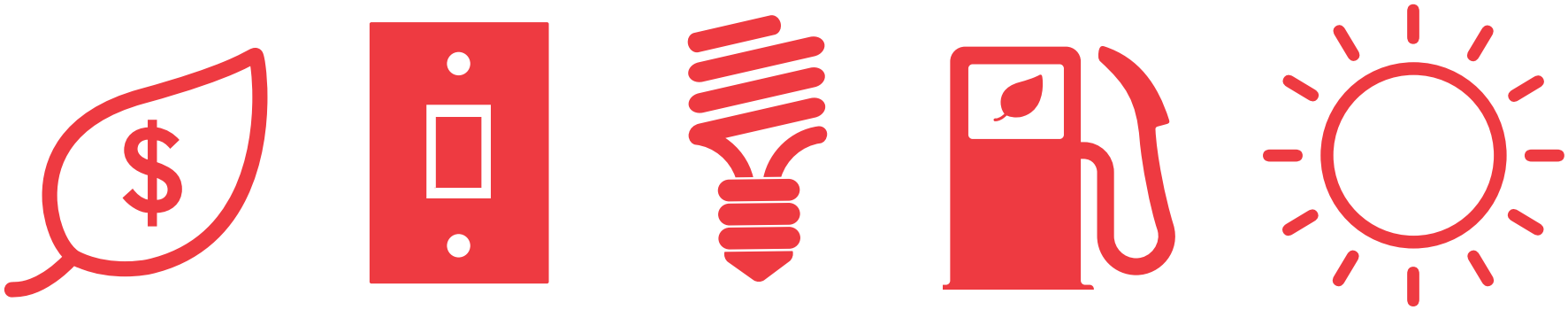

THE BUSINESS GUIDE TO THE LOW CARBON ECONOMY:

CALIFORNIA

THE CLIMATE GROUP ARUP

PARTNERS, FUNDERS AND SPONSORS

The Business Guide to the Low Carbon Economy: California would not have been possible without the contributions of a number of key organizations.

In particular, The Climate Group would like to recognize Arup, a Climate Group member and equal partner in this endeavor. Arup provided extensive support in creating this publication, including dedicated expert staff from Arup's sustainability team who provided many hours of pro bono consultation and written content.

ABOUT THE CLIMATE GROUP

The Climate Group is an independent, nonprofit organization that works with government and business leaders to accelerate the transition to a low carbon economy. The Climate Group was founded in 2004 and has offices in the United Kingdom, the United States, China, India and Australia.

www.theclimategroup.org

ABOUT ARUP

Arup is a global firm of designers, engineers, planners and business consultants providing a diverse range of professional services to clients around the world. Our innovative and fully-integrated approach brings our full complement of skills and knowledge to bear on any given design problem. We exert a significant influence on the built environment and are the creative force behind many of the world's most innovative and sustainable designs. Our firm has over 10,000 staff working in 92 offices in more than 37 countries. At any one time, we have over 10,000 projects running concurrently.

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SPONSORS

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FOREWORD

"California businesses with foresight and entrepreneurial spirit will find opportunity in the emerging low carbon economy as they take action on carbon management and energy efficiency. This *Guide* can help any organization understand the steps needed to save energy, save money, reduce their impacts on the environment and ensure a robust California economy."

Mary Nichols
Chairman
California Air Resources Board

Whether it is rising global temperatures or rising energy and fuel costs that motivate our actions, the need to make changes in our business decisions and our economy is increasingly urgent. California's Global Warming Solutions Act, AB32, sets ambitious greenhouse gas (GHG) emissions reduction goals, directly or indirectly affecting every business and citizen of the state. Although many details of AB32's implementation are still being finalized, some initial measures have been adopted. Additionally, energy and fuel prices are high and likely to go higher. By taking action now, businesses can reduce GHG emissions and save money at the same time.

The future holds both risks and opportunities. Businesses should begin considering how rising sea levels, changing weather patterns and future regulatory requirements might impact their present and future value. Business opportunities will grow for those providing goods or services that enable energy efficiency, provide renewable energy, mitigate climate impacts or help others adapt to a changing world.

Economic analysis by the California Air Resources Board predicts that 100,000 jobs and $27 billion in production activity will be generated by introducing strategies to meet the state's 2020 emissions reduction targets.[1]

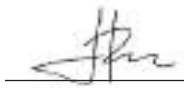
Firms in sectors whose emissions are capped will need to implement cost-effective GHG reduction measures and may be able to generate emission reduction credits to bank or trade. California companies in capped sectors under AB32 will need to reduce annual emissions by 147 million metric tons of carbon dioxide equivalent (MMtCO2e) by 2020. Based on current policy developments, it is foreseeable that a significant portion of these reductions will come through emissions trades or offsets,[2] resulting in a vibrant market for carbon emissions reductions worth many millions of dollars.

As businesses large and small are realizing that significant opportunity lies in this emerging low carbon economy, many struggle to understand what they need to do to save money on energy costs, capitalize on incentives, prepare for imminent regulatory requirements and reduce their climate impact.

The Climate Group and Arup have collaborated on *The Business Guide to the Low Carbon Economy* to provide businesses with an introduction to California's emerging GHG emissions reduction policies and a practical description of steps businesses can take, whether they are just beginning to consider these issues or have been working on them for some time. This document is designed to help businesses prioritize strategies as they determine the optimal mix of abatement, efficiency and offsetting. *The Business Guide* includes case studies and information resources so that California business can evaluate their situation and develop appropriate measures to reduce GHG emissions while saving money at the same time.

The Climate Group and Arup are proud to deliver this collaborative effort. We hope this document will assist businesses in meeting the challenge of global warming and inspire many to become climate action leaders.

Margaret Bruce
Western Regional Director, The Climate Group



Jean Rogers
Principal, Arup

HOW TO USE THIS GUIDE

Who is this guide for?

While sections of this document are applicable to a wide range of audiences, it specifically seeks to provide California businesses with a background in climate policy and preliminary guidance on measuring and reducing GHG emissions. It has not been developed specifically for any size of company, type of operation or sector, but rather provides a starting point for any organization—whether at the beginning, middle or end of the process of managing GHG emissions. The authors hope that readers with more detailed questions on their business' unique climate impacts can use the references in this document for further research.

Accessing the most relevant information

This guide walks through California climate change policy and issues that a business needs to consider when developing a climate strategy, including a framework for managing GHG emissions, case studies and useful terms. It is designed so that readers can easily refer to those sections that are most relevant to them, depending on where they are in the process. Therefore, it should serve as a reference tool and need not be read cover to cover, although the steps recommended in the "Taking Action" section should be followed in order (outlined on page 10).

Businesses in different sectors will find that most opportunities for emissions reductions lie in certain areas. For example, on average, most of the GHG emissions from office-based businesses are due to purchased electricity ("scope 2") and business travel ("scope 3"), while the GHG emissions from distribution companies come mostly from driving ("scope 1"). In order to point our readers to the most relevant parts of the document, we've outlined below where a sampling of different sectors will find the most applicable information. For each sector, the size of the circles illustrates relative GHG emissions and opportunities for action for the average business. For those businesses not in one of the listed sectors, choosing a sector with similar operational attributes and facility types will lead to the most relevant parts of the document.

Guide Sections			Relevance to Sector					Page Number
			Heavy industry	Manufacturing	Retail	Professional services (office based)	Distribution	
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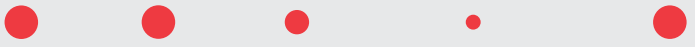
	Step 1. Establish a Baseline		Essential for all sectors					p. 11-19
	Step 2. Reduce Emissions	Scope 1: Direct Emissions						p. 23-25
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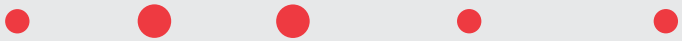
		Scope 3: Other Indirect Emissions						p. 34-37
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INTRODUCTION

Global warming was officially recognized as a problem in 1988, when the World Meteorological Organization and the United Nations Environment Program established the Intergovernmental Panel on Climate Change (IPCC). The IPCC brings together scientists from around the world to provide a comprehensive and impartial view of the science of and solutions to climate change. The results of the first IPCC Assessment Report in 1990 provided the basis for the Rio Earth Summit in 1992, which led to the formation of the United Nations Framework Convention on Climate Change. The mounting scientific evidence highlighting the potential perils of climate change led national policy leaders to craft an international climate action treaty at a conference of policy leaders in Kyoto, Japan, in 1997.

In 2007, the IPCC concluded that "warming of the climate system is unequivocal" and that there was a greater than 90% probability that most of the warming we've seen since the mid-20th century had been caused by human activity—primarily fossil fuel combustion and changes in land use, such as deforestation.[3]

The emerging consensus is that to avert some of the most serious impacts of global warming, global emissions must stop rising by 2020 and then decline to at least 50% below 1990 levels by 2050, while emissions from the US and other developed countries must decline by at least 80% below 1990 levels in the same time.*

Delays in cutting emissions will increase the risk of more severe climate change impacts and also dramatically increase the cost of cutting emissions and dealing with climate-related damages. The 2006 *Stern Review on the Economics of Climate Change*, by Sir Nicholas Stern, head of the UK Government's Economic Services and former Chief Economist of the World Bank, found that if no action is taken to control GHG emissions "the overall costs and risks… will be equivalent to losing at least five percent of global GDP each year, now and forever."[4] In 2008 Stern stated that the 2006 findings "underestimated the risks... underestimated the damage associated with the temperature increases... and… underestimated the probabilities of temperature increases."[5]

It is clear that we must take urgent and decisive action now to drive down greenhouse gas emissions.

The good news is that the GHG reductions required can be achieved at a reasonable cost. A 2008 report by the International Energy Agency estimated that an annual investment of 1.1% of global GDP would be enough to cut worldwide emissions in half by 2050.[6] And, much of the needed investment can be from the redirection of money that would otherwise go into fossil fuel production. In fact, a large portion of what we need to do can be achieved at a negative cost—a McKinsey & Company study estimated that fully 40% of the emissions reductions we need to achieve in the US will save money.[7]

Nations, states, regions and businesses that take early action will enjoy substantial competitive advantages. Achieving a low-carbon economy will create significant advancements and opportunities in technology, process and know-how.†

A new low carbon economy is emerging. Players include businesses of all sizes, government contractors, energy providers, venture capitalists, public sector entities, shareholders, developers of new low carbon solutions and consumers.

Today, green technology businesses directly employ at least 43,000 Californians.[8] Beyond 2020, global investment in sustainable energy technologies is expected to grow to $600 billion annually.[9] By 2030, green businesses in the US are expected to generate revenues of $2.4 trillion and employ 21 million Americans.[10]

In California, the low carbon economy has been galvanized by the Global Warming Solutions Act, AB32, signed into law by Governor Schwarzenegger in 2006, and making California the first state to set an economy-wide cap on emissions. The world's eighth-largest economy[11] has thus signaled that it is serious about addressing this problem.

AB32 mandates real, cost-effective reductions in GHG emissions and aims to shift economic activity away from fossil fuels and towards very

* For more information on required international solutions, see The Climate Group's *Breaking The Climate Deadlock* report and expert briefing papers at www.theclimategroup.org/index.php/special_projects/breaking_the_climate_deadlock/.

† For more on how leading companies, cities and governments are realizing significant financial returns for their GHG emissions reductions, see The Climate Group's *Carbon Down Profits Up* report, at www.theclimategroup.org/resources/publications/.

efficient use of low carbon and carbon-free energy sources. Implementation of AB32 will:

- Send a clear market signal, encouraging market development, innovation, entrepreneurism and investment in low carbon technologies, products and services
- Increase energy efficiency and resulting cost savings to California consumers and businesses
- Catalyze early actions by California businesses, giving them a competitive advantage as other state and national economies look to reduce their emissions
- Serve as a model for other regional, state and federal initiatives, thus maintaining California's reputation as a leader

Of course, this is not new territory for California, which has a history of leadership in smart environmental solutions. The state's building and appliance efficiency standards have avoided the need to build 15 new large power plants and saved consumers more than $56 billion in electricity and natural gas costs since 1978.[12] Such energy efficiency programs will continue to be important and cost-effective parts of AB32's implementation and a source of economic opportunity. For example, California's building and appliance efficiency standards are expected to produce at least another $48 billion in energy savings by 2020.[13]

An undertaking of this scale requires every individual, public sector entity and private sector business to make urgent and substantial progress in reducing their emissions. Businesses can take action now by:

- Anticipating rising fuel and energy prices by implementing a comprehensive program to reduce energy and fuel use
- Identifying sources of GHG emissions and taking steps to reduce those emissions
- Engaging and participating in the AB32 implementation process
- Strategically responding to requirements which will either affect them, their customers or suppliers
- Proactively addressing consumer and investor interest in and demand for transparency and climate-friendly products and services

Businesses that understand current and upcoming policy and manage and reduce their carbon emissions will only stand to gain in the transition to a low carbon economy.

GREENHOUSE GASES 101

There are six main GHGs that contribute to climate change*: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). These gases differ in their ability to trap heat in the atmosphere, so each gas's "Global Warming Potential" (GWP) is used to compare these abilities relative to CO_2. Carbon dioxide has a GWP of exactly 1 since it is the baseline unit to which all other GHGs are compared. Table 1 outlines the GWPs of the six GHGs.

For simplicity, the mass of each gas emitted is commonly translated into a carbon dioxide equivalent (CO_2e) by multiplying by the gas's GWP.

"Carbon" has become a buzzword, but understanding the breadth of the term is important. "Carbon" is now often used interchangeably with "carbon dioxide" as well as CO_2e, although it is not technically equivalent to either.†

Table 1. Global Warming Potential of the Six Kyoto-Defined Greenhouse Gases[14]

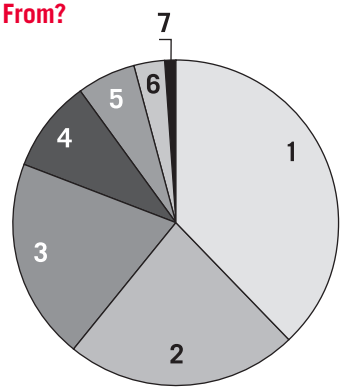
Greenhouse Gas	GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
HFCs	140–11,700
PFCs[§]	7,850
Sulfur Hexafluoride (SF_6)	23,900

[§]This figure is an average GWP for the two PFCs: CF_4 and C_2F_6

Where do GHG emissions come from?

Producing electricity is a major source of GHG emissions because most electricity is made by burning fossil fuels, which produces carbon dioxide. Fuels used in cars, trucks and busses are another major source of GHG emissions. Other sources include deforestation and forest fires (CO_2), waste in landfills (methane), air conditioning systems (HFCs) and electrical transmission and distribution (SF_6).

Figure1. Where do California's Emissions Come From?



California's GHG Emissions (2002-2004 Average)[15]

1. Transportation 38%
2. Electricity 23%
3. Industry 20%
4. Commercial & Residential 9%
5. Agriculture 6%
6. High GWP 3%
7. Recycling & Waste 1%

Water supply, California's largest energy use

In 2005, the California Energy Commission concluded that collecting, treating and delivering water is the largest user of electrical energy in the state, accounting for 19% of all electricity consumed in California, 32% of non-power plant-related natural gas use, and 88 million gallons of diesel burned every year.[16] Although the energy used to move and treat water in California results in the release of an estimated 44 million tons of CO_2 emissions annually,[17] these emissions can be reduced if water use is reduced. In fact, California policy proposals include recommendations for increased requirements for water use efficiency and water recycling, and a public goods charge on water to fund water efficiency improvements.

* As defined by the Kyoto Protocol

† For measurement purposes, one ton of carbon equals 3.67 tons of carbon dioxide.

AB32, GLOBAL WARMING SOLUTIONS ACT OF 2006

On September 27, 2006, Governor Arnold Schwarzenegger signed the Global Warming Solutions Act of 2006 (AB32) into law. AB32 requires California to reduce its GHG emissions to 1990 levels by 2020, roughly 30% below "business-as-usual" estimates. That means reducing California's annual emissions of 14 tons of carbon dioxide per person down to about 10 tons per person by 2020.[18]

In addition, California has set goals of reducing emissions by 80% from 1990 levels by 2050. This is even more challenging considering that California's population is estimated to approach 60 million by 2050, compared to today's approximately 38 million residents.[19]

AB32 mandates that the California **Air Resources Board** (ARB), within the California Environmental Protection Agency, develop and direct the implementation and enforcement of policies to ensure the 2020 targets are met. ARB must prepare a **Scoping Plan** describing the measures needed to achieve the needed GHG emission reductions. The Scoping Plan, set to be finalized by January 1, 2009, will be in full effect by 2012.

AB32 allows the use of "market mechanisms" in addition to specific measures to reduce emissions. "Market mechanisms" include tools such as cap-and-trade programs, carbon fees or taxes, and economic incentives. These strategies, described on the next page, are not mutually exclusive and may be used in various combinations.

AB32 also mandates that the 2020 targets be met with consideration to cost effectiveness, fair allocation of costs to consumers and businesses and maximization of economic and environmental benefits.

