Agenda Item 5
South Coast AQMD's Proposed Draft NOx Stationary Source Measures

2022 Air Quality Management Plan (AQMP)
Control Measures Workshop

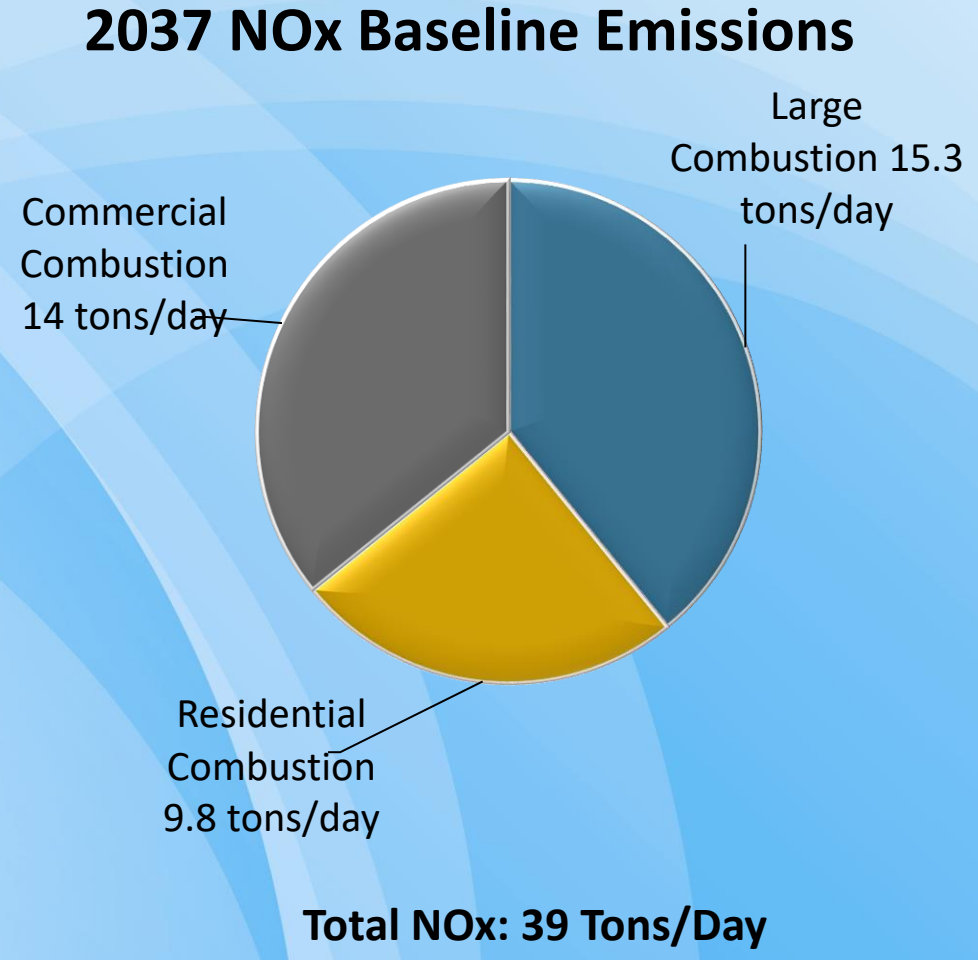
November 10, 2021

Overview of Stationary Source Strategy

- Stationary source strategy focuses on technologies and implementation approaches that can be deployed by 2037 – and are presented as a “2037 goal”
- Many measures rely on deploying ZE technologies for ~10% - 50% of the equipment in that category
  - Substantial transition to low and ultra-low NOx technologies for remaining equipment
- Many stationary source control measures will require technology assessments to better understand where and when ZE technologies can be deployed
- Staff is expecting to pursue a combination of regulations and incentives to help commercialize ZE technologies
- Staff estimates that implementation of the proposed stationary source control strategy can achieve approximately 21 tons per day of NOx reductions

2037 NOx Baseline Emissions

- Stationary source control strategy is based primarily on NOx emission reductions
- Projected 2037 NOx baseline is 39 tons per day
- There are three main categories:
  - Residential Combustion Sources (9.8 tons per day)
  - Commercial Combustion Equipment (14 tons per day)
  - Large Combustion Equipment (15.3 tons per day)



Overview of Stationary Source Control Measures

Residential Combustion Sources

- R-CMB-01: Residential Water Heating
- R-CMB-02: Residential Space Heating
- R-CMB-03: Residential Cooking
- R-CMB-04: Residential Other Combustion Sources

Commercial Combustion Equipment

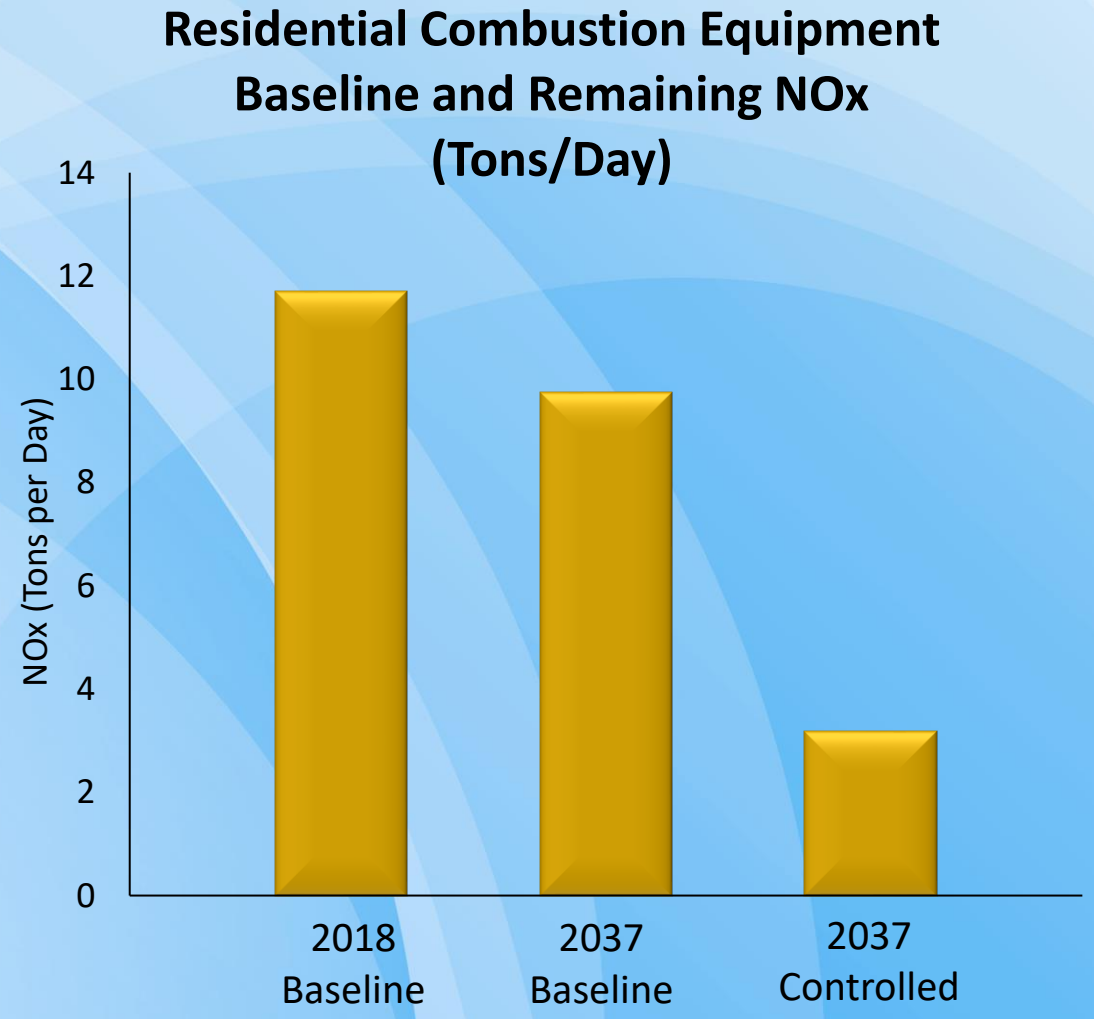
- C-CMB-01: Commercial Water Heating
- C-CMB-02: Commercial Space Heating
- C-CMB-03: Commercial Cooking
- C-CMB-04: Small Internal Combustion Engines (Non-permitted)
- C-CMB-05: Small Commercial Miscellaneous Combustion Equipment (Non-permitted)

