samTrans

emission ZERO

# Emission Zero Program


South San Francisco City Council Meeting
March 22, 2023

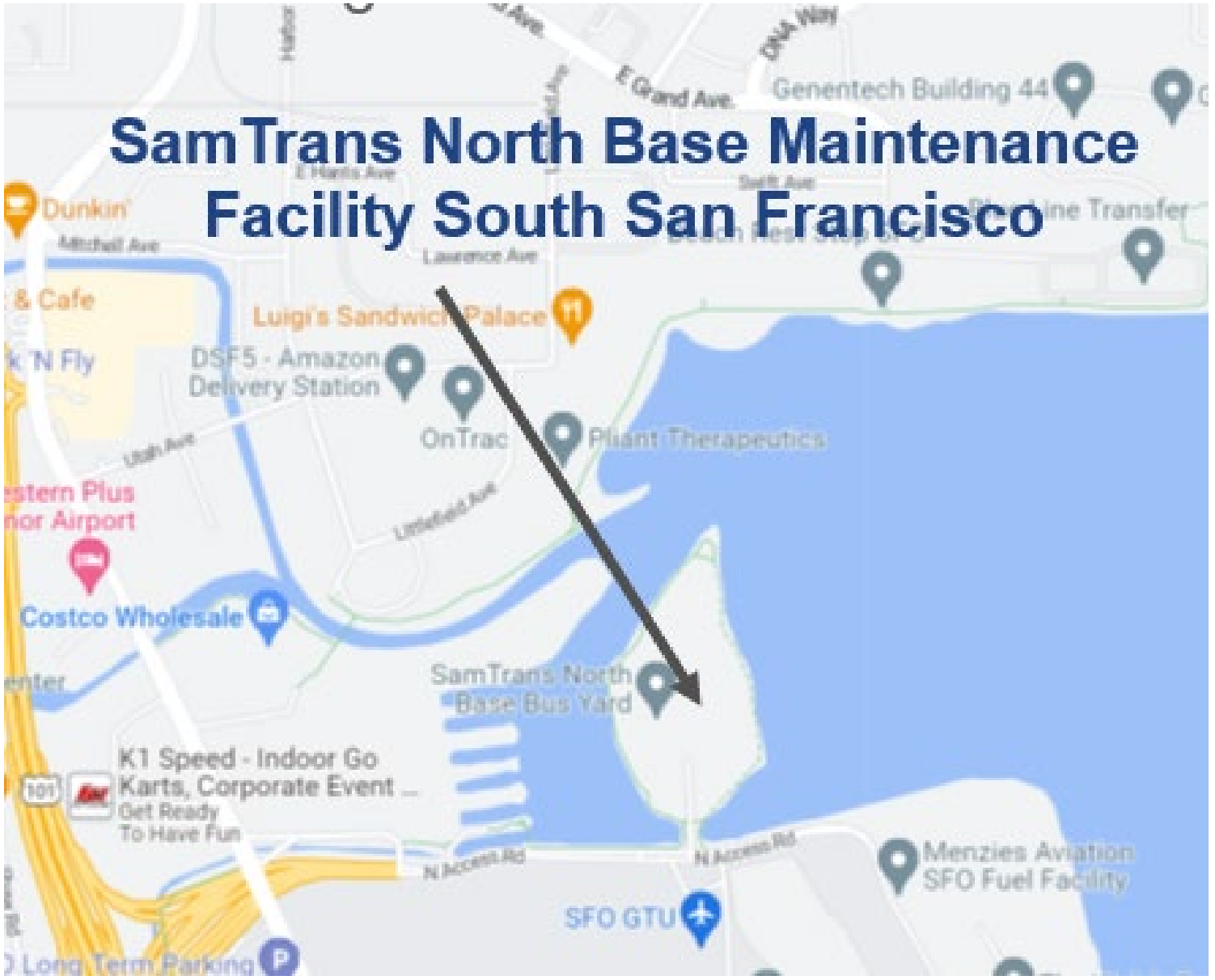
# Topics: North Base ZEB Transition

- Program Scope
- Battery Electric Buse (BEBs)  vs. Hydrogen Fuel Cell Bus (FCEBs) 
- Recommendation
- Next Steps

