ATTACHMENT B

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Evaluation and Discussion of Potential Economic Impacts of the Draft AQMD Air Quality-Related Energy Policy

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Introduction

The draft Air Quality-Related Energy Policy (Policy) provides information on current energy usage in the Basin, a list of policies to guide AQMD efforts, and a list of actions to be undertaken to support the policies. The Policy will be used to guide the AQMD staff in integrating air quality issues with energy use planning. This report accompanies the draft Policy and presents an evaluation and discussion of the potential economic impacts resulting from the draft Policy.

The majority of air quality problems in Southern California are the direct result of energy usage. Currently the South Coast Air Basin (Basin) is in non-attainment with respect to the federal ozone and fine particulate matter criteria pollutant standards. Ozone is a secondary pollutant formed in the atmosphere in the presence of sunlight and emissions from oxides of nitrogen (NOx) and volatile organic compounds (VOC). The formation of NOx primarily results from combustion processes that involve high heat and pressure. Fine particulate matter is both emitted directly from combustion processes and also formed in the atmosphere from NOx, VOCs, and other precursors.

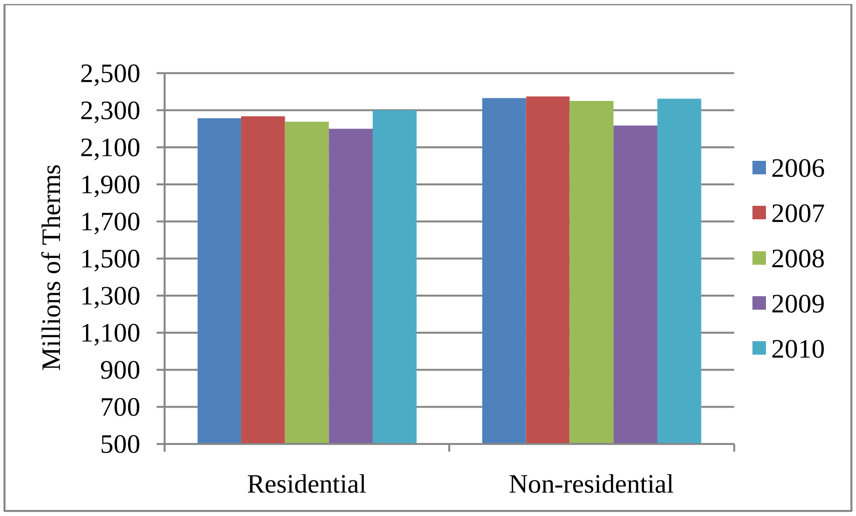
In order to meet the 1997 federal ozone standard of 80 ppb, the Basin needs an additional 67 percent of NOx reductions beyond all the regulatory actions as of 2010. To meet the more recent 2007 federal ozone standard of 75 ppb, an additional 75 percent of NOx reductions are needed above current measures. A newly revised ozone standard is expected to be between 60 and 70 ppb, and this new standard will require an approximately 90 percent of NOx reductions beyond current regulatory actions.

The majority of NOx emissions in the Basin come from mobile sources, including the transportation sector. Therefore, it is necessary to find NOx reductions through current and future technology improvements within this sector. Concurrent benefits will also occur relative to environmental justice, greenhouse gas reductions, and integrated land use and transportation planning. To this end, the AQMD is developing an air quality-related energy policy that would integrate air quality, energy security, and climate change issues in a holistic manner.

Background

The total end use energy consumption for the Basin in 2008 was 2.2 quadrillion BTU, of which 82 percent was from fossil fuels with the remaining from electricity. The total fossil fuel consumption was divided into 46 percent for gasoline, 26 percent for natural gas, 13 percent for diesel, and the remaining 15 percent for jet, residual, and propane. Energy usage also fluctuates with the underlying economic condition. The U.S. economy was in full recession in 2008 and did not begin to recover until June 2009. Figures 1 and 2 show the consumption trends of electricity and natural gas in the four-county area from 2006 to 2010, which spans the period immediately prior to the recession through the end of 2010.

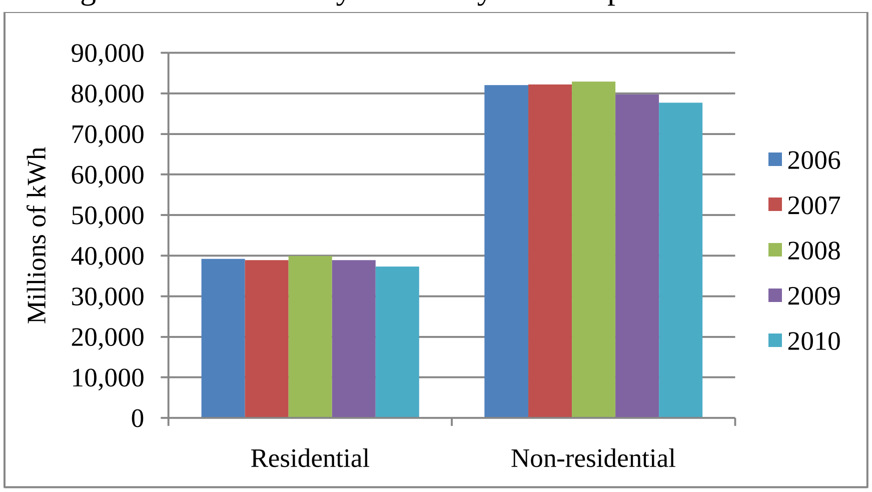
Figure 1: Four-County Natural Gas Consumption 2006-2010*



CEC, Electricity Consumption by County, Downloaded August 1, 2011 from http://ecdms.energy.ca.gov/elecbycounty.aspx.

