



2022 AQMP, Socioeconomic Report, and CARB State Strategy for the SIP



Board Meeting

October 7, 2022

Outline

Current Status of 2022 AQMP

CARB State Strategy for the SIP

- Presentation by Edie Chang, Deputy Executive Officer, CARB

2022 AQMP Draft Socioeconomic Report

Cost-Effectiveness

Zero Emissions Scenario/Black Box

Next Steps

Current Status

- o Since the August Governing Board:
 - o Published Revised Draft 2022 AQMP and Responses to Comments
 - o Held two meetings of the Advisory Council and one meeting of the Scientific, Modeling, Peer Review Advisory Group
 - o Continued public outreach/meetings
- o Draft socioeconomic analysis released October 1
- o Public comment period deadlines:
 - o Revised Draft AQMP: October 18, 2022
 - o Draft Socioeconomic Report: November 2, 2022
- o Materials available at <http://www.aqmd.gov/2022aqmp>



CARB Presentation on Strategy for the State Implementation Plan

Draft Socioeconomic Report

- The Draft Socioeconomic Report evaluates potential control measure costs/benefits in a more refined analysis than preliminary analysis shown in Revised Draft 2022 AQMP
 - Control costs
 - Public health benefits (e.g., premature deaths avoided)
 - Jobs impact
 - EJ analysis
- Subsequent rulemaking to implement control measures will conduct even more refined analysis based on information available at that time

Control Measure Costs

South Coast AQMD Control Measures	Average Annual Amortized Cost, 2023-2037 (Millions of 2021 dollars)
L-CMB-06: Electric Generating Facilities	\$267
MOB-11: Emission reductions from incentive programs	\$155
L-CMB-04: Large Internal Combustion Emergency Standby Engines	\$153
R-CMB-04: Residential Other Combustion	\$125
C-CMB-04: Small Internal Combustion Engines (Non-permitted)	\$123
C-CMB-05: Miscellaneous Small Commercial Combustion Equipment (Non-permitted)	\$110
L-CMB-02: Large Boilers and Process Heaters	\$73
C-CMB-03: Commercial Cooking	\$72
R-CMB-03: Residential Cooking	\$19
L-CMB-03: Large Internal Combustion Prime Engines	\$15
MOB-05: Accelerated retirement of older light-duty and medium-duty vehicles	\$15
L-CMB-07: Petroleum Refining	\$8
L-CMB-10: Miscellaneous Combustion	\$6
CTS-01: Further Emission Reduction from Coatings, Solvents, Adhesives, and Sealants	\$5
FUG-01: Improved Leak Detection and Repair	\$4
L-CMB-05: Large Turbines	\$2
L-CMB-08: Landfills and POTWs	\$1
L-CMB-01: NOx RECLAIM	\$1
L-CMB-09: Incineration	<\$1
Total	\$1,155*

CARB Control Measures	Average Annual Amortized Cost, 2023-2037 (Millions of 2021 dollars)
Cleaner Fuel and Vessel Requirements for Ocean-Going Vessels	\$359
Zero-Emission Standard for Space and Water Heaters	\$251
Advanced Clean Fleets Regulation	\$231
Cleaner Fuel and Visit Requirements for Aviation	\$192
Airport Aviation Emissions Cap	\$174
Cargo Handling Equipment Amendments	\$118
Zero-Emissions Trucks Measure	\$105
In-Use Locomotive Regulation	\$84
Transport Refrigeration Unit Regulation Part 2	\$64
Commercial Harbor Craft Amendments	\$39
Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation	\$39
Off-Road Equipment Zero-Emission Standards Where Feasible	\$22
Tier 5 Off-Road Vehicles and Equipment	\$11
Off-Road Equipment Tier 5 Standard for Preempted Engines	\$8
On-Road Motorcycle New Emissions Standards	\$7
More Stringent NOx and PM Standards for Ocean-Going Vessels	\$4
Consumer Products Standards	\$4
On-Road Heavy-Duty Vehicle Low-NOx Engine Standards	\$3
Spark-Ignition Marine Engine Standards	\$1
Clean Miles Standard	-\$18
Total	\$1,695*

*Significant costs will continue after 2037. For South Coast AQMD measures, less than a quarter of all incremental costs are incurred by 2037.

Zero Emissions Infrastructure Costs

Zero Emission Equipment

- Hardware
- Installation
- Operations and maintenance
- Building electrification
- Stationary source ZE equipment

Included in AQMP Socioeconomic Report

Improvements to Energy Systems

- Energy supply
 - Power plants
 - Microgrids
- Regional transmission
- Local distribution

Generally not included in AQMP Socioeconomic Report

Soft Costs

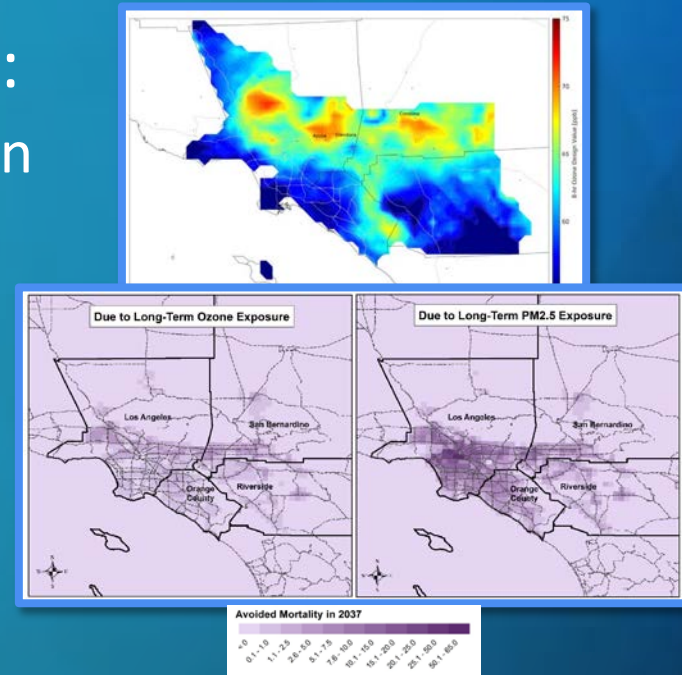
- Land use
 - Site acquisition, site re-design, easements, etc.
- Opportunity costs
 - Permitting delays, malfunctions with new technology, etc.
- Employee training
- Future-proofing
 - Overbuilding infrastructure to prepare for future changes
- Stranded assets
 - New plug technology replacing older plugs
- Climate resiliency

