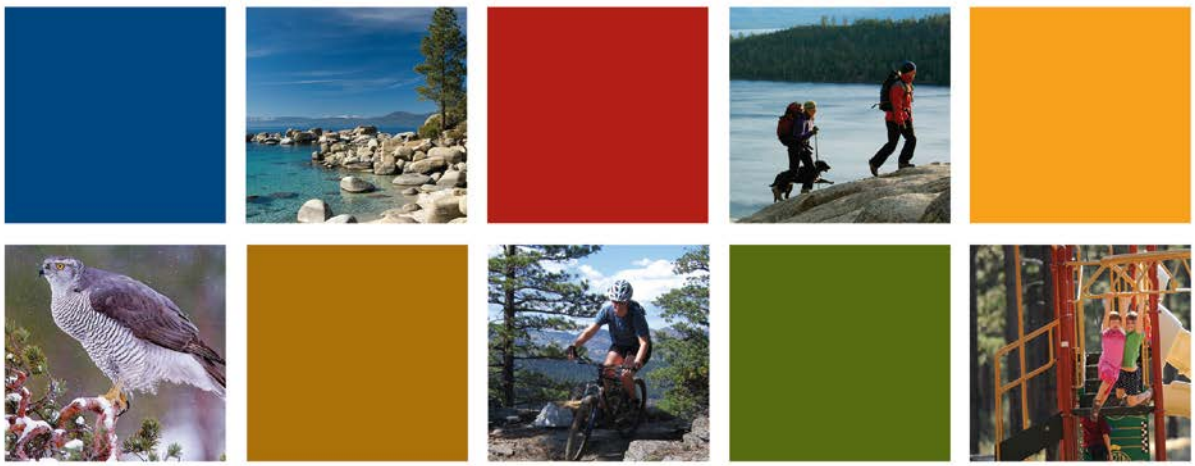
Lake Tahoe Sustainable Communities Program Documents Series #3

Sustainability Action Plan:

A Sustainability Action Toolkit for Lake Tahoe

December 2013



lake Tahoe

Sustainable Communities Program

California Strategic Growth Council

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Disclaimer

Acknowledgements

Tahoe Metropolitan Planning Organization Governing Board

The Tahoe Metropolitan Planning Organization (TMPO) Governing Board is comprised of the members of the Tahoe Regional Planning Agency (TRPA) Governing Board and one representative of the US Forest Service. The TRPA staff serves both the TMPO and TRPA. The TRPA Governing Board is responsible for adopting the Lake Tahoe Regional Plan and Code of Ordinances. The TMPO Governing Board is responsible for adopting the Regional Transportation Plan and Sustainable Communities Strategy.

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Lake Tahoe Sustainability Collaborative

This citizens group is responsible for sustainability planning recommendations, projects, and programs. More information is available at www.sustainabilitycollaborative.org.

Tahoe Basin Partnership for Sustainable Communities

This group, comprised of representatives from the Tahoe Regional Planning Agency, Tahoe Metropolitan Planning Organization, California Tahoe Conservancy, El Dorado County, Placer County, City of South Lake Tahoe, North Lake Tahoe Resort Association, and Sierra Nevada Alliance, was responsible for preparing the original SGC Round 1 Sustainable Community Planning Grant application and has provided ongoing support for completion of these SGC grant-funded tasks.

Consultants

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Introduction to the Lake Tahoe Sustainable Communities Program

The need to embrace sustainability in all planning and implementation activities in the Lake Tahoe Region and beyond has been recognized in a number of ways. At the national level, the Department of Housing and Urban Development has created the Sustainable Communities Regional Planning Grant Program and the Department of Interior Bureau of Reclamation has initiated the Truckee River Basin Study that will include adaptive strategies to respond to climate change and other uncertainties. At the state level, California has adopted the Sustainable Communities and Climate Protection Act of 2008 requiring greenhouse gas (GHG) emission reduction targets for passenger vehicles for 2020 and 2035 for each region covered by a metropolitan planning organization (MPO) and created the Strategic Growth Council, which has awarded grants for sustainable community planning and natural resource conservation. At the Lake Tahoe Region level, the Tahoe Regional Planning Agency (TRPA) has updated the Lake Tahoe Regional Plan to include sustainability policies and mitigation measures, and the Tahoe Metropolitan Planning Organization (TMPO) has adopted a Sustainable Communities Strategy as required by the Sustainable Communities and Climate Protection Act of 2008. At the local level, local governments in the Lake Tahoe Region are in the process of integrating sustainability principles into their local plans. This toolkit can serve as a menu of principles and actions for consideration.

Lake Tahoe Sustainable Communities Program Documents Series

This series of documents (listed in the text box to the right) is organized to generally reflect the tasks associated with the grants received from the California Strategic Growth Council (SGC). While providing valuable information about the Lake Tahoe Sustainable Communities Program to Lake Tahoe Region stakeholders, this series is also designed to provide a reference for other regions involved in addressing the critical issue of sustainability.

This is the third document in the Lake Tahoe Sustainable Communities Program Document Series; the Sustainability Action Plan.

Lake Tahoe Sustainable Communities Program Document Series

1. Sustainability Framework and Vision

2. Sustainability Action Plan Background

3. Sustainability Action Plan

4. Sustainability Measures and Monitoring

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8. Development Commodities Tracking and Exchange System

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10. Lake Tahoe Sustainability Collaborative Strategic Plan

11. Annual Report

12. Lake Tahoe Sustainable Communities Program Summary

Sustainability Action Plan

The Sustainability Action Plan provides tools to assist local governments, agencies, businesses, residents, visitors, and community groups with prioritizing and adopting consistent sustainability actions throughout the Region. The Sustainability Action Plan represents an integrated approach to reducing GHG emissions and striving toward zero-impact in all aspects of sustainability. This document includes the revised GHG emissions inventory (informed by *A Regional GHG Emissions Inventory for the Lake Tahoe Basin* [CTC 2013]) and reduction targets, and climate change and adaptation strategies vetted through the Lake Tahoe Sustainability Collaborative and the

Tahoe Basin Partnership for Sustainable Communities. This document serves as the "deliverable" for the SGC Round 1 Sustainable Community Planning Grant Task 4, Subtask A: Lake Tahoe Sustainability Action Plan.

Proceed to Chapter 1 to learn more about the Sustainability Action Plan and how to use the Plan.

Partnership for Sustainable Communities

In July of 2010, a partnership of agencies and organizations formed to apply for a Sustainable Communities Planning Grant from the California Strategic Growth Council (SGC). This "Partnership for Sustainable Communities" (Partnership) submitted a grant that was funded in August of 2011 to produce a series of tools advancing sustainability planning and monitoring and informing proposed incentives such as transfer of development rights and economic development.

The Partnership, comprised of representatives from the Tahoe Regional Planning Agency, Tahoe Metropolitan Planning Organization, California Tahoe Conservancy, El Dorado County, Placer County, City of South Lake Tahoe, North Lake Tahoe Resort Association, and Sierra Nevada Alliance, was responsible for preparing the original SGC Round 1 Sustainable Communities Planning Grant application and has provided ongoing support for completion of the grant-funded tools.

Lake Tahoe Sustainability Collaborative | www.sustainabilitycollaborative.org

One of the first grant-funded tasks was to start the Lake Tahoe Sustainability Collaborative (LTSC or Collaborative). The Collaborative, a self-selected group of stakeholders, is active in preparing and advocating for sustainability measures in the Lake Tahoe Region. One of the roles this group has is to vet the Sustainability Action Plan. The Collaborative, as an organization, can advocate recommendations from the Sustainability Action Plan be included in the Regional Plan or Area Plans. The Collaborative can also participate directly in these planning processes and public meetings.

Designing the Collaborative, the Partnership developed a matrix of qualities deemed necessary for functional and effective group of individuals pursuing sustainability actions (e.g. experience, interests, availability, networks and connections, and optional demographic information). The invitation to apply was broadly distributed as a survey designed to gather information allowing the Partnership to objectively choose the initial Collaborative membership. One of the hallmarks of this process was the tiered levels of engagement – depending on availability and knowledge, the applicants self-selected into one of three categories, going from most involved to tracking progress and engaging on specific issues: Members, Advisors, and Supporters. This allows the "all are welcome" model while focusing coordination with the most engaged Members.

The Collaborative was launched on May 14, 2012 at an energetic, well-attended workshop at Lake Tahoe Community College. Within the first year, the Collaborative increased from 83 Members, Advisors, and Supporters to over 110, adopted a Charter and approved Livability Principles, established a mission, created a logo, and launched a website. Within three months, the Collaborative established sector-based Work Groups with Co-Chairs drawn from the Partnership and Membership:

- Communications Committee
- Natural Resources and Conservation (NRC)
- Energy, Water, and Waste Efficiency (EWWE)
- Economy, Education, and Culture (EEC)
- Human Health and Social Well-Being (HHSW)
- Community Mobility (CM)

> *Sustain a citizen-based effort to accelerate a shift toward a healthier Lake Tahoe-Truckee community, environment and economy.*
>
> - Lake Tahoe Sustainability Collaborative Mission

Each Work Group established a mission/vision, produced a preliminary scan of short-, mid-, and long-term projects that are summarized in the LTSC "Impact Matrix". Each work group also identified their initial "signature projects", including a community demonstration garden, a Green Business Certification program, a Renewable Energy Regional Exploration Project, among many others. The Work Groups and their individual members have truly become the engines driving an increasing number of voluntary sustainability measures in the Region.

The Collaborative is a resource for regional sustainability efforts, and has workgroups focused on five specific topics: Community Mobility (bikeable, walkable communities); Communications and Outreach; Conservation of Natural Resources and Water Quality; Economy, Education, and Culture; Energy, Water, and Waste Conservation; Human Health and Social Well-Being. Visit the website (www.sustainabilitycollaborative.org) to see work group priorities (e.g., Impact Matrix) and join workgroups.

References

California Tahoe Conservancy. 2013 (January). *A Regional Greenhouse Gas Inventory for the Lake Tahoe Basin*. www.tahoe.ca.gov.

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Chapter 1: Sustainability & Climate Change Background

Sustainability

Sustainability is based on the principle of meeting the needs of today's population without compromising the needs of future generations. Another definition involves improving the quality of human life while living within the carrying capacity of supporting ecosystems. Sustainability is often thought of in regard to the natural environment and environmental resources, but there are also economic and social aspects of sustainability that are linked to the natural environment. In the case of Lake Tahoe Region, the natural environment is an essential driver of the economy, and central to the culture of the communities in the Region.

> *If the communities around this lake can become truly and genuinely sustainable, then the Lake Tahoe community could play a more important role in inspiring the world than any national park could.*
> –Former Vice President Al Gore; 2013 Tahoe Summit.

Sustainability Action Plan

The heart of the Sustainability Action Plan is "Action." The Plan was developed in a way that recognizes the many sustainability efforts already underway in the Lake Tahoe Region, and identifies additional actions that have yet to be taken. The Sustainability Action Plan is intended to serve as a toolkit that Regional agencies and local jurisdictions can use to develop their own sustainability actions under a consistent Regional framework. It is also a resource for residents, businesses, visitors, and all community members to help create a more sustainable region. The Sustainability Action Plan is a pathway that the Region can follow to achieve greenhouse gas (GHG) emission reductions, prepare for climate-readiness and resiliency planning, foster a healthy economy, strive for higher standards for social equity and quality of life, and protect the quality of the environment in the Lake Tahoe Region.

The strategies contained in this Plan have been researched, vetted, and informed by the professional consultants drafting the plan, the Partnership, and the Collaborative, which all together reflect a broad cross-section of the Region's individual communities. This Plan is a menu that regional and local governments, individuals, residents, property owners, visitors, businesses, institutions, organizations, and other entities can use as a tool box for sustainability actions that apply to them. The actions offered in this plan include exceeding the current standards for green buildings, renewable energy, sustainable forest practices, innovative transportation solutions, and increased biological diversity, among many others.

The Sustainability Action Plan is a living document, and it is only a first step on the road toward making the Lake Tahoe Region truly sustainable. Many of the strategies in this Plan are ambitious, and they will only have an effect on quality of life if they are implemented in a concerted and thoughtful way. Accountability and continued engagement will be crucial in the implementation, updating, and success of the Sustainability Action Plan.

How to Use This Plan

This Plan is a collection of existing sustainability actions developed over many years of visioning and planning in the Region, as well as new and innovative ideas for sustainability actions that are not already underway. Sustainability is a cross-cutting concept and relates to nearly all aspects of community

planning, environmental planning, and economic development. Thus, there are numerous opportunities for participation in sustainability of the Lake Tahoe Region, and many of us can potentially play a role in implementing the Sustainability Action Plan. The actions in this plan are organized according to the entity or party responsible for implementing the action. Menus of sustainability actions are provided for representatives of regional and local governments, utilities, agencies, organizations, residents of, businesses in, and visitors to the Lake Tahoe Region. For many actions to be successful, implementation will require partnerships between these different types of entities. For that reason, more than one responsible party may be listed.

If you are a Regional or local government, utility, agency, or a representative of an organization that may partner with one of these entities, the following sections of this plan will be the most helpful for you:

Choosing a **greenhouse gas reduction target**	Chapter 3: pg 8
Menu of **sustainability and greenhouse gas emissions reduction actions**	Chapter 4: pg 5
Menu of **climate change readiness actions** to protect your community and help make your community more resilient to climate change	Chapter 5: pg 16
How you can **lead by example** through implementing sustainability actions into municipal operations	Chapter 6: pg 4

If you are a resident, business, school, or visitor of the Lake Tahoe Region and you want to learn what you can do to help make the your life, your community, and the Region more sustainable, the following sections of this plan will be the most helpful for you:

Residents	How individual community members can stay engaged and assist with implementing the Sustainability Action Plan	Chapter 6: pg 6
	Actions you can take to help minimize your carbon footprint, protect the Region from climate change impacts, and make your community more sustainable	Chapter 6: pg 8
Businesses	Actions your business can take to help reduce greenhouse gas emissions and make your business more sustainable	Chapter 6: pg 18
Schools	Actions schools can take to foster sustainability in the communities they serve	Chapter 6: pg 27
Visitors	Actions you can take to help minimize your impact during your visit	Chapter 6: pg 35

Not every action listed will apply to every user of this Plan or to every situation. However, every action listed results in other community or environmental sustainability co-benefits, which are multi-benefit, win-win interactions associated with sustainability actions. For example, an action that would increase energy efficiency of buildings has the following potential co-benefits:

- reduce GHG and other emissions from power plants,
- improve air quality,
- reduce energy demand and prepare for constrained energy supplies,
- save money on utility bills,
- create jobs in the Region for contractors and inspectors.

Community and environmental co-benefits are depicted throughout this Plan using the following symbols:

Water Quality	Water Supply	Wildfire Hazard Reduction	Flooding Hazard Reduction	Emergency Response	Forest Resources	Biological Resources	Air Quality	Enhanced Economic Activity	Job Generation Potential
									

Energy Supply	Greenhouse Gas Emissions Reduction	Mobility & Goods Movement	Solid Waste & Recycling	Community Health & Education	Social Equity	Public Health & Safety	Recreation Resources	Community Noise Reduction
								

The order of magnitude (low, medium, or high) of Regional GHG reduction potential of an action is presented graphically using the following symbols:

Low		Approximately 10-100 metric tons per year of Region-wide GHG reduction potential
Medium		Approximatley 100-1,000 metric tons per year of Region-wide GHG reduction potential
High		Greater than approximately 1,000 metric tons per year of Region-wide GHG reduction potential

The low, medium, and high rankings are not intended to represent precise values. Instead, are intended to give decision makers a quick-glance reference for comparison purposes within this menu of actions.

Similarly, the order of magnitude (low, medium) estimate of public and private costs or rate of return associated with implementation is presented graphically for each action. “High” cost actions would be defined as consuming a substantial portion of a municipal budget. No “high” cost actions were recommended in this plan because it is unlikely that they would be considered economically feasible. Exact cost estimate or rate of return is not known with any level of precision because the level of implementation for each action presented in this section will vary widely throughout the Region and will be dependent on availability of funding. Examples of how public and private costs were ranked are provided below.

Private Costs or Returns		
Low Cost		Assumes that sufficient incentives, subsidies, or rebates would be available to nearly offset the upfront cost of implementation
Medium Cost		Assumes private businesses would incur short-term costs of improvements, infrastructure, or employee training
Cost-Neutral, Positive Return, or Cost Savings		Assumes that cost savings (e.g., reductions in utility bills) exceed cost of upgrades either with subsidies or over the long term

Public Costs or Revenue		
Low Cost		Assumes that less than one full-time-equivalent employee would be required to oversee implementation
Medium Cost		Assumes more than one full time equivalent employee or operational and maintenance costs and/or capital improvements financing would be required to construct new permanent facilities
Revenue-Neutral or Revenue-Generating		Assumes that administrative costs to implement would be fully or nearly offset by program revenue

Co-benefits and general cost information associated with each action are presented in more detail in Chapters 4 and 5, and are summarized for each action in Table 1.1 below. Note that cost information is not available for climate resiliency actions due to data limitations. This is because climate resiliency actions are focused on monitoring and adaptive management for climate change impacts, and do not necessarily include physical changes in the community or construction of additional infrastructure.

Table 1.1: Summary of Sustainability Actions and Co-benefits					
Sustainability Action	**Page Number**	**Sustainability Co-benefits**	**Region-wide GHG Reduction Potential**	**Private Costs**	**Public Costs**
Green Building Ordinance	4-5				
Property Assessed Clean Energy Financing Program	4-7				
Energy Efficiency and Renewable Energy in Public Facilities	4-9				
Energy Efficient Lighting Development Standards	4-10				
Energy Star Appliances	4-10				
Energy Efficiency Education	4-11				
Community Choice Aggregation	4-11				
Renewable Energy Standards or Incentives for New Development	4-14				
Innovative Approaches to Energy Generation and Distribution	4-15				
Complete Neighborhoods	4-16				
Expand Bicycle and Pedestrian Network	4-17				
Improve Transit Services	4-17				
Clear Sidewalks and Paths	4-18				
Streetscape and Bicycle Amenities	4-18				
Electric Vehicle Changing Network	4-19				
Local Construction Materials Procurement in New Development	4-20				
Alternative Fueled Vehicle Fleet	4-20				

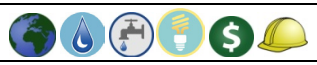
Table 1.1: Summary of Sustainability Actions and Co-benefits					
Sustainability Action	**Page Number**	**Sustainability Co-benefits**	**Region-wide GHG Reduction Potential**	**Private Costs**	**Public Costs**
Solid Waste Diversion	4-21				
Construction and Demolition Debris Diversion	4-23				
Water Meters	4-24				
Water Efficiency Measures/Water Conservation	4-25; 5-17				
Water Efficient Landscaping/Low Impact Development	4-25; 5-17				
Replace Wood Stoves and Wood Fireplaces	4-27				
Curtail Wood Burning on Poor Air Quality Days	4-28				
Best Construction Practices	4-28				
Enforce Idling Time Limitations	4-29				
Prescribed Burning Best Practices	4-30				
Forest Restoration & Reforestation	4-30; 5-27				
Sustainable Business and Residential Certification Program	4-31				
First Time Homebuyer Assistance	4-32				
Workforce Housing Strategy	4-32; 5-28				
Business/Job Retention/Expansion Programs	4-33				
Events Commission	4-33				
Equity and Health in all Policy	4-34				
Neighborhood Services	4-35				
Resources for the Homeless and Transient Populations	4-35				

Table 1.1: Summary of Sustainability Actions and Co-benefits					
Sustainability Action	**Page Number**	**Sustainability Co-benefits**	**Region-wide GHG Reduction Potential**	**Private Costs**	**Public Costs**
Local Food Production & Farmers Markets	4-36				
Local Food Supply Infrastructure for Businesses	4-36				
Consider Allowing Raising of Small Farm Animals	4-37				
Public Art	4-37				
Stormwater Management and Monitoring	5-17			Cost information is not available for climate resiliency actions due to data limitations. This is because climate resiliency actions are focused on monitoring and adaptive management for climate change impacts, and do not necessarily include physical changes in the community or construction of additional infrastructure.	
Historic Drainage	5-18				
Watershed Hydrology Trend Monitoring	5-18				
Water Supply Commitments	5-19				
Coverage Limitations	5-19				
Groundwater Recharge	5-19				
Integrated Regional Water Management Planning	5-19				
Transfer of Development Rights	5-20				
Wildfire Hazard Education	5-20				
Defensible Space	5-21				
Fuel Reduction Treatments	5-21				
Fire Hazard Reduction Measures in New Development	5-21				
Vulnerability Assessment and Outreach	5-21				
Wildfire Emergency Response	5-22				
Emergency and Disaster Preparedness Training	5-22				

Table 1.1: Summary of Sustainability Actions and Co-benefits					
Sustainability Action	**Page Number**	**Sustainability Co-benefits**	**Region-wide GHG Reduction Potential**	**Private Costs**	**Public Costs**
100-year Storm Event Planning	5-22				
Prohibit Development in 100-Year Flood Plain	5-23				
Evacuation Access	5-23				
Coordinated Hazard Mitigation Planning	5-23				
Monitor Achievement of Air Quality Thresholds	5-24				
Social Equity in Planning	5-24				
Public Health Monitoring	5-24				
Vector Control	5-25				
Protect Migration Corridors	5-25				
Prevent Invasive Species	5-26				
Habitat Protection	5-26				
Inventory of Current Research and Monitoring	5-26				
Improve Forest Age Structure	5-27				
Urban Forestry	5-27				
Reduce Ecosystem Fragmentation	5-27				
Warm-season Recreational Opportunities	5-28				

Sustainability Indicators

Sustainability Indicators are currently being developed along-side the Sustainability Action Plan. Two types of indicators are used in order to provide an understanding of what is being done to improve the sustainability of the Lake Tahoe Region, and how the Region is doing in relation to its sustainability goals. **Action indicators** are used to report on the investments and accomplishments intended to improve the sustainability of the Region. These investments and accomplishments include policies, programs, and projects. **Outcome indicators** are used to report progress in relation to the environmental, economic, and social goals that define sustainability of the Lake Tahoe Region. Monitoring of sustainability indicators will and shed light on whether the sustainability actions in this Plan are successful, or if additional actions are needed to achieve the desired outcome.

Sustainability action and outcome indicators, as summarized in Table 1.2, can be tracked to provide information about the level of success of action implementation.

Table 1.2: Sustainability Indicators – Aspects, Action Indicators, and Outcome Indicators

Sustainability Aspects	Sustainability Action Indicator	Sustainability Outcome Indicator
Non-Automobile Transportation	Miles of Bicycle and Pedestrian Paths	Mode Share; Transit Ridership
GHG Emissions		Vehicle Miles Traveled; Energy Consumption
Forest Health & Fire Hazard	Acres of Forest Fuel Reduction Treatments Acres of SEZ Restored or Enhanced	Fire Hazard – Predicted Flame Length
Water Quality	Parcels with Stormwater BMPs Miles of Roads Treated	Lake Tahoe Clarity – Winter Secchi Depth
Invasive Species	Watercraft Inspections	Land Invasive Weeds; Aquatic Invasive Plants
Income	College Classes Offered	Household Taxable Income; Subsidized School Lunches
Employment		Payroll Job Numbers; Unemployment Rate
Business Environment	Percent of Development in Urban Areas	Ratio of Transient Occupancy Tax/Transient Lodging Tax; Total Businesses by Industry
Education		Standardized Test Scores; Graduation Rates
Housing	Affordable Housing Units	Second Home Ownership; Median Home Price
Healthy Behavior		Resident Diagnosis Groups of Concern; Resident Payers for Hospital Services

Notes: BMP = Best Management Practices; GHG = greenhouse gas; SEZ = stream environment zone.
Source: Environmental Incentives 2013

Climate Change Science

Scientists, business leaders, and heads of government around the world agree that climate change is one of the most serious issues facing the earth today. It is extremely unlikely that global climate change of the past 50 years can be explained without taking into consideration the contribution of GHG emissions from human activities (IPCC 2007). Climate change has resulted in increasing air and ocean temperatures, melting polar and sea ice, shrinking mountain snow packs, and rising sea levels. These trends represent serious threats to the health of people, economies, and environments across the globe.

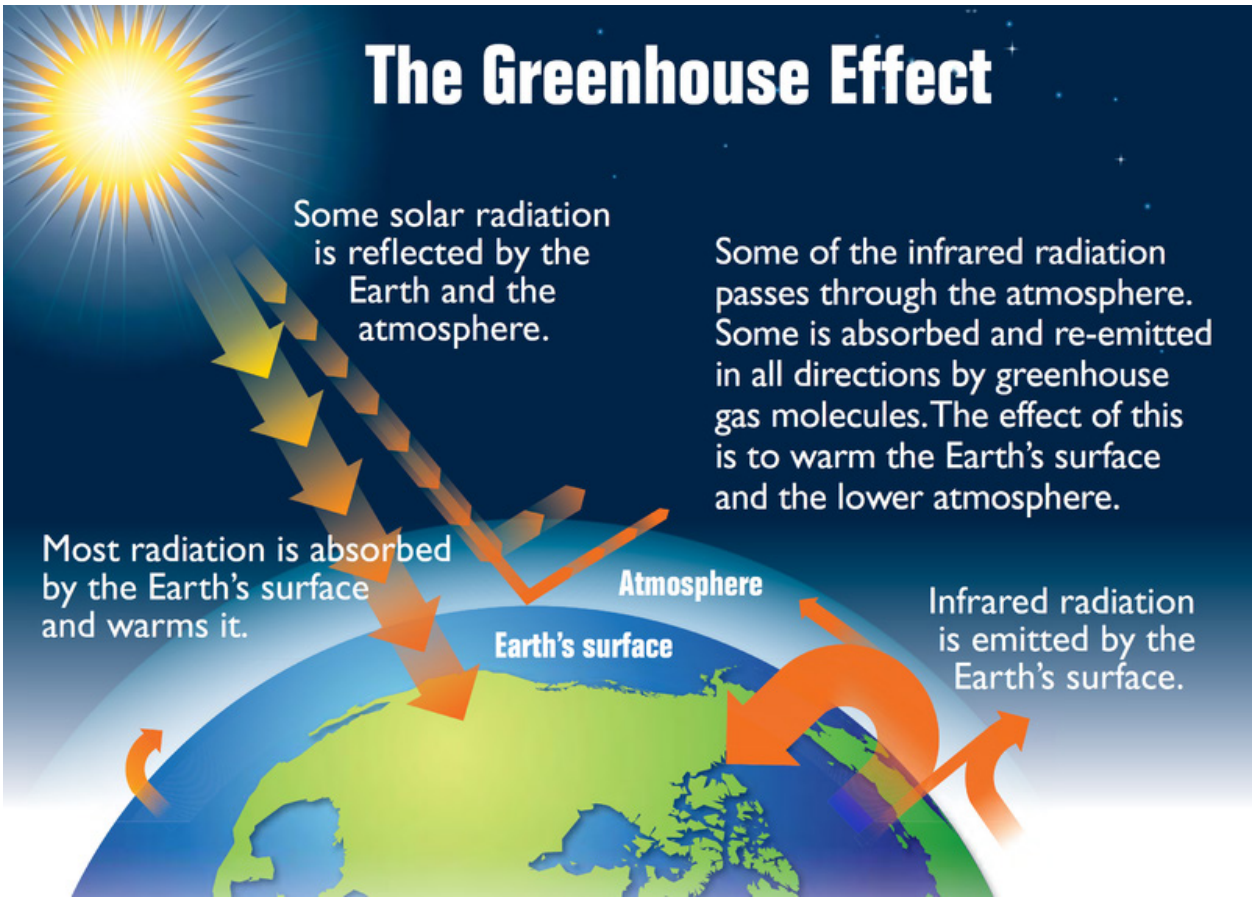
> *The difference between 32 degrees and 33 degrees is a difference of more than one degree. It's the difference between ice and water. It's the difference between rain and snow. That is a threshold of end. The phrase "tipping point" is not just a political metaphor.*
>
> –Former Vice President Al Gore; 2013 Tahoe Summit.

The existing environmental conditions and ecosystem capacity in Tahoe as we know them today are already beginning to be altered by a changing climate. The ecosystems of the Lake Tahoe Region are extremely sensitive and will become more sensitive under a warmer climate with altered precipitation patterns. Thus, it is important for the Region to prepare for the impacts of climate change now while the capacity exists to become resilient. Climate change is a global phenomenon, but as global stewards, it is important for all communities and community members to do their fair share towards minimizing the impacts of climate change by reducing GHG emissions.

The Greenhouse Effect and Global Warming

The greenhouse effect is a natural phenomenon that helps regulate the earth's temperature. Certain gases in the earth's atmosphere, classified as GHGs, play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space. A portion of the radiation is absorbed by the earth's surface, and a smaller portion of this radiation is reflected back toward space. This absorbed radiation is then emitted from the earth as low-frequency infrared radiation. The frequencies at which bodies emit radiation are proportional to temperature. The earth has a much lower temperature than the sun; therefore, the earth emits lower frequency radiation. Most solar radiation passes through GHGs; however, infrared radiation is absorbed by these gases. As a result, radiation that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it. The greenhouse effect is depicted in Figure 1.1 below.

Human-caused emissions of GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global warming or global climate change.



Source: EPA 2012

Figure 1.1 **The Greenhouse Effect**

Thus, if left unchecked, the accumulation of GHG emissions presents a serious climate challenge worldwide and close to home in the Lake Tahoe Region. Chapter 3 of this Plan presents the GHG emissions profile of the Region, the GHG emissions projections without this Plan, and GHG emissions reductions goals and targets for the Region. Chapter 4 of this Plan presents a menu of actions that will form the path to achieve these GHG reductions in the Region and will help minimize the Region's impact on climate change. Chapter 5 includes a detailed discussion of climate change impacts downscaled to the Lake Tahoe Region.

Planning for Climate Change Readiness

Unfortunately, even if GHG emissions were significantly reduced today, the emissions that have already accumulated in the atmosphere are expected to continue to warm the earth through the end of this century. Thus, we are committed to a certain level of climate change that we can expect will occur regardless of GHG reduction efforts. It is also urgent that the Region begin identifying vulnerabilities to climate change impacts and planning for resilience. Chapter 5 of this Plan is dedicated to understanding climate change risks and vulnerabilities and presents a menu of actions to adapt to a changing climate. This includes gathering information and studying changing environmental conditions; enhanced monitoring and protection of natural resources through adaptive management; identifying additional foreseeable hazards and keeping the public out of harm's way; and allocating proper resources to respond in emergency situations.

Fortunately, many actions that can be taken to reduce GHG emissions also contribute to higher quality of life, and can help the Region prepare for climate readiness. Taking action presents numerous sustainability co-benefits resulting in win-win situations for local governments and for community members. The co-benefits of sustainability actions described in this Plan are provided within Chapters 4 and 5.

References

Intergovernmental Panel on Climate Change. 2007. *Contribution of Working Group I to the Fourth Assessment Report: Technical Summary*. Cambridge University Press, Cambridge, United Kingdom.

U.S. Environmental Protection Agency. 2012. Climate Change Indicators in the United States. http://www.epa.gov/climatechange/science/indicators/download.html

Chapter 2: Regulatory Framework

This Plan has been prepared at a time when the laws and practices governing the manner in which public agencies address climate change continue to evolve. This section summarizes the current and relevant federal, State, and local regulatory programs, plans, and policies that apply to greenhouse gas (GHG) emissions and climate change.

Federal

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for implementing the Federal Clean Air Act. The Supreme Court of the United States ruled in 2007 that carbon dioxide (CO_2) is an air pollutant as defined under the Clean Air Act, and that EPA has the authority to regulate emissions of GHGs.

EPA has taken steps to begin to monitor, regulate, and potentially reduce GHG emissions in the United States. Large GHG emissions sources (i.e., facilities that emit 25,000 metric tons (MT) or more of CO_2 per year) must report their emissions to EPA. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are subject to this mandatory reporting rule.

In August 2012 EPA and the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) issued joint Final Rules for Corporate Average Fuel Economy (CAFE) standards for vehicle model years 2017 and beyond (NHTSA 2012). These first-ever national emissions standards will increase fuel economy to the equivalent of 54.5 miles per gallon for cars and light-duty trucks by model year 2025.

Activities are underway across the federal government to build adaptive capacity and increase resilience to climate change. These activities include efforts to improve understanding of climate science and impacts, incorporate climate change considerations into policies and practices, and strengthen technical support and capacity for adaptation decision making. Some efforts are large collaborative undertakings involving federal and non-federal partners while others are smaller and at the program-level. The Climate Change Adaptation Task Force, co-chaired by the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), makes recommendations to President Obama as to how federal policies and programs can better prepare the United States to respond to the impacts of climate change (CEQ 2011). In February 2013, federal agencies released Climate Change Adaptation Plans outlining strategies to protect their operations, missions, and programs from the effects of climate change (Executive Office of the President 2013)

California

Executive Order S-3-05

Executive Order S-3-05, which was signed by Governor Schwarzenegger in 2005, asserts that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra Nevada snowpack, further worsen California's air quality problems, and potentially cause a rise in sea level. To combat those concerns, the Executive Order proclaimed GHG emission targets for California. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050. This Executive Order is binding only on State agencies,

and has no force of law for local governments; however, the signing of S-3-05 sent a clear signal to the California Legislature about the framework and content for legislation to reduce emissions.

It is estimated that in 1990 average global atmospheric concentrations of CO_2 were about 353 parts per million (ppm), which is widely considered to be the maximum concentration of CO_2 that would avoid catastrophic climate change impacts. Furthermore, 280 ppm CO_2 is considered the pre-industrial, or natural concentration that would help stabilize climate change trends, and is approximately 80 percent below the 1990 concentration of 353 ppm. This means that if the pre-industrial CO_2 concentration is achieved in the atmosphere, global average temperatures may stabilize within a likely range of 0.6–1.4°C above pre-industrial values (UCSB 2010). These significant CO_2 concentration levels serve as the scientific basis for GHG reduction benchmarks in California.

Assembly Bill 32, The California Global Warming Solutions Act of 2006

In September 2006, Governor Arnold Schwarzenegger signed Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions statewide. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that went into effect in 2012. The California Air Resources Board (ARB) was charged with implementing AB 32. In December 2008, ARB adopted its Climate Change "Scoping Plan", which describes the strategies California will implement to achieve the mandated reductions. The Scoping Plan does not include specific GHG reduction requirements for local governments. ARB is in the process of updating the Scoping Plan and expects to complete that process by the end of 2013. The Discussion Draft of the updated Scoping Plan was released in October 2013. The Discussion Draft acknowledges that local governments are critical partners in meeting California's GHG goals, but does not include specific GHG reduction requirements for local governments.

Senate Bill 375, The Sustainable Communities and Climate Protection Act of 2008

Senate Bill (SB) 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires each Metropolitan Planning Organization (MPO) adopt a Sustainable Communities Strategy (SCS) as part of the MPO's Regional Transportation Plan (RTP) that sets land use allocation and transportation investments necessary to meet GHG emission reduction targets for the region.

With the assistance of the Regional Targets Advisory Committee (RTAC) and in consultation with the MPOs, ARB provided each affected region with reduction targets for GHGs emitted by passenger cars and light trucks for 2020 and 2035. The ARB-issued targets for the California portion of Tahoe Metropolitan Planning Organization's (TMPO) jurisdiction are a 7 percent reduction in GHG emissions per capita by 2020 relative to 2005 and a 5 percent reduction by 2035 (ARB 2011). As discussed further below under "Lake Tahoe Region Activities", the RTP/SCS was adopted in December 2012. The RTP/SCS demonstrated the Region's ability to meet the GHG reduction targets for passenger vehicles and was verified and approved by ARB (ARB 2013).

California Strategic Growth Council-Funded Sustainability Planning

In 2011, the California Strategic Growth Council (SGC) funded the TRPA/TMPO to develop sustainability tools for use by regional and local agencies, nonprofit organizations, the business community, and local residents in promoting GHG reduction, among other sustainability goals.

Vehicle Emissions Standards

California-specific Low Emission Vehicle (LEV) Clean Car Standards require increased fuel economy of vehicles. Increased fuel economy has the effect of reducing GHG emissions from vehicles as newer, more fuel-efficient vehicles enter the fleet and older, less-efficient vehicles are retired. In California, LEV standards are sometimes referred to as "Pavley" standards in reference to AB 1493 (2002) drafted by California Senator Fran Pavley. The first set of standards aimed at improving fuel economy is referred to as the "Pavley I" standards that went into effect in 2009. The anticipated effects of vehicle emissions standards were factored in to the GHG emissions projections in Chapter 3.

Energy-Efficiency and Renewable Energy Standards

Renewable Electricity Standards

California's Renewable Portfolio Standard (RPS) requires investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 33 percent of total procurement by 2020. RPS applies to Liberty Energy/California Pacific Electric Company (CalPeco), the electric utility provider serving the California portion of the Region.

California Title 24 Building Energy Efficiency Standards

California's Building Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6) were recently updated to require new buildings to become even more energy-efficient than under the current code. The new 2013 standards, which become effective in January 2014, will increase the efficiency of new construction by 20 percent for residential uses and 25 percent for nonresidential uses, compared to the 2008 Title 24 standards currently in effect (CEC 2013). The majority of the Region's buildings were constructed prior to the adoption of energy efficiency building standards and codes.

The anticipated effects of these renewable energy procurement and increased building energy efficiency standards were accounted for in the GHG emissions projections in Chapter 3.

California Climate Adaptation Strategy

In 2009, California adopted a statewide Climate Adaptation Strategy that summarizes climate change impacts and recommends adaptation strategies across seven sectors: Public Health, Biodiversity and Habitat, Oceans and Coastal Resources, Water, Agriculture, Forestry, and Transportation and Energy. The 2009 strategy was the first of its kind in the usage of downscaled climate models to more accurately assess statewide climate impacts as a basis for providing guidance for establishing actions that prepare, prevent, and respond to the effects of climate change. The California Natural Resources Agency, in coordination with other state agencies, began updating the Climate Adaptation Strategy in 2012, and a draft was released for public review and comment in December of 2013 (CNRA 2013). Chapter 5 of this Plan is devoted to climate change adaptation planning in the Lake Tahoe Region.

Nevada

The Nevada Climate Change Advisory Committee (NCCAC) was created through an Executive Order signed in April 2007. The Executive Order directed the committee to propose recommendations for reducing GHG emissions in Nevada. The Committee's final report included 28 recommendations related to reducing emissions from the energy, transportation, waste, agriculture, and other sectors. One of the Committee's priority recommendations is to develop a State Climate Action Plan (NCCAC 2008:7-9). At this time, the Nevada Division of Environmental Protection (NDEP) has not adopted specific reduction goals or climate change regulations.

Of the Committee's 28 recommendations, the following six were identified as priority recommendations. These recommendations were chosen based on importance and action-ability in the near-term with current or minimal additional resources.

- Develop a State Climate Action Plan: As described above, the Committee recommended that the Governor support the development of a State Climate Action Plan for Nevada that will set objectives and performances standards for activities related to the reduction of GHGs.
- Utility Environmental Protection Act (UEPA) Siting Restrictions: The Committee recommended that the State of Nevada amend the UEPA statute to require any utility facility built in Nevada that emits GHGs or consumes water resources to demonstrate its necessity and benefits to customers in the state.
- Greenhouse Gas Reduction (Intensity): The Committee recommended that the State of Nevada establishes and monitors a realistic annual target on the intensity of GHGs emitted per megawatt hour from all electricity generators in a producer's portfolio in the state. A specific target of reduction percentage should be set and a baseline year established for the intensity requirement.
- Energy Transmission Corridors: The Committee recommended that the State of Nevada assist federal land management agencies to develop and utilize a streamlined and environmentally sound analysis and decision process that addresses the need for expanded energy transmission corridors.
- Renewable Portfolio Standard Modification Proposal: The Committee recommended refinements to the existing RPS statute to ensure that it will operate in a more comprehensive and pragmatic fashion.
- Streamline Governmental Permitting and Review Process at State and Federal Levels: The Committee recommended that the Governor pursue a resolution requesting the federal land management agencies seek a coordinated approach for energy applicants especially those exploring alternative energy sources.

Other recommendations from the Committee include energy efficient appliance/equipment standards for public facilities, continued support for biomass conversion to electricity and fuel, demand side management, energy efficient building codes and standards, continued support for brownfield development, advanced travel center electrification for trucks, clean-fueled bus programs, clean fuels and clean vehicle incentive program, alternative fuel vehicles in the state fleet, incentives for ethanol-blended fuels and bio-diesel fuels, high speed train between Los Angeles and Las Vegas, continued support of solid waste recycling efforts, dairy waste to energy, a sequestration initiative, and education and outreach efforts.

Renewable Electricity Standards

Nevada's RPS, Nevada Revised Statutes (NRS) 704.7801, was first adopted by the Nevada Legislature in 1997 and has been modified nearly every legislative session since. The RPS establishes the percentage of electricity sold by an electric utility to retail customers that must come from renewable sources. More specifically, electric utilities are required to generate, acquire or save with portfolio energy systems or energy efficiency measures, a certain percentage of electricity annually. The percentage of renewable energy required by the RPS will increase every two years until it reaches 25 percent in 2025. The procurement requirement for Nevada utilities in 2020 is 22 percent from renewable sources. RPS applies to Nevada Energy, the electric utility provider serving the Nevada portion of the Region. The anticipated effects of Nevada's renewable energy procurement standards were accounted for in the GHG emissions projections in Chapter 3.

Tahoe Region Sustainability Framework

The Lake Tahoe Region is subject to a unique bi-state compact approved by California and Nevada, and ratified by the United States Congress. The regional and local plans that are enabled and required by this compact are two of the four main components of the sustainability framework and have very well-defined processes and procedures for preparation, adoption, and amendment. The other two main components of the framework, The Sustainability Collaborative and the Sustainability Action Plan, are not required. These components interact to create the sustainability framework.

Regional Plan: The Lake Tahoe Regional Plan adopted as required by the Tahoe Regional Planning Compact. It includes goals and policies, the Regional Transportation Plan and Sustainable Communities Strategy, the water quality management plan, the final EIS mitigation measures, and code of ordinances.

Area Plans: City and County plans adopted pursuant to California Planning and Zoning Law or Nevada Revised Statutes Chapter 278. These area plans must conform with the Regional Plan.

Sustainability Collaborative Initiatives: Include plan recommendations, projects, and programs initiated and/or advocated through action of the Lake Tahoe Sustainability Collaborative (e.g., Grow Dome and community garden projects, regional workforce roundtable, advocacy for plastic bag restrictions, community mobility).

Sustainability Action Plan: Prepared independently of the Regional Plan and Area Plans, includes greenhouse gas emission levels and targets, as well as climate change mitigation and adaptation and broader sustainability strategies. As this plan is prepared and updated, recommendations for sustainability measures that can be included in the Regional Plan or Area Plans may be identified. These sustainability recommendations can be made by residents, local governments, and businesses through the ongoing Regional Plan and Area Plan processes.

Lake Tahoe Region Activities

TRPA was the first bi-state regional environmental planning agency in the country. The mission of the agency is to lead the cooperative effort to preserve, restore, and enhance the unique natural and human environment of the Lake Tahoe Region, while improving local communities, and people's interactions with our irreplaceable environment.

The Lake Tahoe Region is subject to the Tahoe Regional Planning Compact, a unique bi-state compact approved by California and Nevada, and ratified by the United States Congress. The Regional Plan (including the Regional Transportation Plan) and local level plans that are required or enabled by this legislation are two of the four primary components of the sustainability framework in the Region. The other two components include the Sustainability Action Plan and Sustainability Collaborative. These components, and the manner in which they interact to create the sustainability framework, are described below.

Regional Plan

The Lake Tahoe Regional Plan is adopted as required by the Tahoe Regional Planning Compact. It includes the land use plan, goals and policies, regional transportation plan and sustainable communities strategy, water quality management plan, the final Environmental Impact Statement (EIS) mitigation measures, and code of ordinances.

The Goals and Policies are the core of the Regional Plan. They provide guidance for decision-making that affects the Region's resources and remaining resource capacities. It is the intent of the Goals and Policies to drive attainment and maintenance of the environmental thresholds, while supporting opportunities for orderly growth and development consistent with the thresholds. The Goals and Policies are implemented through the Code, which compiles the TRPA ordinances, consisting of general provisions, planning, land use, site development, growth management, resource management and protection, and the Shorezone regulations.

In December 2012, TRPA adopted an updated Regional Plan, which, through proposed policies and mitigation measures adopted through environmental review, included additional sustainability policies. Mitigation Measure 3.5-1 of the Regional Plan Update EIS requires TRPA to "coordinate implementation of a GHG Emission Reduction

Policy through TRPA-approved plans, project permitting, or projects/programs developed in coordination with local or other governments addressing Best Construction Practices and ongoing operational efficiency within twelve months of adoption of an updated Regional Plan."

On November 20th, the TRPA Governing Board approved a package of mitigation measures required by adoption of the Regional Plan Update EIS. This package included an amendment to Chapter 13 of the TRPA Code (Area Plans). This amendment is 13.5.3.E - Greenhouse Gas Reduction Strategy, which states: "To be found in conformance with the Regional Plan, Area Plans shall include a strategy to reduce emissions of Greenhouse Gases from the operation or construction of buildings. The strategy shall include elements in addition to those included to satisfy other state requirements or requirements of this code."

Regional Transportation Plan/Sustainable Communities Strategy

The Lake Tahoe RTP/SCS was also adopted in December 2012 concurrent with the Regional Plan Update. The RTP/SCS Environmental Impact Report/Environmental Impact Statement (EIR/EIS) evaluated packages of transportation and land use strategies involving growth directed toward urban centers, transfer of development rights incentives, and infrastructure for alternative modes (e.g., bike and pedestrian infrastructure and waterborne transit). The alternative that was ultimately selected resulted in the lowest vehicle miles traveled per capita of the five alternatives considered and associated GHG emissions per capita. In addition, consistency with transportation-related GHG reduction requirements applicable in California (SB 375, Sustainable Communities and Climate Protection Act of 2008) was evaluated, and the ability to attain the GHG targets was demonstrated by the Regional Plan and RTP/SCS alternative that was selected. Therefore, the analysis of transportation-related sustainability measures has largely been completed through the Regional Plan Update and RTP/SCS processes.

Area Plans

Area plans are local government and agency plans adopted pursuant to California Planning and Zoning Law (Government Code 65000-66037) or Nevada Revised Statutes Chapter 278, and found in conformance with the Regional Plan. The specific requirements for Area Plan preparation, adoption, conformance review, and monitoring are listed in TRPA Code of Ordinances Chapter 13: Area Plans. Local jurisdictions in the Lake Tahoe Region are in the process of integrating sustainability principles and action strategies into their local Area Plans. This Sustainability Action Plan can serve as a menu of sustainability principles and action strategies for consideration to fulfill the requirements of TRPA Code of Ordinances 13.5.3.E - Greenhouse Gas Reduction Strategy.

Sustainability Action Plan

As discussed previously, this document is the Sustainability Action Plan, which, although not regulatory, is intended to serve as an overall planning framework to guide consistent action in the Region, as well as a toolkit that local jurisdictions and agencies can use to develop their own sustainability actions. The Sustainability Action Plan is a pathway that the Region can follow to achieve GHG reductions, help prepare for climate-readiness and resiliency planning, strive for higher standards for social equity and quality of life, foster a healthy economy, and protect the quality of the environment in the Lake Tahoe Region.

Collaborative Sustainability Initiatives

One of the first grant-funded tasks was to initiate the Lake Tahoe Sustainability Collaborative (LTSC or Collaborative). The Collaborative, a self-selected group of stakeholders, is active in preparing and

advocating for sustainability measures in the Lake Tahoe Region. One of the roles of the group is to carefully and critically examine the Sustainability Action Plan. The Collaborative, as an organization, can advocate recommendations from the Sustainability Action Plan be included in the Regional Plan or Area Plans, and can participate directly in these planning processes and public meetings.

Relationship between Framework Components

The formal plans (i.e., Regional Plan and Area Plans) have very well-defined processes and procedures for preparation, adoption, and amendment. These processes and how they interact are shown in the Figure 2.1 and are discussed below

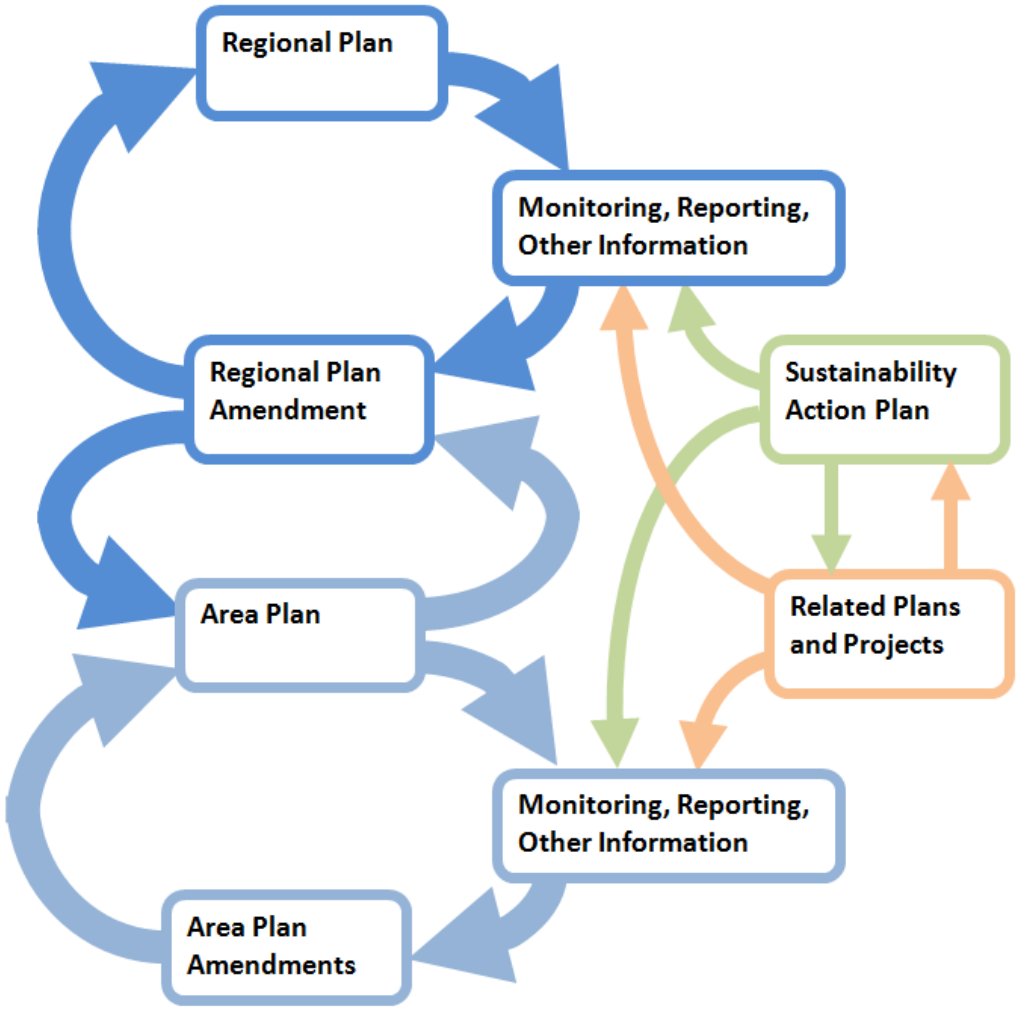


Figure 2.1 **Regional and Area Plan Relationship and Framework**

The Regional Plan must address certain topics, must be updated periodically, is subject to environmental review, and must be revised and adopted through formal public processes. These requirements are well defined in the bi-state compact, Rules of Procedure, Goals and Policies, and Code of Ordinances. In accordance with the Regional Plan implementation policies, the TRPA Governing Board annually reviews monitoring data, reports, and other information to establish priorities for updating the Regional Plan.

