CALIFORNIA GREEN INNOVATION INDEX

2008 INAUGURAL ISSUE

NEXT 10

Next 10 is a nonpartisan, nonprofit organization that educates, engages and empowers Californians to improve the State's future.

California was founded by pioneers driven by big dreams and unafraid to face difficult challenges. Like many of us, they came to California to create a better life for themselves and their families. While this legacy of the California dream continues today, many of us are concerned that the future will not be as bright as our children deserve.

Next 10 is focused on innovation and the intersection between the economy, the environment, and quality of life issues. We create tools and provide information that fosters a deeper understanding of the critical issues affecting our state. Through education and civic engagement, we hope Californians will become empowered to affect change.

We call ourselves Next 10 because we are not here for the quick fix. Our sights are set on joining with others to improve the state over the next ten years, and the ten years after that. The decisions we make together will affect California's economy, environment and quality of life for years to come. Together, we can create the brighter future we all want for ourselves and our children.

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Dear Californians,

California has long played an international role as an incubator of innovation. From the integrated circuit to Web 2.0, recombinant DNA to genomics, world changing ideas and inventions have had their genesis in this state. Lesser known, however, is California's role in "green" innovation, and the significant impact green innovation can make on the state's economic and environmental health.

Next 10 is launching the California Green Innovation Index to track the state's green innovation as well as economic and environmental performance within the context of the landmark California Global Warming Solutions Act (AB 32). The Index analyzes key indicators to better understand the role green innovation plays in achieving two goals critical to California's future: 1) reducing the absolute level of the greenhouse gas emissions that cause global warming, and 2) increasing the state's gross domestic product, which is the basis for our economic vitality. In coming years, we plan to deepen and hone the Index as well as develop new indices. It is our hope that with your feedback we can create a strategic tool for the successful implementation of AB 32.

This inaugural issue contains several important findings:

- As a result of the first wave of green innovation, which began in the 1970s, California has become a world leader in energy efficiency. In relative terms, California is more energy efficient and emits fewer greenhouse gas emissions per person than the rest of the United States, Germany, the United Kingdom or Japan.
- California's economy has grown as a result of this first wave of green innovation.
- California may be at an inflection point between the first and second waves of green innovation driven by factors similar to those that drove the first wave: policy, demand and investment.
- While California has made enormous progress, the state's rate of population growth requires that the next wave of innovation be larger, faster and more powerful than the last to meet the mandate of AB 32.

Working with leading experts, Next 10 produced the California Green Innovation Index in support of our mission to educate and engage Californians on issues important to the state's future. There is no more important issue today than addressing global warming while growing a vibrant economy.

Sincerely,

F. Noel Perry

F. Noel Perry
Founder, Next 10

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California Facts

California's Population

Population	Average Annual Growth	Population Projections
2006	2000-2006	2020
37,195,240	2%	43,695,240

Source: California Department of Finance

California's Economy

Gross Domestic Product (GDP) is a way of measuring the size of an economy, and is calculated by summing the value added from all industries in the economy. This measure can be used for a country as well as a state, in which case it can also be expressed as gross state product (GSP).

Total GDP	Average Annual Growth	Per Capita GDP	GDP Projections
2006	2000-2006	2006	2020
$ 1,727,355,000,000	2%	$46,440	$ 2,604,898,000,000

Inflation adjusted dollars (2006)
Sources: Bureau of Economic Analysis;California Department of Finance

Inflation adjusted dollars (2006)
Source: Moody's Economy.com

Assembly Bill 32, the "California Global Warming Solutions Act of 2006"

Assembly Bill 32 (AB 32) was signed into California law in 2006, mandating the first ever statewide cap on global warming pollution. AB 32 has put California at the forefront of the fight against global warming by requiring the state to reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020.

California's Greenhouse Gas Emissions

Greenhouse gases include carbon dioxide, methane, nitrous oxide and various high global warming potential (GWP) gases including perfluorocarbons, hydrofluorocarbons and sulfur hexafluoride (SF6).

Total GHG Emissions (Million Metric Tons of CO2 Equivalent)		Average Annual Growth	Per Capita GHG Emissions (Metric Tons of CO2 Equivalent)	AB 32 Targets Total GHG Emissions (Million Metric Tons of CO2 Equivalent)
1990	2004	2000-2004	2004	**2020**
411	479	1%	12.9	411

Sources: California Energy Commission, revision February 2, 2007 to "Inventory of California Greenhouse Gas Emissions and Sinks" Report (December 2006); California Department of Finance

California's Carbon Economy

The ratio of GHG emissions to GDP

		Meeting AB 32 Targets
1990	**2004**	**2020**
0.45	0.35	0.18

Sources: California Energy Commission; Bureau of Economic Analysis

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CORE FINDINGS

The inaugural California Green Innovation Index produced by Next 10 provides a comprehensive look at the role of innovation in reducing greenhouse gas emissions while growing the economy. The Index measures progress toward green innovation—green in the sense that it generates both environmental and economic benefits.

California has been driven by waves of innovation in information technology, biotechnology and now energy. Building on a first wave of innovation based on energy efficiency, the Index identifies a next wave of innovation that could bring new breakthroughs in both energy efficiency and clean energy.

THE FIRST WAVE OF GREEN INNOVATION

California has benefited both economically and environmentally from a first wave of green innovation as a result of increasing energy efficiency since the 1970s.

1. California has become a world leader in addressing global warming. In relative terms, California is more energy efficient and has lower greenhouse gas emissions than the United States as a whole and leads Germany, the United Kingdom and Japan (***Chart 2***).

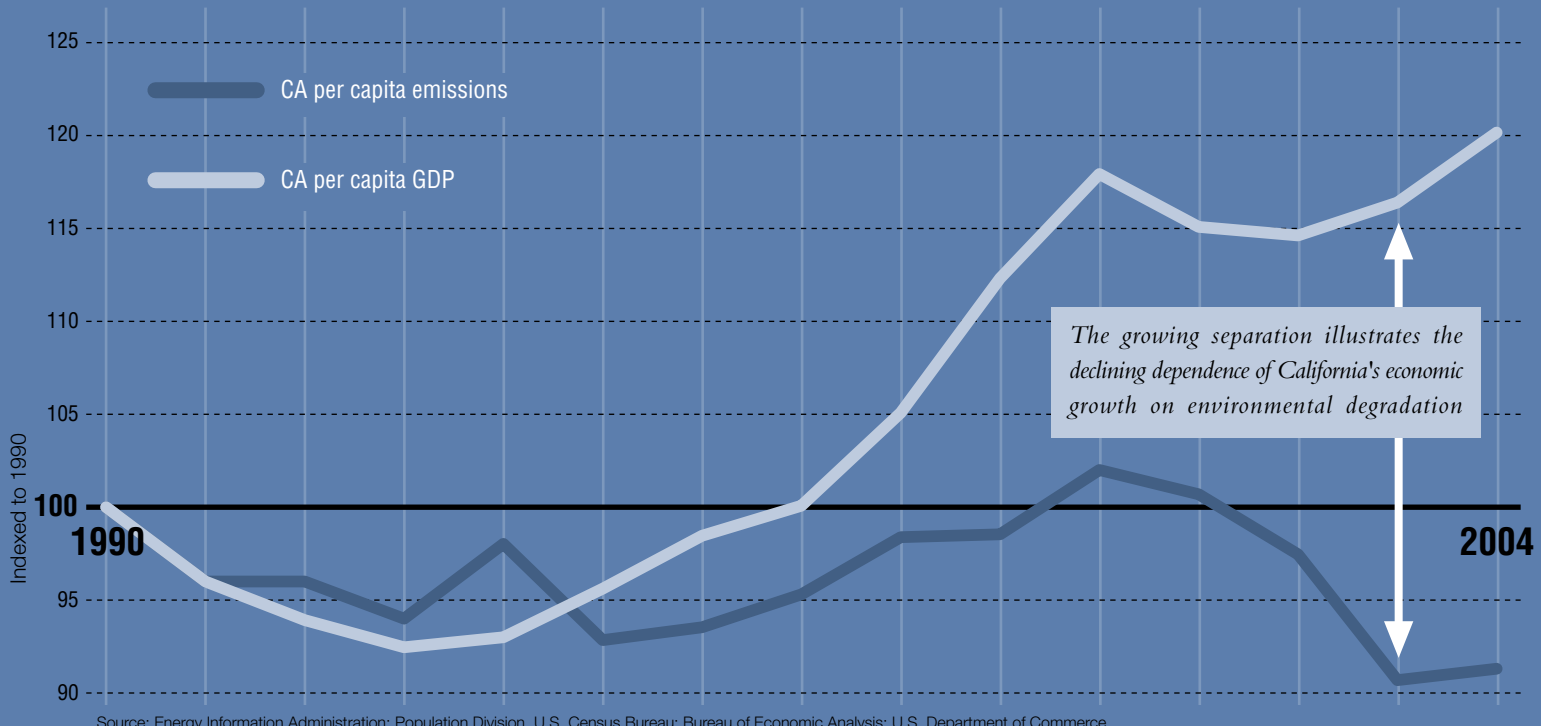
2. California has one of the lowest per capita greenhouse gas emissions and highest gross domestic products in the nation. California's per capita emissions are less than one-half of the rest of the nation and are lower than they were 15 years ago (***Chart 1***). Among states, California has the second lowest emissions per capita while generating the tenth highest gross domestic product per capita in the nation.

3. California is more energy efficient than the nation and other comparable states resulting in significant savings to consumers. Since 1970, California has greatly reduced its total energy consumption per capita (***Chart 6***). Average monthly residential bills for electricity are lower in California than Texas, Florida and the nation (***Chart 8***). Moreover, California's total annual electricity bill as a fraction of GDP is lower than Texas, Florida and the nation (***Chart 7***). What does this mean? If California's annual statewide electricity bill was the same fraction of GDP as Texas, for example, Californians would be paying almost $25 billion more for electricity. Instead, these billions are available for investment in other areas, generating economic benefits for California.

4. California utility programs and efficiency standards yield billions of dollars in savings and have reduced the need to build additional power plants. California utility efficiency programs and Title 20 and Title 24 (appliance and building standards) have yielded tens of billions of dollars in savings and reduced the need for 24 power plants between 1975 and 2003 (***Chart 10***). The net benefits of these programs continue to improve (***Chart 11***). The California Energy Commission estimates that building and appliance standards alone have saved residents and businesses $56 billion through 2003 and are projected to save another $23 billion by 2013.

Emissions and Gross Domestic Product

Carbon emissions per million people – Inflation adjusted GDP dollars per million people; Relative Trends since 1990



Source: Energy Information Administration; Population Division, U.S. Census Bureau; Bureau of Economic Analysis; U.S. Department of Commerce

TRACKING SIGNS OF THE NEXT WAVE OF GREEN INNOVATION

Signs that California may be beginning the next wave of green innovation include continued progress in increasing energy efficiency and the adoption and creation of clean energy.

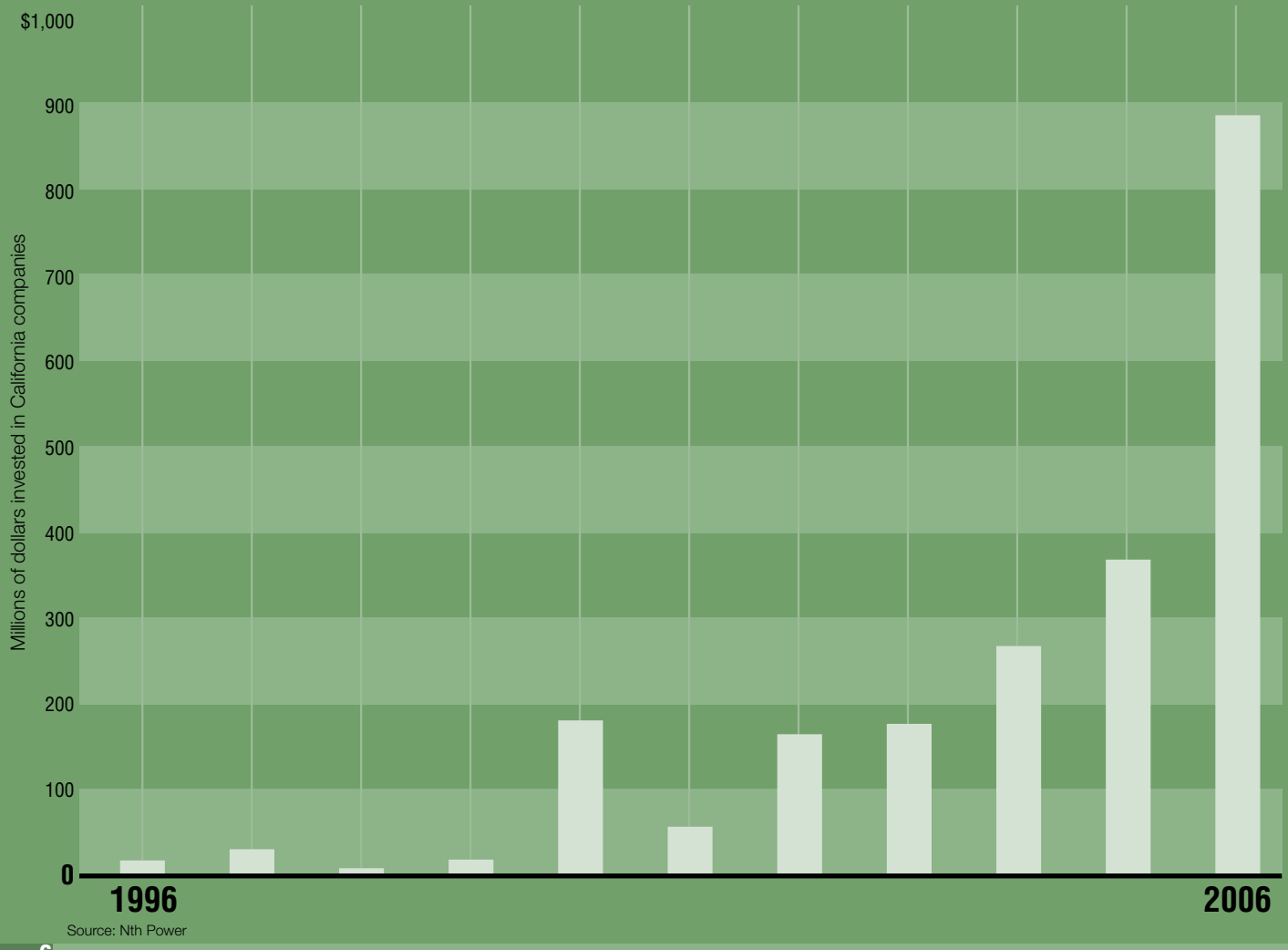
5. Californians are at the forefront in recognizing that global warming is an urgent challenge that can be addressed by citizens and business as well as government. They also believe that California can reduce greenhouse gas emissions and expand jobs and prosperity at the same time, and that new technologies can help solve the challenge (***Survey Results, page 25***).

6. Adoption of existing green products and practices is accelerating in California. Californians are adopting and planning to adopt specific electricity-saving products and practices in homes and businesses (***Page 28*** *and* ***Charts 14, 15, 16, 17*** on CFL bulbs, appliances and buildings). Californians are also installing solar systems (***Chart 29***) and purchasing hybrid vehicles (***Charts 30*** *and* ***31***) at an increasing rate.

7. Creation of new green products and services is increasing in California. California is escalating its share of U.S. patents in solar energy, wind and battery technology (***Chart 34***). Venture capital investment in California clean energy technology is growing rapidly (***Charts 35-37***). Green establishments and jobs are also increasing, especially in energy generation and energy efficiency (***Charts 39-43***).

Venture Capital Investment in Energy Technology

Investment in California companies



Source: Nth Power

THE CHALLENGE AND PROSPECTS FOR THE FUTURE

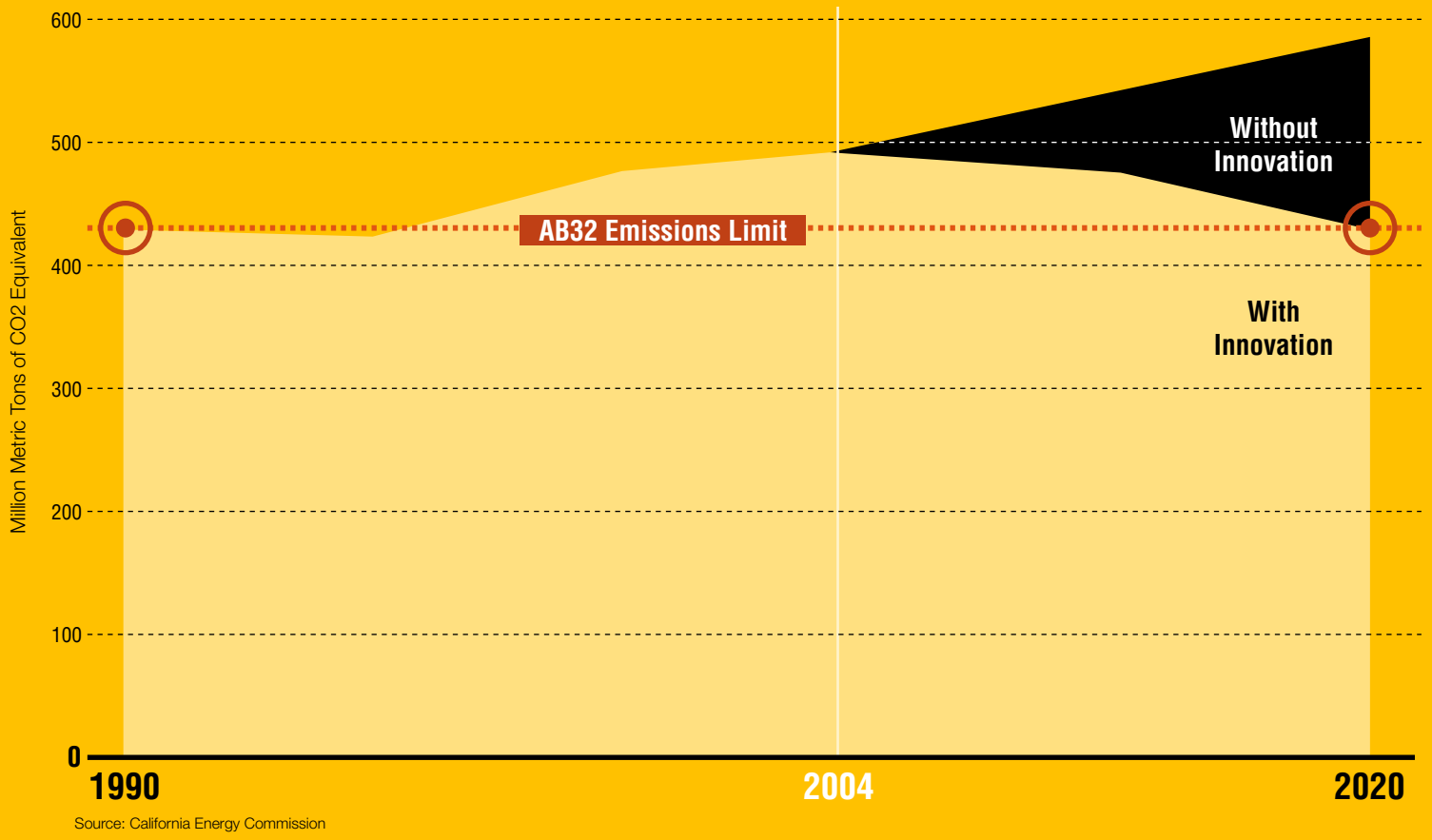
Much more green innovation will be needed if California is to meet the goal of AB 32 (California's Global Warming Solutions Act of 2006 calls for reducing greenhouse gas emissions to the 1990 level by 2020) while also growing the economy.

8. California will need to rapidly increase its pace of change with breakthroughs in energy efficiency and the adoption of clean energy alternatives. This requires significantly accelerating the adoption of clean energy by reducing costs through technological innovation (See solar energy cost curve, ***page 54***). It means substantially reducing transportation-generated emissions, which currently make up 41% of total greenhouse gas emissions. Methods to reduce transportation-generated emissions include reducing vehicle miles traveled (***Charts 21 & 22***) and adopting clean transportation alternatives (***Charts 23, 24, 30, 31***).

9. California will need to continue to invest in research and commercialization that promotes the creation and adoption of clean energy. Although federal investment is lagging, California is drawing increasing R&D investment for clean technology from a variety of public and private sources. The State has been investing its own resources in clean energy through various avenues including the PIER program (***page 41***). The United States government, however, could do much more to support green innovation. While California's share of U.S. patents in clean energy has been increasing, the United States may no longer be a leader in early stage development of green innovation: since 1998, foreign inventors have registered for more green technology patents than U.S. inventors (***Chart 33***).

10. California is taking steps to achieve the goals of AB 32 and the public supports taking action to address global warming. The California Climate Action Team has begun to identify strategies to meet the AB 32 goals (See Climate Action Team Strategies, ***page 51***), and an increasing number of California businesses are members of the California Climate Action Registry (***Chart 48***). The public is very supportive of action to address global warming (***Survey Results, pages 55-57***).

History of California Emissions and Future AB 32 Target



Source: California Energy Commission

INNOVATION IS THE DRIVER OF CALIFORNIA'S ECONOMIC AND ENVIRONMENTAL PROGRESS

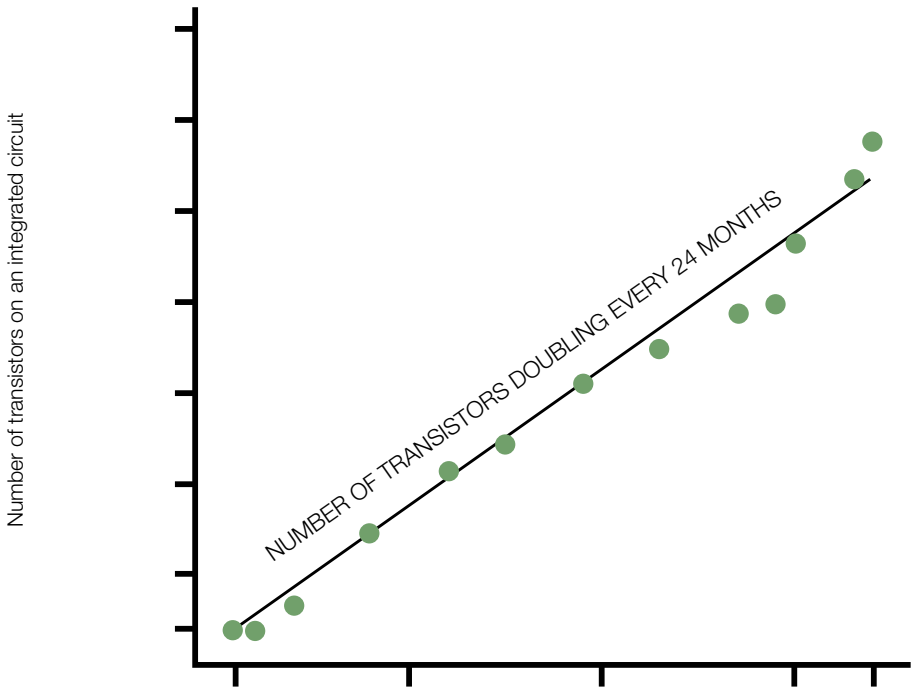
California has relied on its innovative economy to provide growing economic, social, and environmental benefits to its people

California has helped ignite innovation in areas as diverse as information technology (e.g., integrated circuits), biotechnology (e.g., recombinant DNA), agriculture (e.g., water flow technology), entertainment (e.g., digital media), and communications (e.g., wireless internet). Innovation improves efficiency in our economy and creates new sources of value.[1] Gordon Moore, the co-founder of Intel Corporation, famously described the exponential power of innovation to drive efficiency in the information technology industry (see box).

Innovation happens incrementally, but also comes in bursts, producing breakthroughs that rapidly increase efficiencies and value. As the illustration shows, California helped drive waves of innovation in information technology—from defense to the integrated circuit to the personal computer to the internet and now to Web 2.0. A similar series of waves is evident with biotechnology, from recombinant DNA to genomics and now to personalized medicine (i.e., translational genomics). Energy is no different: California has helped drive a first wave of green innovation in energy efficiency that began in the 1970s and continues to this day.

Today, a new wave of innovation that builds on the first wave of improvement in energy efficiency may be underway—one that is beginning to focus growing dollars and talent on clean energy. This next wave may be emerging even as the first wave of green innovation continues delivering benefits to California. What could this next wave look like? It could bring new breakthroughs in both energy efficiency and clean energy, reducing the absolute amount of greenhouse gas emissions while growing the State's economy.

MOORE'S LAW



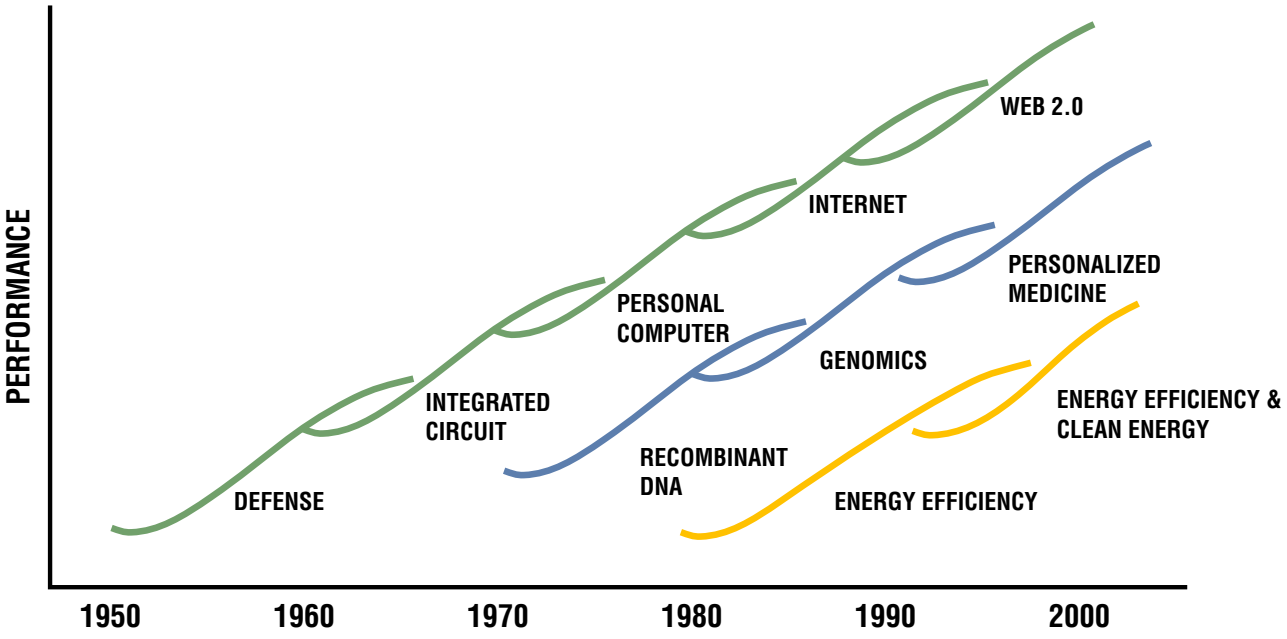
Growth of transistor counts for Intel Processors (dots) and Moore's Law

Moore's Law describes an important trend in the history of information technology: the number of transistors that can be placed on an integrated circuit increases exponentially, doubling approximately every two years.

This observation about continuing innovation in information technology was first made by Intel co-founder Gordon E. Moore in 1965. Moore's Law has been a driving force of technological and social change throughout the late 20th century and early 21st century—not only in information technology, but also in biotechnology, nanotechnology and energy technology.

Intel, *Excerpts from a conversation with Gordon Moore: Moore's Law, Video Transcript, 2005.*

WAVES OF INNOVATION



First Wave

- Breakthroughs primarily in energy efficiency; growth in renewable energy
- Increasing energy efficiency and reducing emissions per capita while growing the economy
- Most progress in electricity efficiency in homes and workplaces; little progress in transportation
- California is a leader in adoption of innovative green practices

Next Wave

- New breakthroughs in both energy efficiency and clean energy alternatives, an alignment of markets, policies, and technology
- Reducing absolute amount of emissions to 1990 levels while growing the economy
- Major improvements in all areas, including transportation via broad-based adoption of alternative fuel technologies and vehicles
- California is a leader in both creation and adoption of green innovations, serving statewide and global markets

OBSERVATIONS ABOUT INNOVATION, EFFICIENCY & THE ENVIRONMENT

"One of the most important lessons from California's history of leadership in energy efficiency is that innovation—technological, economic, and political—can take place at levels far beyond what is initially forecast if a strong commitment is made to advancing the sector."[2]
Daniel Kammen, Founding Director, Renewable and Appropriate Energy Laboratory, University of California, Berkeley

"Properly designed environmental standards can trigger innovations that lower the total cost of a product or improve its value. Such innovations allow companies to use a range of inputs more productively—from raw materials to energy to labor—thus offsetting the costs of improving environmental impact and ending the stalemate. Ultimately, this enhanced resource productivity makes companies more competitive, not less."[3]
Michael Porter, Harvard Business School

"Rather than requiring subsidies, energy-productivity opportunities provide a positive rate of return, freeing up resources that could be consumed elsewhere or invested for faster growth."[4]
Diane Farrell, McKinsey Global Institute

California has a history of policy innovation, which has helped stimulate technological innovation, producing economic and environmental benefits

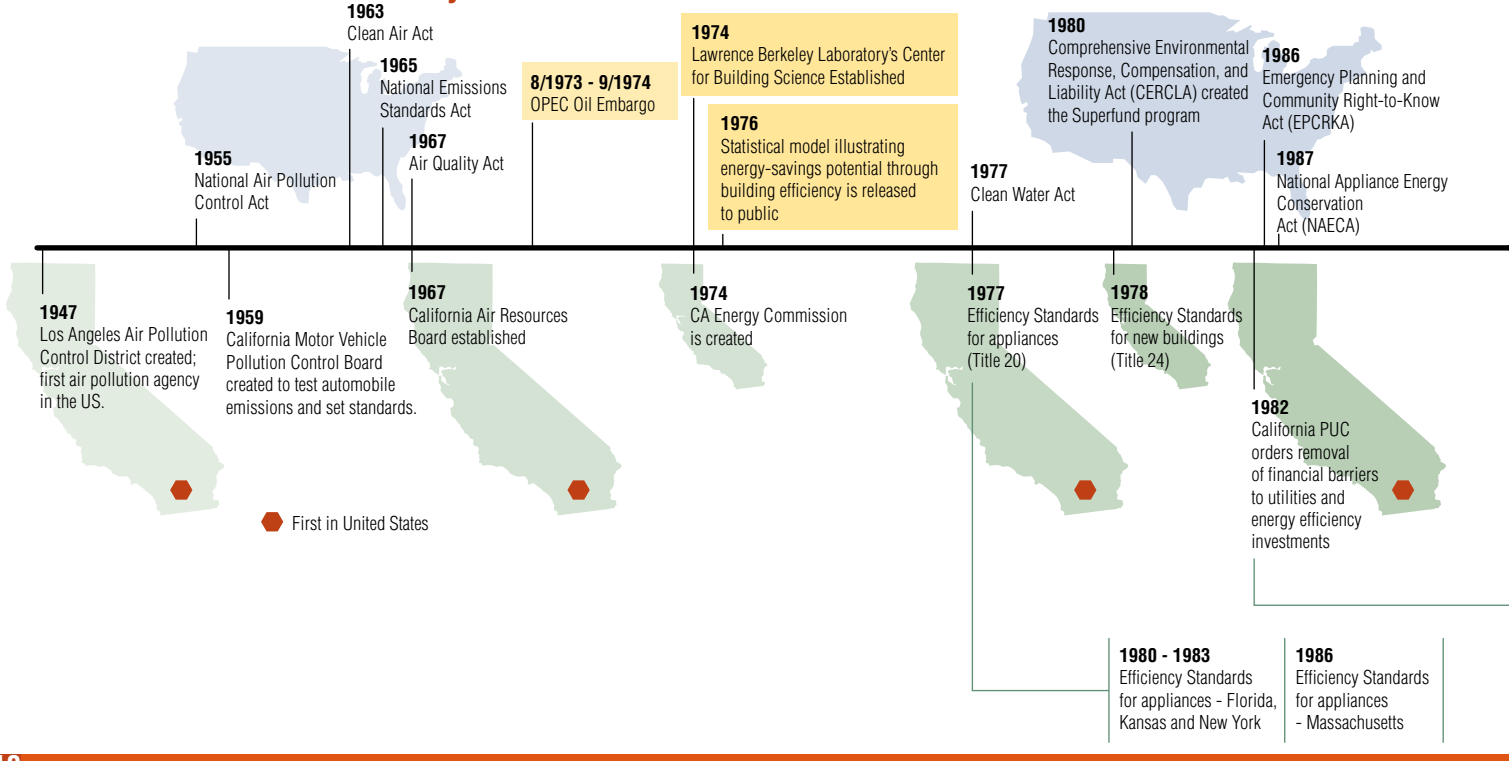
For decades California has been a national leader in innovative environmental policy. States have long been seen as the laboratories for new policies, and in the realm of environmental policy, California's innovative approaches are replicated in other states and used as a model for federal legislation as well as for other countries. According to the Congressional Research Service, "California has served as a laboratory for the demonstration of cutting-edge emission control technologies, which, after successfully demonstrated there, were adopted in similar form at the national level."[5]

Since the 1970s the State has boldly set standards, designed incentives, enforced disincentives, and readjusted major drivers of market dynamics toward improving energy efficiency and protecting natural resources and public health. These policy innovations have been the product of combined efforts by public leaders, business leaders, grassroots organizations, and the State's cutting-edge technology innovation community.