Generally not included in AQMP Socioeconomic Report

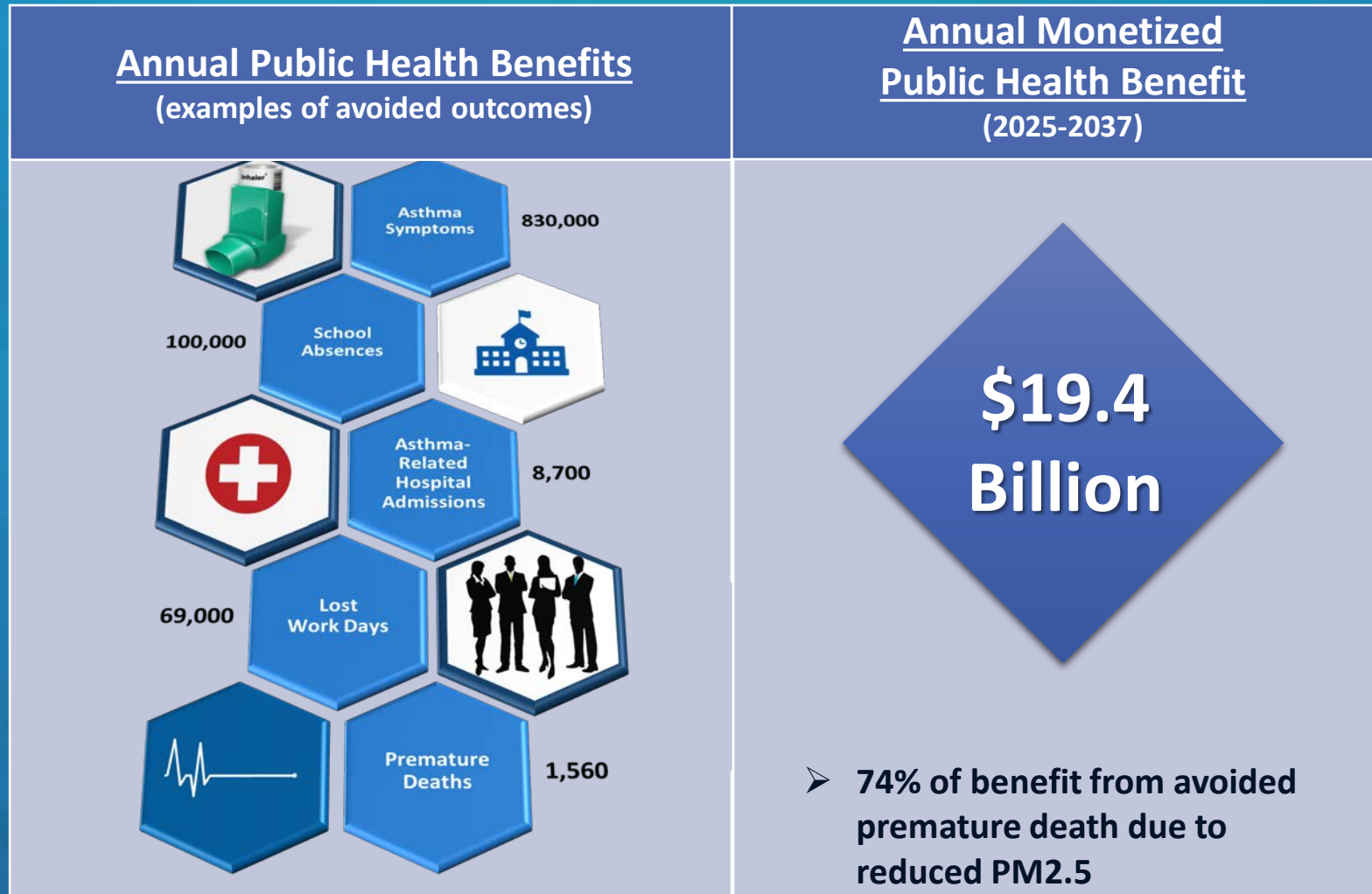
Increased Uncertainty in Cost Estimates

Public Health Benefits

- Primary purpose of AQMP is to improve air quality and public health
- Public health benefits assessed using U.S. EPA methods:
 - Model air quality improvement due to AQMP implementation
 - Model health benefits using U.S. EPA's BenMAP
- Benefits are converted to dollars based on standard methods used by U.S. EPA, CARB, etc.
 - Avoided premature death, reduced asthma, etc.
 - Focus of 2022 AQMP is ozone, but most measures will also reduce PM2.5
 - PM2.5 tends to have higher public health impacts than ozone



Public Health Benefit Analysis Draft Results

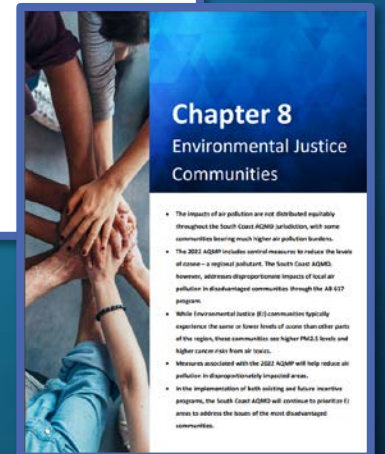
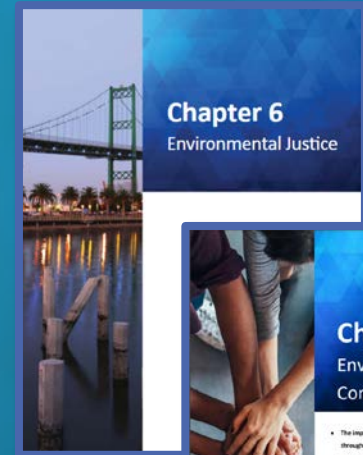


Jobs Impacts

- Almost 29,000 jobs will be foregone on an annual average
 - Companies, organizations, households will allocate more budget to invest in air quality controls and clean technologies
 - Creates jobs for clean technology and control suppliers, but they are not necessarily based in Southern California
- More than 11,000 jobs will be gained on an annual average
 - Some sectors benefit from air quality controls (e.g., electric utilities)
 - Benefits of improved air quality also improve quality of life and economic output of the region
- On the net, draft results show an annual average of 0.16% of jobs foregone between 2023-2037 in an economy with more than 10 million jobs
 - Analysis does not consider any significant increases in government funding to offset costs

