

# Welcome

Zero Emission Bus  
Public Workshop  
will begin shortly.

*El taller público sobre  
autobuses de cero emisiones  
comenzará en breve.*

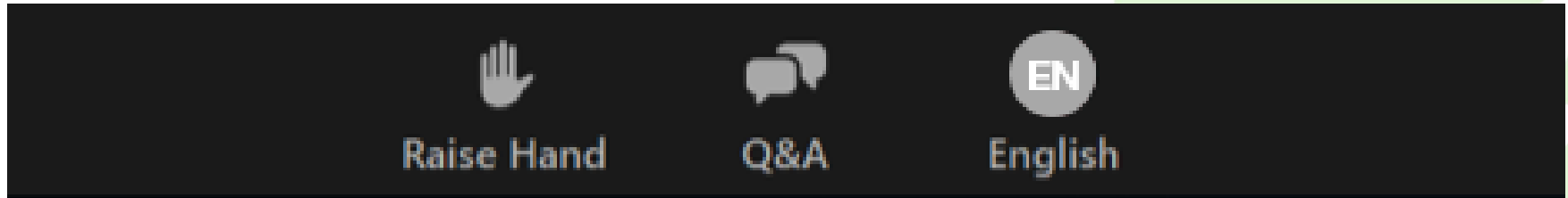


# Introductions & Roles



# Workshop Flow

- Presentation provided in English and Spanish
- How to submit/ask questions
  - Submit a question through the Q&A icon
  - Raise your virtual hand - MTS will call/unmute you to ask question



- Polls will be conducted during presentation to collect feedback

# Workshop Flow

- **Four presentation sections:**
  - MTS Electric Bus Pilot Update
  - MTS Draft Transition Plan
  - Greenhouse Gas Emission Benefit Study
  - Implementation in Disadvantaged Communities
- **There will be a question and answer time period at the end of each section (please keep questions to appropriate sections)**
- **Additional final question and answer session at the end of the presentation**

# Opening Remarks

**Nathan Fletcher**

MTS Board Chair

San Diego County Supervisor,  
District 4

# Opening Summary of Zero Emissions Bus Activities to Date

**Sharon Cooney**

MTS Chief Executive Officer



# Poll

**What comes to mind first when you hear “zero emissions bus fleet?”**

- A. Cleaner air/GHG reductions
- B. Adopting the latest transit technologies
- C. Quieter rides
- D. Healthier communities



# Poll

## Prior to COVID-19, how often did you ride MTS?

- A. Never (non-rider or more than one year since riding)
- B. Rarely (once or twice a year, special events only)
- C. Occasionally (once or twice a month)
- D. Semi-Frequently (once or twice a week)
- E. Very Frequently (three or more times a week)



# Poll

**How would you describe your level of knowledge about zero-emissions vehicles such as electric buses?**

- A. Very knowledgeable
- B. Somewhat knowledgeable
- C. Not very knowledgeable
- D. Not at all knowledgeable

# Zero Emission Bus (ZEB) Pilot Project Overview/Update



# Why Convert Bus Fleet to Zero Emissions?

- Protects the environment/reduces emissions
- Helps the region meet climate action goals
- California Air Resources Board Innovative Clean Transit Regulation
- Technology is improving



# MTS Pilot Project Background

- First ZEBs on MTS Routes: December 2019
- Eight (8) battery electric buses purchased for pilot:
  - **6 in service**
  - **2 arriving Soon**
- 12 chargers installed or planned for installation:
  - 6 chargers in July 2019 (Imperial Avenue Division)
  - 6 chargers in August 2020
    - Two each at South Bay, East County, Kearny Mesa

# ZEB Pilot Project Cost

- Total Pilot Budget: \$12.4 million
- **8 Electric Buses: \$950,000 per bus**
  - MTS Current Natural Gas Bus: \$540,000 per bus
- **Pilot Project Charging Infrastructure: \$2.1 million**
  - 12 depot chargers
  - Design/Construction
- **Training: \$100,000**





# Electric Bus Performance To-Date

## Service Schedule

- 17 out of 95 routes
  - All out of Imperial Avenue Division
- 11 more routes in near future
  - Rotating to South Bay, East County as charging infrastructure becomes available

## Performance

- Range = 148 miles
- Cost Per Mile = \$0.94
- Availability = 82%
- Reliability = 99%
- Passenger/Operator Feedback = Positive
- Environmental Benefit = GHG analysis



# Zero Emission Bus (ZEB) Pilot Program

## Q&A





# Poll

**What parts of the region would you like to see MTS prioritize ZEB rollout?**

- A. Around schools and universities
- B. Beach communities
- C. Disadvantaged communities
- D. East County
- E. High-ridership routes
- F. Mid-City San Diego
- G. South County

# Draft Zero Emission Bus Transition Plan



# Draft ZEB Transition Plan Elements

- Infrastructure
- Cost
- Vehicles
- Workforce Development



# Infrastructure



# Charging Infrastructure Plan



- Gantry structures at each division
- Overhead pantograph dispensers
- Super Off-Peak or Off-Peak, overnight charging

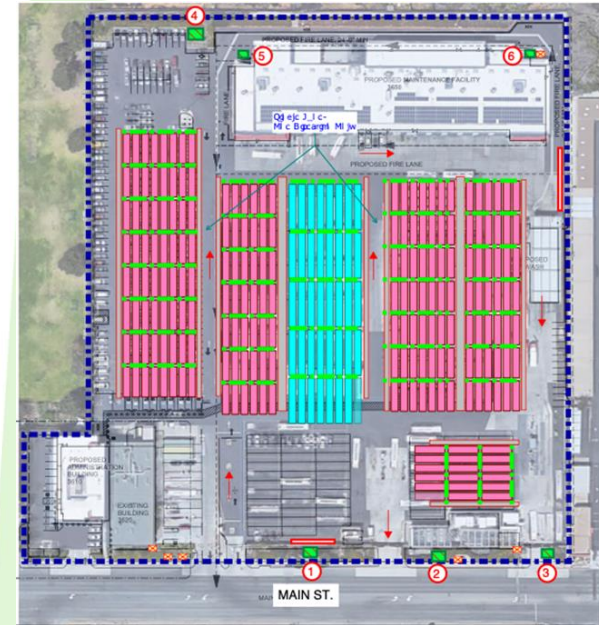
- 1 bus per dispenser
- 2 dispensers per charger
- 2 buses per charger
- Charge management system





# South Bay Division Layout

- New Electric Rapid bus route between Otay Mesa and Imperial Beach (Iris Rapid)
- Twelve (12) sixty-foot battery electric bus purchase
- Overhead charger infrastructure progress:
  - Charger facility planning: **DONE**
  - Operating plan finalized: **DONE**
  - Engineering/Design: **October 2020 – March 2021**
  - Construction **September 2021 – March 2022**
- SDG&E feasibility site assessment for power need



[illegible]