*Does not include power plant consumption for electricity generation.

Figure 2: Four-County Electricity Consumption 2006-2010



CEC, Gas Consumption by County, Downloaded August 1, 2011 from http://ecdms.energy.ca.gov/gasbycounty.aspx.

The fluctuation in natural gas and electricity usage in 2008 and 2009 corresponded, in large part, to the underlying conditions of the Great Recession. Since then, natural gas consumption rebounded in 2010. As of the end of 2010, the four-county area still showed a downward trend in employment on an annual basis; however, for the most part, the monthly employment trend has improved since February 2010.[1] According to a Brookings Institution report, the Los Angeles metropolitan area ranks second in the number of green jobs among the 100 largest metro areas.[2]

Based on the projections of the Regional Economic Models, Inc. (REMI), the GDP in the four-county area is expected to grow between 2010 and 2015 at an annual rate of 3.62 percent to reach $946 billion in 2015. Between 2015 and 2020, the annual growth rate is projected to be at 3.49 percent with a GDP of $1,123 billion in 2020. These estimates are subject to change based on a variety of economic and political factors. Any expansion of the local economy will likely bring an increased demand for energy as well.

Study Approach

The different components of the AQMD Policy are shown in Table 1 and compared generically to the programs of the state agencies and federal laws. Due to the Policy's consistency with other state and federal energy programs, and the lack of specificity of implementation details, this economic evaluation is largely relying on existing reports and analyses conducted by other entities. However, more detailed analysis will be provided to the SCAQMD Governing Board as policy implementation occurs through various actions.

Currently the state agencies are implementing programs identified as components in the AQMD Policy, which are referenced in regulations and planning documents such as CARB's AB 32 Scoping Plan, CEC's Integrated Energy and Planning Report (IEPR), Renewable Portfolio Standard (RPS), CPUC's Long Term Procurement and Planning Process, and Pavley standards. State agencies are implementing these programs for reasons other than criteria pollutant air quality benefits, which is the principal reason these are brought together within the AQMD Policy. Where concurrent NOx reductions can be achieved due to statewide and national energy policy or climate change activities, no additional costs need to be incurred for these reductions. Since the draft Policy is viewed as a long range clean air strategy to meet the federal ozone and PM standards, the potential costs associated with implementing the energy programs are part of the AQMP "black box" and longer term reductions analyzed in the 2007 AQMD socioeconomic assessment.[3] To the extent applicable the previous analysis was used to approximate the potential impacts. As the actions in the AQMD Policy, along with state and federal programs, are further undertaken, specifics within each component will be further analyzed with more detail.

[1]California Employment Development Department, Employment by Industry Data [Data File], ~~Downloaded~~ Retrieved July 2011 from http://www.labormarketinfo.edd.ca.gov/?pageid=166, March 2010 Benchmark.
[2]Muro et al., Sizing the Clean Economy: A National and Regional Green Jobs Assessment, The Brookings Institution, 2011, ~~Accessed~~ Retrieved August 1, 2011 from http://www.brookings.edu/reports/2011/0713_clean_economy.aspx.
[3] The federal Clean Air Act Section 182(e)(5) specifically authorizes the inclusion of such long-term measures for extreme ozone nonattainment areas—these measures are often referred to as the "black box."

Table 1: Comparison of energy policies, regulations and laws with components of draft AQMD Policy.

Components	AQMD	CARB	CEC	PUC	Federal
Energy/Efficiency Conservation	✔	✔	✔	✔	✔
Load Shifting	✔	✔	✔	✔	✔
Renewable	✔	✔	✔	✔	✔
Distributed Generation	✔	✔	✔	✔	✔
Electrification	✔	✔	✔	✔	✔
Alternative Fuel	✔	✔	✔		✔

Impact of Air Quality-Related Energy Policy

The draft Policy contains a number of elements. It promotes zero and near zero emission strategies such as electrification and advanced natural gas based technologies (i.e., Policy #s 1, 2). It also calls for energy efficiency and conservation as well as load shifting (i.e., Policy #4) which can lower overall demand for energy. In addition, greater use of renewables (i.e., Policy #5) such as wind and solar are identified to help ensure that electricity generation to the extent practical will be sustainable and cleanest available. Distributed generation is also identified to reduce the need for peak loads supplied by large central power plants. Potential economic impacts of these key components of the policy are discussed below. Other items in the Policy largely reiterate existing SCAQMD programs and requirements.

Energy Efficiency and Conservation

Energy conservation is a demand side management strategy, which relies on changes in behavior of end-users (e.g., consumer product selection, building material and design, etc.) to reduce energy consumption. As such, conservation programs can be implemented through end-user incentives or regulations. These incentives include consumer education and changes to user costs.