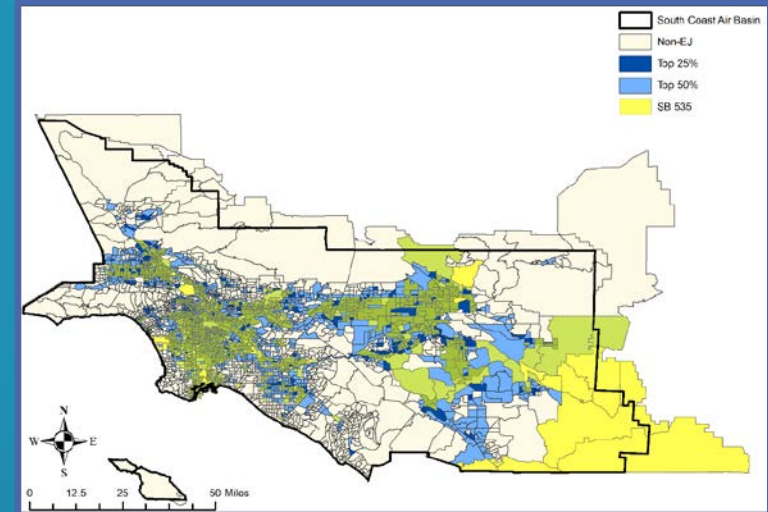
Environmental Justice Analysis

- Environmental Justice (EJ) is a critical component of all South Coast AQMD programs
- 2022 AQMP provides a unique opportunity to conduct a holistic analysis of how efforts to achieve federal air quality standards impact EJ communities
 - Chapter 8 of Revised Draft 2022 AQMP evaluates impact of plan broadly on EJ communities and provides high level overview of South Coast AQMD EJ programs
 - Chapter 6 of Draft Socioeconomic Report provides detailed statistical analysis of how control measures would affect health risk inequities in EJ communities



Key Results of EJ Analysis

- EJ communities* in South Coast AQMD are disproportionately affected by PM2.5, relative to non-EJ communities
 - Ozone tends to be higher in non-EJ communities
- After considering both PM2.5 and ozone, EJ communities are expected to see 10%-15% better improvement relative to non-EJ communities



**Many definitions are possible for an 'EJ community' (e.g, SB 535 Disadvantaged Communities based on CalEnviroScreen). The Draft Socioeconomic Report analyzed the impact of using several different parameters to describe EJ communities.*

Cost Effectiveness

Background

- California Health & Safety Code requires consideration of cost-effectiveness of control measures in the AQMP
 - Must evaluate cost-effectiveness of each control measure to the greatest extent possible
 - Control measures must be ranked by cost-effectiveness
- Cost-Effectiveness is the total cost (capital and annual operating costs) to achieve a standard over the emission reductions for the life of the equipment *compared to a business-as-usual scenario*

$$\text{Cost-Effectiveness} = \frac{\text{Total Costs}}{\text{Tons of Emissions Reduced}}$$

High and Low Cost-Effectiveness Scenarios

High Cost-Effectiveness

Low Cost with
Very Low Reductions

$$\frac{\$50,000}{0.5 \text{ ton}}$$

High Cost with
Moderate Reductions

$$\frac{\$1,000,000}{10 \text{ tons}}$$

Cost-Effectiveness
\$100,000/ton

High cost-effectiveness does not
necessarily mean high cost

Low Cost-Effectiveness

Low Cost with
Moderate Reductions

$$\frac{\$50,000}{10 \text{ tons}}$$

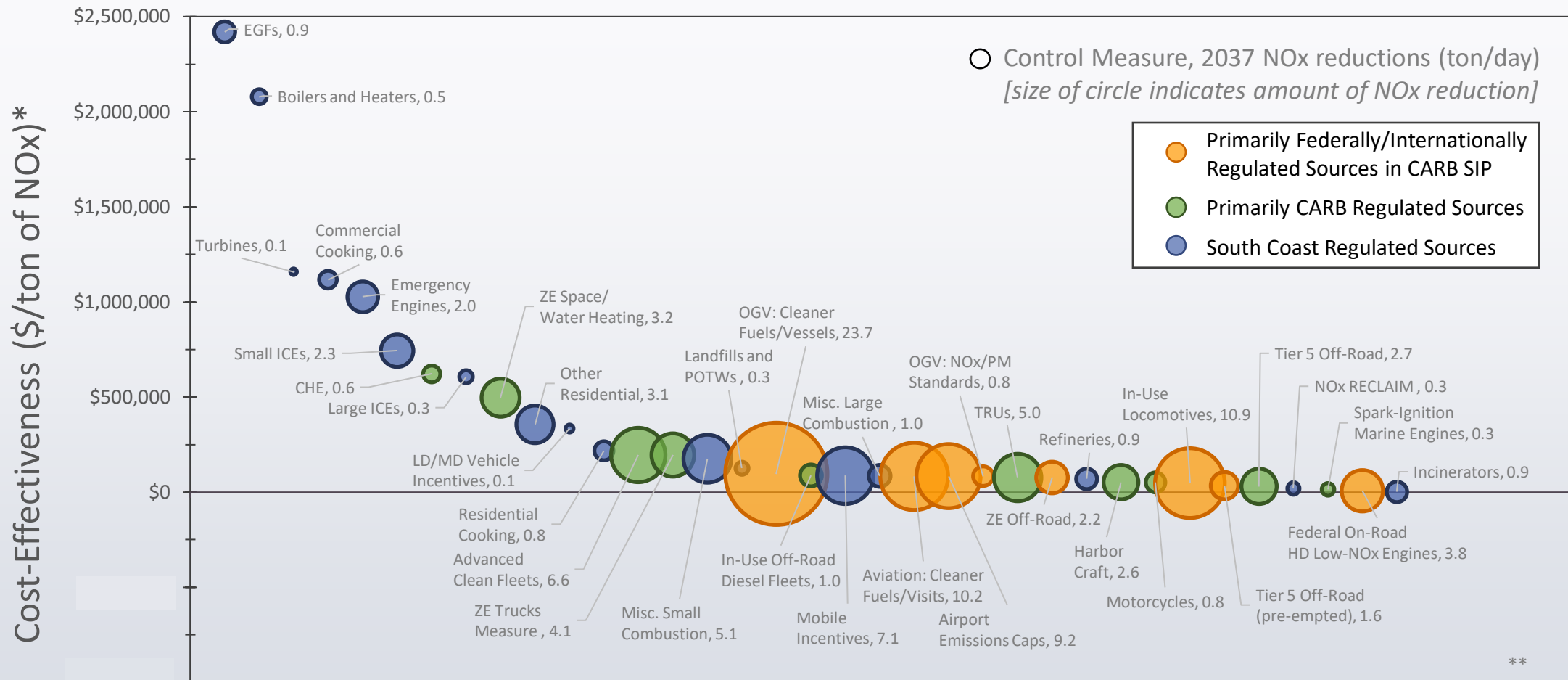
High Cost
Very High Reductions

$$\frac{\$1,000,000}{200 \text{ tons}}$$

Cost-Effectiveness
\$5,000/ton

Low cost-effectiveness does not
necessarily mean low cost

Control Measure Cost-Effectiveness and NOx Emission Reductions



*Using Levelized Cash Flow Method
(modified for costs incurred through 2037)
**Clean Miles Standard, [0.1 tpd] (not shown)
has a cost savings