## Site constraints

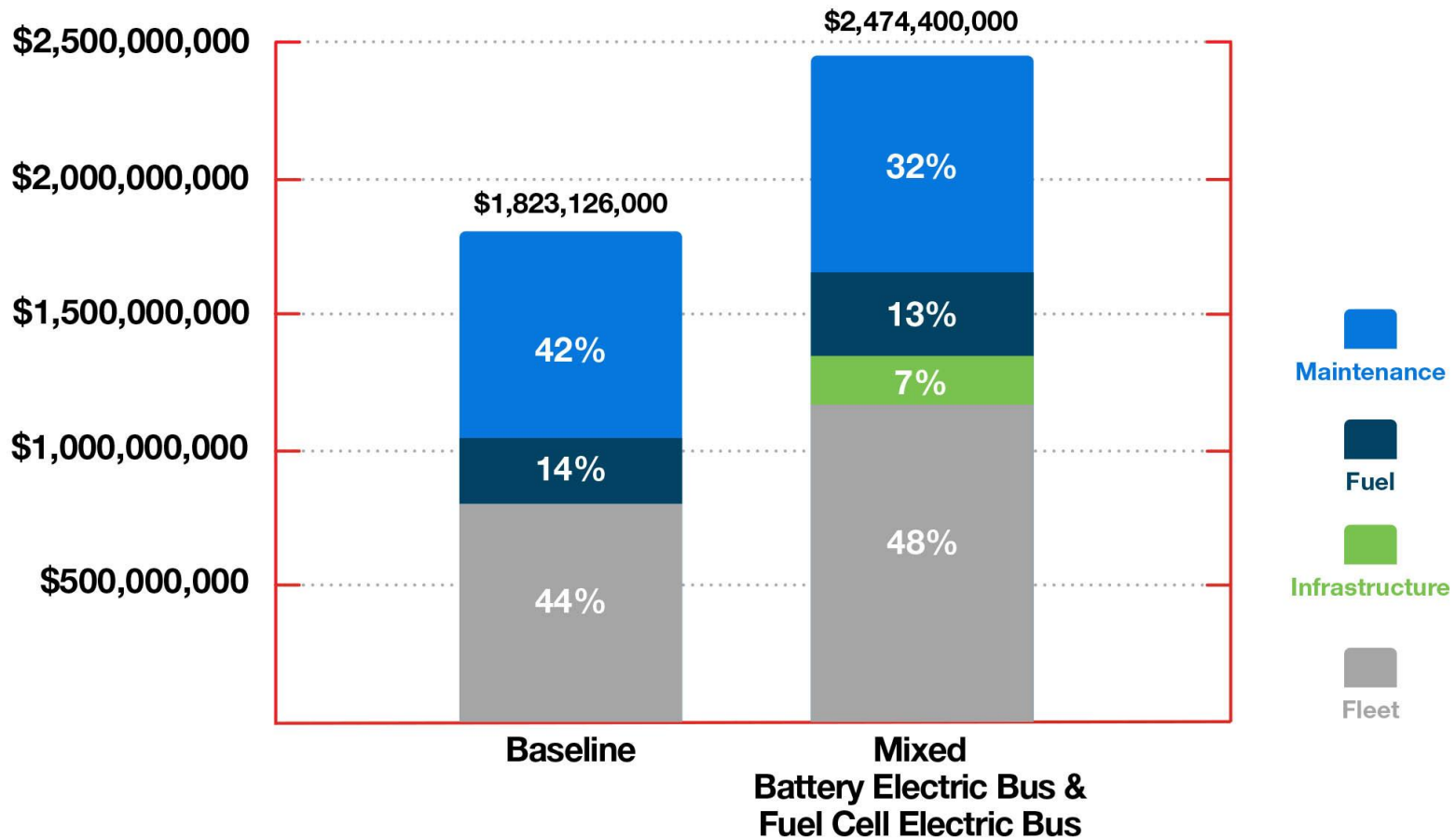


# Transition Costs



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# TOTAL TRANSITION COSTS 2020-2040



# Vehicle Transition



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# Current MTS Fleet

Standard 40' Bus



“Over the Road” 45' Bus



Articulated 60' Bus



- Electric
- CNG/RNG (Near-Zero)

Minibus/Paratransit: 22' – 32'



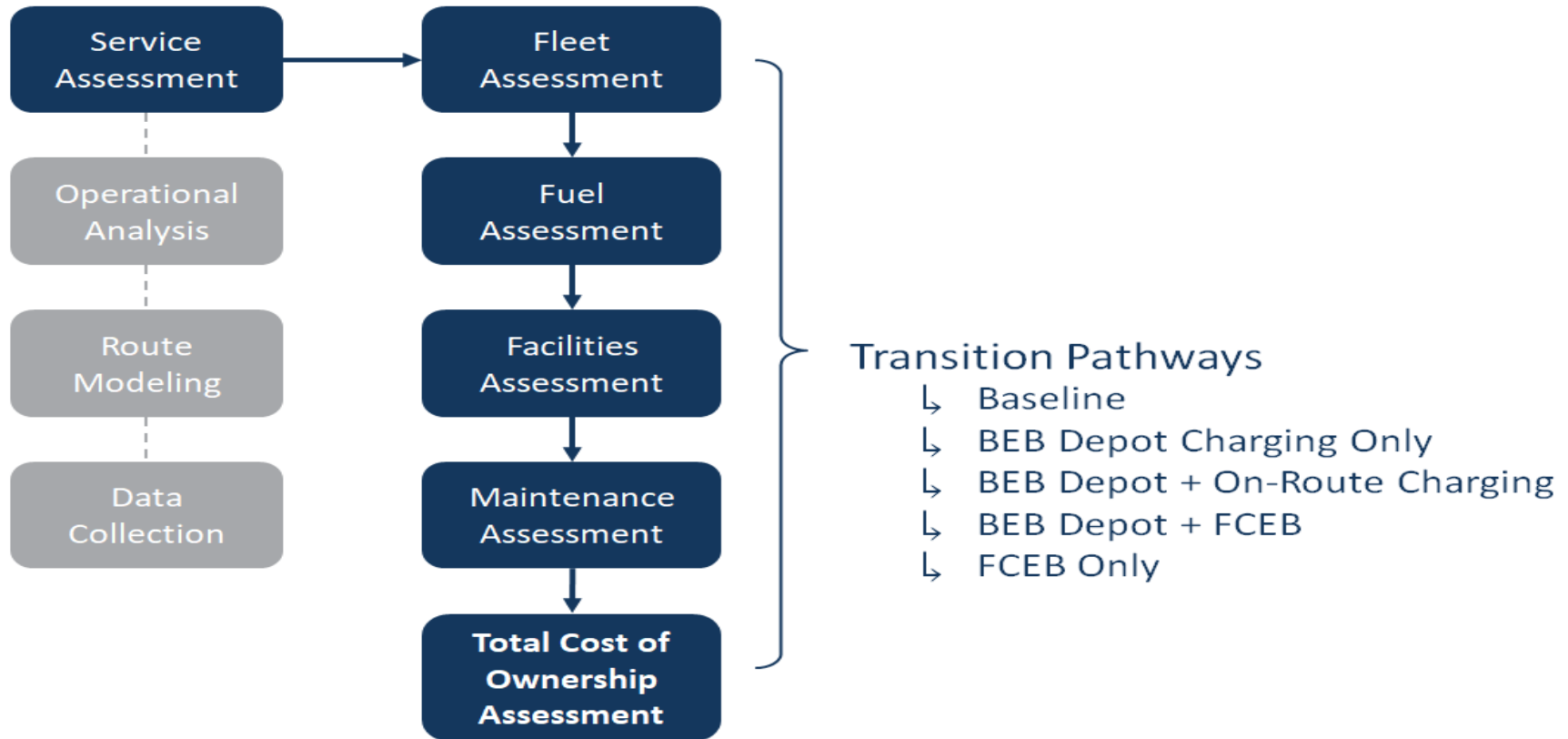
- Propane
- Gasoline/Diesel (phasing out)