The CARB analysis of the AB 32 Scoping Plan (CARB, 2008) showed a net savings of $5 billion from vehicle efficiency (light-duty gasoline passenger, and medium- and heavy-duty vehicles), building and appliance energy efficiency and conservation, refinery energy efficiency process improvement, and industrial boiler efficiency. In all instances, energy savings outweigh additional costs of devices and materials. The majority of affected entities that incur these costs also are the benefactors of the ensuing savings. Automotive service centers and test-only Smog Check service centers as well as consumers may incur additional equipment or device costs under the vehicle efficiency measure for light-duty passenger vehicles. It was assumed that the additional costs incurred by those service centers would be passed on to consumers; however, the ensuing fuel savings will also accrue to consumers.

Energy efficiency and conservation programs reduce energy costs, which makes businesses more competitive and allows consumers to save money. In addition, energy efficiency reduces the cost of meeting peak demand during periods of high temperatures and high prices. Overall, energy efficiency measures are cost effective compared to the cost of generation (CEC, 2009a).

California‘s building and appliance standards have saved consumers more than $56 billion in electricity and natural gas costs since 1978, which averted the building of 15 large power plants. It is estimated the current standards will save an additional $23 billion by 2013 (CEC, 2007a).

In its report, "Unlocking Energy Efficiency in the U.S. Economy," McKinsey & Co (McKinsey, 2009) stated:

> **"The central conclusion of our work:** Energy efficiency offers a vast, low-cost energy resource for the U.S. economy – but only if the nation can craft a comprehensive and innovative approach to unlock it. Significant and persistent barriers will need to be addressed at multiple levels to stimulate demand for energy efficiency and manage its delivery across more than 100 million buildings and literally billions of devices. If executed at scale, a holistic approach would yield gross energy savings worth more than $1.2 trillion, well above the $520 billion needed through 2020 for upfront investment in efficiency measures (not including program costs). Such a program is estimated to reduce end-use energy consumption in 2020 by 9.1 quadrillion BTUs, roughly 23 percent of projected (U.S.) demand, potentially abating up to 1.1 gigatons of greenhouse gases annually."

In 2009, U.S. EPA's ENERGY STAR efforts (U.S. EPA, 2010) helped Americans to:

- Save more than 200 billion kilowatt-hours (kWh)—about 5 percent of U.S. electricity demand.
- Prevent the emissions of 46 MMTCE of GHGs—equivalent to the annual emissions from 31 million vehicles.
- Save $17 billion on their energy bills.

The decline of building-related energy use per capita in past years had been attributed partially to improvements in the efficiencies of appliances and building shells. Efficiency improvements continue to play a key component in the projections of buildings' energy consumption (US EIA, 2011).

The CPUC Long Term California Energy Efficiency Strategic Plan (CPUC, 2011) outlines goals, timelines, and implementation strategies for efficiency measures within various sectors. Some of the goals outlined are:

- New construction will reach "zero net energy" (ZNE) performance (including clean, onsite distributed generation) for all new single and multi-family homes by 2020.

- 50 percent of existing buildings will be retrofit to zero net energy by 2030 through achievement of deep levels of energy efficiency and with the addition of clean distributed generation.
- Establish and maintain a knowledge base sufficient to support development of all available, cost-effective, reliable, and feasible energy efficiency, demand reduction (and renewable) energy resources.
- California regulations, financing mechanisms, and incentive programs affecting the management of energy, air and water resources, solid waste, and climate change will be coordinated to mutual advantage.
- Deliver integrated DSM options that include efficiency, demand response, energy management and self-generation measures, through coordinated marketing and regulatory integration.

Load Shifting

Electricity load shifting is also a demand side management strategy that reduces the demand for energy by shifting the timing of electricity demand away from peak electricity demand hours. By avoiding peak demand hours, generation at more efficient generation sources is used to satisfy the demand for electricity. For instance electrical vehicle charging at night could avoid peak demand hours during the day, reducing the need to add additional generation capacity. To avoid creating new peak demand periods, monitoring systems are being developed to dynamically switch charging or electricity use on or off based on demand or pricing information. Electricity storage is a central component of technology-driven load shifting strategies. Non-technology load shifting strategies rely on end-user incentives through education and electricity rate structure (CMAC, 2010).

CEC (CMAC, 2010) estimated that the lifecycle value (assuming 15 year project life) of the avoided cost of permanent load shifting would range from $500/peak kW to $2,500/peak kW.

Distributed Renewable Electricity Generation

Renewable electricity generation can better align local demand for and local supply of electricity, and minimize emissions as well. The goal is to provide sustainable source of energy with zero or near-zero emissions (i.e., Policy #5).

Renewables

California renewable energy sources are derived using sustainable biologic, climatic, hydrologic and geologic processes. CPUC has identified biogas, biomass, biodiesel, solar photovoltaic, solar thermal, wind, low impact hydrological, and geothermal technologies certified by the Western Renewable Energy Generation Information System (WREGIS) as eligible to participate in the Renewable Portfolio Standards program. The CPUC has identified Los Angeles, Riverside and San Bernardino Counties as locations with substantial renewable generating resource potential in wind and solar power (CPUC, 2009).

In order to implement 33 percent RPS and further reduce the demand for electricity, more intensive investment in renewable generation will be required (CPUC, 2010).

For each category of renewable energy, the cost and economic impacts of increasing its share in California's energy mix depends on several factors. The economic impacts of increased reliance on renewable energy sources depend mainly on the additional cost of production relative to the additional cost of non-renewable alternatives, the cost of distribution to end-users, and reliability. Generally, the cost of renewable energy resources is higher than non-renewable generation (CPUC, 2009). However, due to the high degree of variability in the price of natural gas, which is the main source of fuel for non-renewable generation in California, renewable generation provides an economic benefit equivalent to a decrease in generation costs of $0.02/KWH (CEC, 2007c).

