

Mixed Bus Fleet Composition Strategy

Board of Trustees

August 10, 2022



Proposed Strategy

- 20-year plan
- 50% alternative fuels by 2042
- 38% Battery Electric, 14% CNG and 48% Clean Diesel
- Plan Complies with FTA's Zero Emission Transition Plan
- Review plan every 3 years
- Collaboration with TED, ET, RGM's and Maintenance Managers



Team Members

▪ Chief Enterprise Strategy Office

- Alisha Garrett (Chief Enterprise Strategy Officer)
- Bill Gerow (Sr Continuous Improvement Consultant)
- Jordan Eves (Business & Quality Analyst Supv)
- Jacob Ekker (Business Strategy Specialist)

▪ Chief Planning & Engagement Office

- Eric Callison (Mgr Service Planning)
- Kerry Doane (Mgr Long Range Strategic Planning)

▪ Chief Service Development Office

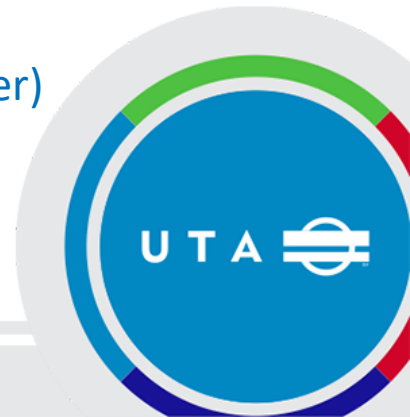
- Kyle Stockley (Mgr Veh Overhaul & Bus Support)
- Hal Johnson (Mgr Project Dev-System Planning)
- Ethan Ray (Proj Development Planner II)
- Daniel Locke (Environmental Compliance Admin)
- Jesse Rogers (Vehicle Procurement-Comm Admin)

▪ Chief Financial Office

- William Greene (Chief Financial Officer)

▪ Chief Operating Office

- Celeste Sloan (Senior Office Specialist)
- Andres Colman (Regional General Manager)



Areas of Analysis

PURPOSE

Develop a data driven mixed bus fleet composition strategy that supports UTA's mission. This strategy will align with UTA's service plan, the long-range transportation plan, and serve as a guide for future vehicle procurement and facilities plans

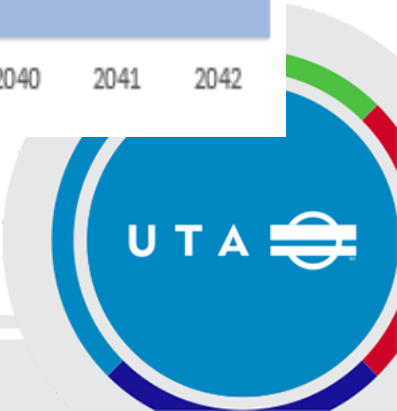
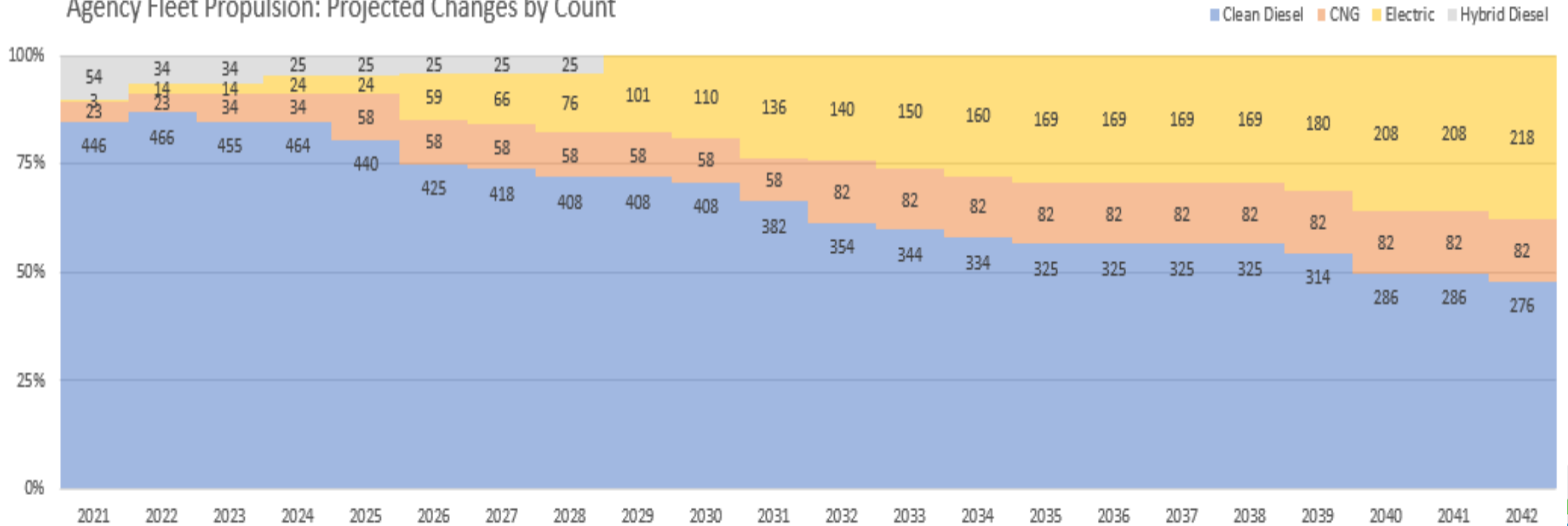
STRATEGY DEVELOPMENT INPUTS

