

CityBus Fleet Electrification

City Council Study Session

April 2, 2019



Study Session Goals

- Review developments in electric bus technology and the factors driving transit fleet electrification
- Review major considerations in the electrification process
- Review CityBus five-year bus replacement and electrification plans
- Provide feedback to staff on CityBus fleet electrification process



Definitions: Buses and Fuel

- “ZEBs” and “BEBs”
 - Zero-Emissions Buses (ZEBs) are buses with zero tailpipe emissions. ZEBs include both Battery-Electric Buses (BEBs) and hydrogen fuel cell buses.
- Cleaner Diesel
 - The bus
 - Diesel exhaust fluid (DEF) solution is injected into a selective catalytic reduction (SCR) to decompose NO_x into water and nitrogen.
 - Diesel particulate filter (DPF) removes up to 85% of the diesel particulate matter.
 - The fuel
 - Traditional diesel vs. Clean Diesel (low sulfur) vs. Renewable Diesel (no petroleum)

CityBus Revenue Fleet—February 2019

Year	Vehicle Type	Fuel Type	End of federal useful life	Number of Vehicles
2002	40' Gillig	Diesel	2015	4
2002	29' Gillig	Diesel	2015	1
2008	29' Gillig	Diesel-Hybrid	2020	3
2011	40' New Flyer	Diesel-Hybrid	2023	7
2013	40' New Flyer	Diesel	2026	6
2016	40' New Flyer	Diesel	2028	4
2018	40' ELDorado	Diesel	2031	4
<i>Total Vehicles</i>				29

Paratransit and Non-Revenue Fleet Composition

Paratransit

Year	Vehicle Type	Fuel Type	#
2010	Cutaway	Gasoline	4
2010	Van	Gasoline	1
2011	Cutaway	Gasoline	1
2014	Cutaway	Gasoline	6
2015	Cutaway	Gasoline	1

Non-revenue fleet

Year	Vehicle Type	Fuel Type
2002	Passenger van	CNG
2003	Pick-up truck	Gasoline
2005	Utility truck	Diesel
2008	Sedan	Gas-hybrid
2008	Passenger van	Gasoline
2011	Passenger van	Gasoline