In the absence of renewable energy investments and energy efficiency measures, the cost to utility providers of meeting the California demand for electricity would increase from $36 to $51 billion ($2008) from 2008 to 2020. Renewable energy investments without energy efficiency improvements would increase the cost of meeting the demand for electricity in 2020 to $55 billion ($2008). Improvements in energy efficiency would lower, to utility providers, the cost of meeting the forecast demand in 2020 by about $4 billion ($2008) in both cases. By combining renewable generation and energy efficiency measures, the cost of generation to utility providers would remain approximately the same as if no efficiency measures or renewable generation investments were undertaken.

However, as indicated by CPUC, investments in renewable generation and energy efficiency resulting from the 33 percent RPS would shift some of the cost of generation to retail consumers. For example, when a homeowner purchases a rooftop solar panel, the homeowner will bear some costs independent of those incurred by the utility provider. When the combined costs from all sources (customer and utility provider) are considered, renewable generation and energy efficiency would increase the cost of meeting the 2020 demand for electricity by approximately $4 billion ($2008) (CPUC, 2010).

The CO2 reduction goals envisioned in the AB 32 Scoping Plan are expected to rely heavily on decreased emissions in the electricity sector. Of the 30 MMTCO2e reductions from the electricity sector to be achieved by 2020, nearly half are expected to come from renewable generation. Wind, solar, and geothermal resources are forecast to result in three-quarters of CO2 reductions from renewable generation (CPUC, 2010).

The CEC concludes that renewable energy sources such as wind, solar, and biogas are essential components of an efficient electricity generation portfolio (CEC, 2007c).

CARB estimated that the 33 percent RPS would result in a net cost of $1.8 billion and a reduction of 21.3 $MMTCO_2e$ in 2020 (CARB, 2008). In addition, CEC (CEC, 2007c), estimated that the standard would reduce electricity generating costs in California by $6.8 billion in 2020, reduce CO_2 emissions by more than 31 million tons per year, and improve overall system reliability.

In its analysis of the 20 percent of retail electricity RPS standard by 2020 in New Mexico (adopted in 2007), Beacon Hill Institute (ATI & RGF, 2011), through the use of a tax model, projected that New Mexico's electricity prices would be 20 percent higher (The average retail price for all sectors in New Mexico was 8.4¢ per kilowatt hour in February 2011, as opposed to 13.08¢ in California)[4] and electricity consumers would pay $619 million more in 2020 due to the additional growth in renewable sources resulting from the RPS standard. It was projected that New Mexico would lose an average of 2,859 jobs in 2020 (The total jobs in New Mexico in 2009 was 1.07 million).[5]

Using the IMPLAN model, the Biobased Energy Analysis Group (BPC, 2009) analyzed the impacts of the two proposed federal RPS's (20 percent RPS under the Bingaman proposal versus 25 percent under the Markey proposal) on the Florida economy. Because both standards allowed the use of energy efficiency credits and alternative compliance payments as means of compliance, the actual percentage of renewable generation in the total electricity generation was much smaller, 4.8 percent in 2015 and 9 percent in 2025, respectively, for both standards. The difference in the impacts of both standards was fairly small. The electricity price under both standards was projected to rise since renewable technologies are more expensive than conventional ones. The price increase would reduce household expenditures on other goods and services. However, there would be positive employment impacts from investments in new technologies. These impacts also included feedstock production for renewable, shifts from traditional crops to dedicated energy crops and their harvesting, and livestock manure collection.

The renewable energy technology sector with $64,884 exports per job in 2009 was the most export-intensive sector, compared to $20,129 for the aggregate clean economy (Norris, 2011).

Many residents living near wind turbines have been concerned about their noise, aesthetics, danger (e.g., fire and obstruction), environmental damage (e.g., erosion and flooding from removing trees to make room for turbines), and effect on property values (L.A. Times, 2011b). Various design technologies are now in the pipeline to ensure that turbines be adapted to a wide range of terrains. As with solar panels, a balance of utility-scale versus urban projects for wind turbines may be needed (L.A. Times, 2011a).

The U.S. Energy Information Administration states "renewable energy sources will have to play a central role in moving the world onto a more secure, reliable, and sustainable energy path. The

[4]U. S. Energy Information Administration, Electricity [Data File], ~~Accessed~~ Retrieved August 4, 2011 from http://www.eia.gov/cneaf/electricity/epm/table5_6_a.html.
[5]U.S. Bureau of Economic Analysis, Regional Economic Accounts [Data File], ~~Downloaded~~ Retrieved August 4, 2011 from http://www.bea.gov/regional/reis/.

potential is unquestionably large, but how quickly they can contribute to meeting the world's growing energy needs hinges critically on the strength of government support to stimulate technological advances and make renewables cost competitive with other energy sources. Government support for renewables can, in principle, be justified by the long-term economic, energy security and environmental benefits they can bring, though it is essential that support mechanisms are cost-effective" (U.S. EIA, 2011).

Finally, it is important to emphasize that California, including the AQMD, is proceeding to add renewable energy production under both state law and regulation. The proposed AQMD policy is supportive of an existing state program and does not cause any known additional impacts at this time.