- Current fleet mix & replacement schedule
- Environmental Impact
- Full life cycle vehicle cost
- Vehicle reliability
- Vehicle compatibility with service plan
- Resources per fleet (onboard, support, maintain)
- Current infrastructure & future needs
- Technological innovations
- National trends (other agencies, climate)
- External conditions (social, political)
- Available funding



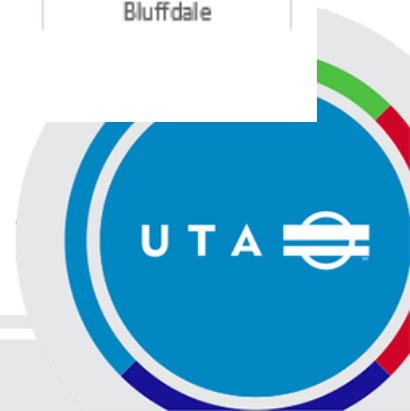
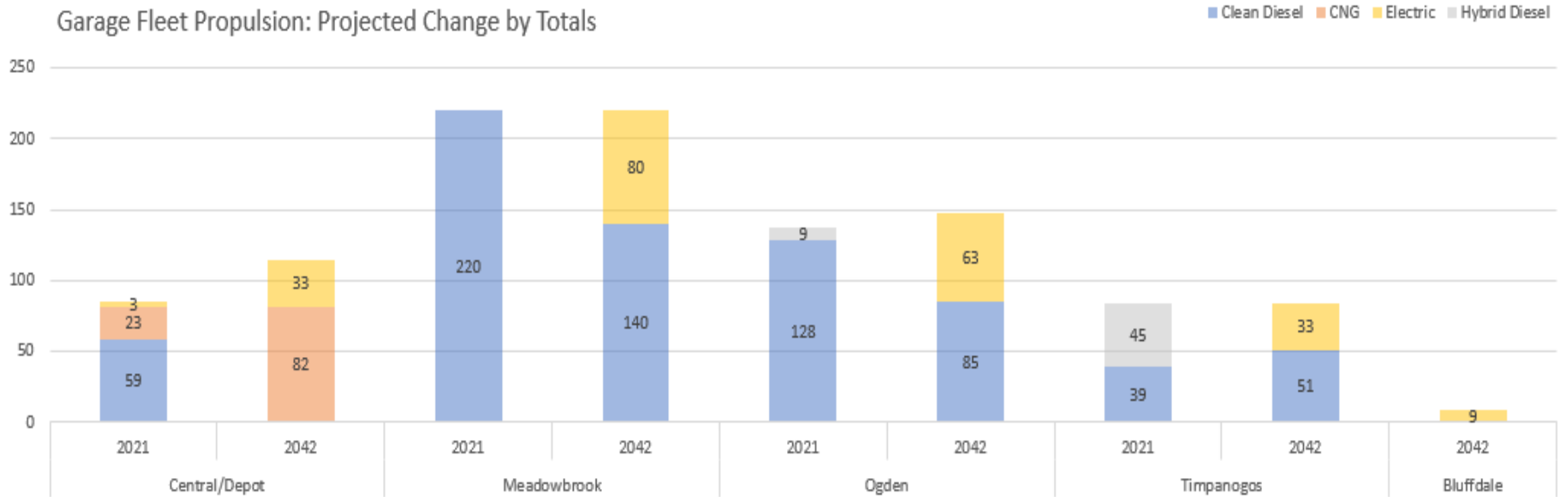
Projected Change Agency