The Regional Plan and Code of Ordinances also establish the framework for Area Plans and associated code to be created and maintained by local jurisdictions in the Lake Tahoe Region. An amendment to the Regional Plan or Code of Ordinances may require an amendment to an Area Plan and/or associated code. The Regional Plan allows a one-year period for this to occur (bottom loop). Once adopted and found to be in conformance with the Regional Plan, the Area Plan and/or code become part of the Regional Plan and/or Code of Ordinances.

Like the Regional Plan, the Area Plans are proposed to be reviewed on an ongoing basis. Amendment of an Area Plan may be completed through well-defined processes and procedures as dictated by the bi-state compact and either California Planning and Zoning Law or Nevada Revised Statutes. These processes include publicly noticed meetings of the local government planning commission and governing body, as well as other meetings determined necessary by the local government. Additional sustainability measures can be recommended for inclusion in Area Plans through this ongoing process and public meetings.

The Sustainability Action Plan addresses GHG emissions reduction actions, climate change resiliency actions, and social, environmental, and economic sustainability actions. As this Plan is implemented, sustainability measures may be identified for incorporation into the Regional Plan or Area Plans.

Related plans and projects include but are not limited to plans, projects, and actions identified by the Lake Tahoe Sustainability Collaborative, Tahoe Basin Partnership for Sustainable Communities, Tahoe Prosperity Plan and Tahoe Prosperity Center, U.S. Forest Service, and other related agencies, organizations, and experts.

Local Jurisdiction Planning

Each city and county in California must prepare a comprehensive, long-term general plan to guide its future growth and development. The general plan expresses the community's development goals and embodies public policy relative to the distribution of future land uses, both public and private. The general plan is a set of policies and programs that form a blueprint for physical development throughout the community. The plan is a basis for land use decision making used by policy decision makers such as the Planning Commission, the City Council and/or Board of Supervisors. All California jurisdictions within the Lake Tahoe Region (Placer County, El Dorado County, and City of South Lake Tahoe) have adopted long range General Plans.

In the Nevada portion of the Region, a Master Plan, or Comprehensive Plan, is required by Nevada Revised Statutes (Chapter 278.150) for the purpose of providing long-term guidance on the development of cities, counties, and regions in Nevada. A Master Plan presents information on existing conditions, highlights current and future issues, and recommends goals, policies, and actions to address identified issues.

Lands within the Region fall within the boundaries of five counties and one city. Planning documents for local governments include:

- City of South Lake Tahoe General Plan
- El Dorado County General Plan
- Placer County General Plan
- Washoe County Master Plan
- Carson City Master Plan
- Douglas County Master Plan

Local jurisdictions can incorporate sustainability goals, policies and actions into the local planning documents (i.e., Area Plans). Local governments can also choose prepare stand-alone Climate Action Plans or sustainability plans that incorporate the reduction target framework and strategies presented later in this document.

Local governments in the Region may prepare Area Plans pursuant to Chapter 13 of the TRPA Code of Ordinances. With the adoption of the Regional Plan and Code of Ordinances, a new approach to sub-regional local government plans, Area Plans, has been established in the Lake Tahoe Region. Before Area Plans adopted by local governments in the Lake Tahoe Region can be put into effect, they must clearly demonstrate that they are consistent with the Regional Plan and advance threshold attainment. To demonstrate that an Area Plan will implement the Regional Plan it must include certain components, including sustainability measures (e.g., bicycle and pedestrian facilities in designated centers). This is achieved through the conformance review process. Further, these Area Plans are subject to annual review and certification.

In the overall regulatory context in the Region, TRPA is the primary permitting agency and the lead agency under the Tahoe Regional Planning Compact. Its charge is to oversee development of the entire Region, on both the California and Nevada sides. As a regional planning organization, TRPA's most strategic role is to build partnerships between federal, State, and local jurisdictions within the Region to deliver environmental gain.

While TRPA maintains authority over the plans, policies, and regulations that guide growth, development, and attainment and maintenance of environmental thresholds, other regulatory bodies have adopted planning documents to address their respective purposes. Other public agencies and units of government may establish equal or more stringent standards for the portions of the Region over which they have jurisdiction. Rules, regulations, ordinances, and policies adopted by TRPA must focus on regional issues and allow states and local jurisdictions to adopt specific local ordinances whenever it is possible to do so without reducing the effectiveness of the Regional Plan.

The remainder of this Plan is devoted to tools that local jurisdictions can use to incorporate sustainability actions into local planning documents.

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Chapter 3: Regional Greenhouse Gas Emissions

Electricity consumption, natural gas consumption, and transportation activities contribute approximately 75 percent of GHG emissions in the Region.

This chapter summarizes the Lake Tahoe Region's (Region's) contribution to climate change (i.e., greenhouse gas [GHG] inventory [CTC 2013]), describes a likely trend if emissions are not reduced in 2020 and 2035 (i.e., emissions projections), and proposes a regional GHG emission reduction target. The regional GHG emissions inventory was prepared by Sonoma Technologies, Inc. (STI) for the California Tahoe Conservancy (CTC 2013) and includes a rigorous accounting of GHG-generating activities in the Lake Tahoe Region. The full supporting GHG inventory documentation is provided in Appendix A.

The GHG emissions inventory is an estimate of a defined set of gases that contribute to climate change. Carbon dioxide (CO_2) is the most prevalent gas that is emitted in the largest quantities; however, there are five other primary GHGs that contribute to climate change: methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). A uniform measurement known as a carbon dioxide equivalent (CO_2e) is used to translate emissions of each GHG to CO_2 by weighting it by its relative "global warming potential." For example, CH_4 is 21 times more potent than CO_2 in its ability to trap heat in the atmosphere. Converting these gases into CO_2e allows consideration of all GHGs in comparable terms and makes it easier to communicate how various sources and types of GHG emissions contribute to global warming. A metric ton of CO_2e ($MTCO_2e$) is the standard measurement of the amount of GHG emissions produced and released into the atmosphere.

Table 3.1: Baseline Region-wide Greenhouse Gas Emissions

Source Sector	Baseline ($MTCO_2e/yr$)[1]
Transportation (on-road mobile sources)	314,815
Electricity Consumption	498,682
Natural Gas Consumption	239,654
Wood combustion	100,999
Solid Waste	68,608
Water Consumption	26,366
Wastewater Treatment	2,279
Wildfires and prescribed burns	47,968
Livestock	12,734
Recreational boats	19,199
Other off-road equipment	56,306
Other Combustion	6,010
Aircraft	4,935
Total	**1,398,554**

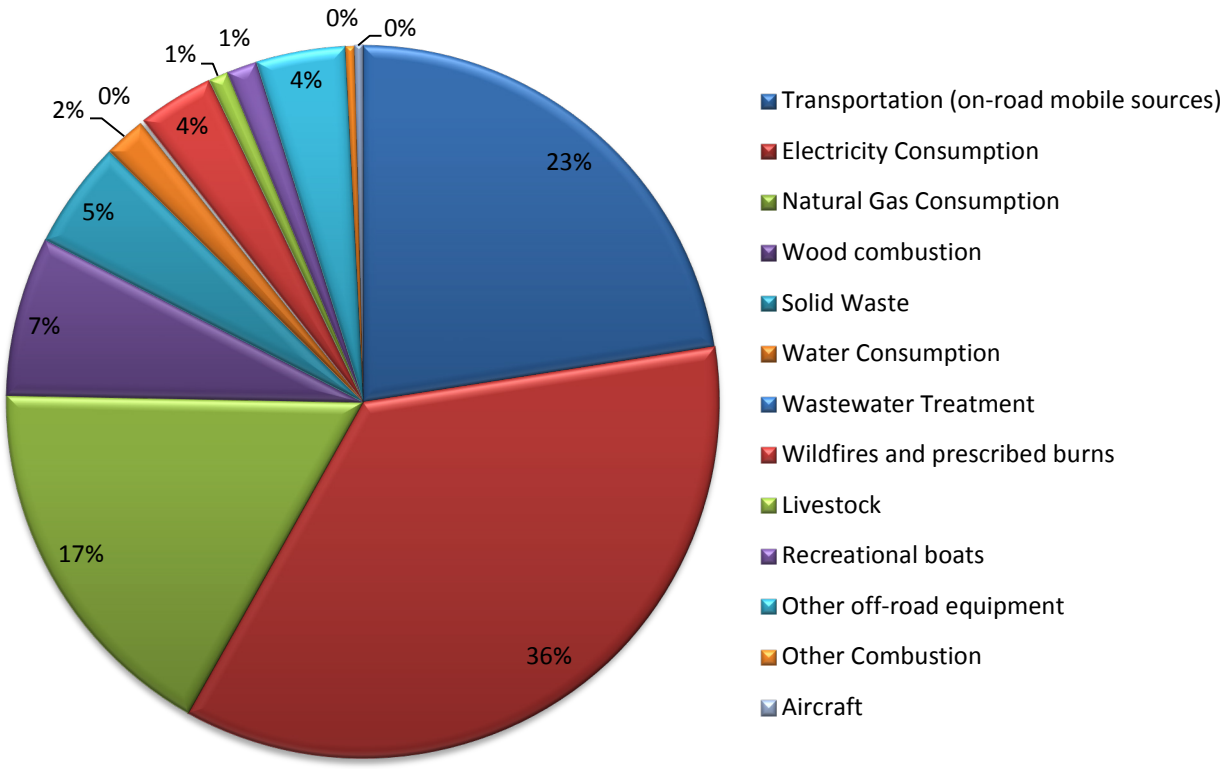
Notes: $MTCO_2e/yr$ = metric tons carbon dioxide equivalent per year.
[1] Baseline GHG emissions were calculated based on the average of emissions from year 2005 and year 2010 emissions to smooth out non-linear factors and other sources of variation, such as the economic downturn.
Numbers may not add up exactly due to rounding.
Source: California Tahoe Conservancy (2013), data compiled by Ascent Environmental, Inc. in 2013.

The purpose of the baseline emissions inventory is to gain an understanding of the sources and levels of GHG emissions within the Region, as well as to establish a level against which future emissions reduction progress can be compared. Emissions sources estimated for the Region include: on-road transportation; recreational boats; off-road equipment; wood, natural gas, and other fuel combustion; wildfires and prescribed burns; livestock; electricity consumption; water consumption; wastewater treatment; aircraft; and solid

waste disposal. Electricity consumption, natural gas consumption, and transportation contribute approximately 75 percent of GHG emissions in the Region.

CTC and STI evaluated emissions for 2005 and for 2010 to quantify the effects of the economic downturn since 2005. There were notable differences between the Region's inventories for 2005 and 2010. Certain sectors showed non-linear changes in emissions due to various reasons discussed further in Appendix A. Therefore, due to the inherent variation in inventory sectors between these two years, the average of the 2005 and 2010 GHG emissions inventories was calculated in an attempt to smooth out changes attributable to non-linear factors between 2005 and 2010. For the purposes of this Chapter, the average of the 2005 and 2010 GHG emissions inventories is used as the baseline reference point against which future comparisons can be made (Table 3.1 and Figure 3.1).

Figure 3.1: Baseline Region-wide Greenhouse Gas Emissions



Source: CTC 2013.

As discussed in Chapter 1, sustainability indicators will be monitored into the future to track the Region's progress on meeting desired sustainability outcomes. Two of the sustainability indicators that will be tracked are vehicle miles traveled and energy consumption, which are two of the greatest factors determining the Region's GHG emissions. The sustainability indicators will assist the Region with monitoring progress on achieving the GHG reduction goals discussed later in this Chapter.

Baseline Inventories by State

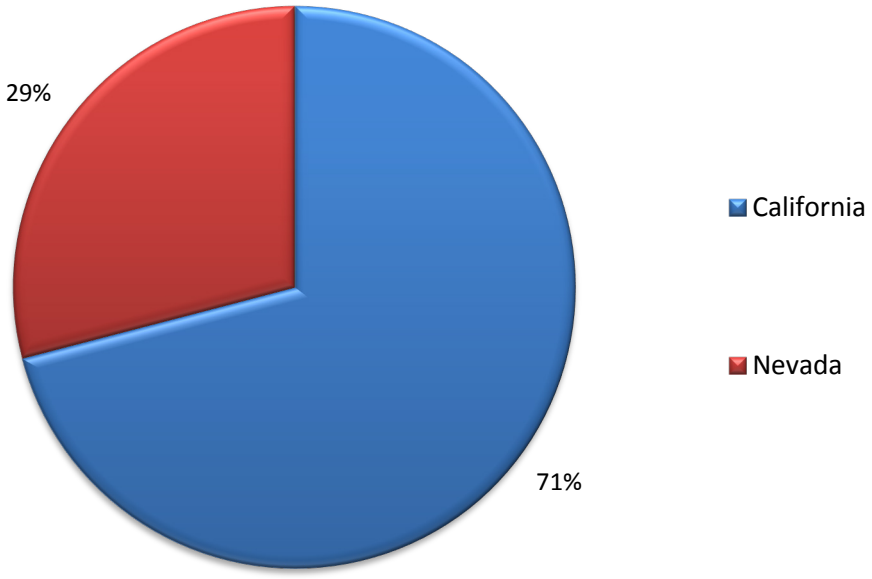
Table 3.2 shows the breakdown of the baseline emissions inventory between the California and Nevada portions of the Region. California accommodates a larger population and associated GHG-generating activity than the Nevada portion of the Region. Figure 3.2 shows the California/Nevada baseline GHG inventory split.

Table 3.2: Greenhouse Gas Emissions by State

Source Sector	Baseline ($MTCO_2e/yr$)[1]	
	CA	NV
Transportation (on-road mobile sources)	195,172	119,643
Electricity Consumption	345,253	153,429
Natural Gas Consumption	176,346	63,308
Wood combustion	90,689	10,310
Solid Waste	45,776	22,833
Water Consumption	17,559	8,807
Wastewater Treatment	2,261	18
Wildfires and prescribed burns	41,367	6,602
Livestock	12,734	–
Recreational boats	12,984	6,214
Other off-road equipment	42,656	13,650
Other Combustion	4,144	1,866
Aircraft	4,935	–
Total	**991,874**	**406,679**

Notes: $MTCO_2e/yr$ = metric tons carbon dioxide equivalent per year; CA = California; NV = Nevada
[1] Baseline GHG emissions were calculated based on the average of emissions from year 2005 and year 2010 emissions to smooth out non-linear factors and other sources of variation, such as the economic downturn. Numbers may not add up exactly due to rounding.
Source: California Tahoe Conservancy (2013), data compiled by Ascent Environmental, Inc. in 2013.

Figure 3.2 Greenhouse Gas Emissions Split between California and Nevada



Source: CTC 2013.

Baseline Inventories by Local Jurisdiction

Local jurisdictions have more control over some GHG-generating activities than others. This is also true for residents, businesses, and visitors to the Region. The GHG emissions inventory is comprised of the main emissions sources in the Region over which there is some level of influence or jurisdiction by local government or by the public, and emissions that occur within the physical jurisdiction of the Region. One exception is GHG emissions associated with electricity purchased from utilities located outside the Region that are also included. Table 3.3 shows the contribution of each local jurisdiction within the Region to the overall baseline emissions inventory. Figure 3.3 shows the baseline inventory split by local jurisdiction.

Table 3.3: Greenhouse Gas Emissions by Local Jurisdiction

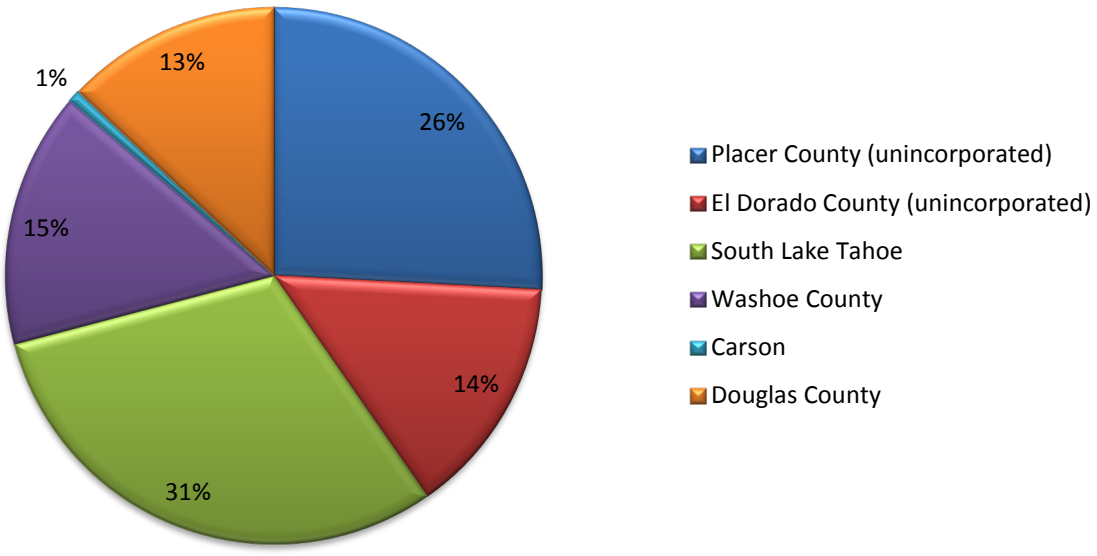
Source Sector	Baseline ($MTCO_2e/yr$)[1]					
	Placer County	El Dorado County	South Lake Tahoe	Washoe County	Carson	Douglas County
Transportation (on-road mobile)	65,736	70,247	59,189	45,755	10,441	63,447
Electricity Consumption	132,078	60,694	151,901	90,301	–	63,822
Natural Gas Consumption	45,496	20,168	110,682	50,047	–	13,262
Wood combustion	40,340	14,345	36,004	3,504	–	6,807
Solid Waste	11,349	7,106	27,321	9,644	–	13,189
Water Consumption	6,951	3,194	7,995	4,753	–	3,359
Wastewater Treatment	2,220	–	42	11	–	8

Table 3.3: Greenhouse Gas Emissions by Local Jurisdiction						
Source Sector	**Baseline ($MTCO_2e/yr$)[1]**					
	Placer County	**El Dorado County**	**South Lake Tahoe**	**Washoe County**	**Carson**	**Douglas County**
Wildfires and prescribed burns	29,859	11,508	–	–	–	6,602
Livestock	9,809	2,925	–	–	–	–
Recreational boats	6,857	1,996	4,132	2,743	–	3,472
Other off-road equipment	9,587	9,320	23,338	8,238	–	5,825
Other Combustion	1,060	829	2,256	421	–	1,446
Aircraft	–	–	4,935	–	–	–
Total	**361,339**	**202,331**	**427,792**	**215,414**	**10,441**	**181,237**

Notes: $MTCO_2e/yr$ = metric tons carbon dioxide equivalent per year.
[1] Baseline GHG emissions were calculated based on the average of emissions from year 2005 and year 2010 emissions to smooth out non-linear factors and other sources of variation, such as the economic downturn.
Numbers may not add up exactly due to rounding.
Source: California Tahoe Conservancy (2013), Data compiled by Ascent Environmental, Inc. in 2013.

The inventory does not include contributions of GHG emissions that occur during the life cycle of goods manufactured elsewhere in the world because doing so would be speculative at the planning level. However, this Plan still recognizes the importance of reducing embedded GHG emissions from the choices we make, and sustainability actions are targeted toward reducing the Region's global carbon footprint in addition to reducing emissions locally. Please see Chapter 4 for the menu of sustainability actions.

Figure 3.3 Greenhouse Gas Emissions by Local Jurisdiction



Source: CTC 2013.

Regional Greenhouse Gas Emissions Projections

The future GHG emissions projections, including the collective impact of current legislation and regulations in California and Nevada, are shown in Table 3.4 below. The collective impact of State and federal legislative actions will reduce GHG emissions in the Region by about 8 percent in 2020 compared to a scenario with no legislation included, without accounting for any local actions. GHG emissions projections shown in Table 3.4 take into account the effects of applicable legislation (renewable electricity standards [both in California and Nevada]); 2014 Title 24 building code standards (California only); and increased vehicle emissions standards ([i.e., Pavley standards; California only] and the transportation and land use strategy of the RTP/SCS, which met the GHG reduction requirements of California's SB 375 [Sustainable Communities and Climate Protection Act of 2008]). Chapter 2 provides detailed descriptions of these legislative actions.

Table 3.4: Region-wide Greenhouse Gas Emissions Projections[1]

Source Sector	Baseline ($MTCO_2e/yr$)[2]	2020 ($MTCO_2e/yr$)	2035 ($MTCO_2e/yr$)
Transportation (on-road mobile sources)	314,815	243,463	268,276
Electricity Consumption	498,682	432,880	443,857
Natural Gas Consumption	239,654	260,555	269,963
Wood combustion	100,999	110,752	115,026
Solid Waste	68,608	31,392	32,644
Water Consumption	26,366	24,048	24,485
Wastewater Treatment	2,279	2,124	2,210
Wildfires and prescribed burns	47,968	47,968	47,968
Livestock	12,734	12,734	12,734
Recreational boats	19,199	29,834	35,767
Other off-road equipment	56,306	55,583	57,038
Other Combustion	6,010	6,656	6,922
Aircraft	4,935	5,304	6,239
Total	**1,398,554**	**1,263,293**	**1,323,129**

Notes: $MTCO_2e/yr$ = metric tons carbon dioxide equivalent per year.
[1] GHG emissions projections take into account the effects of applicable legislation (renewable electricity standards [both in California and Nevada]); 2014 Title 24 building code standards (California only); and increased vehicle emissions standards ([i.e., Pavley standards; California only] and the transportation and land use strategy of the RTP/SCS, which met the GHG reduction requirements of California's SB 375 (Sustainable Communities and Climate Protection Act of 2008).
[2] Baseline GHG emissions were calculated based on the average of emissions from year 2005 and year 2010 emissions in order to smooth out non-linear factors and other sources of variation, such as the economic downturn.
Numbers may not add up exactly due to rounding.
Source: California Tahoe Conservancy (2013), Data modeled by Ascent Environmental, Inc. in 2013.

Regional Greenhouse Gas Emissions Reduction Target

The California Air Resources Board (ARB)'s *Climate Change Scoping Plan* (ARB 2008) lays out California's plan for achieving the GHG reduction target mandates in Assembly Bill (AB) 32 (The California Global Warming Solutions Act of 2006) of returning to 1990 GHG emissions levels by 2020 in California. It is estimated that in 1990 average global atmospheric concentrations of carbon dioxide (CO_2) were about 353 parts per million (ppm), and is widely considered to be the concentration of CO_2 that would avoid catastrophic climate change impacts. Thus, 1990 emissions levels are the desired level to help stabilize

climate change trends. According to the *Scoping Plan*, GHG emissions in California increased approximately 15 percent between 1990 and 2005 and are projected to increase by approximately 30 percent above 2005 levels by year 2020 under a business-as-usual scenario (ARB 2008:ES-1).

The *Scoping Plan* does not include specific GHG reduction requirements for local governments. However, ARB recommends in the *Scoping Plan* that local governments use this 15 percent reduction from existing conditions as a guide in their local target setting processes (ARB 2008:ES-5). "Existing conditions" at the time the *Scoping Plan* was published was a base year of 2005[1]. As discussed above, the average of the 2005 and 2010 GHG emissions inventories is used to represent the baseline GHG emissions for the Region (see Table 3.1).

A Regional GHG reduction target of 15 percent below the Region's baseline by 2020 is recommended for this Plan. The year 2020 is an important target year given the statutory direction provided in AB 32 to reduce GHG emissions to 1990 levels by 2020 in California. The State of Nevada has not adopted GHG reduction legislation similar to California's AB 32 or Executive Order S-3-05. The year 2020 should be seen as an "interim" target year, given that 2020 is approaching. The Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and Regional Plan horizon year is through 2035. Further, California Executive Order S-03-05 directs California to reduce GHG emissions to 80 percent below 1990 levels by 2050. Thus, longer-term (2035) GHG reduction benchmarking is also part of the discussion in the following section.

A 15 percent reduction below baseline emissions would correspond with a GHG emissions target (i.e., emissions limit) of 1,188,771 MT CO_2e in 2020 for the Region. After accounting for reductions that are expected to occur resulting from legislation, the Region would need to reduce GHG emissions by 74,522 MT CO_2e in 2020 through local climate action and sustainability measures to meet this target. A 2050 benchmark was estimated by calculating the emissions level 80 percent below the 2020 target, which is treated as a proxy for 1990 emissions. The 2035 goal was interpolated between 2020 and 2050. These values are presented in Table 3.5.

Table 3.5: Regional Greenhouse Gas Reduction Targets for 2020 and 2035

Year	GHG Emissions ($MTCO_2e/yr$)			
	GHG Emissions (Baseline and Projected)	GHG Reduction Target/ Emissions Limit	GHG Reductions Needed to Achieve Target	% Below Baseline
Baseline	1,398,554	–	–	–
2020	1,263,293	1,188,771	**74,522**	15
2035	1,323,129	713,262	**609,867**	49
2050[1]	–	237,754[1]	–	83

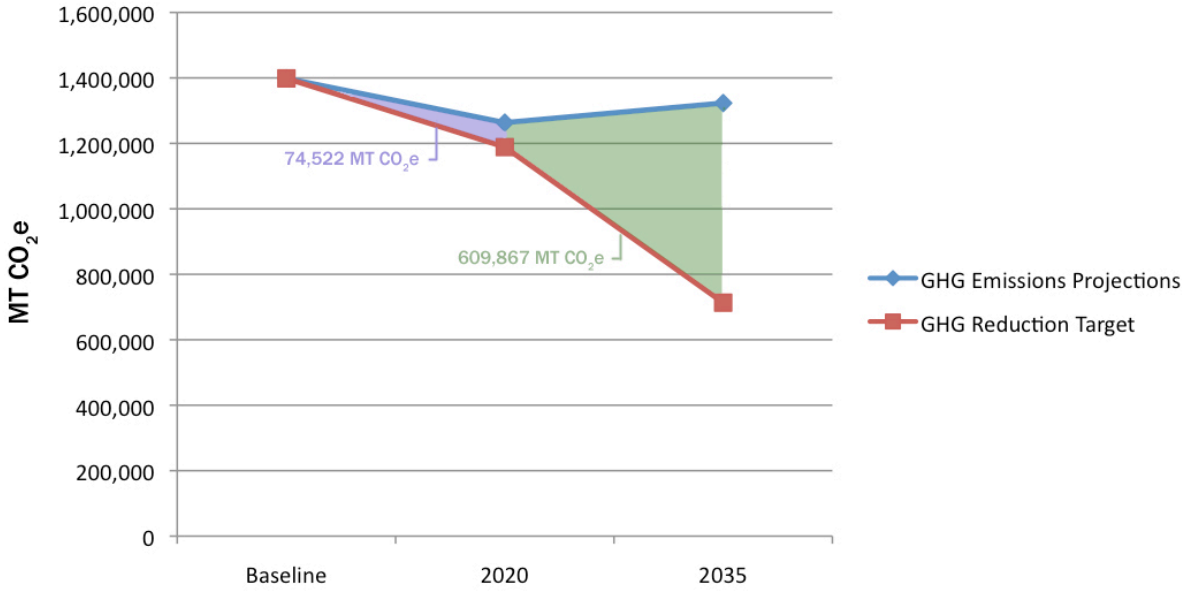
Notes: GHG = greenhouse gas; MT CO_2e = metric tons carbon dioxide equivalent; yr = year.
The 2050 target was estimated by calculating the emissions level 80% below the 2020 target which is considered equivalent to 1990 emissions. The 2035 target was interpolated between 2020 and 2050.
[1] The reduction target shown for 2050 was calculated based on using 80% below the 2020 Reduction Target. Since the Regional Plan horizon is 2035, growth projection data for the Lake Tahoe Region was not available beyond year 2035 and Regional Plan buildout. The value reported for 2050 is only used as a proxy data point in interpolating the 2035 reduction target.
Source: California Tahoe Conservancy 2013; Data calculated by Ascent Environmental, Inc. in 2013.

[1] ARB is currently in the process of updating the *Scoping Plan*. The 2013 *Scoping Plan* update will address ARB's climate change priorities for the next five years and lay the groundwork to reach post-2020 goals set forth in Executive Orders S-3-05 and B-16-2012 (ARB 2013).

As discussed in Chapter 1, scientific evidence indicates that global emissions must be reduced 80 percent below 1990 levels by 2050 to achieve climate stabilization. Thus, 1990 emissions levels are the desired level to help stabilize climate change trends. Therefore, these goals and targets represent the Region's fair share contribution of GHG reductions to levels that would achieve climate stabilization. The midterm targets/goals for 2020 and 2035 will drive continued progress toward meeting the 2050 goal. The 2020 target and 2035 goal that reflect the scientifically-based level of emission reductions necessary will help guide ongoing and future policy decisions in the Region.

Figure 3.4 depicts the Region's future emissions and the GHG reductions needed to achieve the recommended target.

Figure 3.4: Region-wide Greenhouse Gas Emissions Projections and Reduction Target (2020) and Goal (2035)



Local Government-Level Greenhouse Gas Reduction Target Framework

It should be noted that the reduction target and goal recommended above are based on Region-wide GHG emissions. Local jurisdictions within the Region are encouraged to adopt reduction targets that are consistent with the Region's goals within their regulatory framework. Ultimately, a local jurisdiction's reduction targets and goals will be based on its individual GHG emissions profile.

Local jurisdictions can choose to follow the framework provided here for the Region, and select 15 percent below their respective existing GHG emissions levels by 2020 (i.e., 15 percent below the GHG emissions in Table 3.3). However, certain jurisdictions in the Region may present more GHG reduction opportunity than others, and may contribute more GHG reductions to the Regional total, while other jurisdictions contribute fewer GHG reductions. Each local jurisdiction is encouraged to adopt a GHG emissions reduction target that supports achieving the Regional target in the aggregate. The Tahoe Regional Planning Agency (TRPA) will require each local jurisdiction to develop a GHG reduction strategy within each Area Plan, using this Plan as guide.

Chapter 4 provides menus of sustainability actions that Regional agencies and local government jurisdictions can use in their sustainability planning efforts. Information is provided on GHG reduction potential, where available, along with the sustainability co-benefits of each action. Not every action will be appropriate for implementation in every jurisdiction. Local governments and their constituents are the ultimate experts on what actions will best serve their community's needs and interests. However, many of the actions can result in win-win situations for GHG reduction, environmental and community co-benefits, long-term cost savings, job-generation potential, and climate change readiness co-benefits.

The Region is taking an active role in mitigating climate change effects globally and locally through GHG reduction actions and sustainable communities planning. However, some amount of climate change is unavoidable and already beginning to occur in the Region. Chapter 5 provides menus of actions specifically designed to plan for climate change impacts and help make the Region more prepared and resilient to these effects. The actions in Chapters 4 and 5 are highly inter-related and offer cross-cutting, multiple benefits for sustainability. Users of this Plan are encouraged to adopt and implement actions from both Chapters 4 and 5, as they are equally important for sustainability planning in the Region.

Finally, Chapter 6 provides actions that individuals, businesses, schools, and visitors can take to help engage local governments and get involved in implementing this Plan.

References

California Air Resource Board. 2008. *AB 32 Climate Change Scoping Plan*. http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.

California Air Resource Board. 2013. *AB 32 Climate Change Scoping Plan Update.* http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm.

California Tahoe Conservancy. 2013 (January). *A Regional Greenhouse Gas Inventory for the Lake Tahoe Basin.* www.tahoe.ca.gov.

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Chapter 4: Sustainability and Greenhouse Gas Reduction Actions

Introduction

Helping to achieve sustainability in the Lake Tahoe Region is everyone's responsibility. This chapter includes numerous sustainability and greenhouse gas (GHG) reduction actions that can be undertaken by Regional agencies and local jurisdictions. The actions listed in this chapter have been developed based on existing regulatory framework already in place in the Lake Tahoe Region, along with actions successfully implemented elsewhere, recommended by relevant agencies or entities, and/or recommended by the Lake Tahoe Sustainability Collaborative and Partnership.

> *Lake Tahoe is ahead of the curve. You recognized it when the beauty, and clarity, and majesty of this lake was obviously and clearly threatened. When the threat is to communities around the world, it is harder to connect the dots. But those dots connect right back to Lake Tahoe.*
>
> –Former Vice President Al Gore; 2013 Tahoe Summit.

Not every action will be appropriate for implementation in every jurisdiction. Local governments and their constituents are the ultimate experts on which actions will best serve their community's needs and interests. However, many of the actions can result in win-win situations for GHG reduction, environmental and community co-benefits, long-term cost savings, job-generation potential, and climate change readiness co-benefits. Each action is accompanied by a ranking for sustainability co-benefits. This information can be used by jurisdictions as they undertake their own sustainability planning processes to help prioritize their efforts and application of limited resources.

The Region is taking an active role in mitigating climate change effects globally and locally through GHG reduction actions and sustainable communities planning. However, some amount of climate change is unavoidable and already beginning to occur in the Region. Chapter 5 provides menus of actions specifically designed to plan for climate change impacts and help make the Region more prepared and resilient to these effects. The actions in Chapters 4 and 5 are highly inter-related and offer cross-cutting, multiple benefits for sustainability. Users of this Plan are encouraged to adopt and implement actions from both Chapters 4 and 5, as they are equally important for sustainability planning in the Region.

Regional Agencies and Local Jurisdiction Actions

Sustainability actions can be implemented at a variety of levels. Examples range from requiring or mandating a given outcome through ordinances or municipal code changes or by supporting and encouraging a given outcome through incentives and facilitation. The implementation technique employed by a jurisdiction affects the "participation rate" within the community (for example, the percentage of people implementing a particular action) and the associated outcome. Please see Chapter 6 for a model that local governments can follow to increase participation while implementing voluntary actions. Jurisdictions should also be aware of community co-benefits that may be available associated with certain types of sustainability measures. Trade-offs between costs and co-benefits are important factors for decision-makers to consider when determining feasibility of sustainability actions for their jurisdiction.

Actions for Regional agencies and local jurisdictions are organized into 11 sustainability categories designed around associated goals:

Community & Environmental Benefit Symbol	Sustainability Category	Sustainability Goal
	Greenhouse Gas Emissions Reduction	Reduce total region-wide GHG emissions by 15 percent below existing baseline emissions by year 2020.
	Energy	Reduce energy consumption from new and existing development in the Region by making buildings more efficient.
		Increase renewable energy generation in the Region.
	Mobility & Goods Movement	Reduce vehicle miles traveled and increase non-vehicle mode share in the Region.
		Encourage use of local materials and local food supply.
		Provide access to high-quality non-vehicle travel mode choices for mobility in the Region.
	Solid Waste & Recycling	Increase solid waste diversion through recycling, composting, and source reduction.
	Water Resources & Conservation	Reduce indoor and outdoor water consumption and associated electricity use.
		Protect and continuously improve water quality in the Region.
	Air Quality	Promote retirement of wood-burning appliances and replacement with more efficient or alternative fuel appliances.
		Reduce emissions from off-road equipment, including construction equipment and recreational vehicles.
	Forest Resources & Management	Promote forest health and reduce forest fuel to minimize loss due to wildfires.
	Biological Resources	Preserve and protect biological resources in the Region and protect against invasive species.
	Economic Health	Foster a sustainable economy with a variety of employment opportunities and an increase in environment-oriented jobs, such as eco-tourism.
	Social Equity	Promote social equity and fair access to resources for all residents of and visitors to the Region.
		Provide adequate housing opportunities for a variety of income levels.
	Community Health	Improve air quality in the Region and protect public health.
		Promote human health by increasing access to community resources, such as parks and trails, neighborhood services, and healthy food choices.

Additional community co-benefits include:

Public Health & Safety	Recreation Resources	Community Noise Reduction	Job Generation Potential
			

Many sustainability actions also have climate change readiness co-benefits that will help make the Region and its communities less vulnerable and more prepared for the impacts of climate change. Chapter 5 is devoted to planning for the impacts of change on the Lake Tahoe Region. The following climate change readiness co-benefits of each action are also identified in the following sections:

Water Quality	Water Supply	Wildfire Hazard Reduction	Flooding Hazard Reduction	Emergency Response	Forest Resources	Biological Resources	Air Quality	Enhanced Economic Activity	Energy Supply
									

The following sections identify menus of actions that local governments can choose to adopt as part of individual jurisdiction sustainability planning and to achieve jurisdiction-specific GHG reduction goals. A framework for local jurisdiction GHG reduction goal development was described previously in Chapter 3. While the list reflects a comprehensive planning process, it is not exhaustive. Sustainability approaches are continuing to evolve and new opportunities arise regularly.

These menus were inspired by and developed based on sustainability activities already underway by TRPA and other agencies in the Region, as well as actions drawn from sustainability plans elsewhere, and innovative ideas suggested by stakeholders. These actions have been vetted by stakeholders in the Lake Tahoe Region (i.e., the Collaborative and Partnership) and have been identified as important priorities. Thus, the remainder of this chapter serves as a tool-kit from which local jurisdictions can draw based on what makes sense for the context of their community to complement existing Regional Plan and Regional Transportation Plan Policies. Jurisdictions may implement these actions through incorporation into Area Plans or code amendments, forming partnerships with other agencies, allocating funding and/or identifying staff resources to oversee a program.

Greenhouse Gas Reduction Potential

Estimated GHG reduction potential is reported for actions where sufficient data was available to evaluate an action's performance. Region-wide and individual local jurisdiction GHG reduction potential are reported in units of metric tons of carbon dioxide equivalent (MT CO_2e) per year in both years 2020 and 2035. Detailed calculations are provided in Appendix B. Region-wide GHG reduction potential represents the sum of each respective local jurisdiction's potential GHG reduction contribution for each action. GHG reduction potential is an estimate of available GHG emissions reductions based on the expected performance of the action described in each table below, and should not be treated as a precise value. Actual levels of implementation will vary based on local context, availability of funding,

and many other factors that influence feasibility. However, this information can be used by local jurisdictions to select and prioritize sustainability measures in area plans and municipal codes.

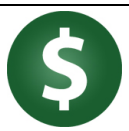
The order of magnitude (low, medium, or high) of Regional GHG reduction potential of an action is presented graphically using the following symbols:

Low		Approximately 10-100 metric tons per year of Region-wide GHG reduction potential
Medium		Approximatley 100-1,000 metric tons per year of Region-wide GHG reduction potential
High		Greater than approximately 1,000 metric tons per year of Region-wide GHG reduction potential

The low, medium, and high rankings are not intended to represent precise values. Instead, are intended to give decision makers a quick-glance reference for comparison purposes within this menu of actions.

Cost Information

Similarly, the order of magnitude (low, medium) estimate of public and private costs or rate of return associated with implementation is presented graphically for each action. “High” cost actions would be defined as consuming a substantial portion of a municipal budget. No “high” cost actions were recommended in this plan because it is unlikely that they would be considered economically feasible. Exact cost estimate or rate of return is not known with any level of precision because the level of implementation for each action presented in this section will vary widely throughout the Region and will be dependent on availability of funding. Examples of how public and private costs were ranked are provided below.

Public Costs or Revenue		
Low Cost		Assumes that less than one full-time-equivalent employee would be required to oversee implementation
Medium Cost		Assumes more than one full time equivalent employee or operational and maintenance costs and/or capital improvements financing would be required to construct new permanent facilities
Revenue-Neutral or Revenue-Generating		Assumes that administrative costs to implement would be fully or nearly offset by program revenue

Private Costs or Returns		
Low Cost		Assumes that sufficient incentives, subsidies, or rebates would be available to nearly offset the upfront cost of implementation to individuals or businesses
Medium Cost		Assumes private businesses or individuals would incur short-term costs of improvements, infrastructure, or employee training
Cost-Neutral, Positive Return, or Cost Savings		Assumes that cost savings (e.g., reductions in utility bills) exceed cost of upgrades either with subsidies or over the long term

Again, the rankings are not intended to represent precise values. Instead, are intended to give decision makers a quick-glance reference for comparison purposes within this menu of actions.

Sustainability and Greenhouse Gas Reduction Actions

Energy

Electricity consumption and heating of buildings are the largest contributors to GHG emissions in the Region. The majority of the Region's buildings were constructed prior to the adoption of energy efficiency building standards and codes. For these reasons, energy conservation, efficiency improvements, and renewable energy present the greatest opportunities for reducing GHG emissions in the Region, as well as cost savings on utility bills.

Energy Efficiency

Green Building Ordinance	Modify the applicable building codes to require or incentivize increased energy efficiency of new development. Permitting-agencies offer incentives (e.g., expedited processing and permit fee reductions or waivers; reduced mitigation/impact fees; coverage, bonus unit, or commercial floor area incentives) to property owners who will exceed energy efficiency code requirements by 15 percent through a combination of energy efficiency, appliances and equipment, on-site renewable energy, or equivalent measures. Conduct training for developers, local contractors, and other interested parties on the desired and effective methods to exceed current energy efficiency standards.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	 Medium	 Medium	 Medium	 Medium	 Low to Medium	 Medium

Notes:	2,996 MT CO_2e/year in 2020 7,526 MT CO_2e/year in 2035	Adjust to temperature extremes Prepare for energy supply variability	Promote energy independence Improve air quality Cost savings to property owner Higher resale Value	Incremental cost to new construction: $1,500 small home (2,000 sf) -$3,000, large home (4,500 sf); $1.50-2/sf for commercial building; Payback time 5-8 years[1]	Administrative costs to implement Loss of some permit fee revenue	Inspectors (Home Energy Rating System [HERS] auditors) and contractors

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	720	1,810
El Dorado County	328	824
South Lake Tahoe	1,065	2,676
Washoe County	569	1,430
Douglas County	313	786
Responsible Party for Implementation: Local Jurisdictions, Developers/Contractors, TRPA		
Applicability: New Development and Redevelopment		

Sources: Sierra Business Council; City of South Lake Tahoe; Douglas County; El Dorado County Air Quality Management District.
[1]Gabel Associates 2010.

Some additional supporting measures for local governments to assist in Green Building Ordinance Implementation:

- Incorporate pre-plumbing for solar water heating and installation of wiring conduit for future photovoltaic installation.
  Source: Placer County Air Pollution Control District
- Adopt design guidelines for passive solar for all new buildings requiring orientation of 75 percent of homes and/or buildings to face either north or south (within 30 degrees of N/S). Update/incorporate solar access guidelines in Code of Ordinances/Green Building Ordinance, consistent with State standards for solar access.
  Source: El Dorado County Air Quality Management District
- Design guidelines and criteria for the Green Building Ordinance may include: tight building construction; increased insulation; location of active living spaces on a building's south side; location of closets mud-room, garages, or storage space on north and east sides; concentration of windows on south side; reduction in number and size of openings on north side; maximum use of double glazing; building overhangs to shield windows from summer sun and to let in winter sun; steeply pitched roofs to deflect winter winds and to reduce roof area affected by winds; use of paved surfaces, rock, or masonry on south side to absorb radiation; earth berms against exterior walls.
  Sources: El Dorado County Air Quality Management District, Sierra Business Council
- Incorporate a "tank-less" water heating system into new building design.
  Source: Placer County Air Pollution Control District

Property Assessed Clean Energy Financing Program	Implement a low interest loan or rebate program for on-site renewable energy installations or energy efficiency retrofits, such as a Property Assessment Clean Energy Financing (PACE) program (e.g., Placer County's and El Dorado County's PACE Programs *mPower Placer* and *EmPower El Dorado,* respectively) in existing residential and commercial buildings.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Medium	Medium	Low	$ to $ None to Low	High
Notes:	2,067 MT CO_2e/year in 2020 4,046 MT CO_2e/year in 2035	Adjust to temperature extremes Improve air quality Prepare for energy supply variability	Promote energy independence Improve air quality Lower utility bills Higher resale Value	Assessed on property tax bill and paid back over long-term as a senior lien on the property	Revenue neutral; administrative costs built in to interest on assessment[1]	Contractors, Inspectors (Home Energy Rating System [HERS] auditors)

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	497	973
El Dorado County	226	443
South Lake Tahoe	735	1,439
Washoe County	393	769
Douglas County	216	422
Responsible Party for Implementation: Local Jurisdictions		
Applicability: Existing Development		

Sources: Sierra Business Council; City of South Lake Tahoe; California Center for Sustainable Energy.
mPower Placer. *http://www.mpowerplacer.org/about-us*
EmPower El Dorado. *http://www.empowereldorado.org/*
PACENow. *pacenow.org*
[1]Potential Economic Impacts of a Commercial PACE Program. May 2011. Prepared for City of Sacramento by Center for Strategic Economic Research.

More information on implementing a PACE program:

One potential mechanism through which local governments can offer financial assistance for energy improvements is a Property Assessed Clean Energy or "PACE" program. On July 21, 2008, Governor Arnold Schwarzenegger signed into law California AB 811, Contractual Assessments: Energy Efficiency Improvements, which enables California cities and counties to pay for clean energy and/or energy efficiency projects with assessment financing arrangements. AB 811 authorizes California municipalities to designate areas within which qualifying property owners can enter into contractual assessments with the municipality to finance the installation of energy efficiency improvements and/or small renewable energy systems that are permanently fixed to the property owner's real property. The State of Nevada also has enacted PACE enabling legislation (SB 358) but no PACE programs have been enacted to date.

The loans provided by municipalities to qualifying property owners for renewable energy generation and energy efficiency improvements will be repaid as an item on the property owner's property tax bill. Through the creation of financing districts, property owners can finance energy efficiency improvements and renewable onsite generation installations through a voluntary assessment on their property tax bills.

Property owners can benefit from a PACE program by avoiding the upfront installation cost of energy efficiency measures and on-site renewable generation systems and eliminating concerns that they will sell the property before recovering the system investment from utility bill savings. The result is that property owners in participating jurisdictions can finance their energy efficiency and renewable energy efforts with a minimal level of financial risk.

Local governments benefit from forming clean energy assessment districts by providing options to their constituents to install clean energy technologies. Clean energy investments funded through these programs will assist local governments in reaching GHG reduction goals and fulfilling other environmental and climate change-related objectives. The PACE mechanism requires little or no investment of general funds and presents very low risk given that the loan repayment is a senior lien on the property, ahead of the mortgage itself (CCSE 2013).

Placer and El Dorado Counties have PACE programs in place to promote more efficient use of water and energy and enable property owners to reduce energy costs. Placer County's program was launched in 2010 and is open to eligible Placer County properties in any of its six incorporated cities and towns, as well as the unincorporated areas. mPOWER Placer (Money for Property Owner Water and Energy efficiency Retrofitting) finances energy efficiency improvements and energy generation systems, such as solar photovoltaic, to qualified Placer County property owners with no upfront costs. The financed amount is amortized and the annual amount due is added to the property tax bill each year until paid in full. If the property is sold, the equipment and the unpaid amount stay with the property (mPOWER Placer 2013, EmPower El Dorado 2013). To date, the program has not disbursed funds in the Region; however, the financing tool is available to residents and businesses in the Tahoe portion of Placer County. Other local governments in the Region could follow the mPOWER Placer and EmPower El Dorado models to assist in implementing the energy and water efficiency and renewable energy strategies evaluated in this section and in the remainder of this report.

Additional supporting measures for local governments to improve energy efficiency of existing development:

- Coordinate with TRPA to evaluate feasibility of leveraging of Air Quality and Traffic Mitigation Fees for financing PACE loans.
- Expand funding for and continue to implement weatherization assistance for low-income homeowners. Resources are available below:
  https://www.nvenergy.com/home/assistance/nvenergyconnection.cfm
  http://www.libertyutilities.com/west/saving/care.html
  https://myaccount.swgas.com/startlira
  http://www.nvhousing.state.nv.us/weatherization/weatherization%20index.htm

In addition, the U.S. Department of Housing and Urban Development offers energy efficient mortgages to help finance the cost of adding energy efficiency features to new or existing housing as part of a Federal Housing Administration-insured home purchase or refinancing mortgage. More information is available at:

http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/eem/energy-r

<table>
<tr><td rowspan="3">Energy Efficiency and Renewable Energy in Public Facilities</td><td colspan="6">Program capital improvements to reduce energy consumption or incorporate renewable energy production into public facilities.

Replace existing traffic lights, street lights, and other public lighting with energy-efficient lighting (e.g., LEDs) during regular maintenance and upgrades. Consider shielding from snow accumulation in streetlight design.</td></tr>
<tr><td>Region-wide GHG Reduction Potential</td><td>Climate Change Readiness Co-benefits</td><td>Environmental & Community Co-benefits</td><td>Private Costs</td><td>Public Costs</td><td>Job Generation Potential</td></tr>
<tr><td>Medium</td><td>Low</td><td>Medium</td><td>None</td><td>Medium</td><td>Low</td></tr>
<tr><td>Notes:</td><td></td><td>Prepare for energy supply variability</td><td>Promote energy independence

Improve air quality

Lower utility bills

Lead by example</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Responsible Party for Implementation: Local Jurisdictions, TRPA, TMPO, TTD, Caltrans/NDOT, Utilities</td></tr>
<tr><td colspan="7">Applicability: Public Facilities</td></tr>
<tr><td colspan="7">Sources: TRPA; Sierra Business Council; City of South Lake Tahoe; Placer County Air Pollution Control District.</td></tr>
</table>

Energy Efficient Lighting Development Standards	Adopt efficient indoor and outdoor lighting standards for new development. Increased efficiency may be achieved through use of LED bulbs, Energy Star® qualified hard-wired fixtures, energy management systems with automatic time switches, occupant sensors and automatic day-lighting control devices, solar powered (photovoltaic) lighting or Energy Star® Advanced Lighting Packages and/or through use of photo sensors or timers.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	Low	None	Low
Notes:		Prepare for energy supply variability	Promote energy independence Improve air quality Lower utility bills Improved safety and security			Energy Auditors
Responsible Party for Implementation: Local Jurisdictions, TRPA						
Applicability: New Development and Redevelopment						
Source: Placer County Air Pollution Control District.						

Energy Star Appliances	Require "Energy Star®" appliances (e.g., water heaters, spa or swimming pool heaters, refrigerators, furnaces, boilers, dishwashers, washers, and dryers) be installed in new private development and public facilities wherever appliances are furnished as standard part of construction.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	Low	None	Low
Notes:		Prepare for energy supply variability	Promote energy independence Improve air quality Lower utility bills Higher resale Value	Energy Star® appliances are widely available		
Responsible Party for Implementation: Local Jurisdictions, TRPA, Utilities						
Applicability: New Development and Redevelopment						
Source: City of South Lake Tahoe.						

Energy Efficiency Education	Local jurisdictions, TRPA partners, neighboring jurisdictions, and energy providers (e.g., CalPeco; NV Energy, Southwest Gas) launch a comprehensive social marketing campaign that leverages available tools from the social sciences to influence behaviors that reduce energy demand and promote conservation.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Low	Low	Low
Notes:		Prepare for energy supply variability Improve air quality	Promote energy independence Improve air quality Lower utility bills			
Responsible Party for Implementation: Local Jurisdictions, TRPA, Utilities						
Applicability: Region-wide						

Renewable Energy Generation

Community Choice Aggregation	Adopt a Community Choice Aggregation (CCA) Ordinance and/or work with the local utility to offer green power/renewable energy purchasing to customers. CCA would enable customers to purchase low-carbon intensive electricity. The primary benefits offered by a CCA are local control over the energy resources used within the community, ability to provide electricity to customers at lower overall cost, and greater use of renewable energy. Through a CCA, the community can choose to structure a supply portfolio that achieves cost efficiencies, fuel and technological diversity, environmental improvements, and/or cost stability.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	High	Medium	Medium	Low	Low	Medium
Notes:	39,800 MT CO_2e/year in 2020 85,600 MT CO_2e/year in 2035	Prepare for energy supply variability Improve air quality	Promote energy independence Improve air quality			

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	14,921	32,806
El Dorado County	6,857	15,075
South Lake Tahoe	17,161	37,729
Washoe County	10,937	19,190
Douglas County	7,730	13,563
Responsible Party for Implementation: Local Jurisdictions, Utilities		
Applicability: Region-wide		
Source: Local Government Commission.		

More Information about Community Choice Aggregation:

Community choice aggregation (CCA) is a State of California policy that enables local governments to aggregate electricity demand within their jurisdictions in order to procure alternative energy supplies while maintaining the existing electricity provider for transmission and distribution services. In 2002, Community Choice Aggregation (AB 117, California) was signed into law. This legislation removed a significant organizational hurdle for California-based local governments interested in providing electricity to their communities. There are many reasons that a community may choose to develop a CCA, including the option to purchase more green power, reduce electricity cost, and provide power from more local sources.

