FTA

FEDERAL TRANSIT ADMINISTRATION

Energy Efficient Technologies for Transit

Federal Transit Administration

Office of Mobility Innovation

U.S. Department of Transportation

Federal Transit Administration

Energy Efficient Technologies for Transit

- Alternative fuels and clean technology in transit: a look back
- The changing transit landscape and drivers for clean fuel technologies
- Current portfolio and some highlights
- Opportunities for agencies

Clean Fuels in Transit

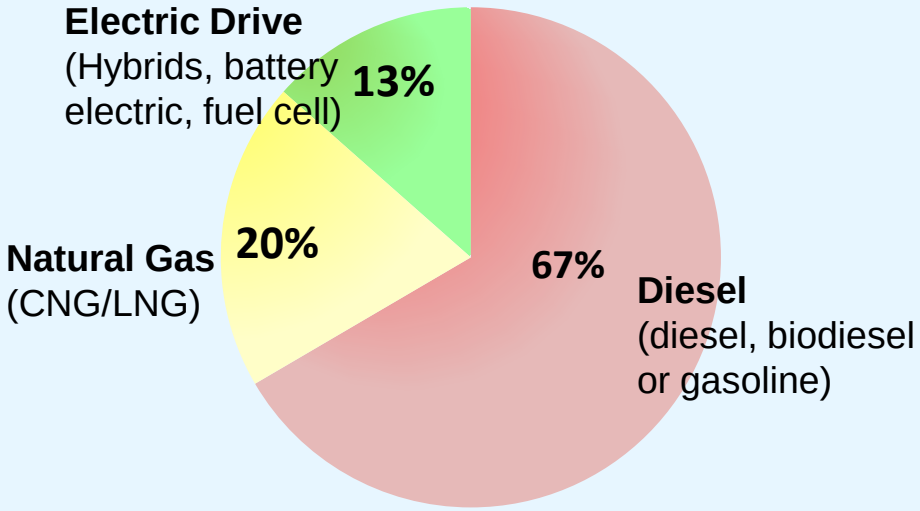
U.S. Transit has a long successful history with developing and demonstrating clean vehicle technologies

- **Transit pressured to look for alternatives to diesel to reduce pollution and smog**
  - Highly visible with broad public exposure, and operates in densely populated areas
- **Transit good platform to implement alternatives to diesel**
  - centrally fueled and maintained, professionally operated and maintained, Federally-funded fleet
- **Early demos expensive, mixed results**
  - Since 1988, over $200 Million FTA Federal investment in CNG and hybrids
  - CNG now most common alternative to diesel buses
  - Hybrid bus market share increasing each year

Clean Fuels in Transit: Bus Propulsion

- Transit leads transportation sector, with over **1/3 of U.S. transit bus fleet alternatively-powered**

