

# Powering the Future

A Vision for Clean Energy, Clear Skies,  
and a Growing Economy in Southern California



California Environmental Protection Agency

 **Air Resources Board**



**Air Quality**

**Mobility**

**Economic Growth**

**Energy Security**

**Climate**

*... a coordinated approach to air pollution, energy, mobility, climate and economic growth.*

# Southern California: At a Crossroads

As our region recovers from recession, it faces long-term challenges to its economy and quality of life. Events half a world away impact our economy with higher fuel costs, traffic congestion steals millions of hours of productivity, cities struggle to accommodate growth without degrading livability, electricity supplies must be augmented, and air pollution shortens lives and causes thousands of lost school and work days every year.

Meeting the air quality challenge offers an opportunity to address many of these concerns. **Clean energy is the key.** To attain air quality standards required by federal law, the region will need to transition from traditional combustion of fossil fuels in cars, trucks and factories, to broad use of clean energy such as electricity. Clean energy solutions can also benefit our economy, mobility, energy security and climate. These issues are currently being tackled by myriad agencies and organizations. To realize the greatest benefits from technology and infrastructure investments, **a coordinated approach to air pollution, energy, transportation and climate is needed.** This document offers a vision for such an approach, and a call for today's leaders to make it happen in the next 20 years.



*Clean  
energy  
is the key*

# The Cost of Air Pollution

Southern California is a leader in reducing emissions, but still, air pollution causes thousands of premature deaths every year – far more fatalities than traffic and crime combined. Many lives are cut short by over a decade.

## Health Impacts

*Over 5,000  
premature  
deaths  
each year*

- Respiratory illness, including asthma
- Lost work and school days
- Hospitalizations
- Acute bronchitis
- Cancer

Source: California Air Resources Board

*Monetary cost  
of air pollution  
in Southern  
California:  
At least \$14.6  
billion per year*



## Reducing Nitrogen Oxides Key to Clean Air

Nitrogen oxides (NOx) are emitted whenever fuel is combusted and react in the air to form ozone (smog) and fine particulates. Cars, trucks, trains, power plants and refineries all generate NOx. Reducing NOx from these and other sources is necessary to meet federal health standards for ozone and particulates.

