

Alameda-Contra Costa Transit District Fuel Cell Bus Program

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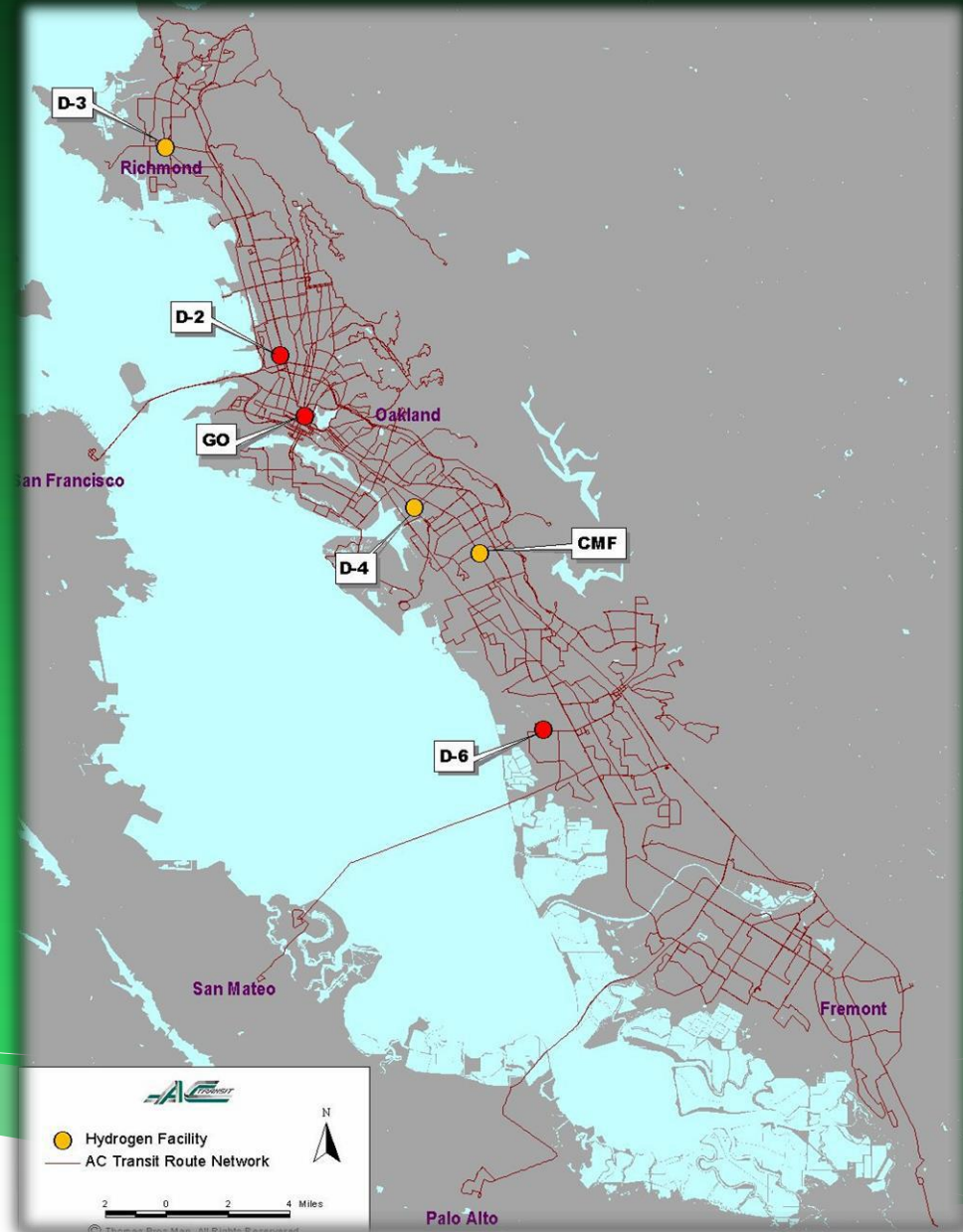
Bus & Paratransit Conference