Large Combustion Equipment

- L-CMB-01: NOx RECLAIM (formerly CMB-05)
- L-CMB-02: Large Boilers and Process Heaters
- L-CMB-03: Large Internal Combustion Engines (Prime Engines)
- L-CMB-04: Large Internal Combustion Engines (Emergency Standby Engines)
- L-CMB-05: Large Turbines
- L-CMB-06: Electric Generating Facilities
- L-CMB-07: Petroleum Refineries
- L-CMB-08: Landfills and POTWs
- L-CMB-09: Incinerators
- L-CMB-10: Miscellaneous Combustion

Overview of Residential Combustion Sources Control Strategy

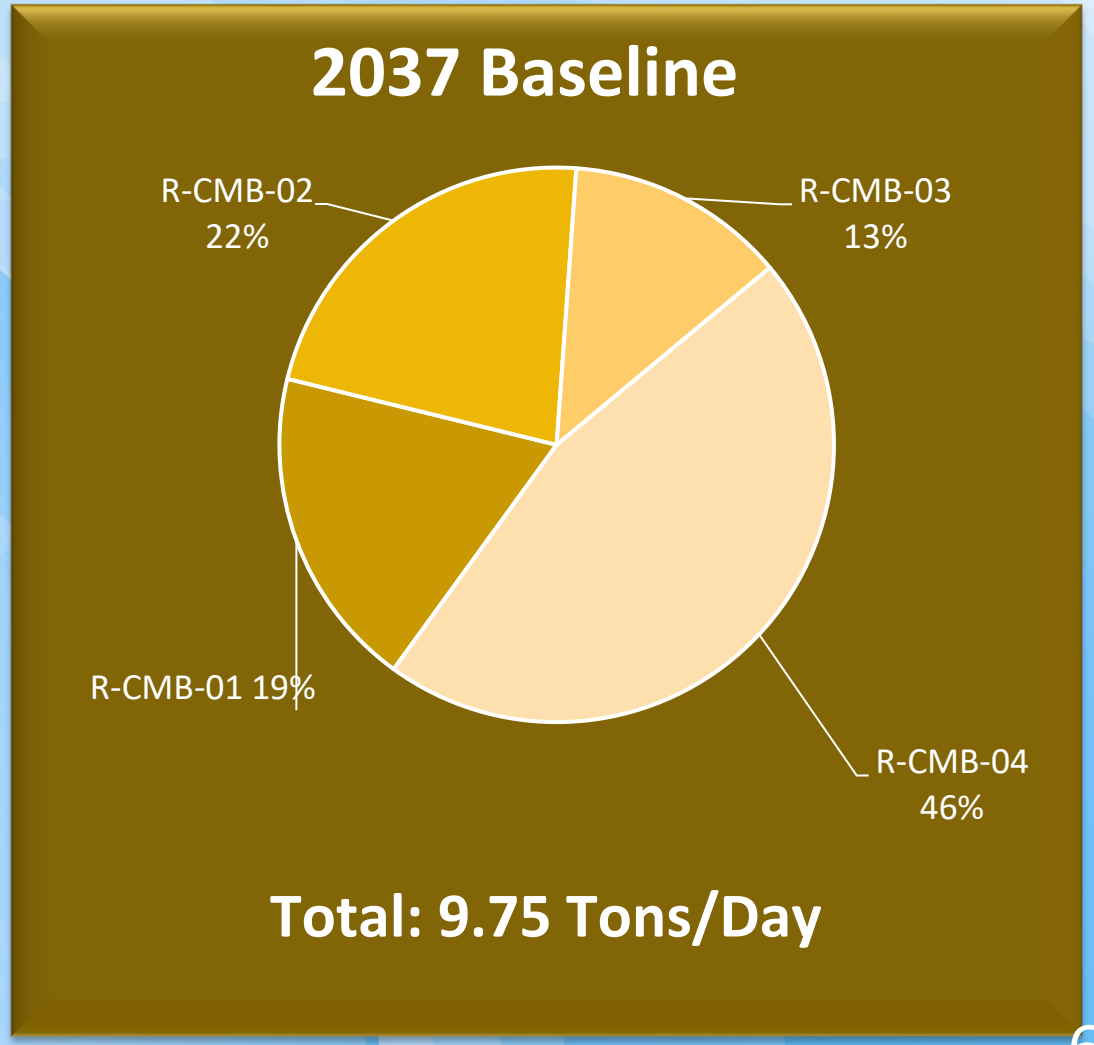
- Overall approach is a combination of zero-emission and other NOx combustion reduction technology approaches
- 2037 Goal: 70 percent reduction in NOx from residential combustion equipment
- All emissions in this category are non-permitted sources
- Expected strategy will focus on manufacturer and incentives for consumers



Control Strategy Approach for Residential Combustion Equipment

Four Control Measures:

- R-CMB-01: Residential Water Heating
- R-CMB-02: Residential Space Heating
- R-CMB-03: Residential Cooking
- R-CMB-04: Residential Other Combustion Sources



R-CMB-01: NOx Reductions from Residential Water Heating

- Source Category
  - Generally will apply to residential water heaters less than 75,000 BTU per hour
  - Currently regulated under Rule 1121 which establishes a NOx limit of 10 ng/J
  - Applies to the manufacturer, seller, and installer of water heaters
- Technologies
  - Zero-emission: All-electric heat pump water heaters; solar water heaters; electric water heaters
  - Near-zero emission: Fuel cell water heaters; gas heat pump water heaters
  - Other technologies: Gas water heaters
- Implementation Approaches
  - Use of incentives to encourage purchase of zero-emission water heaters
  - Regulatory approach for new zero-emission water heaters
  - Regulatory approach to reduce NOx emissions from propane water heaters and areas where zero-emission water heaters are not technically feasible

R-CMB-02: NOx Reductions from Residential Space Heating

- Source Category
  - Generally will apply to furnaces less than 175,000 BTU per hour
  - Currently regulated under Rule 1111 which establishes a NOx limit of 14 ng/J
  - Applies to the manufacturer, seller, and installer of furnaces
- Technologies
  - Zero-emission: All-electric heat pumps
  - Near-zero emission: Natural gas heat pumps; Dual fuel systems - heat pump pairing with gas furnace
  - Other technologies: Natural gas furnaces with lower NOx (e.g., 7 ng/J)
- Implementation Approaches
  - Use of incentives to encourage purchase of zero-emission space heaters
  - Regulatory approach for new zero-emission space heaters
  - Regulatory approach to reduce NOx emissions from propane space heaters and areas where zero-emission space heaters are not technically feasible

