



Zero-Emission Airport Shuttle Bus **WORKGROUP #2** **MEETING**

December 4, 2017
Sacramento, California
10:00 am – 3:00 pm (PST)



CALIFORNIA
AIR RESOURCES BOARD

Topics for Today

1. Welcome and Introductions
2. Workgroup # 2 Goals
3. Recap
4. Meeting Infrastructure Challenges
5. New Developments
6. Survey Results
7. Cost Data
8. Regulation
9. Next Steps

Workgroup Goals

- Sharing of information that will guide and inform the measure development
- CARB Role:
 - Share progress to date
 - Ask for stakeholder input
- Stakeholder Role: Provide data and experience

Zero-Emission Airport Shuttle Bus



RECAP



Measure Goals,
Zero-Emission Manufacturers,
Airport Efforts,
Proposed Regulatory Concept

Zero-Emission Airport Shuttle Bus Measure – Goals

1. Complement existing programs to achieve NO_x 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



Existing Efforts at Airports

- Land use planning efforts replacing shuttles with electric rail, walkable routes, or public transit
- FAA grants for zero-emission airport shuttles
- Cleaner vehicle encouragement programs
- Battery electric parking shuttles
 - Operational - ONT
 - Purchasing – SJC, SMF

Recap



MEASURE CONCEPT



Technology Applicability/Scope,
Measure Strategy

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

Scope

- **Fixed route shuttles** supporting California's **26 primary** airports
 - **3 - Large:** LAX, SAN, SFO
 - **6 – Medium:** BUR, OAK, ONT, SNA, SMF, SJC
 - **4 – Small:** FAT, LGB, PSP, SBA
 - **13 – Nonhub:** ACV, BFL, CRQ, CIC, CEC, MMH, MOD, MRY, RDD, SBP, SMX, STS, SCK
- 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

Proposed Schedule for Fleet Transformation

- **2018-2022:** Incentives/voluntary actions
- **2023:** New purchase requirement
- **2023-2031:** Fleet turnover requirements
 - **2025:** 33% fleet must be ZEV
 - **2028:** 66% fleet must be ZEV
 - **2031:** 100% fleet must be ZEV

ZEV Fleet Compliance Examples

Year	Milestone	Airport Shuttle Fleet Size						
		3	5	7	10	20	50	100
Now-2022	Early Action	Voluntary						
2025	33% Fleet	1	2	2	3	7	17	33
2028	66% Fleet	2	3	5	7	13	33	66
2031	100% Fleet	3	5	7	10	20	50	100

Interface with Facility Based Measures

- **CARB Board Resolution 17-7**
 - Report to the Board on facility based measure concepts for large freight facilities, and any equivalent alternatives, within 12 months (by March 2018)
 - Does not include CA commercial airports
- **SCAQMD Board Measure MOB-04**
 - Facility based measure for non-aircraft sources at commercial airports (by Feb. 2019)
 - Potentially affect all commercial airports located within air district
 - Efforts on-going – Three workgroup meetings held, three more planned
- **Close interaction and coordination between CARB and SCAQMD**
- **Airport Shuttle Bus measure is not dependent on the outcome of these processes**



Questions on Recap?

Webcast email address:

coastalrm@calepa.ca.gov

INFRASTRUCTURE



Power Needs,
Reliability,
Charging Technology
Lunch Break

Electric Utilities' Presentations

- Link for presentations:
<https://www.arb.ca.gov/msprog/asb/asbmtgs.htm>





Discussion on meeting infrastructure challenges

Webcast email address:

coastalrm@calepa.ca.gov

Meeting will resume after break



Zero-Emission Airport Shuttle Bus
**WORKGROUP
MEETING**



NEW DEVELOPMENTS



Recent ZEV Deployment,
Outreach Efforts,
Cost Sharing Opportunities,
Airports Clean Vehicle Programs,
Powertrain Certification for ZEV