Below is a timeline illustrating the AB32 policy process, leading to the 2020 target. ARB is still evaluating the specific steps that will be used to reach the mandated goals. The information on the following pages is the latest available when this publication went to print. You can track new developments and learn how to participate in the policy-making process by visiting the ARB website at *www.arb.ca.gov/cc/cc.htm* and by joining its listserve at *www.arb.ca.gov/listserv/listserv.php.*

Figure 2. California's Emission Reduction Targets

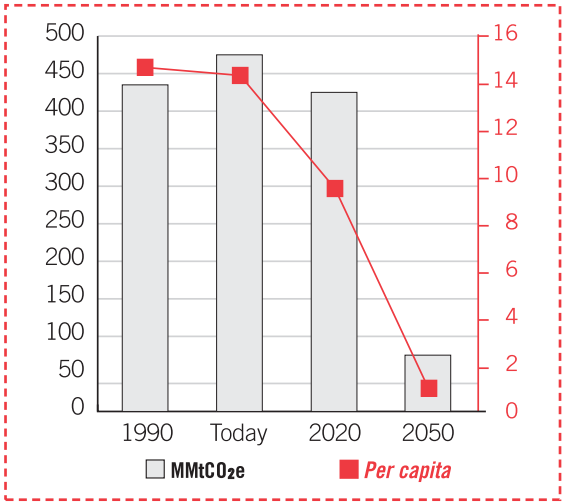
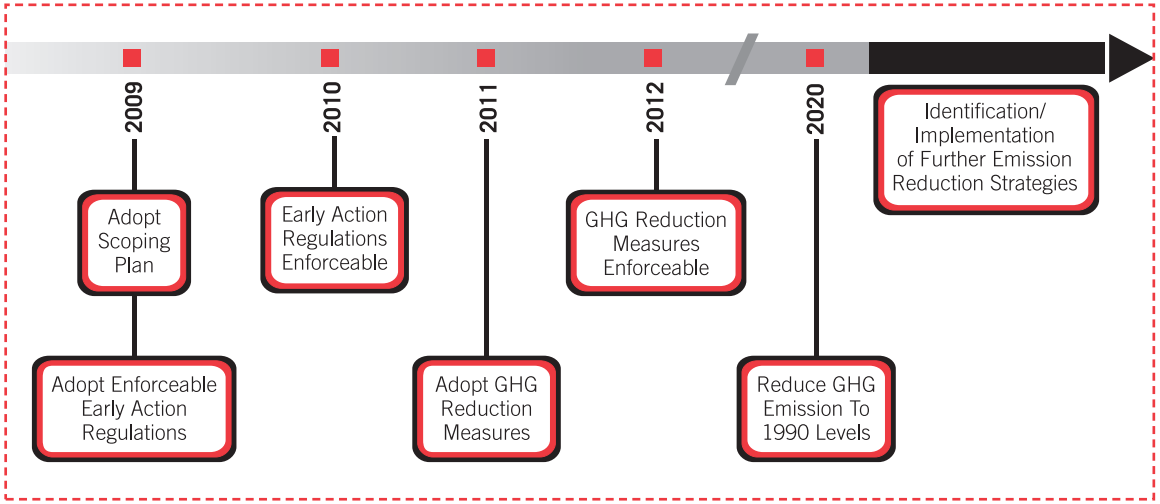


Figure 3. AB32 Policy Process Timeline



HOW WILL BUSINESSES BE AFFECTED?

All businesses will be affected by AB32, either directly in response to mandatory requirements, or indirectly as they adapt to new regulation, respond to market signals, develop new products and services that take advantage of the new economy, or take other voluntary action. Below are some of the policies that are being developed as part of ARB's Scoping Plan, and how California businesses can expect to be affected.

Table 2. ARB Scoping Plan Policies Under Development

Policy	Description	Current Status	Which businesses will be affected?
Emissions reporting	Requires annual emissions reports from approximately 800 of the largest emitting facilities in California starting in 2009 (for 2008 emissions). Emissions reports will need third-party verification starting in 2010 (for 2009 emissions).	Adopted.	Electricity generating facilities, electricity retail providers and power marketers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and industrial sources that emit more than 25,000 tons of CO_2 annually. The groups required to report may expand. Businesses with annual emissions on the scale of 25,000 tons of CO_2 should know what their emission inventory looks like so they can anticipate and take timely action.
Early action measures	Regulations that address specific GHG emissions sources in the near-term, including Discrete Early Action measures that are enforceable in 2010.	Forty-four Early Actions measures have been identified by ARB, including nine Discrete Early Action measures. Regulatory development is ongoing.	Will vary widely. For example, businesses that use refrigeration equipment or operate landfills will need to comply with specific rules as they are developed. For more information on what sectors and sources will be targeted, see *www.arb.ca.gov/cc/ccea/ccea.htm*
Recognition for voluntary action	Recognizing businesses that voluntarily reduce their emissions, especially if done prior to the implementation of the Scoping Plan.	A policy statement encouraging voluntary early actions has been approved and quantification methods are being established.	Businesses that take action to voluntarily measure, manage and reduce GHG emissions. To ensure that voluntary action is recognized, businesses should be able to prove that emissions reductions are real, permanent, additional, quantifiable, verifiable and enforceable. To do this, businesses should use a recognized protocol (as described on page 22).

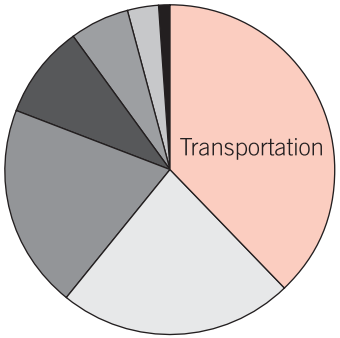
Table 2. ARB Scoping Plan Policies Under Development (cont.)

Policy	Description	Current Status	Which businesses will be affected?
Cap-and-trade system	A market-based mechanism that sets a limit or "cap" on GHG emissions from specific entities or sectors. Tradable emissions allowances (rights to emit) may be distributed either by auction, free allocation or some combination. Each allowance authorizes the release of a specified amount of GHG emissions, generally one ton of CO_2e. Covered entities have to submit allowances equivalent to their level of emissions. The total number of allowances issued decreases over time. High emitting entities must buy extra allowances from those businesses emitting less than their allowance permits. Helps ensure the most cost-effective measures are taken first, resulting in the lowest overall cost to the economy.	Recommended in Draft Scoping Plan, including the following specific recommendations: ■ The cap should include the electricity, transportation fuels, natural gas and large industrial sectors. ■ The system should link to a regional system as part of the Western Climate Initiative, a partnership between California, six other states and three Canadian provinces. If a cap-and-trade system is adopted, these and other elements regarding the design of the system will be determined through a public rulemaking process to be completed by 2011, with the program beginning in 2012.	Besides businesses operating within the capped sectors, any business that purchases products from these sectors is likely to be influenced by price signals that will increase the wholesale price of fossil fuel-fired electricity, petroleum-based transportation fuels and natural gas, and would therefore effect investment decisions, energy use and fuel choices. A cap and trade system will benefit those businesses that capitalize on or supply low carbon solutions. Businesses outside the cap that reduce their emissions may be able to sell "offset credits" to businesses that are required to reduce their emissions under the cap.
Subsidies and rebates	For buying, producing or investing in low carbon and energy efficiency products or technologies.	Many in place, others to be expanded.	Will vary widely. Allows businesses the flexibility to choose appropriate solutions depending on their situation. Examples of rebates and subsidies already in use can be found in the "Step 2. Reduce Emissions" section of this publication.
Carbon emission fee	A set cost per ton of emissions.	Not specifically recommended in Draft Scoping Plan but being evaluated by ARB.	Any business that purchases coal-fired electricity, petroleum-based transportation fuels and natural gas is likely to be influenced by price signals, affecting investment decisions, energy use and fuel choices. Benefits those businesses that capitalize on or supply low carbon solutions.

EXAMPLES OF SUPPORTING STATE POLICIES

A number of complementary policies will help reduce California's GHG emissions from specific sectors, thereby helping the state achieve its reduction targets. The largest share of emissions comes from the transportation and electricity sectors, which are therefore targeted by several policies.

Transportation



California's GHG Emissions

AB 1493 (Pavley) reduces emissions from new passenger vehicles and light-duty trucks sold in California beginning in model year 2009, reducing emissions by an estimated 31 $MMtCO_2e$ in 2020. To date, 13 other states have adopted California's regulations, thereby reducing national emissions as well.[20]

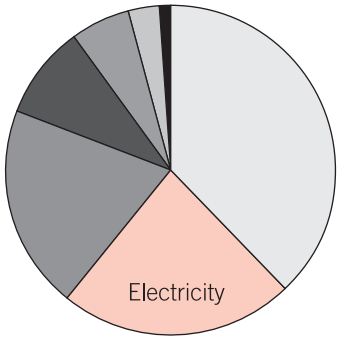
Although the price of a new vehicle will increase, this cost is outweighed by an estimated $30 per month that California drivers will save in avoided fuel costs.[21]

California has faced a series of legal battles over their right to regulate tailpipe emissions. If California is ultimately unable to implement the Pavley regulations, ARB will implement alternative policies to achieve equivalent GHG reductions from California light-duty vehicles.

Other initiatives that specifically target emissions from the transportation sector include:

- Low Carbon Fuel Standard
- Fuel Efficient Tire Program
- Proposed High Speed Rail System connecting Northern and Southern California

Electricity



California's GHG Emissions

California's Renewable Portfolio Standard (RPS) — the most ambitious in the country—requires investor-owned electric utilities to procure 20% of their electricity from renewable sources by 2010. In addition, an executive order from Governor Schwarzenegger and recommendations in the Draft Scoping Plan support increasing the RPS to 33% by 2020.

A high RPS allows financiers the confidence to invest in renewable energy. By increasing the percentage of renewable energy feeding the grid, utility customers are able to buy electricity with lower average GHG emissions.

For example, in order to meet the RPS, PG&E has entered into contracts for more than 3,600 MW of renewable power since 2002, resulting in contracts to provide more than 24% of its future energy supply from renewable sources, and putting the utility on target to meet the 2010 mandate. Contracts include 500-900 MW of solar thermal projects from BrightSource Energy, Inc. and a 553 MW solar thermal project in the Mojave Desert from Solel-MSP-1, which are among the largest solar commitments in the world.[22]

There are several issues that must be addressed in order to implement the RPS. Renewable power sources such as wind and solar are often located far from the populations that they serve, requiring extensive and expensive transmission upgrades and projects. Furthermore, solar and wind often provide intermittent energy that depends on the time of day and the season. Also, the Federal Production Tax Credit for renewable energy has had short-term extensions, which have been allowed to expire before, resulting in boom and bust investment cycles.

Other policies which target emissions from the electricity sector include:

- California Solar Initiative
- Title 24–Building Efficiency Standards

Local Action

Many cities in California have unique programs and policies to further encourage and enable businesses to take positive climate action. Businesses should check with their cities to learn more about local resources, incentives, subsidies, regulations and programs.

For example, the San Francisco Green Business Program recognizes and provides hands-on support to businesses operating in an environmentally responsible way. To be recognized as a San Francisco Green Business, a business must implement a minimum number of resource conservation, waste minimization and pollution prevention practices listed on a Green Business Checklist. The program provides free on-site assessments, technical support and rebate information. For information see *www.abag.org/bayarea/enviro/gbus/index.html*

The City of Los Angeles, owner of the largest municipal utility in the country, has set goals to increase the use of renewable power to 35% by 2020, allow contracts for electricity imports from coal-fired power plants to expire, and increase the efficiency of natural gas-fired power plants.

Many cities are adopting green building programs. Los Angeles' Standard of Sustainability requires that new construction and redevelopment of large buildings meet the intent of Leadership in Energy and Environmental Design (LEED) Certified level. *(www.lacity.org/ead/environmentla/greenbuilding/keyDocuments.htm)*

Investments in Low Carbon Technology

Numerous investment sources in California are funding the development of emerging technologies that reduce carbon emissions while also creating jobs, adding to the economy and generating export opportunities. A few highlights include:

- **Google.org's RechargeIT Program** is a funding and early demonstration project with an overall goal of supporting the large-scale manufacture, sale and adoption of plug-in hybrids by major auto manufacturers. The program includes a $10 million RFP for technologies relevant to this overall goal. In their first round, they will be investing $2.75 million between two businesses, including Aptera Motors of Carlsbad, California, whose work on improved aerodynamics and composite materials helped their prototype vehicle achieve over 230 MPG during testing. Google's program also includes an in-house fleet of plug-in hybrids that allows Google to examine how they work in the real world. In addition, Google has funded work in public engagement, policy and research regarding plug-in hybrids.
- **Clean Tech Open** is an organization of entrepreneurs, academics, investors and businesses working to accelerate the development of clean technology startups by providing resources, education and support for clean tech entrepreneurs. Finalists in the annual California Business Plan Competition receive comprehensive entrepreneur workshops and mentoring services and become part of the Alumni Program, which provides ongoing education and support. Contest winners receive early-stage capital provided by high-level business sponsors, as well as services, office space and expertise. 84% of Clean Tech Open Alumni from the last two competition years are still viable businesses and have secured investments of almost $70 million.
- **Venture Capital:** California's share of national venture capital investment in innovative energy technologies more than tripled from 1995 to 2007.[23] In the second quarter of 2008, California secured the largest single portion of clean technology venture capital, receiving $800 million of the global total of $2 billion.[24]

TAKING ACTION–OVERVIEW

This guide provides your business with a roadmap through the process of addressing climate change so you can play an active role in California's developing low carbon economy. As demonstrated by the diagram below, this guide shows how to "step down the carbon ladder" from current (or baseline) GHG emission levels to a reduced (or potentially net zero) GHG emission level. This is achieved through implementation of a range of suggested reduction strategies, with offsetting emissions as a last resort. Businesses should follow these steps one by one for the most effective and efficient management of GHG emissions. Missing a step could mean efforts are focused in the wrong area and the full potential of and rewards for emissions reductions activities may not be realized.

Step 1. Establish a Baseline describes how to calculate current GHG emissions and manage the inventory process.

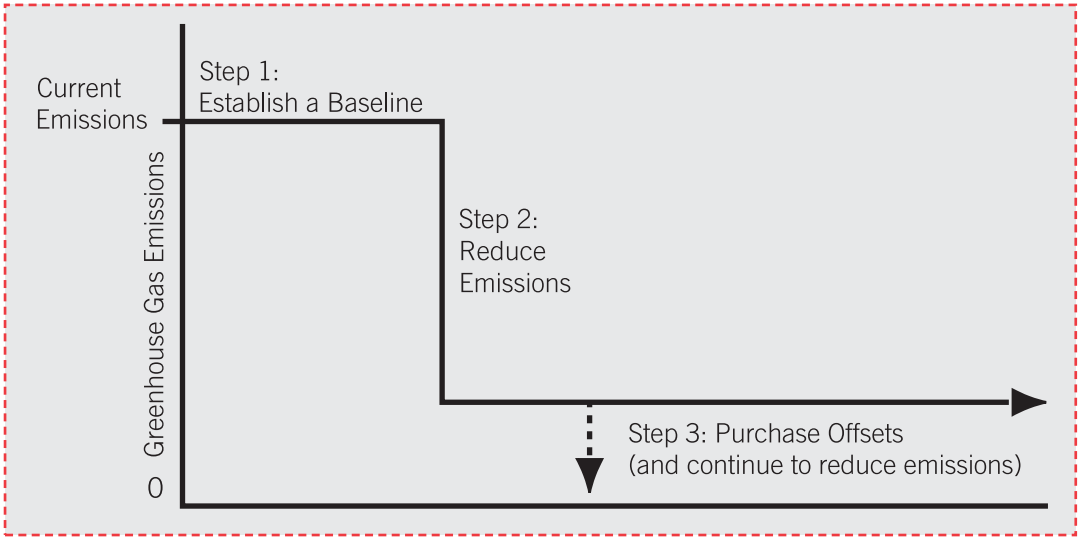
Step 2. Reduce Emissions provides guidance on setting reduction targets, prioritizing your approach, carrying out energy conservation and efficiency measures, and sourcing energy from clean sources.

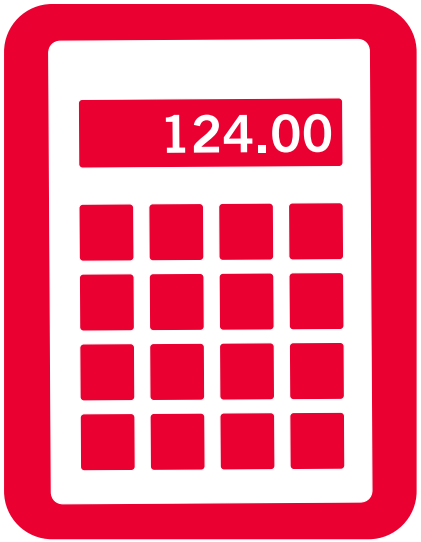
Step 3. Purchase Offsets explains how businesses can pay for carbon-reducing projects to compensate for any remaining emissions.

Reporting provides guidance on how to communicate about the process.

As with any new initiative being implemented in a business, it is essential for all levels of the organization to commit to the effort. From the CEO to the shop floor worker, creating a culture of commitment to climate change action is vital for successful implementation.

Figure 5. Stepping Down the Carbon Ladder





Terms to Know

Scope of Emissions (1, 2 and 3)
The categories of GHG emissions as defined by *The GHG Protocol* for operations of a business. Figure 7 and Table 4 provide descriptions of each of the emissions scopes.

Baseline / GHG Inventory
A reference or starting point to addressing climate change impacts by calculating and documenting the six main GHGs for which a business is responsible.

Establishing a baseline is the first critical step in addressing your business' contribution to climate change. Developing a baseline involves calculating and documenting the six GHGs (usually in tons, normalized to carbon dioxide equivalents) for which your business is responsible. This process is also referred to as developing a "greenhouse gas (GHG) inventory" or a "carbon footprint." Once established, your business will need to update the GHG inventory annually to monitor how your footprint changes when compared to the baseline.

You cannot manage what you don't measure. It is normal practice for businesses to account for profitability, productivity and revenue before making decisions about their financial and human capital. Accounting for GHG emissions should be no different. An inventory allows a business to identify the largest emission sources (i.e., the problem areas) and create a strategy for reducing these emissions through some of the activities suggested in this guide. By calculating the quantity and source of emissions, you can make informed decisions regarding emissions reductions.

How to Establish a Baseline

Developing a baseline of GHG emissions or a GHG inventory involves the following steps:

1. Assign resources
2. Establish a methodology
3. Commit to GHG accounting and reporting principles
4. Define organizational and operational boundaries
5. Establish a baseline year
6. Develop a data collection and management system
7. Calculate emissions
8. Seek third party verification

The rest of this section outlines these steps in more detail.