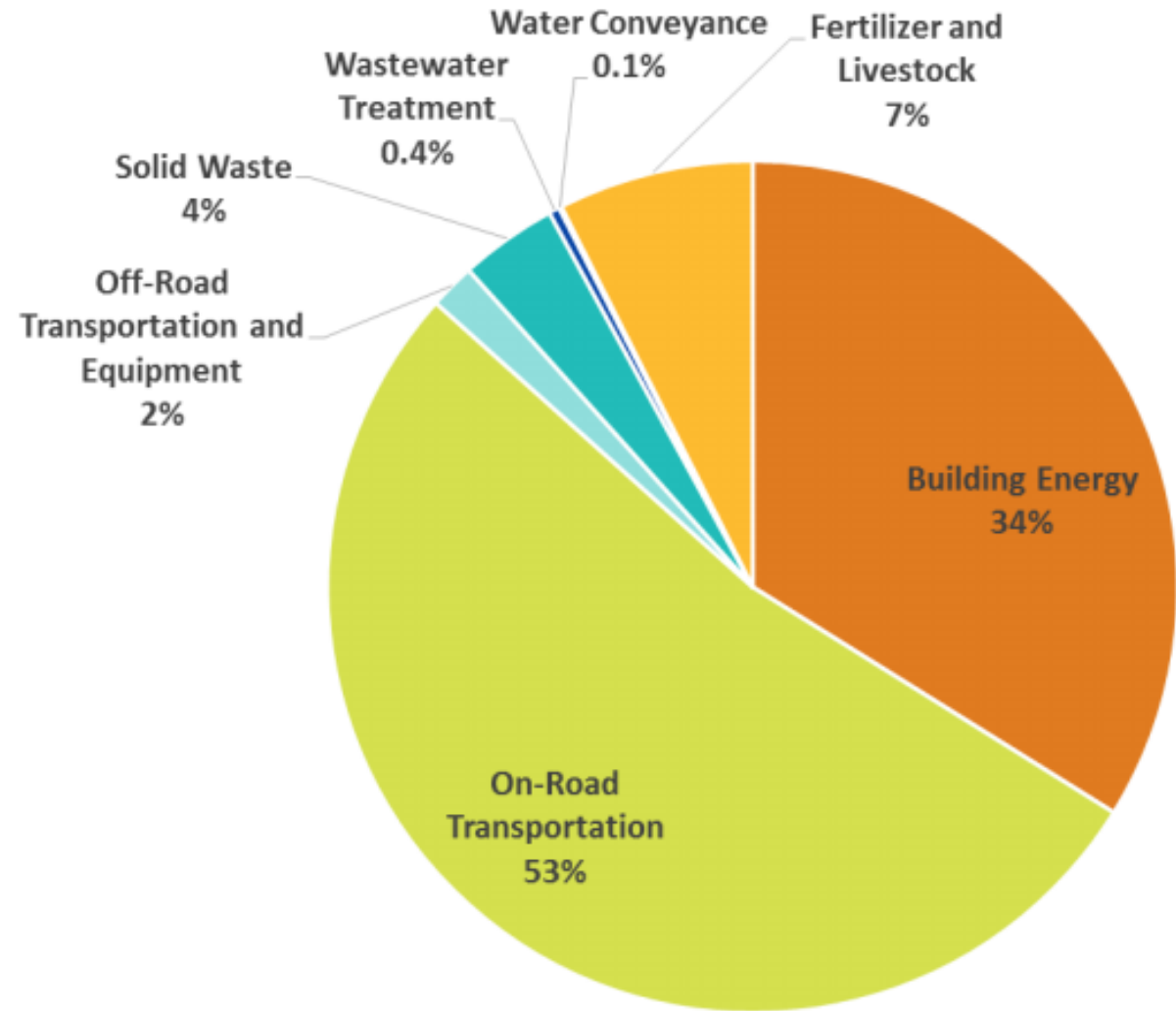


Transit Fleet Electrification: Why Battery Electric Buses?

GHG Sources in Sonoma County

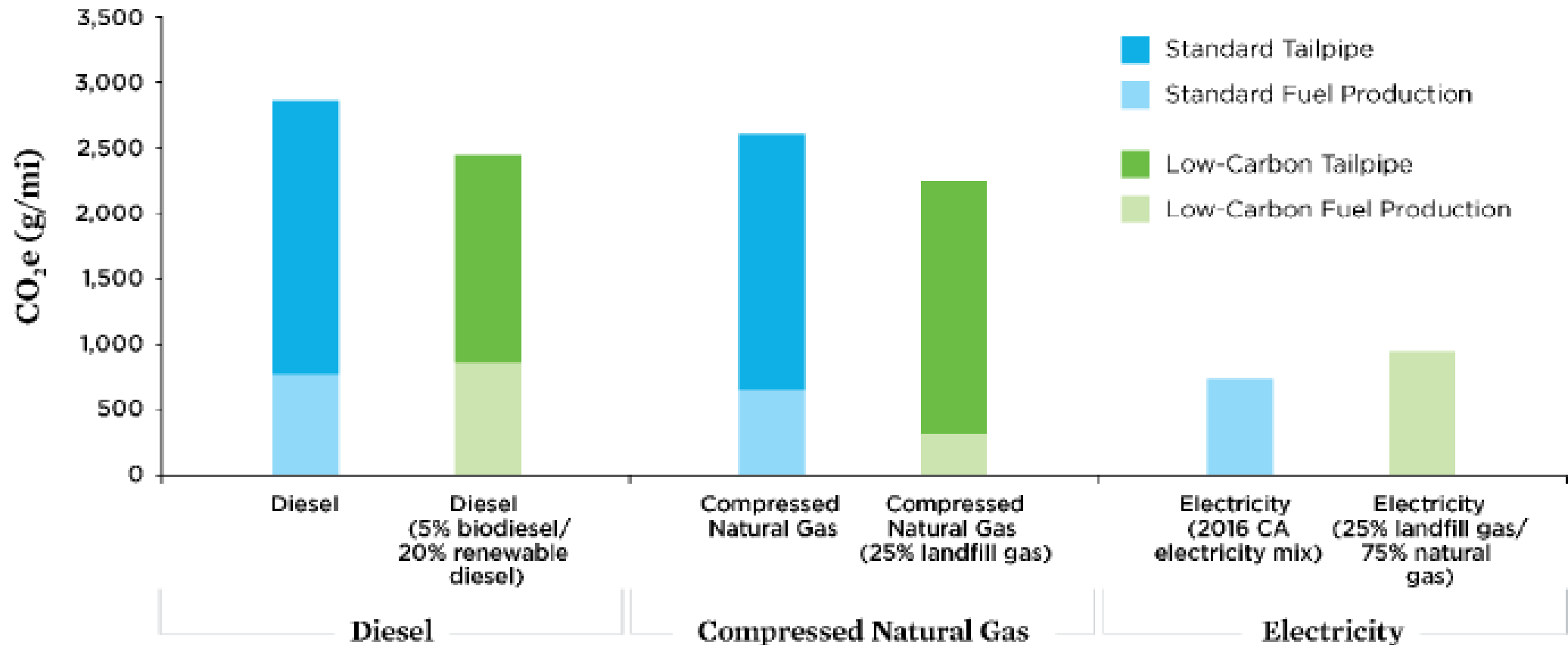
- Transit Electrification a goal
 - City of Santa Rosa Climate Action Plan
 - City of Santa Rosa Municipal Climate Action Plan
 - RCPA Climate Action 2020 and Beyond

Figure 2-1. 2010 Countywide GHG Emissions by GHG Source



Source: Climate Action 2020 and Beyond (2016). Available at https://rcpa.ca.gov/wp-content/uploads/2016/07/CA2020_Plan_7-7-16_web.pdf