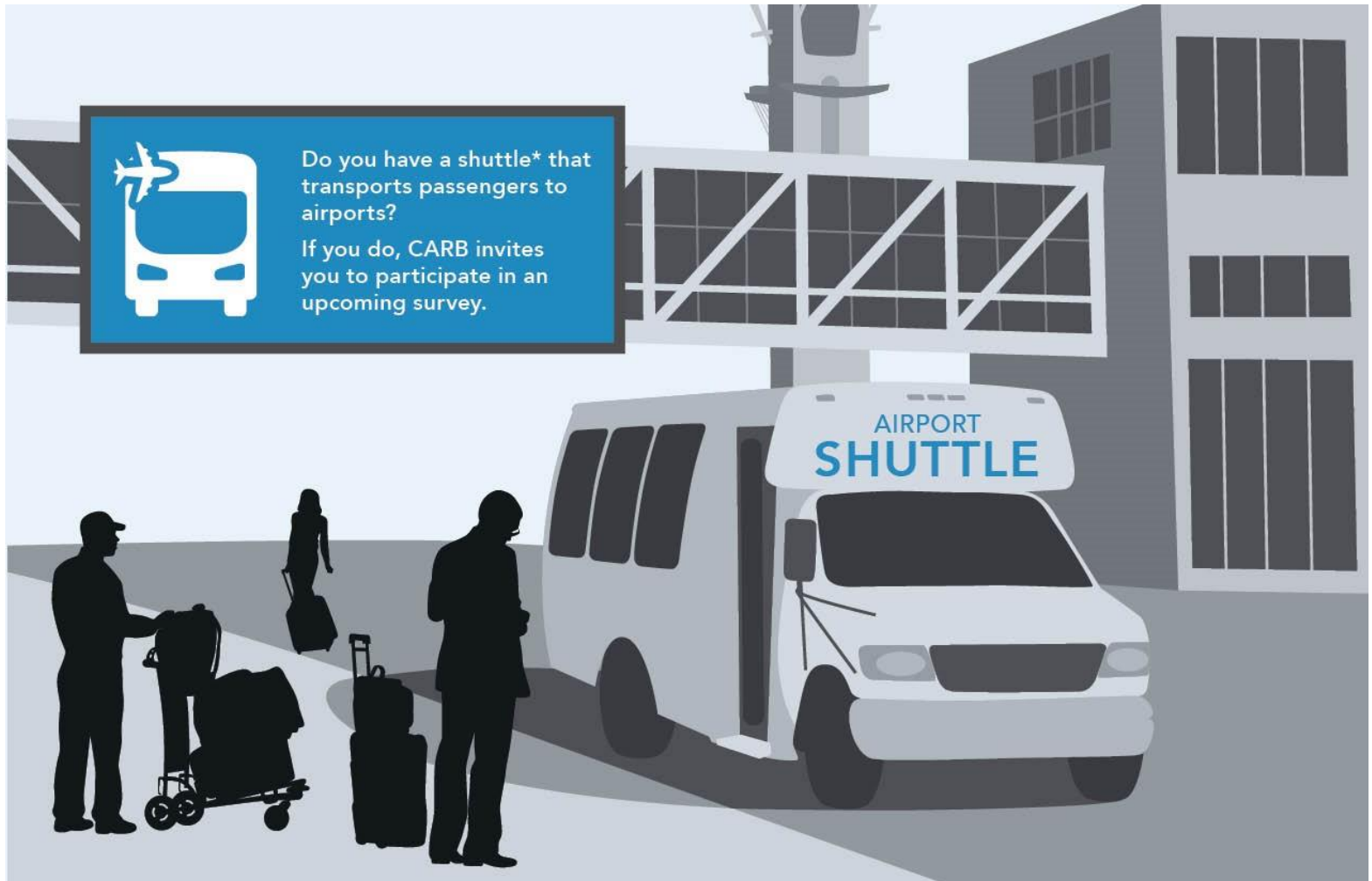
ZEV Developments Near Airports



Outreach to Potentially Impacted Sectors

- **Lodging:** CA Hotel & Lodging Association, CA Lodging Industry Association, Asian American Hotel Owners Association, Hotel Council SF, Gateway to LA, LAX Costal Chamber
- **Airports:** Individual airports, CA Airport Council, CA Airport Clean Air Vehicle Working Group
- **Parking:** National Parking Association, American Ground Transportation Association, International Parking Institute, CA Public Parking Association
- **Technology and Equipment Manufacturers**

Direct Messaging



Cost Sharing Opportunities

Updated Cost Share document:

link <https://www.arb.ca.gov/msprog/asb/asbmtgs.htm>

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 or
(626) 575-6684
- Program meeting and events webpage:
<https://ww2.arb.ca.gov/our-work/programs/zero-emission-powertrain-certification/meetings-and-workshops>

Airports Clean Vehicle Programs

- **SFO:** Roger Hooson on hotel consolidation and other efforts
- **SAN:** Chad Reese slides on Ground Transportation Vehicle Conversion Incentive-Based Program
- **LAX:** Tamara McCrossen-Orr on Alternative Fuel Vehicle Requirements

Airports' Presentations

- Link for presentations:

<https://www.arb.ca.gov/msprog/asb/asbmtgs.htm>



Questions/Comments on Airport Programs?