R-CMB-03: NOx Reductions from Residential Cooking Devices

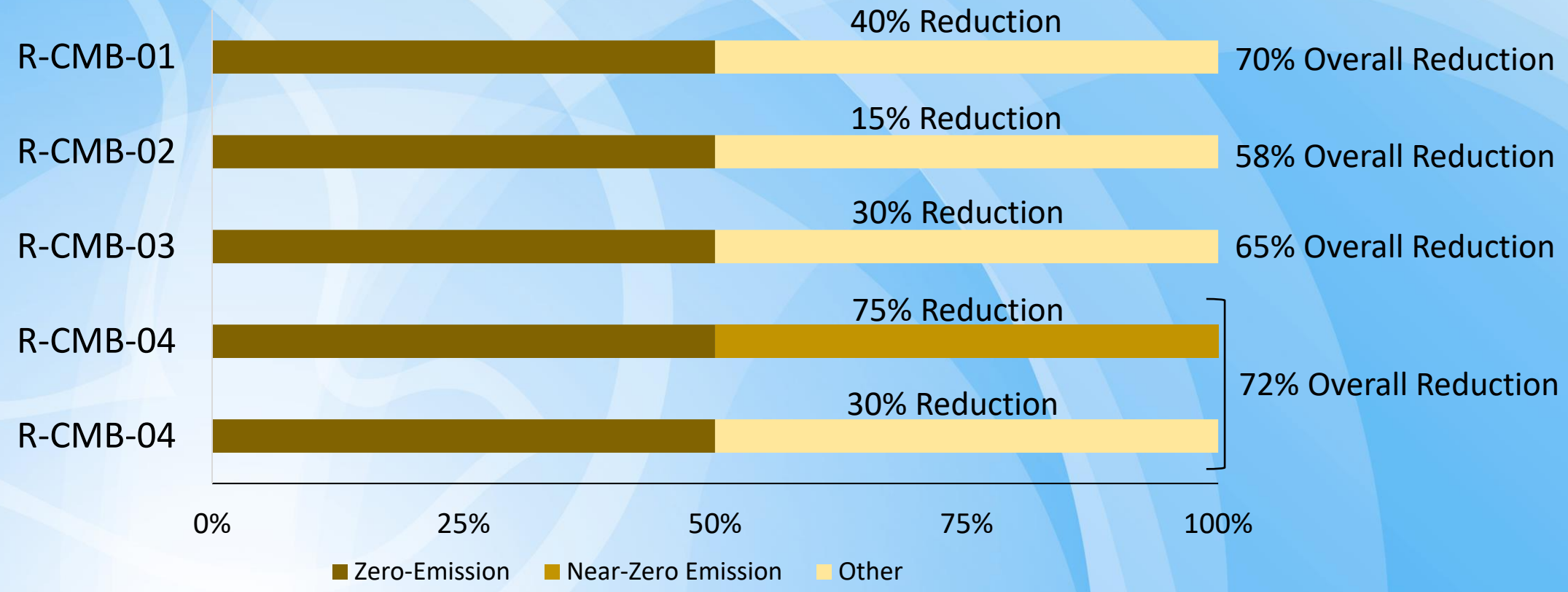
- Source Category
  - Residential cooking devices: stoves, ovens, griddles, broilers, and others
  - NOx emissions from residential cooking devices are not currently regulated by South Coast AQMD or other agencies
- Technologies
  - Zero-emission: Induction or electric cooking devices
  - Near-zero emission: Low-NOx gas burners
  - Other technologies: Conventional gas burners
- Implementation Approaches
  - Replacement of conventional gas cooking devices with new units utilizing low NOx burners or electric cooking devices through regulation and incentives

R-CMB-04: NOx Reductions from Other Residential Combustion Sources

- Source Category
  - Laundry dryers and other appliances in existing and new residential and commercial buildings, excluding other control measures for residential combustion sources such as water heating, space heating, and cooking equipment
- Technologies
  - Zero-emission: Heat pump laundry dryers; electric laundry dryers (electric resistance heating)
  - Other technologies: Natural gas laundry dryers
- Implementation Approaches
  - Assessment to better identify sources in this category, expected other sources will be identified
  - Manufacturer requirements for zero and low-NOx technology
  - Incentives for zero emission technologies

2037 Goal for Residential Combustion Equipment

- Percent of the 2037 baseline emissions that will be zero emission, near-zero, and other NOx technologies and techniques



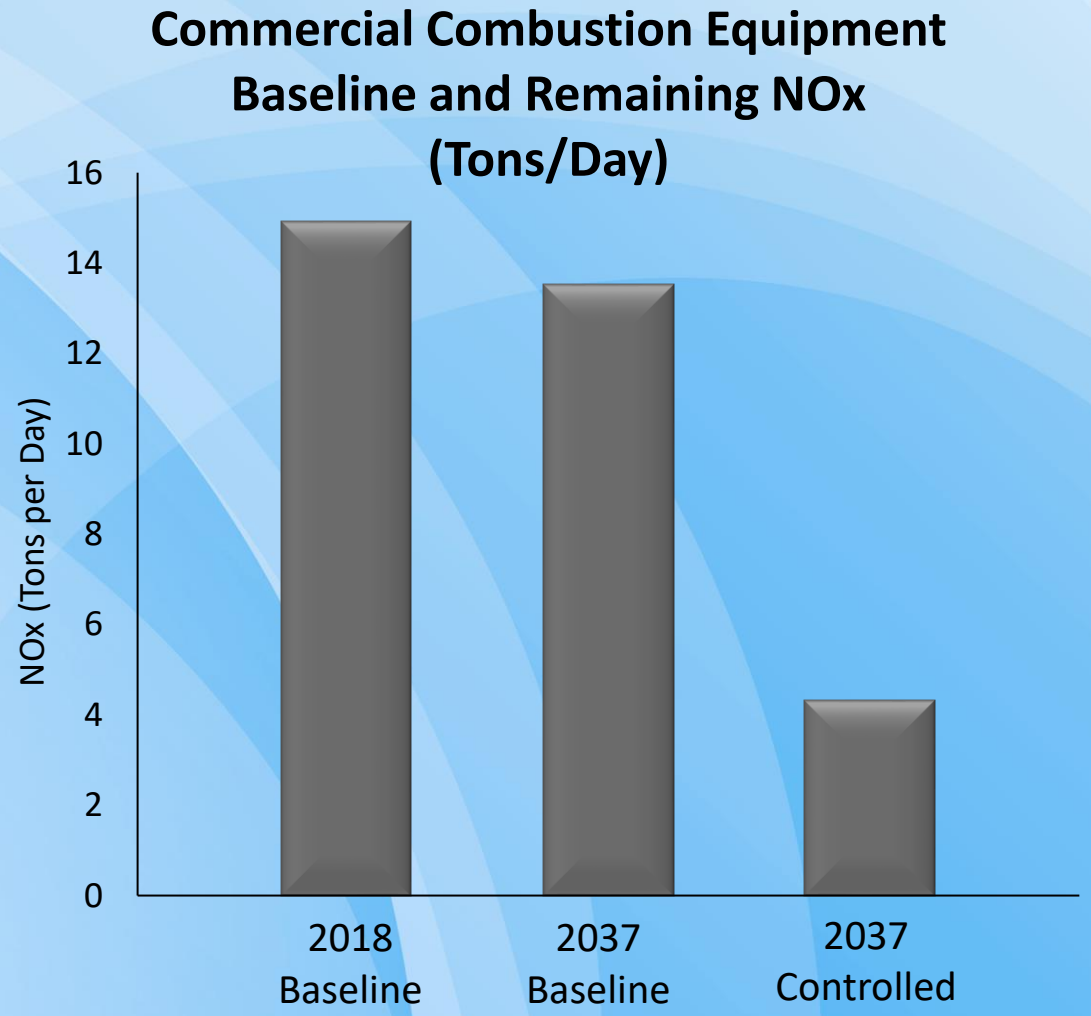
Summary of 2037 NOx Emission Reductions for Residential Combustion Sources Control Measures[1]

Control Measure	Control Measure Name	2037 Baseline (tpd)	2037 Remaining (tpd)	Percent Reduction
R-CMB-01	Residential Water Heating	1.84	0.55	70%
R-CMB-02	Residential Space Heating	2.18	0.92	58%
R-CMB-03	Residential Cooking	1.25	0.44	65%
R-CMB-04	Residential Fuel Combustion	4.49	1.26	72%
Total		**9.75**	**2.65**	**73%**