Agency Fleet Propulsion: Projected Changes by Count



Projected Change Garage

Garage Fleet Propulsion: Projected Change by Totals



Training

ZEB Transition Plan for UTA Bus Operations & Maintenance Personnel

Needs Assessment

- Understand Workforce Skills
- Identify knowledge gaps and concerns
- Assessment/Revision of OEM training + Internal training material

Workforce Training & Deployment

- Lessons learned from peer agencies
- Safety Training
- Emergency procedures
- Best Practices (FTA, APTA)

First Responder Training

- Training to ensure proper emergency response procedures

Training Program

Safety

- Emergency procedures for charging and hazards
- Safe handling of high voltage components

Operations

- Operating time and range
- Optimal driving procedures
- Regenerative braking

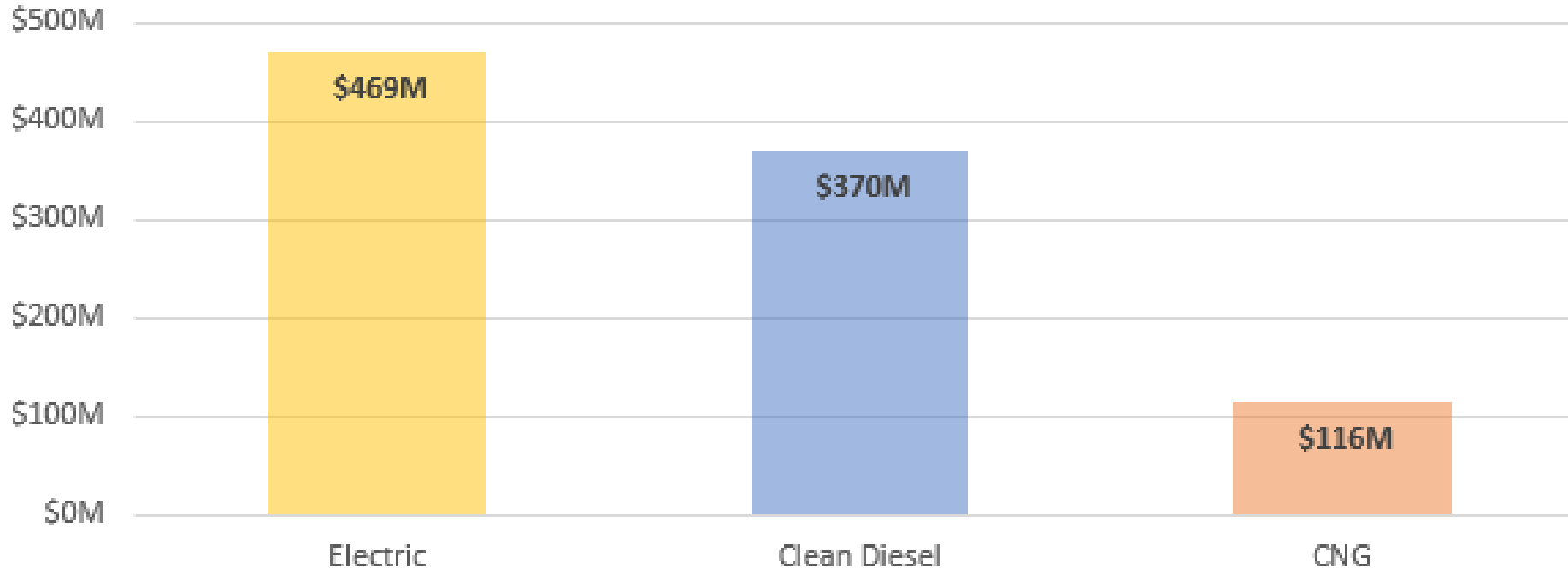
Maintenance

- Servicing and Troubleshooting of new Electrical Systems
- Diagnostic Systems
- Towing & Recovery