Electric Bus Emissions Reductions

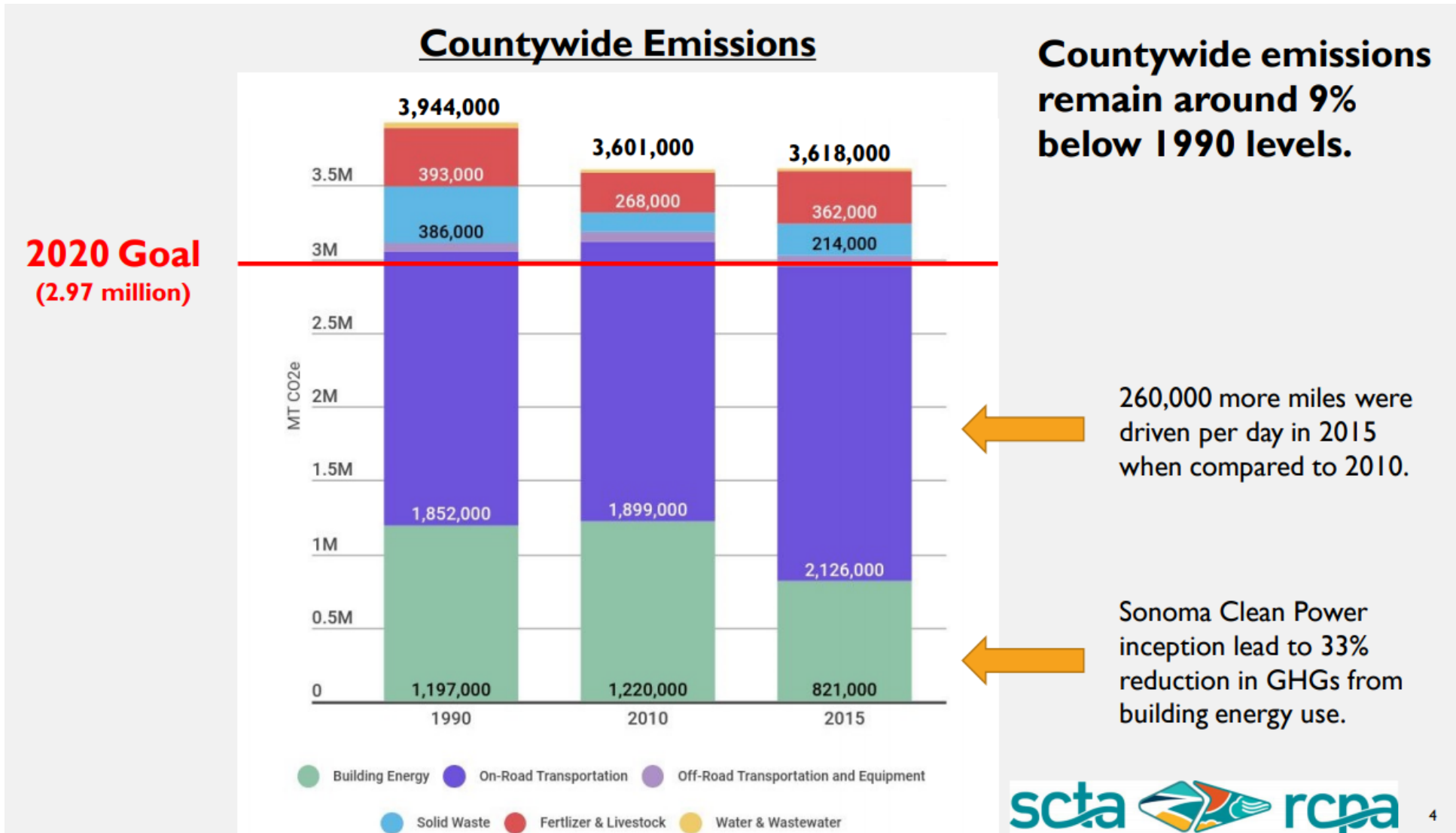


Global warming emissions from transit buses powered by low-carbon fuel blends are lower than those from vehicles powered by conventional fossil fuel-based diesel and natural gas.

Note: CO₂e stands for carbon dioxide equivalent.

Source: TCRP Synthesis 130: Battery Electric Buses – State of the Practice (2018). Available at <http://www.trb.org/Main/Blurbs/177400.aspx>

Countywide GHG Emissions



Source: Climate Action Planning Presentation to Santa Rosa City Council, October 23rd, 2018.

City of Santa Rosa Power Source

- Sonoma Clean Power Clean Start program is 87% carbon free.