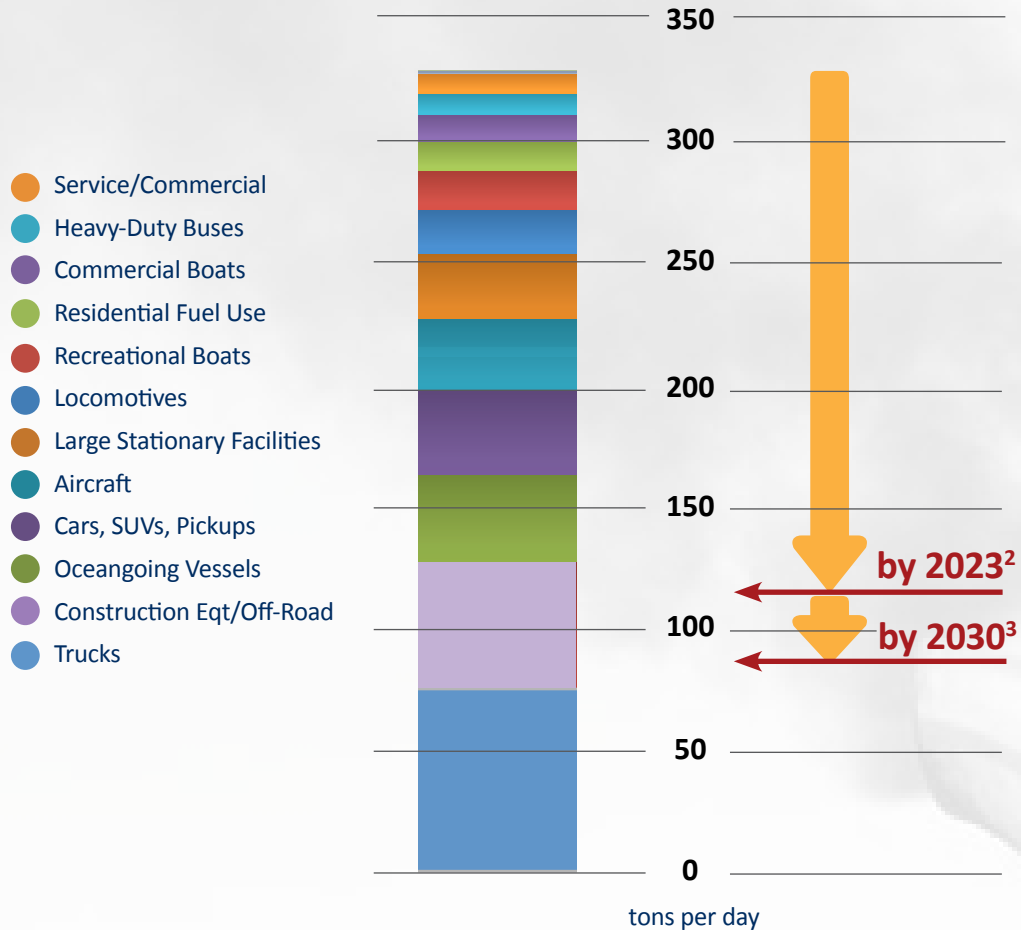
## A Daunting Challenge

National ozone standards require Southern California to reduce nitrogen oxide emissions beyond expected levels by an additional two-thirds in 2023 and three-quarters in 2030.

This is a daunting challenge. Emissions from most sources, including cars and factories, have already been reduced by over 90 percent. In 2030, pollution from just three sources – ships, trains and aircraft – will lead to ozone levels near the federal standard.

# Nitrogen Oxides Emissions in 2023 with Adopted Standards<sup>1</sup>

# Additional Needed Emission Reductions



1. Preliminary SCAQMD emissions estimates based on data from 2007 AQMP, updated where more recent data available: CARB 2010 emissions projections for trucks and off-road equipment; International Maritime Organization Tier 1,2 and 3 standards for ocean vessels; EPA 2008 rule for locomotives; 2007 AQMP short-term measures for other categories. Oceangoing vessels is average of high and low emissions estimates based on varying deployment assumptions for IMO Tier 2 and 3 vessels and range of ports' cargo forecasts.

2. Source: 2007 AQMP; analysis for 80 ppb federal standard adopted 1997.

3. Preliminary SCAQMD analysis for 75 ppb federal standard adopted 2008.

# A New Path: Toward Clean Energy

Southern California is a center for innovation, logistics, university research, and technology development. As such, we are in a unique position to build a clean energy economy that is efficient, globally competitive, and adds good, well-paying jobs.

How can we benefit? As we move away from old technologies that rely on traditional fossil fuel combustion to move our cars, trucks and trains, we can foster industries that engineer advanced vehicles and transportation systems powered by clean energy. We can build products that global markets will demand in a carbon-constrained future. We can grow traditional jobs in logistics, warehousing and transport — just as the ports of Los Angeles and Long Beach are now doing by building green. By burning less fossil fuel, we can lead the nation in reducing dependence on foreign oil, and insulate the region's economy from oil price shocks. We can build clusters of livable communities and efficient buildings near clean transit. We can provide a healthful environment for residents near railyards, ports and highways, and thereby foster public support for transportation infrastructure that will let our economy grow. And we can put billions of dollars that we spend on foreign oil every year to work in our own communities, to create jobs and build the infrastructure we need for the future.

By coordinating solutions for energy, climate, transportation and pollution, we can provide businesses with regulatory and market certainty, and attract private sector investments in innovative technologies to power our economy.

## The Importance of Clean Energy

The additional pollution reductions needed to attain federal health standards for ozone and particulates will require the region to transition from traditional combustion of fossil fuels in cars, trucks and factories, to broad use of electric motors and zero and near zero-emission energy sources such as electricity.