1. Assign Resources

Preparing a carbon inventory should be an annual exercise. It is therefore important to formalize the responsibilities and incorporate the inventory into your existing systems and operations. It is also important to commit internal resources to this process to ensure access to institutional knowledge, encourage ownership of the inventory and streamline annual data collection and reporting efforts. Specific staff should be assigned to the task. Financial and time commitments will vary depending on the size and nature of the organization's activities. The person or team responsible for the inventory need not be expert with numbers, but training in the method you use to measure emissions will certainly help the process run smoothly.

2. Establish a Methodology

There are a number of methodologies that provide guidance on creating a GHG inventory. Regardless of which one you select, it is important to apply the chosen methodology consistently.

The most internationally recognized framework for conducting an emissions inventory is *The Greenhouse Gas (GHG) Protocol*, led by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Other international standards such as ISO 14064 are based on *The GHG Protocol*. *The GHG Protocol* provides clear standards for measuring and documenting GHG emissions for an organization, including inventory design, calculating emissions, managing inventory quality, verification of emissions and setting GHG targets. For the purposes of consistency, terminology from *The GHG Protocol* will be used throughout this guide.

STEP 1–ESTABLISH A BASELINE

In California, one of the most prominent methods to date has been the *General Reporting Protocol* developed by the California Climate Action Registry (California Registry or CCAR). Based on *The GHG Protocol*, the California Registry protocol provides step-by-step guidance for public and private organizations to calculate and publicly report their GHG emissions. California Registry members independently verify and publicly report emissions following completion of their inventories. The *General Reporting Protocol* guides participants through the reporting rules, emission calculation methodologies and the Registry's standardized reporting mechanism through its web-based reporting system, the Climate Action Registry Reporting Online Tool (CARROT).

In the last year, staff at the California Registry were integral to the development of a North American registry called The Climate Registry (The Registry). The Registry is being positioned as the central national body for reporting GHG emissions in the US, Canada and Mexico and is intended to help reporting organizations prepare for GHG regulation. Organizations and governments across North America can join The Registry and report North American and worldwide emissions. Members of the California Registry will be able to transition easily into The Registry as the protocols, online reporting tool and methodologies are very similar.

Table 3 on page 13 lists some of the standards and protocols available to businesses in California, including those mentioned above. All of the protocols listed are available online and are free to access with the exception of the ISO 14064-1, which can be purchased for about $85.

Generally, these protocols provide guidance for developing "organizational" inventories to measure and track the quantity of GHG emissions produced from the core operations of a business. Businesses should measure organizational-level emissions from core business operations before calculating the avoided emissions from reduction projects.

Once you begin reducing emissions (Step 2 in this guide), you should also use protocols to measure and track the quantity of GHG emissions avoided from GHG reduction strategies such as renewable energy generation, carbon sequestration (e.g., reforestation) or landfill methane capture and reuse. WRI's *GHG Protocol for Project Accounting* provides a robust methodology for measuring emissions reductions achieved.

As a first step, some organizations may decide to use online emissions calculators that quickly quantify GHG emissions from simple data such as building characteristics, average vehicle miles traveled, number of air trips, etc. While these calculators may provide some preliminary guidance, the transparency of methodologies and consistency of results can be questionable. If you are looking for a quick calculation, it is best to use calculators which have clearly stated the assumptions and sources of emissions factors, such as the WRI GHG Protocol online calculators. For an accurate picture of emissions—which can provide a baseline to begin emission reduction activities, assist with monitoring progress towards goals and provide a basis to obtain recognition for early action—we recommend you begin your inventory process by using a formal protocol.

Table 3. GHG Reporting Protocols available to California Businesses

Creator	Name of Protocol	2008 Membership Costs	Public Reporting Required?
World Resources Institute and World Business Council for Sustainable Development	GHG Protocol: Corporate Accounting and Reporting Standard	No membership program	No
California Climate Action Registry	California Climate Action Registry: General Reporting Protocol	Revenue-based membership fees ($600-$10,000 for commercial organizations, $450–$5000 for not-for-profits/government/academic)	Yes (if member)
The Climate Registry	The Climate Registry: General Reporting Protocol	Same as California Climate Action Registry	Yes (if member)
US Department of Energy	US Department of Energy 1605(b) Program: Technical Guidelines for Voluntary Reporting of GHG Emissions	No membership program	No (but can voluntarily report if you wish)
US EPA	■ US EPA Climate Leaders Program: Design Principles ■ Small Business and Low Emitter Guide to Greenhouse Gas Management	Free, but must agree to conditions	Yes
California Air Resources Board	California Air Resources Board (ARB): Regulation for the Mandatory Reporting of GHG Emissions	No membership program—mandatory regulation for the largest emitters in California (see page 6)	Yes (but only for specific businesses affected by AB32 legislation)
International Standards Organization	ISO14064-1 Specifications with guidance at the organization level for quantification and reporting of GHG emissions and removals	No membership program	No
Sustainable Silicon Valley (SSV)	CO_2 Reporting Protocol	Annual partnership fee ($250-$2500 for businesses depending on size, $100 for non profits, $1000 for government, $10,000 for sustaining partner)	No. Participants who choose to report are included indirectly via SSV Annual Reports summarizing information from the region.

3. Commit to GHG Accounting and Reporting Principles

Ensure your GHG inventory follows the five accounting and reporting principles: relevance, completeness, consistency, transparency and accuracy.

4. Define Organizational and Operational Boundaries

This is perhaps the most important aspect of the inventory. It involves deciding which GHG emissions will be included and excluded in the baseline. For example, you will need to decide whether to include the emissions of your subsidiaries, joint ventures, customers and suppliers, or the emissions of your employees as they travel to and from work.

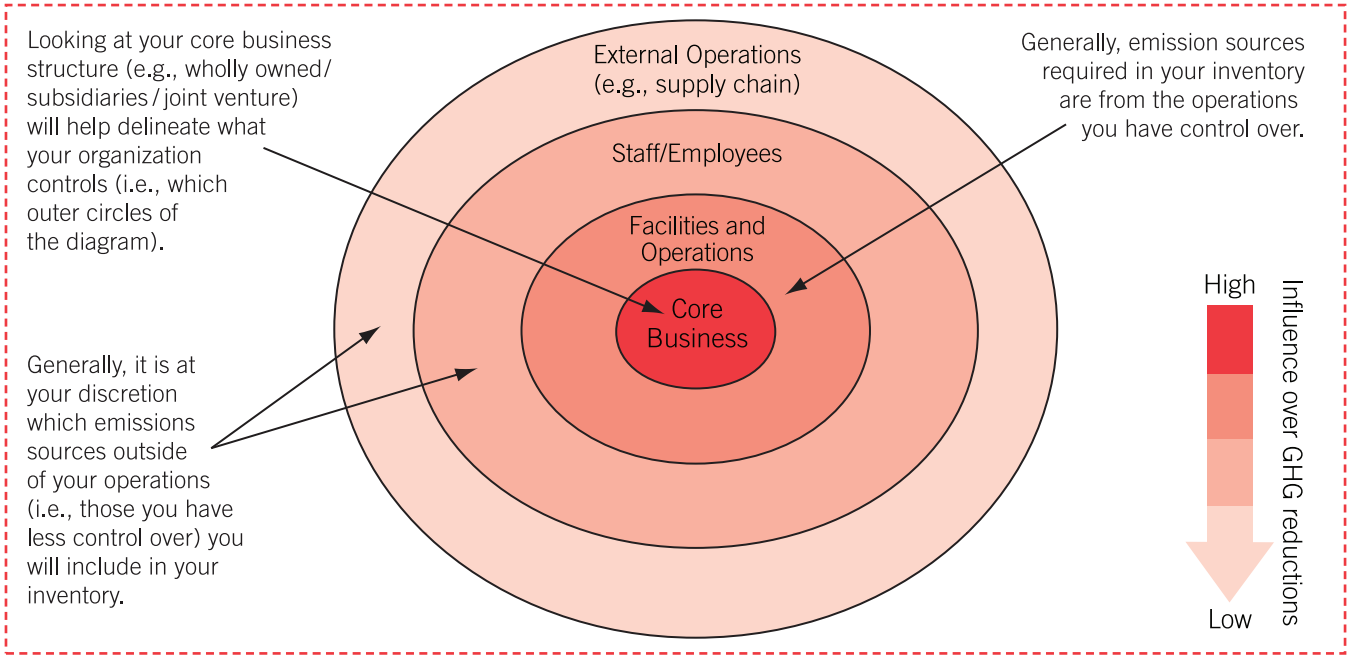
Figure 6 below illustrates the extent to which an organization can influence its business activities.

Understanding the extent of influence can help you better measure and manage your GHG emissions. It is important to take a prioritized approach. Begin with what you can influence directly (core operations, in the center of the diagram) before addressing other parts of the value chain where reducing emissions often presents a greater challenge.

Organizational Boundaries

For the purposes of financial accounting, various aspects of a business (e.g., owned operations, joint ventures and subsidiaries) are treated according to established rules. In the same vein, *The GHG Protocol* also recognizes different business structures by defining two boundary approaches for organizations—the equity share approach and the control approach.

Figure 6. Identifying Organizational Boundaries for your GHG Inventory



Arup, 2008, based on The Prince of Wales International Business Leaders Forum, *Selling Sustainable Success*, 2001.

For the purpose of GHG accounting, you should select a boundary for emissions and consistently apply this to your inventory over time.

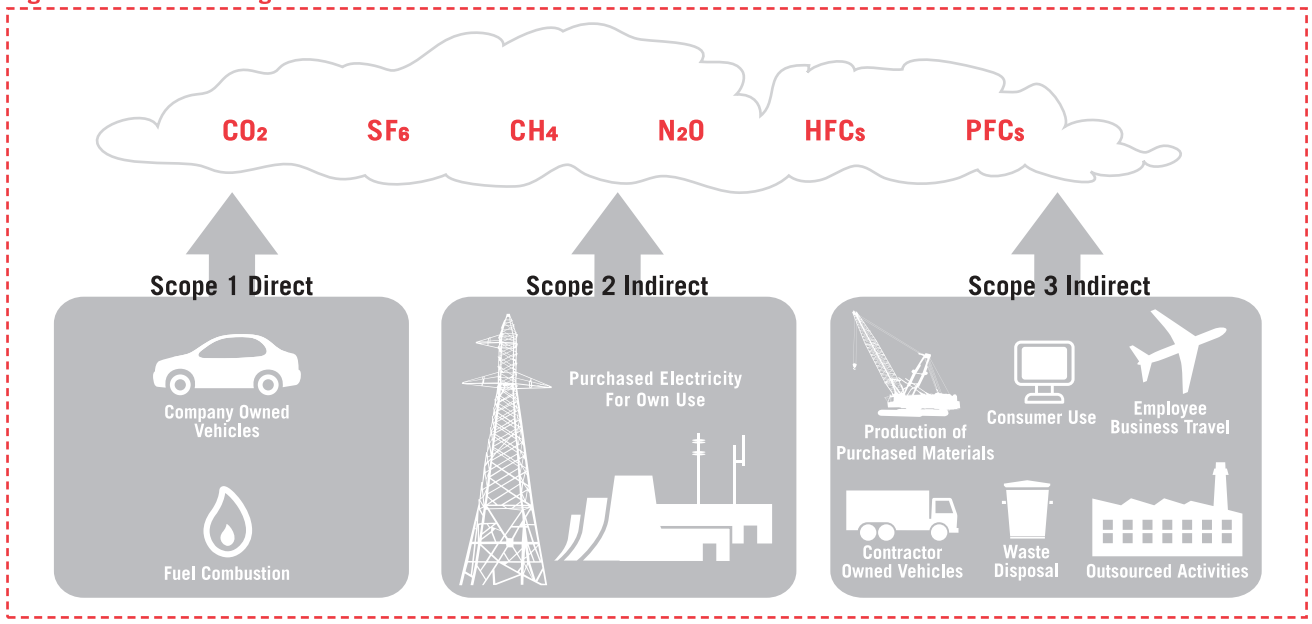
Operational Boundaries

The operational boundary is defined as the scope of emissions for operations that fall within a business' established organizational boundary. *The GHG Protocol* identifies three different "scopes" of operational boundaries for accounting and reporting purposes, as illustrated in Figure 7.

Many other reporting programs provide their own interpretation and terminology of these scopes. Table 4 on page 16 provides the various labels given to emission scopes by different bodies.

Many organizations are unsure of where to draw the boundary for their operations. Scope 1 and 2 emissions can usually be quantified relatively easily using readily available fuel and electric bills, and existing environmental management reports (see Table 4). Most emission reporting programs therefore require these emissions to be calculated. Scope 3 emissions are those not covered by scope 1 and 2. It is your decision whether or not to include scope 3 emissions in your inventory. At this time, there are no clear voluntary or regulatory protocols that provide guidance on where the boundary should be drawn for these downstream and upstream emissions. Calculating scope 3 emissions in addition to scope 1 and 2 provides a more holistic and inclusive measurement of your GHG emissions. If data are available or can be collected for any of these sources, it is recommended they be measured, tracked and reduced over time.

Figure 7. Understanding GHG Sources



Adapted from The World Resources Institute, *The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard*, 2004

STEP 1–ESTABLISH A BASELINE

5. Establish a Baseline Year

Businesses should update their GHG inventories annually. This allows you to track your emissions profile over time. For more on targets, see the "Step 2. Reduce Emissions" section.

To track emissions over time, it is important for you to establish a reference point with which to compare current emissions. Depending on the reason for measuring a GHG inventory (e.g., voluntary program or internal management goal), there are different approaches for selecting a baseline year. This could be a single year (most likely the first inventory year) or the average of emissions over a number of years (to level-out any variations [high or low emissions] that would bias the selection of one particular year). The Kyoto Protocol identifies 1990 as the baseline year to which industrialized countries must reduce their emissions; therefore, in order to stay consistent with the Kyoto Protocol, 1990 may be selected as the baseline year. However, it may be very difficult to obtain reliable data from this year, and many businesses were not in existence at that time. The *GHG Protocol* recommends selecting a base year as "the earliest relevant point in time for which you have reliable data." Should a business undergo changes to its organizational structure, such as an acquisition or divestment, it is important to recalculate the baseline to take into account any added or subtracted emissions. Organic growth or decline (such as increase or decrease in production output or closing and opening of new facilities) will not require a recalculation of the baseline. These changes will be reflected in the GHG inventory as additional or reduced emissions in the year the change occurred.

Table 4. Examples of Terminology and Where to Find Data for GHG Emission Sources

Examples of Terminology				Examples of Emission-Generating Activities	Where to Find the Data
GHG Protocol	**CCAR Protocol**	**ARB Mandatory Reporting Regulation**	**US DOE 1605(b) Technical Guidelines**		
Scope 1	Direct	Direct	■ Stationary Source Combustion ■ Mobile Sources ■ Industrial Processes	■ Mobile combustion (e.g., owned/controlled mobile sources such as trucks, trains, ships, airplanes, etc.) ■ Stationary combustion (e.g., on-site combustion of fuel in furnaces, boilers, turbines) ■ Process emissions (e.g., manufacture or processing of chemicals and materials such as cement) ■ Fugitive emissions (e.g., equipment leaks, HFC emissions from refrigeration and air conditioning)	■ Fuel purchase receipts or records ■ Vehicle logbooks (odometer readings or mileage; fleet make, model, year) ■ Refrigerant purchases, equipment nameplates ■ Natural gas bills or meter readings
Scope 2	Indirect	Indirect	Indirect	■ Purchased electricity (e.g., electricity produced off-site) ■ Purchased heat, steam or cooling (e.g., natural gas for heating)	■ Utility electricity bills or meter readings ■ Square-foot measurements of space
Scope 3	Optional	N/A	N/A	All activities not included in the above, such as emissions from: ■ Extraction and production of purchased materials ■ Use of sold products and services ■ Waste disposal ■ Other transportation (e.g., employees, business travel, transporting purchased fuel/goods/waste)	■ Depends on which emissions source is selected ■ Examples include staff survey for employee commuting or life cycle emissions data from product manufacturers **Note:** data for Scope 3 emissions is often more difficult to obtain

6. Develop a Data Collection and Management System

Developing a data collection and management system will help create an efficient and simple inventory. The system should list the data required, identify the source of the data, assign responsibility for data collection, provide data quality control to avoid errors, and manage the data via a central source such as a database.

Software is available for emissions data management (for example, the EPA Climate Leaders Inventory Management Plan, the California Climate Action Registry's CARROT tool and The Climate Registry's CRIS tool). Some businesses with larger inventories may choose to hire a third party to maintain and monitor their inventory data.

7. Calculate Emissions

Most businesses do not have the time or financial means to measure emissions at their source, so emissions factors have become the most popular method for quantifying GHG emissions. An emissions factor allows the conversion of activity data (such as the amount of fuel used) to emissions data. Activity data is usually sourced from monthly electricity bills and fuel purchase or use records. An example of this calculation is given below.

Equation:	Activity Data	x	Emissions Factor	=	Emissions
Description:	Annual fuel consumption		Amount of CO_2 emitted per gallon of fuel consumed		Total annual CO_2 emissions for vehicle
Example:	100 gallons	x	19.4 lbs CO_2/gallon	=	1940 lbs CO_2

A number of calculation tools are available to businesses to avoid the guesswork of calculating emissions and finding emissions factors. *The GHG Protocol* provides tools with clear guidance and explanations for a variety of activities across a number of sectors and The Climate Registry offers members access to their online tool, CRIS, with built-in emissions factors and calculation tools.

Some unique emissions sources may require a search for specific emissions factors, which are published by a number of US and international climate change expert organizations listed in the resources section at the end of this document.

