THE CITY of Milford DELAWARE

Milford City Hall Council Chambers 201 South Walnut Street Milford DE 19963

CITY COUNCIL AGENDA
Wednesday, February 14, 2024*

Attendees are welcome to participate virtually as well. Public Comments are encouraged on the agenda items designated with a Ⓟ. Virtual attendees may alert the City Clerk that they wish to speak by submitting their name, address, and agenda item via the Zoom Q&A function or by using the Raise Your Hand function during the meeting.
Those attending in person may comment when the floor is opened for that purpose.
All written public comments received prior to the meeting will be read into the record.

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6:00 PM

15-Minute Public Comment Period

Virtual attendees must register prior to start time of meeting by calling 302-422-1111 Extension 1300 or 1303, or by sending an email to cityclerk@milford-de.gov and providing your name, address, phone number, and the specific agenda item you wish to comment on. Persons in attendance must sign up prior to the start of the meeting.

WORKSHOP

Milford Corporate Center Update
EV Feasibility Study
Springboard Village
Former Police Station Options

ALL SUPPORTING DOCUMENTS MUST BE SUBMITTED TO THE CITY CLERK IN ELECTRONIC FORMAT NO LATER THAN ONE WEEK PRIOR TO MEETING. NO PAPER DOCUMENTS WILL BE ACCEPTED, DISTRIBUTED, OR PRESENTED AT MEETING ONCE PACKET HAS BEEN POSTED ON THE CITY OF MILFORD WEBSITE. ANY MATERIALS UTILIZED DURING THE MEETING SHALL BE FROM THE COUNCIL PACKET AND REFERENCED BY PRESENTER USING AUDIO AND VISUAL MEANS TO ENSURE VIRTUAL PARTICIPATION BY ALL IN ATTENDANCE.

*Time Limit is three minutes per speaker, not to exceed a total of fifteen minutes for all speakers prior to start of meeting/workshop.
Ⓟ Designated Items only; Public Comment, up to three minutes per person will be accepted.

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*Rescheduled to 022824 (Mayor Request)

City of Milford

Fleet Electrification Feasibility Study Report

November 2023

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List of Acronyms

AFLEET - Alternative Fuel Lifecycle Environmental and Economic Transportation Tool developed by Argonne National Lab

AWD – All-Wheel Drive

AEV – All-Electric Vehicle (also referred to as Battery Electric Vehicle (BEV))

EV – Plug-in Electric Vehicle, including both AEV and PHEV models

EVSE – Electric Vehicle Supply Equipment, often referred to as EV charging equipment

ICE – Internal Combustion Engine

MSRP – Manufacturer's Suggested Retail Price

PHEV - Plug-In Hybrid Electric Vehicle

SUV – Sport Utility Vehicle

TCO – Total Cost of Ownership

Executive Summary

The City of Milford is interested in adopting electric vehicles (EVs) and electric equipment to support its municipal operations while also reducing its carbon footprint. Milford secured Energize Delaware program funding for a fleet electrification feasibility study. This feasibility study report provides a comprehensive financial and operational assessment of Milford's municipally-owned fleet for potential electrification, recommends vehicles for EV replacement, and meets Energize Delaware's feasibility study requirement for a vehicle incentive application.

The following analysis is a review of Milford's entire fleet of on-road vehicles (as well as riding mowers and low-speed utility vehicles) to determine which vehicles are suitable candidates for near-term EV replacement (Phase One). Vehicles not considered near-term candidates were also analyzed, including estimates of when replacement EVs may be available on the market so Milford can plan ahead for these replacements (Phase Two).

VEIC recommends Milford replace 74 vehicles including sedans, full-size cargo vans, light-duty (LD) pickup trucks and medium-duty (MD) pickup trucks, heavy-duty (HD) bucket and dump trucks, motorcycles, riding mowers, low-speed utility vehicles (LSVs), sport utility vehicles (SUVs), heavy-duty refuse trucks and street sweepers in two phases over the next 12 years.

Phase One (2023-2026)

Replace 29 internal combustion engine (ICE) vehicles including sedans, full-size cargo van, LD pickup trucks, motorcycles, riding mowers, all-terrain utility vehicles, administrative police sedans and SUVs, and a refuse truck (Appendix A) with all-electric equivalent vehicles. These replacements can occur within the next three years (2023-2026) due to availability of comparable EVs that are expected to meet operational requirements.

- AEV Sedan Replacement: the all-electric Chevrolet Bolt EV (259-mile electric range) is the best-value EV option for replacement of Milford's existing sedans in the Customer Service and Police departments.
- AEV Full-Size Cargo Van Replacement: the all-electric Ford E-Transit Cargo Van (126- mile electric range) is the most cost-effective option for replacement of Milford's existing full-size cargo vans in the Parks & Recreation and Public Works-Water departments.
- AEV Light-Duty Pickup Replacement: the all-electric Ford F-150 Lightning Pro (230-mile electric range) is the most cost-effective option for replacement of Milford's existing light-duty pickup trucks in the Parks & Recreation, Police, and Public Works-Electric departments.
- AEV Motorcycle Replacement: the all-electric Harley Davidson Livewire One (146- mile electric range) is the most cost-effective option for replacement of Milford's existing motorcycle in the Police department.

- AEV Mower Replacement: the all-electric Greenworks Optimus Z 60 Zero Turn commercial mower is the most cost-effective option for replacement of Milford's existing gas- and diesel-powered commercial mowers in the Parks & Recreation - Armory and Public Works departments.
- AEV All-Terrain Utility Vehicle Replacement: the all-electric John Deere 4X2 Electric Gator is the most cost-effective option for replacement of Milford's existing gas-powered Gators in the Parks & Recreation and Police departments.
- AEV Police Admin Sedan and SUV Replacement: the all-electric Ford Mustang Mach-E all-wheel drive (AWD) and Ford F-150 Lightning Pro are the most versatile AEV options for replacement of the Police department administrative sedans and SUV.
- AEV Refuse Truck Replacement: the all-electric Mack LR Electric (up to 100-mile electric range) is the best value EV option for replacement of the existing diesel refuse truck in the Public Works-Solid Waste department.

These vehicles represent Milford's best opportunity for cost-effective, near-term electrification because their predictable daily range needs and low to moderate annual mileage can be easily met by existing AEVs.

Sixteen of the 29 recommended Phase One replacement AEVs are projected to offer a total lifetime savings compared to existing ICE vehicles, after accounting for estimated vehicle and charging station capital and operating costs, and available incentives. These vehicles are projected to save Milford a total of approximately $75,000 over their lifetime.

The remaining 13 recommended Phase One vehicles are projected to result in increased total lifetime ownership costs relative to existing ICE vehicles and would require additional subsidy or incentives to break even. These 13 vehicles are projected to cost an additional $221,000 over their lifetime.

Combining the projected TCO savings and costs of all 29 recommended Phase One vehicles results in a net lifetime cost of approximately $147,000. However, if Milford receives $175,000 in Energize Delaware funding for the seven administrative Police vehicles included in Phase One, Milford is expected to achieve a net lifetime savings of approximately $28,000 by replacing these 29 vehicles with AEVs.

These 29 vehicles are also projected to reduce lifetime carbon emissions by approximately 5,700 short tons (58%) and criteria air pollutants by approximately 28 short tons (99%) relative to existing ICE vehicles.

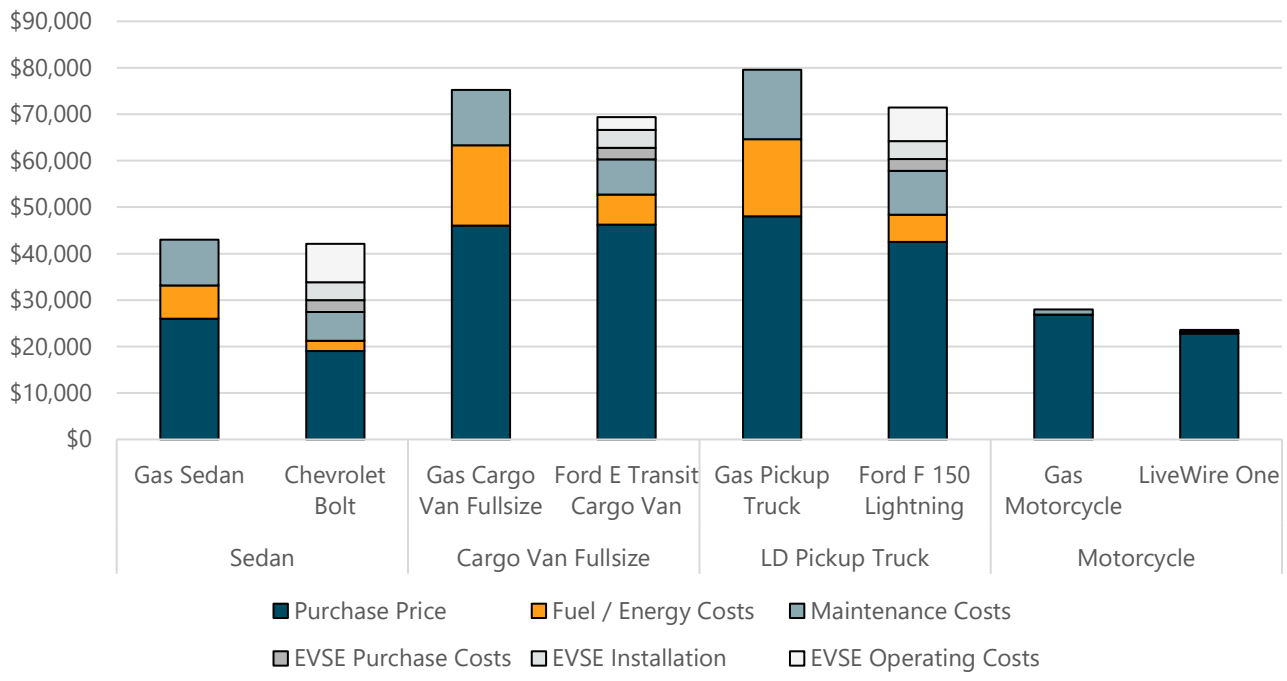


Table ES- 1: Lifetime total cost of ownership for Chevrolet Bolt, Ford E Transit Cargo Van, Ford F-150 Lightning, and LiveWire One AEVs replacing gasoline-powered sedan, full-size cargo vans, light-duty pickup trucks, and motorcycle equivalents.

