



# Zero-Emission Airport Shuttle Bus **PUBLIC WORKSHOP #2**

**March 7, 2018: Sacramento, 10:00 am – 12:00 pm (PST)**

**or**

**March 8, 2018: Los Angeles, 1:00 pm – 3:00 pm (PST)**



**CALIFORNIA**  
AIR RESOURCES BOARD

# Topics for Today

1. Welcome and Introductions
2. Background
3. Revised Regulatory Proposal
4. Draft Regulatory Language
5. Next Steps

Zero-Emission Airport Shuttle Bus

# BACKGROUND



Measure Goals,  
Zero-Emission Manufacturers,  
Airport Efforts,  
Inventory,  
Cost Information



# Zero-Emission Airport Shuttle Bus Measure – Goals

1. Complement existing programs to achieve NO<sub>x</sub> and GHG emission reductions through use of zero-emission technology
2. Increase the penetration of the first wave of zero-emission heavy-duty technology

*-- 2016 State Strategy for the State  
Implementation Plan, March 2017*

# Best Applications for Zero-Emission Vehicles Serving Airports

- Operational characteristics:
  - Fixed route
  - Low-mileage
  - Stop and go operation
  - Low average speeds
  - Centrally maintained and fueled

# Zero-Emission Manufacturers



**PROTERRA**



**NEW FLYER**



**BAE SYSTEMS**

INSPIRED WORK

**ZENITH**  
MOTORS

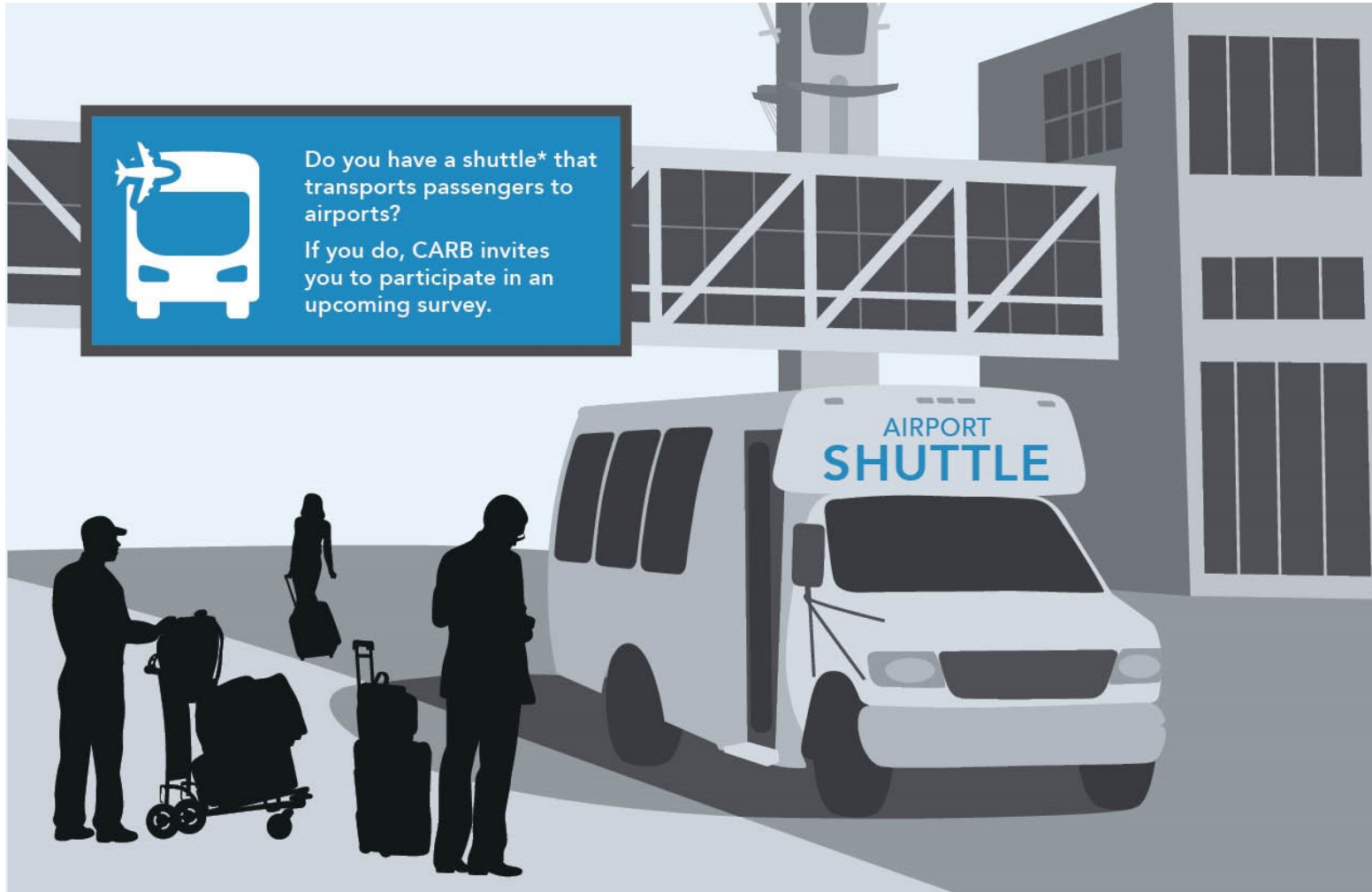


**CCW**  
COMPLETE COACH WORKS



REV GROUP

# Outreach to Potentially Impacted Sectors



# Airports Plugging into Zero-Emission Shuttles

Airport	Battery Electric Buses
Mineta San Jose International Airport (SJC)	10
Ontario International Airport (ONT)	3
Sacramento International Airport (SMF)	5
Hartfield-Jackson Atlanta International Airport (ATL)	2
Indianapolis International Airport (IND)	6
Kansas City International Airport (MCI)	4
Raleigh-Durham Airport (RDU)	4
Amsterdam Airport Schiphol (AMS), Netherlands	35
Sydney International Airport (SYD), Australia	46