The OPEC oil embargo in 1973 served as a major force in spurring policy and technology innovation relating to energy efficiency. The next year, the State established the California Energy Commission to implement energy policy and planning, and Lawrence Berkeley National Laboratory established the Center for Building Science to research means for improving energy efficiency. In an early contribution to the cause, the Center developed a computer program that modeled the energy performance of buildings. This program established the basis for the path-breaking legislation on energy efficiency standards for appliances and buildings (Title 20 and Title 24, see page 29). Enactment in California was followed by the enactment of similar standards across the United States and other countries. By 1987, a uniform national standard for efficiency in appliances was in place.

A pioneering effort led by a bold group of efficiency advocates, utilities, and enlightened leaders led to the realignment of investor-owned utilities' financial incentives from expanding consumption to investing in efficiency. This was made possible through the implementation of a decoupling mechanism of electricity and natural gas providers in 1982. This policy innovation removes the financial disincentive for utilities to encourage energy efficiency and conservation by making their profits independent of their sales.[6] Following California's lead, other states and countries are pursuing similar mechanisms to unlink economic incentives from environmental degradation.

California Policy Innovations Over Time (Regulatory, Investment, Incentives) Set in Context with U.S. Policy Innovations and Other Historical Events



The California energy crisis in 2000 and 2001 provided another major force in spurring policy and technology innovation relating to energy efficiency. A result of the failed attempt at utility market deregulation, rolling black-outs characterized the two-year period. As in 1973, this crisis provided a fresh impetus for policy and technology innovation targeting improved energy efficiency in California. Ensuing policy innovations include broad-based energy efficiency campaigns, incentives for renewable energy sources, investment in technology research, and standards that reduce greenhouse gas emissions. Recent novel approaches include the following:

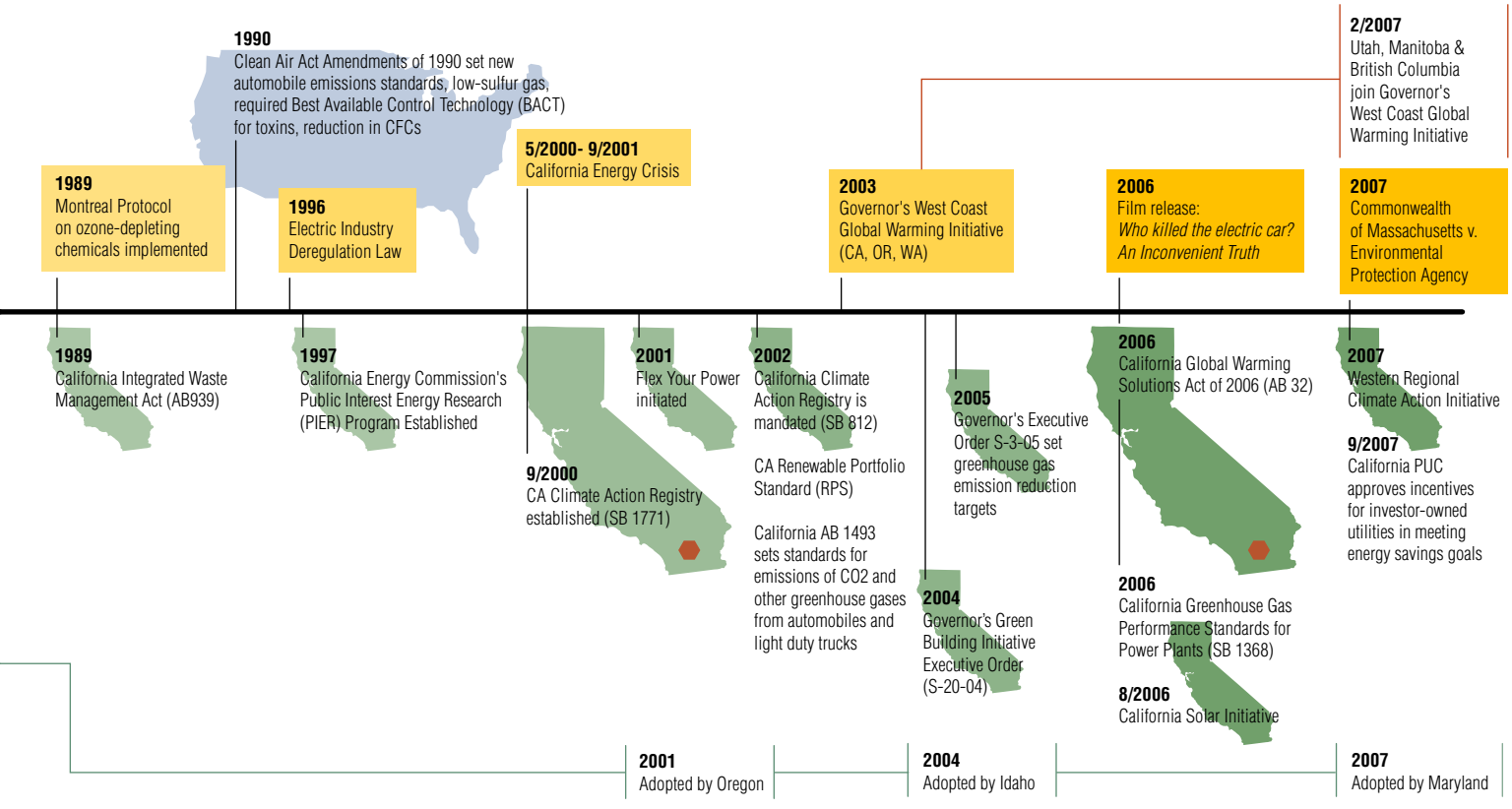
- **Flex Your Power,** *the statewide energy conservation campaign, was launched in 2001, funded primarily by a Public Goods Charge of one percent added to investor-owned utility bills. This outreach effort aims to inform residents, businesses, industry and public entities of methods for reducing energy use and of financial incentives that encourage adoption of such methods.*

- **California's Renewable Portfolio Standard Program** *was established with the goal of increasing the percentage of renewable energy in the State's electricity mix of investor-owned utilities (IOUs) to 20% by 2017. This goal has since been accelerated to be achieved by 2010.*

- **California's Clean Cars Law of 2002 (AB 1493)** *requires carmakers to reduce global warming emissions from new passenger cars and light trucks beginning in 2009. First in the world to reduce global warming pollution from cars, this law has now been adopted by 11 other states. Affecting nearly one-third of the U.S. market, global warming emissions in 2020 will be reduced by more than 64 million tons of carbon dioxide a year.*

- **The California Global Warming Solutions Act of 2006 (AB 32)** *is the first law to comprehensively limit greenhouse gas (GHG) emissions at the state level. Five Western states (Washington, Oregon, Utah, Arizona, New Mexico) have joined California to combine efforts toward reducing greenhouse gas emissions with the Western Regional Climate Action Initiative.*

California has the creative capacity through its ample assets of innovative technology, policy, and public outreach to make meaningful progress toward reducing greenhouse gas emissions. As history shows, the investment and risk-taking in innovation pays off beyond the State's borders.



California will need to build on its tradition of innovation if it is to reduce its absolute amount of carbon emissions to address global warming and produce economic benefits in the years ahead

If the past is a guide, California's tradition of innovation could flow in both familiar and unpredictable ways—from breakthroughs in energy efficiency to adoption of clean energy alternatives. It will need to be "green innovation"—green in the sense that it generates both environmental and economic benefits.

Green innovation is a shared responsibility. It is the product of government, private sector, and individual actions. There are actions that all these parties can take that can lead to positive results, but it is the result of the process of interactions among these parties that creates a far greater impact on reducing greenhouse gas emissions and generating economic benefits. As this process of action and reaction progresses, patterns of adoption (e.g. purchase of upgraded appliance) and creation (e.g. commercialization of new technology) continue and build upon each other thereby increasing the speed of innovation and increasing the impact on reducing emissions and stimulating the economy.

The diagram on the next page illustrates the three parties: People, Public Sector and Private Sector. The curved arrows represent the interaction between each party, and this is where innovation takes place. This interaction generates the exchange of ideas, adoption of new behaviors and the creation of new products and finally results in a larger impact on reducing emissions by each of the parties.

Green innovation is a two-way street. Government plays a critical role in setting the policy environment, and the private sector and individuals respond to mandates and incentives. However, the private sector and individuals can provide catalysts for green innovation as well.

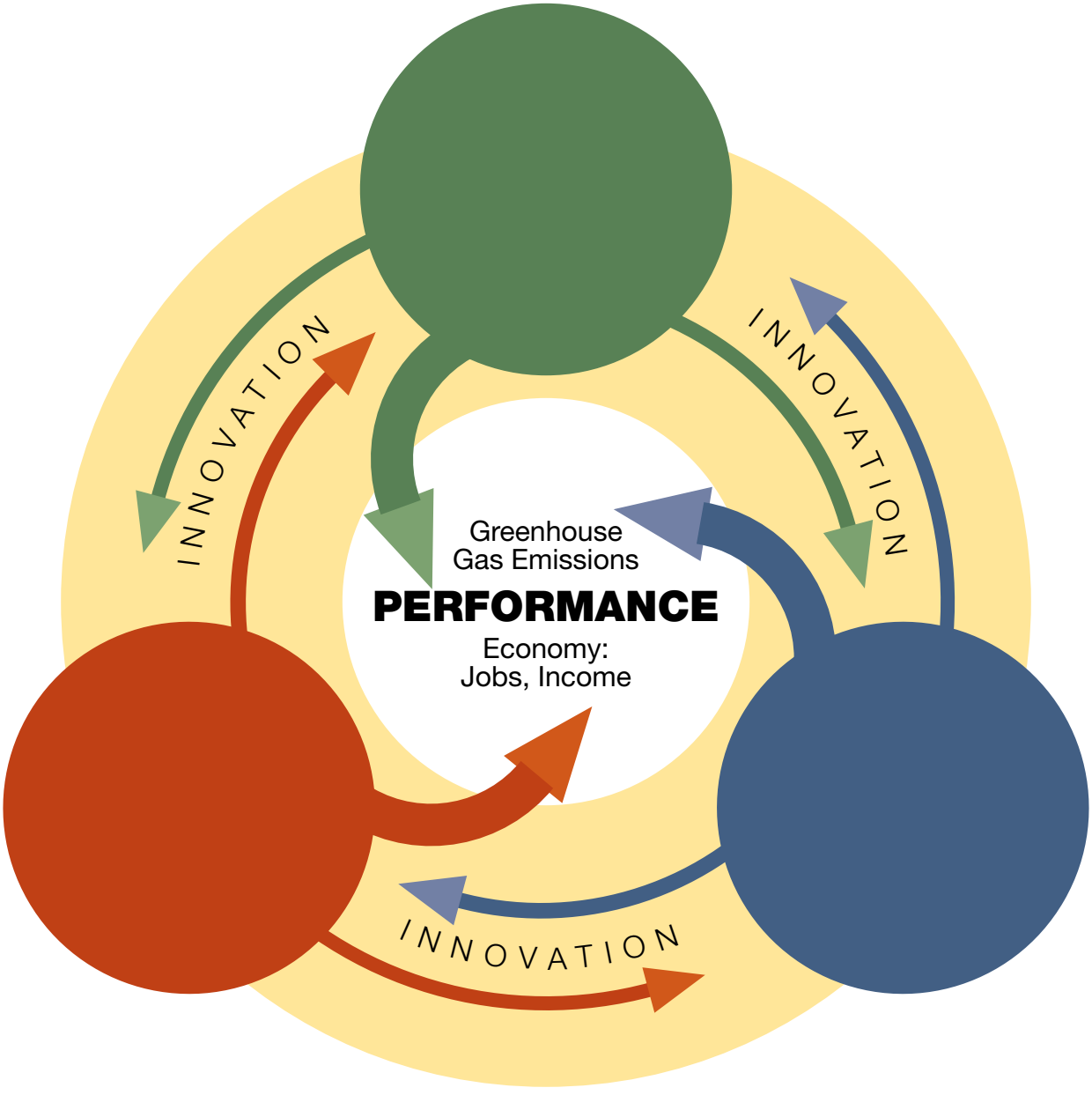
Government adopts policy innovations, which creates an environment that encourages both private sector and individual innovation. At the same time, government policy is influenced by the emergence of new technologies, products, and business practices in the marketplace, which demonstrate what could be possible on a larger scale. Elected officials also pursue policy innovations in response to growing concerns from the public—interests shaped by the media, consumer experience, and personal values, as much as by government information and incentives.

Private sector businesses respond to government mandates and incentives, but also to global market forces (like the price of oil). Businesses pursue innovations to meet emerging industry and consumer demand for new green products and practices. These innovations not only help the bottom line of California businesses, but also create jobs, help inform policy, and change individual behavior by offering tangible applications of green innovation.

The private sector also includes a diverse mix of non-profit groups that promote changes in government policy, business practices, and individual behaviors. This "independent sector" of organizations is an important catalyst for green innovation.

Individuals not only respond to government incentives and availability of new products, but also influence the direction of policy through the political process and generate demand for new green products in the marketplace.

DYNAMICS OF GREEN INNOVATION



A government mandate with significant coordination with businesses and consumers

Special Analysis prepared by Howard Chong, U.C. Berkeley

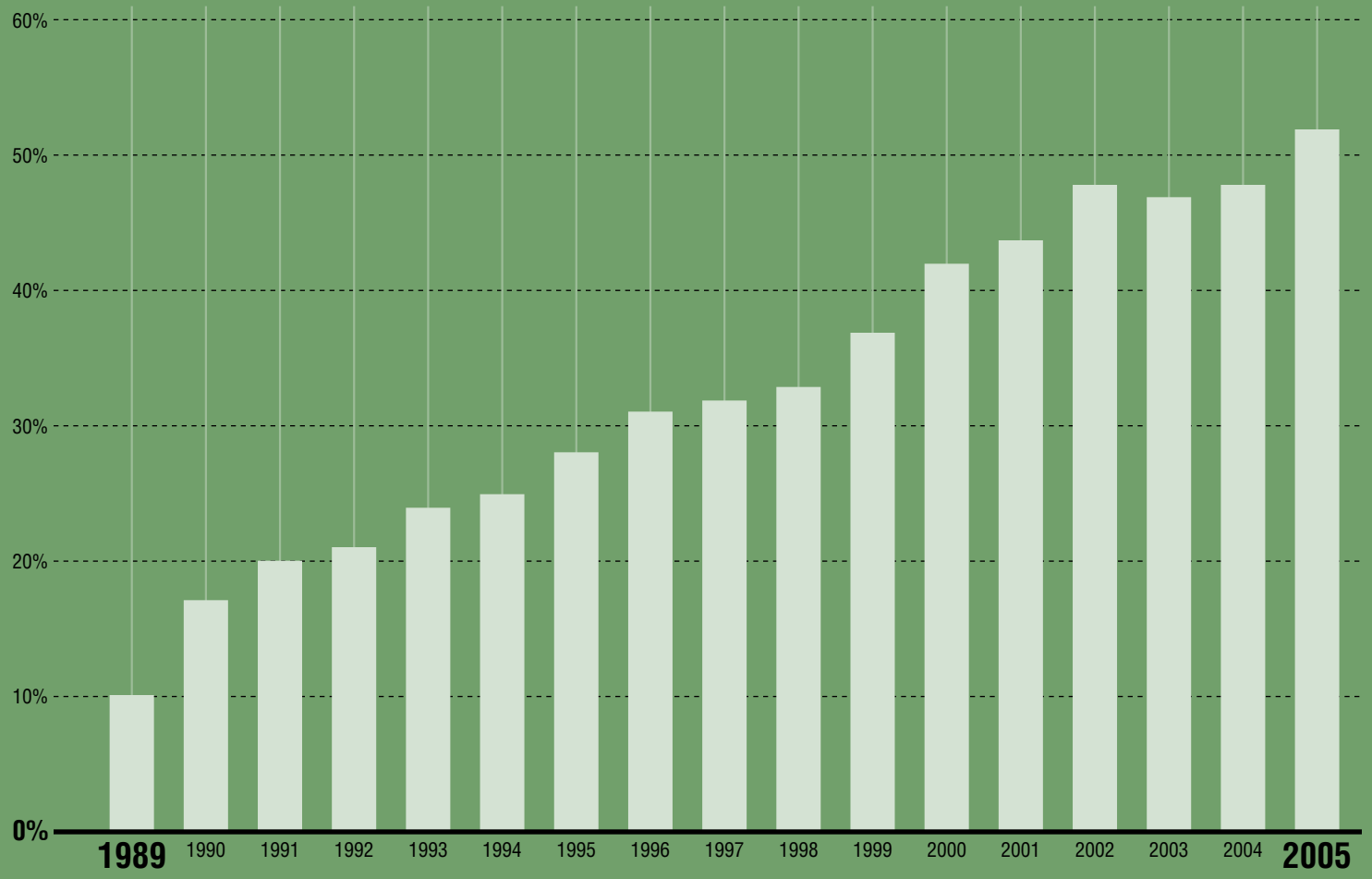
MORE CALIFORNIANS RECYCLE THAN VOTE

In the span of 20 years, California transformed recycling from an industry of waste to one of efficacy. California's story of recycling—using innovation to turn waste into prosperity—mirrors the current challenges presented by greenhouse gas emissions levels and meeting the goals of AB 32.

In 1989, the waste diversion rate in California was stuck at 10%, and California was running out of places to put its trash. Recycling requirements were born out of the perception of a landfill crisis. Within 20 years, California developed a new recycling infrastructure and moved from a 10% diversion rate to a 50% diversion rate. This was not just a matter of mandating reduction; success required significant coordination with business consumers to create "Buy Recycled" markets to integrate recycled materials into manufacturing processes and consumer choices. Furthermore, there was a concurrent effort to address regulation of landfills and the pollution that they create despite the conventional wisdom that "more garbage equals economic prosperity."

Recycling has similarities to, and offers potential lessons on dealing with, the current issue of climate change. Energy use has historically been linked to economic prosperity but is now identified as having environmental consequences that require public action. By combining policy with private industry and individual action, California has the opportunity to reduce the impact of global warming, while simultaneously strengthening the economy.

California Statewide Diversion Rates



Source: California Integrated Waste Management Board

Similiarities and Potential Lessons between Recycling and Climate Change

Criteria	Recycling	Climate Change
Conventional Wisdom	More waste = more "stuff" = prosperity	More energy use = prosperity
Impending Crisis	Pollution from landfills, running out of landfill space	Global warming, energy shortages
Corrective Action Needed	Generate less waste	Consume less energy
Government Action	AB 939 in 1989: Target of 50% diversion by 2000	AB 32 in 2006: Target of reduction to 1990 levels by 2020 (29.5% reduction from business as usual)
Early Innovations	Significant improvements in characterizing the waste stream, including mandatory reporting requirements	Significant improvements in characterizing GHG emissions, including mandatory reporting requirements
Effect on Economic Growth	Did not sacrifice economic development; evidence shows that recycling had a positive impact on job creation and economic growth	Official State and private forecasts predict a net positive impact on job creation and economic growth, though some industries may suffer while others gain
Impact on Individuals	Increased disposal costs; voluntary participation in sorting recyclables from garbage	Predicted increased energy costs, possibly mitigated or offset by a shift toward less energy-intensive consumption; voluntary action otherwise
Public Attitude	Extremely positive attitude to recycling, evidenced by high public participation	Concern about global warming and willingness to make adjustments to decrease GHG emissions

THE FIRST WAVE OF GREEN INNOVATION

California has been at the forefront of the first wave of green innovation that began in the 1970s and continues to this day. This first wave proved that California could increase its energy efficiency and reduce its greenhouse gas emissions per capita, while also growing its economy.

The first wave of green innovation was driven by a confluence of many forces—including rising oil prices, supportive state policies (as outlined earlier), shifting attitudes and behaviors about energy and water conservation; and technological innovation in green building, materials, appliances, lighting, and other areas. It produced breakthroughs in energy efficiency and stimulated growth in renewable energy in California. While it is difficult to discern how much each of the many different factors contributed to this first wave, it is clear that California today has one of the lowest per capita greenhouse gas emissions and highest per capita gross domestic products in the nation. On a per capita basis, the State's economy has become less dependent on emissions and has used less energy to produce more economic growth over time. California's situation more closely resembles that of Germany, the United Kingdom, and Japan than the rest of the United States—especially other large states with diverse economies like Texas and Florida.

California has one of the lowest levels per capita of greenhouse gas emissions and highest gross domestic products in the nation

California has some of the lowest per capita GHG emissions in the U.S. In fact, per capita CO2 emissions in Texas are double those of California. Per capita emissions levels in California today are slightly lower than they were 15 years ago, dropping from 12.2 to 11 MTCO2E[7] (**Chart 1**).

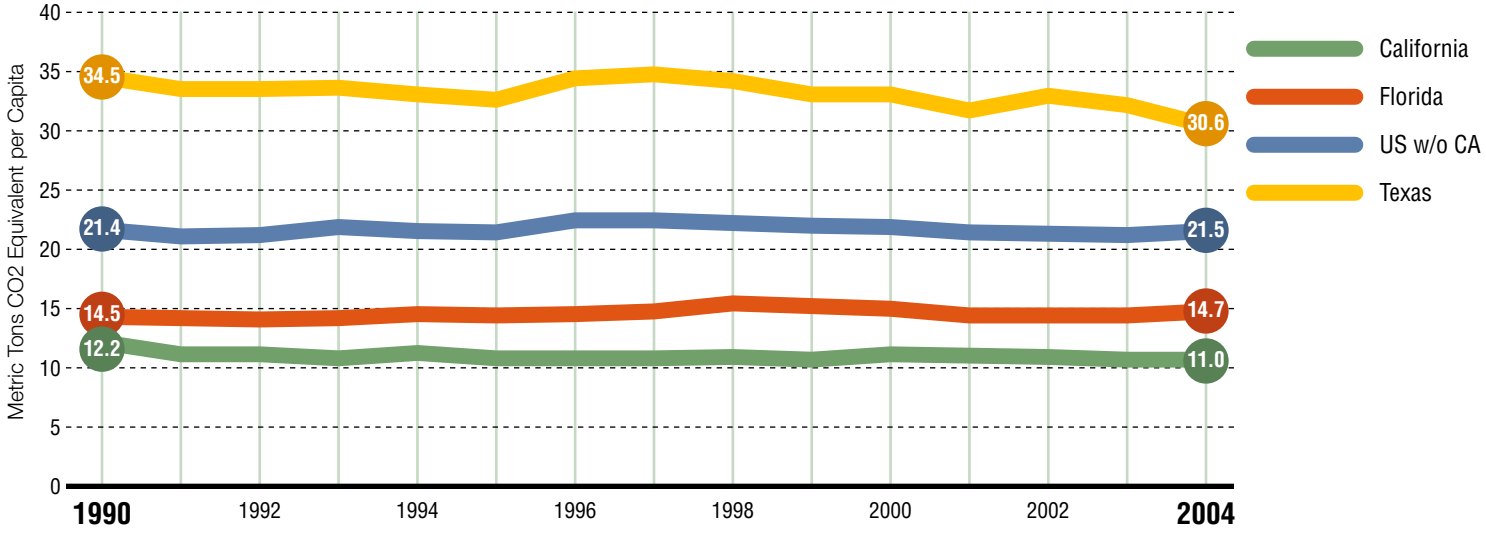
2004 National Ranking

	Lowest GHG Emissions Per Capita	Highest GDP Per Capita	GDP in Billions ($2004)	Share of Total U.S. GDP
California	2	10	$ 1,540	13%
Texas	40	18	886	8%
Florida	11	37	601	5%

Source: Energy Information Administration; Population Division, U.S. Census Bureau; Bureau of Economic Analysis; U.S. Department of Commerce

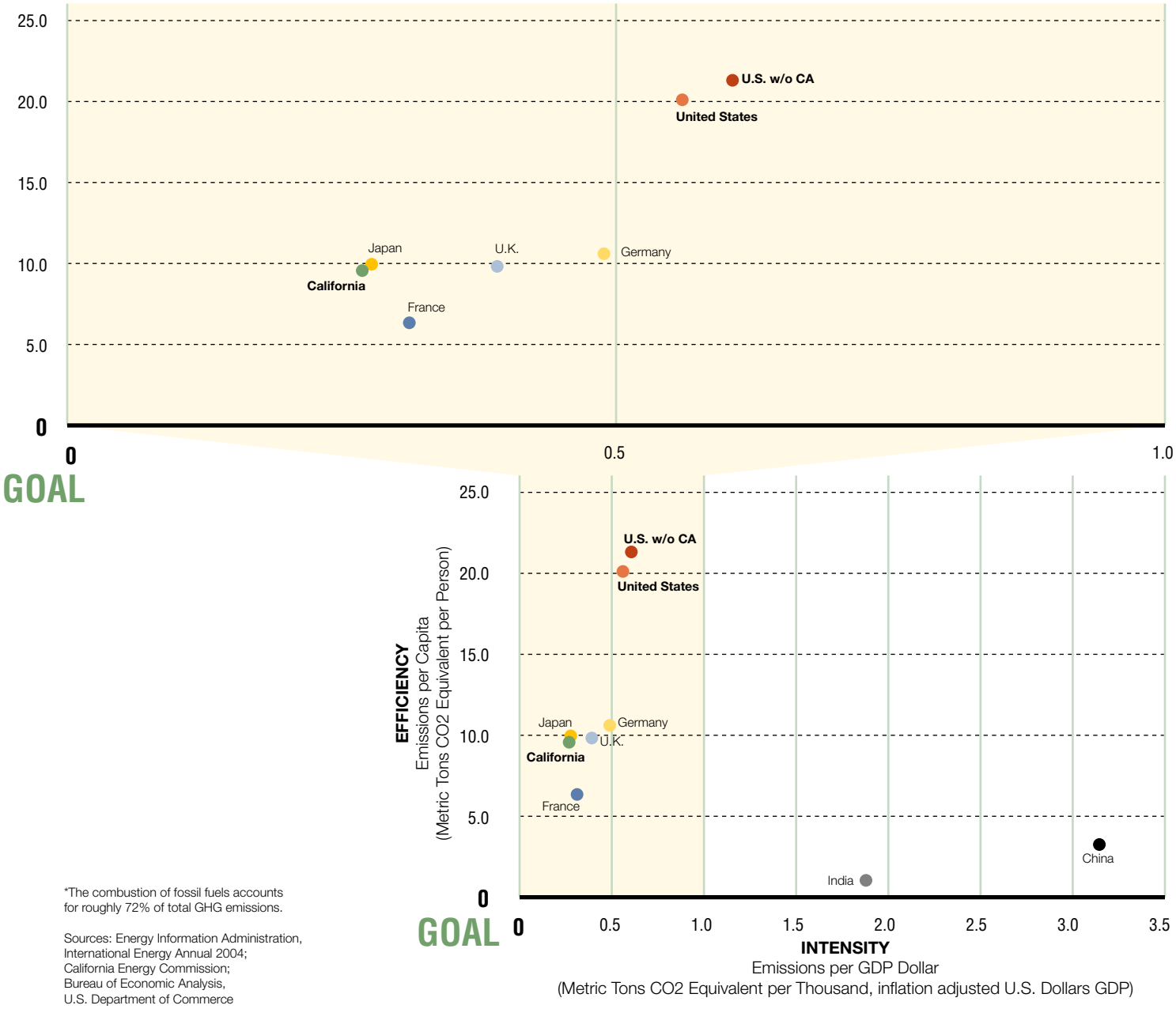
1: GHG Emissions in California and Other States

CO2 emissions from fossil fuel combustion – metric tons CO2 equivalent (MTCO2E) per capita



Source: Energy Information Administration; Population Division, U.S. Census Bureau; Bureau of Economic Analysis; U.S. Department of Commerce

2: Global Fossil Fuel Combustion*



*The combustion of fossil fuels accounts for roughly 72% of total GHG emissions.

Sources: Energy Information Administration, International Energy Annual 2004; California Energy Commission; Bureau of Economic Analysis, U.S. Department of Commerce

California's economic growth has become less dependent on greenhouse gas emissions over time

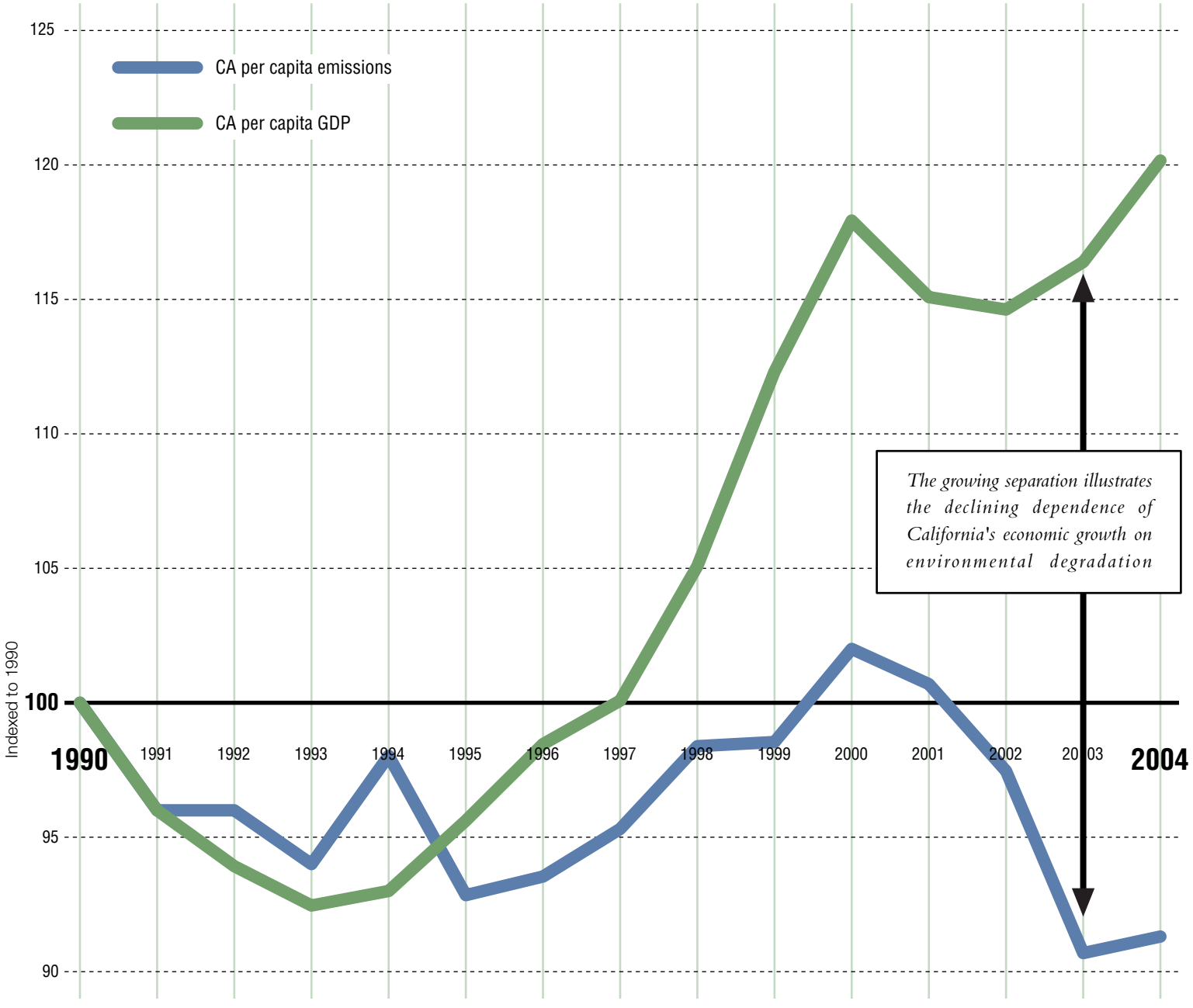
Compared to other countries, California is among the most advanced and efficient economies, which sets it apart from the rest of the U.S. Mainly due to structural changes in the economy, the global economy is becoming less carbon intensive in terms of emissions per gross domestic product (GDP). Greater disparities exist in terms of efficiency, or emissions per capita. Resulting primarily from electricity generation and transportation, fossil fuel combustion (petroleum, natural gas & coal) makes up the largest category of carbon emissions in the world. As economies such as China and India continue their rapid growth, absolute emissions and emissions per capita will climb. In view of both emissions per dollar of GDP and emissions per capita, California is comparable with Japan. Per capita emissions in the rest of the U.S. are twice California's (**Chart 2**).