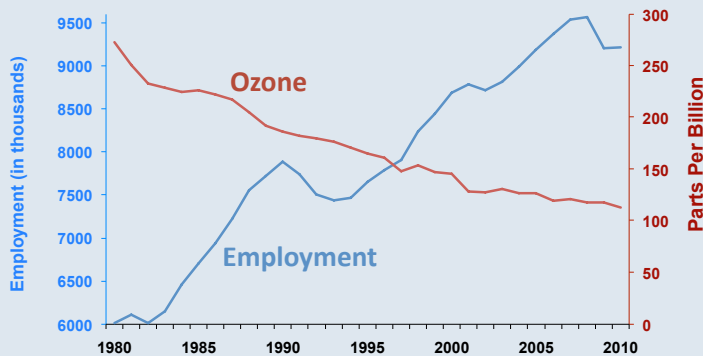


# Leading the Transformation

We begin in the greater Los Angeles region, a place rich in imagination and diversity, but marked by smog, traffic and sprawl. The future will be a place where cars plug in like appliances and houses produce their own clean power. Electric trains will speed across the region, and trucks powered by hybrid-electric, fuel cell, or other clean energy technologies will deliver the goods. Thousands of people will work in well-paying jobs designing, building and maintaining clean technologies, as well as in traditional jobs such as logistics.

Southern California will lead the way it always has – by innovating. The following pages present three key areas for action.

## Economic Growth and Pollution Reduction Can Go Together - With the Right Technologies




Since 1980, Air Pollution has Been Cut by 60%  
While Employment has Grown by 55%




California can build global competitiveness by creating a world-class freight transportation system for the 21st century.





The clean energy transformation begins with transportation. Emissions from cars, trucks, trains, ships, aircraft and other mobile equipment account for 90 percent of key types of regional air pollution, and about 40 percent of greenhouse gases. Much of this comes from goods movement.


About 40 percent of the nation's imported goods – worth \$300 billion annually – comes through the ports of Los Angeles and Long Beach. Cargo volumes through these ports are projected to almost double by 2025, and almost triple by 2035. While this trade is a major job generator in our region, diesel-powered goods movement increases traffic congestion and harms public health, especially near ports, highways, and railyards.



California can build global competitiveness, create jobs, and improve quality of life by creating a world-class freight transportation system for the 21st century that uses clean technology to swiftly move goods without pollution. Much of the necessary technology is already available. Zero-pollution technologies can be incorporated into cargo handling equipment such as cranes and yard trucks, and can move containers from ports to railyards and warehouses. Key freight transportation corridors, such as the Long Beach Freeway, can feature designated lanes for electric, hybrid electric or other clean energy trucks, and technologies are being developed that could provide power to vehicles and charge their batteries on such corridors. Freight rail through the Alameda Corridor and beyond can be electrified — some of the world's largest railways have already done so.

Clean energy technologies will break the connection between cargo growth and pollution, and will help foster community consensus for building capacity-increasing infrastructure projects. But transportation infrastructure intended to serve the region for the next 30 to 50 years or more is being planned now, so vision and action are needed today.





Southern California has nine million passenger vehicles, with millions more on the way. By 2035, its population is projected to grow by six million people — equivalent to adding two Chicanos. Automobile emissions are relatively well-controlled compared to cargo transport equipment. But, by sheer numbers, cars are responsible for much of our pollution, congestion and energy use.

Expanding our transit rail and intercity rail networks, with electrified or other clean energy technology, will help relieve traffic, add jobs and reduce emissions. And efforts to link local land-use decisions with pollution reductions create opportunities to fashion towns with more clean-energy transit options and less long-distance commuting. Meanwhile, California is leading the adoption of forthcoming plug-in electric and fuel cell cars and buses. As the nation's biggest and cleanest vehicle market, California can also capture much of the clean-car and electric charger manufacturing market before global competitors do.