The California Public Utilities Commission (CPUC) is in charge of creating guidelines for a CCA program. CCA is a substantial undertaking for any community, but the benefits may be worth the effort and risk. One of the first things to consider is whether there is the political commitment to form and, ultimately, implement a CCA. Local elected officials will make the decision about establishing a CCA and are accountable for its successes or shortcomings. Implementing a CCA program will take several years. As a result, the elected officials who initiate the process of forming a CCA may not be the ones who vote to establish it, or make resource selection and rate-setting decisions. And there will likely be opposition to CCA formation within the community.

Well-managed power purchasing and development should mitigate any risk of CCA rates being higher than utility rates. A well-balanced portfolio of resources that includes short and long-term contracts and CCA financed new generation projects result in competitive rates. Future regulatory decisions could result in cost increases for CCA programs. However, most of the decisions about CCA programs have already been made by the CPUC. Local governments participated in that process, and their concerns were favorably reflected in those decisions. Continued participation in CPUC proceedings will be necessary to protect CCA interests (LGC 2013).

Supporting measures for local governments to assist in CCA Implementation:

- Coordinate with local utility providers (including South Tahoe Public Utilities District) to obtain and disperse grant funding to develop renewable energy projects within the community.
- Carefully consider opportunities for biomass power generation where appropriate. Support projects that demonstrate carbon neutrality, reduce forest fuels, and improve air quality. Evaluate whether natural gas vehicles can be used to collect and transport biomass material. *Source: Tahoe Prosperity Center.*

<table>
<tr><td rowspan="3">Renewable Energy Standards or Incentives for New Development</td><td colspan="6">Require or incentivize renewable energy (e.g., solar PV, solar water heating, solar thermal spa or swimming pool heaters) in new development where solar access is available. Require or incentivize that a minimum of 15 percent of the project's energy be generated on-site through renewable sources.

Offer incentives (e.g., expedited processing and permit fee reductions or waivers, reduced mitigation/impact fees) to property owners who apply for a permit to install renewable energy systems that would generate at least 15 percent of the customer's energy on-site.

Solar panels or other alternative energy equipment may be exempted from the requirements of TRPA Code of Ordinances 36.6.1.A and B if a project level assessment demonstrates that scenic threshold standards will not be adversely impacted.</td></tr>
<tr><td>Region-wide GHG Reduction Potential</td><td>Climate Change Readiness Co-benefits</td><td>Environmental & Community Co-benefits</td><td>Private Costs</td><td>Public Costs</td><td>Job Generation Potential</td></tr>
<tr><td>Medium</td><td>Medium</td><td>Medium</td><td>Medium</td><td>Low</td><td>Medium</td></tr>
<tr><td>Notes:</td><td>3,031 MT CO_2e/year in 2020

7,595 MT CO_2e/year in 2035</td><td>Prepare for energy supply variability

Improve air quality</td><td>Promote energy independence

Improve air quality

Cost savings to property owner

Higher resale value</td><td></td><td>Loss of some permit fee revenue</td><td>Contractors and renewable energy installers

7.14 jobs/MW installed[1]</td></tr>
<tr><td colspan="3">Local Jurisdiction GHG Reduction Potential</td><td colspan="2">MT CO_2e/year in 2020</td><td colspan="2">MT CO_2e/year in 2035</td></tr>
<tr><td colspan="3">Placer County</td><td colspan="2">729</td><td colspan="2">1,826</td></tr>
<tr><td colspan="3">El Dorado County</td><td colspan="2">332</td><td colspan="2">832</td></tr>
<tr><td colspan="3">South Lake Tahoe</td><td colspan="2">1,078</td><td colspan="2">2,701</td></tr>
<tr><td colspan="3">Washoe County</td><td colspan="2">576</td><td colspan="2">1,444</td></tr>
<tr><td colspan="3">Douglas County</td><td colspan="2">316</td><td colspan="2">793</td></tr>
<tr><td colspan="7">Responsible Party for Implementation: Local Jurisdictions, TRPA</td></tr>
<tr><td colspan="7">Applicability: New Development and Redevelopment</td></tr>
<tr><td colspan="7">Sources: TRPA; City of South Lake Tahoe; Douglas County.
[1] Environment California Research and Policy Center, 2003. Renewable Energy and Jobs. http://www.localcleanenergy.org/files/The_21st_Century_Energy_Greenprint_Full_Report.pdf</td></tr>
</table>

<table>
<tr><td rowspan="3">Innovative Approaches to Energy Generation and Distribution</td><td colspan="6">Consider opportunities for alternative energy generation when appropriate.

As water and wastewater conveyance, and other infrastructure, is replaced or upgraded, incorporate energy recapture (in-conduit hydro, co-generation) and distributed energy storage systems. Pursue funding for in-conduit hydro to generate renewable energy as wastewater is pumped out of the Basin.

Encourage and support the Region’s largest energy consumers (e.g., resorts and gaming establishments) to consider co-generation and distributed generation projects where feasible.

Consider the feasibility of distributing waste heat beneath sidewalks and multi-use paths to melt snow in the winter.

Encourage local utilities to apply for eligibility for the California Public Utilities Commission (CPUC)’s Self-Generation Incentive Program (SGIP) so that projects may be eligible for rebates.</td></tr>
<tr><td>Region-wide GHG Reduction Potential</td><td>Climate Change Readiness Co-benefits</td><td>Environmental & Community Co-benefits</td><td>Private Costs</td><td>Public Costs</td><td>Job Generation Potential</td></tr>
<tr><td> 
High</td><td> 
Medium</td><td> 
High</td><td> 
Low</td><td> 
Medium</td><td> 
Medium</td></tr>
<tr><td>Notes:</td><td></td><td> 
Prepare for energy supply variability

Improve air quality</td><td> 
Promote energy independence

Improve air quality

Mobility & community health</td><td></td><td>California Public Utilities Commission offers Self-Generation Incentive Program (CalPeco not currently eligible)</td><td>SGIP-approved California manufactures</td></tr>
<tr><td colspan="7">Responsible Party for Implementation: Local Jurisdictions, Large Energy Consumers, Utilities</td></tr>
<tr><td colspan="7">Applicability: Public Facilities</td></tr>
<tr><td colspan="7">Sources: Sierra Nevada Alliance;
California Public Utilities Commission. http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/</td></tr>
</table>

Mobility and Goods Movement

Vehicles are another major source of GHG emissions in the Region, as well as a major source of air and water pollution that affects Lake Tahoe. Local governments play an important role in providing mobility options and removing obstacles to individuals selecting non-vehicle mode choices, in coordination with state and Regional partners (e.g., TMPO, TTD, and state transportation agencies [Caltrans, and NDOT]). As discussed previously in Chapter 2, the Regional Transportation Plan/Sustainable Communities Strategy adopted in 2012 contains the package of transportation capital improvements planned for the Region by the Tahoe Metropolitan Planning Organization (TMPO) for the next 20 years. However, there are additional mobility actions that can be implemented by local governments to reduce GHG emissions from cars and trucks, as well as promote community health by offering a wide range of mobility choices.

Complete Neighborhoods	Promote complete and distinct neighborhoods that promote walking to services, biking, and transit use; foster community pride; enhance neighborhood identity and public safety; and are family-friendly.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	High	Medium	High	Low	Low	Low
Notes:		Reduced vulnerability of disadvantaged populations	Improve air quality Culture & sense of place Reduce VMT Active transportation Increased public safety			
Responsible Party for Implementation: Local Jurisdictions, TMPO, TTD, TRPA						
Applicability: Region-wide						
Source: TMPO; City of South Lake Tahoe						

Expand Bicycle and Pedestrian Network	Maintain the Lake Tahoe Region Bicycle and Pedestrian Plan, and integrate within Area Plans. Prioritize projects that fill identified gaps in the network. Promote Safe Routes to School Programs and prioritize associated projects. Evaluate the feasibility of bike-share programs targeted toward resort and tourist accommodations where applicable.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	High	Low	High	Medium Costs may be shared between public facilities improvements and private development requirements		Medium
Notes:		Improve air quality	Improve air quality Culture & sense of place Reduce VMT Active transportation	Class I facilities: $375,000-$5 million/mile Class II facilities: $75,000-$4 million/mile Higher-end of range involves land acquisition for public right-of-way dedication[1]		
Responsible Party for Implementation: Local Jurisdictions, TMPO, TRPA, School Districts						
Applicability: Region-wide						

Source: *TRPA.*
[1] SACOG. 2009. Regional Bicycle Pedestrian Master Plan.

Improve Transit Services	Improve existing transit systems through increased frequency, expanded service areas, extended service hours, and safer facilities. Improve transit accessibility during winter through providing additional shelters and cleared sidewalks and paths around stops. Evaluate linkages with existing public and private transit systems both within and out of the Region, and with the future waterborne transportation system. Coordinate schedules to minimize wait time to transfer between systems. Evaluate locations of transit stops to improve linkages with the pedestrian and bicycle network. Identify barriers to transit use and work with the community and transit districts to overcome those barriers. Coordinate with resorts and tourist destinations in the Region identify successful models for targeted, route-specific shuttles.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	High	Low	Medium	None	Medium	Low

Notes:		Improve air quality	Improve air quality Reduce VMT			
Responsible Party for Implementation: Local Jurisdictions, Transit Districts, TMPO, TRPA						
Applicability: Region-wide						
Source: *TMPO*						

Clear Sidewalks and Paths	Clear snow and obstructions from sidewalks and multi-use paths at the same priority level as clearing snow from roadways. Work with residents and businesses to encourage them to help clear snow from sidewalks and paths on their property in accordance with regulations. Consider feasibility of opportunities for distributed waste heat beneath sidewalks to melt snow in the winter.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Low	Low	Low
Notes:		Improve air quality	Improve air quality Reduce VMT Active transportation	Assessment or improvement districts		
Responsible Party for Implementation: Local Jurisdictions, Property Owners						
Applicability: Region-wide						
Source: Sierra Nevada Alliance.						

Streetscape and Bicycle Amenities	Require streetscape amenities (e.g., sidewalks, traffic calming features) and sufficient bicycle parking to meet demand in all new development and redevelopment plans of over 10 units or 10,000 square feet of commercial floor area. Require that a maintenance plan and secured funding source for the life of the project accompany the plan.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Medium		Low

Notes:		Improve air quality	Improve air quality Culture & sense of place Reduce VMT Active transportation	$150-300/bike rack (2 bikes) $1,000-4,000/bike locker (2 bikes)[1] $100,000-800,000 / streetscape improvements project (e.g., crosswalks, traffic calming features, sidewalks)[2, 3]	
Responsible Party for Implementation: Local Jurisdictions, TMPO, TRPA					
Applicability: New Development and Redevelopment					
Source: [1] http://www.bicyclinginfo.org/engineering/parking.cfm [2] SACOG. 2009. Regional Bicycle Pedestrian Master Plan. [3] ITE 1999. Traffic Calming: State of the Practice.					

Electric Vehicle Charging Network	Promote provision of plug-in electric vehicle (PEV) charging stations and coordinate Regionally to create a complete system. A complete system should accommodate charging opportunities at home, at the workplace, at tourist destinations, at shopping and entertainment establishments, and at sufficient locations throughout the roadway network. Evaluate current code requirements to ensure that codes enable PEV parking and permitting of charging stations. Consider reducing parking requirements in exchange for installation of charging units or allowing PEV charging spaces to count toward minimum parking requirements. Resorts should be highly-encouraged and incentivized to provide PEV charging stations. Partner with local business and tourism organizations to construct changing stations and advertise the availability of charging. This may encourage tourists driving PEVs to visit. Coordinate with campgrounds for availability of charging sites, which are frequently already wired for electrical hookups for recreational vehicles. Coordinate with the local utility to ensure that electric grid capacity is available for the size of the charging infrastructure envisioned. Solar-powered PEV charging stations are highly-encouraged. More information on building an PEV network is available here: http://opr.ca.gov/docs/ZEV_Guidebook.pdf					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Medium	Medium	Low
Notes:	Embedded in GHG emissions projections as part of future vehicle fleet	Improve air quality	Improve air quality Reduce noise levels			
Responsible Party for Implementation: Local Jurisdictions, TRPA, State Parks, Utilities						
Applicability: Region-wide						
Source: Governor's Office of Planning and Research.						

Local Construction Materials Procurement in New Development	Require new development to procure local construction materials for a minimum of 10 percent of the total material costs with a minimum of 10-15 percent recycled content; use of building materials from renewable sources; the use of materials within 500 miles of the project site (10 percent of total cost); use of salvaged materials (5 percent of total cost); Reduction in vehicle delivery trips to site; Use Recycled Content Aggregate (Minimum 25 percent) for Walkway and Driveway Base, Roadway Base and Foundation; Replacement of Portland Cement in Concrete with Recycled Fly Ash and/or Slag (Minimum 20 percent); Install Insulation with 75 percent Recycled Content in Walls, Ceilings and Floors.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	 Low	 Low	 Medium	 Medium	 None	 Medium
Notes:		 Improve air quality	 Improve air quality Reduce solid waste			Local contractors and suppliers
Responsible Party for Implementation: Local Jurisdictions, Construction Contractors						
Applicability: New Development and Redevelopment						
Sources: Sierra Business Council; City of South Lake Tahoe.						

Alternative Fueled Vehicle Fleet	Pursue grant funding to obtain electric or alternative-fueled solid waste haul trucks, transit vehicles, or other fleet vehicles. Adopt a sustainable fleet policy and strive to achieve electrification of a minimum 20 percent of municipal fleets by year 2020 as funding is available.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	 Low	 Low	 Medium	 Low		 Low
Notes:		 Improve air quality	 Improve air quality Reduce noise levels	Dependent on grant funding availability and staff time to pursue and administer		
Responsible Party for Implementation: Local Jurisdictions, Regional Agencies, Franchise Waste Haulers						
Applicability: Region-wide						

Solid Waste and Recycling

Solid waste disposal in landfills results in GHG emissions associated with decomposition. Lockwood Landfill, located in Nevada, accepts solid waste collected in the Region (CTC 2013). Lockwood Landfill captures and flares methane, a potent GHG, on-site, which minimizes emissions. Reducing the amount of solid waste sent to the landfill prevents GHG emissions from the landfill and from the transportation of solid waste to the landfill.

Solid Waste Diversion	Adopt a local policy goal of to achieve no less than 75 percent of solid waste generated be reduced, recycled, or composted by the year 2020 and a goal of becoming "zero-waste" by 2040.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	None	Low	Low
Notes:	7,473 MT CO_2e/year in 2020 12,668 MT CO_2e/year in 2035	Improve air quality	Reduced solid waste Improve air quality			

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	363	1,188
El Dorado County	683	1,217
South Lake Tahoe	3,250	5,330
Washoe County	1,897	2,661
Douglas County	1,279	2,272
Responsible Party for Implementation: Local Jurisdictions (already required in California), Refuse and Recycling Companies		
Applicability: Region-wide		
Sources: TRPA; City of South Lake Tahoe; Placer County; California AB 341.		

This action is based on the framework established in California AB 341, Solid Waste Diversion. The California Integrated Waste Management Act of 1989, which is administered by the Department of Resources Recycling and Recovery, requires each city, county, and regional agency, if any, to develop a source reduction and recycling element of an integrated waste management plan containing specified components, including a source reduction component, a recycling component, and a composting component. Though AB 341 sets a statewide target, the implementation responsibility would primarily lie with local governments that are responsible for the local solid waste sector. This is analogous to the way the California Integrated Waste Management Act has been implemented in the State.

Local jurisdictions are already recycling and diverting much of their solid waste. Diversion rates for the local jurisdictions in the Region are:

- Placer County: 68 percent (CalRecycle 2006),
- El Dorado County: 54 percent (CalRecycle 2006),
- South Lake Tahoe: 49 percent (CalRecycle 2006),
- Washoe County: 32 percent (Washoe County 2008), and
- Douglas County 54 percent (Douglas Disposal and Recycling Services 2011).

Supporting implementation measures to help local governments achieve the solid waste diversion goal include:

- Conduct waste-reduction consultations with major waste generators (e.g., resorts, hotels, businesses, multi-family complexes) and recommend strategies to reduce waste and increase recycling while reducing costs.
- Consider a Business Recycling Ordinance and work with commercial solid waste customers and franchise haulers to increase diversion rates to 30 percent.
- Adopt an ordinance banning single-use carry-out plastic bags at grocery stores and retail establishments.
- Participate in the California Take-It-Back Partnership, a collaborative effort among businesses and State and local agencies to provide convenient locations for consumers to take back certain types of waste, including batteries, fluorescent lamps, compact-fluorescent light (CFL) bulbs, and other electronic devices.
- Offer alternatives for e-Waste recycling and drop-off locations for household batteries and fluorescent lamps, including:
    - Incentivizing and promoting businesses that take back universal waste and e-waste.
    - Encouraging and supporting extended producer responsibility.
- Institute a Multi-family Recycling Ordinance which requires apartments and multi-family dwellings of 5 or more units to have a recycling program.
- Support the development and implementation of model recycling lease language for residential and commercial building managers.
- As funding becomes available, expand availability of public recycling containers in public parks, along commercial corridors and public right-of-ways, and reduce the waste generated from public events.
- Develop and implement residential and commercial waste audit programs that educate residents and businesses on what materials can and cannot be recycled and when and where to recycle.
- Encourage food waste and green waste composting programs, and encourage collaboration between solid waste haulers and local farmers.

Construction and Demolition Debris Diversion	Increase construction and demolition (C&D) debris diversion and recycling to 75 percent of non-hazardous material by year 2020.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Low	None	Low
Notes:	1,625 MT CO_2e/year in 2020 and 2035	Improve air quality	Reduce solid Waste Improve air quality			

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	281	281
El Dorado County	176	176
South Lake Tahoe	676	676
Washoe County	208	208
Douglas County	285	285
Responsible Party for Implementation: Local Jurisdictions		
Applicability: New Development and Redevelopment		
Sources: TRPA; City of South Lake Tahoe; Placer County; El Dorado County; Douglas County.		

Currently, the City of South Lake Tahoe, Placer County, and El Dorado County all require recycling or salvage of a minimum of 50 percent of (C&D) waste. Douglas County has a program in place to divert concrete and asphalt from landfills.

Supporting actions for local governments to increase C&D waste diversion:

- Require 100% diversion of Asphalt, Concrete and salvageable wood, which have established re-use markets and re-sale value.
- *Source: Sierra Business Council*
- Use recycled content aggregate (minimum 25 percent) for walkway and driveway base, roadway base and foundation.
- Replace Portland cement in concrete with recycled fly ash and/or slag (minimum 20 percent); Install insulation with 75 percent recycled content in walls, ceilings and floors.
  Source: Sierra Business Council
- Work with community organizations (i.e. Habitat for Humanity) to develop a local re-use center for diversion of deconstructed building materials that can be reused in new construction/ remodels.
  Source: Sierra Business Council

Water Resources and Conservation

Conveyance and treatment of water and wastewater consumes energy and results in GHG emissions. Water conservation measures are important to reduce consumption in the Region, and prepare for threatened future reduced water supply.

Water Meters	Utility districts shall continue to implement water metering with water conservation rate structure in the Region. Strive to have all customers metered by year 2025.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	High	Medium	Low	Medium	Medium
Notes:	7,633 MT CO_2e/year in 2020 10,504 MT CO_2e/year in 2035	Prepare for water supply variability Prepare for impaired water quality	Water conservation Lower utility bills Energy conservation	Cost savings for conservation	$1,090 per connection[1]	

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	1,139	1,139
El Dorado County	1,106	1,106
South Lake Tahoe	2,771	2,771
Washoe County	1,533	3,215
Douglas County	1,084	2,273
Responsible Party for Implementation: Utility Districts		
Applicability: Region-wide		

Sources: Sierra Nevada Alliance; Placer County; City of South Lake Tahoe.
[1]City of Sacramento Draft Interim Water Conservation Plan.

Water districts in the Region are in the process of installing water meters in residential and commercial land uses. Water meters will result in customers paying for water according to their usage. AB 2572 mandates water meters in all California cities by 2025. In addition, California Water Code Section 525(a) requires that every water purveyor who sells, leases, rents, furnishes, or delivers water service to any person shall require, as a condition of new water service on and after January 1, 1992, that a suitable water meter to measure the water service shall be installed on the water service facilities.

Water Efficiency Measures	Enforce requirements for new construction to implement CalGreen Water Efficiency measures (in California) or equivalent (in Nevada) within building codes. Incorporate water efficiency measures into the Green Building Ordinance.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	High	Medium	Low	Low	Medium
Notes:	210 MT CO_2e/year in 2020 500 MT CO_2e/year in 2035	Prepare for water supply variability Prepare for impaired water quality	Water conservation Lower utility bills Energy conservation		Inspection/ Code enforcement cost	Contractors, Inspectors

Local Jurisdiction GHG Reduction Potential	MT CO_2e/year in 2020	MT CO_2e/year in 2035
Placer County	55	132
El Dorado County	26	61
South Lake Tahoe	64	152
Washoe County	38	90
Douglas County	27	64
Responsible Party for Implementation: Local Jurisdictions, Utilities		
Applicability: New Development and Redevelopment		
Sources: TRPA; Sierra Nevada Alliance; Placer County.		

Water Efficient Landscaping	Promote native, water-efficient, nutrient-efficient, fire-resistant and non-invasive vegetation in urban areas and require it during revegetation of disturbed sites. Utilize at least 75 percent native or drought-tolerant plant and tree species appropriate for the region. Expand the turf-buy-back program currently being implemented as part of the South Tahoe Public Utilities District pilot program. Consider wastewater treatment technologies that present an opportunity to treat basin wastewater to an advanced level for irrigation and other potential beneficial reuse sites within the Region without negative impacts to receiving waters or groundwater.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	High	Medium	Low	None	Low

Notes:		 Prepare for water supply variability Prepare for impaired water quality Prepare for flooding hazards	 Water conservation Lower utility bills Energy conservation			
Responsible Party for Implementation: Local Jurisdictions, TRPA						
Applicability: Region-wide						
Sources: TRPA; El Dorado County; Placer County; Sierra Business Council.						

Additional supporting strategies for local jurisdictions to implement water conservation actions:

- No additional development requiring water should be allowed in any area unless it can be demonstrated that there is adequate water supply within an existing water right, and that there exists adequate storage and distribution systems for domestic consumption and fire protection.
  Source: TRPA
- Low water appliances and fixtures shall be installed in new facilities or when replaced in existing facilities: low-flow flush toilets; low-flow showerheads (3 gpm rated maximum flow); faucet aerators; water-efficient appliance (e.g., washing machines and dishwashers); timers and weather-based irrigation systems.
  Source: TRPA; Placer County Air Pollution Control District
- Consider the feasibility of water-wise practices (e.g., water recycling, rainwater collection) where applicable and appropriate in the Region.
  Source: Sierra Nevada Alliance.

Air Quality (Area Sources, Off-road Equipment, and Construction Emissions)

Area sources (e.g., fireplaces and wood burning), off-road equipment (e.g., boats, snowmobiles, landscaping and snow removal equipment), and construction vehicles and equipment contribute GHG emissions and other air pollutants in the Region. Local jurisdictions are somewhat limited in ability to influence these sources. Examples of action are provided below where local jurisdictions can reduce emissions from these sources.

<table>
<tr><td rowspan="3">Replace Wood Stoves and Wood Fireplaces</td><td colspan="6">Enforce TRPA Code of Ordinances (2012) (Section 65.1.4.B.3); which requires that prior to any sale, transfer or conveyance of any building, all existing wood heaters in the building, excluding legally existing open fireplaces that are not primary heat sources, shall be in conformance with the emissions standards set forth in the TRPA Code of Ordinances.
Promote and incentivize (with rebates) the replacement of existing woodstoves and wood heaters with EPA-certified woodstoves or natural gas fireplaces. Since 1988, EPA has required manufacturers of wood stoves to certify that each model line of wood stoves offered for sale in the United States comply with the EPA particulate emissions guidelines in the Clean Air Act. EPA-certified wood stoves are cleaner and more efficient than a wood stove manufactured before 1988.</td></tr>
<tr><td>Region-wide GHG Reduction Potential</td><td>Climate Change Readiness Co-benefits</td><td>Environmental & Community Co-benefits</td><td>Private Costs</td><td>Public Costs</td><td>Job Generation Potential</td></tr>
<tr><td>High</td><td>Low</td><td>Medium</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td>Notes:</td><td>6,608 MT CO_2e/year in 2020
21,345 MT CO_2e/year in 2035</td><td>Improve air quality
Improve water quality</td><td>Improve air quality
Improve water quality</td><td>Rebates available to defer cost of replacement</td><td>Enforcement cost</td><td>Retail sales and contractors/ installers</td></tr>
<tr><td colspan="3">Local Jurisdiction GHG Reduction Potential</td><td colspan="2">MT CO_2e/year in 2020</td><td colspan="2">MT CO_2e/year in 2035</td></tr>
<tr><td colspan="3">Placer County</td><td colspan="2">2,639</td><td colspan="2">8,525</td></tr>
<tr><td colspan="3">El Dorado County</td><td colspan="2">939</td><td colspan="2">3,032</td></tr>
<tr><td colspan="3">South Lake Tahoe</td><td colspan="2">2,356</td><td colspan="2">7,609</td></tr>
<tr><td colspan="3">Washoe County</td><td colspan="2">229</td><td colspan="2">740</td></tr>
<tr><td colspan="3">Douglas County</td><td colspan="2">445</td><td colspan="2">1,438</td></tr>
<tr><td colspan="7">Responsible Party for Implementation: Local Jurisdictions, TRPA, Association of Realtors</td></tr>
<tr><td colspan="7">Applicability: Existing Development</td></tr>
<tr><td colspan="7">Sources: TRPA; City of South Lake Tahoe; El Dorado County; El Dorado County Air Quality Management District; Placer County Air Pollution Control District</td></tr>
</table>

Curtail Wood Burning on Poor Air Quality Days	Mandate "no burn days" when ambient air quality conditions are predicted to exceed standards, such as on designated "Spare the Air" days by Placer County APCD and El Dorado County AQMD.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	None	Low	Low
Notes:		Improve air quality Improve water quality	Improve air quality Improve water quality		Enforcement cost	
Responsible Party for Implementation: Local Jurisdictions, TRPA, Air Quality Management Agencies						
Applicability: Region-wide						
Sources: TRPA; El Dorado County Air Quality Management District; Placer County Air Pollution Control District.						

Best Construction Practices	Implement the following Best Construction Practices where applicable: Require the construction fleet to meet Best Available Control Technology such as using diesel construction equipment meeting California Air Resources Board's Tier 2, 3 or 4 certified engines or installing California Verified Diesel Emission Control Strategies. Require construction contractors to utilize existing power sources (e.g., power poles) or clean fuel (e.g., gasoline, biodiesel, natural gas) generators rather than temporary diesel power generators where feasible. Require construction contractors to maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determined to be running in proper condition before it is operated. Require the training of equipment operators in proper use of equipment, proper sizing of equipment for jobs, on-site material hauling with trucks equipped with on-road engines (if determined to be less emissive than the off-road engines), reductions in electricity use in the construction office by using compact fluorescent bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones. Require construction contractors to provide construction crew commute reduction programs requirement for projects of a certain size through providing a combination of carpools, shuttle vans, transit passes and/or secure bicycle parking for construction worker commutes, as well as the preparation of a vehicle mile traveled (VMT) plan for the reduction of commute miles traveled and truck haul trips. Strategies to reduce VMT can be incentive programs for contractors or the placing of staging areas for materials in close proximity to the construction site, and choosing materials (e.g. sediment for grading projects) from quarries or vendors as close to a project site as practicable. While potential sites for materials staging areas may be limited at a project location, equal consideration should be given to the resulting VMT as to other selection criteria. Require quantification of carbon released from removal of trees from a construction site to discourage excessive removal of vegetation.

	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Medium	Low	Low
Notes:		Improve air quality Improve water quality	Improve air quality Improve water quality Reduce noise levels		Enforcement cost	
Responsible Party for Implementation: Local Jurisdictions, TRPA, Air Quality Management Agencies, Construction Contractors						
Applicability: New Development; Redevelopment						
Sources: TRPA; Sierra Business Council; El Dorado County Air Quality Management District; Placer County Air Pollution Control District						

Enforce Idling Time Limitations	Limit idling time for all construction and recreational equipment to five minutes in California, and 15 minutes in Nevada, as required by TRPA. Coordinate with local Air Quality Management agencies to disseminate information about idling time restrictions and to conduct enforcement activities.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	Low	Low	Low
Notes:		Improve air quality	Improve air quality Reduce noise levels		Enforcement cost	
Responsible Party for Implementation: Local Jurisdictions, TRPA, Air Quality Management Agencies						
Applicability: Region-wide						
Source: TRPA						

Forest and Biological Resources

Healthy forest ecosystems sequester carbon dioxide, sustain the health of many of the Region's biological resources, and reduce the risk of wildfire. Protecting forest and biological resources is important for sustainability of the Region's interconnected resources and the Region's identity, and can also result in GHG emissions reductions. Additional actions to help local governments improve sustainability of forest and biological resources while accounting for the effects of climate change are provided in Chapter 5.

Prescribed Burning Best Practices	Promote technologies and practices that reduce emissions from prescribed burning, or non-burning methods of reducing hazardous forest fuels, where practical. Coordinate forest fuel reduction review through Tahoe Fire and Fuels Team (TFFT).					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Medium	Medium	None	None	Medium
Notes:		Reduce wildfire risk Improve air quality Protect forest resources	Improve air quality Protect forest resources			
Responsible Party for Implementation: US Forest Service (already underway), State Fire Agencies, Local Fire Districts						
Applicability: Region-wide						
Sources: TRPA; USDA Forest Service – Lake Tahoe Basin Management Unit.						

Forest Restoration	Prioritize restoration of forest resources. Support the goals of the USDA Forest Service Lake Tahoe Basin Management Unit to restore or regenerate at least 25 acres of aspen per year.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	High	High	Medium	None	Low	Low
Notes:	5,540 MT CO_2e/year in 2020 60,984 MT CO_2e/year in 2035	Reduce wildfire risk Protect forest resources Protect biological resources	Protect forest resources Protect biological resources			

Responsible Party for Implementation: Local Jurisdictions, US Forest Service
Applicability: Region-wide
Source: TRPA; USDA Forest Service – Lake Tahoe Basin Management Unit.

Economic Health

Economic sustainability is linked to a healthy environment and quality of life for the Region's population. The Lake Tahoe Basin Prosperity Plan (Prosperity Plan) sets forth a vision for both the economic and environmental health and renewal of the Region. The Tahoe Prosperity Center was formed to implement the Prosperity Plan and is a coalition of government, private and philanthropic stakeholders in the Lake Tahoe Region. The following actions are derived from the Prosperity Plan, as well as other sources to promote the economic sustainability of the Region.

Sustainable Business and Residential Certification Program	Develop a Region-wide Sustainable "Green Business" Certification program or expand "Keep the Sierra Green" program for businesses and non-residential properties, and a "Tahoe-certified" home certification program for residential properties. The program should be designed to recognize property and business owners that have successfully implemented applicable BMPs for water quality, met coverage standards, met energy efficiency standards, have sufficient defensible space, and installed bear-proof solid waste containers. Identify local community sponsors of the program. Expand the "Local First Program" to encourage and support local business throughout the Region as permitted under State law.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Medium	Medium	None	Low	Medium
Notes:		Reduce wildfire risk Prepare for impaired water quality	Economic sustainability Protect water quality Energy conservation Increased property value	Assumes cost of participation would be offset by revenue generated by certification		Marketing to customer base
Responsible Party for Implementation: TRPA, Chambers of Commerce, Association of Realtors						
Applicability: Region-wide						
Source: City of South Lake Tahoe. Keep the Sierra Green. *http://www.keepthesierragreen.org/about/*						

First Time Homebuyer Assistance	Offer assistance to tenants to become homeowners, and preserve affordability of housing for first-time homebuyers.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	None	Low to Medium	Low
Notes:			Promote community stability Promote social equity		Dependent on level of financial assistance, funding sources, and staff time	
Responsible Party for Implementation: Local Jurisdictions, TRPA, Housing Authority, Land Trusts						
Applicability: Region-wide						
Source: City of South Lake Tahoe.						

Workforce Housing Strategy	Coordinate with current TRPA efforts to update the Region's Workforce Housing Strategy. Evaluate how the Region's tourism industry may be affected by climate change, and how associated employment demands reflect the range of housing opportunities.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Medium	Medium	Low to Medium	Low	Medium
Notes:		Economic sustainability	Reduce VMT Improve air quality Promote social equity			
Responsible Party for Implementation: Local Jurisdictions, TRPA, Housing Authorities						
Applicability: Region-wide						
Sources: Tahoe Prosperity Plan; City of South Lake Tahoe.						

Business/ Job Retention/ Expansion Programs	Support programs and activities that promote business/job retention, expansion, and new business/job development including high-tech and environmentally-sustainable businesses. Prioritize creation of living-wage jobs. Pursue design and implementation of a rebranding program for the Region as a center of innovation and a sustainable tourism destination.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Medium	Medium	Low	Low	High
Notes:		Economic sustainability	Attract and retain talent Long-term, living-wage jobs Diversify workforce			
Responsible Party for Implementation: Local Jurisdictions, TRPA, Chambers of Commerce						
Applicability: Region-wide						
Sources: City of South Lake Tahoe; Tahoe Prosperity Plan.						

Events Commission	Convene a regional commission to evaluate the potential for attracting events and activities in the Region that do not conflict with the Region's GHG Reduction and Sustainability Goals. Market proactively to attract annual meetings of organizations, conferences, workshops and symposia. Promote health and wellness-related events and volunteerism opportunities. Coordinate opportunities around transportation and access to locations and amenities throughout the Region. The commission should coordinate around transportation and access to locations and amenities throughout the Region to minimize GHG emissions associated with travel to events.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Medium	Medium	None	Low	High
Notes:		Economic sustainability	Long-term, living-wage jobs			
Responsible Party for Implementation: Local Jurisdictions, TRPA, Social Service Groups, Health Organizations, Chambers of Commerce						
Applicability: Region-wide						
Source: Tahoe Prosperity Plan.						

Community Health and Social Equity

Community and human health are fundamental aspects of sustainability. There are opportunities to incorporate health in all local government planning. The concept of "Health in All Policies" promotes health, equity, and sustainability through two avenues: (1) incorporating health, equity, and sustainability into specific policies, programs, and processes, and (2) embedding health, equity, and sustainability considerations into government decision-making processes so that healthy public policy becomes the normal way of doing business. Promoting equity is an essential part of Health in All Policies, given the strong ties between inequity and poor health outcomes for all members of society (American Public Health Association 2013).

Equity and Health in all Policy	Ensure the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of land use and environmental laws, regulations, and policies. Continuously strive to ensure that no member of the public suffers disproportionately from adverse human health or environmental effects, and all residents live in a clean, healthy, and sustainable community. More information on incorporating Health in All Policies is available in the Health in All Policies Guidebook: http://www.apha.org/programs/cba/CBA/health_all_policies					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Medium	Medium	None	None	Low
Notes:		Public health	Social equity Community health			
Responsible Party for Implementation: Local Jurisdictions, TRPA						
Applicability: Region-wide						
Sources: City of South Lake Tahoe; American Public Health Association.						

Neighborhood Services	Provide appropriate neighborhood-serving amenities and compatible high-quality, family-oriented recreation and public facilities, including parks, community gardens, and government services that support a high quality of life for all age groups.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Medium	Low	Medium	Low	Medium	Low
Notes:		Improve air quality	Social Equity Reduce VMT Active transportation Improve air quality			
Responsible Party for Implementation: Local Jurisdictions, School Districts, State Parks						
Applicability: Region-wide						
Sources: Tahoe Prosperity Plan; City of South Lake Tahoe.						

Resources for the Homeless and Transient Populations	Coordinate with surrounding jurisdictions to address the causes of homelessness and the needs of the transient homeless persons on a regional basis.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	None	Low	Low
Notes:			Promote social equity			
Responsible Party for Implementation: Local Jurisdictions, Social Service Organizations						
Applicability: Region-wide						
Source: City of South Lake Tahoe.						

Local Food Production & Farmers Markets	Continue efforts to provide a healthy and local food supply in the community through year-round farmers markets and provision of land available to community gardening and greenhouse gardening. Encourage outdoor or greenhouse gardening in neighborhoods with good soils, access to water, and adequate sunlight while protecting groundwater. Consider code amendments to streamline permitting of outdoor greenhouses that would be constructed to specifications that can withstand snow loads.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	None	Low	Low
Notes:			Reduce VMT Community health Culture & sense of place			
Responsible Party for Implementation: Local Jurisdictions, TRPA, School Districts						
Applicability: Region-wide						
Source: City of South Lake Tahoe.						

Local Food Supply Infrastructure for Businesses	Provide assistance to restaurants and stores to supply local and seasonal food products and ingredients. Encourage food-oriented businesses in the Region to collaborate with culinary institutions to improve access to organic and local food sources. Encourage development of a locally-owned or non-profit managed and ecologically-sound food storage and distribution system for fresh food distribution.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	to Low to Medium		Medium
Notes:			Local food supply Reduce VMT	Varies depending on source of financial support		Local agricultural industry jobs
Responsible Party for Implementation: Local Jurisdictions, TRPA, Community Colleges						
Applicability: Region-wide						
Sources: City of South Lake Tahoe; Tahoe Prosperity Plan.						

Consider Allowing Raising of Small Farm Animals	Consider feasibility of allowing the raising of a limited number of small farm animals (e.g., chickens, goats) to support local food production. Include provisions to avoid conflicts with nuisance ordinances, odor control regulations, and noise control standards.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Low	None	Low	Low
Notes:			Local food supply			
Responsible Party for Implementation: Local Jurisdictions						
Applicability: Rural portions of Region						
Source: El Dorado County.						

Public Art	Promote art in public places such as pedestrian areas, tourist accommodation areas, social gathering places, and commercial shopping centers. Encourage public art that promote sustainability or include sustainability concepts.					
	Region-wide GHG Reduction Potential	Climate Change Readiness Co-benefits	Environmental & Community Co-benefits	Private Costs	Public Costs	Job Generation Potential
	Low	Low	Medium	to None to Low		Low
Notes:			Culture & sense of place	Depends on whether source of financing is private or public. Can be indirectly revenue-generating; Attracts visitors to spend time in commercial areas		
Responsible Party for Implementation: Local Jurisdictions, Community Organizations, Local Businesses						
Applicability: Region-wide						
Source: City of South Lake Tahoe.						

Chapter 6, Community Engagement, includes lists of actions that individual residents, businesses, schools, and visitors can take to be leaders in making the Region a model for sustainability. Individual actions that reduce GHG emissions often result in cost savings, and have other benefits to the community and environment. Chapter 6 also includes information on how the community can stay engaged with local governments and help implement this Plan.

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Chapter 5: Climate Change Readiness

> *What is the future of Lake Tahoe in the age of global warming? … What about the economy and the environment? … What is left? There is a lot left but the center piece of what is left is Lake Tahoe and ecotourism. And people wanting to come here from all over the world because it is the fairest place that nature has to offer. So protecting it is important for the economy and the economic future of this entire area.*
>
> –Former Vice President Al Gore; 2013 Tahoe Summit.

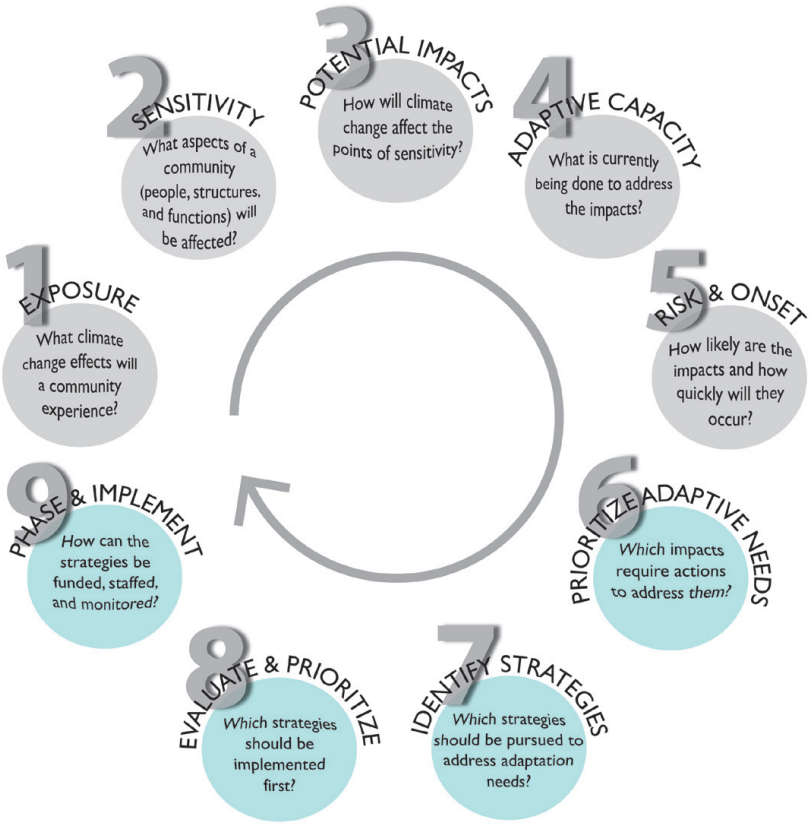
Climate change effects have arrived in the Lake Tahoe Region and are projected to continue well into the foreseeable future. Current and projected climate changes include increased air and lake temperatures, reduced winter snowpack, altered precipitation patterns, and more frequent storm events. These changes have the potential for a wide variety of impacts, such as altered forest productivity, wildfire risk, water supply, public health, public safety, ecosystem function, and economic continuity (CNRA 2012a).

Activities are already underway at the federal and State government levels to build adaptive capacity, develop readiness, and increase resilience to climate change. These activities include efforts to improve understanding of climate science and impacts, incorporate climate change considerations into policies and practices, and strengthen technical support and capacity for adaptation decision-making. Some efforts are large collaborative undertakings involving federal and non-federal partners, while others are smaller and taking place at the regional or local program level. The national Climate Change Adaptation Task Force, co-chaired by the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), makes recommendations to the President on how federal agency policies and programs can better prepare the United States to prepare for and respond to the impacts of climate change.

The California Natural Resources Agency (CNRA) has published the 2009 California Climate Adaptation Strategy, the update to the California Climate Change Adaptation Strategy, called *Safeguarding California: Reducing Climate Risk* (2013), the California Adaptation Planning Guide (2012a), and Draft California Adaptation Policy Guide (2012b). The California Adaptation Planning Guide outlines a basic process for adaptation planning, illustrated in Figure 5.1. The general process involves evaluating risk from climate change impacts; exposure, sensitivity and vulnerability to those impacts; and prioritization and strategy development to address the impacts. This can vary from general and qualitative to very detailed, depending on the scale of the planning process.

The CNRA and California Energy Commission, through the Public Interest Energy Research Program, have established the Cal-Adapt website (cal-adapt.org). Cal-Adapt is a web-based climate adaptation planning tool. It allows identification of potential climate change risks in specific geographic areas throughout the state. Cal-Adapt synthesizes existing downscaled climate change data and creates scenarios in an easily available, graphical layout that is intended to support local planning efforts. The source data are available for download at http://cal-adapt.org/data/ along with other relevant scientific publications.

Several Lake Tahoe-specific climate change impact studies have been conducted by research organizations operating in the Region. Indications of climate change specific to the Lake Tahoe Region, associated risks and vulnerabilities, and actions to help the Lake Tahoe Region become “climate-change ready” are described in this chapter.



Source: CNRA 2012a

Figure 5.1: The Climate Change Adaptation Planning Process

Expected Climate Change Impacts

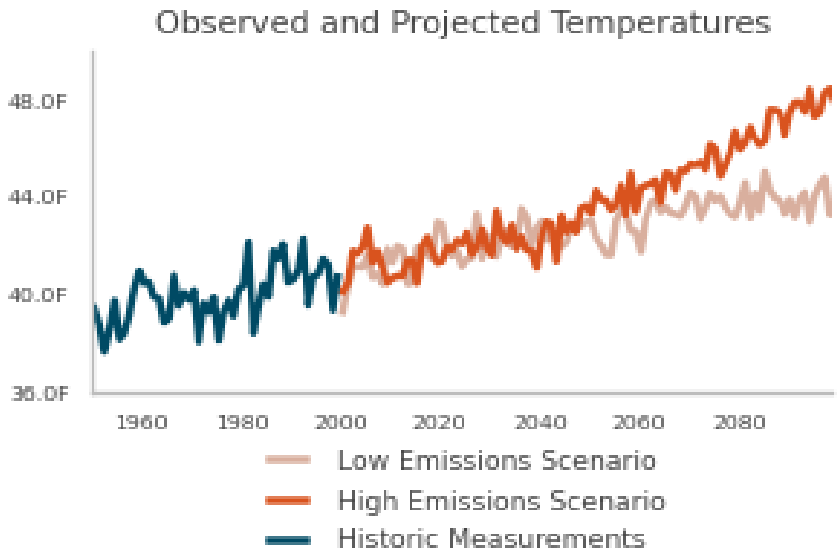
Increasing Temperatures

Temperature increases during recent decades have been measured throughout California and the Sierra Nevada region. California annual nighttime temperatures have increased by 0.33°F per decade since 1920 and annual daytime temperatures have increased 0.1 °F per decade (Moser et al., 2009).

Temperature data collected at weather stations in the Lake Tahoe Region show a strong upward trend in air temperatures that is consistent with global and regional changes (Coats et al., 2006), primarily in spring and late summer (Coats 2010). Average daily temperature records in the Lake Tahoe Region show an increase in the daily minimum temperatures by approximately 1.5 °F and nightly minimum temperatures have increased by more the 4°F since 1910.

According to Cal-Adapt, annual average temperatures in the Lake Tahoe Region are projected to rise 4-7°F by 2100, with the range based on low and high emissions scenarios (Cal-Adapt 2013). Cal-Adapt downscales global climate model data to local and regional resolution under two emissions scenarios; the A-2 scenario represents a business-as-usual future emissions scenario, and the B-1 scenario represents a lower greenhouse gas (GHG) emissions future.

Observed and projected temperatures for the Lake Tahoe Region are shown in Figure 5.2 (CalAdapt 2013).

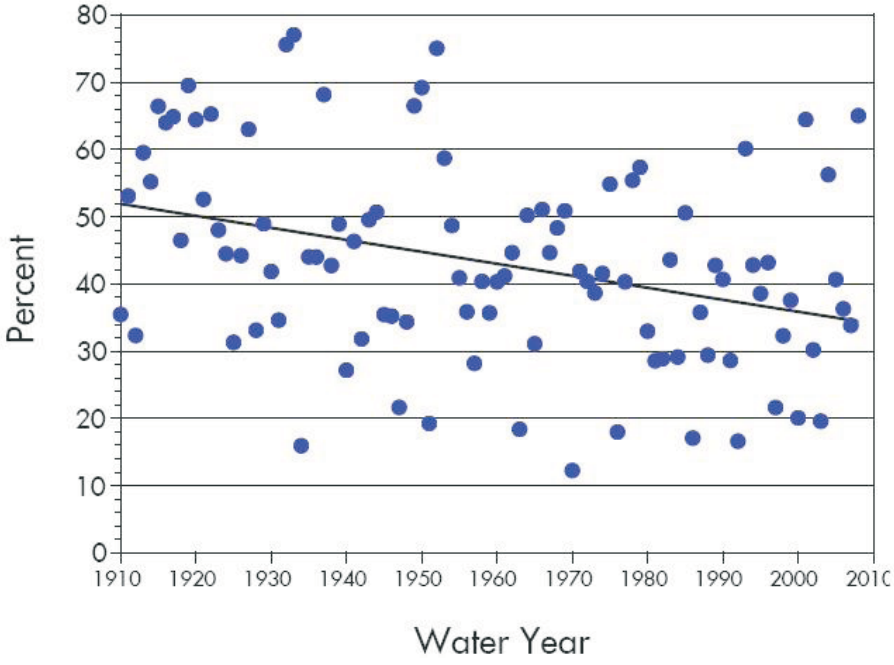


Source: Cal-Adapt 2013.

Figure 5.2: Observed and Projected Temperatures for Lake Tahoe Region under Low and High Emissions Scenarios

Precipitation Patterns

Annual precipitation totals over the last century in the Lake Tahoe Region have ranged from 23 to 174 cm (TERC 2009). While there are no readily identifiable trends in the total annual precipitation, changes in the character of the precipitation patterns are evident in data collected from 1910 to 2008, which show a shift from snow to rain, increased rainfall intensity, and increased inter-annual variability (Coats 2010). In the Sierra Nevada region, warmer winter and spring temperatures are causing a decrease in the proportion of precipitation delivered as snow relative to rain (Dettinger and Cayan, 1995; Mote, 2003; Dettinger, 2005; Mote et al., 2005; Knowles et al., 2006). Historically, more than 50 percent of the annual precipitation totals in the Lake Tahoe Region are delivered as snow. Analysis of historic precipitation records indicates an approximate 12 percent reduction in snowfall as a fraction of total precipitation from 52 percent in 1910 to 34 percent in 2009 (Figure 5.3, TERC 2009). While the proportion and amount of snow vary substantially from year to year, less snow generally results in a faster depletion of the snow storage reservoir during the spring/summer season. This will increase the likelihood that that in a given year the local hydrologic system will not be sufficient during the dry months to maintain aquatic ecosystems or support the same magnitude of water consumption in the future.

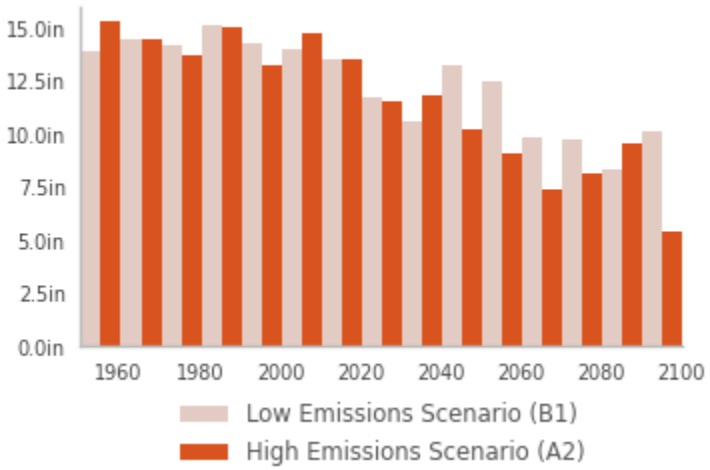


Source: Tahoe Environmental Research Center 2009.

