millions of dollars in energy costs and produces power for the electricity grid.

There are opportunities at pumping stations to take advantage of downgrade water flow to provide hydroelectric electricity to pumping stations. In addition to hydroelectric power, onsite solar arrays or cogeneration systems at pumping stations can provide energy for water pumping while reducing impacts on the electricity grid. Wind and solar photovoltaic facilities are excellent power sources from a water perspective as they do not use water during operation. Distributed energy systems are essentially air-cooled machines that requires little to no water for operations. Many water agencies can install have potential for installation of solar panels on rooftops and structures and on other unused or underutilized land within their control. Water agencies can take advantage of renewable energy opportunities to offset their own electricity load and potentially even send power to the grid and contributing to regional goals for the generation of renewable power (e.g., Renewable Portfolio Standard goals).

5.4.7 Recommended Actions for Energy and Water

SANDAG, local governments, or other regional entities can undertake the following actions to encourage reduced water-related energy use. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions for Energy and Water

Local Governments	Recommended Action
EW-1	Increase energy conservation and efficiency of water end-uses in the residential and commercial sectors, with priority on the largest end uses of water (e.g., landscape irrigation, toilets, and showers) and the water end-uses with the most embedded energy (e.g., dishwashers, residential clothes washers and commercial laundries, and showers).
SANDAG, Local Governments, or other Regional Entities	Recommended Action
EW-2	Identify existing or develop new financing mechanisms that end users can utilize to reduce water-related energy consumption (e.g., purple pipe to support use of reclaimed water), such as those available for energy measures (e.g., on-bill financing [property tax or utility] and low interest loans).
EW-3	Integrate measures that save water and energy into any regional retrofit program(s) to incorporate energy efficiency and distributed generation into the existing building stock.
EW-4	Promote energy efficiency, demand response and self generation efforts to local governments that own or operate water pumping stations and water or wastewater treatment facilities.
EW-5	Support or identify uses for existing unused reclaimed water to decrease the amount of energy needed to meet the water needs of the San Diego region.
EW-6	Identify and support programs for residential re-use of gray water to decrease the amount of energy needed to meet water needs.
EW-7	Support landscape design educational programs to help residential customers install low water use landscaping, thereby reducing water-related energy use.

5.5 Peak Demand

Introduction

After energy efficiency, demand response is the next highest priority in the state's preferred loading order for meeting new energy needs and reducing GHG emissions. Like energy efficiency, demand response is given a high priority in the loading order because addressing peak demand can help meet energy needs and lower GHG emissions

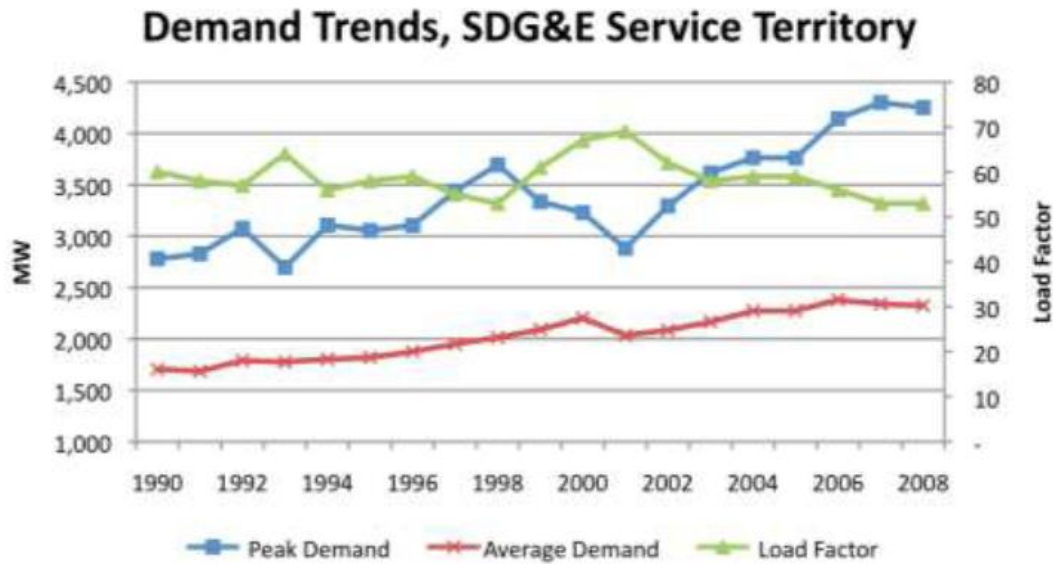
with measures consumer benefits like cost savings and little or no environmental impact. Lower peak demand can improve air quality for the region, particularly in areas near peak electricity-producing power plants.

Peak demand is the maximum level of electric load, measured in megawatts (MW) for a specified time period. In contrast, average demand measures the total annual demand over all 8,760 hours in a year. The ratio of average demand and peak demand is called the load factor. This measures how effectively the total capacity of the electrical system is used on average. The higher the load factor, the more effectively the system is being used. A load factor of 100 percent, which is nearly unattainable, would mean the average and peak demand were equal and that system capacity was fully used 100 percent of the time. The RES uses the Energy Commission's June 2009 peak demand forecast. SDG&E relies on the Energy Commission forecast for its resource planning. Recent trends for peak demand, average demand, and the resulting load factor for the SDG&E service territory are presented in Figure PD-1.

Peak Demand Goal:

Implement cost-effective steps and incentives to utilize demand response and energy efficiency measures to reduce peak demand.

Figure PD-1. Demand Trends in SDG&E Service Territory, 1990 – 2008



Source: Energy Policy Initiatives Center, University of San Diego, 2009.

The current regional load factor is approximately 53 percent, lower than the average over the 1990-2008 period (59 percent) and significantly lower than the highest load factor of about 70 percent at the beginning of the decade. The increased load factor in the early 2000s was primarily the result of decreased demand during the California Energy Crisis. While average demand has modestly increased over this period, peak demand has increased more significantly.

Weather and behavior are major determinants of peak demand. On an annual basis, the region generally experiences high peak demand periods driven by air conditioning use on the hottest days of the year and during continuous heat waves.

Peak demand is a significant concern for energy planners about 80 to 100 hours each year. During that time, when electricity demand increases significantly, base-load electricity supply has been surpassed and electricity prices are at their highest. Increased demand must be offset by increasing supply or reducing demand. Supplemental power plants called “peaking units” or “peaker plants” can be used to increase supply for these short durations. These resources are generally more expensive to operate, less efficient, and have higher emission rates than base-load power. Reducing peak demand and thus the need for peaking resources can minimize their impacts.

Measures to Address Peak Demand

5.5.1 Demand Response

In general, demand response means shifting end-user electric use from high demand periods to lower demand periods, when electricity is cheaper and more abundant. Doing so can reduce the overall demand (MW) on the electric system but does not necessarily reduce overall energy use (MW-hours), so demand response may not lower greenhouse gas and other emissions associated with electricity use. Demand response can be achieved by rate designs that provide customers lower electricity prices during most hours in exchange for higher prices during the times of peak demand when supply reserves are small. Traditional energy efficiency programs that result in peak demand reductions are another tool to manage demand. Demand response program also can reduce peak demand by providing customers with incentives for reducing their electric load in response to a call for load reduction by the utility, particularly during critical times like high temperature days. Incentives can include a credit on a utility bill, a dynamic rate, or exemption during a time of rolling blackouts.

Demand response includes new rate designs and incentive programs for on-peak load reductions. New rate designs would provide customers lower electricity prices during most hours in exchange for higher prices during the times of peak demand when supply reserves are small and electricity typically costs more (this is referred to as dynamic pricing).

Demand response programs are available at the retail level primarily through utility programs administered through the CPUC. The Federal Energy Regulatory Commission identifies Demand Response as a high priority and issued Order 719 on October 17, 2008, which directs regional transmission organizations, such as the California Independent System Operator (CAISO), to implement demand response programs. CAISO established a Proxy Demand Resource program to facilitate demand response in wholesale markets, to be implemented by the summer of 2010.

SDG&E manages several types of demand response programs in which local governments and SANDAG can participate or educate employees, businesses and residents. Residential programs include “Summer Saver,” which allows SDG&E to install a device on a central air conditioning unit and to cycle the unit on and off during specific summer days. Ratepayers receive an annual bill credit ranging from an average of \$46 to \$184. Business programs include cash rebate assistance to replace existing equipment with newer high-efficiency models, and capacity bidding, which offers monthly incentives to businesses that commit to reducing power by a pledged amount for the month. SDG&E also offers a variety of third party programs administered by other contractors under competitive bid contracts awarded by SDG&E.

5.5.2 Distributed Generation

In addition to demand response programs, distributed generation systems can reduce peak demand. Rooftop solar photovoltaics, fuel cells, and combined heat and power systems can produce electricity during peak times and reduce demand on the electricity grid. The amount of peak reduction varies by technology type and operating characteristics. For example, summer peak period in the region occur between 3-5p.m. Solar photovoltaics do not produce at full capacity during that time and may only contribute half of its capacity during the peak. Other technologies such as CHP that generate electricity more hours of the year can contribute more during peak periods. For more on distributed generation, please see Section 3, Distributed Generation.

5.5.3 Advanced Metering Infrastructure

Smart meters and advanced metering infrastructure, can help to reduce regional peak demand by providing customers with detailed information about their energy consumption and charging dynamic rates for electricity. 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.

In addition, smart meters can communicate to smart end-use devices and appliances. This will enable energy consumers to cycle air-conditioning units off and on, set clothes dryers and dishwashers to run at off-peak hours, and manage other energy intensive equipment based on the time of use, the cost and availability of electricity. The electric utility or the customer will be able to remotely enable demand response programs and measures that could reduce some of the need for new electric generation resources.

Electric Vehicles and Peak Demand Management

The electricity and transportation sectors may converge in the coming decades. Several major automakers are introducing electric vehicles and plug-in hybrid electric vehicles in to U.S. auto markets. Use of electricity as a transportation fuel has significant potential to reduce regional GHG emissions but could require major changes to the existing electrical infrastructure. For example, large numbers of drivers returning home from work on a hot summer day and plug in their cars to charge would increase the existing peak demand. In addition, high concentrations of electric vehicle owners in the same neighborhoods could potentially strain local circuits.