# ZEV Developments Near Airports



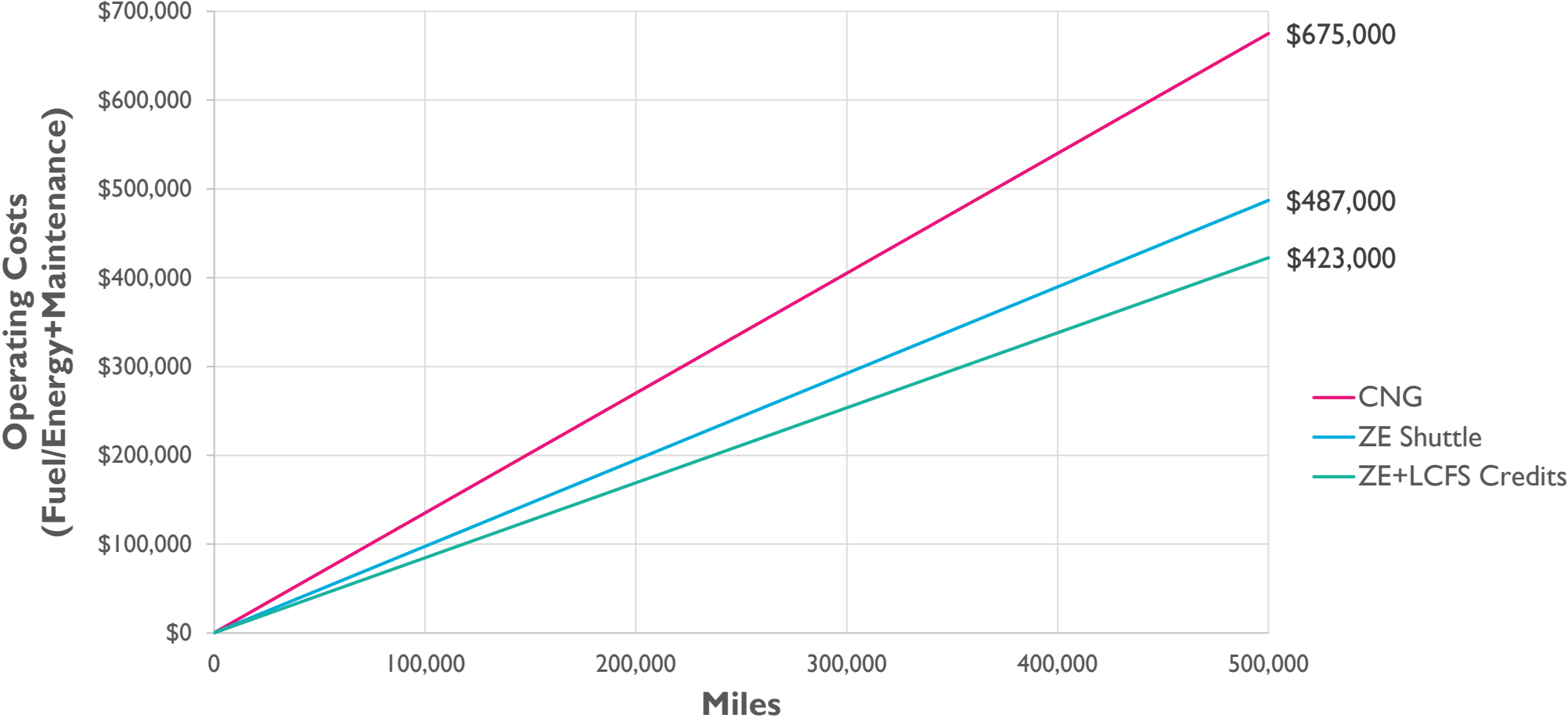
# Airport Shuttle Inventory

Vehicle Weight Class	Vehicle Type	Annual Mileage	Number of Vehicles		
			Part I: On-Airport	Part II: Off-Airport	Part I + Part II
Class 2b-3	Van/Cutaway	10,000-68,000	3	277	280
Class 4-5	Cutaway	10,000-54,000	82	409	491
Class 7-8	32'-40' Low-Floor Bus	17,500-65,000	156	0	156
Class 8	60' Articulated Bus	4,700	21	0	21
<b>Total</b>			<b>262</b>	<b>686</b>	<b>948</b>

# Cost Comparison for 40ft Airport Shuttle

Component	Class 8 CNG	Class 8 ZE (No Incentives)	Class 8 ZE (With Incentives)
Vehicle Cost	\$450,000	\$735,000	\$735,000
Charger and Infrastructure	\$0	\$120,000	\$120,000
HVIP Vehicle Incentive Amount	-	(\$0)	(\$150,000)
HVIP Infrastructure Incentive Amount	-	(\$0)	(\$30,000)
FAA Incentive Amount	-	(\$0)	(\$428,000)
<b>Total Cost</b>	<b>\$450,000</b>	<b>\$855,000</b>	<b>\$247,000</b>