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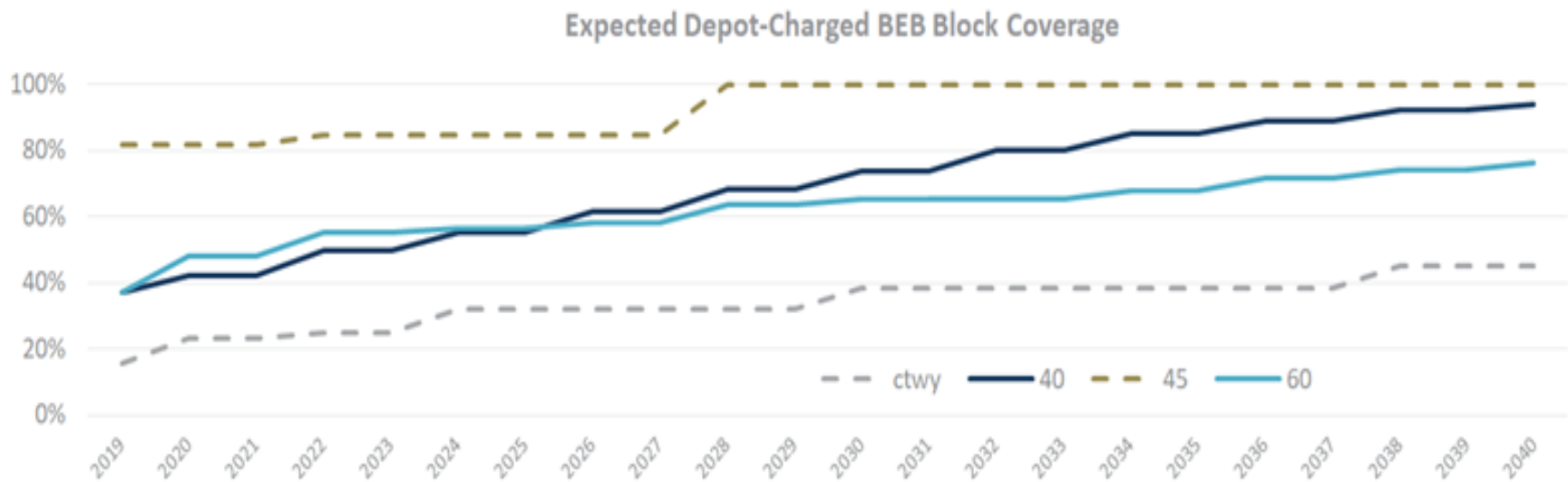
# ZEB Transition Pathways

In 2018, partnered with the Center for Transportation and the Environment (CTE)



# Prioritizing MTS' Transition Based on Technology

- Electric buses can meet 49% of the route schedules
- Hurdles to manage:
  - Altoona tested bus types
    - Allows Federal funds to be used
  - Meets range requirements
  - Infrastructure / Construction
  - Cost
- Depot charging assumptions by 2040:
  - 94% - 40' Battery Electric
  - 76% - 60" Battery Electric
  - 100% - 45' (Commuter) Battery Electric
  - 45% - Minibus/Paratransit Battery Electric





# Minibus/Paratransit Considerations

- Very limited commercially available options
- Significant range limitation
- Cost / Service Life:  
Seven (7) year vehicle
- Demand response

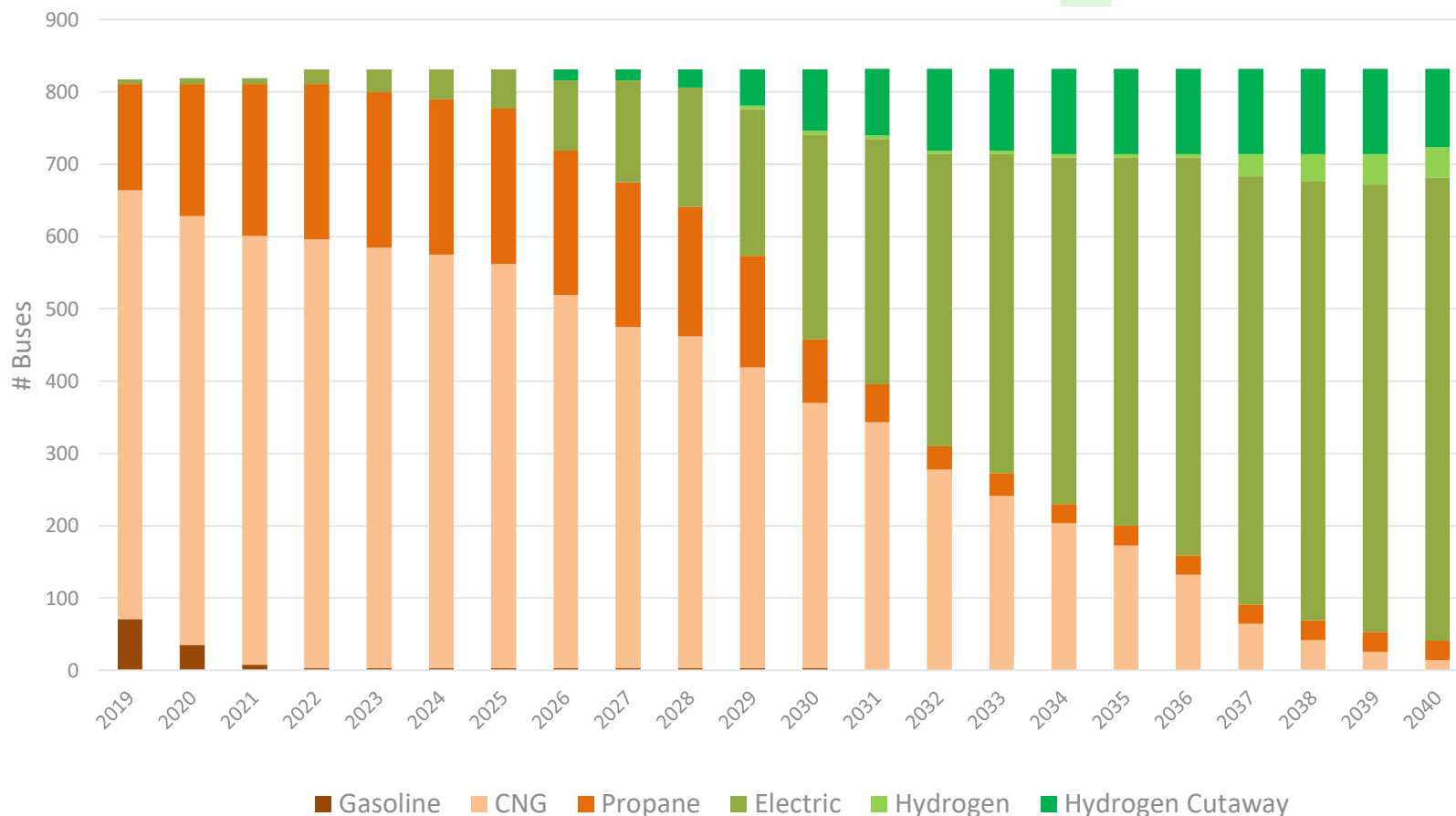
## Emission Benefits of Propane:

- Reduction in emissions: 61%

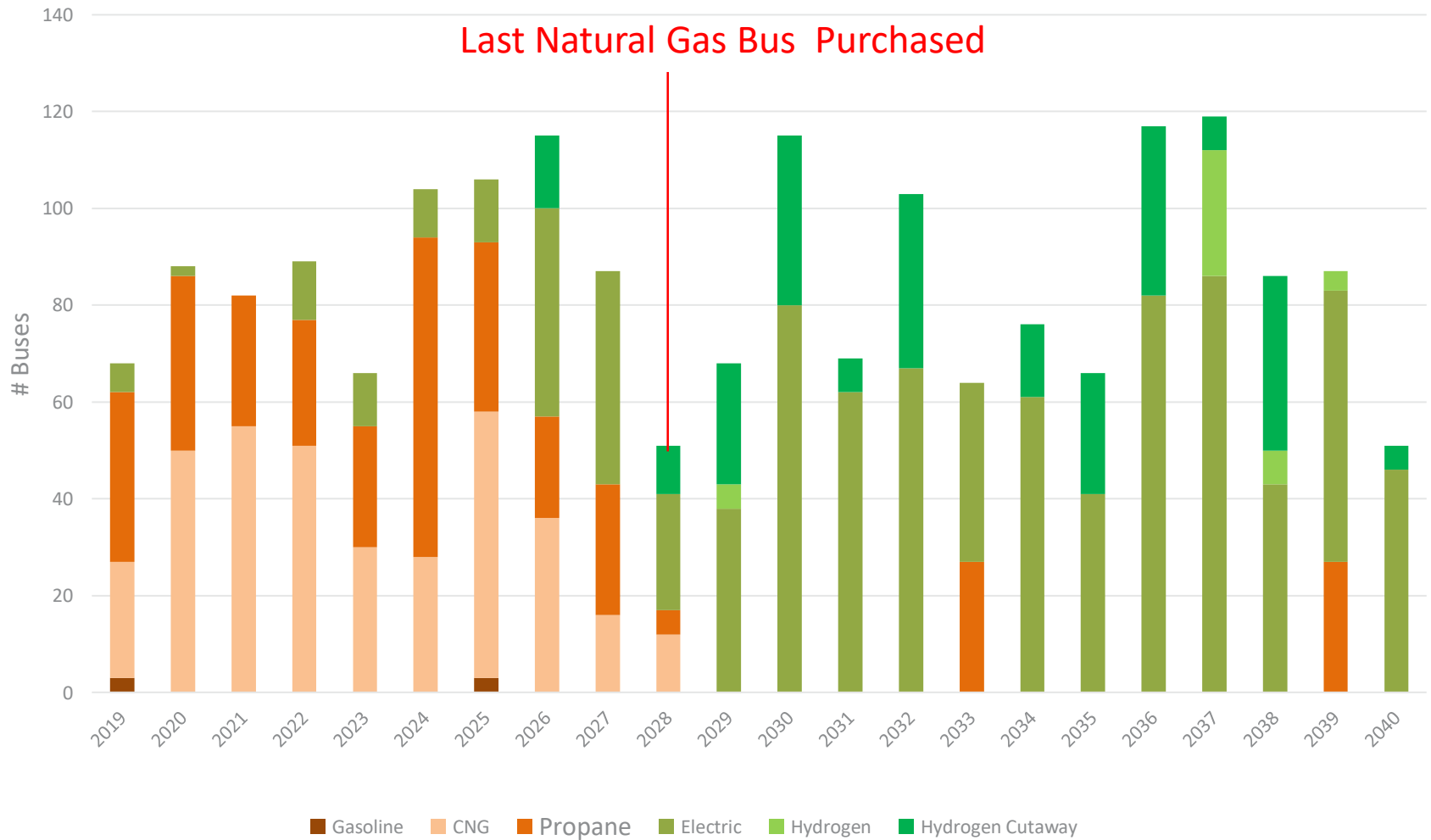




# Fleet Composition through Transition



# Annual Vehicle Purchases



# Workforce Development



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# Workforce Development

## CARB Regulation Requirements

- MTS has a State Accredited training program to develop mechanics
- Administered by MTS and local community colleges
- Content developed with the International Brotherhood of Electrical Workers
- Four (4) year program

## Maintenance Training modules include:

- High-voltage safety
- Power and Battery Systems
- Preventive and reactive repair procedures

## Staff and Regional Partner Training:

- Bus Operators
- First Responder
- Cleaners and Body Shop
- Facilities and Management



\*\*Construction and repair of high voltage of the infrastructure will require Electric Vehicle Infrastructure Training Program (EVITP) certification

# Peer Transit Agency Review



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# What are other transit agencies doing?

## LA Metro - 2200 bus fleet:

- In 2016, committed to 100% ZEB by 2030
- In 2019, amended procurement plans to include CNG buses to bridge the gap
- Over 600 CNG buses have been authorized



## Foothill Transit - 376 bus fleet:

- In 2016, committed to 100% ZEB by 2030
- Originally implemented BEB's with overhead (In-route) charging
- In 2020, original plans amended to reflect purchase and placement of depot charging
- Currently evaluating hydrogen fuel cell buses for transition





# What are other transit agencies doing?

## Antelope Valley Transit Authority - 88 bus fleet:

- In 2016, committed to 100% ZEB by 2018
- To date, roughly 50% are ZEB's – remainder fleet Diesel/ Diesel Hybrid
- Operating yard is approximately 16 acres



## North County Transit District - 152 bus fleet:

- Consultant on board to help develop transition plan
- Currently no ZEB's on order
- Early data indicates a mix fleet approach with BEB first





# Main Considerations for Transition



# Main Considerations

- Infrastructure
- Constrained footprint
- New site (estimate \$185M)
- Grid capacity/Redundancy
- Range limitations
- Funding
- Minibuses/Paratransit services



# Zero Emission Bus (ZEB) Draft Transition Plan

## Q&A



# Poll

## What do you think about a 20-year conversion path for 800 buses?

- A. I think it should happen quicker than 20 years, regardless of cost
- B. I think it should happen quicker than 20 years, as long as cost does not impact service levels
- C. I think it should take longer than 20 years
- D. I think this is a good timeline