Implementation Cost

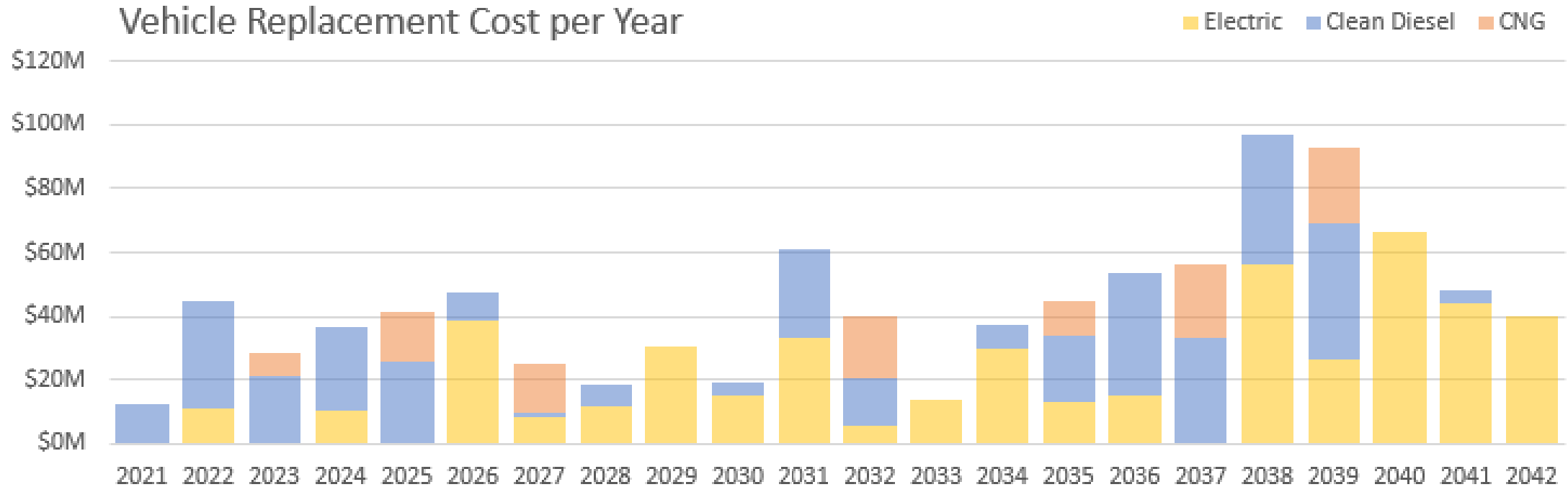
Total Cost by Propulsion Type
Years: 2021 - 2042



- Vehicle costs assume a 3.25% annual inflation increase. While current inflation rates are higher, the costing model does not speculate on uncertain conditions.