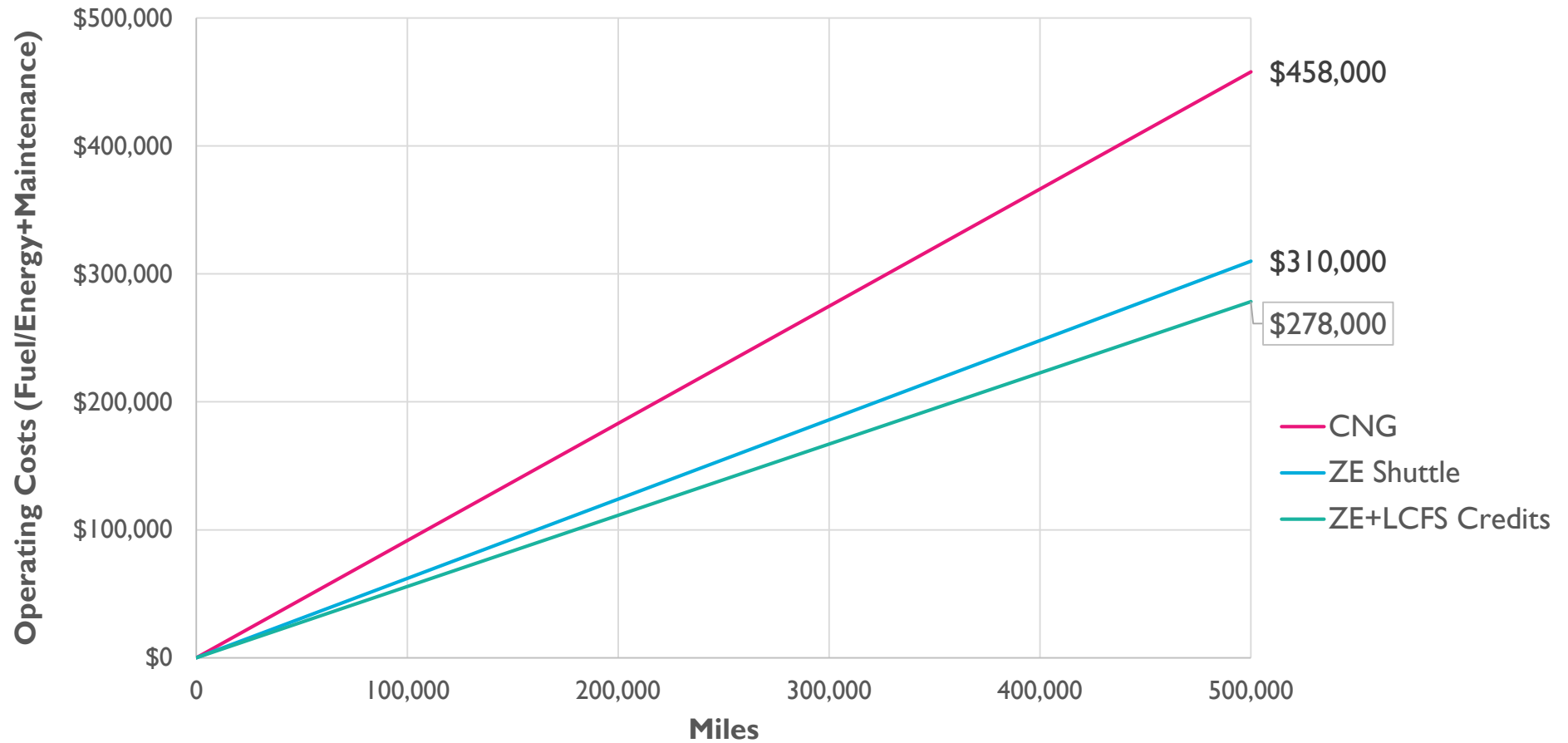
# Total Operating Costs by Mile: 40' Shuttle



# Cost Comparison for Cutaway Shuttle

Component	Class 4 CNG	Class 4 ZE (No Incentives)	Class 4 ZE (With Incentives)
Shuttle Cost	\$90,000	\$190,000	\$190,000
Charger and Infrastructure	\$0	\$50,000	\$50,000
HVIP Vehicle Incentive Amount	-	(\$0)	(\$80,000)
Local Air District Infrastructure Incentive Amount	-	(\$0)	(\$25,000)
<b>Total Cost</b>	<b>\$90,000</b>	<b>\$240,000</b>	<b>\$135,000</b>

# Total Operating Costs: Class 4 Cutaway



# Cost Comparison on Maintenance and Fuel

Vehicle Type	Fuel/Energy Economy	Fuel/Electricity Cost		Maintenance Cost per Mile	Total Cost per Mile	ZE Shuttle Savings per Mile
		Per Unit	Per Mile			
40' CNG Shuttle	4 mpg	\$2.00/gallon	\$0.50	\$0.85	\$1.35	-
40' ZE Shuttle	2 kwh/mile	\$0.17/kwh	\$0.37*	\$0.60	\$0.97	<b>\$0.38</b>
Class 4 CNG Cutaway	6 mpg	\$2.50 /gallon	\$0.42	\$0.50	\$0.92	-
Class 4 ZE Cutaway	1.3 kwh/mile	\$0.17/kwh	\$0.24*	\$0.38	\$0.62	<b>\$0.30</b>