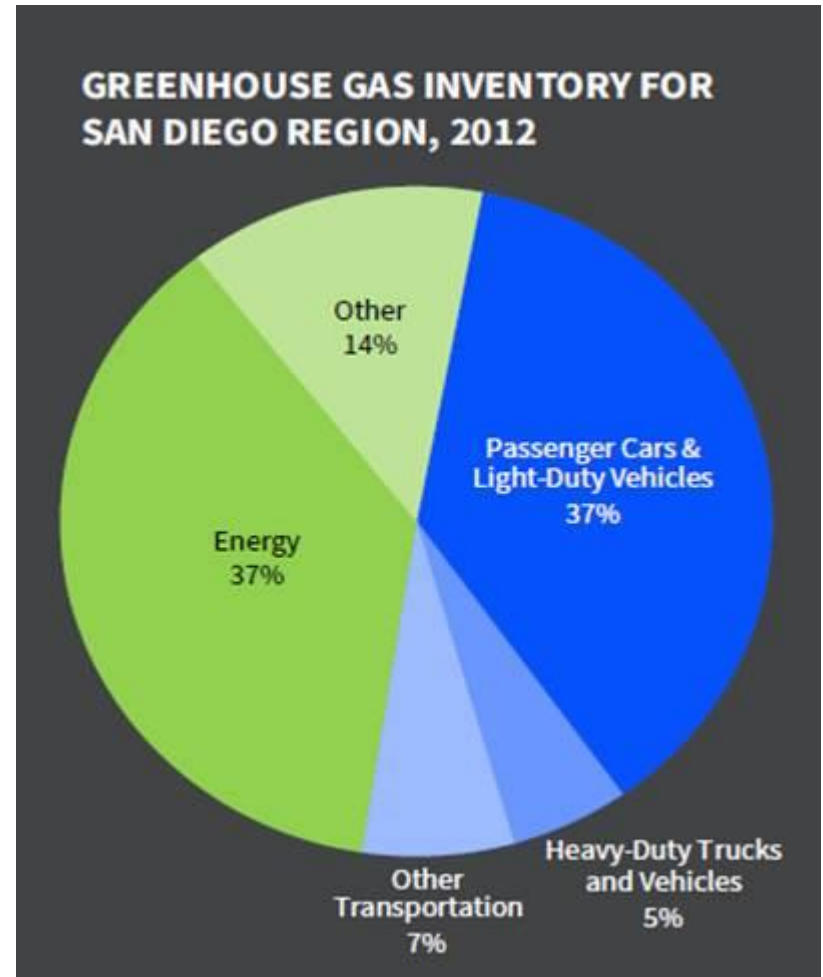
# Greenhouse Gas Emission Benefit Study





# San Diego Greenhouse Gas Inventory

- The total San Diego regional emissions were estimated at 23.82 million MTCO<sub>2</sub>e
- Heavy duty trucks and vehicles = 1.89 (5%) MTCO<sub>2</sub>e



*\*SANDAG (2012). Accelerate to Zero Emissions: A Regional Collaboration to Combat Air Pollution through Transportation Electrification.*



# GHG Benefits – 2040 Transition



- Current Transition Plan Proposal

# GHG Benefits – Early Adoption 25%



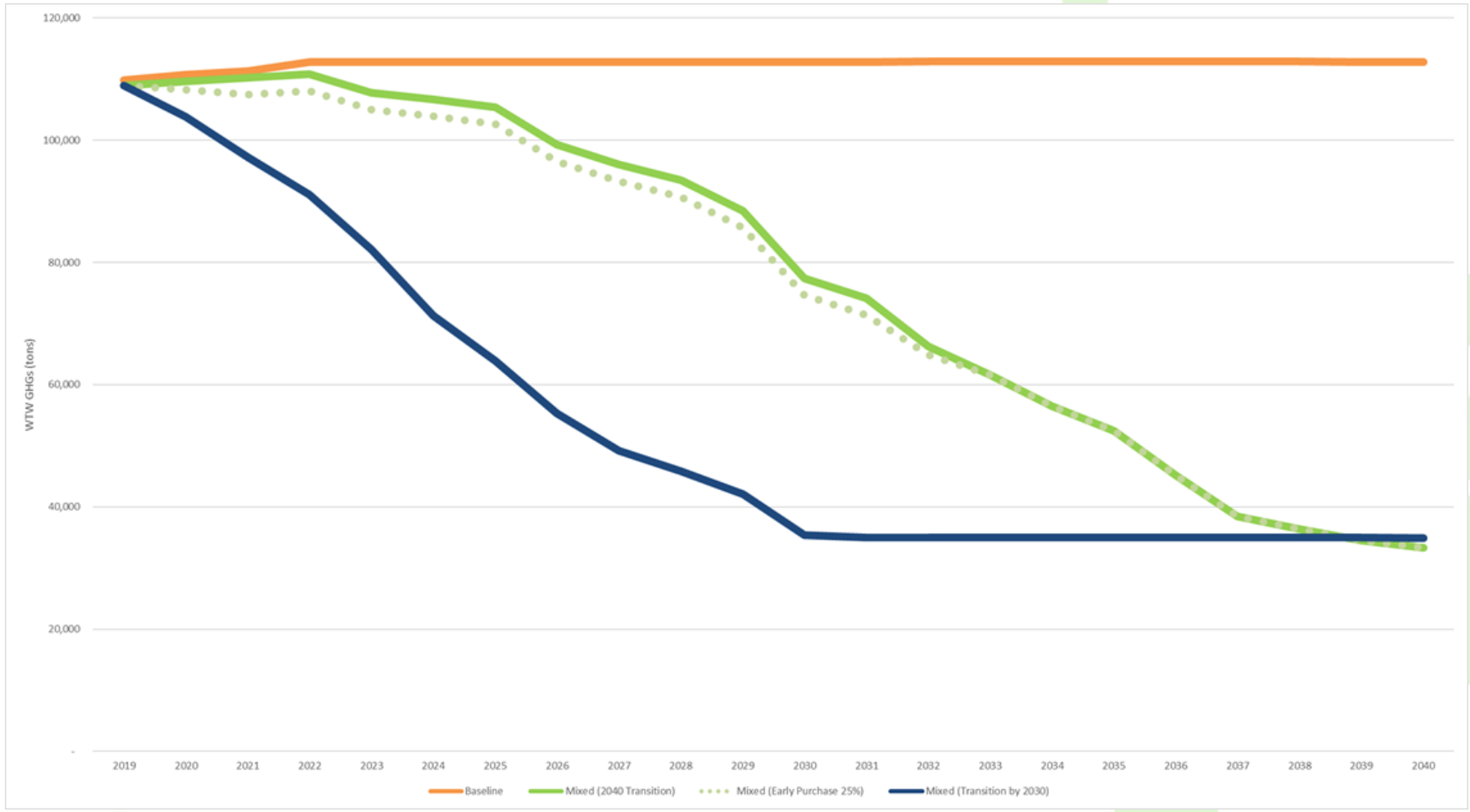
- Infrastructure timeline
- Bus Production Schedule

# GHG Benefits - Transition by 2030



- Infrastructure can't meet timeline
- No viable Minibus options
- Bus Range Limitations (One for One)
- Funding unknowns
- GHG Increase

# GHG Benefits - Comparison



# Greenhouse Gas Emission Benefit Study

## Q&A



# Poll

**After seeing the difference in GHG emissions for three different scenarios, I think the best plan is:**

- A. The 25% early adoption rollout, with 20-year full transition
- B. The 10-year full transition plan, no matter what
- C. The 10-year full transition plan, as long as service levels are not impacted
- D. The 20-year full transition plan, as-is



# Connecting with Disadvantaged Communities



# ZEB Deployment Proposal

## CalEnviroscreen 3.0

- Prioritize deployment in communities with high pollution burden and vulnerable population characteristics
- Utilize SB 535 disadvantaged communities (DACs) identified through CalEnviroscreen 3.0
- Identify bus routes with **at least one stop** in an SB 535 DAC