To avoid adverse impacts from plug-in electric vehicles, strategies must be developed to accommodate electric vehicles while ensuring that the grid is not stressed. One potential strategy would be to encourage electric vehicle charging overnight during off-peak hours through pricing incentives. This strategy could be enhanced through smart

charging capabilities that would allow the utility to determine the best times for vehicle charging and even out the increase in electric demand caused by electric vehicles.

Electric vehicles could also play a role in helping to control peak demand. In the future, utilities may be able to provide vehicle-to-grid capability in which a plug-in electric car owner can sell electricity from their car battery back to the grid, providing benefits to the electric grid as well as financial benefits to the car owner. Section 5. Demand Response, and Section 6. Smart Grid offer more discussion of the approaches and measures to address the potentially adverse impacts of plug-in electric vehicles.

For discussion of plug-in electric vehicles, please see Section 9, Transportation Fuels.

5.5.4 Recommended Actions to Support Peak Demand Reduction

SANDAG, local governments, or other regional entities can undertake the following actions to support reduced peak demand for electricity. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions also would contribute to other energy goals, and the peak demand goal would be enhanced by the recommended actions identified in other topic areas, as described below.

Recommended Actions to Support Peak Demand Reduction	
Local Governments	Recommended Action
PD-1	Participate in peak demand reduction programs and undertake peak demand reduction measures at local government facilities.
PD-2	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.
PD-3	Develop policies to reduce energy use in existing buildings.
SANDAG, Local Governments, or other Regional Entities	Recommended Action
PD-4	Support fair and reasonable rate designs and incentives that encourage customers reduced electricity consumption during peak demand periods.
PD-5	Support the establishment of building retrofit programs or other mechanisms that can reduce energy consumption during periods of peak demand, such as heating, ventilation and air conditioning (HVAC) systems.
PD-6	Provide information and resources to help residents, businesses, developers, builders, non-profits, agencies, jurisdictions, schools, colleges and universities, and other institutions understand individual and community costs associated with peak electricity demand.
PD-7	Monitor regional peak demand and measure the impacts of efforts to reduce peak demand.

5.6 Smart Grid

Introduction

The smart grid concept is generally characterized by increased use digital communication and control technologies across the entire electric transmission and distribution system. An intelligent electric grid could help the region achieve many of the goals included in this strategy, including increasing renewable energy, integrating electric vehicles, increasing energy efficiency and demand response, and increasing use of distributed generation. Smart grid technologies and strategies also can support other important goals, such as increased power reliability and cost savings for both the utility and end user. The smart -grid can accurately report power outages to the utility and customers, which may reduce their frequency and duration.

Smart Grid Goal:
Modernize the electricity grid with smart meters, smart end-use devices, and interactive communication technologies.

Smart meters and advanced metering infrastructure can automate utility billing, optimize electricity resources connected to the grid, and provide energy consumers with greater information on their electricity use. Smart meters are designed to give consumers access to their previous day's electricity consumption and electricity cost information via the internet. 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.

Table SG-1. Summary of San Diego Smart Grid Study Cost-Benefit Analysis Results

Total Annual Benefits	\$141 million
System Benefits (20 years)	\$1,433 million
Societal (Consumer-side) Benefits (20 years)	\$1,396 million
Total Capital Cost	\$490 million
Annual Operating and Maintenance Cost	\$24 million

Source: Energy Policy Initiatives Center, 2006

Smart grid implementation can occur at a region-wide and smaller or micro-grid level. For instance, the University of California, San Diego was awarded a U.S. Department of Energy grant to create a campus micro-grid combining fuel cells and advanced energy-storage technologies. The project will demonstrate smart grid benefits at a campus scale.

In 2006, the Energy Policy Initiatives Center (EPIC) of the University of San Diego released the San Diego Smart Grid Study, which included extensive analysis of the technologies, utility and societal costs and benefits as depicted in Tables SG-1 and SG-2, as well as scenarios for implementing a smart grid in the San Diego region⁷.

As the results show, the benefits of modernizing the electric grid through smart grid technologies far outweigh the costs. By supporting implementation of the smart grid, SANDAG and local governments can help residents and businesses save money on energy, increase job creation and regional GDP, protect environmental resources like air quality and habitat, and reduce peak demand. Smarter communications also will improve reliability and reduce outages, as well as enable electric vehicles, renewable energy, and distributed generation technologies to be accurately integrated into the electricity grid.

⁷ In the study, societal benefits are those benefits that accrue to non-utility stakeholders (i.e. the region at large) and represent such things as fewer outages resulting in avoidance of lost revenue to local businesses, job growth, and an increase in high-tech businesses that require and value high power reliability (e.g., biotech, pharmaceutical and research and development) and the resultant economic development attributes. System benefits are those benefits that can be achieved through the operations of the grid system.)

Table SG-2: Smart Grid Benefits for the San Diego Region

Benefit Type	Societal Benefits	System Benefits
Reduction in congestion cost	-	\$13.1 million
Reduced blackout probability	\$1.5 million	-
Reduction in forced outages/ interruptions	\$38.6 million	-
Reduction in restoration time and reduced operations and management due to predictive analytics and self healing attribute of the grid	-	\$11.3 million
Reduction in peak demand	-	\$25.6 million
Other benefits due to self-diagnosing and self-healing attribute of the grid	-	\$0.2 million
Increased integration of distributed generation resources and higher capacity utilization	-	\$14.7 million
Increased security and tolerance to attacks/ natural disasters	-	\$1.2 million
Power quality, reliability, and system availability and capacity improvement due to improved power flow	\$1.3 million	-
Regional job creation and increased Gross Domestic Product (GDP)	\$28.3 million	-
Increased capital investment efficiency due to tighter design limits and optimized use of grid assets	-	\$0.2 million
Tax benefits from asset depreciation, tax credits, and other	-	\$3.1 million
Environmental benefits gained by increased asset utilization	-	\$2.4 million
Subtotals	\$69.7 million	\$71.8 million
Total	\$141.5 million	

Source: Energy Policy Initiatives Center, 2006

5.6.1 Recommended Actions to Support the Smart Grid

SANDAG, local governments, or other regional entities can undertake the following actions to support the smart grid. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by the recommended actions identified in other topic areas, as described below.

Recommended Actions to Support the Smart Grid	
SANDAG, Local Governments, or other Regional Entities	Recommended Action
SG-1	Support efforts to modernize communications across the electricity grid through implementation of smart grid technologies and strategies in the San Diego region.
SG-2	Support mechanisms that encourage installation of smart appliances that interface with smart meters and provide real time electricity pricing information to electricity consumers.
SG-3	Support rate structures that reflect the real time price of electricity.
SG-4	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.
SG-5	Support educational information on the regional deployment of the smart grid and smart meters.
SG-6	Support regional entities such as universities and the utility in acquiring state and federal funds to implement components of the smart grid in the San Diego region.

5.7 Natural Gas Power Plants

Introduction

Despite long-term efforts to promote preferred resources like energy efficiency, demand response, distributed generation, and renewable energy, natural gas power plants remain an important source of electricity for the region. State-of-the-art utility-scale natural gas plants will be

Natural Gas Power Plants Goal:
Increase overall efficiency of electricity production and support replacement of inefficient power plants consistent with the state's preferred loading order.

needed to reduce the GHG intensity of the region's energy supply, at least in the short-term. Natural gas power is needed to promote grid reliability as intermittent renewable resources like wind and solar power are integrated into the electricity mix. Intermittent renewables offset need for fossil fuel power generation, but existing technology does not allow wind and solar to be quickly dispatched to meet peak power needs; natural gas peaker plants are therefore needed for this crucial function.

While the region mostly uses natural gas to generate electricity, natural gas also is used for end uses like space heating and water heating for homes and buildings, industrial processes, distributed energy systems, and increasingly in the transportation sector. This section focuses on use of natural gas for power plant electricity generation. Other natural gas applications are addressed in the following sections of the RES: 5-1 - Energy Efficiency and Conservation, 5-2 – Renewable Energy, 5-3 – Distributed Generation, 5-5 – Peak Demand, and 5-8 – Transportation Fuels.

5.7.1 RES Approach to Natural Gas Use for Transportation, End-Uses, and Electricity Generation

While it may seem contradictory, the energy strategy calls for increased use of natural gas for certain transportation applications, decreased use of natural gas for end-uses like water heating, and more efficient use of natural gas in electricity generation. This reasoning is primarily based on the availability of alternative technologies in these unique sectors. For example, increased use of natural gas in transportation applications like heavy-duty trucks and transit buses can displace petroleum consumption, reduce air pollution, and lower GHG emissions compared to the conventional diesel alternative. For at least the near-term, natural gas is one of the best options in the heavy-duty transportation sector. By contrast, for end-uses like water heating, gas can be replaced with proven solar water heating technology, so the RES calls for decreased use of natural gas in these types of applications. And while renewable resources like solar and wind offer superior environmental benefits for electricity generation, existing

technologies do not have the capability of providing the same supply benefits as natural gas-fired power plants. As a result, the RES identifies more efficient natural gas plants as a needed component of the region's electricity resource mix.

5.7.2 California Policies Related to Natural Gas Power Plants

The following key policies affect natural gas power plants:

- State Water Resources Control Board's (SWRCB) Once Through Cooling Resolution (2006) seeks to reduce marine impacts from once through cooling systems used by 21 coastal power plants in California, including natural gas and nuclear plants. This began a coordinated process between several government agencies to phase out the use of once through cooling (described in further detail in the following section).
- Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006) limited long-term investments in baseload generation by the state's utilities to power plants that meet a GHG emissions performance standard (EPS) jointly established by the Energy Commission and the CPUC. The regulations require a baseload standard for generation of 1,100 lbs CO₂ per megawatt-hour, roughly equivalent to the emissions of a combined cycle natural gas power plant.
- 2005 and 2007 Energy Commission IEPR Policy on Aging Power Plants recommended that the CPUC require IOUs to procure enough capacity from long-term contracts to allow for the orderly retirement or re-powering of aging plants by 2012. In the 2007 IEPR, the Energy Commission recommended that California's utilities adopt all cost-effective energy efficiency measures for natural gas, including replacement of aging power plants with new efficient power plants. In addition, the 2007 IEPR recommended the Energy Commission, the CPUC, the California ISO, and other interested agencies work together to complete studies on the impacts of retiring, re-powering, and replacing aging power plants, particularly in Southern California.
- The ARB Climate Change Scoping Plan calls for industrial facilities, such as power plants, to implement cost-effective GHG emissions reduction strategies. Specifically, the Climate Change Scoping Plan requires a reduction in GHG emissions from fugitive emissions from oil and gas extraction and gas transmission. The policies directing the state to meet climate change goals, such as the Renewable Portfolio Standard, intend to reduce the state's dependence on fossil fuels—such as natural gas—and replace these with cleaner fuel resources.
- The State Water Resources Control Board (SWRCB) draft policy for addressing OTC calls for replacing existing once through cooling facilities with some combination of re-powered technologies onsite, new generation located in other areas, and/or upgrades to the transmission system.

