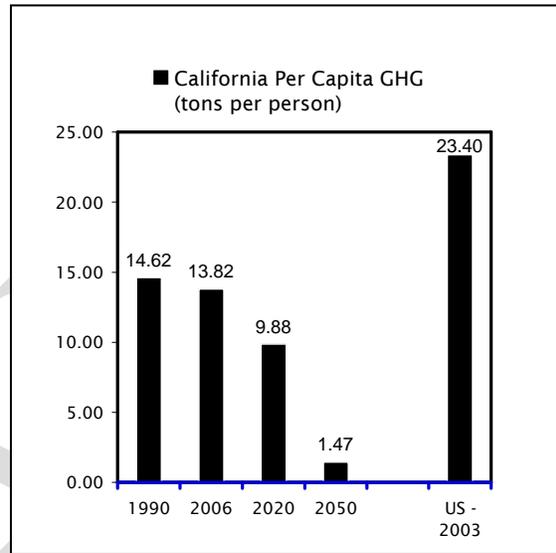


1. INTRODUCTION

I. Challenge and Opportunity

Global warming presents California with a serious challenge to the health of its ecosystems and the vitality of its economy. Recognizing this threat, the California Legislature and Governor Schwarzenegger put into place the California Global Warming Solutions Act of 2006 (AB 32). AB 32 requires that the state cut greenhouse gas (GHG) emissions by 25% relative to the expected business as usual level by 2020. Further, California was among the first to identify the need for a long-term goal. The 80% GHG emission reduction (relative to 1990 levels) by 2050 set in the Governor’s 2005 Executive Order was confirmed by the most recent international report on climate science as an appropriate target for industrialized economies as part of the global effort to limit the dangerous effects of climate change. Increasingly, other states and nations are now adopting this target. Given expected population growth in population, this means California will need to achieve a reduction of 90% in per capita greenhouse gas emissions by 2050 relative to 1990 levels. This objective creates great challenges for California, as a 90% reduction means vastly more efficient use of energy, and the virtual elimination of greenhouse gases from energy sources.



A challenge this great also creates large economic, environmental and public health opportunities for California. Developing clean new energy and transportation systems will give us a chance to improve the security of our fuel supply, address air pollution concerns, and develop better designed urban centers and better methods of moving people and goods. In many cases these solutions will provide important benefits by addressing difficult problems like the inequitable distribution of the environmental costs or the burden of traffic congestion.

California has taken a leadership position in both national and international efforts for reducing greenhouse gas emissions, continuing California’s long-standing tradition of innovation in environmental policies. For example, California’s power plants now emit less than 90 percent of the fine particulates and ozone-forming nitrogen oxides than they did two decades ago. California’s greenest new passenger cars are more than 99 percent cleaner for Volatile Organic Compounds (VOC) and Nitrogen Oxides (NOx) than in 1970. A combination of energy efficiency polices, higher energy prices, and a transition towards a service-oriented economy has helped California keep its per capita electricity consumption essentially flat for decades while providing a net economic benefit. Importantly, California has achieved these successes through a balanced portfolio of

policies, including efficiency and performance standards as well as market-based incentives. These policies addressed important market failures such as pollution externalities, market barriers to private sector research and development, misplaced incentives (such as inconsistent incentives between owners and occupants for energy efficiency in rental housing) and imperfect information available to energy consumers. As California turns its attention to fighting global warming, policies designed to surmount these market failures and others must expand in scope to address climate change.

In addition to demonstrating that significant reductions are possible, the initial AB 32 target of reducing California’s greenhouse gas emissions back to 1990 levels by 2020 has positioned California for national and international policy, business and economic leadership. This, however, is only the first step. The long-term reduction goals for 2050 and beyond are equally important, and will require fundamental changes in our behavior, our use of energy, and our infrastructure. The state will inevitably encounter tradeoffs and decisions between the actions and policies that are necessary to bring about the long-term goals of wide scale transformation and those that may bring about the lowest cost emissions reductions in the short term. Both goals are important, and balanced and innovative approaches are needed to achieve them. For instance, electric-drive vehicles are not economic today but could be in the long run if improved battery technologies are developed. In the short term, however, they may have significant co-benefits such as increasing transportation energy supply diversity and reducing air pollution.

Major Strategies and Opportunities

The Economic and Technology Advancement Advisory Committee (ETAAC) was established by AB 32 to “advise the state board on activities that will facilitate investment in and implementation of technological research and development opportunities, including, but not limited to, identifying new technologies, research, demonstration projects, funding opportunities, developing state, national, and international partnerships and technology transfer opportunities, and identifying and assessing research and advanced technology investment and incentive opportunities that will assist in the reduction of greenhouse gas emissions...”