# Program Scope

- California Air Resources Board Mandate (ICT Regulation)
- Vehicle Replacement
- New Infrastructure
- Facility Modifications
- Work Force Training


# SamTrans North Base Maintenance Facility South San Francisco



# ICT Regulation

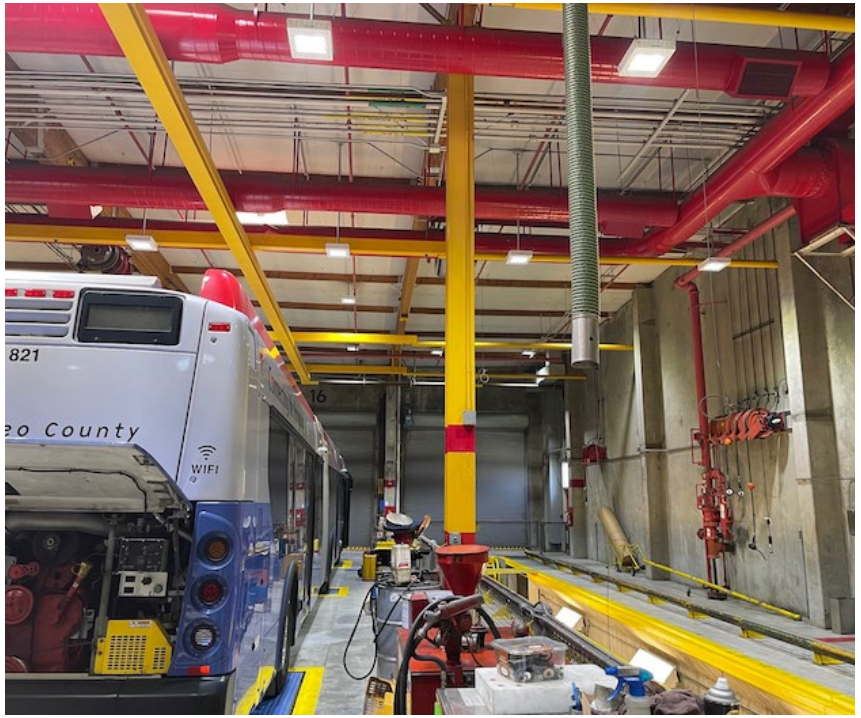
- Instituted by California Air Resources Board (CARB) in 2018
- Requires transit providers to transition their fleets to zero emission technology (ZE) by 2040
- SamTrans developed ICT Plan to plan; goal to convert fleet by 2034 ahead of mandate

# Vehicle Replacement

- **319 Fixed-Route Vehicles**
  - **40’ Buses**
  - **60’ Buses**
- 70 Paratransit Vehicles


# Facility Modifications

- Electric System Upgrades
- Maintenance Facility Modifications



# Work Force Training


# BEBs vs. FCEBs

- Vehicle Performance
- Infrastructure
- Life Cycle Costs
- Emissions
- Resilience


# Vehicle Performance

| Criteria | BEBs | FCEBs |
|---|---|---|
| Range | 180 - 200 miles | 260 - 300 miles |
| Charging/Fueling Time | 4 to 6 hours | 6 to 20 minutes |

# BEBs: Range Requirements

**BEBs** 

**Range: up to 200 miles**

| Buses | | Number of Miles Traveled per Day | |
|---|---|---|---|
| Type | Number | Less than 200 miles | Greater than 200 miles |
| 40' | 114 | 97 buses | 17 Buses |
| 60' | 21 | 15 buses | 6 Buses |

Options for routes that travel more than 200 miles per day, includes Route ECR (over 20% of SamTrans service):

- Purchase 17 additional 40’ BEBs and 6 additional 60’ BEBs
- Charge buses along the routes

