

# Hybrid-Electric and Electric Garbage Trucks Could be the Future, but they're Not Ready

August 2019

## *at a glance*

Hybrid-electric powertrains for existing garbage trucks and fully-electric garbage trucks are technologies that are in development and are not fully utilized by any U.S. garbage collection providers. Staff research shows that neither option is in production at this time. Wrightspeed is not testing or selling its technology at this time. Manufacturers such as Peterbilt and Kenworth are testing hybrid-electric technology internally while also testing over 50 electric trucks in multiple, large cities such as Los Angeles and Seattle. Staff recommends reviewing this research each year, as the technologies develop. In the meantime, staff recommends continuing its commitment to a green fleet by continuing to use 20 percent biodiesel fuel for the City's diesel fleet vehicles.

## Scope

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City Council and Administration directed Public Works to research the possibility of using hybrid-electric garbage trucks, based on research provided by Professor Emeritus William Rau, and both hybrid-electric and electric garbage trucks, based on previous research performed by Public Works staff. Staff has prepared this document to examine several aspects of hybrid-electric or electric garbage trucks, including the merits, effectiveness, availability, and price of each technology.

## Background

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The Fleet Management Section of the Public Works Department has continued to explore ways to "green" the fleet in responsible and practical manners, which is consistent with Strategic Plan and Comprehensive Plan goals. The Section uses 20 percent bio-diesel in all units that fill up at the Public Works fueling site. This includes all Solid Waste trucks. Bio-diesel is an alternative, renewable fuel. The city uses biodiesel derived from soybean oil. In total, the city has 191 vehicles that run on this alternative fuel. The city also has many cars and trucks that are compatible with E85 fuel. However, the City does not have an available fuel tank for this type of fuel, and off-site E85 fuel is not cost-effective at this time.

In February 2018, William Rau, Professor Emeritus of Sociology at Illinois State University, brought the issue of using hybrid-electric garbage trucks to union leadership by reaching out to the media. As a result, staff performed an internal, preliminary review of the information, but found it was not something that should be considered at that time.

In August 2019, Rau contacted Council prior to their consideration of purchasing three new diesel solid waste trucks. As a result, Council tabled the consideration of the purchase until September 2019 in order to generate this report, which discusses hybrid-electric and electric garbage trucks and whether they are feasible alternatives to the staff-recommended diesel solid waste trucks that would run on 20 percent biodiesel.

## Findings

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### Hybrid-Electric Garbage Trucks

#### Wrightspeed

Hybrid-electric powertrains, theorized by Wrightspeed, are installed on an existing truck. Once the conversion is completed, the truck would run on an electric powertrain until the batteries run low and then uses a biodiesel turbine generator to charge the batteries (Wrightspeed Powertrains, n.d.). Unfortunately, the company found that biodiesel turbine generators are not compliant with 2020 vehicle emissions standards based on information Wrightspeed provided to staff.

The information provided by Peter Kelly-Detweiler in an article in Forbes (Kelly-Detweiler, 2015), that makes claims about brakes only lasting three months and powertrains lasting five years or less, is based on quotes from Founder and CEO of Wrightspeed, Ian Wright, and does not have supporting data. Unfortunately, this technology is not well-tested for garbage trucks and buses and has failed to come to fruition in multiple communities, including Santa Rosa, California (McCallum, 2018), and Wellington, New Zealand (George, 2019). While FedEx tested Wrightspeed's technology on 2 delivery vehicles, and subsequently ordered 25 delivery vehicles for an additional test (Golson, 2014), staff could not find that FedEx has implemented the technology beyond those 25 test units. FedEx has more than 47,000 vehicles in its fleet, so the 27 vehicles would be under 0.06 percent of their fleet (Golson, 2014).

The company who manufactures the hybrid-electric powertrains appears to have gone dormant (Gitlin, 2019). Staff found that the company has had no press releases since 2016 and no consistent social media presence on Facebook, Twitter, or LinkedIn since 2017. However, staff was able to call Wrightspeed, and a representative estimated it would cost \$200,000 per truck to install their drivetrain, assuming it could go into production with the 2020 vehicle emissions standards. The representative said the company installed the unit on two garbage trucks, but none of them are in operation at this time. In addition, the representative said the company does not have service centers in Illinois, and they would only install units on a few vehicles at a time to test before installing on the entire fleet.