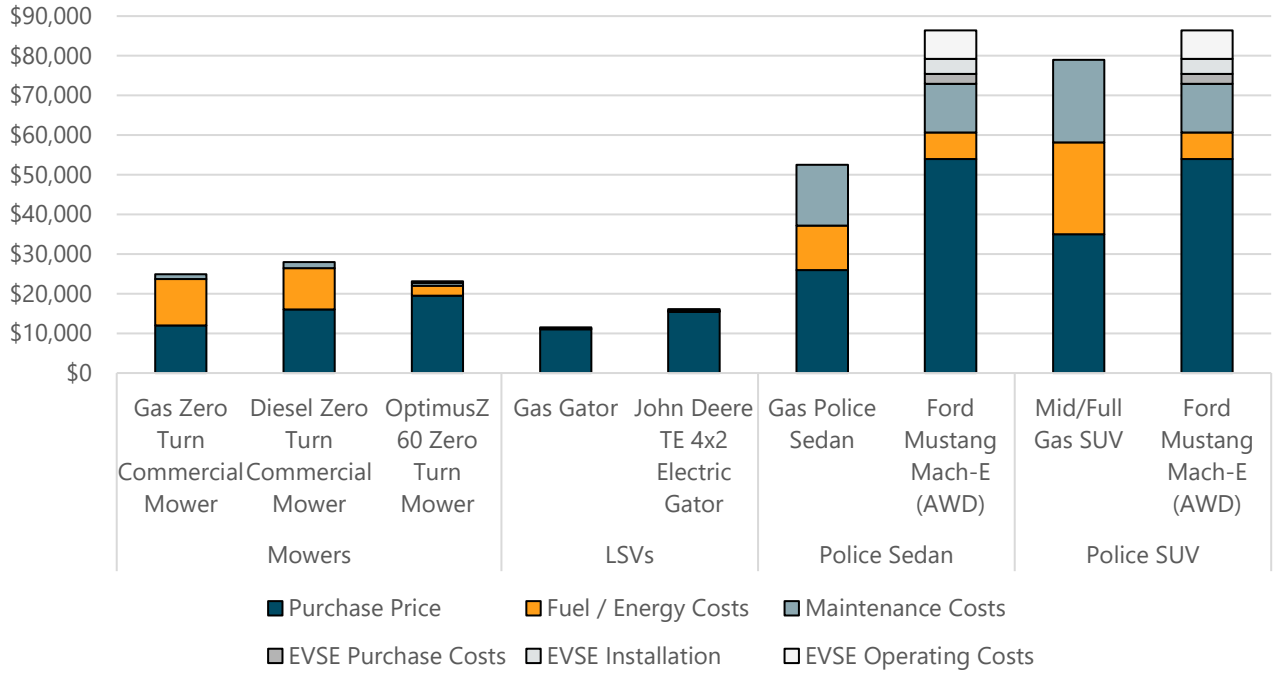


Table ES- 2: Lifetime total cost of ownership for Greenworks OptimusZ 60 Zero Turn commercial mower, John Deere TE 4X2 Electric Gator, Ford Mustang Mach-E (AWD) replacing gasoline and diesel-powered commercial mowers, all-terrain utility vehicle, police sedans and police SUV equivalents.

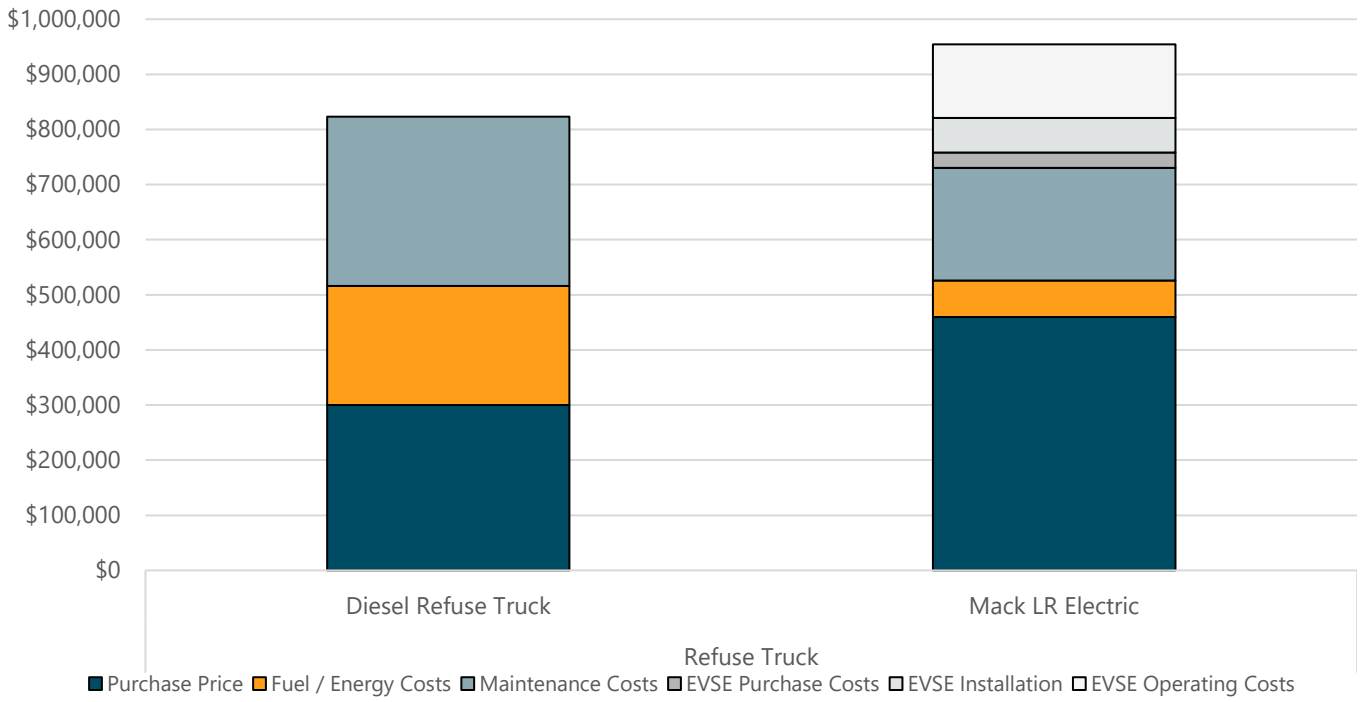


Table ES- 3: Lifetime total cost of ownership for Mack LR Electric commercial refuse truck replacing diesel-powered commercial refuse truck equivalent.

Phase Two (2027-2035)

Replace 45 ICE vehicles including hybrid sedans and SUVs, cargo vans, LD and MD pickup trucks, motorcycles, riding mowers, all-terrain utility vehicles, and HD refuse trucks and a street sweeper (Appendix A) with all-electric equivalents. These replacements can occur within a nine-year period (2027-2035) due to vehicle replacement schedules and anticipated market availability.

Recommended Phase Two AEV replacements are projected to add additional significant lifetime costs and reduce overall carbon emissions. Current Phase Two AEV vehicle replacements are based on current market availability. Additional AEV vehicle types and models are expected to become available between now and 2035, which Milford will also want to consider when replacing. In addition to the vehicles recommended in Phase One, the following are recommended for the additional vehicle types included in Phase Two:

- AEV SUV Replacement: the all-electric Volkswagen ID.4 (245–280-mile electric range, trim dependent) is the best value EV option for replacement of the hybrid SUVs in the Information Technology, Public Works, and Public Works-Electric departments.

- AEV Medium-Duty Pickup Replacement: medium-duty AEV pickup trucks are not currently widely available, but some options are expected to be on the market in the next several years[1].
- AEV Bucket Truck Replacement: the all-electric Terex HR55 All-Electric Aerial Truck is the only current EV option for replacement of the existing diesel aerial trucks in the Public Works-Electric department.
- AEV Street Sweeper Replacement: the all-electric Battle Motors Elgin Broom Bear (130-150 mile electric range) is the best value EV option for replacement of the existing diesel refuse truck in the Public Works-Streets department.

AEV medium-duty pickup trucks, bucket trucks and street sweepers are currently projected to be more expensive over their lifetime compared to ICE equivalent vehicles, based on Milford's annual mileage. Purchase costs for these vehicles (and all AEVs), however, are expected to decrease in the coming years, which should bring their total lifetime costs closer to equivalent diesel vehicles.