Figure 5.3: Percent of Precipitation as Snow in the Lake Tahoe Region

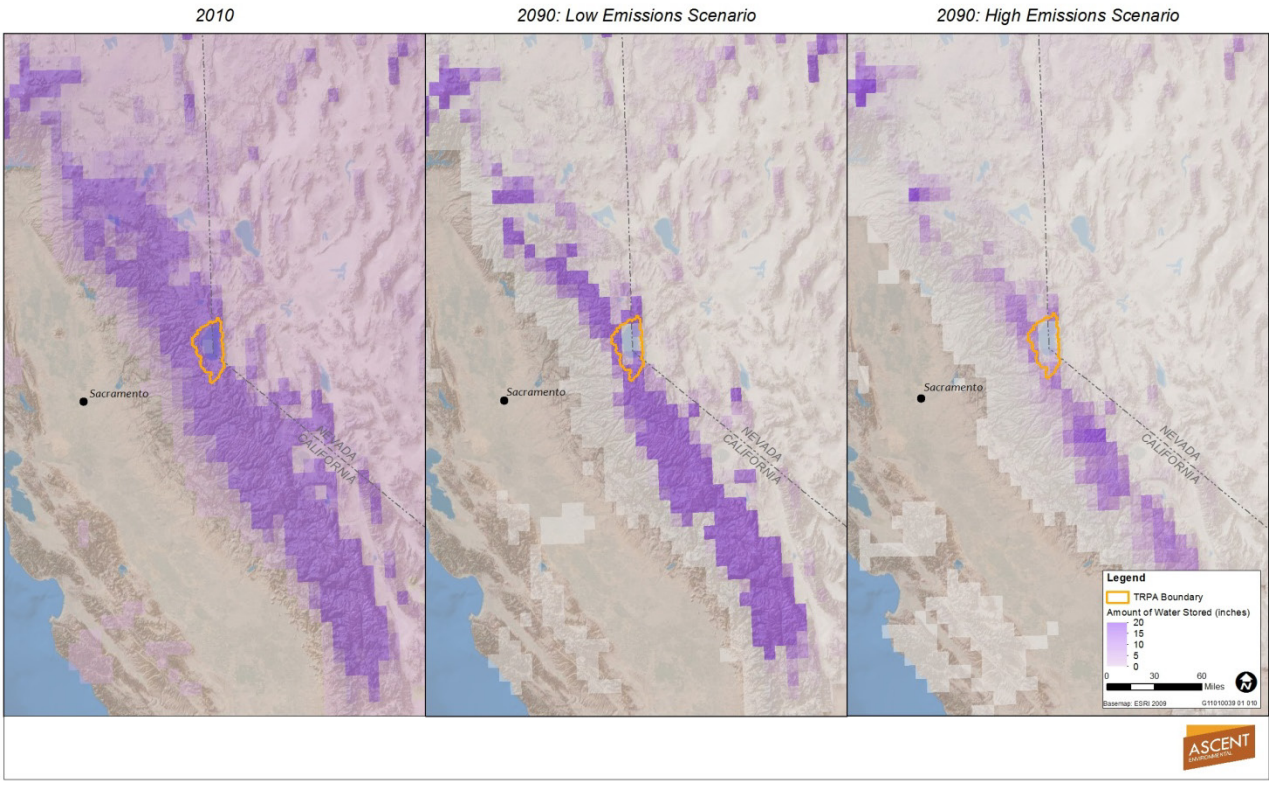
Snowpack Conditions

Snow water equivalent can be thought of as the depth of water that would theoretically result if the entire snowpack melted instantaneously. It indicates how much water is stored in the snowpack reservoir that can be gradually released as melt water during the spring and summer months. Lower elevations are more vulnerable to the effects of warming, because a small rise in average temperature will create an earlier and/or faster snowmelt. Also, a shift in precipitation delivery from snow to rain can occur. Historic and projected snowpack conditions are shown in Figures 5.4 and 5.5 (CalAdapt 2013).



Source: Cal-Adapt 2013.

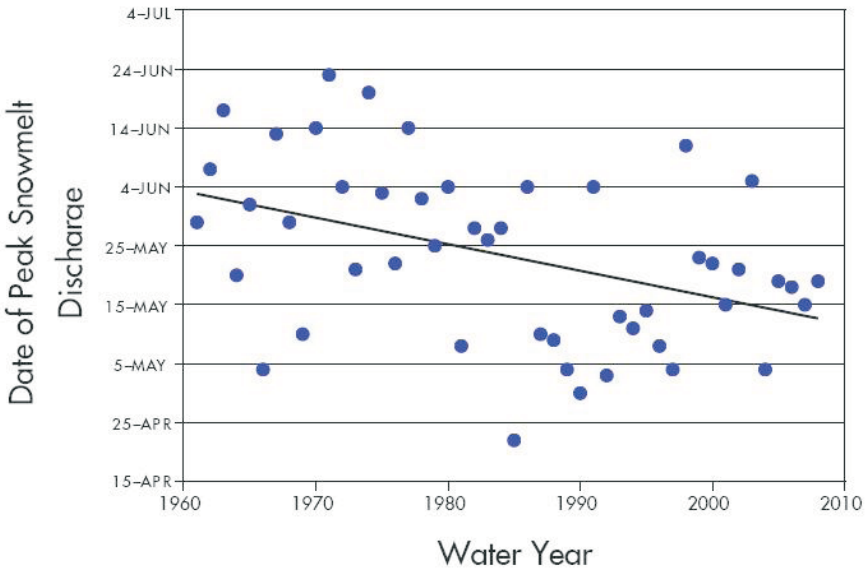
Figure 5.4: Historic and Projected Snowpack Conditions in the Lake Tahoe Region



Source: Cal-Adapt 2013.

Figure 5.5: Average Sierra Nevada Snowpack under Low and High Emissions Scenarios

The majority of monitoring stations in the Sierra Nevada have recorded simultaneous reductions in April 1 snow water equivalent, which is attributed to earlier snowmelt rather than reductions in total snowfall (Kapnick and Hall 2010). The date of peak snowmelt, discharged to the Upper Truckee River from 1961 through 2007 is shown in Figure 5.6. The date of peak snowmelt has trended earlier by nearly three weeks over the previous 50 years (TERC 2009).



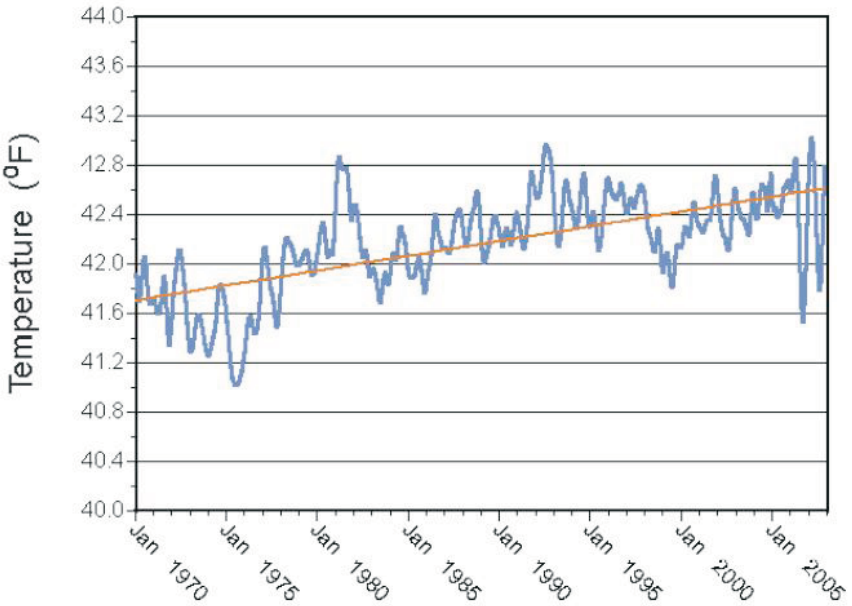
Source: Tahoe Environmental Research Center 2009.

Figure 5.6: Date of Peak Snowmelt Discharge in the Lake Tahoe Region

Lake Tahoe Temperature and Dynamics

High heat capacity of water bodies dampens short-term temperature variability, and highlights long-term variations in temperature. Therefore, long-term lake water temperature patterns can be good indicators of climate change. Thermal infrared satellite imagery has been used to show that the surface waters of lakes in the Sierra Nevada region have been warming at a rate of 0.11°C (0.2°F) per year since 1992 and that this pace of warming is approximately twice as fast as the increase in average minimum surface air temperature (Schneider et al., 2009).

Data from the Tahoe Environmental Research Center (TERC) monitoring network shows that Lake Tahoe water temperature reflects these regional trends. The average daily surface temperatures rose from 10.1 °C in 1968 to 10.9°C in 2008, and the volume-averaged temperatures have increased by 0.5 °C from 1970 to 2008. Figure 5.7 shows the volume-weighted mean water temperature of Lake Tahoe, which is increasing at a rate of 0.015°C per year with the highest rate of warming at the surface of the lake (Coats et al., 2006).



Source: Coats et. al., 2006

Figure 5.7: Long-Term Warming Trend of Lake Tahoe Water Temperature

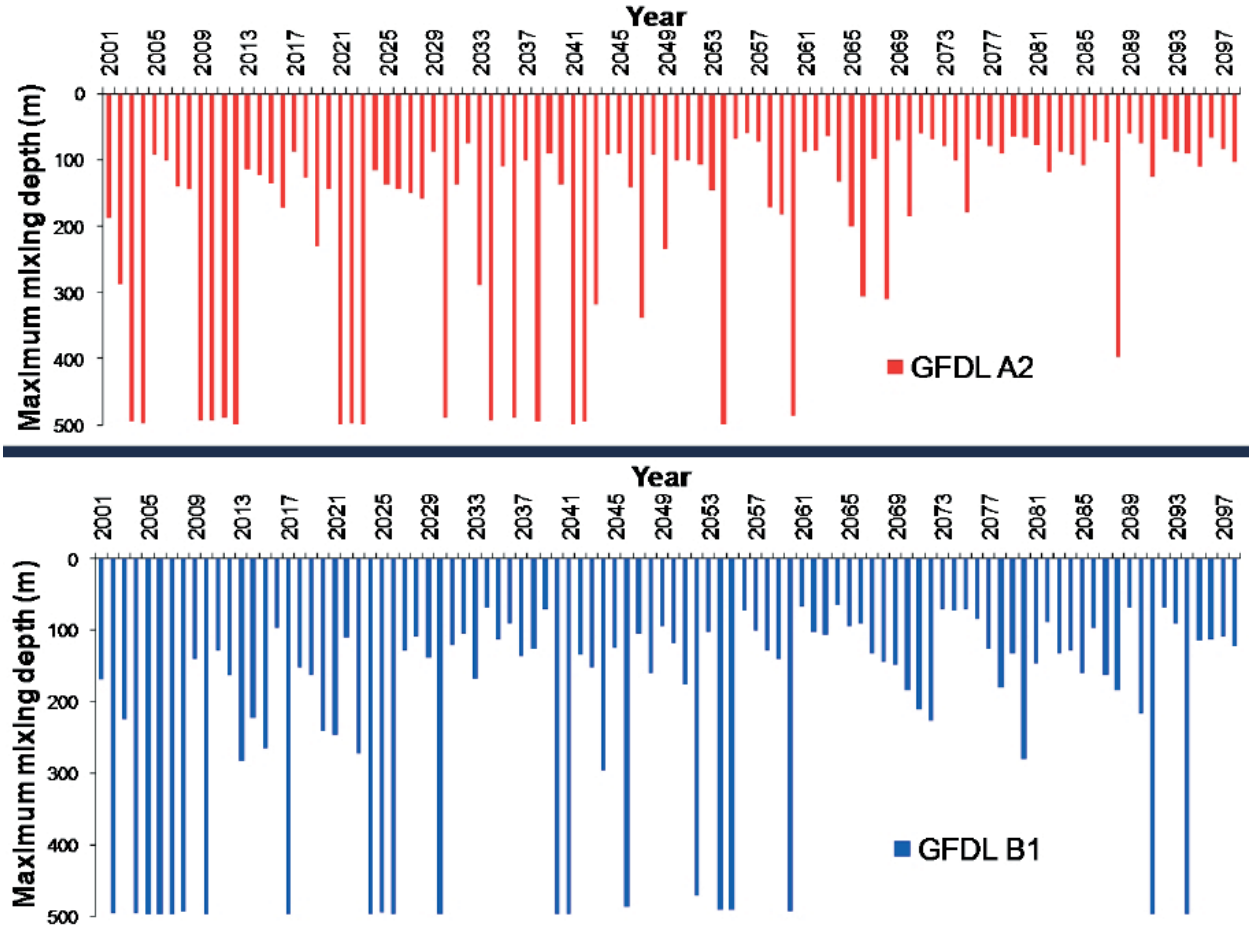
Assessing Risks and Vulnerabilities of Climate Change

Water Resources

Water Quality

The depth and stability of the vertical temperature differences (i.e., thermal stratification) influence the mixing depth of lakes. Wind is also a factor in mixing depth. During the warm summer months the surface waters are relatively warmer than the bottom waters, resulting in a thermal stratification. The thermal gradient acts as a barrier preventing free exchange between the surface and bottom waters for dissolved oxygen and dissolved nutrients. During the winter months the surface waters cool and the vertical temperature of Lake Tahoe becomes uniform, eliminating the vertical stratification barrier.

During years when the surface waters become colder than the bottom waters, the denser cold waters sink and the Lake completely mixes or "turns over." This annual exchange maintains the vertical chemical balance of Lake Tahoe, bringing nutrients to the surface where they promote algae growth and, more importantly, periodically oxygenating the deep waters on regular intervals. The deepest level of mixing varies from year to year and generally occurs in late February to early March. According to historic records, Lake Tahoe turns over an average of once every four years. TERC monitoring data demonstrate that persistence of thermal stratification within the lake has increased since 1970 and that complete mixing of Lake Tahoe during two or more successive years has only occurred three times since 1973 (TERC 2009). The warming of Lake Tahoe's surface waters and an increase in the annual minimum surface water temperature will reduce the frequency of these mixing events and affect the Lake's function. Maximum mixing depths for Lake Tahoe from 2001 projected through 2097 according to high (GFDL A2) and low (GFDL B1) GHG emissions scenarios are shown in Figure 5.8.



Source: Coats et al., 2006.

Figure 5.8: Projected Mixing Depth of Lake Tahoe under High and Low Emissions Scenarios

The consequences of increased thermal stability include the potential for prolonged periods of reduced clarity that follow heavy runoff (Coats et al., 2006). Deep mixing moves nutrients from the lake bottom to the water surface, where they promote the growth of algae, and distributes the algae throughout the lake, which supports aquatic life. Conversely, deep mixing moves dissolved oxygen from the surface waters to the bottom waters. If the lack of turnover persists or if turnover ceases completely, then the oxygen demand of the detritus that sinks to the bottom of the lake will exceed the supply of oxygen in the bottom waters. When the oxygen supply is exceeded, anaerobic conditions in the bottom of the lake will develop. The development of anoxic conditions within the bottom waters of Lake Tahoe would have numerous deleterious water quality and ecological impacts. One potential implication is the dissolution of soluble reactive phosphorus that is currently stored in the oxygenated lake-floor sediments (Coats, et al., 2006).

Water Supply

The Intergovernmental Panel on Climate Change (IPCC) reports that droughts are likely to become more frequent and persistent throughout the globe in the 21st century due to changes in atmospheric temperatures and dynamics (IPCC 2007) and the anticipated hydrologic response within the Lake Tahoe Region is similar. Increasing air temperatures and earlier melting of the Sierra Nevada snowpack will result in earlier spring conditions and earlier increases in evapotranspiration rates. The projected shift in

snowmelt timing (Stewart et al., 2004) will significantly reduce the annual water storage that the snowpack historically has provided. In the future, years with relatively low winter snowpack followed by warmer spring and summer temperatures are expected to result in more severe drought conditions throughout the West, and global climate model outputs suggest a greater frequency of these seasonal events may be likely under a range of emission scenarios. In the Lake Tahoe Region, recent calculations using climate model simulation outputs indicate that droughts will become more severe during the next century, especially on the drier eastern portion of the Region (Coats et al., 2010).

Hazards

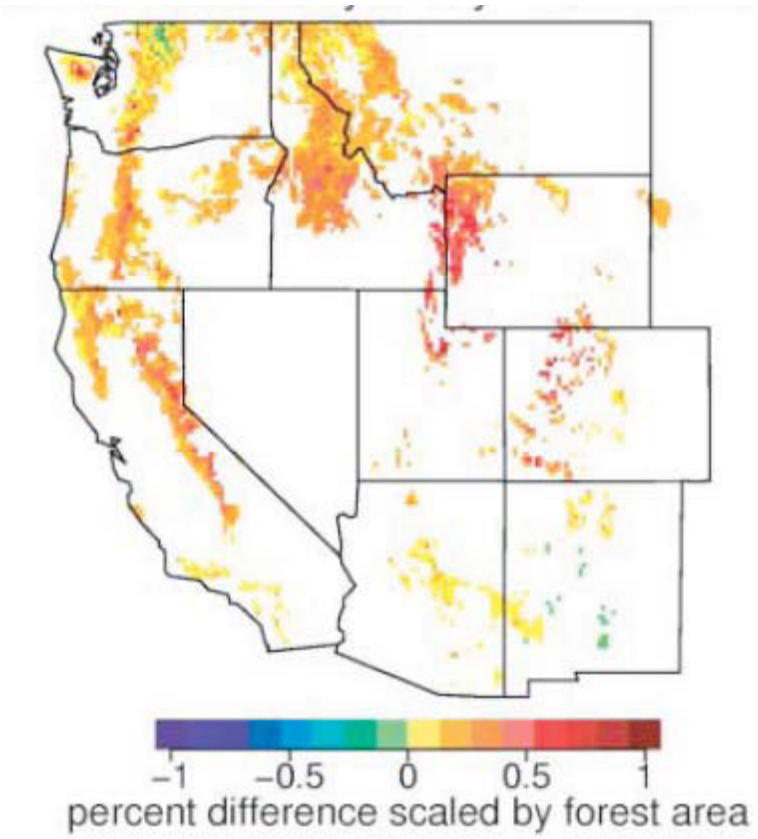
Wildfire

The California Climate Adaptation Strategy states, "the most significant climate change risk facing California is associated with the increase in wildfire activity" (CNRA, 2009). Warmer spring and summer weather, reduced snowpack, earlier snowmelt, and longer, drier fire seasons can be expected to increase fuel hazards and ignition risks (Westerling 2006). Given that these climate changes are projected to continue, there will be a continued risk of large damaging forest wildfires in the future (Running 2006). Wildfire regime characteristics likely to be affected include the amount of area burned (extent), how often they occur (frequency), the time averaged amount of energy released during a fire (intensity). Climate conditions that increase wildfire intensity and duration will result in increases in wildfire severity (Running 2006), which is a measure of the biomass alteration resulting from fire (Keeley 2009). Climate change effects on fire regimes will partially depend on resource management decisions, including fuel alteration (McKenzie et al., 2004).

Historically, fire occurrence in the western United States has been associated with higher spring and summer temperatures and earlier spring snowmelt, and strongly associated with inter-annual changes in weather as well as decadal climate changes (Lenihan et al., 2008). To investigate changes in wildfire regimes associated with future climate conditions, researchers use outputs from global climate models to drive landscape ecosystem models that include wildfire disturbances (e.g., Fried et al., 2004). Despite substantial uncertainties associated with understanding how ecosystems will respond to climate changes (Lenihan et al., 2008; Hurteau and North, 2008), a number of modeling experiments provide useful information about how wildfire regimes are likely to change in the future.

Similarly, simulations by Fried et al. (2004) showed that future climate scenarios produced higher-intensity and faster-spreading fires in most locations, with 41 percent greater area burned and 125 percent more fires that escaped from containment in the Sierra Nevada region. Areas with distinct hydrologic and fire regimes throughout the west may respond differently to climate change scenarios.

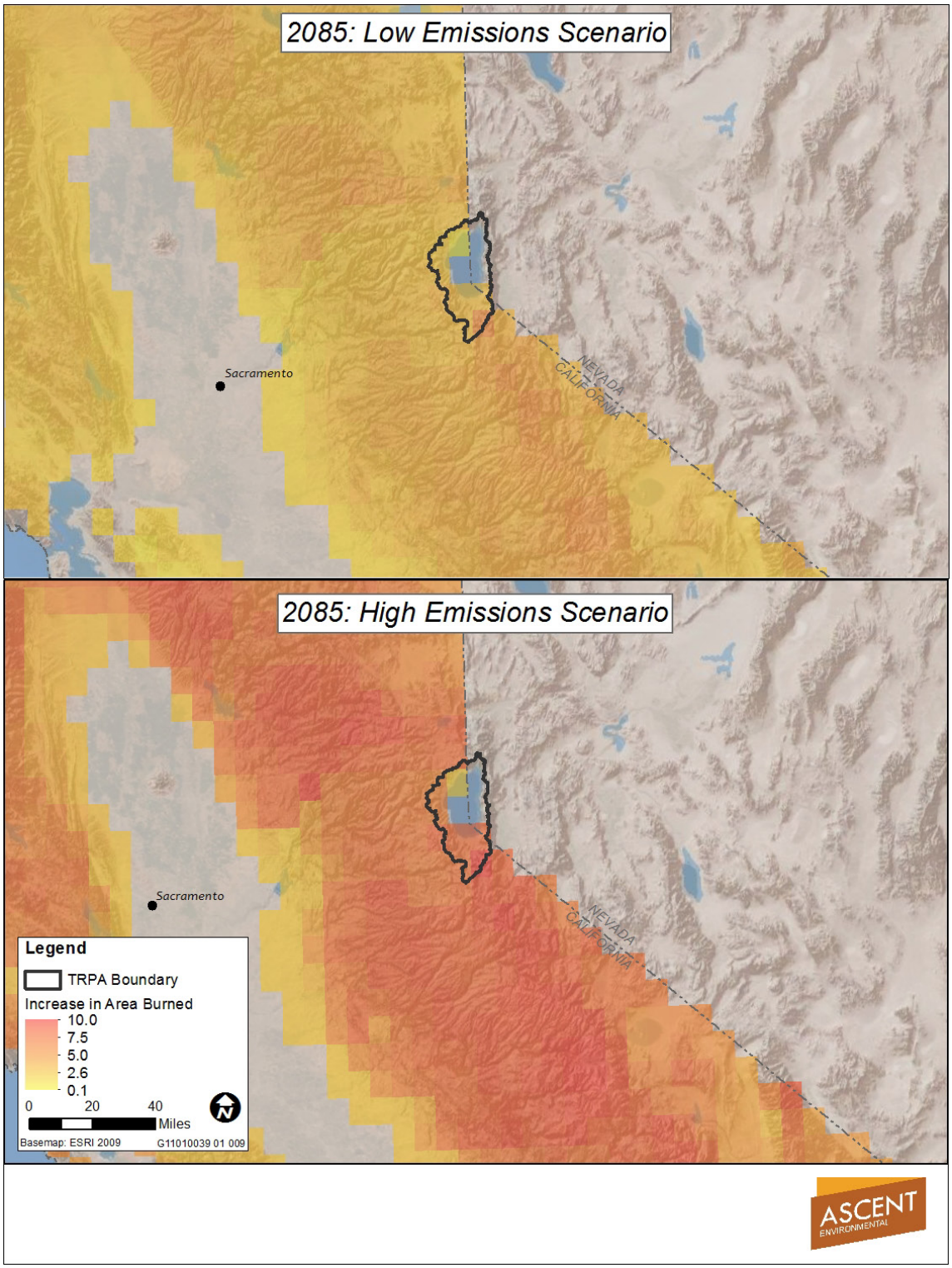
Figure 5.9 shows that the northern Sierra Nevada, including the Lake Tahoe Region, is considered to be highly vulnerable to more frequent fires in the future.



Note: Estimated forest vulnerability to more frequent wildfires as a function of soil moisture differences resulting from the change in spring snowmelt timing. Percent difference in the soil moisture deficit (cumulative difference between potential evapotranspiration and actual evapotranspiration) is scaled by forest area to indicate areas that are highly vulnerable to more frequent fires in the future (red shades)

Source: Westerling et al. 2006

Figure 5.9: Increased Wildfire Vulnerability – Western United States



Source: Cal-Adapt 2013.

Figure 5.10: Increased Area Burned Due to Wildfire Risk under Low and High Emissions Scenarios

Figure 5.10 shows the modeled increase in area burned by wildfires toward the end of the century under both emissions scenarios. The Cal-Adapt tool only contains wildfire risk data for California; thus,

data for Nevada are not available. However, similar increased risk areas are expected in the Nevada portion of the Region, recognizing that similar climate variations will occur.

Wildfires will have indirect impacts on watershed health including stream morphology changes, water quality impacts, vegetation conversions from forests to shrublands or grasslands, habitat fragmentation, and release of CO_2 to the atmosphere from smoke (CNRA 2009). Intense rain events on recent and severely burned areas can result in significant increases in fine sediment loading to the adjacent stream. The amount of biomass consumed by wildfire is estimated to at least double in the western United States during the 21st century under several future climate scenarios (Bachelet et al. 2001). Given the projected changes in wildfire regimes, western US forests may become a source rather than a sink of carbon dioxide to the atmosphere in the future, thereby magnifying the threat to local ecosystems (Westerling et al. 2006).

A report prepared for the Pacific Southwest Research Station estimates and maps 2010 and 2020 modeled fire risk indicators associated with vegetation characteristics in the Lake Tahoe Region. The report noted that the majority of wildfires in the Region during the last 40 years were ignited by humans, as opposed to lightning. Within the wildland urban interface, human caused ignitions made up over 80% of ignitions. The vast majority of these fire starts are controlled before they can grow to an acre or more in size, resulting in a near absence of fire on the landscape over the 20th century. While there have been several fires over 100 acres in size in the last decade, current policies focused on fire exclusion and difficulties implementing large scale prescribed burning have essentially removed fire as an ecosystem process at a landscape scale from the Lake Tahoe Basin over the last century (Saah et al. 2013).

Vegetation data for the Region was obtained using LiDAR data, satellite data, parcel data, and field visits. This data was used to map fire risk indicators for each area of the Region in 2010 and modeled fire risk in year 2020 with implantation of planned fuel reduction treatments. The fire risk indicators include: fire type, flame length, and conditional burn probability. Fire risk is consistently lower in areas that have been treated for fuel reduction compared to areas that were untreated (Saah et al. 2013). The fire risk indicators can be used to prioritize fuel reduction treatments and identify vulnerable areas that are not already scheduled for treatment.

Floods

Although substantial uncertainty exists, several lines of evidence from hydrologic modeling experiments indicate the potential for increased frequency and magnitude of flooding. Greater frequency of extreme precipitation events in the future (Cayan et al. 2008) and associated hydrologic responses are likely to shift flood regimes (timing and magnitude of flood events) throughout California (CNRA 2009). Land use management decisions that have disconnected streams from their historical floodplains have reduced the adaptive capacity of riparian systems, which may become more important given projected climate changes in the future (CNRA 2009). Lake Tahoe watersheds are likely to mirror the general tendency projected throughout the Sierra Nevada with increases in the magnitude of three-day flood events due to more precipitation at higher altitudes, wetter winter soils, earlier springtime melting of the snowpack, and higher snow lines (Hayhoe et al. 2004, Dettinger et al. 2009).

Earlier snowmelt resulting from warmer spring temperatures will cause maximum water storage in Lake Tahoe watersheds (in snow and soil pore spaces) to occur earlier in the spring. When soils are already saturated, subsequent runoff events can result in a greater fraction of surface water runoff due to the reduction in the soil infiltration capacity. Storms are expected to become approximately 3°C (5.4°F) warmer causing snowlines to move about 500 meters higher during the 21st century. Higher snowlines

may increase the frequency of rain-on-snow events (Dettinger et al. 2009), which may contribute to greater flood frequency and magnitude.

Community Health

Disease Vectors

Because interactions between mosquito and host populations depend upon ecological conditions, changes in climate may have a profound impact on the abundance of vectors and the transmission of mosquito-borne pathogens. The amount and pattern of available surface water due to precipitation or water management determine the quality and quantity of mosquito habitat as well as food for vertebrate host populations. Temperature impacts the rate of growth of mosquito populations, virus development in the mosquito, the frequency of blood feeding (host contact) and hence the frequency of transmission and risk of outbreaks. The potential impacts of long-term warming trends include the extended geographic range of mosquito populations, the elongation of the transmission season, and the enhanced rate of pathogen transmission (OEHHA 2013).

Changes in temperature and precipitation are likely to cause changes both in the geographic distribution and the quantity of vectors (such as ticks and mosquitoes) that carry human disease. In California, three vector-borne diseases are of particular concern: human hantavirus cardiopulmonary syndrome, Lyme disease, and West Nile virus. These diseases vary in their response to climate-related factors such as temperature, humidity, and rainfall.29 The distribution of vectors may change as humid areas become drier and less suitable habitats, while other areas may become wetter, allowing for the vectors to exist where they previously did not. Abundance of small mammal reservoirs may similarly be affected (CNRA 2009).

Extreme Heat and Air Quality

Increasing trends in air temperature and summertime temperature extremes in California over the past century are expected to continue. Generally, heat-related illnesses range from mild heat cramps to severe, life-threatening heat stroke, to death. The Lake Tahoe Region's mild summer climate can be attributed to the high elevation, and the Region's population is not considered highly-vulnerable to mortality due to extreme heat. However, the Lake Tahoe Region is anticipated to become a destination for populations seeking to escape heat waves that will be experienced more intensely in the surrounding Carson Valley and Sacramento Valley areas. While an influx of additional visitors to the Region during the warmest periods of the summer may offer economic benefits, it could also have implications for air quality threshold indicators associated with mobile sources of emissions (i.e., ozone precursors, particulate matter, and visibility). If increased extent or frequency of wildfires occur, as discussed earlier in this section, this could result in greater frequency of unhealthy air quality episodes and impaired visibility, which would also have implications for continued achievement of air quality threshold indicators.

Biological Resources

Climate change has been linked to changes in physiology, phenology, distributions, interactions, and disturbance regimes of species. Projected future climate changes will result in even more dramatic shifts in the state of many ecosystems. These shifts will provide one of the largest challenges to natural resource managers and conservation planners. Managing natural resources and ecosystems in the face of uncertain climate requires new approaches. A number of important ecosystem changes that are likely to occur in the Sierra Nevada forests that may contribute to species assemblage changes over time (Moser et al., 2009):

- Phenological life cycle events, such as blooming, migration, insect emergence, leaf unfolding, coloring and fall, fruit ripening, breeding, occurring earlier in spring and/or later in fall,

- Species interactions becoming decoupled from each other as individual species react differently to warming, and
- Biomass increasing due to warmer temperatures, a longer growing season, and higher CO_2 levels.

As the rate of climate change increases some tree species may not be able to adapt to new climate patterns and hydrologic impacts. Globally, terrestrial plant and animal species are shifting poleward and to higher elevations towards cooler temperatures. Entire species populations are increasing in some areas and declining in others (CNRA 2009). Alpine and subalpine forests and associated plant species are particularly vulnerable because they currently exist at the upper range of elevations that exist in the Sierra Nevada. Forest response to climate change will involve complex interaction of location-specific landscape factors such as physical habitat attributes, stressors, climate changes, and land uses that may create substantial heterogeneity in the extent and rate of ecosystem shifts (Millar et al. 2007).

Ecologists are skeptical that plant communities are able to migrate intact. As a result, forest and range communities may change in species composition as they migrate to elevations or latitudes where the climate conditions exist that they can tolerate (CNRA 2009). Because individual members of species assemblages will not necessarily respond in the same way to climate changes, the composition of the flora and fauna in these communities will change as climate conditions and disturbance frequency change over time. System function can be maintained as the community composition changes over time; however, warming temperatures will reduce suitable area for alpine and subalpine forest communities in the Lake Tahoe Region.

Forest Resources

Individual tree species responses will vary but the combined effects of climate change and increased wildfire are expected to impair forest health and encourage invasive species. For example, existing trees that experience higher temperatures or changes in hydrologic regime outside of their species' needs can become stressed, weakened, and, therefore, more vulnerable to infestation. These conditions may lead to a loss of forest habitat due to increased risk of tree mortality (McKenzie, et al., 2004). A recent analysis of tree mortality information collected over the last five decades in the western United States, including older established Sierra Nevada forests, determined that trees have been dying at a faster rate in recent decades. The tree mortality rates were directly related to both temperature and water deficit (Van Mantgem, et al., 2009).

Biodiversity

Biodiversity can be defined as the number and variety of species of plant and animal life within a given region. It is a measure of the resilience of an ecosystem, and a higher level of biodiversity indicates a greater number of functional habitats and niches available for a wide range of species to occupy and survive. Many expressions of ecosystem or trophic structure function influence the degree of biodiversity, and these functional expressions can be affected by climate change. For example, increased inter-species competition for resources may result in a reduction of biodiversity due to the competitive advantage of species more tolerant to climate changes (e.g., more frequent heat waves) or climate change impacts (e.g., wildfire regime changes).

Biodiversity can be used to express the condition over a range of spatial and community scales such as the complete region (Lake Tahoe Region biodiversity); a system (riparian (SEZ) biodiversity), or biological communities (fisheries biodiversity or songbird biodiversity). Climate change may dramatically change forested and range landscapes, resulting in expansions of some forest types and the contraction of others (CNRA, 2009). For example, increased air temperature could affect plant species behavior, including seed production, seedling establishment, growth, and resilience. It also reduces moisture

availability for plants, increases the risk of wildfire, and is likely to enhance the survival and spread of destructive insects, pathogens and/or diseases (CNRA, 2009).

In addition, events such as fires, floods, and other effects of climate change can benefit invasive species, given their tolerance to a wide range of environmental conditions, and can be an important driver of vegetation change on the landscape. Invasive species threaten the diversity or abundance of native species through competition for resources, predation, parasitism, interbreeding with native populations, transmitting diseases, or causing physical or chemical changes to the invaded habitat. For example, the combined effects of warming and increased wildfire frequency may lead to a reduction of species dependent on old forest, such as the Northern Spotted Owl (*Strix occidentalis caurina*), and may increase abundance of species dependent on early successional habitat, such as the Northern Pocket Gopher (*Thomomys talpoides*) (McKenzie et al., 2004). Native animal species include the endangered Sierra Nevada red fox, Sierra bighorn sheep, and yellow-legged frog (Sierra Nevada Alliance 2010).

Energy

Energy infrastructure can be affected by climate change through direct disruption of service due to fire, landslide, changes in efficiency and maintenance requirements, and increased demand (CNRA 2012b). . Decreased snowpack, earlier snow melt, and increased precipitation events and droughts may all contribute to less stability in those electricity supplies. Prolonged periods of drought may lower reservoir levels, limiting the amount of water that may be released to generate hydroelectric power production. In addition, increasing average temperatures and more prolonged, intense heat waves are expected to increase demand for electricity to operate air conditioning. Portions of the Lake Tahoe Region's energy infrastructure (e.g., transmission lines) are vulnerable to wildfire because they are located in forested areas. Increased demand, combined with vulnerable infrastructure may result in service gaps in the existing utility network.

Economy

Tourism is a primary economic activity in the Lake Tahoe Region, including both warm-weather and cold-weather (winter) tourism. Continued global warming will have widespread implications for winter tourism. Declines in Sierra Nevada snowpack would lead to later starting and earlier closing dates of the ski season and changes in ski area operations at lower elevations. Toward the end of the century, if temperatures rise to the lower warming range, the ski season at lower and middle elevations could shorten by as much as a month (CEC 2006). If temperatures reach the higher warming range and precipitation declines, there might be years with insufficient snow for skiing and snowboarding. As warmer conditions persist for longer periods of the year, the Region could attract increased visitation for warm-weather activities, such as trail use, beach activities, and boating. Also, as mentioned previously, to that extent that severe heat waves occur more frequently in Northern California and Great Basin regions, an increase in visitors seeking refuge from the heat would be expected in the Lake Tahoe Region. In general, a shift of visitation from winter to warmer weather periods is a reasonable expectation.

Vulnerability and Climate Change Readiness

The climate change impacts described above present risks to both the natural and built environments in the Region. Climate change "Readiness," "Adaptation," or "Resilience" are planning concepts intended to anticipate, plan for, and adapt to climate-related impacts. Vulnerability describes the intersection of risk and adaptive capacity. Some risks present severe, sometimes irreversible consequences. Other risks are may be readily managed through existing planning processes or regulations.

Regional and local governments have numerous options for helping their communities become better prepared and less vulnerable to climate change impacts. Options include conducting continued research, gathering information to better understand the anticipated impacts, providing public education, elevating protection of natural resources, allocating emergency response resources, and over time guiding new development away from hazardous areas.

The actions recommended in the following sections are intended to provide tools for regional and local governments and partner agencies to make the Region more resilient and less vulnerable to the reasonably foreseeable impacts of climate change. Because climate change impact predictions will continue to evolve with additional research and modeling, it will be important to monitor the availability of updated projections, analyses, and strategies over time. All of these actions have multiple sustainability co-benefits and are important for numerous reasons, in addition to climate change readiness. Climate change readiness co-benefits are illustrated using the following symbols:

Water Quality	Water Supply	Wildfire Hazard Reduction	Flooding Hazard Reduction	Emergency Response	Forest Resources	Biological Resources	Public Health & Air Quality	Enhanced Economic Activity	Energy Supply
									

Other community and sustainability co-benefits are illustrated using the following symbols:

Greenhouse Gas Emissions Reduction	Mobility & Community Health	Job Generation Potential	Social Equity	Public Health & Safety	Recreation Resources
					

Because of the unique regulatory circumstances in the Lake Tahoe Region, many of these actions are already planned for implementation in some form, because of the need to attain and maintain environmental threshold carrying capacities under Tahoe Regional Planning Agency (TRPA) requirements.

Actions for Regional Agencies and Local Governments

Water Resources Actions

With reduced snowpack, variable precipitation levels, rising temperatures, and drought on the horizon, areas of California and Nevada that rely on the Lake Tahoe Region will be left with an unpredictable water supply. In addition, increased frequency of warm storm events will increase excessive amounts of runoff, which can threaten water quality of Lake Tahoe. The following actions primarily address water supply and water quality vulnerabilities.

Stormwater Management and Monitoring	Develop a stormwater management program that considers the altered storm frequency/intensity related to climate change to minimize increased flows and pollutant loads in urban runoff, improve area-wide stormwater runoff quality, and promote retention and reuse of stormwater runoff. Consider climate change-related predictions for meteorology, storm frequency and intensity, and altered snow/rain delivery of precipitation when developing and implementing programs and policies to address drainage (i.e., excessive water quantity) and pollution, by promoting development and retrofits that minimize the discharge of stormwater runoff to infrastructure. Key elements of this program include (1) pollutant source monitoring; (2) pollutant reduction monitoring; (3) BMP design, operation, and maintenance monitoring; and (4) data management, analysis, and dissemination. Data collected under this program will be used to support research on BMPs and pollutant load reduction. Incentivize state-of-the-art stormwater management techniques, which ensure maintenance or improvement of the quality of the water entering surface water systems from stormwater drainage systems. Require development to incorporate storm drainage facilities that reduce urban runoff pollutants within the site or as part of a regional facility.
Primary Vulnerability Area	Water Quality
Co-benefits	Flooding, Water Supply
Responsible Party for Implementation:	Local Jurisdictions, Regional Water Quality Control Agencies, TRPA
Applicability	Region-wide
Sources: TRPA Regional Plan; City of South Lake Tahoe; Tahoe Science Consortium; Douglas County.	

Water Conservation	Require water-wise practices (e.g., water recycling, rainwater collection) where applicable and appropriate in the Region to help prepare for the potential of reduced water supplies in the future. Low water appliances and fixtures shall be installed in new facilities or when replaced in existing facilities: low-flow flush toilets; low-flow showerheads (3 gpm rated maximum flow); faucet aerators; and water-efficient appliances (e.g., washing machines and dishwashers).
Primary Vulnerability Area	Water Supply
Co-benefits	Flooding, GHG Reduction, Lower Utility Bills
Responsible Party for Implementation:	Local Jurisdictions, Water Suppliers
Applicability	Region-wide
Source: Sierra Nevada Alliance	

Low Impact Development	In addition to current requirements in the Regional Plan (CD 2.1 Dii), require Low Impact Development (LID) practices for all new development and redevelopment and during revegetation of disturbed sites to improve water quality. Practices should include native, water-efficient, nutrient-efficient, fire-resistant and non-invasive vegetation.
Primary Vulnerability Area	Water Quality

Co-benefits	Flooding, Water Supply, GHG Reduction, Lower Utility Bills
Responsible Party for Implementation:	Local Jurisdictions, TRPA
Applicability	New Development and Redevelopment
Sources: TRPA; Douglas County; Sierra Nevada Alliance.	

Historic Drainage	Prioritize restoration of meadows and wetlands to maximize water storage in natural infrastructure, maintain late summer flows, enhance water quality, and reduce flood risk. Restoration projects should aim to utilize historic drainage patterns, and pre-development runoff rates and volumes. Restore existing flood control and riparian corridors. Develop projects that mitigate riverine flooding, improve surface retention and subsurface water storage, and enhance timing of water delivery through restoration of waterways to more natural states.
Primary Vulnerability Area	Water Quality
Co-benefits	Flooding, Water Supply, Biological Resources
Responsible Party for Implementation:	Local Jurisdictions, TRPA, US Forest Service
Applicability	Region-wide
Sources: TRPA; Douglas County; Sierra Nevada Alliance; California Natural Resources Agency.	

Watershed Hydrology Trend Monitoring	Initiate long-term status and trend monitoring of watershed hydrology and pollutant loads entering Lake Tahoe to (1) inform Lake Tahoe total maximum daily load (TMDL) land use and lake clarity models, and other water quality-related management models; (2) evaluate progress in meeting TMDL allocation requirements and other regulatory obligations; and (3) evaluate snowpack and snowmelt trends as they pertain to lake clarity. Validate pollutant reduction crediting tools that are currently being developed to track progress in implementing the Lake Tahoe TMDL. At the same time, develop a science-based adaptive management program to guide pollutant load reduction activities. Conduct modeling of the Region's water system and conduct risk analysis to determine future water demand under a reasonably foreseeable future climate change scenario with altered precipitation and temperature regimes.
Primary Vulnerability Area	Water Quality, Water Supply
Co-benefits	Flooding
Responsible Party for Implementation:	TRPA
Applicability	Region-wide
Sources: Tahoe Science Consortium; Sierra Nevada Alliance.	

Water Supply Commitments	Consider climate change influences on water supply when making commitments about future water deliveries. Water suppliers should avoid predictions of water deliveries based solely on current hydrology, without taking future climate conditions into account. Hydropower utilities should also plan ahead to meet their minimum requirements for FERC and other federal and state agencies under future climate change scenarios in which the water regime will change.
Primary Vulnerability Area	 Water Supply
Co-benefits	 Water Quality, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Regional Water Quality Control Agencies, Water Suppliers, TRPA, Utilities
Applicability	Region-wide
Source: Sierra Nevada Alliance.	

Coverage Limitations	Implement the impervious surface coverage limitations in the Regional Plan. Prioritize compliance of areas that would be more sensitive to climate change effects within Area Plans (e.g., faster snow melt, large storm events).
Primary Vulnerability Area	 Water Quality
Co-benefits	 Water Supply, Flooding
Responsible Party for Implementation:	Local Jurisdictions, TRPA
Applicability	Region-wide
Source: TRPA Regional Plan.	

Groundwater Recharge	Research groundwater vulnerabilities associated with altered hydrologic conditions and investigate methods to maximize groundwater recharge.
Primary Vulnerability Area	 Water Supply
Co-benefits	 Water Quality, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Regional Water Quality Control Agencies, Water Suppliers
Applicability	Region-wide
Source: Sierra Nevada Alliance.	

Integrated Regional Water Management Planning	Improve coordination between land use planning and water agencies through integrating water data into land use planning documents; supporting Integrated Regional Water Management (IRWM) plans and projects; and integrating land use data into water planning.
Primary Vulnerability Area	 Water Supply
Co-benefits	 Water Quality, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Regional Water Quality Control Agencies, Water Suppliers, TRPA
Applicability	Region-wide
Source: Sierra Nevada Alliance.	

Hazard Mitigation Planning Actions

Hazards, such as floods, wildfires, and extreme weather events pose safety risks that threaten public health. Similarly, rising temperatures will have implications for maintaining health-based air quality standards, and increased frequency of wildfire will lead to more hazardous air quality episodes. Education and emergency preparedness are important resources in preventing future health risks and safety hazards. By monitoring existing conditions, the Region can keep residents informed on how to best protect themselves against the changing elements.

Transfer of Development Rights	Development is preferred in and directed toward Centers, and away from environmentally-sensitive lands furthest from non-residential support services, as identified on the regional land use map. Increase the average number of units transferred to Centers from sensitive and remote land compared to the annual average rate between 2002 and 2012. Prioritize the retirement of development rights and the restoration of sensitive land, especially within the Wildland Urban Interface (WUI). Monitor the effectiveness of Regional efforts to direct development away from environmentally sensitive lands.
Primary Vulnerability Area	Wildfire
Co-benefits	Water Quality, GHG Emissions Reduction, Community Health & Mobility, Biological Resources, Forest Resources, Air Quality
Responsible Party for Implementation:	Local Jurisdictions, TRPA
Applicability	Region-wide
Source: TRPA Regional Plan.	

Wildfire Hazard Education	Continue and increase wildfire hazard education, fire prevention techniques, human-caused ignition reduction programs, and forest fuel management education programs (e.g., www.livingwithfire.info/tahoe). Continue a fire prevention program that reduces the number of human-caused fires through an aggressive program of public contact, education, outreach, and enforcement. Monitor the program's effectiveness and evaluate the need for increased resource allocation to the program if the number of human-caused fires does not decline.
Primary Vulnerability Area	Wildfire
Co-benefits	Forest Resources, Biological Resources, Air Quality, GHG Emissions Reduction, Energy Supply
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, State Fire Protection Agencies, Fire Protection Districts
Applicability	Region-wide
Sources: TRPA Regional Plan; USDA Forest Service – Lake Tahoe Basin Management Unit	

Defensible Space	Require a minimum 100-foot radius of defensible space in the WUI. Evaluate whether a larger radius should be required in untreated forest fuel areas or high fire risk probability areas.
Primary Vulnerability Area	Wildfire
Co-benefits	Forest Resources, Biological Resources, Air Quality, Energy Supply
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, State Fire Protection Agencies, Local Fire Protection Districts, Utilities
Applicability	Region-wide
Sources: USDA Forest Service - Lake Tahoe Basin Management Unit; City of South Lake Tahoe.	

Fuel Reduction Treatments	Reduce accumulated fuel load through thinning and brush removal and perform fuel reduction treatments on a minimum of 2,000 acres per year in the Region. Coordinate inter-agency review of fuel management on private parcels to improve forest health and reduce risk of wildfire through Tahoe Fire and Fuels Team (TFFT).
Primary Vulnerability Area	Wildfire
Co-benefits	Forest Resources, Biological Resources, Air Quality
Responsible Party for Implementation:	US Forest Service, State Fire Protection Agencies, Fire Protection Districts
Applicability	Region-wide
Sources: USDA Forest Service - Lake Tahoe Basin Management Unit; City of South Lake Tahoe; Tahoe Science Consortium.	

Fire Hazard Reduction Measures in New Development	Require that discretionary permits for new development in fire hazard areas be conditioned to include requirements for fire-resistant vegetation, cleared fire breaks, or a long-term comprehensive fuel management program. Fire hazard reduction measures shall be incorporated into the design of development projects in fire hazard areas (e.g., fire resistant construction materials).
Primary Vulnerability Area	Wildfire
Co-benefits	Forest Resources
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, State Fire Protection Agencies, Fire Protection Districts
Applicability	New Development and Redevelopment
Sources: City of South Lake Tahoe; Placer County.	

Vulnerability Assessment and Outreach	Pursue and secure funding to conduct a vulnerability assessment to determine where the highest concentrations of vulnerable populations are located in the Region. Develop an outreach program specifically targeting vulnerable populations. Provide vulnerable populations with information on what they need to know about the hazards associated with climate change (e.g., wildfire, flooding) and what they can do to prepare and gain access to emergency resources.

Primary Vulnerability Area	Emergency Response
Co-benefits	Public Health, Social Equity, Wildfire, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Emergency Management Agencies
Applicability	Region-wide
Source: California Natural Resources Agency.	

Wildfire Emergency Response	Evaluate current fire response resources, emergency evacuation resources, and shelters to determine if those resources would be adequate under a future condition with increased frequency and intensity of wildfire.
Primary Vulnerability Area	Emergency Response
Co-benefits	Public Health, Social Equity, Wildfire, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Emergency Management Agencies
Applicability	Region-wide

Emergency and Disaster Preparedness Training	Coordinate with local, regional, State, and Federal agencies to conduct emergency and disaster preparedness exercises to test operational and emergency plans.
Primary Vulnerability Area	Emergency Response
Co-benefits	Public Health, Social Equity, Wildfire, Flooding
Responsible Party for Implementation:	Local Jurisdictions, Emergency Management Agencies
Applicability	Region-wide
Source: City of South Lake Tahoe.	

100-year Storm Event Planning	Evaluate the effects of climate change (e.g., warmer storm events, altered precipitation patterns) on the current definition of a 100-year storm event. Evaluate stormwater collection and conveyance systems to ensure that capacities are appropriate for 100-year storm events under altered precipitation patterns. Consider the research of the Tahoe Science Consortium regarding extreme storm events (ARkstorm@Tahoe Project: http://tahoescience.org/arkstorm-project/)
Primary Vulnerability Area	Flooding
Co-benefits	Water Quality, Emergency Response
Responsible Party for Implementation:	Local Jurisdictions, Utility Districts, Emergency Management Agencies
Applicability	Region-wide
Source: Tahoe Science Consortium.	

Prohibit Development in 100-Year Flood Plain	Prohibit development within the 100-year flood plain and evaluate on an ongoing basis, as data is available, how the 100-year flood plain may change over time under new precipitation patterns and warmer storms. Provide transfer incentives to remove public and private development from Stream Environment Zones (SEZs) and 100-year flood plains to reduce drainage problems and damage to public and private property. Require property owners and developers to dedicate land within 100- year floodplains, conservation easements, and SEZs to the jurisdiction or other designated entity when a development project is approved.
Primary Vulnerability Area	 Flooding
Co-benefits	 Emergency Response
Responsible Party for Implementation:	Local Jurisdictions, Emergency Management Agencies, TRPA
Applicability	Region-wide, New Development, and Redevelopment
Sources: TRPA Regional Plan; Sierra Nevada Alliance; City of South Lake Tahoe.	

Evacuation Access	Determine transportation improvements required to allow for a minimum of one functional access point to communities during 100-year flood events, and if needed, implement improvements.
Primary Vulnerability Area	 Flooding
Co-benefits	 Emergency Response, Community Health & Mobility
Responsible Party for Implementation:	Local Jurisdictions, TMPO/Caltrans/NDOT, Emergency Management Agencies
Applicability	Region-wide
Sources: Douglas County	

Coordinated Hazard Mitigation Planning	Develop coordinated plans for mitigating future flood, landslide, and related impacts through concurrent adoption of updated general plan safety elements and local hazard mitigation plans. Evaluate projected risks of flooding, landslides, and related hazards in all communities. Determine long- and near-term action plan priorities to reduce potential losses. Identify hazard mitigation projects to include in five-year capital improvement programs.
Primary Vulnerability Area	 Flooding
Co-benefits	 Wildfire, Emergency Response
Responsible Party for Implementation:	Local Jurisdictions
Applicability	Region-wide
Sources: California Natural Resources Agency	

Community Health Actions

As stated in the previous section, wildfires, and extreme weather events pose risks that threaten public health and safety. Similarly, rising temperatures will have implications for maintaining health-based air quality standards, and increase the risk of vector-borne disease. Education and emergency preparedness are important resources in preventing future health risks and safety hazards. By monitoring existing conditions, the Region can keep residents informed on how to best protect themselves against the changing elements.

Monitor Achievement of Air Quality Thresholds	Continue to monitor attainment of air quality threshold standards. Evaluate adaptive management approaches for attainment of threshold standards for ozone, particulate matter, and visibility under warmer climate conditions.
Primary Vulnerability Area	Air Quality
Co-benefits	Public Health, Water Quality
Responsible Party for Implementation:	TRPA
Applicability	Region-wide
Source: TRPA.	

Social Equity in Planning	Focus planning and intervention programs on groups that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts. Include social equity and public health as considerations in all policy development processes.
Primary Vulnerability Area	Public Health
Co-benefits	Social Equity
Responsible Party for Implementation:	Local Jurisdictions, TRPA
Applicability	Region-wide
Source: California Natural Resources Agency.	

Public Health Monitoring	Use performance metrics and data provided by public health agencies to evaluate and monitor the impacts of climate change (i.e., heat events, impaired air quality) on public health. Coordinate monitoring and data collection by health agencies and departments with health care providers.
Primary Vulnerability Area	Public Health
Co-benefits	Air Quality, Social Equity
Responsible Party for Implementation:	Local Jurisdictions, Public Health Departments, TRPA
Applicability	Region-wide
Source: California Natural Resources Agency.	