U.S. TRANSIT BUS FLEET, 2013 by power source*



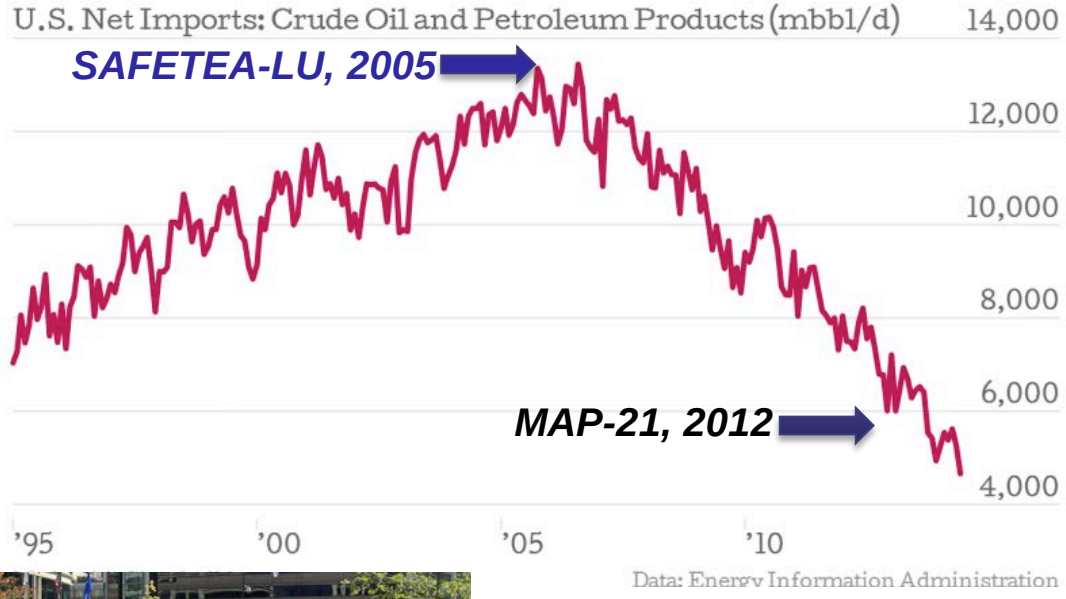
- More buses orders for alternatives (natural gas or electric drive buses) than for diesel-powered buses

Source: * **2014 PUBLIC TRANSPORTATION VEHICLE DATABASE, APTA**

Improving Energy Efficiency of Transit

- Transit leader in deploying technologies, to improve efficiency and reduce emissions:
  - *Alternative fuels and electric drive bus propulsion technologies*
  - Facilities improvements, e.g. solar installations, geothermal
  - Rail efficiency improvements, e.g. vehicle upgrades, wayside energy
  - Operational efficiencies , e.g, Intelligent Transportation Systems
- Focus **on improving transit efficiency** and providing **environmentally-sustainable transportation solutions**

Changes in Transportation and Energy Landscape



Emphasis on reducing the dependence on imported petroleum

Peak oil concerns

U.S. importing less foreign oil than we are producing domestically

Dramatic shifts in mobility landscape, in last 10 years

Transportation and Energy Landscape
Current Drivers

- Need for safe, reliable, efficient transportation solutions still relevant
- The drive toward zero emissions continues, including state-level requirements
- Environmentally-sustainable transportation – GHG concerns
- Control operating costs
- Solutions must be scalable and flexible
- Energy and transportation landscape will continue to evolve

FTA Research, Demonstration and Deployment Efforts on Energy Efficiency

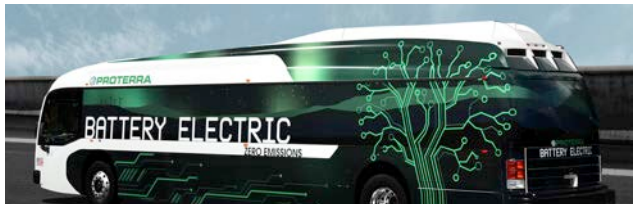
- Recent research efforts focus on electric drive vehicles

  LONO, TIGGER, NFCBP, BEERD

- Other FTA research efforts on ITS and Mobility, also have energy efficiency component

Current Portfolio:
Low and Zero Emission Buses

- Adds options for transit -- technology is available, but capabilities vary
- Electric drive technologies share common platform
  - battery electric, hybrid electric, and hydrogen fuel cell buses
- R&D advances in batteries and drive technologies
- New ways to charge buses – on route, fast-charging
- Natural Gas (CNG and LNG) will continue to be good solution for many agencies – low emission, fuel cost low
- *Unique operating characteristics of ZEBs may require more planning to implement successfully*