Implementation Cost



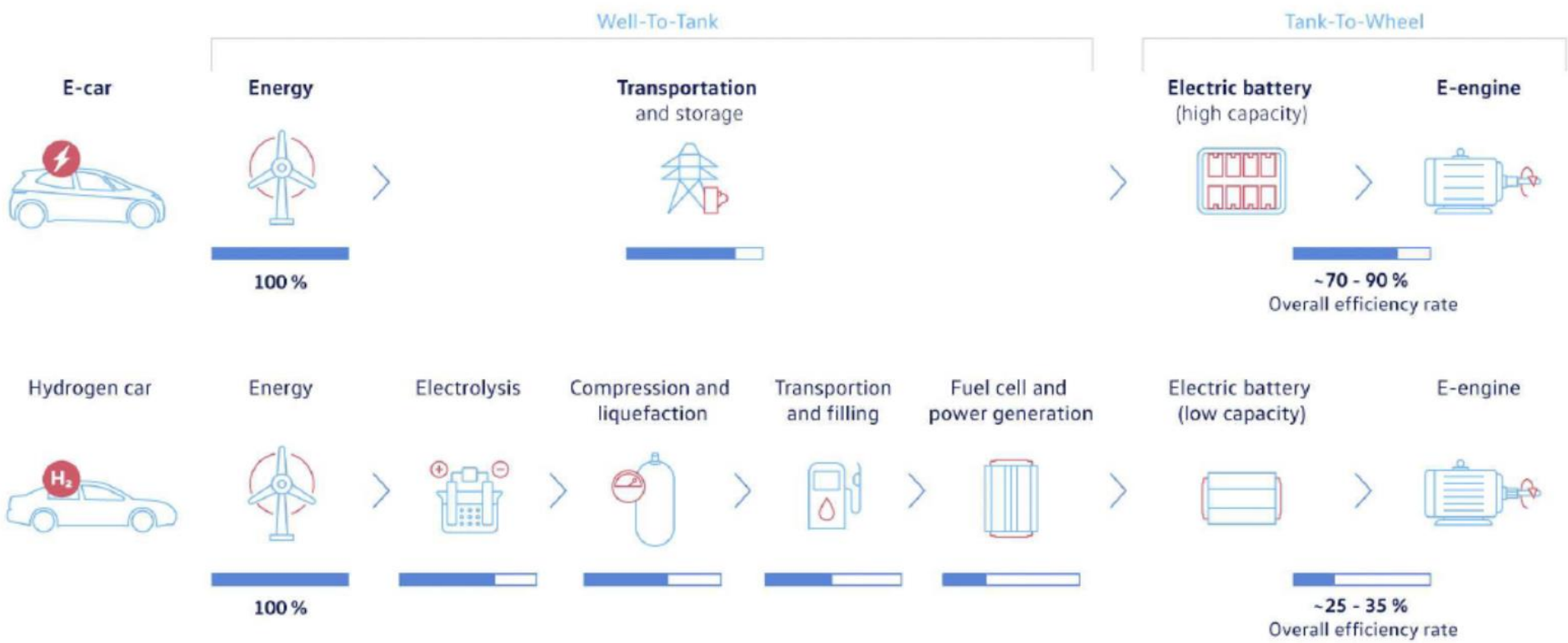
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How Hydrogen Drive Works

