



# Small Off-Road Engines: 2021 Pre-Rulemaking Workshop

March 24, 2021

# 2021 SORE Pre-Rulemaking Schedule

**September 2019**

First  
workshop

**June 9, 2020**

Second  
workshop

**Fall 2021**

Propose new  
emission standards



**May 29, 2020**

Release of draft  
regulation text

**March 24, 2021**

Third  
workshop

These changes to SORE regulations have not been considered by the Board. Any proposed changes will be presented to the Board to decide whether to adopt after the required notice and public comment period and any required analyses have been presented to the Board.

# Workshop Overview

- Background and Regulatory History
- Governor's Executive Order (EO N-79-20)
- Zero-Emission Equipment (ZEE) Feasibility
- Comments Received in Response to June 2020 Workshop
- Updated Staff Proposal Developed in Response to Comments
- Stakeholder Feedback Needed
- Rulemaking Process

# Background and Regulatory History

# Small Off-Road Engines (SORE)



# Sources of Emissions

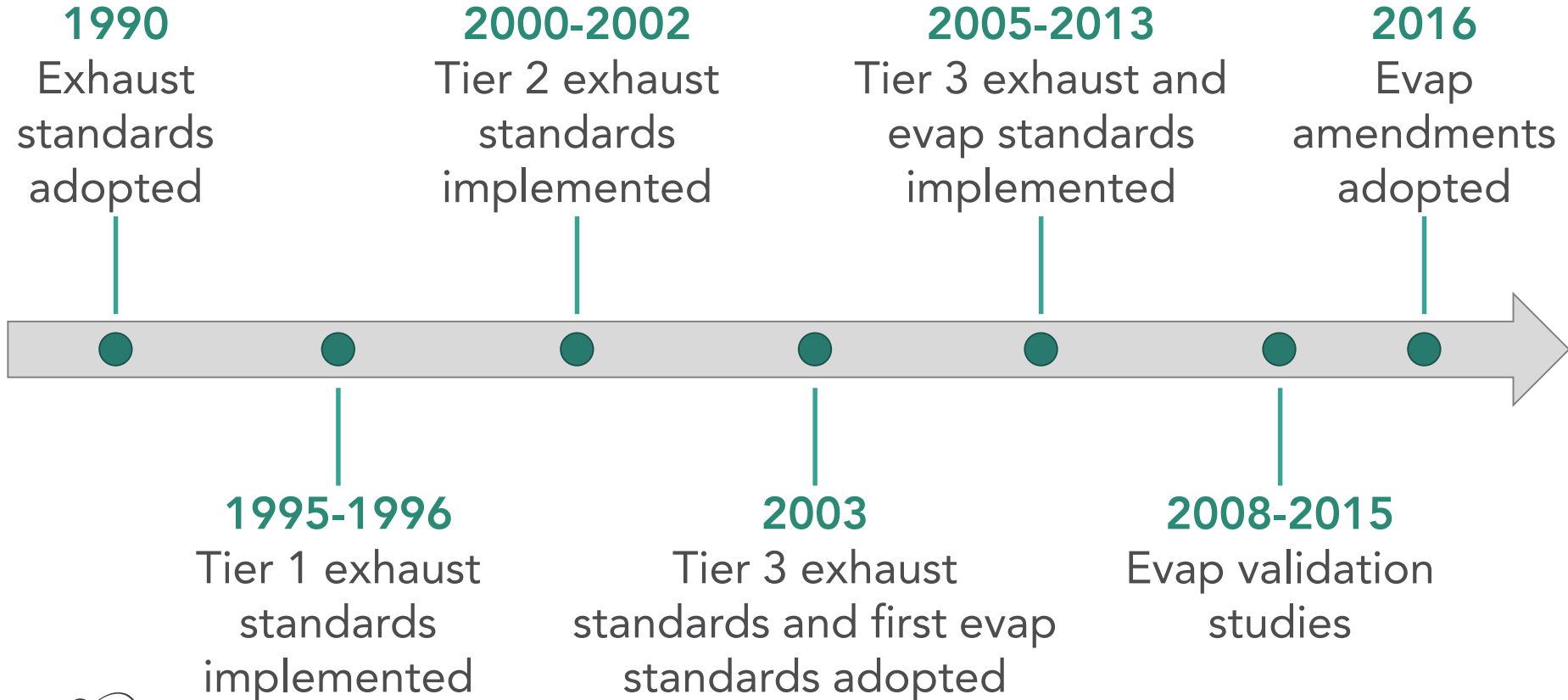


During operation:  
Exhaust and evaporative

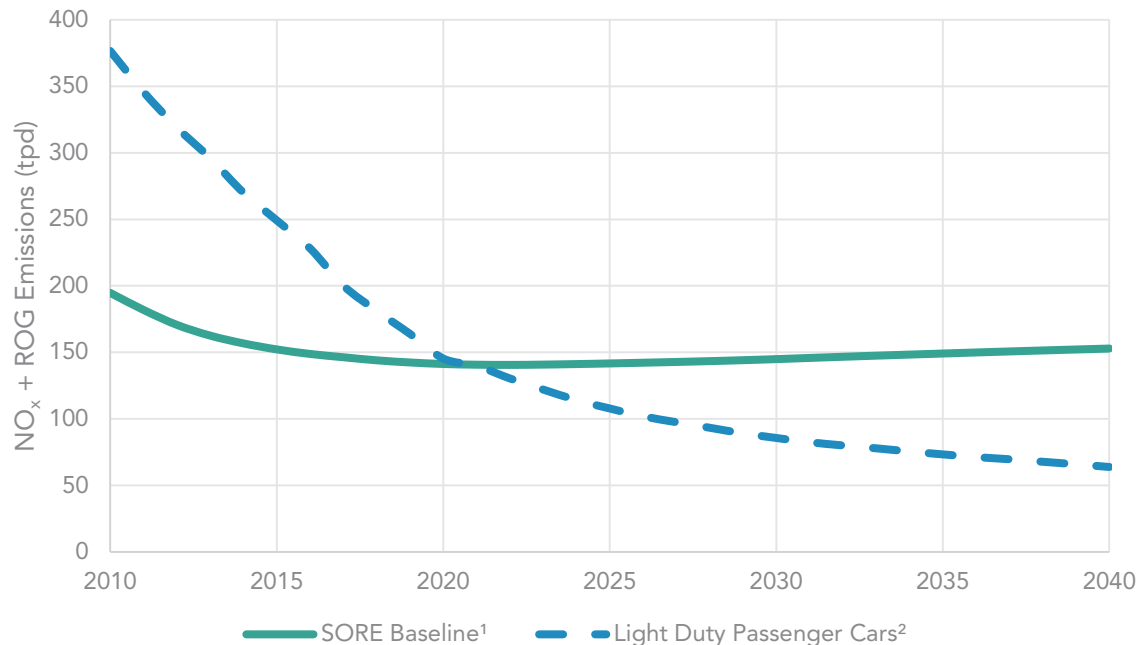


During storage:  
Evaporative

# SORE Regulatory History



# SORE Emissions Versus Cars (Statewide)



- SORE<sup>1</sup> smog-forming emissions surpass light-duty passenger cars<sup>2</sup> in 2021

<sup>1</sup>SORE 2020 <sup>2</sup>EMFAC2021



# Need for Further Reductions

## 2016 State Implementation Plan (SIP) Strategy

	Statewide Reductions (tons per day, expected)	
	NO <sub>x</sub>	ROG
Total	168	86
SORE	4	36
Additional Off-Road	18	20

# Governor's Executive Order (EO N-79-20)

# Executive Order N-79-20

- Issued September 23, 2020
- Accelerated move toward a low-carbon, sustainable, and resilient future
- “Zero emissions technologies, especially trucks and equipment, reduce both greenhouse gas emissions and toxic air pollutants that disproportionately burden our disadvantaged communities of color”

## N-79-20 Section 2

- CARB, in coordination with other State agencies, U.S. Environmental Protection Agency and local air districts, shall develop and propose strategies to achieve 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035
- CARB shall act consistently with technological feasibility and cost-effectiveness