8. Seek Third Party Verification

Independent assessment of emissions information by a third party is an international best practice for GHG inventories. The verifier evaluates the accuracy of inventory information and issues an opinion of the data's quality and completeness, which provides an indication of its reliability. Both voluntary and mandatory US emissions reporting programs now require third party verification of emissions inventories. These include (but are not limited to):

- The California Climate Action Registry
- US DOE 1605(b) program
- The Climate Registry
- ARB Mandatory Emissions Reporting
- Chicago Climate Exchange

Most of these programs have their own verification protocol providing guidance on how to verify an inventory. Verification activities may involve auditing documentation, site visits and meetings.

The ISO 14064-3 verification standard is a program and policy-neutral internationally accepted standard. It can be applied to organizational or GHG project quantification, including monitoring and reporting carried out in accordance with ISO 14064-1.[25]

Challenge: Collecting Data

Collecting data for a GHG inventory can be time consuming, especially for larger businesses. Sourcing the correct activity data for the first time takes effort, but once data collection systems and methods are in place, the process becomes more streamlined and embedded in everyday operations.

Some activity data (such as electricity use) will need to be sourced from a third party, such as a landlord or your local utility.

Cisco Systems: Coordination and management of an ongoing global inventory process

The experience gained from reporting their carbon inventory for six years through The Carbon Disclosure Project (described on page 43) has enabled Cisco to build and improve upon their data collection and has helped them to establish a robust baseline. Using the WRI *GHG Protocol* and internal tracking software, Cisco's scope 1 and 2 GHG inventory is based on utility and other data from 90% of their leased and owned facilities. Cisco also reports scope 3 emissions from business air travel using flight segment data gathered from their travel service provider.

To coordinate a comprehensive emissions calculation covering about 500 buildings in more than 80 countries, Cisco engaged and trained over 100 people worldwide to feed data into this inventory, and integrated this collection process into the business. Providing strong management support for this effort is an executive-level "EcoBoard." As a result of this collaboration across the business, the data collection and emissions calculation has become more comprehensive and more accurate each year.

As part of the baselining process, Cisco confirmed the major sources of emissions were purchased electricity and business air travel. In response, Cisco has created initiatives to leverage its own technology to improve efficiency and reduce power consumption in buildings and labs as well as reduce the need to travel. As part of the Clinton Global Initiative, Cisco has set a goal to reduce emissions from air travel by 10%. As part of the EPA Climate Leaders partnership, Cisco has set a goal to reduce GHG emissions from its worldwide operations by 25% over the next four years. These goals are an important step to focus the organization's attention and allocate the necessary resources to address GHG emissions.

In the future, Cisco plans to continue to increase the coverage of the inventory, as well as make the process more automated and scalable. Cisco views the process as a multi-year journey and believes that a climate-responsive policy needs to be adopted by every business process, function and employee in order to be successful.

Bentley Prince Street: Straightforward inventory and early involvement provides voice and legitimacy

Bentley Prince Street (BPS), the largest commercial carpet manufacturer on the West Coast, conducts its carbon inventory through the California Climate Action Registry (CCAR). Since 2002, CCAR has provided BPS with a local voice and platform to measure and reduce its emissions.

BPS is both a charter member of CCAR and the only carpet manufacturer member. The company's early and proactive participation with CCAR sets it apart from its competitors as well as helps promote legitimacy, transparency and trust in the marketplace. CCAR provides BPS with expanded visibility in the sustainability arena, as well as access to much broader platforms, such as international dialogues on climate change. At the national level, BPS has tracked its emissions in conjunction with parent company Interface Inc. since 1996 using WRI's *GHG protocol*.

Through CARROT, CCAR's online GHG reporting and calculation tool, BPS calculates its GHG emissions from natural gas and electricity usage. Other emission sources (e.g., BPS company vehicles) are considered small enough to be "de minimus," and a detailed inventory is not required. However, with high internal sustainability standards, BPS tracks all emissions of every size.

Among other advantages, calculating its baseline lets BPS closely examine all emissions sources at every company location across the country. Collecting data on its emissions is relatively straightforward for BPS; the sustainability team records the data when bills for the purchase of energy sources are approved.

Once BPS has submitted its inventory to CARROT, the data is verified by a CCAR-approved third party verifier, a process that consists of a desk and on-site audit. The verification process has helped BPS continue to improve its inventory and each year the inventory and auditing process has become easier and more routine. In total, conducting its inventory through CCAR costs BPS $5,000 per year, plus the cost of verification and staff time for its three-person sustainability team.

BPS strives to reduce its emissions 10% per unit produced over the previous year and believes reducing emissions will improve its bottom line. BPS has reduced its absolute emissions 51% since 1996, and continues to work towards its goal of zero emissions. BPS believes that reaching its goal cannot be accomplished without educating every associate about emissions-reducing protocols and processes.

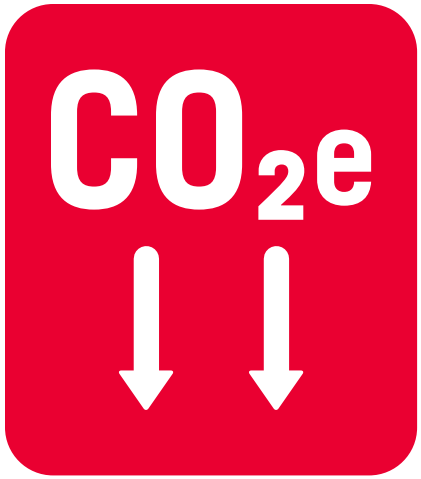
California Climate Action Registry Annual Emissions Report • Bentley Prince Street (Emissions from California operations)

Verified Emissions Information	
Reporting Year:	2006
Reporting Protocol:	General Reporting Protocol, Version 2.2 (March 2007)
Baseline Year (Direct Emissions):	2002
Baseline Year (Indirect Emissions):	2002

Direct Emissions	CO_2e	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Unit
Mobile Combustion	**44.94**	44.26	0.00	0.00	0.00	0.00	0.00	metric ton
Stationary Combustion	**8,424.04**	8,399.88	0.94	0.01	0.00	0.00	0.00	metric ton
Process Emissions	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	-
Fugitive Emissions	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	-
TOTAL DIRECT	**8,468.98**	8,444.13	0.94	0.02	0.00	0.00	0.00	metric ton

Indirect Emissions	CO_2e	CO_2	CH_4	N_2O	Unit
Purchased Electricity	**2,638.13**	2,633.91	0.02	0.01	metric ton
Purchased Steam	**0.00**	0.00	0.00	0.00	-
Purchased Heating and Cooling	**0.00**	0.00	0.00	0.00	-
TOTAL INDIRECT	**2,638.13**	2,633.91	0.02	0.01	metric ton

STEP 2–REDUCE EMISSIONS



After completing the GHG inventory and identifying emissions sources, the next step is to find ways to reduce emissions. For most businesses, this means reducing electricity or direct fuel consumption. Opportunities can be found across operations, in buildings, manufacturing processes and transportation.

Even simple changes in employee behavior can achieve positive impacts. While the baseline exercise will help you understand under which scope the most significant emissions lie, the emissions reduction strategy will need to be developed to suit the needs of your business.

How to Reduce Emissions

As discussed earlier, there are a number of drivers for reducing GHG emissions, including reduced operating costs, improved brand equity and corporate social responsibility (CSR) performance, and incentives offered under new California policies.

Each business' emissions will vary in source and quantity, and there will be have a mix of possible solutions of varying cost. Different industries will have different focus areas: in office-based operations, the majority of emissions will be from air conditioning systems, indoor lighting use and business travel; in retail, display lighting is often a major use of energy; in manufacturing, process loads can far outweigh those related to the buildings themselves.

The inventory provides a clear picture of emissions so that you can begin to address your most significant impacts. Once you have identified major sources of emissions in the baseline exercise, it is time to tackle the problem areas.

Setting a target for reducing emissions from this baseline gives you something to work towards. Some companies set targets and then figure out how to meet them. Others take an iterative approach, deciding what is achievable within a given timeframe. Either way, the target should be developed with clear support from management. Different ways to express the target are given in Table 5, below:

Table 5. Emissions Reductions Targets

Target Type	Description	Example
Absolute	Reduce absolute emission over time	Reduce GHG emissions by 25% from baseline by 2010
Intensity	Reduce the ratio of emissions relative to a business activity over time	Reduce GHG emissions by 10% per "widget" produced between 2004 and 2008

Setting your target will also depend upon the feasibility of different approaches. Ideally, there will be a range of emissions reduction strategies from which to choose. Actions will range in cost, effectiveness, and complexity of implementation. The process of identifying promising ideas will result in a list that you can categorize according to criteria that matter most to your business, for example:

- Capital costs
- Operating costs
- Payback
- Potential for GHG reduction
- Ease of implementation

Terms to Know

Absolute Reductions
Reductions in total GHG emissions over time.

Intensity Reductions
A reduction in GHG emissions relative to a unit of activity (e.g., CO_2 per gallon of water delivered) over time.

Where possible, target your major emissions sources first while considering the last two criteria above: potential impact and ease of implementation. Examining these, it is possible to identify the "quick hits" and the larger, more strategic actions. Figure 10 below shows how this process can highlight the most suitable initiatives for implementation.

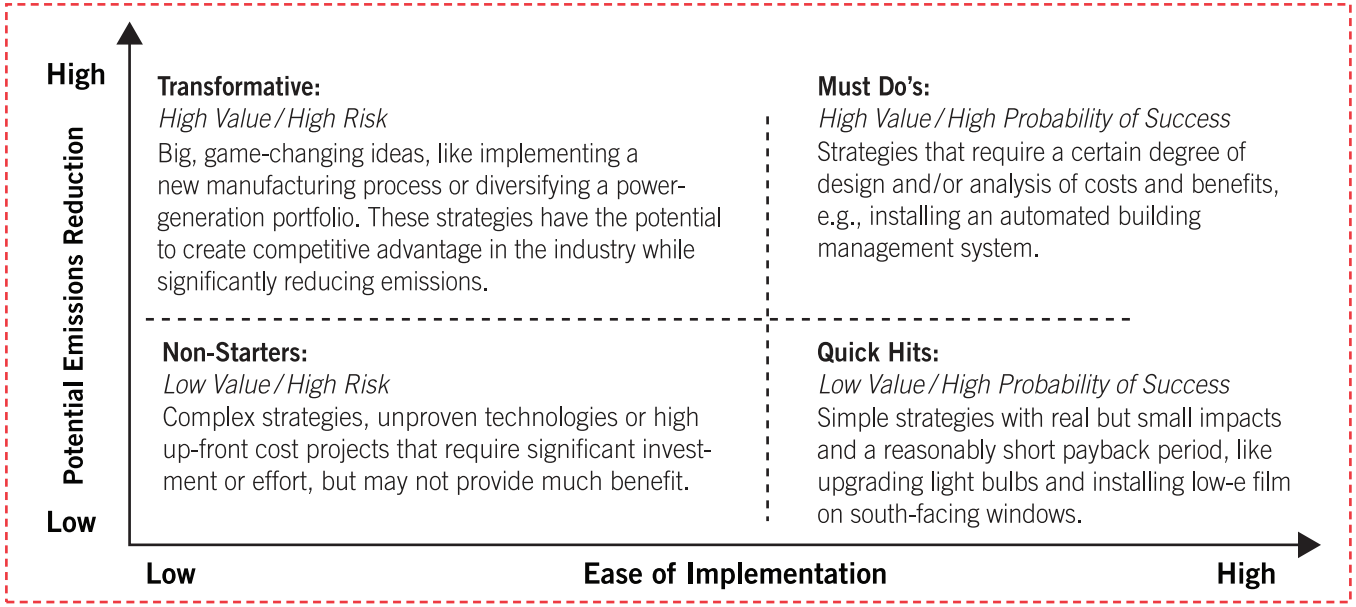
The more significant undertakings will require an objective cost-benefit analysis that considers the life-cycle cost of the solution. This will help identify the optimal means for reducing emissions while managing capital costs and maximizing long-term operating savings. You may need outside help for some of the more complex items that demand more sophisticated analysis of the costs and benefits. Overall, developing your carbon reduction strategy will be part science, part art, and will most certainly change over time.

Engage the Whole Company

The implementation and follow-through of an emissions reduction program depends on the understanding, patience and buy-in of the major stakeholders — no initiative will succeed without these components. To this end, it is imperative that divisional leaders, human resources, finance and logistics are all involved in the process, as these are the groups that will help infuse a culture of conservation throughout the rest of the organization. During implementation, it will be very important to keep staff informed and find ways to get people involved on an ongoing basis.

- **Brainstorm Together**: Conduct a brainstorming session to generate ideas for specific emissions reductions and business opportunities.

Figure 10. Sorting Carbon Reduction Strategies



Arup, 2008

STEP 2–REDUCE EMISSIONS

- **Decide on the Vision**: If key stakeholders are engaged in setting goals, targets and budget allocations, they will be more committed to helping achieve them. Determine what is possible using available resources.
- **Educate the Workforce**: As different strategies are rolled out, it is important to keep the workforce informed so that new systems do not fail as a result of misunderstanding, e.g., adjusting the summertime space temperature could cause some complaints among those who are still dressing for 72°F.

Emissions Reduction Strategies

The following section is organized according to *The GHG Protocol* framework: Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased electricity) and Scope 3 (other indirect emissions). It is important to consider each initiative within the context of your organization and its facilities and operations.

Note: We recommend that you follow WRI's *GHG Protocol for Project Accounting* or another nationally recognized protocol to ensure that your success in reducing emissions is recorded accurately. Such records will be necessary should you wish to sell offsets into a future California cap-and-trade carbon market, should one be developed.

You will find some ideas for getting started on the following pages. Relative costs and benefits of specific actions have been labeled according to the following key:

Capital Cost	
None	No cost
$	Low cost, maintenance budget
$$	Mid-range cost, annual budget
$$$	High cost, long-term project

Benefits	
None	No benefit
	Slight benefit
	Significant benefit
	Great benefit

Initial capital costs and benefits given are relative estimates—neither is intended to replace your own analysis. Costs and benefits will vary depending upon the reach of implemented projects and economic factors such as energy costs and available rebates. For example, a project with a high capital cost may still save money over the longer term, and may be quite affordable in the short term once available rebates are taken into account (see pages 24, 26 and 32 for examples).

Scope 1. Direct Emissions

Stationary Combustion

If fuel is burned on-site, for example for electricity generation, space heating or domestic hot water, changing feedstock from a non-renewable fuel to a clean fuel (known as "fuel-switching") will not only reduce emissions, but may also qualify to be sold as an emissions offset project.

On-site electricity generation from a renewable source is often the most capital intensive of the emissions reduction strategies. However, this approach has many benefits, including fewer emissions of other air pollutants, reduced peak power operating costs, availability of financial incentives and increased energy supply reliability.

Some ideas to get started:

- **Solar Water Heating** $$$
  This technology consists of a series of collectors, typically roof-mounted, oriented to capture the sun's energy. Heat is collected and redistributed to create hot water for a variety of uses, ranging from domestic hot water systems to process applications and radiant floor heating. A standard gas boiler can be used to supplement the solar collectors when required. There are obvious constraints related to available roof or ground area and the ability of existing structures to bear this load.
- **Combined Heat and Power** $$$
  Combined heat and power systems (CHP) capture waste heat from the power generation process and use it to produce heating and/or cooling. If you are already generating power on-site using an engine or turbine, this approach can result in significant emissions reductions. Known as "cogeneration," combining these processes is much more efficient and cost-effective than buying each service separately.

  These systems find ideal applications in facilities with a large demand for domestic hot water or space heating, e.g., hotels, swimming pools, mall food courts and some manufacturing processes.

  Depending on the type of generator, the "engine" usually runs on gas, hydrogen, propane or diesel, resulting in comparatively clean energy. However, it is now possible to run generators on biodiesel, which would add a renewable quality to the system.

  Fuel cells have become increasing popular for this type of application. These devices use an electro-chemical process to generate electricity from hydrogen and oxygen. They are not only highly

Terms to Know

Stationary Combustion
Burning of fuels to generate electricity, steam, or heat.

Fugitive Emissions
Uncontrolled or unintentional emissions from fuels and chemicals, typically arising from storage, transfer or replacement, e.g., HFC leaks from refrigeration systems, SF_6 from electrical transformers, and methane from landfills.

Mobile Combustion
Burning of fuels by transportation devices such as cars, trucks, airplanes, vessels, etc.

STEP 2–REDUCE EMISSIONS

Rebates and Incentives

Federal incentives are available for certain hybrid and diesel vehicles, solar water heating systems, and the installation of fuel cells and microturbines. For more information, see *www.energytaxincentives.org/business/*

The California Energy Commission offers cash rebates on eligible grid-connected fuel cell systems through its Emerging Renewables Program. For more information, see *www.consumerenergycenter.org/erprebate/index.html*

efficient, but also very clean, given that the main by-product of the reaction is water. Natural gas is the most readily available and affordable source of hydrogen, and while GHGs still arise from its use, these are low compared to more traditional combustion technologies. Maintenance costs are sometimes prohibitive, but in remote locations, fuel cells can have an attractive return on investment.

In recent times, absorption chillers that use heat to generate chilled water are making a comeback. "Tri-generation," where both heating and cooling are derived from waste heat, is approximately 90% efficient.

The cost-benefit analysis usually depends on the local cost of electricity, fuel costs, and the capacity to use the heating or cooling created.

Absorption chillers can also be used in conjunction with solar water heating technologies described above.

Fugitive Emissions

The main sources of fugitive emissions are refrigeration equipment and landfills:

- **Refrigeration Equipment** $
  Ongoing refrigerant leaks and the act of replacing the refrigerant fluid both result in fugitive emissions to the atmosphere. When equipment needs to be replaced, choose models using refrigerants with a low GWP, e.g., ammonia or water. (**Note:** be aware that the use of ammonia requires specific safety measures.)
- **Landfills** $$$
  Methane gas generated by the decomposition of organic waste can be captured to prevent it from entering the atmosphere. In some cases, the collected gas is used to generate electricity and/or heat.