Natural Gas Power Plants in the San Diego Region

The major existing natural gas-fueled power plants in the region include the aging and less efficient Encina plant in the City of Carlsbad and South Bay plant in the City of Chula Vista, as well as the newer Palomar plant in Escondido and the newer plant at Otay Mesa. There are also a number of smaller plants, including cogeneration facilities, which generate electricity at high overall efficiency rates when use of ancillary heat is taken into account.

Power plants are the region's largest users of natural gas, and some of the older plants are inefficient relative to the latest technology, combined cycle gas turbine plants. Natural gas is a low polluting fossil fuel, and is the primary fuel used for in-state power generation due to its clean burning characteristics and stringent state emissions requirements. Natural gas provides approximately 56 percent of power plant electricity generation in the region. The region will need to rely on natural gas plants for part of its fuel supply for the foreseeable future to provide dispatchable power when the electricity system requires it.

All natural gas is produced outside of the San Diego region, and some even outside the nation. It is imported into the region through pipelines to end users. SDG&E is the region's distributor of natural gas. A reliable infrastructure system is needed to support the receipt and delivery of adequate supply to the region and keep prices low.

5.7.3 Natural Gas Power Plants and Once Through Cooling

The Encina and South Bay power plants use once through cooling, a process by which water is drawn directly from a source water body, used to absorb heat, and then discharged back into the source water body at elevated temperatures. Because the water is not re-circulated, this process can require millions of gallons of water per day. Marine impacts from once-through cooling power plants are another major environmental concern of natural gas power plants. These plants pump large amounts of ocean, bay, or estuary water each day, impinging on fish, invertebrates, and crustaceans, destroying thousands of fish eggs and larvae, and harming marine organisms with heat discharged water.

As part of an interagency working group, the Energy Commission, CPUC, and California ISO have been working with the SWRCB to outline a proposal to maintain electric grid reliability while reducing once through cooling coastal power plants, including those in the San Diego region. The SWRCB has issued a compliance schedule for retiring, refitting, or repowering OTC plants to comply with federal water policy.

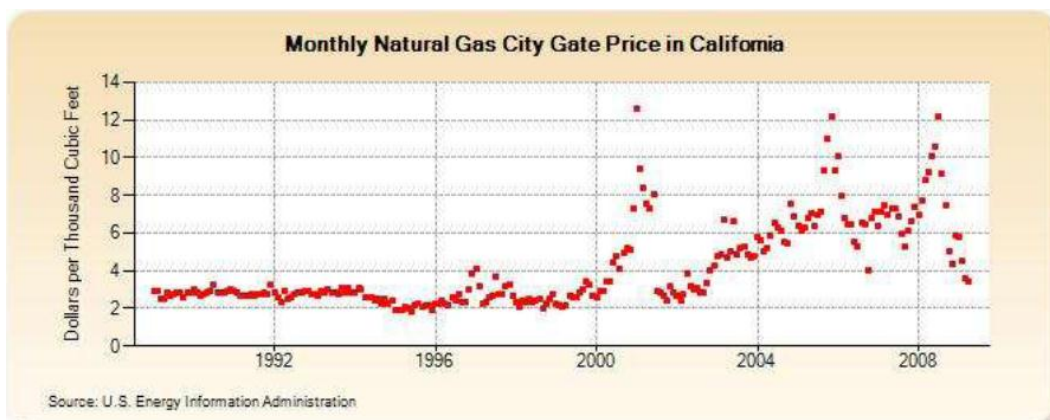
New generating capacity will be needed to replace OTC power plants. The SWRCB draft policy calls for replacing existing OTC facilities with some combination of re-powered

technologies onsite, new generation located in other areas, and/or upgrades to the transmission system. In addition, demand response programs (discussed in Section 5) can offset the need for some natural gas peaker plants. Replacement power sources will have to meet local air quality requirements. In some cases emission offsets will have to be obtained before replacement power can be built, which can be challenging. For example, in order to cite the Otay Mesa power plant, Calpine agreed to replace over 100 Waste Management diesel-powered trash haulers with liquefied natural gas (LNG) vehicles and construct an LNG fueling station in the City of El Cajon. The emission reduction credits earned through the cleaner-burning LNG vehicles and fueling station allowed construction of the needed power plant.

5.7.4 Natural Gas Prices

At present, California imports about 87 percent of its natural gas needs from out of state, and at the same time in-state production is decreasing. Natural gas markets have been proven to be very volatile over the last decade, thus most price forecasts are unreliable. Federal changes in energy policy will likely impact natural gas markets, creating some uncertainty for California and the San Diego region regarding access to stable, reasonably priced supply. For example, the establishment of federal carbon caps or laws to reduce GHG emissions will likely cause many states that rely heavily on coal for electricity generation to switch to natural gas power plants. What effect federal policy changes will have on supply that currently comes to California is not known. Natural gas prices and volatility also are affected by factors such as supply and demand imbalances, infrastructure (storage and pipeline) issues, the weather, regional and global economic conditions, speculative trading, market manipulation, and unreliable data and drilling technologies and rig deployment.

Figure NG-1: Monthly Natural Gas City Gate Price in California



Recent technological advancements in exploration, drilling, and hydraulic fracturing have transformed shale formations from marginal natural gas producers to substantial and expanding contributors to the nation's natural gas portfolio. Recoverable shale reserve estimates range as high as 842 trillion cubic feet, a 37-year supply for the U.S. at today's consumption rates. However, while natural gas production from shale formations has significantly increased domestic production, there is ongoing investigation of potential environmental concerns related to shale gas development, including the potential for increased GHG emissions and groundwater contamination from the activities required to extract the gas.

Past efforts to forecast natural gas prices have been highly inaccurate compared to actual prices, even when price volatility was largely dominated by traditional, physical market factors. Recent natural gas price volatility is at least partially explained by evolving, less traditional, financial market factors that are complicating efforts to accurately forecast future natural gas prices. Additionally, as the United States continues moving to a carbon-constrained economy, GHG policies will further complicate these efforts, likely rendering future natural gas price forecasts even less accurate and more uncertain. The uncertainty associated with predicting major input variables and the resulting natural gas price forecasts brings into question the value in producing date specific, single-point natural gas price forecasts.

5.7.5 Recommended Actions for Supporting Replacement of Inefficient Natural Gas Power Plants

SANDAG, local governments, or other regional entities can undertake the following actions to support replacement of inefficient natural gas power plants using OTC technology, consistent with state policy. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions to Support Natural Gas Power Plants

SANDAG, Local Governments, or other Regional Entities	Recommended Action
NG-1	Support the re-powering, replacement, or removal of older, inefficient coastal power plants in the region with the most efficient natural gas technology or renewable sources in other areas, or transmission upgrades, as needed -- consistent with state policy direction to address aging power plants and those with once through cooling.
NG-2	Monitor the availability and price of natural gas.
NG-3	Monitor and evaluate regional natural gas storage and pipeline capacity to accommodate future demand.
NG-4	Support policies that reduce regional exposure to natural gas market volatility.

5.8 Transportation Fuels

Introduction

The region can improve air quality, promote public health, protect against petroleum price volatility and supply uncertainty, reduce GHG emissions, and benefit the economy by substantially improving the transition to alternative fuel vehicles in the region. Passenger vehicles, heavy-duty trucks and buses, aircraft, watercraft, off-road vehicles, and rail transportation can each improve the efficiency of fuel consumption or operate fully or in part on fuels other than gasoline or diesel.

Transportation Fuels Goal:
Substantially increase the deployment of alternative transportation fuels and vehicles.

Alternatives to petroleum-based fuels include:

- Biofuels (ethanol and biomass-based diesels), electricity, hydrogen, natural gas, and liquefied petroleum gas (LPG or propane);
- Electricity, which can displace the most petroleum and reduce GHG emissions (electric drives are able to utilize renewable energy as a fuel source, and existing electricity infrastructure in the region would facilitate the deployment of this alternative fuel faster than others);
- Hydrogen and renewable biofuels, which also offer significant GHG emission and petroleum reduction benefits, but significant economic and technological barriers must be overcome before these fuels can be deployed on a large scale; and
- Natural gas and propane, which can also achieve economic and environmental benefits for the region, but of a more modest nature.

Please consult the SANDAG Regional Alternative Fuels, Vehicles, and Infrastructure Report for a detailed assessment and comparison of petroleum-based and alternative fuels, vehicle technologies, and infrastructure.

Alternative fuels and vehicle technologies, although generally offering more benefits than petroleum, are not without potential drawbacks. For example, natural gas is a finite fossil fuel, as is propane, with many other important applications including electricity generation, residential and commercial end uses like space and water heating, as well as the raw material in fertilizers critical to food production. Electric vehicles, deployed on a large scale, would have a potentially significant impact on the electricity grid. In addition, there is a limited amount of land to produce feedstocks for biofuels, and hydrogen fuel must be created from another energy source like natural gas or electricity. Moreover, production of alternative fuel vehicles is an energy-intensive process that requires the extraction of raw materials, industrial assembly, and typically

long-distance distribution to customers. A careful, holistic approach to the use of alternative transportation fuels will help the region minimize the unintended consequences of a transition to alternative fuels and vehicle technologies.

State and federal energy policy provides significant opportunities for the region to increase the deployment of alternative fuel vehicles and infrastructure, including funding and tax credits. Moreover, 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. Hydrogen, natural gas, and propane are also the focus of public and private sector research and dollars.

Government funding sources include the Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act (Assembly Bill 118, 2007). As part of the AB 118 Investment Plan, the Energy Commission performed a gap analysis to help determine where best to apply state funding for alternative fuels. They found that overall funding from federal, state and private sources totaled about \$35 billion per year and that biofuels was the most funded fuel category. Of the \$35 billion, research and development (R&D) expenditures totaled about \$11 billion per year with most funding focused on biofuels, followed by fuel cells and batteries.