#### Other Manufacturers

Based on staff conversations with vendors, Peterbilt, Kenworth, and other companies are internally testing other forms of hybrid-electric garbage trucks. These include electric/biodiesel hybrids that use a traditional generator when the batteries run low and electric/compressed natural gas (CNG) hybrids that use a generator powered by CNG. However, none of these options are available on the market at this time.

### Electric Garbage Trucks

Electric garbage trucks are fully electric and use no other fuel. When the batteries run low, the vehicle must return and recharge or recharge on the road, which requires charging infrastructure and room for charging at either the domicile of the vehicle or on the road. This technology is in the testing phase for garbage trucks. Staff contacted distributors for Peterbilt and Volvo (owner of Mack) via e-mail to inquire about pricing for electric vehicles. Peterbilt is testing over 50 units across the country but has not announced a production launch date due to a lack of demand. Volvo (Mack) will start testing next year, but they estimate that production will not start for a couple of years.

Staff was not able to locate a U.S. solid waste collection provider that has a fleet of electric garbage trucks in service. Notably, Chicago, Sacramento, Los Angeles, and Seattle each have an electric garbage truck to use as a pilot. However, Chicago is currently suing the company that produced the truck they received in 2015 due to its inability to be in service. Sacramento and Los Angeles received their trucks in 2018 (Greenwalt, 2018), and Seattle received a truck in 2019 (Gitlin, 2019). Staff could not find resources that show that these cities have reported back about how the trucks are performing. New York City will pilot an electric garbage truck in 2020 (Dzikiy, 2019).

Some cities in the United States have purchased electric buses, but they are not widely utilized. The United States has 300 electric buses total, which is small, compared to China, which has 421,000 (Eckhouse, 2019). This is partially due to the fact that U.S. municipalities replace buses at the end of their useful lives, which averages to about 12 years, and electric buses, while cheaper to maintain than diesel models, are more expensive up-front (Eckhouse, 2019).

Connect Transit in Bloomington received discretionary grants from the FAST Act and the Federal Transit Administration's Buses and Bus Facilities Competitive Grant Program to replace 12 out of 42 diesel buses with electric buses and install charging infrastructure (Denham, 2018) (Denham & Schlenker, 2017). Since the technology is not available for garbage trucks, grants are also not available. Connect Transit has not purchased electric buses at this time. Staff met with Connect Transit Chief Operating Officer Martin Glaze and Safety and Training Director Dave White, who said that the organization advertised a Request for Proposals for the buses they want to purchase, which they estimate will cost about \$1 million per bus, including parts and labor for a charging station for each bus.

Interestingly, in Bloomberg New Energy Finance (NEF) (2019) reports buses and heavy commercial vehicles, such as garbage trucks, in different segments of the global fleet, which shows that they are quite different when it comes to adoption of fully-electric vehicles. Figure 1 forecasts that less than one percent of heavy commercial vehicles will be fully electric by 2026, and eleven percent will be fully electric by 2040. However, the Figure 1 also forecasts that 37 percent of buses will be fully electric by 2026, and 67 percent of buses will be fully electric by 2040. Figure 2 shows that, among heavy commercial vehicles, natural gas will outpace electricity as the main fuel each year until 2040. These figures demonstrate that heavy commercial vehicles have a long way to go before adoption by garbage truck fleets and other, similar fleets, whereas bus fleets will see a much larger increase in adoption of fully-electric vehicles.

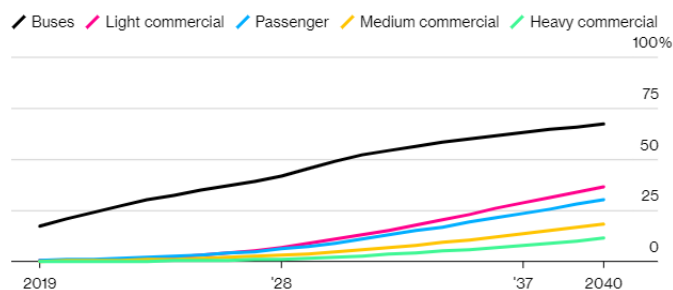


Figure 1: Percentage of electric vehicles in each segment of the global fleet (Bloomberg New Energy Finance, 2019)