Hydrogen and electric drive

Efficiency rates in comparison using eco-friendly energy



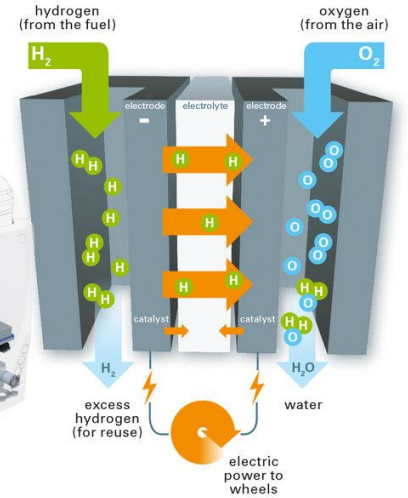
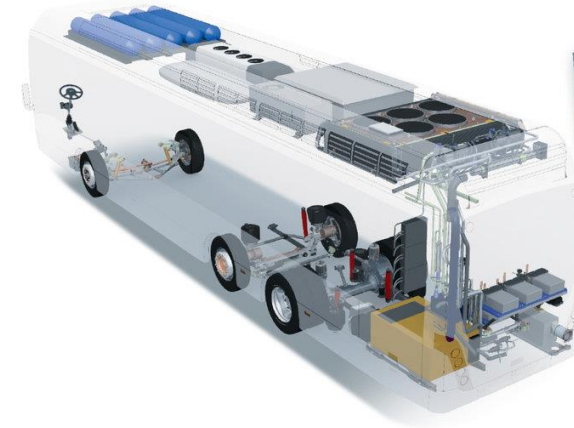
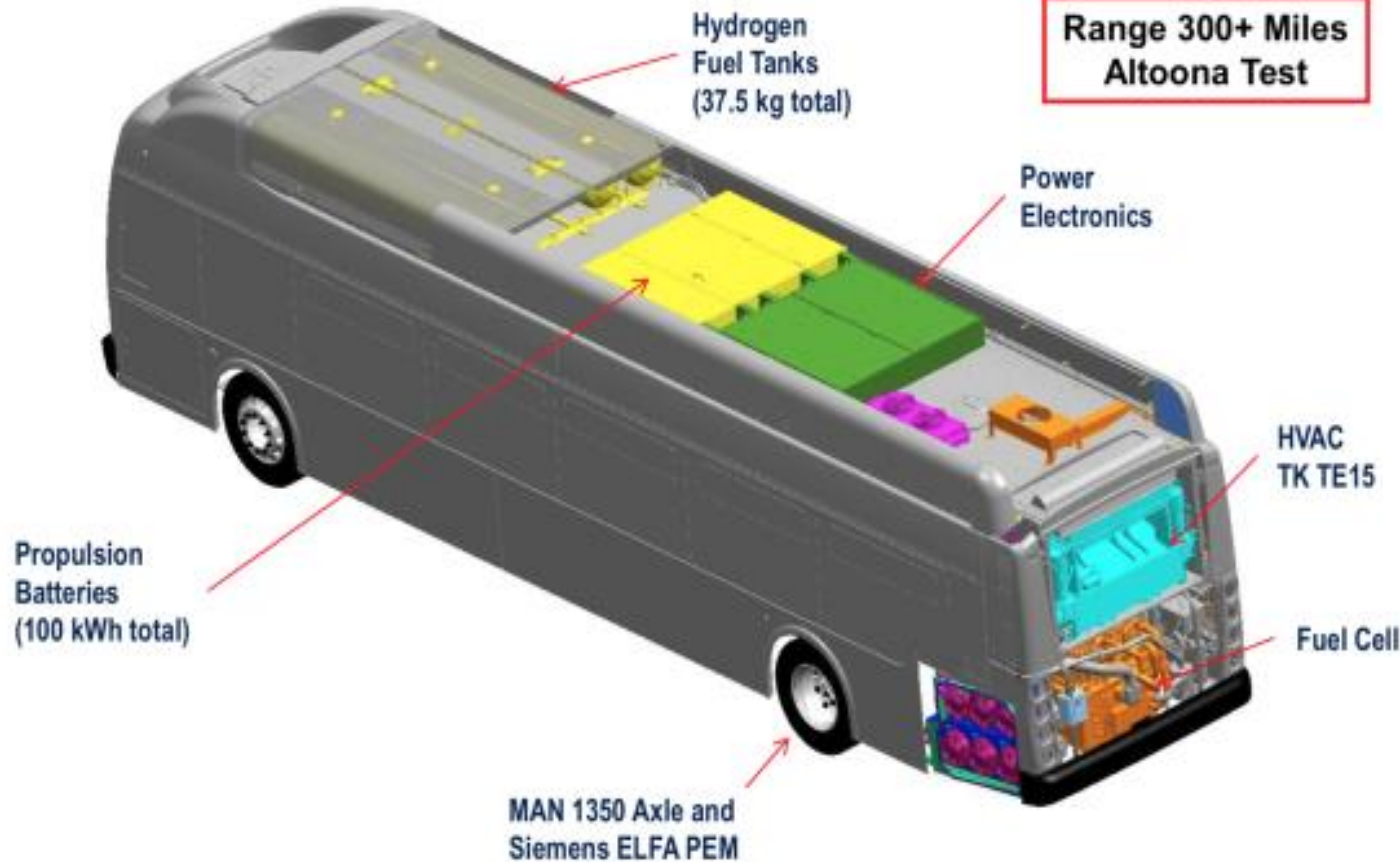
Source Volkswagen



Fuel Cell Bus Architecture



Xcelsior XHE40 Fuel Cell Bus



Bus Comparison: OCTA/UTA

Vehicle (Bus) System	Fuel Cell (OCTA)	CNG (UTA)	Clean Diesel (UTA)	Electric Battery (UTA)
Bus Purchase Cost (\$)	1.3 M	0.57 M	0.55 M	0.93 M
Miles per DGE	9.79	3.88	5.48	16.14
Miles Between Road Calls (Maint.)	7,124	12,769	16,869	19,653



