

Executive Summary

VTA/Church Street Induction Charging Research Report (full version)
Chittick 11-30-20 Research Report (updated 12/01/20)

Author: Jane Chittick – former member of the VTA/Church Street Committee (2020); former appointed and elected town and county official; founding executive director of the Historic Preservation Trust (1980-93); Co-author of Edgartown’s Historic District By-Laws (1987)

Purpose: This research report was prepared to rebut and/or reveal unproven assertions and assumptions in the VTA/Church Street Committee’s Report dated 11/09/20 made by the VTA Administrator and the remaining six of the eight original Committee members. My initial interest was due to the VTA’s choice of the site and the significant and damaging changes being proposed to Edgartown’s Historic District. This led me to investigate the technology being proposed, which led me to other transit authorities and published articles as to why they were other cities were not using this technology. During my time attending the eight-member Committee meetings, I was struck by the continuing bias of the 6 proponents of induction technology as they refused to listen to verifiable research and only listened to the VTA Administrator’s opinion, which was not based on factual analysis.

Sources:

- Telephone interviews with Transit Authorities in the United States
- US and foreign public transit authorities’ websites
- VTA: Administrator, website, Minutes, Staffing, Fleet, Technical Manuals
- Transit manufacturers (buses/battery/fuels/urban planner) websites
- FTA/EPA/DOT, etc., government administration and agency publications
- Credible internet articles: national and international newspaper articles, trade journals such as public transit journals, energy and transit publications, environment, and transit publications, etc.

Implications: Installing induction chargers in Church Street and the resulting infrastructure and damage to our historic street and town is:

- an untested and short-term technology that obscures the fact that electric bus batteries today are not performing as they should
- unlike any other advances in transit technology today ('clean diesel' and hybrid-electric), which are increasing and successfully being used in cities everywhere while everyone waits for reliable electric batteries to attain all-electric bus transit
- a waste of important Federal Transportation Administration (FTA) government funding that is being used by other cities to purchase reliable and environmentally friendly transit buses and infrastructure
- arrived at by erroneous conclusions drawn over the past 3- 4 years by the VTA Administrator and then furnished to the remaining 6-member Committee, as outlined in their Report dated 11/09/20

Action:

Underlying the above, this report stresses the critical fact that the island's VTA should reassess its decision-making processes with the help of nationally recognized, qualified, independent transit consultants who will look at the VTA's business and management capabilities; the unique transit issues our island faces; and, of course, the best technology for now and near future. These consultants should come from public universities recognized for their expertise in public transit and transit engineering and, above all, to retain their independence, should not report to the VTA. An article to fund such expertise should be prepared and presented at the 2021 Edgartown Annual Meeting. At the same time, we need to pay equal attention to our Historic District and heritage and what makes Edgartown unique and so inviting a community in which to live and preserve. I also heartedly recommend that the Edgartown Selectmen invite an official from the Massachusetts Historical Commission to present at a public forum wherein the Selectmen, Planning Board, Zoning Board of Appeals, Finance Advisory Committee, Highway Department, Edgartown Board of Trade, and, particularly the Historic District Commission are urged to attend, along with town voters.

VTA/CHURCH STREET RESEARCH REPORT (full version)

9/30/20

Submitted by Jane Chittick

(former member, VTA Church Street Review Committee)

All-electric Goals

While the goal of a fully electric VTA bus fleet is desirable, it is only a goal at the present moment: the technology is not here yet. Bus batteries have been underperforming, although great strides are being made to improve their actual range. Many people believe the next generation of electric bus batteries will be available within a few years. Until then, it is not wise to over-invest now, buying only current all-electric buses. Instead, transit authorities all over the world are purchasing new generations of other environmentally friendly buses, called “low-emission.”

In addition, the United States and Europe are testing new transit buses run by hybrid, electric, hydrogen cells, solar and, soon, we will have new energy sources we don't even know about yet.

Transit Authorities Here and Abroad: Led by experts

Transit Authorities here and abroad are wise enough to employ recognized electrical engineering and charge-dynamics experts at universities to assess what technology mix and fleet mix is best for their particular city or country to avoid foolhardy, damaging, and expensive decisions. These Transit Authorities are led by experienced, advanced degree business and transit planning leaders who have held increasing levels of management experience with positions in different parts of the country in a highly competitive and fluid market.

VTA Decision-making

The current Martha's Vineyard VTA staff do not have the advanced technical expertise and large urban transit experience of their counterparts. It appears that the VTA staff are unwilling to seriously explore using reputable, independent, advanced scientific and technological experts as consultants who could better guide our community. Research into their decision to purchase in-ground induction chargers has confirmed that their decision to do so is unlike that of any other towns and cities here and abroad (Specific examples follow in Appendices A, B, & C).

Townspeople's Concerns

Since well-known experts have never weighed in on the induction project on Church Street, the town successfully petitioned the Selectmen for a referendum to postpone the VTA's Church Street project until a committee could convene and attempt to validate, or not, the VTA's decision. This solution was far short of convening *bona fide* experts, but... it was better than nothing. The townspeople voted in favor of a review on June 13, 2020. However, the committee selected by the Selectmen was unabashedly biased and unbalanced: 6 diehard proponents of the induction charger installation project (i.e., the losing side of the townspeople's vote) were pitted against only 2 citizens (the ones who led the town's voters to demand a review of the site and technology before proceeding).

One of the two on the winning side of the town's vote, Jane Chittick, undertook copious and verifiable empirical research, using the internet and actual interviews with other transit authorities in the country, in an attempt to steer the committee to an intellectual discussion on these findings and to be conducted in a transparent fashion. Week after week, she formally presented all this information to the committee, but its substance was kept from being openly discussed in a forum thereafter. The Chair of the committee attempted to keep speakers to a 10-minute presentation before moving directly, in alphabetical order, to the next person on the committee, whether they had anything to say or not. Needless to say, with a format that was more like a bus schedule there was virtually no open or serious discussion of these facts.

This report summarizes Ms. Chittick's verifiable and factual findings, as well as correct serious errors in the Committee report they presented on November 9, 2020. Ms. Chittick has offered before and again now to furnish this detailed information should someone want it. She is particularly entreating the Selectmen to read the entire report and together discuss these findings at one of their meetings before the end of this year. Ms. Chittick will attend this meeting and be ready to answer any questions.

Report Findings

Why is the VTA not ready yet to go all-electric? (The need to wait for batteries that will extend electric buses' battery range.)