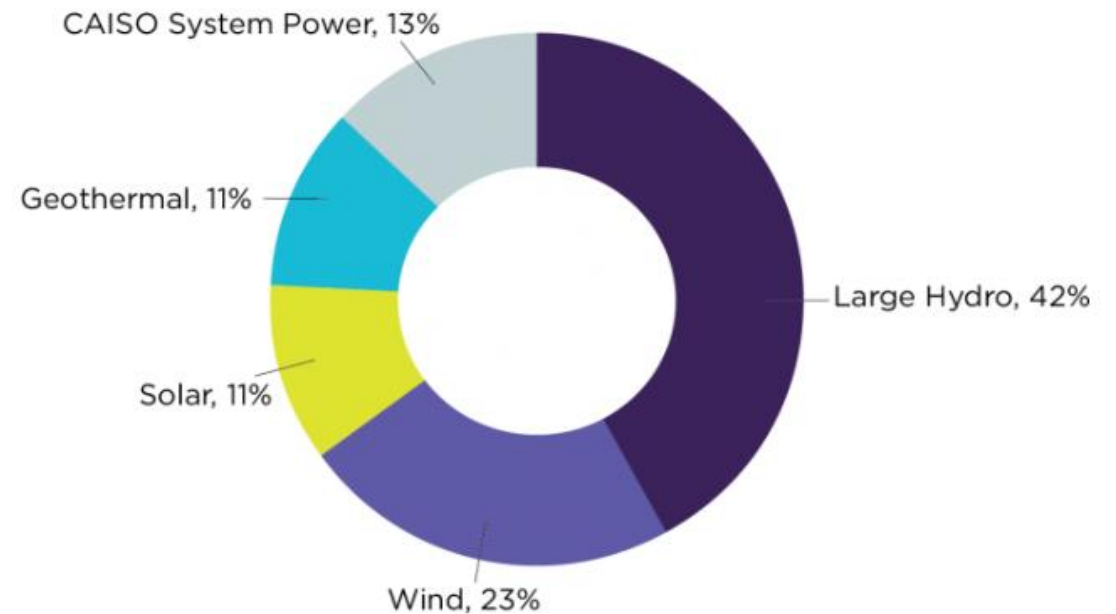
CleanStart

Mix of Sources

45% renewable electricity (wind, solar, geothermal, etc.)

42% large hydroelectric power

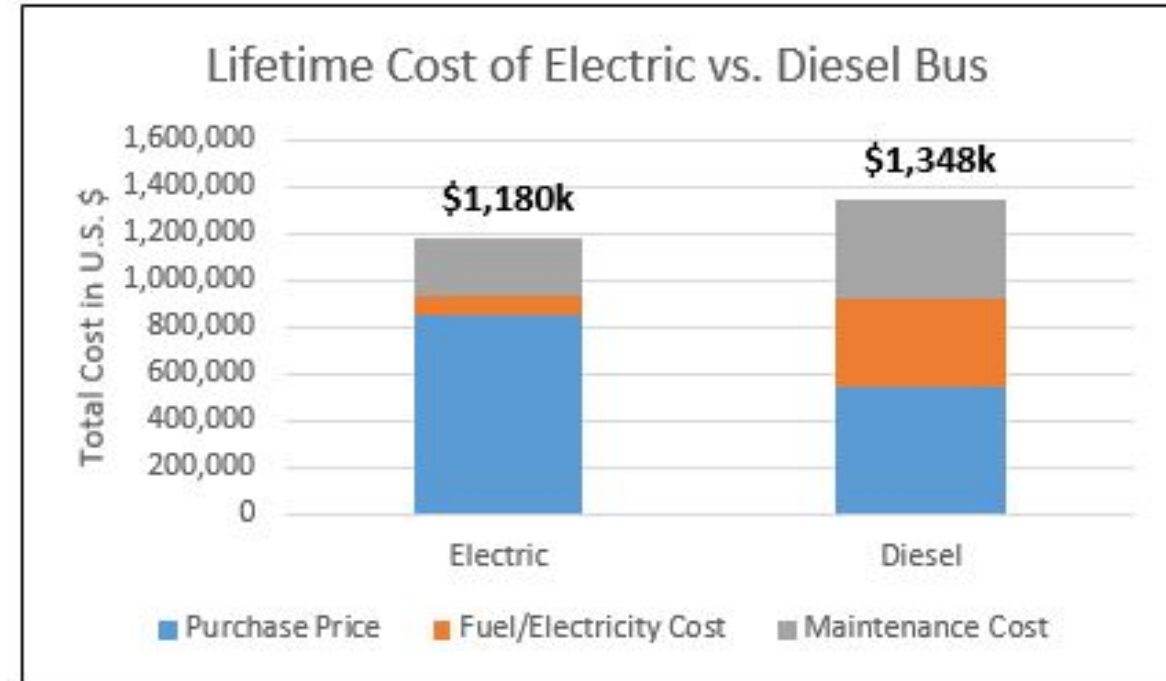
13% general system power



Source: Sonoma Clean Power website. Available at <https://sonomacleanpower.org/power-sources>

Life-cycle Cost Savings

- Capital Costs
 - Cost of BEB new vehicle purchase
 - Cost of charger and installation of charger
 - Cost of grid to charger infrastructure
- Operational Costs
 - Fueling consumption—electricity costs
 - Maintenance
 - Component replacement
 - Labor
 - Preventive Maintenance
- Health Care/Cost of Carbon



Lifetime cost of electric buses vs. diesel buses in U.S.\$ excluding cost savings associated with health benefits.