# FCEB: Range Requirements

**FCEBs** 

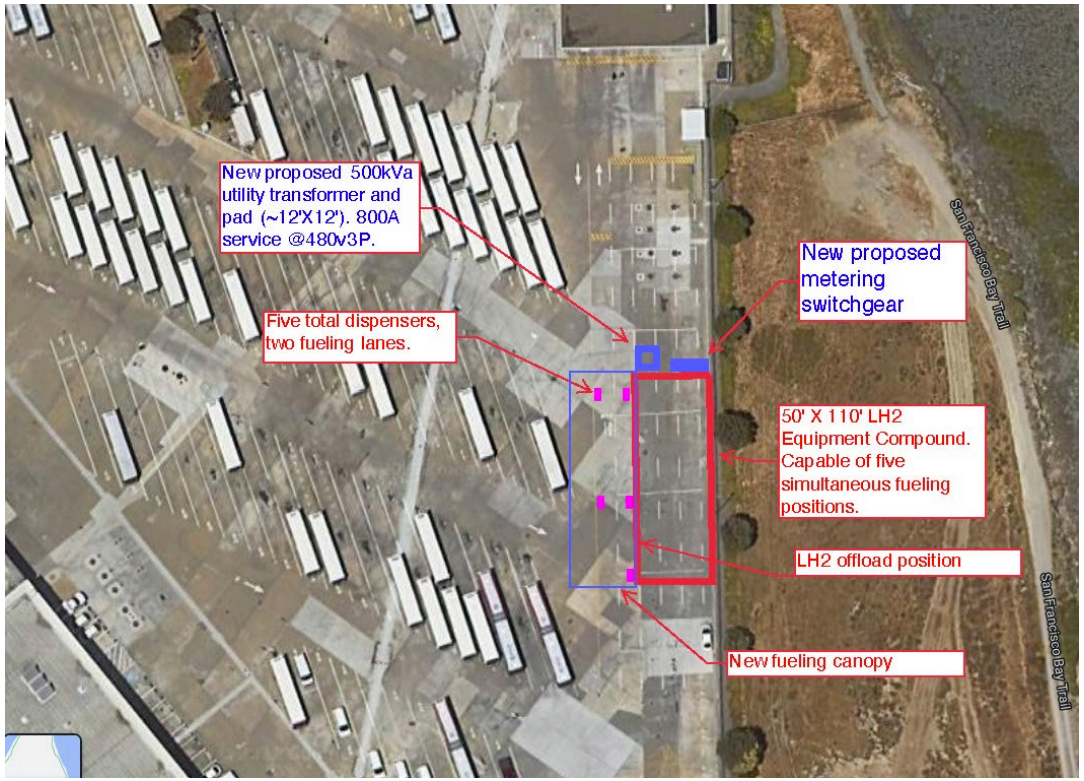
**Range: up to 300 miles**

| Buses | | Number of Miles Traveled per Day |
|---|---|---|
| Type | Number | Less than 300 miles |
| 40' | 114 | 114 Buses |
| 60' | 21 | 21 Buses |

No need to purchase additional buses to maintain the same service level.