Distributed Generation

In the 2007 Integrated Energy Planning Report, the CEC states "the benefits of distributed generation go far beyond electricity generation. Benefits of DG include the reduced need to build new transmission and distribution infrastructure, reduced losses at peak delivery times, and protection against outages and brownouts. Other advantages include increased grid reliability, energy price stability, and reduced emissions, especially in industrial applications.

Large scale distributed generation such as combined heat and power, also referred to as cogeneration, is an efficient and cost-effective form of distributed generation. The Climate Change Scoping Plan has a target of adding 4,000 megawatts of combined heat and power capacity to displace 30,000 gigawatt hours of demand, thus reducing greenhouse gas emissions by 6.7 million metric tons of carbon by 2020.

California is promoting distributed generation technologies through such programs as the California Solar Initiative, the Self-Generation Incentive Program, the New Solar Homes Partnership program, and the Emerging Renewables Program, all of which support distributed generation on the customer side of the meter." (CEC, 2009a)

Customers have used distributed generation to reduce their use of grid-connected power during peak periods to allow electric utilities to reduce peak loads, provide ancillary services, and improve power quality. Distributed generation has shorter lead and construction times, reduces exposure to technology obsolescence, and can create local jobs (U.S. DOE, 2007).

SCAQMD's proposed policy supports existing state and national efforts to increase use of distributed generation and does not materially affect the economic impacts associated with potential distributed generation use as related to the overall strength of the Southern California economy. However, AQMD's grant funds do provide a small stimulus which can increase jobs associated with design, manufacture, and installation of distributed generation.

Zero- and Near-Zero Emission Technologies

The development and implementation of zero- and near-zero emissions technologies in both mobile and stationary source technologies is needed to meet attainment strategies set forth in Air Quality Management Plans (AQMP). In every AQMP since 1989, zero- and near-zero advanced technologies have been presented as control strategies in reducing NOx and other criteria pollutant emissions (~~AQMP~~AQMD, ~~multiple years~~1989, 1991, 1994, 1997, 2003 & 2007a). These technologies, identified in the AQMPs for NOx benefits and being reviewed by state agencies to meet GHG goals and fuel mileage standards, often utilize electrification of all or part of the systems and/or alternative fuels to a large degree. Some of the technologies presented in past AQMPs include fuel cells, hybrid-electric vehicles, advanced batteries, and use of alternative fuels such as natural gas, liquid petroleum gas, Fischer-Tropsch fuels, and di-methyl ether. CARB's development of the LEV III program later this year and the 2012 AQMP will further define proposed implementation strategy and associated economic impacts.

To help accelerate the implementation and commercialization of technology needs identified within the Air Quality Management Plans, the Clean Fuels Program was established in 1999. This AQMD program co-sponsors projects for low- and zero-emission technologies to achieve clean air standards in the Basin. Since its establishment in 1999, funding provided through the AQMD has amounted to $110.6 million with total project funding amounting to $386.2 million.

Electrification

Electrification of certain sectors, ~~most~~ especially in mobile source applications often provides energy efficiency gains along with zero- or near- zero emissions. For instance, electricity use provides an overall energy efficient gain as compared to internal combustion. Sectors such as transportation and goods movement would greatly benefit through the efficiencies provided through electrification.

The Ports of Los Angeles and Long Beach recently released their Roadmap for Zero Emissions (~~RZE~~POLB&LA, 2011). Within their roadmap zero-emission technologies are identified as a way to not only reduce port-related emissions but to also a significant strategy for helping reduce America's dependence on foreign oil. Analysis indicates that oil dependence, price volatility, and the setting of global oil prices by cartels have cost the U.S. economy $5.5 trillion since 1970 (MIT, 2010). SCAG recently issued a draft report regarding new technology alternatives, including potential zero- and near-zero emission options, for line-haul container freight with cost information. When the document is finalized, it could provide useful information for the 2012 RTP and the 2012 AQMP.

"Electrification of transportation through the use of plug-in electric vehicles and fuel cell vehicles coupled with a cleaner energy supply will become a central component of an efficient path to greenhouse gas emissions reductions and energy security. Electric retail rate reform and wholesale market price signals will be used to ensure that additional electrification minimizes infrastructure cost and maximizes both integration of renewable resources and GHG emissions impact, and California will develop the infrastructure and operational capabilities necessary to absorb a targeted 1,000,000 fully electric and plug-in hybrid-electric vehicles by 2020." (~~CCEF~~Cal Agencies, 2010)

Future technologies, in conjunction with a set of appropriate standards, might allow EVs to monitor real-time price signals from the utility and begin to charge when prices fall below a certain threshold. This would also allow the EV owner to set certain charging goals, for example, charging to 100% when the price is low, but only 50% when prices are high. Others have proposed charging signals that would allow charging based on the current load or availability of renewable energy. The latter would allow the realization of EVs charged almost entirely by renewable resources (MIT, 2010).

Alternative Fuel

CEC estimated that the 2007 State Alternative Fuels Plan would divert purchases from traditional petroleum fuels, resulting in projected avoided petroleum purchases of up to $19 billion in 2022 and $42 billion in 2050. Consumer and government spending will shift from the petroleum sector to 10 other sectors of the economy, including agriculture ($9 to $12 billion), the natural gas/propane industry ($8 billion), and chemical industries ($6 to $15 billion) in 2050 (CEC, 2007b).

