

Milwaukee County Transit System Vehicle Memorandum

1. VEHICLE MEMO

1.1 Overview

The Milwaukee County Transit System (MCTS) is Milwaukee County's fixed route public transportation system providing a robust service to residents and visitors throughout Milwaukee County. In 2023, MCTS provided over 17 million rides, a 10% increase over 2022. In addition, MCTS opened the first bus rapid transit (BRT) system in Wisconsin, the CONNECT 1.

Currently MCTS continues to look to enhance transit with the development of the North-South Transit Enhancement Project, a BRT service connecting the cities of Oak Creek, Franklin, Greenfield, Milwaukee and Glendale in Milwaukee County, Wisconsin. The project proposes to improve the current PurpleLine bus route, one of MCTS's most used routes. The BRT service would operate on an 18-mile route traveling primarily along 27th Street, Teutonia Avenue and Silver Spring Drive. The route would travel in a combination of dedicated bus lanes and mixed-traffic lanes and feature 32 destinations, served by 64 platforms.

The goal of this enhanced transit service is to decrease passenger travel times, increase service frequency, ensure reliability, and add amenities to improve service to individuals, neighborhoods, and businesses in the corridor, as well as transit users across the County.

The following provides an overview of the existing MCTS bus fleet, the CONNECT 1 battery electric bus fleet experience, and analyzes and recommends future bus procurement activities for County Board consideration.

1.2 Current MCTS Fleet

Milwaukee County Transit system currently maintains 307 40-foot vehicles¹, a combination of clean diesel and battery electric buses. This fleet gives MCTS the flexibility and resilience to meet its peak requirement of 256 vehicles.

Clean Diesel Buses

MCTS' fleet of 292 clean diesel buses is comprised of buses from two different manufacturers; 169 40-foot New Flyer 'Clean Air Diesel' buses and 123 40-foot Gillig 'Clean Air Diesel' buses. Clean diesel buses make up 95% of MCTS' current fleet and have a life expectancy of 12 years or 500,000 miles.

¹ This total fleet size includes the four additional BEB anticipated for delivery in May and September of 2024.

Battery Electric Buses

Currently, MCTS has 11 Nova Bus Battery Electric Buses (BEB) for use on the CONNECT 1 service. An additional four BEBs are planned for delivery by fall 2024 (two in May 2024; two in September 2024). The BEB vehicles charge at one of eight 150 kW chargers at the Kinnickinnic maintenance facility or at a 450 kW in-route charger at the western terminus of the CONNECT 1 route. These buses can operate for 247 miles on a single charge and have a life expectancy of 12 years or 500,000 miles. CONNECT 1 service is supplemented with spare clean diesel buses to assure that the CONNECT 1 service reliably maintains 10-minute frequency throughout the busiest times of the day.

In the first eight months of the CONNECT 1 service, there have been mixed results with the reliability and performance of the BEBs.

- June 4, 2023: Connect 1 service began with a mixed fleet of BEB and traditional clean diesel buses. This combination was necessitated by delivery delays from the bus manufacturer, Nova Bus, who cited issues acquiring parts and preventing on-time delivery of the fleet of 11 BEBs.
- June 21, 2023: Nova Bus announces that it is exiting bus production in the U.S. market, and no longer receiving new orders for BEBs.
- July 6, 2023: One of the new BEBs required the replacement of its battery after one month of service.
- July 24, 2023: An additional BEB required a battery replacement.
- August 24, 2023: Nova Bus issued a manufacturer's recall for all 11 of the BEBs, causing MCTS to remove all BEBs from service out of an abundance of caution.
- December 28, 2024: Only two BEBs in-service, with the remaining nine out-of-service for a variety of issues.
- February 1, 2024: Only five BEBs have returned to daily service on the CONNECT 1 route; clean diesel buses are being deployed to fill the gaps.
- February 6, 2024: Seven BEBs have returned to daily service on the CONNECT 1 route; clean diesel buses are being deployed to fill the gaps. Four buses remain out-of-service with an expected in-service date of February 15, 2024.

The BEB industry is still in the early stages of development, and the technology for these buses is constantly changing. Global supply chain issues have made obtaining new BEBs challenging for agencies such as MCTS. Due to a limited supply of BEB manufacturers (as well as the announcement of Nova Buses exiting the U.S. market), procuring BEBs is a challenge for all transit agencies in an already saturated market. The use of clean diesel buses has been essential to the initial success and reliability of CONNECT 1 service.

1.3 Future Vehicle Options

MCTS' experience with previous BEB purchases and deployment will be a consideration when evaluating future vehicle purchases. MCTS monitors transit and vehicle trends in the U.S. and must incorporate market realities into our decision-making process. MCTS is committed to reducing emissions and making Milwaukee County as sustainable as possible in the long run. However, we must also consider the reliability required of our vehicles to be able to provide a quality transit experience to our riders and the fiscal sustainability needed to preserve our current levels of service.

There are several alternative fuel options that provide varying levels of fiscal and environmental sustainability in the current marketplace. As the industry evolves and trends in the marketplace mature, MCTS has been and will continue to evaluate and explore the ability for their fleet to transition to alternative fuel sources while meeting transit service goals. **Table 1** includes descriptions of the vehicle options that MCTS sees as viable options at this time.

Table 1: Basic Breakdown of 40-foot Bus Types

	Clean Diesel	Hybrid Electric	Battery Electric
Approximate Cost per Bus (as of 2023)**	\$650,000	\$950,000-\$1,000,000	\$1,200,000
Fuel Use Change	-	-20%	-100%*o
Emissions Change	-	-26% Nitrous Oxide	-45%*

* Actual gross carbon reduction depends on the energy source of the electrical grid (i.e. renewables versus fossil fuels).

oElectricity is cheaper than diesel fuel, and there are no tailpipe emissions.