Cities are now recognizing that **all**-electric bus transit will not take place within the next twenty or more years. Bus manufacturers are working on second and third generation batteries as we speak. Testing will then have to take place—first in the manufacturers' facilities, then in the government facilities, and then on the streets before they can be put into regular daily use. Even when the new buses hit the streets, communities cannot afford to buy all new-generation electric buses all at once. Existing diesel fleets have to be replaced gradually due to the enormity of the total replacement cost of an entire fleet, and the new generation buses need to be purchased on a scheduled timetable. For these reasons, American cities are now projecting it will be sometime between 2030-2050 when we will see all zero-emission buses in our cities. Therefore, to promote an immediate “all-electric” VTA transit system right now on the island would be a myth and irresponsible to promote. Here are a few of the nation's leading transit authorities and what they have concluded about the viability of an “all-electric fleet” now:

In early 2020, NYC's MTA announced Nova Bus has received one of its biggest U.S. contracts in its history from the Metropolitan Transportation Authority (MTA) of New York. The contract is for **165 hybrid buses**, with BAE propulsion system, with **options for 126 hybrid buses and 209 diesel buses** for a potential total amount of **up to 500 buses. Nothing electric.**

September 2020, Philadelphia SEPTA spokesperson Andrew Busch acknowledged that the transportation agency's entire fleet of 25 all-electric buses (a \$23.8 million investment), the third-largest fleet in the U.S., **has been “fully sidelined” since February 2020.** “We made the decision to fully take them out of service,” he said in response to a PlanPhilly inquiry about the missing buses. “We're not able to get into the specific issues...but we're hopeful we can come up with resolutions that will allow us to get them all back into service.” The new buses, though, compose a small percentage of **the transit agency's almost 1,500-bus fleet**, and **SEPTA won't commit to going fully electric.** Electric buses used elsewhere have proved less reliable than their emissions-spewing predecessors, and it is unclear whether the buses' cost and SEPTA's battery charging capacity will prevent them from being used widely in a big city.

Chicago (December 2019): *Why isn't Chicago upgrading its fleet faster, when electric buses can save the agency money in fuel and maintenance costs, while also giving the city cleaner air? And why is the agency still planning to buy diesel buses?*

CTA officials say that upgrading to an electric fleet is complicated and involves not just acquiring the buses but upgrading the agency's infrastructure to build charging stations. It also needs to be sure the buses work in all weather conditions, and over long distances, the CTA said. It also **plans to buy between 50 and 400 "clean diesel" buses over the next several years, likely through 2028**, spokesman Steve Mayberry said. Steele explained that the diesel buses are needed to replace old buses. Of the agency's more than 1,800 buses, close to 1,000 will need to be replaced in the next two to three years, he said. **The agency uses both diesel and 300 hybrid diesel-electric buses.**

(See Appendices A, B and C for more examples).

A. Concerns with Use of Induction Chargers

1. Momentum Dynamics Induction Chargers: Performance Measures

Only 1 transit system in Wenatchee, WA uses the Momentum Dynamics induction-charger.¹ It has been only in service for a little over a year and it is used on only one 11-mile-long route only and therefore, not a good measure for performance and reliability. **The rest of the city uses "clean diesel" buses.** One year ago, they announced a new fleet of "clean-diesel"-fueled buses to serve riders between Wenatchee, Leavenworth and Chelan counties. **Twelve** (12) new 40-foot long coaches are the first arrivals in a fleet replacement effort that will see about 75% of Link's buses replaced by the end of 2020. The buses are powered by clean diesel, and are equipped with the latest in emissions control technology, which makes them significantly cleaner than the buses they replace. **So, the one city transit authority using Momentum Dynamics induction-charging (for just a little over 1 year now) is now heavily investing in "clean diesel" buses.**
(<https://www.ncwlife.com/link-transit-unveils-new-buses/>)

Another transit authority (Pinellas, FL) starting early this fall (2020) is trying out a different induction charger, but it is simply being *tested* as **a matter of research**

¹ Howard County MD), 50 kW induction charger at the Columbia Mall in service. This is a 5-mile shuttle loop between the Mall and the County Hospital/Community College) and cannot be compared to the VTA service area.

and no decision has been made yet whether to keep it in use in the future. Currently, they are using 2 electric, 89 hybrids and have been given FTA funding for another 9 hybrids (2020). The total number of buses in their fleet is 100 – with only 2 electric buses, that means **98% of their fleet is hybrid**.

In other words, we, the tiny island of Martha’s Vineyard, would be guinea pig #2 if we were to proceed. It would be very risky for our small island transit authority because we would have to have the majority of our buses use such a charger on our major routes.

2. Momentum Dynamics Inductive Chargers: Useful Life

The VTA Committee Report states: *“The useful life of the inductive chargers for purposes of financial accounting has been set at 12 years by experienced accountants. The technology is relatively new, so this 12-year useful life may or may not prove to be correct, ... so their useful life could be longer.”*

This is an unsubstantiated claim by the Committee: First, *no one* has any idea of the useful life of a Momentum or Wave induction charger as they have only been in use for a single year or part of a single year.

Second, there is *no data* from the claimed “experienced accountants” who have determined that the charger’s life is “most likely 12 years”.

Third, their statement about the Momentum Dynamics “useful life” appears to come from their November 9, 2020 Committee Report. The Committee wrote: *“A committee member reported that mini-buses with inductive charging from a different manufacturer, not Momentum Dynamics, were used in Genoa and Turin, Italy, for 15 years.”*

That Committee member was Ms. Chittick. In other words, 1) they did not do the research themselves and 2) they did not grasp what she actually reported. She stated that there *were* a few European cities who *had* used induction electric buses, *but* they have abandoned the use of *in-ground* induction chargers. She was referring to *roof-mounted* Pantographs² in Genoa, Italy which is *about to begin* using both Irizar buses and RampiniE80 buses with *roof-mounted* Pantographs located in the bus depots. Genoa is *not* using in-ground induction ‘opportunity chargers’ on transit buses. Therefore, if the ‘experienced accountants’ based the

² overhead induction mounted on large pillars that attach to the electric-bus-roof

“useful life” estimate of inductive chargers on Ms. Chittick’s paper, they would have been incorrect and their assertion of a “12-year lifetime” is false.

In any event, engineers and accountants cannot extrapolate predictions as no one yet knows the “useful life” of inground induction chargers because they have only been used for a little over a year, on only one of the Wenatchee, WA’s many different transit routes serving two large counties. Engineers and “experienced accountants” (sic) are not clairvoyant.

3. Momentum Dynamics Inductive Chargers: Cost of the purchase and installation of the chargers

It has been difficult to pin down the VTA as to estimated costs associated with the Church Street Induction Chargers costs; therefore, these are only very imprecise guesstimates:

a. The VTA applied for and received a Federal Transportation Administration (FTA) grant (+/- \$1.4 million) and other funds from MA DOT. The VTA has not provided any dollar costs that were put into the Committee’s Report so it is impossible to determine how much will be spent on “LoNo” (low or zero bus emissions) bus purchases or towards Momentum induction chargers.

b. If the townspeople vote against the Church Street induction project, the VTA could negotiate with the FTA to convert any induction charging portion of a grant over to the purchase of low-emission buses. The FTA is fully in favor of grant money going to hybrid-electric bus purchases and are funding them now.