Mobile Combustion

There are many opportunities to reduce emissions from mobile sources. Scope 1 (direct) emissions include those from the business' owned or leased vehicles. Vehicles that are owned or leased by another organization, such as rental or contractor-owned vehicles, are classified as scope 3 (other indirect) emissions.

- **Fleets** $$$
  Organizations with vehicle fleets have an opportunity to specify the most fuel efficient, lowest emitting vehicles available. As older vehicles are retired, they should be replaced with more efficient models. As procurement policies such as these have expanded, the number of vehicle choices has also increased so that many types of low emissions and alternatively-fueled passenger and service vehicles are available. Many major car companies now offer hybrid versions of some of their standard models.
- **Fuels** $$
  Some organizations have switched a portion or all of their vehicle fuel from standard gasoline or diesel to biodiesel, where appropriate and available. However, the GHG emissions reductions from fuel-switching may be complicated to determine, as the source of the biofuel can significantly influence its GHG emissions.

Process Emissions

Emissions from manufacturing processes are beyond the reach of this document because there are so many different kinds of possible processes to consider. However, we encourage manufacturers to identify process changes that would reduce emissions of GHGs wherever possible. These may include actions as simple as replacing older, less efficient pumps or motors with newer, more efficient ones.

Cenveo Anderson Lithograph: Cogeneration plant provides low carbon electricity supply and generates $90,000/month on average

In the 1990s, Cenveo Anderson Lithograph (CAL), a commercial printer in Los Angeles that produces high quality catalogs, brochures, magazines and marketing materials, saw a need for more chilled water in their processes and equipment, while at the same time improving the reliability of their electricity supply and reducing electricity costs. CAL found a way to satisfy these often conflicting goals by displacing one of their utility providers and building an on-site cogeneration plant. The plant is designed so that an initial input of natural gas is used to create electricity, then waste heat is used to drive a second steam turbine, creating more electricity, and finally, spent steam is used to create chilled water for facility operations.

Built in 1995, the plant paid for itself in five years through avoided electric utility costs and generates enough electricity and chilled water for all of the facility's needs. Today, CAL generates electricity at an incremental cost of about 3.4 cents per kWh (most of which is spent on natural gas), versus 13-19 cents if they were to buy it externally from the utility. Beyond this enormous savings, whenever CAL produces electricity in excess of their needs (usually around 1–1.25 of 5.25 MW total generated), Southern California Edison buys the surplus from them at 3.8–8 cents per kWh through a 15-year contract, making CAL an average of $90,000 per month and supplying the LA grid with low carbon electricity.

Through the combination of creating electricity from natural gas (which has relatively low GHG emissions) and generating additional electricity from recovered waste heat, CAL's cogeneration plant saves an average of 15,125 tons CO_2e from being released each year when compared to generating all of the electricity from natural gas alone. Since project inception, this amounts to about 185,250 tons CO_2e and 61% more thermal and electrical energy from the same single unit of fuel input that would have been derived if the waste heat was not captured and utilized.

In addition, due to the innovative facility design, volatile organic compounds (VOCs) generated by printing processes are captured, fed into the cogeneration plant and destroyed as part of the electricity generation process. As a result, CAL is the only "enclosed" printing facility in the country, avoiding 2,700,000 lbs VOC emissions since 1995 without using any extra fuel for the destruction process.

Safeway: Saves fuel and reduces GHG emissions through efficiency and biodiesel initiatives for distribution fleet

To increase the fuel efficiency of its distribution fleet, Safeway enrolled their entire owner-operated 900-plus private truck fleet in EPA's SmartWay Transport Partnership, a voluntary public-private initiative designed to improve environmental performance of the freight delivery system in the United States through money saving, market-based approaches. The technologies and initiatives implemented include an anti-idling policy, automatic tire inflation systems, distribution route optimization and driver training. These programs save more than 6.7 million gallons of diesel fuel annually and prevent approximately 145 million pounds of CO_2 emissions, comparable to removing 14,000 passenger cars from the road for one year and providing tens of millions of dollars in fuel cost savings.

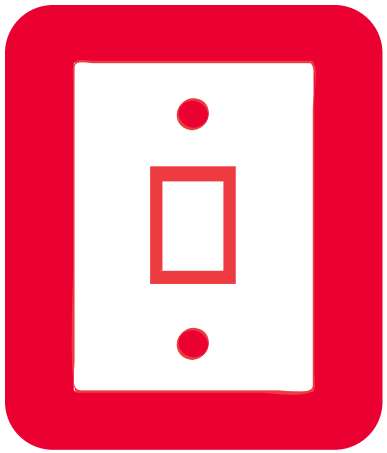
Safeway also joined EPA's SmartWay Grow & Go program, the renewable fuel component for EPA's SmartWay Transport Partnership. Safeway is one of the first major retailers in the United States to convert its mainland distribution truck fleet to run on biodiesel fuel. The fleet consists of more than 1,000 owned and leased trucks now operating primarily on B20—a blend of 20% biodiesel and 80% petroleum diesel—which is supplied from bulk storage tanks located at 15 distribution centers across the United States. The biodiesel portion of the fuel is made from 100% virgin soy and canola, which are un-subsidized feedstocks. This initiative was originally piloted in California and Arizona to develop the required transportation operations process changes, and the national rollout was completed by January 2008.

Through a combination of strategic supply agreements and the potential for valuation of voluntary early action under AB32, Safeway is able to justify the slight premium associated with biodiesel in today's market. Consideration of AB32 and anticipation of future federal carbon legislation were critical in the development of these initiatives. Safeway believes that their proactive approach demonstrates leadership and will save them money in the long-term by placing them in a strong position to earn early action credit that could potentially be applied to mandatory or voluntary reduction and offset programs.

Using B20 biodiesel to fuel their distribution truck fleet reduces Safeway's annual CO_2 emissions by an additional 75 million pounds, equivalent to removing approximately 7,500 passenger cars from the road each year. Biodiesel fuel also reduces toxic particulate emissions that impact air quality.

STEP 2–REDUCE EMISSIONS

Scope 2. Indirect Emissions from Purchased Electricity



Conservation and Efficiency

The first, most cost-effective steps are to improve energy conservation and efficiency. An organization should only consider installing clean electricity generation on-site or purchasing carbon offsets once these steps have been taken.

Approximately 25% of California's 2004 GHG emissions can be attributed to buildings.[26] The buildings your business occupies and the equipment used inside them will likely be responsible for a significant portion of your emissions, particularly if your business is office-based.

The easiest place to begin is with simple behavioral changes, such as switching off lights and making use of the auto-sleep function in computers and monitors when they are not in use. Again, to ensure the long-term success of these initiatives, it is important to involve the workforce through "advertising" or other approaches.

Incentives, Rebates and Free Services

The state's three investor-owned electric utilities and numerous municipal utilities offer extensive rebates, incentives and free services to help businesses with energy conservation and efficiency initiatives. For example, many utilities offer **free energy audits**, which identify operational inefficiencies and offer suggestions for improvements.

In addition, all utilities offer basic incentives and rebates for the installation of efficient lighting and equipment such as refrigeration, air conditioning, motors and power management software.

Visit Flex Your Power (*www.fypower.org*) and input your zip code to learn about conservation and efficiency incentives in your area.

Below is a sampling of programs offered by some of the state's largest utilities that illustrate the types of programs available to businesses. For the most up-to-date information, to see the full array of programs available to you and to schedule an energy audit, call your electric utility or visit their website.

Pacific Gas and Electric *(www.pge.com/mybusiness/energysavingsrebates/)*

- The **Demand Response** program offers incentives for businesses that reduce electric power use during times of peak demand.

Southern California Edison
(www.sce.com/RebatesandSavings/)

- The **Direct Install Program** provides a free energy assessment and free efficient lighting, refrigeration and LED exit signs, including installation, for customers with less than 100kW electric demand.

San Diego Gas and Electric
(www.sdge.com/business/esc/index.shtml)

- The **Small Business Super Saver** program offers cash rebates for upgrading to energy-efficient equipment, such as lighting, refrigeration and natural gas.
- The **Peak Day Credit** program offers a 10-20% bill credit for reducing power usage during hot summer days.

Los Angeles Department of Water and Power
(www.ladwp.com/ladwp/cms/ladwp001859.jsp)

- The **Small Business Direct Install** program offers free lighting assessments and upgrades and installation of energy efficient lighting equipment worth up to $2,500 for qualifying customers.

Sacramento Municipal Utility District
(www.smud.org/business/rebates/index.html)

- **Customized and Express Incentives** are available for efficient lighting, HVAC, motors, refrigeration equipment and management systems, and network PC power management software.

Silicon Valley Power
(www.siliconvalleypower.com/bus/?sub=busrebates)

- The **Optimal Power Use Service** helps customers manage the installation of energy efficient equipment by preparing technical specifications, obtaining competitive bids, monitoring construction and providing post-installation inspections.
- The **Bright Start** program helps new tenants move into properties that already have energy-saving equipment and provides incentives for brokers, property managers, owners and prospective tenants to upgrade facility lighting and HVAC.

Federal Government. The Tax Incentives Assistance Project (TIAP) provides information on how to make use of the federal income tax incentives for energy efficient products and technologies passed by Congress as part of the Energy Policy Act of 2005. For more information visit: *www.energytaxincentives.org/business/*

STEP 2–REDUCE EMISSIONS

An **energy audit** is often the first step in developing an energy reduction strategy. This is the easiest way to determine where energy is being used and what changes might be recommended. Many utilities will conduct an energy audit for free, and consultants can also provide this service.

There are also some simple purchasing decisions that can have a positive impact, including:

- **Purchase Energy Star® products** $
  Energy Star® equipment, ranging from office equipment to household appliances and air-conditioners, has been certified by the US EPA and DOE as more energy efficient than other products in their category.
- **Use LCD computer monitor screens** $
  These use less energy than traditional cathode ray tube monitors.
- **Install internal blinds** $$
  These can be used to reduce internal heat gain from the sun during hours of peak direct sunshine, thus reducing the need for air conditioning.

Lighting

- **Label light switches clearly** None
  A simple strategy that help users identify the correct switch for the lighting they require.
- **Retrofit for energy-efficient lighting** $$
  Compact fluorescent light (CFL) bulbs are about 75% more efficient and last much longer than standard incandescent bulbs. Light Emitting Diodes (LEDs) are now coming into the market in a wide variety of cost effective applications. LEDs last even longer than CFLs, require even less energy and do not contain mercury, reducing the costs and hazards of disposal.
- **Install task lighting** $$
  Designing lighting systems that illuminate specific tasks or work areas allows reductions in overhead lighting density, thus reducing overall lighting energy consumption.
- **Install daylighting controls** $$
  Daylight sensors can be installed to reduce artificial lighting levels when there is sufficient light coming through the windows. There are two types of control—on/off, and dimming. Dimming systems are more complex, help maintain consistent lighting levels year-round and incur higher capital costs.
- **Install occupancy sensors** $$
  Occupancy sensors switch off artificial lighting when no one is present. This is particularly effective in transient or intermittent spaces, such as hallways, parking garages, conference rooms, guest rooms and restrooms.
- **Install light shelves** $$
  Light shelves are simple features that are mounted to the interior or exterior of the building, typically on the southern facade. Sunlight reflects off the surface and into the interior space, away from the window, resulting in deeper daylight penetration. Increased access to daylight also improves the quality of the working environment, making a positive impact on productivity and occupant satisfaction. This strategy would work particularly well when used with daylight sensor controls, thus switching off unnecessary lighting where there is sufficient daylight.
- **Install light tubes and skylights** $$
  In areas without much access to daylight, interior lighting can be reduced by installing either of these features, which both create a link with the outdoors. Light tubes are especially suited to spaces without windows, as the tube can bend through the roof structure and HVAC system, delivering light where needed.

HVAC Systems

Heating, ventilation and air-conditioning systems provide thermal comfort to building occupants. Energy consumption can often be reduced through minor adjustments to the way the systems operate, or through major design changes and/or retrofits.

- **Reset thermostats** None
  In the US, indoor temperatures are typically set to 70-72°F year round. Resetting the thermostat just two degrees in either direction (68°F in winter, 74°F in summer) will start saving energy immediately. Additionally, in the summertime even higher set-points can and should be considered—when the outdoor temperature is well above 90°F, an indoor temperature of 76-78°F is often a welcome relief.
- **Install a building management system (BMS)** $$$

  A BMS is a software program that interacts directly with building systems to monitor and control them, optimizing efficiency. These systems often realize significant energy reductions, but are better suited to situations where the business owns and/or operates a whole building.

STEP 2–REDUCE EMISSIONS

- **Upgrade motors** $$
  Used throughout HVAC systems and manufacturing, today's motors are much more efficient. You can often realize significant savings by replacing older models with new, premium-efficiency or variable speed motors.
- **Insulate exposed ductwork and pipework** $$
  This reduces the heat lost or gained within the system where this is not desirable.
- **Capture waste heat** $$$
  Look for opportunities to recover and reuse waste heat. In the HVAC system, warm exhaust air can be used to pre-heat incoming cold air using a variety of technologies. Process heat can be captured to pre-heat air for adjacent offices or other processes.

Building Envelope

The building envelope refers to the built structure that houses the people and processes, and consists of walls, windows, doors, floors and roofs. Most envelope retrofits are expensive, and so need to be timed appropriately (e.g., facade upgrade), but there are some that are less costly. Here are just a few examples of building envelope retrofits:

- **Install double glazing** $$$
  In much of California's older building stock, single-glazed windows are the norm. However, many locations would benefit from the additional insulation offered by a double-glazed window assembly to reduce heat gain and loss in the summer and winter, respectively.
- **Install tinted windows or reflective coatings** $$
  These two strategies are very effective at reducing cooling loads within the building, which is often one of the greatest energy consumers compared to other building systems.
- **Paint roof with reflective paint** $
  This will reduce the amount of solar heat gained through the roof, thus reducing the need for air-conditioning indoors.
- **Limit air infiltration** $$
  Older buildings are prone to "leakage," meaning that outside air can enter the building and place a greater load on the HVAC systems. A building pressure test can help identify any serious issues in this area, which can usually be rectified with a standard sealant or caulking.
- **Insulation** $$
  Improving the level of insulation within wall and roof cavities can reduce heat loss in the winter, thus reducing the need for heating.

Challenge: Working with the Landlord

Obtaining electricity consumption data for leased office space often poses a significant challenge. If you are a tenant and your individual space is not metered, it is likely that you are paying a flat rent that includes utilities. This will make it difficult to calculate your business' emissions associated with indirect electricity generation and use. Moreover, it could also be difficult to make significant efficiency improvements to building systems, since these often serve multiple tenants.

In September 2007, the California Public Utilities Commission adopted new rules that will permit the utility PG&E to provide sub-metering of tenants in high rise commercial buildings.

Green Buildings and LEED

Developed by the US Green Building Council, LEED (Leadership in Energy and Environmental Design) is the nationally accepted benchmark for the design, construction and operation of high performance green buildings. While LEED does not specifically address GHG emissions, it has a strong focus on many building-related emissions reduction activities, such as energy conservation, efficiency and renewable energy. Businesses interested in using LEED's resources for building design, construction, or operation, and potentially gaining recognition for their emissions reduction efforts, should visit *www.usgbc.org/leed* to learn more.

Zen Compound/Temple Nightclub: Capitalizing on free services saves energy and money

Zen Compound/Temple Nightclub, an entertainment complex with fewer than 50 employees that houses Temple Nightclub, Prana Restaurant, Temple Music Group, Green Temple and other units in San Francisco, has taken advantage of PG&E's free services, resulting in decreased energy usage, reduced GHG emissions and cost savings.

One of their first actions was to call PG&E to schedule a free energy audit. The auditor examined their exit signs, refrigeration equipment, HVAC system and appliances, and found that their recently-purchased ice machines were eligible for a $1,000 rebate from PG&E because they were energy efficient models.

The auditor recommended that they call a lighting specialist, Energy Watch, to conduct a free lighting inventory of the building. Temple provided them with information about how long each light is on per week, and Energy Watch used this information to provide a cost assessment and suggest efficient replacement lighting such as CFLs and LEDs. Temple is currently in the process of making the changes Energy Watch recommended, and once completed, they will have received $17,000 worth of rebates after $12,000 in upfront costs. In addition, Energy Watch supplied them with free installation and information on recommended light vendors.

In addition, from July 2007 to September 2008, Temple has offset their over 177,000 pounds of CO_2e emissions from electricity use and almost 132,000 pounds of CO_2e emissions from natural gas use through PG&E's Climate Smart Program (see Step 3: Purchase Offsets).

Temple is working with others in their industry to encourage similar changes by sharing their strategy and the economic rewards. This "coopetition" allows Temple to participate in their community, a core part of their mission as a business. Temple believes such collective action allows them to learn from others, increase their exposure, and make sure their industry stays proactive rather than reactive. As a result, Temple has been invited to help develop, participate and advise chamber of commerce, city and state-level programs in this area.

Fresh & Easy: Innovative lighting, refrigeration and building design reduces energy use and costs

Fresh & Easy's stores incorporate numerous design elements intended to reduce their electricity consumption and GHG emissions. New stores have skylights and automatically dimming overhead lighting, and external signs and freezer cases use LED lighting. Night shades on refrigeration cases keep cool air from escaping, and a secondary-loop system captures and reuses cool air. The buildings also have increased insulation to reduce heating and air conditioning needs. To help them manage and further reduce their energy use and GHG emissions, Fresh & Easy also uses web-based, real-time monitoring and auditable and verifiable reports of their energy use, refrigerants and emissions, through the services of Verisae.

Focusing on the efficiency and design of their refrigerators was especially important to Fresh & Easy, since refrigerants have a high GWP, contributing approximately 20-35% of an average grocery retailer's GHG emissions. Beyond carbon savings, replacing leaked refrigerants costs $6-10 per pound. Due to the design and usage of their refrigeration systems, 30-44% of Fresh & Easy stores' energy usage goes to refrigeration, compared to 50-70% in an average grocery store.