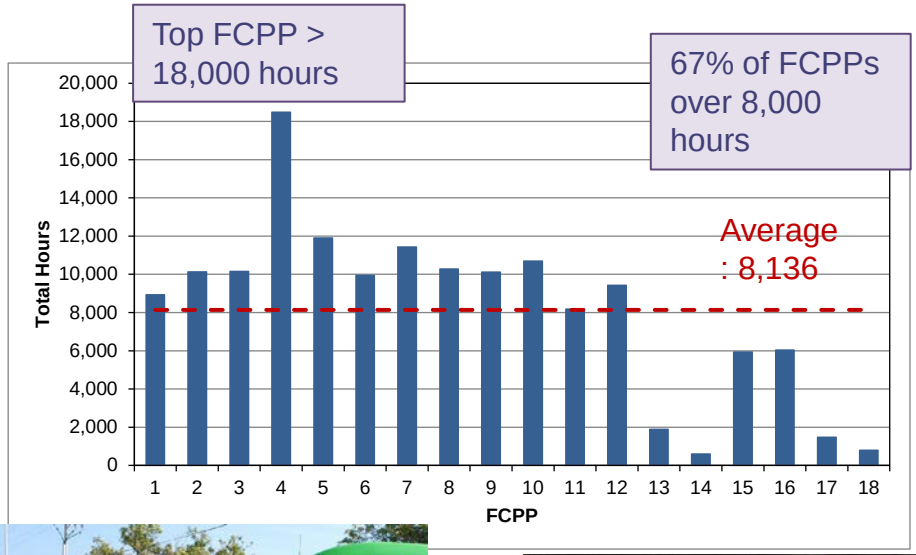
Current Portfolio:
National Fuel Cell Bus Program (NFCBP)

- Research, development & demonstration program to advance commercialization of fuel cells
- Focused on transit needs
- In cooperation with industry
- Over $90 Million Federal funding to date (2006-13)
- Target: : 12 year bus, $600,000 USD

National Fuel Cell Bus Program (NFCBP)
Where are we now?

- ✓ Fuel cell buses less costly and more reliable – FC life-times have doubled, costs have declined by 50 percent.
- ✓ Multiple technologies & platforms
- ✓ Demonstrations throughout U.S.
- ✓ "Buy America" compliant buses
- ✓ Supply chain emerging
- ✓ Benefit hybrid and battery buses

Total hours accumulated on each FC powerplant

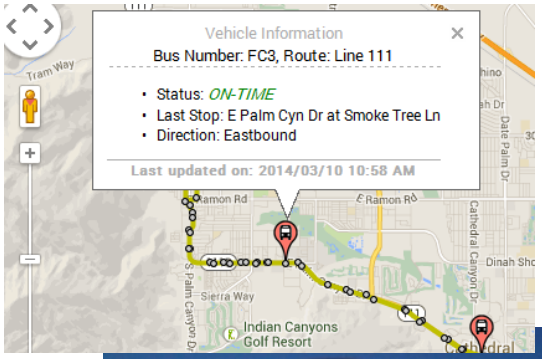


National Fuel Cell Bus Program

Fuel Cell Buses in the U.S: SunLine Transit

American Fuel Cell Bus (AFCB) model developed under NFCBP

- SunLine, Coachella Valley in California, is leader in alternative fuels
- *All* buses CNG or hydrogen-70 fixed route
- Fuel cell bus operates in daily service since 2011-meeting performance expectations
- 5 new fuel cell buses planned delivery for 2016-2017
- New buses acquired through FTA capital (not research) program
- Additional delivers of AFCB planned for Boston, NY, CA and Ohio, Altoona testing