As previously stated, we cannot reach all-electric for perhaps twenty plus years. Therefore, in the interim period, the VTA needs new low-emission buses and not using our FTA grant on an *unsure, unproven, costly temporary fix. It is not a wise use of this government funding.* No other city receiving the FTA grants have asked to use their funds on induction chargers. Instead, they are buying electric, “clean diesel” and hybrid-electric buses with their grant money.

c. If the townspeople support the VTA/Church Street project, the following hidden costs have not been addressed:

- Digging up and widening Church Street and repaving
- Repositioning the existing water main
- Installing the chargers in-ground and connection to the electric storage

- Eversource costs: removing and burying overhead wires; installation of the two electric storage units; installation of the street lanterns
- the VTA said Eversource has stated there is "not enough power now" on Church Street for the chargers. What does that mean? What exactly does Eversource need to do to get that extra power there? Are there other costs or infrastructure needed?
- Arborist cost to hack down the mature shade trees on both sides of the street
- Arborist costs to purchase/plant new young trees
- Hardscaping the Visitor's Center
- Installing benches at the Visitor's Center
- Painting and improving the Center
- The design of the electric storage cabinets
- Wrapping the two (2) large and noisy electric storage cabinets in saran wrap in an effort to beautify and hide these very large metal units, which are respectively 1) 7.5 feet long x 6 feet high x 3 feet wide and 2) 6 feet high x 5.5 feet long x 3 feet wide
- Building a noise-reduction fence around the two units
- The estimated daily ongoing electric cost of the inductive chargers

4. Closing Church Street During Construction

Another expense of the proposed project is the displacement of the buses during Church Street construction.

- If Church Street is as the Committee Report purports the "only" street on the island that can accommodate the VTA buses, where will these buses go during construction if there is "no other place" that can possibly take passengers
- How will traffic be routed? Will there be an Environmental Impact Statement required for this temporary solution?
- How long is this construction?

5. Environmental Costs

Removing 75-year-old shade trees and replanting them with young ones will be yet another blow to the environment. It will be 75 years before the replacement trees provide full foliage and shade.

6. "No Cost to the Town" (as per the Committee Report)

The Committee states that there is "no cost" to the town for this project, the truth is they do not know what the actual monetary cost, nor what the human and environmental costs, will be. Therefore, one cannot do a cost-benefit assessment of

the project itself as **there is not any financial data contained in the Committee Report.**

What we should be asking: **Is the short-term “benefit” of a temporary, quick-fix to current underperforming electric bus batteries, *worth the expense of the entire long-term permanent project?*** Furthermore, expenses should include the FTA federal and state portion of the capital expense, the County and Town expenses, and the historic environmental expenses of historic Edgartown).

7. *“An all-electric fleet of buses will also result in reduced maintenance and fuel costs for the VTA.”* (as per the Committee Report)

Once again, there are no financial details and therefore no financial analysis, which should have been provided by the VTA staff certainly could have provided these figures. Instead, once again, assertions are flung through the air without any tangible data and are therefore worthless. There is no tangible evidence that this is true. And, as stated earlier, **it is unrealistic to expect all-electric before one or two decades.**

8. *“If the project were delayed one year, the capital costs of the project would probably not be materially increased, but the VTA will need to ask the Federal Transit Administration (FTA) to move various costs from earlier grants to later grants and vice versa in order not to lose the funding for the project.”* (as per Committee Report)

Currently, it is not known whether these adjustments will be permitted by the FTA. It is urgent that the VTA contact the FTA and other grant authorities to determine what it would take to rearrange their grant awards in order to 1) not lose their funding and 2) possibly switch the funding award from chargers to the purchase of hybrids or electric buses. This action is necessary to look at the full range of options and preempts a possible funding crisis.

B. *“Why do we need Induction chargers if our electric buses are running without them?”* (as per Committee Report)

We don’t. We need more environmentally friendly buses. The proposed inductive chargers are a stopgap measure as we wait for the next generation of electric batteries and these inground induction chargers are neither technically proven over time nor economically wise, and their installation in Church Street will permanently harm an area in the Edgartown Historic District

In the meantime, the VTA is purporting that induction chargers are the *only* answer to our ultimate goal of becoming all-electric in the next few decades. Transit administrators across the United States have acknowledged the chargers will soon become obsolete and are not worth the investment. Instead they are using their federal, state, and local funding to invest now, present time, in the new low-emission “clean diesels,” low-emission hybrids and some electric buses. Therefore, it is not economically wise for the VTA to invest and install these chargers currently. They have no “shelf life” that we know of and the project is expensive. A Cost-Benefit analysis would show this.

C. If we don’t have induction chargers, and don’t invest all of our resources in imperfect all-electric buses now, what else can the VTA do while we and the rest of the world wait for reliable electric batteries?

The answer is the newest generations of “clean diesel” and hybrid-electric (diesel and electric), which unlike all-electric, they don’t run out of “charge,” per se.

Hybrid electric buses are used in over 60 transit agencies in North America and transit agencies are announcing their intention to buy more. The benefits of hybrid buses are:

- Significantly reduce emissions that cause smog, greenhouse gases, and public health issues
- Reduce fuel consumption about 33%
- Require less maintenance
- Reduce diesel exhaust odor, vehicle noise
- Have same operating reliability as traditional propulsion engine buses
- Buses have a life cycle of 14-16 years

How does the hybrid bus work?

- Diesel-electric hybrid buses use both electricity and diesel, the same concept as hybrid automobiles.
- Bus batteries store energy and recharge when the bus decelerates. When demand for power exceeds battery capacity, the diesel engine provides extra energy.
- The stored electricity is used for a cleaner and smoother propulsion.
- A computer controls the output of the two power sources, diesel and electricity, so the buses always use the most efficient source.

Because the emissions of these new engines are now deemed negligible, the Federal Transportation Administration (FTA) funding is now able to call them “low emission” and “environmentally sound.” While all other cities are now dedicated to adding “clean diesels,” hybrids and some all-electric buses, no one is banking on the all-electric basket at this time. And, cities have recognized that for the present time it is better to replace their older dirty diesel fleet vehicles with a combination of mostly hybrid-electric buses and “clean diesel buses,” along with some all-electric. Right now, the FTA funding requests are weighted toward hybrids. Everyone is waiting until the electric bus batteries are proven before they heavily invest in them. (Although this is well in the future, it is wise to acknowledge that even when “all-electric” is possible, a transit system can never be 100% electric. In times of crisis, when the electric grid is out or damaged, transportation would grind to a complete stop).