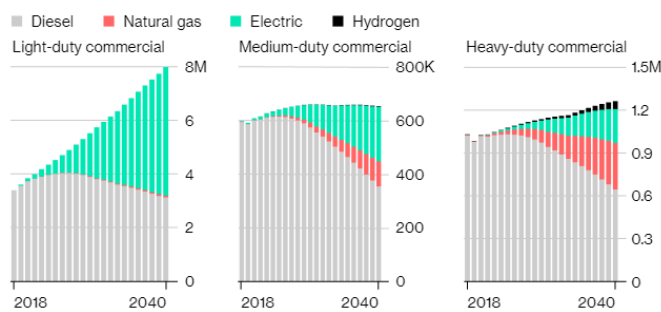


Figure 2: Commercial vehicle sales forecast by segment in the U.S., China and Europe (Bloomberg New Energy Finance, 2019)

## Recommendations

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At this time, staff recommends continuing to purchase diesel vehicles that run on 20 percent bio-diesel fuel until one or more of the technologies are proven and available on the market. Wrightspeed's technology is unproven and unavailable, but Peterbilt, Kenworth, and others companies are testing alternative hybrid-electric options internally. Electric garbage trucks are also in the testing stage, with more than 50 units spread across multiple, larger cities in the United States. Staff also recommends researching these technologies each year, prior to budget preparation, to determine whether they have developed enough to consider for garbage trucks.

## References

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- Bloomberg New Energy Finance. (2019). *Electric Vehicle Outlook 2019*. New York, NY.
- Denham, R. (2018, September 20). *Connect Transit Gets \$6 Million Grant For Electric Buses, Transfer Center*. Retrieved from WGLT: <https://www.wglt.org/post/connect-transit-gets-6-million-grant-electric-buses-transfer-center#stream/0>
- Denham, R., & Schlenker, C. (2017, September 19). *Connect Transit Gets \$1.5M Grant For Electric Buses, Solar Panels*. Retrieved from WGLT: <https://www.wglt.org/post/connect-transit-gets-15m-grant-electric-buses-solar-panels#stream/0>
- Dzikiy, P. (2019, May 8). *Mack Trucks debuts electric garbage truck, will test on NYC streets next year*. Retrieved from Electrek: <https://electrek.co/2019/05/08/mack-electric-garbage-truck/>
- Eckhouse, B. (2019, May 15). *The U.S. Has a Fleet of 300 Electric Buses. China Has 421,000*. Retrieved from Bloomberg: <https://www.bloomberg.com/news/articles/2019-05-15/in-shift-to-electric-bus-it-s-china-ahead-of-u-s-421-000-to-300>
- George, D. (2019, April 24). *Wellington's trolley buses gathering dust 18 months after they were expected to be running again*. Retrieved from Stuff: <https://www.stuff.co.nz/national/112233348/wellingtons-trolley-buses-gathering-dust-18-months-after-they-were-expected-to-be-running-again>
- Gitlin, J. M. (2019, May 22). *Seattle makes history with electric garbage truck*. Retrieved from Ars Technica: <https://arstechnica.com/cars/2019/05/seattle-makes-history-with-electric-garbage-truck/>
- Golson, J. (2014, September 30). *FedEx's New Electric Trucks Get a Boost from Diesel Turbines*. Retrieved from Wired: <https://www.wired.com/2014/09/fedex-wrightspeed-diesel-ev-trucks/>
- Greenwalt, M. (2018, January 3). *Pilot to Benefit ERVs Released in Two California Cities*. Retrieved from Waste 360: <https://www.waste360.com/trucks/pilot-benefit-ervs-released-two-california-cities>
- Kelly-Detwiler, P. (2015, Mar 4). *Electric Garbage Trucks: Huge Energy Savings And They Won't Wake* . Retrieved from Forbes: <https://www.forbes.com/sites/peterdetwiler/2015/03/04/electric-garbage-trucks-huge-energy-savings-and-they-wont-wake-you-up-in-the-morning/#2b363adf6368>
- McCallum, K. (2018, January 4). *New year, new garbage services for Santa Rosa*. Retrieved from The Press Democrat: <https://www.pressdemocrat.com/news/7827823-181/new-year-new-garbage-services>
- Wrightspeed Powertrains. (n.d.). *Introducing the Wrightspeed Route Powertrain*. Retrieved from Wrightspeed Powertrains: <https://www.wrightspeed.com/the-route-powertrain>