Overall, federal funding for alternative fuels has focused on three primary areas: next generation biofuels processes and pilot plant construction; energy storage; and plug-in hybrid electric vehicles. The federal stimulus bill allocates \$3 billion for transportation programs and an additional \$2 billion to transportation-related tax incentives. The Energy Commission has stated it will work with the DOE to leverage AB 118 funds and support projects in the clean energy sector that provide long-term economic benefits and promote sustainability.

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 SDG&E. SANDAG will also partner in the recently-announced ARRA funded project between eTec and Nissan North America ([The EV 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.

It should be noted that the future of alternative fuels in general, as well as individual technologies, is uncertain. While this strategy attempts to identify broad future trends in alternative transportation fuels, the many variables that affect these trends can be

unpredictable, including but not limited to national and global economic conditions, the price and availability of crude oil and natural gas, national and global energy policy, technological developments, and levels of state and federal funding and support. This alternative fuels strategy should be revisited and revised as needed in the case that any of these or other important variables change significantly.

Increasing efficiency and reducing the growth in vehicle travel demand are also essential components of a comprehensive approach to achieving goals for air quality, climate change, public health, and energy security. Measures to reduce vehicle travel demand are discussed in Section 9. Land Use and Transportation Planning.

5.8.1 Passenger Cars and Light-Duty Trucks

California has developed a 2050 vision for alternative fuels and vehicles based on fair-share GHG emission reductions from passenger vehicles. Although transportation accounts for a larger proportion of regional than statewide emissions and a fair-share approach is not established by statute, the vision illustrates the magnitude of change the region must undergo over the next four decades. By 2030, the horizon year of the RES, substantial progress toward this vision must be achieved. Major attributes of the state's 2050 vision include:

- Average vehicle fuel economy of 60 miles per gallon (mpg); 80 mpg equivalent for electric vehicles, significantly higher than current average of about 22 mpg;
- Fuel mix consisting of 40 percent electricity and hydrogen, 30 percent biofuels, and 30 percent petroleum-based fuels, substantially different than existing supply of nearly 100 percent petroleum;
- Carbon intensity reductions of 90 percent below today's gasoline vehicles for electricity and hydrogen, 80 percent for biofuel vehicles, and at least 10 percent for other fuel and vehicle types;
- Per-capita vehicle miles traveled (VMT) of about 8,200, approximately 20 percent lower than projected statewide for 2050 without change in policy or behavior (about 14 percent lower than the regional 2030 projection); and
- Transportation measures complemented by changes to land use policies in order to realize full GHG reductions.

The Regional Alternative Fuels, Vehicles, and Infrastructure Report provides a detailed analysis of alternative fuels and vehicles, including recommendations for passenger cars and light-duty trucks. At least for the near-term, plug-in hybrids and electric vehicles are the priority alternative fuel and vehicle recommendations for the region. Electricity can achieve significant GHG and petroleum reductions, and electric charging points are relatively inexpensive. Electric vehicles will likely first become available to the region in 2010, with additional automaker vehicle rollouts over the next two to five years. While

hydrogen and biofuels (when produced from renewable sources) show potential to significantly reduce petroleum consumption and GHG emissions, there are technological and economic barriers to making these alternative fuel sources commercially viable. The cost and availability of infrastructure and fuel production (as well as vehicles for hydrogen) currently makes hydrogen and renewable biofuels uncompetitive with other alternative fuels. If these technologies become commercially viable on a large scale, they could offer benefits of a similar level to plug-in hybrids and electric vehicles. Natural gas and propane can help the region achieve modest near-term benefits, although not of equal magnitude to plug-in hybrids and electric vehicles. Long-term, natural gas and propane will comprise a minor portion of the passenger vehicle fleet. Government coordination of public access to electric charging and alternative fueling infrastructure is required to support private sector rollout and purchase of vehicle and fuels in the San Diego region.

5.8.2 Heavy-Duty Trucks and Buses

Although heavy-duty trucks and buses represent a small portion of transportation fuel consumption relative to passenger vehicles, there are opportunities to reduce petroleum energy consumption from the movement of people and goods by transitioning heavy-duty trucks and buses to alternative fuels. Other heavy-duty vehicles such as trash haulers and street sweepers can operate on alternative fuels and efficient vehicle technologies. The emerging fuels and vehicle technologies included in this analysis are renewable diesel, hydraulic hybrids, battery-electric hybrids, full-electric vehicles, hydrogen fuel cells, propane, CNG, and LNG.

The state's 2050 vision for heavy-duty vehicles foresees CNG, LNG, propane, biodiesel and hybrid technologies with the greatest potential for displacing petroleum-based fuels and improving efficiency. Biodiesel blends up to B20⁸ can be used in most existing vehicles and equipment, when consistent with manufacturer warranty. Changes in diesel engines may allow the use of blends greater than B20, while efforts to produce biodiesel from renewable feedstocks like algae and waste may be commercially viable within the timeframe of the RES. Natural gas is recommended for heavy-duty trucks and buses: CNG is best suited for short- and medium-haul applications, while LNG is better suited for longer distances. Both propane and natural gas can be applied to more medium-duty vehicles like vans and cargo trucks. Hybrid electric and hydraulic hybrids are viable options for a variety of medium and heavy-duty applications like refuse trucks, drayage trucks, and utility trucks as well as transit and school buses. Where opportunities arise to incorporate electricity and hydrogen fuels into the heavy-duty vehicle sector, the region should take advantage of them. However, electricity and

⁸ Biodiesel can be legally blended with petroleum diesel in any percentage. The percentages are designated as B20 for a blend containing 20% biodiesel and 80% petroleum diesel. B20 is the most common biodiesel blend in the United States.

hydrogen will play an important, but likely smaller role in the heavy-duty truck and bus sector.

Additional information on statewide goods movement goals and policies is available in the California Goods Movement Action Plan. SANDAG also participated in the development of the Multi County Goods Movement Action Plan along with five other Southern California counties.

It should be noted that, after air transport, heavy-duty trucks are the least efficient form of goods movement. Rail and ocean-based goods movement are more energy efficient modes than heavy-duty trucks.

5.8.3 Regional Planning for Alternative Fuels and Vehicles

Siting alternative fueling stations, electric charging points, vehicle maintenance facilities, and other infrastructure in coordination with vehicle availability and purchases is of critical importance to a successful transition to alternative fuel vehicles in the on-road transportation sector. Such coordination is needed to provide customers like fleet managers and the general public with a level of certainty that infrastructure will be available to support their investment in an alternative fuel passenger vehicle. Planning for truck stop electrification (TSE) and anti-idling (AI) measures can help save energy from heavy-duty trucks in the goods movement sector. Outfitting the region with electric charging points and alternative fuel infrastructure can also help attract private investment associated with alternative transportation to the region.

SANDAG is a logical entity for coordinating the planning of alternative fuel infrastructure and identifying suitable locations for infrastructure. As a regional planning agency, SANDAG can ensure that alternative transportation considerations are integrated with development of the regional transportation network and recommend specific alternative fuel and vehicle technologies for different transportation sectors that are tailored to the unique characteristics of the region. In addition, SANDAG can facilitate vehicle and infrastructure deployment through actions such as development of a unified regional vision, identification of funding opportunities and coordination of funding applications, and development of standardized guidelines for infrastructure siting, permitting, and education. Please see the SANDAG Regional Alternative Fuels, Vehicles, and Infrastructure Report for a detailed assessment of alternative fuels, vehicles, infrastructure status and additional requirements, and recommended actions for the San Diego region.

5.8.4 Recommended Actions to Support Increased Use of Alternative Transportation Fuels

SANDAG, local governments, or other regional entities can undertake the following actions to support increased use and deployment of alternative transportation fuels and technologies. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals; likewise, the alternative transportation fuel goal can be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions to Support Increased Use of Alternative Transportation Fuels	
SANDAG, Local Governments, or other Regional Entities	Recommended Action
TF-1	Create an action plan that incorporates alternative fuel vehicles into SANDAG and local government-owned vehicle fleets, and the vehicle and equipment fleets of contractors and funding recipients, such as the vehicle fleet for the SANDAG vanpool program or for local government trash haulers.
TF-2	Use the Regional Alternative Fuels, Vehicles, and Infrastructure Report and the RES as tools to support the integration of alternative transportation options into local government fleets, planned regional transportation projects, and future updates of the Regional Transportation Plan and the Regional Comprehensive Plan.
TF-3	Develop a regional approach to infrastructure planning for alternative fuels by facilitating continued development of a public-private strategic alliance.
TF-4	Support electricity and natural gas tariffs that encourage their use as transportation fuels.
TF-5	Develop streamlined permitting requirements and standardized design guidelines and siting criteria for all types of electric charging stations (e.g., single- and multi-family residential, commercial, public access, etc.).
TF-6	Accelerate the transition to plug-in hybrid electric and battery electric vehicles by developing a regional plan for the installation of a public access electric car charging network, as recommended in the Regional Alternative Fuels, Vehicles, and Infrastructure Report.
TF-7	Analyze the potential impacts of widespread plug-in hybrid and electric vehicle deployment on the electricity grid.

5.9 Land Use and Transportation Planning

Introduction

5.9.1 Energy and the Built Environment

Regional energy consumption is strongly related to urban form, the physical features and composition of the built environment. The built environment is comprised of the building stock, land use pattern, transportation network, open space system, and distribution of other public facilities such as parks and schools. In turn, the energy

demand of the built environment is strongly dependent upon the design and orientation of buildings, distribution and density of development, types of transportation infrastructure and policies, and the design of public facilities. Although there is considerable variation throughout the region, the existing built environment generally features segregation between land uses and transportation systems and policies and urban design that favor the automobile over biking, walking, and public transit. In addition, many existing buildings are relatively energy inefficient compared to requirements for new construction, particularly those buildings constructed prior to the 1980s. To a large degree, these factors influence the amount of energy residents of the San Diego region consume in everyday activities by influencing travel modes and distances and the type and amount of energy they use⁹. In fact, personal vehicle use (e.g., passenger cars; sport utility vehicles; pick-up trucks), residential electricity use and natural gas consumption together account for about 56 percent of total GHG emissions in the region, while the commercial and industrial sectors account for about 21 percent and 11 percent of total GHG emissions, respectively.