In this, our first report, ETAAC has identified five major strategies that support five major categories of opportunities for economic and GHG reduction technology advancement. We provide a general description of our observations below and a map of how each recommendation in the report reflects these major themes in a chart at the end of this chapter.

Strategy #1: Accelerate GHG emission reductions

AB 32 establishes a fixed timeframe of 2020 to achieve a 25% reduction in emissions relative to projected business-as-usual levels. This timeframe is useful in part because it gives business and the state specific targets for long-term planning. However, the interests of many different groups (including industry, labor, environmentalists, land

owners, and others) have created a system for project approval that is very complex, time-consuming, costly, and often litigious. Thus, the political process in California has created government processes and approval mechanisms that do not currently work in the same timeframe. The committee has identified areas (for example the deployment of large scale renewables, methane digesters, etc.) where the process significantly could move significantly faster without compromising environmental integrity. To do so, however, will require addressing the interests that created the slow processes and approvals to begin with, and leadership to help design politically acceptable compromises.

The committee has also identified that investment in GHG reductions leading up to the start of the cap on greenhouse gases in 2012 is proceeding slower than it could. This “early action” by business would proceed faster if ownership of the potential economic benefits for early action were made explicit. The actual value of “credits” for early action will depend on market and regulatory decisions that may not occur immediately. If those credits were defined early in the regulatory process, it would increase the investment in greenhouse emission reduction projects and leave the state much better positioned to achieve the targets.

Strategy #2: Balance a portfolio of economic and technology policies

Placing a price on carbon is a critical step towards responding to the climate change threat as it allows private markets to incorporate the value of reducing emissions into their everyday decisions: business investment, consumer choices, etc. One potential option is a market based cap & trade system with a declining cap. Thus, when consumers make choices about the products and services they buy, and companies decide what to produce, how to produce it and how to invest in research and development, a price on carbon can help efficiently tilt those decisions toward alternatives that produce fewer GHG emissions. This avoids the danger of having government or other centralized decision-makers make choices that lock-in advantages for particular technologies without flexibility for other choices to emerge on a level playing field.

If markets were perfect, this effect would be strong and effective in bringing new technologies into the market and stimulating industrial R&D on technologies that are close to being economical. However, as the Market Advisory Committee notes, placing a price on GHG emissions addresses only one of many market failures that impede solutions to climate change. Additional market barriers and co-benefits would not be addressed. Complementary policies will be needed to spur innovation, overcome traditional market barriers, and address distributional impacts from the higher prices for goods and services in a carbon-constrained world. For example, California can utilize revenue-neutral fee shifting to reward the purchase of lower GHG products.

These complementary strategies form the core of ETAAC’s policy recommendations. However, many of these strategies would be less effective without a policy that places a price on carbon which a declining cap on greenhouse gas emissions would create. With imperfect markets and potentially inequitable distributional impacts, complementary

policies will improve the economic efficiency and overall desirability of a policy that places a price on carbon. A well conceived portfolio combining both market and non-market based policies and measures will be much more efficient and therefore much less costly than relying exclusively on options from either category on their own.

Strategy #3 Create innovative public funding to complement private investment

One of the most important market failures not addressed by putting a price on carbon is the inadequate level of research and development (R&D) for new technologies. Because firms expect a high return on their capital and cannot be certain they will be able to recoup all the benefits from their R&D investments, they invest much less in R&D than is socially optimal. Therefore, stimulating innovation is a key goal of policies designed to complement a price on carbon. Broadly speaking, there are two ways to do so: by funding R&D directly and by requiring improved performance in the marketplace. In the energy sector, where new technologies are often very capital intensive and integrated into complex production systems, a balanced approach that uses both methods is desirable.

The policies created to support AB 32 will produce significant private sector investment in California, but this investment will not be enough to reach the overall emissions reduction goals. The ETAAC committee reviewed areas where public financing, possibly leveraged with private capital, can stimulate innovation and accelerate adoption of existing products. ETAAC has identified demonstration/pre-commercialization as a critical stage for this type of investment. If California decides to utilize an auction for some portion of the emission allowances under the cap, ETAAC proposes that a California Carbon Trust can direct investments towards funding university research, financing initial technology projects and encouraging emissions reduction projects, often with co-benefits such as air quality improvements and job creation, in disadvantaged communities and throughout the state of California, and fill research gaps by leveraging the capabilities of university and other research leaders in the state

If GHG auction revenues are sufficiently large, they can also be used to reduce distorting taxation in addition to providing resources for GHG reductions. This represents another potentially important policy option because it could improve the economic efficiency of the overall California economy. Alternatively, these revenues could be used to make the California economy more equitable, in particular by assisting communities or industries that are disproportionately affected by climate change or by climate change mitigation. Any such assistance should not eliminate the incentive created by placing a price on carbon, but instead should help with short-term transitions to a more competitive, low-GHG economy.