*\*Includes 90 percent kwh charging efficiency*

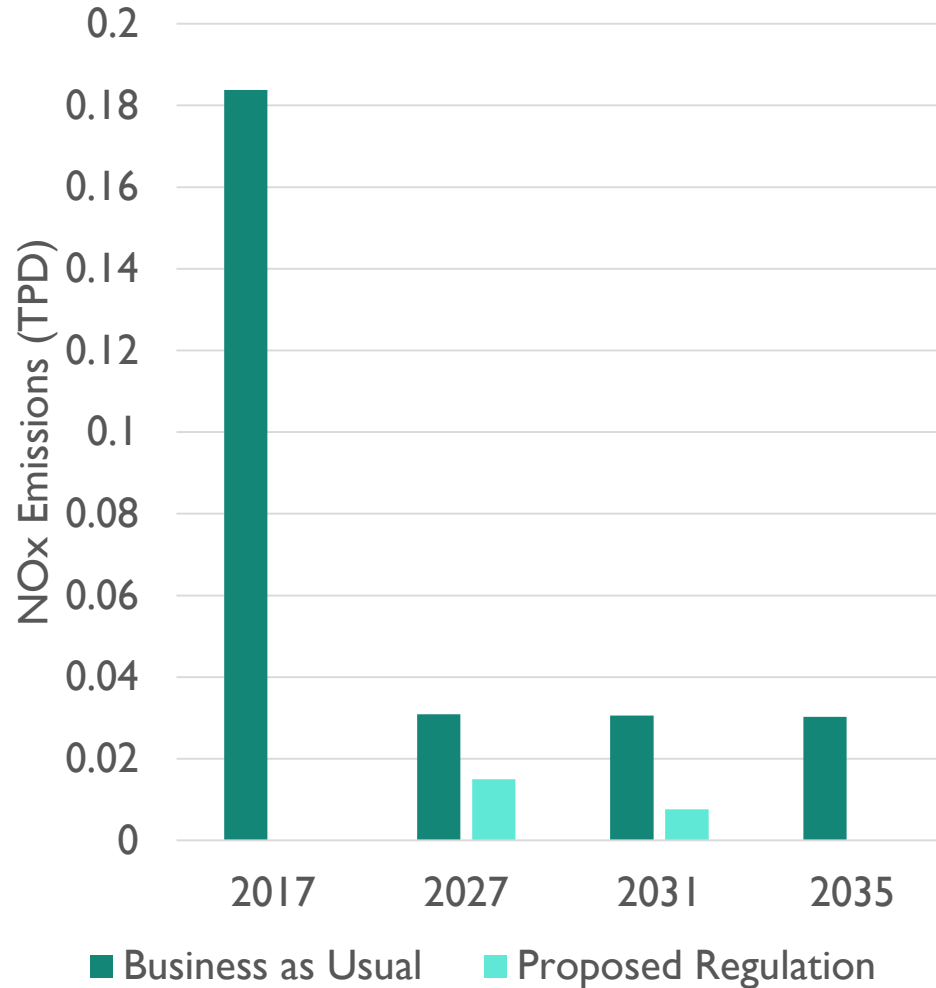
# Estimated Air Emission Reductions

- EMFAC 2017 model utilized to estimate emission reductions from 2017 airport shuttle inventory
- A steady state future growth rate was assumed
- Regulatory analysis assumed an average vehicle life of 12 year lifespan