** \$650,000 was the 2023 cost for a 40-foot clean diesel Gillig bus; \$950,000-\$1,000,000 is the range cost for hybrid electric vehicles in 2023; \$1,200,000 was the 2023 cost for a Nova Bus BEB.

Clean Diesel Buses

As observed by the agency through current fleet operation, clean diesel buses utilize advanced emission control technologies to reduce particulate matter and nitrogen oxides. They rely on low-sulfur diesel fuel to minimize environmental impact. Currently, clean diesel buses account for approximately 43.6% of the total U.S. Fleet and 12.9% of the total U.S. new bus orders. At this time, buses are priced \$650,000, as of 2023, for a 40-foot clean diesel bus.

Pros:

- **Established Technology** – Clean diesel buses have a long history of operation and are well-established in the industry. They are interchangeable with the existing fleet and require minimal new maintenance training. They are also generally unaffected by environmental factors and have proven to be reliable in most operating environments.

- **Wide Availability** – Diesel fuel and infrastructure are widely available, making these buses accessible and easy to maintain. They are the lowest in cost due to a mature operating and production infrastructure.
- **Environmental Impact** – Today’s clean diesel buses are 90% cleaner than they were in 2006, yet still emit particulate matter, nitrogen oxides and other greenhouse gases. Every year clean diesel buses are becoming more innovative, reliable, and easier to maintain. The U.S. Environmental Protection Agency (EPA) adopted a final rule, “Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards,” that sets stronger emission standards for heavy-duty vehicles and engines starting in model year 2027.

Cons:

- **Fuel Dependency** – Continued reliance on fossil fuels raises concerns about long-term sustainability due to rising costs in fuel.

Hybrid Electric Buses

Hybrid electric buses combine an internal combustion engine with an electric propulsion system. They use regenerative braking to recharge batteries and improve fuel efficiency and allow for periods of all-electric vehicle operation. Currently, hybrid buses account for approximately 20.2% of the total U.S. Fleet and 40.5% of the total U.S. new bus orders. There are limited manufacturers in the U.S. market at the current time. Hybrid buses are priced between \$950,000 and \$1,000,000, as of 2023, for a 40-foot hybrid bus.

Pros:

- **Fuel Efficiency** – Hybrid buses offer improved fuel efficiency and reduced emissions compared to traditional diesel buses. This results in a reduction in fuel consumption and costs and can be used for both short- and long-range routes.
- **Transition Technology** – Provides a stepping stone towards full electrification, allowing agencies to gradually adopt cleaner technologies without heavy investment in expensive new charging infrastructure.

Cons:

- **Complexity** – Hybrid systems add complexity to maintenance and repair, potentially increasing operational costs.
- **Supply Chain Issues** – Due to limited qualified manufacturers in the U.S. market and high demand for hybrid buses, there are long backlogs for new bus orders.
- **Limited Zero-Emission Range** – Hybrid buses still rely on fossil fuels, especially during extended routes or high-demand periods.

Battery Electric Buses

Battery electric buses operate solely on electric power stored in batteries. They produce zero tailpipe emissions and offer a sustainable solution. Currently, battery electric buses account for approximately 2.3% of the total U.S. Fleet and 29% of the total U.S. new bus orders. The

available manufacturers in the U.S. market are limited, and there is a high demand for these vehicles. Due to the market, BEBs are taking much longer to procure than for clean diesel buses. BEB buses were priced at \$1,200,000, as of 2023, and are expected to increase in the near-term for a 40-foot BEB.

Pros:

- **Zero Emissions** – Battery electric buses are environmentally friendly, contributing significantly to air quality improvement.
- **Reduced Operating Costs** – With fewer moving parts, electric buses often have lower maintenance costs and reduced fuel expenses.

Cons:

- **True Zero Emissions** – Can only be established when We Energies achieves net zero carbon electricity. The utility's current target for achieving this is 2050).
- **Infrastructure Challenges** – Limited charging infrastructure may pose challenges, especially during the initial implementation phase.
- **Supply Chain Issues** – Due to limited qualified manufacturers in the U.S. market and high demand for BEBs, there are long backlogs on new bus orders.
- **Range Limitations** – Concerns about range anxiety may arise, particularly for long routes in areas with inadequate charging infrastructure.
- **Infrastructure Cost** – To introduce new BEBs to the MCTS system, there would be additional cost whether considering to retrofit existing facilities (approximately \$200,000 per bus) or building a new facility to transition part or all of the bus fleet to BEB (approximately \$500,000 per bus).

1.4 Conclusion and Recommendation

MCTS recommends pursuing 40-foot, right-door loading, clean diesel buses in the near-term for any bus purchases for the following reasons:

- Vehicle purchase cost makes clean diesel a fiscally responsible and sustainable option for MCTS. Alternative fuel vehicles are almost double the price of a regular clean diesel bus.
- Challenges related to BEB fleets (particularly with the CONNECT 1 experience over the past eight months).
- Volatility of the current BEB market due to supply chain issues, high demand and limited U.S. manufacturers.
- MCTS customers rely on public transit to get to their jobs, healthcare, businesses, households and more. The current clean diesel fleet provides that reliability, and MCTS expects to provide that reliability for future MCTS services.

MCTS remains open to the prospect of alternative fuel bus options and continues to plan ahead to realize zero-emission technologies come to Milwaukee County when the time and resources available align. MCTS will stay at the forefront of industry news and trends to inform vehicle-related decisions in the future. Additionally, MCTS is actively working to understand the benefits and challenges of BEBs with the use of the current fleet on the CONNECT 1 service.