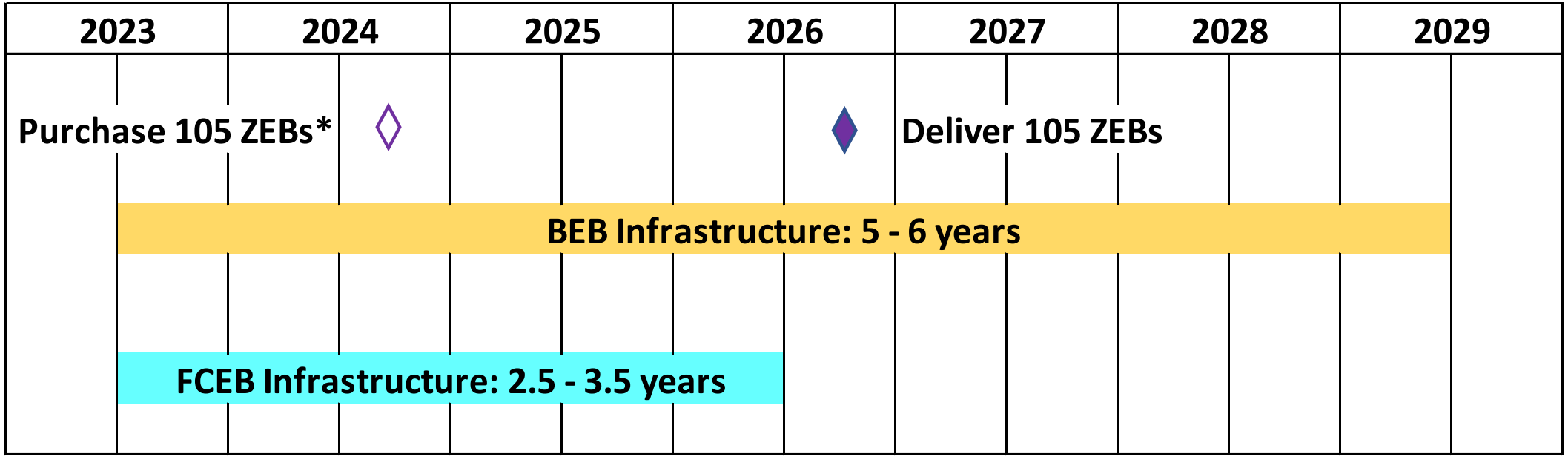
# BEB Infrastructure


# FCEB Infrastructure



# Facility Modifications for FCEBs


# Infrastructure Schedule




*105 buses have reached their useful life

# Life Cycle Costs: Assumptions

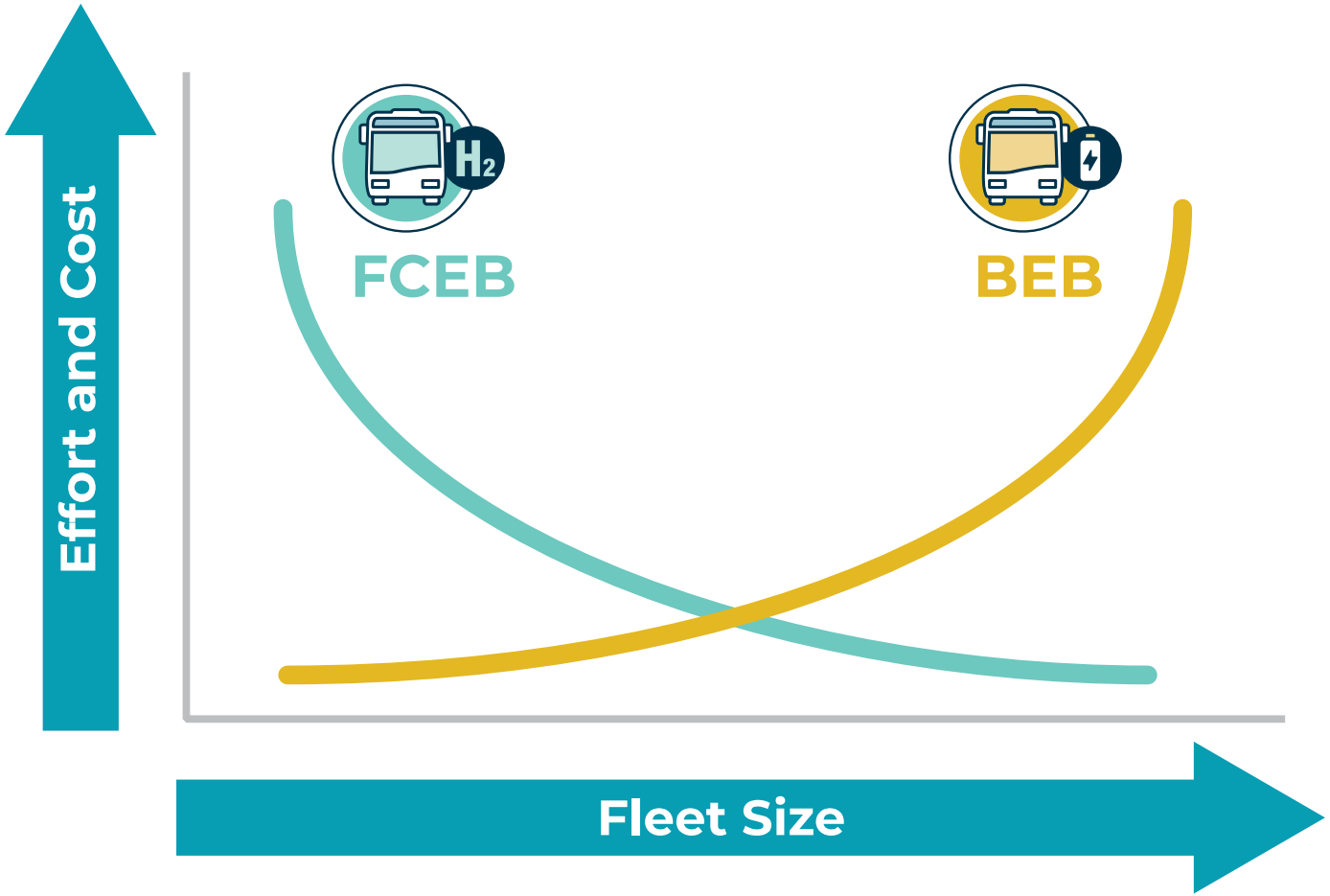
- Revenue Fleet at North Base (NB)
- 12 Year Life Cycle
- Reimagine SamTrans Service Level
- Costs in Year of Expenditure Dollars