Fresh & Easy partnered with several groups in designing their stores and calculating and receiving the financial benefits of their initiatives. Savings By Design, a program administered by California utilities, helped design the stores and calculate the cost savings. In addition to their monitoring services, Verisae managed Fresh & Easy's applications for rebates from local utilities, which were significant. Beyond these upfront incentives, a modeling exercise revealed that their stores are about 30% more energy efficient than the average supermarket, saving them about 30% on their energy bills.

Fresh & Easy found that it was important to coordinate efforts between all the disciplines involved early on in the design process. Moreover, Fresh & Easy's understanding of the long-term energy savings rather than the short-term construction costs of the initiatives was crucial in their adoption.

STEP 2–REDUCE EMISSIONS

Work with the landlord to determine what they are willing to invest to upgrade building systems—it is possible that as a tenant you might contribute to the work. Tenants are often successful in these endeavors when they join together to garner the landlord's or building owner's support. However, be aware that the landlord could be reluctant to pass on the benefit of reduced energy bills, although the goal of lower emissions will have been achieved.

Challenge: Beware The Rebound Effect

Energy efficiency improvements can give rise to an unexpected response known as the "rebound effect." When savings are realized in one aspect of operations, it gives false freedom to increase emissions elsewhere. For example, retrofitting all lighting with compact fluorescent bulbs, only to leave them on longer, does not reduce overall emissions.

Challenge: The Information Technology Industry

The IT industry faces a unique challenge with regard to its "process" loads. Globally, PC ownership is predicted to quadruple, mobile phone ownership will almost double and broadband uptake will triple between 2007 and 2020. Despite the major anticipated advances in the energy efficiency of products, as internet traffic continues to grow and e-commerce expands, so will the demand for server capacity and the need for energy-intensive cooling of server farms. Emissions from the IT sector are expected to increase 6% per year and double by 2020.[27] Currently, the industry is looking for solutions that do not conflict with economic growth and is taking positive steps to reduce energy consumption in server farms.

However, the IT sector also has the unique ability to monitor energy use and maximize energy efficiency both within and outside of its own sector. By enabling other sectors to reduce their emissions, the IT industry could reduce global emissions by as much as 15% by 2020—five times its own footprint in 2020.[28] For more information, see *www.smart2020.org.*

HP: Data center consolidation and efficiency measures save energy and money

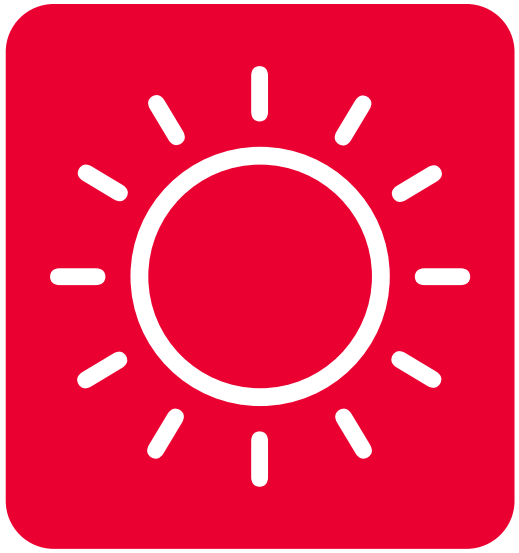
HP's ambition to lead in energy efficiency and GHG reductions stems from their commitment to global citizenship, the likely impacts of unmitigated climate change on the global economy per the IPCC and Stern reports, and the opportunities to grow their business by helping customers reduce their carbon footprint.

Energy use accounts for over 97% of the GHG emissions generated by HP's internal operations and is one of their largest operating costs. With this in mind, HP has set a goal of reducing GHG emissions from energy consumption at global HP-owned and HP-leased facilities by 16% from 2005 levels by 2010.

One way HP is reaching this goal is by consolidating data centers, thereby decreasing energy use, the associated carbon footprint of their facilities, as well as costs. Over three years ending in 2008, HP has been consolidating its 85 data centers into six new generation data centers in three US cities. In total, the consolidated data centers occupy more than 38,000 square meters, 35% less than the original 85 sites.

In addition, the consolidated sites are being optimized with HP's latest energy efficiency technology, including energy-saving features and cooling technology to enable real-time adjustments to air conditioners, fans, vents and computing equipment. Such cooling systems typically yield energy savings of 20-40% over legacy HP data centers.

When the initiative is complete and fully optimized, HP anticipates yearly energy savings from data center consolidation of up to 350 million kWh and annual cost savings of up to $25 million. This will build on other initiatives which have already decreased natural gas and electricity consumption and changed manufacturing processes. HP's total energy use decreased approximately 4% in 2007 and GHG emissions from operations (not including business travel) decreased 5% in absolute terms and 17% per unit of revenue.



Low Carbon Supply

Once you have implemented the selected conservation and efficiency strategies, it is time to explore low carbon options to meet your facility's remaining energy demand.

You can generate electricity on-site using low-carbon sources (see section on scope 1, page 23), purchase electricity from a utility using only low-carbon sources, or pursue a combination of the two.

When stand-alone on-site energy generation systems are generating more electricity than required by your facility, interconnection allows you to sell electricity back to the local utility. These "distributed generation" agreements are becoming more and more common as new feed-in tariffs are developed and improved upon. (See Challenge: "Grid-connection and Net-metering," on page 32.)

The type of system pursued will depend on a number of things, including budget, available space, maintenance requirements and reliability.

Start by consulting with a local installer to get guidance on the potential generation capacity on your site, as well as a quote for installation, operation and maintenance. The different technologies have varying payback periods and a thorough cost-benefit analysis will support your decision-making process.

In addition to the technologies discussed for scope 1 emissions, the following options are becoming increasingly popular:

Building-Integrated Wind $$$

There are two types of small-scale wind power:

- Horizontal axis—smaller versions of the utility-size turbines; these require space on site, and might encounter zoning issues.
- Vertical axis—these turbines are much smaller and are designed specifically for roof-mounted applications.

The viability of a wind installation depends heavily on the available wind resources and hinges on the average annual wind speed. Many turbines do not generate any power at all below a given wind speed, known as the "cut-in speed." Regional wind speed information can be found at *www.doe.gov*.

Terms to Know

Renewable Energy
Energy made from a source that replenishes itself, for example solar, hydropower or wind.

Clean Energy
Energy that produces little or no pollutants in the air when generated. The energy source is not necessarily self-replenishing (for example, natural gas).

Solar Photovoltaics $$$

Solar photovoltaic cells, also known as PV or PVs, are made from silicon and convert solar radiation directly into electrical energy.

Silicon cells come manufactured into "solar panels" that are then mounted onto buildings or on the ground. Alternatively, "thin film" PV requires the silicon to be deposited directly onto a glass or metal substrate, which is then used in place of typical window or roof material, providing both electricity and roofing or shading at the same time.

Both types of PV cells can also be used in building-integrated applications such as canopies and window shading devices. Building-integrated applications often reduce cost of installation and materials because the purchase only needs to happen once.

STEP 2–REDUCE EMISSIONS

Challenge: Grid-connection and Net-metering

The intermittent nature of wind and sunshine requires a way to divert or store excess power so that it can be available later. Traditional storage technologies (i.e., batteries, pumped-storage dams) are very costly, so grid interconnection is crucial. Electricity generated on-site can be "sold" in return for additional grid supply when required. Most utilities have already developed rules for this process, known as "net-metering," along with associated "feed-in tariffs" (the payment you receive for electricity you supply to the grid). More information can be found at *www.eere.energy.gov/greenpower/markets/netmetering.shtml*

British Telecommunications: On-site solar installation requires no upfront capital cost and qualifies for rebates

British Telecommunications (BT), a global IT and communications solutions provider, is currently installing a 2,000-module solar photovoltaic system for its Americas' headquarters site in El Segundo, California. The system, being constructed on the building's roof and over the parking area, is expected to be fully installed and operational by November 2008. Once completed, the system is expected to be among the largest of its type in Southern California.

After examining electricity prices and non-renewable and off-site and on-site renewable projects, BT chose an on-site solar project because it guaranteed its electricity supply at a predictable price, met its carbon reduction goals and was less expensive than or equivalent to other options.

The project is the result of a partnership between BT and three other entities: Solar Power Partners (SPP), which is financing the project and will own and maintain the system; EI Solutions, which has designed and is currently installing the system; and Broadreach Capital Partners, the site's owner. Once constructed, BT will purchase 100% of the electricity produced through a Power Purchase Agreement with SPP, without incurring any upfront capital costs.

The vast majority of the system's solar modules will be mounted on top of an elevated single-axis tracking system, enabling the solar panels to move during the course of the day to track the sun, thereby maximizing energy production. BT's El Segundo building was an ideal location for the solar power system due to its large, unobstructed, south-facing areas. Some of the solar panels of the project will also provide an ancillary benefit of a shaded parking area for employees.

Once completed, the system is expected to generate approximately 917,000 kWh per year, approximately 15% of BT's energy requirements for the site. In addition, the system is expected to reduce GHG emissions by 642,000 pounds (more than 290 metric tons) annually. The project has also qualified for rebates under the California Solar Initiative.

BT's established framework for supporting emissions reductions was integral to its decision to move forward with the El Segundo solar project. Rather than being an isolated initiative, the project is part of BT's overall global commitment to tough GHG emission reduction targets. As part of its Climate Stabilization Intensity target, BT will cut its global GHG emissions (from scope 1, scope 2, and some scope 3, e.g., business travel) per unit of contribution to GDP by 80% from 1996 levels by 2020.

Rebates and Incentives

- The California Solar Initiative offers performance-based incentives for photovoltaic systems. The incentive payment levels will be reduced over the duration of the CSI program in 10 steps, so early movers are eligible for larger incentives. For more information, see *www.gosolarcalifornia.ca.gov/*

  The California Solar Initiative website also houses information on federal tax incentives. *See www.gosolarcalifornia.org/csi/tax_credit.html*
- In addition, many utilities also offer financial incentives. For example, Self-Generation Incentive Programs provide incentives for businesses that generate their own power using qualifying systems in parallel with the electric grid. Check with your utility to see what's available.
- The California Energy Commission offers cash rebates on eligible grid-connected small wind turbines through its Emerging Renewables Program. For more information, see *www.consumerenergycenter.org/erprebate/index.html*
- For information on federal tax credits for renewable energy through the National Energy Policy Act of 2005, see *www.energytaxincentives.org/business/*

Addressing Costs

The most common obstacle to any emissions reduction strategy is the capital expenditure required. In addition, cheap grid electricity can often skew the cost-benefit analysis for reductions in scope 2 emissions.

There are many incentives available for building, lighting and HVAC upgrades as well as for renewable energy installations (see pages 26 and 32). For the latter in particular, it is important to determine an acceptable return-on-investment early on, and work with the power utility to agree on the best rate structure possible. Investigate all possible incentives to offset capital costs, including tax breaks and grants. If you are a non-profit organization, seek donors or sponsors who would be amenable to providing the capital investment required.

Ensure that you are working with the most up-to-date information and are able to make an informed decision about whether to proceed. It is, of course, possible that the intangible benefits of brand equity and reputation outweigh the financial burden, and these factors should be taken into account.

As an alternative to internal investment, consider partnering with a utility or a DBOO (a company that designs, builds, owns and operates the system). DBOOs and ESCOs (Energy Service Companies) design, install, maintain and, in many cases, finance renewable energy installations. A common operating structure for this arrangement is a Power Purchase Agreement (PPA). Put simply, the PPA lays out the terms of ownership, operation, and negotiated rates for electricity generated. This frees the customer from capital investment, allowing them to pay only for the electricity generated on-site. These agreements typically run for 10-25 years, locking in agreeable rates and reducing exposure to increasing electricity prices. These systems may be especially attractive if you are looking for ways to reduce high cost energy during “peak” hours, as solar electrical generation peaks at about the same time of day as the need for air-conditioning and the cost of electricity. In most PPAs, operation and maintenance remains the responsibility of the owner.

STEP 2–REDUCE EMISSIONS

Scope 3. Other Indirect Emissions

Indirect emissions that do not arise from electricity purchases include:

- Business-related travel
- Employee commuting
- Waste disposal
- Contractor-owned vehicles
- Outsourced activities
- Product use
- Production of purchased materials
- Material and product transport

Transport

The transportation sector, including road, railway, marine transport and aviation, accounts for about 38% of California's current GHG emissions.[29] Typically, the areas in which a business has the most impact are business-related travel, employee commuting and the supply chain, but this will vary according to the type of business. For example, a small office-based business located in a central business district will have operational transportation needs very different from a retailer such as Safeway. Scope 3 emissions include those from vehicles that are owned or leased by an organization external to the company rather than vehicles that are owned or leased directly by the organization (which are classified as scope 1 emissions).

Business-Related Travel

- **Use video-conference facilities** $$
  Advances in video-conferencing have come a long way in recent years. Additional cameras allow parties to view documents on the conference table, and "smart-boards" allow participants to record and e-mail notes and actions at the touch of a button.
- **Remote Access** $
  It is now possible to invite remote users to access a central PC desktop and teleconference at the same time.

Sun Microsystems: Distributed workforce reduces costs while increasing employee satisfaction and productivity

One way Sun Microsystems is addressing scope 3 emissions is through their Open Work program, which allows an increasingly mobile and distributed employee population the flexibility to work from home or widely distributed shared workspaces. Initially developed ten years ago, the program now supports nearly 20,000 employees without a dedicated office, while the average employee works from home 2.3 days per week. In California, approximately 37% of employees work from home either some or all days. Technology solutions such as video-conferencing equipment and remote access to electronic files allow employees to work effectively from any location.

The initiative is providing Sun with impressive reductions in their scope 3 emissions through commute avoidance. On average, each employee saves 1 metric ton of carbon emissions annually, as well as 100 hours from commute avoidance. These emissions savings are 50-100 times greater than the emissions produced as a result of working from home. In total, Sun's Open Work program prevented 31,000 tons of CO_2 from entering the atmosphere in 2007, mostly from avoided commute, but also through decreased use of electricity in real estate (scope 2).

Beyond carbon savings, in fiscal year 2006, Sun reduced its real estate operating costs by $67.8 million as a result of the Open Work Program. Based on a June 2008 internal survey, employees believe that the Open Work platform provides them with the tools and technologies to support their work environment and to help them feel more productive. The flexible and innovative work environment and Sun's ability to attract and retain top talent are two of the top reasons 82% of employees said they would recommend Sun. Moreover, employee participants in a 2006 commuter study reported that they gave 60% of their saved commute time back to the company.

- **Multi-task** None
  If it is absolutely necessary to travel by air, use the opportunity to meet with other potential clients or interview a prospective employee. Consider combining trips using a multi-city itinerary instead of flying two roundtrips.
- **Rent hybrid or electric cars** $
  Many major car rental companies now offer hybrid vehicles. If more businesses request these, rental companies will respond by making more available.

Employee Commute

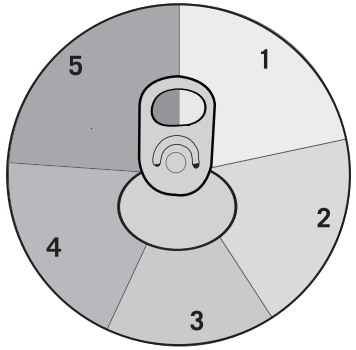
Your employees' commute is not explicitly covered by inventory frameworks, but clearly work-related commuting has an impact on climate change in California and is something that employers can influence.

The results of an employee survey will give insight into commute patterns and help you decide how to best reduce these emissions. (See page 17 on how to calculate emissions.)

- **Offer telecommuting** $
  Where possible, allow some flexibility in employee schedules, encouraging them to work from home as often as appropriate.
- **Offer incentives to take public transit to work** $
  Provide tax-free transit passes (e.g., commuter checks); provide on-site cars for employee use to attend off-site meetings during the day.
- **Offer incentives to walk or cycle to work** $
  Provide bicycle parking and changing/shower facilities.
- **Support carpools** None
  Provide information on internal and local carpool options.

Figure 8. Sample Carbon Footprint of a Can of Cola

1. Raw Materials	2. Project Manufacturing	3. Distribution & Retail	4. Consumer Use	5. Disposal & Recycling
Aluminum Production	Cola Production	Transportation	Refrigeration	Can Collection
Sugar Farming & Refining	Packaging	Chilled Storage & Retail		Recycling or Disposal



Based on The Carbon Trust, *Carbon Footprints in the Supply Chain*, 2006.

Supply Chain

Supply chains consist of a network of manufacturers, wholesalers, distributors and retailers who turn raw materials into finished goods and services and deliver them to consumers. GHG emissions resulting from individual products as they pass through the supply chain can account for a significant amount of a business' overall emissions.

A product's "carbon footprint" takes into account all associated impacts of a product, from sourcing the raw materials, to manufacture, through to use and disposal. An example carbon footprint of cola is illustrated in Figure 8.

Understanding these impacts is called a "life cycle analysis" (LCA), and moves away from single-company carbon management to covering multiple sites and multiple businesses operating in a supply chain. Many businesses are taking responsibility by working closely with others in their supply chain to help them reduce emissions, or identifying new suppliers who have already taken steps to reduce emissions in their operations. Businesses need to collaborate closely with

STEP 2–REDUCE EMISSIONS

suppliers and distributors (upstream and downstream) to understand issues such as:

- Practices and energy use in order to identify where efficiency improvements can be made
- Opportunities to use materials that are less emissions intensive
- Use of local materials
- Benefits of centralized manufacturing compared to increasing distribution miles.

By looking beyond core operations, businesses often discover interesting and sometimes unexpected carbon spikes in other parts of their supply chain. As a result, they are able to prioritize and take more effective actions, which in turn lead to emissions reductions, improved efficiencies and financial benefits.