[1] Summer planning inventory

Overview of Commercial Combustion Equipment Control Strategy

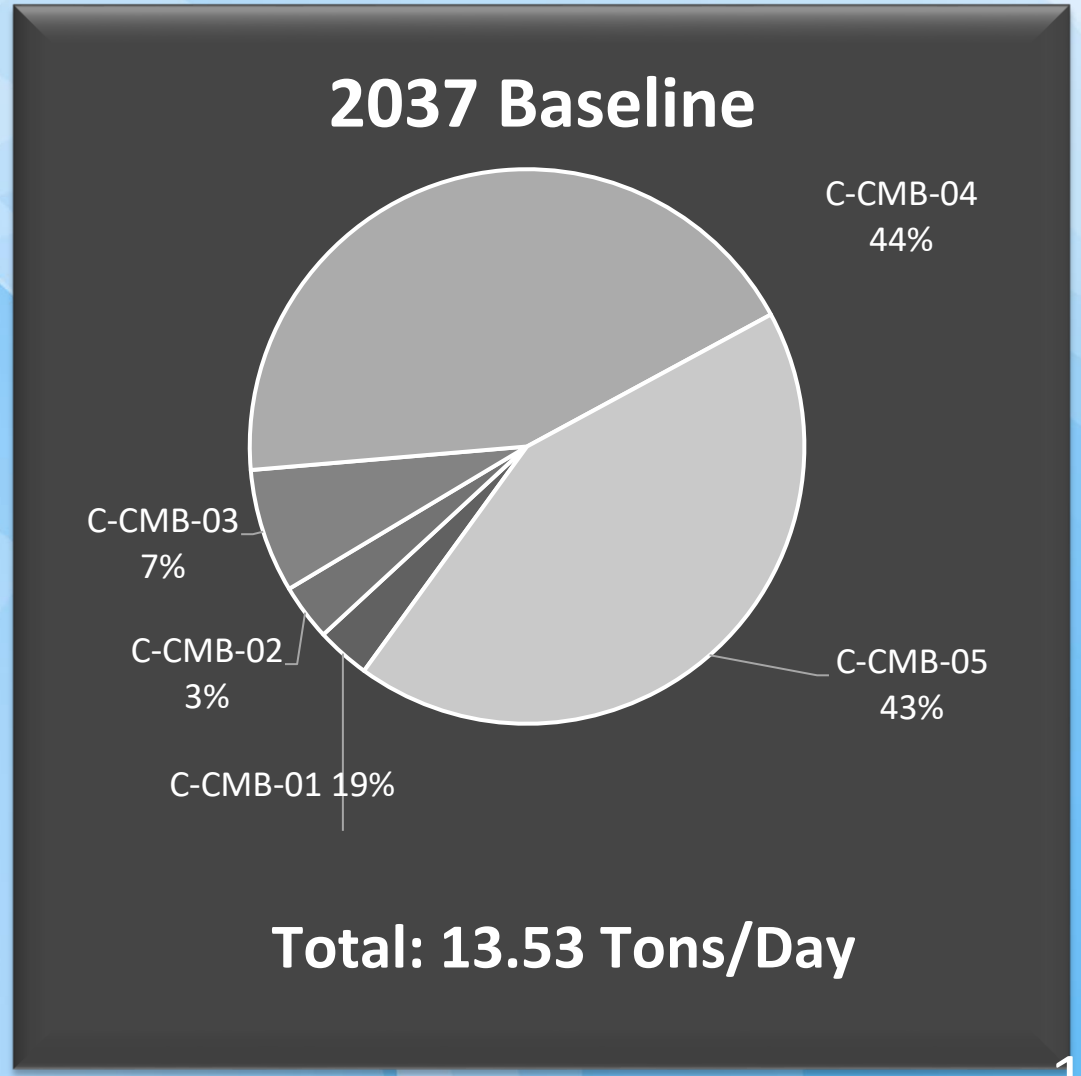
- Overall approach is a combination of zero-emission, near-zero, and other NOx combustion reduction technology approaches
- 2037 Goal: 70 percent reduction in NOx from commercial combustion equipment
- 99 percent of the emissions in this category are non-permitted sources
- Expected strategy will focus on manufacturer and incentives for consumers



Control Strategy Approach for Commercial Combustion Equipment

Five Control Measures:

- C-CMB-01: Commercial Water Heating
- C-CMB-02: Commercial Space Heating
- C-CMB-03: Commercial Cooking
- C-CMB-04: Small Internal Combustion Engines (Non-permitted)
- C-CMB-05: Small Commercial Miscellaneous Combustion Equipment (Non-permitted)



C-CMB-01: NOx Reductions from Commercial Water Heating

- Source Category
  - Generally will apply to water heaters/boilers at or less than 2,000,000 BTU per hour, excluding units regulated by Rule 1121
  - Currently regulated under Rule 1146.2 which establishes a NOx limit of 20 ppm
  - Applies to the manufacturer, seller, installer of furnaces, and the operator of existing large units
- Technologies
  - Zero-emission: All-electric heat pumps; electric resistance water heaters
  - Near-zero emission: Natural gas heat pumps; fuel cell water heaters
  - Other technologies: Natural gas water heaters and boilers with lower NOx (e.g., 12 ppm)
- Implementation Approaches
  - Use of incentives to encourage purchase of zero-emission water heaters
  - Regulatory approach for new zero-emission water heaters
  - Regulatory approach to reduce NOx emissions from areas where zero-emission water heaters are not technically feasible

C-CMB-02: NOx Reductions from Commercial Space Heating

- Source Category
  - Generally will apply to space heating furnaces with a rated heat input capacity between 175,000 BTU/hr and 2,000,000 BTU/hr
  - Currently unregulated for NOx emissions
  - Would apply to the manufacturer, seller, and installer of furnaces
- Technologies
  - Zero-emission: All-electric heat pumps and variable refrigerant flow (VRF) systems
  - Near-zero emission: Natural gas heat pumps
  - Other technologies: Natural gas furnaces with lower NOx (e.g., 8 ng/J)
- Implementation Approaches
  - Use of incentives to encourage purchase of zero-emission space heaters
  - Regulatory approach for new zero-emission space heaters
  - Regulatory approach to reduce NOx emissions from areas where zero-emission space heaters are not technically feasible

C-CMB-03: NOx Reductions from Commercial Cooking Devices

- Source Category
  - Commercial cooking devices: ovens, fryers, stoves, roasters, griddles, broilers, and others
  - Rule 1153.1 regulates NOx emissions from large commercial food ovens
  - NOx emissions from other commercial cooking devices are not currently regulated by South Coast AQMD or other agencies
- Technologies
  - Zero-emission: Induction or electric cooking devices
  - Near-zero emission: Low-NOx gas burners
  - Other technologies: Conventional gas burners
- Implementation Approaches
  - Replacement of conventional gas cooking devices with new units utilizing low NOx burners or electric cooking devices through regulation and incentives

C-CMB-04: NOx Reductions Small Internal Combustion Engines (Non-permitted)