Vector Control	Evaluate resources allocated to disease vector control districts for adequacy on a recurring basis to provide adequate pest management activities and provide for monitoring as conditions change (i.e., expanded pest ranges, new occurrences of disease and illness). Consider the need for regional coordination of local vector control districts and public health departments to help disseminate information and prevent spread of pests and disease vectors.
Primary Vulnerability Area	Public Health
Co-benefits	Forest Resources, Biological Resources
Responsible Party for Implementation:	Local Jurisdictions, Vector Control Districts, Public Health Departments, TRPA
Applicability	Region-wide
Source: USDA Forest Service – Lake Tahoe Basin Management Unit.	

Biological and Forest Resources Actions

Even though climate change is a result of human activity, it does not only adversely impact humans. Temperature change and variable precipitation also disrupt natural ecosystems and migration routes. Even slight changes in climate can result in more hospitable conditions for invasive species that can interrupt native species. To prepare for future ecosystem stressors, it is important to preserve and restore fragile habitats already at risk.

Protect Migration Corridors	Identify future migration corridors that may be different from current conditions due to climate change (e.g., reduced or fragmented habitat) and other physical changes to the Region. Prioritize conservation of these future geographically altered migration corridors. Establish development regulations and design guidelines to minimize impacts of new development on sensitive or critical habitats and migration routes. Engage the academic community to monitor changing conditions, indicators, outcomes, research needs, and methods to improve connectivity between habitats and wildlife corridors to facilitate migrations, range shifts, and protection of wildlife populations for future generations. Consider establishing Region-wide design guidelines to minimize impacts of new development on sensitive habitats and migration routes. Collaborate with partners to establish priority locations for maintaining and restoring habitat connectivity.
Primary Vulnerability Area	Biological Resources
Co-benefits	Forest Resources
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, Regulatory Agencies
Applicability	Region-wide
Sources: Sierra Nevada Alliance; Douglas County; Placer County; USDA Forest Service – Lake Tahoe Basin Management Unit.	

Prevent Invasive Species	Identify aggressive, prevention-oriented, and adaptive approaches to control the spread of invasive species before lands and waters become invaded. Continue watercraft inspections and treatment of lands for invasive species. Monitor scientific research efforts regarding the extent of invasive species for new ranges that may extend to the Region. Implement specific integrated pest management strategies as needed to respond to immediate native or exotic forest insect or disease threats to forest health, which may include removal or treatment of beetle-infested trees, when identified that threaten developed recreation and administrative sites, and private property, prior to beetle emergence, to reduce the likelihood of further infestation. Evaluate the potential to create a market for invasive species, such as the Crayfish.
Primary Vulnerability Area	Biological Resources
Co-benefits	Forest Resources, Water Quality, Economy
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, TRPA
Applicability	Region-wide
Sources: Sierra Nevada Alliance; USDA Forest Service – Lake Tahoe Basin Management Unit; Lake Tahoe Region Aquatic Invasive Species Management Plan.	

Habitat Protection	Protect environmentally sensitive and habitat areas that serve valuable ecological functions by limiting their development or by requiring mitigation of adverse impacts resulting from development. Engage local experts regarding mitigation development.
Primary Vulnerability Area	Biological Resources
Co-benefits	Forest Resources
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, Regulatory Agencies, TRPA
Applicability	Region-wide
Sources: Douglas County; Placer County.	

Inventory of Current Research and Monitoring	Identify and monitor habitat diversity for changes or for reductions in size. Conduct an inventory of species and habitat types that are of concern, and the groups currently conducting research or monitoring of those respective resources. Determine where gaps exist and work with the scientific community to fill those gaps.
Primary Vulnerability Area	Biological Resources
Co-benefits	Forest Resources, Job Generation
Responsible Party for Implementation:	US Forest Service, Regulatory Agencies, TRPA
Applicability	Region-wide
Source: Sierra Nevada Alliance.	

Improve Forest Age Structure	Investigate methods to improve age structure and diversity of plant communities consistent with environmental considerations. Engage academic institutions to determine areas where additional study and monitoring are needed. Actively seek and encourage research activities that may be beneficial in informing management of National Forest Service lands. Routinely evaluate research findings to inform adaptive management.
Primary Vulnerability Area	 Forest Resources
Co-benefits	 Wildfire, Biological Resources, GHG Emission Reduction
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service
Applicability	Region-wide
Sources: TRPA Regional Plan; Sierra Nevada Alliance; USDA Forest Service – Lake Tahoe Basin Management Unit.	

Urban Forestry	Develop urban forestry components within Area Plans as required by TRPA Code 13.5.3.C in a manner that does not increase the risk of catastrophic wildfire.
Primary Vulnerability Area	 Forest Resources
Co-benefits	 Wildfire, Biological Resources, GHG Emission Reduction
Responsible Party for Implementation:	Local Jurisdictions
Applicability	Region-wide
Source: TRPA.	

Forest Restoration & Reforestation	Prioritize reforestation projects that focus on restoring native tree cover on lands that were previously forested or were otherwise disrupted. Retain, protect, and restore aspen and riparian plant communities to enhance wetland function and provide habitat for disturbance tolerant species that utilize urban forests. Restore or stimulate regeneration of at least 25 acres of aspen per year.
Primary Vulnerability Area	 Forest Resources
Co-benefits	 Wildfire, Biological Resources, GHG Emission Reduction
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service
Applicability	Region-wide
Source: Sierra Nevada Alliance; USDA Forest Service – Lake Tahoe Basin Management Unit.	

Reduce Ecosystem Fragmentation	Reduce fragmentation and degradation of forests to improve forest resiliency and promote of overall ecosystem health.
Primary Vulnerability Area	 Forest Resources

Co-benefits	Wildfire, Biological Resources, GHG Emission Reduction, Recreation Opportunities
Responsible Party for Implementation:	Local Jurisdictions, US Forest Service, TRPA
Applicability	Region-wide
Source: Sierra Nevada Alliance.	

Economic Actions

Given the expected impacts of climate change, residents and businesses face a future that may be more economically unstable and more costly. The most effective ways to prepare the economy for the effects of climate change is to improve technology, develop new skills, and keep residents and businesses informed of what can be expected.

Warm-season Recreational Opportunities	Support development of tourist and recreational facilities that extend the High Sierra's tourist season. Seasonal facilities should consider additional opportunities for alternative uses in the warm-season, wherever appropriate. Encourage facilities that minimize GHG emissions, water consumption, and noise (e.g., passive recreation opportunities; non-motorized activities). Consider economic incentives that support an economically-diverse and prosperous year-round economy for regional residents and visitors.
Primary Vulnerability Area	Economy
Co-benefits	Job Generation, Recreation Opportunities
Responsible Party for Implementation:	Local Jurisdictions, TRPA, or other regional entity
Applicability	Region-wide
Sources: TRPA Regional Plan; Placer County; City of South Lake Tahoe.	

Workforce Housing Strategy	Create an effective Region-wide Workforce Housing Strategy. Evaluate how the Region's tourism industry may be affected by climate change (e.g., shift in season or type of tourism), and how associated employment demands reflect the range of housing opportunities in the TRPA Housing Needs Assessment.
Primary Vulnerability Area	Economy
Co-benefits	GHG Emissions Reduction, Social Equity, Jobs/Housing Balance
Responsible Party for Implementation:	Local Jurisdictions, TRPA
Applicability	Region-wide; Local Jurisdictions
Sources: Tahoe Prosperity Center; City of South Lake Tahoe, TRPA.	

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Chapter 6: Community Engagement

Introduction

This Plan serves as a menu of climate and sustainability actions from which regional agencies, local jurisdictions, businesses, groups, schools, individual residents, and visitors can pull to develop sustainability actions. The preceding Chapters 4 and 5 presented menus of actions with which regional agencies and local governments can implement to make the Region more sustainable. This chapter describes how individuals, businesses, schools, and others can engage to implement this Sustainability Action Plan and create a thriving region for today and future generations.

Outside of the local jurisdiction planning process, some individuals are empowered to take leadership roles in implementing sustainability actions within their own communities. For example, a local Parent Teacher Association of a school could determine that developing a 'Grow Dome' at the local school is an excellent way to increase nutritious food served at the school and providing a living classroom for learning how food grows within an earth science curriculum. This chapter suggests an approach for moving forward to action.

The following sections outline what sustainability actions regional agencies, local governments, residents, businesses, schools and other individuals can take to help achieve results in the Region. It will take leadership from all these sectors and this Sustainability Action Plan can help to prioritize which tools they will implement and inspire their coordination with other stakeholders.

Education and Engagement

Broad community awareness is needed so that people can take advantage of the cost savings and the increased quality of life that result from sustainable behavior, in the form of improved economic, community, and environmental health. Community and government leaders can support education and outreach campaigns, but effective community engagement requires partnerships between multiple sectors and populations of your community.

Successful implementation of voluntary sustainability actions (those not required by your jurisdiction through ordinance or law) requires particularly targeted and direct outreach and education to the correct community members. A model for implementing voluntary actions is described below, and specific examples of leadership are identified in the sections that follow.

A Robust Model for Implementing New Voluntary Actions

The following four-step model for implementing and increasing success of voluntary actions is recommended for community members and local governments.

This is an iterative process where the measurement or evaluation of success is used to inform any one or all of the four steps until you successfully implement a pilot strategy and develop an effective way to share the story and inspire more adopters. The Steps are illustrated in Figure 6.1 below and are described in more detail below.

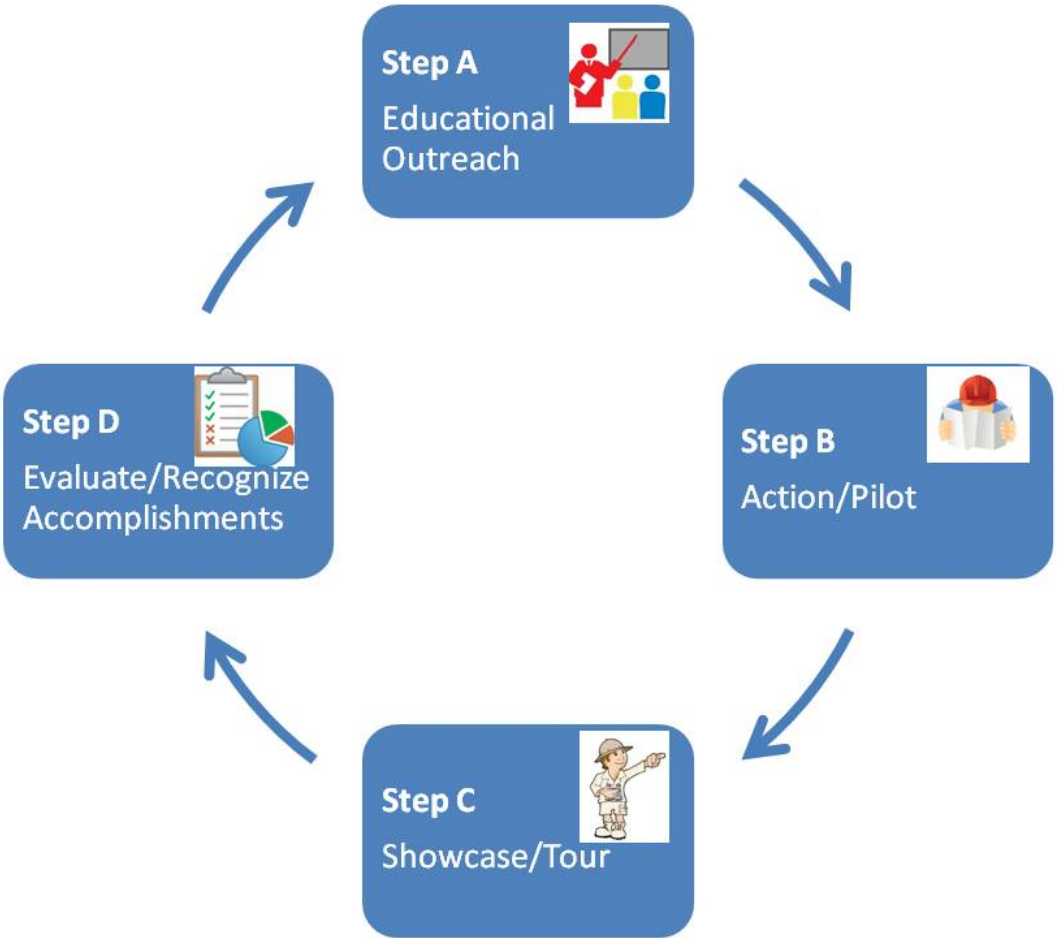

Figure 6.1: Voluntary Action Implementation Model

Step A: educate yourself and your target audience about the benefits of implementing the strategy.

For example, increase understanding of the benefits and methods of large-scale composting in the Lake Tahoe Region. Conduct outreach about the basics of why composting is good for reducing waste in landfills, providing nutrients to improve soil health, and creating healthier food or landscapes. Examples of Educational Outreach include: distributing factsheets on compost, getting articles in local papers about the need to compost, doing a series of public lectures, and speaking at civic group meetings on the subject. Consider researching and providing examples of where a relevant action/pilot has worked in other places in order to help locals better accept the idea.

Step B: identify an early-adopter in order to get a small-scale pilot implementation project on the ground.

An example would be to identify five local restaurants to start composting their food waste. They would develop a waste pickup system and identify a local farmer or centralized facility to take the waste and make it into compost. The pilot restaurants would then bring the compost back to their facilities to use in their restaurant landscaping; or buy food from the local farmer who used the waste. These pilot efforts would help determine what aspects work well, the true costs and benefits gained, challenges encountered, and areas for improvement.

Step C: **use tours and other means to showcase the pilots and early-adopting examples to showcase the success to a broader audience.**

Examples include tours of the local restaurants' green waste diversion system and the local farmers' or facility's composting operation. Tours could be sponsored by local Chamber of Commerce or the refuse company, and the target audience could be other restaurants. The tours would be a way to showcase the on-the-ground success of the pilot project.

Step D: **evaluate and measure the pilot implementation to gauge success and celebrate accomplishments.**

This step includes developing indicators of success and recognizing the accomplishment internally and externally. In this example, an annual report showing how much compostable waste sent to the facility was actually composted. Another indicator could be the number of restaurants who separate their compostable waste. Each quarter or year these indicators could be updated and they would serve to measure success over time. The success should be communicated to the target audiences (e.g., restaurants, elected officials/decision makers) and recognized at an event. The success of each of the four steps should be gauged independently with both successes and failures used to inform future efforts.

The reason this model is important to consider is that if one stage is not done with the others, there is little momentum for wide-scale voluntary adoption of a new technologies or actions. If you – a community member or local government – implements or identifies a model pilot effort – but never gets the word out to others on its success, others will not follow. If you educate on a concept but never show on the ground implementation with pilot efforts, many are skeptical it can be done. If you do the pilot efforts and tours, but do not measure larger indicators, you do not see if these efforts are resulting in wide-scale adoption and if your goals are being met.

Leadership

Regional

Strategy: Establish a Regional Sustainability Task Force to Track, Coordinate, and Encourage Regional Sustainability

This Plan is a menu of strategies that will be used by a variety of entities. Ultimately, it will be up to the users of the Plan to fund and implement the necessary programs that accompany each action. However, establishing a Sustainability Task Force at the regional level to guide, track, and monitor the Region's progress implementing the Sustainability Action Plan is key for success. This Task Force would be tasked with coordinating between the local governments, Lake Tahoe Sustainability Collaborative, state and federal agencies working in the Region, school districts, chambers of commerce, and non-governmental organizations to encourage and track implementation of sustainability actions and update this Plan. Being sensitive to costs of and potential complications from adding more levels of government and oversight, rather than creating a "Sustainability Task Force," entities such as those listed above could establish a "Sustainability Team" with existing staff from multiple departments. No matter the method, the Task Force's primary focus would be the Sustainability Action Plan.

The Task Force would:

Release a State of Sustainability Report for the Region on a regular basis (e.g., annually or bi-annually). This report would track which actions in the Plan have been implemented and also report on the

Sustainability Indicators described in Chapter 1. The Task Force would provide a means for the diverse stakeholders to gauge whether collective efforts were resulting in Region-wide success.

Help secure and distribute grants in the Region to encourage implementation of top-priority sustainability actions.

Issue awards and host an annual event recognizing those entities that did the most to reduce greenhouse gas (GHG) emissions and create a more sustainable Region.

Update the region-wide Plan document every two years with new actions or update existing actions with new information.

Local Governments

Strategy: Lead by Example

Chapters 4 and 5 provide menus of sustainability actions that local governments can incorporate into local planning framework. Local governments can make their communities more sustainable by educating others on sustainability, acting as early-adopters and piloting projects to develop new efforts, leading tours and showcasing their successes, and monitoring indicators within their jurisdiction to track sustainability. Local governments can also demonstrate their commitment to sustainability by leading by example.

Sustainability Action Planning and implementation is known to be most successful in communities that have a sustainability champion or advocate. An important first step is creating an Office of Sustainability, Sustainability Commission, or Sustainability Advisory Committee to lead Sustainability action and outreach. A dedicated set of staff, elected officials and community volunteers provides the focus, talent, and commitment to secure resources and achieve the best results.

Some examples of ways local governments can lead by example:

Step A: Educational Outreach

Provide best practice information, resource ideas, and sustainability tools.

Provide information on local government sustainability efforts in pamphlets, public buildings, and government websites.

Share information with other local governments on costs and benefits.

Create and maintain an online **directory of local green businesses**.

Provide technical and financial assistance to residents and businesses.

Survey the population to identify what sustainability actions have already been taken and to identify high priority and high potential sustainability actions to pursue (homeowners, renters, businesses, visitors: are you currently doing it, are you planning to, have you ever heard of it, are you completely resistant to it).

Step B: Action/Pilot

Institute a **"Green Purchasing Policy"** that requires the purchase of environmentally preferable products within 10 percent of the lowest bid (and submit to the public a detailed yearly purchasing report.)

Reduce the impact of government fleets. Inventory all vehicles in the government fleet and create a plan for gradual replacement of the existing fleet with vehicles that are alternatively fueled, energy efficient, and right-sized.

Conduct energy audits on local government owned buildings and improve their efficiency.

When significant upgrades or modifications to an existing publicly owned building are made, **complete a "LEED for Existing Buildings Checklist"** to assess the feasibility of incorporating sustainable design into the project (GBC 2009).

Improve energy efficiency in government facilities. Through measures such as lighting upgrades, improved insulation, and better HVAC systems, municipalities can reduce energy costs, reduce GHG emissions, and increase buildings' asset value (EPA 2011).

Purchase power from green power sources. Energy managers can visit EPA's "Green Power Locator" to find what options are available in their area (EPA 2012).

Install Solar, Wind, passive solar energy, and other **renewable energy generation** at your facilities.

Install **electric vehicle charging stations** at your facilities.

Step C: Showcase/Tour

Track the energy and cost savings of each measure undertaken and share this information on tours to the public and other government representatives.

Provide tours of efficiency and sustainability efforts to local schools.

Gain media coverage on the installation of new technologies and achievements above.

Prominently **display your sustainability efforts** with signs in and at your facilities.

Help your city or community pursue "We Can City," or equivalent ***Healthy City* status, and "Bike Friendly City" status** to show everyone that your community takes sustainability and health seriously (Alliance for Healthy Cities 2013, League of American Bicyclists 2013).

Step D: Evaluate/Recognize Accomplishments

Track energy and cost savings.

Create your own **government indicators of sustainability** and efficiency beyond energy and cost savings.

Release an **annual report** on government sustainability/efficiency

Give out **awards** to the departments, buildings or staff that did the most in furthering sustainability/saving money/promoting efficiency.

Residents

Strategy: Influence the Planning Process

Residents must get involved with their local governments and Regional agencies in order to support, advise, and inform plans, policies, and ordinances. Land use and transportation planning are key components of sustainability outcomes. There are several types of agency-adopted plans that provide guidelines for development in the Lake Tahoe Region and within its communities. Applicable plans include General Plans (prepared by California cities and counties), Master Plans (prepared by Nevada counties), Area Plans (community plans in the Lake Tahoe Region), and the overarching Regional Plan and Regional Transportation Plan (prepared by TRPA). Chapter 2 discusses the relationship between these plans in more detail.

The Sustainability Action Plan is a toolkit for Regional agencies and local governments to incorporate sustainability actions into their respective plans based on the appropriate scale and context. Residents are some of the best experts to assist the agencies in determining what actions are consistent with the values and vision for the community and how to remove barriers for implementation. Residents are also a resource for innovative ideas that can help increase the rate of success.

Development of these plans is conducted in a process that is open to all members of the public. You do not have to be a professional planner or technical expert to engage in this process. However, personal initiative is required to stay informed about opportunities for involvement.

Residents can get involved in development of Regional and local plans through some of the following methods:

Attend public meetings and workshops related to plan visioning conducted by TRPA and by the local jurisdiction where you live. Check the calendar on the respective agency website to find out where and when meetings will occur. Some website resources are provided below this section.

Sign up for email updates for agency agendas and meeting notifications.

- Check the meeting agendas for items such as plans, ordinances, and presentations that relate to sustainability. You can provide comments on the content in-person or via email or letter.
- Additionally, plans and related environmental review documents are available for public comment for a period of 30-90 days prior to adoption, which presents another opportunity to provide input.
- Review draft plan and environmental documents carefully, and offer specific suggestions wherever possible.

By making your voice heard and asking for meaningful sustainability action language, you can help implement many of the actions laid out in Chapters 4 and 5 of this Plan.

Resources for residents to track and attend public meetings in your community:

Land Use Planning Agencies

Tahoe Regional Planning Agency (TRPA): http://www.trpa.org/calendar/

El Dorado County: https://www.edcgov.us/EventsandMeetings.aspx

City of South Lake Tahoe: http://www.cityofslt.us/calendar.aspx

Placer County: http://www.placer.ca.gov/BOS.aspx

Douglas County: http://www.douglascountynv.gov/index.aspx?nid=46

Washoe County: http://www.washoecounty.us/citizens

Transportation Planning Agencies

Tahoe Metropolitan Planning Organization: http://tahoempo.org/calendar.aspx?SelectedIndex=-1

Tahoe Transportation District: http://www.tahoetransportation.org/doing-business/meetings

Truckee-North Tahoe Transportation Management Association*: http://www.laketahoetransit.com

South Shore Transportation Management Association*: (775) 588-2488

**Note: TMAs are not transportation planning agencies.*

Some government meetings may occur during normal business hours, which can make it difficult for some residents to attend in person. You can send a letter to the City Manager or County Clerk ahead of the meeting and request for it to "be read into the public record." This instructs the City Manager or County Clerk to read your comments aloud before elected officials and audience members on your behalf, in addition to it considered as part of the documented administrative record.

The Lake Tahoe Regional Plan and Regional Transportation Plan were updated in 2012, and are intended to be updated every four years. This presents nearly continuous opportunities to get and stay involved. Several Area Plans are currently in development or will be developed during the next few years, so the time to start getting involved is now.

Strategy: Influence Plan Implementation

Agency-adopted land use plans can be subject to amendment and interpretation. Agency staff and decision-makers implement the plans when they make recommendations and land use decisions. Transportation plans rely on availability of funding for implementation. Ordinances, municipal code, or jurisdiction-specific laws, are another opportunity to implement sustainability actions. For example, local government building codes may include energy efficiency or renewable energy standards.

Residents can assist with implementation of plans through some of the following methods:

Advocate to **elected officials** on priority sustainability areas, many of which are identified in chapters 4 and 5 as well as the rest of this chapter.

Advocate to **transit districts** for transit service improvements or facility enhancements (e.g., increase availability of ski racks and bike racks on all buses).

Comment on **Capital Improvement Plan** priorities (e.g., prioritize bicycle and pedestrian-oriented projects over projects that benefit auto-oriented transportation).

Contact **utility providers** and indicate support for renewable energy procurement and energy efficiency incentives.

Comment and advise on **local building codes and Area Plans** (e.g., increase energy efficiency standards and set standards for renewable energy generation).

Comment on consistency of **jurisdiction actions** with adopted plans and policies in a public forum.

Be Proactive and Get Involved

You do not have to wait for your local government, agency, or utility to put sustainability measures on their agendas or schedules. You can indicate support for an ordinance or program by contacting the City Manager, County Clerk, commission, or committee. For example, in South Lake Tahoe a group of residents worked with the Sustainability Commission (now disbanded) to research and write an ordinance banning free single-use plastic bags in retail establishments. The citizens and commissions worked with City staff to get the ordinance on the City Council agenda and rallied support of the ban, which eventually passed.

Contact the Lake Tahoe Sustainability Collaborative (www.sustainabilitycollaborative.org) to find out how you can get more involved in sustainability projects in addition to the planning process. Not only a resource for regional sustainability efforts and organizations, the Collaborative has workgroups focused on five specific topics: Community Mobility (bikeable, walkable communities); Communications and Outreach; Conservation of Natural Resources and Water Quality; Economy, Education, and Culture; Energy, Water, and Waste Conservation; Human Health and Social Well-Being. Visit the website to see work group priorities (Impact Matrix) and sign up for workgroups.

Strategy: Lead by Example, Follow the Voluntary Action Implementation Model

Full-time and part-time residents should help and support their local governments, businesses, and schools prioritize and implement sustainability actions, but there are countless actions that individuals and families can take to make the Region more sustainable.

Here are just a few ways that citizens can lead their community in sustainability efforts:

Energy

Step A: Educational Outreach – educate yourself

Electricity consumption and heating of buildings are the largest contributors to GHG emissions in the Region. The majority of the Region's buildings were constructed prior to the adoption of energy efficiency building standards and codes. For these reasons, energy conservation and efficiency improvements present the greatest opportunity for reducing GHG emissions in the Region, as well as cost savings on utility bills.

<table>
<tr><td rowspan="3">Upgrade the Energy Efficiency of your Home</td><td colspan="3">Sign up for a free energy audit and use the information to make investments in the energy efficiency of your home through measures such as upgrading windows, HVAC system or furnace, adding insulation, weather stripping, air duct sealing, natural lighting and efficient lighting, purchasing Energy Star appliances, and installing renewable energy systems. Explore the rebates and incentives available to your through your utility and state and local jurisdictions.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Residents</td><td>Potential Participants</td></tr>
<tr><td> 
GHG reduction

Promote energy independence

Improve air quality

Cost savings to property owner or tenant

Higher resale value</td><td> 
Low</td><td>Homeowners, Renters</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Sign up for a free energy audit</td><td colspan="2">Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html</td></tr>
<tr><td colspan="2">  Upgrade windows, HVAC system or furnace</td><td colspan="2" rowspan="3">Explore the rebates and incentives available through your utility or your community:
• Energy Upgrade California: https://energyupgradeca.org/overview
• Energy Fit Nevada: http://www.energyfitnevada.org/rebates-financing/rebates/
• Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html
• NV Energy: https://www.nvenergy.com/home/saveenergy/rebates/
• Southwest Gas: http://www.swgasliving.com/dsm/efficiency/nv
• Placer County mPower: http://www.mpowerplacer.org/about-us
• Low Income Weatherization Assistance: http://www.nvhousing.state.nv.us/weatherization/weatherization%20index.htm</td></tr>
<tr><td colspan="2">  Add insulation, weather stripping, air duct sealing</td></tr>
<tr><td colspan="2">  Use natural and efficient lighting</td></tr>
<tr><td colspan="2">  Purchase Energy Star appliances</td><td colspan="2">Energy Star for renters and tenants: http://www.energystar.gov/buildings/facility-owners-and-managers/small-biz/renters-and-tenants</td></tr>
<tr><td colspan="2">  Make your house a “model green home” by exceeding energy efficiency standards. Set up tours for friends and the community.</td><td colspan="2"></td></tr>
<tr><td colspan="2">  Create a competition within or between your neighborhood/s or community/ies to see who can reduce their energy use the most.</td><td colspan="2">Energy Smackdown: http://www.energysmackdown.com
Portfolio Manager: http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager</td></tr>
</table>

Track your energy, water, and cost savings seasonally and annually.	Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx
Conduct a follow-up audit for energy in order to identify additional opportunities for resource and cost savings.	Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html

Conserve Energy in your Home	Save money on your utility bills through easy, no-cost or low-cost behaviors and technology targeting appliances, insulation, lighting, heating and cooling, and insulation.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings to property owner or tenant Higher resale value	TO Zero to Low	Homeowners, Renters

Actions:	**Resources/Details/Examples:**
Conserve energy through lighting and small appliances	Turn off lights and unplug small appliances (cable boxes, modems, gaming systems, computers, etc.) when not in use
	Swap out incandescent light bulbs for LED or CFL bulbs in all lights inside and outside of your home
Conserve energy from large appliances	Clean coils on the back and bottom of the refrigerator
	Set your hot water heater at 120° and turn hot water heater down to its lowest setting when you're not at home
	Wrap hot water heater and pipes with insulation and use a water heater timer
	Hang clothes to dry using a clothes line or drying rack
Conserve energy from heating and cooling year-round	Install weather-stripping around windows and doors
	Check your furnace and air ducts, and repair any leaks
	Replace furnace and air intake filters regularly
	Install a programmable thermostat (Liberty Utilities 2013)
Conserve energy from heating in the winter	In the cold months, set the thermostat to 68° when home and to 55° when you're not at home. Add a blanket to your bed and dress in warm layers rather than turning up the thermostat
	In the cold months, open window coverings on the sunny side of your home to take advantage of free heat from the sun. Close the coverings on cloudy days or right after the sun sets
	Close foundation vents during the winter months
	Close the damper and cover fireplaces when not in use after fires are completely extinguished
Conserve energy from cooling in the summer	In warm months, set the thermostat to 78-80° when home and 5-10° warmer at night or when you're not home

	In the warm months, close blinds and shades during the day to keep heat out
	Set ceiling fans to counter-clockwise rotation during summer
Make your house a **"model green home"** by exceeding energy efficiency standards. Set up tours for friends and the community.	
Create a **competition** within your neighborhood or community or between neighborhoods or communities to see who can reduce their energy use the most.	Energy Smackdown: http://www.energysmackdown.com Portfolio Manager: http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager
Track your energy and cost savings seasonally and annually.	Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx
Conduct a follow-up audit for energy in order to identify additional opportunities for resource and cost savings.	Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html

Install Renewable Energy Systems for your Home	The owner of a renewable energy system is also sheltered from rising electricity costs, which have historically increased on average of 3-5% each year. This presents homeowners with opportunities to save money each month on energy and also reduces their reliance on third-party utility companies. By purchasing a renewable energy system with cash or through a loan, a homeowner can completely pay off his or her system and then independently produce clean energy.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings to property owner Higher resale value	Medium	Homeowners

Actions:	**Resources/Details/Examples:**
PACE Program for residential	Placer County *mpower*: http://www.mpowerplacer.org/property-owners/residential EmPower El Dorado County: http://www.empowereldorado.org/
HERO Program for residential. Low-interest, long-term, tax-deductible financing option that is repaid through your property taxes.	www.heroprogram.com
Take advantage of state incentives	Database of State Incentives for Renewables & Efficiency www.dsireusa.org
Make your house a **"model green home"** by exceeding energy efficiency standards.	

Set up tours for friends and the community.	
Create a **competition** within your neighborhood or community or between neighborhoods or communities to see who can reduce their energy use the most.	Energy Smackdown: http://www.energysmackdown.com Portfolio Manager: http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager
Track your energy and cost savings seasonally and annually.	Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx
Conduct a follow-up audit for energy in order to identify additional opportunities for resource and cost savings.	Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html

Mobility and Goods Movement

Step A: Educational Outreach – educate yourself

Motor vehicles are a major source of GHG emissions in the Region, as well as a major source of air and water pollution that affects Lake Tahoe. Residents that choose non-vehicle methods of travel demonstrate to local government decision makers that there is community demand for mobility choices and elevate the need to make them a priority. Access to multiple, high-quality mobility options, including walking and biking, is an indicator of a healthy community. Access to healthy food choices, neighborhood amenities, and resources are aspects of community health that are important to sustainability of the Region. Below are low-cost actions that residents can take to help expand and maintain mobility options and promote other aspects of community health.

Reduce Reliance on Motor Vehicles for Personal Transportation	Choosing to bike, walk, or take public transportation shows local government decision makers that there is community demand for mobility choices and elevates the need to make them a priority. By reducing dependence on internal combustion engines and personal vehicles, residents can reduce their impact on the local and global environment.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings Health benefits	TO Zero to Low	Residents, Businesses, Visitors
Actions:		**Resources/Details/Examples:**	
Bike, walk, or take public transportation whenever possible		Tahoe Bike map: http://www.tahoebike.org/index.php?option=com_content&view=article&id=70&Itemid=1	

	Airport Shuttle: http://www.northlaketahoeexpress.com/airport-transportation Tahoe Transportation District: http://www.tahoetransportation.org/transit/bluego Tahoe Area Regional Transit: http://www.placer.ca.gov/Departments/Works/Transit/TART/Schedules.aspx
Carpool and combine trips as often as possible	
Clear snow from sidewalks on your property in a timely manner	
Bike-pool to work, school, run errands, and recreate (ride with others for fun and safety)	
Tell your friends and other networks when you are going on a longer car trips (other side of the lake, out of the Basin) to help advertise and coordinate carpools	
Track your walking and biking miles, calories burned, and GHGs saved, and compete with others year-round	Tahoe Bike Challenge: http://tahoebikechallenge.org

Reduce Distance Foods and Goods Travel	Purchasing food and goods from local sources and producing your own food results in fewer greenhouse gas emissions, healthier lifestyles, and a more robust local economy.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings Health benefits Local jobs and economy	Low	Residents, Businesses
Actions:		**Resources/Details/Examples:**	
Buy local produce and goods and advertise local sourcing (buying food and other products from other local businesses).		http://www.keepthesierragreen.org	
Grow your food with a Grow Dome or greenhouse.		Contact Slow Food Lake Tahoe (http://www.slowfoodlaketahoe.org/) or Small World (http://smallworld.cloudaccess.net/) for information on existing and future Grow Domes in the Lake Tahoe Region.	
Treat yourself to a meal, products, or services from a local, sustainable business with your savings!			

Water Resources

Step A: Educational Outreach – educate yourself

Step A: Water Resources. Conveyance, distribution, and treatment of water consume energy and result in GHG emissions. Conserving water in the home saves energy and preserves availability of water for other important and beneficial uses. Practices for maintaining property in the Region have a major influence over the amount of pollution that reaches Lake Tahoe. Best practices residents can implement in their home and on their property to conserve water and protect the Lake are recommended below.

Reduce Water Use in the Home	Residents can reduce water use inside their homes through efficiency, conservation, and behavior changes. Reducing water use not only protects the valuable resource, but reduces the energy and greenhouse gases associated with moving, heating, and treating water.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	Water quality and supply GHG and energy reduction Cost savings	TO Zero to Low	Residents, Businesses, Visitors

Actions:	**Resources/Details/Examples:**
Install low-flow fixtures	Environmental Protection Agency: • http://www.epa.gov/WaterSense/products/bathroom_sink_faucets.html • http://water.epa.gov/polwaste/nps/chap3.cfm
Purchase water-efficient appliances	
Change your water use habits	• Run the dishwasher only when it is full • Fill the sink or dish tub instead of running water • Turn off faucet when brushing teeth or shaving • Match washing machine water level to load size
Create a **competition** within your neighborhood or community or between neighborhoods or communities to see who can reduce their water use the most.	
Track your water and cost savings seasonally and annually.	Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx

<table>
<tr><td rowspan="3">Reduce Outdoor Water Use</td><td colspan="3">Residents can reduce water use inside their homes through efficiency, conservation, and behavior changes. Reducing water use not only protects the valuable resource, but reduces the energy and greenhouse gases associated with moving, heating, and treating water.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Residents</td><td>Potential Participants</td></tr>
<tr><td> 
Water quality and supply
GHG and energy reduction
Cost savings</td><td> 
Zero to Medium</td><td>Residents, Businesses, Visitors</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Landscape your property with low-water, native, and fire-resistant vegetation</td><td colspan="2">Sierra Nevada Yard & Garden Guide: http://www.sierranevadaalliance.org/publications/SNLG/SNYG_lores.pdf</td></tr>
<tr><td colspan="2">  Install Best Management Practices (BMPs) on your property</td><td colspan="2">TRPA Stormwater Management Program: http://tahoebmp.org</td></tr>
<tr><td colspan="2">  Do not purchase or use phosphorous fertilizers or cleaning products (especially if you purchase products outside of the Region).</td><td colspan="2">Carefully examine the contents of household products for chemicals that are harmful to water quality.</td></tr>
<tr><td colspan="2">  Change your water use habits</td><td colspan="2">• Watering your small lawn early in the morning or late in the evening and on cooler days to reduce evaporation
• Let grass to grow slightly taller to reduce water loss by providing more ground shade for the roots and by promoting water retention in the soil
• Turn off the water between rinses if washing your car and wash it on the lawn to reduce runoff
• Sweep sidewalks and driveways instead of using water</td></tr>
<tr><td colspan="2">  Make your yard or garden a “model landscape” by complying with TRPA regulations for pervious coverage, using low impact development (LID) landscaping practices, and using the Yard and Garden Guide. Set up tours for friends and the community through a local garden club.</td><td colspan="2">Lake of the sky Garden Club: http://lakesky.homestead.com</td></tr>
<tr><td colspan="2">  Track your water and cost savings seasonally and annually.</td><td colspan="2">Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx</td></tr>
</table>

Protect Against Invasive Species	Residents and visitors can protect Lake Tahoe's water from aquatic invasive species that harm the water environment. We don't want to introduce destructive snails or mussels to Lake Tahoe and we don't want to inadvertently transport aquatic weeds that have invaded Lake Tahoe and several of its tributaries.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	 Water quality and supply Biological resources	 Zero	Residents, Businesses, Visitors
Actions:		**Resources/Details/Examples:**	
 **Clean, Drain, and Dry** your boat to avoid introducing invasive species to the lake		http://tahoekeepers.org/tahoekeepers.aspx	
 Become a **Tahoe Keeper**			

Wildfire and Emergency Preparedness

Step A: Educational Outreach – educate yourself

Step A: Wildfire and Emergency Preparedness. Wildfires result in substantial GHG emissions, create unhealthy air quality conditions, deposit particulate pollution into Lake Tahoe, and threaten rural communities at the urban/forest interface in the Region. In addition, the majority of wildfire ignitions in the Region are human-caused (Saah et al, 2013). There are a number of other disasters that threaten the Lake Tahoe Region (e.g. flood, extreme weather). Being prepared for disasters reduces the risk to health, life, property, and family. Actions suggested below can go a long way towards increasing sustainability of the Region and protecting life and property.

Wildfire Hazard Reduction for your Home and Environment	Residents can reduce the risk of and damage from wildfire, both around their homes and in their environment by following a few tips.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	 Wildfire hazard reduction Air quality protection GHG reduction Cost savings (avoided costs) Emergency response	 Zero to Medium	Residents, Businesses, Visitors
Actions:		**Resources/Details/Examples:**	
 Maintain a minimum 100-foot radius of **defensible space** around all structures on your property located adjacent to forested lands		CalFire: http://www.fire.ca.gov/communications/communications_firesafety_100feet.php	

Be responsible with fire. **Comply** with the wilderness permit system and observe fire restrictions to minimize wildfire ignition risks.	• Campfire permits: http://www.fire.ca.gov/communications/communications_firesafety_camping_campfirepermits.php • Fire Restrictions: http://www.fire.ca.gov/fire_protection/fire_protection_burnpermits.php
Show your neighbors how you created defensible space and otherwise protected your property from wildfire.	

Emergency Preparedness for your Home and Family	Not all disasters can be avoided or predicted. Residents and their families can be ready for the unexpected by preparing a plan and sticking to it.		
	Environmental & Community Co-benefits	Costs to Residents	Potential Participants
	Wildfire hazard reduction Air quality protection GHG and reduction Cost savings (avoided costs) Emergency response Public health & safety	$ TO $ Zero to Low	Residents, Businesses, Visitors
Actions:		**Resources/Details/Examples:**	
Have an **emergency plan** and discuss the plan with your family. Designate a place where you will meet in the event of a disaster or evacuation and how you will communicate during an emergency		FEMA: http://www.ready.gov/school-and-workplace	
Do not store **portable generators** or equipment that will be needed during an emergency in a basement or other vulnerable area			
Prepare a **disaster supplies kit**		Ready.gov: http://www.ready.gov/build-a-kit	
Create a **neighborhood safety team** to coordinate efforts in case of an emergency and encourage your neighbors to create emergency plans		FEMA: http://www.fema.gov/community-emergency-response-teams	

Local Business

Strategy: Leading the Way
Businesses are an integral part of the community and oftentimes lead the way in implementing sustainability measures. Businesses can work with their local Chambers of Commerce to connect with other businesses interested in taking sustainability actions as well as share best practices and successful pilots and actions. Groups are oftentimes stronger than individuals.

Many actions that apply to residents also apply to business owners, so be sure to review the actions for residents above. Some additional examples of ways businesses can be community leaders in sustainability include:

Energy

Step A: Educational Outreach – educate yourself

Electricity consumption and heating of buildings are the largest contributors to GHG emissions in the Region. The majority of the Region's buildings were constructed prior to the adoption of energy efficiency building standards and codes. For these reasons, energy conservation and efficiency improvements present the greatest opportunity for reducing GHG emissions in the Region, as well as cost savings on utility bills.

<table>
<tr><td rowspan="3">Upgrade the Energy Efficiency of your Business</td><td colspan="3">Sign up for a free energy audit and complete the LEED Checklist. Use the information to make investments in the energy efficiency of your business through measures such as upgrading windows, HVAC system or furnace, adding insulation, weather stripping, air duct sealing, natural lighting and efficient lighting, purchasing Energy Star® appliances (Energy Star 2013). Explore the rebates and incentives available to your through your utility and state and local jurisdictions.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Businesses</td><td>Potential Participants</td></tr>
<tr><td> 
GHG reduction
Promote energy independence
Improve air quality
Cost savings to property owner or tenant
Higher resale value</td><td> 
Low</td><td>Business Owners</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Sign up for a free energy audit</td><td colspan="2">Liberty Utilities:
http://www.libertyutilities.com/west/saving/save_energy.html</td></tr>
<tr><td colspan="2">  Complete a "LEED for Existing Buildings Checklist" to assess the feasibility of incorporating sustainable design into the project</td><td colspan="2">United States Green Building Council (Excel file):
http://www.usgbc.org/resources/existing-buildings-v2009-checklist-xls</td></tr>
</table>

 Upgrade windows, HVAC system or furnace	Explore the rebates and incentives available through your utility or your community: • Energy Upgrade California: https://energyupgradeca.org/overview • Energy Fit Nevada: http://www.energyfitnevada.org/rebates-financing/rebates/ • Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html • NV Energy: https://www.nvenergy.com/home/saveenergy/rebates/ • Southwest Gas: http://www.swgasliving.com/dsm/efficiency/nv • Placer County mPower: http://www.mpowerplacer.org/about-us
 Add insulation, weather stripping, air duct sealing	
 Use natural and efficient lighting	
 Purchase Energy Star appliances	• Energy Star for small business: http://www.energystar.gov/buildings/facility-owners-and-managers/small-biz
 Coordinate with other local businesses to **offer tours** highlighting your sustainability efforts.	
 Participate in local **green business directories**. These not only lead people to your business, they convey educational information on sustainability.	Keep the Sierra Green Sustainability & Waste Reduction Business Recognition Program: www.keepthesierragreen.org
 **Track** your energy, water, and cost savings seasonally and annually.	• Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx • Create your own **indicators of sustainability and efficiency** and track annually
 **Conduct a follow-up audit** for energy in order to identify additional opportunities for resource and cost savings.	Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html
 Release an **annual report** on your sustainability efforts.	PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml

Install Renewable Energy Systems for your Business	The owner of a renewable energy system is also sheltered from rising electricity costs, which have historically increased on average of 3-5% each year. This presents business owners with opportunities to save money each month on energy and also reduces their reliance on utility companies. By purchasing a renewable energy system with cash or through a loan, a business can completely pay off his or her system and then independently produce clean energy. Renewable energy systems are also highly visible and prominently show that you care about the environment.		
	Environmental & Community Co-benefits	Costs to Businesses	Potential Participants

	 GHG reduction Promote energy independence Improve air quality Cost savings to property owner Higher resale value	 Medium	Business Owners
Actions:		**Resources/Details/Examples:**	
 **PACE Loan Program** for businesses		Placer County *mpower*: http://www.mpowerplacer.org/property-owners/commercial EmPower El Dorado County: http://www.empowereldorado.org/	
 **HERO Loan Program** for businesses. Low-interest, long-term, tax-deductible financing option that is repaid through your property taxes.		www.heroprogram.com	
 Take advantage of **state incentives**		Database of State Incentives for Renewables & Efficiency www.dsireusa.org	
 **Purchase power from green power sources**.		EPA's "Green Power Locator": http://www.epa.gov/greenpower/pubs/gplocator.htm	
 Contact your local paper, radio, and television in order to **gain media coverage** on the installation of new technologies and achievements above.		Business Wire, How to Write a Press Release: http://www.businesswire.com/portal/site/home/how-to-write-press-release	
 Coordinate with other local businesses to **offer tours** highlighting your sustainability efforts.			
 **Track the energy and cost savings** of each measure undertaken, including available rebates and incentives, and share this information with your customers.		• Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx • Share on your website, social media, e-newsletters, and advertising	
 **Conduct a follow-up audit** for energy in order to identify additional opportunities for resource and cost savings.		Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html	
 Release an **annual report** on your sustainability efforts.		PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml	

Mobility and Goods Movement

Step A: Educational Outreach – educate yourself

Motor vehicles are a major source of GHG emissions in the Region, as well as a major source of air and water pollution that affects Lake Tahoe. Businesses can help residents and local governments implement prioritize alternative transportation options by creating demand. By preferentially purchasing local food, goods, and services, businesses can reduce their environmental impact and foster a strong local economy.

<table>
<tr><td rowspan="3">Reduce Reliance on Motor Vehicles for Personal Transportation</td><td colspan="3">By providing mobility options for employees and customers, businesses show local government decision makers that there is community demand for mobility choices. Additionally, businesses are able to accommodate more customers with less parking and demonstrate their commitment to sustainability.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Businesses</td><td>Potential Participants</td></tr>
<tr><td> 
GHG reduction
Promote energy independence
Improve air quality
Cost savings
Health benefits</td><td> 
Zero to Low</td><td>Businesses Owners, Employees, Customers</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Provide information on public transportation routes and schedules to employees and customers by posting in employee areas and on website and other advertising</td><td colspan="2"></td></tr>
<tr><td colspan="2">  Nominate a transportation coordinator to disseminate information and coordinate employee carpools for employees arriving and departing on the same shift.</td><td colspan="2"></td></tr>
<tr><td colspan="2">  Evaluate the travel mode choices available to your employees and customers, and consider how you might incentivize or promote non-vehicle travel choices (e.g., bike, walk, bus, carpool) by your employees and patrons</td><td colspan="2">Options to consider include:
• Install plentiful and secure bicycle parking
• Remove snow from bicycle paths and walkways on or adjacent to your property
• Subsidize public transportation passes for your employees
• Offer preferential parking for carpools
• Minimize the availability of on-site parking and/or coordinating a shared parking strategy with neighboring properties</td></tr>
</table>

Encourage your employees to **bike and walk to work**. Participate in Bike to Work Week, offer shower facilities, provide bike racks, provide free monthly bus passes, and even offer financial incentives.	• Tahoe Bike to work Week: http://www.tahoebike.org • Incentive ideas: http://www.inc.com/guides/2010/04/bike-to-work.html
Clear snow from sidewalks on your property in a timely manner	
Prominently display signage showing the location of bike racks and routes and bus routes and schedules.	
Track your walking and biking miles, calories burned, and GHGs saved, and compete with others year-round	Tahoe Bike Challenge: http://tahoebikechallenge.org
Provide **awards** to staff or departments who accomplished the most	

Reduce Distance Foods and Goods Travel	Purchasing food and goods from local sources results in fewer greenhouse gas emissions, healthier lifestyles, and a more robust local economy.		
	Environmental & Community Co-benefits	Costs to Businesses	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings Health benefits Local jobs and economy	Low	Business Owners, Employees

Actions:	**Resources/Details/Examples:**
Buy local produce and goods and advertise local sourcing (buying food and other products from other local businesses).	http://www.keepthesierragreen.org
Right-size delivery/service fleets and use alternative fuels, transit, and high efficiency vehicles if and when possible.	
Large and/or seasonal employers coordinate with your local government to share information about adequacy or inadequacy of **local housing needs** of your workforce.	
Indicate which of your products and services are **locally-sourced**	

Water Resources

Step A: Educational Outreach – educate yourself

Step A: Water Resources. Conveyance, distribution, and treatment of water consume energy and result in GHG emissions. By conserving water, businesses save energy and preserve availability of water for other important and beneficial uses. Many water efficiency and conservation measures that residents can take also apply to businesses. Please review the action s for residents above and a few actions that are specific to businesses are outlined below.

<table>
<tr><td rowspan="3">Reduce Water Use in your Business</td><td colspan="3">Businesses can reduce water use necessary to run a successful business through efficiency, conservation, and behavior changes. Reducing water use not only protects the valuable resource and saves businesses money, but reduces the energy and greenhouse gases associated with moving, heating, and treating water.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Businesses</td><td>Potential Participants</td></tr>
<tr><td> 
Water quality and supply
GHG and energy reduction
Cost savings</td><td> 
Zero to Medium</td><td>Businesses Owners, Employees</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Install low-flow fixtures</td><td colspan="2" rowspan="2">Environmental Protection Agency:
• http://www.epa.gov/WaterSense/products/bathroom_sink_faucets.html
• http://water.epa.gov/polwaste/nps/chap3.cfm</td></tr>
<tr><td colspan="2">  Purchase water-efficient appliances</td></tr>
<tr><td colspan="2">  Conserve water through using ozone wash for linens, replacing turf with native plants, and installing drip irrigation.</td><td colspan="2"></td></tr>
<tr><td colspan="2">  Contact your local paper, radio, and television in order to gain media coverage on the installation of new technologies and achievements above.</td><td colspan="2">Business Wire, How to Write a Press Release: http://www.businesswire.com/portal/site/home/how-to-write-press-release</td></tr>
<tr><td colspan="2">  Coordinate with other local businesses to offer tours highlighting your sustainability efforts.</td><td colspan="2"></td></tr>
<tr><td colspan="2">  Track the water and cost savings of each measure undertaken, including available rebates and incentives, and share this information with your customers.</td><td colspan="2">• Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx
• Share on your website, social media, e-newsletters, and advertising</td></tr>
<tr><td colspan="2">  Release an annual report on your sustainability efforts.</td><td colspan="2">PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml</td></tr>
</table>

Wildfire and Emergency Preparedness

Wildfire Hazard Reduction and Disaster Preparedness	Businesses can help protect their community from wildfire and help employees and customers prepare for unexpected disasters.		
	Environmental & Community Co-benefits	Costs to Businesses	Potential Participants
	 Wildfire hazard reduction Air quality protection GHG reduction Cost savings (avoided costs) Emergency response Public health and safety	 Zero to Low	Business Owners, Employees

Actions:	**Resources/Details/Examples:**
Maintain a minimum 100-foot radius of **defensible space** around all structures on your property located adjacent to forested lands	CalFire: http://www.fire.ca.gov/communications/communications_firesafety_100feet.php
Have an **emergency plan** and communicate the plan your employees	FEMA: http://www.ready.gov/school-and-workplace
Sell emergency supply kits	South Tahoe Emergency Guide disaster kit: http://www.southtahoeemergencyguide.com/steg/preparekit.aspx
Advertise that you and your employees have an emergency plan and that local residents should do the same and can purchase a disaster preparedness kit at your business	

Solid Waste and Recycling

Step A: Educational Outreach – educate yourself

Step A: Solid Waste Reduction. Solid waste disposal in landfills results in GHG emissions associated with decomposition. Lockwood Landfill, located outside of Sparks, Nevada, accepts solid waste collected in the Region. Lockwood Landfill captures and flares methane, a potent GHG, on-site, which minimizes emissions. Reducing the amount of solid waste sent to the landfill prevents GHG emissions from the landfill and from the transportation of solid waste to the landfill. The nearest commercial composting facility is outside of Minden, Nevada, about one-third the distance from Lake Tahoe as the landfill.