These vehicles represent suggested replacement opportunities for cost-effective, long-term electrification because their short, predictable daily range needs and moderate to high annual mileage can be easily met by existing AEVs. Current MSRP estimates Phase Two vehicles are likely to decrease over time as more EV models enter the market and technology improves.

If Milford replaced all Phase Two vehicles in 2023, they would result in an estimated total lifetime cost increase of $2,183,977 relative to equivalent ICE vehicles. Actual costs in 2027-2035, however, are expected to be considerably lower as additional, lower cost EV models become available over the next 12 years with net saving likely to follow.[2] These purchases should be planned for 2027-2035 in response to the market dynamics noted above.

Charging Infrastructure (2023-2035)

- Milford should plan for installation of up to 53 additional electric vehicle supply equipment (EVSE) ports over the next 3-12 years.
    - Each light and medium-duty AEV replacement should ideally have a dedicated Level 2 EVSE port to ensure they are fully-charged each morning and to minimize staff efforts to shuffle vehicles between any shared charging station ports.

[1] https://gmauthority.com/blog/2021/08/gm-has-plans-to-offer-a-new-all-electric-medium-duty-chevy-truck/
[2] DOE Projects Zero Emissions Medium- and Heavy-Duty Electric Trucks Will Be Cheaper than Diesel-Powered Trucks by 2035: https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheaper-diesel

- The Livewire One motorcycle would benefit from having a dedicated Level 1 EVSE port to ensure it is fully-charged each morning due to its smaller battery size and capabilities.
- Each heavy-duty AEV replacement (including all refuse and dump truck replacements) are expected to each require a dedicated 50kW DC charging station to ensure sufficient charging speeds overnight.
- Selecting more basic, lower-cost EVSE options is recommended to reduce capital and operating costs to maximize lifetime TCO savings.

Funding Opportunities

Milford should pursue the following incentives to support EV and EVSE deployment and monitor for any additional opportunities that may become available. Note that due to varying eligibility and program requirements, only the Energize Delaware Government EV Fleets and federal Commercial Clean Vehicle Credit incentives were included in the Phase One and Phase Two cost estimates provided above. If Milford can utilize the additional state and federal funding below, Phase One project-wide total cost of ownership savings may increase considerably.

State Funding

- Energize Delaware Grants for Local Government EV Fleets – $175,000 per municipality for police and other first-responder AEVs and related EVSE only. Limit of up to $80,000 MSRP per vehicle. Requires EV feasibility study prior to application for more than three vehicles.[3]
- Alternative Fuel Vehicles Rebate – $2,500 per AEV, up to 6 vehicles. MSRP's not to exceed $50,000 to qualify. Administered by the Delaware Department of Natural Resources and Environmental Control (DNREC).[4]
- EV Charging Station Rebate Program – $2,500 for a single port charging station and $5,000 for dual port chargers. Limited to 10 ports (or 5 dual ports). Rebates are available for public access fleet and workplace charging. Rebates cover up to 60% of charging station for commercial projects and up to 80% for government and nonprofit projects. Administered by DNREC.[5]

Federal Funding

- Commercial Clean Vehicle Credit – Up to $7,500 for gross vehicle weight ratings (GVWRS) of under 14,000 pounds and $40,000 for all other vehicles. Businesses and tax-exempt

[3] https://www.energizedelaware.org/ev-fleets/

[4] https://afdc.energy.gov/laws/11638

[5] https://dnrec.alpha.delaware.gov/climate-coastal-energy/clean-transportation/ev-charging-equipment-rebates/

organizations qualify for the credit. There is no limit on the number credits your entity can claim.[6]

- Alternative Fuel Infrastructure Tax Credit – up to $100,000 or 30% of the cost for electric fueling equipment or 6% in the case of property subject to depreciation.
    - Eligible projects that meet prevailing wage and apprenticeship requirements may be eligible to receive the full 30% tax credit, regardless of depreciation status. Permitting and inspection fees are not included in covered expenses.[7]
    - Qualified fueling equipment must be installed in locations that meet the following census tract requirements: (1) the census tract is not an urban area; (2) A population census tract where the poverty rate is at least 20%; or (3) Metropolitan and non-metropolitan area census tract where the median family income is less than 80% of the state medium family income level.

[6] https://www.irs.gov/credits-deductions/commercial-clean-vehicle-credit
[7] https://afdc.energy.gov/laws/10513

Background

The City of Milford is a municipality in the state of Delaware serving approximately 12,000 residents. Milford selected VEIC to help them plan for a fully electrified vehicle fleet over the next 12 years to increase operational efficiency and to reduce their carbon footprint. This study identifies immediate and long-term candidates for vehicle electrification over a two-phase period.

Recommendations

Vehicles

This study focused on evaluating potential AEV replacement for Milford's identified 108 light, medium, and heavy-duty fleet vehicles (including riding mowers and all-terrain utility vehicles).

Based on estimates of Milford's vehicles replacement timeframes, annual mileage and operation needs of current vehicles, as well as projected market availability and purchase price by vehicle type, we recommend Milford deploy AEVs into their fleet in two distinct phases between now and 2035:

- The 29 recommended Phase One vehicles consist of older sedans, full-size cargo vans, light-duty pickup trucks, motorcycles, riding mowers, administrative police vehicles, all-terrain utility vehicles, and refuse truck replacements. These current fleet vehicles are due for replacement within the next 3 years (2023-2026), have comparable AEVs available for purchase now and net projected lifetime cost savings as a group (after incentives).
- The 45 recommended Phase Two vehicles consist of the same vehicle types in Phase One, plus newer medium-duty pickup trucks, heavy duty dump and bucket trucks, and street sweeper replacements. These current fleet vehicles are due for replacement within the next 3-12 years (2027-2035), and when comparable medium and heavy-duty vehicles are expected to be available on the market (and more cost-effective than current options).

The recommended vehicles present Milford's best opportunity for cost-effective electrification because their short, predictable daily range needs and low to moderate annual mileage can be easily met by existing AEVs that charge overnight at their current parking locations.

Phase One

Sedans

We identified two sedans in Milford's existing fleet as strong candidates for replacement with all-electric sedans during Phase One: a Toyota Camry assigned to Milford's Customer Service department, and a Dodge Stratus from Milford's Police department. They each travel an estimated average of approximately 5,000-miles per year with a maximum daily travel distance of roughly 50 miles for one and 200 miles for the other.

Of available AEV models, we recommend the all-electric Chevrolet Bolt as the most cost-effective AEV option for replacement of Milford's existing gasoline sedans. Its 259-mile range should be sufficient to meet the maximum daily mileage of the existing gasoline sedans, including reductions in range due to cold-weather[8]. The Nissan Leaf is also a potential replacement but has a slightly higher MSRP and is not currently eligible for the federal Commercial Clean Vehicle Credit.

Make / Model	EV Type	Class	Standard Electric Range (mi)	Cold-Weather Electric Range (mi)	Base Model MSRP
Chevrolet Bolt	AEV	Sedan	259	155	$25,600
Nissan Leaf	AEV	Sedan	149	90	$28,040

Table 1: Recommended EV replacement options for identified Milford's Sedans[9]

Full-Size Cargo Vans

We identified two full-size cargo vans in Milford's existing fleet as strong candidates for replacement with either a plug-in hybrid minivan or all-electric cargo van during Phase One. The current candidates are a Ford Econoline Van and a Dodge Sprinter 3500 Cargo Van in Milford's Parks & Recreation and Public Works-Water departments. They travel an estimated average of approximately 4,000-miles per year with a maximum daily travel distance of roughly 50 miles.

Of available AEV models, we recommend the all-electric Ford E Transit as the most cost-effective AEV option for replacement of Milford's existing gasoline full-size cargo vans. Its 126-mile range will be more than sufficient to meet the maximum daily mileage of the existing gasoline full-size

[8] https://www.driveelectricvt.com/blog/winter

[9] See Appendix F – Technical Memo –State of Technology: Light and Medium Duty Electric Vehicles and Charging Equipment for details.

cargo vans, including reductions in range due to cold-weather (which may reduce the range down to 76 miles).

In contrast, if Milford chooses to procure a PHEV replacement, the plug-in hybrid electric Chrysler Pacifica PHEV would make a suitable cost-effective option for replacement of Milford's existing full-size cargo vans. Its 32-mile electric range and 520-combined mile range will be more than sufficient to meet the maximum daily mileage of these two existing gasoline full-size cargo vans, including reductions in range due to cold-weather (which may reduce the electric range down to 19 miles on sub-zero days). The Chrysler Pacifica PHEV should only be considered if downsizing is suitable to meet Milford's current full-size cargo van needs.

Make / Model	EV Type	Class	Standard Electric Range (mi)	Cold-Weather Electric Range (mi)	Base Model MSRP
Ford E Transit Cargo Van	AEV	Utility Cargo Van	126	76	$49,575
Chrysler Pacifica Hybrid	PHEV	Minivan	32	19	$46,978

Table 2: Recommended EV replacement options for identified Milford's Full-Size Cargo Vans

Light-Duty Truck

We identified three light-duty pickup trucks in Milford's existing fleet that are strong candidates for replacement with all-electric full-size pickup trucks during Phase One. The current vehicles are all Dodge Rams, which are assigned to Milford's Parks & Recreation, Police, and Public Works-Electric departments. They travel an estimated average of approximately 8,000 miles per year with a maximum daily travel distance of roughly 50 miles for most (and one vehicle at 200 miles).