# Benefits of ZEE

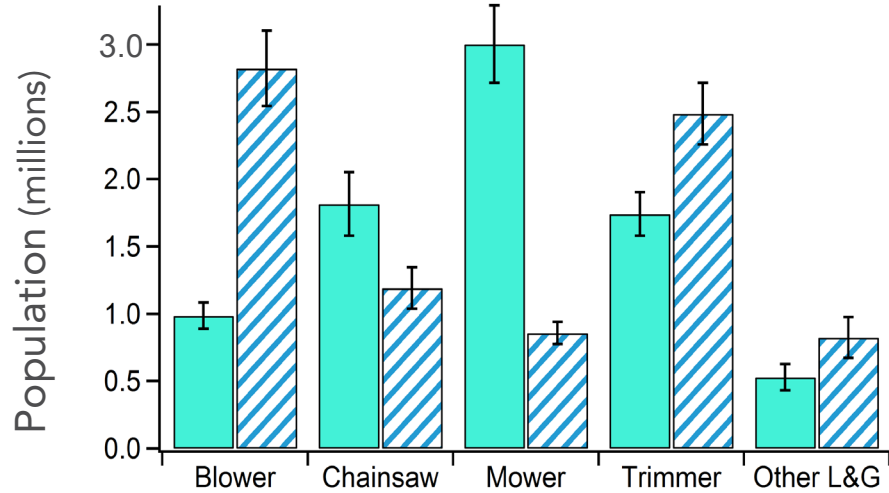
- Lower cost of ownership over life of equipment
- Lower noise pollution
- Lower exposure to vibration
- No exposure to engine emissions



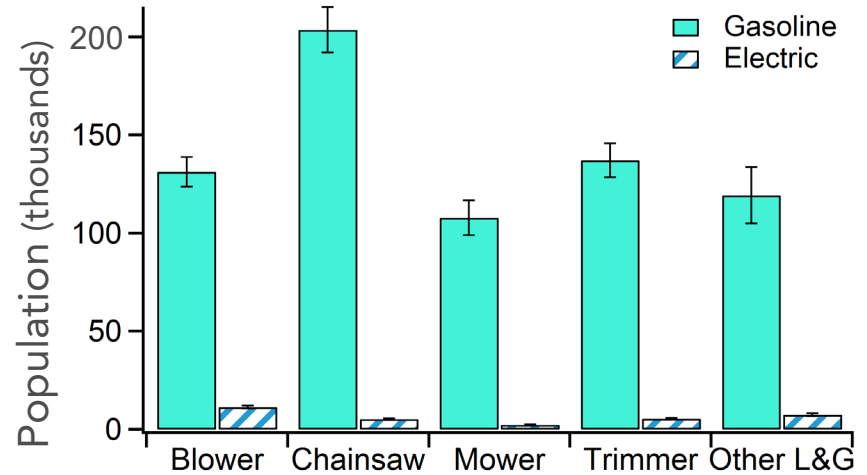
# Zero-Emission Equipment (ZEE) Feasibility

# SORE and ZEE Populations in CA

## Households



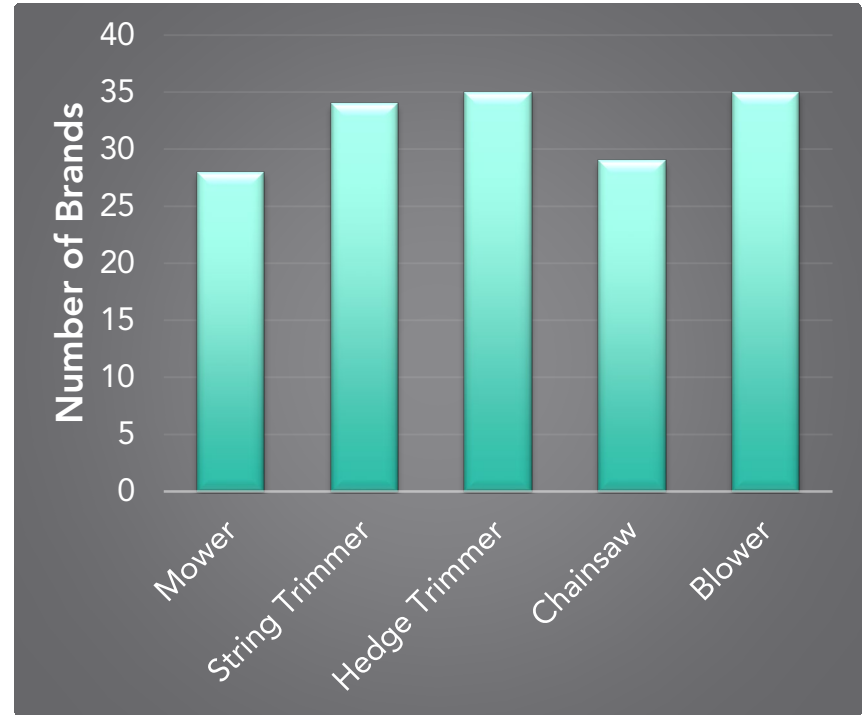
## Landscapers



- Over half of household lawn and garden equipment is already ZEE
- Landscapers have historically had lower ZEE adoption rates