# Life Cycle Costs: Total Cost of Buses (NB)

| | BEB | | FCEB | | Variance |
|---|---|---|---|---|---|
| | Number* | Cost | Number | Cost | |
| 40’ Bus | 148 | $169,542,050 | 131 | $175,120,390 | |
| 60’ Bus | 37 | $82,851,107 | 31 | $71,887,784 | |
| **Total** | **185** | **$252,393,157** | **162** | **$247,008,174** | **$5,384,983** |

** Additional BEBs are required for routes that exceed the 200 mile range of BEBs*

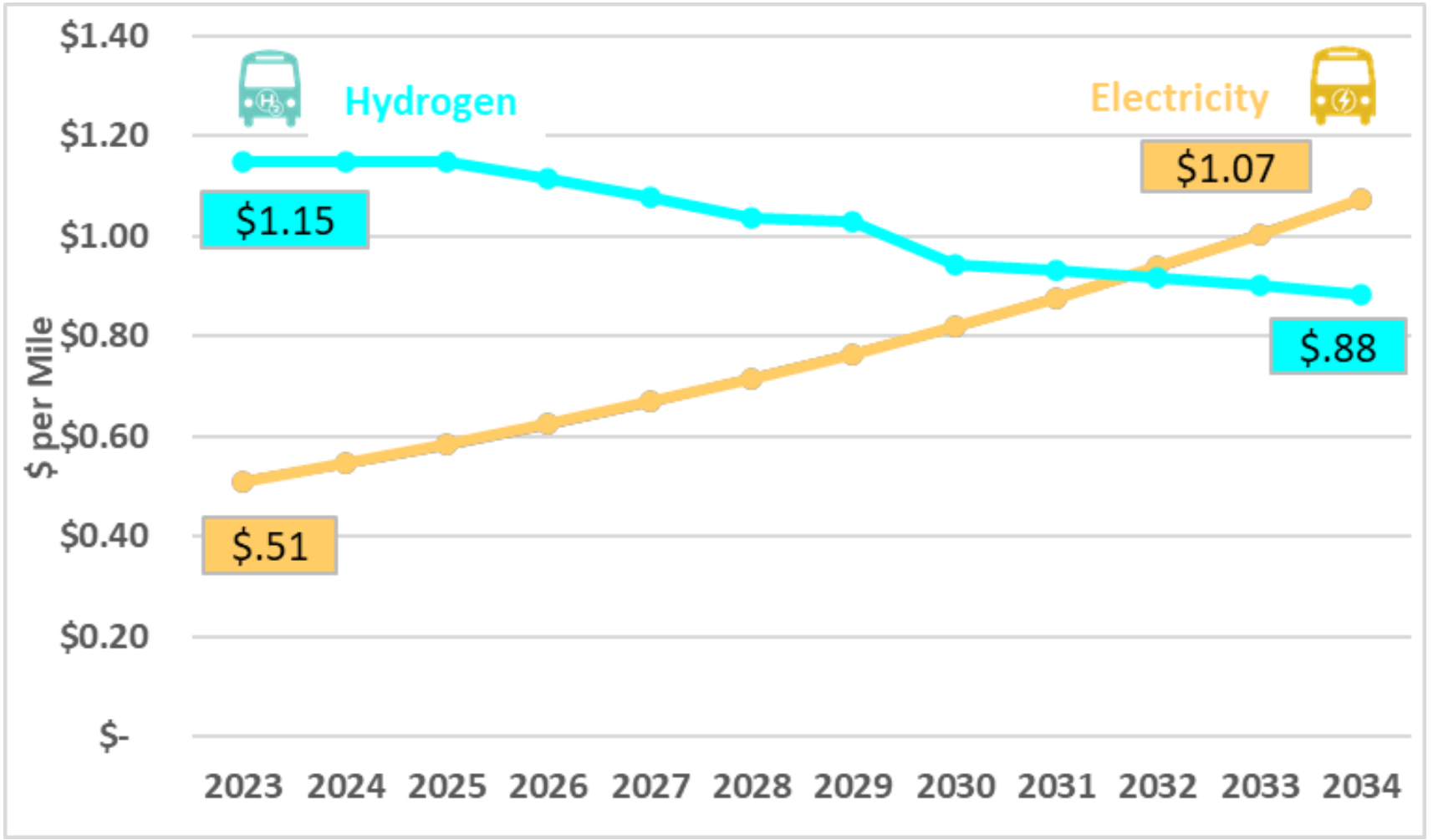
# Infrastructure Costs: BEB vs. FCEB



# Life Cycle Costs: 12-Year Total (NB)

| | BEB | FCEB | Variance |
|---|---|---|---|
| Buses | $252,393,157 | $247,008,174 | $5,384,983 |
| Infrastructure | $144,950,000 | $36,150,000 | $108,800,000 |
| Vehicle Maintenance | $36,592,886 | $42,106,882 | ($5,513,996) |
| Infrastructure Maintenance | $3,900,000 | $8,580,000 | ($4,680,000) |
| **Total** | **$437,836,043** | **$333,845,057** | **$103,990,987** |

# Energy Costs: Electricity vs. Hydrogen



# Life Cycle Costs: 12-Year Total + Energy (NB)

| | BEB | FCEB | Variance |
|---|---|---|---|
| Buses | $252,393,157 | $247,008,174 | $5,384,983 |
| Infrastructure | $144,950,000 | $36,150,000 | $108,800,000 |
| Vehicle Maintenance | $36,592,886 | $42,106,882 | ($5,513,996) |