Hydrogen Implementation Barriers

- Greater than 90% of the hydrogen produced today comes from steam methane reformation
 - This process uses high temperature and pressure to breakdown CNG (methane) into hydrogen (H₂) gas and carbon oxides (e.g., CO, CO₂- greenhouse gas)
- The 2nd most used technology to produce H₂ is the electrolysis of water
 - 45 percent of the energy (electricity) to produce H₂ is lost through the generation of heat
 - 55 percent of the remaining energy of H₂ is lost in the conversion to electricity, when combining with oxygen (O₂) to make water (H₂O) and to drive the electric motor
 - Only 25 – 35 percent of the energy in the process is converted to useable electricity for traction power
- The National Renewable Energy Laboratory (NREL) estimated cost for a hydrogen fuel station is \$5.05M (2019)



Hydrogen Next Steps

- Per H.B. 404 UTA will continue to monitor and evaluate business opportunities
- New hydrogen sources and opportunities are coming to the market
- More green hydrogen is becoming available

Green

U.S. Earmarks \$504 Million to Back World's Largest Hydrogen Hub

- Developers for Utah project gain DOE conditional commitment
- Hub to provide over 300 gigawatt-hours of clean energy a year



Infrastructure – Facilities Strategic Plan

- As the Wasatch Front’s population continues to grow, transit service will have to expand to meet the demand
 - Additional buses, light rail vehicles, and commuter trains will be required. The maintenance of UTA’s fleet and infrastructure is vital to provide safe and efficient service to the public
 - This plan provides a blueprint for UTA’s facilities as the region continues to grow
- As UTA expands its electric bus fleet, additional infrastructure will be needed

Utah Transit Authority Facilities Strategic Plan

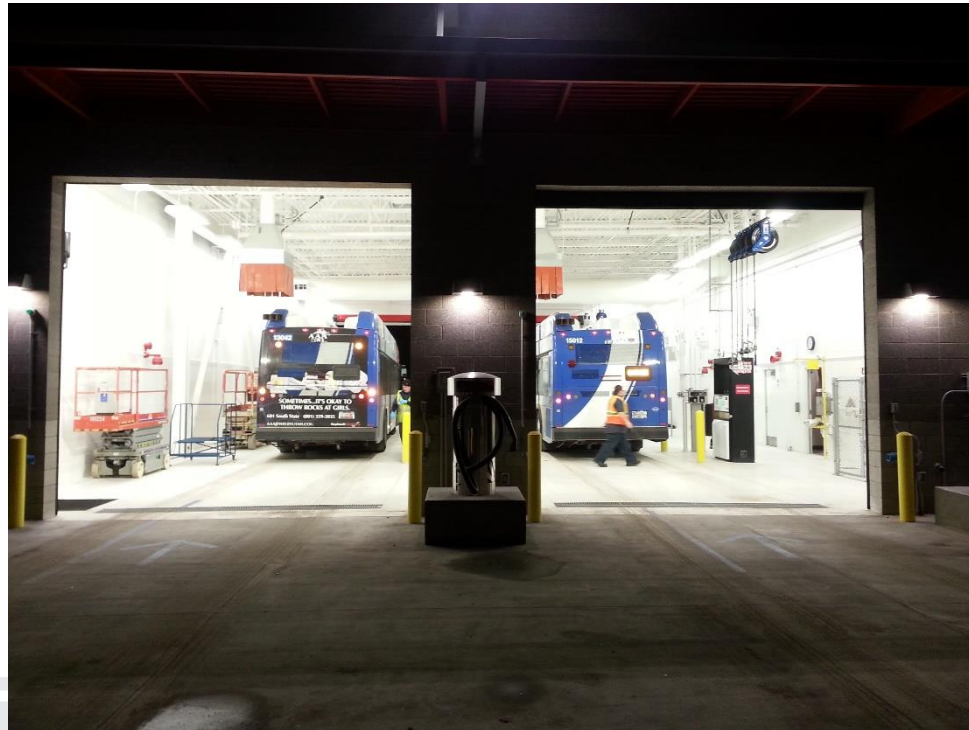
March 2020 Update

Version 1.0



Infrastructure – CNG Buses

- All CNG buses are planned to operate out of Depot District
- Existing fueling infrastructure will have to be expanded to support more CNG buses (new fuel pump included in the plan)