# Residential ZEE

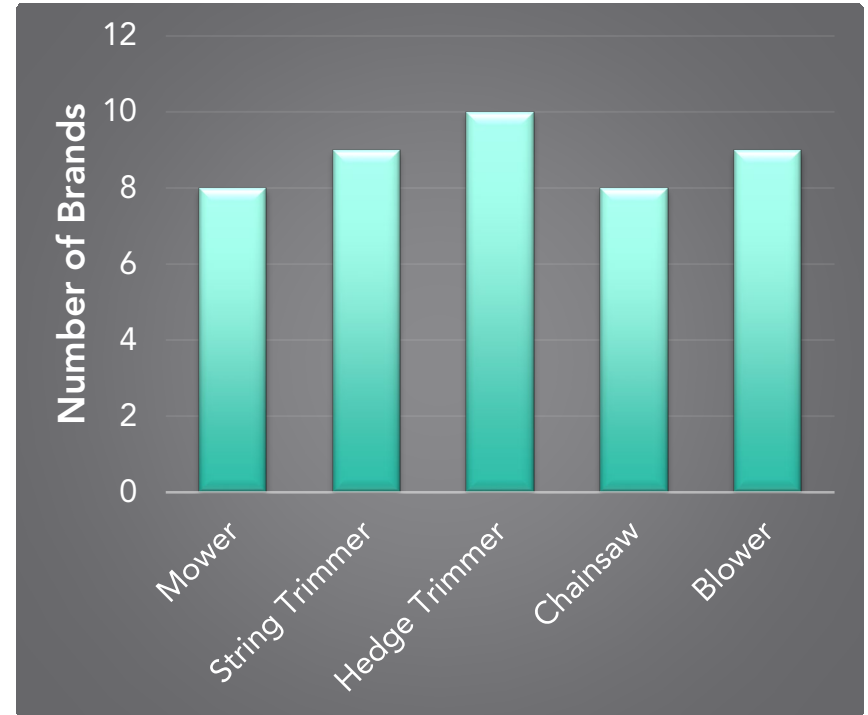
- 18.4 million units of residential ZEE are in use in California (SORE2020)
- At least 25 brands produce ZEE in each major equipment category





# Commercial ZEE

- 414,000 units of commercial ZEE are in use in California (SORE2020)
- At least 8 brands produce ZEE in each major equipment category



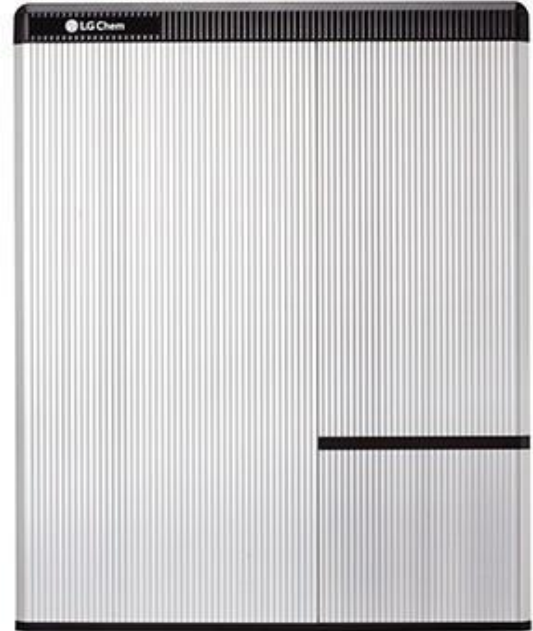
# Zero-Emission Generator Availability

- Currently 2 main technologies being used:
  - Battery Storage
    - Often utilizes portable solar panels for recharging
  - Fuel Cell
    - Refueling infrastructure is being developed