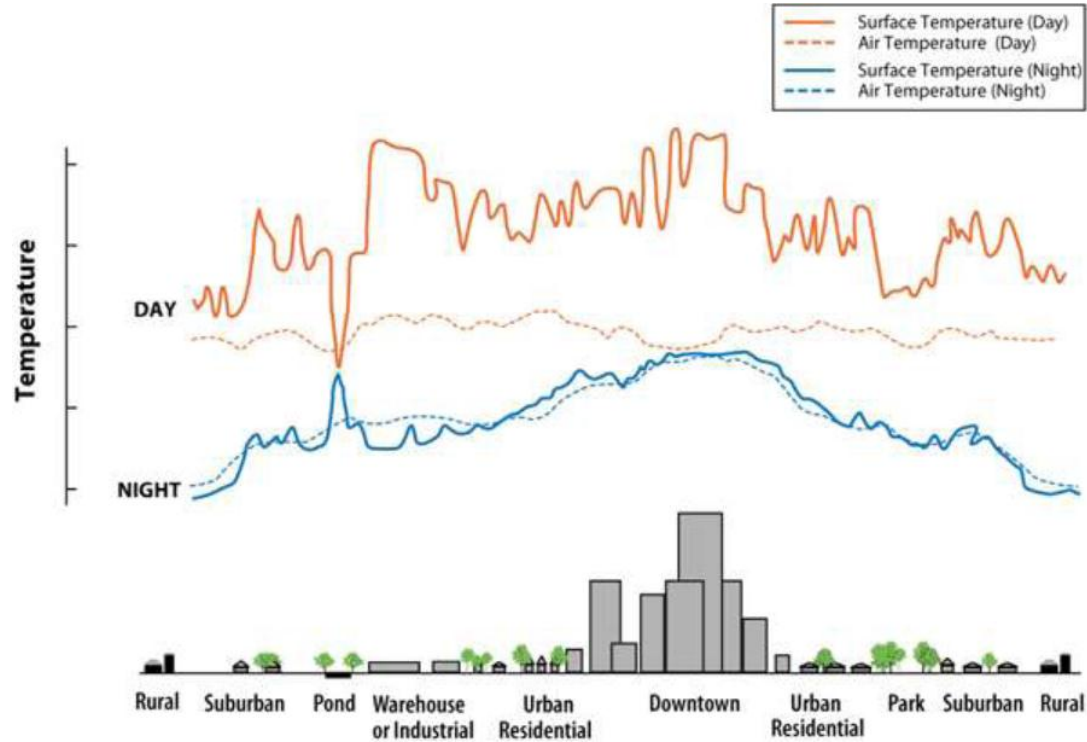
Exposed urban surfaces like roofs and pavement absorb heat and cause surface and air temperature in the built environment to become warmer than less developed or undeveloped areas through a process known as the urban heat island effect (Fig. LUPT-1). Several negative impacts are associated with urban heat islands, including increased energy demand for cooling during summer months, particularly during periods of peak electricity demand.

***Land Use and Transportation
Planning Goal:***

Reduce the energy demand of the built environment through changes in land use and transportation planning.

⁹ As of 2008, international travel into or out of Baja California, Mexico accounts for about three percent of total regional vehicle miles traveled. This figure is expected to increase to four percent by 2030.

Figure LUTP-1: The Urban Heat Island Effect



Source: United Environmental Protection Agency.

5.9.2 Government Influence Over the Built Environment

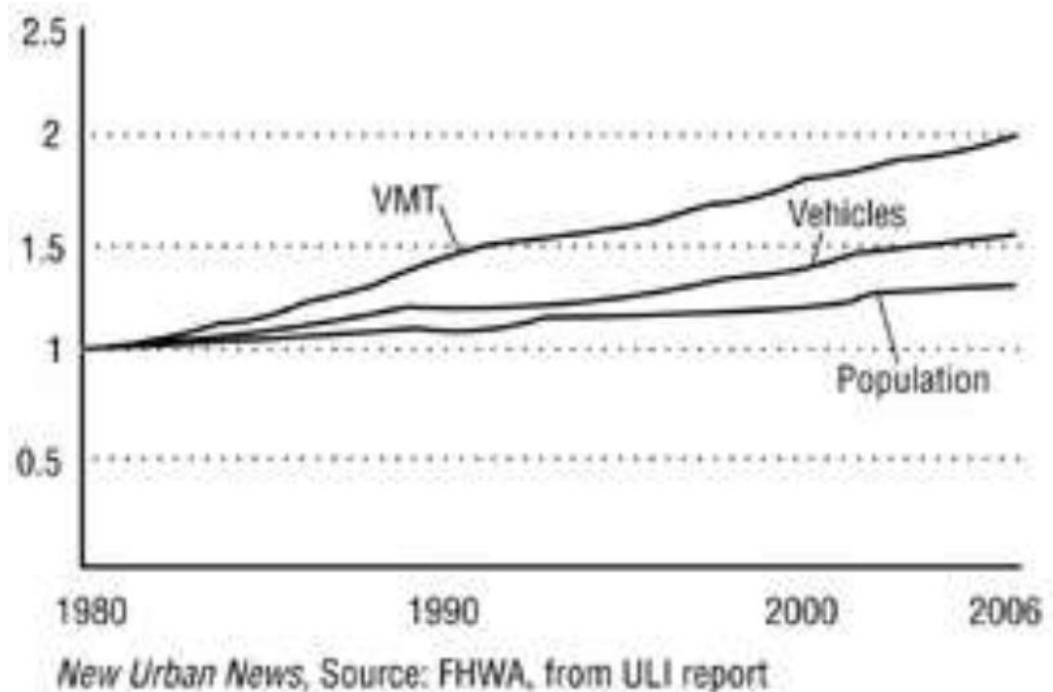
Local governments and SANDAG can influence the built environment, including the amount of energy consumed, through their ability to regulate, provide incentives, collaboratively plan, and make infrastructure investments that affect land use patterns, the transportation system, and other public infrastructure investments. Local governments' ability to influence building energy use, efficiency, distributed energy systems is discussed in Section 1 – Energy Efficiency and Conservation.

In addition, local governments can contribute to regional energy goals for increased distributed generation and large scale renewable power by considering the spatial requirements of energy infrastructure in local land use plans, ranging from on-site and distributed generation systems to larger- and utility-scale renewables, power plants, substations and transmission lines requiring larger areas of land. The RES provides policy guidance for local governments in their consideration of these issues. The approach of SANDAG and local governments to these issues will influence regional energy consumption, GHG emissions, types of available energy sources, and overall quality of life.

Land Use and Transportation Planning in the San Diego Region

A major objective of local land use and regional transportation planning is to identify the land and infrastructure needed to accommodate projected population, housing, and job growth while maintaining and enhancing quality of life. In the past, population, economic and job growth have resulted in increased total electricity, gasoline, and diesel consumption, and increased vehicle miles traveled (VMT). In fact, since 1980, national VMT has increased about three times faster than population growth, in large part due to auto-oriented development patterns, increasing vehicle trip distances, and declines in walking and public transit use (Figure LUTP-2). Relatively stable and low fuel prices also likely contributed to the past VMT growth rate.

Figure LUTP-2: Growth in Vehicle Miles Traveled, Vehicles, and Population in the US

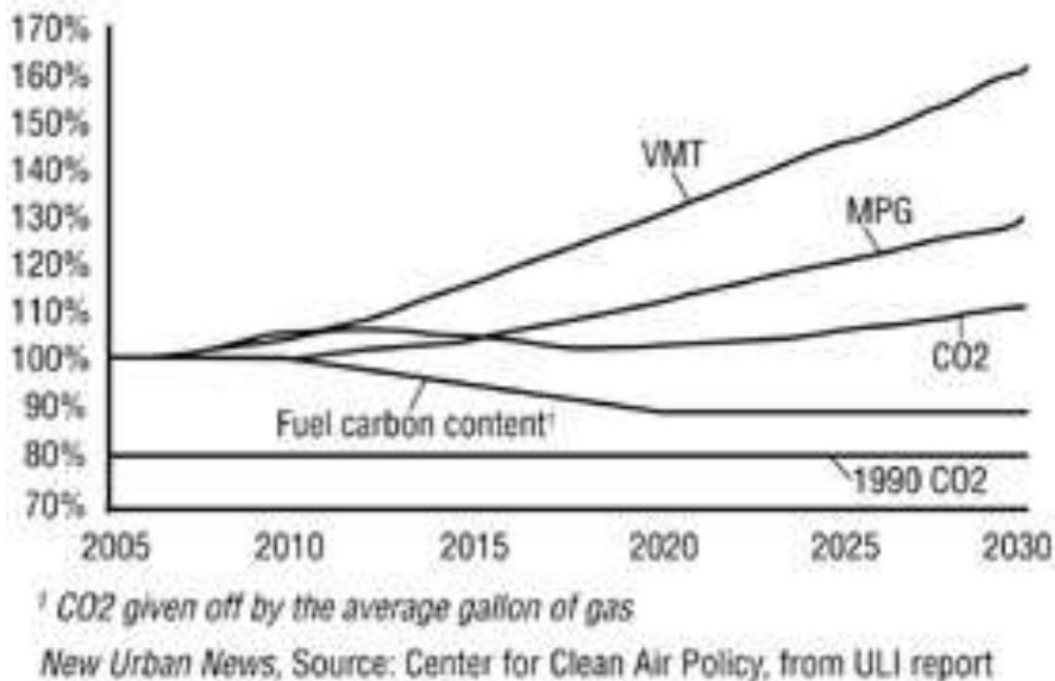


The relationship among population and economic growth, energy consumption and travel behavior will continue to follow past trends unless the region develops a new strategy for population growth and the built environment that addresses total VMT and the amount and types of energy used for transportation and to power buildings and industries. Moreover, as shown in Figure LUTP-3, efforts to reduce GHG emissions from on-road transportation through more fuel efficient vehicles and lower carbon fuels will fail if VMT continues to follow past trends and increase. Projections for all of California show that the state cannot reduce its GHG emissions to 80 percent of 1990 levels by 2050 unless VMT is reduced by at least 17 percent¹⁰. The trend of VMT growth must be

¹⁰ California Energy Commission, State Alternative Fuels Plan, December 2007, CEC-600-2007-011-CMF, p. 75, available at: [<http://www.energy.ca.gov/ab1007/index.html>].

slowed, stopped, and eventually reversed in order to successfully lower GHG emissions from the on-road transportation sector.