| Infrastructure Maintenance | $3,900,000 | $8,580,000 | ($4,680,000) |
| **Total** | **$437,836,043** | **$333,845,057** | **$103,990,987** |
| Energy (electricity & H2) | $41,096,703 | $51,129,786 | ($10,033,083) |
| **Total + Energy** | **$478,932,746** | **$384,974,842** | **$93,957,904** |

# Emissions (Tail Pipe)

| | BEBs | FCEBs |
|---|---|---|
| Tail Pipe Emissions | Zero | Zero |

# Green House Gas (GHG) Reduction

| Diesel | BEBs | FCEBs |
|---|---|---|
| 0% | 77% - 100%* | 60% |

** Depends on electricity source*

# Resilience

| | BEBs | FCEBs |
|---|---|---|
| Energy Source | Single Source – Electric Grid | Multiple Sources |
| Infrastructure | Fixed | Can be relocated |

| Criteria | BEBs | FCEBs |
|---|---|---|
| Range | | ✓ |
| Fueling Time | | ✓ |
| Infrastructure | | ✓ |
| Maintenance | ✓ | |
| Energy Costs | ✓ | |
| GHG Reduction | ✓ | |
| Resilience | | ✓ |

# Other Transit Agencies in CA

- Bay Area Transit Agencies
  - BEBs: SF MTA
  - BEBs & FCEBs/FCEB Plans: AC Transit, VTA, Golden Gate
- At least 19 Agencies have FCEBs/ FCEB Plans
  - AC Transit: 70% FCEBs – 30% BEBs
  - Foothill Transit: 1 Facility for FCEBs, 1 Facility for BEBs
  - FCEBs: 157 by 2023; 1500 by 2031
  - H2 Stations: 12 by 2023; 34 by 2031