Grand Sierra, Reno, Nevada

May 9, 2017



- 7 member, publicly elected Board of Directors
- Michael Hursh, General Manager
- Serving 1.5 million people
- 364 square mile service area
- 151 lines (31 Transbay)
- 18.4 million annual service miles
- 629 buses (13 – ZEB)
- 6 facilities in the East Bay
- 2,243 employees



Zero-Emission Bay Area (ZEBA) Advance Demonstration Program

- **CARB Fuel Path Mandate**
 - Three bus demonstration program
 - Twelve bus advanced demonstration program
- **Consortium Agencies in ZEBA Program**
 - Funding support for AC Transit program
 - Requirement to operate buses in revenue service



Program Advancement



2003-2006

- 1 FC Buses
- 30' Thor
- 60kW UTC PEM
- 48, 12v Panasonic batteries
- 25kg H2 storage
- 175-200 mile range



2006-2010

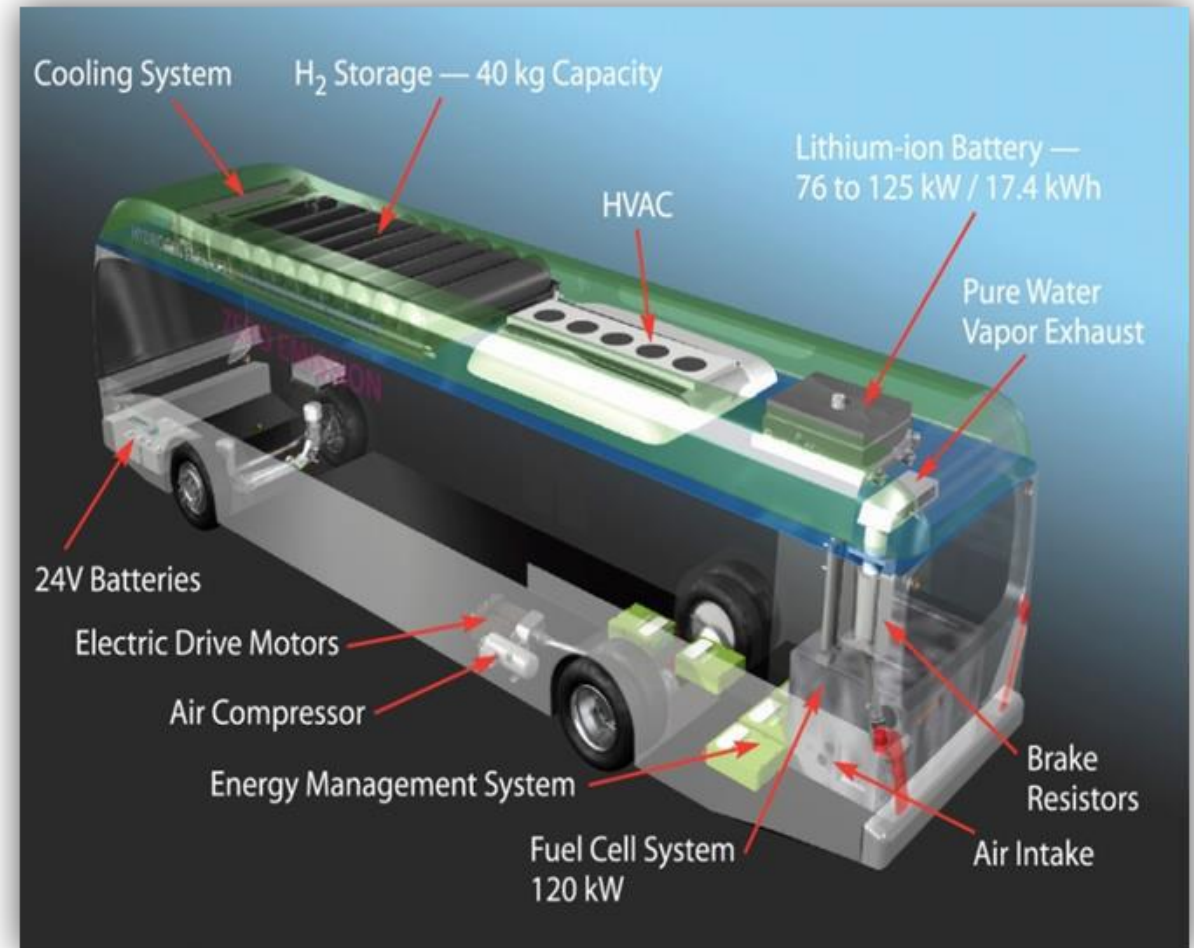
- 3 FC Buses
- 40' VanHool A330
- 120kW UTC PEM
- Zebra battery system
- 50kg H2 storage
- 250-300 mile range