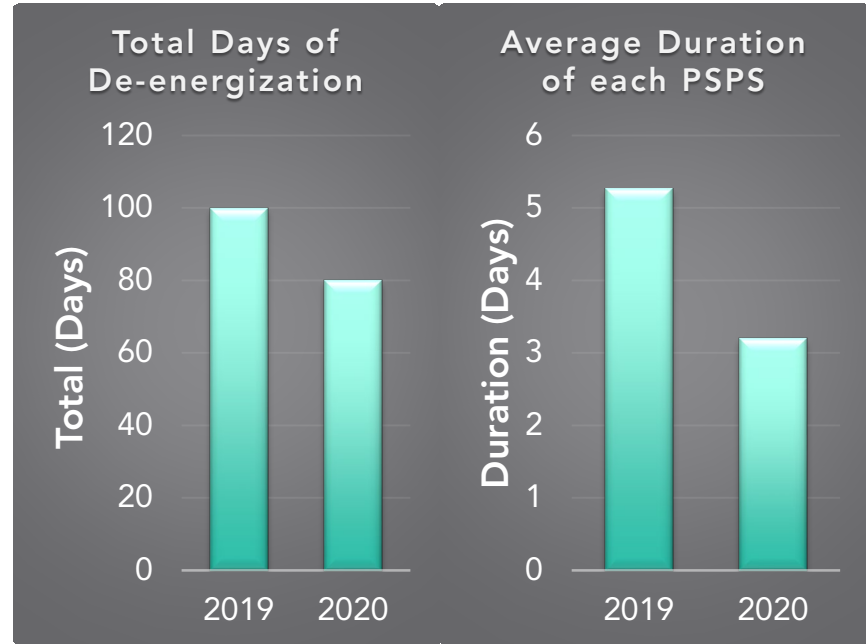
# Zero-Emission Generator Challenges

- Purchase price is higher
  - Determining appropriate sizing
  - Total cost of ownership depends on use
- Refueling/recharging



# Public Safety Power Shutoffs (PSPS)

- PSPS projected to be less frequent
- Average duration of PSPS expected to decrease



<https://www.cpuc.ca.gov/deenergization/>

# Comments Received in Response to June 2020 Workshop

# Comments Received

- Comments received: 1,964
  - Environmental Organizations: 1,894
  - SORE Industry: 15
  - California Residents: 55

# Environmental Organization Comments

- Total of 1,894 comments from environmental organizations
- 1,880 similar comments from Sierra Club members
- Requested alternative to transition to ZEE in 2023 or earlier

# Industry Comments

- Many are supportive of transition directly to ZEE
- Suggested alternatives:
  - Omit interim emission standards
  - Retain existing durability periods
  - Exempt generators and pumps





# California Resident Comments

- Expressed a need for engine-powered generators
- Requested increased incentive program availability
  - Buyback and dismantle programs
  - Equitable availability of programs
- Expressed concern over an increase in battery waste

# Updated Staff Proposal Developed in Response to Comments

# Updates to Staff Proposal in Response to Specific Comments Received

Specific Comments Received and Alternatives Suggested	Changes Made to Regulatory Proposal
Transition to ZEE as soon as possible	Set emission standards for SORE, except generators, to zero <sup>1</sup> for Model Year 2024
Transition to ZEE without interim emission standards	
Generators are not currently ready to transition to ZEE	Set emission standards for generators to zero <sup>1</sup> for Model Year 2028 and implement a zero-emission generator credit program
Emissions durability periods proposed in June 2020 are not feasible	Emissions durability periods are equivalent to existing periods for “extended” operation

<sup>1</sup> Emission standards of 0.00 g·kWh<sup>-1</sup> (exhaust) and 0.00 g·test<sup>-1</sup> (hot soak + diurnal)

# Updates to Emission Standards

- Set exhaust and evaporative emission standards to 0 for Model Year (MY) 2024 for all SORE except generators
- Set more stringent emission standards for generators for MY 2024 through MY 2027
- Set generator exhaust and evaporative emission standards to 0 for MY 2028
- Implement a zero-emission generator emission reduction credit program

# Potential Exhaust Emission Standards for Engines used in Generators

Displacement category	Current HC+NO <sub>x</sub> Emission Standard (g·kWh <sup>-1</sup> )	MY 2024-2027 HC+NO <sub>x</sub> Emission Standard (g·kWh <sup>-1</sup> )
< 225 cc	10-72	6.0
≥ 225 cc - < 825 cc	8	3.0
≥ 825 cc	8	0.80