California is an example of how an innovative economy can thrive and grow while simultaneously reducing the environmental damage associated with growth. Breaking the link between "environmental bads" and "economic goods" occurs when the growth rate of an environmental pressure is less than that of economic expansion over a period of time.[8]

California's GDP is a measurement of the State's economic output. Examining the growth in GDP alongside the growth in carbon emissions illustrates the changing relationship between the two over time. (Carbon emissions account for roughly 72% of all greenhouse gas emissions.) **Chart 3** depicts the growth rates per capita of GDP and emissions for California relative to 1990. The growing distance between the trend lines of GDP rising and emissions dropping represent the delinking of GHG emissions from economic growth. *(Per capita emissions represented here are based on the California Energy Commission's GHG Inventory and vary slightly from the federal GHG data represented in* ***Chart 1****.)*

3: California Emissions and Gross Domestic Product

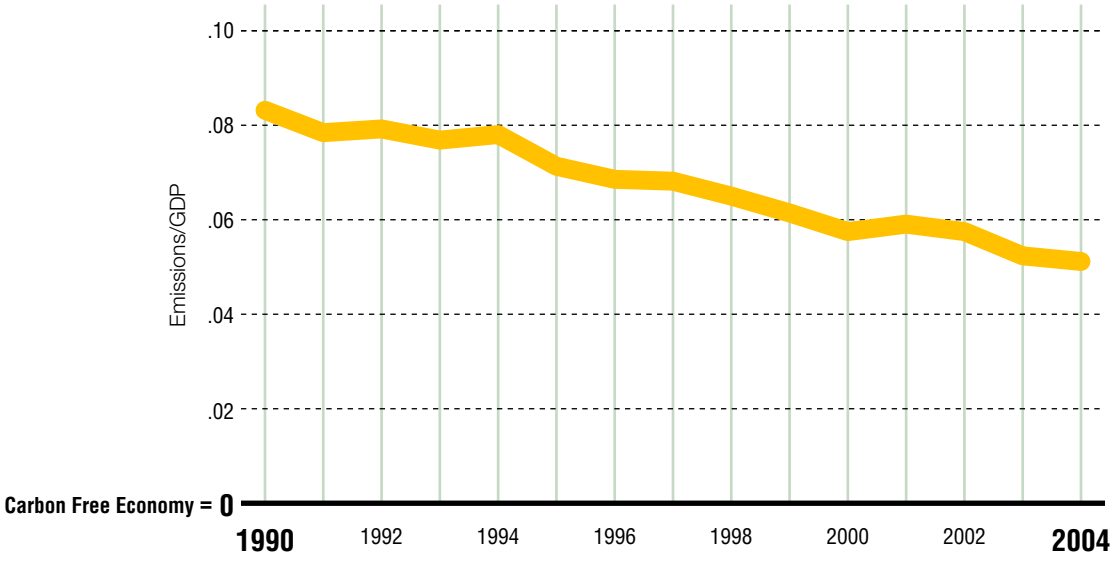
Carbon emissions per million people - Inflation adjusted GDP dollars per million people
Relative trends since 1990



Source: Energy Information Administration; Population Division, U.S. Census Bureau; Bureau of Economic Analysis; U.S. Department of Commerce

4: The Carbon Economy

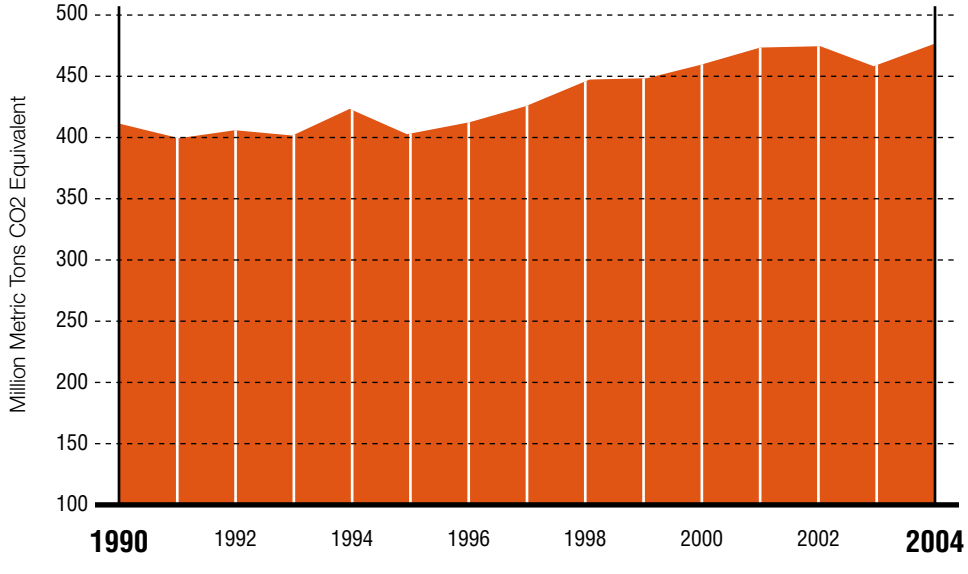
Emissions relative to GDP: California



*Gross GHG emissions including electricity imports
Source: California Energy Commission; Bureau of Economic Analysis; U.S. Department of Commerce

5: Total GHG Emissions in California

Annual Emissions



Source: California Energy Commission

Note: Total Baseline greenhouse gas emissions includes fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon ghg emissions (in CO2 equivalents). Non-carbon ghg emissions are made up of Agriculture (CH4 and N2O). Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6). Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N2O from Fossil Fuel Combustion.

Illustrated as a ratio of emissions to GDP, **Chart 4** depicts California's carbon economy and its gradually decreasing carbon character. While improvements are evident, in order to meet the requirements of AB 32, this decrease will need to be steeper in the future. As represented in **Chart 5**, the State's absolute emissions continue to rise.

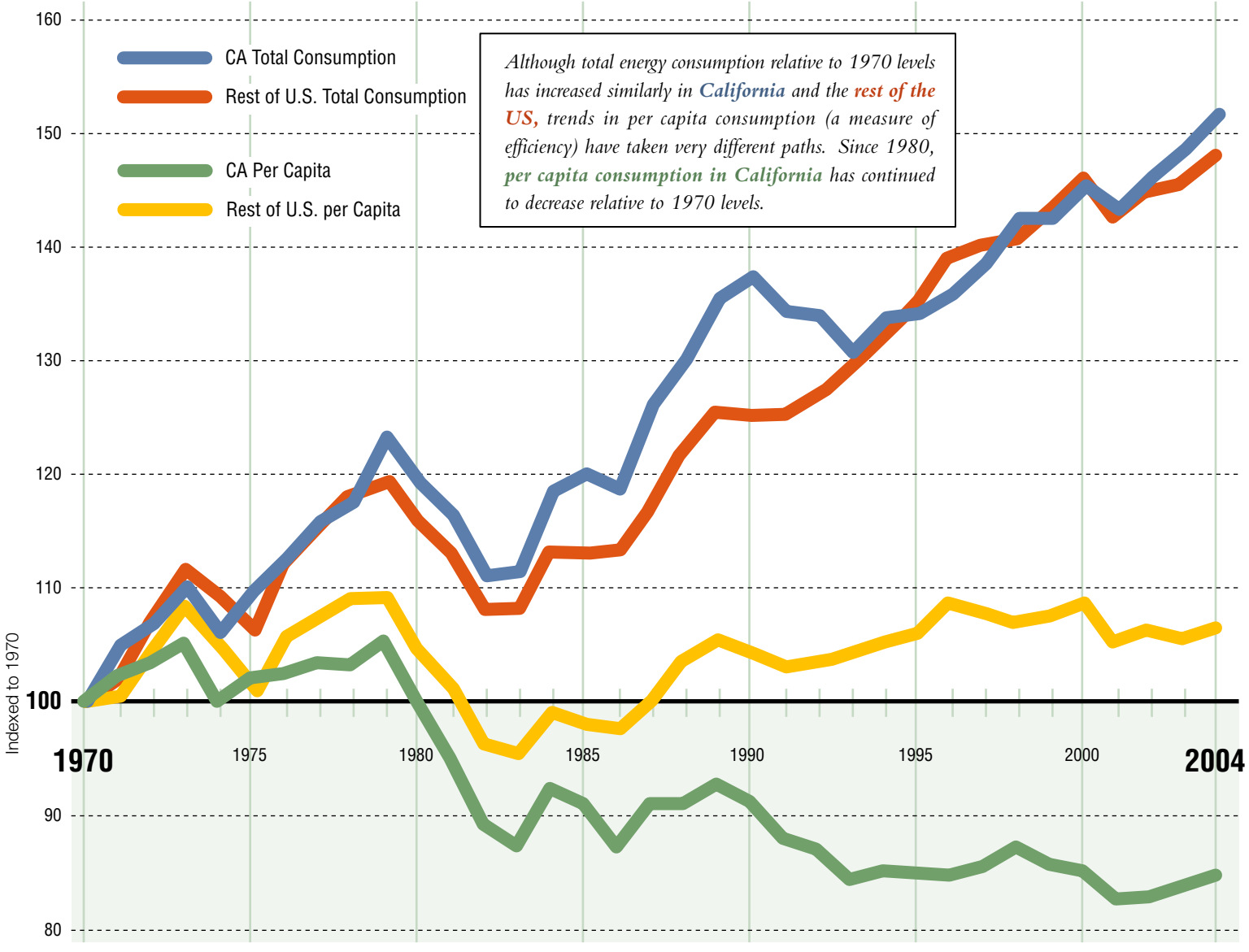
California demonstrates that energy efficiency can translate into economic gain

While California's economy has grown substantially over the past several decades, the State has consistently improved its efficiency in energy consumption (**See pages 22-23**). Since 1970, California has greatly reduced its total energy consumption per capita (**Chart 6**); however, in absolute terms, the State's total energy consumption continues to rise as its population grows, underscoring the need for continued efforts to increase efficiency. Total energy consumption includes all of the following sources: petroleum, natural gas, electricity retail sales, nuclear, coal and coal coke, wood, waste, ethanol, hydroelectric, geothermal, solar and wind energy.

The State has shown that it is possible to have lower electricity bills through greater energy efficiency than most states. This means Californians have more to spend on other uses—money that their counterparts in other states spend on energy.

6: Total Energy Consumption Relative to 1970

California and the Rest of the U.S.



Source: Energy Information Administration; U.S. Census

In **Chart 7**, the state electricity bill is represented as a fraction of state GDP. As a fraction of the state economy, the Texas electricity bill is almost double the California bill.

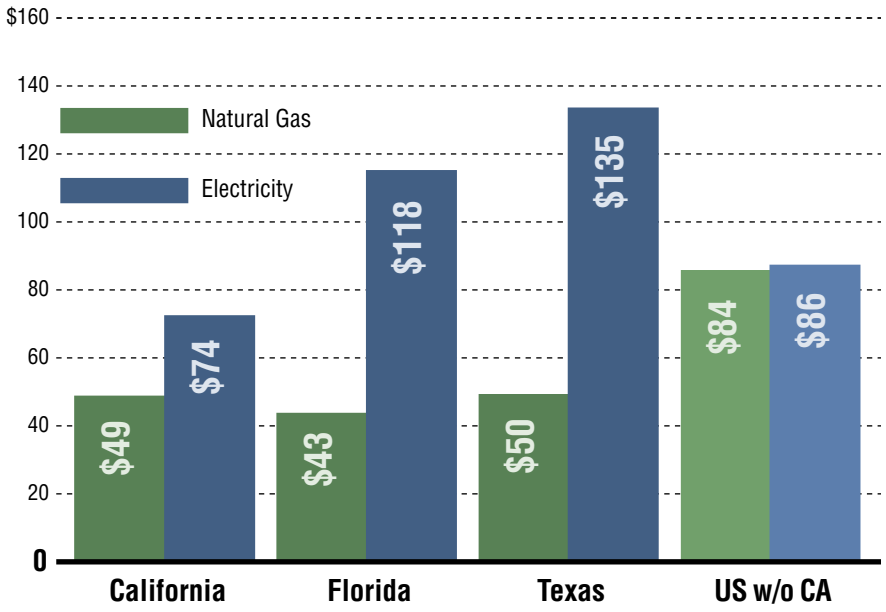
Looking at the most recent year, 2005, California's bill represents 1.79% of GDP – about half the Texas bill which equates to 3.24% of GDP. The difference between the two states of 1.45%, when put into terms of California's GDP, translates into $24.7 billion that Californians do not spend on electricity.[9]

Though the price per Kwh is higher in California **(Table 9)**, the average monthly electricity bill is lower. In 2005, the average monthly residential electricity bill in California was almost half that of Texas and two-thirds the average bill in Florida **(Chart 8)**. In view of natural gas, while similar to bills in Florida and Texas, California's average monthly residential bill is roughly half as high as bills in the rest of the country **(Chart 9)**.

Recent work by researchers at U.C. Berkeley concludes that California's residential low energy use is real. "From 1970 to 2004, California decreased its annual residential energy consumption by 35% while other states increased. Alternative explanations including weather, income, prices and economic structure account for at most 15%."[10]

8: Average Monthly Residential Gas & Electrical Bills

2005

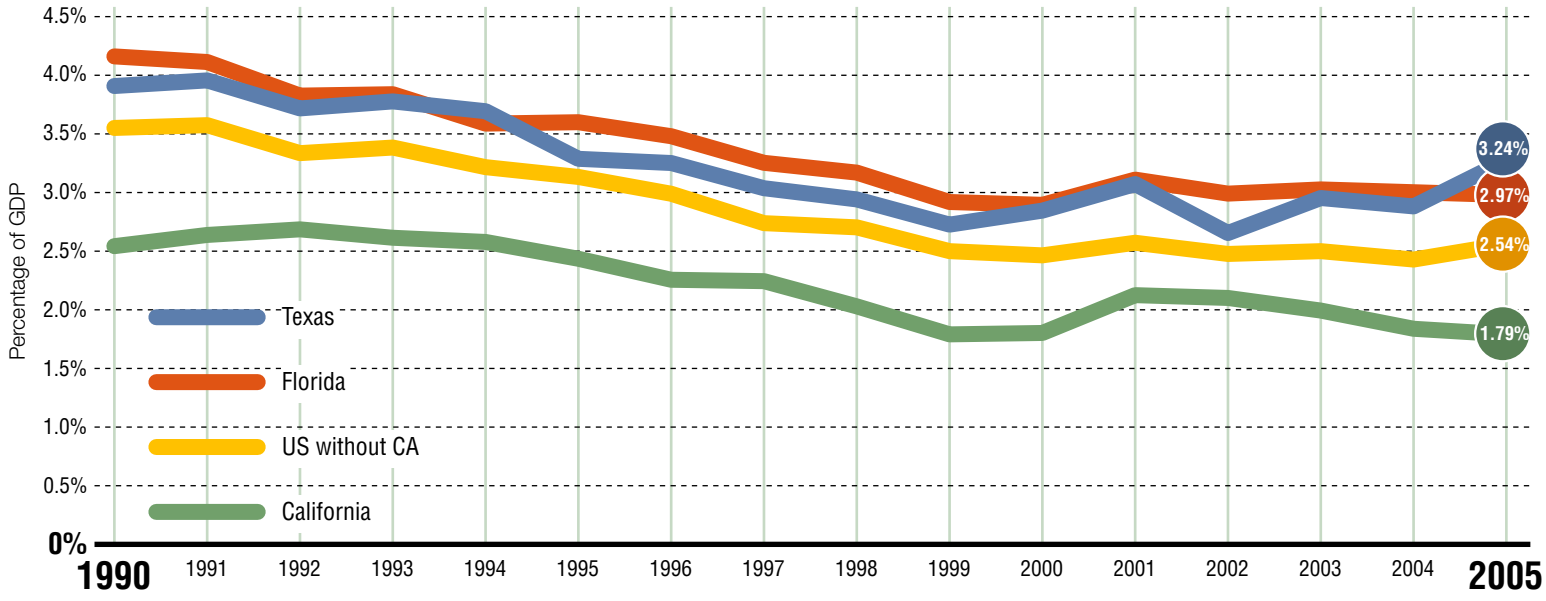


Source: Energy Information Agency, U.S. Department of Energy

9: 2005 Residential Electricity

	Price (Cents per Kwh)	Average Kwh per month
California	$ .13	570
Florida	.10	1193
Texas	.11	1195

7: Statewide Electricity Bill as a Fraction of GDP



Source: Energy Information Agency, U.S. Department of Energy; Bureau of Economic Analysis, U.S. Department of Commerce

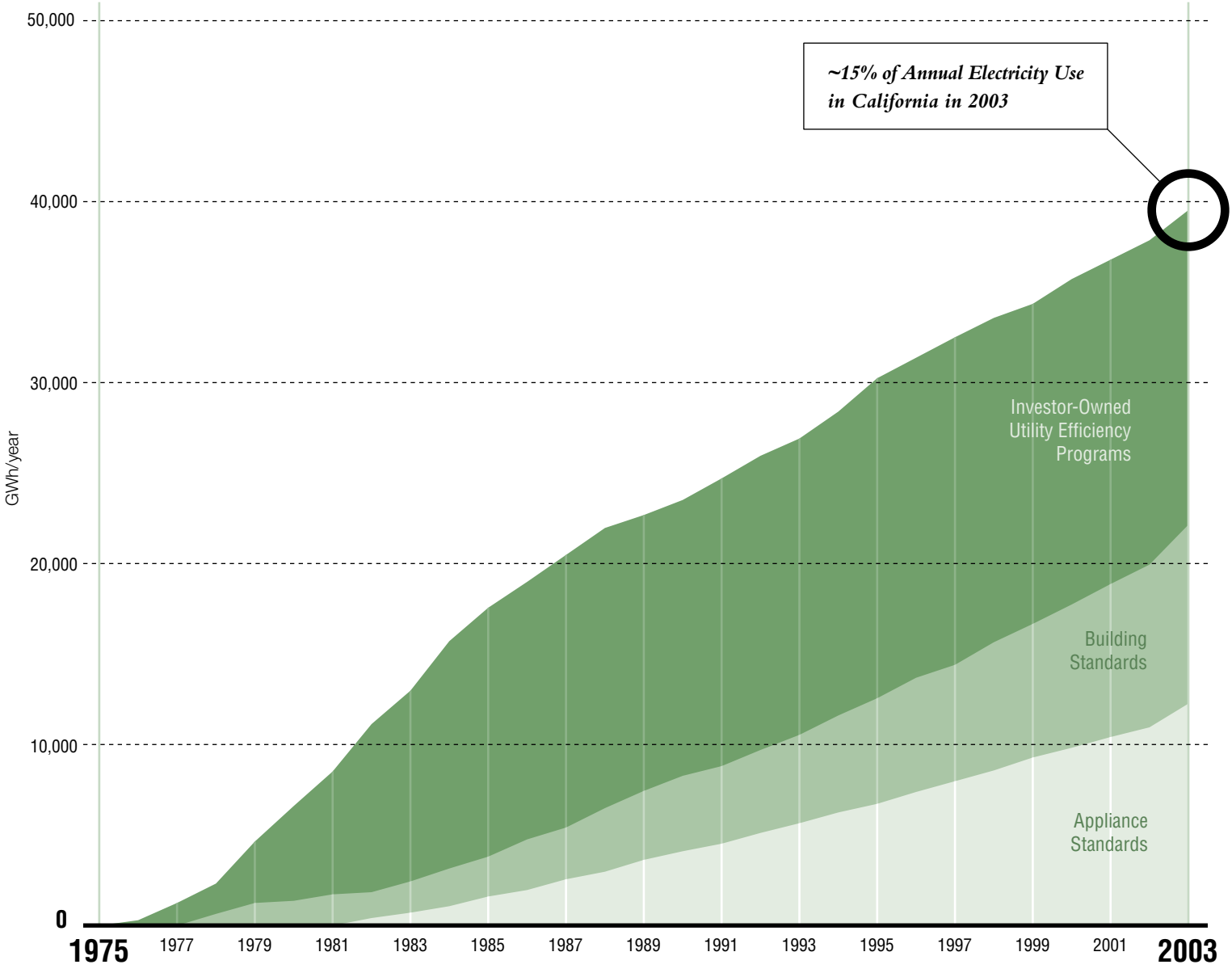
Californians have experienced substantial and growing energy savings as a direct result of efficiency programs

California has implemented efficiency programs and standards that have yielded increasing electricity savings. In 2003, the State saved 40,000 Gigawatt-hours through utility efficiency programs which equated to 15% of annual electricity use in California that year (**Chart 10**). Since 1975, this energy savings has supplanted the need for 24 new, large-scale (500-megawatt) power plants.[11] Although **Chart 10** only includes programs of investor-owned utilities, California's publicly owned utilities have more than tripled their energy savings targets, which cumulatively now total about 120 MW per year (compared to 500 MW for the three major investor-owned utilities).

In addition, projected savings associated with recently adopted updates to California's energy efficiency standards for buildings and appliances are expected to avoid the need for five giant power plants in the next 10 years.[12] *(See page 29 for description of Title 20 Appliance Efficiency Standards and Title 24 Building Efficiency Standards.)*

10: Annual Energy Savings from Efficiency Programs and Standards

Gigawatt-hours per year



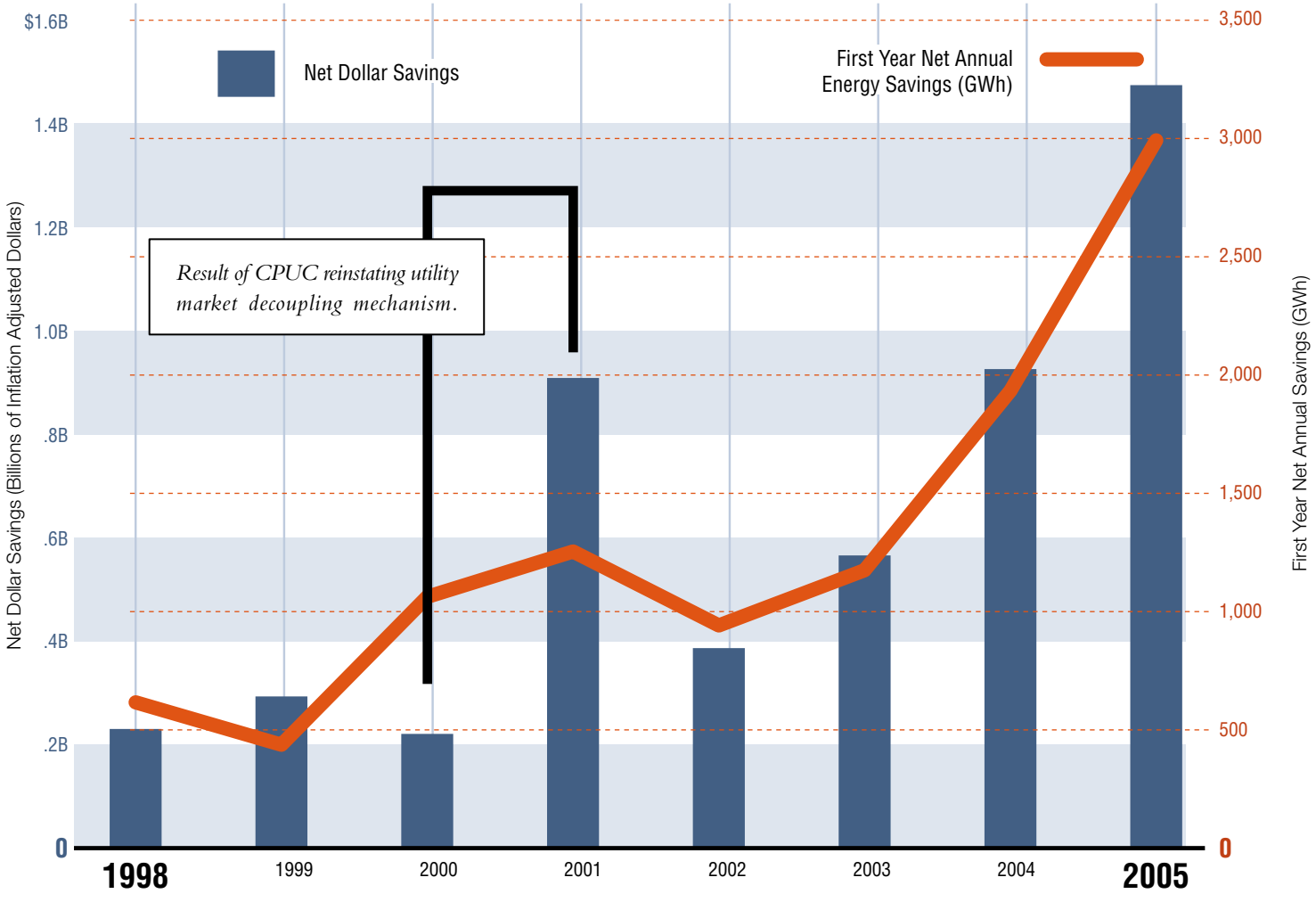
Source: California Energy Commission
Note: This dataset is part of a demand forecast output. As of October 2007, the CEC does not have 2004 and 2005 data available yet, as data for more recent years have not been normalized to this particular set of data.

Utility efficiency programs are now generating more return on investment—electricity savings are growing while the cost of funding these programs is getting lower (**Chart 11**). In terms of dollars saved, the California Energy Commission estimates that building and appliance standards alone have saved residents and businesses $56 billion through 2003 and are to save another $23 billion by 2013.[13] Additionally, projected savings resulting from new appliance efficiency standards adopted in 2004 are expected to reduce consumer utility bills by $3.3 billion during the first 15 years they are in effect.[14]

During the failed electricity deregulation period in the late 1990s, the California Public Utilities Commission (CPUC) did away with "decoupling," the regulatory mechanism that enables the State's investor-owned utilities (IOUs) to promote and provide energy efficiency programs to their customers, without cutting into utility profits. The elimination of decoupling accounts for the significant drop-off in energy savings from 1998-2000. The up-tick in 2001 occurred once the CPUC reinstated decoupling.

11: Net Dollar Savings and GWh Saved from Utility Efficiency Programs

Investor-owned utility efficiency programs



Source: Pacific Gas and Electric Company, Southern California Edison, and San Diego Gas & Electric, "Energy Efficiency Annual Reports," May 1999–2005, filed at the California Public Utilities Commission.
*Note: Net benefits & energy savings includes Electricity & Natural Gas

TRACKING SIGNS OF THE NEXT WAVE OF GREEN INNOVATION

California may be in the early stage of the next wave of green innovation. A similar confluence of forces from the first wave may be at work, ushering in this next wave—including rising oil prices, state policies promoting energy efficiency and emission reductions, shifting attitudes and behaviors regarding global warming and new technologies such as alternative fuel vehicles, and increasing innovation in energy technology areas.

There are signs that in recent years the adoption of existing green products and practices in California has accelerated. There are also signs that much higher levels of investment are pouring into energy technology innovation in California, that the State is producing a growing share of patents in areas such as solar and wind technology, and that a conservative estimate of green jobs in California now tops 20,000—reflecting growth by about 50% over the last decade.

While it is too early to tell what this new wave might ultimately look like, the California Green Innovation Index intends to track signs of change in three key areas.

The environment for change.

The next wave of green innovation will need a supportive environment if it is to build momentum. At its most basic, this means that large numbers of Californians will need to recognize the nature and urgency of the problem of global warming—and be receptive to innovation as a way to solve the problem and bring economic benefits to the State.

The adoption of existing green products and practices.

Green innovation takes place when residents, businesses, and governments adopt existing products and practices to improve energy efficiency or increase energy alternatives in ways that reduce greenhouse gas emissions and generate economic benefits (e.g., financial savings available for re-investment in more productive activities).

The creation of new green products and services.

Green innovation also takes place when businesses create new products and services that improve energy efficiency or increase energy alternatives in ways that reduce greenhouse gas emissions and generate economic gains (e.g., new companies, new jobs, public revenues). This kind of innovation can serve the needs not only of the California market, but also those of the global marketplace, generating additional economic benefits for the State.

Californians recognize the urgency of the problem—and believe a lot can be done about it

As a component of the inaugural California Green Innovation Index, Next 10 commissioned the 2007 Field/Next 10 Global Warming Survey of Californians - a survey of California residents on their understanding of global warming and the steps they are taking and are willing to take for the purpose of stemming the impacts of climate change.

More so than Americans in general, Californians recognize that global warming is very real, urgent, and is having or will have serious negative impacts—including environmental impacts (coastlines, snow pack), economic impacts (agriculture, the broader California economy), and social impacts (health, overall quality of life). But Californians also believe that the general public, industry, and others can do a lot to successfully address the problem.

SURVEY RESULTS:
Californians' Views on Global Warming

51% of Californians have heard "a great deal" about global warming, compared with **42%** of Americans overall.[14]

70% of Californians say that the issue of global warming is "extremely" or "very" important to them, compared with **52%** of Americans overall.[15]

75% of Californians agree that some action should be taken to combat global warming, compared with **61%** of Americans overall.[16] Moreover, **43%** of Californians agree that "global warming has been established as a serious problem and immediate action is necessary", compared with **28%** of Americans overall.[17]

Large percentages of Californians believe global warming is a "very serious" threat to the State's economy (**41%**), overall quality of life (**49%**), coastal communities (**51%**), farmers in the Central Valley (**53%**), the State's snowpack and water supply (**63%**), and the health of Californians living where air quality is poor, such as near freeways, ports and industrial sites (**66%**).

Large percentages of Californians believe that the following groups can do "a lot" to reduce global warming: major corporations (**67%**), gas and electric utility companies (**63%**), government (U.S. **56%**, other countries **51%**, state and local **49%**), and clean energy companies (**52%**).

57% also believe that the general public ("people like you") can do a lot about reducing global warming, compared with **27%** of Americans overall.[18]

Californians believe that reducing emissions and growing the economy is both possible and desirable—and believe that new technologies will help solve the problem

SURVEY RESULTS:
Californians Believe We Can Reduce Emissions and Grow the Economy at the Same Time

85% agree that California can reduce greenhouse gases that contribute to global warming and expand jobs and economic prosperity at the same time. More than half (**54%**) agree "strongly" with this statement.

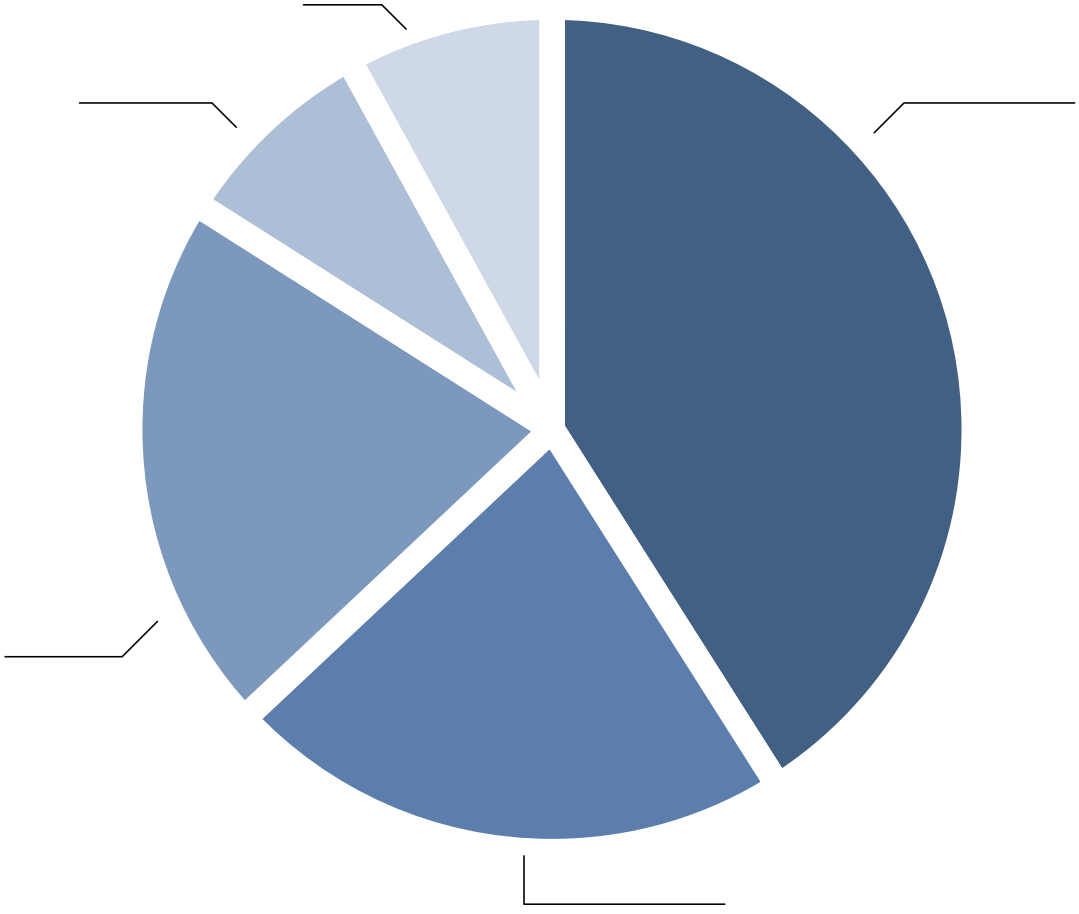
77% agree that firms and government researchers will develop new technologies to solve the problem of global warming; **39%** agree "strongly" with this statement.