Control Measures Ranked by Cost-Effectiveness

Requirements for Cost Effectiveness Under the Health and Safety Code

2022 AQMP

Requires cost-effectiveness analysis of each control measure to the greatest extent possible

Requires that control measures are ranked by cost-effectiveness

Rulemaking

Must account for economic impacts when establishing BARCT standards

Requires cost-effectiveness analysis when establishing BARCT

AQMP Control Measure
Initial cost-effectiveness estimate



Proposed Rule
Comprehensive cost-effectiveness analysis

Cost-Effectiveness Analysis in Rulemaking

Comprehensive cost-effectiveness analysis conducted when establishing BARCT standards during rulemaking

Capital Costs (One-Time Costs)

- Equipment costs
- Installation costs
- Permitting fees

Annual Costs (Recurring Costs)

- Labor and maintenance
- Fuel, Electricity, etc.
- Source Testing
- Monitoring, Reporting, and Recordkeeping
- Catalyst, filters or other materials for pollution controls

Bottom-Up Approach

- Facility-specific information where available
- Use actual cost data where available from affected facilities and equipment vendors

Other Considerations

- Stranded assets
- Cost savings
- Equipment life

Cost-Effectiveness Threshold for Rulemaking

- Comprehensive cost-effectiveness analysis will continue to be conducted during rulemaking
- To guide rulemaking efforts, previous AQMPs included cost-effectiveness thresholds to assess the cost-effectiveness of a proposed rule
- If the average cost-effectiveness exceeded the threshold, previous AQMPs suggested that the rulemaking include:
 - A more comprehensive cost-effectiveness analysis (e.g., incremental, etc.)
 - Alternatives to lower the cost
 - Additional public meetings
- Draft 2022 AQMP proposed a cost-effectiveness threshold of \$59,000/ton of NO_x reduced, which is based on past AQMP costs adjusted to inflation
- Some Board members expressed concern that \$59,000/ton may be too low
 - Particularly when considering the cost-effectiveness of measures in the 2022 AQMP

Alternative Cost-Effectiveness Threshold

- Staff is proposing an alternative cost-effectiveness threshold based on public health benefits instead of cost of pollution controls
- Public health benefits threshold monetizes public health impacts associated with specific air contaminants such as:
 - Premature deaths, lost school and work days, hospital admissions, respiratory and cardiovascular symptoms
- Public health benefits threshold:
 - Accounts for health impacts and overall benefit to society from improved air quality
 - Used by U.S. EPA and CARB for rulemaking



Proposed Public Health Benefits Threshold

- Proposing a Public Health Benefit Screening Threshold of \$325,000/ton of NOx reduced
- Public Health Benefits Threshold is based on nationwide U.S. EPA studies and 2016 AQMP
- Threshold would be used as a guide for evaluating the:
 - Cost-effectiveness and incremental cost-effectiveness for stationary and mobile source rulemakings
 - If cost-effectiveness or incremental cost-effectiveness of the proposed rule exceeds the threshold, public meeting would be required
- Public meeting would identify alternatives to reduce the cost-effectiveness

Staff Recommendation for Rulemaking Cost-Effectiveness Threshold

- Staff is recommending use of the Public Benefit Screening Threshold as guide for cost-effectiveness for future rulemakings
- Benefit-Cost approach is consistent with how U.S. EPA and CARB evaluate costs associated with development of their regulatory programs
- Reflects the social cost associated with air pollution
- During rulemaking staff will continue to seek maximum reductions while minimizing costs
 - All proposed rulemakings and their cost-effectiveness and incremental cost-effectiveness will continue to be presented to the Board for their consideration

Zero Emissions Scenario/Black Box

Zero Emission AQMP

During August Board meeting
numerous commenters
requested additional zero
emission measures to avoid
reliance on “black box”

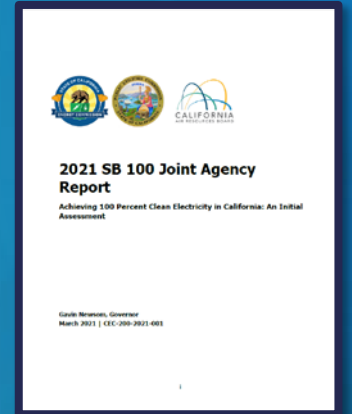
Board directed staff to consider
a Plan that maximizes zero
emission measures and
minimizes the black box

Current Draft Plan is a Zero Emission Plan

- Contains aggressive control measures to push deployment of zero emission technologies across all sectors *wherever feasible*
 - Zero emission technologies not feasible for certain applications
 - Examples: industrial processes that require high temperature combustion, trans-pacific shipping, etc.
- Aggressive approach required to achieve the 67% reduction in emissions needed to meet the ozone standard
- Current draft plan results in about 40-80% emission reduction in each stationary and area source category (62% overall 2018-2037)
 - These sources have already been reduced by 61% between 2000-2018 and are already subject to stringent controls

Implications of Zero Emissions Scenario – Electric Grid

- CEC, CPUC, and CARB studied impacts to grid from statewide policies focused on decarbonization
- Electric generation capacity *needs to approximately double* in next two decades (SB100 report)
 - Average of 6 to 7 GW of new generation every year statewide
 - 8 to 9 GW per year for 100% electricity generation with no combustion
 - In past decade, the average new solar + wind addition is 1.3 GW per year, with a max annual increase of 3.7 GW
- Electrification will play significant role with zero emissions, but hydrogen's role is still emerging
 - Fuel cell vehicles, stationary applications, electrical grid support