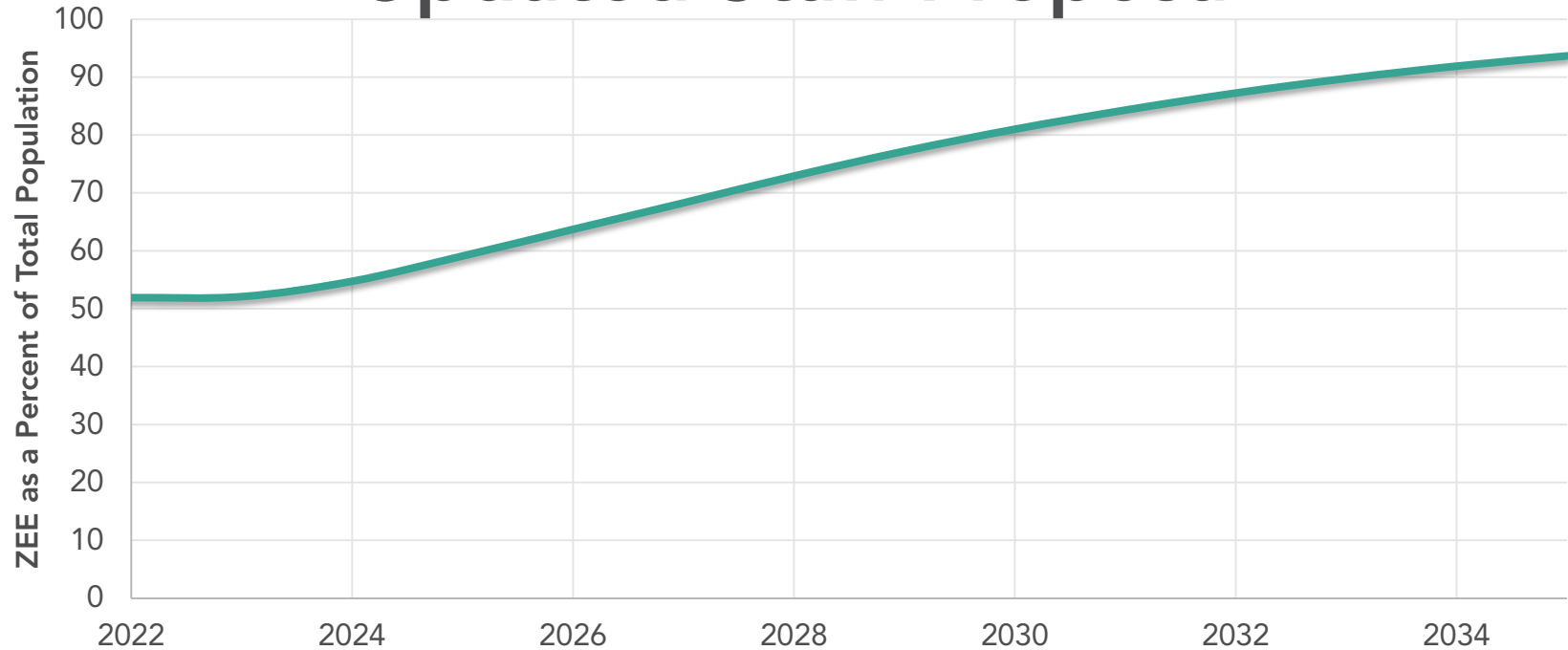
- Updated emission standards would apply only to generators
- Based on certification levels of existing engines

# Potential Evaporative Emission Standards for Engines used in Generators

Displacement category	Current Emission Standard (diurnal, g·day <sup>-1</sup> )	MY 2024-2027 Emission Standard (hot soak + diurnal, g·test <sup>-1</sup> )
≤ 80 cc	N/A	0.50
80-225 cc	$0.95 + 0.056 \times \text{nominal capacity (liters)}$	0.60
≥ 225 cc	$1.20 + 0.056 \times \text{nominal capacity (liters)}$	0.70