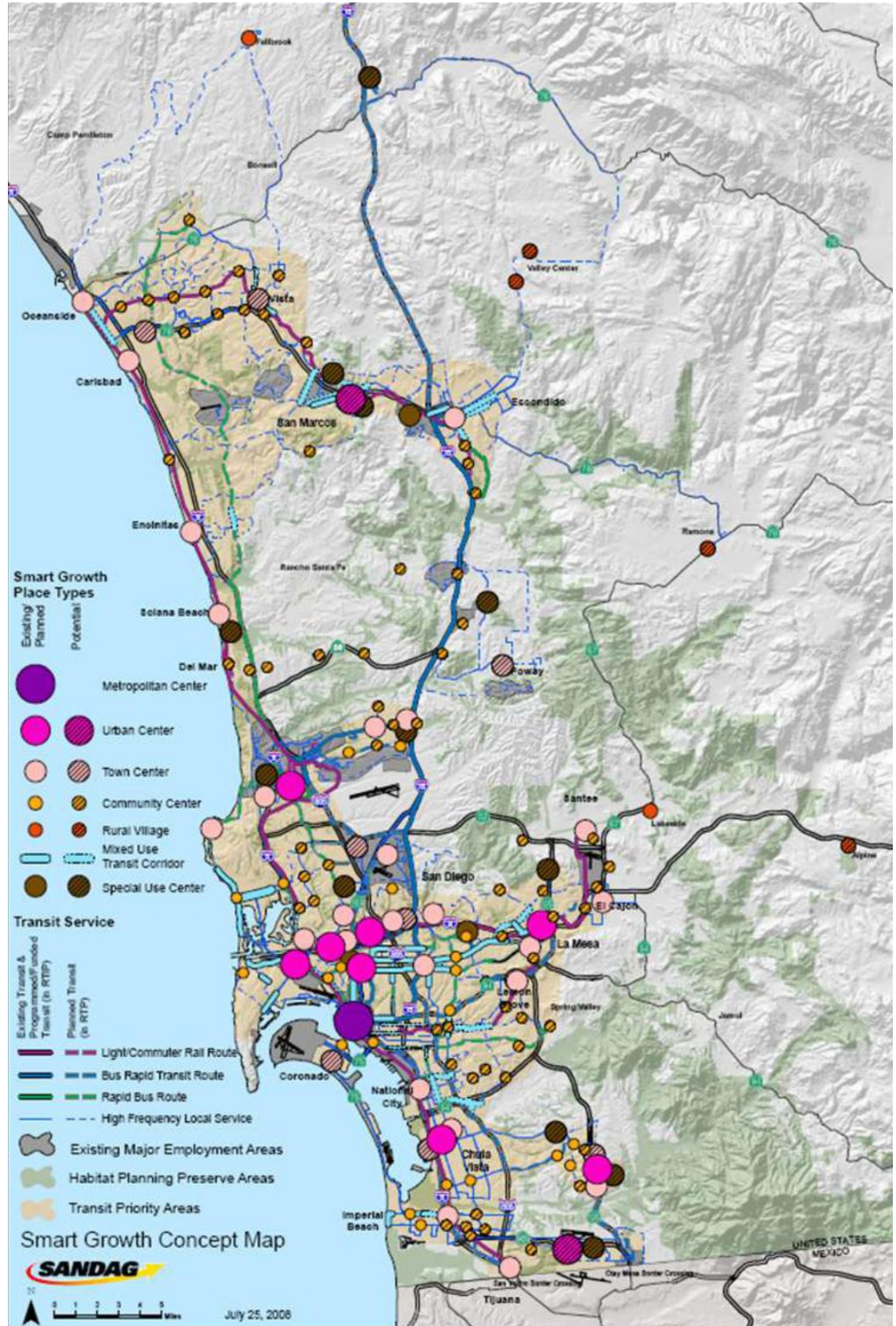
Figure LUTP-3: Projected US Mileage, Vehicles Miles Traveled, and CO2 Emissions



5.9.3 Existing Smart Growth and Transportation Planning Efforts

SANDAG and the local jurisdictions, through a collaborative process, have developed a strategy to accommodate projected growth based on an adopted smart growth policy. Under smart growth principles adopted by the SANDAG Board of Directors, smart growth opportunity areas are identified as places that could accommodate higher residential and employment densities within pedestrian-friendly activity centers connected to other activity centers by public transit. By promoting walking, bicycling, and public transit as viable alternatives to driving, and creating shorter vehicle trips, smart growth leads to lower total VMT. The Smart Growth Concept Map (Figure LUTP-4) illustrates the nearly 200 locations of existing, planned, and potential smart growth opportunity areas in seven smart growth place type categories, reflecting the notion that smart growth is not a “one-size-fits-all” concept. The Map also shows the relationship between smart growth areas and existing, planned, and potential public transit service. SANDAG uses the Map to provide funding for transportation and transportation-related infrastructure improvements and planning efforts that support smart growth development through the TransNet Smart Growth Incentive Program.

Figure LUTP-4: SANDAG Smart Growth Concept Map



The SANDAG Regional Comprehensive Plan – the blueprint for the region’s growth – describes the importance of better integrating smart growth development with transportation planning. SANDAG also updates the Regional Transportation Plan (RTP) every four years to allocate funding to implement the long-range vision for the regional transportation network to 2030. The adopted 2007 RTP is founded on four main components: (1) better integration of smart growth land use with the transportation system, (2) systems development including improvements to the highway, road, and public transportation systems, (3) systems management to make more efficient use of existing facilities and investments, and (4) demand management to encourage alternatives to driving alone and minimize demand during peak travel periods. These two plans are the broad framework for SANDAG land use and transportation planning efforts and are the foundation for developing other related plans.

5.9.4 Business-As-Usual Fuel Consumption and GHG Emissions Projections

The Environmental Impact Report (EIR) for the 2007 RTP projects that implementation of the set of transportation projects, funding allocations, policies, and adopted local land use plans identified in the RTP would increase annual gasoline and diesel fuel consumption by about 500 million gallons (31 percent) and 46 million gallons (23 percent), respectively, and GHG emissions by 30 percent by 2030, relative to baseline (2006) conditions. Population is expected to increase by about 32 percent by 2030, relative to 2006. In addition, total daily on-road gasoline and diesel fuel consumption per capita are projected to increase by about 4 percent, and daily VMT per capita is expected to increase by about 3 percent. This indicates that VMT and transportation-related energy use are projected to increase slightly faster than population growth under adopted regional transportation and local land use plans.

5.9.5 State Legislation related to Land Use and Transportation Planning: Senate Bill 375

The state’s Climate Change Scoping Plan and Senate Bill (SB) 375 (Statutes of 2008) emphasize the need to better connect land use plans with regional transportation networks to help achieve the state’s GHG emissions reduction target for 2020. SB 375 requires MPOs like SANDAG to create a Sustainable Communities Strategy (SCS) that integrates the transportation network with development patterns in a way that achieves GHG emissions reduction targets from passenger cars and light-duty trucks while meeting housing needs and other regional planning objectives.

SANDAG is required to develop a SCS demonstrating how changes to land use patterns, transportation infrastructure investments, funding allocations, and policies, or any other measures will achieve the targets to be established through the SB 375 process in the

next update of the RTP. Since the state and federal government regulate vehicle fuel economy and fuel carbon content, SANDAG is responsible for lowering GHG emissions through measures that reduce the amount of vehicle miles traveled and maximize the efficiency of vehicle travel. Potential land use and transportation-related policy measures available to help the region are discussed below, will be explored in greater detail in the forthcoming SANDAG Climate Action Strategy, and ultimately addressed in the next update of the SANDAG Regional Transportation Plan currently under preparation and scheduled for adoption in 2011, and the next update of the SANDAG Regional Comprehensive Plan, which is slated for preparation after the adoption of the RTP.

Addressing Energy and Climate Change through Land Use and Transportation Planning

5.9.6 Land Use and Transportation Strategies

In the past, energy-related criteria like gasoline and diesel consumption and GHG emissions were not explicit factors in land use and transportation planning in the region, in many other metropolitan regions of California, or in the U.S. However, past investments and decisions that shaped the region's land use patterns and transportation systems are major determinants of current and future energy consumption. Once in place, land use patterns and transportation infrastructure will likely remain part of the built environment and influence travel behavior and energy consumption for several decades, perhaps longer. As a result, it is imperative that future planning take into account the energy and 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 the region several years and decades into the future.

Past decisions and investments in areas like smart growth planning, public transportation, and demand management contribute to energy savings and climate change objectives. The connection between past and current these and other land use and transportation strategies and energy and climate change goals should be made explicit. Likewise, land use and transportation strategies that do not save energy or contribute to climate change objectives also must be recognized and understood. Generally speaking, segregated, low-density land use patterns and automobile-oriented transportation investments and urban design do not contribute to energy savings or GHG reduction.

There are many land use and transportation-related policy measure options available to help the region save energy and achieve the level of GHG reductions required by state policy and demanded by climate science. These options address vehicle travel, and

primarily seek to save energy and lower GHG emissions by decreasing the total amount of driving or vehicle miles traveled (VMT). Policy measure options to lower VMT include:

- Enhancing or expanding investments in public transportation, walking, and bicycling infrastructure;
- Increasing development of compact, mixed use projects and communities in which walking, bicycling, and public transit are convenient transportation options and vehicle trips are shorter; and
- Reducing transportation demand through policies like telecommuting, alternative work schedules, congestion, road, and parking pricing, and parking reform.

Land use and transportation-related policy options that address energy and GHG emissions but not necessarily VMT include:

- Measures to optimize the efficiency of vehicle travel by reducing congestion and limiting excessive vehicle speeds, and
- Installing publicly accessible infrastructure to support alternative fuel vehicle charging and fueling.

Further analysis of these broad land use and transportation policy measures is needed prior to their potential implementation to understand a variety of issues including their potential for fuel savings, contribution to near- and long-term cuts in GHG emissions, possible barriers to regional or local implementation, and their potential for regional economic, financial, environmental and social costs and benefits. Preliminary analysis of the policy measures will be included in the Climate Action Strategy, while additional analysis will be conducted for the next update of the Regional Transportation Plan, which is anticipated for adoption in 2011.