Webcast email address:

coastalrm@calepa.ca.gov

Airport Shuttle Bus Operators

◦ **SURVEY**



Part 1 & 2 Results

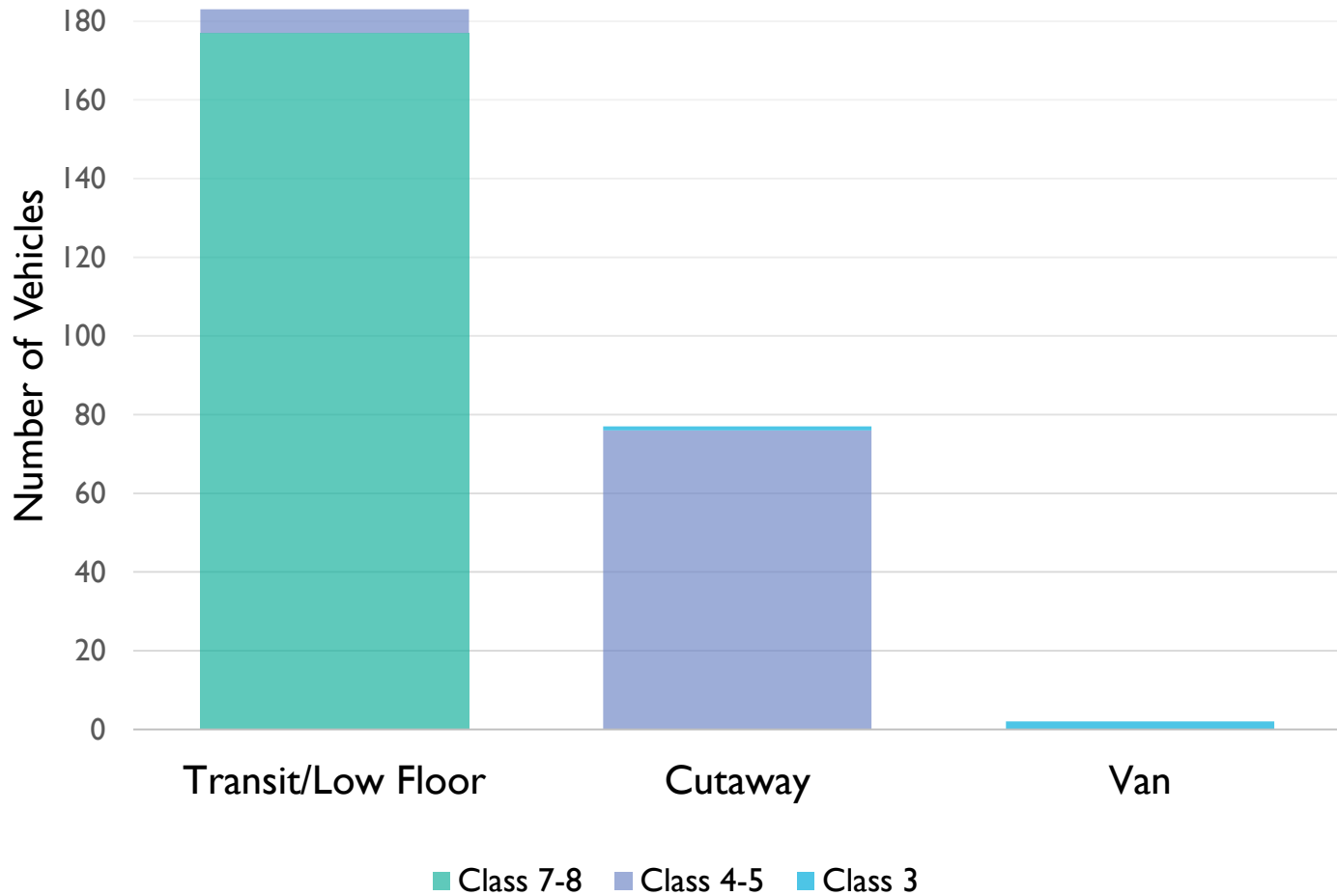
Purpose of Survey

- Better understanding of airport shuttle buses and off-airport transportation shuttles
- Analysis of results will help refine the proposed measure strategy
- Part I: Survey of On-Airport Shuttle Buses
- Part II: Survey of Off-Airport Passenger
- Shuttles Surveys posted:
<https://www.arb.ca.gov/msprog/asb/asbsurvey.htm>