Reduce your Waste Stream	Businesses can reduce the amount of trash sent to the landfill by adding and increasing recycling and composting efforts.		
	Environmental & Community Co-benefits	Costs to Businesses	Potential Participants
	GHG Reduction	Zero to Low	Businesses Owners, Employees
Actions:		**Resources/Details/Examples:**	
Provide separated, clearly-labeled **recycling** and waste containers and **compost** your food waste		Join other businesses to leverage composting resources. On the South Shore, MacDuffs Restaurant, Fire and Ice, Diamond Resorts, and Zephyr Cove restaurant currently share truck space to the nearest compost facility, Full circle Compost in Minden, NV. For more details on recycling and composting contact: Jeanne Lear at South Tahoe Refuse at jlear@southtahoerefuse.com	
Prominently display signage in your business advertising your recycling and composting efforts			
Coordinate with other local businesses to **offer tours** highlighting your sustainability efforts.			
Track the amount of solid waste that your business diverts from the landfill and share this information with your customers.		Share using in-store signage, on your website, social media, e-newsletters, and advertising	
Release an **annual report** on your sustainability efforts.		PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml	
Provide **awards** to staff or departments who accomplished the most			

Economic Health

Step A: Educational Outreach – educate yourself

Step A: Economic Health. Economic sustainability is linked to a healthy environment and quality of life for the Region's population. The Lake Tahoe Basin Prosperity Plan (Prosperity Plan) sets forth a vision for both the economic and environmental health and renewal of the Region. Individual businesses can help implement the Prosperity Plan and make our region's economy more environmentally and financially sustainable.

Becoming More Prosperous Through	Economic sustainability is linked to a healthy environment and quality of life for the Region's population. Businesses can help accelerate the shift to a more sustainable economy by taking some of these actions.		
	Environmental & Community Co-	Costs to Businesses	Potential Participants

Sustainability	benefits		
	 GHG Reduction Job Generation Potential Revenue Generation	 Zero to Low	Businesses Owners, Employees

Actions:	**Resources/Details/Examples:**
Provide information on sustainability in advertising and in-store.	For example, motels can promote water conservation programs in their rooms.
Indicate which of your products and services are **sustainably-sourced**	
Institute a **"Green Purchasing Policy"** that requires the purchase of environmentally preferable products for your business.	• This can include recycled paper, environmentally-friendly cleaning supplies, organic food, efficient and alternative fuel vehicles, and energy and water efficient facilities and appliances. • Completely phase out retail availability and/or use of phosphorous fertilizers and cleaning products from business practice.
Participate in local **green business directories**. These not only lead people to your business, they convey educational information on sustainability.	Keep the Sierra Green Sustainability & Waste Reduction Business Recognition Program: www.keepthesierragreen.org
Prominently display signage in your business advertising your recycling and composting efforts	
Contact your local paper, radio, and television in order to **gain media coverage** on the installation of new technologies and achievements above.	Business Wire, How to Write a Press Release: http://www.businesswire.com/portal/site/home/how-to-write-press-release
Release an **annual report** on your sustainability efforts.	PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml
Provide **awards** to staff or departments who accomplished the most	

Schools and Colleges

Strategy: Community Education

Many actions recommended above for local governments, residents, and businesses also apply to schools, especially the energy, water and mobility strategies. Please review the previous sections.

This section provides a few additional strategies for the energy, mobility, water, wildfire and emergency preparedness, and solid waste sectors, but appropriately focuses on education.

Schools, from elementary to college-level, can lead by example, ingraining sustainability practices and the importance of environmental, economic, and community health at an early age. Schools are effective incubators because they reach students at an early age, and connect with parents as well.

Some examples of ways schools and colleges can teach a community to be more sustainable include:

Improve Sustainability Education in all Schools in the Region	**This table applies to all other Action Tables in this section.** By adding and improving sustainability curriculum and activities and showcasing them in the school, in other schools, and in the community, the Lake Tahoe Region can lay a solid foundation for the next generation of sustainability leaders.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	 Provide education GHG reduction Promote energy independence Protect water resources Create high salary, year-round 'green' jobs in the Region	 Low to Medium	College, elementary school, and high school teachers, parents, and students.

Actions:	**Resources/Details/Examples:**
Develop sustainability curriculum for each grade	Lake Tahoe Sustainability Collaborative, "Economy, Education, and Culture" work group http://www.sustainabilitycollaborative.org
Invite sustainability speakers to provide forums, programs, talks, and field trips	Lake Tahoe Sustainability Collaborative, "Sustainability Directory" http://www.sustainabilitycollaborative.org
Provide field trip opportunities to visit green buildings, recycling centers, renewable energy production facilities, water utilities, etc.	
Use the pilot projects below as continuous on-site classrooms	Use the projects and actions listed in this section and in this chapter
All Actions/pilots in previous sections, this section, and the following section	
Challenge other schools in and out of your district to see who can reduce their water and energy use the most	Dream in Green, Green Schools Challenge http://www.dreamingreen.org
Challenge yourself! Set goals for water, energy, and waste reduction year-to-year. You can also make it a competition between grades or classes	
Organize tours each year of the sustainability features of your school.	Do these for students, but also offer during parent nights and other gatherings
Invite parents and community members to a "Sustainability Showcase," recycled clothes	Truckee high School "Trashion Show" example: http://ths.ttusd.org/?PageName=%27OrganizationPage%2

fashion show, and other fun, sustainability-themed programs run by students	7& OrganizationID=%2717740%27
Gain media coverage on the installation of new sustainability technologies and achievements	School press release tips and example: http://www.palmbeachschools.org/pao/PDFs/Tips-Writing_News_Releases.pdf
Display signage in your facilities explaining sustainability efforts	
Track the water and cost savings of each measure undertaken, including available rebates and incentives, and share this information with your customers.	• Oak Ridge National Laboratory: http://sustainability-ornl.org/your/Pages/TrackingTools.aspx • Share on your website, social media, e-newsletters, and advertising
Release an **annual report** on your sustainability efforts.	PwC Sustainability Reporting Tips: https://www.pwc.com/gx/en/corporate-reporting/sustainability-reporting/sustainability-reporting-tips.jhtml
Provide **awards** to staff, students, clubs, or classes who accomplished the most	
See **challenges and competitions** above	

Energy

Remember to use the education, showcase/tour and evaluate/award actions from the "Improve Sustainability Education in all Schools in the region" table at the beginning of this section.

Also, please review the Energy Action Tables in the previous sections and chapters, particularly the actions for residents and businesses.

Upgrade the Energy Efficiency of your School	Sign up for a free energy audit and complete the LEED Checklist. Use the information and the Energy Action Tables for Residents and Businesses to make investments in the energy efficiency of your school.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings	Low	School administrators, staff, and students
Actions:		**Resources/Details/Examples:**	
Sign up for a free **energy audit**		Liberty Utilities: http://www.libertyutilities.com/west/saving/save_energy.html	
Complete a "LEED for Existing Buildings Checklist" to assess the feasibility of		United States Green Building Council (Excel file): http://www.usgbc.org/resources/existing-buildings-v2009-	

incorporating sustainable design into the project	checklist-xls
Implement energy efficiency measures such as upgrading windows, HVAC system or furnace, adding insulation, weather stripping, air duct sealing, natural lighting and efficient lighting, purchasing Energy Star® appliances.	See the Energy Action Tables in pervious sections of this chapter, especially in the Residents and Businesses sections.
Explore the **rebates and incentives** available to your through your utility and state and local jurisdictions.	See the Energy Action Tables in pervious sections of this chapter, especially in the Residents and Businesses sections. See the "Economic Health" Action Table, below in this "Schools" section.
Time lights and heating for school hours	
Install **motion sensors** on interior and exterior lights	

Mobility and Goods Movement

Remember to use the education, showcase/tour and evaluate/award actions from the "Improve Sustainability Education in all Schools in the region" table at the beginning of this section.

Also, please review the Energy Action Tables in the previous sections and chapters, particularly the actions for residents and businesses.

Reduce Reliance on Motor Vehicles for Personal Transportation	By providing mobility options for teachers, staff, and students, schools show local government decision makers that there is community demand for mobility choices. Additionally, schools are in the unique position to ingrain sustainable transportation choices into our next generation.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	GHG reduction Promote energy independence Improve air quality Cost savings Health benefits	TO Zero to Low	School administrators, staff, and students
Actions:		**Resources/Details/Examples:**	
Nominate a **transportation coordinator** to disseminate information and coordinate employee carpools for employees arriving and departing on the same shift.			

Evaluate the travel mode choices available to your employees and customers, and consider how you might **incentivize or promote non-vehicle travel choices** (e.g., bike, walk, bus, carpool) by your employees and patrons	Options to consider include: • Install plentiful and secure bicycle parking • Remove snow from bicycle paths and walkways on or adjacent to your property • Encourage students to walk or take the school bus • Offer preferential parking for carpools • Minimize the availability of on-site parking and/or coordinating a shared parking strategy with neighboring properties
Prominently display signage showing the location of bike racks and routes and bus routes and schedules.	
Track your walking and biking miles, calories burned, and GHGs saved, and compete with others year-round	Tahoe Bike Challenge: http://tahoebikechallenge.org

Water Resources

Remember to use the education, showcase/tour and evaluate/award actions from the "Improve Sustainability Education in all Schools in the region" table at the beginning of this section.

Also, please review the Water Resources Action Tables in the previous sections and chapters, particularly the actions for residents and businesses.

Reduce Water Use in Schools and Colleges	Schools and Colleges can reduce water use efficiency, conservation, and behavior changes. Reducing water use not only protects the valuable resource and saves schools money, but reduces the energy and greenhouse gases associated with moving, heating, and treating water.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	Water quality and supply GHG and energy reduction Cost savings	TO Zero to Medium	School administrators, staff, and students
Actions:		**Resources/Details/Examples:**	
Conserve water through low flush toilets and other efficient appliances. Replace some turf with native plants, and install drip irrigation.		Environmental Protection Agency: • http://www.epa.gov/WaterSense/products/bathroom_sink_faucets.html • http://water.epa.gov/polwaste/nps/chap3.cfm	

Wildfire and Emergency Preparedness

Remember to use the education, showcase/tour and evaluate/award actions from the "Improve Sustainability Education in all Schools in the region" table at the beginning of this section.

Also, please review the Wildlife and Emergency Preparedness Resources Action Tables in the previous sections and chapters, particularly the actions for residents and businesses.

<table>
<tr><td rowspan="3">Wildfire Hazard Reduction and Disaster Preparedness</td><td colspan="3">Schools can help protect their community from wildfire and help employees and customers prepare for unexpected disasters.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Schools</td><td>Potential Participants</td></tr>
<tr><td> 
Wildfire hazard reduction
Air quality protection
GHG and reduction
Cost savings (avoided costs)
Emergency Response
Public Health and Safety</td><td> 
Zero to Low</td><td>School administrators, staff, and students</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Maintain a minimum 100-foot radius of defensible space around all structures on your property located adjacent to forested lands</td><td colspan="2">CalFire:
http://www.fire.ca.gov/communications/communications_firesafety_100feet.php</td></tr>
<tr><td colspan="2">  Have an emergency plan and communicate the plan your staff and students</td><td colspan="2">FEMA:
http://www.ready.gov/school-and-workplace</td></tr>
<tr><td colspan="2">  Make sure each classroom and office has a disaster preparedness kit</td><td colspan="2">South Tahoe Emergency Guide disaster kit:
http://www.southtahoeemergencyguide.com/steg/preparekit.aspx</td></tr>
<tr><td colspan="2">  Conduct regular and surprise emergency drills</td><td colspan="2"></td></tr>
</table>

Nutrition and Health

Improve Health and Nutrition in Schools	Many children do not get healthy food or exercise outside of school. Nutritional and physical health build the foundation for a quality education. Studies show that healthy students are more attentive and learn more effectively. Healthy, educated students can be the future leaders in sustainability that our region needs.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	GHG reduction Cost savings Health benefits Social equity	TO Zero to Low	School administrators, staff, students, and parents

Actions:	**Resources/Details/Examples:**
Fully integrate **nutrition and physical fitness education** into school curriculum. Ensure that students have adequate exercise, nutrition, and mental health breaks during the day	Lake Tahoe Sustainability Collaborative, "Economy, Education, and Culture" work group http://www.sustainabilitycollaborative.org
Grow your food with a Grow Dome or greenhouse.	Contact Slow Food Lake Tahoe (http://www.slowfoodlaketahoe.org/) or Small World (http://smallworld.cloudaccess.net/) for information on existing and future Grow Domes in the Lake Tahoe Region.
Make these **demonstration gardens**	Tours with parents, garden clubs, community to showcase growing spaces and education
Identify foods, growing methods, and fitness programs that are most popular with students and focus on accelerating and enhancing them	

Solid Waste and Recycling

Remember to use the education, showcase/tour and evaluate/award actions from the "Improve Sustainability Education in all Schools in the region" table at the beginning of this section.

Also, please review the Solid Waste and Recycling Resources Action Table in the Actions for Businesses section. Schools and businesses can work together to leverage resources.

Case study in school composting: South Lake Tahoe elementary schools

On December 2, 2013 a group of parents working with school staff started a school composting program at Bijou Elementary similar to the one in place at Sierra House Elementary. The goal is to reduce garbage

pick-up at the schools from 2 times per week to one. Students separate all of their food waste at lunch and breakfast and parents and staff work together to encourage more recycling throughout the school.

There is a parent volunteer in the cafeteria at lunch every day to help the children separate out the food waste, and a group of student volunteers will begin to take over this role in early 2014. We will begin in-class lessons on recycling and composting through a grant secured by a teacher. South Tahoe Refuse (STR) and Clean Tahoe have been great partners in educating the kids on the importance of this and STR is covering the costs for the time being. There is interest in doing this at the Magnet school in the spring.

Successful sustainability efforts like this will ultimately result in students bringing the lessons home and maintaining them through life.

<table>
<tr><td rowspan="3">Reduce your Waste Stream</td><td colspan="3">Schools can reduce the amount of trash sent to the landfill by adding and increasing recycling and composting efforts.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Schools</td><td>Potential Participants</td></tr>
<tr><td>GHG Reduction</td><td>TO
Zero to Low</td><td>School administrators, staff, and students</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">Initiate robust recycling and composting programs. Provide separated, clearly-labeled recycling and waste containers and compost your food waste.</td><td colspan="2">For more details on recycling and composting contact: Jeanne Lear at South Tahoe Refuse at jlear@southtahoerefuse.com</td></tr>
<tr><td colspan="2">Join other schools to leverage composting resources</td><td colspan="2">Sierra House Elementary and Bijou Elementary currently share truck space to the nearest compost facility, Full circle Compost in Minden, Nevada</td></tr>
</table>

Economic Health

Schools and colleges are faced with increasing costs and decreasing funding. Oftentimes “extra” programs such as health, fitness, and environmental and sustainability curriculum and programs are the first to be cut.

Remember to use the education, showcase/tour and evaluate/award actions from the “Improve Sustainability Education in all Schools in the region” table at the beginning of this section.

Also, please review the Economic Health Action Table in the Actions for Businesses section.

Helping Fund Sustainability in Schools	This table provides some potential funding mechanisms that can help implement and maintain sustainability curriculum and programs. It is important for parents, teachers, and administrators to work together in order to apply for and use outside funding sources.		
	Environmental & Community Co-benefits	Costs to Schools	Potential Participants
	GHG Reduction Job Generation Potential Revenue Generation	TO Zero to Low	School administrators, staff, and parents

Actions:	**Resources/Details/Examples:**
Pursue Safe Routes to School funding (in California, now part of the Active Transportation Program) to increase the walkability and bikeability of the Region's schools. Organize bike to school parades, providing chaperoned, highly visible groups coming back and forth to school.	National Center for Safe Routes to School: http://www.saferoutesinfo.org
California Clean Energy Jobs Act (Proposition 39) funding for schools to improve energy efficiency and create clean energy jobs	• Prop 39: http://www.cde.ca.gov/ls/fa/ce/ • Senate Bill 73 specifies the details of how the funds will be allocated to California's K-12 schools and community colleges: http://www.leginfo.ca.gov/pub/13-14/bill/sen/sb_0051-0100/sb_73_bill_20130627_chaptered.htm
Institute a **"Green Purchasing Policy"** that requires the purchase of environmentally preferable products for your business.	• This can include recycled paper, environmentally-friendly cleaning supplies, organic food, efficient and alternative fuel vehicles, and energy and water efficient facilities and appliances. • Completely phase out retail availability and/or use of phosphorous fertilizers and cleaning products from business practice.

Visitors

Strategy: Reduce Impact

Tourism is the number one industry in the Region. Tourists are encouraged to ask visitors authorities and tourism organizations about sustainability programs, events, and activities to get the latest information and show demand for sustainable tourism.

Sustainable Tourism Resources

Sierra Nevada Geotourism MapGuide: http://www.sierranevadageotourism.org

Lake Tahoe Visitor Beuraus: http://www.visitinglaketahoe.com

Lake Tahoe Visitors Authority:
http://ltva.org

Reno/Tahoe Visitor Information: http://www.visitrenotahoe.com

Many actions recommended above for local governments, residents, businesses, and schools also apply to visitors, especially the energy, water and mobility strategies. Please review the previous sections.

This table provides a few additional strategies for environmental education, conserving natural resources, and enjoying the Lake Tahoe Region without a personal vehicle, among others.

Some examples of ways visitors can reduce their impact include:

<table>
<tr><td rowspan="3">Be a Sustainable Visitor</td><td colspan="3">Visitors want to do their part to preserve and protect our beautiful Region. By learning about the Lake Tahoe Region environment and the need to protect it, visitors can become more motivated and capable to pursue sustainable activities while enjoying all the Region has to offer. There are a few unique actions that visitors can take to help protect the environment and show demand for sustainable tourism options.</td></tr>
<tr><td>Environmental & Community Co-benefits</td><td>Costs to Visitors</td><td>Potential Participants</td></tr>
<tr><td> 
Provide education
GHG and energy reduction
Protect water, forest, biological, and recreational Resources</td><td> 
Zero to Low</td><td>Visitors</td></tr>
<tr><td colspan="2">Actions:</td><td colspan="2">Resources/Details/Examples:</td></tr>
<tr><td colspan="2">  Educate yourself about the Lake Tahoe Region’s unique environment and the need to protect it</td><td colspan="2">• UC Davis Tahoe Environmental Research Center: http://terc.ucdavis.edu
• California Tahoe Conservancy: http://tahoe.ca.gov
• Environmental improvement Program: http://www.trpa.org/about-trpa/how-we-operate/environmental-improvement-program
• Tahoe Resource Conservation District: http://tahoercd.org
• Keep Tahoe Blue: http://www.keeptahoeblue.org</td></tr>
<tr><td colspan="2">  Conserve natural resources during your stay by following these no-cost behaviors</td><td colspan="2">• Turn off lights, water, and appliances when not in use.
• In the winter, open window coverings to take advantage of free heat from the sun. Close the blinds or shades on cloudy days or right after the sun sets.
• In the summer, close blinds or shades during the day to keep heat out.</td></tr>
</table>

	• Travel with warm clothes to avoid turning up the thermostat above 68 degrees in your accommodations.
 Pursue **non-vehicle travel choices** while planning and during your visit	Explore **public transportation** options to get to Tahoe (e.g., ski resort shuttle bus, Amtrak). Enjoy alternative transportation during your stay • Tahoe Bike map: http://www.tahoebike.org/index.php?option=com_content&view=article&id=70&Itemid=1 • Airport Shuttle: http://www.northlaketahoeexpress.com/airport-transportation • Tahoe Transportation District: http://www.tahoetransportation.org/transit/bluego • Tahoe Area Regional Transit: http://www.placer.ca.gov/Departments/Works/Transit/TART/ Schedules.aspx **Bring your bicycle**, helmet, and bike lock along with you during your visit to the Lake Tahoe Region and so you can park your car during your stay. **Rent** a bike, standup paddle board, canoe, or kayak to enjoy the Lake Tahoe Region's amazing human-powered transportation and recreation opportunities.
 Bring your own **reusable bags** for shopping at local businesses.	
 Choose to **patronize local businesses** that advertise their sustainability measures.	
 **Comply** with the wilderness permit system and observe fire restrictions to minimize wildfire ignition risks.	• Tahoe Wilderness Permits http://www.tahoeadventuresports.com/misc/backcountryinfo.htm • Campfire permits: http://www.fire.ca.gov/communications/communications_firesafety_camping_campfirepermits.php • Fire Restrictions: http://www.fire.ca.gov/fire_protection/fire_protection_burnpermits.php
 **Clean, Drain, and Dry** your boat to avoid introducing invasive species to the lake	Become a Tahoe Keeper: http://tahoekeepers.org/tahoekeepers.aspx
 **Compete with your family and friends** for highest number of walking and biking miles, calories burned, and GHGs avoided, and compete with others year-round.	Use the Tahoe Bike Challenge: http://tahoebikechallenge.org
 **Share** how amazing your sustainable trip was with your community back home	
 **Track and reduce** miles driven during each visit	Use the Tahoe Bike Challenge: http://tahoebikechallenge.org

Next Steps for Engaging Government, Schools, and Businesses

Individuals Working with Local Governments

This section provides ideas and tools that community members, businesses, and schools can use to help local governments achieve sustainability objectives.

- **Participate in Local Planning.** Those who show up at planning meetings and other venues shape the outcomes. Participation in workshops, meetings and hearings is critical to promoting and supporting sustainability actions.
- **Create an Online Hub.** Work with the relevant agency or a community group (e.g. TRPA, City of South Lake Tahoe, Lake Tahoe Sustainability Collaborative) to create an online hub for opportunities to engage through workshops run by the jurisdictions, schools and colleges, and community organizations; area plan, community plan, specific plan processes (e.g. Tahoe Valley, Meyers, Placer County, Douglas county Master Plan update, etc.).
- **Brief state, regional, and local elected officials** on sustainability goals, measures, and actions.
- **Comment and provide advice on local building codes and area plans** currently being developed to ensure a focus on energy efficiency, passive solar and enabling technologies. Encourage the inclusion of regulations that require all new construction to follow LEED criteria or CalGreen Building Code standards.
- **Offer to volunteer or recruit volunteers to help with activities** the government does not have funding for (e.g. outreach and education campaigns, clean-ups, hosting community and neighborhood meetings).
- **Monitor Sustainability indicators**. Ask local governments for this information and an annual report.
- **Communicate to your elected officials when they do great things**. Send letters of support and encouragement when they take sustainability actions.

Key players within the local government typically include but are not limited to:

- **Mayor or county executive** - provide leadership and ensure follow-through
- **City or county council** - provide leadership on policies requiring legislative action
- **Local government agencies** - maintain government data and analytic capacity and have policy and implementation jurisdiction in sectors of interest
- **Municipal utilities** - provide technical expertise and data
- **State and federal government** - provide resources, tools, and best practices information and may provide technical and financial assistance
- **County, regional, and neighboring local governments** - provide opportunities for cost and information sharing on programs with common goals

Individuals Engaging Businesses

Business owners also provide unique opportunities for collaboration and access to a few key stakeholder groups; generally sharing a concern for economic health of the community. Because businesses are generally focused on the economic bottom line, leading with the economic benefits of sustainability is important. Here are some ways community members can introduce sustainability to the business world:

Community Members can encourage and support green businesses through a certification process or grassroots "carrot mobs"[1] or other "buycotts" (a form of consumer activism where a community buys a lot of goods from one company in a small time period to reward a business's commitment to making socially responsible changes to the business).

Meet with Building (new construction) **and real estate** (existing) industries to identify barriers and opportunities associated with energy efficiency measures and renewable energy generation.

Design and provide resources to help businesses become more resource-efficient, save money and reduce their overall impact, and become more profitable. Examples of this are creating composting transportation and centralized storage.

Create a web-based Green Jobs & Non-Profit Network to connect employers and employees interested in careers in sustainability.

Volunteer and Intern, with local businesses to help promote sustainability. Your free service can help small businesses take action.

Support with your Dollars and Send more customers their way: Buy from your local businesses who are taking sustainability actions! Voting with your dollars is powerful!

Working with Schools

Schools provide unique opportunities for collaboration and access to a few key stakeholder groups. Parents, teachers, and administrators generally share a concern for community health and children are enthusiastic and teachable. Unfortunately, school districts are often underfunded and may have priorities influenced by state-mandated performance measures. Here are a few ways that community members can help K-12 schools, community colleges, vocational training programs, and universities pursue sustainability actions:

Meet: Meet with school Superintendents to discuss the various sustainability actions listed above the schools could work on and determine what the leadership is most interested in starting with or building upon.

Ask: Create demand for and interest in sustainability actions. Have parents write, call and petition the school to take actions.

Volunteer: Parents and families increase their participation in school sponsored programs.

Design sustainability curriculum that meets state requirements and promotes sustainability.

Train contractors, handy men, and owner-builders in green building and energy efficiency techniques and how to promoting these practices.

Support: Thank your schools and write letters of support and letters to the editor acknowledging strong sustainability actions and progress.

Key players within the schools systems typically include but are not limited to:

Superintendent of the School District - provide leadership and policies at the district level. Hired by the School Board.

Principal - provide leadership on policies requiring action at the school. Hired and supervised by the Superintendant

[1] Carrot Mobs: a form of boycott (opposite of boycott): https://carrotmob.org

School Board Members – elected by the public and hire and fire the Superintendant, approve the budget, set policy.

Teachers – members of the community and often the primary contact between parents and the school

Staff – ability to implement some sustainability measures (low-impact cleaning supplies) and required for others (energy efficiency tracking and upgrades)

Conclusion

Many sustainable neighborhoods and communities aggregate to a sustainable Lake Tahoe Region. Everyone working together and supporting each other will make the Region a sustainability leader. There are opportunities everywhere you go; school, shopping, dining, recreating, and enjoying public places and services. Sustainability can become the common theme, and new residents and visitors will follow the lead.

The Sustainability Action Plan has all the tools that can help local governments, residents, businesses, schools, and others do their part to prevent catastrophic climate change, protect Lake Tahoe, ensure good jobs, secure a strong local economy, and have a healthier community. The key is transforming this Plan into action, and consistently using the tools provided. Communities and community members can provide key leadership by encouraging local governments, businesses, schools, and neighbors to engage in sustainability actions. Coordinating, collaborating, and learning from each other will make this process more successful.

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Additional Resources

ICLEI (Local Governments for Sustainability) Small Communities Toolkit: http://www.icleiusa.org/action-center/learn-from-others/small-communities-toolkit

Appendix A

Regional Greenhouse Gas Inventory for the Tahoe Basin

A Regional Greenhouse Gas Inventory For the Lake Tahoe Basin

Final Report

January 2013

Prepared by Sonoma Technology, Inc. (STI)
and the Tahoe Basin Greenhouse Gas Work Group

This PDF document contains blank pages to accommodate two-sided printing.

A Regional Greenhouse Gas Inventory For the Lake Tahoe Basin

Final Report
STI-911006-5371-FR

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Cover graphic illustrates the Lake Tahoe shoreline.

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Use of this Document-Citation Policy

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1. Introduction

This report documents the methods used to develop baseline and future-year regional greenhouse gas (GHG) emissions inventories for the Lake Tahoe Basin. This work was funded and managed by the California Tahoe Conservancy (CTC), and GHG emissions estimates were developed by Sonoma Technology, Inc. (STI) under subcontract to the University of California at Davis (UCD).

1.1 Background

In 1997, the Lake Tahoe Environmental Improvement Program (EIP) was created to better implement projects and programs designed to achieve and maintain the Basin's environmental quality standards. Recently, EIP stakeholders and partners identified a fundamental knowledge gap regarding the direct and indirect[1] emissions of GHGs in the Lake Tahoe region. To address this gap, the CTC, an EIP partner agency, funded the development of a regional GHG emissions inventory designed to establish a baseline of information on current and forecasted GHG emissions by source sector so planning agencies can set emissions reduction targets, develop mitigation strategies, and establish incentive programs within the regional planning process.

In addition, the results of the GHG inventory project will provide essential information to EIP agencies and stakeholders as they seek to comply with California GHG regulations, such as California Assembly Bill 32 (AB 32, or the Global Warming Solutions Act), which requires statewide GHG emissions to return to 1990 levels by 2020. Under AB 32, Tahoe planning agencies are required to meet regional GHG reduction targets through integrated land use and transportation planning as part of Senate Bill 375 (SB 375), the Sustainable Communities and Climate Protection Act.

1.2 Technical Issues

1.2.1 Overview

The greenhouse effect is a natural process that traps radiant heat in the Earth's lower atmosphere, making the planet habitable. The Earth's surface absorbs sunlight and emits infrared radiation (heat) to the atmosphere, a portion of which is absorbed and re-emitted by GHGs such as carbon dioxide (CO_2),[2] capturing heat that would otherwise escape into space. Over time, human activities have added to the naturally occurring levels of GHGs in the atmosphere, thereby enhancing the greenhouse effect.

A GHG emissions inventory provides a detailed estimate of the amount of GHGs emitted into the atmosphere annually by various emissions sources across a given geographic area.

[1] Direct emissions are emitted by sources located within the region of interest, while indirect emissions are emitted by sources outside the region of interest but result from activities occurring within the region (e.g., electricity consumption).

[2] The six "Kyoto" GHGs are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

This quantification of GHG emissions from various source sectors is the first step toward developing strategies for reducing such emissions over time.

In general, GHG emissions are calculated by quantifying the intensity of emissions-producing activities and then applying appropriate emission factors to the activity data. Emission factors represent the amount of a given pollutant emitted per unit of activity, and for CO_2, emission factors are generally derived from the characteristics of the fuel combusted. For a given fuel, a CO_2 emission factor is calculated using the fuel's carbon coefficient and heat content and an oxidation factor that accounts for the fraction of carbon that may not be oxidized during combustion, as shown in **Equation 1** (California Climate Action Registry, 2009).

$$EF = \text{Heat Content} \times \text{Carbon Coefficient} \times \text{Oxidation Factor} \times 44/12 \quad \textbf{(1)}$$

Where

$EF = CO_2$ emission factor (kg CO_2/gallon)
Heat Content = energy per unit volume (BTU/gallon)
Carbon Coefficient = mass of carbon (C) per energy unit (kg C/BTU)
Oxidation Factor = fraction of carbon oxidized (default = 1.0)
44/12 = ratio of the molecular weight of CO_2 to that of carbon

GHG emissions inventory methods and protocols providing guidance on activity data and emission factors have been established by the Intergovernmental Panel on Climate Change (2006), the California Climate Action Registry (2009), the U.S. Energy Information Administration (2008), and the U.S. Environmental Protection Agency (2009). We based the inventory methodologies for this project on these established protocols.

1.2.2 Key Inventory Steps

In keeping with established methods and protocols, the inventory development process involved a number of key decisions and steps:

- **Engaging project stakeholders** – At the outset of the project, CTC and STI convened a GHG inventory work group consisting of staff from local planning agencies and research institutions (see Acknowledgements). The work group provided guidance in selecting inventory years, identifying available data, and coordinating the project with other planning efforts for the Basin.
- **Establishing inventory boundaries** – The geographic scope of this inventory is defined by Tahoe Regional Planning Agency's (TRPA) jurisdictional boundaries, which lie within the borders of both California and Nevada. The California side of the Basin includes portions of Placer and El Dorado counties and all of the City of South Lake Tahoe, while the Nevada side includes portions of Douglas County, Washoe County, and Carson City[3] (see **Figure 1-1**). Because of the multiple entities present within the Basin, the GHG emissions estimates developed during the project were geographically disaggregated so the contributions of individual counties and cities could be assessed.

[3] The portion of Carson contained in the Basin is forested land with no human population; therefore the only GHG emissions for this uninhabited area are related to on-road motor vehicle traffic.

- **Selecting inventory years** – In consultation with the GHG inventory work group, CTC selected 2005 as the baseline inventory year on the basis of data availability and the compatibility of 2005 with other planning efforts (e.g., 2005 is also the baseline year for regional GHG reduction targets being developed for the Basin in response to SB 375). CTC also requested that emission estimates be prepared for 2010 to quantify the impact of the recent economic downturn on GHG emissions in the Basin. Future-year emissions estimates were prepared for 2020 and 2035, which also align with SB 375 target years and other regional planning efforts.
- **Identifying emissions sources** – STI and CTC worked with the GHG inventory work group to identify the emissions sources to be included in the inventories (see **Table 1-1**). The Tahoe Basin includes source categories that are typically not of concern in municipal GHG inventories (e.g., forestry, wildfires, and recreational boats), and also lacks industrial facilities that would normally be included in GHG inventories (e.g., cement production and iron and steel manufacturing).
- **Collecting activity data** – STI and CTC worked with the GHG inventory work to identify and review available data for characterizing baseline and future-year GHG emissions in the Basin. On the basis of this review, we compiled a list of primary data sources recommended for GHG emissions estimation, as well as secondary sources of data that could be used if primary data were not available for years of interest (Reid et al., 2011). Data sets used to estimate and forecast emissions for specific source categories are documented in Section 2 of this report.
- **Prioritizing source sectors** – To allocate available resources appropriately, we made an initial estimate of GHG emissions associated with key source sectors and with source sectors that are not well-characterized in existing emissions inventories for the Basin. On the basis of this analysis, we prioritized several source categories (e.g., on-road motor vehicles, electricity usage, residential wood combustion, and recreational boats) and determined that other source categories were unlikely to be significant sources of GHG emissions in the Basin (e.g., construction equipment and lawn and garden equipment) and could therefore be addressed with readily available data.

More detailed information about the data and methods used to estimate GHG emissions for the Tahoe Basin is provided in Section 2 of this report.

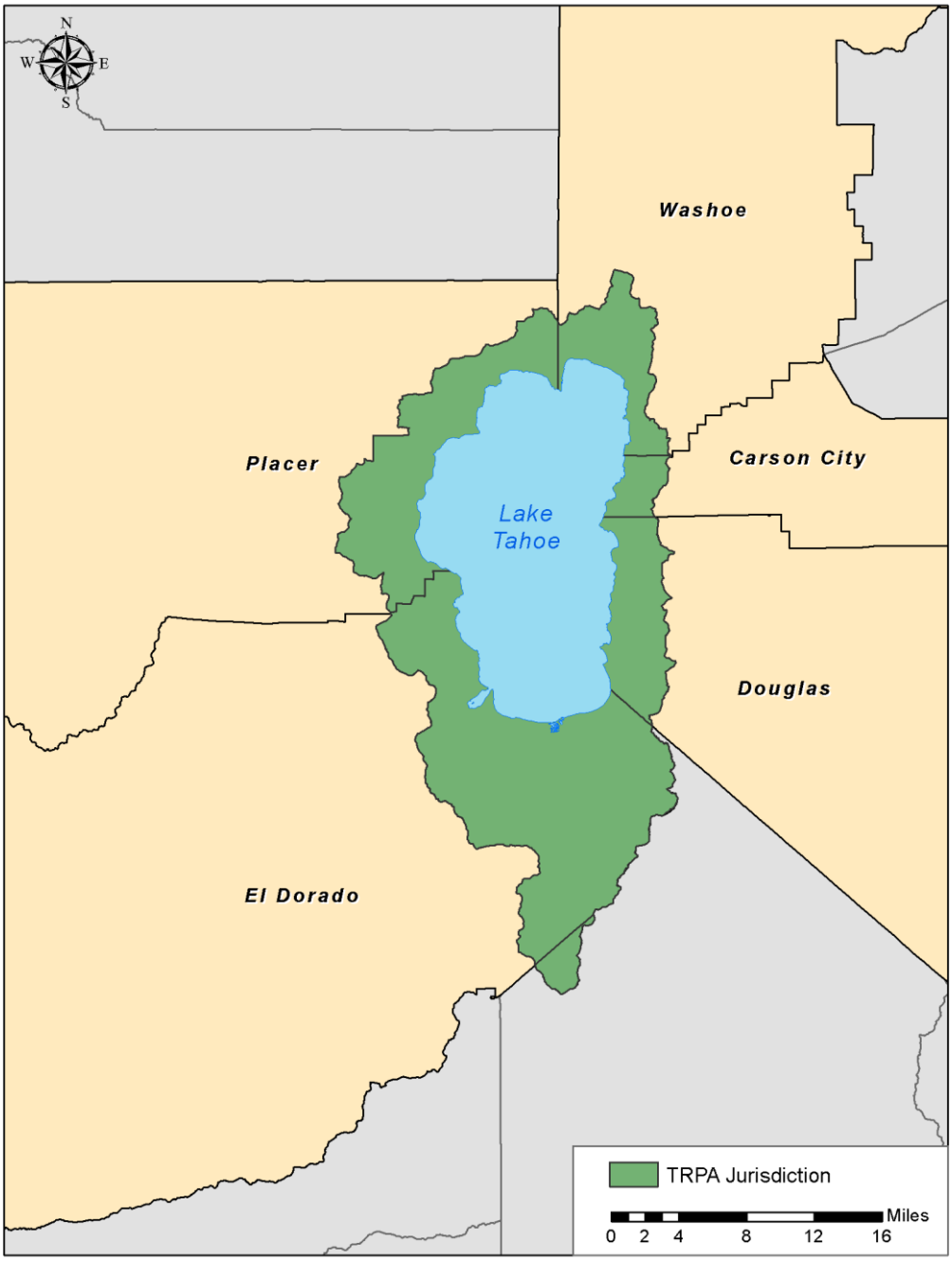

Figure 1-1. Map of TRPA's jurisdictional boundaries around Lake Tahoe Basin.

Table 1-1. Source categories included in the GHG emissions inventories for the Lake Tahoe Basin.

Emissions Type	Source Sector	Source Category
Direct[a]	Transportation	On-road mobile sources (motor vehicles: passenger cars, trucks, buses)
		Off-road vehicles (boats, snowmobiles, lawn and garden equipment, construction equipment, etc.)
	Fuel combustion	Wood combustion (campfires, fireplaces, stoves)
		Natural gas combustion (residential and commercial)
		Other fuel combustion
	Fires	Wildfires and prescribed burns
	Land use	Livestock
		Forestry carbon stock
	Waste	Wastewater treatment
Indirect[b]	Energy	Electricity consumption
		Wastewater treatment
	Transportation	Aircraft
	Waste	Municipal solid waste
		Wastewater treatment

[a] Direct, or "Scope 1," emissions are emitted by sources located within the region of interest.
[b] Indirect emissions are emitted by sources outside the region of interest but result from activities within the region. "Scope 2" indirect emissions are associated with electricity consumption, and all other indirect emissions (e.g., transport-related activities, waste disposal) are classified as "Scope 3" (California Air Resources Board et al., 2010).

1.3 Emissions Summary

The Lake Tahoe Basin generated approximately 1,363,734 metric tons of CO_2-equivalent[4] (CO_2e) emissions in 2005 and approximately 1,433,374 metric tons of CO_2e emissions in 2010. Electricity consumption is the largest source of emissions, producing 487,553 metric tons of CO_2e in 2005 and 562,543 metric tons of CO_2e in 2010 (see **Table 1-2**). These emission levels represent over 36% the total CO_2e emissions in each year, as shown in **Figure 1-2**). The transportation sector was the next largest source, accounting for 30% of total CO_2e emissions in 2005 and 27% of total CO_2e emissions in 2010. The third largest source is fuel combustion, which includes wood, natural gas, and other fuel combustion sources. Fuel combustion in the Basin accounts for over 25% of total CO_2e emissions in 2005 and 2010. The other source sectors (fires, land use, and waste) account for only about 8% of the total CO_2e emissions in 2005 and 2010.

[4] Emissions for non-CO_2 GHGs are converted to CO_2-equivalent values based on each GHG's global warming potential (GWP). GWP is an index that quantifies the radiative forcing effects of a given GHG using CO_2 as the reference gas (California Climate Action Registry, 2013).

Table 1-2. Basin-wide CO_2e emissions by source sector and category (metric tons/year).

Type	Source Sector	Source Category	2005	2010
Direct	Transportation	On-road mobile sources	325,282	304,348
		Recreational boats	22,403	15,994
		Other off-road equipment	53,860	58,751
	Fuel combustion	Wood combustion	97,700	104,297
		Natural gas combustion	236,232	243,075
		Other fuel combustion	5,858	6,161
	Fires	Wildfires and prescribed burns	4,284	91,652
	Land use	Livestock	12,734	12,734
	Waste	Wastewater treatment	57	62
Indirect	Energy	Electricity consumption	487,553	562,543
		Wastewater treatment[a]	2,115	2,300
	Transportation	Aircraft	5,131	4,739
	Waste	Municipal solid waste	110,512	26,704
		Wastewater treatment[a]	12	12
Total Emissions			**1,363,734**[b]	**1,433,374**

[a] The indirect components of wastewater treatment account for wastewater processed outside the Basin in Truckee. A portion of the electricity consumed by the Truckee facility is treated as an indirect source for the Basin-wide GHG inventory, as well as a portion of nitrous oxide emissions from the facility.
[b] CO_2e are rounded to the nearest whole number. Many values were less than 1 and were not included in the table Total CO_2e was calculated using decimals and unlisted values less than 1.

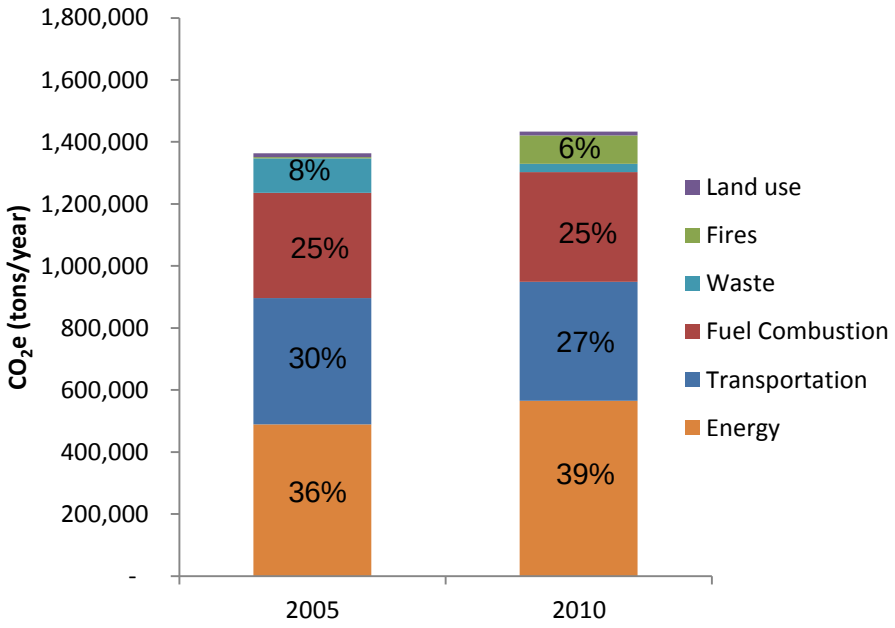

Figure 1-2. Basin-wide CO_2e emissions breakdown by source sector for 2005 and 2010.

In the remainder of this document, we further describe the data sources and methods used to develop GHG emissions estimates for the Lake Tahoe region for the baseline and future years. We also discuss the key findings and results of the emissions inventories for the baseline and future years, and present recommendations for improving these inventories.

2. Technical Approach

For the GHG inventory, emissions were calculated from emission factors and activity data. Emission factors represent the amount of a given pollutant emitted from a source per unit of activity (e.g., grams of CO_2 per gallon of fuel burned); for CO_2, emission factors are derived from the characteristics of the fuel combusted. For a given fuel, a CO_2 emission factor is calculated using the fuel's carbon coefficient and heat content and an oxidation factor that accounts for the fraction of carbon that may not be oxidized during combustion, information that is readily available from GHG reporting protocols (California Climate Action Registry, 2008).

Activity data represent the intensity of an emissions-producing activity or process (e.g., fuel consumption or product output). For the Tahoe Basin GHG inventory, activity data was collected for the source sectors listed in Table 1-1. Required activity data for the Basin include annual vehicle miles traveled (VMT), electricity consumption in megawatt-hours (MWh), total fuel consumption by residences and businesses (wood, natural gas, etc.), and prescribed burning acreages.

The following sections summarize the technical approach used to estimate GHG emissions for each source category in the baseline inventories, as well as the methods used to project the baseline emissions to 2020 and 2035. More detailed information on the emission factors and activity data used to estimate GHG emissions for each category is provided in **Appendix A**.

2.1 Source Categories

2.1.1 On-Road Motor Vehicles

CO_2 emissions, which represent the majority of GHG emissions from motor vehicles, are directly related to the quantity of fuel combusted. For a regional inventory, it is very difficult to convert available fuel sales data into estimates of fuel consumed within the study area. First, fuel sales are typically tracked at the state or county level and are not readily apportioned to sub-county areas like those in the Basin. Also, fuel sold within the Basin is consumed in areas outside the Basin, just as fuel sold outside the Basin is consumed within the Basin. Therefore, the preferred approach is to develop VMT estimates from available traffic counts and travel demand model outputs and convert those VMT data to fuel consumption using fuel economy estimates for vehicles in the region of interest.[5] In addition, VMT data are required to estimate CH_4 and nitrous oxide (N_2O) emissions from motor vehicles; these emissions depend on vehicle control technologies and are therefore based on vehicle characteristics and distance traveled (California Climate Action Registry, 2008).

Vehicle activity data was available from TRPA's TransCAD travel demand model (see **Figure 2-1** for network coverage). TransCAD is a geographic information system (GIS)-based traffic model for which development began in 2004. For the Basin, TransCAD was informed by

[5] For CO_2 emissions calculations, VMT data were converted to fuel consumption estimates using vehicle classifications and fuel economy data from the California Air Resources Board's (ARB's) EMFAC2011 on-road mobile source emissions model (see Appendix A).

a travel survey that collected data from over 1,200 households (Tahoe Regional Planning Agency, 2008). To calculate GHG emissions, VMT outputs from TransCAD must be classified by the following vehicle trip types:

- Internal: trips begin and end within the Basin.
- Internal-external: trips begin in the Basin and end outside the Basin, or vice versa.
- External-external: trips begin and end outside the Basin (i.e., pass-through trips).

The requirement to classify the VMT outputs is driven by SB 375, which requires local planning agencies to meet regional GHG reduction targets through integrated land use and transportation planning. According to SB 375 guidance documents, VMT totals for estimating GHG emissions in a given region should include all internal trips, half of the internal-external trips, and none of the external-external trips (Regional Targets Advisory Committee, 2009). For the base years, this formula results in GHG VMT estimates for the basin of 1,539,088 miles per day for 2005 and 1,459,299 miles per day for 2010.[6]

These VMT data were converted to fuel consumption estimates using fuel economy data derived from the California Air Resources Board's (ARB) EMFAC2007 model.[7] The resulting fuel consumption estimates were combined with CO_2 emission factors to estimate CO_2 emissions. For CH_4 and N_2O, VMT data were combined directly with emission factors to estimate emissions. Emissions were allocated to various jurisdictions within the Basin (i.e., counties and the City of South Lake Tahoe) based on the distribution of VMT data across TRPA's transportation network. Additional details on these calculation steps are provided in Appendix A.

[6] Total VMT for the Basin, including external-external trips, is summarized in Appendix A.

[7] These methods, including the use of EMFAC2007, are consistent with the approach used to estimate GHG emissions from on-road vehicles for the Final Environmental Impact Statement (FEIS) prepared for the Lake Tahoe Regional Plan Update (Ascent Environmental, 2012). We compared the on-road GHG estimates in Table 1-2 against the values reported in Table 3.5-3 of the FEIS and verified that 2010 Basin-wide estimates were consistent in both inventories. For 2005, the FEIS reported only on-road GHG emissions for vehicles subject to SB 375 regulations (i.e., automobiles and light trucks on the California side of the basin), so this estimate is not directly comparable to Table 1-2.

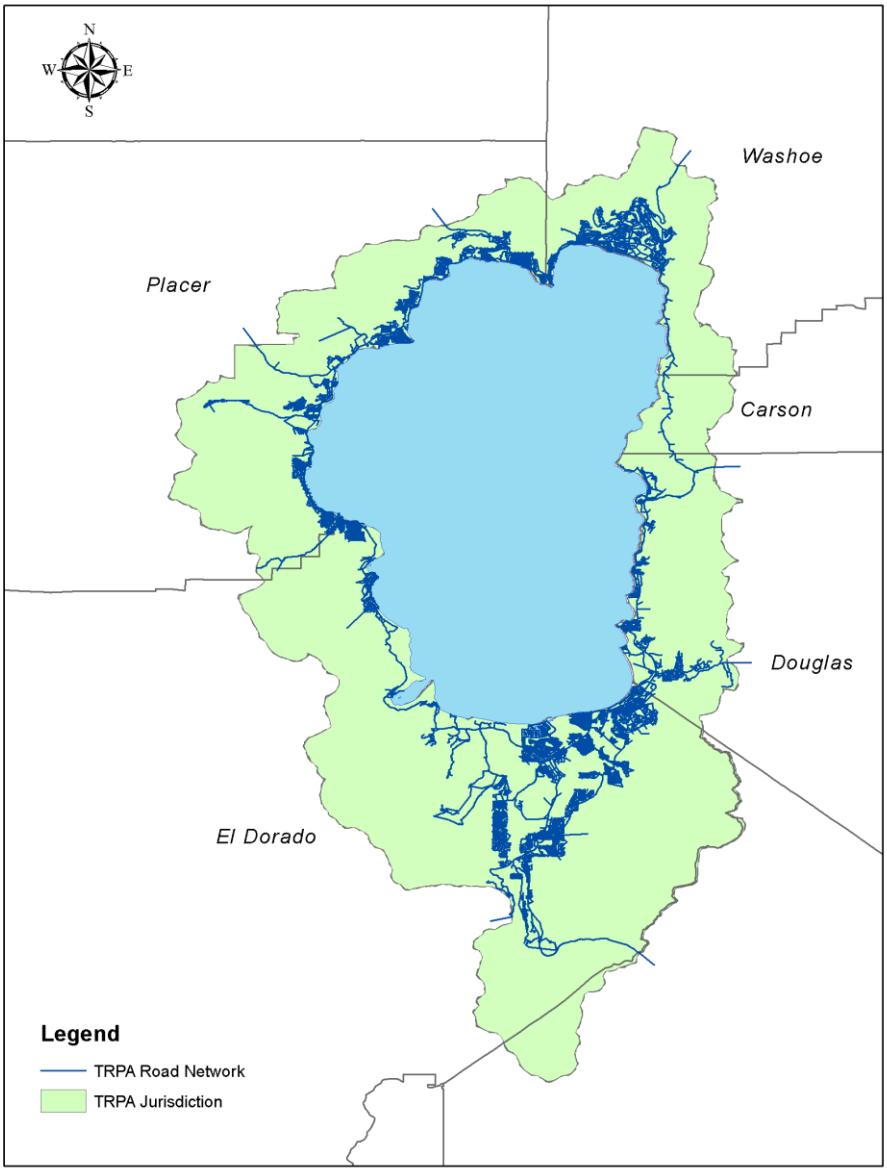

Figure 2-1. TRPA road network.

2.1.2 Recreational Boats

For recreational boats operating in Lake Tahoe, baseline emissions were estimated using fuel consumption activity from TRPA and relevant emission factors from the California Climate Action Registry's general and local reporting protocols (California Climate Action Registry, 2008; California Air Resources Board et al., 2010). TRPA developed estimates of annual launches, fuel consumption, and emissions as part of the development of an environmental impact statement (EIS) for the Lake Tahoe Shorezone (Tahoe Regional Planning Agency, 2006). These estimates included fuel use and hours of operation estimates for recreational boats for 2004 and 2010 (2005 was estimated by interpolating between 2004 and 2010), as well as activity forecast data for various scenarios for 2014 and 2027. Fuel

consumption estimates were summed by engine type and fuel type (gasoline and diesel) and then multiplied by appropriate emissions factors.

The Basin-wide emissions for recreational boats were allocated to the county and city level using boat launch locations provided in the Shorezone study (see **Table 2-1**). The Shoreline study provided a list of existing marinas and boat ramps in the Basin and each marina was assigned to the appropriate county.

Table 2-1. County-level locations of boat launches.