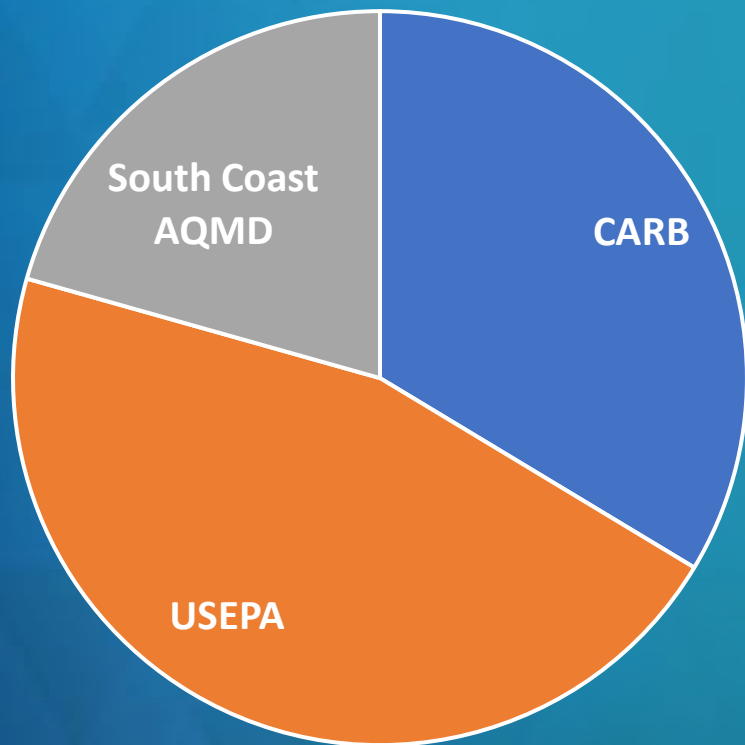


<https://www.energy.ca.gov/publications/2021/2021-sb-100-joint-agency-report-achieving-100-percent-clean-electricity>

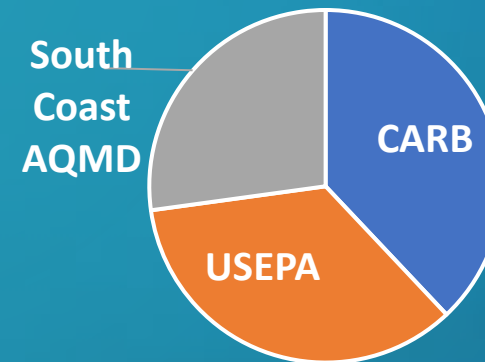
South Coast AQMD will continue to support state efforts to estimate costs from this transition

Emissions under South Coast AQMD Authority are a Fraction of Overall Emissions

2037 Baseline NOx Emissions
(184 tons per day)



2037 Attainment NOx Emissions
(60 tons per day)

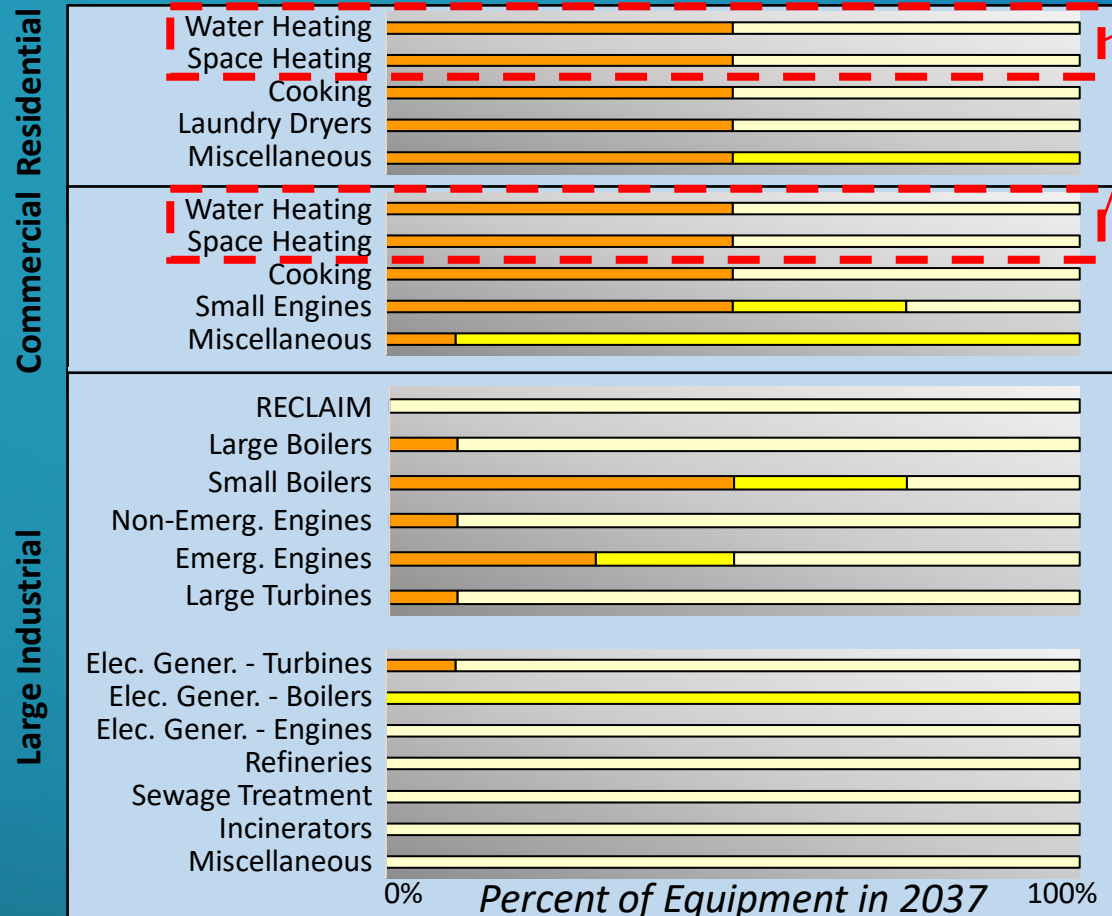


This shows remaining emissions from the attainment scenario. Reductions are already assigned to USEPA through Black Box and CARB's measures