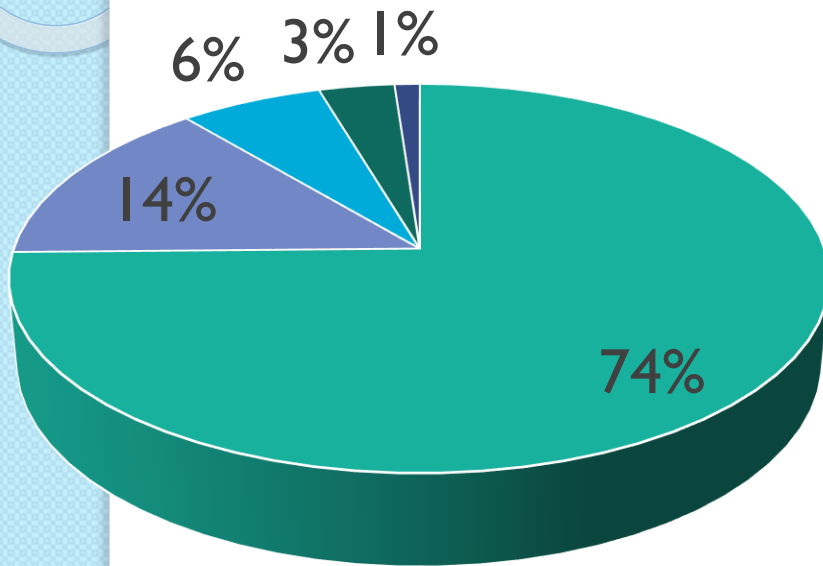
Part I Survey Results - Airport Fleet General Information

Survey Reporting Percentage	100%
Total Number of Vehicles	264
Average Useful Life	12 years
Average Miles per Day/Year	95/34,573
Average Model Year	2010
Top Factors in Purchasing	Capitol Cost, Total Cost of Ownership, Safety, Reliability