ADOPTION OF GREEN PRODUCTS AND PRACTICES

The combination of actions by individuals, businesses and government leaders that comprise green innovation in the forms of technology, preferences and policy, has a compounding effect. To measure green innovation in terms of the adoption of green products and practices, we focus on vehicles, homes, and workplaces—the major users of energy and, directly or indirectly, the major drivers of greenhouse gas emissions. As illustrated in **Chart 12**, transportation accounts for the highest percentage of gross greenhouse gas emissions (41%). Businesses and residences, by virtue of their electricity use, also drive needs for both in-state electricity generation and electricity imports—which together account for 22% of gross emissions. In addition, industrial activities produce 21% of gross GHG emissions. Thus, adoption of green products and practices in homes, workplaces, and vehicles is critical to the reduction of greenhouse gas emissions.

12: California GHG Emissions by Source – 2004

Includes electricity imports and excludes international bunker fuels



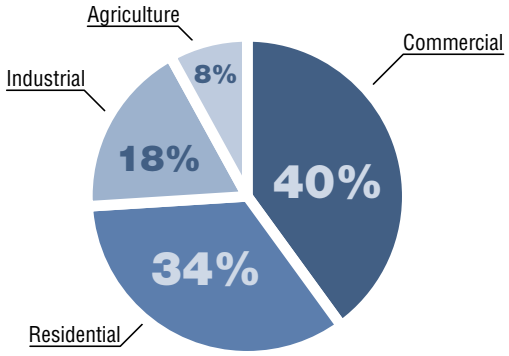
Source: California Energy Commission, Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004. Staff Final Report. CEC-600-2006-013-SF. December 2006.

Californians are accelerating their adoption of green products and practices to reduce electricity consumption

There are signs that Californians have begun to adopt a less energy-intensive lifestyle. Throughout the past 15 years, per capita electricity consumption has not increased in California. In fact, electricity consumption per capita has consistently been lower than 1990 levels, with the exception of a spike in 2000 (**Chart 13**).

Electricity Consumption by Sector

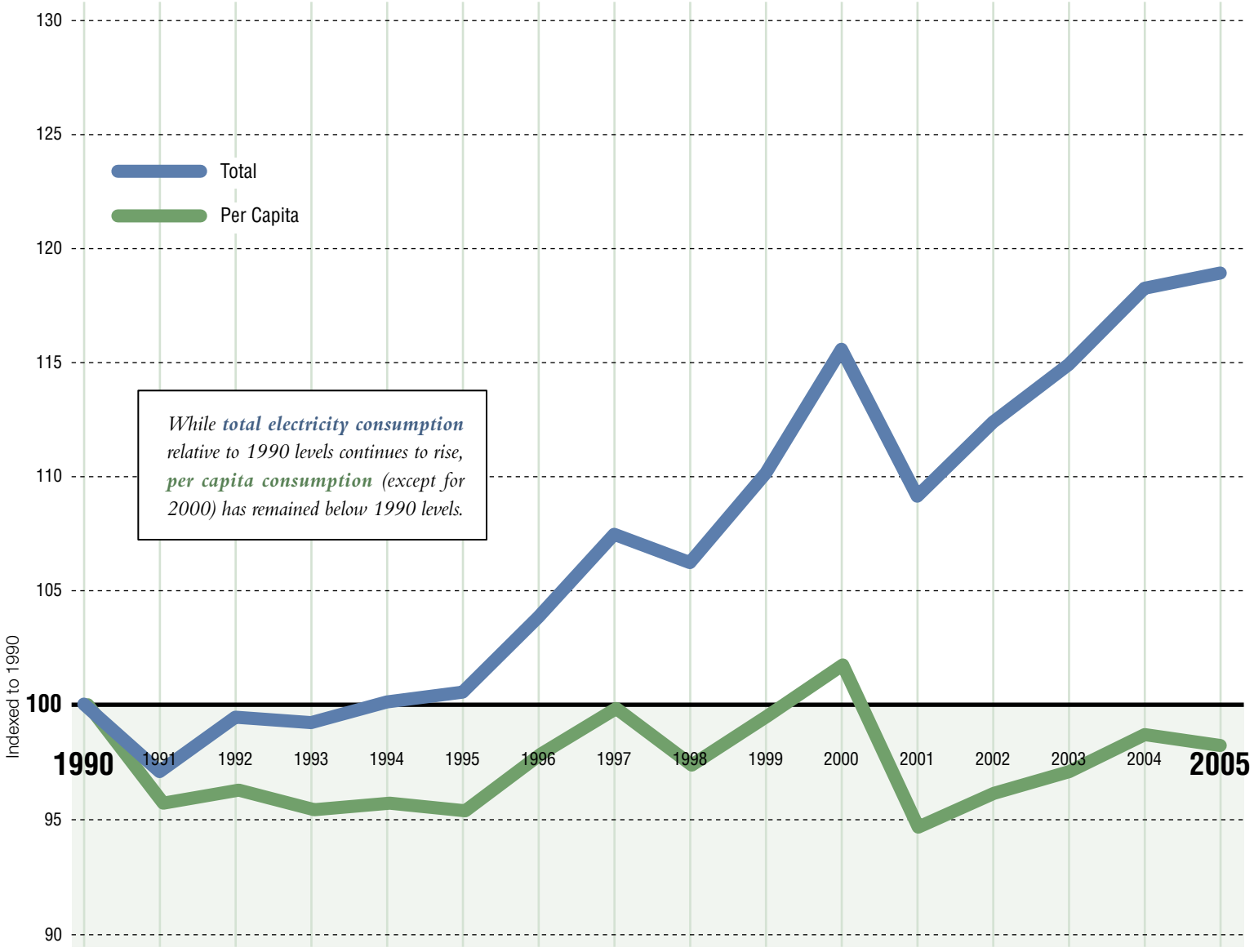
2005



Source: California Energy Commission

13: Electricity Consumption in California

Trends relative to 1990



Source: California Energy Commission; U.S. Census Bureau

Our survey results show that the majority of homeowners in California are already adopting or are planning to adopt specific electricity saving products and practices. Data shows that an increasing number of Californians are purchasing energy efficient light bulbs—even more so than in the rest of the country. Since 2002, the share of Compact Fluorescent Lamps (CFLs) purchased in California has been steadily on the rise. Although in 1999, the share of CFLs purchased was less than 1% in both California as well as the rest of the U.S., in 2005, the share of these energy efficient light bulbs purchased in California was over double that of the rest of the U.S. (**Chart 14**).

Energy Star Appliances are becoming increasingly more pervasive in the California market. In 2005, approximately 90% of the dishwashers purchased in California were Energy Star qualified. The adoption of green products is helping Californians to reduce electricity consumption, thereby also contributing to a reduction in electricity bills (**Chart 15**).

SURVEY RESULTS:

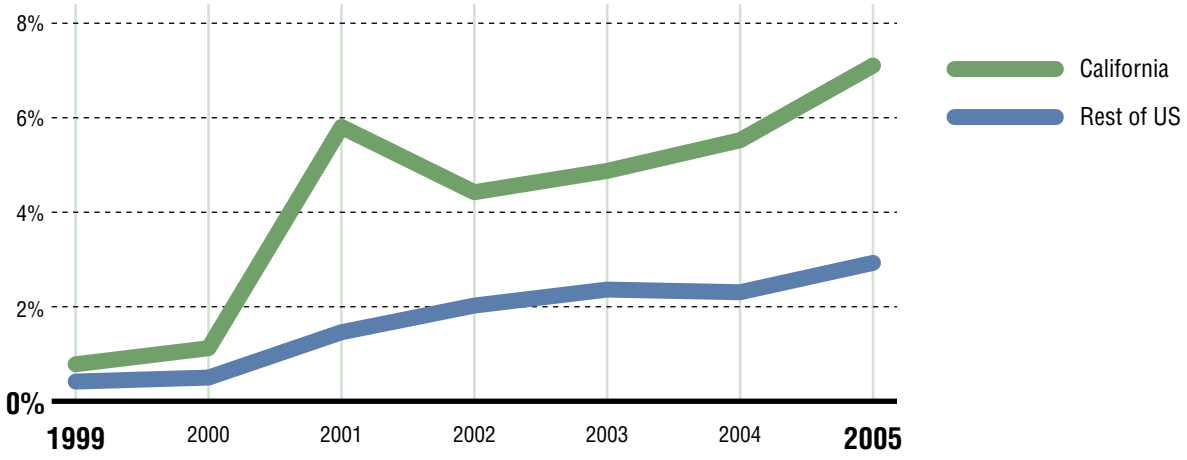
Large Percentages of Californians are adopting and planning to adopt specific electricity saving products and practices.

Behavior	Already Doing	Likely in Coming Year	Considering For Future
Turn off computers, etc.	93%	3%	2%
Adjust heating/AC to save energy	84%	3%	2%
Buy/use CFL or LED bulbs	76%	10%	7%
Buy/use Energy Star appliances★	84%	6%	9%
Install water-saving devices★	76%	5%	12%
Insulate home, water heater, etc.★	75%	6%	12%

(★ Share of homeowners only)

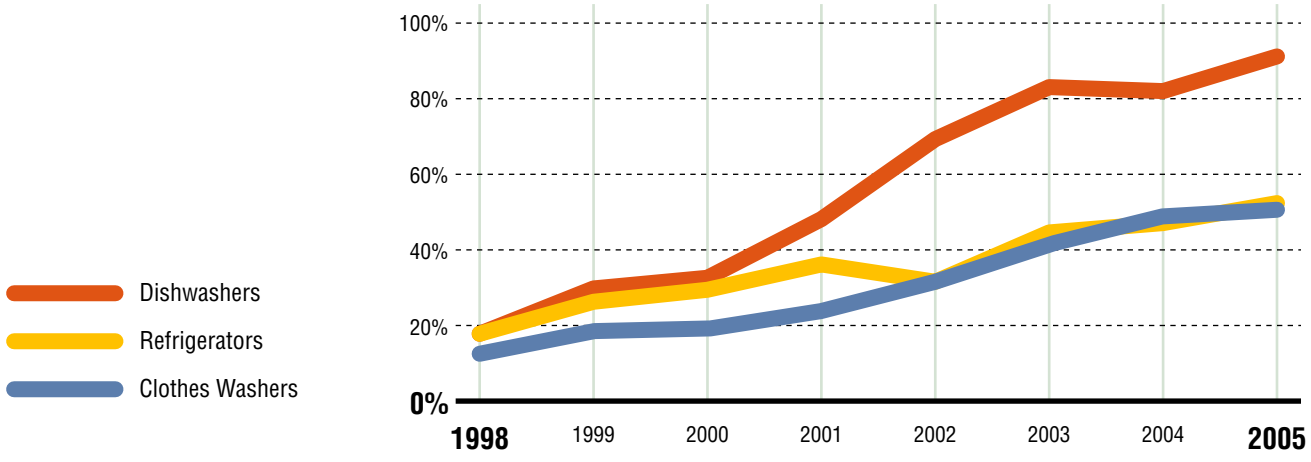
14: Market Share of CFL Light Bulbs

Share of CFLs purchased as a percent of all medium screw-based lamps



Source: California Measurement Advisory Council (CALMAC)

15: California Market Share of Energy Star Appliances



Source: California Measurement Advisory Council (CALMAC)

Title 20

Appliance Efficiency Standards

In 1980, the California Energy Commission was granted the right to adopt efficiency standards for appliances. These standards, under the California Code of Regulations, cover refrigerators, freezers, washing machines, air conditioners and lighting.

Title 24

California Building Standards

The Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce California's energy consumption. Periodically updated to allow for new energy efficiency technologies and methods, these standards include minimum requirements for building insulation as well as heating, ventilating, air conditioning, and water heating equipment.

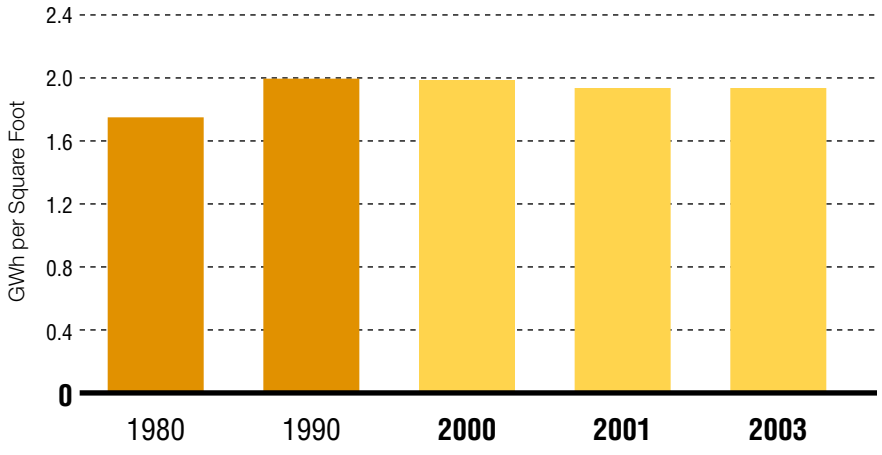
California Energy Commission

The commercial business sector– the largest consumer of electricity in California– has become more energy efficient in recent years

Although the electricity intensity of the commercial business sector increased between 1980 and 1990, over the course of the following decade it has made gradual progress in becoming more energy efficient (**Chart 16**). Overall, commercial electricity consumption per square foot declined slightly from 1990-2003 (**Chart 16**). Looking at commercial sector electricity consumption by industry shows that specific industries have been making considerable strides in reducing electricity use (**Chart 17**). While key industry sectors such as retail, restaurants, food stores, and large offices experienced substantial reductions in energy consumption, the commercial sector still has much potential to become more energy efficient, as other key sectors continue to consume more electricity.

16: Office Building Electricity Consumption

Consumption per Square Foot



Source: California Energy Commission

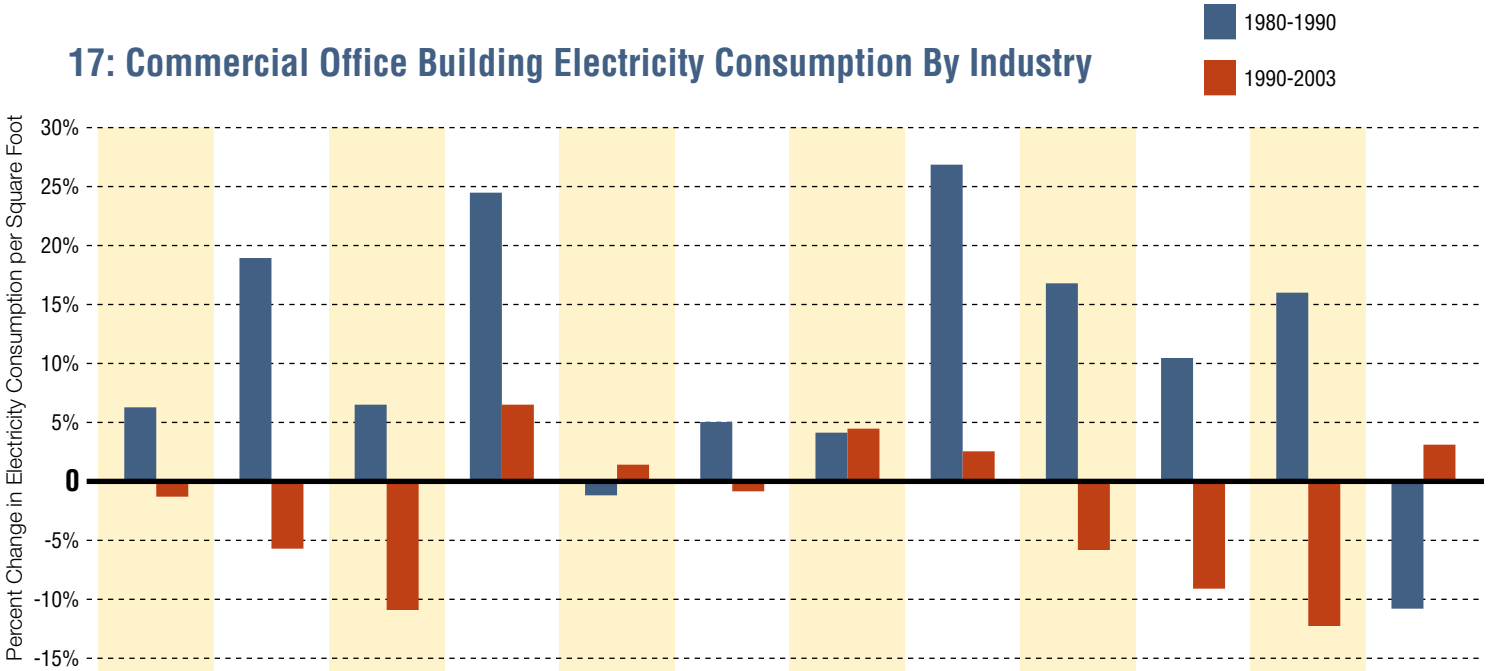
SURVEY RESULTS:

Californians are reporting that their employer encourages specific behaviors to improve energy efficiency

25% of working Californians say their employer provides incentives to employees to take public transit, work from home, or purchase hybrid, electric, or alternative fuel vehicles.

35% of working Californians say their employer has provided information about ways to conserve energy and reduce greenhouse gas emissions at the workplace.

17: Commercial Office Building Electricity Consumption By Industry

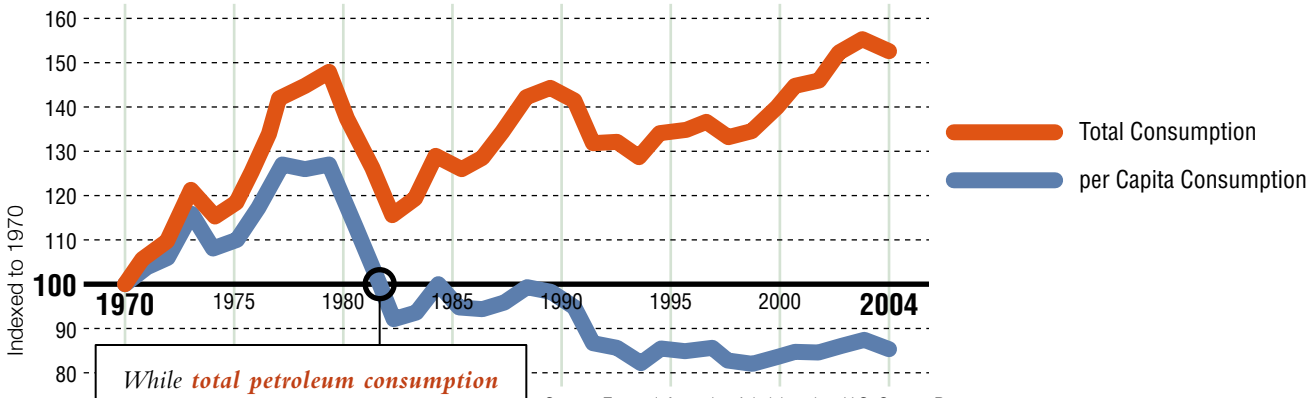


	Large Offices	All Other Buildings	Retail	Warehouses	Schools	Small Offices	Colleges	Hospitals	Hotels/ Motels	Food Stores	Restaurants	Refrigerated Warehouses
Total Sq. Feet (millions of square feet)	1,075	1,052	948	779	457	354	287	285	284	247	163	47

Source: California Energy Commission

18: Petroleum Consumption in California

Trends relative to 1970

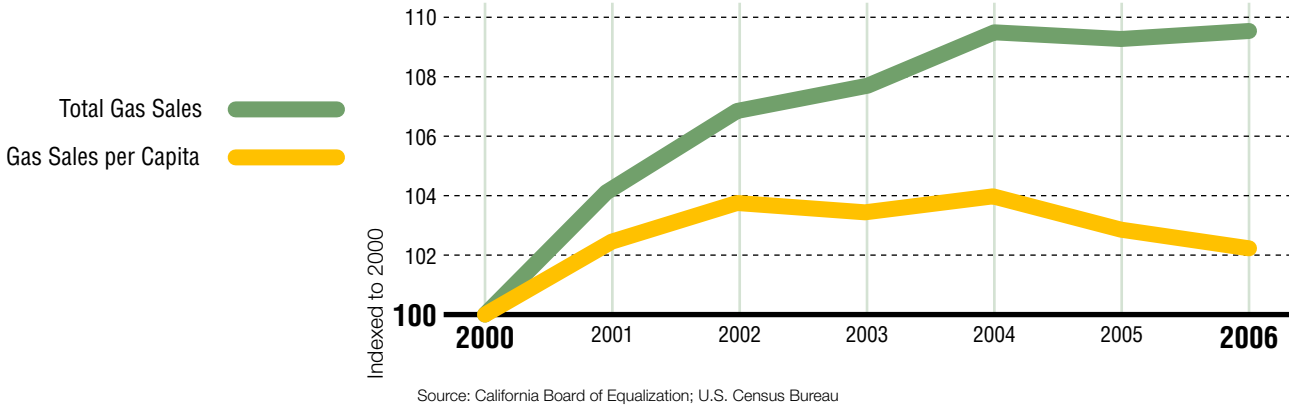


*While **total petroleum consumption** relative to 1970 has continued to rise, **per capita consumption** since the 1980s has remained below levels in 1970.*

Source: Energy Information Administration, U.S. Census Bureau

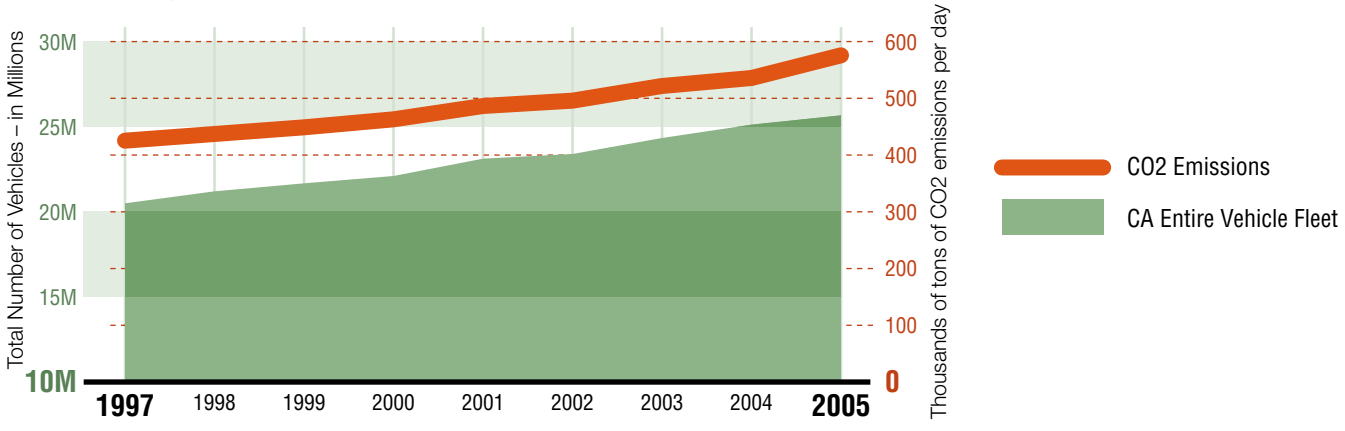
19: Gas Sales in California

Trends relative to 2000



Source: California Board of Equalization; U.S. Census Bureau

20: Registered Vehicles and Emissions – California



Source: California Air Resources Board

Gasoline sales and vehicle miles traveled have leveled off

To meet the needs of a rapidly growing population in California, total consumption of many resources, including petroleum, has been growing accordingly. While there has been an increase in total petroleum consumption, since the 1980s per capita consumption has dropped below 1970 levels (**Chart 18**). Other observable trends include the leveling off of gas sales since 2004 relative to 2000 (**Chart 19**) and the continued increase in total CO2 emissions and number of vehicles (**Chart 20**).

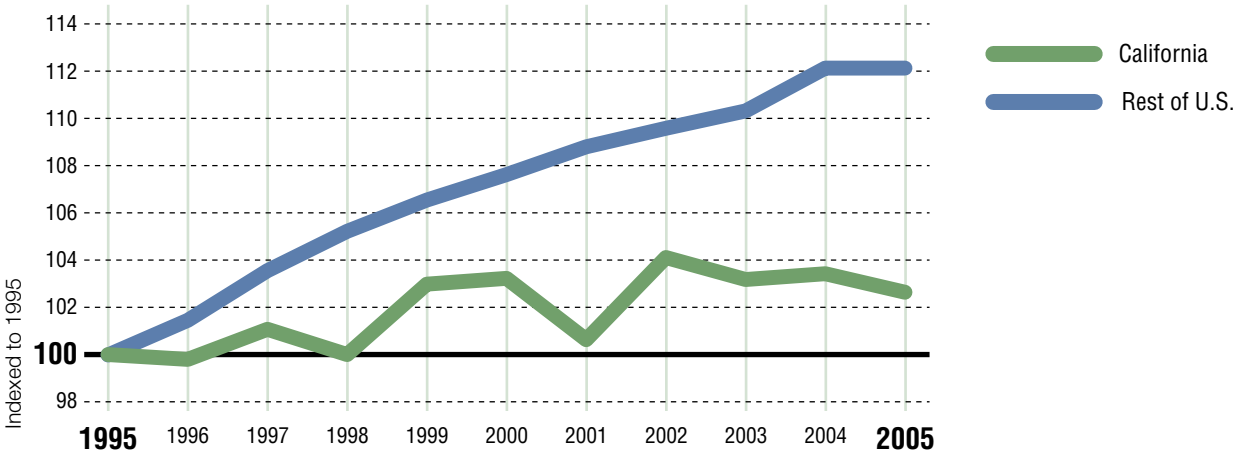
Vehicle-miles traveled (VMT) per capita have begun to decrease since 2002, showing that Californians are driving shorter distances on average. In the rest of the U.S., however,VMT per capita has grown much faster (**Chart 21**).

While there are signs that rising gas prices can impact gas consumption, **Chart 22** illustrates the relative inelasticity of demand for gas in the State as the rate of price increases far outpace the drop in consumption. Gas prices alone have not brought about change in behaviors.

Although the share of the population using alternative means of commute has been decreasing in California and the rest of the U.S. alike (**Chart 23**), Californians are less likely to drive alone than other Americans. Over the past decade, there has been a long-term trend of growing public transit use. Though dipping with the economic contraction in 2002 and 2003, transit ridership in 2004 was back to levels seen in 2000 (**Chart 24**).

21: Vehicle-Miles Traveled

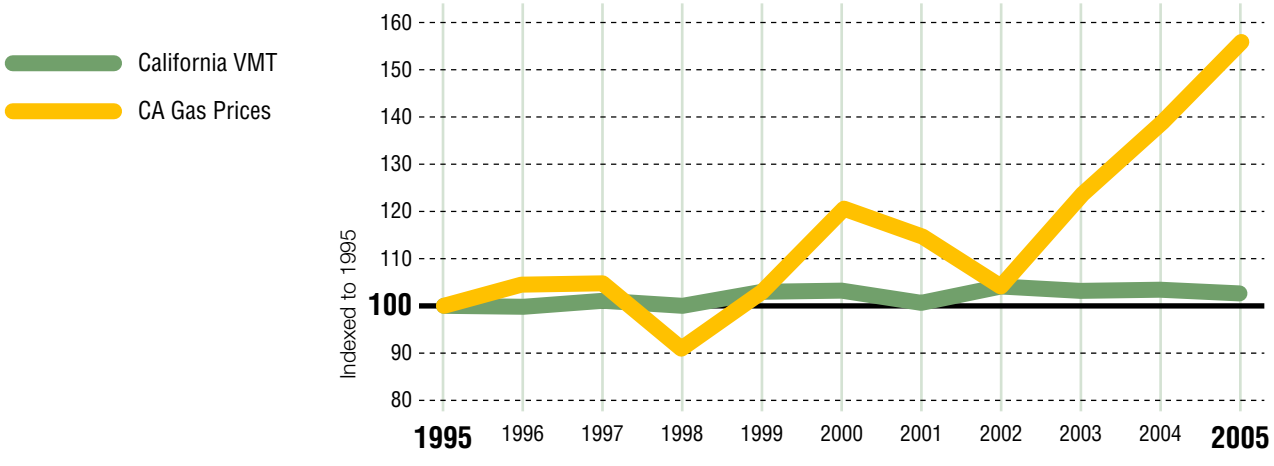
California & Rest of U.S., Per Capita trends relative to 1995



Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics; California Department of Transportation Californnia Motor Vehicle Stock, Travel and Fuel Forecast

22: California VMT & Gas Prices

Per Capita trends relative to 1995



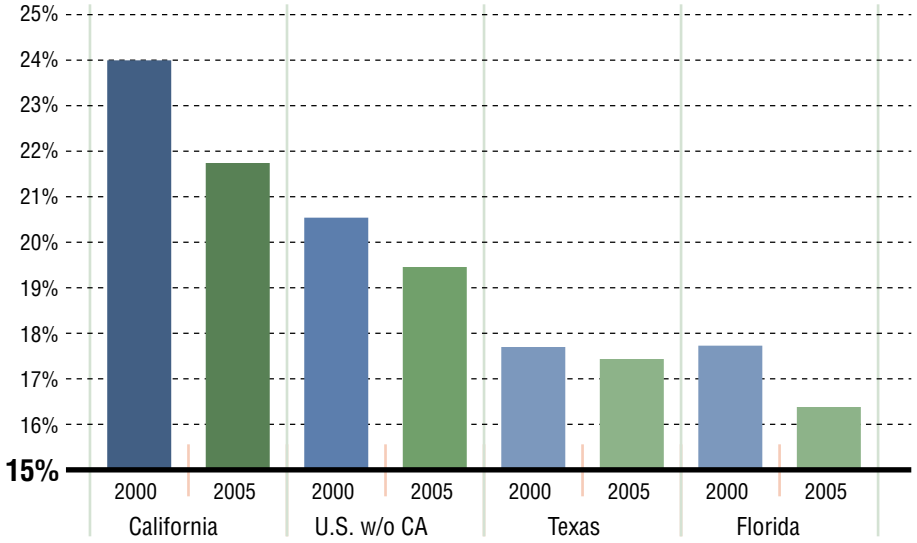
* Inflation adjusted to 2005 dollars

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics; Enegy Information Administration, Petroleum Marketing Annual; California Department of Transportation, Californnia Motor Vehicle Stock, Travel and Fuel Forecast

23: Alternative Means of Commute

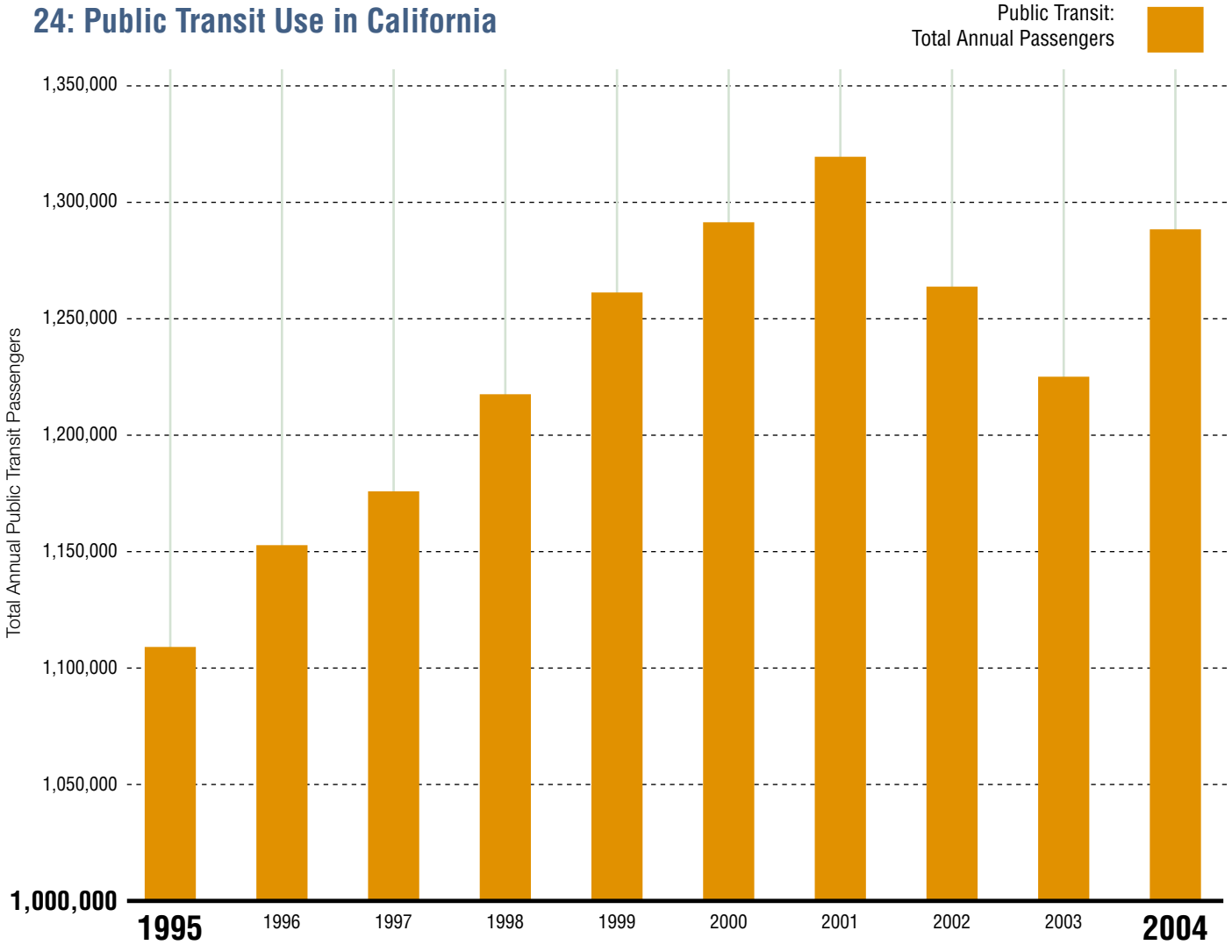
Share of commuters who did NOT drive alone

Means of commute: carpool, public transportation, walked, taxicab, motorcycle, bicycle, or other means



Source: U.S. Census Bureau, American Community Survey

24: Public Transit Use in California



Source: California State Controller

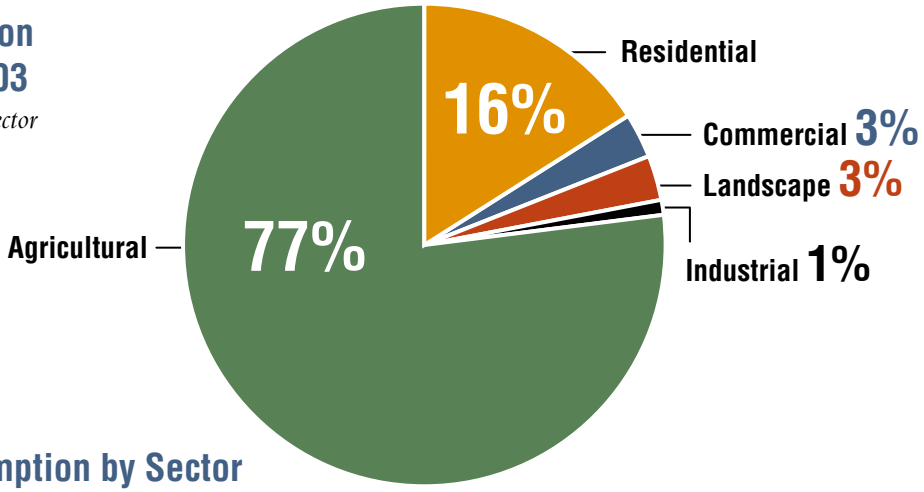
Water consumption and pumping—responsible for about 20% of California's gross electricity use—are using less electricity than in the past

California's water system accounts for approximately 20% of the State's gross electricity use.[20] Depicted in the pie chart below, agricultural water use makes up almost 80% and residential 16% of total water use in California. In 2003 (the most recent year available), total water consumption **(Chart 25)** was lower than in the three preceding years.