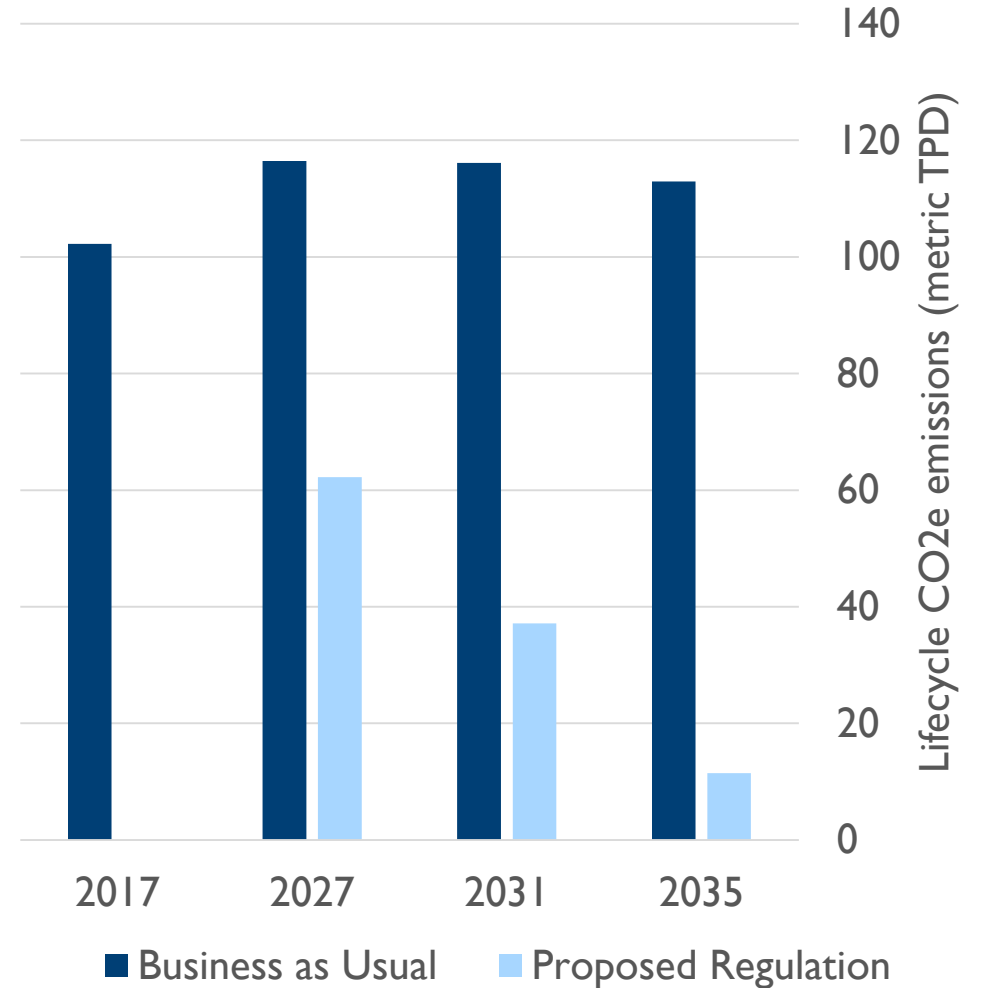


# Preliminary Statewide Emission Impacts

## Nitrogen Oxide Emissions



## Greenhouse Gas Emissions



Revised

# REGULATORY PROPOSAL



Technology Applicability/Scope,  
Measure Strategy

# Regulatory Guiding Principles

- Fair and equitable requirements
- Keep it simple
- Opportunity to achieve air quality goals and the greatest deployment of ZEVs
- Enforceability of requirements
- Assurance that real emissions reductions are achieved

# Key Inputs

- 12-year shuttle useful life for all vehicle types
- Assume flat vehicle growth throughout the regulatory schedule
- Voluntary early action period since incentives may be limited once regulation implementation schedule starts
- 2023 start of regulation with longer phase-in schedule

# Technology supports fixed route shuttle operation

- **Fixed destination** = vehicles that provide service along a prescribed route with few course deviations
- **Not include:**
  - Door-to-door charter service (limousine, vans)
  - Light-duty vehicles (taxis, TNCs, private cars)
  - Transit buses
- **Include:**
  - Fixed airport routes and depot housed vehicles
  - Low-mileage, stop and go operation, and low average speeds
  - Examples: Vehicles servicing parking lots, rental car facility, off-airport parking, hotels, destinations