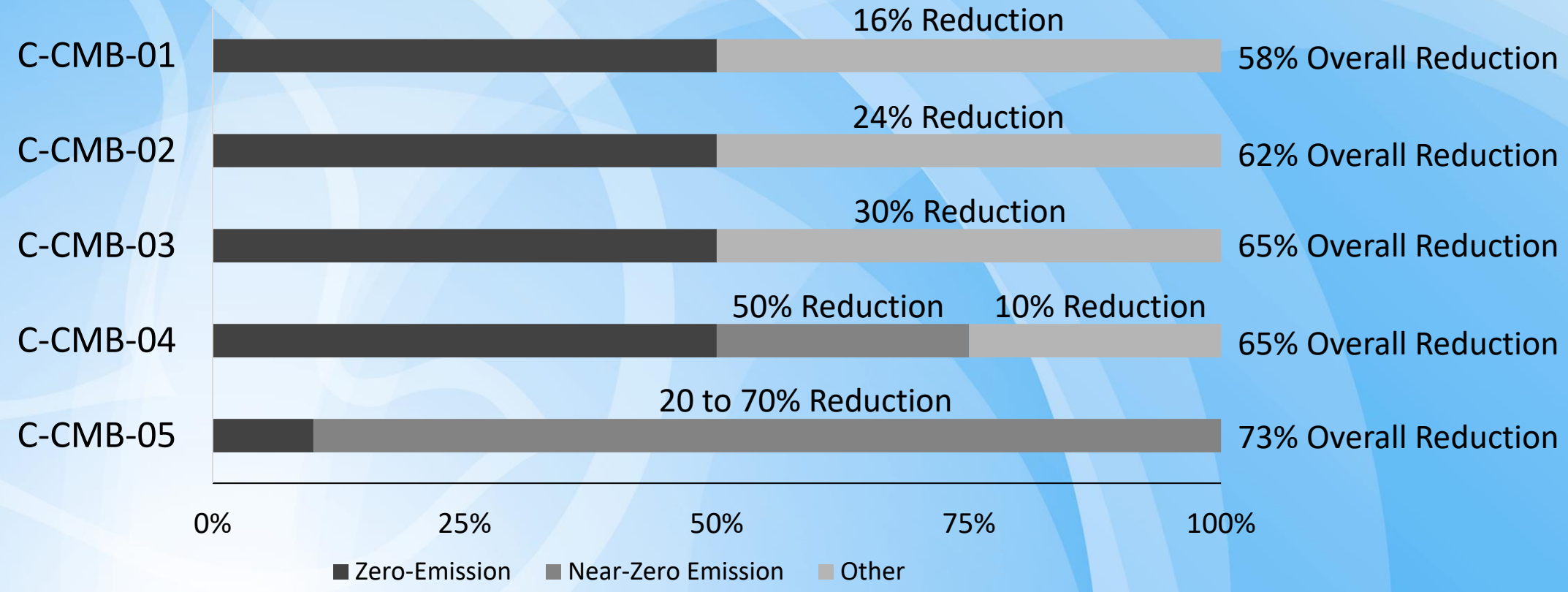
- Source Category
  - Non-permitted engines rated 50 brake horsepower or less, powering standby generators
- Technologies
  - Zero-emissions: Battery energy storage systems, hydrogen fuel cells
  - Near-zero emissions: Natural gas fuel cells
  - Other technologies: Renewable diesel, microturbines
- Implementation Approaches
  - Use of incentives to encourage purchase of battery energy storage systems or fuel cells
  - Develop education and outreach materials to encourage use of near-zero and zero-emission technology options

C-CMB-05: NOx Reductions from Small Miscellaneous Commercial Combustion Equipment (Non-permitted)

- Source Category: Unpermitted equipment at service and commercial facilities is mostly unregulated for NOx emissions
  - Equipment includes boilers, engines, ovens, and other miscellaneous equipment currently exempt from permitting
  - Many units are likely uncontrolled
- Technologies
  - Zero-emissions: Electrification
  - Other technologies: Ultra-low NOx burners
- Implementation Approaches
  - Assessment to evaluate zero-emission technology
  - Incentives for electrification of equipment
  - Re-evaluation of permit exemption thresholds

2037 Goal for Commercial Combustion Equipment

- Percent of the 2037 baseline emissions that will be zero emission, near-zero, and other NOx technologies and techniques



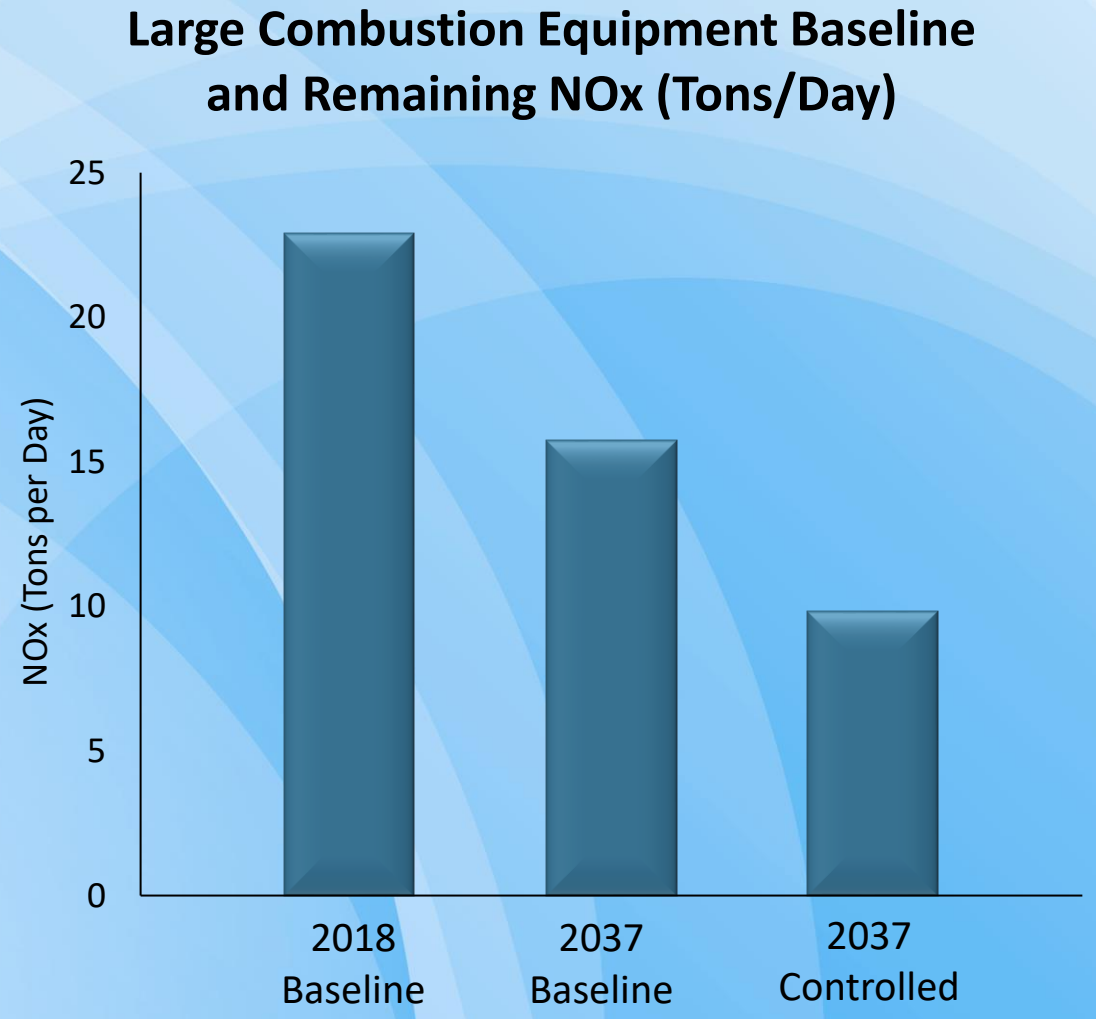
Summary of 2037 NOx Emission Reductions for Commercial Combustion Equipment Control Measures[1]

Control Measure	Control Measure Name	2037 Baseline (tpd)	2037 Remaining (tpd)	Percent Reduction
C-CMB-01	Commercial Water Heating	0.42	0.18	58%
C-CMB-02	Commercial Space Heating	0.44	0.17	62%
C-CMB-03	Commercial Cooking	0.98	0.34	65%
C-CMB-04	Small Internal Combustion Engines (Non-permitted)	5.88	2.06	65%
C-CMB-05	Miscellaneous Small Commercial Combustion Equipment (Non-permitted)	5.81	1.57	73%
Total		**13.53**	**4.25**	**69%**