2010 - Present

- 13 FC Buses
- 40' VanHool A300
- 120kW UTC PEM
- EnerDel battery system
- 40kg H2 storage
- 200-220 mile range

- 5,000 lbs. Lighter than 1st Generation Bus
- PC40 fuel cell power plant
- Liquid Cooled Lithium-Ion Battery System
- All-Electric Drive Rooftop Cooling
- All-Electric HVAC System
- Electric-Drive Power Steering and Air Compressor
- Active Regenerative Braking
- Rooftop 40Kg H2 Storage
- Two 85kW Siemens Drive Motors



Future ZEB Programs

- New Flyer Xcelsior XHE60
- 60 foot fuel cell transit bus
- Target range of 250 miles
- Arrives in late 2017



- Xcelsior XHE40 (hydrogen fuel cell)
 - 7-10 buses
- Xcelsior XE40 (battery electric bus)
 - 5 buses, depot charging
 - 4 buses, in-route charging
- NREL reports of ZEB fleet: performance & reliability, same agency, same service environment

40' Fuel Cell Bus Price

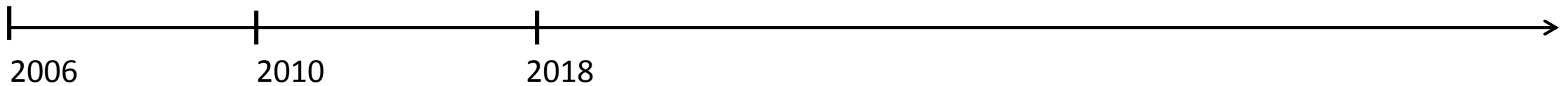
\$3.2 M (Build of 4)

\$2.5 M (Build of 16)

\$1.2 M (Build of 25)

\$700K (Build of 144)

\$300K (Build of 300)



Hydrogen Fuel Stations

Emeryville D2 Station



Oakland D4 Station



Fuel Cell Fleet Advancements

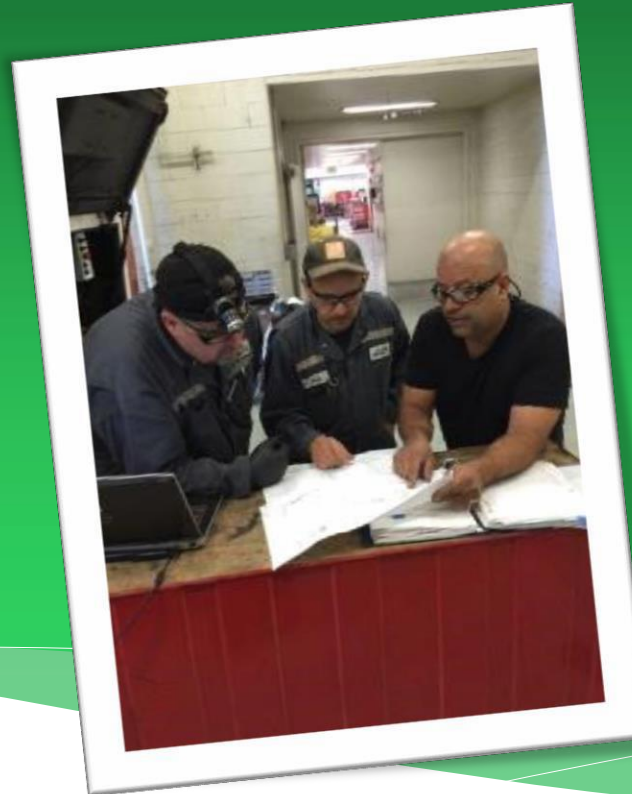
BUS #	HOURS	LTD MILES
FC4	18,041	164,980
FC5	17,446	163,574
FC6	17,929	134,953
FC7	24,614	160,010
FC8	16,727	100,578
FC9	16,267	137,281
FC10	20,843	182,448
FC11	19,933	174,434
FC12	20,756	175,741
FC13	8,822	94,235
FC14	21,023	176,348
FC15	17,061	149,130
FC16	20,099	165,138
	Hours	Fleet LTD
	239,561	1,978,850