Conveyance of water across the state in 2001 accounted for 11% of total electricity use related to water.[22] Water use in California is particularly energy-intensive because much of the State's water demand is located far away from available sources, and the process of moving the water (pumping) results in high energy costs. According to the Energy Commission, "Nearly 70 percent of the state's total stream runoff is north of Sacramento, but 80 percent of the water demand is south of Sacramento."[21] Reducing consumption and improving the efficiency of California's water-use system would yield high energy savings and thereby reduce greenhouse gas emissions.

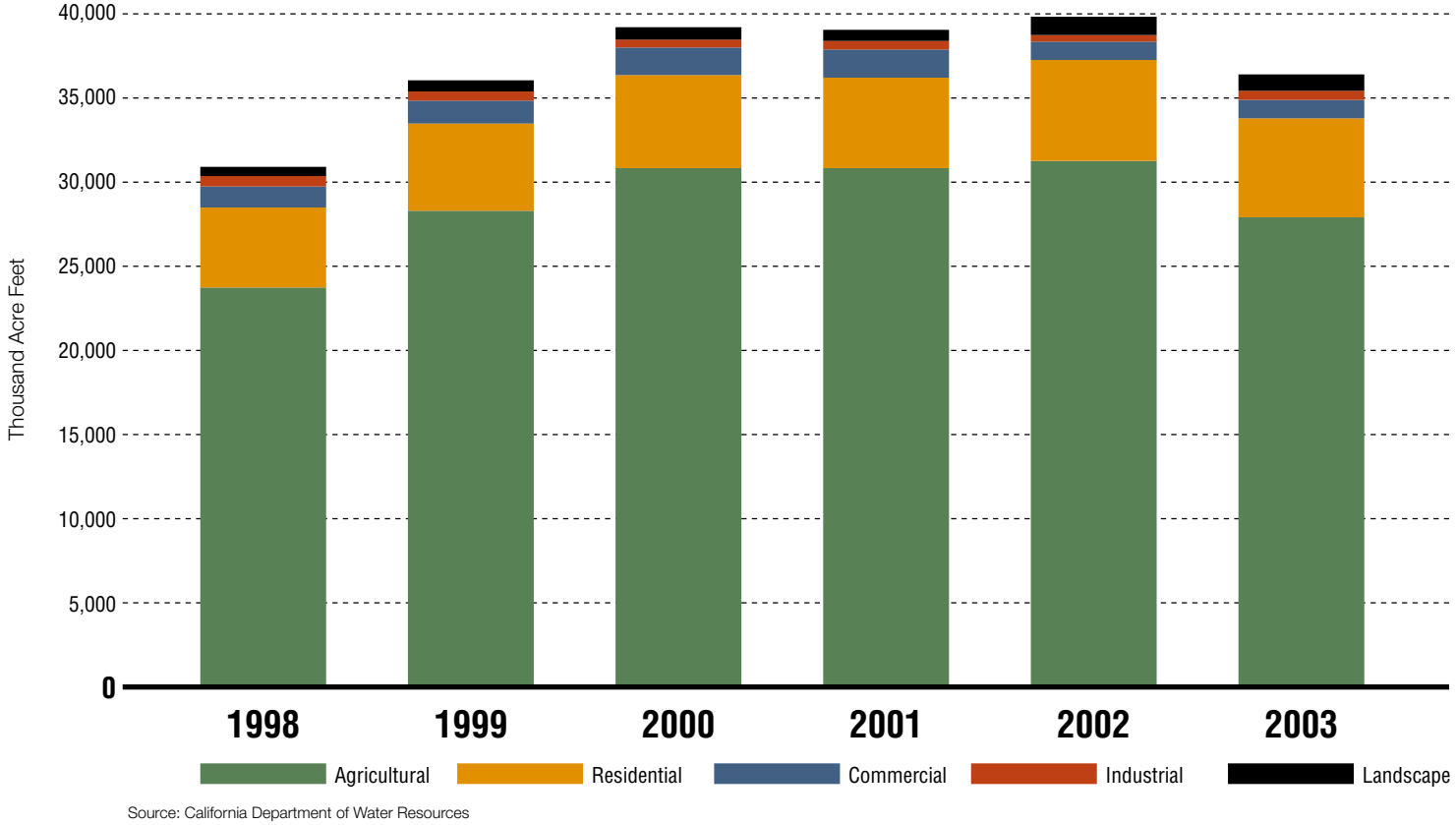
Water Consumption in California - 2003

Share of Water Use by Sector



25: Water Consumption by Sector

California



Source: California Department of Water Resources

From 2004-2005, California reduced electricity use attributed to water pumping, for both urban and agricultural uses (**Chart 26**). In addition, public sector initiatives have been established to improve water efficiency through funding projects and research for new technology, such as water recapture.

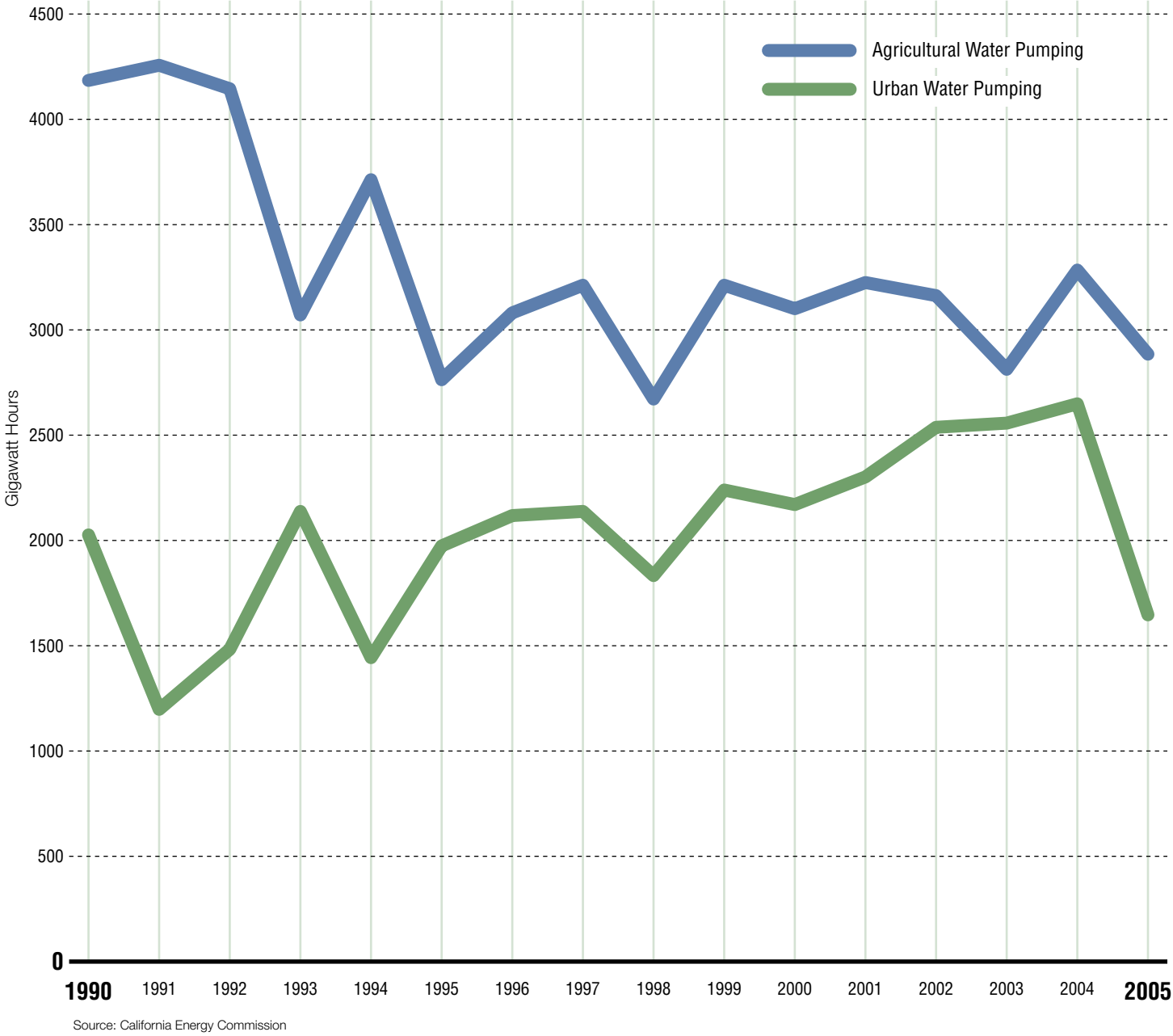
Los Angeles's Water Conservation Success

Prompted by the drought of 1987-1992, the City of Los Angeles has invested over $100 million in conservation measures over the last decade. Even with steady population growth, these measures have slowed annual average demand growth from 2.1% in the pre-conservation period to 1.3% projected over the next 20 years. Conservation efforts include a public awareness program and education campaign that have resulted in the widespread installation of low-flow hardware devices (e.g. toilets and showerheads) and change in use habits. Additionally, the City is implementing water recycling for non-potable uses such as landscaping and industrial uses.

Los Angeles Department of Water & Power

26: Energy Use Through Water Pumping

California



Source: California Energy Commission

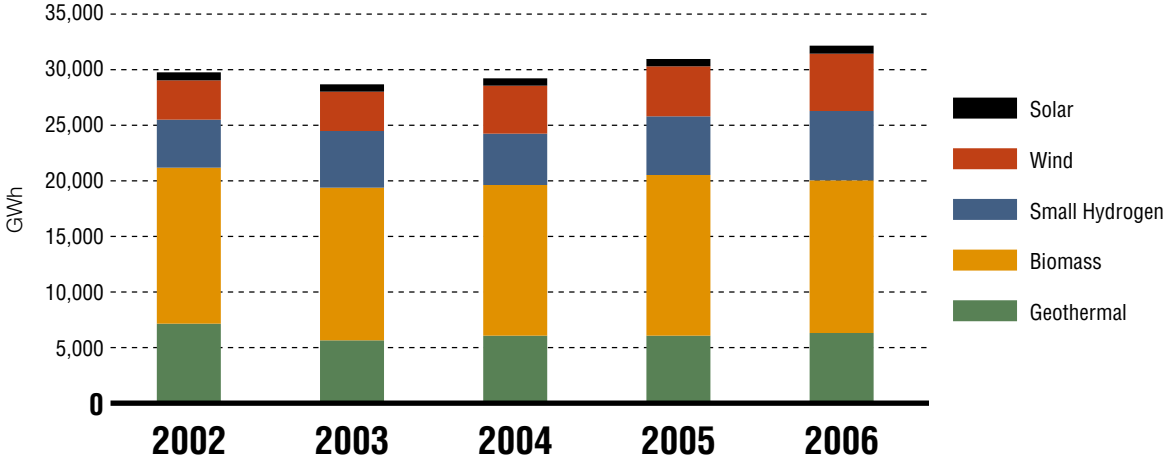
Californians are increasing their use of cleaner energy to reduce greenhouse gas emissions both at home and on the road

In recent years, many steps have been taken to increase the generation and procurement of renewable energy. From 2002 to 2006, total renewable energy generation in the State grew by 8%, with growth primarily in wind generation[23] (**Chart 27**). Over this period, electricity generation from renewable sources has accounted for 11% of California's total electricity generation.

In 2002, the Renewable Portfolio Standard (RPS) was established to ensure that Californians use cleaner energy. Since the RPS was introduced, investor-owned utilities (IOUs) have been procuring a larger share of renewable energy (**Chart 28**). As old contracts expire, the IOUs have new renewable energy contracts in the pipeline to help them attain the RPS target of 20% renewable energy generation by 2010.

27: Renewable Energy Generation in California

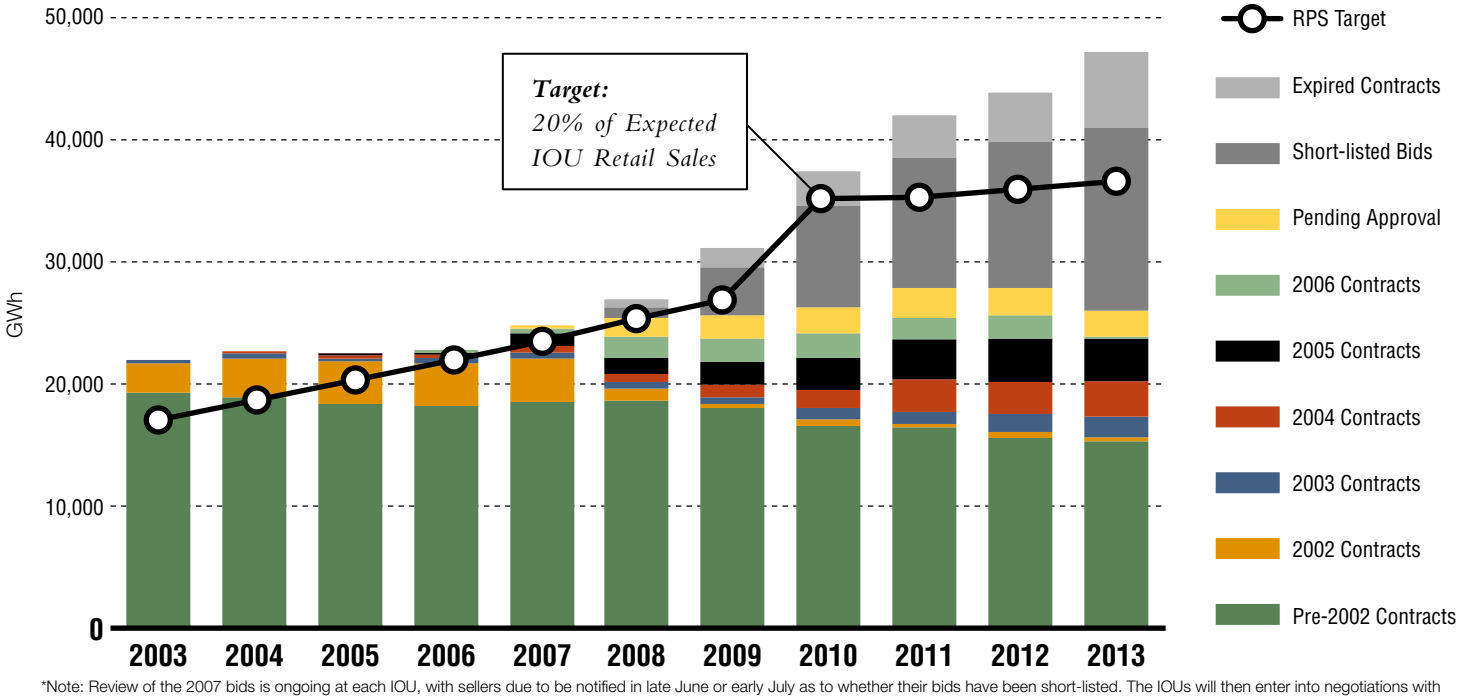
Gigawatt hours by source



Source: California Energy Commission

28: California Renewable Portfolio Standard

Actual and Forecasted RPS Generation from Investor-Owned Utilities (IOUs)

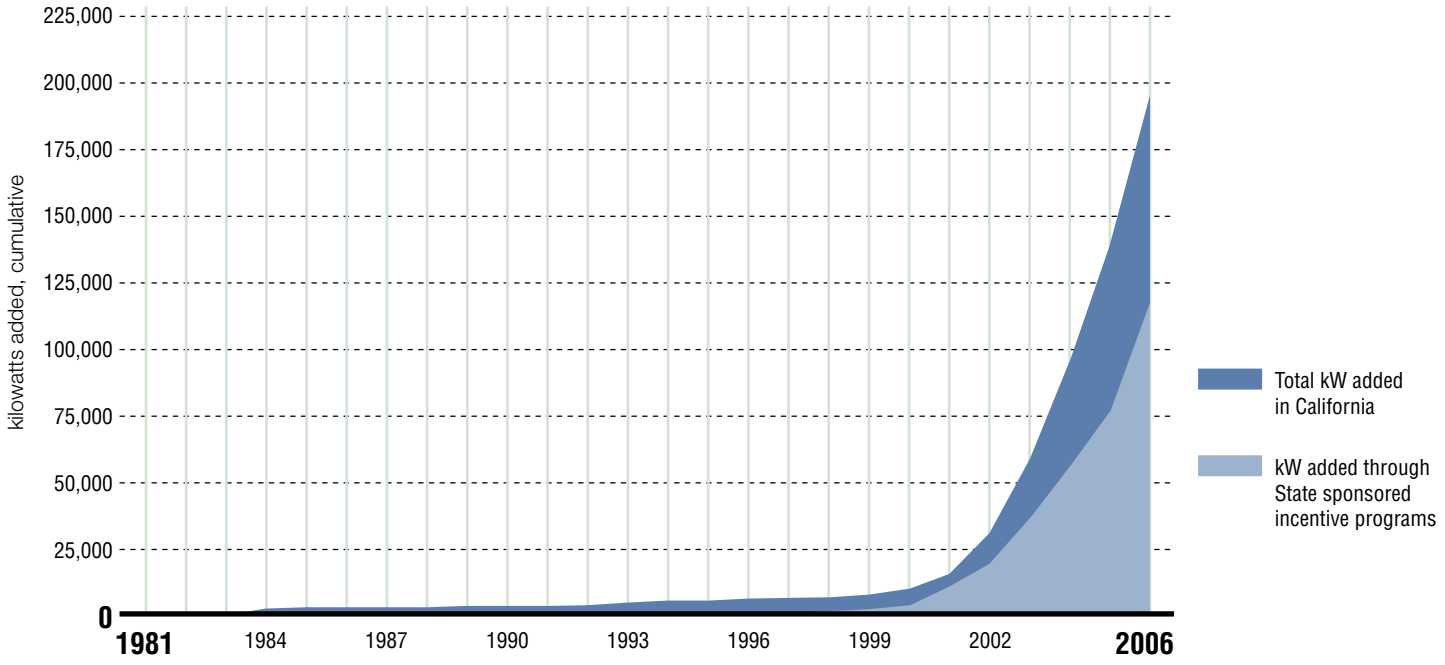


*Note: Review of the 2007 bids is ongoing at each IOU, with sellers due to be notified in late June or early July as to whether their bids have been short-listed. The IOUs will then enter into negotiations with those short-lived bidders who agree to post a deposit and withdraw any conflicting offers they had made to other solicitors. Negotiations will continue through 2007, and any resulting RPS contract should be filled with the CPUC for approval by the end of the year. Some of the short-listed bids may not receive contracts, but many represent viable projects that may receive contracts and contribute to the 2010 goal.
Source: California Energy Commission

Since 2000, California has been experiencing a growing trend in solar installation, as depicted in **Chart 29**. Programs have been established to encourage solar installation and make solar energy more accessible and affordable. The California Solar Initiative provides information on rebates and federal tax incentives to help lower the cost of solar systems for Californians. Californians have already proven receptive to these programs—in 2006, 58% of residential solar installation was added through state-sponsored incentive programs, the California Solar Initiative and the earlier Emerging Renewables Program and Self-Generation Incentive Program.[23] From 1981-2006, approximately 200 MW of grid connected solar photovoltaic was installed in California, equivalent to 40% of the capacity of a large power plant (500MW).

29: Energy from Solar Installations in California

Grid-Connected Solar Photovoltaics



Note: The Self-Generation Incentive Program and the Emerging Renewables Program were replaced by the California Solar Initiative in 2006.
Source: California Energy Commission

California's Renewable Portfolio Standard (RPS) is One of the Most Ambitious Renewable Energy Standards in the Country

Established in 2002 under Senate Bill 1078 and accelerated in 2006 under Senate Bill 107, California's RPS obligates investor-owned utilities, energy service providers and community choice aggregators to procure an additional 1% of retail sales per year from eligible renewable sources until 20% is reached, no later than 2010. The California Public Utilities Commission and the California Energy Commission are jointly responsible for implementing the RPS program.

California Public Utilities Commission, July 2007 Report to the Legislature

An increasing number of Californians are purchasing hybrid, compressed natural gas and electric vehicles. From 2000 to 2005, registrations of such alternative fuel vehicles increased by 18 times (**Chart 30**). In contrast, the growth of all other vehicles purchased remained relatively unchanged. There remains plenty of potential for improvement in the alternative vehicle market, as the share of alternative vehicles still only makes up less than 1% of all operational vehicles in the State (**Chart 31**).

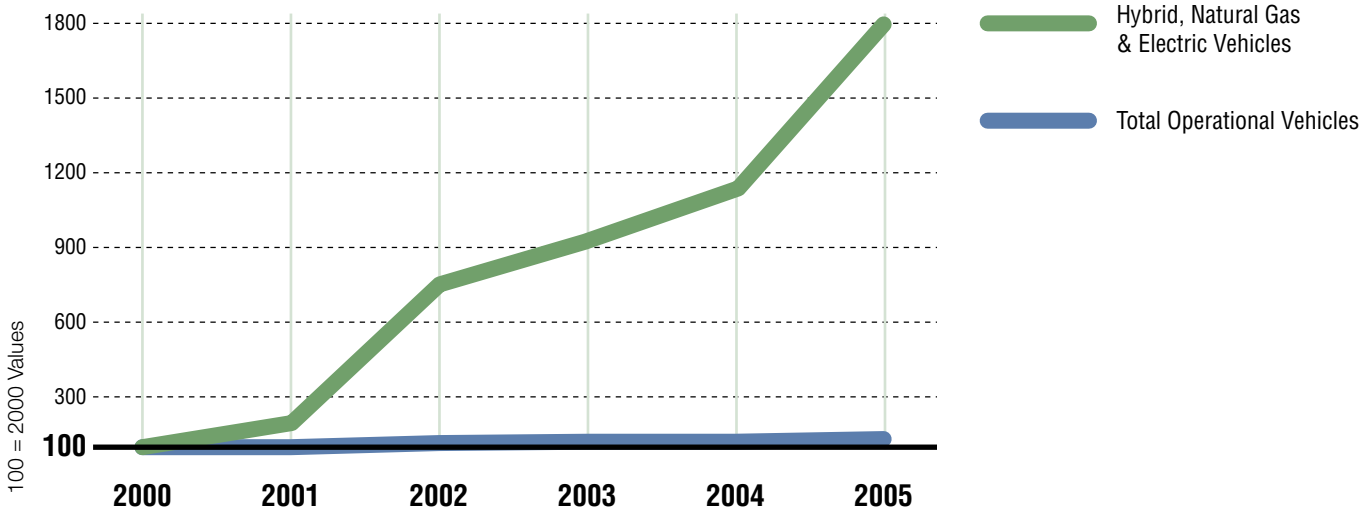
SURVEY RESULTS

Californians reporting past or potential purchase of a hybrid/alternative fuel vehicle

As of 2005, according to the latest state vehicle registration figures available, approximately **3%** of households in California had purchased a hybrid, electric, or alternative fuel car. Two years later, **6%** of respondents to the 2007 Field/Next 10 Global Warming Survey of Californians, said that they have purchased a vehicle of this kind. Another **10%** of Californians responded that they are likely to do so in the next year, and **50%** said they are considering such a purchase in the future.

30: Alternative Fuel Vehicles

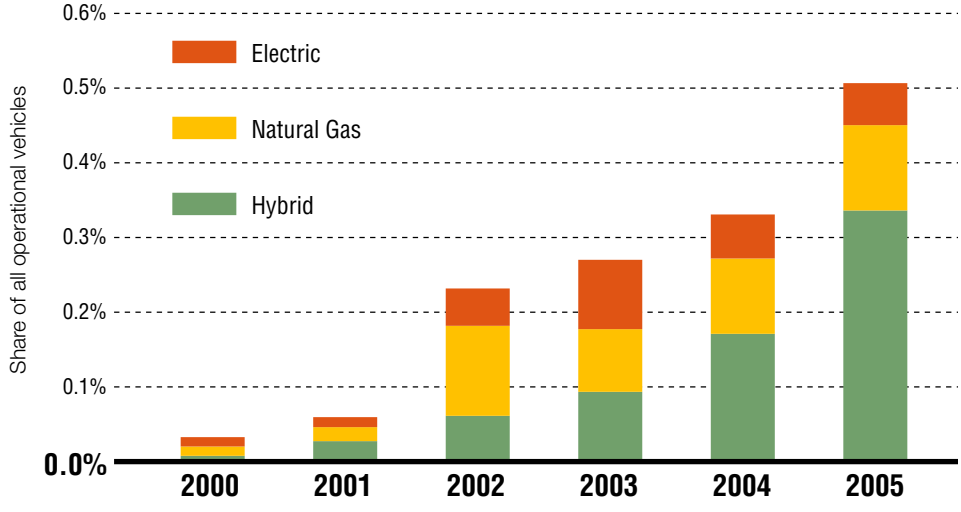
Growth in operational vehicles registered relative to 2000



*Note: Includes hybrid and electric vehicles as well as vehicles running on natural gas. Does not include diesel engine vehicles or vehicles running on all alcohol based and gaseous noncarbon fuels.
Source: California Department of Motor Vehicles

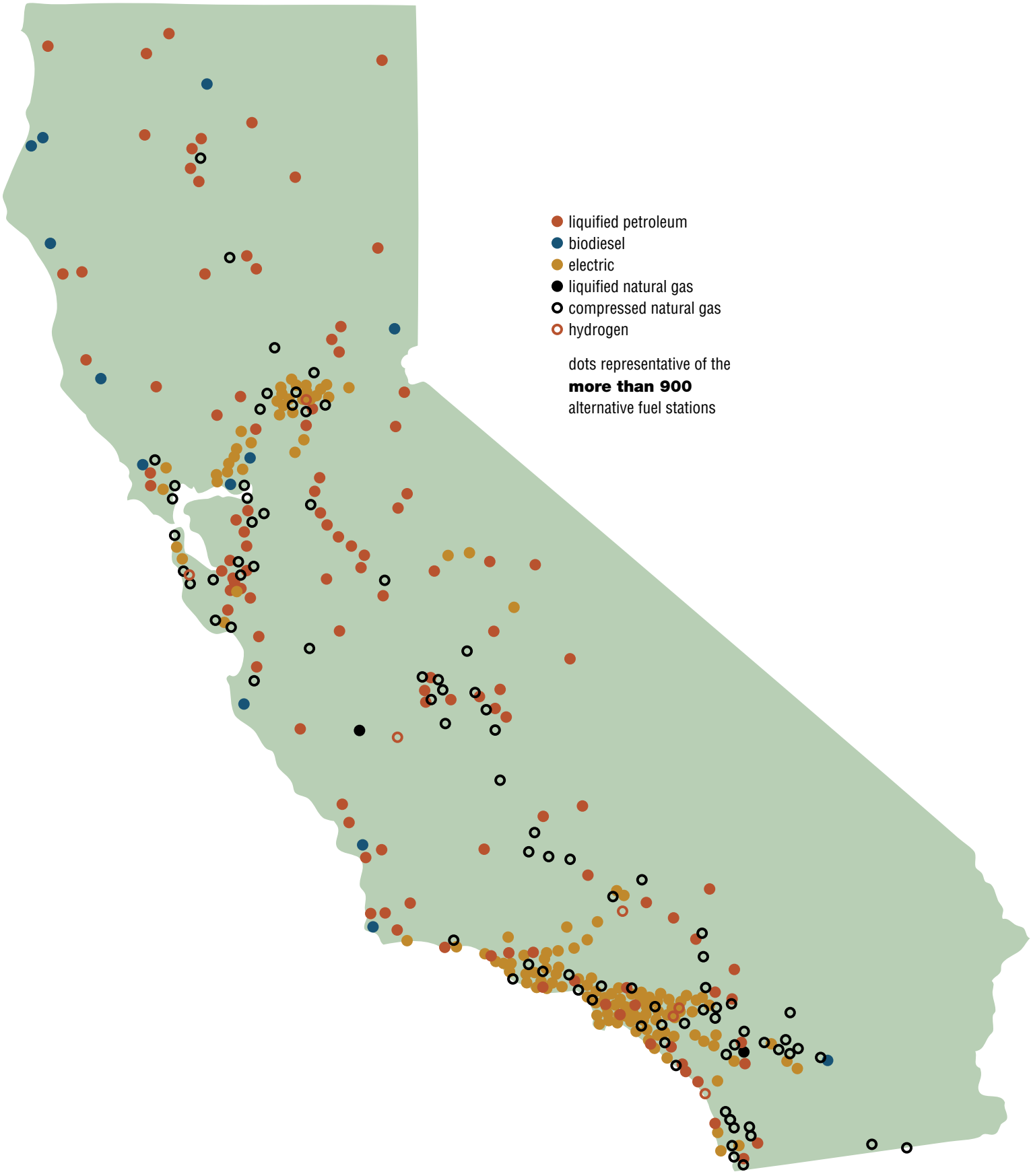
31: Alternate Fuel Vehicles by Type

As share of all operational vehicles in California



*Note: Includes hybrid and electric vehicles as well as vehicles running on natural gas. Does not include diesel engine vehicles or vehicles running on all alcohol based and gaseous noncarbon fuels.
Source: California Department of Motor Vehicles

ALTERNATIVE FUEL STATIONS



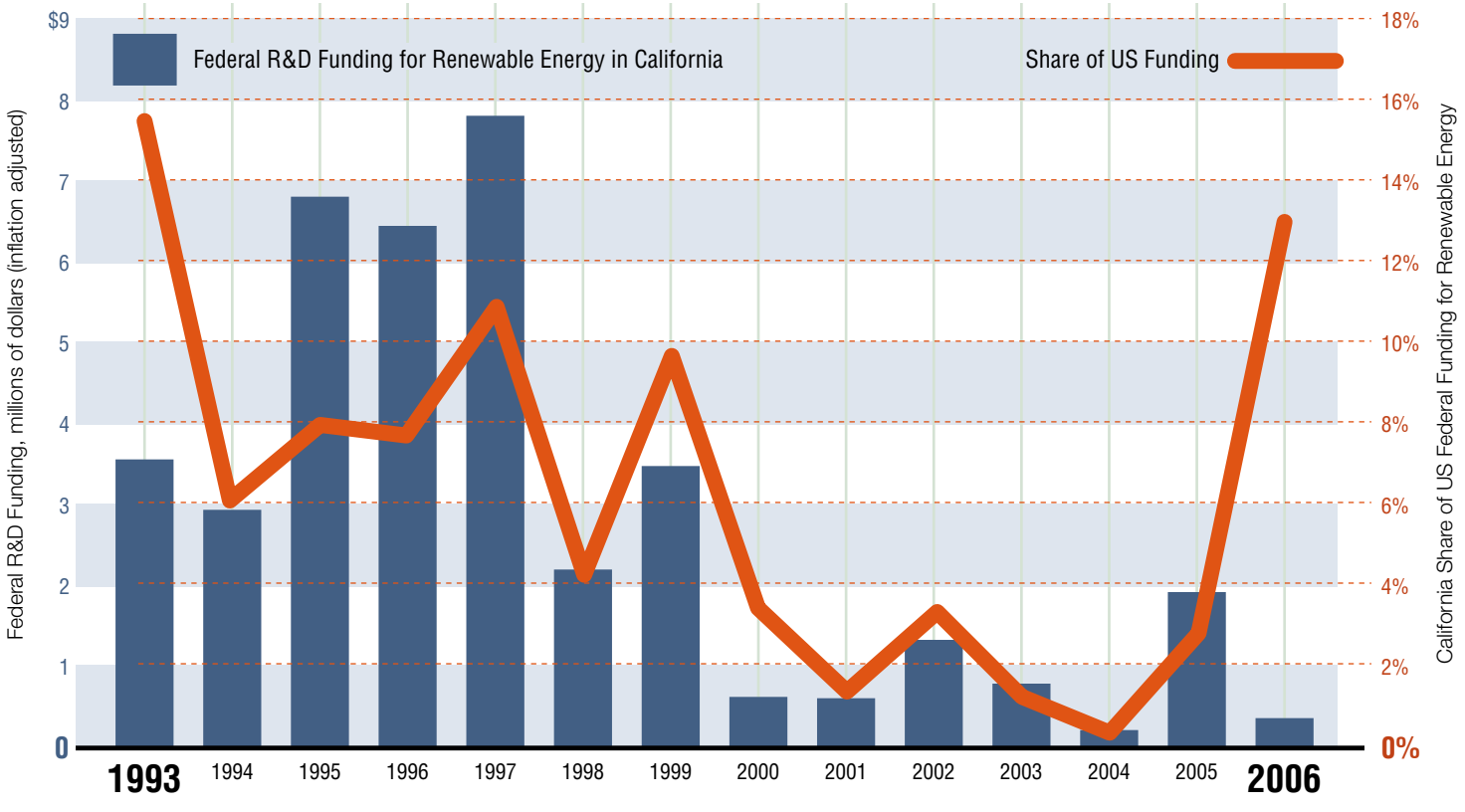
INNOVATION LIFECYCLE: CREATION OF NEW PRODUCTS AND PRACTICES

California's capacity for technological innovation and the commercialization of new ideas has made it a driving force in the U.S. and global economies. Advances in technology create new markets that spur new demand through continued product differentiation and technological development. With its developed innovative capacity, California is exceptionally well-positioned to advance the development of new green technologies and products and bolster their broad distribution.

