

Aspects of New Technologies

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Let's Talk About Buses in Our Community

- Diesel/electric hybrid technology
- Battery electric bus (BEB) technology
- Hydrogen fuel cell technology
- Existing fleet electric conversion
- Alternative fuels update
- Clean diesel technology
- New technology strategy
- 2019 Gillig bus purchase update
- 2018 Dial-A-Lift (DAL) bus update

Pros and Cons of Diesel/Electric Hybrid

- Improved comparable fuel economy
- Quieter customer experience
- Favorable public perception
- Infrastructure requirements
- Specialized technician training
- Undefined longevity
- Higher upfront costs
- Expensive parts

Pros and Cons (continued)

- Underpowered in service
- Reliability concerns such as electrical subsystems
- Parts availability challenges
- End-of-life realities
- Greater exhaust emissions than predicted
- Engine is not rebuildable
- Have yet to complete a full lifecycle

Pros and Cons of Battery Electric Buses

- Quiet with favorable public and political perception
- Too new to have a track record
- \$1.2 million to purchase one bus
- Most models require special hoists to lift vehicle
- Expensive charging infrastructure
 - Depot charger – \$200K (\$100K charger/\$100K installation)
 - En route charging – \$1M (\$600K charger/\$400K installation)
 - Conductive charging no longer available
 - Cloud management/additional IS employees
- Advertised range not equal to reality
- Affects of heat and cold

Pros and Cons (continued)

- Utility sources
 - Natural gas
 - Coal
 - Nuclear
 - Hydroelectric
 - Solar and wind
 - Diesel generators
- 100 percent spare fleet not uncommon
- Maintain contingency bus fleet as backup
- Production delays
- Electric buses can have fewer seats than a diesel bus
- Evolving charger technology

Pros and Cons (continued)

- By the numbers
 - Gillig – production pending
 - New Flyer – 25
 - Proterra – 180
 - BYD – (six calls to Sales went unanswered)
 - Nova – not in the electric bus market
 - Green Power – exited the electric transit bus market

Pros and Cons of Hydrogen Fuel Cell Buses

- Hydrogen generates electricity to charge a small battery pack and propel electric motors
- 100 percent of exhaust emission is pure water
- Fairly new technology to the transit bus market
- Eldorado National is the only provider
- Fuel source options
- \$1.2 million per bus
- Facilities modifications
- Lack of consumer familiarity
- Fuel costs 25 percent more than diesel
- Limited range (250 miles)

Pros and Cons of Converting Existing Buses to Electric Propulsion

- Complete Coach Works
 - Remove diesel propulsion and replace with electric drive
 - Costs approximately equal to a new clean diesel bus
 - On-board charger
 - Gillig bus familiar to Maintenance and Operations
 - 46 in service today with 2-million-mile service
 - Range of approximately 150 miles per charge

Amazing Facts About Alternative Fuels

- Ethanol
 - Produced from corn and other plants
 - E-85 is 85 percent ethanol and 15 percent traditional gasoline
 - Primarily for use in automotive applications
 - Challenges with regional availability and cost
- Biodiesel
 - Made from soybeans and other organic products
 - Blended with diesel in concentrations up to 20 percent
 - Operating 5 percent biodiesel adds 6 cents/gallon to diesel costs
 - Burns cleaner than traditional diesel
 - Does have a shelf life
- Compressed natural gas
 - Costly fueling infrastructure
 - Emissions equal to that of clean diesel
 - Midlife vehicle costs – tank replacement

Alternative Fuels (continued)

- Propane
 - Fuel costs less than half of gasoline or diesel
 - Exhaust emissions a fraction of the gasoline or diesel operating profile
 - Less weight, cleaner, quieter, safer, and powerful
 - About the same cost as diesel option
 - No threat to soil, surface, or ground water
- Renewable diesel (R-99)
 - Produced from vegetable oil, animal fat, and other renewable sources
 - Double the cloud point of diesel (-40 Fahrenheit vs. -20 Fahrenheit)
 - Direct diesel replacement (no modifications needed)
 - Cetane rating approximately double that of diesel

Alternative Fuels (continued)

- R-99 emission benefits
 - 90 percent less carbon dioxide emissions than diesel
 - 33 percent less particulate matter than diesel
 - 9 percent less nitrogen oxides than diesel
 - 24 percent less carbon monoxide than diesel
 - 33 percent less hydrocarbons than diesel
 - Gaining popularity in California and Oregon
 - Not yet available in Washington
- Clean diesel technology
 - Continual improvement
 - “Decades of innovation has resulted in near zero emissions from diesel engines.” – APTA Diesel Technology Forum

Show-and-Tell

- Gillig
 - Just starting production
- Complete Coach Works
 - Convert Gillig diesel buses to electric drive
- Proterra
 - Catalyst 35- and 40-foot bus
- New Flyer
 - Expect a visit soon
- BYD
 - Invited, but unable to recharge
- Nova
 - Not in the BEB market

Our Strategies for New Technology

- Listen
 - Continue to research technological evolution
 - Continue to track peer evaluations
 - Continue to invite new technology for review
 - Plagiarize everyone's best ideas
- Evaluate
 - Take new technical aspects and lessons into account to make an informed decision that best meets the needs of the community and agency
- Involve and inform
- Strategize a solution
- Celebrate

2019 Gillig Bus Purchase Update

- Eight new 35-foot buses with clean diesel technology
- Passenger and driver amenities
 - New driver seat with more adjustability and heated lumbar
 - New Q'Straint Q'Pod wheelchair systems
 - Passenger handheld straps from upper handrails
 - Independent HVAC for driver's compartment
 - New electric door control module, including kneel and lift
 - Stroller/cart space with flip-up seats
 - Three-position bike racks
 - External electric door switch to secure bus when unoccupied
 - Additional driver gear storage space
 - New technology digital dash
 - Tint band on upper windshield
 - Reconfigured interior mirror arrangement

2019 Gillig Bus (continued)

- Fuel and labor savings
 - New Voith transmission
 - New three-ply coolant hoses
 - Preset cabin HVAC settings
 - New technology vinyl driver and passenger seats
 - New technology engine cooling system
 - New technology engine charging system
 - Pre-wired for automatic chaining system
 - New disc brake systems
- Safety amenities
 - Additional defrost fans
 - Lighted signals on mirror glass
 - Additional side signals
 - Additional rear-facing camera
 - Backup camera
 - High-mount mirrors
 - Unit numbers on roof

2018 Propone DAL Update

- Driver and passenger amenities
 - Yellow handrails and stanchions throughout
 - Diagonal handrails on door halves
 - Non-slip flooring
 - Newly design wheelchair restraints
 - New driver seat
 - New low-profile interior air conditioning compartment
 - Single flip-seats at the rear for caregivers
 - Sound deadening fabric ceiling
 - New Braun wheelchair lifts
 - Quiet and powerful powertrain
 - Newly coordinated interior color scheme
 - LED lighting

2018 Propone DAL (continued)

- Fuel and labor savings
 - Propane-powered engine
 - New Euro-Nozzle quick-connect fuel fill
 - Recycled composite materials throughout
 - Galvanized body framework
 - New stepwell battery storage
 - New high-output charging system
 - Stainless steel exterior hardware
 - Coach heating system integrated into air conditioning system
 - Eliminated roof hatch
- Safety amenities
 - Rear emergency door
 - Additional exterior lighting
 - Reflective graphics
 - Backup camera
 - Fire suppression system
 - Automatic tire chaining systems
 - Additional exterior cameras
 - Lighted signals in exterior mirror glass

THANK YOU!