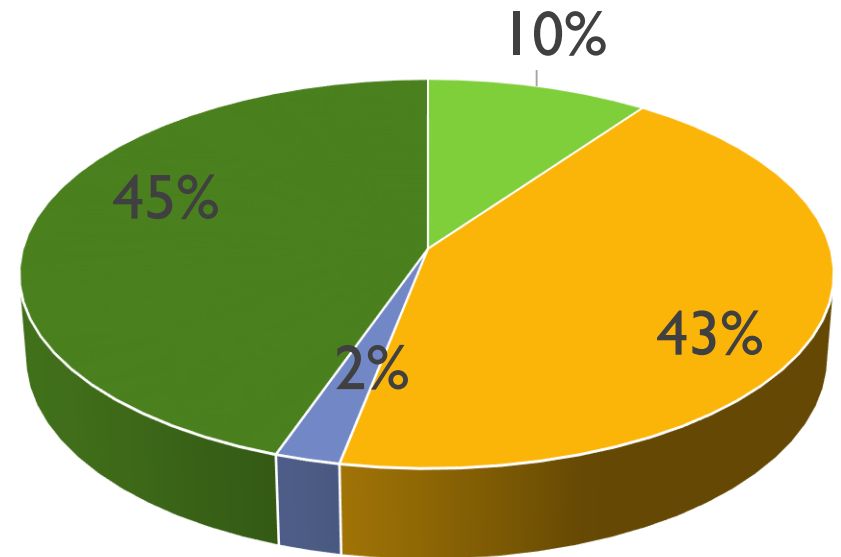
Airport Shuttle Vehicle Types



Airport Fleets: Fuel Type & Annual Vehicle Miles



- CNG
- DIESEL
- EV
- LPG
- Biodiesel



- 2,000-9,999
- 10,000-29,999
- 30,000-49,999
- 50,000-70,000

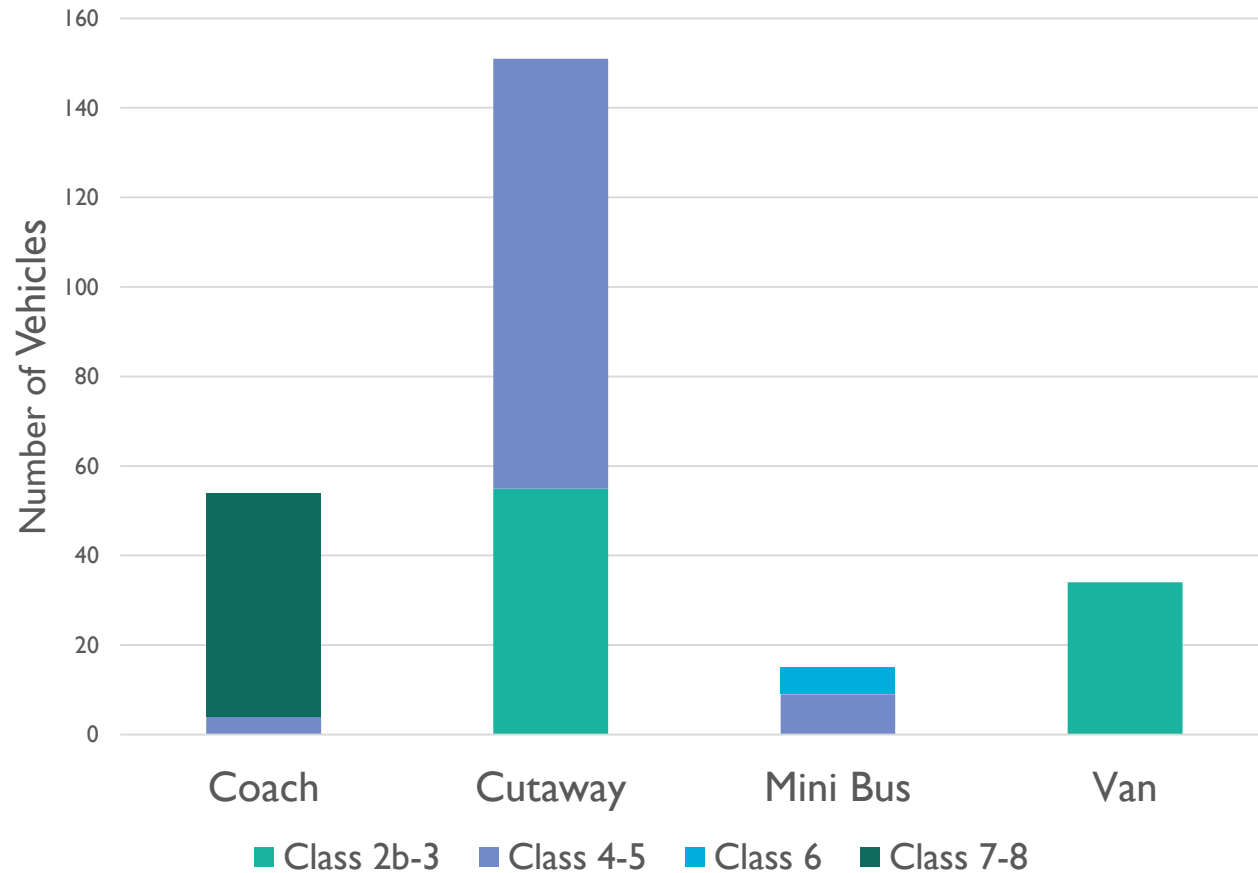
Airport Route Characteristics - Excellent Applications for ZEVs

Average Number of Routes per Airport	2.5
Route Average Distance (miles)	3.5
Number of Routes > 5 Miles	8
Number of Average Stops	7
Average Speed (mph)	17
Maximum Average Speed (mph)	34