5.9.7 Non-Transportation Strategies

Land use plans and tools could more broadly address energy demand, supply, and infrastructure issues by broadening the smart growth planning efforts to include a comprehensive package of energy saving strategies. Some of the non-transportation related strategies that could fall under a broader definition of smart growth and produce significant energy savings within the region include:

- Increasing onsite production of renewable energy;
- Using distributed electricity generation;
- Orienting residences in relation to the sun;
- Increasing shading and incorporating roofs and pavements that reflect heat;
- Producing food locally;

- Improving energy efficiency in new construction and through existing building retrofits; and
- Smart community strategies (including the use of information technology to change how a community uses its physical space, which may also reduce the energy demand of the built environment by reducing the amount of vehicle travel).

A review of the region's existing land use and transportation planning strategies against the following general characteristics of low-energy demand built environments, at a minimum, would ensure that energy considerations are more fully integrated into the region's land use and transportation planning efforts. The SANDAG Smart Growth Design Guidelines include some discussion of important energy considerations such as renewable energy technologies like distributed photovoltaics, building orientation to promote solar access and natural ventilation, green building, and using tree planting and other techniques to minimize the urban heat island effect. The guidelines also discuss the energy saving and GHG reduction benefits of smart growth land use and alternative transportation choices like walking, bicycling, and public transportation.

General Characteristics of a Low-Energy Demand Built Environment

1. Building stock featuring energy efficiency, distributed generation, and solar orientation.
2. Compact land use patterns with convenient access to public transit, a mixture of land uses and a person's daily needs, and jobs-housing balance.
3. Transportation infrastructure and policies that reduce the amount of vehicle miles traveled and support high levels of use for energy efficient transportation choices like walking, bicycling, and public transit as well as alternative fuel vehicles.
4. Public realm designed to reduce urban heat island effect (e.g., increased tree and vegetative cover; cool pavements) and convey a scale and character that supports convenient access and energy efficient transportation choices.
5. Smart community strategies that deploy information technology to change how a community uses its physical space to save energy (e.g., telecommuting to avoid vehicle trips).
6. Consideration of spatial requirements of small- and large-scale energy infrastructure.

Since the existing built environment is the result of several decades of land use development and transportation investments, reducing energy demand within the region will likely be incremental in the near-term. However, by 2030, land use and transportation planning decisions made to accommodate future growth will likely have a large impact on the amount of energy consumed, the distribution of land uses,

efficient access to destinations, the design of the public realm, and how people travel. The evolution of the built environment will not only affect achievement of energy and climate change goals, but the region's ability to maintain and enhance residents' quality of life through co-benefits like improved public health and air quality. The region can lower the energy demand of the built environment through continued smart growth development, increased energy efficiency and distributed generation, improved urban design, and transportation planning and investments that reduce energy consumption.

5.9.8 Recommended Actions for Land Use and Transportation Planning

SANDAG, local governments, or other regional entities can undertake the following actions to facilitate reduced energy use in the built environment. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions for Land Use and Transportation Planning

SANDAG	Recommended Action
LUTP-1	Continue to encourage and assist local governments in implementing smart growth development (e.g., incorporating Potential Smart Growth Opportunity Areas into adopted land use plans, identifying new areas, and developing Planned Opportunity Areas) in part as a means to lower total vehicle miles traveled, save energy, and lower GHG emissions.
SANDAG, Local Governments, or other Regional Entities	Recommended Action
LUTP-2	<p>Support policy measures that promote the general characteristics of a low-energy demand built environment (described above), energy efficient transportation choices, and alternative fuels and vehicles in future updates of the Regional Transportation Plan, and Regional Comprehensive Plan, such as:</p> <ul style="list-style-type: none"> • Investments in pedestrian, bicycle, and public transit travel. • Measures to reduce transportation demand like telecommuting, congestion and road pricing as well as parking pricing and reform. • Compact, walkable, mixed-use and human-scale smart growth community design. • Measures to optimize the efficiency of vehicle travel conditions. • Infrastructure to support alternative fuel vehicle charging and fueling.
LUTP-3	Coordinate public investments related to transportation, energy, water supply, parks and open space and others in a manner that supports energy savings and climate change goals.
LUTP-4	Explore opportunities to support one or more demonstration projects in the region that exemplify adopted smart growth principles along with comprehensive energy saving strategies such as distributed photovoltaic installation and energy efficient improvements in building retrofits or new construction.
LUTP-5	Include comprehensive estimates of energy consumption and GHG emissions for land use and transportation planning scenarios at the regional, local, and project levels.

5.10 Energy and Borders

Introduction

Energy supply, usage, and conservation in the San Diego region are impacted by actions of its neighbors and vice versa. San Diego County borders include Orange, Riverside and Imperial Counties, Mexico, and 17 tribal governments¹¹ (the most in any county of the United States). Collaborative efforts are

Energy and Borders Goal:
Integrate energy considerations into existing and future collaborative border initiatives.

underway among SANDAG, its member agencies and its neighbors on various issues including transportation congestion management and goods movement. SANDAG and its member agencies can take steps to further integrate energy considerations into its border planning activities as the region strives to diversify its fuel sources, expand renewable energy resources, and address environmental and climate-related pollutants from transportation. The region cannot be successful in any of these areas without the involvement of its neighbors. Through its Borders Committee, SANDAG addresses policy issues related to cross-border planning from three perspectives—tribal, interregional, and binational.

5.10.1 Tribal Governments

The tribal governments in San Diego County and SANDAG are working together to develop and implement innovative government-to-government strategies to address transportation and other regional planning issues. Existing tribal coordination includes goals, policy objectives and actions focused on improving communication and collaboration with tribal governments in areas of regional importance such as economic development, transportation, housing and water supply. Energy can be integrated into these discussions in terms of transportation fuels, mobility choices, efficient building design and retrofits, renewable energy development, and water-energy issues.

In 2009, under a SANDAG-administered Caltrans Environmental Justice grant, the Reservation Transportation Authority (RTA) representing Southern California tribal governments completed a tribal transportation demand management (TDM) project to (1) facilitate staff training in TDM management practices; (2) develop a business plan for a tribal transportation management association (TTMA); (3) develop a marketing

¹¹ Federally recognized tribal nations in San Diego County: Barona Band of Mission Indians, Campo Kumeyaay Nation, Ewiiaapaayp Band of Kumeyaay Indians, Inaja-Cosmit Band of Mission Indians, Jamul Indian Village, A Kumeyaay Nation, La Jolla Band of Luiseño Indians, La Posta Band of the Kumeyaay Nation, Los Coyotes Band of Cahuilla/Cupeño Indians, Manzanita Band of the Kumeyaay Indians, Mesa Grande Band of Mission Indians, Pala Band of Mission Indians, Pauma-Yuima Band of Luiseño Indians, Rincon Luiseño Band of Indians, San Pasqual Band of Diegueño, Mission Indians of California, Santa Ysabel Band of Diegueno Indians, Sycuan Band of the Kumeyaay Nation, Viejas Band of Kumeyaay Indians.

strategy; (4) develop marketing materials, including a web site; (5) assess and survey the transportation and commuting needs of tribal enterprise staff in six locations; and (6) develop a collaborative TDM strategy with SANDAG with the potential establishment of a tribal TMA. A report was produced highlighting the work effort and partnership between SANDAG, RTA, and participating tribal government administrations. Because transportation staff capacity is often limited within most tribes, SANDAG can act as a regional partner bringing together the interests of diverse tribes and enabling the sharing of resources and information to address common transportation goals.

5.10.2 Interregional Coordination

During the 1990s, the San Diego region's average annual population growth rate paralleled the national average. However, growth rates in neighboring Orange, Riverside, and Imperial Counties during the same period were substantially higher. Through interregional coordination, neighboring councils of government and transportation planning agencies have begun to develop collaborative strategies in economic development, transportation, and housing. These collaborations will improve the quality of life for residents in each county by reducing the impacts of interregional commuting, creating more jobs in housing-rich areas and more housing in jobs-rich areas. SANDAG and its member agencies can foster the integration of energy considerations into existing interregional efforts, such as the voluntary partnership between Western Riverside and San Diego region centered on the two-county commute corridor along the Interstate 15. The I-15 Interregional Partnership (I-15 IRP) has completed three phases of work with notable products including identification of transit priority treatments and transit infrastructure development to support possible future Bus Rapid Transit (BRT) and commuter express on the I-15 and I-215 corridors, and creation of a pilot Smart Growth Opportunity Area Map for selected cities in Western Riverside modeled after the SANDAG Smart Growth Concept Map.

5.10.3 Binational Coordination

Given San Diego's unique position as an international gateway, binational coordination already exists to address economic development, homeland security and other pressing cross-border issues. In 2008, SANDAG hosted its annual binational event in which participants met to discuss smart growth issues, including climate change. The 2009 event focused solely on climate change initiatives on both sides of the border, and explored opportunities to share information and work together to address climate change. Continued coordination between California and Baja California can help identify common issues, interdependencies and policies and actions to address energy planning and infrastructure on both sides of the border.

5.10.4 Recommended Actions for Energy and Borders

SANDAG, local governments, or other regional entities can undertake the following actions to further integrate energy considerations into binational planning efforts. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals; likewise, the energy and borders goal can be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions for Energy and Borders	
SANDAG	Recommended Action
EB-1	Encourage regional coordination on energy and climate change issues in the border region that come within the purview of SANDAG including the Borders Committee, Committee on Binational Regional Opportunities, and the Regional Energy Working Group.
EB-2	Support measures related to cross-border goods movement that reduces petroleum use and GHG emissions from heavy duty vehicles.
SANDAG, Local Governments, or other Regional Entities	Recommended Action
EB-3	Support the integration of energy-saving measures for buildings, transportation and overall project design for the (re)development of the land Ports of Entry between San Diego and Baja California.
EB-4	Encourage conservation, energy efficiency, and peak demand reduction in San Diego and Baja California that relieve stress on the shared regional electricity system.
EB-5	Support coordination with binational stakeholders to explore opportunities for developing renewable energy that benefits the binational region.

5.11 Clean Energy Economy

Introduction

According to the California Economic Strategy Panel, green products and practices, including those in the Clean Energy Sector, can be found in the same industries as conventional products and practices. As such, an economic analysis of the type and amount of clean energy jobs (sometimes referred to as green jobs) and investment based primarily on tracking business and employment growth by industry is difficult to quantify. Table CEE-1 shows the types of industries and jobs that comprise the Clean Energy Sector:

Clean Energy Economy Goal:
Collaborate with workforce entities, employers, and labor unions to identify and expand local job placement mechanisms in the Clean Energy Sector.