## Generating Needed Power

Transitioning from fossil fuels to electricity for goods movement and passenger transportation could substantially increase electricity demand over several decades. In the near term, existing power plants will be able to handle much of the load, especially if plug-in electric vehicle charging occurs off-peak. But additional clean power plants and grid infrastructure will be needed to supply changing demands over time. Incorporating increasing levels of renewable power is necessary, but remains challenging.

## Electrification Decreases Total Pollution

Electricity generation produces less than one percent of NO<sub>x</sub> emissions in Southern California, and the increase in emissions from greater generation to serve electrified transportation would be dwarfed by a large decline in emissions from vehicles and trains, even if the additional electricity is generated by powerplants in the region.

# Clean Energy Can Mean Economic Benefits

## Reducing Outflow of Funds from Region:

Southern Californians spend billions of dollars per year on foreign oil.

## Greater Energy Price Certainty:

Powering our economy by electricity and other types of energy produced locally can insulate the region's economy from oil price shocks due to instability in foreign countries and depletion of the most readily available supplies. The federal government acknowledges significant uncertainty regarding future petroleum costs.

## Potential Energy Cost Reduction:

Electric motors are very efficient and, given projected energy costs, electrifying transportation could save consumers and businesses billions of dollars in fuel costs per year.

## Potential for Lower Operating and Maintenance Costs:

Electric motors have fewer moving parts than fossil fuel engines.



When it comes to energy, California leads the nation in doing more with less. The state's GDP per unit of energy is 60 percent higher than the rest of the nation. When businesses spend less on energy, they can invest more in production, research and workers. California energy conservation policies have led to an estimated 1.5 million jobs and \$45 billion in additional payroll over the last 35 years.

But power generation remains a challenge. About half of the region's power plants are more than 40 years old, and many will have to be replaced in the next decade. Siting power plants, even the cleanest, is difficult, and it takes years to build major transmission lines to desert solar and wind energy farms.

Yet within these challenges lie opportunities to transform Southern California's electrical generating system. Replacing or repowering older power plants will improve efficiency. Commercial and residential sites can be attractive for local and clean "distributed" generation of renewable power – sunny Southern California has hundreds of millions of square feet of warehouse rooftops, representing a vast potential solar resource. Hydrogen fuel cells and other distributed zero-emission energy sources can be applied in factories and other commercial applications. Smart meters can link information technology and markets, so that customers use energy more wisely. And new electricity storage technologies can help integrate renewable power and meet peak load demands.





## Making the Right Decisions

Over a century ago, Southern California began to build an electrified transit system – the Pacific Electric Railway, with its “Red Cars.” By 1944, the system extended from the Inland Empire to the sea, with more passengers than today’s rail systems. Then, by 1961, the entire system was scrapped as the region built freeways.

We can only wonder how Southern California would be different today if the Pacific Electric Railway had been retained and expanded: How much less pollution, congestion, and noise? How much less dependence on foreign oil? How many more walkable communities near transit hubs?

Poor decisions can have lasting impacts. Today’s leaders have the opportunity to make lasting decisions that will benefit energy security, air quality, economic growth, mobility, and the climate, for decades into the future.



## Can We Get to Clean Energy?

We already are there in many ways, and Southern California is leading the way.

### Some examples:

1. Electric cargo crane at the Port of Los Angeles
2. Hydrogen fuel-cell electricity generation
3. Battery-electric bus with quick charge capability
4. Electric light rail transit
5. Fuel cell bus
6. Hybrid electric truck
7. Plug-in hybrid car
8. Container ship plugged into grid power at berth to eliminate emissions from power generators





... today's  
decisions  
will shape  
the region  
for decades.

The future belongs to those with the vision to see it and the commitment to act. California has always been an innovator, and it can be again.