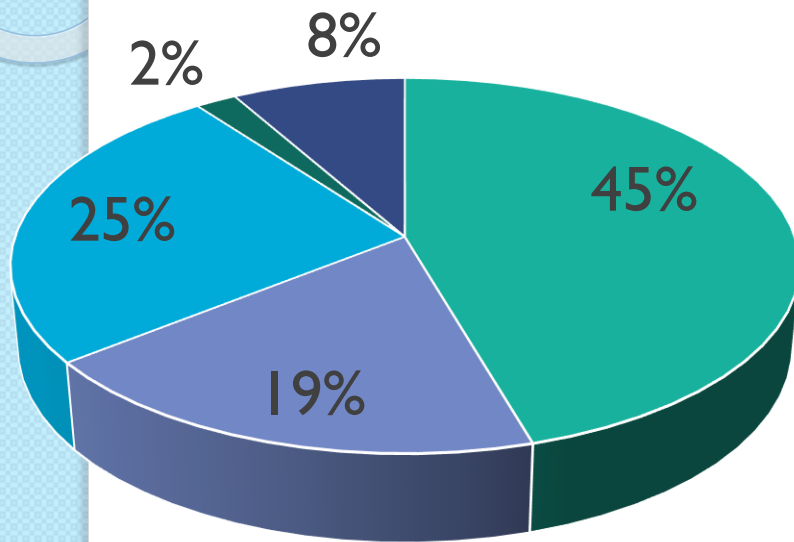
Part 2 Survey Results – Off-Airport Fleet General Information

Survey Reporting Percentage	15%
Total Number of Vehicles	255
Average Useful Life	10 years
Average Miles per Day/Year	104/37,925
Average Model Year	2011
Top Factors in Purchasing	Reliability, Total Cost of Ownership, Safety, Capitol Cost

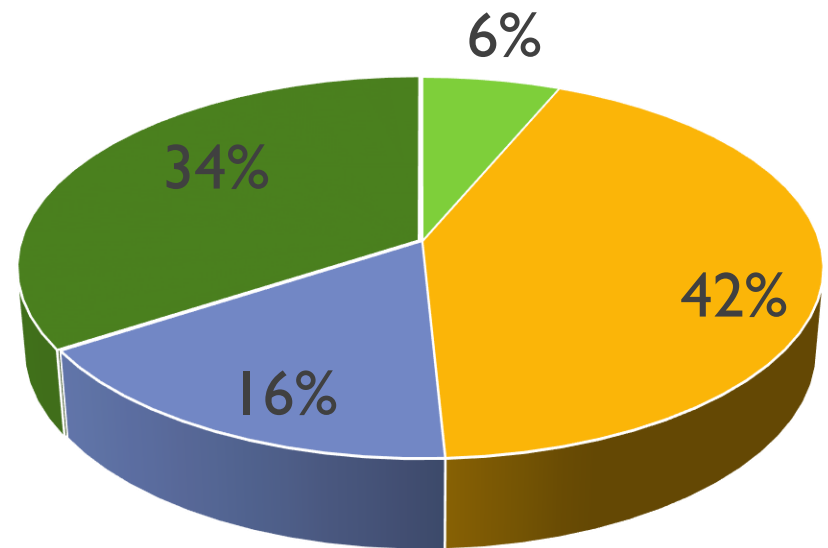
Off-Airport Shuttle Vehicle Types



Survey Part 2- Fuel Type & Annual Vehicle Miles



■ CNG ■ Gasoline ■ DIESEL
■ Biodiesel ■ EV



■ 2,000-9,999 ■ 10,000-29,999
■ 30,000-49,999 ■ 50,000-70,000

Off-Airport Route Characteristics – Applicable for ZEVs

Average Number of Routes per Business	1
Total Number of Unique Routes	27
Number of Routes <15 Miles	17
Number of Routes >100 Miles	7
Number of Average Stops	5
Average Speed (mph)	41
Maximum Average Speed (mph)	51



Comments/Questions on Survey Results?

Webcast email address:

coastalrm@calepa.ca.gov



COST DATA



Capital
Operational & Maintenance

Capital Vehicle Reported Costs: ICE to ZEV

Vehicle Type	Incremental Cost Ranges
Van	\$70,000 - \$80,000
Cutaway	\$60,000 - \$120,000
30ft Transit Bus	\$50,000 - \$100,000
35ft Transit Bus	\$100,000 - \$175,000
40ft Transit Bus	\$100,000 - \$350,000
60ft Transit Bus	\$300,000 - \$525,000
Coach	Collecting data