- Clean Energy Sector jobs are defined as blue or white collar positions that:
- Preserve, restore, or improve the environment.
- Help save energy, advance new energy efficient technologies, or foster a more sustainable regional and national energy system.
- Have been updated to adopt sustainability as a core segment of the job description.
- Provide career pathway opportunities leading to sufficient income to support a household and potential for advancement.

Opportunities and advantages to the region from expanding the Clean Energy Sector:

- Creating new jobs or retraining the unemployed and under-employed in a time of economic downturn.
- Providing opportunities for career advancement in the sustainability fields.
- Reducing our dependence on foreign oil, and strengthening national security.
- Promoting the use of domestic renewable energy resources.
- Reducing high utility costs of energy-inefficient public buildings and public housing.
- Mitigating climate change by cutting GHG emissions.

Table CEE-1: Sample Jobs and Industries in the Clean Energy Sector

Strategies for Green Economic Investment	Representative Jobs
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit/Freight Rail	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
Smart Grid	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Laborers, Operating Engineers, Electrical Power Line Installers and Repairers
Wind Power	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Advanced Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Source: Political Economy Research Institute, University of Massachusetts-Amherst, 2008

Through 2019, significant investment will be injected into the Clean Energy Sector through the American Recovery and Reinvestment Act (ARRA) of 2009. Nationally, ARRA will provide \$787 billion of stimulus funding, with most made available in 2009-2011. As of June 2009, energy-related allocations to California are listed in Table CEE-2 below.

Table CEE-2: California ARRA Energy Funding as of June 2009

Program	Agency	Allocation
State Energy Program	California Energy Commission	\$226 million
Energy Efficiency and Conservation Block Grants	U.S. Dept. of Energy and California Energy Commission	\$352 million
Weatherization Assistance Program	CA Dept. of Community Services & Development	\$185 million
Science	U.S. Department of Energy	\$184 million
Environmental Management	U.S. Department of Energy	\$62 million
Biomass	U.S. Department of Energy	\$111 million

Source: California Energy Commission, 2009.

5.11.1 Growing Investment in the Clean Energy Sector

Even without ARRA funds, the Clean Energy Sector is expected to grow. Clean Edge, which tracks the growth of clean-tech markets, reports that global revenues for solar photovoltaics, wind power, and biofuels expanded from \$75.8 billion in 2007 to \$115.9 billion in 2008, an increase of about 53 percent. Clean Edge's 2009 energy trends study identified a 30 percent growth of clean energy venture capital investments as a percentage of total venture capital investments in U.S.-based companies from 2007 (9.1 percent) to 2008 (11.8 percent). In 2000, clean energy venture capital comprised only 0.6 percent of the total.

5.11.2 Job Creation by Clean Energy Sector

The influx of federal stimulus funding creates the potential for significant growth in the Clean Energy Sector. Various levels of job creation are identified in economic studies from the U.S. Environmental Protection Agency, American Council for an Energy-Efficient Economy (ACEEE), American Solar Energy Society (ASES), US Council of Mayors, University of California Berkeley, among others. In 2008, a comprehensive analysis of national energy efficiency and energy supply investments by ACEEE found that since 1970, energy efficiency and energy productivity gains have met 75 percent of new energy service demands in the U.S., while new energy supplies contributed 25 percent. A summary of revenues and job creation in the U.S. renewable energy and energy efficiency industries is provided in Table CEE-3.

Table CEE-3: Summary of U.S. Renewable Energy and Energy Efficiency Industries in 2006

Industry	Revenues	Direct Jobs Total	Jobs Created (direct and indirect)
Renewable Energy	\$39.2 billion	196,000	452,000
Energy Efficiency	\$932.6 billion	3,498,000	8,046,000
Total	\$971.8 billion	3,694,000	8,498,000

Source: Bezdek, Management Information Services, Inc. for ASES, 2007

Existing Building Retrofits and Green New Construction

Generally, green construction, retrofit, and conventional construction projects are bid and worked on by similar contractors. In construction, some of the differences between green and conventional renovations are the composition of materials used in the process, where and how the materials are produced and how waste is addressed. Continual training and continuing education programs can provide the knowledge needed about green construction for contractors, architects, inspectors, permitters, and marketers that communicate with customers.

Renewable Energy and Smart Grid Workers

Similar to construction, many workers in renewable energy also fall under the traditional job classifications of the construction trades. Increasing demand for energy efficiency and renewable energy systems can be expected to generate new employment opportunities for electricians, HVAC technicians, carpenters, inspectors and permitters, plumbers, roofers, laborers, and insulation workers, among others. Comprehensive home and commercial building programs also would increase demand for green building materials, and would stimulate associated manufacturing industries. Training and retraining of existing workers is integral to expanding the region's clean energy sector. Table CEE-4 shows show the job creation potential of investments in clean energy industries.

Table CEE-4: Clean Energy Investment and Resulting Job Creation

Level of Investment	Job Creation
\$1 million in renewable energy systems	5 full time employment component manufacturing jobs
\$1 million in energy efficiency programs	3-4 building material manufacturing jobs 5 energy efficient appliance manufacturing jobs
1 direct manufacturing job	2.9 indirect jobs (finance, transportation, supply chains, installers, and other related businesses) (EPI 2003)

Sources: Apollo Alliance Green Manufacturing Action Plan, 2009, Economic Policy Institute

Clean Transportation

Continuing and rapid changes in transportation technology to improve vehicle or system operation efficiency, to switch from petroleum based to alternative fuels, to reduce environmental emissions, and to effectively integrate transportation systems have also resulted in major changes in skill requirements. Some of these skills are enhancements of existing ones; however there is a substantial difference between working on a diesel powered vehicle and one powered by natural gas. Hybrid vehicles require advanced electrical training and biodiesel requires a working knowledge of chemistry. Training and retraining of existing workers is critical to reducing petroleum use and limiting adverse environmental emissions.

5.11.3 Regional Clean Energy Job Development Opportunities

Leverage state and federal resources such as California's Green Collar Jobs Council (formed by passage of Assembly Bill (AB) 3018) and Clean Energy Workforce Training Partnership, which was formed to best utilize ARRA funding to stimulate quality job growth.

The Green Jobs Guidebook prepared by the Environmental Defense Fund provides detailed job descriptions for renewable energy and energy efficiency related jobs in California for employment year 2008-2009. Links to apprenticeship programs and job placement programs are included.

Job training and assistance are also available through the California Clean Energy Workforce Training Program, a partnership between the Energy Commission and a number of state agencies, educational institutions, local workforce investment boards, community organizations, and employers to deliver 21st century training programs for workers with all levels of experience. The goal of the CEWTP is to promote the use of industry sector strategies as the framework for addressing the need for skilled workers

in the industries related to energy efficiency, water efficiency, renewable energy (distributed generation and utility-scale), and alternative and renewable transportation technologies.

5.11.4 Recommended Actions for Clean Energy Economy

SANDAG, local governments, or other regional entities can undertake the following actions to expand the clean energy economy. In some cases, active collaboration among multiple jurisdictions will be needed to implement the recommended actions. The following recommended actions will contribute to other energy goals, and likewise be enhanced by recommended actions identified in other topic areas, as described below.

Recommended Actions for Clean Energy Economy	
SANDAG, Local Governments, or other Regional Entities	Recommended Action
CE-1	Promote the integration of Clean Energy workforce training initiatives into existing workforce systems.
CE-2	Support existing and future pathways to provide technical training for clean energy jobs to help integrate students and newly trained workers into the local workforce.
CE-3	Support the development and implementation of clean energy workforce training programs amongst the region's private and governmental organizations and labor unions.
CE-4	Support local workforce training and education on Home Energy Rating Systems (HERS) rating and whole-building improvements.
CE-5	Support training and education to building officials and associated building trades on energy codes.
CE-6	Collaborate with regional economists to identify metrics for measuring the clean energy economy, such as levels of investment, number of businesses, total jobs, etc.

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Findings

6.1 Priority Early Actions from the RES

During the update, stakeholders, elected officials and members of the public identified actions that, if implemented, would go a long way toward helping the San Diego region meet its energy goals. While all of the recommended actions identified in the RES are considered important, the following six have emerged as priorities, or core strategies, that are essential to meeting the regional goals. These are implementation actions that can be pursued upon completion of the strategy; indeed, efforts related to most of these actions are already underway. SANDAG and local governments can play an integral role in implementing each of the following priority actions, and in many cases, coordination and collaboration amongst many jurisdictions and stakeholders will be needed to ensure successful implementation.

Priority Early Actions

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-SDG&E Local Government Partnership to implement the RES at the local level. SANDAG will work with local governments to 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 GHG emissions;
5. Support planning of electric charging and alternative fueling infrastructure throughout the region; and
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.

6.2 Broad Strategies to Implement Multiple RES Goals

During preparation of the RES, broad strategies were identified with overarching connections to several regional energy goals. By implementing these broad strategies, SANDAG and local governments will contribute to achievement of most, if not all of the goals identified.

Broad Strategies to Implement Multiple RES Goals

1. Identify, secure, or develop funding mechanisms to pay for energy-related projects and programs;
2. Educate and engage the general public or other stakeholders;
3. Support enabling legislation or policy changes from state or federal government;
4. Take early actions that set examples for residents and businesses; and
5. Develop standardized approaches and programs that can be implemented by all member agencies.

7

Conclusion

The goals and recommended actions of the Regional Energy Strategy will help the San Diego region meet its energy needs while beginning and making substantial progress on a path to a clean, low carbon energy future. Moreover, the RES identifies actions that can improve air quality, reduce traffic congestion, save money, create jobs, increase the use of alternative fuels, expand transportation alternatives, ensure an adequate energy supply to meet growth projections, and improve the region's quality of life.

The core strategies for implementing the region's energy goals will be pursued upon completion of this strategy. The Energy Working Group will continue to coordinate the implementation of the RES and advise SANDAG's policy committees and Board in this regard. SANDAG and local governments can play an integral role in implementing each of the following priority actions, and in many cases, coordination and collaboration amongst many jurisdictions and stakeholders will be needed to ensure successful implementation.

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