



# **Pathways to the Zero-Emission Bus CTA's 51<sup>st</sup> Annual Fall Conference & Expo**

**Today's Transit for Tomorrow's World SunLine's  
Zero Emission Bus Program**

**Commercializing zero emissions bus  
technology for the benefit of communities**

# Three Distinct Business Units



- **SunLine Transit Agency**

- SunLine is the consolidated transportation service agency for the Coachella Valley, with a 1,120 square mile service area utilizing 74 fixed route buses (5 Hydrogen Fuel Cell, 3 Battery Electric, 66 CNG), and 34 paratransit CNG vehicles for a total of 108 revenue vehicles

- **SunLine Services Group**

- Regulates taxi service
  - 180 taxicabs in the Coachella Valley
  - 276 taxicab drivers
  - 3 franchises

- **SunFuels**

- SunFuels (Thousand Palms) provides CNG & Hydrogen Fleet and Public access 24/7
- SunFuels (Indio) provides CNG Fleet and Public access 24/7

# SunLine Facts



## SunLine Operations

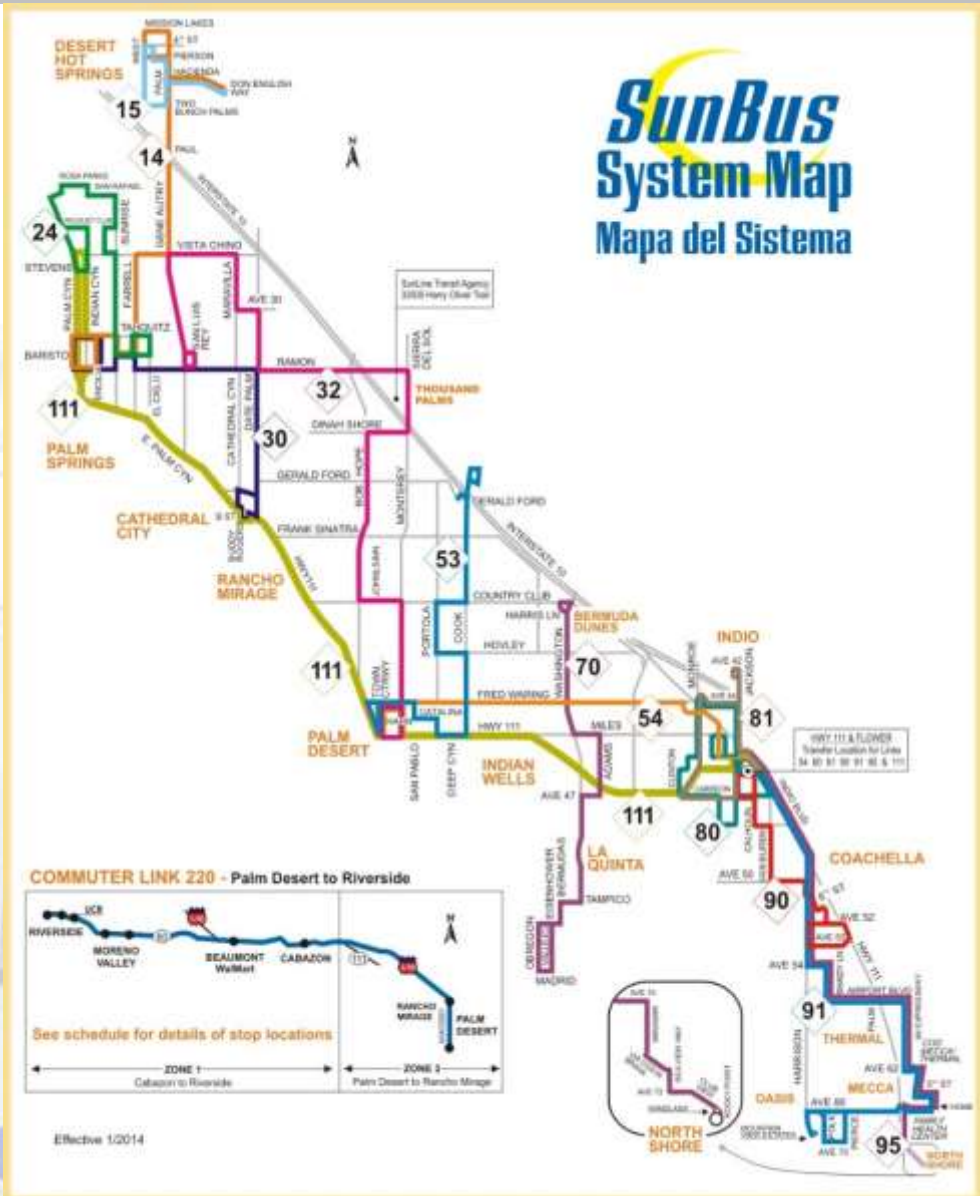
Operate fourteen (14) local SunBus fixed routes and Riverside Commuter Link 220