California's innovative economy has a track record that can be built upon to achieve reductions in greenhouse gas emissions while stimulating the economy. There are signs that this process is readily underway. There are signs too of potential weaknesses in the innovation process for green technology.

The innovation lifecycle combines critical resources of talent, technology, investment and infrastructure with the dynamic processes of an innovation habitat to produce competitive businesses, quality jobs and economic vitality. The innovation process is reflected in idea generation, technology commercialization and entrepreneurship. This dynamic innovation process is an essential component of a competitive economy, because it translates ideas into high-value products and services.

32: Federal R&D Funding for Renewable Energy in California



Source: RaDiUS - The RAND Database for Research and Development in the US

California is drawing increasing R&D investment for clean energy from a variety of public and private sources

Research and development (R&D) funding is vital for driving the innovation process. R&D invested in the State's universities, laboratories and private sector companies supports capital-intensive labs and the development of cutting-edge technologies. With California's defense, IT and biotech industries, it is a top recipient state of federal R&D dollars.

After rising by 118% from 1993 to 1997, federal funding in California for R&D in clean energy has diminished from $7.8 million in 1997 to $410,000 in 2006 (**Chart 32**). While federal support continues to lag, California has been making a substantial effort to develop an innovative R&D infrastructure.

Since the 1980s, the focus of California's technology programs has evolved from matching grants to institutional support for research institutions, to investments in strategic R&D funds. There has been a shift in emphasis from funding university research to public-private partnerships with more industry leadership. The State and private industry recognize the critical need for supporting energy R&D. An open innovation model has been emerging, with involvement from government, private industry, and university entities reinforcing each other to create an unparalleled R&D infrastructure.

Public and private universities have established research centers focused on clean energy funded by public and private sources. The State of California has contributed $70 million in public funding to these efforts.[24] Additionally, in 1996, the State of California established the Public Interest Energy Research (PIER) Program. Administered by the California Energy Commission, this program has been granting at least $62.5 million a year in R&D funding since its inception. (See box on PIER Program.)

Public Interest Energy Research (PIER) Program

The California Energy Commission's Public Interest Energy Research (PIER) Program supports energy research, development and demonstration (RD&D) projects that will help improve the quality of life in California by bringing environmentally safe, affordable and reliable energy services and products to the marketplace. The PIER Program was established in 1996 under Assembly Bill (AB) 1890, which provided authority for a fundamental restructuring of California's electric service industry. Among other things, AB 1890 requires that at least $62.5 million be collected annually from investor-owned utility ratepayers for "public interest" energy RD&D efforts not adequately provided by competitive and regulated markets.

The mission of the PIER Program is to conduct the most promising public interest energy research by partnering with RD&D organizations including individuals, businesses, utilities, and public or private research institutions. PIER brings new energy services and products to the marketplace and creates state-wide environmental and economic benefits.

PIER funding efforts are focused on the following RD&D program areas:

- *Buildings End-Use Energy Efficiency*
- *Climate Change Program*
- *Energy Innovations Small Grant Program*
- *Energy-Related Environmental Research*
- *Energy Systems Integration*
- *Environmentally-Preferred Advanced Generation*
- *Industrial/Agricultural/Water End-Use Energy Efficiency*
- *Natural Gas Research*
- *Renewable Energy Technologies*
- *Transportation Research*

The essential purpose of PIER projects is to benefit California's electric consumers:

- *Reduce the cost of electricity and increase its value*
- *Increase the reliability of the electric system*
- *Reduce the environmental impacts of electricity generation, distribution and use*
- *Enhance California's economy*
- *Demonstrate a connection to the market*
- *Advance science and technology not provided by competitive and regulated markets*

Source: California Energy Commission

California is a leader in green technology innovation as measured by patents

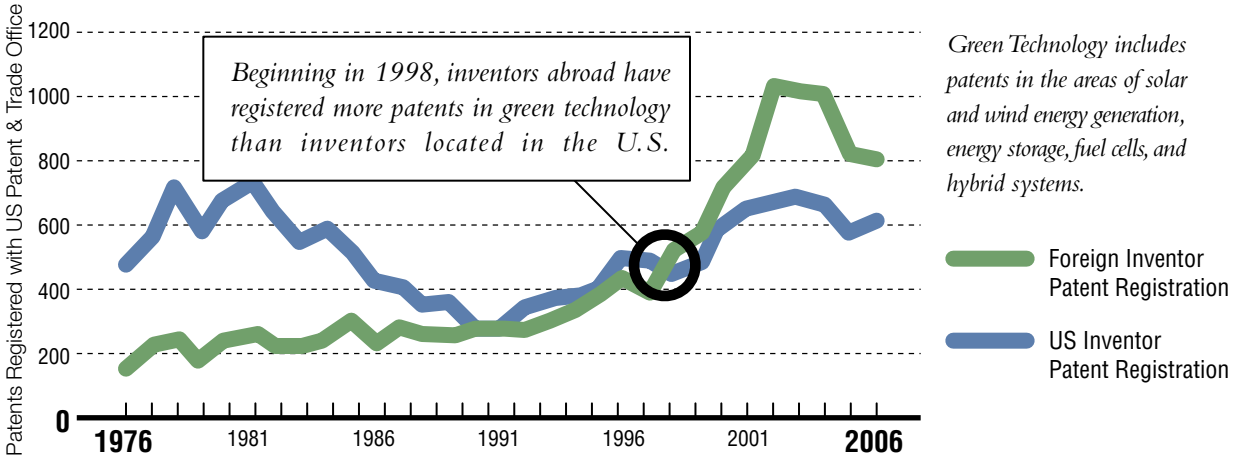
Patents reflect the initial discovery and registry of innovative ideas. Strong patent activity usually reflects significant R&D taking place. A key motivator to obtain patent protection is the potential relevance to a marketable product or process. Patent activity can trigger high-impact discoveries that lead to new innovation downstream. Further, the ability to generate and protect new ideas, products and processes is an important source of regional competitive advantage.

Among patents registered in the green technology areas of solar and wind energy generation, energy storage, fuel cells and hybrid systems, since 1998, registrations by inventors located outside the U.S. have outpaced registrations by U.S. inventors (**Chart 33**). These trends suggest that while U.S. investment in green technology may be lagging, investment in green technology by other countries is not.

Nationally, California continues to contribute strongly to U.S. patent registrations in green technology. Most recently, California accounted for 44% of all U.S. patents in solar and 37% in wind technologies (**Chart 34**).

33: Green Technology Patent Registration

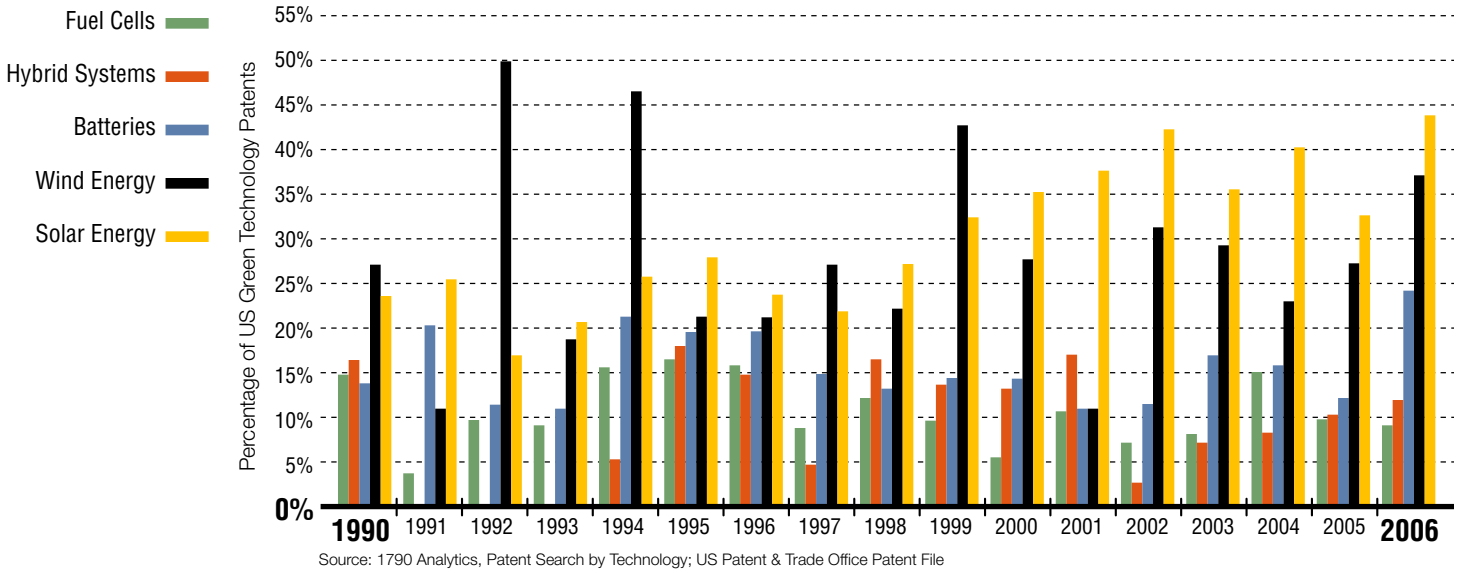
By primary inventors in U.S. and abroad



Source: 1790 Analytics, Patent Search by Technology; US Patent & Trade Office

34: Patents by Green Technology

California share of U.S. green technology patents



Source: 1790 Analytics, Patent Search by Technology; US Patent & Trade Office Patent File

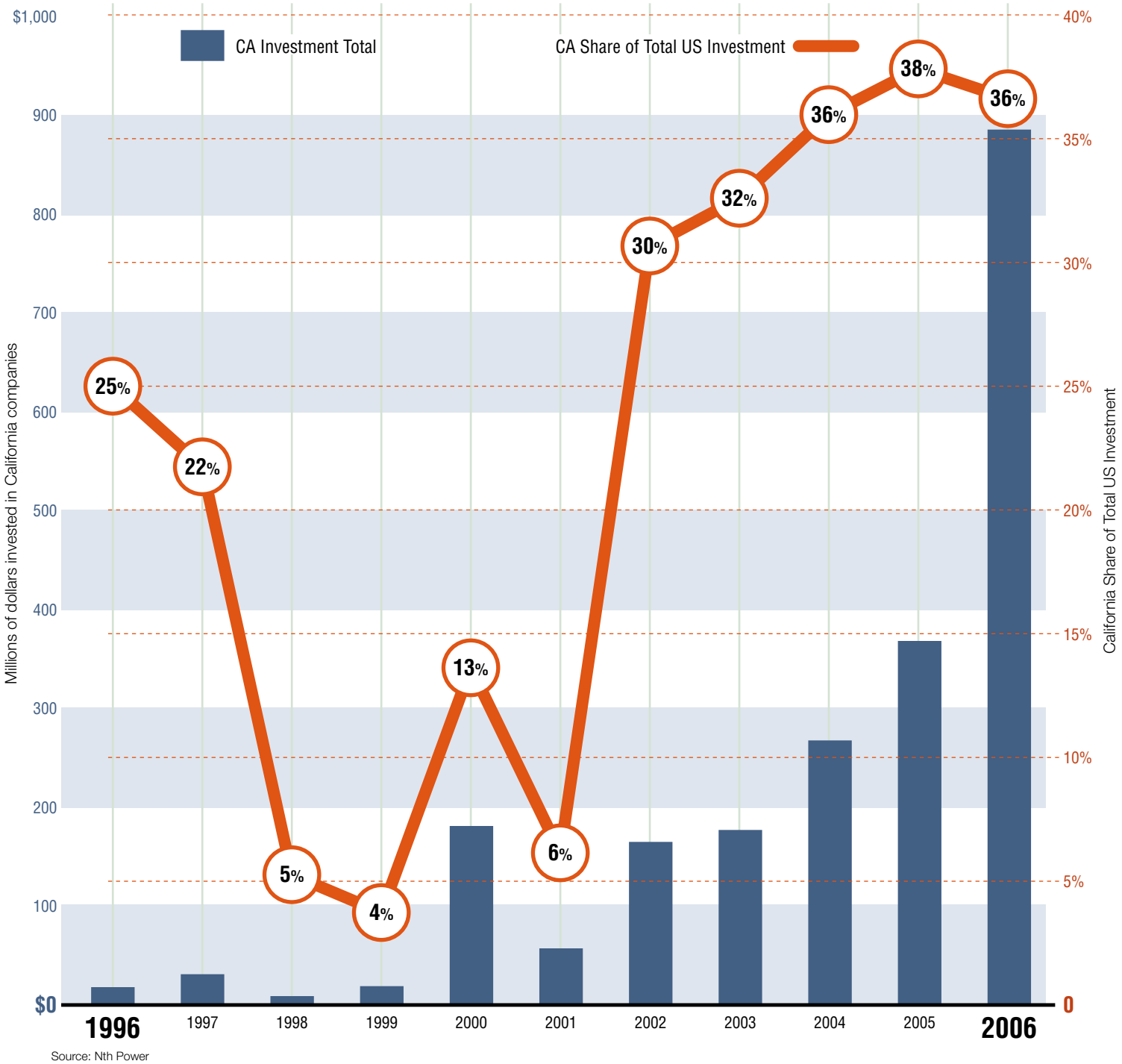
California is the top state for U.S. venture capital investment in green technology

New venture capital (VC) investment is a leading indicator of innovation and economic growth. Companies that have passed the screen of venture capitalists are innovative, entrepreneurial and have growth potential. The amount of venture capital invested and the types of industries supported are predictors of future job and revenue growth.

In 2006, 36% of VC investment in energy technology[26] invested in the U.S. went to firms located in California (**Chart 35**). Attracting $884 million in 2006, California is the top recipient state for energy VC. Roughly a third of investment was in transportation and fuels and 41% went into distributed energy, primarily in solar.

35: Venture Capital Investment in Energy Technology

Investment in California companies



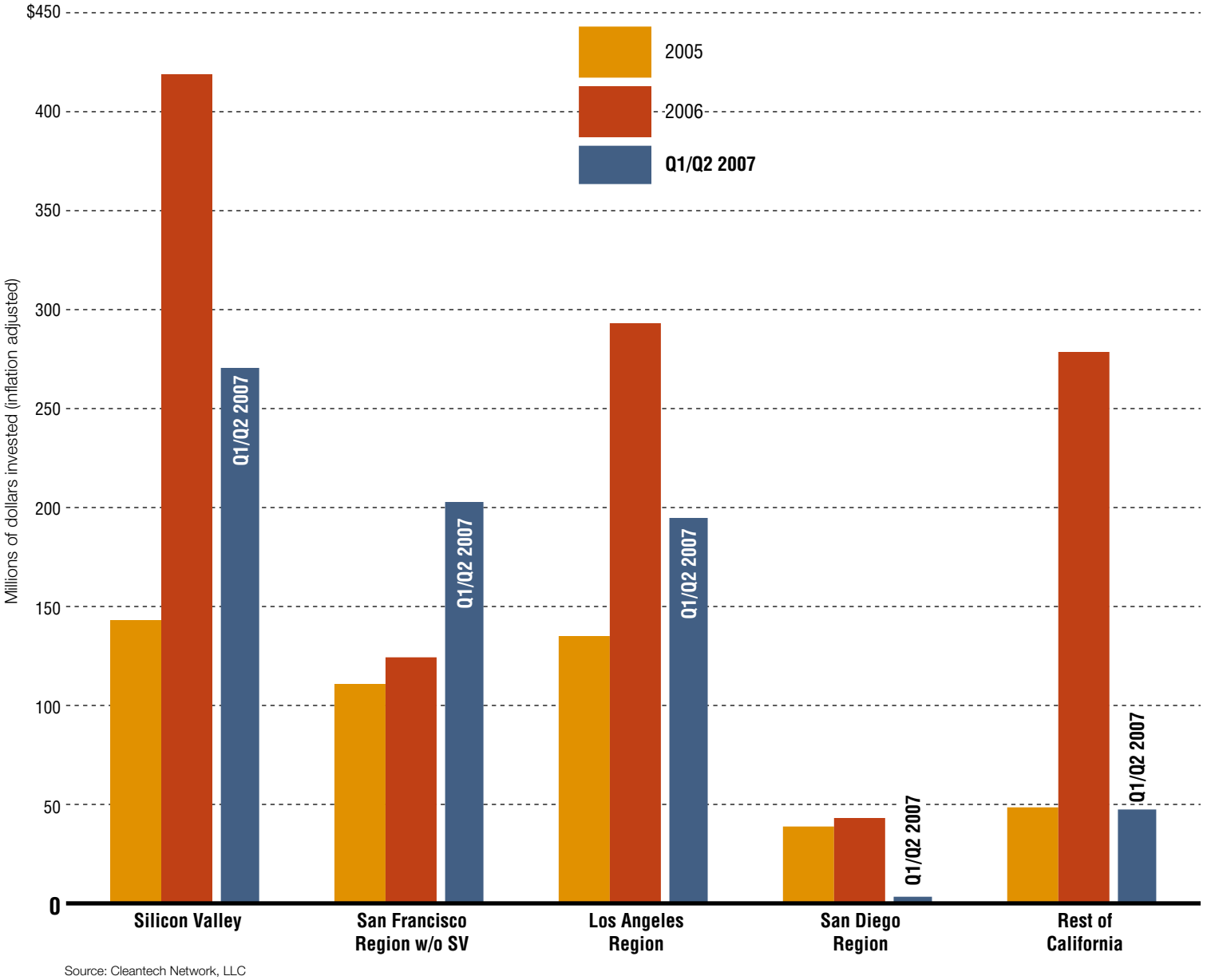
Source: Nth Power

Across a broader scope of technology, California attracted 49% of all cleantech VC investment in the U.S. during the first half of 2007 (**Chart 36**). The Cleantech Network describes cleantech as new technology and processes, spanning a range of industries that enhance efficiency, reduce or eliminate negative ecological impact, and improve the productive and responsible use of natural resources (See box of cleantech segments). Within California, Silicon Valley draws the greatest share of cleantech investment. In the first half of 2007, 53% of cleantech VC was invested in companies focusing on energy generation (**Chart 37**).

With assets exceeding $230 billion, California's Public Employees' Retirement System has a series of environmental investment initiatives which target investment in environmental technology solutions that reduce pollution and improve efficient use of natural resources. Contributing to VC funding in these areas, these investments grew from $206 million to $400 million from 2005 to 2006 (**Chart 38**).

36: Venture Capital Investment in Clean Technology, California

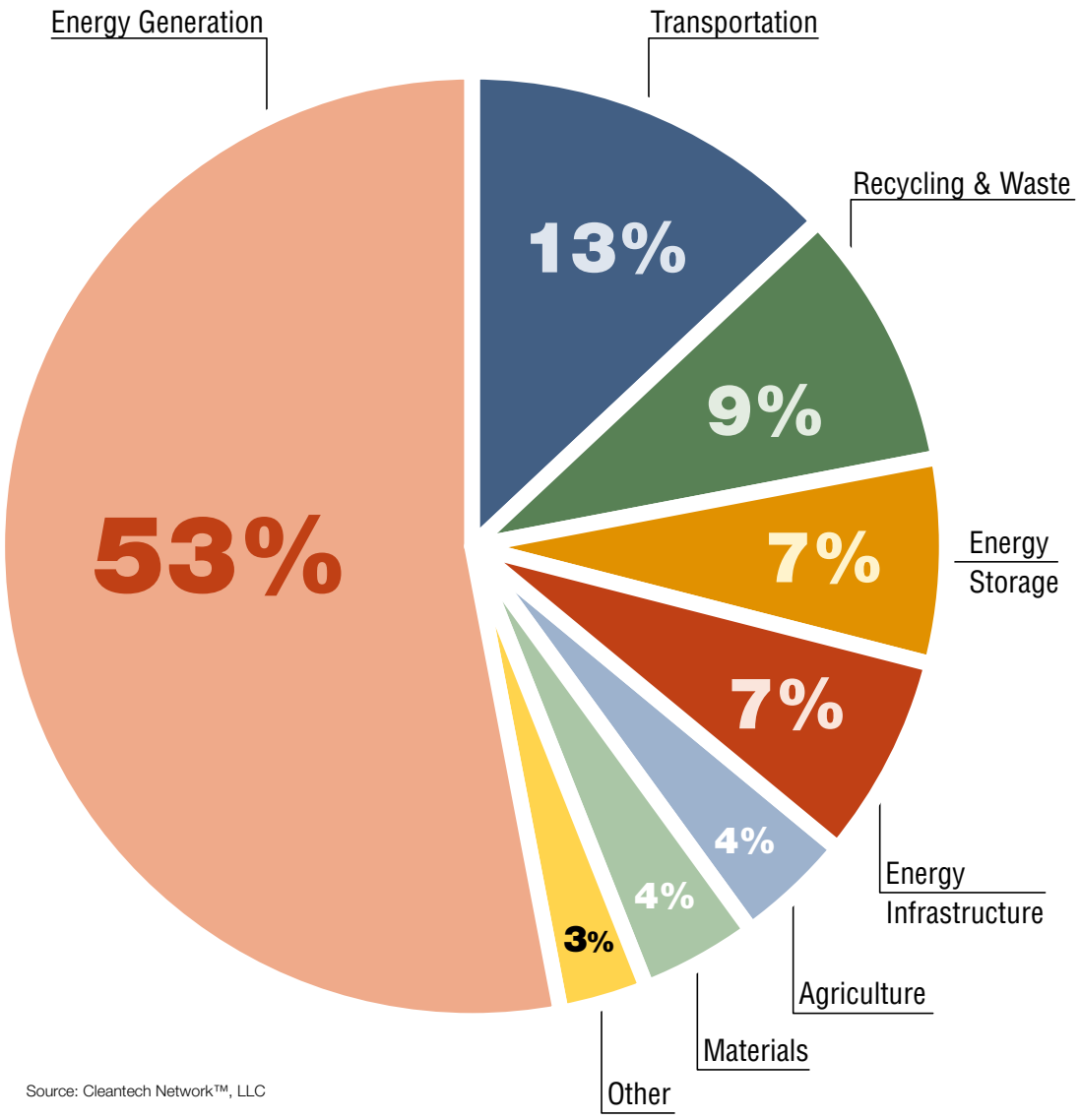
By region



Source: Cleantech Network, LLC

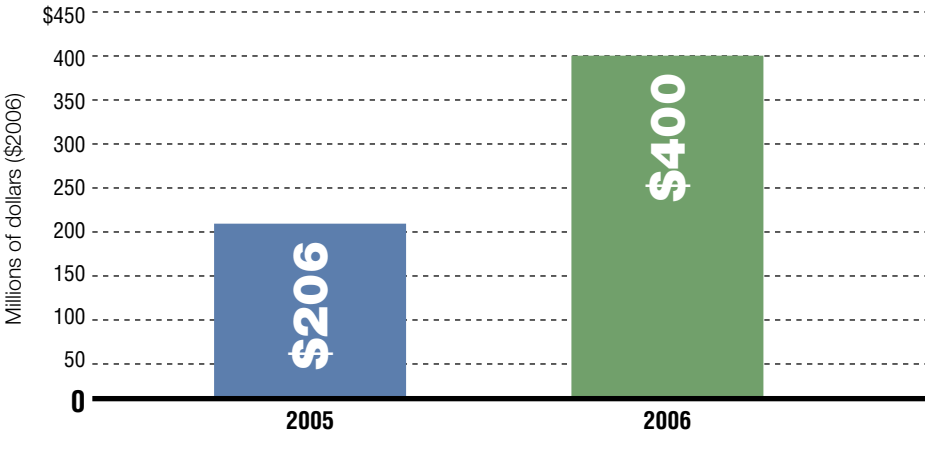
37: Venture Capital Investment in Clean Technology, California

By Cleantech Segment; Q1-Q2 2007



Source: Cleantech Network™, LLC

38: California Pension Fund Investments in Cleantech Firms



Source: CalPERS

Cleantech Industry Segments

Energy Generation
- Wind
- Solar
- Hydro/Marine
- Biofuels
- Geothermal
- Other

Energy Storage
- Fuel Cells
- Advanced Batteries
- Hybrid Systems

Energy Infrastructure
- Management
- Transmission

Energy Efficiency
- Lighting
- Buildings
- Glass
- Other

Transportation
- Vehicles
- Logistics
- Structures
- Fuels

Water & Wastewater
- Water Treatment
- Water Conservation
- Wastewater Treatment

Air & Environment
- Cleanup/Safety
- Emissions Control
- Monitoring/Compliance
- Trading & Offsets

Materials
- Nano
- Bio
- Chemical
- Other

Manufacturing/Industrial
- Advanced Packaging
- Monitoring & Control
- Smart Production

Agriculture
- Natural Pesticides
- Land Management
- Aquaculture

Recycling & Waste
- Recycling
- Waste Treatment

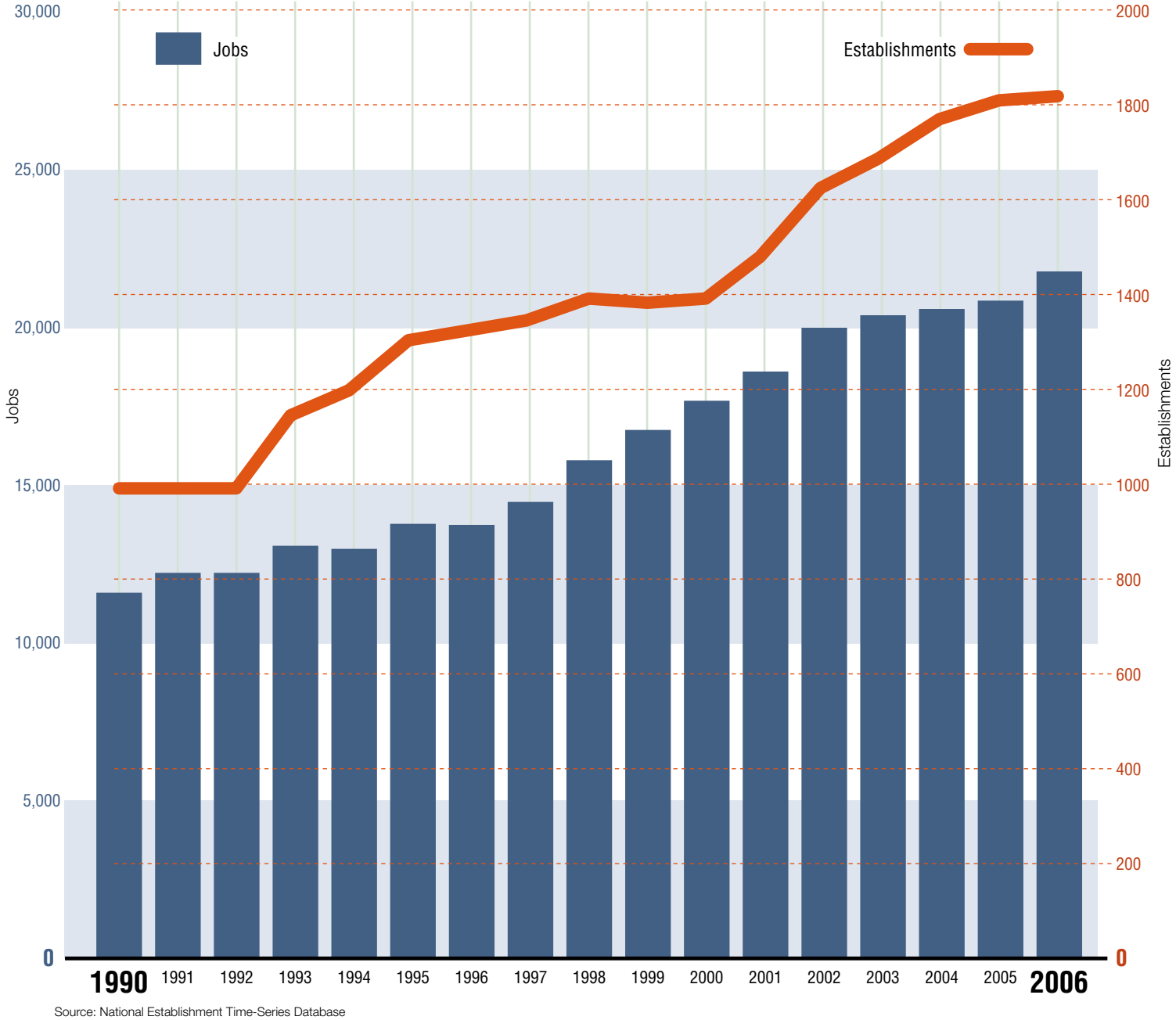
Source: Cleantech Network™, LLC

California is home to a growing green industry, which is creating thousands of new companies, jobs, and products to help reduce emissions

California's innovative economy translates new ideas into high-value products and services that result in new markets, industries, businesses and jobs. Evidence of this is emerging around developments in green technology. A recent economic analysis by researchers at the University of California at Berkeley suggests that climate policies can provide broad based economic stimulus and growth by providing incentives for investment in new technologies (see next page).