As an example, and more follow in the Appendices, close to home, Boston’s MBTA just announced that their all-electric *Silver Line* is not working and they will be buying hybrid-electric buses:

“At the end of Monday’s Fiscal and Management Control Board (FMCB) meeting, Erik Stoothoff, the MBTA’s Chief Engineer, reviewed the T’s long-range plans for its bus fleet and bus maintenance facilities. Stoothoff had previously briefed the FMCB in September about the disappointing results from its battery-electric bus pilot on the Silver Line. Stoothoff acknowledges that battery technology is improving quickly, and says he’s “bullish” on the technology in the future – but for the short term, the MBTA will only buy buses that burn diesel fuel... Those buses will be replaced with “enhanced electric hybrid” buses that would be exclusively powered by diesel engines... In 2022 and 2023, the T also plans to buy 160 of these “enhanced electric hybrid” buses to replace the fleet’s dirtiest diesel buses. (**Boston Globe November 11, 2020**)

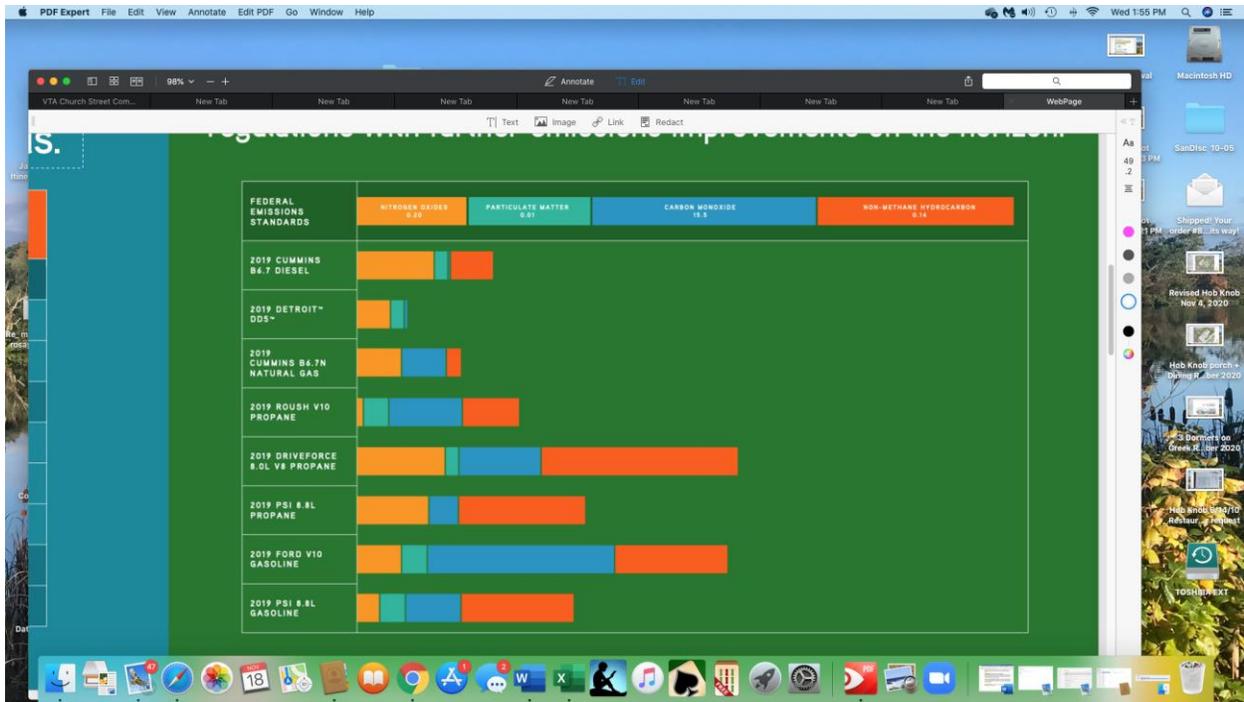
Earlier, the Globe had reported: “A network of clean, quiet, electric-powered buses may one day carry MBTA riders all across the region, but not until bus manufacturers figure out how to pack more miles into their batteries. That’s the primary issue that transit officials discussed Monday as they reviewed the performance of five electric buses that began running on the Silver Line last year. “We’re really constrained by the operating restrictions of the buses with the battery capacity they currently have,” chief engineer Erik Stoothoff said at Monday’s MBTA board meeting. A related issue is that it takes upwards of six hours to charge the battery, complicating

the process of getting them in and out of service. The MBTA’s hybrid buses, by contrast, take about 20 minutes to fuel, which lasts about 400 miles. **(Boston Globe, September 16, 2020)**

The Surprise of new “clean-diesels” (low-emission)

The FTA is now funding low-emission hybrid-electric buses and new “clean diesel” buses because manufacturers have made extraordinary advances in diesel buses in the past decade. Most people still conjure up the older models that spewed fumes and gases one still sees on many trucks today. In fact, we have these old buses in service now on the island. However, today’s diesel buses are very different:





	NITROGEN OXIDES (grams per brake hp per hour)	PARTICULATE MATTER (grams per brake hp per hour)	CARBON MONOXIDE (grams per brake hp per hour)	NON-METHANE HYDROCARBON (grams per brake hp per hour)	
2017 FEDERAL EMISSIONS STANDARDS	0.20	0.01	15.5	0.14	
DIESEL	2019 CUMMINS B6.7	0.15	0.001	0.04	0.03
	2019 DETROIT™ DDS™	0.06	0.001	0.3	0.000
CNG	2019 CUMMINS B6.7N	0.08	0.000	3.0	0.01
	2019 ROUSH V10	0.01	0.002	5.0	0.04
PROPANE	2019 DRIVEFORCE 8.0L V8	0.16	0.001	5.6	0.14
	2019 PSI 8.8L	0.13	0.000	1.9	0.09
	2019 FORD V10	0.08	0.002	12.9	0.08
GAS	2019 PSI 8.8L	0.04	0.002	3.7	0.08

*RESULTS ARE BASED ON FEDERAL TEST PROCEDURE (FTP) CYCLE.

Please note, the top chart re diesel emissions stops in 2017. More recent studies has shown the emissions to be <1%.

In the meantime, in **June 2020** the FTA announced their annual awards: **\$425 million** went to **96 projects** and not one project was for induction-charging.

Had our VTA used our own FTA grant application to request funding for more electric or “clean diesel” or hybrid buses, today we would have additional buses on our streets, whether electric or the new diesel or hybrid-electric, to replace the antiquated, environmentally unfriendly fleet of old-generation diesels that the VTA now has (dating back to 2010).³

However, *we* used up our federal funds to buy unproven, temporary fix induction chargers that no other community in the United States has purchased.⁴ Although the Committee said the project is “free,” it is not. We could have used the federal funds instead to purchase the much-needed new hybrid buses and/or more electric buses.

D. Matters Outside the Charge Given to This Committee

If these were matters that were not allowed to be discussed by this Committee, it should not have devoted three (3) full pages to this subject! This is another reason why this Committee has not done its job: they should only have discussed why induction chargers should, or should not, be placed in Historic Church Street.

Despite this not being a sanctioned topic for the Committee, their discussion of these sites was nevertheless meaningless.