Provides SunDial ADA Paratransit service and Taxi Voucher Program for older adults

Operated 4.3 million revenue miles for 4.5 million passenger rides FY 15/16

## SunLine Employees

227 union employees  
88 non-union employees  
315 Total



# LEADERS IN ALTERNATIVE FUEL TECHNOLOGY



First Public Transit Agency in the Nation to operate a 100% CNG fleet

1994



40 CNG Buses

2016



34 Para-Transit CNG buses

2016



66 CNG 5 H2 Electric  
3 Battery Electric



SunFuels Fueling Station

# Leaders In Alternative Fuel Technology

## Current Battery Electric Buses



Three BYD 40' Battery Electric Buses Leased and put in service January 2016

# Leaders In Alternative Fuel Technology

## Current Battery Electric Buses



- Total Miles through October over 70,000
- Total kWh purchased 131,597 kWh
- kWh per mile 1.86 kWh >>Cost per mile \$.25 before LCFS credits
- Limited Issues so far none with drive system A/C, WC Ramp, Doors, 24v battery overnight draws/drain
- Use on our Line 20 Express 4 hrs. 92 mi. am & 4hrs 92 mi. hrs. pm

# Leaders In Alternative Fuel Technology Early and Current Hydrogen Projects



1<sup>st</sup>  
GENERATION



2<sup>nd</sup>  
GENERATION



3<sup>rd</sup>  
GENERATION



4<sup>th</sup>  
GENERATION



5<sup>th</sup>  
GENERATION



6<sup>th</sup>  
GENERATION



7<sup>th</sup>  
GENERATION



8<sup>th</sup>  
GENERATION



9<sup>th</sup>  
GENERATION

Leaders in Hydrogen Electric Fuel Cell Bus  
Technology for over a decade

# Leaders In Alternative Fuel Technology

## Current H<sub>2</sub> Fuel Cell Electric Buses



- Total Miles through September Over 500,000 miles
- Total H<sub>2</sub> produced/used 73,550 Kg
- Cost of H<sub>2</sub> per mile \$ 1.18 compared to CNG \$ 0.50
- Cost maintenance per mile \$ 0.53 compared to CNG bus @ \$ 0.54
- Availability H<sub>2</sub> buses average 80% compared to CNG buses average 85%



# Leaders In Alternative Fuel Technology

## What Does it Take to Transition



- Zero Emission Buses Really Work!!  
H2 F/Cell and Battery Electric buses have good performance, reliability, and warranties
- H2 F/Cell Electric Buses & Battery Electric Buses use the same drive systems, the difference is how they get and store the energy
- H2 extends the range of Electric bus comparable with CNG/Diesel bus ranges
- H2 is very similar to CNG as both are a high pressure gaseous fuel, fueling very similar, Technicians find fuel systems very similar to work with
- Training, Training, Training as with any emerging technology
- Maintenance shop upgrades minor from CNG to H2

# Leaders In Alternative Fuel Technology

## Future Zero Emission Projects



- FTA Funded: 1 Battery Dominate H2 F/C Bus  
El Dorado, BAE, US Hybrid Tech/Partners
- CEC Funded: 1 Battery Dominate H2 F/C Bus  
New Flyer, Hydrogenics Tech/Partners
- FTA LoNo Funded: 5 AFC Buses El Dorado, BAE, Ballard
- CARB AQIP/FTA Funded: 5 H2 Fuel Cell Buses New  
Flyer, Hydrogenics
- TIRCP Funded: 4 Battery Electric Buses
- CEC Funded: 2 H2 Fuel Cell 29' Shuttle buses El  
Dorado, US Hybrid
- **By the end of 2018 SunLine Transit Agency will have  
over 20% ZEB fleet with 23 Zero Emission Buses in  
Service**

# Definition of Opportunity



- **Commercialization of Zero Emission Technology must include the Transit Industry's perspective in three key areas:**
  - Risk associated with the investment in the technology (purchase readily accepted vs. introductory technology)
  - Performance associated with the reliability of the equipment
    - Mission focus and organization communication focused on Zero Emission Program that starts at the top but is routinely reinforced at all levels
  - Affordability of initial investment and support costs