# Recommendations

- North Base (SSF)
- South Base (San Carlos)
- Progress and Timeline

# Recommendation: North Base

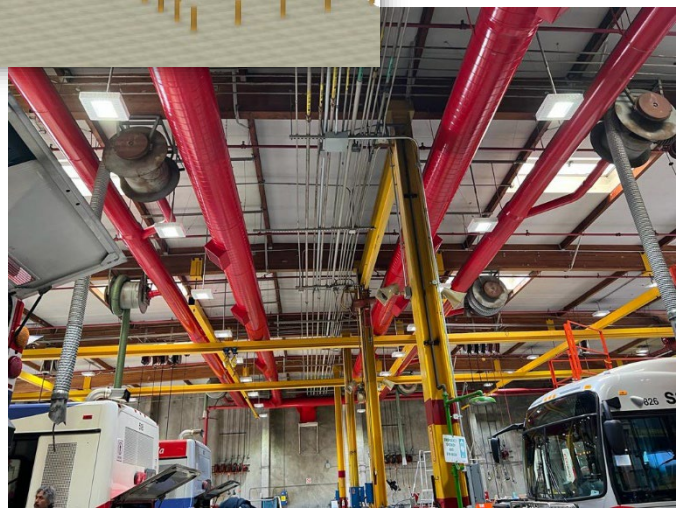
- Replace North Base Diesel Fleet with FCEBs
  - Operational Flexibility: Range & Fueling Time
  - Infrastructure Cost & Schedule
  - Resilience
  - Experience of other transit agencies

# Recommendation: South Base

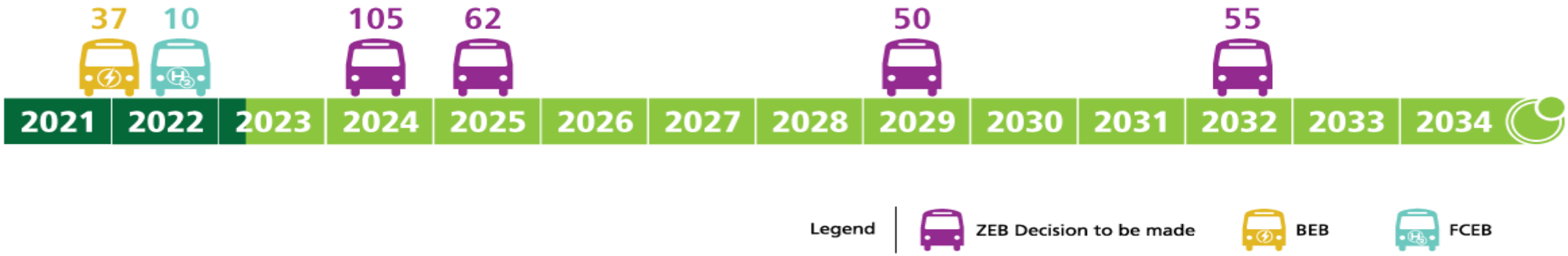
- Decide in 2024 on type of zero emission bus for the rest of the South Base Fleet based on the following:
  - Actual experience with BEBs and FCEBs
  - Actual Costs of Electricity and Hydrogen
  - Actual Infrastructure Costs & Schedule
  - Additional Experience of Other Transit Agencies

# Progress: FCEB Infrastructure – North Base

- Completed Feasibility Studies
- Conforms to Safety Standards
  - Updated and obtained requirements from SSF Fire Marshal – no major concerns
- Temporary Hydrogen Fueling Station by Winter 2023
- Facility Modifications for 10 FCEBs by Spring 2024



# Vehicle Procurement Timeline



# Vehicle Procurement Timeline


Legend | ZEB Decision to be made | BEB | FCEB

## FCEB Infrastructure Timeline

# Next Steps

- Next Steps Review
- Request: Support for Funding Applications


# Next Steps Review

- Seek outside funding for zero emission vehicles & infrastructure
- Procure 105 FCEBs for North Base (NB)
- Design & Construct Permanent Hydrogen Fueling Station at NB
- Design & Construct Facility Modifications at NB
- Decide in 2024 on ZEB for Rest of SB Fleet

# Request: Support for Funding Applications

SamTrans is requesting support from the City of South San Francisco for its Emission Zero plan to use when applying to multiple funding sources:

- **FTA Low-No Emission & Bus & Bus Facilities**
- Department of Energy's Federal Hydrogen Hub
- CTC Local Partnership Program (LPP)
- Others as they arise

# Questions?