- First, Dark Woods is a residential community: it is not the “Park and Ride” parking lot
- Second, Edgartown selectman Smadbeck on June 18, 2020 told Ms. Chittick that the VTA had already alerted him that Oak Bluffs would be the fallback position if the town were to vote down the Church Street project.
- Third, in the three VTA “Tech Memos: I, II, and III” as well as in the VTA’s own published Minutes of Meetings and in the Vineyard Gazette, the VTA names West Tisbury, Aquinnah, Oak Bluffs and Tisbury as being under discussion for the induction chargers’ site(s).
- Fourth, no serious discussion by the Committee ever took place on alternate sites: The above towns and places (2 Park & Ride) were simply quickly

³ On June 2, 2020, the FTA noted that the \$130 million in new Low-No grants will support 41 projects in 40 states and the District of Columbia to purchase buses through its Low- or No-Emission (Low-No) grant program to support the purchase or lease of zero-emission (all-Electric) and low-emission transit buses (Hybrid-Electric and Diesel) as well as supporting facilities. For example, the City of Jackson, MS will receive \$5.5 million in funds to purchase new diesel electric hybrid buses to replace aging diesel buses that have reached their useful life expectancy. Other cities bought charging stations and infrastructure upgrades for their existing and new Electric buses.

⁴ Three communities were given the Momentum chargers free-of-charge by the BYD bus company and yet only one is in use.

mentioned as being other places for the VTA/towns to explore – and since no discussion of this was allowed, the Committee is fabricating arguments that should not have been in their Report while they claimed they did a serious examination of these topics and actually researched and discussed in enough depth to reach their unsubstantiated assumptions. **This entire section should be removed from their Report and not referred to in public.**

- Fifth, one good thing in this report, however, is that the committee *does*, finally, acknowledge there *are* other induction charging units to be installed elsewhere on the island (**West Tisbury and Oak Bluffs**), **despite** being told by the VTA Administrator in October that the *only possible site is Church Street*.
- Sixth, what these “Matters Outside the Charge Given to the Committee” also proves is the following: The VTA needs outside, competent and nationally recognized-in-the-transit-field consultants to make a thorough study of their entire VTA leadership and decision-making bodies. Chattanooga, for example, is using Abhishek Dubey (B.S, M.S., PhD., Electrical Engineering), a professor of computer science and computer engineering. He leads a four-person team at Vanderbilt University’s School of Engineering to help them determine if induction charging is worthwhile. CARTA also is using a team of experts from Vanderbilt, University Chattanooga, and University of South Carolina to study all modes of transit, including inductive chargers vs improved batteries. Other transit authorities are using university experts to guide them in their decision making. No one in the VTA currently has any of the comparable expertise necessary to these and other consultants.

Committee: “Inductive chargers on Church Street will enable routes 1, 8, 11, and 13 to be fully electric.”

Church Street is now - and has been for many years - an end point for four bus routes (routes 1, 8, 13, and 3-5-6, which is discussed below) This is erroneous: Route 8 and 11 are only *seasonal* buses: they *don’t operate year-round*. How do these buses (8,11) which don’t need recharging compare to the cost of those buses using inductive chargers?

Committee: “Taking the electric buses out of service for several hours when their batteries get low during the day and charging them at the airport VTA headquarters.”

All buses charge overnight by nozzle at the Airport facility. However, there is nothing preventing additional nozzle charging elsewhere in the island. Why is it that right now, 2020, we don't need to recharge during the day? How are our electric buses running without daytime charging? Virtually all charging in the US and abroad is done by nozzle, not induction or even Pantographs.

As an example of ever fast evolving technology, just this month, Proterra unveiled High-Powered Charging Stations (<https://cleantechnica.com/2020/11/04/proterra-unveils-high-powered-charging-stations/>). (see Appendix for details) Technology break throughs like this, can allow the island to look creatively at all transit systems used in the county. The new chargers utilize interoperable, universal charging technology and are equipped to power a diverse range of 100% battery-electric vehicles, including battery-electric transit buses, school buses, delivery vans, and other commercial vehicles. The chargers are also capable of powering personal passenger electric vehicles.

Whether or not this is a good option for the Vineyard recharging, it does show that our VTA has not kept up on the evolving technology and instead insists there is only one option (induction technology), which as stated, is unused or rejected by virtually other transit authorities. Before the Vineyard invests in Momentum's short-term, unused charging, which causes enormous damage to our historic village, we need advice from qualified independent transit consultants before it is too late.

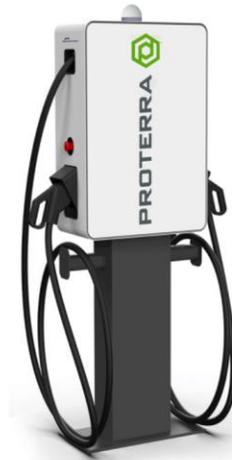
Proterra High-Powered Charging Stations

The high-power charging stations target the needs of large-scale vehicle fleets, such as mass transit operators. For large fleets of vehicles, where customers need to address the challenge of charging dozens or hundreds of vehicles in a single fleet yard, Proterra's new charging systems range from 75 kilowatts to 150 kilowatts to 250 kilowatts to 500 kilowatts. For example, and up to 1.5 megawatts, that can power up to 20 vehicles simultaneously. The new Proterra 1.5 megawatt fleet-scale charging system can also tie directly into higher voltage utility power lines (up to 35kV). The equipment total square footage is a 33% savings over a bus yard with standard charging equipment and electrical gear.



PROTERRA
500 kW
CHARGING SYSTEM

SPECS



PROTERRA
CHARGING SYSTEM
DISPENSER

SPECS

<https://cleantechnica.com/2020/11/04/proterra-unveils-high-powered-charging-stations/>

“The buses on this long route will likely charge at two inductive chargers to be installed in West Tisbury”

The committee *does*, finally, acknowledge there are other induction charging units to be installed elsewhere on the island (West Tisbury).

Committee: “As noted above, passengers are likely to feel frustrated and inconvenienced by an extended dwell time for charging at a stop which is more of a through stop with fewer passengers getting off and on...”

We need to weigh the value of bus passengers’ potential feelings of “inconvenience” over the importance of preserving our Historic District. Furthermore, the buses are often completely empty and at other times have just one of two passengers on board. We need to examine why we are running big, empty buses and tearing up our almost 400-year-old authentic village?

There would not be any “extended dwell time for charging” if a replacement bus was waiting there at the stop for the passengers. But this is not even a matter under consideration.

Committee: “If there are not going to be inductive chargers on Church Street, then the 3-5-6 bus route, in addition to bus routes 1, 8, and 11 (and possibly 13, depending on whether there is an inductive charger at Oak Bluffs) will have diesel buses for part of each day after the electric buses have depleted their batteries.”

Oak Bluffs *is indeed another site* for induction chargers despite being told by the VTA Administrator in October that the *only* possible site is Church Street.