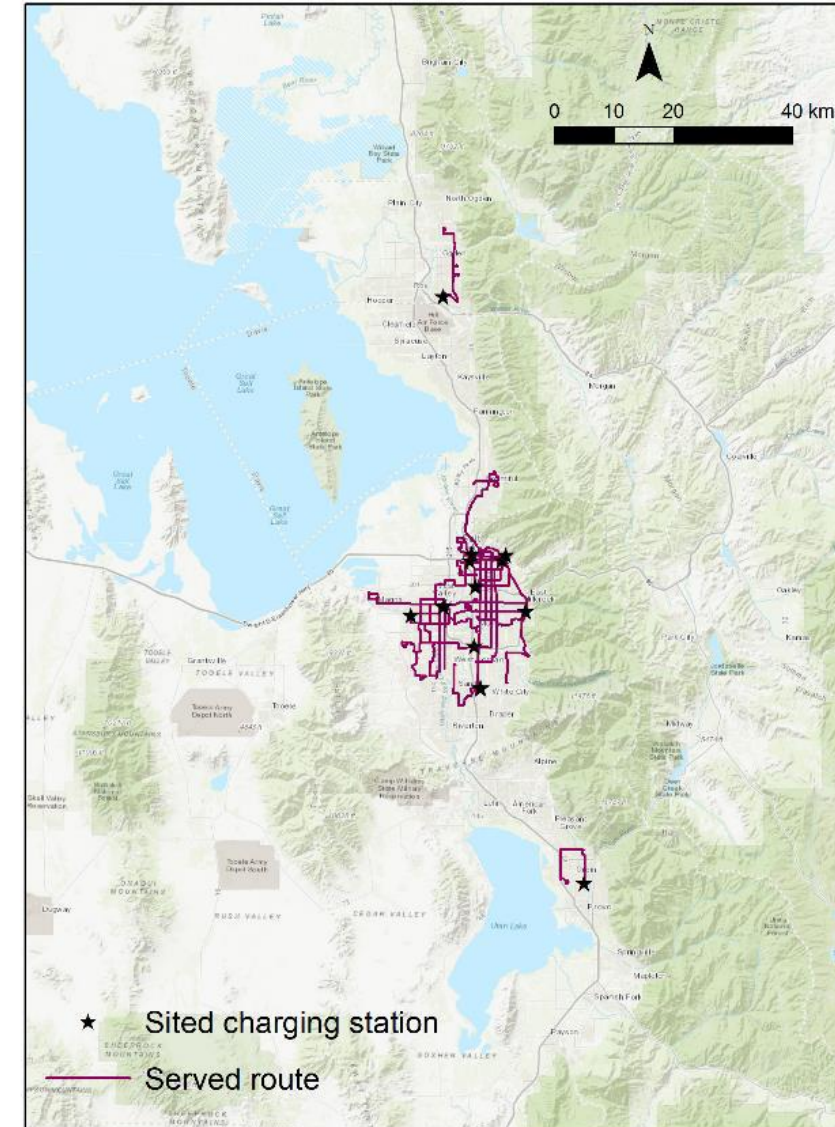
Infrastructure – Electric Buses

- Overhead and Depot Chargers support the battery electric buses



Infrastructure – Electric Buses

- On route chargers are being located based on study completed by the University of Utah
 - Equity was a consideration in the proposed deployment
 - Ideal locations for charging include West Valley Central, Millcreek, North Temple, SL Central, Murray, Ogden, and Orem (among others)



Transportation Electrification Forum

- This event will be an opportunity to discuss various endeavors to electrify transportation and create better air quality
 - It will include groups such as UTA, Rocky Mountain Power, academic researchers, FHWA, UDOT, WFRC, Envision Utah, CALSTART, CTE, government officials, and the public
- UTA will be able to discuss our efforts to electrify our bus fleet, and the benefits of doing so
- Stakeholders will be able to discuss their respective efforts regarding transportation electrification and air quality



Thank You