# Evolution of Technology Risks



- **CNG Risk**

- Perception of No Risk

- Transit Agency's have struggled with an exclusive manufacturer and fleet defects
    - There are no emerging engine providers entering the market to provide competition and component choice

- **Hydrogen/Battery Electric Risk**

- Perception of Unacceptable Risk

- An emerging market with similar technical challenges as CNG
      - Current increased interest by OEM's to produce components that may lead to more configuration choice with Hydrogen than with CNG platforms

- **Successful Commercialization Elements from an Operator Transit Prospective:**
  - Builds on operator successes representing the demand for the technology
  - Identifies risks from an operator position
  - Represents the value proposition from a Transit Agency Perspective
  - Provides technical assistance to the industry
  - Establishes visibility of initiatives



# Building Partnership Success



- **SunLine's Position**

- **Assumption that manufacturers can drive technology changes**

- Manufacturers are key partners, but successful relationships for technology growth cannot rely on the creator of the product
- Extended focus on cost versus reliability
  - Economic order/quantity models for commercialization versus usefulness of the technology

- **Non-profit Collaboration and Project Acquisition**

- Transit Operators need technical assistance in the grant and implementation phases of these projects
- Operators must commit to the program for sustained success and full operation requirements of the vehicle

# SunLine's Center of Excellence



- **Establish a Center of Excellence to house investments in learning**
  - For every investment in technology, there is investment in training and learning
    - Funding partners have already made substantial investments in the technology
  - Center of Excellence will be a site to preserve and enhance those learning investments
    - Acquisition and in-service management
    - Leverages prior investments and prevents duplication in future technology projects
    - Is not limited to transit technology and can transcend other “spill over” applications

- Increased demand for Zero Emission Vehicles
  - Improve visibility of zero emission programs in California and Nationwide
  - Solidify funder/manufacturer investments
  - Prepare for sustained success and strengthen transit operator commitment

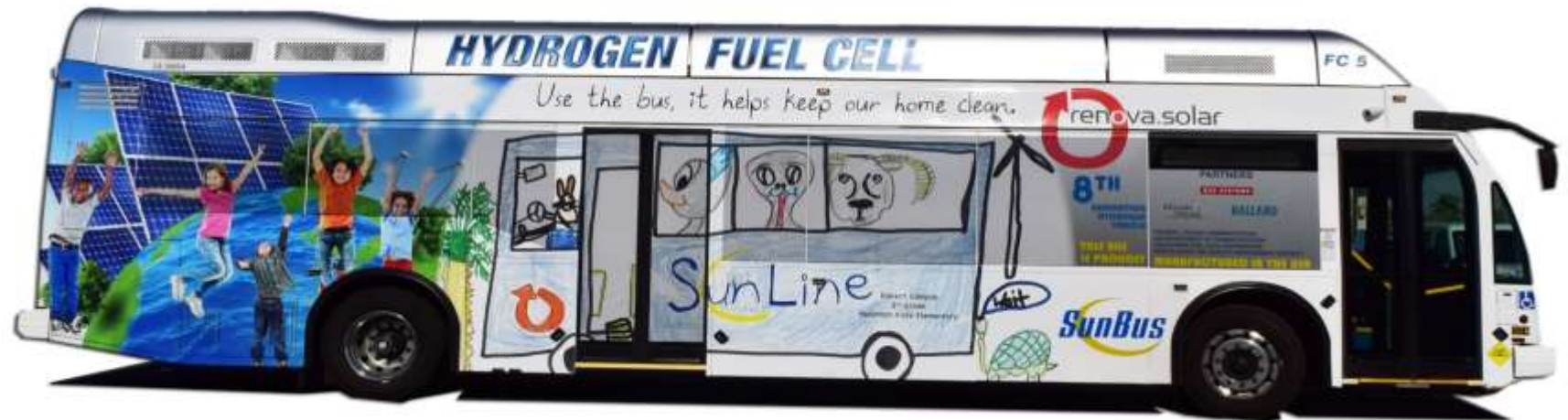




# KEY TAKEAWAYS

- Commitment to zero emission technology must be in place at project initiation
- Reliability, competition, value proposition, and successful partnerships must be communicated
- Risk must be accepted by all partners
- Zero emission technology works
- Don't wait until the funding opportunities sunset to create a renewable energy mission/focus

# Engaging the Community



Thank You! Tommy Edwards  
[www.sunline.org](http://www.sunline.org)