The state of California has identified "alternative fuels vehicles will become a central component of an efficient path to GHG emissions reductions and energy security. California's transportation sector will be comprised of a portfolio of low-carbon fuel and vehicle technologies including battery and fuel cell electric drive vehicles, low carbon biofuels, increased vehicle efficiency, and natural gas and propane vehicles" (Cal Agencies, 2010).

The California Energy Commission showed that it is feasible to significantly reduce the state's dependence on petroleum by increasing vehicle efficiency and the use of alternative fuels and recommended that the state increase the use of nonpetroleum fuels to 20 percent of on-road fuel consumption by 2020, and 30 percent by 2030, based on identified strategies that are achievable and cost-beneficial (CEC, 2009a).

Economic Modeling

The draft Policy will promote and foster the development and application of zero- and near-zero emission technologies that are required to meet the federal ozone and PM2.5 standards. The AQMD has been using BenMAP for the health benefit assessment of clean air and the Regional

Economic Models, Inc. (REMI) for economic impact assessments of its regulations and major policies. The REMI model has been widely used for economic impact assessment of climate and energy options for a few states' climate action plans. McKinsey & Company used REMI to estimate the economic implications of energy and climate policies for the U.S. ICF International used BenMAP and REMI for the analysis of the Midwestern Greenhouse Gas Reduction Accord.

The use of REMI requires extensive input data. For the draft Policy, data requirements include capital and operating and maintenance expenditures on electric generation by fuel by technology, expenditures on and savings from energy efficient policies, expenditures on production and distribution systems as well as other infrastructure for alternative fuels, investment expenditures on new technologies for the renewable portfolio standards, and so on (ICF, 2010). Many of these data hinge on the control measures that the AQMD, CARB, SCAG, and potentially U.S. EPA will recommend during the AQMP development and implementation process. Control measures may consist of regulatory actions, incentive programs or simply recognition of the CEC or CPUC proceedings. A quantitative assessment will be provided for control measures in future AQMPs. As a control measure goes through the rulemaking process, more detailed assessments are performed by the implementing agency. No additional analysis would be provided to any state policy that is implemented for reasons other than air quality, although the AQMD may receive air quality co-benefits resulting from the implementation.

The implementation cost of the 2007 AQMP for compliance with the federal ozone (80 ppb) and PM2.5 standards was projected to be approximately $4 billion in 2023 when all the control measures would be implemented, compared to benefits (including health benefits) of $23 billion for the same year. The projection was performed for short-term quantified measures, short- and long-term measures, (i.e., the black box measures), as shown in Table 2.

Table 2: Projected Cost of the 2007 AQMP for 2023

Cost Category	Amount (in millions of 2000 dollars)
Total Cost	$3,963
Short-Term Quantified Measures	$2,138
NOx "Black Box" Measure	$1,665
Others*	$160

*Short-term unquantified measures and VOC "black box" measure

The cost of $1.7 billion for the NOx black box measure was based on a weighted average cost-effectiveness of $12,470 per ton of all pollutants across all quantified mobile source measures because the majority of NOx reductions in the black box come from mobile sources.

Achieving the current federal ozone standard of 75 ppb requires 224 tons of NOx reductions per day from the black box while approximately 244 tons of NOx reductions would be needed to achieve the potential new federal standard between 60 and 70 ppb.[6] Using the methodology for the socioeconomic analysis of the 2007 AQMP, it is projected that the annual costs of implementing the ozone standards of 75 and 60-70 ppb are $2 and $2.1 billion, respectively, as shown in Table 3.[7] Although the new ozone standard is not likely to be implemented until 2030, for the purpose of consistency with the 2007 AQMP, a more conservative projection relative to the year 2023 is presented here. As technology breakthroughs occur and become more commercially available, the cost of today's new technologies should gradually decline. However, as greater and greater levels of controls are required, control costs could increase absent significant technology advancement. It should be noted that the projected costs associated with the black box do not include the potential savings from energy efficiency and conservation activities.

Table 3: Projected Annual Cost of NOx Black Box by Ozone Standard

Ozone Standard	Cost (in millions of 2000 dollars)
80 ppb	$1,665
75 ppb	$1,955
60-70 ppb	$2,126

Based on the Socioeconomic Report for the 2007 AQMP, implementation of the federal ozone (80 ppb) and PM2.5 standards would reduce morbidity and mortality, improve visibility, increase expenditures on other goods and services in exchange for lower expenditures on refurbishing damaged materials, relieve traffic congestion, and increase crop yields. These benefits would make the region more attractive, thereby promoting economic growth. It was estimated that the total quantifiable benefit of achieving the federal standards would amount to $23 billion in 2023, as shown in Table 4.