[1] Summer planning inventory

Overview of Large Combustion Equipment Control Strategy

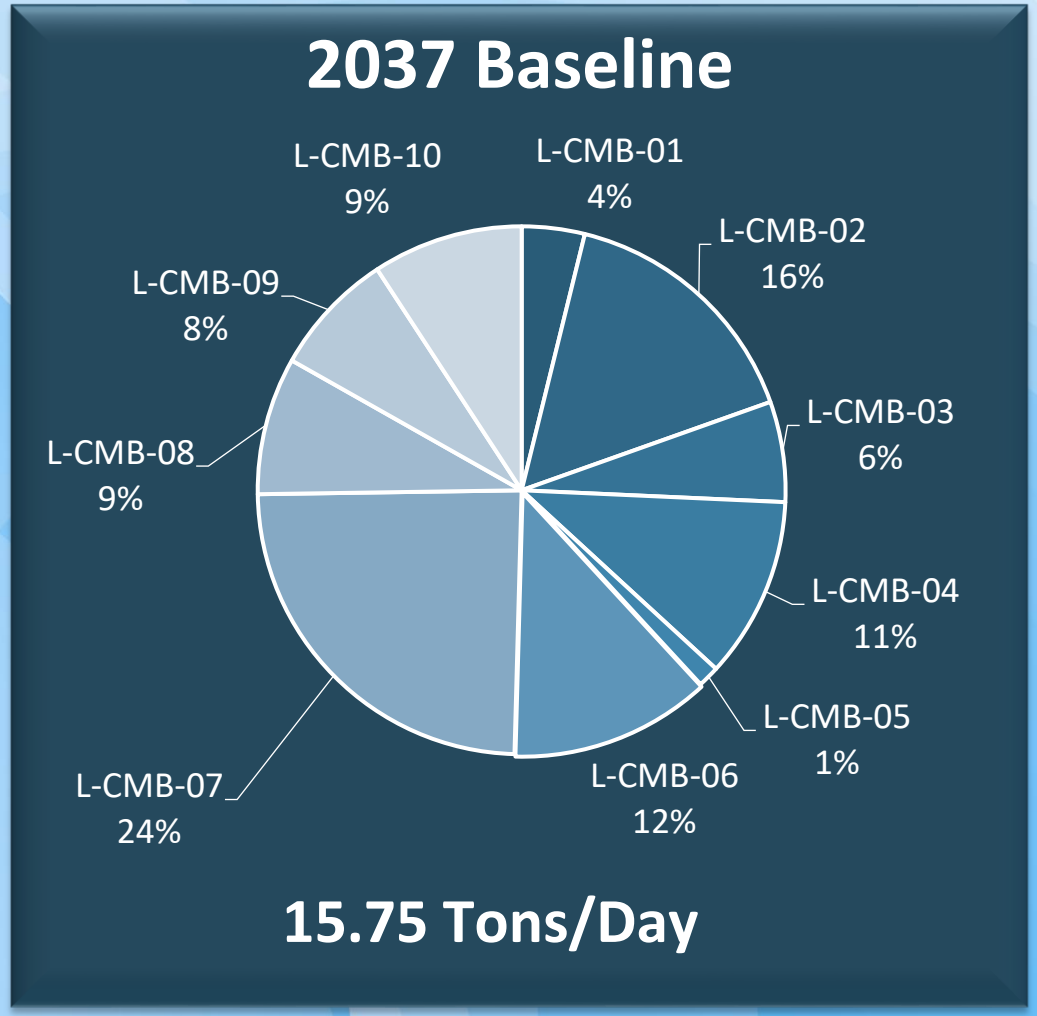
- Overall approach is a combination of zero-emission, near-zero, and other NOx combustion reduction technology approaches
- 2037 Goal: 37 percent reduction in NOx from commercial combustion equipment
- Nearly all emissions in this category are permitted sources
- Expected strategy will focus on traditional source-specific and industry-specific command and control rules



Control Strategy Approach for Large Combustion Equipment

Ten Control Measures:

- L-CMB-01: NOx RECLAIM (formerly CMB-05)
- L-CMB-02: Large Boilers and Process Heaters
- L-CMB-03: Large Internal Combustion Engines (Prime Engines)
- L-CMB-04: Large Internal Combustion Engines (Emergency Standby Engines)
- L-CMB-05: Large Turbines
- L-CMB-06: Electric Generating Facilities
- L-CMB-07: Petroleum Refineries
- L-CMB-08: Landfills and POTWs
- L-CMB-09: Incinerators
- L-CMB-10: Miscellaneous Combustion (Permitted)



L-CMB-01: NOx Reductions for RECLAIM Facilities

- Source Category
  - Furnaces subject to Proposed Rule 1147.2 – NOx Reductions from Metal Melting and Heating Furnaces
  - Food ovens subject to Proposed Amended Rule 1153.1 – Emissions of Oxides of Nitrogen from Commercial Food Ovens
  - Nitric Acid tanks subject to Proposed Rule 1159.1 - Control of NOx Emissions from Nitric Acid Tanks
- Technologies
  - Near-zero emissions: Selective Catalytic Reduction, Scrubbers
  - Other technologies: Ultra-low NOx burners
- Implementation Approaches
  - Regulatory approach requiring Best Available Retrofit Control Technologies

L-CMB-02 NOx Reductions from Boilers and Process Heaters (Permitted)

- Source Category
  - Boilers and process heaters used in industrial, institutional, and commercial operations with a rated heat input ≥ 2,000,000 BTU/hour are currently regulated under Rules 1146.1 and 1146
  - Boilers and process heaters combust fuel to generate heat
  - Boilers are used to produce steam or heat water
  - Process heaters are used to transfer heat from the combustion gases to water or process streams
- Technologies
  - Near-zero emissions: Ultra-low NOx burners
- Implementation Approaches
  - Regulatory approach to reduce NOx emissions from boilers and process heaters
  - Use of incentives to encourage purchase or new boilers and process heaters

L-CMB-03 NOx Reductions from Permitted Non-Emergency Internal Combustion Engines

- Source Category
  - Non-emergency engines provide power in lieu of direct electrical power
  - Engines rated over 50 brake horsepower require South Coast AQMD permits
  - Non-RECLAIM engines required to meet Rule 1110.2 emission limits
  - Approximately 296 permitted non-emergency engines
    - 65% - Natural Gas-fueled
    - 17% - Diesel-fueled (mostly used in remote locations)
    - 11% - Digester Gas-fueled
    - 7% - Other-fueled
- Technologies
  - Zero emissions: Battery cells, electrification of engines
- Implementation Approaches
  - Assessment to evaluate zero-emission technology
  - Transition older, higher-emitting engines in RECLAIM to meet NOx limits in Rule 1110.2
  - Outreach to non-emergency engine customers on low emission technologies, including near- and zero-emission technologies

L-CMB-04: NOx Reductions from Emergency Standby Engines (Permitted)

- Source Category
  - Permitted emergency standby engines used to provide backup power during power outages
    - Engines rated over 50 brake horsepower require South Coast AQMD permits
  - Challenges with Source Category
    - Low usage - emergency standby engines limited to 200 hours or less per year
    - Need for reliability
    - May have high cost-effectiveness based on low use and potentially high costs even for new diesel replacements
- Technologies
  - Zero emissions: Battery energy storage systems, hydrogen fuel cells
  - Near-zero emissions: Natural gas fuel cells
  - Other technologies: Renewable diesel, turbines

L-CMB-04: NOx Reductions from Emergency Standby Engines (*Continued*)

- Implementation Approaches
  - Develop rule to replace older, higher-emitting emergency standby engines with cleanest technology feasible
  - Conduct feasibility assessment to identify industries or other categories of emergency engines that can move towards zero and near-zero technologies and develop rules based on recommendations of feasibility assessment
  - During permitting of emergency standby engines, provide information on non-diesel, near-zero and zero-emission technology options and their benefits
  - Require use of renewable diesel for diesel-fueled emergency standby engines