Of available AEV models, we recommend the all-electric Ford F-150 Lightning Pro as the most cost-effective AEV option for replacement of Milford's existing gasoline light-duty pickup trucks. Its 230-mile range will be more than sufficient to meet the 50 maximum daily mileage of most of Milford's pickups, including reductions in range due to cold-weather (which may reduce the range down to 138 miles).

We note that Milford does have one pickup identified with a maximum trip distance of 200 miles, which exceeds the Ford F-150 Lightning Pro's estimated minimum winter range. If this trip distance must be met during the coldest days of the year, Ford also offers an extended range option (300 miles) for an additional $20,000. Adding one or more longer-range pickups into Milford's light-duty fleet may also enable Milford to assess whether the additional battery capacity is worthwhile to have during extended emergency deployments. Alternatively, longer-range needs in winter could be met by one of Milford's existing gasoline or diesel light or medium-duty trucks in the near-term.

The Ford F-150 Lightning is the only fleet-focused mass-market all-electric pickup truck on the market currently. Additional options for Milford in the next three years will likely include the GM all-electric Silverado EV pickup, GMC Sierra EV, and Dodge Ram 1500 REV; however, production and delivery details for these three models will not be available until early 2024. Luxury-oriented electric pickup trucks (like the Rivian R1T and GMC Hummer EV) have dramatically higher pricing (starting at $74,000) so are not projected to be cost-effective options.

Make / Model	EV Type	Class	Standard Electric Range (mi)	Cold-Weather Electric Range (mi)	Base Model MSRP
Ford F150 Electric	AEV	Pickup Truck	230	138	$49,995
Ford F150 Electric (extended range)	AEV	Pickup Truck	300	180	$69,995

Table 3: Recommended EV replacement options for identified Milford's Light-Duty Pickup Trucks

Motorcycle

We identified one gasoline motorcycle in Milford's existing fleet that is candidate for replacement with an all-electric motorcycle during Phase One. The current vehicle is a Harley Davidson Standard Police motorcycle, which is assigned to Milford's Police department. It travels an estimated average of approximately 100 miles per year with a maximum daily travel distance of roughly 100 to 200 miles.

Of available AEV models, we recommend the all-electric Harley Davidson LiveWire One as the most cost-effective AEV option for replacement of Milford's existing gasoline motorcycle. Its 146-mile range should be sufficient to meet the 100 to 200 mile maximum daily mileage in mild weather (and assuming that Milford's police motorcycles are not used during colder months).

Make / Model	EV Type	Class	Standard Electric Range (mi)	Cold-Weather Electric Range (mi)	Base Model MSRP
Harley Davidson LiveWire One	AEV	Motorcycle	146	80	$22,799

Table 4: Recommended EV replacement options for identified Milford Motorcycle

Mowers

We identified two standing and six riding mowers in Milford's existing fleet that are candidates for replacement with all-electric mowers during Phase One. The current vehicles are two John Deere Stand Up Z-Turn mowers, five Kubota Riding Mowers, and one Kubota Riding Mower with

plow attachment, which are assigned to Milford's Parks & Recreation and Public Works-Sewer departments. They run an estimated average of approximately 900 hours per year with a maximum daily runtime of roughly six hours.

Of available AEV models, we recommend the all-electric GreenWorks OptimusZ 60 Zero-Turn Mower as the most cost-effective AEV option for replacement of Milford's existing gasoline and diesel mowers. Its eight-hour runtime should be sufficient to meet the six-hour daily runtime of most of Milford's mowers. The Gravely Pro-Turn EV 48 Rear Discharge mower is also a potential replacement but has a slightly higher MSRP and lower estimated runtime.

Make / Model	EV Type	Class	Standard Electric Runtime (hrs)	Base Model MSRP
OptimusZ 60 Zero-Turn	AEV	Mower	8	$27,000
Gravely Pro- Turn EV 48 Rear Discharge	AEV	Mower	6	$32,667

Table 5: Recommended EV replacement options for identified Milford Mowers

All-Terrain Utility Vehicles

We identified five all-terrain utility vehicles in Milford's existing fleet that are strong candidates for replacement with all-electric full-size ATUVs during Phase One. The current vehicles are five John Deere Gator 4x2 vehicles, which are assigned to Milford's Parks & Recreation and Police departments. They travel an estimated average of approximately 50 hours per year with a maximum daily runtime of roughly six hours.

Of available AEV models, we recommend the all-electric John Deere TE 4X2 Electric Gator as the most cost-effective and comparable AEV option for replacement of Milford's existing ATUVs.

Make / Model	EV Type	Class	Standard Electric Range (mi)	Estimated Cold-Weather Electric Range (mi)	Base Model MSRP
John Deere TE 4X2 Electric	AEV	ATUV	Not Listed	Not Listed	$15,499

Table 6: Recommended EV replacement options for identified Milford ATUVs

Police Sedan

We identified three police sedans in Milford's existing fleet that are strong candidates for replacement with all-electric sedans during Phase One. The current vehicles are three Ford Crown Victoria police sedans, which are assigned to Milford's Police department and used for

administrative purposes. They travel an estimated average of approximately 8,300 miles per year with a maximum daily travel distance of roughly 100 to 200 miles.

Of available AEV models, we recommend the all-electric Mustang Mach E AWD as the most versatile option for Milford's Police department. Its maximum 303-mile range should be sufficient to meet the maximum daily mileage of the existing gasoline police sedans, including reductions in range due to cold-weather.[10] The Chevy Blazer EV is another strong candidate, similar in price and capability to the Mustang Mach-E, and should be considered if available when Milford is ready to procure.

The Chevy Bolt is also a potential replacement that would offer considerably greater savings, but reduced cargo capacity, acceleration and braking performance, and all-wheel drive.

Make / Model	EV Type	Class	Standard Electric Range (mi)	Estimated Cold-Weather Electric Range (mi)	Base Model MSRP
Chevrolet Bolt	AEV	Sedan	259	155	$25,600
Nissan Leaf	AEV	Sedan	149	90	$28,040
Ford Mustang Mach E (RWD)	AEV	Compact Crossover SUV	224-303	134-180	$54,975
Ford Mustang Mach E (AWD)	AEV	Compact Crossover SUV	224-303	134-180	$57,675
Chevrolet Blazer EV	AEV	Compact Crossover SUV	279	167	$56,715

Table 77: Recommended EV replacement options for identified Milford Police Sedans

Police SUV

We identified four full-size police SUVs in Milford's existing fleet that are strong candidates for replacement with all-electric light-duty pickup trucks during Phase One. The current vehicles are four Ford Expeditions, which are assigned to Police department. They travel an estimated average of approximately 11,400 miles per year with a maximum daily travel distance of roughly 100 to 200 miles.

Of available AEV models, we recommend the all-electric Ford F-150 Lightning Pro, XLT or Pro SSV as the most cost-effective AEV option for replacement of Milford's Police department. Its maximum 230-mile range should be sufficient to meet the maximum daily mileage of the

[10] https://www.driveelectricvt.com/blog/winter

existing gasoline police SUVs, including reductions in range due to cold-weather. MSRPs listed below for Ford F-150 Lightning Pro do not include SSV police package upgrades. [11]

Make / Model	EV Type	Class	Standard Electric Range (mi)	Estimated Cold-Weather Electric Range (mi)	Base Model MSRP
Ford F150 Electric Pro	AEV	Pickup Truck	230	138	$49,995
Ford F150 Electric Pro (extended range)	AEV	Pickup Truck	300	180	$69,995
Volkswagen ID.4	AEV	Compact Crossover SUV	240-280	155	$46,295
Ford Mustang Mach E (RWD)	AEV	Compact Crossover SUV	224-303	134-180	$54,975
Ford Mustang Mach E (AWD)	AEV	Compact Crossover SUV	224-303	134-180	$57,675
Chevrolet Blazer EV	AEV	Compact Crossover SUV	279	167	$56,715

Table 88: Recommended EV replacement options for identified Milford Police SUVs

Refuse Truck

We identified one refuse truck in Milford's existing fleet that is a candidate for replacement with all-electric refuse truck during Phase One. The current vehicle is a single Freightliner Trash Truck, which is assigned to Milford's Public Works-Solid Waste department. It travels an estimated average of approximately 11,100 miles per year with a maximum daily travel distance of roughly 50 to 100 miles.

Of available AEV models, we recommend the all-electric Mack LR Electric as the most cost-effective AEV option for replacement of Milford's existing diesel refuse truck. Its 100 "on-the-job" mile range should be sufficient to meet the 100-mile maximum daily mileage of Milford's refuse truck. We recommend Milford contact Mack directly to discuss winter operations and determine whether range is expected to be impacted considerably enough to affect Milford's collection routes and schedules.

[11] https://www.driveelectricvt.com/blog/winter

Make / Model	EV Type	Class	Standard Electric Range (mi)	Estimated Cold-Weather Electric Range (mi)	Base Model MSRP
Mack LR Electric	AEV	HD Refuse Truck	100	60	$500,000+

Table 99: Recommended EV replacement options for identified Milford Refuse Truck

Phase Two

Light-Duty Vehicles

Twenty-eight of Milford's 45 vehicles recommended for replacement with AEVs during Phase Two represent the same types of vehicles recommended for replacement in Phase One (sedans, full-size cargo vans, light-duty pickup trucks, motorcycles, riding mowers, all-terrain utility vehicles, and refuse truck replacements). They are recommended for replacement in Phase Two simply because they are newer vehicles that aren't expected to be ready for retirement until sometime between 2027-2035.