	Units	This Report ^a	2016 Target	Ultimate Target
Bus lifetime	years/miles	5.3/ 8,300–131,900 ^b	12/500,000	12/500,000
Power plant lifetime ^c	hours	4,000–21,400 ^d	18,000	25,000
Bus availability	%	74	85	90
Fuel fills ^e	per day	1	1 (<10 min)	1 (<10 min)
Bus cost ^f	\$	2,500,000 ^g	1,000,000	600,000
Power plant cost ^{g,f}	\$	N/A ^h	450,000	200,000
Hydrogen storage cost	\$	N/A ^h	75,000	50,000
Roadcall frequency (bus/fuel cell system)	miles between roadcalls	4,500/ 23,200	3,500/ 15,000	4,000/ 20,000
Operation time	hours per day/days per week	7–14/ 5–7	20/7	20/7
Scheduled and unscheduled maintenance cost ⁱ	\$/mile	1.15	0.75	0.40
Range	miles	235 ^j	300	300
Fuel economy	miles per diesel gallon equivalent	6.18	8	8

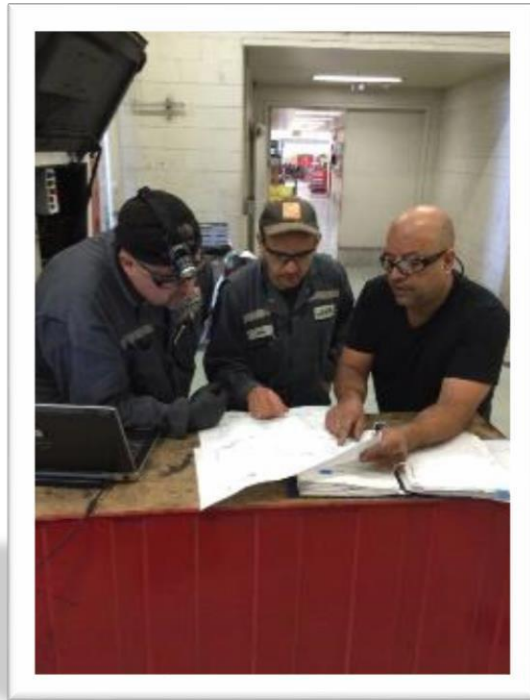
- DOE/FTA targets for FCEB
- Five fuel cells met the target by Oct 2016
- Twelve baseline fuel cells expected to achieve target by end of 2017
- FC7 expected to achieve “Ultimate Target” by mid 2017

ZEB Training Initiatives

- H2 Fuel Cell Safety & Familiarization
- Lithium Ion Battery Safety
- Fuel Cell Power Plant
- Siemens Drive System



Hands-on Technical Experience



5 week program

- Basic P.M.I.
- Basic Diagnostics & Repair
- Advanced Diagnostics & Repair

Training Provided:

- 215 Mechanics
- 6,592 Hours
- Every Bus Operator



Thank You!

For further Information:

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