L-CMB-05 NOx Reductions from Large Turbines

- Source Category
  - Stationary gas turbines ≥ 0.3 MW that are not subject to an industry specific rule are regulated by Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines
  - Approximately 75 turbines regulated by Rule 1134
- Technologies
  - Zero emissions: Fuel cells, electrification
- Implementation Approaches
  - Transition of higher emitting turbines to zero emission technologies

L-CMB-06 NOx Reductions from Electricity Generating Facilities

- Source Category
  - Gas turbines including associated duct burners, boilers, and diesel internal combustion engines at electricity generating facilities are regulated by Rule 1135 – Emissions of Oxides of Nitrogen from Electricity Generating Facilities
  - Electricity generating facilities are investor-owned electric utilities, publicly owned electric utilities, or facilities with a combined electrical power generation capacity of ≥ 50 MW for distribution in the state or local electrical grid system
  - Approximately 133 electric generating units regulated by Rule 1135
- Technologies
  - Zero emissions: Electrification, fuel cells
  - Near-zero emissions: Repower with new lower-emitting turbines
- Implementation Approaches
  - Assessment to evaluate zero-emission technology

L-CMB-07 NOx Reductions from Petroleum Refineries

- Source Category
  - Boilers and process heaters used in petroleum refineries are currently regulated under Rule 1109.1
  - Boilers used to generate steam
  - Process heaters are used to transfer heat from the combustion gases to water or process streams
- Technologies
  - Zero emissions: electrification, new burner technology
  - Near-zero emissions: advanced selective catalytic reduction (e.g., multi-stage), next generation ultra-low NOx burner technology
  - Other technologies: control systems (e.g., feedback loop)
- Implementation Approaches
  - Assessment to evaluate zero-emission technology
  - Regulatory approach to further reduce NOx emissions from boilers and process heaters by lower limits or additional requirements (e.g., periodic SCR tuning)

L-CMB-08 NOx Reductions from NOx Combustion Equipment at Landfills and Publicly Owned Treatment Works (POTW)

- Source Category
  - Boilers, process heaters, and turbines located at MSW landfills and landfill gas to energy facilities are regulated by Rule 1150.3 – Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills
  - Boilers, process heaters, turbines, and engines located at a POTW are regulated by Rule 1179.1 – Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities
  - Approximately 110 units are regulated by Rules 1150.3 and 1179.1
- Technologies
  - Near-zero emissions: Selective Catalytic Reduction
  - Other technologies: New lower emitting turbines; ultra-low NOx burners
- Implementation Approaches
  - Regulatory approach to reduce NOx emissions from landfills and POTWs

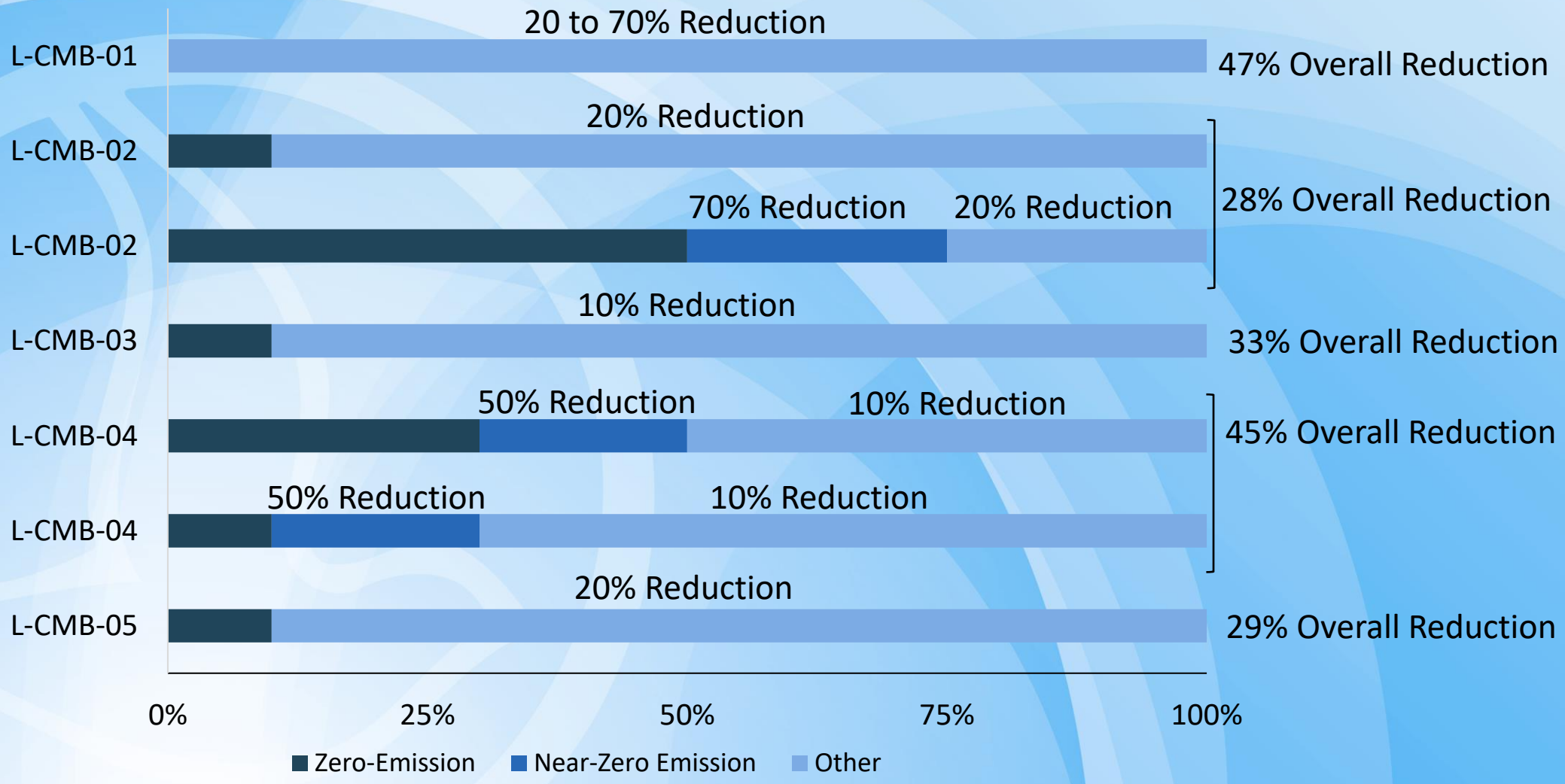
L-CMB-09 NOx Reductions from Incinerators

- Source Category
  - Incinerators and other NOx generating equipment used to eliminate solid waste
- Technologies
  - Near-Zero Emissions: Selective Catalytic Reduction
  - Other technologies: Ultra-low NOx burners
- Implementation Approaches
  - Regulatory approach to reduce NOx emissions from solid waste incineration