California has a variety of incentive fund programs (outlined in appendix III). They serve specific functions but none is currently targeted specifically at GHG reductions nor are they currently coordinated to achieve the maximum GHG co-benefits. ETAAC recommends that the State of California make an affirmative commitment to research, development and demonstration programs geared toward GHG abatement, and examine how to best integrate GHG reductions with existing program goals. By not just supporting but actively promoting clean energy innovation, the state has the opportunity

to seed the California marketplace with promising new technologies that may aid in achieving GHG abatement goals - particularly for goals beyond 2020. This will also drive new investment dollars to California and better enable our state to attract and nurture the most promising clean energy start-up businesses. The state should also consider creating a new organization to house these and other programs.

Strategy #4: Create international and domestic partnerships

Achieving success domestically will require partnerships between the public and the private sector, between state and local governments, and between the state and other nations. Broad deployment of technology will generally drive down costs and lead to subsequent generations of innovation. The state must leverage agreements with the European Union, United Kingdom, and western North American states. Achieving true success on climate change will also require the transfer of clean technology to developing nations. Exporting both information on public policy solutions and the benefits of a strong Cleantech industry is one example recommended by ETAAC; and partnering with other states, the federal government, and other nations on low and zero tailpipe emission vehicles is another.

Strategy #5: Coordination across state agencies

There must be effective coordination across all agencies to reduce GHG emissions from their own operations and from the organizations that they regulate and/or oversee. Just as all sectors of the state’s economy need to participate in the opportunities and challenges of meeting California’s GHG goals, all state agencies must also participate with Cal EPA playing a key coordination role. This will also be important for planning efforts to adapt to the climate change effects that will potentially occur even if atmospheric GHG levels are stabilized at a level that avoids more severe effects of climate change.

Some new technologies and new practices to lower GHG emissions will also have co-benefits such as less air pollution or lower water consumption but they may also have higher costs, and some may even exacerbate other problems. It will be necessary for California to identify and manage tradeoffs that will occur as it addresses global warming. A key principal is that tradeoffs among different public policy objectives should be integrated across all state decisions, including those associated with AB32 directly as well as others such as air pollution regulations, infrastructure development, and so forth. Such reciprocity is needed to avoid an unbalanced set of regulatory and project decisions that would result in missed opportunities to help meet climate change goals.

Opportunity #1: Accelerate efficiency measures

The most cost-effective reduction measures continue to be investment in energy efficiency. Whether it is more efficient buildings, appliances or vehicles, the initial investment is rewarded with reduced future use of energy. While California has led the nation in building and appliance efficiency, we have significant opportunity to do more.

In some cases, we need to force technology innovation for more efficient products. In other cases, for example distributed generation with combined heat and power, we need to encourage faster adoption of existing technology.

The ETAAC committee believes that new types of financing will increase the development and adoption of energy efficient technologies and practices. Consequently, we recommend financing policies that can be implemented through utilities or municipalities to increase investment in efficiency. We also discuss the potential use of auction proceeds to help finance efficiency to lower future energy bills in historically disadvantaged communities and help achieve another of the goals of AB 32.

Opportunity #2: Remove carbon from energy

California's future sources of electricity, transportation fuels and natural gas will need to be zero or near-zero GHG by 2050, possibly combined with the removal and permanent storage of carbon. Renewable energy technologies such as wind, solar, and others offer the technical potential to produce all of California's electricity generation needs, but there are a number of technical and implementation challenges that will not be simple to overcome. ETAAC examined how to quickly scale up renewable energy – both distributed and central utility scale. In this timeframe, we also believe energy from fossil fuels, including natural gas, can play an important part through the separation and permanent storage of emitted carbon. Energy from biomass with carbon sequestration would produce renewable power and actually permanently remove carbon out of the atmosphere.

Low carbon, zero carbon and even negative carbon energy will likely require methods to permanently sequester carbon that today are neither proven nor cost-effective. California should continue to partner with other states, federal agencies and should also look to international partners to encourage research and development to find both cost-effective and safe methods of sequestering CO₂ streams from energy generation.

Lastly, to accelerate the long-term transition to renewable energy California will need the ability to store electricity from renewable energy sources that generate mainly during periods of lower demand (such as wind) so that it can be used for peak electrical demand. Potential storage systems include plug-in hybrid and zero emission electric or fuel cell vehicles, as well as stationary storage systems.

Opportunity #3: Rethink transportation to lower demand and carbon emissions

Transportation accounts for the largest fraction of greenhouse gas (GHG) emissions in California. In order to meet the 2050 goals, this sector will need to accomplish a drastic reduction of GHG – to zero and near zero for new technologies.

ETAAC recommends that California build upon existing programs to reduce pollution and "decarbonize" transportation. These existing programs include the Pavley – Schwarzenegger vehicle GHG regulations passed in 2004, the Low Carbon Fuel Standard, the Low/Zero Emission Vehicle program and the Zero-Emission Bus program.