Source: Electric Bus Analysis for NYC Transit (2016). Available at <http://www.columbia.edu/~ja3041>

ZEBs in California Public Transit Industry





Transit Fleet Electrification Challenges and Opportunities

Capital Costs

Challenge: Higher vehicle purchase costs

- Up to 65% higher cost than for comparable diesel bus (200-300K/40' vehicle)
 - Fewer vehicles can be replaced at existing funding levels
 - May impact timely bus replacement



Opportunities:

- Federal funding programs
 - Two successful FTA grant applications totaling \$2.9 million
- CARB Hybrid and Zero-Emission Voucher Incentive Program (HVIP)
 - \$150,000 voucher per electric bus
- BAAQMD Carl Moyer Program



Federal Transit
Administration



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

Capital Costs

Challenge: Costs of charging infrastructure deployment

- Currently can charge up to 3 electric buses overnight at MSCS by diverting service to Garage
- Improved capacity requires upgrades from pole to charger
- Chargers needed at ~\$50,000 each
- Additional charging locations likely needed

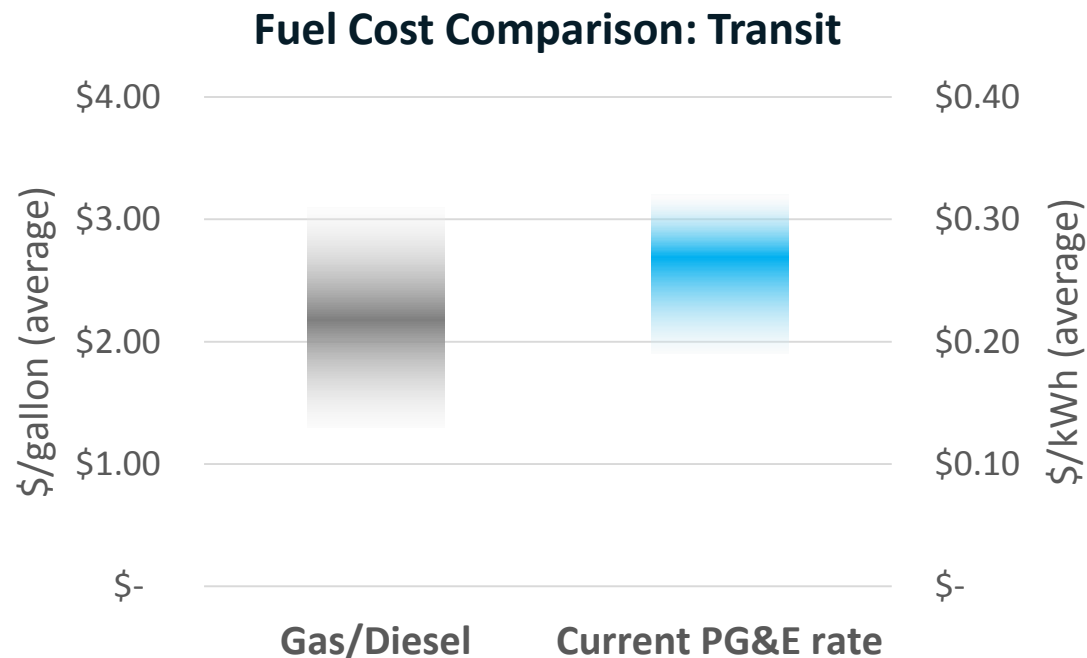
Opportunities:

- PG&E FleetReady Program expected in spring 2019
- Federal, state, and regional grant programs for EV infrastructure