### Pollution Burden

#### Exposures

- Ozone Concentrations
- PM2.5 Concentrations
- Diesel PM Emissions
- Drinking Water Contaminants
- Pesticide Use
- Toxic Releases from Facilities
- Traffic Density

#### Environmental Effects

- Cleanup Sites
- Groundwater Threats
- Hazardous Waste
- Impaired Water Bodies
- Solid Waste Sites and Facilities

### Population Characteristics

#### Sensitive Populations

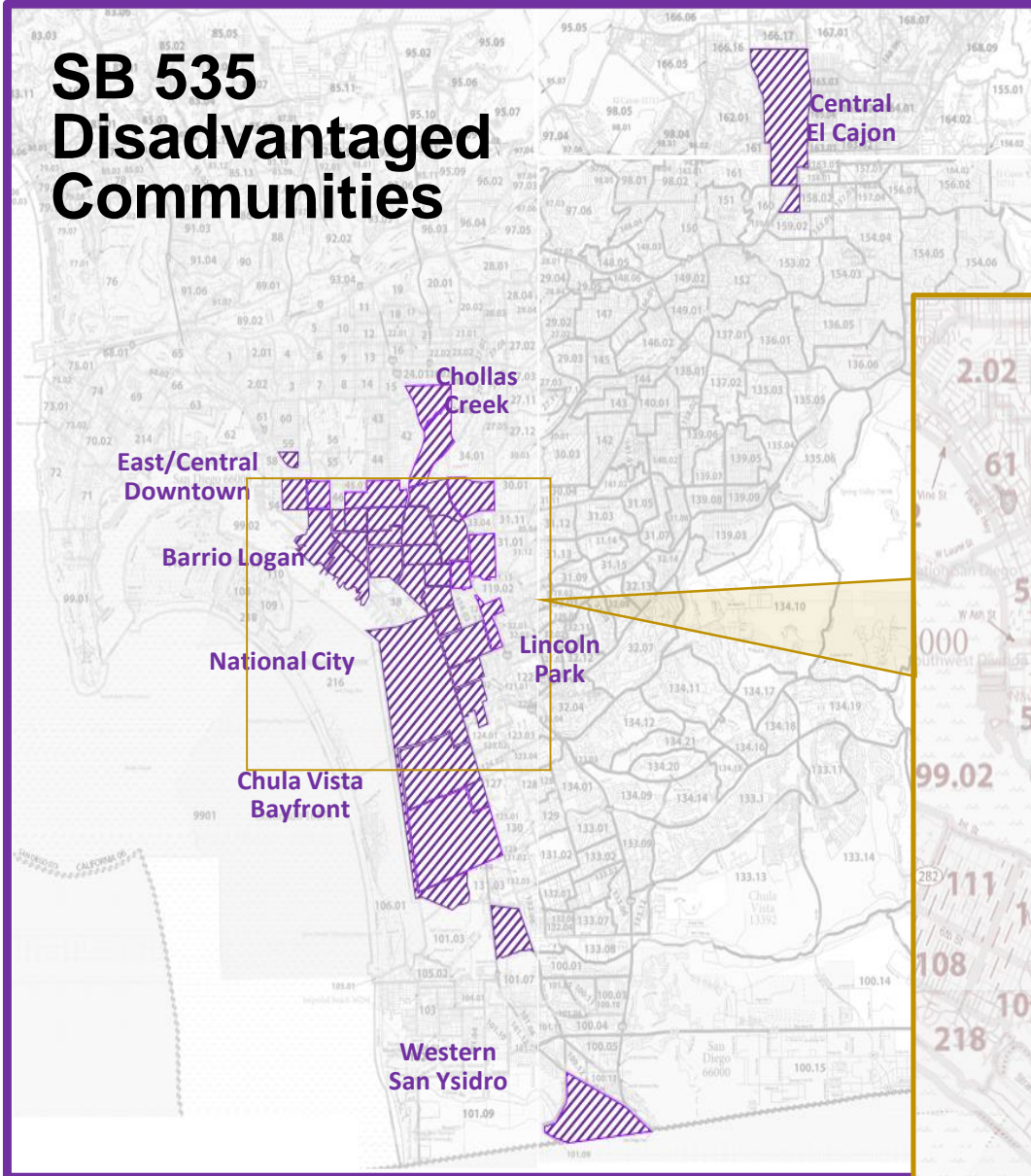
- Asthma Emergency Department Visits
- Cardiovascular Disease (Emergency Department visits for Heart Attacks)
- Low Birth-Weight Infants

#### Socioeconomic Factors

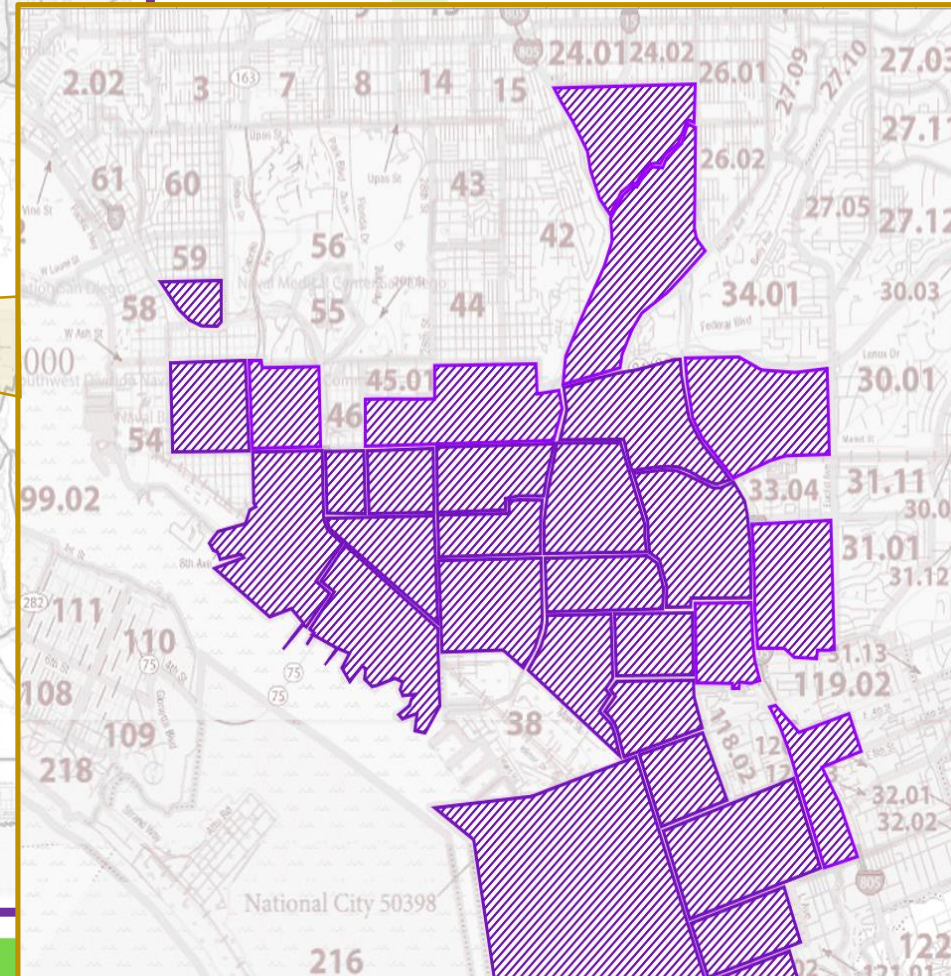
- Educational Attainment
- Housing Burdened Low Income Households
- Linguistic Isolation
- Poverty
- Unemployment