The recommended equivalent AEV light-duty vehicle model options identified in the Phase One section would work as replacements for these light-duty Phase Two vehicles. However, at least several new models per vehicle category are likely to be available by 2027 onward, so Milford should revisit these recommendations based on market updates.

Medium-Duty Pickup Trucks

The remaining 17 vehicles are medium-duty pickup trucks, heavy duty dump and bucket trucks, and street sweepers. While these vehicles are relatively new and expected to be retired between 2027-2035, there are also limited (or no) AEV replacement options for these vehicle types on the market currently.

Twelve of Milford's current medium-duty pickup trucks are expected to be good candidates for replacement with AEV equivalents between 2027 and 2035. These trucks support Milford Public Works, Parks and Recreation, and Planning departments, and range from Ford F-250s to F-550s, several with dump bodies. They all travel less than 50 miles per day.

There are currently no AEV medium-duty pickup trucks available on the market, and major truck manufacturers have not offered much information on pricing and delivery expectations. GM recently noted they plan to offer a medium duty pickup truck after 2025[12], but Ford has not committed to developing an equivalent electric medium-duty truck[13].

[12] https://gmauthority.com/blog/2021/08/gm-has-plans-to-offer-a-new-all-electric-medium-duty-chevy-truck/
[13] https://insideevs.com/news/550764/ford-superduty-lightning-not-planned/

Heavy-Duty Trucks

Five of Milford's current heavy-duty dump, bucket and street sweeper trucks are expected to be good candidates for replacement with AEV equivalents between 2027 and 2035. These trucks support Milford Public Works Electric and Streets divisions. They all travel less than 50 miles per day.

VEIC's research identified one commercially available Class 8 AEV bucket truck (the Terex HR55 EV Aerial Truck[14]) and Class 8 Street Sweeper (the Battle Motors Elgen Broom Bear Electric Street Sweeper[15]). Both are still in pilot deployments with large municipalities or utilities and have considerably higher purchase prices relative to their diesel counterparts. VEIC is not aware of any commercially available heavy-duty dump trucks at this time.

Due to greater weight and power demands, medium and heavy-duty trucks require larger batteries than existing light-duty all-electric vehicles. As battery prices continue to decrease in the coming decade, vehicle type diversity, availability and demand will increase. We expect capital costs for these vehicles will also decrease, bringing their total lifetime costs closer to equivalent gasoline or diesel vehicles.[16]

Milford should plan to monitor the AEV market over the next several years for all light, medium and heavy-duty vehicle types recommended for replacement during Phase Two, and update procurement plans annually based on market developments. The EV market is currently developing rapidly, and it is possible that several vehicle types that are not currently available or financially feasible may become so sooner than currently expected.

[14] Terex Electric Vehicle (EV) | Terex Utilities
[15] Elgin Broom Bear – Battle Motors
[16] Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis (nrel.gov)

Charging Stations

We recommend that Milford install up to 53 charging station ports to support the recommended AEVs.

Each light and medium-duty AEV should have a dedicated Level 2 charging station port to ensure they are fully-charged each morning. If Milford chooses one or more PHEVs, each new PHEV can charge on dedicated Level 1 charger. However, because of their smaller batteries and reduced charging time, PHEVs could share ports if desired.

Each heavy-duty AEV should have a dedicated Level 3 or DC fast charging station port to ensure they are fully-charged each morning. Due to larger battery sizes, vehicle weight and use will require significantly more charging capacity necessary to operate daily including vehicles such as Milford's refuse, dump, and street sweeping trucks.

Note that the number and timing of AEV deployment may be limited by how many Electric Vehicle Supply Equipment (EVSE, aka Charging Stations) units can be deployed at overnight parking locations, and how quickly.

Location Selection

Milford fleet vehicles are parked in seven main locations across the municipality –Armory, City Hall, Customer Service, Police department, Parks and Recreation, Public Works, and Silicato Park. All identified replacement vehicles are parked overnight at each of these seven locations; however, only six of the seven locations will require Level 2 or 3 charging infrastructure. The smaller recommended AEV replacements such as motorcycles, mowers, and all-terrain utility vehicles can be charged using a standard 120V outlet (known as Level 1 charging) and so will require minimal infrastructure upgrades or costs.

Table 10 displays Milford's parking locations that require EVSE Level 2 and 3 infrastructure over Phase One and Two.

Parking Location	Phase One (2023-2026)	Phase Two (2027-2035)
Armory	1	6
City Hall	0	1
Customer Service	1	0
Police Department	9	1
Parks and Recreation	1	1
Public Works	3	29
Total	**15**	**38**

Table 10: Number of recommend EVSE Level 2 and 3 installations by location and phase

Many vehicles recommended for replacement during Phase One and Phase Two are parked at Public Works. Additionally, the Armory and Police department houses a significant portion of overnight vehicles in both phases.

We recommend Milford continue to work with the Delaware Municipal Electric Corporation (DEMEC) to assess existing electrical infrastructure and develop phased plans for any necessary infrastructure upgrades, as well as purchase and installation of charging stations, that align with the expected timing of vehicle replacements at these four main locations.

For example, Milford may wish to focus on planning for deployment of 15 (or more) charging station ports at Public Works, the Armory, City Hall, Customer Service, Police and Parks and Recreation parking areas in the next three to four years to accommodate expected Phase One vehicle replacements, while postponing detailed planning and site work for the 38 charging station ports expected to be needed until closer to Phase Two. Milford and DEMEC can assess and plan for overall fleet and facility-wide charging needs between all parking areas based on full fleet electrification by 2035 and determine whether any infrastructure upgrades (such as transformers, switchgears, panels or conduit runs) will need to be made in order to enable deployment of up to 53 charging station ports by 2035, and how these upgrades should be staged.

Alternatively, if Milford is planning facility upgrades in the near term that could streamline EVSE installation, then vehicle parking locations may be adjusted to provide lower-cost access to AEV replacements recommended in the first phase of implementation.

Note that these recommendations do not include consideration of additional charging stations for employee workplace charging. Milford may wish to assess during their EVSE planning process whether they would like to support employee personal EV adoption by providing workplace charging opportunities, and if so, whether this could be accomplished by making unoccupied fleet charging stations available to employee personal vehicles during the day, or

whether additional designated employee or guest charging stations should be deployed concurrently with Phase One or Two fleet charging stations.

EVSE Equipment

Power: We recommend that Milford consider mid-power Level 2 charging stations for most of their parking locations. All Level 2 charging stations operate on 240V power, and mid-powered units require 50-60A circuits while providing roughly 9 – 12 kW of charging power. For a standard-range Ford F-150 Lightning, these charging stations would be able to deliver 15-20 miles of range per hour of charging.

Milford may also wish to consider dual-port Level 2 charging stations that can run off a single 80A circuit and either deliver a slightly faster charge when one vehicle is plugged in, or a slightly slower charge when two vehicles are plugged in.

As Milford's electric fleet expands, and medium and heavy-duty electric trucks with larger batteries begin to be added, Milford will want to consider adding one or several higher-powered charging stations to enable faster charging of specific vehicles when needed. These options include:

- High-powered Level 2 charging stations - 240V alternating current (AC), requiring 100A circuits, while providing 19.2kW of charging power. Roughly 30 miles of range per hour of charging for standard range Ford F-150 Lightning.
- Medium-powered Level 3 Direct Current (DC) charging stations - typically either 240V (single phase) or 480V DC (three phase), 60A circuits, while providing up to 24kW of charging power. Roughly 40 miles of range per hour of charging for standard range Ford F-150 Lightning.
- High-powered Level 3 Direct Current (DC) charging stations - 480V DC, requiring three-phase power, while providing 50kW or more of charging power. This type of charging station may be necessary to ensure sufficient charging within available parked periods for Milford's refuse, dump, and streetsweeper replacement vehicles. Roughly 6-8 hours of overnight charging is needed to ensure a heavy-duty vehicle such as an all-electric refuse truck will be fully charged using 50-100kW power.

Features: To reduce annual operating costs and maximize lifetime AEV savings, we recommend that Milford select basic, lower-cost EVSE options with the following capabilities and design for their charging locations:

- Level 2 and 3 charging stations that are networked via WiFi. Milford would provide WiFi (if not already in place) rather than purchase cellular service that require additional service plans with monthly service charges.
- Level 2 and 3 charging stations that are networked and offer "managed charging" capability though a software management platform. This would enable Milford to reduce power demands (and electricity costs) when many vehicles are anticipated to be plugged in at the end of the day, while still ensuring all vehicles will be fully charged the following morning.
- Make any needed repairs on an as-needed basis, rather than paying higher upfront costs for extended warranties and maintenance plans. As-needed repairs are likely to be more cost-effective for chargers installed in non-public locations, which are less prone to damage from abuse.
- Wall-mounted charging stations with manual cable wraps will be more cost-effective than more expensive pedestal-mounted charging systems with integrated cord management.

If Milford's facilities are accessible only to staff and guests, their charging stations are less likely to encounter heavy use, misuse, or vandalism, making them ideal candidates for lower-cost, more basic EVSE. Charging infrastructure costs are detailed later in this report under Costs and Benefits of Electrification.