The infrastructure to deploy the technologies that emerge from these programs must also be developed based on low and zero emission energy supplies.

California should also initiate, within the next year, a program to reduce GHG from heavy-duty vehicles (HDV) and continue to work with the federal government in substantially improving national fuel efficiency standards. In addition to transportation technology, it is time to rethink current methods of mobility for both people and freight. The growth in vehicles and roads occurred largely during a period of inexpensive fuels while in Europe, such growth has occurred in spite of much higher fuel prices. Reducing the growth in vehicle miles traveled (VMT) will be critical to GHG reductions, and will bring important co-benefits in terms of reduced time lost in congestion as well as (possibly) improved quality of life. Putting a price on carbon and congestion will help reduce vehicle use, but these approaches are limited and must be complemented by transit options and city designs that provide better and affordable options to encourage reductions in VMT.

Land use planning will need to connect to state-wide priorities to encourage transit-oriented development such that overall vehicle miles traveled will decline despite current growth rates. This is just one of many ways in which local governments are a key partner with the state in achieving GHG goals.

Our freight systems will need similar rethinking as the ports and central valley freeways become increasingly congested and alternative modes of goods movement become both a necessity and an opportunity to reduce GHG and other air pollutants.

Opportunity #4: Reduce GHG emissions from industry, agriculture, forestry and water

Not all GHG emissions are from energy use. They also come from forest, agricultural and industrial practices. Opportunities exist to reduce emissions through established best practices. In addition, both agriculture and forests hold the long term potential to sequester carbon in soil and biomass.

Water use in California is extremely energy intensive. Today, more than 19% of electricity, 32% of natural gas that isn't used to produce electricity, and 100 million gallons of diesel fuel are used to treat, deliver and heat water in California each year. Policies and technologies that increase the efficiency of water systems and reduce end-use will produce the multiple benefits of less demand on water resources, and reduced emissions of GHG and other air pollutants from reduced energy use.

Opportunity #5: Encourage Cleantech manufacturing and green-collar jobs

The Cleantech industry encompasses a broad range of products and services, from alternative energy generation to wastewater treatment to more resource-efficient industrial processes. Although some of these industries are very different, all share a common thread: they use new, innovative technology to create products and services that

compete favorably on price and performance while reducing humankind’s impact on the environment. California is well positioned to attract venture capital investments in Cleantech companies. California led the nation in Cleantech venture capital in 2006 with \$1.13 billion, representing 44 percent of total Cleantech investments in the U.S.

Cleantech represents a new export opportunity for California as Cleantech products will be needed world-wide to address climate change and the decreasing availability of natural resources. Cleantech is also spurring new green-collar jobs in areas such as solar installation and energy efficiency. ETAAC proposes training programs to encourage the development of green-collar jobs.

At present, the state is doing little to encourage the manufacturing of products in California. In fact, it is possible that many Cleantech companies will locate their manufacturing out-of-state while keeping their headquarters and RD&D facilities in California. The state can consider a variety of recommendations to make it more economically attractive to both invent and manufacture in California.

Summary

California has a prime opportunity to meet the aggressive AB 32 goals. By acting sooner rather than later, California can lower the costs of transitioning to an economy less dependent upon carbon and other GHG emitting energy sources¹ while reaping the rewards of a more sustainable, efficient and competitive economic system. The opportunities cut across all sectors examined in this ETAAC report – transportation, industrial, energy, agriculture and forestry. Renewable energy, alternative fuels, and energy efficiency could create environmental benefits and jobs in all stages of economic development, ranging from research and development to manufacturing and the rest of equipment lifecycles.

Policy makers, industry and consumers must bear in mind that the long-term effects of decisions made today will still be with us in 2020, and in many cases, in 2050 and beyond. Land-use decisions and choices about new electric power generation infrastructure will either help or hinder California’s efforts to meet both the 2020 and 2050 GHG reduction targets. Development of new kinds of clean vehicles and other transportation technologies over the next decade may dictate whether the state is on a trajectory toward meeting the AB 32 mandates or falling behind the curve on achieving these critical long-range goals.

Californians are ready to respond to the challenge of addressing climate change. Doing so will require:

- continuing our long-standing commitment to environmental policy and building on the success of existing programs and regulations,
- attracting private capital,
- developing and retaining new green collar jobs

- continuing the business and technology innovations for which California is famous.

In addition to mitigating the worst effects of climate change, effective action can also yield the co-benefits of cleaner air and new Cleantech industries and jobs here in the state. The knowledge and products created in response to our climate policies can both strengthen the California economy and strengthen our international leadership on environmental issues and climate change.

ⁱ Stern Review, 2006, Cabinet Office - HM Treasury

DRAFT