Further, there is no reason to think we need to have these VTA antiquated diesel buses on the street. Get hybrid-electric or the newer “clean diesels” where emissions are near zero. The VTA has put all their eggs in the induction chargers for more than five years now—without coming up with a plan to swap out the old “dirty diesel” buses with additional low- or no-emission buses **as all other communities are doing.**

E. Historic Edgartown and Church Street

Edgartown Village: 1642

With land grants given to Thomas Mayhew Elder and Junior and five friends in 1642, great Harbour (later, Edgartown) was founded. The men arrived in 1646 and immediately built their church. In 1987, the townspeople overwhelmingly approved the creation of the Historic District and created the Commission to oversee this authentic village area so as to preserve it for all time. Needless to say, the townspeople hoped then they would make a lasting impact on their authentically historic village, despite what others call progress. But, as happens with many good things that tend to go by the wayside, developers, builders, landscapers, architects, retail owners, ice cream shops, pop-up bars and restaurants, and modern transportation advocates began to whittle away, and still continue to do so, at the heart of this little village's historic authenticity, now approaching its 400th year.

To the contrary, historic preservation is an endeavor that seeks to preserve, conserve and protect buildings, streetscapes, landscapes, and neighborhoods of authentic historical significance to the community. Our bylaws dictate that we must prevent developments incongruous with the historic aspects or the architectural characteristics of the surroundings and of the Historic District and must uphold the historic authenticity of the town and its property that would otherwise be materially affected by incongruous changes.

Two (2) Huge Electric Storage Metal Cabinets:

- (1) 7.5 feet long x 6 feet high x 3 feet wide and 2) 6 feet high x 5.5 long x 3 feet wide

The following is one of the Committee's most bizarre comments in terms of Historic Preservation: they propose mitigation by wrapping the two (2) **huge** and **noisy** metal electric storage cabinets in vinyl wrap in an effort to hide these two grey 'elephants in the room'.

Committee: *"...these metal cabinets are the most unsightly part of the project, but that they could be wrapped with graphics printed on vinyl that could be attractive and of interest to bus riders. The cabinets could also be screened with fencing."* (as per Committee Report)

Preservation is not about "pretty" or "unsightly" things. Wrapping vinyl graphics around the two ugly huge metal electric boxes (taller than most people) or erecting "attractive" fencing would be an anathema. Preservation is about congruity with the town and its historic attributes. It's insulting to intelligent people to think that

some “pretty” graphics of “quaint” images of the 400-year-old town will hide what’s really behind there – 21st century metal whirring electric cabinets!

Committee: *“There will be cooling fans in these cabinets, and they will make a whirring noise when buses are actually in place and being charged. The sound level is reported to be 70 dBA, a sonic level that various sources compare to air conditioners, modern vacuum cleaners, and office conversation.”*

The Committee spent a full meeting and a site visit to determine the wording for the noise these storage cabinets will make. Mark Snider insisted that comparing it to a vacuum cleaner was “not for public consumption.” What the Committee failed to do is grasp what the real issue here is *not the noise* but the *visual* impact of these incongruous and invasive metal cabinets – the largest of anything we have now on the island and would be ruinous in the Historic District?



Source: “Momentum Dynamics”

Preservation is not about “pretty” or “unsightly” things. Wrapping vinyl graphics around the two ugly huge metal electric boxes (taller than most people) or erecting “attractive” fencing would be an anathema. Preservation is about congruity with the town and its historic attributes... not what’s “pretty” or “quaint” or “olde”.

Committee: “Instead of the streetlights now on the three utility poles, eight old-fashioned street lanterns matching the style of those on Main Street and elsewhere in the Edgartown Historic District will be added. Removing the utility poles and installing the old-fashioned street lanterns will make Church Street look more consistent with other streets in the Edgartown Historic District.”

Next the Committee tries to argue that the old-fashioned street lanterns could make the damage done to Church Street “more consistent” with the rest of Edgartown’s Historic District? These street lanterns will not compensate for these huge electrical storage units, the beautiful mature shade trees that would have to be hacked down, the expansion of Church Street’s width, the grass sidewalk that will be shortened by half its width, the generic 21st century hardscape, and concrete benches? The lanterns will not resurrect the authenticity that would be lost by this project.

Widening of the Church Street Sidewalk

Widening the narrow sidewalk in Church Street would lead to further degradation. Instead of finding a suitable space for these gigantic vehicles to park, the VTA choose a tiny, one-way, narrow 17th century street in the heart of the Historic District.

Removal of Norway Maples

One of the worst things about this project in regard to the Historic District is the hacking down of mature shade trees. The Report suggests the removal of the following:

- A Norway maple near the southwest corner of the Visitor Center property **needs** to be removed to make room for one of the new electrical cabinets.
- **Removal of a Norway maple across the street from the Visitor Center.** This tree removal will make it **easier and safer for parked buses** to pull out and pass each other on Church Street. The arborist from Beetlebung Tree Care LLC found that this tree is in poor condition because it has multiple structural defects, multiple trunk and branch wounds, an extensive trunk wound from a large branch that recently broke off on the side away from Church Street, and the roots are girdling and heaving and breaking up the

asphalt curb and surrounding ground. The large branches and sections of the trunk that have grown over the street show **damage from multiple collisions of trucks and other tall vehicles, including buses.**

The reasons to cut down these large shade trees are one and the same: It's all about **the project's needs to make room for one of the huge electrical metal cabinets and room for buses to pull out of the charging area.** It's simply to make room for the buses. Period.

But the environment is not mentioned. Normally, if there is anticipated environmental damage, today, a construction project is secondary in consideration. However, in our case this 21st century engineering project that takes precedent over beautiful 75-year-old maple trees that have not seen the end their natural life. One of the trees has been butchered by the wide bus mirrors and yet is still standing and producing foliage and shade and reducing pollution:

“The benefits that trees provide can help cities and countries meet 15 of the 17 internationally supported United Nations Sustainable Development Goals. This critical review provides a comprehensive argument that trees should be considered an important part of the equation by project managers and civic leaders as we collectively work toward reaching these sustainability goals...One of the most important benefits for human health that trees can provide is the interception and reduction of air pollution. Not only do trees provide shade through intercepting and absorbing light, but through evapotranspiration trees actively cool the air of cities. Trees are beneficial to storing carbon, which is a major contributor to climate change - that not only do urban trees in the coterminous United States sequester 22.8 million tons of carbon each year, but the urban forest in this area stores 700 million tons of carbon. The more mature a tree is, the more carbon it stores in its woody biomass (<https://nph.onlinelibrary.wiley.com>)

Finally, any arborist could state that a tree should come down: It's “damaged”, the roots are “showing”, etc. What isn't said here is how much is 1) the arborist being paid and 2) why, if the trees were *already* in such bad shape, didn't the town get bids and remove them *years ago*? The answer is that there is no need now to remove them other than for the buses.

We live in a planting zone 7a. The new trees to be planted will be +/-5 inches in diameter and a 10-year old tree is typically 16 feet high. Maples can reach heights of 65-100 feet. The moving truck pictured here is about 12 feet in height. It will take 75 or more years for the new trees to reach the height of the Church Street trees we have now.