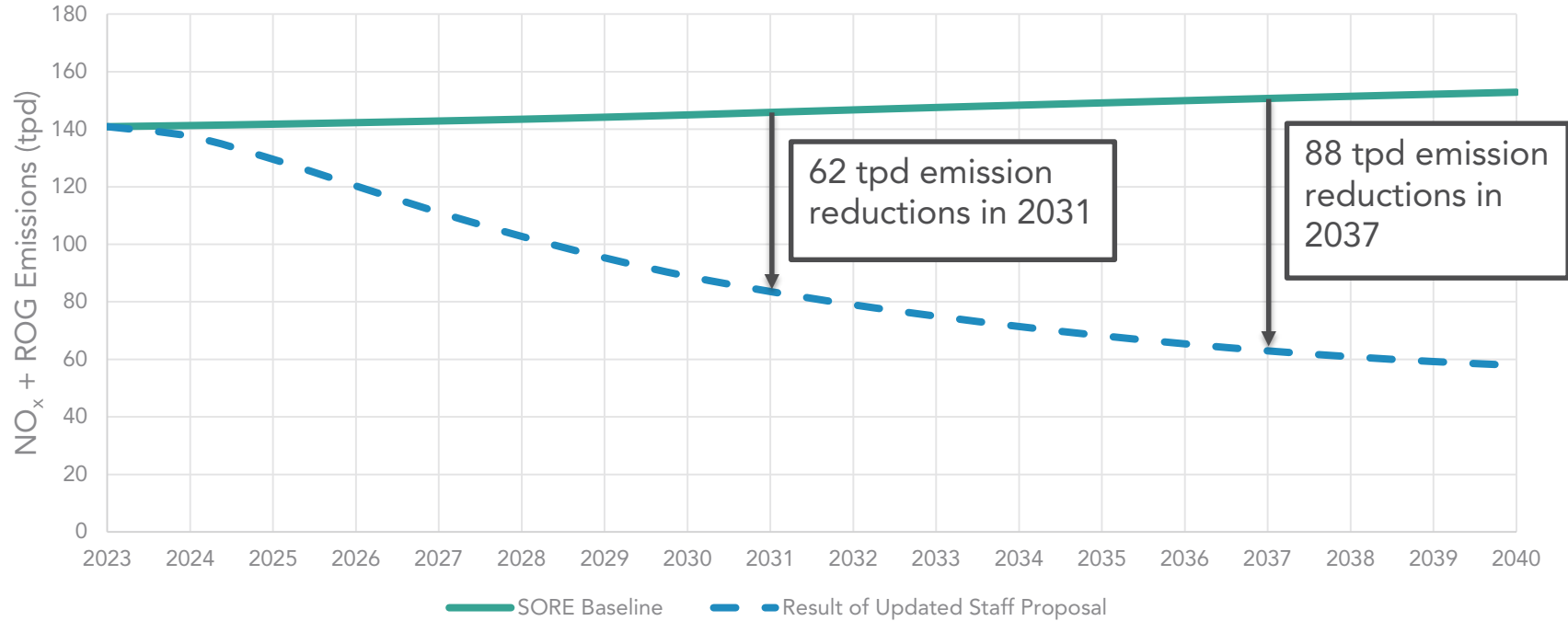
- Updated emission standards would apply only to generators
- Based on certification levels of existing engines

# Transition to ZEE as a Result of Updated Staff Proposal



- In 2035, 94% of equipment subject to CARB regulations would be ZEE

# Emission Reductions as a Result of Updated Staff Proposal





# Stakeholder Feedback Needed

# Comments and Alternatives Solicited on Following Topics

- Zero-emission generator credit provisions
- Repeal of variance section
- Elimination of design certification
- Test procedure updates

# Zero-Emission Generator Credit Provisions

## Goals:

- Provide market signal to encourage growth in this sector
- Remain technology neutral to encourage innovation
- Incentivize the transition from SORE generators to zero-emission generators

# Zero-Emission Generator Credit Provisions

- Establish 4 levels of zero-emission generators
  - Continuous power delivery capability
  - Surge power delivery capability
- Zero-emission generator credits available for both exhaust and evaporative emissions
- Zero-emission generator credits can only be used to offset emissions from generator engines

# Exhaust Emission Credits for Zero-Emission Generators

Product Type	Power Supply Requirements	Power Surge Requirements	Credit Eligibility
Level 1 Zero-Emission Generator	2.5 kWh over 8 hours	3,000 watts for 10 seconds	1,500 g HC+NO <sub>x</sub>
Level 2 Zero-Emission Generator	6 kWh over 8 hours	3,000 watts for 10 seconds	2,200 g HC+NO <sub>x</sub>
Level 3 Zero-Emission Generator	12 kWh over 8 hours	5,000 watts for 10 seconds	3,200 g HC+NO <sub>x</sub>
Level 4 Zero-Emission Generator	25 kWh over 8 hours	5,000 watts for 10 seconds	4,700 g HC+NO <sub>x</sub>

# Evaporative Emission Credits for Zero-Emission Generators

Product Type	Power Supply Requirements	Power Surge Requirements	Credit Eligibility
Level 1 Zero-Emission Generator	2.5 kWh over 8 hours	3,000 watts for 10 seconds	0.5 g organic material hydrocarbon equivalent per day or per test
Level 2 Zero-Emission Generator	6 kWh over 8 hours	3,000 watts for 10 seconds	0.5 g organic material hydrocarbon equivalent per day or per test
Level 3 Zero-Emission Generator	12 kWh over 8 hours	5,000 watts for 10 seconds	0.6 g organic material hydrocarbon equivalent per day or per test
Level 4 Zero-Emission Generator	25 kWh over 8 hours	5,000 watts for 10 seconds	0.6 g organic material hydrocarbon equivalent per day or per test