Operating Costs

Challenge: Higher fueling costs

- Electricity costs tend to exceed diesel equivalent in this region



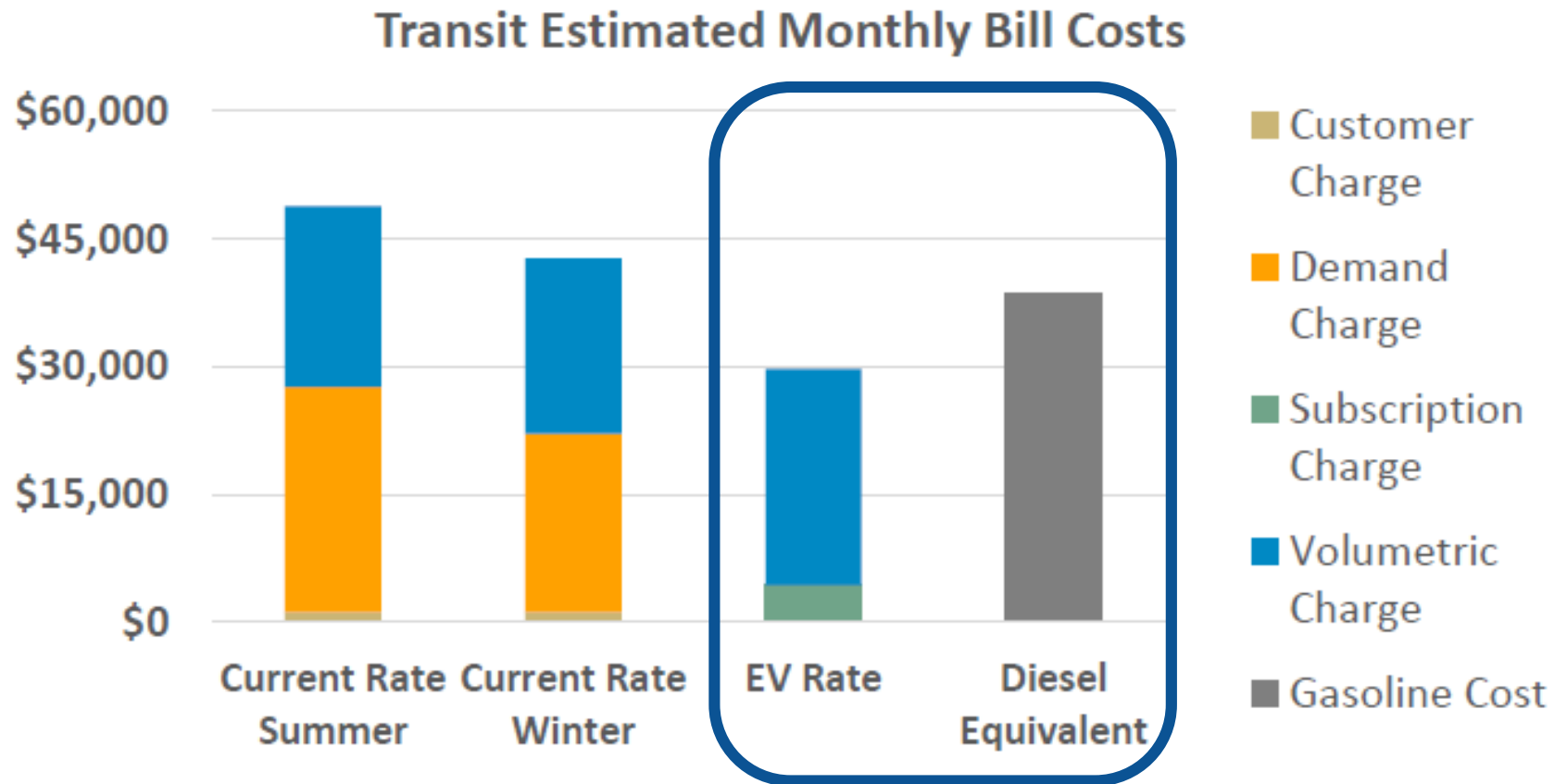
Source: PG&E Commercial EV Rate Proposal Overview (11/16/18)

Opportunities:

- New PG&E commercial EV rate structure before CPUC expected to reduce electricity costs below diesel equivalent
- Anticipated to be in place by mid-2020

Operating Costs

Comparison of current and proposed (“EV Rate”) PG&E electricity costs



Source: PG&E Commercial Rate Proposal presentation (11/20/18). Modeled for agency with 24 buses operating 150 miles/day and charging mostly overnight.

Implementation Considerations

Challenges:

- Learning curve with new technology—bus purchase, operations, and maintenance
- Unknowns related to vehicle range/performance in our operating environment
- Highly complex infrastructure development planning and implementation process

Opportunities:

- Transit industry and funding agencies developing new technical assistance resources
- Bay Area deployments can provide useful point of reference
- Multi-agency partnership to define electric bus charging needs
 - Sonoma Clean Power, transit operators, RCPA



Infrastructure Considerations

Charging Infrastructure Needs

- Transit staff working with fleet, electrical, and facilities staff to identify needs
- Limitations identified in current capacity for electric vehicle charging at MSC yard
- Grid to panel/meter – Utility’s responsibility
- Panel/meter to charger on City property



Charging Infrastructure Needs

- Identify charging methods/locations
 - Depot vs “en route” charging
- Charger types:
 - Plug-in
 - Overhead conductive
 - Wireless inductive



Charging Infrastructure Next Steps

- Regional Battery Electric Bus Partners
 - Partners
 - Sonoma Clean Power
 - Regional Climate Protection Authority
 - Santa Rosa CityBus
 - Sonoma County Transit
 - Petaluma Transit
 - Mendocino Transit Authority
- Infrastructure Needs Assessment
 - Sonoma Clean Power issued RFQ in February.
 - Scope –assess short and long-term infrastructure needs and costs for BEB deployment



Charging Infrastructure Next Steps



- PG&E expected to launch FleetReady Program in spring 2019
 - Plans to provide \$236 million for 700 sites supporting 6,500 new electric vehicles over five years
 - Provides technical assistance, funding and maintenance of “make-ready” connection from grid to meter for heavy duty fleets
 - Meter to charger funding also available
 - Funding up to 50% of the cost of chargers for transit agencies
- Authorization to apply for FleetReady on regular Council agenda today



Transit Fleet Plan— Introducing Electric Vehicles

Fleet Planning Considerations

- Federal useful life for 40' transit buses is 12 years
- CityBus will retire three 19 year-old buses in February 2019
 - Five 17 year-old buses will still remain in active fleet
- Ideally bus replacements maintain an average fleet-wide bus age around 6 years
 - CityBus average is 10 years; will drop to 8 years with new Eldorados
- A fleet plan lays out the funding program to support regular bus replacements and identifies gaps
 - Sets aside federal formula funds, as well as required 20% local match
 - CityBus is in “catch up” mode to bring the fleet into a state of good repair