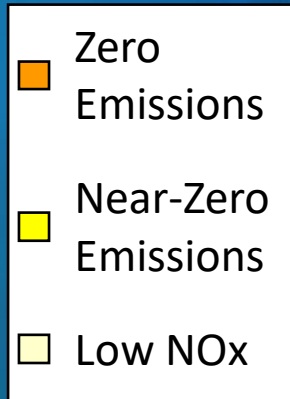
Current Control Measures are Aggressive, but are also Achievable/Feasible

- 100% ZE technology pursued broadly in all sectors
 - Where feasible
 - ZE technology will continue to be pursued to the greatest extent during rulemaking
- Control measures are legal commitments to USEPA on what can actually be achieved
 - Would have to find additional emission reductions to make up for the shortfall if not achieved

South Coast AQMD Stationary & Area Source Control Measures*

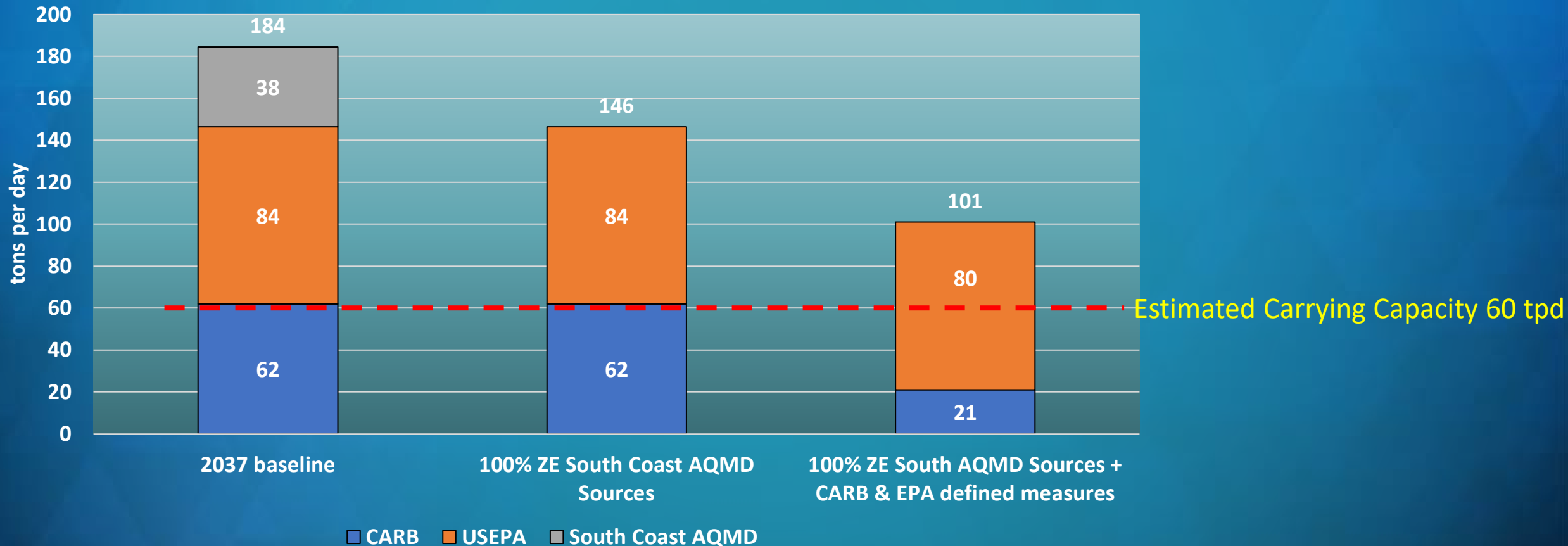


CARB proposing 100% ZE phase-in starting 2030



Eliminating All South Coast Emissions Will Not Be Enough to Attain

South Coast Air Basin NOx emission in 2037

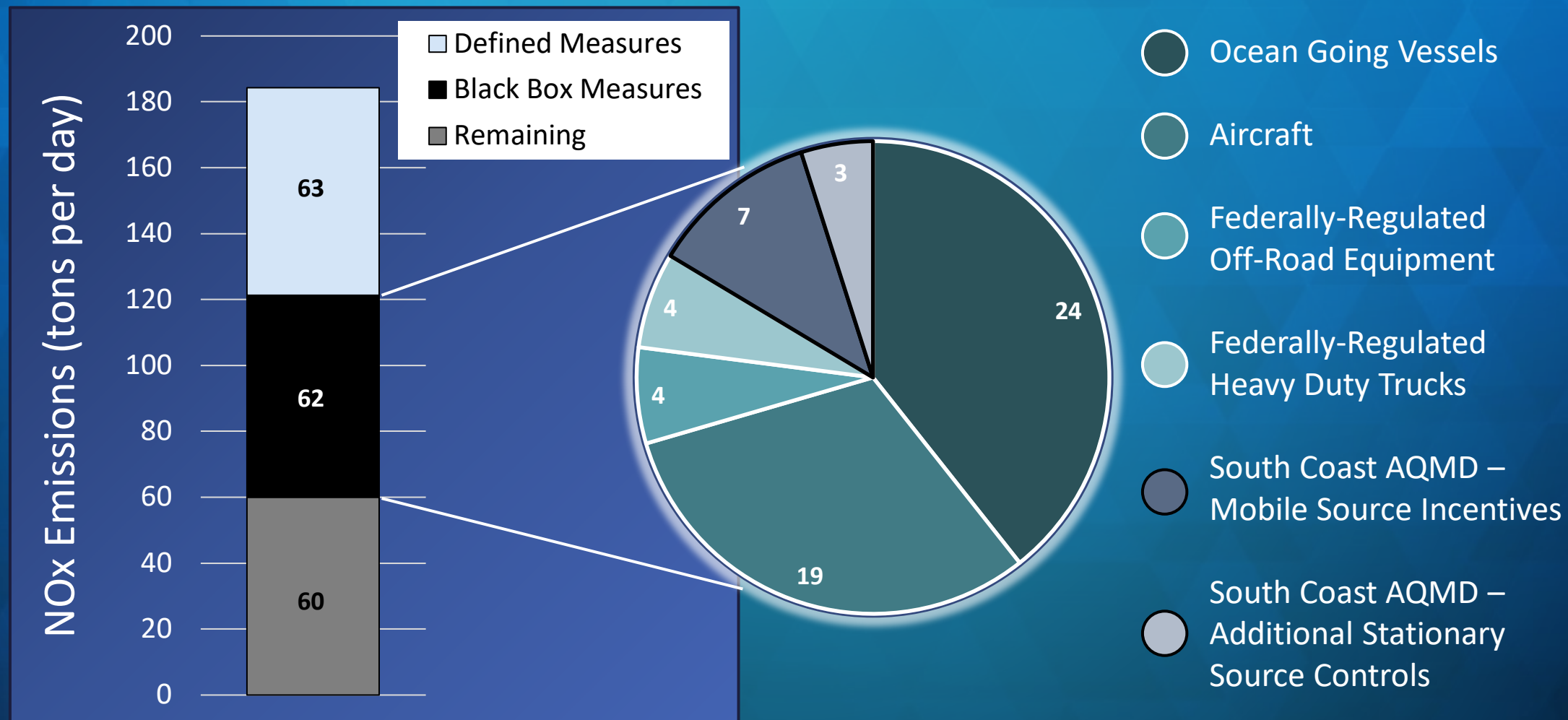


Impacts of a Zero Emission South Coast Plan

- AQMP likely wouldn't be approvable by USEPA
 - Would need to show sufficient funding to provide for/feasibility of control measures
 - Hypothetical screening level analysis possible outside of AQMP
- AQMP would be even more expensive
 - Costs for zero emissions could be four to twenty times more expensive than conventional control technologies
- There will be stranded assets
- The money spent to zero out the remaining South Coast stationary sources could achieve greater emission reductions from mobile sources
- Overall additional emission reductions benefit beyond Revised Draft AQMP = ~17 tpd
 - In comparison, black box reductions = 62 tpd

What is in the “Black Box”?

Vast majority of black box emissions are from CARB measures which South Coast cannot change



Federal Action is the Only Way to Attain

- Prior reliance on black box measures hasn't resulted in attainment because the federal government has failed to do its share
 - Federal rules for heavy-duty mobile sources largely untouched the past 20 years
- Emissions under South Coast direct authority will have been reduced by 85% from 2000 through 2037 once the AQMP is fully implemented
- It is impossible for the region to meet the standard even if South Coast sources are eliminated without additional federal action.

Next Steps



Submission to USEPA

Early 2023 (USEPA must act on Plan <18 months after submission)



CARB Public Hearing

Early 2023



South Coast AQMD Public Hearing

December 2, 2022