Electric Vehicle Incentives and Funding Programs:

There is significant policy activity at the state and federal level that could increase the availability of incentives or other funding for electric vehicles and charging equipment. Milford should pursue the following incentives to support EV and EVSE deployment and monitor for any additional opportunities that may become available.

Note that due to varying eligibility and program requirements, only the Energize Delaware Government EV Fleets and federal Commercial Clean Vehicle Credit incentives were included in the Phase One and Phase Two cost estimates provided above. If Milford can utilize the additional state and federal funding below, Phase One project-wide total cost of ownership savings may increase considerably.

State Funding

- Energize Delaware Grants for Local Government EV Fleets – $175,000 per municipality for police and other first-responder AEVs and related EVSE only. Limit of up to $80,000 MSRP

per vehicle. Requires EV feasibility study prior to application for more than three vehicles.[17]

- Alternative Fuel Vehicles Rebate – $2,500 per AEV, up to 6 vehicles. MSRP's not to exceed $50,000 to qualify. Administered by the Delaware Department of Natural Resources and Environmental Control (DNREC).[18]
- EV Charging Station Rebate Program– $2,500 for a single port charging station and $5,000 for dual port chargers. Limited to 10 ports (or 5 dual ports). Rebates are available for public access fleet and workplace charging. Rebates cover up to 60% of charging station for commercial projects and up to 80% for government and nonprofit projects. Administered by DNREC.[19]

Federal Funding

- Commercial Clean Vehicle Credit – Up to $7,500 for gross vehicle weight ratings (GVWRS) of under 14,000 pounds and $40,000 for all other vehicles. Businesses and tax-exempt organizations qualify for the credit. There is no limit on the number credits your entity can claim.[20]
- Alternative Fuel Infrastructure Tax Credit – up to $100,000 or 30% of the cost for electric fueling equipment. Or 6% in the case of property subject to depreciation.
    - Eligible projects that meet prevailing wage and apprenticeship requirements may be eligible to receive the full 30% tax credit, regardless of depreciation status. Permitting and inspection fees are not included in covered expenses.[21]
    - Qualified fueling equipment must be installed in locations that meet the following census tract requirements: (1) the census tract is not an urban area; (2) A population census tract where the poverty rate is at least 20%; or (3) Metropolitan and non-metropolitan area census tract where the median family income is less than 80% of the state medium family income level.

[17] https://www.energizedelaware.org/ev-fleets/

[18] https://afdc.energy.gov/laws/11638

[19] https://dnrec.alpha.delaware.gov/climate-coastal-energy/clean-transportation/ev-charging-equipment-rebates/

[20] https://www.irs.gov/credits-deductions/commercial-clean-vehicle-credit

[21] https://afdc.energy.gov/laws/10513

Implementation Plan

Table 11 lays out a possible project timeline for Milford.

Establish goals around EV replacement rates – Milford should determine how many of the recommended vehicles they intend to replace with EVs. This will provide staff with the support needed to develop budgets and schedule EV and EVSE deployment over the next three years.	**Q1 to Q2 2024**
Engage with DEMEC on EVSE installations – DEMEC staff will be able to advise on specific site considerations (including electric rate structure and demand), qualified vendors, and EVSE.	
Work with DEMEC, proceed with EVSE purchase and installation to support planned specific AEVs.	**Q2 to Q3 2024**
Schedule specific EV acquisitions to coincide with or shortly follow planned EVSE availability – AEVs require operational charging stations, and procurement/delivery should be coordinated with EVSE deployment.	
Procure EVs – Review and confirm any available vehicle purchase incentives, and investigate procurement options, especially if seeking to procure multiple identical EVs at a discount.	
Deploy EVs (ongoing)	**Q3 to Q4 2024**
Evaluate performance and purchase additional EVs as appropriate (ongoing) – following initial EV and EVSE deployments, staff can evaluate the performance of the various EVs to ensure they are meeting operational needs and achieving predicted cost savings, which will lay the groundwork for wider EV deployment in future years.	**Q1 2025+**

Table 1110: Proposed project implementation timeline for Milford's EV and EVSE deployment.

Costs and Benefits of Electrification

Replacing gasoline-powered fleet vehicles with AEVs will increase capital costs for vehicle purchases and charging station deployment but should result in lower annual operating costs and overall lifetime total cost of ownership in most cases, along with significant emissions reductions.

Vehicle Costs

AEVs currently cost more than their fossil fuel counterparts, with a typical price premium of around $8,000-$10,000 for light-duty vehicles and often greater premiums for medium and heavy-duty vehicles. However, AEVs achieve operational energy and maintenance savings relative to conventional gasoline vehicles over their lifetime. AEVs have fewer moving parts requiring less maintenance. Their electric motors and regenerative braking capability enable them to operate much more efficiently than gasoline-powered internal combustion engine vehicles. PHEVs generally achieve smaller fuel cost savings than AEVs (depending on how much

of their travel is in electric-only mode) but achieve only marginal maintenance savings, as they contain both electric and conventional powertrains which require regular maintenance.

In addition, Milford's cost of electricity is roughly equivalent to $1.16 per gallon of gas on a kWh basis, compared with DE average pricing (June 2023) of approximately $3.37 per gasoline gallon and $3.67 per diesel gallon[22]. Table 12 presents example per-vehicle budgetary estimates for EV planning purposes. (Methodology and assumptions are documented in Appendix C – Methodology).

Vehicle Recommendations	Chevrolet Bolt replacing Gasoline Sedan	Ford F 150 Lightning replacing LD Gasoline Pickup Truck	AEV Zero Turn Commercial Turf replacing Gasoline Mowers	Chevrolet Bolt replacing Gasoline Police Sedan	Ford Mustang Mach E-(AWD) replacing Gasoline Police SUV
One-time Upfront Capital Costs					
Purchase Premium	$7,000	$5,505	-$7,500	$7,000	-$18,925
EVSE Capital Cost	-$6,356	-$6,356	-$380	-$6,356	-$6,356
Total Upfront Cost	$644	-$851	-$7,880	$644	-$25,281
Annual Operating Costs					
Electricity/Fuel Cost	-$174	-$516	-$238	-$287	-$601
Avoided Vehicle Maintenance	$279	$486	$43	$460	$772
Avoided Fuel Cost	$375	$939	$794	$618	$1,454
EVSE Operating & Maintenance Costs	-$637	-$637	$0	-$637	-$637
Total Annual Operating Cost Savings	$18	$787	$837	$441	$1,589
Lifetime Savings					
Lifetime Operating Cost Savings	$231	$8,986	$9,470	$5,438	$17,881
Net Lifetime Savings	$875	$8,134	$1,590	$6,082	-$7,400

Table 1211: Example-per vehicle EV capital and operating budgetary estimates

When calculating total cost of ownership for AEVs, expected investments in the charging infrastructure needed for them to operate are factored in to provide a more complete picture of overall costs and savings.

[22] AAA Gas Prices

Energy Costs

Because electric vehicles are considerably more efficient than conventional vehicles, per-vehicle annual energy savings are predicted to range from $400 to over $1,400 based on per-kWh electricity rates.

However, AEVs can draw enough power while charging to increase monthly electricity demand charges for the facility where they are charged. This is most likely to occur at facilities that have steady electricity demand throughout the day and night, and where multiple EVs are charged at the same time.

For example, Milford's recommended fullsize pickup replacements are anticipated to consume roughly 4,600 kWh of electricity per vehicle per year, assuming they travel 8000 miles/year. The recommended Ford F-150 Lightning Pro draws up to 11.3 kW of power when charging with its standard onboard charger.

Milford's electric rate class was assumed to be Small General Service Schedule (SGS)[23] for their various buildings and parking facilities. SGS is a General Services rate, with volumetric energy costs ($/kWh) of $0.11 and no demand charges. However, as Milford's EV deployments increase, it is possible that certain facilities may be shifted to the Medium General Service Schedule, which has a lower volumetric rate ($0.05/kWh) but a demand cost of $16.20/kW.

Demand charges could add approximately $1,900-$2,200 in annual electricity costs per AEV pickup for charging if not properly managed. These demand charges were not included in the total cost of ownership estimates in this report.

The roughly 4,600 kWh of electricity consumption at a rate of $0.11/kWh would cost roughly $510 per year (which is included in the TCO estimates in this report) – or $230/year if on the MGS schedule. If the AEV pickup was charged when the facility electricity demand was already at its highest point, the overall electricity demand of the facility would increase by up to 11.3 kW. If this occurred at a facility that was under Milford's MGS schedule, during off-peak hours, this would result in a demand charge of $2,200 annually.

To minimize these potential costs:

- Work with DEMEC and/or Efficiency Smart to analyze rate structure, current electricity demand and costs and potential measures to reduce the impact of EV charging activity on facility demand peaks.
- Use networked EVSE with capability to modulate charging to reduce power demand while ensuring vehicles are fully charged when needed

[23] https://www.cityofmilford.com/DocumentCenter/View/4948/2023-2026-Electric-Rates

- Schedule charging to occur when facility demand is lowest during both peak and off-peak hours.

Charging Infrastructure Costs

Charging infrastructure costs can vary considerably based on charging station power, features, and amenities. VEIC's analysis assumes low-end costs for EVSE. Note that expenses will increase with higher-end, fully featured options that include extended warranties, maintenance contracts, higher annual network fees and more consumer-oriented optional amenities (such as cable management, pedestal mounts and user payment interfaces). Table 13 lays out general EVSE costs estimates by EVSE type, which are based on national average default values provided by Argonne National Laboratory's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool[24].