# SB 535 Disadvantaged Communities



San Diego Detail

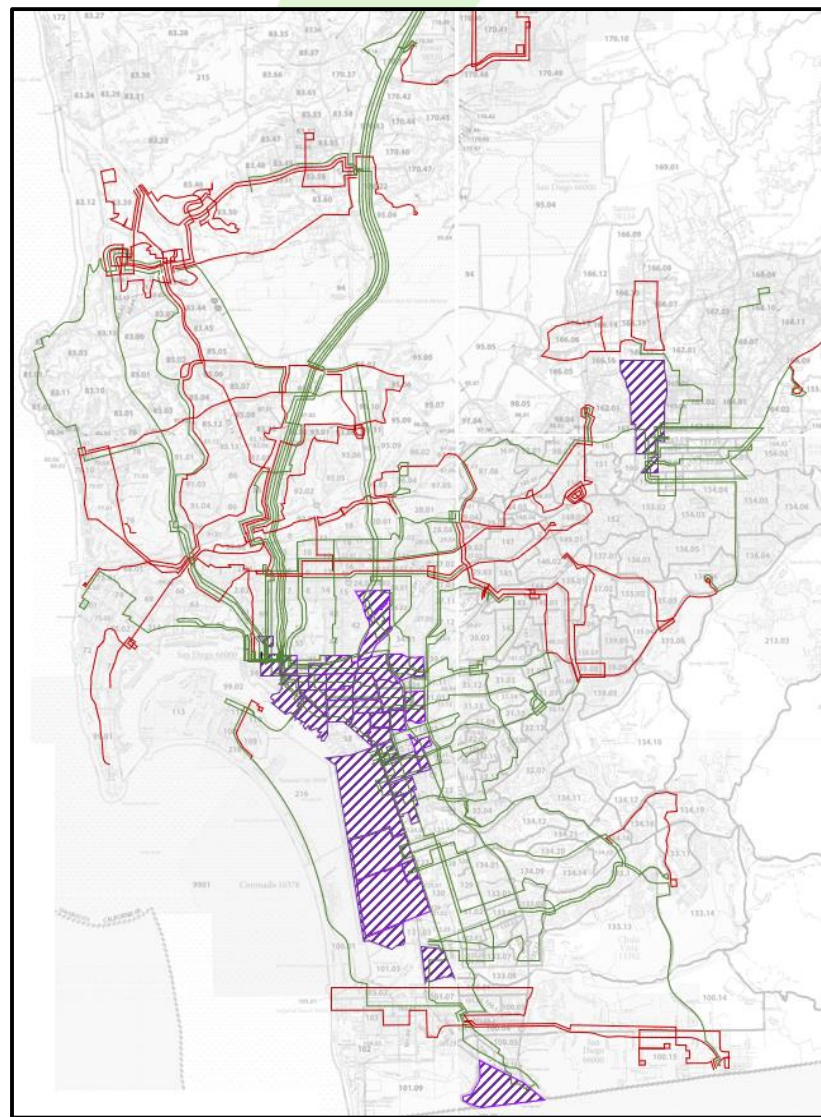




# ZEB Deployment

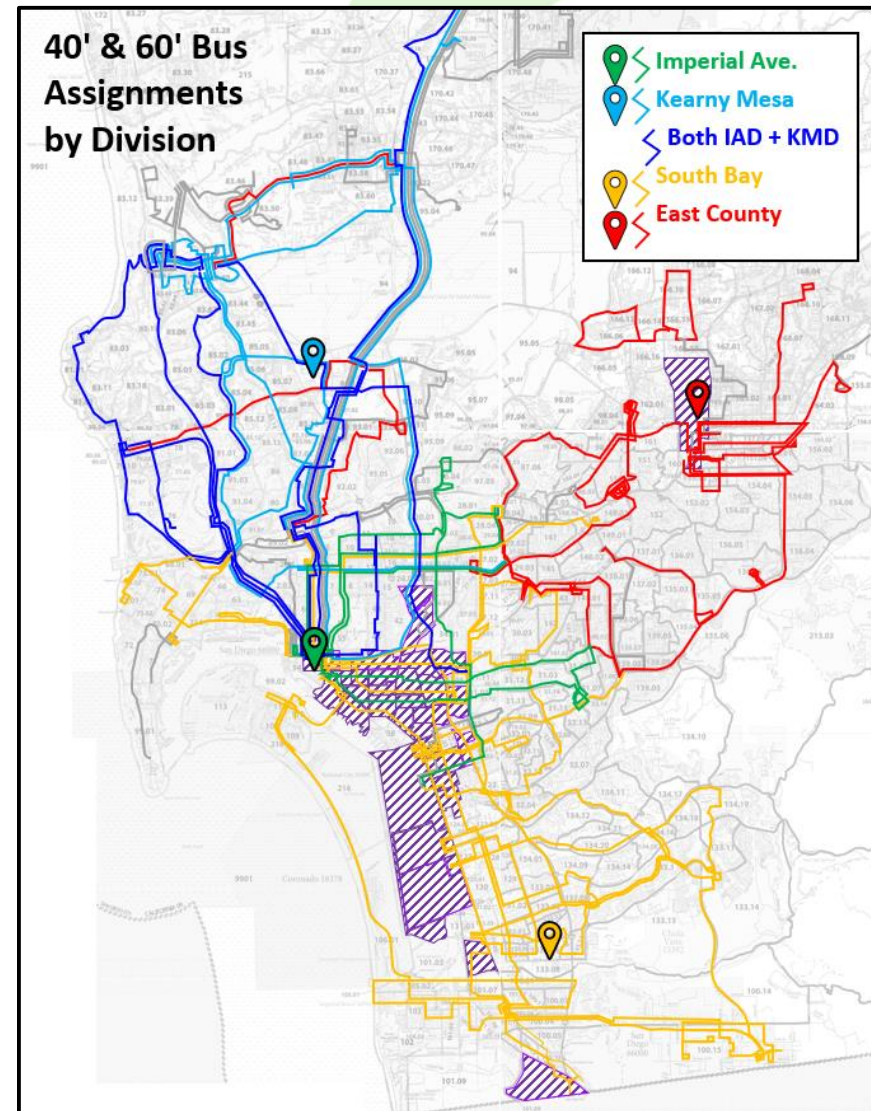
## MTS Bus Network Map All routes, all bus types

- Green Lines = DAC Routes  
(at least one stop in an SB 535 DAC)
- Red Lines = Non-DAC Routes  
(no stops in an SB 535 DAC)