# Revised Scope

**New**

- **Fixed route shuttles** supporting California's large, medium & small airports
  - **3 - Large:** LAX, SAN, SFO
  - **6 – Medium:** BUR, OAK, ONT, SNA, SMF, SJC
  - **4 – Small:** FAT, LGB, PSP, SBA
- What is an **airport shuttle**?
  - Heavy-duty vehicles class size 2b (8,501 lbs.) to 8 (>33,000 lbs.)
  - Transports travelers to airports and around airport facilities
  - Domiciled within 15-miles of the serviced airport

# Revised Schedule for Fleet Transformation

**New**

- **2018-2022:** Incentives/voluntary actions
- **2023:** New purchase requirement
- **2023-2035:** Fleet turnover requirements
  - **2027:** 33% fleet must be ZEV
  - **2031:** 66% fleet must be ZEV
  - **2035:** 100% fleet must be ZEV

# Revised ZEV Fleet Compliance Examples

**New**

Year	Milestone	Airport Shuttle Fleet Size						
		3	5	7	10	20	50	100
<b>Now-2022</b>	<b>Early Action</b>	Voluntary						
<b>2027</b>	<b>33% Fleet</b>	1	2	2	3	7	17	33
<b>2031</b>	<b>66% Fleet</b>	2	3	5	7	13	33	66
<b>2035</b>	<b>100% Fleet</b>	3	5	7	10	20	50	100



*Draft*

# REGULATORY LANGUAGE



Applicability,  
Requirements

# Who would be responsible to comply with the regulation?

§ 95690.X(x): fleet owner of an airport shuttle with GVWR of 8,501 pounds and greater at a regulated (large, medium and small hub) airport.

- Airport entities
- Companies contracted by airport entities
- Private entities (depot located within 15 mile radius of airport)
- Provide shuttle service at large, medium and small hub airports located in California
- Airport shuttle may include vans, cutaways or buses

# Regulation would not apply to following vehicles

- Airport shuttles that operate at:
  - Non-hub airports
  - General aviation airports
  - Long distance fixed routes
- Vehicles operated by Transit Agencies
- Light-duty vehicles: personal, taxi cabs, or Transportation Network Company

# What would be the fleet owner requirements?

- Fleets will have annual reporting requirements starting January 1, 2022
  - Fleets will receive certificate of compliance
  - Fleet changes must be reported to CARB within 30 days
- Fleets must retain certificate of compliance, fleet list, and shuttle ownership records for minimum of 36 months
- If fleets acquire a new airport shuttle on or after January 1, 2023, it must be a ZEV
- Fleets must achieve ZEV fleet percentage requirements on or before December 31<sup>st</sup> deadline of 2027, 2031, and 2035

# Next Steps

- Continuing Informal Feedback
- Staff Report Published: June 8, 2018
  - 45 Day Comment Period Begins
  - Environmental Analysis will be an Appendix to the Staff Report
- CARB Board Hearing: July 26, 2018

# Powertrain Certification of ZEV

- Current efforts underway for certification and testing procedures for zero-emission powertrains
- Certification process would include performance and durability requirements on zero-emission drive trains

- Lead Staff Contact:

Matthew Diener, [Matthew.Diener@arb.ca.gov](mailto:Matthew.Diener@arb.ca.gov) or  
(626) 575-6684

- Program meeting and events webpage:

<https://ww2.arb.ca.gov/our-work/programs/zero-emission-powertrain-certification/meetings-and-workshops>

# Additional Comments or Questions

**Please contact:**

**Katherine Garrison, Lead Staff**

[Katherine.Garrison@arb.ca.gov](mailto:Katherine.Garrison@arb.ca.gov)

**(916)322-1522**



**Web Page:** <https://www.arb.ca.gov/msprog/asb/asb.htm>

- Updated Cost Share
- Current ZEV Manufacturers

***Sign up for the Airport Shuttle Bus list-serve to receive updates!***



March 7<sup>th</sup> Workshop

Webcast email address:

[SierraRm@CALEPA.ca.gov](mailto:SierraRm@CALEPA.ca.gov)