Per Port	Level 1 Single Station	Level 2 Parking Garage	Level 2 Curbside Single Station	DC Fast: 50 kW
Purchase Cost	$380	$2,500	$2,500	$27,900
Installation Cost	$0	$3,856	$7,000	$62,700
Annual Maintenance	$0	$250	$250	$14,790
Annual Network Fees	$0	$387	$387	$387
Total Cost (rounded)	**$380**	**$6,995**	**$10,135**	**$105,775**

Table 13 12: Comparative Costs of Basic 1,2 and 3 Networked Charging Stations (Per Port)

VEIC utilized the "Parking Garage" defaults for Milford's recommended EVSE and vehicle TCO calculations.

Installation costs are highly variable based on many site-specific considerations, such as whether existing electrical infrastructure needs to be upgrade and/or run to a new location, and whether trenching will be required. Table 13 provides a placeholder Level 1, 2 and 3 basic charging station installation costs. Most of Milford's fleet will benefit from a Level 2 charger which roughly costs $7,000 per port for high-level planning purposes, but those costs at specific sites could vary between $1,000 to over $10,000 per port for installation (depending on the complexity/difficulty).

Medium-powered DC fast chargers (25kW) are more expensive ($10,000-$15,000 for more basic equipment to more than $40,000 for larger, more powerful stations, and typically $50,000 or greater for high-powered DC fast charging stations (50kW or greater).

[24] https://greet.es.anl.gov/afleet_tool

Medium and high-powered charging stations have considerably higher installation costs due to more robust electrical infrastructure requirements (such as 480V, three-phase power supply). These costs can range $4,000 to $15,000 per port on the lower end to over $50,000 for larger and more complex projects.

Note that VEIC assumes an anticipated charging station unit lifespan of 10 years, and a lifespan of 25 years for the electrical infrastructure supporting the charging station (circuits, wires, conduit, panel, concrete pad, etc.).

EVSE Equipment Costs

Level 2 charging stations can range in price from about $1,500 per port up to $5,000 per port. For charging at Milford's limited-access facilities, lower-cost, more basic EVSE should suffice. Instead of pedestal-mounted systems with integrated cord management, Milford should seek wall-mount units with manual cord wraps to maximize cost-savings.

Figure 1. L to R - Single wall-mounted EVSE (Juicebox, ChargePoint); Dual pedestal-mounted EVSE (ChargePoint)

EVSE Operating Cost

Networked charging can provide numerous benefits, such as the ability to manage charger access and user fees, station, and energy use analysis, as well as minimize electricity demand charges through automated "managed charging" protocols. Annual network fees can be substantial. Lower-cost options are available if Milford can provide site WiFi.

Maintenance contracts pushed by vendors can be expensive and are generally not cost-effective for protected, private EVSE. Milford should either negotiate for a very low-cost maintenance contract for their new stations or plan to assign Milford staff to check EVSEs for damage quarterly. If any locations are accessible to the public and subject to vandalism, they may warrant consideration of service contracts.

Lifetime Cost-Savings

Based on known data, each of the following figures demonstrate Milford's fleet total cost of ownership (TCO) for replacement with AEVs and highlight potential **lifetime operating savings for their Phase One vehicles of at least $213 per vehicle** to justify the higher initial capital investment into vehicle and charging station costs, after taking incentives into account. Figures 2, 3 and 4 presents a visualization of simple total cost of ownership, assuming low-end EVSE costs and average annual mileage by vehicle type.

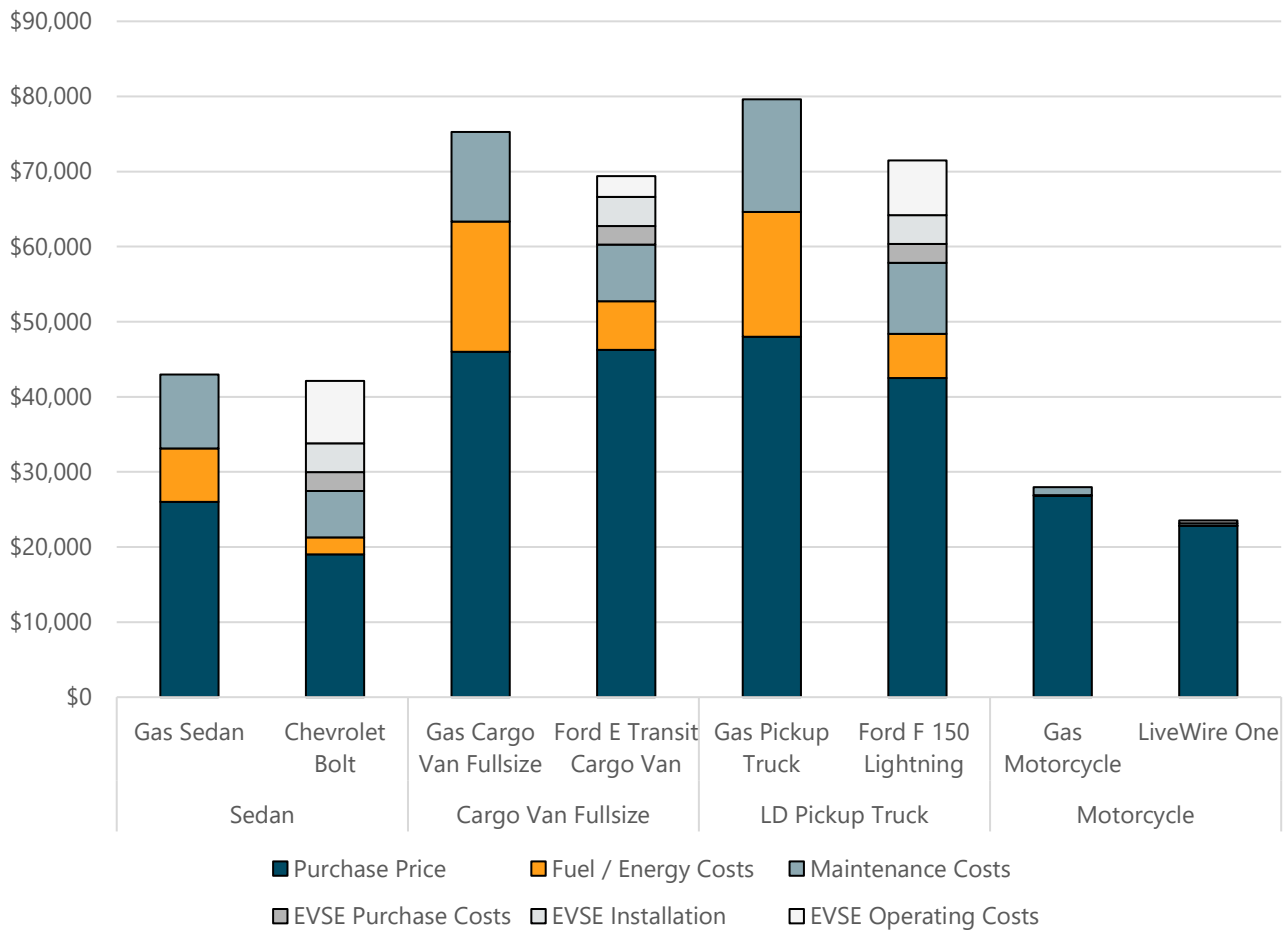


Figure 2: Lifetime total cost of ownership for Chevrolet Bolt, Ford E Transit Cargo Van, Ford F-150 Lightning, and LiveWire One AEVs replacing gasoline-powered sedan, full-size cargo vans, light-duty pickup trucks, and motorcycle equivalents.