# Repeal of Variance Section

- Currently provides for a manufacturer that cannot meet evaporative requirements due to extraordinary reasons beyond its reasonable control to apply for a variance
- Implement when amendments become effective
- Repeal will ensure equity for all manufacturers
- Introduction of non-compliant engines would delay the transition to ZEE
- Credit trading will alleviate need for variances

# Elimination of Design Certification

- Originally proposed by Staff in September 2019 workshop
- Staff requested data demonstrating design standards that would enable equipment to meet hot soak + diurnal emission standards
- No data were received demonstrating any design standards that would result in compliance
- Staff requests submission of data supporting design certification for generator engines



# Test Procedure Updates

- TP-902 tilt test
  - Would no longer include tilting towards the carburetor
    - Comments on June 2020 workshop noted that a tilt towards the carburetor is known to cause fuel spillage
  - Can be omitted for engines  $\geq 225$  cc not used in equipment that is designed to be tilted

# Summary of Updated Staff Proposal

- Transition new sales to ZEE
  - Implement emission standards of 0 for all SORE except generators for MY 2024
  - Implement emission standards of 0 for generators for MY 2028
- Implement zero-emission generator credits\*
- Repeal variance section\*
- Update test procedures\*

\*Comments solicited

# Rulemaking Process

# Stakeholder Engagement

- Stakeholders
  - Participate in workshops and meetings
  - Share test data and product information
  - Submit alternatives and comments on potential changes to regulations
- CARB staff
  - Public process

# 2021 SORE Pre-Rulemaking Timeline

**September 2019**

First  
workshop



**June 9, 2020**

Second  
workshop



**April 8, 2021**

Comments on third  
workshop due



**May 29, 2020**

Release of draft  
regulatory text



**March 25, 2021**

Third  
workshop

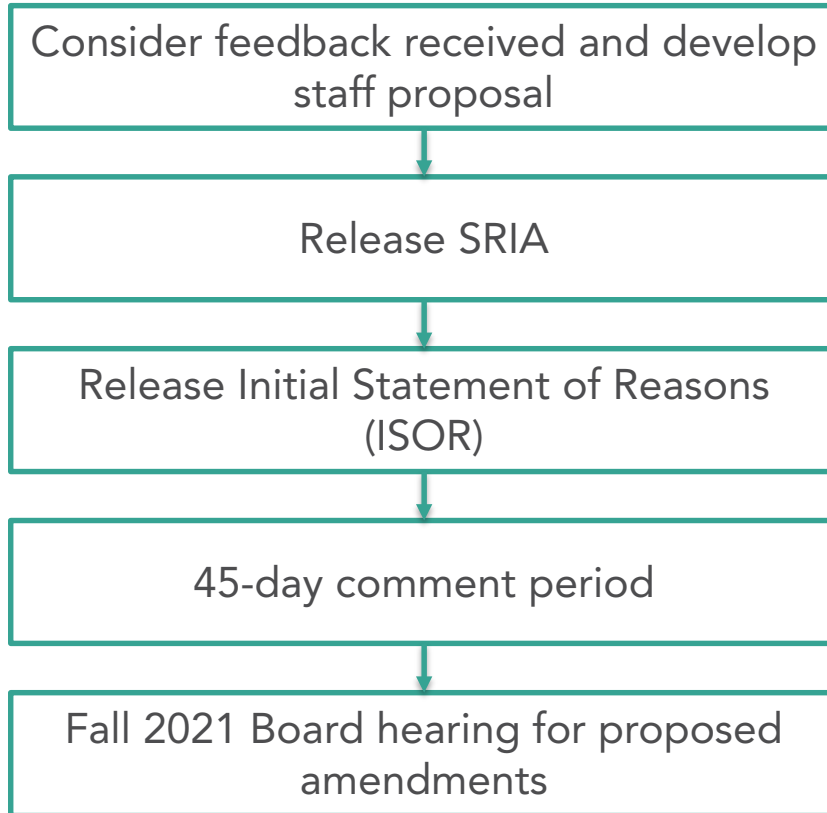


**Fall 2021**

Propose new  
emission standards



# Next Steps



# CARB Staff Contact Information

- **Send comments to: [sore2021@arb.ca.gov](mailto:sore2021@arb.ca.gov)**
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