What is the Importance of the Historic District?

Ms. Chittick prepared a paper for the use of the VTA/Church Street Committee and Selectmen explaining that Historic Preservation has nothing at all to do with the terms “quaint,” “aesthetically pleasing,” “attractiveness,” or “beauty.” Yet the Committee Report continues to address “taste” and “attractiveness.” And, unfortunately, the current HDC confuses the issues too. Representatives from the Commonwealth’s Historical Commission are available to come speak to local HDC, and this would be a good idea for all of Edgartown’s affected departments: Selectmen, ZBA, Planning, HDC, etc.

Summary:

Installing induction chargers in Church Street and the resulting infrastructure and damage to our historic street and town is

- 1) an untested and short-term technology that obscures the fact that electric bus batteries today are not performing as they should
- 2) and that other advances in transit technology today (“clean diesel” and hybrid-electric) are successfully being used in every cities while we wait for reliable electric batteries, so that we all—everywhere —can have all-electric bus transit
- 3) a waste of government funding

Finally, we need to reassess our decision-making processes with the help of nationally recognized, qualified, independent transit consultants who will look at

- the business and management capabilities
- the unique transit issues the island faces
- and, of course, the best technology for now and the near future.

At the same time, we need to pay equal attention to our Historic District and heritage and what makes Edgartown unique and so inviting a community in which to live and preserve.

APPENDIX A

USA cities/Induction Chargers in the last year (2019-2020)

Ms. Chittick looked at and had conversations with multiple cities in the United States: they have no similarity to the Vineyard in terms of population, urban environment, multi-lane roads, and ridership. Each city also has large transit facilities for buses, trains, parking garages and taxis.

- **Frederick MD** (August 2020): (population 75,000; 667 square miles; National Historic District downtown; 2-lanes to 4-lanes (no 1-lane); Ridership 1.2 million.
 - Considered buying Momentum’s induction chargers, but the basic infrastructure (simply digging up street, installing charger plates) cost were upwards of \$500,000 to \$700,000 and that excluded retrofitting the electric buses.
 - Most important, it would have been installed in their Historic District and that would have proved “difficult” if not “impossible” to get approved by the HDC* and they didn’t even bring it before the townspeople, so sure were they that it would be voted down. “It wasn’t worth it to involve the townspeople”.
 - Bought 4 new BYD 30’ K7M electric Iron Phosphate batteries buses. One has been on the road since August 7, 2020; the other 3 BYD buses (they’ve had since 2019) will be on the road “sometime this year”.
 - The buses are charged by nozzle at the base. The buses will take 4-6 hours to charge.

Note: “Howard County (Columbia Shopping Mall) had a very bad experience with their new 40’ BYD bus, induction charged, and BYD took it back. There were multiple issues with the bus

Wenatchee WA (July 2020): (100,000 people - two counties; city has 45,000). County covers 4,845 square miles; 1 million bus riders; 11 hydroelectric dams making electricity extremely cheap; wide city roads; modern transportation center with 3-lanes and a circular road; plenty of space. Wenatchee is the only city in the US that has installed and is using one bus with Momentum’s induction-chargers.

- Electric and Hybrid buses. BYD gave three 300 kW Momentum chargers and installed them free of charge and retrofitted their 5 old buses in an effort to keep Wenatchee from returning the buses.
 - The buses with induction chargers charge for 7 minutes adding 7 miles (not the “4-5 minutes to get 10 miles” as says VTA). The city is trying these buses on a limited run.
 - But! All buses charge overnight by nozzle at their Columbia Transportation Center
- **Chattanooga TN** (February 2020 + July 2020 update): (population 180,000; ridership 3 million; 4-8 lanes)
 - Three (3) new BYD K9 35’ buses, March 2019. BYD retrofitted buses with Momentum Dynamics chargers (200 kW) and installed the induction chargers – all free-of-charge
 - \$400,000 Momentum 200 kW Induction Chargers are technically operable, but “it is not necessary” and “has not yet been used”.

- (2/04/20): multi-year study by computer scientists and engineers at universities: studying all modes of transit (including the inductive chargers vs improved batteries): Questions being addressed are:
 - How we move into more electric vehicles means we'll have to get better in understanding charge dynamics"
 - Do we need more remote charging stations like this one?"
 - "Will battery technology get so good that buses won't need to be charged while on their routes?"
 - "We're figuring that out right now"
 - The transit agency is studying how to incorporate the charging technology into scheduling routes to gain the most efficiency in its electric vehicles.
 - The cost to install the inductive chargers, with all the capital infrastructure (electric company, etc.) needed has proven very expensive (\$700,000+). They question now if it is worth the overall price, even if it were free of charge.
 - Their buses are conventionally nozzle-charged (@80 kW) after one shift and leave again at 2:00 pm for the evening run. They return to the facility for overnight charging.
 - *IF* the inductive chargers *were* used at their Shuttle Terminal, they calculate it might take about 10 minutes to add 15 miles of range (others have said it's a 1:1 charge). [Whatever the actual number, it is NOT what Momentum claims (4.5 minutes @200 kW to get "10 miles or 4.5 minutes @ 300 kW to get 13.4 miles)]

Update (7/27/20)

- They were given Induction Chargers but still not installed en route as "no need to"
- They do have 1 induction charger at the terminal but it's not used as it's "inconvenient" to stop to allow a 20-minute charge (1 mile = 1 minute.; 20 miles = 20-minute charge). 'Maybe next year?'
- They now charge with 80 kW nozzles for their 200 kWh buses– they could buy bigger buses than the 200 kWh but not going to invest as "technology is changing" and they will wait.
- They would only use induction in the future *if* "they have a need for it".
- He likened it to iPhone upgrades – its appeal is "cool new technology", but the cost is too high, and it doesn't provide more than small amounts of range.

Update (7/28/20)

- As of March 2019, they have three 35' BYD & Momentum Electric Induction buses and 51 non-Induction buses. Momentum did install the plate on the bus, and they hooked up the induction pad, that they could use, but the induction chargers are not needed. Therefore, they continue to charge by nozzle.
- 2021-2022: "Possibly" might buy more BYD K7 30' buses that could be ordered with or without chargers. "Not yet decided".