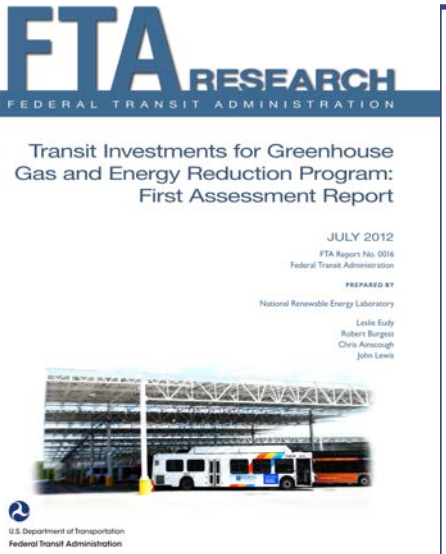


FTA Energy Efficiency Program: TIGGER Program

- FTA Grant program to reduce transit energy consumption, and greenhouse gas emissions
- Total over $225 Million (USD)
- Potential lifetime energy cost savings more than twice the Federal investment
- Projects in Bus Efficiency, Facility Efficiency, Rail Technologies

FTA Energy Efficiency Program: TIGGER Projects

- Hybrid electric buses
- Zero emission buses
- Facility upgrades
- Solar
- Wind turbines
- Geothermal HVAC
- Stationary fuel cells
- Locomotive upgrades
- On-board energy storage systems
- Wayside energy storage systems



Published Evaluation include:

- ☐environmental impacts,
- ☐reduction of fossil fuel use,
- ☐emission savings,
- ☐economic impacts,
- ☐viability of technologies, and
- ☐benefits versus costs.

Zero Emission Buses funded with TIGGER Program

- FootHill Transit, CA - 12 Proterra fast-charge BEBs
- Long Beach, CA - 10 battery electric buses
- Star Metro, Tallahassee, FL - 5 Proterra BEBs
- Chicago Transit Authority, Chicago, IL – 2 BEB
- Maryland Dept of Transportation, Howard County, MD – 3 inductive BEBs
- RTC of Washoe County, Reno NV – 4 Proterra BEBs
- SC Dept of Transportation Clemson, SC -5 Proterra fast-charge BEBs
- CARTA, Chattanooga, TN – 3 BEBs
- VIA Metro Transit, San Antonio - 3 Proterra BEB
- City of McAllen, McAllen, TX - 3 inductive BEBs
- Utah Transit Authority, Salt Lake City, UT – 1 BEB
- Link Transit, Wenatchee, WA – 5 Ebus BEB, plus 3 more BEBs
- King County Transit, Seattle, WA -1BEB
- Flint, MI -2 fuel cell buses
- Sunline Transit -2 AFCB fuel cell buses

60 Battery Electric Buses

4 Fuel Cell Buses

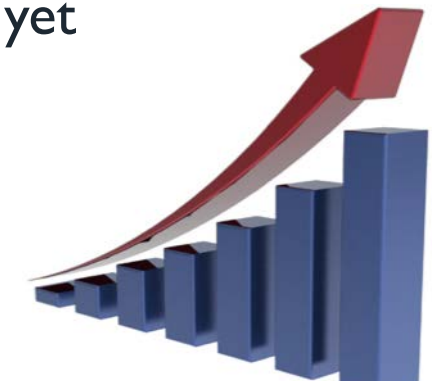
Battery Electric Buses in the U.S.: Foothill Transit

- Foothill Transit provides service in the San Gabriel and Pomona Valley, in the LA area in California
- Agency operates ~ 330 buses
- In 2002 began running CNG buses, retired last diesel buses in 2013
- In 2010, became the first agency to introduce a fast-charge electric bus in the U.S.
- 15 fast charge electric buses (12 funded under TIGGER)
- 2 Additional "new model" buses planned for 2015, with13 more in 2016
- One fully electrified route - with more routes to follow
- Bus operating well, good response from public