County	% of Total Launches	Lake Area (km^2)[1]	% of Total Area[a]
El Dorado	10%	142.57	31%
South Lake Tahoe	22%		
Placer	36%	203.49	44%
Douglas	18%	65.53	14%
Washoe	14%	54.65	12%

[a] Note that the lake area and percentage of total area values were not used in the GHG emissions estimation process and are shown here only as a point of comparison with the percentage of total launches by county and city.

2.1.3 Aircraft (Indirect)

Aircraft emissions were estimated for the Lake Tahoe airport using fuel data collected for 2010 and fuel combustion emissions factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008). Fuel consumption for jet fuel and aviation gasoline was provided by the airport's fuel vendor for 2009 and 2010 (Golden, 2011). In 2005, the airport used a different fuel vendor and the fuel consumption data were unavailable; therefore, 2005 fuel consumption was estimated by scaling the 2010 fuel consumption using airport traffic activity from the Federal Aviation Administration (FAA)[8].

Since the airport lies in the jurisdiction of the City of South Lake Tahoe, all emissions from the airport were geographically allocated to South Lake Tahoe/El Dorado County (see **Figure 2-2**).

[8] Airport traffic activity data available from the FAA website (http://aspm.faa.gov/main/taf.asp).

Figure 2-2. Location of the Lake Tahoe Airport.

2.1.4 Other Off-Road Equipment

Emissions for all other off-road equipment were estimated using emissions and fuel consumption output from ARB's OFFROAD2007 model. The OFFROAD2007 model addresses a wide variety of off-road equipment types, including recreational vehicles, lawn and garden equipment, and construction equipment. The model relies on county-level equipment populations and activity data (e.g., annual hours of operation) to estimate emissions and fuel consumption. we used the model to estimate emissions for off-road equipment in the California portion of the Basin, except for off-road sources for which more refined local estimates are available (e.g., recreational boats). In keeping with previous emissions inventory development for the Basin conducted by the Desert Research Institute (DRI) (Gertler et al., 2008), emissions for the California side were scaled up to account for the Nevada side of the Basin using the ratio of Basin-wide population for California and Nevada to the population of the California side of the Basin only. This step was performed to provide a complete inventory that includes both the California and Nevada sides of the Basin.

2.1.5 Wood Combustion

Wood fuel combustion was calculated using wood burning activity estimates from a local wood burning survey, the number of Basin-wide households and visitors, and emission factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008). TRPA and researchers from the University of California, Riverside (UCR) conducted wood burning surveys in 2002, collecting information on residential wood combustion during winter months and campfire wood combustion during summer months (Fitz and Lents, 2004). UCR researchers used results of these surveys to estimate the distribution of

wood-burning appliances (e.g., woodstove, fireplace with insert, fireplace without insert, and pellet stove) in the region, the type of wood burned (hardwood versus softwood), and the average quantity of wood burned per day. In 2004, the UCR results were revisited and updated by researchers at DRI as part of the development of an improved particulate matter (PM) emissions inventory for the Tahoe Region (Kuhns et al., 2004).

These updated activity data for 2004 were used to represent 2005 activity levels for wood combustion. To account for changes in activity levels between 2005 and 2010, the 2004 wood combustion data were adjusted based on the change in total households between 2004 and 2010. The resulting emission estimates derived from these activity data were allocated to jurisdictions across the Basin using census data[9] (U.S. Census Bureau, 2000) representing the number of households that use wood as their primary home heating source (see **Table 2-2**).

Table 2-2. Households in the Basin that use wood as their primary home heating source (from the 2000 U.S. Census).

County	Households	Percentage
El Dorado County (including South Lake Tahoe)	503	50%
Placer	403	40%
Douglas	68	7%
Washoe	35	3%
Basin Total	**1,009**	**100%**

2.1.6 Natural Gas Fuel Combustion

Natural gas fuel combustion emissions were calculated using fuel consumption activity from local utilities and emission factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008). We acquired 2005 and 2010 activity data for total fuel consumption from the local utilities.[10]

- For most of the Basin, Southwest Gas, the primary provider of natural gas to residential and commercial customers, provided activity data for total consumption for residential and commercial gas use.
- For areas not covered by Southwest Gas data (i.e., the unincorporated portion of El Dorado County) residential natural gas consumption rates derived from the Southwest Gas data were applied to the number of households in these areas to estimate residential fuel usage.

[9] Note that the American Community Survey (ACS) conducted by the U.S. Census Bureau also contains information on household fuel types, but fewer households are sampled during this survey than during the full census. However, geographic distributions between the ACS data and the full census are very similar.

[10] Southwest Gas provides service to Placer, Washoe, and Douglas counties, as well as the City of South Lake Tahoe. Pacific Gas and Electric (PG&E) serves the unincorporated areas of El Dorado County.

- For the unincorporated portion of El Dorado County, commercial fuel use was derived based on the ratio of residential to commercial usage from the data provided by Southwest Gas. This step was required because PG&E did not provide activity data for this portion of El Dorado County in time for use in this inventory.

Figure 2-3 provides a summary of natural gas usage (in million metric British Thermal Units [MMBtu]) for 2005 and 2010 for the Basin.

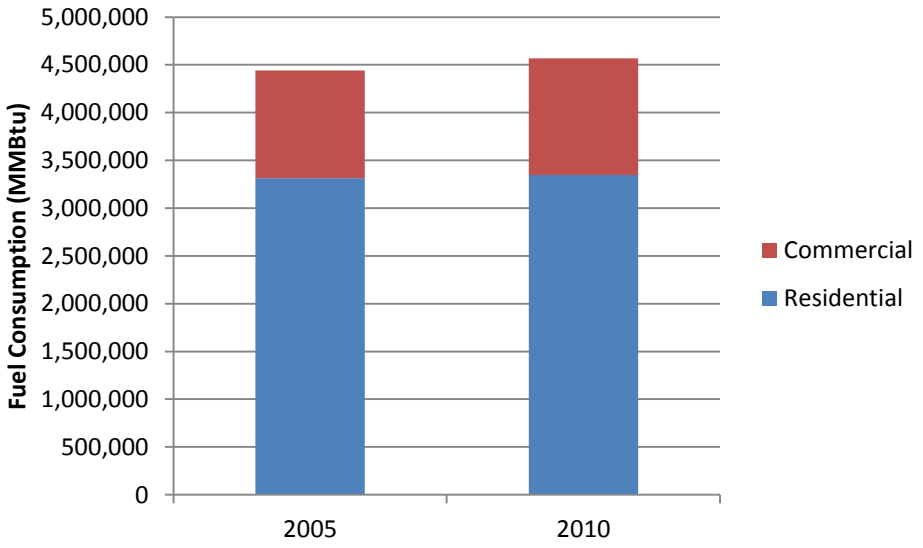

Figure 2-3. Basin-wide natural gas usage for residential and commercial use.

2.1.7 Other Fuel Combustion

Emissions from the combustion of propane (liquefied petroleum gas [LPG]) and distillate oil were calculated based on (1) number of households using these fuels for home heating and (2) emission factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008). Since propane is an unregulated fuel in California, no data are collected on sales or usage. In a guidance document for regional GHG inventories, EPA recommends that, in the absence of detailed consumption data, consumption be estimated based on the number of heating degree days (HDDs)[11] in the region for the year of interest, the number of households using LPG as heating fuel, and an average household consumption rate of 11,647 British Thermal Units (Btu per HDD (U.S. Environmental Protection Agency, 2009). We applied this methodology using census data on home heating fuels and annual average heating degree day values for 2005 and 2010 from the Western Regional Climate Center (Western Regional Climate Center, 2012).

[11] HDDs provide a representation of how cold a region's average temperature was over some period of interest and are calculated as the difference between a day's average temperature and some base temperature (e.g., 65° F).

Resulting emissions estimates were assigned to geographic jurisdictions based on census-tract-level information on the number of households using propane or distillate oil as their primary home heating fuel (see Appendix A).

2.1.8 Wildfires and Prescribed Burns

Emissions from wildfires and prescribed burns are a function of the type and amount of vegetation consumed by each fire event. Previously, STI generated a national inventory of CO_2 emissions from fires using the BlueSky Smoke Modeling Framework, a system developed by STI and the USDA Forest Service (Raffuse et al., 2008). The BlueSky system reconciles satellite fire detections with ground-based reports to estimate the area burned by each fire event, then uses detailed land cover data, fuel consumption algorithms, and emission factors to calculate the type and amount of vegetation burned and the resulting emissions. The BlueSky system includes the SmartFire model (Raffuse et al., 2009), a geospatial processing tool that aggregates and reconciles information about when and where fires occur.

In addition, the California Department of Forestry and Fire Protection (CalFire) maintains a GIS database of fire history as part of its Fire and Resource Assessment Program (FRAP). The CalFire data is available for years back to 1990 and were used to verify BlueSky data and evaluate fire trends.

The BlueSky/SmartFire system was the most complete data set available (i.e., it includes fires not included in the CalFire database) and was used to develop activity data for 2005 and 2010 for major wildfires and large prescribed burns. For smaller prescribed fires (e.g., pile burns) that are not captured by SmartFire, activity data were derived from the Lake Tahoe Fuel Reduction Plan (USDA Forest Service, 2007) and other sources that describe forest management and fire activities in the Basin. Those sources include the Lake Tahoe Basin Management Unit of the United States Department of Agriculture (USDA) Forest Service website (USDA Forest Service, 2012) and local newspaper articles (Osborn, 2012).

These data indicate that wildfire and prescribed burning activities vary greatly from year to year within the Basin, as shown in **Figure 2-4**. Between 2001 and 2010, according to CalFire, all prescribed burning activities occurred in 2006, while wildfires predominantly occurred in 2007. For 2005, activity data was low since there were no wildfires and less prescribed burning. For 2010, fire activity was higher since there was a recorded wildfire and increased prescribed burning.

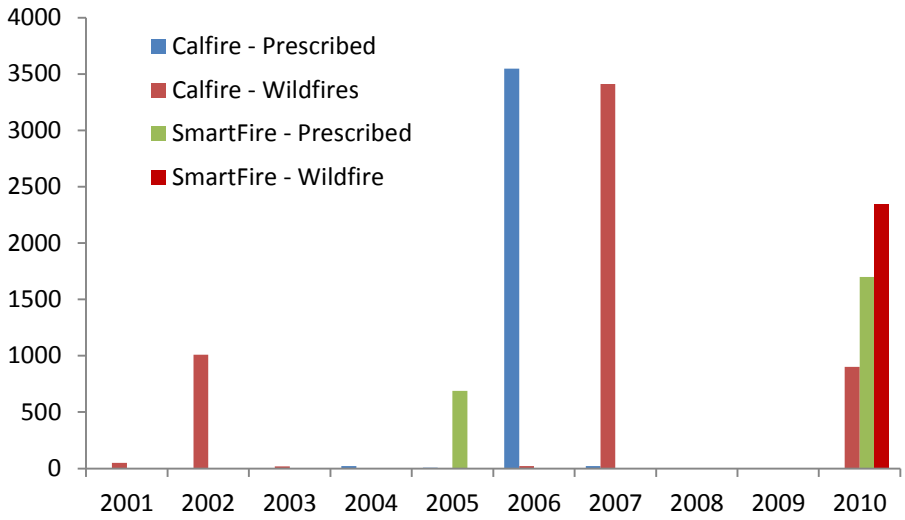

Figure 2-4. Summary of acres burned by wildfire and prescribed burns in the Lake Tahoe Basin, 2001–2010.

2.1.9 Livestock

Emissions from livestock were based on ARB estimates of animal populations in the Basin and emission factors for each animal type from EPA GHG guidance documents (U.S. Environmental Protection Agency, 2009). ARB produces refined livestock population estimates by county and air basin (Reid et al., 2008). These estimates combine statewide summaries of livestock populations from the annual Agricultural Resource Directory for dairy and beef cows published by the California Department of Food and Agriculture and the Agricultural Census developed by the USDA, providing populations for other animal types (e.g., swine, sheep, horses, and goats). The most recent population numbers (which are from 2003) were downloaded from ARB's website. These numbers were held as being constant for 2005 and 2010.

2.1.10 Solid Waste (Indirect)

GHG emissions from solid waste are a result of methane generation from the anaerobic decomposition of organic wastes deposited in a landfill. Because of this process, emission rates are a function of the amount of waste generated and type of waste generated (e.g., paper products, food waste, plant debris, wood/textiles) within the region of interest. In addition, methane recovery systems at regional landfills must be taken into account where applicable.

Because emissions from landfills continue for many years after waste disposal, two methods exist for estimating GHG emissions from this source. The Waste-in-Place method quantifies the annual amount of methane emitted by a given landfill, regardless of when the waste was disposed. The Methane Commitment method calculates emissions resulting from waste disposed in a given year, regardless of when the emissions occur. The former method requires historical waste disposal information and is not sensitive to source reduction or recycling activities. Moreover, waste from the Tahoe Basin is sent to Lockwood Regional

Landfill in Storey County, Nevada, so the actual methane emissions are occurring outside the Basin at a facility that Basin agencies have no direct control over. Therefore, the Methane Commitment method was used to estimate emissions for waste generated in the Basin during 2005 and 2010, and these emissions are treated as an indirect source in the inventory.

Emissions estimates for solid waste were calculated using data on solid waste generation from local utilities (South Tahoe Refuse and Tahoe Truckee Sierra Disposal) and the solid waste module in the International Council for Local Environmental Initiative's (ICLEI) Clean Air and Climate Protection (CACP) software. The CACP solid waste module is based on EPA's Waste Reduction Model (WARM); it calculates methane emissions based on the amount and type of waste generated in a given year and the capture efficiency of the methane recovery system at the landfill in question.

For the Basin, 165,460 tons of solid waste were generated in 2005 and 159,915 tons were generated in 2010. These totals were broken down into waste types (e.g., paper, food, etc.) using waste composition percentages developed by the California Integrated Waste Management Board (CalRecycle) (Cascadia Consulting Group, 2009). Because Lockwood Landfill did not have a methane recovery system prior to 2009 (Ling-Barnes, 2010), emissions estimates for 2005 (110,512 tons of CO_2e) are much higher than for 2010 (26,704 tons of CO_2e) (see **Figure 2-5**).

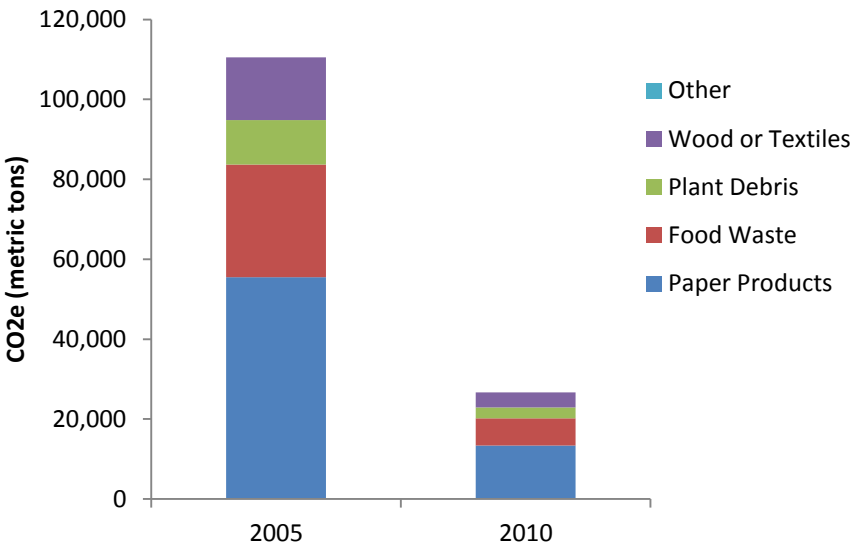

Figure 2-5. CO_2e emissions by type of waste for 2005 and 2010.

2.1.11 Wastewater Treatment

Three wastewater treatment plants currently operate in the Basin. They are managed by the South Lake Tahoe Public Utilities District, Douglas County Sewer Improvement District #1, and Incline Village General Improvement District (see **Figure 2-6**). In addition, a portion of the wastewater from Tahoe's north shore is sent to a treatment plant in Truckee operated by the

Tahoe-Truckee Sanitation Agency. these facilities we contacted and provided information on annual wastewater throughput, wastewater treatment methods, and any control systems for methane that may be in use.

The wastewater treatment method is an important consideration, as anaerobic methods rely on bacterial processes that are carried out in the absence of oxygen and produce methane emissions. On the other hand, aerobic treatment systems, which are generally used at smaller-scale facilities, do not produce methane emissions and produce only small amounts of nitrous oxide (N_2O) emissions. We found that all four facilities identified above treat their wastewater aerobically; therefore no methane emissions are produced at these facilities. For N_2O, emissions were calculated using a population-based method from the Intergovernmental Panel on Climate Change (IPCC) guidance (2006).

To estimate direct GHG emissions for the three facilities in the Basin, emissions were assigned to each facility based on the population of the area it serves (see Figure 2-6). For the Truckee facility, which lies outside the Tahoe Basin, a portion of: (1) N_2O emissions; and (2) GHG emissions resulting from electricity consumption at that facility were treated as indirect sources for the Basin-wide inventory. The portion of the Truckee facility's emissions included as an indirect source in the inventory was based on the percentage of the facility's annual waste that comes from the Basin (35%). This percentage and annual electricity consumption at the Truckee treatment plant were obtained from staff at that facility.

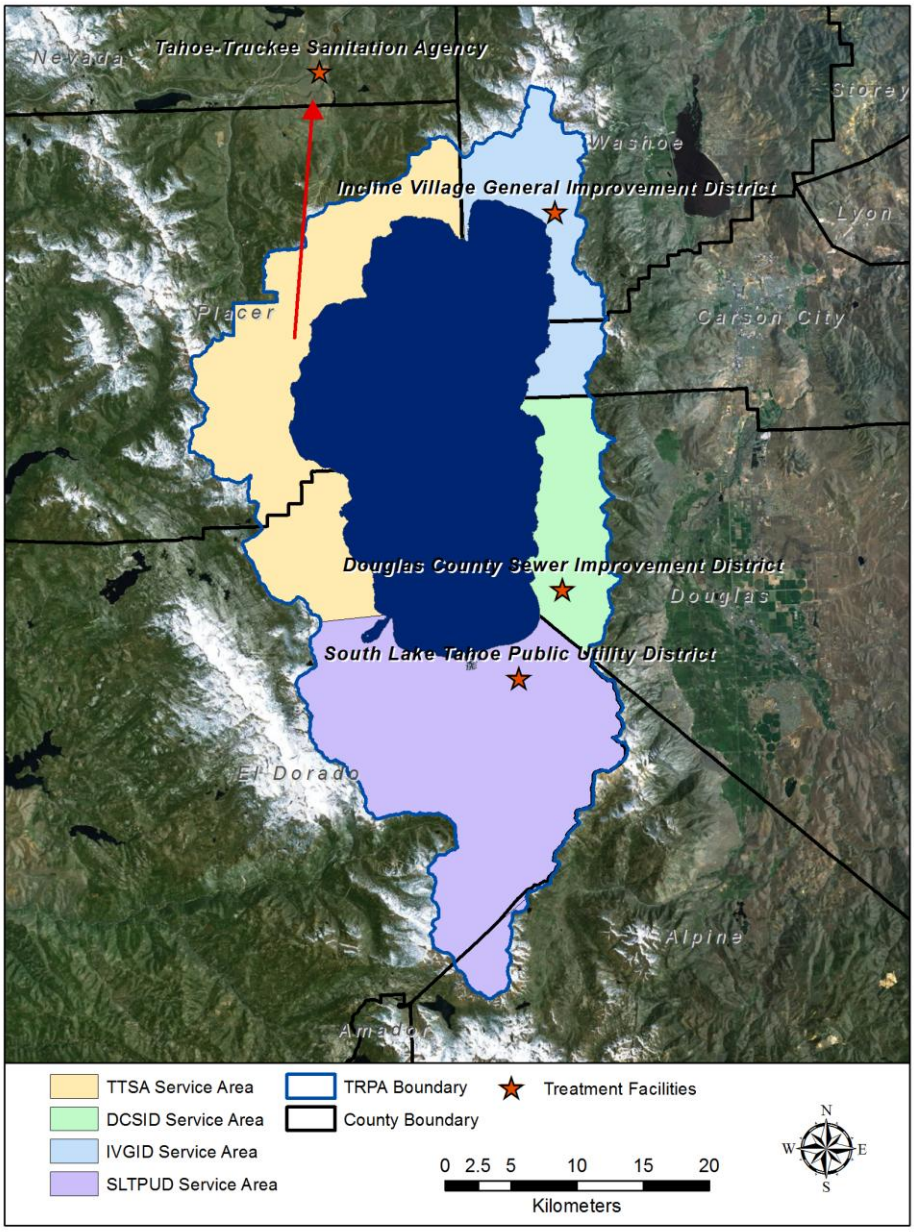

Figure 2-6. Locations of wastewater treatment plants that service the Basin.

2.1.12 Electricity Consumption (Indirect)

Emissions from electricity consumption were calculated using activity information from local utilities (Nevada Energy and Liberty Energy) and emission factors from local utilities and the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008). Electricity consumption data was acquired (in megawatt-hours [MWh]) for commercial, government, and residential activity from Liberty Energy, which services the California side of the Basin, and residential and commercial activity from Nevada Energy, which services the Nevada side of the Basin. **Figure 2-7** summarizes the total energy consumption by

county and type. To reflect the mix of fuels used to generate the electricity, the utilities provided emission factors for 2005 and 2010 for CO_2.[12] For methane and nitrous oxide, emissions factors from the California protocol were used.

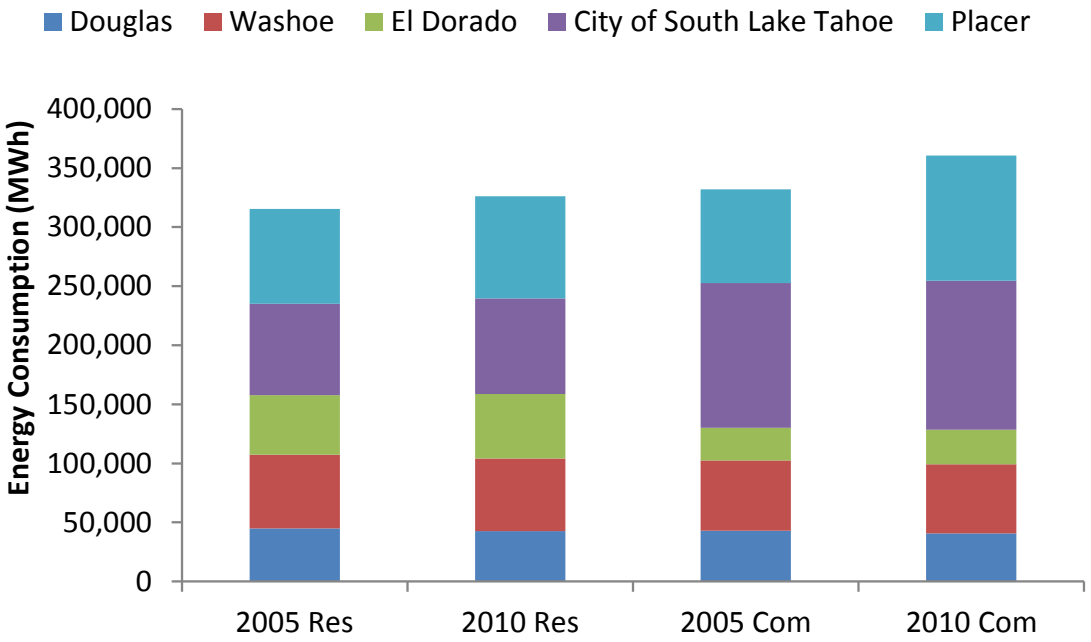

Figure 2-7. Commercial and residential energy consumption (MWh) in 2005 and 2010 for the Basin (provided by Liberty Energy and Nevada Energy).

2.1.13 Forestry Carbon Stocks

Removal of CO_2 from the atmosphere by forests can represent a significant emissions sink for heavily-forested regions like the Tahoe Basin. According to EPA estimates, forests sequestered the equivalent of 10.6% of nationwide GHG emissions in 2006; however, the amount of carbon sequestered by forests at a regional level can vary greatly depending on the mix of tree species in the region (U.S. Environmental Protection Agency, 2009). In addition, protocols have been developed for assessing the impact of forestry projects (e.g., reforestation, improved forest management) on net GHG emissions. Recommended methods include procedures for assessing the risk that carbon sequestered by a project may be released back into the atmosphere within a defined timeframe (Climate Action Reserve, 2010).

Because the Lake Tahoe region is heavily forested, we developed estimates of baseline carbon stocks associated with forested lands. These baseline values can be used to develop future carbon sequestration estimates associated with any changes to forest management practices in the region. To develop these baseline estimates, we relied on the Carbon Online

[12] Emission rates depend on the electricity generation methods (e.g., natural gas combustion, renewables, etc.); the mix of methods can change over time.

Estimator v2 (COLE2) database, which is maintained by the Forest Inventory and Analysis (FIA) program as a record of the health of forests in the United States.

The number and size of the trees in various forests are recorded into the COLE2 database by manual surveys of the forests. Due to resource limitations, these plots are usually subdivided and only a portion of the plot is surveyed during a select year; then the data for that parcel are used to estimate the carbon stock of rest of the plot. For the next year, another portion of the plot may be estimated and those results are used to make a new estimate of the carbon stock for the plot (which could vary significantly from the previous year due to fires or other activity in the plot).

Because of this process, the tree carbon data for plots in the Basin obtained from the COLE2 database were averaged over a 10-year period to create a single baseline scenario. The tree carbon data were converted to CO_2 stock in metric tons by multiplying total carbon by 3.76, which is the ratio of the molar weight of CO_2 to the molar weigh of carbon. **Table 2-3** summarizes the 10-year average tree carbon (metric tons) and resulting CO_2 (metric tons) for the Basin by geographical jurisdictions.

Table 2-3. Ten-year average tree carbon (metric tons) and CO_2 (metric tons) for the Basin.

Region	Tree Carbon	10-Year Average
Carson	32,777	123,242
Douglas	117,240	440,822
Washoe	2,422	9,107
El Dorado (unincorporated)	392,749	1,476,736
South Lake Tahoe	-	-
Placer	138,246	519,805
Nevada Total	152,439	573,171
California Total	530,995	1,996,541
Basin Total	**683,434**	**2,569,712**

2.2 Forecasting GHG Emissions

GHG emissions inventories for 2020 and 2035 were developed using the Tahoe Metropolitan Planning Organization (TMPO) alternative growth scenarios for the Basin from the draft Regional Transportation Plan (RTP) 2035 (Tahoe Metropolitan Planning Organization, 2012a) and draft EIS for 2035 (Tahoe Metropolitan Planning Organization, 2012b). The RTP integrates land use and transportation strategies to allow the Basin to achieve targets for reducing GHG emissions by 2035. The TMPO report provides projections of 2020 and 2035 Basin-wide and statewide population (see **Table 2-4**), employment (see **Table 2-5**), and VMT (see **Table 2-6**) totals for each of the following five alternatives:

- Alternative 1 – No Project, which represents the business-as-usual (BAU) case
- Alternative 2 – Low Development, Increased Regulation
- Alternative 3 – Low Development, Highly Incentivized Redevelopment
- Alternative 4 – Reduced Development, Incentivized Redevelopment
- Alternative 5 – Rate of Development and Regulatory Structure Similar to 1987 Regional Plan

Table 2-4. Population by TMPO alternative growth scenario for 2020 and 2035.

Region	2020					2035				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
California	41,709	42,735	43,934	43,737	44,277	42,005	44,102	45,468	45,950	44,227
Nevada	13,423	13,475	14,115	13,582	13,619	13,682	13,711	14,897	13,823	15,725
Total	**55,132**	**56,210**	**58,049**	**57,319**	**57,896**	**55,687**	**57,813**	**60,365**	**59,773**	**59,952**

Table 2-5. Employment by TMPO alternative growth scenario for 2020 and 2035.

Region	2020					2035				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
California	12,365	12,674	12,587	12,933	13,127	12,723	12,946	12,946	13,170	13,393
Nevada	10,370	10,630	10,556	10,847	11,010	10,670	10,858	10,858	11,045	11,233
Total	**22,735**	**23,304**	**23,143**	**23,780**	**24,137**	**23,393**	**23,804**	**23,804**	**24,215**	**24,626**

Table 2-6. VMT to calculate GHG emissions[13] and total Basin VMT by TMPO alternative growth scenario for 2020 and 2035.

Region	2020				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
California	928,908	944,010	925,150	963,786	981,457
Nevada	448,828	443,676	450,370	463,344	472,743
GHG Total	**1,377,736**	**1,387,686**	**1,375,520**	**1,427,130**	**1,454,200**
Basin Total	2,015,976	1,990,698	2,033,362	2,095,270	2,117,242
	2035				
California	989,899	1,004,890	1,017,955	1,068,686	1,095,393
Nevada	580,555	547,780	567,380	581,888	604,996
GHG Total	**1,570,454**	**1,552,670**	**1,585,335**	**1,650,574**	**1,700,389**
Basin Total	2,141,100	2,094,300	2,131,000	2,244,800	2,321,100

[13] VMT used to calculate GHG emissions include VMT from internal-internal trips and half of the VMT from internal-external trips.

In order to estimate future-year emissions, some source category activity data or emissions are forecasted using other socioeconomic categories (households and visitors). The socioeconomic categories were developed from the 2005 baseline estimates and were grown to future-year estimates using population growth rates for each of the five alternatives (see **Tables 2-7 and 2-8**).

Table 2-7. Households by TMPO alternative growth scenario for 2020 and 2035.

Region	2020					2035				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
California	16,204	16,521	17,062	16,847	17,017	16,367	16,992	17,742	17,568	17,621
Nevada	6,033	6,151	6,353	6,273	6,336	6,094	6,327	6,606	6,541	6,561
Total	**22,238**	**22,673**	**23,414**	**23,120**	**23,353**	**22,462**	**23,319**	**24,348**	**24,110**	**24,182**

Table 2-8. Number of visitors by TMPO alternative growth scenario for 2020 and 2035.

Region	2020					2035				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
California	41,728	42,544	43,936	43,383	43,820	42,148	43,757	45,689	45,240	45,376
Nevada	15,948	16,259	16,791	16,580	16,747	16,108	16,723	17,461	17,290	17,342
Total	**57,675**	**58,803**	**60,727**	**59,963**	**60,567**	**58,256**	**60,480**	**63,150**	**62,531**	**62,718**

For most of the source sectors, TMPO-based socioeconomic data were used to forecast the activity data or emissions to 2020 and 2035. However, future-year emissions from aircraft and recreational boats were estimated using other sources of forecast data. For aircraft, the FAA provides estimates of future-year airport operations (number of flights) and this data was used to scale 2005 baseline emissions to 2020 and 2035. For recreational boating, the Lake Tahoe Shorezone study (Tahoe Regional Planning Agency, 2006) included boat trips and fuel consumption forecast for various Shorezone buildout alternatives for 2014. During discussions with the work group, it was decided to use the “no build” scenario, which uses existing Shorezone ordinances (adopted in 1987) and prohibits construction of Shorezone structures in prime fish habitat areas. The Shorezone study provided fuel use for 2004 and estimates for 2027. Fuel estimates were interpolated between these two years to provide estimates for 2020 and 2035, which were then used to estimate the emissions from recreational boating.

Table 2-9 lists each source category and corresponding growth activity used to develop the future-year emissions inventories. Note that for on-road mobile sources, future-year emissions estimates are impacted not only by changes in VMT, but also by changes to the vehicle fleet over time (e.g., improving fuel economy standards).

Table 2-9. Growth activity for each of the source sectors in the inventory.

Sector	Source Category	Growth Activity
Transportation	On-road mobile sources	TMPO VMT
	Recreational boats	Forecasted fuel use from the Shorezone study
	Other off-road equipment	Population and employment
	Aircraft	FAA forecast activity
Fuel combustion	Wood combustion	Household and visitor
	Natural gas combustion	Household and employment
	Other combustion	Household
Fires	Wildfires and prescribed burns	Average annual activity
Land use	Livestock	Held constant
Waste	Municipal solid waste	Population
	Wastewater treatment	Population
Energy	Electricity consumption	Household and employment
	Wastewater treatment	Population

3. Summary of Results

Greenhouse gas emissions inventory estimates were produced for the Lake Tahoe Basin for the base years of 2005 and 2010 and the future years of 2020 and 2035 (BAU and four additional growth scenarios). The results of the emissions inventories are presented by Basin (regional), state (CA and NV), and local government jurisdiction. Emissions totals for CO_2e are presented below and emission totals for CH_4 and N_2O are presented in **Appendix B**.

3.1 Baseline Basin-Wide Emissions

Basin-wide CO_2e totals by year and source sectors are shown in **Figure 3-1** and **Table 3-1**. In 2005, the direct and indirect emissions from the Basin amounted to approximately 1,363,000 metric tons of CO_2e, and total CO_2e emissions increased by about 5% in 2010 to 1,433,000 metric tons. For both years, the energy sector is the largest source of CO_2e emissions, accounting for 36% of total emissions in 2005 and 39% in 2010.

In addition, the top three source sectors (energy, transportation, and fuel combustion) account for 91% of total CO_2e emissions for 2005 and 2010. Transportation-related emissions decreased about 6% from 2005 to 2010 due to a decrease in Basin-wide VMT, while emissions from solid waste decreased by 76% over that timeframe due to the implementation of a methane recovery system at Lockwood Landfill in 2009. Due to an increased amount of prescribed burning and wildfires occurring in the Basin, emissions from fires increased by 21% between 2005 and 2010. As shown in Table 3-1, the California side of the Basin produces the majority of the GHG emissions, accounting for 69% and 73% of the total emissions for 2005 and 2010, respectively.

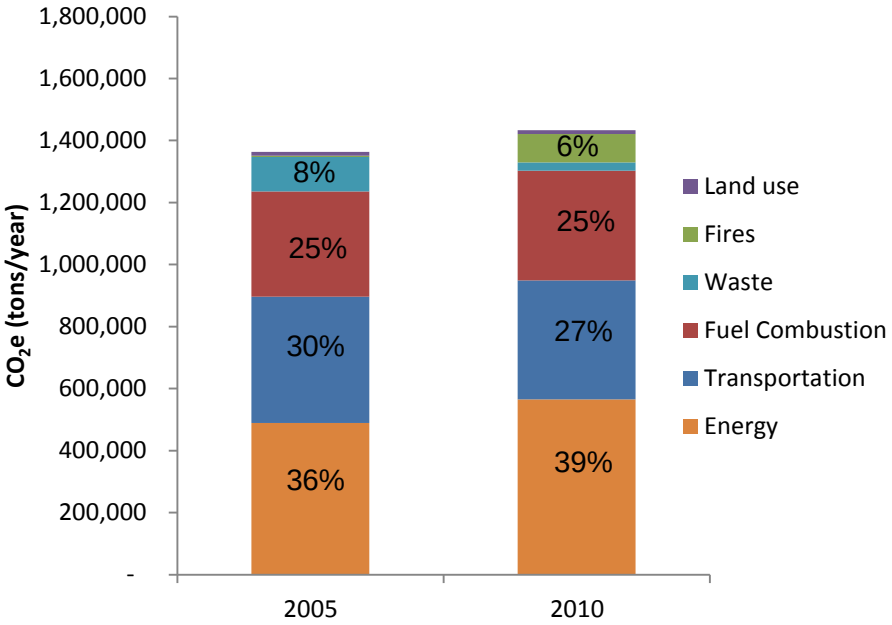

Figure 3-1. Baseline Basin-wide CO_2e emissions by source sector.

Table 3-1. Baseline CO_2e emissions (metric tons/year) by state and Basin-wide.

Type	Source Sector	Source Category	2005			2010		
			CA	NV	Basin	CA	NV	Basin
Direct	Transportation	On-road mobile sources	200,727	124,555	325,282	189,616	114,731	304,348
		Recreational boats	15,151	7,251	22,403	10,817	5,177	15,994
		Other off-road equipment	40,803	13,057	53,860	44,509	14,243	58,751
	Fuel combustion	Wood combustion	87,726	9,973	97,700	93,651	10,647	104,297
		Natural gas combustion	171,435	64,797	236,232	181,256	61,819	243,232
		Other combustion	3,970	1,888	5,858	4,317	1,844	6,161
	Fires	Wildfires and prescribed burns	3,083	1,201	4,284	79,650	12,002	91,652
	Land use	Livestock	12,734	-	12,734	12,734	-	12,734
	Waste	Wastewater treatment	39	18	57	44	18	62
Indirect	Energy	Electricity consumption	329,627	157,926	487,553	395,998	166,545	562,543
		Wastewater treatment	2,115	-	2,115	2,300	-	2,300
	Transportation	Aircraft	5,131	-	5,131	4,739	-	4,739
	Waste	Municipal solid waste	71,595	38,917	110,512	19,956	6,748	26,704
		Wastewater treatment	12	-	12	12	-	12
Total			**944,149**	**419,585**	**1,363,734**	**1,039,600**	**393,774**	**1,433,530**

3.2 Baseline Emissions by Geographic Jurisdiction

GHG emissions were estimated for the portion of the five counties (Placer, El Dorado, Washoe, Douglas, and Carson) that lie inside the TRPA jurisdiction, as well as the City of South Lake Tahoe. **Figures 3-2 and 3-3** and **Tables 3-2 and 3-3** show baseline emissions by source sector for each local government jurisdiction. Jurisdiction total emissions are also shown proportionally to each other, with the size of the "pie" representing the magnitude of emissions for a given area. For both years, the City of South Lake Tahoe accounts for about 29% of total emissions, followed closely by Placer County, which contributes about 24% to the overall inventory in both 2005 and 2010. Contributions to the baseline GHG inventories from unincorporated El Dorado County and Nevada counties range from 1% to 17%.

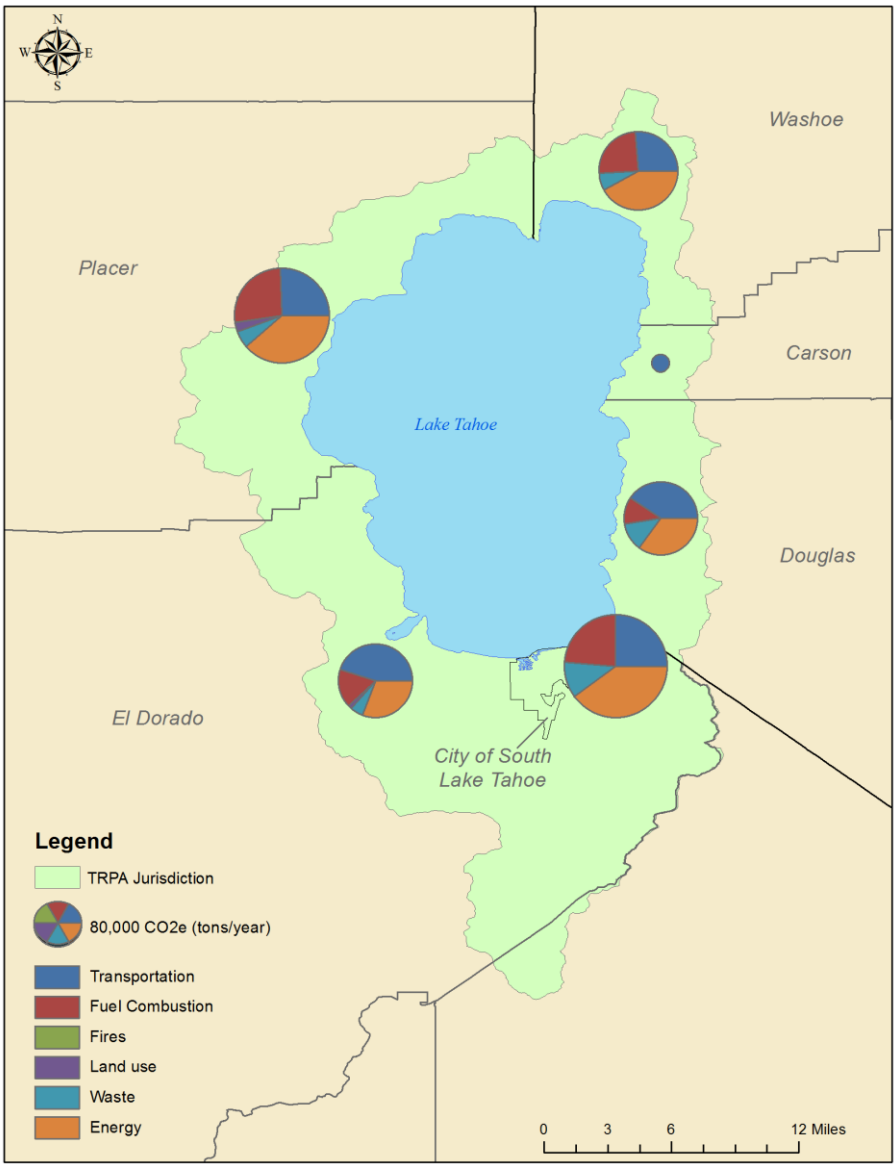

Figure 3-2. Baseline CO_2e emissions for 2005 by source sector and geographic jurisdiction (note that the size of each "pie" is proportional to the amount of total emissions).

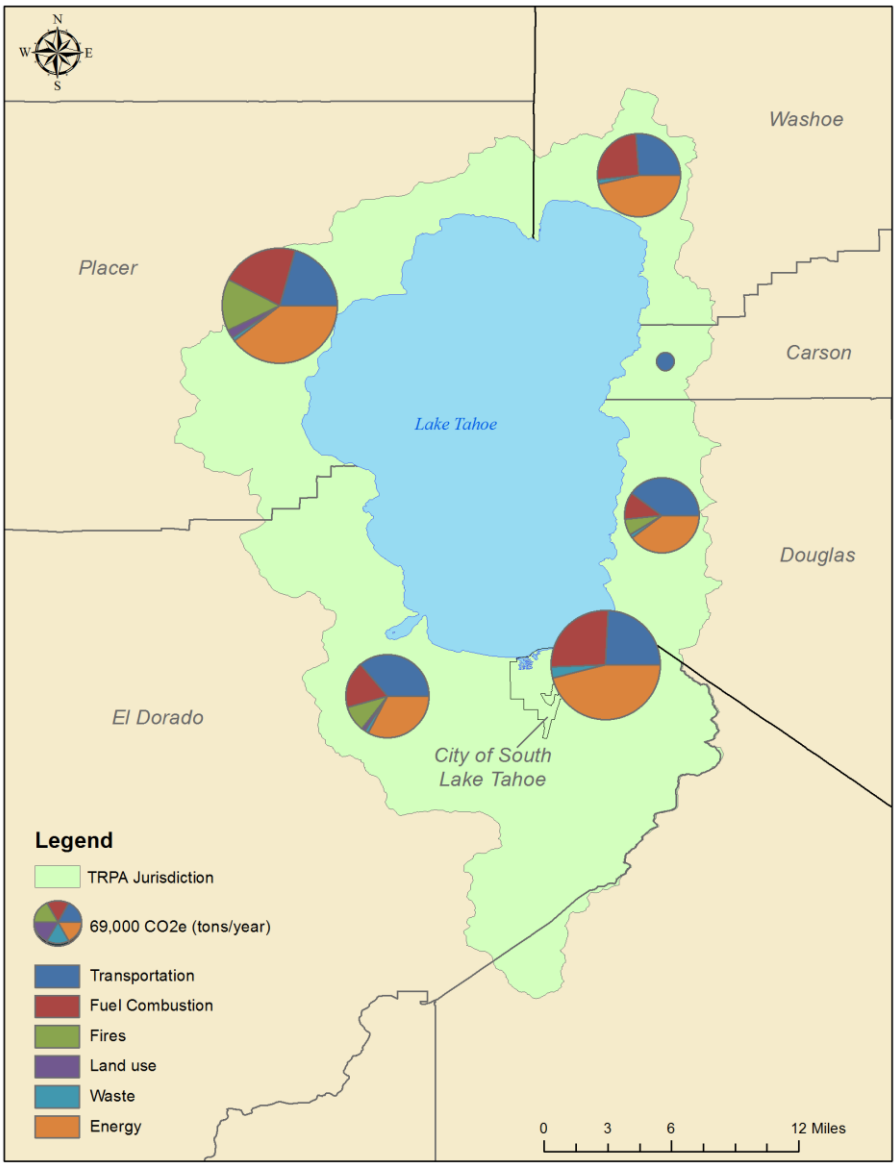

Figure 3-3. Baseline CO_2e emissions for 2010 by source sector and geographic jurisdiction (note that the size of each "pie" is proportional to the amount of total emissions).

Table 3-2. Baseline CO_2e emissions for 2005 by source sector and geographic jurisdiction.

Type	Source Sector	Source Category	Geographic Jurisdiction					
			Placer	El Dorado (unincorporated)	South Lake Tahoe	Washoe	Carson	Douglas
Direct	Transportation	On-road mobile sources	62,904	75,752	62,071	46,397	11,206	66,952
		Recreational boats	8,001	2,329	4,821	3,200	-	4,051
		Other off-road equipment	9,602	8,274	22,026	8,100	-	5,857
	Fuel combustion	Wood combustion	39,022	13,299	35,405	3,389	-	6,584
		Natural gas combustion	44,792	18,128	108,515	50,235	-	14,563
		Other combustion	1,073	747	2,150	418	-	1,470
	Fires	Wildfires and prescribed burns	1,345	1,738	-	-	-	1,201
	Land use	Livestock	9,809	2,925	-	-	-	-
	Waste	Wastewater Treatment	-	-	39	11	-	8
Indirect	Energy	Electricity consumption	120,258	58,922	150,447	91,652	-	66,274
		Wastewater treatment	2,115	-	-	-	-	-
	Transportation	Aircraft	-	-	5,131	-	-	-
	Waste	Municipal solid waste	18,251	10,838	42,506	15,397	-	23,520
		Wastewater treatment	12					
Total			**317,184**	**192,952**	**433,111**	**218,800**	**11,206**	**190,480**

Note: Blank cells in this table indicate that the given source category is not applicable to a specific jurisdiction. Population data for each jurisdiction can be found in Table A-1 of Appendix A.

Table 3-3. Baseline CO_2e emissions for 2010 by source sector and geographic jurisdiction.

Type	Source Sector	Source Category	Geographic Jurisdiction					
			Placer	El Dorado (unincorporated)	South Lake Tahoe	Washoe	Carson	Douglas
Direct	Transportation	On-road mobile sources	68,567	64,742	56,307	45,113	9,675	59,942
		Recreational boats	5,712	1,663	3,442	2,285	-	2,892
		Other off-road equipment	9,571	10,365	24,649	8,375	-	5,792
	Fuel combustion	Wood combustion	41,657	15,391	36,602	3,618	-	7,029
		Natural gas combustion	46,200	22,207	112,849	49,858	-	11,961
		Other combustion	1,046	911	2,361	423	-	1,421
	Fires	Wildfires and prescribed burns	58,372	21,278	-	-	-	12,002
	Land use	Livestock	9,809	2,925	-	-	-	-
	Waste	Wastewater treatment	-	-	44	11	-	7
Indirect	Energy	Electricity consumption	157,801	68,854	169,344	98,456	-	68,089
		Wastewater treatment	2,300	-	-	-	-	-
	Transportation	Aircraft	-	-	4,739	-	-	-
	Waste	Municipal solid waste	4,446	3,374	12,136	3,890	-	2,858
		Wastewater treatment	12					
Total			**405,493**	**211,710**	**422,473**	**212,028**	**9,675**	**171,994**

Note: Blank cells in this table indicate that the given source category is not applicable to a specific jurisdiction. Population data for each jurisdiction can be found in Table A-1 of Appendix A.

3.3 Future-Year Emissions

Future-year GHG emissions inventories were developed by projecting the 2005 baseline inventory using growth rates from each of the five TMPO growth alternatives for 2020 and 2035 (see **Figures 3-4 and 3-5**). For 2020, the GHG emissions inventory total CO_2e ranges from -2% to 3% higher than 2005 baseline totals; alternative 1 (BAU) projects the smallest increase in emissions and alternative 5 projects the largest increase in emissions. For 2035, the GHG emissions inventory total CO_2e ranges from 2% to 9% higher than 2005 baseline totals; as with the year 2020, alternative 1 (BAU) projects the smallest increase in emissions, with alternative 5 projecting the largest increase in emissions. The BAU scenario projects lower emissions because it extends the current plan, which relies on existing land use zoning and would authorize no additional development rights or allocations beyond those authorized in the 1987 RTP.

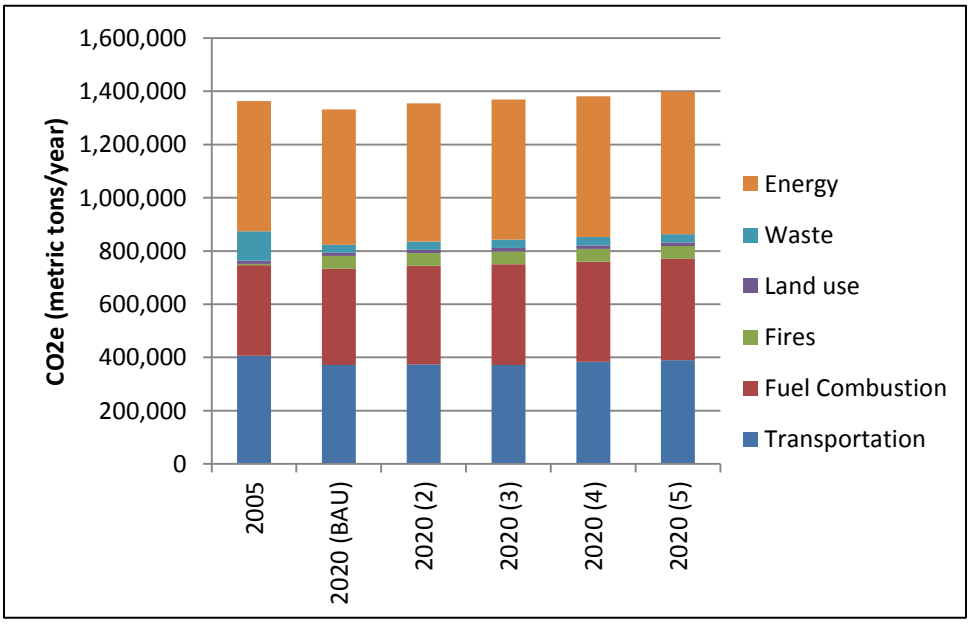

Figure 3-4. GHG CO_2e emissions by source sector for 2020 for each scenario.

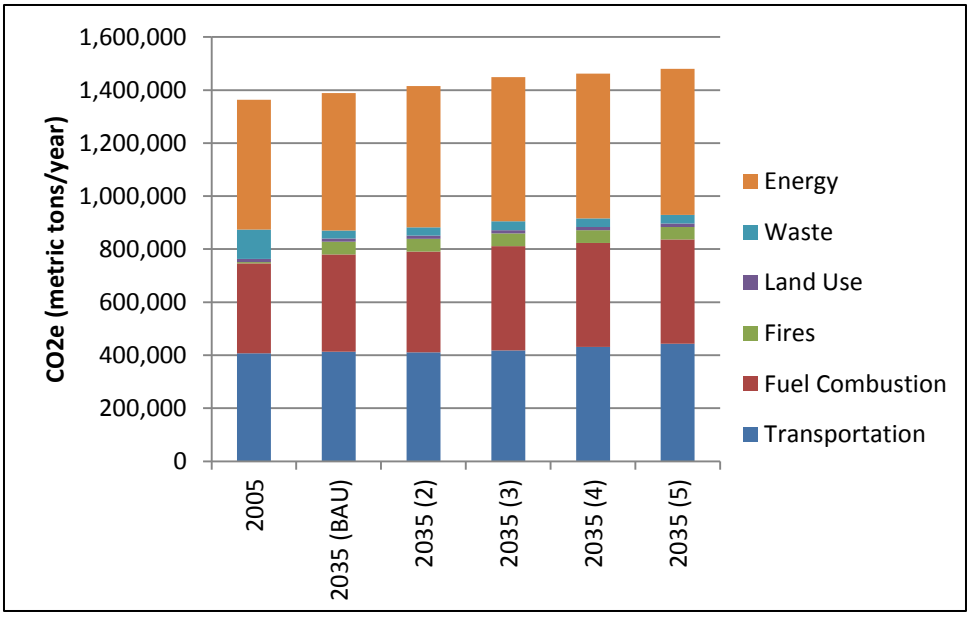

Figure 3-5. GHG CO_2e emissions by source sector for 2035 for each scenario.