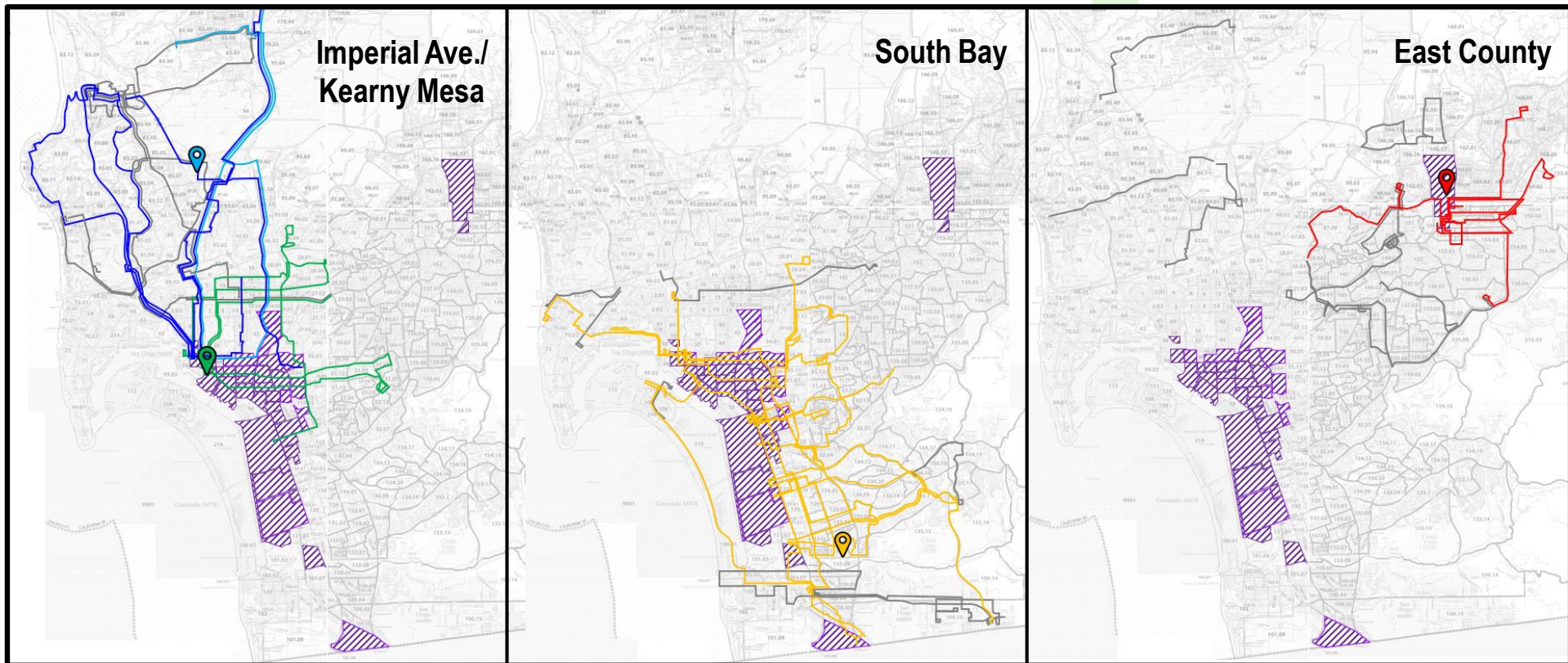
# ZEB Deployment

- Four divisions for 40'/60' buses
  - Imperial Ave. (Downtown)
  - Kearny Mesa
  - South Bay (Chula Vista)
  - East County (El Cajon)
- Divisions require charging infrastructure
  - Prioritize charging infrastructure
  - How many DAC-serving routes operate from each division?





# DAC Routes by Division








# DAC Routes by Division

IMPERIAL AVE. / KEARNY MESA	
ROUTE	FY19 RIDERSHIP
2	846,251
4	683,197
6	357,664
7	2,174,381
8	419,835
9	388,726
10	1,175,265
11	706,255
12	1,142,007
13	1,823,187
20	534,173
30	1,579,366
31	106,759
41	1,113,043
44	1,017,661
50	140,309
60	82,709
105	279,555
110	39,999
120	693,557
150	824,005
201/202	2,525,053
204	73,677
215	1,907,762
235	1,494,413
237	267,962

SOUTH BAY	
ROUTE	FY19 RIDERSHIP
1	1,106,014
3	1,578,894
5	750,910
28	349,758
35	573,496
225	236,103
701	561,124
704	451,508
705	241,612
707	65,551
709	886,522
712	715,360
901	788,763
904	171,848
905	441,903
906/907	1,923,490
909	48,743
916/917	160,068
923	212,314
929	2,086,806
932	1,124,493
933/934	1,592,518
950	387,435
955	1,325,995
961	590,123
962	521,807
963	162,665
968	48,960
992	420,252

EAST COUNTY	
ROUTE	FY19 RIDERSHIP
27	222,253
115	228,865
815	431,559
816	132,355
832	37,652
834	20,252
848	339,643
852	287,762
854	108,853
855	217,883
856	520,222
864	294,475
872	42,331
874/875	371,813
921	252,326
928	269,855
936	456,447

*DACs at end-of-line only.*  
*DACs on major route segments.*

 +  All DAC Routes  
 DAC Routes due to end-of-line stop(s) only

TOTALS (40' + 60' Buses)	IAD + KMD	SBD	ECD
All Routes	26	29	17
DAC Routes	15	20	7
Percentage of DAC Routes	57.7%	69.0%	41.2%
All Annual Ridership	22,396,771	19,525,035	4,234,546
DAC Route Annual Ridership	14,671,571	14,787,769	1,841,041
Percentage of Riders on DAC Routes	65.5%	75.7%	43.5%
Excluding "end-of-line" DAC Routes	IAD + KMD	SBD	ECD
All Routes	26	29	17
DAC Routes	3	11	2
Percentage of DAC Routes	11.5%	37.9%	11.8%
All Annual Ridership	22,396,771	19,525,035	4,234,546
DAC Route Annual Ridership	3,648,391	10,902,906	414,144
Percentage of Riders on DAC Routes	16.3%	55.8%	9.8%

# ZEB Deployment Plan

- Proposed Charging Infrastructure Priority
  1. South Bay
  2. Imperial Ave.
  3. Kearny Mesa
  4. East County
- Proposed Route Assignment Priority
  - Buses assigned on a daily basis: “Ready lanes” for CNG buses and BEBs
  - BEBs prioritized to routes in disadvantaged communities
    - DAC route listing kept updated for Operations Divisions (route changes, ridership, CalEnviroscreen updates)
  - Bus assignment tracking for accountability
  - Constraints
    - Range limitations vs. route block lengths
    - Bus types & availability (40' vs. 60')
    - 60' BEB buses purchased specifically for Iris Rapid (non-DAC route) per grant requirements
    - Other considerations: interlines mix DAC and non-DAC routes; standbys and unplanned events require flexibility

# Connecting with Disadvantaged Communities

## Q&A



# Poll

**How important is it to you that deployment of zero-emission buses in Disadvantaged Communities (DACs) are prioritized over other areas?**

- A. Very important
- B. Somewhat important
- C. Somewhat not important
- D. Not important at all

# Poll

**As an initial reaction do you think MTS is on the right track with this 20-year/2040 transition plan?**

- A. Very much on the right track
- B. Somewhat on the right track
- C. Somewhat on the wrong track
- D. Very much on the wrong track

# Anticipated Next Steps

- ZEB Pilot ongoing (8 buses)
- Working with SDG&E
  - SB 350 Program
- Early fleet transition (Iris Rapid – 12 sixty-foot buses)
- South Bay facility charging design & construction
- Secure additional funding for ZEB transition costs
- Share public workshop results with MTS Board
- Submit CARB Transition Plan





# Final Comments



# Thank You!