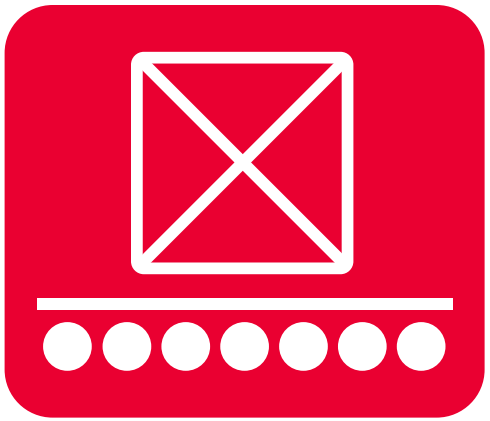
Many businesses are at different stages in the process of calculating, tracking, managing and reducing emissions across the various elements of their supply chain, and they are adopting many different approaches. For example, various businesses are:

- Conducting a full LCA for some of their products
- Tackling distinct parts of their supply chain such as distribution logistics or packaging
- Working with their individual suppliers to encourage them to be more energy or fuel efficient
- Providing tools, financing and models to their suppliers to ensure reductions without becoming directly involved

Recommendations and Resources

1. **Encourage your suppliers to disclose their GHG emissions** in order to better understand how they are considering climate change and GHG emissions reductions.
2. **Work with your suppliers** by sharing information and resources to help them address and reduce their scope 1 and scope 2 GHG emissions. In other words, encourage your suppliers to follow the steps laid out in this guide. Make carbon an integral part of supply chain engagement, just as labor, chemical management and human rights may already be.
3. **Influence the value chain** through:
   - *Purchasing decisions*—develop a low carbon purchasing policy, designed to direct business towards suppliers that have taken steps to reduce their emissions.
   - *Participation in sector collaborations* that determine best practices, codes of conduct, or similar standards for business conduct on mechanisms and standards for supply chain management.
4. **Use recognized and widely-used LCA software tools,** for example SimaPro7 and GaBi, and ensure the quality of data when analyzing supply chains (see the Resources section).
5. **Use protocols.** WRI and WBSD are in the process of developing new standards to provide guidance for product lifecycle and supply chain emissions. The Carbon Trust, British Standards Institution and the UK Government are also developing a standard method for the measurement of lifecycle GHG emissions of goods and services (called PAS 2050).

The Carbon Disclosure Project (CDP) recently formed a Supply Chain Leadership Collaboration (SCLC) group and provides guidance for suppliers on how to disclose their GHG emissions. The CDP sent a questionnaire to a targeted number of suppliers on behalf of SCLC members to elicit information on GHG emissions, climate strategy and associated risks and opportunities.[30]



6. **Be aware of resources.** For example, The Carbon Trust is an independent company set up by the UK government to work with businesses to pioneer supply chain case studies. (See the Resources section for other organizations.)

Businesses that act as suppliers need to be aware that their customers may be following the steps above, and should be prepared to measure, disclose, and reduce their GHG emissions for customers that demand it.

Challenge: Control versus Influence

As illustrated in Figure 6 on page 14, the degree to which supply chain emissions can be influenced and controlled can be a challenge.

Apple: Including product lifecycle emissions in a corporate footprint reduction strategy

Apple's carbon inventory captures both emissions from upstream suppliers and downstream customers as well as their own operations. Their 2006 assessment revealed that emissions from their owned and leased facilities, including office buildings and retail outlets, along with employee travel, accounted for less than 5% of the total emissions when product supply chain emissions were included.

As a result, Apple concluded that in order to foster a meaningful reduction in their corporate footprint, they needed to address product-related impacts. This means integrating lifecycle environmental impact data into the product design process. This holistic approach focuses on developing product-specific analyses encompassing an entire lifecycle, from raw material extraction and component manufacturing, to use and recycling.

In order to conduct product-based lifecycle analyses (LCAs), Apple first carefully defined the lifecycle stages and products to be examined. Then, using data collected from a range of sources and LCA tools, Apple conducted assessments on an array of products according to LCA guidelines specified by ISO 14040 and ISO 14044.

The completed LCA allowed Apple to identify individual activities and suppliers that account for the largest share of emissions in the production, transportation, use and end-of-life phases of their product lifecycles. In some cases, their findings helped to reaffirm Apple's existing design recommendations. For example, the large share of emissions attributed to the power consumed during product use helped reinforce Apple's dedication to improving product power management. Other cases that were identified led to a more detailed investigation into the footprint of specific parts and components. For example, Apple learned that integrated circuits and chipsets not only form a significant part of the production emissions, but also play a key role in determining the system's total power consumption during use. Measuring emissions at each phase of a product's lifecycle is key to being able pinpoint product improvements that can deliver meaningful reductions in GHG emissions.

STEP 3–PURCHASE OFFSETS

Terms to Know

Offset
Reduction, removal or avoidance of GHG emissions from a specific project that is used to compensate for emissions occurring elsewhere.

Offset credit
An offset of one metric ton of CO_2e.

Additional, Additionality
Emission reductions that are "in addition to" reductions that would have occurred without the incentive provided by offset credits. In other words, the revenue from selling the project's emission reductions should have incentivized the project's implementation to ensure that emissions reductions are not "business as usual."

* *Establishing why a project was implemented can be difficult; thus, demonstrating a project's additionality generally involves a series of tests to assess the regulatory, financial, technical and institutional barriers a project faces. No single approach is the best for all projects or project types, and generally a combination of tests is necessary.*

Renewable Energy Certificate (REC)
Tradable environmental commodity signifying that an electricity provider supplied 1 megawatt-hour (MWh) of renewable electricity (such as solar, wind or biomass) to the grid.

Carbon Neutral
When an organization or a specific activity emits no net carbon emissions to the atmosphere because its carbon impact has been reduced and offset.

* *There is no widely accepted definition of this term.*

A GHG offset represents the reduction, removal or avoidance of GHG emissions from a specific project that is used to compensate for emissions from other activities that are unavoidable. Examples of offset projects include capturing the methane from manure at a dairy farm or replanting forests to store carbon.

Offsets can be bought on two types of offset markets:

- **Compliance market:** Businesses falling under a regulated cap may have a number of choices if they are required to reduce their emissions. They can reduce emissions internally, purchase allowances from other capped entities who do not need their entire allocation of allowances as part of a cap-and-trade system, or they may be allowed to purchase offset credits from projects outside the cap that have been approved by the regulating authority. The California Air Resources Board is considering whether to allow offsets to be used under the policies it is developing, and some California businesses have started developing offset projects in anticipation of a compliance market as part of AB32 and the Western Climate Initiative (see page 7).

  Such compliance markets are already in place in the EU (Emissions Trading Scheme) and the Northeast/Mid-Atlantic US (Regional Greenhouse Gas Initiative [RGGI]).

- **Voluntary Market:** In an unregulated, voluntary market, or for those outside a regulated cap, businesses and individuals are not required to reduce their emissions.[31] But they may choose to purchase offsets from the voluntary market in order to tackle the remaining "last mile" of emissions, i.e., those which cannot be addressed by internal reductions. Businesses may chose to invest in offset projects to reduce GHGs in amounts equal to the amount they are still emitting (for example, emissions caused by unavoidable employee business travel) in order to become carbon neutral.

Because offsets are accounted for as emission reductions made by the paying entity, the key criterion is that the CO_2e reduction, removal or avoidance is *additional*, or *in addition to* reductions that would have occurred under "business as usual" scenario (see detailed definition on page 38). Buyers of offsets can only claim a unique, incremental "offset" reduction if the reduction is additional.

Besides being additional, a true offset must meet several other criteria, including:

A total volume of 65.0 $MtCO_2e$ was transacted in voluntary carbon markets in 2007, with an estimated value of $330.8 million. This is more than three times the 2006 calculated market value. Regulated markets have also risen significantly and accounted for close to $64 billion in 2007, $50 billion of which was attributable to the EU Emissions Trading Scheme.[32]

- Based on a realistic baseline
- Real
- Permanent
- Verifiable
- Unambiguously owned
- Quantified and monitored
- Avoid leakage
- Do no net harm

For a detailed description of these criteria, see the Offset Quality Initiative website, at *www.offsetquality.org*

How to purchase offsets

1. **Develop a tailored, robust strategy** to determine the type and amount of offsets to purchase. Some questions to consider:
   - What emissions will the offsets cover (e.g., organizational boundaries, specific products or services, or certain events)?
   - What is the budget? When purchasing offsets, the least cost option may lack quality, and conversely, the most expensive option is no substitute for due diligence.
   - Will buying offsets help you anticipate or comply with a mandatory cap-and-trade system?
   - How will the decision to purchase offsets be communicated, both internally to employees and shareholders, and externally to customers and the media? What claims and messages are you hoping to convey?
   - Who will pay for offsets? In order to encourage accountability and responsibility, consider requiring individual business units to purchase offsets in proportion to their emissions.

   Offset projects vary in their advantages, disadvantages and co-benefits, which are important to understand in order to identify which project aligns best with your organization's goals. Some questions to consider:
   - Are there preferred areas of geographic or sector focus? Investing in a specific area may have valuable co-benefits for your operations in that region.
   - Are there particular technology types that your business wishes to either support or avoid?
   - How important are the sustainable development attributes of projects?
2. **Determine from whom to purchase offsets.** Offset sellers should provide transparent and easily accessible information about the types of projects they use to generate their offsets. Established organizations may have more experience and carry reputational risks if they sell poor quality offset credits.

PG&E's ClimateSmart™ program is a voluntary program that enables customers to make their home or office energy use "climate neutral" by adding a small, tax-deductible amount to their monthly utility bill to offset the emissions from their actual energy usage. PG&E invests 100% of the payments to the program in new environmental projects in California, such as conserving and restoring forests and capturing methane gas from dairy farms and landfills, thereby absorbing or reducing greenhouse gas emissions from the atmosphere and balancing out the climate impact of ClimateSmart customers' energy use. To learn more about the ClimateSmart program, visit *www.pge.com/climatesmart*.

STEP 3–PURCHASE OFFSETS

Here are some additional questions to ask of offset sellers:

- What offset standard do their offsets use? (see #3 below)
- Do their offsets result from specific or single projects, or from a pool of projects (which can spread risk)?
- Are they selling credits that have already been issued or credits that represent emission reductions that will occur in the future? While it is acceptable for companies to sell the rights to future emissions reductions prior to an offset project's implementation or occurrence of the GHG emission reductions, these offsets cannot be applied by the purchasing company until the actual emission reduction project has been verified and credited.
- What are they doing to educate their buyers about global warming and the need to take direct action?

3. **Choose an offset standard suited to your needs**. Offset sellers should be using recognized standards to ensure the quality of the product and that they meet the criteria listed on page 39. For example, standards are used to ensure additionality and that offsets have been verified by a third party against credible and rigorous protocols. There are a number of standards available—see examples in Table 6 on page 41, adapted from the 2008 WWF publication *Making Sense of the Voluntary Carbon Market: A Comparison of Carbon Offset Standards.*
4. **Undertake Due Diligence.** Before and after purchasing offsets, you should assess projects to ensure they are delivering what they say. Non-profits and consultants can help with this.
5. **Ensure offsets are retired on a credible GHG registry**, meaning they will be taken out of circulation, removing the risk of double counting. There are several registries offering these services and many offset retailers also operate independently audited internal registries.
6. **Be transparent about offset purchases**. Disclose information on carbon footprint calculations, emission reduction activities, the type of offsets being used, where offsets have been retired and any uncertainties related to these issues. For more information on reporting, see page 43.
7. **Review your approach on a regular basis** to ensure it is still in line with best practice. Your organization's GHG inventory and approach to carbon management will change over time, as will the carbon market.

- **Challenge:** The voluntary market for offsets has grown very quickly and some dubious practices have led to criticism in the media around the credibility of offsets.
- **Challenge:** As different US mandatory markets develop at differing rates, it is unclear in some regions what the role of offsets will be and how they will be treated. It is possible that each region will treat offsets differently.

Table 6. Offset Standards

Standard	Additionality Tests (relative to CDM)	Third-party verification required	Registry	Project types	Exclude project types with high chance of adverse impacts	Co-benefits (relative to CMD)	Price
Clean Development Mechanism (CDM)	=	Yes	Yes	LULUCF, RE, EE, IG (but not new HFC)	No	=	$20-42
California Climate Action Registry (CCAR) / Climate Action Reserve	=/+	Yes	Yes	LULUCF, REDD landfill, livestock waste management. (Others forthcoming)	Yes	+	~$8-11
Gold Standard	=/+*	Yes	Yes	EE, RE	Yes	+	VERs: $14-28 CERs: up to $14 premium
Voluntary Carbon Standard (VCS)	=†	Yes	Yes	LULUCF, REDD, RE, EE, IG (but not new HFC)	No	-	$7-21‡
Chicago Climate Exchange	-	Yes	Yes	LULUCF, REDD, RE, EE, landfill, livestock waste management, IG	No	-	$1.5-3
Climate, Community & Biodiversity Standard (CCBS)	=	Yes	N/A	LULUCF, REDD	Yes	+	$7-14
Plan Vivo	=	No	Yes§	LULUCF	Yes	+	$2.5-13

Based on WWF, *Making Sense of the Voluntary Carbon Market: A Comparison of Carbon Offset Standards*, 2008.

Notes on the table:

Additionality Tests (relative to CDM): The CDM additionality tool most commonly used for testing the additionality of CDM projects was developed carefully over several years. In this column it is used as a reference against which the other standards' project-based additionality testing procedures are compared:

+ Requirements go beyond and are more stringent than CDM rules
– Requirements are less stringent than CDM
= Requirements are the same or very similar to CDM

Project Types: Each standard accepts different types of offset projects as listed in the column.

LULUCF	Land Use, Land-Use Change and Forestry (Bio-Sequestration)
REDD	Reduced Emissions from Degradation and Deforestation of Existing Forests
RE	Renewable Energy
EE	Energy Efficiency
IG	Industrial Gases, e.g., HFC, SF_6, N_2O

* For large scale projects the Gold Standard requirements are the same as for CDM. Yet unlike CDM, the Gold Standard also requires the CDM additionality tool for small-scale projects.
† The VCS is open to performance standard additionality tests if project proponents bring forward credible tests.
‡ Prices are for projects implemented under VCS ver. 1.
§ It verifies and sells ex-ante credits only. Third party verification is not required but recommended.

In 2005, The Climate Group, The International Emissions Trading Association and The World Economic Forum, responding to a need in the voluntary offset market for credible voluntary offset standards, began work on the Voluntary Carbon Standard (VCS). The VCS was released in 2007, after two years of work, the establishment of a 19-member steering committee, and a rigorous stakeholder process. The World Business Council for Sustainable Development joined as a founding partner in 2007.

The resulting VCS Program provides a robust global standard and program for approval of credible voluntary offsets, and is rapidly becoming the leading standard in the voluntary carbon market. In 2007, the VCS had 29% of the market share by transaction volume, and according to a recent survey, more industry respondents planned to use the VCS in 2008 than any other standard.[33] For more information on the VCS, please visit *www.v-c-s.org/*

STEP 3–PURCHASE OFFSETS

Yahoo: Taking responsibility for corporate impact by purchasing quality offsets

In 2007, Yahoo! Inc. co-founders David Filo and Jerry Yang announced their intention to make Yahoo! carbon neutral. After measuring their GHG emissions and making reductions where possible, Yahoo! invested in GHG reduction projects to offset 100% of their remaining 2006 emissions from scope 1, scope 2, and some scope 3 (business travel and employee commute), estimated at 250,000 metric tons of CO_2e.

Yahoo! received over 100 responses to their request for proposals for offset projects and used several criteria to sift through them. For example, additionality had to be proven through the provisions of the CDM standards used under the Kyoto Protocol and projects had to be verified by an independent third party. Furthermore, Yahoo! decided that projects had to be located in regions where Yahoo! has a presence; as local consumers of electricity, Yahoo! has a stake in the development of the electricity grid and wanted to immediately encourage low-carbon growth.

After careful consideration, Yahoo! acquired carbon reduction credits from project developer Ecosecurities and through the brokering services of CantorCO_2e. The credits are derived from three renewable energy projects: a small scale run-of-river hydropower project in Western Brazil, and wind turbines in Tamil Nadu and Maharashtra states in India.

Yahoo! recognized several benefits to offsetting their emissions. The cost of offsetting their emissions gave them an extra incentive to examine their consumption and GHG emissions patterns more closely and increased their understanding of the accelerating value and attractiveness of efficiency, which businesses tend to undervalue. Additionally, becoming carbon neutral gave them credibility in the eyes of their 500 million users, whom they encourage to make low carbon choices through sites like Yahoo! Green.

Yahoo! continues to see offsets as a necessary part of taking full responsibility for their impact, and intends to purchase offsets to cover their 2007 GHG emissions.

Renewable Energy Certificates

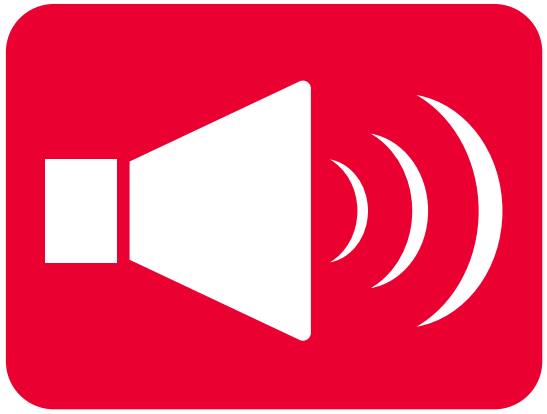
Renewable Energy Certificates (RECs), also known as Green Tags, Renewable Energy Credits, or Tradable Renewable Certificates (TRCs), are tradable environmental commodities which represent proof that 1 megawatt-hour (MWh) of electricity was generated from a qualifying renewable energy resource connected to the grid. A renewable generator can sell both commodities together as "renewable electricity" or sell the electricity as "generic" electricity to one buyer and the RECs to other buyers.