- **Indianapolis IN** (metro population: 1,781,000; 368 square miles; ridership 10 million; 4,000 stops)
 - 2019: Launched 13.1-mile Red Line service with purchase of BYD electric buses. Plans to start construction of the companion 15.2 mile, 90% dedicated lanes, Purple Line starting 2020-21(?)
 - The Red Line project was jeopardized: 6 BYD K11 buses not reach 275 miles per charge under real conditions.
 - As with Wenatchee and Chattanooga, BYD, as a stop-gap measure, so their buses wouldn't be returned, installed Momentum induction chargers at the terminal and retrofitted the BYD electric buses free of charge.
 - Momentum "salesperson" claims the chargers will boost the range to 275 miles (vs 200 miles that *IndyGo* Tech people claim). *IndyGo* has asked to try for themselves to test the charging time, which Momentum claims is 10 minutes, but so far, *IndyGo* has not been allowed to test it themselves. Momentum claims they can charge the buses from 0% to 100% in "3-4 hours". Darrow says to take everything Momentum says 'with a grain of salt'.
 - February 10, 2020: *IndyGo* had not paid BYD for those buses, even though the buses were in their possession for over a year. "We have reminded them that they signed a contract with *IndyGo* to produce a bus that could go 275 miles. That bus is not doing that at this time...Once we have confirmed that we will and they have met all their other contractual things, then we can render payment but not until that time".
 - February 28, 2020 "Evans reported that *IndyGo* canceled an order for five additional BYD buses. Instead, the transit agency has ordered 27 hybrid buses from Gillig, a California-based manufacturer. Evans said the manufacturer has promised a 480-mile range and that the buses will reduce emissions by 75% per bus compared to conventional diesel buses. She added that *IndyGo* remains committed to using all- electric buses on future BRT lines, when the buses perform up to standards.

One other Induction Charger (WAVE) being tested in Florida (July 2020 started)

- **Pinellas Sunshine Transit Authority (PSTA): St. Petersburg, Clearwater, Tampa:** Ridership: 12.5 million annually; Bus Routes: 40 with 4,602 stops (Route 100Xpressway and 300Xpressway St Pete to Tampa); Service area: 600 square miles; Network: four major hubs: downtown St. Petersburg, Grand Central Station in St. Petersburg, the Pinellas Park Transit Center, and the Park Street Terminal in downtown Clearwater. Transit Roads: "Most main roads we travel on are 2-4 travel lanes on one side only (4-8 lanes for the entire road). Some routes to travel on single lane (2-lanes for the entire road) but there are only a few areas that we have narrow conditions that make servicing them challenging."
- Fleet: Currently, 89 Hybrid low-emission buses; 2 BYD K 97 Electric (arrived February 2020) and 4 more coming late 2021 (6 BYD in all). The electric buses will average 180 miles or 15 hours before having to recharge.
- Hybrid: (9) new 40' Gillig Hybrid buses just ordered (July 2020)

- FTA will fund hybrid technology. Mass Transit (6/30/20) GILLIG, LLC, has announced that nine of its transit agency partners have been awarded grants under the Federal Transit Administration (FTA) Low- or No-Emission Program (Low-No).
- They will not commit to further purchases until the studies test both Hybrid and Induction to see which type are best are done. “Goal is to be able to use Hybrid and Electric on any route, we are still testing and collecting data to make these types of decisions, using them on multiple routes of different profiles”.
- June 2020, WAVE started: began using the 2 buses on several other routes, all of which already service the terminal where there are 6 berths and where the charger is located. The chargers are also there as the Maintenance department is too.” (in a big complex, not on a tiny side road)
- The charger is being used about 1 x hour and takes about 10 minutes to charge. They get 1 kWh from 1 minute of charging (1:1), “which isn’t a lot”, he said but it ‘helps’.
- They selected Wave vs. Momentum, as believed WAVE to be more “financially sound” than Momentum.
- They decided on buying only 1 induction unit for financial and logistical reasons. He said “eventually we will not need induction batter technology. It will be obsolete so financial issues must be addressed now – is it worth the cost to invest now in induction for the future?”
- “If” they were to buy more Electric, they would have to install additional WAVE induction chargers along the BRT (Bus Rapid Transit Route) but they will “not commit more money for induction installation until the studies are complete”.

APPENDIX B

Fall, 2020: Further examples (beyond Boston above) of major US cities and their electric bus failures

In early 2020, NYC's MTA announced Nova Bus has received one of its biggest U.S. contracts in its history from the Metropolitan Transportation Authority (MTA) of New York. The contract is for 165, 40-foot hybrid buses, with BAE propulsion system, with options for 126 hybrid buses and 209 diesel buses for a potential total amount of up to 500 buses

September 2020, Philadelphia SEPTA spokesperson Andrew Busch acknowledged that the transportation agency's entire fleet of 25 all-electric buses (a \$23.8 million investment), the third-largest fleet in the U.S., has been "fully sidelined" since February. "We made the decision to fully take them out of service," he said in response to a PlanPhilly inquiry about the missing buses. "We're not able to get into the specific issues...but we're hopeful we can come up with resolutions that will allow us to get them all back into service." The new buses, though, compose a small percentage of the transit agency's almost 1,500-bus fleet, and SEPTA won't commit to going fully electric. Electric buses used elsewhere have proved less reliable than their emissions-spewing predecessors, and it is unclear whether the buses' cost and SEPTA's battery charging capacity will prevent them from being used widely in a big city.

Chicago (December 2019): *Why isn't Chicago upgrading its fleet faster, when electric buses can save the agency money in fuel and maintenance costs, while also giving the city cleaner air? And why is the agency still planning to buy diesel buses?*

CTA officials say that upgrading to an electric fleet is complicated and involves not just acquiring the buses but upgrading the agency's infrastructure to build charging stations. It also needs to be sure the buses work in all weather conditions, and over long distances, the CTA said. It also plans to buy between 50 and 400 "clean diesel" buses over the next several years, likely through 2028, spokesman Steve Mayberry said. Steele explained that the diesel buses are needed to replace old buses. Of the agency's more than 1,800 buses, close to 1,000 will need to be replaced in the next two to three years, he said. The agency uses both diesel and 300 hybrid diesel-electric buses.

APPENDIX C

Brief survey of selected European Cities experience with induction-chargers (in-ground and Pantographs):

- **Berlin, Germany** (population 4 million): after four years testing, December 2019 abandoned their entire induction fleet (4 buses). Buying Hybrid.
- **Madrid, Spain:** (population: 7 million) they have one 7-mile-long line with chargers at each end, the only induction in their fleet. “The large-scale installation of direct current distribution and charging infrastructure for opportunity charging in Madrid’s urban landscape is not considered as a viable option in economic terms. (Madrid buying 150 electric buses to be procured this year and 100 next year, with more to follow. None will be induction charged. By 2027, one-third of their bus fleet will consist of electric buses and two-thirds of gas-powered buses. (March 2020)
- **Italy:** Among charging station type, overnight chargers held the largest share in the market: the public and private agencies prefer overnight charging buses over opportunity charging buses. IPT Technology is the same company that supplied the induction charging system for the electric minibuses in operation in Genoa and Turin, Italy (“with mixed fortunes, but 15 years have passed on and technology is moving fast”). These chargers are “Pantographs” – overhead induction chargers mounted by large crane-like structures on the top of buses.
- Bombardier and Alstom have also developed inductive charging systems, but so far authorities and transport companies are mostly focused on fast-charging stations via pantograph on the roof and the classic plug-in charger in depot. Inductive charging systems offer an invisible solution that don’t have impact on the urban environment. On the other hand, maintenance operations are not that easy. (October 2019)