Tables 3-4 and 3-5 summarize the Basin-wide 2020 and 2035 GHG emissions inventories for each source category by each of the five TMPO growth alternatives. Emissions from on-road mobile sources are lower than 2005 for all five of the growth scenarios (this is due to VMT totals that are lower in 2020 than in 2005). This decrease in emissions is consistent with TMPO's draft RTP and EIS (Tahoe Metropolitan Planning Organization, 2012a, b), which note the reduction of VMT from the TransCAD model outputs. For other source categories, average growth in CO_2e emissions from 2005 is 7% for 2020 and 10% for 2035.

Table 3-4. Future-year GHG emissions for 2020 by source category for each TMPO alternative.

Type	Sector	Category	2005	2020				
				Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Direct	Transportation	On-road mobile sources	325,282	281,319	283,351	280,867	291,405	296,932
		Recreational boats	22,403	29,834	29,834	29,834	29,834	29,834
		Other off-road equipment	53,860	54,458	55,798	55,583	56,934	57,591
	Fuel combustion	Wood combustion	97,700	105,431	107,397	110,752	109,420	110,522
		Natural gas combustion	236,232	250,520	255,749	261,663	260,838	263,776
		Other combustion	5,858	6,322	6,445	6,656	6,573	6,639
	Fires	Wildfires and prescribed burns	4,284	47,968	47,968	47,968	47,968	47,968
	Land use	Livestock	12,734	12,734	12,734	12,734	12,734	12,734
	Waste	Wastewater treatment	57	62	63	65	64	65
Indirect	Energy	Electricity consumption	487,553	505,661	516,913	523,698	527,289	533,887
		Wastewater treatment	2,115	2,282	2,327	2,403	2,373	2,397
		Aircraft	5,131	5,304	5,304	5,304	5,304	5,304
	Waste	Municipal solid waste	110,512	29,814	30,397	31,392	30,997	31,309
		Wastewater treatment	12	14	14	14	14	15
Total			**1,363,734**	**1,331,722**	**1,354,294**	**1,368,933**	**1,381,747**	**1,398,972**

Table 3-5. Future-year GHG emissions for 2035 by source category for each TMPO alternative.

Type	Sector	Category	2005	2035				
				Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Direct	Transportation	On-road mobile sources	325,282	315,870	312,293	318,863	331,985	342,004
		Recreational boats	22,403	35,767	35,767	35,767	35,767	35,767
		Other off-road equipment	53,860	55,785	56,849	57,038	57,902	58,823
	Fuel combustion	Wood combustion	97,700	106,492	110,370	115,026	113,946	114,272
		Natural gas combustion	236,232	254,181	262,605	271,406	270,456	272,165
		Other combustion	5,858	5,423	6,629	6,922	6,854	6,874
	Fires	Wildfires and prescribed burns	4,284	47,968	47,968	47,968	47,968	47,968
	Land use	Livestock	12,734	12,734	12,734	12,734	12,734	12,734
	Waste	Wastewater treatment	57	62	65	68	67	67
Indirect	Energy	Electricity consumption	487,553	515,457	529,849	541,715	543,470	548,809
		Wastewater treatment	2,115	2,305	2,393	2,499	2,474	2,482
		Aircraft	5,131	6,239	6,239	6,239	6,239	6,239
	Waste	Municipal solid waste	110,512	30,114	31,264	32,644	32,324	32,421
		Wastewater treatment	12	14	15	15	15	15
Total			**1,363,734**	**1,388,412**	**1,415,041**	**1,448,902**	**1,462,200**	**1,480,641**

4. Conclusions and Recommendations

To address a fundamental knowledge gap regarding direct and indirect GHG emissions in the Lake Tahoe region, we used regional GHG inventories for baseline years of 2005 and 2010 and future years of 2020 and 2035. Local activity data was collected to be used to estimate baseline emissions for various source sectors and forecasts data that could be used to project baseline estimates to the future years of interest. Key findings from the work are summarized below:

- Basin-wide CO_2e emissions total 1,363,734 metric tons in 2005, and these emissions increased by 5% to 1,433,374 metric tons in 2010.
- The energy sector (i.e., electricity usage) is the single largest source of GHG emissions in the Basin-wide inventories, accounting for 36% of total CO_2e emissions in 2005 and 39% in 2010.
- On-road motor vehicles are the second-largest source of CO_2e emissions in the Basin, accounting for 30% of total CO_2e emissions in 2005 and 27% in 2010.
- The top three sectors (energy, transportation, and fuel combustion) account for over 90% of CO_2e emissions in both 2005 and 2010.
- The California side of the Basin is responsible for 69% and 73% of the baseline emissions for 2005 and 2010, respectively. The City of South Lake Tahoe accounts for 32% of total emissions in 2005 and 30% of total emissions in 2010.
- GHG emission changes from 2005 to 2020 range from -2% to 3%, and changes from 2005 to 2035 range from 2% to 9%.
- Alternatives 1 and 2 have the lowest forecasted GHG emission levels for 2020 and 2035. Alternative 1, the BAU scenario, extends the current plan, relies on existing land use zoning, and would authorize no additional development rights or allocations beyond those authorized in the 1987 RTP.
- From 2005 to 2020, on-road mobile source emissions decreased by 9% to 14% across the various forecast scenarios. From 2005 to 2035, emissions decreased by 2% to 4% for scenarios 1 through 3, while emissions for scenarios 4 and 5 increased by 2% and 5% respectively.

These findings identify the major sources of GHG emissions within the Basin and provide a starting point for setting reduction targets and identifying potential mitigation strategies that can be implemented to meet those reduction targets in the future. Going forward, we offer the following recommendations for improving these inventories:

- As part of Mobility 2035, the Lake Tahoe Regional Transportation Plan Update, an integrated model that converts travel demand model output to EMFAC2011, is being developed. This model will produce CO_2 estimates for on-road mobile sources (Norberg, 2012). Results from this model should be compared to inventory results presented here to ensure the consistency of emission estimates for on-road mobile sources.

- For the baseline inventories, high-quality activity data for some categories were more readily available for the California side of the Basin than the Nevada side. For example, electricity consumption from Nevada Energy was only available at the regional (multi-county) level. As a result, improved Nevada data should be incorporated into inventory estimates should such data become available in the future.
- Fire activity in the Basin is highly variable from year-to-year. As a result, consideration should be given to developing a "typical year" baseline inventory that could be used for comparisons to emissions resulting from planned burning projected to occur in future years.
- Limited information is available on future-year prescribed burning plans and goals; therefore, baseline fire emissions were held constant for future years (based on the average emissions from 2005 and 2010). Better future-year estimates of fire emissions should be developed as information becomes available.

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Appendix A

Detailed Activity Data and Emissions Factors by Source Sector

This appendix provides detailed information on the activity data and emission factors that were used to calculate GHG emissions for each source category in the Tahoe Basin, as well as information on the data that were used to allocate Basin-wide emissions to individual jurisdictions (i.e., counties and the City of South Lake Tahoe).

A.1 Activity Data for Spatial Allocation

Table A-1 summarizes population, households, and employment for the Lake Tahoe Basin by geographic jurisdiction. These data were provided by TRPA for the base years of 2005 and 2010.

Table A-1. Population, households, and employment by region (provided by TRPA).

Region	Population		Households		Employment	
	2005	2010	2005	2010	2005	2010
Carson	0	0	0	0	0	0
Douglas	5,556	5,370	2,390	2,334	12,206	6,516
Washoe	7,684	7,765	3,201	3,262	5,031	3,795
El Dorado (unincorporated)	7,848	9,610	2,902	3,581	484	550
South Lake Tahoe	20,893	22,854	8,351	9,277	7,536	8,191
Placer	9,108	8,874	3,763	3,693	3,626	3,553
California	37,849	41,338	15,016	16,551	11,646	12,294
Nevada	13,240	13,135	5,591	5,596	17,237	10,311
Total	**51,089**	**54,473**	**20,607**	**22,147**	**28,883**	**22,605**

A.2 On-Road Mobile Sources

For on-road mobile sources, emissions were calculated using VMT data from TRPA's TransCAD travel demand model, fleet mix and fuel economy data from ARB's EMFAC2007 model, and emissions factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008) (see **Table A-2**). VMT data from TransCAD are not vehicle specific; therefore, output from the EMFAC2007 model was used to determine

what fraction of the VMT is attributable to gasoline and diesel vehicles and also to determine the average fuel economy (miles per gallon) of gasoline and diesel vehicles.

Table A-2. Summary by year and fuel type of the fleet characteristics and corresponding emission factors for the Lake Tahoe Basin.

Year	Fuel Type	Fleet Characteristics		Emission Factors		
		VMT Fraction	MPG	CO_2 (metric tons / gallon)	CH_4 (metric tons / mile)	N_2O (metric tons / mile)
2005	Gasoline	0.95	16.7	0.00881	4.55×10^{-8}	5.56×10^{-8}
	Diesel	0.05	7.5	0.01015	3.57×10^{-9}	3.56×10^{-9}
2010	Gasoline	0.93	16.0	0.00881	4.55×10^{-8}	5.56×10^{-8}
	Diesel	0.07	9.8	0.01015	3.57×10^{-9}	3.56×10^{-9}
2020	Gasoline	0.93	16.6	0.00881	4.55×10^{-8}	5.56×10^{-8}
	Diesel	0.07	8.9	0.01015	3.57×10^{-9}	3.56×10^{-9}
2035	Gasoline	0.92	16.7	0.00881	4.55×10^{-8}	5.56×10^{-8}
	Diesel	0.08	8.7	0.01015	3.57×10^{-9}	3.56×10^{-9}

Basin-wide on-road vehicle activity data (miles/day) was provided by TRPA for the base years of 2005 and 2010 (see **Table A-3**). Following SB 375 guidance on assigning VMT to various regions across California, GHG emissions from mobile sources should be estimated based on VMT from all internal-internal trips (trips that start and end in the Basin) and half of the internal-external trips (trips that start in the Basin and end outside or vice versa). VMT from all external-external trips (those that start and end outside the Basin) should be excluded (Regional Targets Advisory Committee, 2009). This formula was used to derive the GHG VMT value shown in Table A-3; **Figure A-1** shows the breakdown of VMT by trip type that was used for all calculations (Tahoe Metropolitan Planning Organization, 2012b).

Table A-3. VMT (miles/day) by region and year (provided by TRPA).

Region	2005	2010
Carson	71,265	67,192
Douglas	425,785	416,276
Washoe	295,067	313,294
El Dorado (Unincorporated)	485,974	405,581
South Lake Tahoe	398,209	352,739
Placer	403,549	429,540
Tahoe Total	2,079,849	1,984,623
GHG VMT Total	1,539,088	1,459,299

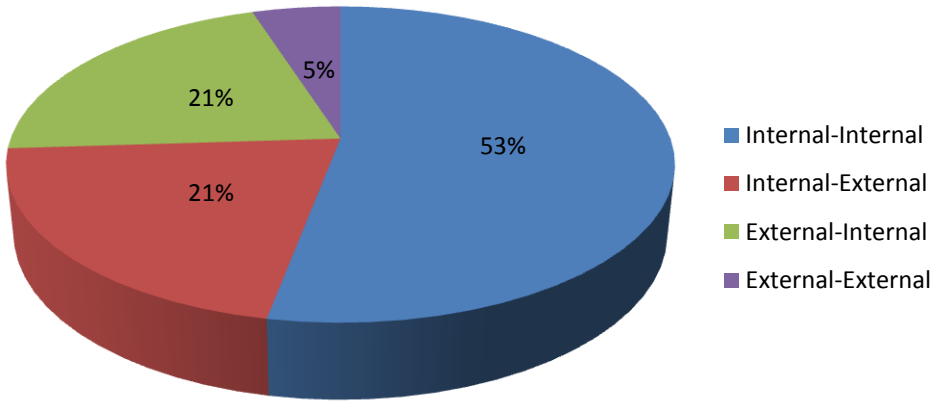

Figure A-1. Breakdown of VMT by trip type.

A.3 Recreational Boats

For recreational boats operating in Lake Tahoe, emissions were estimated using fuel consumption activity from TRPA and emission factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008) (see **Table A-4**).

Table A-4. Emission factors for ships and boats by fuel type (metric tons/gallon).

Fuel Type	CO_2	CH_4	N_2O
Gasoline	8.81×10^{-3}	6.40×10^{-7}	2.20×10^{-7}
Diesel	1.02×10^{-2}	7.40×10^{-7}	2.60×10^{-7}

Table A-5 shows the fuel estimates from a TRPA EIS for the Lake Tahoe Shorezone (Tahoe Regional Planning Agency, 2006). The EIS provided fuel use for 2004 and the future year of 2027 and hours used for 2004 and 2010. For 2010, fuel use was estimated by multiplying the hours used by the gallons/hour based on the 2004 data. Fuel use for 2005 was interpolated between 2004 and 2010.

Table A-5. Total fuel consumption in the Basin by fuel types provided by TRPA (gallons).

Fuel Type	2004	2005	2010
Gasoline	2,639,068	2,509,272	1,781,440
Diesel	3,884	8,884	15,072

A.4 Aircraft

Aircraft emissions were estimated for the Lake Tahoe airport using fuel data collected for 2010 and emissions factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008) (see **Table A-6**).

Table A-6. Emission factors by fuel type (metric tons/gallon).

Fuel Type	CO_2	CH_4	N_2O
Jet Fuel	9.57×10^{-3}	2.70×10^{-4}	3.10×10^{-7}
Aviation Gasoline	8.32×10^{-3}	7.04×10^{-3}	1.10×10^{-7}

Fuel consumption for jet fuel and aviation gasoline was provided by the airport's fuel vendor for 2009 and 2010 (Golden, 2011). For 2005, the airport used a different fuel vendor and the fuel consumption data were unavailable. Therefore, 2005 fuel consumption was estimated by scaling the 2010 fuel consumption using airport traffic activity (number of flights) from the FAA.[14] According to the airport fuel vendor, 95% of the fuel sold at the airport is jet fuel. Using this breakdown, emissions were calculated for each fuel type by multiplying fuel consumption with the appropriate emissions factor and relative percentage of use. **Table A-7** summarizes the fuel consumption (gallons) for jet fuel and aviation gasoline for the Lake Tahoe airport.

Table A-7. Fuel sales data for the Lake Tahoe airport and number of flights.

Activity	2005	2010
Flights	24,662	22,777
Fuel sales (gallons)	229,279	211,754

A.5 Other Off-Road Equipment

For all other off-road equipment, ARB's OFFROAD2007 model was run for the base years of 2005 and 2010 (see **Table A-8**). Annualized emissions for off-road vehicles[15] were calculated by multiplying the daily emissions by 365. These emissions only represent the California portion of the Basin. Therefore, in keeping with previous emissions inventory development for the Basin conducted by the DRI (Gertler et al., 2008), emissions for the California side were scaled up to account for the Nevada side of the Basin using the ratio of Basin-wide population for California and Nevada to the population of the California side of the Bain only. A population scaling factor of 1.32 was calculated using population data from TRPA. Emissions were allocated to geographic jurisdiction using population estimates.

[14] Airport traffic activity data available from the FAA website (http://aspm.faa.gov/main/taf.asp).
[15] Emissions from pleasure craft were excluded since they are calculated separately.

Table A-8. Daily emission from OFFROAD2007 (metric tons/day).

Class	CO_2		CH_4		N_2O	
	2005	2010	2005	2010	2005	2010
Construction and Mining Equipment	73.18	79.33	0.01	0.01	0.00	0.00
Entertainment Equipment	0.09	0.09	0.00	0.00	0.00	0.00
Industrial Equipment	9.34	10.51	0.01	0.00	0.00	0.00
Lawn and Garden Equipment	3.41	3.74	0.01	0.01	0.00	0.00
Light Commercial Equipment	5.09	5.72	0.00	0.00	0.00	0.00
Logging Equipment	17.98	17.98	0.01	0.00	0.00	0.00
Other Portable Equipment	0.13	0.13	0.00	0.00	0.00	0.00
Railyard Operations	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Equipment	2.88	3.65	0.03	0.03	0.00	0.00
Transport Refrigeration Units	7.01	8.99	0.00	0.00	0.00	0.00
Total	**119.10**	**130.13**	**0.06**	**0.06**	**0.01**	**0.01**

A.6 Wood Combustion

Wood fuel combustion was calculated using wood burning activity estimates from a local wood burning survey (Kuhns et al., 2004), data on the annual number of households and visitors, and emissions factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008).

Wood combustion emission factors for wood combustion are in kilograms per Million British Thermal Unit (kg/MMBtu). Since fire activity data is the mass of wood burned, the emission factors were converted to metric tons per Mega-gram wood (metric tons/Mg wood) for each pollutant using the default wood moisture of 12% and wood heat content of 15.38 MMBtu per ton of wood burned from the reporting protocol (see **Table A-9**).

Table A-9. Default wood moisture, heat content, and CO_2 equivalent emission factors by pollutant.

Wood Moisture	Wood Heat Content (MMBtu/ton)	Emission Factor (kg CO_2e /MMBtu)			Emission Factor (metric tons CO_2e/Mg wood)		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
12%	15.38	93.86	0.32	0.004	1.6	0.005	0.00006

A local study of PM source characterization in Lake Tahoe, estimates a wintertime wood burn rate of 450 Mg wood/day (120 days in winter) and a summertime wood burn rate of 29 Mg wood/day (90 days in the summer) (Kuhns et al., 2004); see **Table A-10**. It was assumed that for 2005, burn rates were similar to 2004 rates. For 2010, the amount of wood burned in 2005 was scaled using household and visitor growth rates from 2005 and 2010. Emissions from

wood consumption were then allocated to geographic jurisdictions based on the number of households that use wood to primarily heat their homes, which was collected from the 2000 U.S. Census (U.S. Census Bureau, 2000); see **Table A-11**.

Table A-10. Wood consumption by fire type (Mg/year).

Type	2005	2010
Residential Fires	54,000	57,577
Campfires	2,610	2,397
Total	**56,610**	**59,974**

Table A-11. Households primarily heated with wood by region.

Region	Households
Carson	-
Douglas	68
Washoe	35
El Dorado	503
Placer	403
Total	**1,009**

A.7 Natural Gas Fuel Combustion

Natural gas fuel combustion emissions were calculated using fuel consumption activity from local utilities and emissions factors from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008); see **Table A-12**.

Table A-12. Emission factors for natural gas combustion (metric tons/MMBtu). (California Climate Action Registry, 2008) (California Climate Action Registry, 2008)

Fuel	CO_2	CH_4	N_2O
Natural Gas	53.06	0.005	0.0001

For most of the Basin, Southwest Gas is the primary provider of natural gas to residential and commercial customers. Southwest Gas (Rader, 2011) provided activity data for total consumption (therms)[16] for residential and commercial gas use for Placer, Washoe, and Douglas counties, and for the City of South Lake Tahoe (see **Table A-13**). Residential natural gas consumption rates, derived from the Southwest Gas data, were applied to the number of households in the unincorporated portion of El Dorado County to estimate residential fuel

[16] 10 therms = 1MMBtu

usage. Similarly, commercial fuel use for the unincorporated portion of El Dorado County was derived based on the ratio of residential to commercial usage from the data provide by Southwest Gas. This step was required because PG&E, the utility serving this portion of El Dorado County, did not provide activity data in time for use in this inventory.

Table A-13. Natural gas usage by region from Southwest Gas.

Region	Usage (therms)			
	2005		2010	
	Res.	Com.	Res.	Com.
Carson	-	-	-	-
Douglas	2,348,038	389,491	1,825,502	423,039
Washoe	7,443,001	2,000,356	7,041,221	2,331,298
El Dorado (unincorporated)	2,742,987	664,875	3,277,281	897,215
South Lake Tahoe[a]	13,795,666	6,603,333	14,253,781	6,960,074
Placer	6,790,702	1,629,419	7,074,904	1,609,971
Nevada Total	9,791,039	2,389,847	8,866,723	2,754,337
California Total	23,329,355	8,897,627	24,605,966	9,467,260
Tahoe Total	**33,120,394**	**11,287,474**	**33,472,689**	**12,221,597**

[a] Usage for the City of South Lake Tahoe is from 2006 as this is the closest complete year. Usage from 2006 to 2010 varies little and ranges from 1,079 to 1,126 therms per year.

A.8 Other Fuel Combustion

Emissions from home heating fuel combustion of propane (LPG) and distillate oil were calculated based on (1) the number of households using these fuels to heat their homes and (2) emissions factors (see **Table A-14**) from the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008).

Table A-14. Emission factors for LPG (metric tons/Btu).

Fuel Type	CO_2	CH_4	N_2O
LPG	6.3×10^{-8}	1.1×10^{-11}	6.0×10^{-13}
Distillate Oil	7.3×10^{-8}	8.0×10^{-13}	3.0×10^{-13}

In the absence of detailed consumption data, the EPA recommends that consumption can be estimated using the number of HDDs[17] in the region for the year of interest, the number of households using the fuel to heat their homes, and an average household consumption rate

[17] HDDs provide a representation of how cold a region's average temperature was over some period of interest and are calculated as the difference between a day's average temperature and some base temperature (e.g., 65°F).

per HDD (U.S. Environmental Protection Agency, 2009). The number of households using LPG and distillate oil as their primary home heating source from the 2000 U.S. Census (U.S. Census Bureau, 2000) was scaled to 2005 and 2010 using the household growth rate from 2005 to 2010 (see **Table A-15**). Heat consumption for the Basin was then calculated by multiplying the number of households using LPG and distillate oil as their primary home heating source with the Basin annual average HDD value of 7,882[18] and the average household consumption rate of 11,647 BTU/HDD.

Table A-15. Households using LPG as their primary home heating source by region.

Region	Fuel Type					
	LPG			Distillate Oil		
	2000	2005	2010	2000	2005	2010
Carson City	-	-	-	-	-	-
Douglas	191	185	178	70	68	65
Washoe	39	39	40	32	32	33
El Dorado (including South Lake Tahoe)	414	468	528	26	29	33
Placer	166	162	158	23	22	22
Nevada Total	230	224	218	102	100	98
California Total	580	629	686	49	52	55
Tahoe Total	**810**	**853**	**904**	**151**	**152**	**153**

A.9 Wildfires and Prescribed Burns

Emissions from wildfires and prescribed burns are a function of the type and amount of vegetation consumed by each fire event. Previously, STI generated a national inventory of CO_2 emissions from fires using the BlueSky Smoke Modeling Framework, a system developed by STI and the USDA Forest Service (Raffuse et al., 2008). The BlueSky system reconciles satellite fire detections with ground-based reports to estimate the area burned by each fire event, then uses detailed land cover data, fuel consumption algorithms, and emission factors to calculate the type and amount of vegetation burned and the resulting emissions. The BlueSky system includes the SmartFire model (Raffuse et al., 2009), a geospatial processing tool that aggregates and reconciles information about when and where fires occur.

In addition, CalFire maintains a GIS database of fire history as part of its FRAP. The CalFire data is available for historical years back to 1990 and were used to verify BlueSky data and evaluate fire trends.

The BlueSky/SmartFire system was used to develop activity data for 2005 and 2010 for major wildfires and large prescribed burns. For smaller prescribed fires (e.g., pile burns) that

[18] Annual average HDD for the Basin was calculated using a climate summary from the South Lake Tahoe airport for the years 2000 to 2008 (http://www.wrcc.dri.edu/summary/tvl.ca.html).

are not captured by SmartFire, activity data were derived from the Lake Tahoe Fuel Reduction Plans (LTFRP) (USDA Forest Service, 2012) and other sources that describe forest management and fire activities in the Basin (USDA Forest Service, 2012) and (Osborn, 2012); see **Table A-16**.

Table A-16. Acres burned and number of piles by region from SmartFire and LTFRP.

Region	2005		2010	
	SmartFire (acres burned)	LTFRP (# of piles)	SmartFire (acres burned)	LTFRP (# of piles)
Carson	-	-	-	-
Douglas	-	162	1,000	400
Washoe	-	-	-	-
El Dorado (unincorporated)	-	365	400	900
South Lake Tahoe	-	-	-	-
Placer	-	162	949	400
Nevada Total	-	162	1,000	400
California Total	-	527	1,349	1,300
Total	**-**	**689**	**2,349**	**1,700**

BlueSky only estimates CO_2 emissions; therefore, using EPA guidance (U.S. Environmental Protection Agency, 2011), the CO_2 emissions were scaled by 0.0001641 to calculate N_2O and by 0.0029813 to calculate CH_4

A.10 Livestock

Emissions from livestock were based on ARB estimates of animal populations in the Basin and emission factors for each animal type from EPA GHG guidance documents (U.S. Environmental Protection Agency, 2009) (see **Table A-17**).

ARB produces refined livestock population estimates by county and air basin (Reid et al., 2008). They combine statewide summaries of livestock populations from the annual Agricultural Resource Directory for dairy and beef cows published by the California Department of Food and Agriculture and the Agricultural Census developed by the USDA, providing populations for other animal types (e.g. swine, sheep, horses, and goats). **Table A-18** summarizes the livestock population from the 2003 ARB livestock population report[19] for the Basin; these populations were held as being constant for 2005 and 2010.

[19] Data summarized from the ARB livestock population report (http://www.arb.ca.gov/ei/areasrc/lstkpopmeth.pdf).

Table A-17. Emission factors by livestock category (metric tons/head-year).

Category		CH_4	N_2O
Dairy Cattle	Young Heifers	6.70×10^{-2}	5.96×10^{-3}
	Calves	4.50×10^{-2}	5.96×10^{-3}
Range Cattle	Beef Cows	9.40×10^{-2}	2.54×10^{-3}
	Beef Bulls	5.30×10^{-2}	2.54×10^{-3}
	Beef Heifers	5.90×10^{-2}	2.54×10^{-3}
	Beef Calves	5.90×10^{-2}	2.54×10^{-3}
	Stockers	5.80×10^{-2}	2.54×10^{-3}
Poultry	Broilers	-	2.36×10^{-4}
	Layer & Pullets	-	2.36×10^{-4}
	Turkeys	-	8.74×10^{-4}
Other	Swine	1.50×10^{-3}	3.81×10^{-6}
	Sheep	8.00×10^{-3}	-
	Horses	1.80×10^{-2}	-
	Goats	5.00×10^{-3}	-

Table A-18. Livestock population in 2005 by region and category (number of head).

Category		El Dorado	Placer	Total
Dairy Cattle	Young Heifers	38	184	222
	Calves	75	367	442
Range Cattle	Beef Cows	549	1,000	1,549
	Beef Bulls	25	45	70
	Beef Heifers	99	179	278
	Beef Calves	230	418	648
	Stockers	83	406	489
Poultry	Broilers	55	91	146
	Layer & Pullets	150	289	439
	Turkeys	210	11,570	11,780
Other	Swine	23	26	49
	Sheep	261	329	590
	Horses	194	237	431
	Goats	46	53	99

A.11 Solid Waste

Emission estimates for solid waste were calculated using data on solid waste generation from local utilities, waste composition percentages developed by CalRecycle (Cascadia Consulting Group, 2009), and the solid waste module in the ICLEI's CACP software. Total

municipal solid waste (MSW) quantities were collected for the Basin for 2005 and 2010 from South Tahoe Refuse, which provided data on MSW produced from the City of South Lake Tahoe, El Dorado County, and Douglas County. For the northern portion of the Basin, Tahoe Truckee Sierra Disposal manages the collection of solid waste; however, they were unable to provide data in time for use in this project. Therefore, waste generation was calculated for Washoe and Placer Counties using the average per-capita waste generation rates from the counties for which data were available. **Table A-19** shows total solid waste by jurisdiction and year.

Table A-19. Solid waste generated by region (tons/year).

Region	2005	2010
Carson	-	-
Douglas	35,213	17,116
Washoe	23,051	23,295
El Dorado (unincorporated)	16,226	20,207
South Lake Tahoe	63,636	72,676
Placer	27,324	26,622
Nevada Total	58,264	40,411
California Total	107,186	119,504
Total	**165,450**	**159,915**

Table A-20 shows the waste composition percentages derived from CalRecycle data that were used in the CACP software. For the year 2005, a methane capture efficiency of zero was used in the CACP software, as Lockwood had not installed a methane recovery system at that time. For the year 2010, a methane capture efficiency of 75% was used (Ling-Barnes, 2010).

Table A-20. Waste composition percentages from CalRecycle.

CACP Waste Type	Percentage
Paper Products	17.3%
Food Waste	15.5%
Plant Debris	10.8%
Wood or Textiles	17.3%
Other	39.1%

A.12 Wastewater Treatment

All four of the treatment plants that process the Basin's wastewater treat the water aerobically, producing no methane emissions and only small amounts of N_2O. N_2O emissions estimates from these wastewater treatment plants were calculated based on population using guidance from the IPCC greenhouse gas emissions inventories documentation (Intergovernmental Panel on Climate Change, 2006). N_2O emissions from wastewater treatment processes were calculated as shown in **Equation 2**.

$$N_2O = \text{Population} \times \text{Protein fraction} \times \text{Emissions factor} \quad \textbf{(2)}$$

An emissions factor of 3.5274×10^{-6} tons of N_2O per person per year was used along with a default protein fraction of 1.25, which represents the amount of food waste that may have been washed down the drain.

For direct GHG emissions estimated for the three facilities in the Basin, emissions were assigned to each facility based on the population of the area it serves (see Figure 2-6). For the Truckee facility, which lies outside the Tahoe Basin, a portion of N_2O emissions and GHG emissions resulting from electricity consumption at that facility were treated as indirect sources for the Basin-wide inventory. The portion of the Truckee facility's emissions included as an indirect source in the inventory was based on the percentage of the facility's annual waste that comes from the Basin (35%). This percentage and annual electricity consumption at the Truckee treatment plant were obtained from staff at that facility.

A.13 Energy

Natural gas fuel combustion emissions were calculated using fuel consumption activity from local utilities (Liberty Energy and Nevada Energy) and emission factors from local utilities and the California Climate Action Registry's general reporting protocol (California Climate Action Registry, 2008); see **Table A-21**.

Table A-21. Emission factors (metric tons/KWh) for energy consumption.

Year	CO_2	CH_4	N_2O
2005	7.52×10^{-4}	1.36×10^{-8}	3.67×10^{-8}
2010	8.18×10^{-4}	1.28×10^{-8}	2.83×10^{-9}

Historically, electricity for the California and Nevada sides of the Basin has been provided by Sierra Pacific Power Company and Nevada Energy, respectively. However, Sierra Pacific Power was recently sold to Liberty Energy Utilities Company, and the customers previously served by Sierra Pacific are now served by a subsidiary of Liberty Energy known as California Pacific Electric Company.

To estimate GHG emissions from electricity consumption on the California side of the Basin, we obtained usage data (KWh) for commercial, government, and residential activity from Liberty Energy. These data covered the unincorporated portion of El Dorado County, the City of South Lake Tahoe, and Placer County. For the Nevada side of the Basin, electricity consumption for residential and commercial activity was obtained from Nevada Energy. However, the data represented a service area that includes most of western Nevada (they were unable to provide data at a smaller spatial geographic level). Therefore, for Douglas and Washoe counties, energy consumption was estimated using county-level population and default electricity consumption rates (KWh/person) for 2005 and 2010 from the California Energy

Commission's (CEC) energy almanac[20] (see **Tables A-22 and A-23**).

In addition to residential and commercial energy use, energy consumption by wastewater treatment plants was considered. There are three plants in the Basin, but their energy use is captured in the data provided by Liberty Energy. However, portions of the north shore send their waste to a treatment plant in Truckee. Energy consumption for the Truckee plant was provided by the Tahoe-Truckee Sanitation Agency (Parker, 2011), and this plant was treated as an indirect source in the inventory. Since only 35% of the wastewater treated at the plant is from the Basin, the total energy consumption from the plant (7,800,000 KWh) was scaled down to represent the energy used to treat the Basin's wastewater.

Table A-22. Total energy consumption in the Basin for 2005 (KWh).

Region	Wastewater Treatment	Other		
		Residential	Commercial	Total
	2005			
Carson	-	-	-	-
Douglas	-	45,032,562	42,961,768	87,994,330
Washoe	-	62,277,127	59,413,352	121,690,478
El Dorado	-	50,508,001	27,725,315	78,233,316
South Lake Tahoe	-	77,296,460	122,458,783	199,755,243
Placer	2,808,000	80,272,646	79,398,687	159,671,333
Nevada Total	-	107,309,689	102,375,119	209,684,808
California Total	2,808,000	208,077,107	229,582,785	437,659,892
Total	**2,808,000**	**315,386,795**	**331,957,905**	**647,344,700**

Table A-23. Total energy consumption in the Basin for 2010 (KWh).

Region	Wastewater Treatment	Other		
		Residential	Commercial	Total
	2010			
Carson	-	-	-	-
Douglas	-	42,539,653	40,583,493	83,123,146
Washoe	-	61,512,180	58,683,580	120,195,760
El Dorado	-	54,753,474	29,303,393	84,056,867
South Lake Tahoe	-	80,729,417	126,006,353	206,735,770
Placer	2,808,000	86,459,092	106,185,396	192,644,488
Nevada Total	-	104,051,833	99,267,074	203,318,906
California Total	2,808,000	221,941,983	261,495,142	483,437,125
Total	**2,808,000**	**325,993,815**	**360,762,215**	**686,756,031**

[20] Data from the CEC's energy almanac are available from the following website: http://www.energyalmanac.ca.gov/electricity/us_per_capita_electricity-2010.html

A.14 Forestry Carbon Stocks

To determine the quantity of forest in the Tahoe region, we relied on the COLE2 database, which is maintained by the FIA program as a record of the health of forests in the United States. The number and size of the trees in various forests are recorded into the COLE2 database by manual surveys of the forests. Due to resource limitations, these plots are usually subdivided and only a portion of the plot is surveyed during a select year; then the data for that parcel are used to estimate the carbon stock for the rest of the plot. For the next year, another portion of the plot may be estimated and those results are used to make a new estimate of the carbon stock for the plot (which could vary significantly from the previous year due to fires or other activity in the plot).

Because of this process, the tree carbon data obtained from the COLE2 database were averaged over a 10-year period to create a single baseline scenario. The tree carbon data were converted to CO_2 stock in metric tons by multiplying total carbon by 3.76, which is the ratio of the molar weight of CO_2 to the molar weigh of carbon. **Table A-24** summarizes the 10-year average tree carbon (metric tons) for the Basin by geographical jurisdictions.

Table A-24. Total tree carbon (metric tons) by geographic jurisdiction.

Region	2005
Carson	32,777
Douglas	117,240
Washoe	2,422
El Dorado (Unincorporated)	392,749
South Lake Tahoe	0
Placer	138,246
Nevada Total	152,439
California Total	530,995
Total	**683,434**

Appendix B

Emissions Summary by Greenhouse Gas Pollutant

Each GHG differs in its ability to absorb heat in the atmosphere. Non-CO_2 emissions data are converted to CO_2e values based on each GHG's GWP.[21] N_2O has a GWP of 310 (it absorbs 310 times more heat per molecule than carbon dioxide) and CH_4 has a GWP of 21. Total CO_2e emissions are summed across all pollutants. **Tables B-1 and B-2** summarize GHG emissions by pollutant and the resulting total CO_2e for each source category. Values in tables B-1 and B-2 are rounded to the nearest whole number. Many values were less than 1 and were not included in the table. Total CO_2e calculations included decimals and unlisted values less than 1.

Table B-1. 2005 baseline emissions (metric tons/year) by pollutant and CO_2e for each source category.

Type	Source Sector	Source Category	2005			
			CO_2	N_2O	CH_4	CO_2e
Direct	Transportation	On-road mobile sources	315,740	29	24	**325,282**
		Recreational boats	22,197	1	2	**22,403**
		Other off-road equipment	52,056	4	28	**53,860**
	Fuel combustion	Wood combustion	90,081	4	303	**97,700**
		Natural gas combustion	235,628	0	22	**236,232**
		Other combustion	5,820	0	1	**5,858**
	Fires	Wildfires and prescribed burns	3,848	1	11	**4,284**
	Land use	Livestock	-	22	280	**12,734**
	Waste	Wastewater treatment	-	0	-	**57**
Indirect	Energy	Electricity consumption	486,631	2	9	**487,553**
		Wastewater treatment	2,111	0	0	**2,115**
	Transportation	Aircraft	2,180	0	140	**5,131**
	Waste	Municipal solid waste	-	-	5,262	**110,512**
		Wastewater treatment	-	0	-	**12**
Total Emissions			**1,216,292**	**63**	**6,082**	**1,363,734**

[21] GWP is an index developed by the(IPCC to quantify the relative radiative forcing effects of a given GHG using CO_2 as the reference gas (California Climate Action Registry, 2009).

Table B-2. 2010 baseline emissions (metric tons) by pollutant and CO_2e for each source category.

Type	Source Sector	Source Category	2010			
			CO_2	N_2O	CH_4	CO_2e
Direct	Transportation	On-road mobile sources	295,231	28	23	**304,348**
		Recreational boats	15,847	0	1	**15,994**
		Other off-road equipment	56,878	4	26	**58,751**
	Fuel combustion	Wood combustion	96,165	4	324	**104,297**
		Natural gas combustion	242,454	0	23	**243,075**
		Other combustion	6,120	0	1	**6,161**
	Fires	Wildfires and prescribed burns	82,312	14	245	**91,652**
	Land use	Livestock	-	22	280	**12,734**
	Waste	Wastewater treatment	-	0	-	**62**
Indirect	Energy	Electricity consumption	561,757	2	9	**562,543**
		Wastewater treatment	2,297	0	0	**2,300**
	Transportation	Aircraft	2,013	0	129	**4,739**
	Waste	Municipal solid waste	-	-	1,272	**26,704**
		Wastewater treatment	-	0	-	**12**
Total Emissions			**1,361,074**	**75**	**2,333**	**1,433,374**

Appendix B

Greenhouse Gas Emission Reductions Calculations

Energy Efficiency and Renewable Energy Actions

Green Building Ordinance (Region-wide)	Portion of Inventory Affected (MT/yr)	Legislative Reduction	Adjusted Affected Inventory	% of development	Measure Performance	GHG Reduction
15% improvement over building code energy standards (applied to new development over 10 units or 10,000 square feet)						
Reduction in 2020						
Residential	12,535	7.28%	11,623	90%	15%	1,569
Nonresidential	11,773	10.24%	10,567	90%	15%	1,427
Reduction in 2035						
Residential	32,772	7.61%	30,278	90%	15%	4,088
Nonresidential	28,635	11.05%	25,471	90%	15%	3,439

	2020			2035		
	Residential	Nonresidential	Total	Residential	Nonresidential	Total
Placer	377	343	720	983	827	1810
El Dorado	172	156	328	448	377	824
South Lake Tahoe	558	507	1065	1453	1223	2676
Washoe	298	271	569	777	654	1430
Carson	0	0	0	0	0	0
Douglas	164	149	313	427	359	786
Regional Total			2,996			7,526

Property Assessed Clean Energy Financing Program (Region-wide)

Property Assessed Clean Energy Financing Program	Measure Performance	Sector (Residential Energy)	Participation Rate	Eligible Housing Stock	Scaled % Reduction	GHG Reduction	Aggregate GHG Reduction
2020	15%	54.9%	3%	90.3%	0.22%	2,067	2,067
2035	15%	54.2%	3%	84.8%	0.21%	1,979	4,046

	2020	2035
Placer	497	973
El Dorado	226	443
South Lake Tahoe	735	1439
Washoe	393	769
Carson	0	0
Douglas	216	422

Community Choice Aggregation Ordinance (CA)	Measure Performance	Adjusted Measure Performance	Participation Rate	Subsector (Electricity)	Scaled % Reduction	GHG reduction (MT CO2e/yr)	total
	100%	67.00%	5%	35%	1.2%	11,008	
2020	50%	17.00%	50%	35%	3.0%	27,931	38,939
	100%	67.00%	25%	35%	5.9%	56,791	
2035	50%	17.00%	50%	35%	3.0%	28,819	85,610

Community Choice Aggregation Ordinance (NV)	Measure Performance	Adjusted Measure Performance	Participation Rate	Subsector (Electricity)	Scaled % Reduction	GHG reduction (MT CO2e/yr)	total
	100%	78.00%	5%	31%	1.2%	4,067	
2020	50%	28.00%	50%	31%	4.3%	14,599	18,666
	100%	75.00%	25%	29%	5.4%	19,652	
2035	50%	25.00%	50%	29%	3.6%	13,101	32,753

	2020	**2035**
Placer	14,921	32,806
El Dorado	6,857	15,075
South Lake Tahoe	17,161	37,729
Washoe	10,937	19,190
Carson	0	0
Douglas	7,730	13,563
Regional Total	57,605	118,362

Renewable Energy in New Residential Development projects > 10 units and New Commercial Development >10,000 square feet (Region-wide)	Portion of eligible building stock	Participation Rate	Portion of GHG Inventory Affected (Electricity)	Legislative Reduction (Electricity)	Adjusted Inventory (Electricity)	Portion of GHG Inventory Affected (Natural Gas)	Legislative Reduction (Natural Gas)	Adjusted Inventory (Natural Gas)	Measure Performance	GHG reduction
2020	90.00%	100%	14,136	12.84%	12,321	10,172	0.42%	10,130	15%	3,031
2035	90.00%	100%	36,785	13.63%	31,771	24,622	0.53%	24,491	15%	7,595

	2020	**2035**
Placer	729	1,826
El Dorado	332	832
South Lake Tahoe	1,078	2,701
Washoe	576	1,444
Carson	-	-
Douglas	316	793
Regional Total	3,031	7,595

Water Conservation Actions

Water Conservation Standards in new development (Region-wide)	Portion of Inventory Affected (MT/yr)	Legislative Reduction	Adjusted Inventory	Measure Performance	Subsector (Indoor/Outdoor)	Subsector (R, NR)	Scaled % Reduction	GHG Reduction
2020	640	11.34%	568					
Nonresidential								
30% reduction in indoor water consumption				20%	62%	22%	2.7%	15
65% reduction in outdoor water consumption				60%	38%	22%	4.9%	28
Residential								
20% reduction in indoor water consumption				20%	61%	78%	9.6%	55
60% reduction in outdoor water consumption				65%	39%	78%	19.7%	112
Total (2020)								210
2035	1,542	12.26%	1,353					
Nonresidential								
30% reduction in indoor water consumption				20%	62%	22%	2.7%	36
65% reduction in outdoor water consumption				60%	38%	22%	4.9%	67
Residential								
20% reduction in indoor water consumption				20%	61%	78%	9.6%	130
60% reduction in outdoor water consumption				65%	39%	78%	19.7%	266
Total (2035)								500

	2020	2035
Placer	55	132
El Dorado	26	61
South Lake Tahoe	64	152
Washoe	38	90
Carson	0	0
Douglas	27	64

Water Conservation Actions

Water Meters (CA)	Proportion of Customers Affected	% of pre-1992 homes (unmetered)	# units metered during time period	% units metered	Measure Performance	Sector (water/waste water)	Scaled % Reduction	GHG Reduction
Water meters installed between prior to 2005	4.4%	93.5%	1,445	4.1%	20.0%	2.1%	0.0%	234
Water meters installed between 2005-2010	19.5%	92.2%	4,935	13.9%	20.0%	2.0%	0.1%	802
Water meters installed between 2010-2020	100%	89.5%	27,840	76.0%	20.0%	2.1%	0.3%	3,980
Reductions in 2035	100%	84.4%	4,935					5,016

South Tahoe Public Utility District Water Meter Account Information

	Metered	Not Metered	Total accounts	Proportion
2005	636	13,787	14,423	4.4%
2010	2,711	11,215	13,926	19.5%
2015	9,602	5,756	15,358	62.5%
2020	15,866	0	15,866	100.0%
2035	17,390	0	17,390	100.0%

Metering data from STPUD was applied to the measure analysis for all California customers.
STPUD projects that all customers will be metered by 2020. The same assumption was retained for all California customers
Source: South Tahoe Public Utility District Final 2010 Urban Water Management Plan (June 2011)

Water Meters (NV)	Proportion of Customers Affected	% of pre-1992 homes (unmetered)	# units metered during time period	% units metered	Measure Performance	Sector (water/waste water)	Scaled % Reduction	GHG Reduction
Water meters installed between prior to 2005	0.0%	0.0%	-		20.0%	2.1%	0.0%	-
Water meters installed between 2005-2010	0.0%	0.0%	-		20.0%	2.0%	0.0%	-
Water meters installed between 2010-2020	50%	100.0%	5,881	50.0%	20.0%	2.1%	0.2%	2,617
Water meters installed between 2020-2035	100%	100.0%	6,841	53.8%	20.0%	2.0%	0.2%	2,871

Based on population ratio by state

	2020	**2035**
Placer	1,139	1,139
El Dorado	1,106	1,106
South Lake Tahoe	2,771	2,771
Washoe	1,533	3,215
Carson	-	-
Douglas	1,084	2,273
Regional Total	7,633	10,504

Solid Waste Actions

Solid Waste Diversion - Placer County	Portion of Inventory Affected	Measure Performance	GHG Reduction
75 percent diversion from the waste stream by 2020	31,392	7.0%	363
90 percent diversion from the waste stream by 2035 100 percent diversion by 2040	32,644	22.0%	1,188
Diversion rate (2006)	68%		

Current diversion rates (2006): Placer County - 68%. Source: CalRecycle Jurisdiction Diversion/Disposal Rate Summary [1995 – 2006]. Available at: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversion.aspx.

Solid Waste Diversion - El Dorado County	Portion of Inventory Affected	Measure Performance	GHG Reduction
75 percent diversion from the waste stream by 2020	31,392	21.0%	683
90 percent diversion from the waste stream by 2035 100 percent diversion by 2040	32,644	36.0%	1,217
Diversion rate (2006)	54%		

Current diversion rates (2006): El Dorado County - 54%. Source: CalRecycle Jurisdiction Diversion/Disposal Rate Summary [1995 – 2006]. Available at: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversion.aspx.

Solid Waste Diversion - South Lake Tahoe	Portion of Inventory Affected	Measure Performance	GHG Reduction
75 percent diversion from the waste stream by 2020	31,392	26.0%	3,250
90 percent diversion from the waste stream by 2035 100 percent diversion by 2040	32,644	41.0%	5,330
Diversion rate (2006)	49%		

Current diversion rates (2006): South Lake Tahoe - 49%. Source: CalRecycle Jurisdiction Diversion/Disposal Rate Summary [1995 – 2006]. Available at: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversion.aspx.

Solid Waste Actions

Solid Waste Diversion - Washoe County	Portion of Inventory Affected	Measure Performance	GHG Reduction
75 percent diversion from the waste stream by 2020	31,392	43.0%	1,897
90 percent diversion from the waste stream by 2035	32,644	58.0%	2,661
100 percent diversion by 2040			
Diversion rate (2008)	32%		

Current diversion rates (2008): Washoe County - 32%. Source: Solid Waste Management Plan and Plan Element of the Regional Plan for Washoe County (2011). Available at: http://www.washoecounty.us/repository/files/4/Solid-Waste-Plan-4.pdf

Solid Waste Diversion - Douglas County	Portion of Inventory Affected	Measure Performance	GHG Reduction
75 percent diversion from the waste stream by 2020	31,392	21.2%	1,279
90 percent diversion from the waste stream by 2035	32,644	36.2%	2,272
100 percent diversion by 2040			
Diversion rate (2011)	53.8%		

Current diversion rates (2011): Douglas County - 53.8%. Source: Douglas Disposal and Recycling Services Available at: http://douglasdisposal.com/recycling.html

	2020	**2035**
Placer	363	1,188
El Dorado	683	1,217
South Lake Tahoe	3,250	5,330
Washoe	1,897	2,661
Carson	-	-
Douglas	1,279	2,272
Regional Total	7,473	12,668

Solid Waste Actions

Construction and Demolition Waste Diversion (Region-wide)

	CA	NV		
Average disposal tonnage (2005 and 2010 average)	113,345	49,338	tons	
C&D Waste (Inerts and Others)	29.10%	29.10%		
	32,983	14,357	tons	
Assume that the C&D waste sector remains relatively constant in the Region				
Current diversion rate	50%	50%		
Target Diversion	75%	75%		
Reduced C&D tonnage	8,246	3,589	tons	69.67%
CO2e savings (2020 and 2035)	1,132	493	MT CO2e/yr	

Source: ICLEI CACP 2009 Version 3.0
Landfill with a methane recovery system with 75% efficiency

	2020	**2035**
Placer	281	281
El Dorado	176	176
South Lake Tahoe	676	676
Washoe	208	208
Carson	-	-
Douglas	285	285

Area Source Actions - Wood Burning Appliances

Promote and incentivize EPA certified wood-stove retrofit & natural gas fireplace retrofit (Region-wide)

Replacement with EPA certified wood appliance	Measure Performance	Sector (Wood combustion)	% sales (annual)	# years	% units affected	Eligible Housing Stock	Participation rate (% units likely to choose wood retrofit)	% units with wood retrofit	Scaled % Reduction	GHG Reduction	Aggregate GHG Reduction
2020	20%	8.8%	2%	6	12%	90.3%	13%	1.4%	0.02%	312	312
2035	20%	8.7%	2%	15	30%	83.4%	13%	3.3%	0.06%	748	1,060

	2020	2035
Placer	125	423
El Dorado	44	151
South Lake Tahoe	111	378
Washoe	11	37
Carson	0	0
Douglas	21	71

Replacement with natural gas fireplace	Sector (Wood combustion)	% sales (annual)	# years	% units affected	Eligible Housing Stock	Participation rate (% units likely to choose NG fireplace)	% units with fireplace retrofit
2020	8.8%	2%	6	12%	90.3%	87%	9.4%
2035	8.7%	2%	15	30%	75.3%	87%	19.7%

	Number of units	Wood Emissions (MTCO2e)	NG Emissions (MTCO2e)	GHG Reduction	Aggregate GHG Reduction
2020	4562	11,132	4,836	6,296	6,296
2035	10137	24,734	10,745	13,989	20,285

	2020	2035
Placer	2,515	8,102
El Dorado	894	2,881
South Lake Tahoe	2,244	7,231
Washoe	218	704
Carson	-	-
Douglas	424	1,367

Combined program effects

	2020	2035
Placer	2,639	8,525
El Dorado	939	3,032
South Lake Tahoe	2,356	7,609
Washoe	229	740
Carson	-	-
Douglas	445	1,438

Forest Management Actions

Restore/stimulate regeneration of aspen

Acres per year	25.00	acres
Default CO2 accumulation per tree (Aspen)	0.0352	MT CO2/year
Aspen density per acre	300	trees per acre
Total restored/regenerated trees per year	7500	trees
Growing period	20	years
CO2 sequestered	5,280.00	MT CO2 over 20 years
CO2 sequestered per year	264.00	MT CO2

Assumed to begin in 2014	# Years	GHG Reduction
2020	6	5,544
2035	21	60,984

Source: Aspen Sequestration factor from CalEEMod Version 2013.2

Goods Movement Actions

C&D Waste Diversion

Reduced C&D Tonnage (from Solid Waste tab)	11,835	tons
Garbage truck capacity	21	tons
Truck trips avoided	564	
Average Distance to Lockwood Landfill	60	miles one way
VMT Reduction	67,629	miles
CO2 emission factor	1184.44	g/mile
GHG Reduction	80	MT CO2e

Source: EMFAC2011 (Emission factor for diesel T6 out-of-state heavy vehicle class)
Source: EPA. Waste Transfer Stations: A Manual for Decision-Making.
Available at http://www.epa.gov/osw/nonhaz/municipal/pubs/r02002.pdf.
The manual reports that average payload of transfer truck hauling from transfer station to landfill is 21 tons.

	2020	2035
Placer	13	13
El Dorado	8	8
South Lake Tahoe	32	32
Washoe	11	11
Carson	-	-
Douglas	15	15