In other words, businesses buying RECs are helping an electricity provider to provide renewable power (such as solar, wind or biomass) on the grid.

It is generally acknowledged that RECs cannot be considered offsets, as they are not currently required to be “additional,” a key element of a quality offset, as discussed on page 39.

However, REC purchases can potentially reduce the emissions that would have been produced by fossil fuel generation, and help to stimulate a demand for clean power, encouraging innovation and helping to reduce the cost of renewable energy over time.

RECs are available from a number of sources, and markets are increasingly overseen through regional tracking systems (see Resources section). When purchasing RECs, businesses should conduct due diligence and buy from providers certified by organizations such as Green-e or Environmental Resources Trust.



Reporting GHG emissions involves communicating the results of your GHG inventory and emissions reductions activities to an external audience.

By disclosing GHG emissions information to stakeholders and ensuring quality management of data and emission reductions activities, your business can realize significant benefits such as:

- Communicating performance to concerned stakeholders and the public to improve brand and reputation
- Improving understanding of climate change impacts to better influence future policy
- Meeting and addressing any mandatory reporting requirements such as the ARB's mandatory requirements
- Being recognized for early action measures under legislation
- Benefit under a cap-and-trade system
- Establishing credibility when advocating for policy

How to Report Emissions

When reporting GHG emissions to the public there are several ways to organize and display emissions data. GHGs can be reported for individual "entities" (e.g., factories or offices) or reported centrally for the entire organization. California voluntary and mandatory reporting programs are recommending entity-level reporting to demonstrate greater transparency of emissions from a business.

For holistic reporting of your GHG inventory, it is important to:

- Calculate the emissions of all six GHGs to demonstrate a clear picture of the total emissions. Activity data for some gases (such as nitrous oxide, methane and HFCs) is sometimes difficult to obtain so some programs (such as the California Climate Action Registry) allow reporting of CO_2 only for the first year or two.
- Report GHGs in metric tons emitted annually with CO_2 equivalents. The inventory may divide the emissions sources into key activities (e.g., fuel use, electricity use) or key facilities (e.g., by office, by factory). Tons of GHGs produced can also be normalized to profiling aspects of a business (e.g., per capita, per $M turnover, per fiscal year, per product, etc.).
- Disclose the baseline and recalculation policy, and methodologies used to calculate emission (e.g., emissions factors or calculation tools). Businesses may also opt to report on the process and any challenges or successes experienced throughout the process. Many reporting programs provide clear guidance and rules on how emissions should be reported.
- Illustrate emissions reductions achievements as you annually report your performance. Graphs, diagrams, tables, dashboards and meters have been used to illustrate successful emissions reductions achievements.
- Maintain relevancy, consistency, completeness, transparency and accuracy, and use the best data available at the time of reporting.

Shareholders, employees, other businesses, the environmental community and the public all may want to learn about your business' commitment to protecting the climate. California businesses can participate in a wide variety of reporting programs—Table 3 on page 13 outlines a number of these. These programs provide businesses with organizational level (and sector-specific) protocols, reporting instructions, calculation tools, online reporting systems and more to make the inventory process credible, professional and straightforward. Businesses can also join additional voluntary reporting programs to maximize exposure of their reporting performance and enhance public relations and marketing benefits. Some include:

- The Carbon Disclosure Project
- WWF Climate Savers

Many of these programs also offer awards and recognition for businesses who have achieved significant emissions reductions.

REPORTING

You may also wish to report your emissions inventory and reduction achievements in internal or external reporting such as intranet sites, newsletters and bulletins and corporate annual/environment / sustainability reports.

Challenge: Greenwashing

Consumers will reward environmentally preferable products and business practices, but at the same time are growing wary of unmerited green marketing tactics and reporting. In order to garner positive reactions for genuinely "greener" business practices, it is important to be as transparent as possible. TerraChoice Environmental Marketing recommends the following tactics:[34]

- Understand the environmental impacts of your products and processes across their entire life cycle.
- Pursue public, third-party, multi-attribute certifications and provide evidence to anyone that asks.
- Avoid using vague names and terms without explicitly explaining your meaning.
- Don't claim any environmental benefit that is shared by most of your competitors or is required by law.
- Confirm the scientific basis behind any claims you make.

Overall, by avoiding greenwashing, your business can reduce competitive pressure from illegitimate green claims, prevent consumers from becoming jaded and skeptical of green claims, and establish a long-lasting, honest dialogue with customers.

Waste Management: Reporting emissions amplifies environmental performance and provides positive exposure

Waste Management (WM), a provider of comprehensive trash and waste removal, recycling, and management services, reports its GHG emissions through both the CDP (Carbon Disclosure Project) and CCAR (California Climate Action Registry). WM first started reporting through the CDP in 2004. Initially only reporting emissions from their trucks, they now also include emissions from their real estate in over 1,000 locations in the US and Canada. The CDP reporting process is facilitated by their Investor Relations Division and also includes work by their environmental management team.

In a sector traditionally seen as waste-producing, reporting through CDP helps WM communicate with investors and potential investors about their accomplishments, beneficial use projects, and efforts to be ahead of competitors, thereby opening up a dialogue about their environmental performance and showing their sector in a positive light. Furthermore, reporting helps WM ensure that an effective GHG strategy is an integral part of their business model.

In addition to reporting on the CDP, in 2006, WM became the first waste and recycling services to join and report their emissions in California through CCAR. CCAR reporting demands a high degree of accuracy; WM's third-party verifier, Tetra Tech, found that their 2006 inventory was within 2% accuracy (5% is required for reporting). WM felt that joining and reporting through CCAR would help them be proactive in the development of procedures and protocols, and as a result, WM has been able to participate in the development of state policy.

Looking forward, WM is developing a comprehensive system to report all its North American emissions. A multidisciplinary team has been tasked with identifying the required data sources, collection methods and systems, and WM hopes to use the new process to report 2009 emissions in 2010. They have also been working with The Climate Registry and EPA to provide practical experience as these groups develop protocols for federal reporting.

GLOSSARY

Absolute Reductions	Reductions in total GHG emissions over time.
Additional, Additionality	Emission reductions that are "in addition to" reductions that would have occurred without the incentive provided by offset credits. In other words, the revenue from selling the project's emission reductions should have incentivized the project's implementation to ensure that emissions reductions are not "business as usual."
ARB	California Air Resources Board
Baseline/GHG Inventory	A reference or starting point to addressing climate change impacts by calculating and documenting the six main GHGs for which a business is responsible.
Biofuel	Gas or liquid fuel made from plant material (biomass).
Cap-and-trade	An emissions trading scheme that sets an overall limit on the emission of a certain pollutant and allows participating entities to trade emission allowances.
Carbon Capture and Storage	Proposed method of reducing GHG emissions by capturing them from large stationary sources and storing them deep underground or deep in the ocean.
Carbon Footprint	The total amount of CO_2 and other GHGs emitted over the full life cycle of a product or entity.
Carbon Neutrality	When an organization or activity emits no net carbon emissions to the atmosphere by taking steps to reduce and offset their carbon impact. (*There is no widely accepted definition of this term.)*
CFL	Compact fluorescent light bulb
Clean Energy	Energy that produces little or no pollutants in the air when generated. The energy source is not necessarily self-replenishing, for example natural gas.
CO_2e	Carbon dioxide equivalent. A unit, measured in tons, that allows emissions of non-CO_2 GHG emissions to be expressed as if they were CO_2 emissions, using global warming potential coefficients to make the conversion.
Energy Star	Voluntary labeling program jointly run by the US Environmental Protection Agency and Department of Energy to identify energy-efficient products and buildings.
Fugitive Emissions	Uncontrolled or unintentional emissions from fuels and chemicals, typically arising from storage, transfer or replacement, e.g., HFC leaks from refrigeration systems, SF_6 from electrical transformers and methane from landfills.

GLOSSARY

Greenhouse Gases (GHGs)	A group of gases that absorb and re-emit infrared radiation. These gases occur through both natural and human-influenced processes and include: carbon dioxide, nitrous oxide, methane, sulphur hexafluoride, hydrofluorocarbon and perfluorocompounds.
HVAC	Heating, ventilation and air conditioning systems and/or equipment and related control systems.
Intensity Reductions	Reductions in GHG emissions relative to a unit of acitivity (eg., CO_2 per gallon of water delivered) over time.
kWh	Kilowatt-hour of energy (1,000 watt-hours).
LED	Light emitting diode. Semiconductor diode that emits visible or infrared light when current passes through it.
LEED	Leadership in Energy and Environmental Design. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction and operation of high performance green buildings.
Mobile Combustion	Burning of fuels by transportation devices such as cars, trucks, airplanes, vessels, etc.
MW	Megawatt of power (one million watts).
Offset	Reduction, removal or avoidance of GHG emissions from a specific project that is used to compensate for emissions occurring elsewhere.
Offset Credit	An offset of one metric ton of CO_2e.
Photovoltaic	Solar power technology that uses solar cells to convert light from the sun directly into electricity.
Renewable Energy	Energy made from a source that replenishes itself, for example solar, hydropower, or wind.
Renewable Energy Certificates (RECs)	Tradable environmental commodities proving that an electricity provider supplied 1 megawatt-hour (MWh) of renewable power (such as solar, wind or biomass) on the grid.
Renewable Portfolio Standard (RPS)	Policies mandating a state to generate a percent of its electricity from renewable sources.
Scope of Emissions (1, 2 and 3)	The categories of GHG emissions as defined by The GHG Protocol for operations of a business. Table 4 provides definitions of each of the emissions scopes.
Stationary Combustion	Burning of fuels to generate electricity, steam, or heat.

RESOURCES

Below are a selection of suggested resources and information sources to help you learn more about what's outlined in this publication. (Please check the main body of the document for additional resources).

CALIFORNIA'S LOW CARBON FUTURE	
International Panel on Climate Change (IPCC)	www.ipcc-nggip.iges.or.jp/EFDB
California Air Resources Board (ARB)	www.arb.ca.gov
ARB Scoping plan and related documents	www.arb.ca.gov/cc/scopingplan/scopingplan.htm
California Climate Change Portal	www.climatechange.ca.gov
California Clean Tech Open	www.cacleantech.org
California Public Utilities Commission	www.cpuc.ca.gov/puc
California Energy Commission	www.energy.ca.gov

STEP 1. ESTABLISH A BASELINE	
WRI's GHG Protocol	www.ghgprotocol.org
California Climate Action Registry	www.climateregistry.org
CCAR members will soon be able to easily transition into the national registry, The Climate Registry (see below).	
The Climate Registry	www.theclimateregistry.org
US Department of Energy	www.eia.doe.gov/environment.html
US EPA Climate Leaders	www.epa.gov/stateply
US EPA Climate Leaders: Small Business and Low Emitters Program	www.epa.gov/stateply/resources/lowemitters.html
ARB AB32 mandatory reporting requirements	www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep.htm
International Standards Organization	www.iso.org
Sustainable Silicon Valley	www.sustainablesiliconvalley.org
International Energy Agency	www.iea.org
GHG Management Institute	www.ghginstitute.org
To learn more and seek qualifications	
ISO14064 standard under which third party verifiers should be trained:	
American National Standards Institute	www.ansi.org
Canadian Standards Association	www.csa.ca

STEP 2. REDUCE EMISSIONS, Scope 1	
California Public Utilities Commission - Solar Hot Water Program	www.cpuc.ca.gov/PUC/energy/Solar/080220_SD_SolarPilot.htm
EPA SmartWay Transport	www.epa.gov/smartway
Caliornia Energy Commission Renewble Energy Center	www.consumerenergycenter.org/renewables/index.html

RESOURCES

STEP 2. REDUCE EMISSIONS, Scope 2: Conservation and Efficiency	
Flex Your Power	www.fypower.org
Alliance to Save Energy	www.ase.org
American Council for an Energy Efficient Economy	www.aceee.org
California Appliance Efficiency Regulations	www.energy.ca.gov/appliances
Energy Star	www.energystar.gov
EPA Power Profiler	www.epa.gov/cleanenergy/energy-and-you/how-clean.html
Climate Savers Initiative	www.climatesaverscomputing.org

STEP 2. REDUCE EMISSIONS, Scope 2: Low Carbon Supply	
Database of State Incentives for Renewables and Efficiency	www.dsireusa.org
Grid Alternatives	www.gridalternatives.org
California Energy Commission – Renewable Energy Programs	www.energy.ca.gov/renewables

STEP 2. REDUCE EMISSIONS, Scope 3	
The Carbon Trust	www.carbontrust.co.uk
Commuter Check Benefit Solutions	www.accorservicesusa.com/services/CommuterCheck.aspx
Energy Saving Trust (UK)	www.energysavingtrust.org.uk
European Supply Chain Institute's Carbon Council	www.escinst.org/html/carboncouncil.html
Institutions looking at adding carbon to their existing supply chain work:	
Electronic Industry Code of Conduct (EICC)	www.eicc.info
The Global e-Sustainability Initiative	www.gesi.org
Lifecycle analysis research for carbon and other environmental attributes:	
University of California Berkeley, Department of Civil and Environmental Engineering	www.ce.berkeley.edu/~horvath
Lawrence Berkeley National Laboratory, Energy Analysis Department	eetd.lbl.gov/r-ea.html
Cambridge University, Center For Transportation and Logistics	ctl.mit.edu/index.pl?id=9149
MIT, Carbon Efficient Supply Chain Research	ctl.mit.edu/index.pl?id=7099
Life cycle analysis tools:	
SimaPro7	www.pre.nl/simapro
GaBi	www.gabi-software.com
LCA Tools, Services and Data	lca.jrc.ec.europa.eu/lcainfohub/toolList.vm
ELCD Data System	lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm

STEP 3. PURCHASE OFFSETS

Offset standards:	
Clean Development Mechanism (CDM)	www.global-greenhouse-warming.com/clean-development-mechanism.html
Climate Action Reserve (CCAR)	www.climateregistry.org/offsets.html
Gold Standard	www.cdmgoldstandard.org
Voluntary Carbon Standard	www.v-c-s.org
Chicago Climate Exchange	www.chicagoclimatex.com
Climate, Community and Biodiversity Standard (CCB)	www.climate-standards.org
Plan Vivo	www.planvivo.org
Information on quality offsets:	
Offset Quality Initiative	www.offsetqualityinitiative.org
Renewable Energy Certificates:	
Green-e	www.green-e.org/
Environmental Resources Trust, EcoPower Program	www.ert.net/ecopower/index.html
The Climate Neutral Network	www.climateneutralnetwork.org

REPORTING

Many of the protocols listed in Step 1 also have reporting programs (see page 47)	
Global Reporting Initiative	www.globalreporting.org
Carbon Disclosure Project	www.cdproject.net
WWF Climate Savers	www.worldwildlife.org/climate
Business Council on Climate Change (BC3)	www.bc3sfbay.org

MISCELLANEOUS RESOURCES

Cool California	www.coolcalifornia.org
Plans to include a small business calculator	
Andrew Hoffman	www.andrewhoffman.net
Climate change and business strategy	
GreenBiz	www.greenbiz.com
News and information aligning environmental responsibility with business success	
US EPA	www.epa.gov/climatechange
US Green Building Council and LEED	www.usgbc.org
Business advocacy organizations for effective climate change policy:	
Silicon Valley Leadership Group	www.svlg.net
E2 - Environmental Entrepreneurs	www.e2.org
New Voice of Business	www.newvoiceofbusiness.org

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FROM THE CLIMATE GROUP

Sarah Skikne

Doreen Reid

FROM ARUP

Caroline Fricke

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LAYOUT AND DESIGN

Kaleidoscope Graphic Design
Barbara Lee
Contact: leecreative@razzolink.com
T: +1 (831) 634-1234

EDITING AND PROOFREADING

Word Magic
Marcie Lynn Smith
Contact: wordmagic@sbcglobal.net
T: +1 (408) 253-8580

GUIDE PROMOTION

Thanks to Bennett Charles for providing pro bono consultation.
Contact: bennett@trendeffect.com
T: +1 (415) 309-7184

The Climate Group is a registered charity: No. 1102909

THE CLIMATE GROUP

HEAD OFFICE, UK:
THE TOWER BUILDING
YORK ROAD
LONDON, SE1 7NX
UNITED KINGDOM

T: +44 (0) 207 960 2970
F: +44 (0) 207 960 2971

USA, NEW YORK:
444 PARK AVENUE SOUTH
2ND FLOOR
NEW YORK, NY
10016

T: +1 (646) 233 0550
F: +1 (646) 861 4606

USA, CALIFORNIA:
SILICON VALLEY
201 SAN ANTONIO CIRCLE, SUITE 290
MOUNTAIN VIEW, CA 94040
T: +1 (650) 305 3060
F: +1 (650) 305 3061

LOS ANGELES
T: +1 (310) 739 6220
F: +1 (310) 564 7754

USA, FLORIDA:
PO BOX 310
INDIAN ROCKS BEACH, FL
33785

T: +1 (727) 595 7314
F: +1 (727) 499 6954

USA, CHICAGO:
175 W JACKSON BLVD
SUITE 1900
CHICAGO, IL 60604

T: +1 (312) 831 3151
F: +1 (312) 831 3889

CHINA, HONG KONG:
UNIT B, 21ST FLOOR
CNT TOWER
338 HENNESSY ROAD
WANCHAI
HONG KONG

T: +852 2836 5703
F: +852 2836 5707

CHINA, BEIJING:
SUITE 1502 GOLDEN TOWER
1 XIBAHE SOUTH ROAD, CHAOYANG DISTRICT
BEIJING
CHINA
100028

T: +86 10 64403639
F: +86 10 64403749

AUSTRALIA:
LEVEL 39 RIALTO, 525 COLLINS STREET
MELBOURNE
VIC 3000
AUSTRALIA

T: +61 (0)3 9617 4329
F: +61 (0)3 9614 2103

www.theclimategroup.org ● info@theclimategroup.org