Innovative Clean Transit (ICT) Rule

- Rule passed by ARB in December 2018 requires transit agencies to convert to zero-emissions fleets by 2040
 - Current focus on fixed-route vehicles, with paratransit vehicle mandate anticipated to follow
- ICT timeline for small agencies:
 - Submit a ZEB Rollout Plan approved by governing board by July 2023
 - Purchase 25% ZEBs in each bus purchase starting in 2026
 - Purchase 100% ZEBs by 2029



Introducing Electric Buses into Fleet Plan

- Need to balance timely bus replacement and retiring very old vehicles with integrating more expensive electric vehicles needed to meet environmental goals and state mandate
- Electric bus purchases should be phased with improvements to electrical supply and infrastructure to support charging
- Given unknowns related to infrastructure, looking five years out
 - Will revisit fleet plan when infrastructure needs assessment completed
- Can return to Council for adoption of a timeline for transit fleet electrification

Electric Bus Range Considerations

- 20 of the 25 CityBus daily vehicle “blocks” are between 142-168 miles
 - Five vehicle blocks between 43 and 92 miles
- With overnight “depot” charging proposed for initial deployment, buses will likely need to have a range of 150+ miles per charge
- Bus manufacturers cite baseline energy consumption based on Altoona testing results
 - Grades, standees, HVAC load, vehicle speed, and ambient temperature can have a significant impact on actual vehicle range
- Modeling of specific route applications and testing advisable

Electric Bus Purchasing Options

Federal procurement rules define bus purchase options:

1. Stand-alone procurements
2. Joint procurements
3. Assignment of contract options (“piggybacking”)
 - Only allowed under very limited circumstances
4. State contracts
 - California state contract for battery-electric buses under development, anticipated Spring 2019

Examples of Available Electric Vehicles and Estimated Base Costs

Bus length	Manufacturers	Available Battery Size	OEM Stated Max Mile Range	2017 Estimated Base Cost
29-30'	BYD, Gillig, GreenPower	197-296 kWh	Up to 150 miles	\$455,000-\$628,000
35'	BYD, Gillig, New Flyer, Proterra	94-440 kWh	Up to 260 miles	\$616,000-693,000
40'	BYD, Gillig, GreenPower, New Flyer, Proterra	94-660 kWh	Up to 327 miles	\$786,000-816,000

OEMs eligible through CA HVIP program listed.

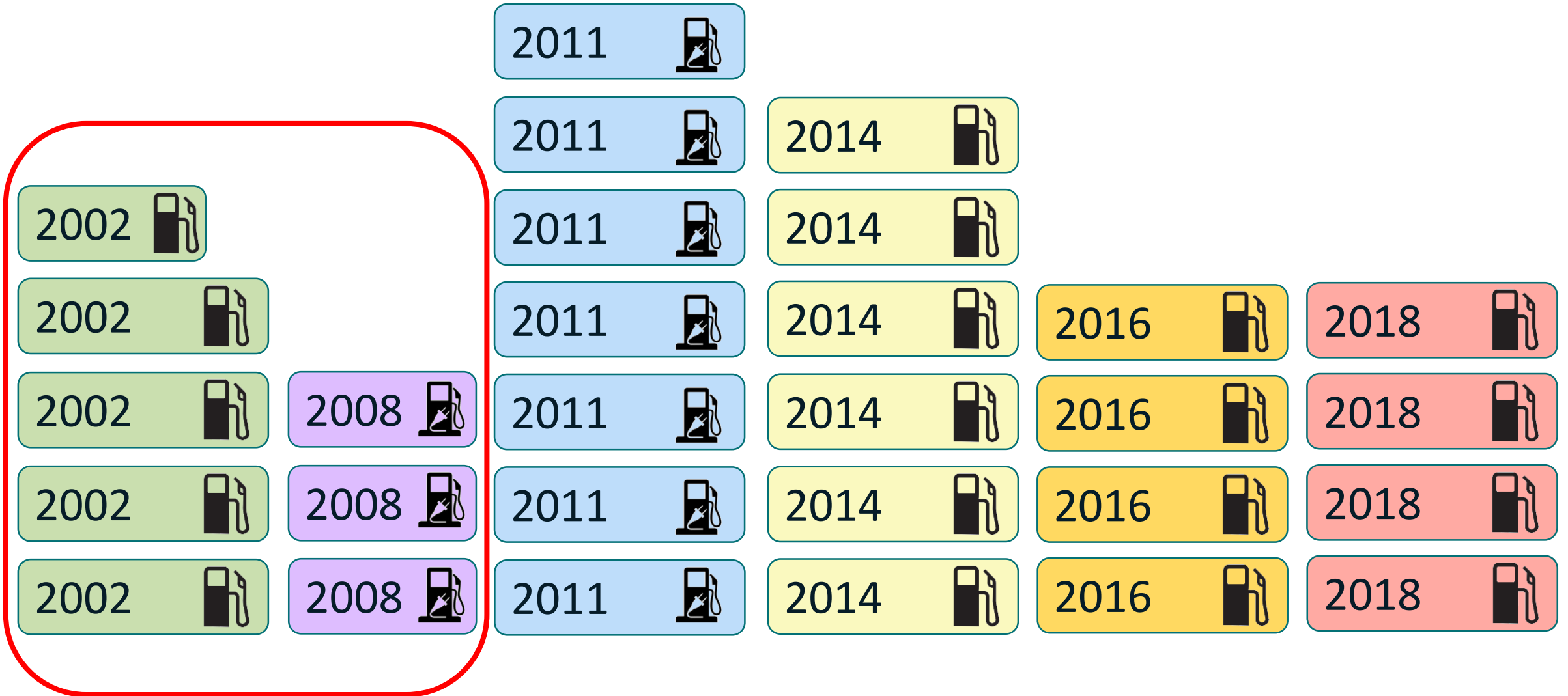
OEMs not currently HVIP-eligible: Complete Coach Works (conversion only), Double K (trolleys), Ebus, Nova Bus

