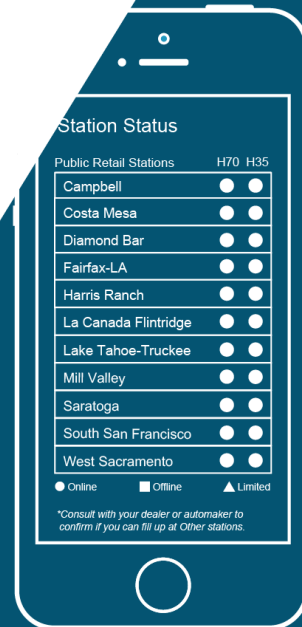


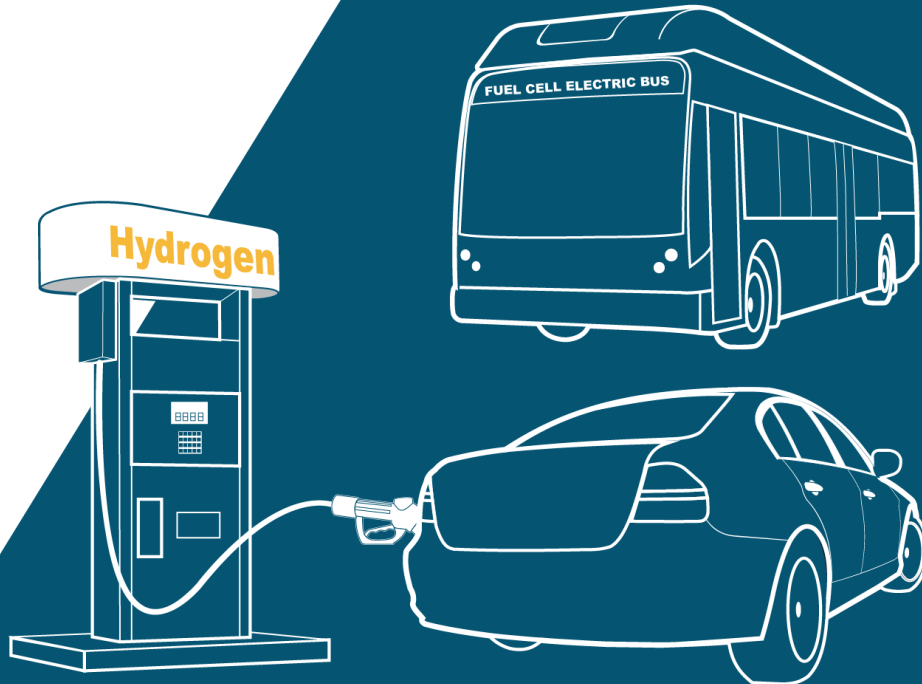
#TheOtherElectricBus

Fuel cell electric buses in California



Keith Malone

2019





#Pioneer



Sunline Transit

- 18 years
- Buses just over \$1million, below quoted price
- 900-kg capacity hydrogen station
 - Fuels 26-30 buses
- On-site production
- Center of Excellence
 - Training
 - Facility



#Performance



AC Transit

- 15 years
- Fuel cell longevity
 - 5 stacks exceed 25,000 hours
 - 12 of 13 stacks exceed 20,000
 - 1 exceeded 30,000 hours
- Reno trip
 - 224 miles each way (2xs!)
 - Rain and snow
 - Steep grade
 - 10.91 miles per gallon
- 2.9 million miles of service
- Trained 270 mechanics
 - 14,000+ hours of fuel cell bus mechanic training
- Dispensed 88,000+ kgs of H₂ in 2017
 - More in 2018



#WelcomeToTheClub



- 1 fuel cell bus
 - 2.5 years of operation
- Soon, 1st bus of a 10-bus purchase
- H2 station commissioned soon
 - Trillium's first H2 station

Orange County Transportation Authority (OCTA)



#HereWeAre



- 30 buses in revenue service
- Another 22 funded and in development
- 4 cutaway shuttles in development

- 18 years of experience
- 14 years of federally collected performance data
- 4+ million miles of service



#HighFives

- High hours on fuel cell stack lifetime
- Availability numbers are looking good
- Transit agency comfort levels increasing
- Learning curves are not as steep anymore
- Bus OEMs taking on leadership role



#Challenges

- Infrastructure for a large fleet
- Infrastructure cost for a small fleet
- Federal and state funding for infrastructure
- Supply of parts
- Cost of components



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