South Coast AQMD Regional Public Hearings

October – November, 2022



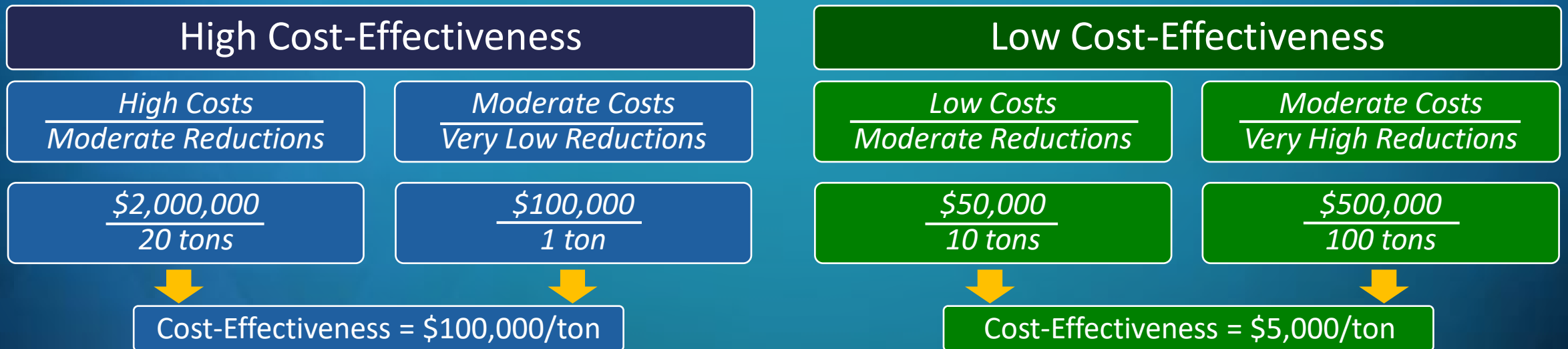
Released Revised Draft AQMP/Draft Socioeconomic Report
September 2, 2022/September 30, 2022

Background

- Cost-Effectiveness is the total cost (capital and annual operating costs) over the emission reductions for the life of the equipment

$$\text{Cost Effectiveness} = \frac{\text{Cost of Controls}}{\text{Tons of Emissions Reduced}}$$

- High cost-effectiveness does not necessarily mean high cost
- Low cost-effectiveness does not necessarily mean low cost





2022 State Strategy for the State Implementation Plan

Edie Chang, Deputy Executive Officer

October 7, 2022

70 ppb Challenge Across the State

- EPA revised the 8-hour ozone standard to 70 ppb in 2015
- 19 nonattainment areas in California
 - Attainment years 2020-2037
- 10 areas classified Moderate+ and must submit SIPs
- San Joaquin Valley and South Coast most challenging
- 7 areas need new emission reduction commitments



2022 State SIP Strategy

- CARB approved on September 22, 2022
- Includes unprecedented variety of new State measures to reduce emissions using all mechanisms available
- Identifies the level of action needed to meet air quality standards and protect public health
- Drives pace and scale of CARB rulemakings
- Identifies federal actions needed in the South Coast

Proposed
2022 State Strategy for the State Implementation
Plan

August 12, 2022



2022 State SIP Strategy Measures

On-Road

- Advanced Clean Fleets Regulation
- Zero-Emission Trucks
- On-Road Motorcycle New Emissions Standards
- Clean Miles Standard*
- Enhanced Regional Emission Analysis in State Implementation Plans

Off-Road

- Tier 5 Off-Road Engine Standard
- Amendments to In-Use Diesel-Fueled Fleets Regulation
- Zero-Emission TRU Part II
- Commercial Harbor Craft*
- Cargo Handling Equipment
- Off-Road Zero-Emission Targeted Manufacturer Rule
- Clean Off-Road Fleet Recognition Program
- Spark-Ignition Marine Engine Standards

Primarily Federally-Regulated

- In-Use Loco Regulation
- Future Measures for Aviation Emissions Reductions
- Future Measures for OGV Emissions Reductions

Other

- Consumer Products Regulation Amendments
- Zero-Emission Standard for Space and Water Heaters
- Pesticides: 1,3-D