Based roughly on the range of business activities encompassed by "cleantech" described earlier, green establishments in the State have grown by 84% in number and have added more than 10,000 jobs since 1990 (**Chart 39**). The bulk of these establishments and jobs are in the areas of energy generation and energy efficiency (**Chart 40**).

39: Green Jobs & Establishments in California



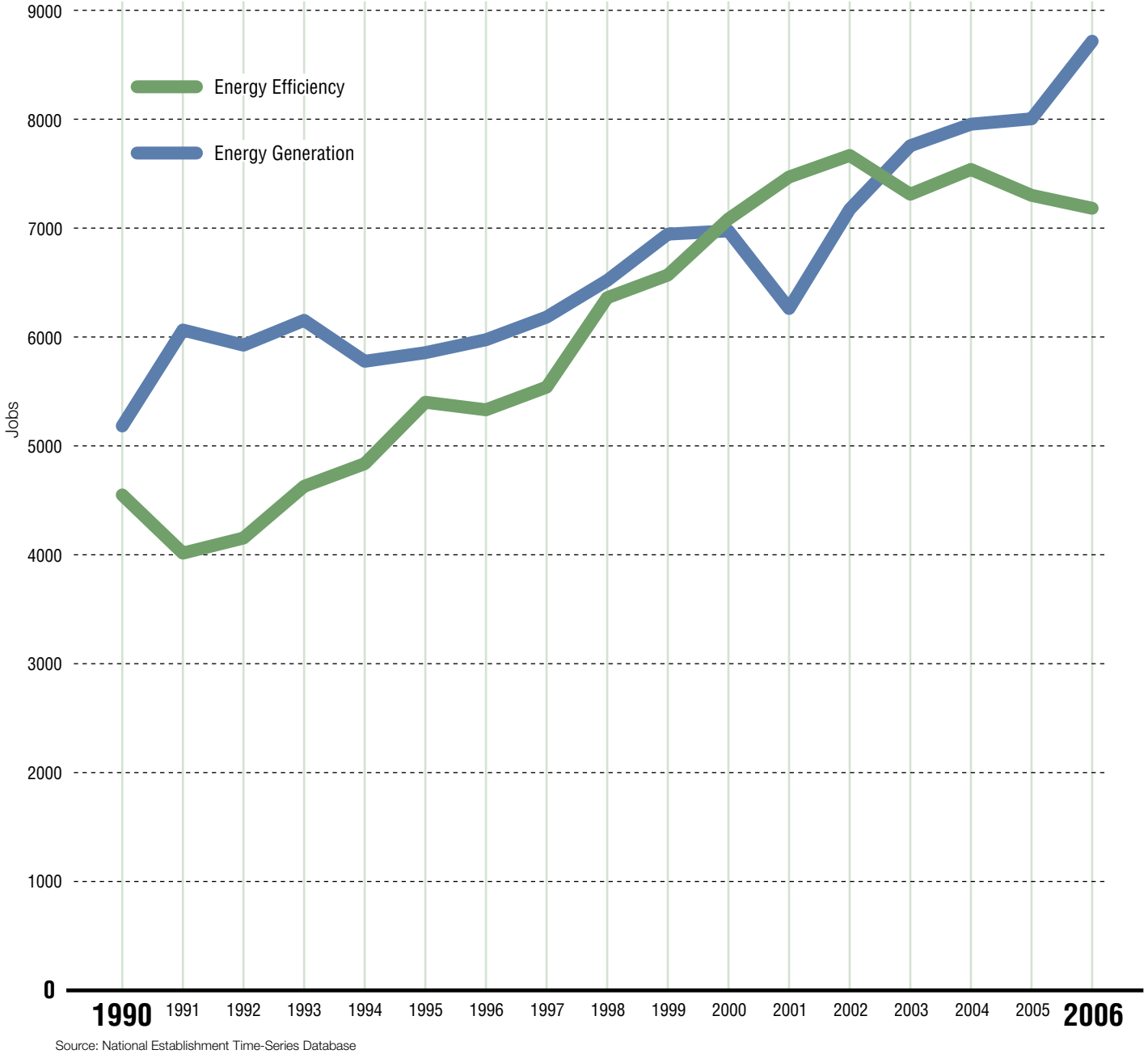
Source: National Establishment Time-Series Database

MACROECONOMIC ANALYSIS: THE IMPACT OF AB 32

A 2006 economic analysis by researchers at U.C. Berkeley on economic growth and greenhouse gas mitigation in California found that "climate policies that create direct incentives for industries to invest in new technologies can provide additional stimulus for new employment and growth." The macroeconomic analysis examined the impact of AB 32 as well as eight leading policy recommendations by the California Climate Action Team, and found that impacts of these eight climate action team policies plus the 2020 greenhouse gas emissions cap under AB 32 would be a $74 billion increase in GDP and would generate 89,000 additional jobs across all industries above a 2020 baseline (i.e., business as usual). The analysis states, "the findings indicate that California can establish global leadership in growth-oriented climate policy and energy innovation. Well-designed and implemented strategies can bring forth the state's innovation potential and apply it to one of the most compelling challenges of our era."

David Roland-Holst, "Economic Growth and Greenhouse Gas Emissions in California" U.C. Berkeley, August 2006

40: Employment by Green Sector in California



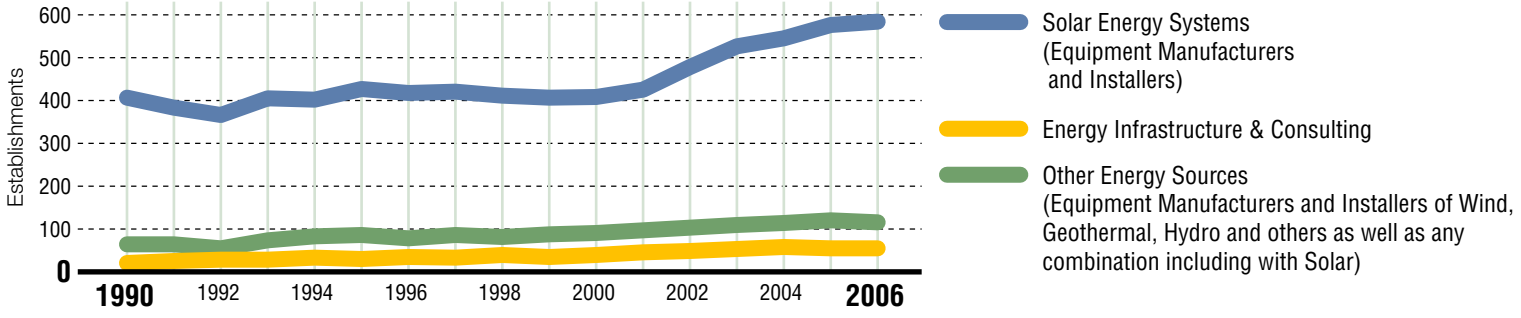
Source: National Establishment Time-Series Database

Growth in green establishments has been strongest in solar energy generation encompassing solar equipment manufacturers as well as system installers (**Chart 41**). Energy conservation consulting is a growing field of services (**Chart 42**). In the area of transportation (**Chart 43**), developers and distributors of renewable fuels have increased in number at an average annual rate of 8.9%, which is twice the average annual rate of 4% over this period for green businesses as a whole.

The geographic distribution of green establishments and employment across the State is widespread. As may be expected, concentrations are highest in the urban centers of the San Francisco Bay Area, Los Angeles, Sacramento, and San Diego; however, green establishments are located throughout the State.

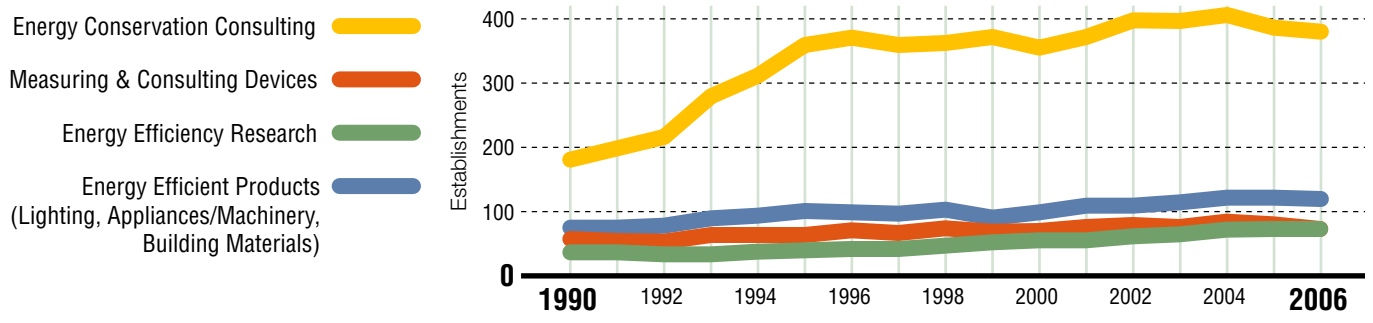
Without a formal definition of the green industry sector, it is not possible to precisely track employment and establishment growth. Using a set of companies identified as having primary activities that fall roughly within the definition of cleantech used by the Cleantech Network described earlier, establishment and job growth since 1990 were tracked using the National Establishments Time-Series database based on Dun & Bradstreet establishment data. This sample offers a conservative estimate and is by no means a comprehensive accounting of the industry in California.

41: Establishments in Energy Generation



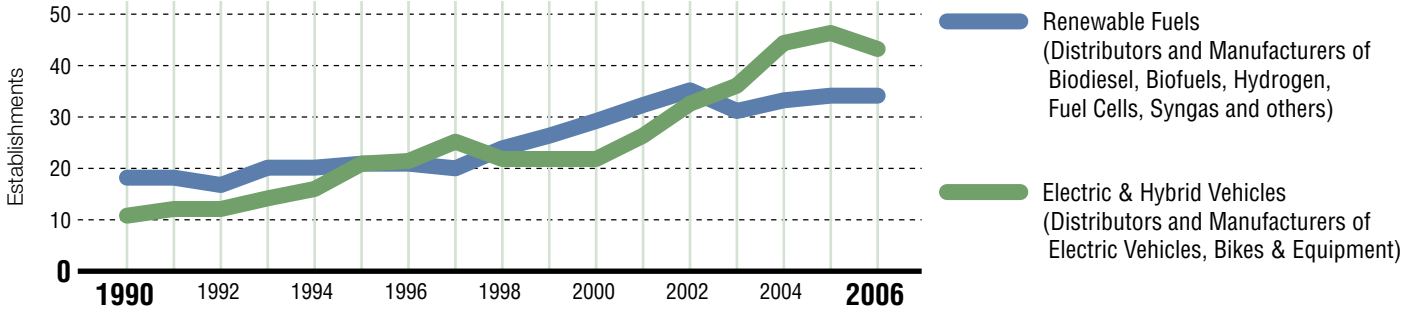
Source: National Establishment Time-Series Database

42: Establishments in Energy Efficiency



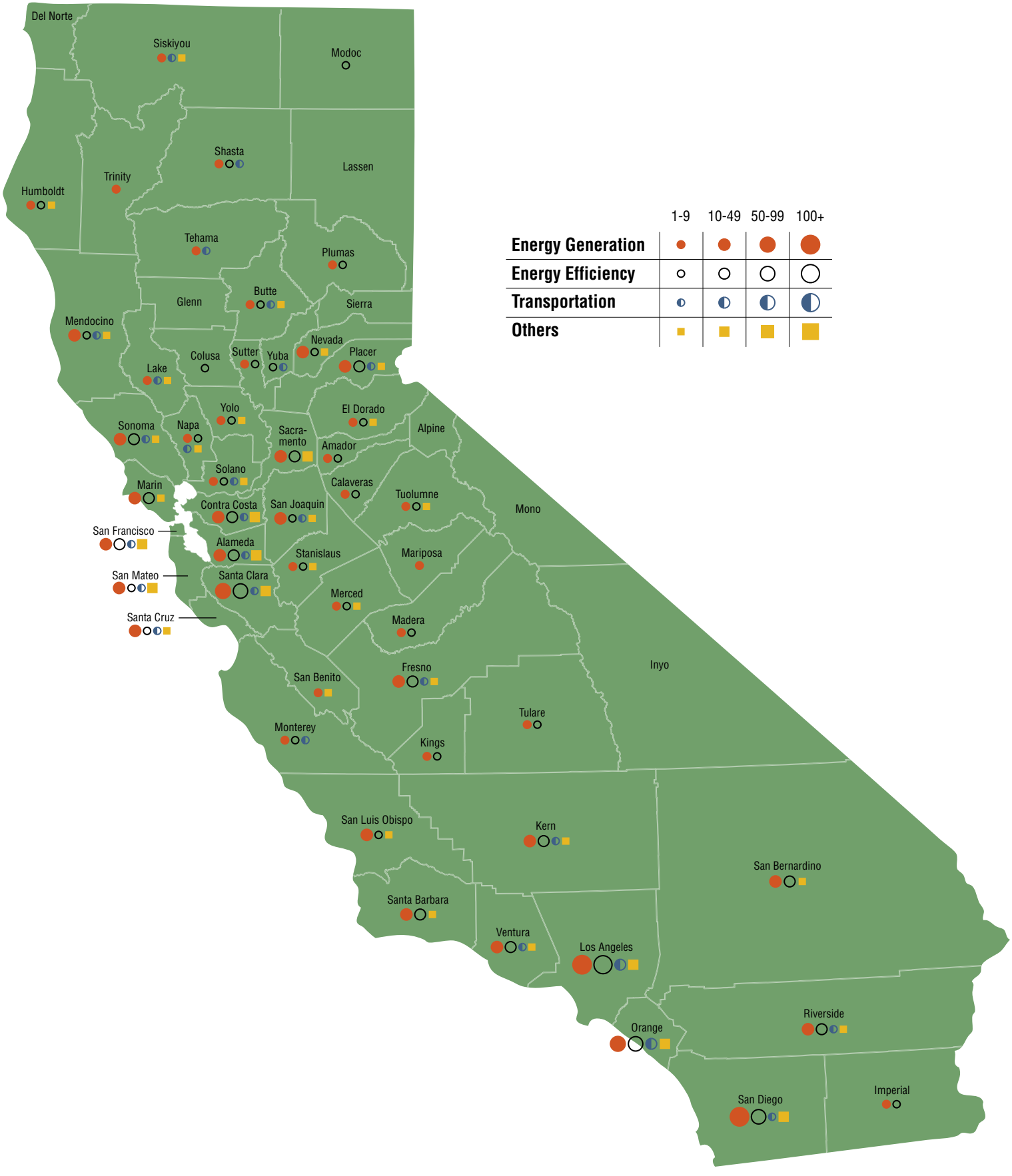
Source: National Establishment Time-Series Database

43: Establishments in Green Transportation



Source: National Establishment Time-Series Database

GREEN ESTABLISHMENTS



THE CHALLENGE & PROSPECTS FOR THE FUTURE

California has helped drive, and has benefited from, a first wave of green innovation that delivered breakthroughs in energy efficiency. There are growing signs that the State may be at the beginning of the next wave. However, it is also clear that the challenge facing California is substantial—and will require that the next wave of green innovation grows well beyond what we see today.

It is unlikely that California will meet the challenge of reducing emissions to 1990 targets without capitalizing on the opportunity to both reduce emissions and stimulate the economy through green innovation:

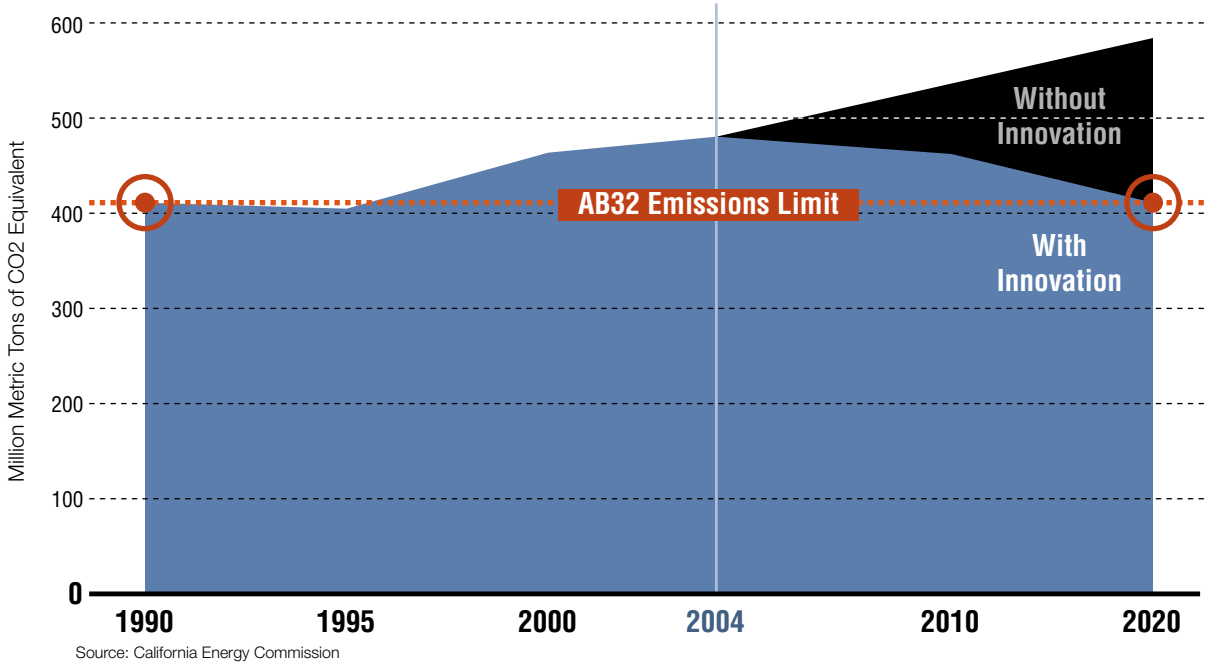
> If meeting the challenge of reducing emissions means primarily painful lifestyle and industry changes, there is a greater likelihood of **resistance** to change.
>
> If meeting the challenge of reducing emissions means changes that also produce growing payoffs in terms of energy savings, economic growth, and job creation, there is a greater likelihood of **persistence**—the kind of sustained change over many years required to achieve or exceed AB 32 targets.

If California is going to meet the challenge of AB 32, it will need to grow and sustain this new wave of green innovation, extending and building on earlier innovations. Tackling the challenge of global warming will require reductions in the absolute amount of carbon emissions by a variety of means. What could this new wave look like?

To meet the challenge of AB 32, California would need to rapidly increase its pace of change—from breakthroughs in energy efficiency to adoption of cleaner energy alternatives.

California has a history of well-documented breakthroughs—in information technology, biotechnology, and other fields. This history includes breakthroughs in energy efficiency and recycling—through the adoption of new green practices. In fact, breakthroughs can be either leaps in new technology or in the use of existing technology. Both will likely be needed for California to rapidly increase its pace of change.

44: History of California Emissions and Future AB 32 Target



Source: California Energy Commission

To meet the requirements of AB 32, we must reduce our CO2 emissions to 1990 levels by 2020; however, if we continue emitting at current levels, our emissions levels in 2020 will be the highest they have ever been in history. Many of the policy and behavioral innovations tracked in this index will contribute to reducing emissions from the "business-as-usual" level to the AB 32 target. Although there have been some dips in emission levels, none of the major emitters has consistently reduced emissions. Despite gains in energy efficiency and emissions reductions, there must be much greater energy efficiency and use of clean energy alternatives during the next wave of green innovation. The table below provides the estimates by the Climate Action Team of the potential impacts of different strategies that if fully implemented would help meet this challenge.

Strategies Underway in California that Reduce Greenhouse Gas Emissions

The table below lists greenhouse gas (GHG) emission reduction strategies that are already underway in California. These strategies, if fully implemented, would significantly reduce greenhouse gas emissions in the state. The strategies listed here are considered "high-confidence" strategies and were evaluated by the California Climate Action Team to determine reasonable emission reduction targets. These strategies will bring California halfway towards meeting the 2010 target.

		Estimated GHG Savings (Million Tons CO2 Equivalent)	
Lead Agency	**Strategy**	**2010**	**2020**
Air Resources Board	GHG Vehicle Standards (AB 1493)	1	30
	Diesel Anti-idling	1	2
Energy Commission/ Public Utilities Commission	Accelerated Renewable Portfolio Standard (33% by 2020)	5	11
Integrated Waste Mgmt. Board	Million Solar Roofs (California Solar Initiative)	0.4	3
	Zero Waste/High Recycling Programs	7	10
	Full cost-effective natural gas efficiency improvements	1	6
Energy Commission	Appliance Efficiency Standards*	3	5
	Fuel-efficient Replacement Tires & Inflation Programs	3	3
Business Trans. & Housing	Reduced Venting and Leaks in Oil & Gas Systems	1	1
State and Consumer Services	Green Buildings Initiatives	not yet estimated	
Air Resources Board/CalEPA	Hydrogen Vehicles	not yet estimated	
TOTAL POTENTIAL EMISSIONS REDUCTIONS		**23****	**70**

* Included in the baseline are the 2004 energy efficiency goals, which will result in an estimated reduction of 4 million tons of GHG emissions in 2010 and 13 million tons of GHG emissions in 2020.
** Rounding may cause this number to be slightly different than the sum of the numbers for each strategy.

It should be noted that other strategies, such as the use of biofuels and landfill methane capture and use, are still being evaluated and will be vetted internally by the agencies represented on the Climate Action Team. The Team will ultimately be responsible for determining which other strategies are most likely to be successful in the state as well as considering any additional strategies not yet evaluated.

Source: California Climate Action Team, Fact Sheet: Greenhouse Gas Reduction Strategies, 2005-06

Transportation is the largest source of GHG emissions, making up 41% of gross emissions in 2004 (**Chart 12**). Current standards regulating the pollution emitted by vehicles in the U.S. are weaker than in other countries including China. More stringent fuel economy standards and emissions standards in the U.S. could help to drive the next wave of green innovation.

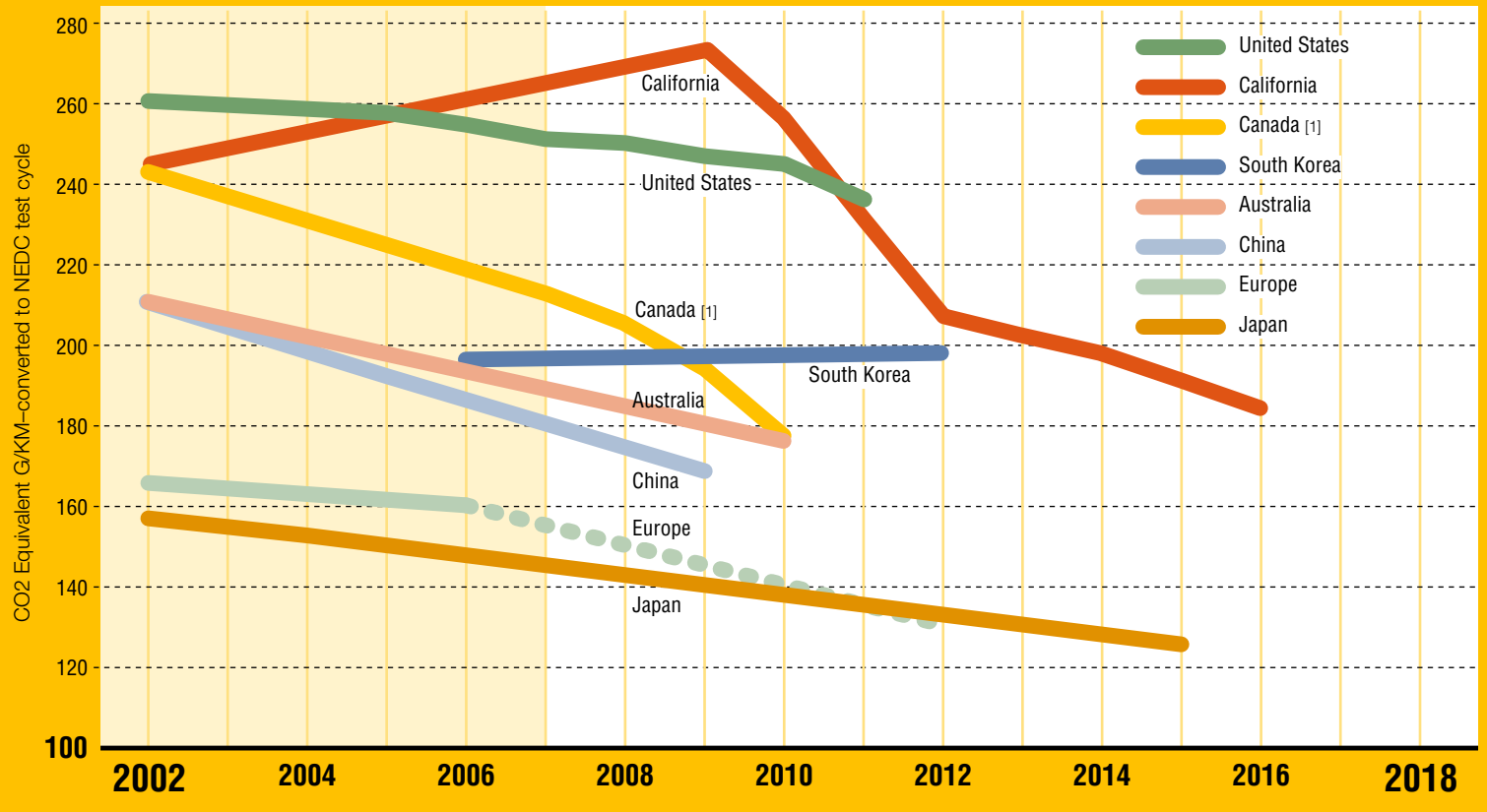
Using Vehicle Performance Standards to Reduce Greenhouse Gas Emissions

Automobile performance standards have proven to be one of the most effective tools in controlling oil demand and greenhouse gas emissions from the transportation sector in many regions and countries around the world. **Chart 45** illustrates the relative stringency and implementation schedules of GHG emissions standards across the globe. (In order to make comparisons, standards across countries have been normalized by converting to units of grams of carbon dioxide equivalent per kilometer traveled on the New European Drive Cycle (NEDC).) The emissions performance of U.S. cars and light trucks—both historically and as projected based on current policies—lags behind most other nations.

While the U.S. relies on Corporate Average Fuel Economy (CAFE) standards, requiring manufacturers to meet specific fleet average fuel economy levels for light-duty passenger vehicles sold in the U.S., California has passed fleet average GHG emission standards for new vehicles sold in the State. While it has not been implemented due to litigation, passage of the Pavley Bill (AB 1493) makes California the first state to regulate motor vehicle GHG emissions. Twelve other states have adopted California's regulation, and another three are in the process of adopting the regulation.

45: Actual and Projected GHG Emissions for New Passenger Vehicles by Country

Relative to 2002



Note: Solid lines denote actual performance or projected performance due to adopted regulations; dotted lines denote proposed standards; values normalized to NEDC test cycle in grams of CO2-equivalent per km.
[1] for Canada, the program includes in-use vehicles. The resulting uncertainty on new-vehicle fuel economy was not quantified.
Source: Feng An, Deborah Gordon, Hui He, Drew Kodjak, and Daniel Rutherford. 2007. "Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update" The International Council on Clean Transportation (July 2007).

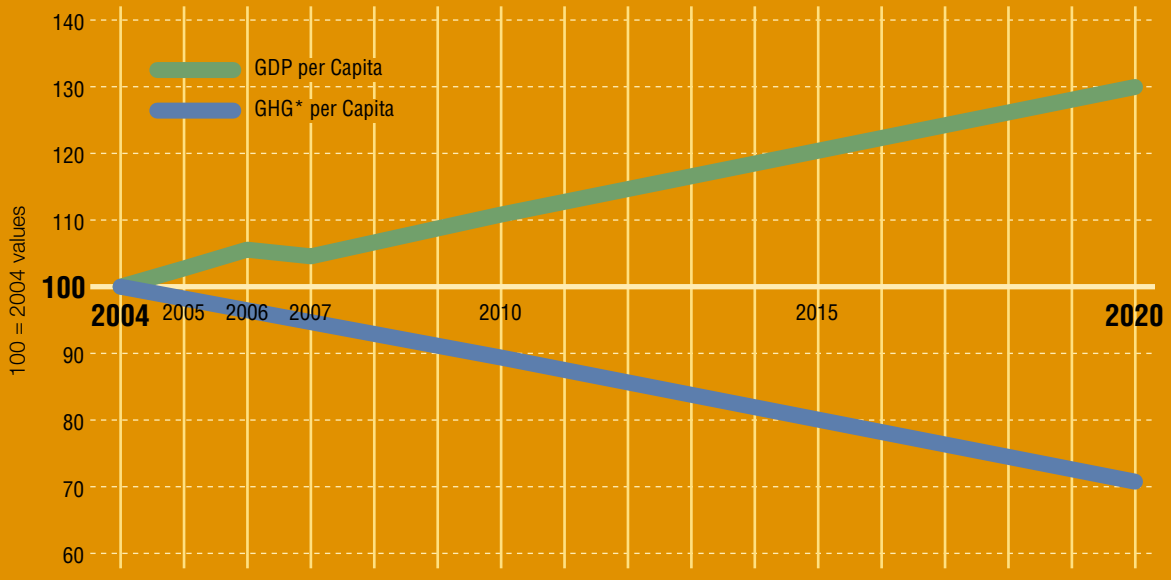
CALIFORNIA IN 2020

California's population is expected to grow by 17% between 2007 and 2020, adding roughly 6.5 million residents according to California Department of Finance population projections. At an annual rate of 2.9%, California's economy is projected to grow by 45% over the same period.

If California achieves the goals laid out in AB 32, the State's economy will accelerate its separation of economic growth from GHG emissions. In terms of the carbon intensity of its economy, the State will achieve a significant reduction of 46% in its ratio of emissions per GDP.

46: California GDP & GHG in 2020

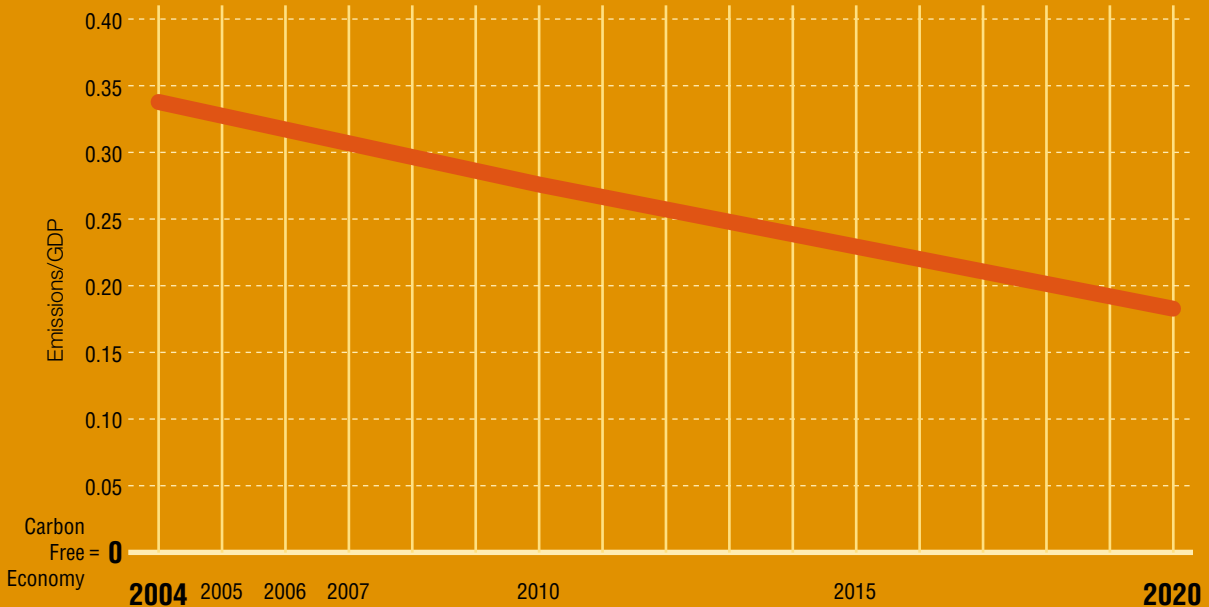
Relative to 2004



* Gross GHG emissions include electricity imports. Predictions based on California Energy Commission's 2003 Integrated Energy Policy Report (2003 IEPR)
Source: California Energy Commission; Department of Finance; Moody's Economy.com

47: The 2020 Carbon Economy

GHG Emissions Relative to Gross Domestic Product*



* Gross GHG emissions include electricity imports. Predictions based on California Energy Commission's 2003 Integrated Energy Policy Report (2003 IEPR)
Source: California Energy Commission; Moody's Economy.com

California now depends on renewable energy sources for about 11% of its total energy use. Growth in renewable energy has kept pace with the increase in overall energy generation. Keeping pace, however, will not be enough to substantially impact greenhouse gas emissions.