Low or No (LONO) Emissions Vehicle Deployment Program

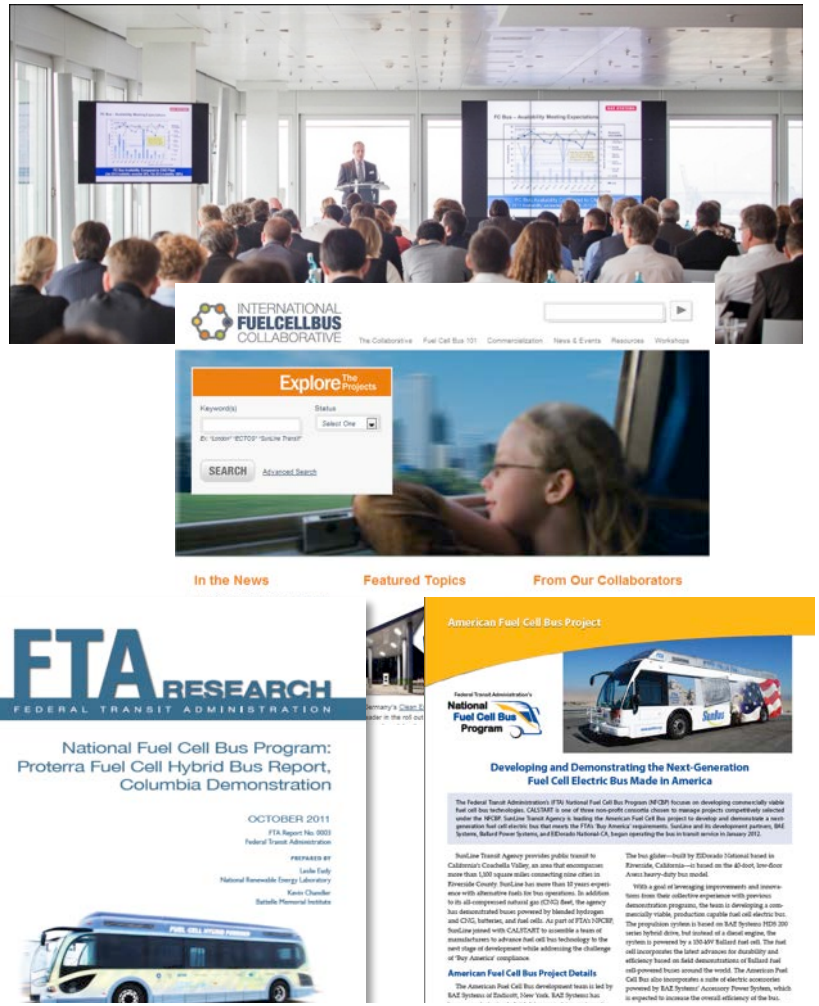
Builds on research efforts, moves technologies closer to commercialization

- ***Deployment focus -*** funds low or no emissions transit buses
- Targets vehicles that have been demonstrated, but are not widely deployed in transit
- $55 Million in projects to date
  - ***43 zero emission buses(fuel cell and battery), 17 low emission buses***
- Will evaluate how technology performs in ***fleet***
- **Additional $22.5M** in 2015 – RFP not released yet



Reports and Resources

- Independent evaluations of fuel cell bus and TIGGER projects published
- Evaluations of LoNo Projects – results will be available to industry
- Project reports and Best practices guidelines, Procurement, fueling, and maintenance
- Meetings for users to exchange experiences, website



Moving Forward

- Focus: Transition technologies to commercial market
- Conventional procurement practices and requirements
  - How to best enable new technology procurements while protecting Federal investment and meeting transit agency requirements
- Infrastructure - new fuels, and charging capabilities
- How to continue support advanced technology with end of dedicated research funding
- How to address different safety concerns than conventional technology
- How to support nascent industry – supply chain, spare part warranty assurance

Energy Efficient Bus Technology Research

Innovative technology for better transit solutions

- Need for clean energy efficient technology solutions, regardless of future transportation landscape
- Research investments can widen our options and lead to unanticipated benefits
- New technologies must enhance transit agencies ability to provide transportation, mobility
- Technologies successfully demonstrated in limited deployments –how to ensure success for fleet applications

Thank you!
More Information

FTA website includes program information and links to evaluation reports: www.fta.dot.gov

Christina Gikakis
Christina.gikakis@dot.gov

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