Table 4: Quantified Benefits of Clean Air for 2023 in the 2007 AQMP

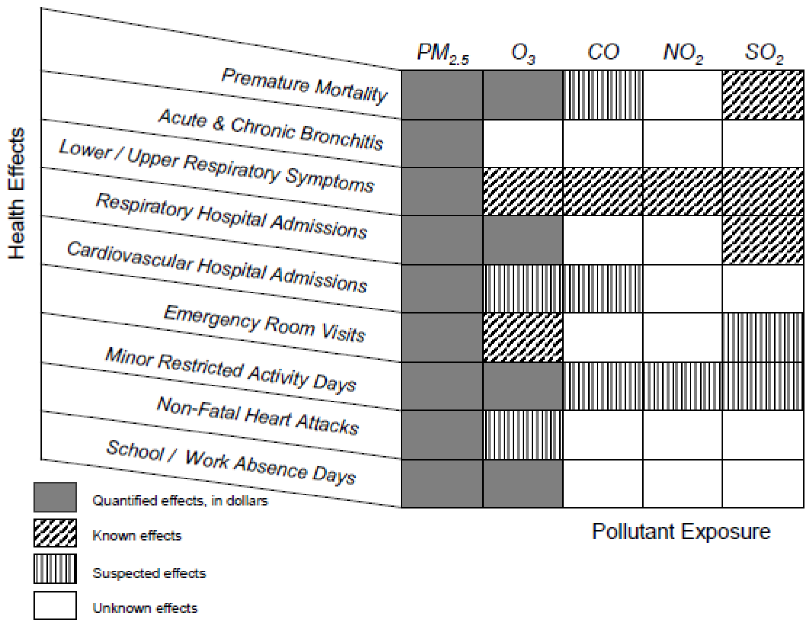
Benefit Category	Amount (in millions of dollars)
Total	$23,277
Reduction in Morbidity & Mortality	$16,011
Visibility	$5,587
Congestion Relief	$308
Reduced Materials Expenditures	$1,349
Increased Crop Yields	$23

[6]Subsequent to the AQMD SIP submittal, NOx reductions in the black box have been adjusted to reflect changes that CARB made to mobile sources. Specifically,, CARB has moved some short-term mobile source measures into the black box. For the purpose of comparison with the 2007 AQMP, the cost calculations for the black box herein were based on NOx reductions in the published AQMP documents. As a result of the CARB revision, the cost of the black box would be larger than what is presented herein. However, this revision does not change the total cost of the 2007 AQMP.

[7]A factor of 1.87 is used here to calculate emission reductions for the black box when the measure is implemented independently of other control measures in the AQMP.

There are many areas of benefits that have been identified, but cannot be quantified. Only 29 percent of the potential health impact areas (13 shaded cubes out of 45 in Figure 3) can be quantified in the 2007 AQMP. As the ozone standard becomes more stringent, it is expected that the benefit of the new standard will be larger than the $23 billion benefit assessed for the 2007 AQMP.

Figure 3: Health Effects of Criteria Pollutants



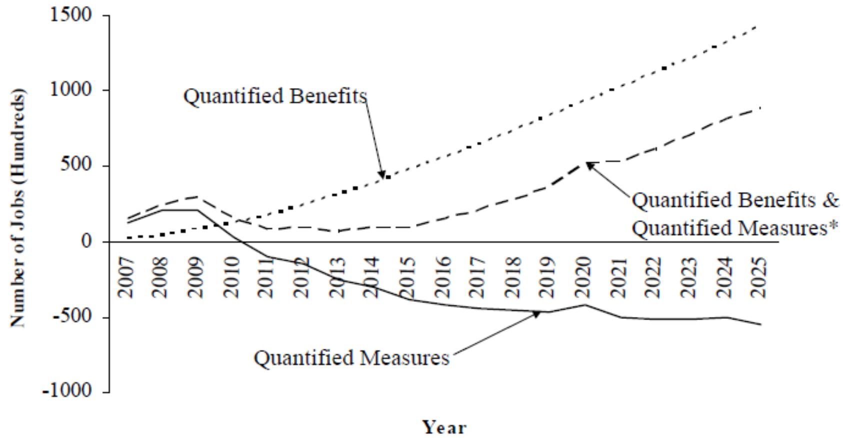
It was projected that the $23 billion benefit alone would result in 121,971 jobs created in 2023, as shown in Table 5. As the economy adapts to new, clean technologies, implementation of quantified control measures ($2.1 billion cost in 2023) would result in 51,693 jobs forgone in 2023.

Table 5: Job Impact of Clean Air Benefits and Quantified Measures for the 2007 AQMP

Category	Year 2023
Quantified Clean Air Benefits	+121,971
Reduction in Morbidity & Mortality	+50,327
Visibility	+50,900
Congestion Relief	+14,620
Reduced Materials Expenditures	+4,326
Increased Crop Yields	+679
Quantified Control Measures	-51,693

Figure 4 shows the four-county area would grow over time from ~~quantified~~ clean air benefits and quantified measures.

Figure 4: Job Impact Trends of Clean Air Benefits and Quantified Measures



*For illustration purposes, as the quantified cost analysis did not include long-term measures.

Table 6 shows the distribution of jobs impacts of ~~quantified~~ clean air benefits and quantified measures by industry in 2023. Mobile source reductions accounted for approximately 70% of these reductions and 90% of the quantified costs. As the four-county area becomes more attractive due to cleaner air, more people and businesses will move in and thus demand more consumer-related services, thereby resulting in additional jobs created across the board. Implementation of quantified measures would benefit manufacturers of transportation equipment and bring the additional cost of doing business to others. Sectors such as the construction industry would benefit from the heavy infrastructure investment. On the other hand, the same sector would be regulated by off-road mobile source measures, including CARB-adopted regulation. It should be noted that the majority of short-term mobile source measures quantified here have been adopted by CARB. As such, the job impacts related to these measures will be reflected in the future economic baseline as these measures are being implemented.