Capital Infrastructure Costs

- Infrastructure costs vary depending on fleet requirements
 - Number of electric vehicles
 - Charging strategies (i.e. inductive, overhead, depot)
 - Voltage capacity
 - Amount/length of trenching needed for conduit
- Reported Infrastructure Costs (not including construction costs)

Device	Depot		In-Route
Charger Type	Level 2	DC 50kW	Overhead Charger
Cost	\$2,500	\$25,000-\$50,000	\$400,000

Capital Infrastructure Costs

- Current Airport Shuttle Bus Projects

Location	Sacramento International Airport	San Jose International Airport	Off-Airport Parking Company	Off-Airport Parking Company
No. of Vehicles	5	10	16	19
No. of Chargers	5 DC 50 kW 1 Overhead	10 DC 50 kW	5 DC 50 kW 3 Level 2	6 DC 50 kW 6 Level 2
Total Cost of Charging Equipment	\$610,000	Collecting data	\$130,000	\$240,000

- Ongoing research
 - We need additional data from On-Airport and Off-Airport shuttles to gather more real world cost examples

Battery Electric Shuttle: Maintenance and Fuel Savings

- Savings depend on several factors
 - Duty Cycle
 - Fuel and electricity costs (depends on charging strategy and utility provider)
 - A/C Usage
 - Fuel type of baseline vehicle
 - Fuel economy
 - Driving “style” of operator
- Potential savings vary among vehicle types

Vehicle	Van - Class 2-3	Cutaway - Class 4-5	Bus - Class 6-8
Maintenance Savings	\$0.06 - 0.10/mile	\$0.09 - 0.13/mile	\$0.19 - 0.25/mile
Fuel Savings*	\$0.10 - 0.24/mile	\$0.18 - 0.40/mile	\$0.17 - 0.48/mile
Total	\$0.16 - 0.34/mile	\$0.27 - 0.53/mile	\$0.36 - 0.73/mile

**Not including LCFS credits totaling \$10,000 per year for a transit-style bus operating 50,000 annual miles*



Discussion on Cost Data

Webcast email address:

coastalrm@calepa.ca.gov



REGULATION



Environmental Analysis,
Guiding Principles,
Discussion on Current Proposal

Environmental Analysis

- Environmental Analysis (EA) being prepared analyzing potentially significant adverse impacts caused by reasonably foreseeable actions.
- Meets requirements of CARB's certified program under the California Environmental Quality Act (CEQA).
- The CEQA Environmental Checklist (CEQA Guidelines Appendix G) is used to identify and evaluate potential indirect impacts.
- The EA will be an appendix to the Staff Report.

Environmental Analysis to be Prepared

- The EA will include:
 - Description of reasonably foreseeable actions taken in response to the proposed regulation.
 - Programmatic level analysis of potential adverse impacts caused by reasonably foreseeable actions
 - Beneficial impacts
 - Feasible mitigation measures to reduce/avoid significant impacts
 - Alternatives analysis
- Input invited at this early stage on appropriate scope and content of the EA.
- Draft EA will be released for 45 day public comment period.

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 11% annual fleet turnover (100% by 2031)

CA Airport Council Comments

- Prefer voluntary agreements to achieve necessary emission reductions
- Willing to commit to use FAA funds for ZEVs and infrastructure
- Suggest exempting nonhub airports that handle only ~10% of State's passenger traffic
- Concern of limited ZEV product availability and private fleet access to high power

Discussion Points

- Many shuttles operate almost around the clock. How can this regulation maximize ZEVs while accommodating this operation?
- Shuttles include many vehicles types and sizes. Some vans are light-duty and others are heavy-duty; does it make sense to include all vans in the regulation scope?
- How can the regulation address the need for continuing passenger ground travel during emergency power outages?
- How can the regulation support expansion of the heavy-duty ZEV market to ensure greater consumer choices?



Feedback on Proposed Regulation

Webcast email address:

coastalrm@calepa.ca.gov

Next Steps

- **Workshop #2 Series**
 - January 30, 2018 (LAX airport)
 - February 2, 2018 (Sacramento)
 - *Staff will present:*
 - *Regulatory options*
 - *Cost of regulation*
 - *Draft regulatory language*
- **CARB Board Hearing June 28, 2018**

Additional Comments or Questions

Please contact:

Katherine Garrison, Lead Staff

Katherine.Garrison@arb.ca.gov

(916)322-1522



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

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