The next wave of green innovation will have to usher in a much higher share of clean energy alternatives. Solar energy could play a major role if innovation brings down the cost curve to "China prices" (*see box below*).

SOLAR COST CURVE: MOVING TOWARD THE CHINA PRICE OF ENERGY?

How is clean energy going to get down to the "China price" of energy? As Curtis Carlson, CEO of SRI and others suggest, this is essential to both creating a world market for clean energy and dramatically reducing global warming.[27] The "China price" is the price that is widely affordable in China, such as the price for coal-fired electricity today in China. The answer may be a Moore's Law for energy (see **page 8** on Moore's Law).

One of the challenges to the adoption of solar energy has been its relative costs. However, the cost of photovoltaics (PV) has decreased by a factor of nearly 100 since the 1950s. As a result of declining cost and favorable public policies, markets have been expanding rapidly, growing at 40% per year.

Can we expect future dramatic decreases in cost in PV or breakthrough solar technologies in the future? One way to answer this question is to examine potential future cost curves for PV. The cost curve is a function of experience of firms' increased capacity to serve growing markets as well as technology innovation.

Figure 1 portrays lines representing potential solar cost scenarios: the slow experience curve is based on current silicon technology and a fast experience curve assumes moving beyond silicon to new technologies such as thin-films. A $1.00/W target price would not achieve the China price of energy. As depicted in **Figure 2**, while the cost curve will continue to bring the cost of PV electricity down to the U.S. average retail price, there is still a significant gap.

Thus reaching the "China price of energy" will require significant technology innovation. However, as a result of venture funding, at least five new companies are now gearing up production lines in Silicon Valley to make ultra-cheap solar cells from new materials such as copper indium gallium selenide (CIGS) instead of more traditional silicon including Nanosolar in San Jose, Miasole in Santa Clara and SoloPower in Milpitas. Moving beyond traditional technologies will be essential for pushing down the solar cost curve – and that is why innovation is so important.

Figure 1: Scenarios comparing cost model, experience curves, and $1.00/Watt

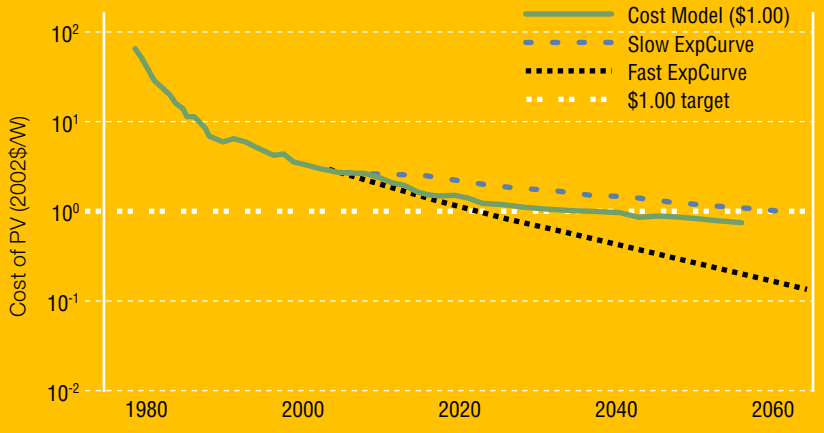
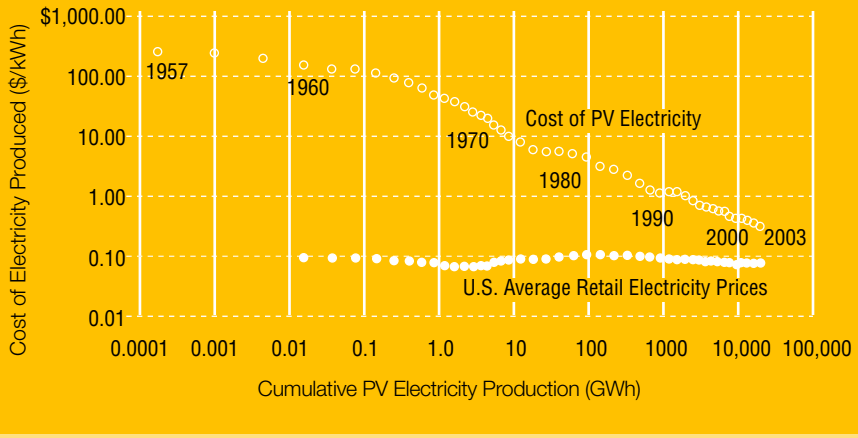


Figure 2: U.S. electricity prices and leveled cost of electricity produced



Source: Gregory Nemet, "Behind the learning curve: Quantifying the sources of cost reductions in photovoltaics," June 1, 2006.

California would need to play a dual role in adopting and creating green innovations that reduce emissions and stimulate the economy—both statewide and globally.

California is increasingly well-positioned to play a dual role—as a leader in both the adoption and creation of new products that help reduce emissions globally while stimulating the State's economy. Because of the size of the State's population, consumer market, and economy, California can set an example for the adoption of new green products and practices and spur their worldwide application.

With its strong technology base, entrepreneurial culture, world-class research institutions, global companies, and venture capital, California may make an even bigger contribution by creating innovative green products and services for use worldwide. In this way, California can help address the challenge of global warming inside and outside the State, while producing economic benefits for Californians.

Based on recent trends, California is becoming a leader in creating and implementing breakthrough clean energy technologies that reduce emissions, drive the State's economy, and serve a multibillion dollar global clean tech market. Californians widely believe that the State could play a central role in the future: 90% agree that "California can be a leader in new technologies to improve efficiency and reduce global warming". Two-thirds (66%) agree "strongly" with this statement.

Estimate of the Global Market for Clean Energy Technology

According to the California Environmental Protection Agency, worldwide demand for new technologies developed to reduce global warming emissions will create a global market potential of more than $180 billion annually.[28]

Californians would need to work together, and with the U.S. Government, to grow and sustain the next wave of green innovation.

There is much that needs to happen to grow and sustain the next wave of green innovation in California. If the past is a guide, state government will clearly need to play a critical role through policy innovations that both reduce greenhouse gas emissions and stimulate the economy.

The next wave would also benefit from a much greater commitment from the federal government to innovation in energy efficiency and clean energy alternatives. This would mean a reversal in the trends of diminishing federal R&D investment in clean energy, as well as the advantage foreign inventors have over U.S. inventors in patents (**see Charts 32** and **33**). But, as the past has shown, green innovation also requires more than government policy by itself. It will require changes in how businesses operate, how residents use energy at home and on the road, and how the independent non-profit sector helps promote energy efficiency and clean energy alternatives. In fact, a majority of Californians believe that public, private, and independent sectors—as well as the general public—can do "a lot" about global warming. Most Californians believe all these parties can make some contribution to addressing the challenge.

SURVEY RESULTS:

Californians Believe Many Can Do A lot To Reduce Global Warming

	Can Do A lot	Can Do Some
Major Corporations	**64%**	**21%**
Gas and Electric Utility Companies	**63%**	**25%**
General Public	**57%**	**29%**
U.S. Government	**56%**	**28%**
Clean Technology Companies	**52%**	**33%**
State and Local Government	**49%**	**32%**
Non-Profits Dedicated to Reducing Global Warming	**44%**	**36%**
Farmers and Agricultural Companies	**41%**	**37%**

California businesses will need to embrace innovations that reduce emissions, improve efficiency, and grow jobs.

The increasing number of businesses joining the California Climate Action Registry **(Chart 48)** illustrates that the business commitment is growing over time. Reflecting on their own employers, working Californians believe that much more can be done—and they value companies and products that help save energy and reduce emissions.

SURVEY RESULTS:

Californians Recognize and Value the Contribution Business Can Make to Reducing Emissions

73% of working Californians think their employer can take action to save energy, reduce greenhouse gas emissions, and help the environment. **40%** think their employer can do "a lot" in these areas.

61% of working Californians say that given job options with comparable pay and work responsibilities, a prospective employer's policies toward energy conservation and environmental protection would influence their decision to take the job. In fact, **26%** say it would matter "a great deal".

59% of Californians are "more likely" to buy products with a carbon footprint documenting the amount of greenhouse gases produced to create the product than comparable products without this information.

California's independent sector has an important role to play in promoting and supporting the next wave of green innovation.

Californians tend to trust information from the independent sector, as well as authorities such as research scientists and medical professionals. Large percentages trust both environmental protection groups as well as non-profits that promote emission reductions in ways that benefit the economy.

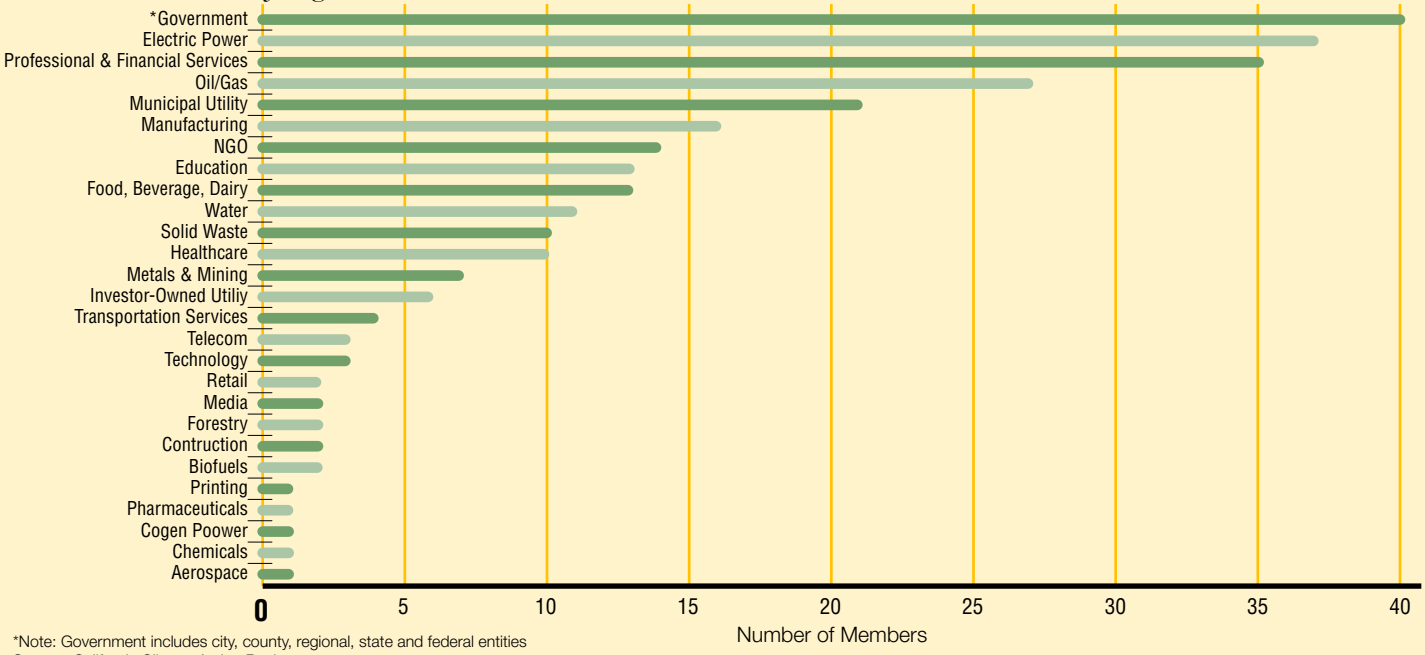
SURVEY RESULTS:

Californians Trust the Independent Sector When it Comes to Global Warming, Energy Conservation, and the Environment

Group	Total Trust	Trust A lot	Trust Somewhat
Research Scientists	80%	45%	35%
Environmental Protection Groups	**76%**	**40%**	**36%**
Non-profits promoting emission reductions in ways that benefit the economy	**76%**	**37%**	**39%**
Medical professionals	66%	31%	35%

48: California Climate Action Registry Membership by Industry

Total members as of August 2007



*Note: Government includes city, county, regional, state and federal entities
Source: California Climate Action Registry

Californians themselves are becoming active on the issue of global warming and energy conservation—and expect to become more engaged in the future.

About four in ten Californians have sought information on the internet about global warming and energy conservation. Another four in ten are likely to do so in the coming year or are considering it in the future. Whether it be donations, investing, contacting government officials, attending meetings, or volunteering with organizations involved with global warming and energy conservation, a large percentage of Californians say they are involved or planning to get involved in the future. Perhaps more than anything else, the growing commitment of Californians to address global warming in ways that reduce emissions and grow the economy is critical—because this support encourages innovation in both government and business.

SURVEY RESULTS:

Californians are Becoming Active on the Issue of Global Warming and Energy Conservation—and Expect to Become More Engaged in the Future

What Californians are saying:

38% have sought out information on the internet about global warming (GW) and energy conservation (EC), with another **11%** likely to do so in the coming year (and an additional **33%** considering it for the future). **12%** have written a letter to the editor or posted a comment on the internet regarding GW/EC, with another **12%** likely to do so in the next year (and an additional **24%** considering it for the future).

21% have donated money to organizations concerned with GW and EC, with another **10%** likely to do so in the coming year (and an additional **28%** considering it for the future).

16% are investing in environmentally or socially responsible funds or companies, with another **10%** likely to do so in the coming year (and an additional **32%** considering it for the future).

14% have contacted government officials about GW and EC, with another **13%** likely to do so in the coming year (and an additional **25%** considering it for the future).

13% have attended meetings on GW and EC in their community, with another **15%** likely to do so (and an additional **28%** considering it for the future).

11% have volunteered with organizations concerned with GW/EC, with another **11%** likely to do so in the coming year (and an additional **33%** considering it for the future).

ENDNOTES

1. This section is based on extensive research on innovation that examines the compound economic benefits of an innovative economy as well as the key characteristics of an economy that creates new ideas and products and can commercialize them. James Utterbach. 1994. *Mastering the Dynamics of Innovation*. Harvard Business School Press. William Baumol. 2002. *The Free Market Innovation Machine.* Princeton University Press. Chong Moon-Lee, William F. Miller, Margerite Gong Hancock and Henry S. Rowen, eds. 2002. *The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship.* Stanford Business School Books. Paul Romer. 1990. "Endogenous Technological Change," *Journal of Political Economy,* Vol. 98, No. 5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems (Oct., 1990), pp. S71-S102. Ian Morrison. 1996. *The Second Curve: Managing the Velocity of Change.* Ballantine Books.

2. Testimony of Dr. Daniel M. Kammen before the August 11, 2005 Select Committee on Air & Water Quality Climate Hearing.

3. Porter, M. and C. van der Linde. 1995. "Green & Competive." *On Competition*. Harvard Business Review Book. page 352.

4. Farrell, D., S. Nyquist, M. Rogers. 2007. "Making the most of the world's energy resources." *McKinsey Quarterly* McKinsey & Company (Number 1, 2007), page 29.

5. James McCarthy. 2007. "California's Waiver Request to Control Greenhouse Gases under the Clean Air Act." CRS Report for Congress. Congressional Research Service. (August 20, 2007).

6. Utility revenues have historically been tied to sales volumes, so companies were rewarded for selling more power and penalized for selling less. Therefore, there was a strong disincentive for utilities to encourage energy efficiency and conservation. The implementation of "decoupling" removes this barrier by assuring utilities (investor-owned) a fixed amount of revenues regardless of sales volumes. "The result of this simple, but profound, change has been that utilities have been free to aggressively help consumers reduce energy usage without doing financial harm to their business. As a direct result of decoupling and the programs it made possible, California's per capita energy usage has remained flat over the past 30 years, compared with an increase of 50 percent for the rest of the country." Pacific Gas and Electric Company. 2006. "Global Climate Change: Risks, Challenges, Opportunities and a Call to Action." Page 5.

7. This data represents carbon dioxide emissions from fossil fuel combustion which make up over 70% of total greenhouse gas emissions. The comparison of California with other states in Chart 1 is based on federal emissions data from the U.S. Energy Information Agency (EIA). The EIA uses a slightly different methodology for calculating GHG emissions than the California Energy Commission (CEC). Unless otherwise noted, reported GHG emissions for California are based on CEC data.

8. Organization for Economic Cooperation and Development (OECD) Environment Programme. 2002. "Indicators to measure decoupling of environmental pressure from economic growth." SG/SD(2002)/FINAL (May 16, 2002).

9.

	Total Revenue from Electricity Sales *(Million Dollars, $2006)*	GDP *(Million Dollars, $2006)*	Sales as Fraction of GDP
California	$30,521	$1,705,861	1.79%
Texas	$31,550	$973,797	3.24%
Difference			**1.45%**
Difference in Dollars		$1,705,861 * 1.45% = **$24.7 billion**	

10. Howard Chong & Michael Hanemann. 2007. "Executive Summary, Energy Use Analysis." Unpublished study conducted on behalf of Next 10. Department of Agricultural and Resource Economics, University of California at Berkeley, (October 8, 2007).

11. California Energy Commission. 2005. Integrated Energy Policy Report. CEC-100-2005-007. Page 70.

12. Susan Brown. 2005. Global Climate Change. In Support of the 2005 Integrated Energy Policy Report. Staff Paper. California Energy Commission. Page 14. "The cumulative targets set for program years 2004-2013 are 26,508 Gigawatt-hours (Gwh), 6,892 Megawatts (MW), and 290 million therms [for natural gas]."

13. Ibid, page 13.

14. California Energy Commission, July 2005, Implementing California's Loading Order for Electricity Resources, CEC-400-2005-043.

15. CBS/New York Times Survey, April 2007.

16. ABC News/Washington Post/Stanford University Poll, April 2007.

17. Massachusetts Institute of Technology Poll, March 2007.

18. Ibid.

19. CBS/New York Times Survey, April 2007.

20. California Energy Commission. 2005. *California's Water-Energy Relationship, Final Staff Report.* Publication CEC-700-2005-011-SF (November 2005), Page 8.

21.

California Electricity Use, 2001

	Electricity (GWh)
Total Water Pumping Electricity Use*	5,500
Total Water Related Electricity Use**	48,012
Total Electricity Use**	250,494

* See Chart 26, for year 2001.
** *California's Water-Energy Relationship, 2005*

22. California Energy Commission. 2005. *California's Water-Energy Relationship, Final Staff Report.* Publication CEC-700-2005-011-SF (November 2005), Page 9.

23. The displayed variation from year to year in mini hydro power generation is due directly to the variability in snow pack.

24. These programs are funded through revenues collected from investor-owned utility rate payers. In 2008, publicly-owned utilities will adopt a similar program.

25. The State contributed $30 million to the Helios Project at the Lawrence Berkeley National Lab and $40 million to the Energy Biosciences Institute at U.C. Berkeley.

26. Energy technology in this instance consists primarily of investment in solar, wind, fuel cells, engines, and alternative fuels.

27. "The Power of Green," New York Times, April 15, 2007.

28. Office of the Governor. 2006. "Gov. Schwarzenegger, California Clean Energy Fund Announce $1 Million Grant to Build Nation's First Energy Efficiency Center." Press Release 4/12/2006.
http://www.governor.ca.gov/state/govsite/gov_htmldisplay.jsp?sCatTitle=Press+Release&sFilePath=/govsite/press_release/2006_04/20060412_GAAS22606_EnergyEfficiencyCenter.html

APPENDIX

California Factbox

California's Population

Data are from the California Department of Finance, "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark".

California's Economy

Gross Domestic Product data come from "Table 5, Current-Dollar GDP by State, 2003-2006" by the Bureau of Economic Analysis, U.S. Department of Commerce. The California Department of Finance's, "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark" were also used to derive per capita GDP.

California's Greenhouse Gas Emissions

Data are provided by the California Energy Commission (CEC), "Table F-2 -- California Greenhouse Gas Emissions (Revised) (Energy Commission's 1990 to 2004 GHG Inventory & 2005 IEPR for Projections)." This dataset is a revision to the CEC's December 2006 "Inventory of California Greenhouse Gas Emissions and Sinks" Report, and were provided by the CEC in September, 2007. Total Baseline GHG emissions include fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon GHG emissions (in CO2 equivalents). Non-carbon GHG emissions are made up of: Agriculture (CH4 and N2O), Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6), Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N20 from Fossil Fuel Combustion. The California Department of Finance's, "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark" were also used to derive per capita GHG emissions.

The First Wave of Green Innovation

Emissions in California and Other States

Emissions data are from the U.S. Department of Energy, Energy Information Administration, "CO2 Emissions from Fossil Fuel Combustion Million Metric Tons CO2 (MMTCO2)." Emission estimates are based on energy consumption data from EIA's State Energy Consumption, Price, and Expenditure Estimates (SEDS) released June 1, 2007. Population estimates from the U.S. Census Bureau, Population Distribution and Population Estimates Branches were used to compute per capita analysis.

Global Fossil Fuel Combustion

For U.S. and other countries, data for GHG emissions from the combustion of fossil fuels, gross domestic product (GDP), and population are from U.S. Department of Energy, Energy Information Administration, International Energy Annual 2004. For California, GDP data come from "Table 5, Current-Dollar GDP by State, 2003-2006" by the Bureau of Economic Analysis, U.S. Department of Commerce. Population estimates are from California Department of Finance, "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark". Carbon emissions data are provided by the California Energy Commission (CEC), "Table F-2 -- California Greenhouse Gas Emissions (Revised) (Energy Commission's 1990 to 2004 GHG Inventory & 2005 IEPR for Projections)". This dataset is a revision to the CEC's December 2006 "Inventory of California Greenhouse Gas Emissions and Sinks" Report, and were provided by the CEC in September, 2007. Total Baseline GHG emissions include fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon GHG emissions (in CO2 equivalents). Non-carbon GHG emissions are made up of: Agriculture (CH4 and N2O), Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6), Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N20 from Fossil Fuel Combustion.

APPENDIX

Emissions and Gross Domestic Product & The Carbon Economy

Gross Domestic Product data come from "Table 5, Current-Dollar GDP by State, 2003-2006" by the Bureau of Economic Analysis, U.S. Department of Commerce. Carbon emissions data are provided by the California Energy Commission (CEC), "Table F-2 -- California Greenhouse Gas Emissions (Revised) (Energy Commission's 1990 to 2004 GHG Inventory & 2005 IEPR for Projections)." This dataset is a revision to the CEC's December 2006 "Inventory of California Greenhouse Gas Emissions and Sinks" Report, and were provided by the CEC in September, 2007. Total Baseline GHG emissions include fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon GHG emissions (in CO2 equivalents). Non-carbon GHG emissions are made up of: Agriculture (CH4 and N2O), Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6), Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N20 from Fossil Fuel Combustion. Population estimates are from California Department of Finance, "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark".

Total GHG Emissions

Gross GHG emissions (total baseline) data are provided by the California Energy Commission (CEC), "Table F-2 -- California Greenhouse Gas Emissions (Revised) (Energy Commission's 1990 to 2004 GHG Inventory & 2005 IEPR for Projections)" This dataset is a revision to the CEC's December 2006 "Inventory of California Greenhouse Gas Emissions and Sinks" Report, and were provided by the CEC in September, 2007. Total Baseline GHG emissions include fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon GHG emissions (in CO2 equivalents). Non-carbon GHG emissions are made up of: Agriculture (CH4 and N2O), Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6), Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N20 from Fossil Fuel Combustion.

Energy Consumption Since 1970

Energy data are from the U.S. Department of Energy, Energy Information Administration. Population estimates from the U.S. Census Bureau, Population Distribution and Population Estimates Branches were used to compute per capita analysis. Total energy consumption includes all of the following sources: petroleum, natural gas, electricity retail sales, nuclear, coal and coal coke, wood, waste, ethanol, hydroelectric, geothermal, solar and wind energy.

Total Revenue from Electricity Sales as Fraction of GDP

Electricity sales revenue data comes from the U.S. Department of Energy, Energy Information Administration. Gross Domestic Product data come from "Table 5, Current-Dollar GDP by State, 2003-2006" by the Bureau of Economic Analysis, U.S. Department of Commerce.

Average Monthly Residential Electricity Bills

The data are from the U.S. Department of Energy, Energy Information Administration, Survey Form EIA-861, "Annual Electric Power Industry Report." Data for all years are final.

Average Monthly Residential Natural Gas Bills

Residential Price, Consumers, and Consumption data are from the U.S. Department of Energy, Energy Information Administration.

Annual Energy Savings from Efficiency Programs and Standards

California Energy Commission, Implementing California's Loading Order for Electricity Resources, Staff Report, Publication CEC-400-2005-043, July 2005, Figure E-1, p. E-5.

Energy Savings from Utility Efficiency Programs

Data come from the Pacific Gas and Electric Company, Southern California Edison, and San Diego Gas & Electric, Energy Efficiency Annual Reports, May 1999-2005, filed at the California Public Utilities Commission, and were compiled by the Natural Resources Defense Council.

APPENDIX

Tracking Signs of the Next Wave of Green Innovation

GHG Emissions by Major Source

Data are from the California Energy Commission., Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004, Staff Final Report. CEC-600-2006-013-SF, December 2006.

Electricity Consumption by Sector

Data are from the California Energy Commission, "2005 California Electricity Consumption by Sector - For residential, commercial, industrial and agricultural."

Share of Compact Fluorescent Lamps Purchased as a Percent of All Medium Screw Based Lamps Purchased &Market Share of Energy Star Appliances

Data are from the California Measurement Advisory Council (CALMAC).

Commercial Electricity Consumption

Data are from the California Energy Commission, "California Energy Demand 2003-2013 Forecast." A detailed list of the types of buildings in the "All Other Buildings" category is available from the California Energy Commission, California Commercial End Use Survey: Appendix A-J, March 2006.

Petroleum Consumption in California since 1970

Data are from the U.S. Department of Energy, Energy Information Administration, "State Energy Consumption, Price, and Expenditure Estimates". Total consumption of all petroleum products is the sum of individual petroleum products, which include: aviation gasoline, distillate fuel, jet fuel (kerosene type), jet fuel (naphtha type), kerosene, liquefied petroleum gases, lubricants, motor gasoline, residential fuel, other petroleum products. Other petroleum products are made up of crude oil (including lease condensate), miscellaneous petroleum products, natural gasoline (including isopentane), petroleum feedstocks (naphtha less than 401° F), petroleum feedstocks, (other oils equal to or greater than 401° F), petroleum feedstocks (still gas), plant condensate, pentanes plus, special naphtha. Population estimates from the U.S. Census Bureau, Population Distribution and Population Estimates Branches were used to compute per capita analysis.

Gasoline Sales in California since 2000

Data are from the California State Board of Equalization, "Taxable Gasoline Gallons 10 Year Report." Population estimates from the U.S. Census Bureau, Population Distribution and Population Estimates Branches were used to compute per capita analysis.

California Vehicle Fleet and Emissions

Data is for California's entire vehicle fleet and were provided by the California Air Resources Board, EMFAC 2007.

Vehicle-Miles Traveled and Gas Prices

Vehicle-Miles Traveled Data is from U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, annual editions, Figure 5-1: Highway Vehicle-Miles Traveled, United States and California. "Table 1: E-4 Population Estimates for Counties and State, 2001-2007 with 2000 DRU Benchmark" were also used to derive per capita VMT in California. Data on gas prices came from the Energy Information Administration, Petroleum Marketing Annual. Population estimates from the U.S. Census Bureau, Population Distribution and Population Estimates Branches were used to compute per capita VMT analysis for the rest of the U.S.

Alternative Means of Commute

Data are from the U.S Census Bureau, American Community Survey. Alternative means of commute is made up of those who Carpooled (Car, truck, or van), Public transportation (excluding taxicab), Walked, used Taxicab, motorcycle, bicycle, or other means:, and Worked at home.

APPENDIX

Public Transit Use
Public Transit use is reported by the California State Controller, Transit Operators and Non-Transit Claimants Annual Report, 1997-2005.

Water Consumption
Data are from the California Department of Water Resources, Water Use Database 2006.

Water Pumping
Data were provided by the California Energy Commission, and are for surface and groundwater pumping.

Renewable Energy Generation in California
Data are from the California Energy Commission, "Net System Power Reports" 2002-2006.

California Renewable Portfolio Standard
California Public Utilities Commission, July 2007 Report to the Legislature

Grid-Connected Solar Photovoltaics Installed in California
Data are from the California Energy Commission, "Amount (MW) of Grid-Connected Solar Photovoltaics (PV) in California, 1981 to Present," updated on April 18, 2007.

Alternative Fuel Vehicles
Statistics are from the California Energy Commission, compiled using vehicle registration data from the California Department of Motor Vehicle. Alternative fuel vehicles include all hybrids and electric vehicles as well as vehicles running on natural gas. Diesel engine vehicles are not included in the analysis, because there is no differentiation given between vehicles running on carbon and those running on biological diesel fuels. Does not include vehicles running on all alcohol based and gaseous noncarbon fuels.

Federal R&D Funding for Renewable Energy in CA
Data are from the RAND Database for Research and Development in the U.S. (RaDiUS), and were compiled using search queries of "renewable energy" and "alternative energy."

Green Technology Patents
1790 Analytics, Patent Search by Technology (solar & wind energy generation, energy storage, fuel cells, hybrid systems); U.S. Patents & Trade Office.

Venture Capital Investment in Clean Technology
Data provided by Nth Power Venture Capital Energy Technology Fund.

California Venture Capital Investment in Clean Technology
Data provided by Cleantech Network, LLC. For this analysis, venture capital is defined as disclosed cleantech investment deal totals.

Investment in Clean Technology by California Pension Funds
Information was provided through email correspondence with the CalPERS Office of Public Affairs.

Green Jobs and Establishments in California
Using a set of companies identified as having primary activities that fall roughly within the definition of cleantech used by the Cleantech Network described earlier, establishment and job growth since 1990 were tracked using the National Establishments Time-Series database based on Dun & Bradstreet establishment data. This sample offers a conservative estimate and is by no means a comprehensive accounting of the industry in California.

APPENDIX

The Challenge & Prospects for the Future

History of California Emissions and Future AB 32 Target

Data are provided by the California Energy Commission (CEC), "Table F-2 -- California Greenhouse Gas Emissions (Revised) (Energy Commission's 1990 to 2004 GHG Inventory & 2005 IEPR for Projections)." This dataset is a revision to the CEC's December 2006 "Inventory of California Greenhouse Gas Emissions and Sinks" Report, and were provided by the CEC in September, 2007. Total Baseline GHG emissions include fossil fuel CO2, with electric imports and international fuels (carbon dioxide only) and non-carbon ghg emissions (in CO2 equivalents). Non-carbon GHG emissions are made up of: Agriculture (CH4 and N2O), Soils and Forests Carbon Sinks, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6), Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N20 from Fossil Fuel Combustion.

California Climate Action Registry Membership

Data were provided by the California Climate Action Registry, and include California Climate Action Registry members as of 8/13/2007.

2007 California Green Innovation Index Survey Results

All survey results, unless otherwise noted, are from the 2007 Field/Next 10 Global Warming Survey of Californians.

Field Research Corporation (Field), a San Francisco-based independent public opinion research organization, was responsible for overseeing all phases of the research effort. The survey was developed in partnership with Collaborative Economics, a strategic consulting group based in Mountain View, California.

The findings in this report are based on a random sample survey of 1,003 California adults. All interviewing was conducted by telephone in English and Spanish from a central location telephone interviewing facility during the period of August 10 – 28, 2007. In order to cover a broad range of issues and still minimize possible respondent fatigue, the overall sample was divided into two sub-samples, Forms A and B on several questions. Households in the survey were sampled using a random digit dial methodology, which randomly selects operating landline telephone exchanges within all area codes serving California households in proportion to population. Within each exchange, telephone numbers were created by adding random digits within each selected telephone exchange. This method gives each phone listing an equal chance of being selected and permits access to all landline telephone numbers statewide, both listed and unlisted.

Acknowledgements

Special thanks to the following people and organizations that contributed data and expertise:

Josh Bushinsky
Pew Center on Climate Change

Morrow Cater
Cater Communications

Howard Chong
U.C. Berkeley

Susan Clark
Common Knowledge

Orion Fulton
Presidio School of Management

Christina Haro
Cater Communications

Eric Heitz
The Energy Foundation

Jason Mark
The Energy Foundation

Leon Panetta
Panetta Institute

Beau Perry
Presidio School of Management

Rosaline Raj

Kristin Reed

Roxanna Smith
Cater Communications

Justin Sternberg
Presidio School of Management

Andy Taylor
Presidio School of Management

Steve Tiell
Presidio School of Management

Mary Jo Waits
Pew Center on States

Adam Wiskind
Presidio School of Management

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California Air Resources Board
California Board of Equalization
California Climate Action Registry
California Climate Action Team
California Department of Finance
California Department of Motor Vehicles
California Department of Water Resources
California Energy Commission
California Integrated Waste Management Board
California Measurement Advisory Council (CALMAC)
California Public Utilities Commission
California State Controller
CalPERS
Cleantech Network, LLC
National Establishment Time-Series Database
Natural Resources Defense Council
Nth Power
The RAND Corporation
U.S. Census Bureau
U.S. Department of Commerce
U.S. Department of Energy, Energy Information Administration
U.S. Department of Transportation

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