Table 6: Job Impacts by Industry for Quantified Clean Air Benefits and Quantified Measures for 2023

Industry	NAICS	Quantified Clean Air Benefits		Quantified Measures	
		Jobs	% Baseline	Jobs	% Baseline
Agriculture, Forestry, Fishing & Hunting	11	298	0.73	-5	-0.01
Mining	21	59	0.82	-36	-0.51
Utilities	22	286	1.19	-91	-0.38
Construction	23	11899	1.81	-4353	-0.66
Transportation Equipment Mfg.	336	469	0.68	238	0.34
Petroleum & Coal Products Mfg.	324	34	0.87	-24	-0.63
Other Manufacturing	31-33 ex. 324 & 336	8346	1.29	-1876	-0.29
Wholesale Trade	42	2892	0.8	-1095	-0.3
Retail Trade	44-45	9921	0.98	-4547	-0.45
Rail Transportation	482	37	0.83	-35	-0.8
Water Transportation	483	7	0.48	-78	-5.67
Truck Transportation	484, 492	-601	-0.34	-645	-0.37
Other Transportation & Warehousing	48-49 ex. 482-484 & 492	1062	0.56	-617	-0.32
Information	51	1550	0.47	-687	-0.21
Finance and Insurance	52	4501	0.93	-2049	-0.42
Real Estate and Rental and Leasing	53	6075	1.24	-2121	-0.43
Professional and Technical Services	54	7434	0.8	-3191	-0.34
Management & Support Services	55-56	9889	0.87	-3994	-0.35
Education, Health and Social Services	61-62	17677	0.97	-3625	-0.2
Arts, Entertainment, and Recreation	71	1639	0.46	-806	-0.23
Accommodation and Food Services	72	5367	0.73	-3141	-0.43
Other Services	81	4293	0.69	-3113	-0.5
Government	92	28837	2.37	-15,800	-1.3
Total		**121971**	**1.08**	**-51,693**	**-0.46**

The estimated cost of the NOx black box measure for the potential new federal ozone standard is projected to be $2.1 billion in 2023 (using existing AQMP data). Many, if not all, of the cost can be attributed to mobile sources, which requires substantial infrastructure buildup and could be similar, in scale, to the transportation projects in the transportation control measures (TCM) of the 2007 AQMP. The 2007 AQMP has shown that approximately 1,240 jobs would be created from constructing HOV lanes, intelligent transportation and control systems, and public transit infrastructure as a result of the annual investment of $430 million in the TCMs. The draft Policy and the required NOx reductions in the black box mostly affect mobile sources. In addition, 90 percent the cost of quantified short-term measures was attributed to mobile sources. As such, the magnitude of the job impact projected for the TCMs in the 2007 AQMP serves as a credible surrogate for the anticipated job impact of the black box. Therefore, it is inferred that the cost of the black box would not create significant jobs forgone in the local economy.

A detailed assessment of the impact of the black box measure cannot be performed without key assumptions and detailed data. The assessment herein will be refined as more data becomes available during the RTP and AQMP.

Summary & Conclusion

The draft Policy outlines several programs that are being developed and implemented at the federal and state levels. To the extent that these programs are implemented in the Basin, the associated co-benefit would be realized. In addition, the draft Policy provides an integrated strategy to attain the health-based air quality standards while achieving other environmental objectives simultaneously. Based on existing studies, the economic evaluation herein discusses various means to promoting zero- and near-zero emission strategies to help achieve the requisite NOx emission reductions in order to meet the federal ozone and PM standards. The results of these studies would guide the AQMD as it takes actions in developing the AQMP and implementing control measures.

The implementation cost of total emission reductions required to achieve the federal air quality standards (80 ppb ozone and 35 $\mu g/m^3$ PM2.5) was estimated to be $4 billion in 2023 in the 2007 AQMP, of which approximately $1.7 billion was attributed to the intended NOx emission reductions contained in the "black box." In 2023, the required NOx emission reductions in the black box were 190 tons per day. Zero- or near-zero emitting technologies are needed to achieve reductions in the black box. Otherwise, substitute strategies must be found or the Basin will face sanction. If a sanction is triggered, the offset ratio for new and modified sources will become 2 to 1 instead of 1.2 to 1 for VOC and NOx. Furthermore, billions of highway funding to this region will be cut off while the U.S. EPA is preparing its Federal Implementation Plan to bring the Basin into compliance.

The quantified clean air benefit for the 2007 AQMP was projected to be $23 billion in 2023. There are many areas of benefits that have been identified, but cannot be quantified. Furthermore, as the ozone standard becomes more stringent, it is expected that the benefit of the new standard will exceed the $23 billion estimate.

Despite the vast amount of data requirements to quantitatively assess economic impacts of the necessary NOx reductions, the AQMD has made a rough estimate of the cost of the black box at $2.1 billion in 2023 in order to achieve the potential new federal ozone standard. As technology achieves its breakthrough and becomes more commercially available, the cost of today's new technologies should gradually decline. For this reason, it is essential to begin the research and development effort to help promote zero- or near-zero technologies so as to make them readily available. It should be noted that the projected costs associated with the black box do not include the potential savings from energy efficiency and conservation activities.

Many, if not all, of the required black box NOx reductions can be attributed to mobile sources, which requires substantial infrastructure buildup. The 2007 AQMP has shown that expenditures on infrastructure in the transportation control measures would result in job creation. As such, it is inferred that the cost of the black box would not create significant jobs forgone in the local economy.

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