Five-Year Bus Replacement Plan

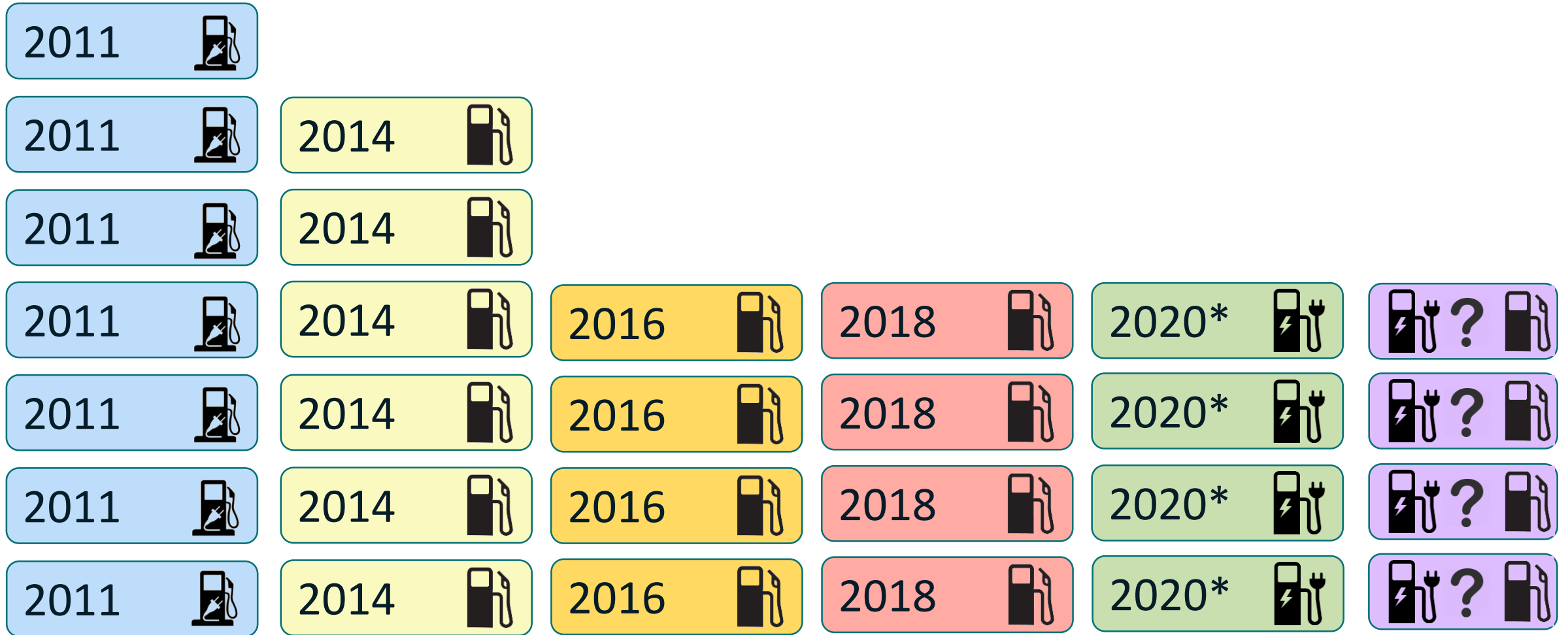
- Four new diesel buses going into service shortly, replacing remaining model year 2000 buses
- City awarded \$2.9 million from Federal Transit Administration's 5339 Bus and Bus Facilities Program for purchase of four BEBs
- FTA formula funds for purchase of three diesel buses programmed in FFY 19



Current Active Fleet (29 Vehicles)



2024 Anticipated Fleet (29 Vehicles)



Anticipated Future Council Items

- Application to PG&E FleetReady Program
 - Future Council item to approve contract if application successful
- Report on partnership with Sonoma Clean Power for assessment of short-term and long-range charging infrastructure needs
- Approval of both electric and diesel bus purchases within the next five years
- Adoption of transit fleet electrification plan



Questions and Feedback