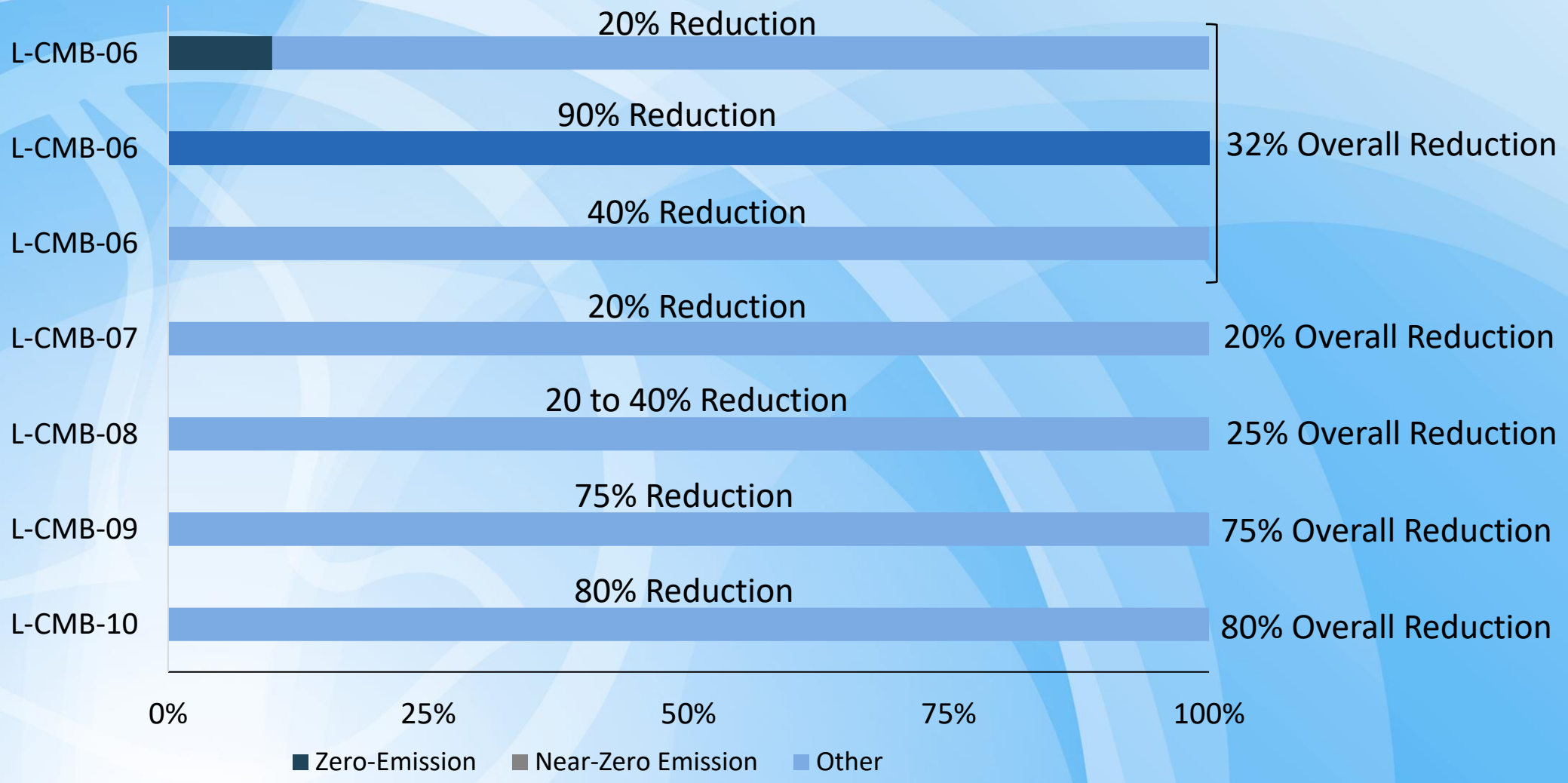
L-CMB-10 NOx Reductions from Miscellaneous Permitted Equipment

- Source Category: Miscellaneous permitted equipment currently regulated by Rule 1147 – NOx Reductions from Miscellaneous Sources
  - Applies to miscellaneous permitted equipment > 325,000 Btu/hr
  - More than 5,100 units at 3,100 facilities
  - Wide range of combustion equipment including ovens, kilns, and heaters
- Technologies
  - Zero-emission: All-electric equipment
  - Near-zero emission: Ultra-low NOx burners
  - Other technologies: Low NOx burners
- Implementation Approaches
  - Assessment to evaluate zero-emission technology
  - Use of incentives for purchases of equipment
  - Regulatory approach for new equipment

2037 Goal for Large Combustion Equipment



2037 Goal for Large Combustion Equipment



Summary of 2037 NOx Emission Reductions for Large Combustion Equipment Control Measures[1]

Control Measure	Control Measure Name	2037 Baseline (tpd)	2037 Remaining (tpd)	Percent Reduction
L-CMB-01	NOx RECLAIM	0.60	0.32	47%
L-CMB-02	Large Boilers and Process Heaters	2.47	1.78	28%
L-CMB-03	Large Internal Combustion Prime Engines	0.97	0.65	33%
L-CMB-04	Large Internal Combustion Emergency Standby Engines	1.74	0.96	45%
L-CMB-05	Large Turbines	0.21	0.15	29%
L-CMB-06	Electric Generating Facilities	1.93	1.31	32%
L-CMB-07	Petroleum Refining	3.82	3.05	20%
L-CMB-08	Landfills and POTWs	1.32	0.99	25%
L-CMB-09	Incineration	1.19	0.30	75%
L-CMB-10	Miscellaneous Combustion	1.45	0.29	80%
Total		**15.69**	**9.79**	**38%**

[1] Summer planning inventory

Energy and Climate Change Related Measures

ECC-01 Co-Benefits from Existing and Future Greenhouse Gas Programs, Policies, and Incentives

ECC-02 Co-Benefits from Existing and Future Residential and Commercial Building Energy Efficiency Measures

ECC-03 Additional Enhancements in Reducing Existing Residential Building Energy Use

Overview of Energy and Climate Change Control Measures

2016 AQMP	2022 AQMP Update
ECC-01 Co-Benefits from Emission Reductions from Greenhouse Gas Programs, Policies, and Incentives • Incorporate co-benefits from federal, State, and local programs that aim to reduce GHGs emissions	Updated to include co-benefits from both existing and future GHG programs, policies, and incentives
ECC-02 Co-Benefits from Existing Residential and Commercial Building Energy Efficiency Measures • Incorporate co-benefits from Title 24 building energy standards, SB 350 and other energy efficiency programs	Updated to include co-benefits from both existing and future energy efficiency measures
ECC-03 Additional Enhancements in Reducing Existing Residential Building Energy Use • Reduce end use energy consumption by implementing highly efficient zero-emission appliance technologies and efficiency measures	Updated to continue the efforts on incentive-based approach
ECC-04 Reduced Ozone Formation and Emission Reductions from Cool Roof Technology • Technical analysis to quantify the impact of cool roofs on air quality	Technical analysis published* and ECC-04 considered implemented **https://www.pnas.org/content/114/34/8991*

ECC-01 Co-Benefits from Existing and Future Greenhouse Gas Programs, Policies, and Incentives

- Source Category
  - Applicable stationary sources
- Proposed Approach
  - Incorporate co-benefits from state legislature such as AB3232 (2018) – set the stage to reduce GHGs from the state's residential and commercial building stock by at least 40% below 1990 levels by 2030
  - Incorporate co-benefits from incentive programs such as CEC's Building Initiative for Low Emissions Development (BUILD) Program and Technology and Equipment for Clean Heating (TECH) Program
  - Monitor the development of future programs and quantify benefits when feasible
- Emissions Reduction and Cost Effectiveness
  - To be determined

ECC-02 Co-Benefits from Existing and Future Residential and Commercial Building Energy Efficiency Measures

- Source Category
  - Residential and commercial buildings
- Proposed Approach
  - Incorporate co-benefits from Title 24 Building Energy Efficiency Standards
    - 2019 Update: New residences must install solar PV
    - 2022 Update: New residences must be electric-ready
  - Incorporate co-benefits from incentive programs such as CSD's Low Income Weatherization Program (LIWP)
  - Monitor the development of future programs and quantify benefits when feasible
- Emissions Reduction and Cost Effectiveness
  - To be determined

https://www.energy.ca.gov/

ECC-03 Additional Enhancements in Reducing Existing Residential Building Energy Use

- Source Category
  - Residential buildings
- Proposed Approach
  - Reduce end use energy consumption and provide emission reductions within existing residences
  - Incentivize advanced highly efficient zero-emission appliance technologies and efficiency measures when cost effective and feasible, and near-zero emission technologies in other applications
  - Close co-ordination with utilities and other agencies
- Emissions Reduction and Cost Effectiveness
  - To be determined

https://commons.wikimedia.org/

Q & A and Public Comments

For ZOOM:

- Click on the “Raise Hand” button.

For TELEPHONE:

- Dial *9 on your keypad