Approved Measure Schedule

Measures	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Enhanced Regional Emission Analysis in SIPs																	
Clean Miles Standard	★																
Commercial Harbor Craft Amendments		★															
Amendments to the In-Use Off-Road Diesel Fueled Fleets		★															
Pesticides: 1,3-Dichloropropene Health Risk Mitigation		★															
On-Road Motorcycle New Emissions Standards		★															
Advanced Clean Fleets			★														
In-Use Locomotive Regulation			★														
Cargo Handling Equipment Amendments					★												
Clean Off-Road Fleet Recognition Program					★												
Tier 5 Off-Road Vehicles and Equipment					★												
Zero-Emission Standard for Space and Water Heaters					★												
Transport Refrigeration Unit Regulation Part 2						★											
Consumer Products Standards							★										
Future Measures for Aviation Emission Reductions							★										
Off-Road Zero-Emission Targeted Manufacturer Rule							★										
Future Measures for OGV Emission Reductions							★										
Zero-Emissions Trucks Measure								★									
Spark-Ignition Marine Engine Standards									★								



Federal Actions Needed



On-Road Heavy-Duty Vehicles

- Low-NOx Engine Standards
- Zero-Emission Engine Standards



Off-Road Equipment

- Tier V Standards
- Zero-Emission Standards Where Feasible



Locomotives

- More Stringent National Emission Standards
- Zero-Emissions Standards for Locomotives
- Address Unlimited Locomotive Remanufacturing



Ocean-Going Vessels

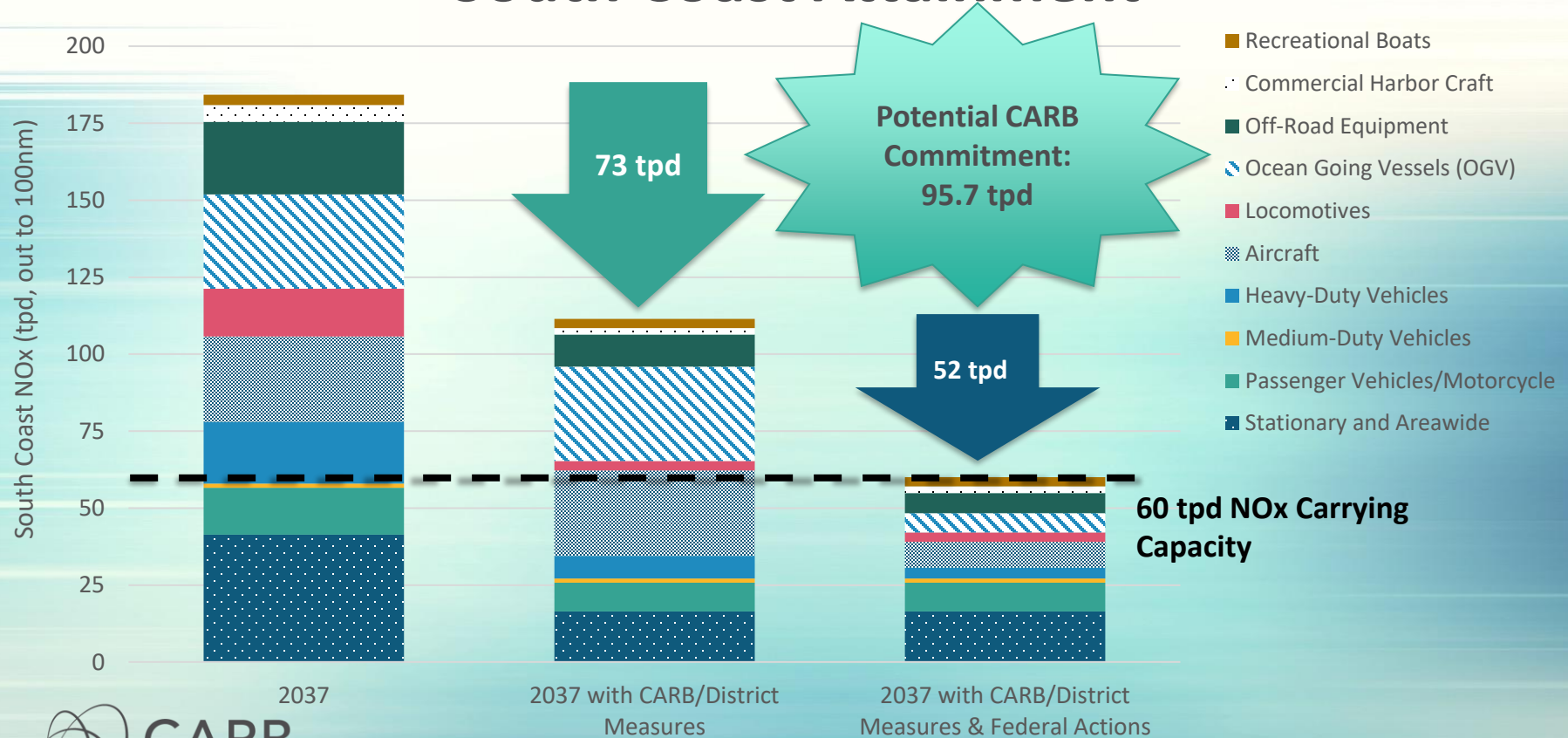
- More Stringent NOx and PM Standards Requirements
- Cleaner Fuel and Visit Requirements



Aviation

- More Stringent Engine Standards
- Cleaner Fuel and Visit Requirements
- Zero-Emission Airport On Ground Support Requirements
- Airport Aviation Emissions Cap

State SIP Strategy Supporting South Coast Attainment



State Approach to Economic Analysis



PROPOSED
MEASURES



COST
ESTIMATES



ECONOMIC IMPACT
ANALYSIS

Statewide Economic Impacts

Category of Cost or Benefits	Value
Total Amortized Cost of Control Measure Through 2037 (Billion 2021\$)	\$96.18
Average Annual Amortized Cost (Billion 2021\$)	\$8.84
Cumulative NOx Reduction (Million tons through 2037)	1.04
Average Annual Job Impacts (From 2023 through 2037)	-53,000
Cost-Effectiveness (\$ per ton of NOx)	\$92,000

Health Impacts



Clean and Healthy Environment is a Fundamental Right

- Over 5,000 premature deaths and hundreds of illnesses and emergency room visits in California are linked to PM2.5 pollution annually
- Low-income and disadvantaged communities continue to face disproportionate burdens from exposure to air pollution
- The mobile and stationary source measures contained in these plans will deliver significant health benefits

2022 State SIP Strategy

CARB Next Steps



Thank you