How do we do it? We distance ourselves from business-as-usual choices— more of the same types of freeway lanes, more sprawl, more engines burning fossil fuels. Instead, we think regionally and long-term. We ask how each decision supports a shared long-term vision for Southern California. **Wherever possible, decisions and actions should be part of one integrated strategy to address multiple needs with single investments.**

We should start by aligning our actions to improve mobility and air quality with global efforts to reduce petroleum consumption. We should seek consensus on coordinated air and transportation plans, and pursue federal funding, because solutions to Southern California's mobility and air quality problems serve important national energy policies as well. We should position Southern California industries and universities as technology innovators that serve emerging global needs, and give them every opportunity to succeed by developing partnerships and accelerating demand for clean energy solutions.

And we should do these things now. An economic leadership opportunity exists, since technologies the world needs by 2050 for climate protection and energy security are needed in Southern California within two decades to attain federal air quality standards. Global competitors are not waiting.

As we emerge from recession, we can innovate to build a better Southern California. But we must set a course down this new path now, because today's decisions will shape the region for decades.

# Steps to Powering Clean Growth



# 10 Steps for Government

## Passenger Transport

- Acquire clean energy vehicles for public fleets (e.g. electric, hybrid, fuel cell), and create incentives to do so for businesses and individuals
- Incentivize and install zero-emission charging and fueling infrastructure
- Extend electric rail systems

## Goods Movement

- Demonstrate and deploy zero-emission container movement systems from ports to railyards
- Deploy electric or other zero-emission cargo handling equipment such as cranes and yard trucks at railyards, ports etc.
- Develop lanes for use by electric or other clean energy trucks on key corridors such as I-710, potentially with infrastructure to provide power and charge vehicle batteries
- Work to electrify rail lines

## Land Use

- Encourage growth near clean transit and freight system hubs and corridors
- Incentivize zero-emission charging and fueling infrastructure in tandem with conventional fueling stations

## Adopt Policies to Encourage Industry Action

- Electric motors and other zero-emission equipment where feasible
- Fuels with reduced air pollution impacts (e.g. natural gas) where electrification or other zero-emission technology is not feasible

## Construction Equipment

- Demonstrate and deploy hybrid electric, hydraulic hybrid and other clean technologies

## Encourage Actions for Residences

- “Greening” of homes with strategies such as solar roof panels, and energy conservation and efficiency strategies
- Plug-in vehicle charging capability
- Electric water and space heaters

## Electricity Generation and Storage

- Promote renewable power generation and storage
- Establish incentives for zero-emission distributed electrical generation for industrial, commercial and residential applications (e.g. fuel cells, photovoltaics)

## Ships

- Establish incentives or requirements for the lowest polluting ships to call on Southern California ports
- Expand shore-power, or equivalent, for ships at berth beyond regulatory requirements

## Research

- Fund research to advance and demonstrate electric drive, hybrid electric, hydrogen and other zero and near-zero emission technologies

## Funding

- Seek federal and other funding sources for transportation infrastructure that enables or facilitates deployment of zero-emission and near zero emission technologies (e.g. dedicated truck lanes, rail electrification)
- Develop partnerships to be well positioned to receive competitive grants and maximize other funding opportunities

# 10

## Steps for Individuals and Businesses

- Drive a fuel-efficient car
- Carpool, take transit, ride a bike or walk, where possible
- Explore alternatives to vehicles and stationary equipment powered by fossil fuels, e.g. electric, hybrid electric
- Purchase electricity from renewable sources where available
- Consider installing solar panels
- Use electric or energy-efficient appliances, lighting, water heaters, and home heating and cooling equipment
- Ensure your home or business is well insulated
- Conserve water, which will help reduce energy usage
- Consider buying products manufactured domestically, and produce grown locally, to reduce long-range transportation
- Support governmental actions to define, incentivize and help implement these steps

In setting forth the “Powering the Future” vision,  
the South Coast Air Quality Management District, the Southern California  
Association of Governments and the California Air Resources Board aim  
to stimulate more active dialogue about positive change.

We invite you to share your thoughts online at  
[poweringthefuture@aqmd.gov](mailto:poweringthefuture@aqmd.gov).

*This is the first in a series describing a vision for  
the future of Southern California and strategies  
to achieve a healthful economy and environment.*

*Coming... an advanced technology menu, funding options, and more.*



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