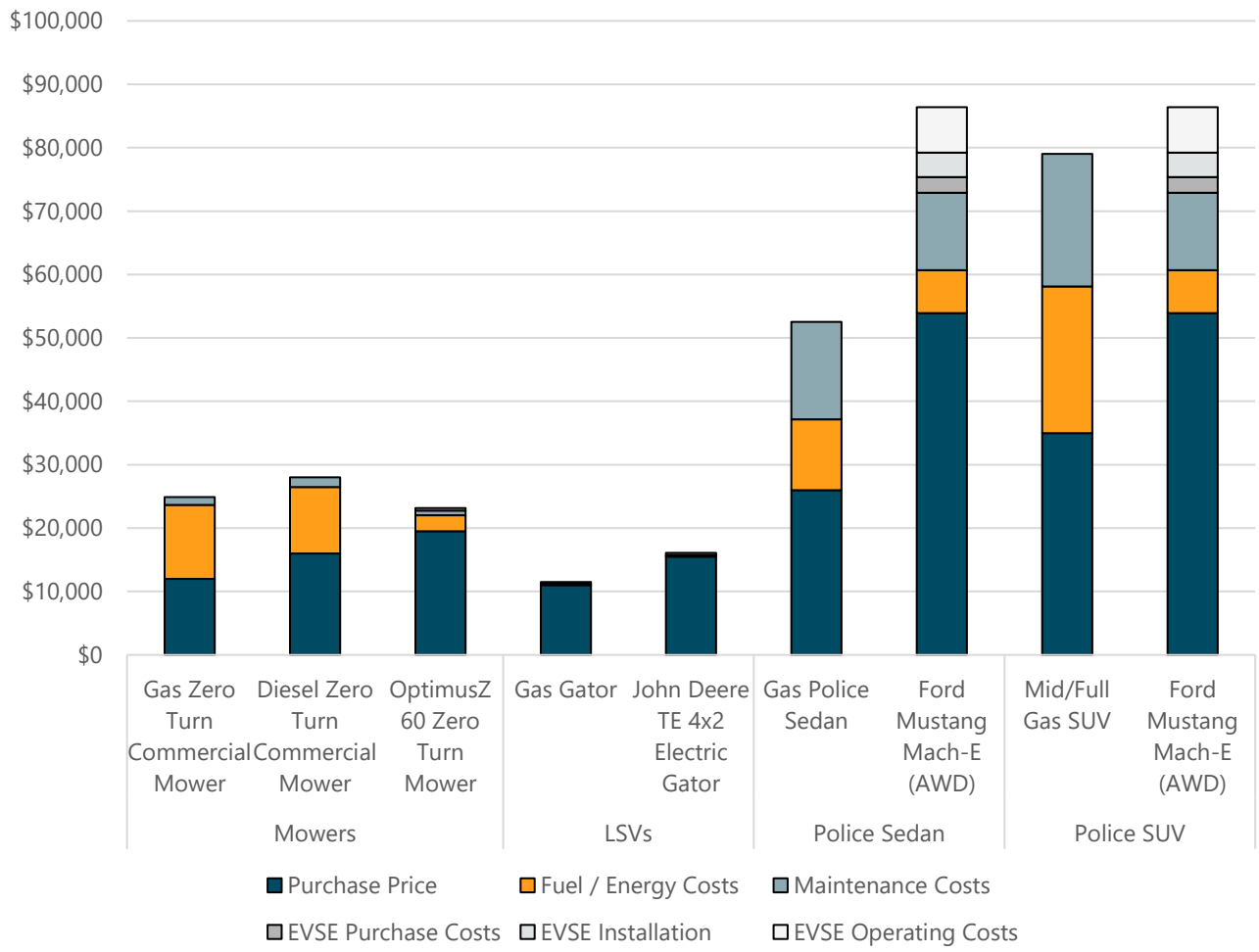


Figure 3: Lifetime total cost of ownership for Greenworks OptimusZ 60 Zero Turn commercial mower, John Deere TE 4X2 Electric Gator, Ford Mustang Mach-E (AWD) replacing gasoline and diesel-powered commercial mowers, low-speed vehicles, police sedans and police SUV equivalents.

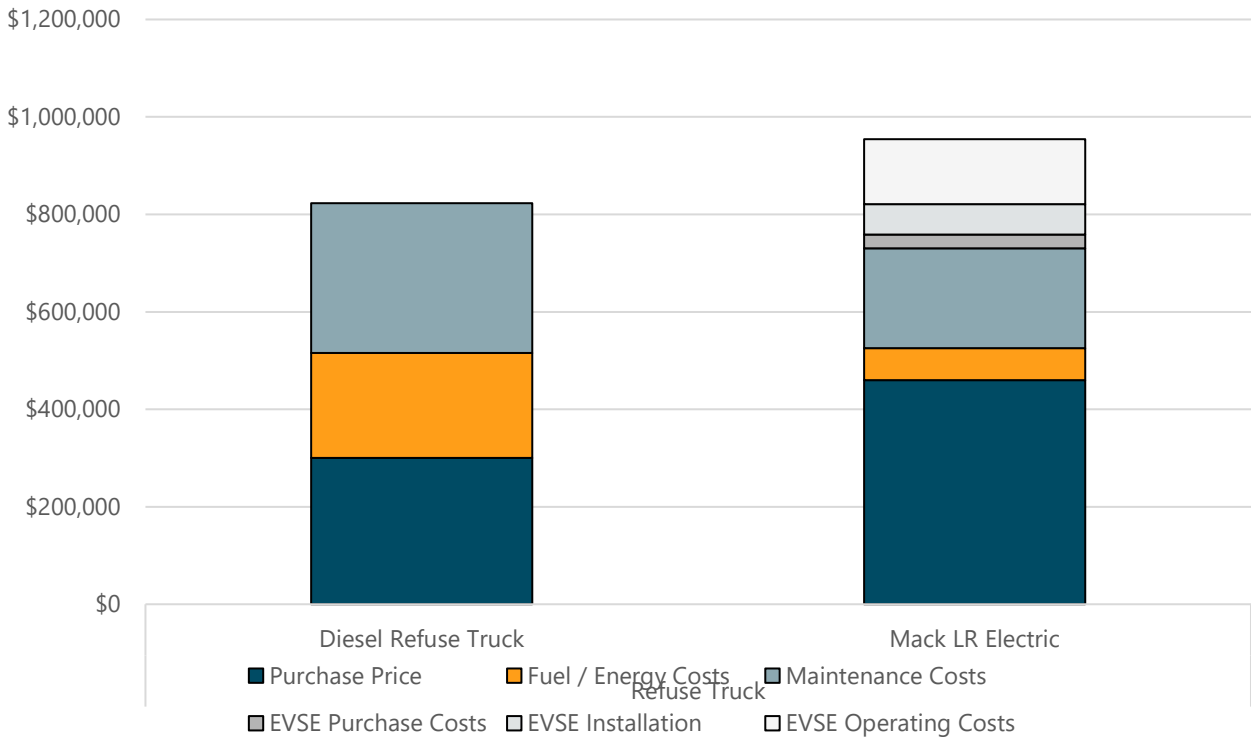


Figure 4: Lifetime total cost of ownership for Mack LR Electric commercial refuse truck replacing diesel-powered commercial refuse truck equivalent.

AEV replacements for Milford's fleet are based on the assumptions identified and outlined in the Milford Existing Conditions slide deck and include vehicle type average annual miles traveled and lifetime age as a main factor in determining final estimates listed in figures 2, 3, and 4. Estimated lifetime savings of each vehicle are a result of lower fuel/energy costs and maintenance costs when switching to AEVs, and include the federal Commercial Clean Vehicle Credit incentives factored into the purchase price where applicable.

Note that not all identified vehicles for AEV replacement currently generate a lower lifetime cost of ownership. This is due to significantly higher estimated MSRPs for certain medium and heavy-duty vehicles. As vehicle and battery technology continues to evolve overall costs are projected to decrease considerably, making these types of vehicles more affordable.

Appendices

Appendix A – EV Candidates

Recommended EV Candidates: Phase One vehicles to be replaced by 2026

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
CS Lot	C/S	Car	Toyota	Camry	2011	1	6,567	less than 50	$875	F-001
PD Lot	Police	Car	Dodge	Stratus	2006	1	3,516	100-200	$875	5127
PR Lot	Parks & Recreation	Cargo Van - Fullsize	Ford	Econoline Van	2014	1	812	less than 50	$5,868	PR-006
PW Lot	PW-Water	Cargo Van - Fullsize	Dodge	Sprinter 3500 Cargo Van	2006	1	626	less than 50	$5,868	W-029
Armory	Parks & Recreation	Light-Duty Pickup	Dodge	Ram 1500 Pickup	2017	1	8,878	less than 50	$8,134	PR-041
PD Lot	Police	Light-Duty Pickup	Dodge	Ram	2004	1	8,352	100-200	$8,134	5185
PW Lot	PW-Electric	Light-Duty Pickup	Dodge	Ram 1500 Pickup Quadcab	2017	1	15,026	less than 50	$8,134	E-101
PD Lot	Police	Motorcycle	Harley Davidson	Motorcycle	2004	1	88	100-200	$4,403	5196
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Stand Up Mower, Z-Turn	2019	1	900	less than 50	$1,590	PR-050
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Stand Up Mower, Z-Turn	2019	1	900	less than 50	$1,590	PR-051
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Mower	2004	1	900	less than 50	$4,840	PR-018

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower	2013	1	900	less than 50	$4,840	PR-008
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower	2015	1	900	less than 50	$4,840	PR-020
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2	2004	1	50	less than 50	-$4,602	PR-013
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2	1999	1	50	less than 50	-$4,602	PR-010
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2 (Cemetery)	2007	1	50	less than 50	-$4,602	PR-029
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator	1989	1	50	less than 50	-$4,602	PR-034
PD Lot	Police	Off-Road Equipment - Small	John Deere	Gator	2016	1	50	less than 50	-$4,602	5184
PW Lot	PW-Sewer	Off-Road Equipment - Small	Kubota	Lawn Mower	1994	1	900	less than 50	$4,840	SE-019
PW Lot	PW-Sewer	Off-Road Equipment - Small	Kubota	Mower F3060	2011	1	900	less than 50	$4,840	SE-010
PW Lot	PW-SEWER	Off-Road Equipment - Small	Kubota	Mower w/plow	2015	1	900	less than 50	$4,840	SE-025
PD Lot	Police	Police Car	Ford	Crown Victoria	2010	1	8,638	100-200	-$34,071	5104
PD Lot	Police	Police Car	Ford	Crown Victoria	2011	1	9,321	100-200	-$34,071	5108
PD Lot	Police	Police Car	Ford	Crown Victoria	2011	1	6,941	100-200	-$34,071	5114
PD Lot	Police	Police SUV	Ford	Expedition SUV	2010	1	6,824	100-200	-$7,400	5101
PD Lot	Police	Police SUV	Ford	Expedition SUV	2011	1	10,544	100-200	-$7,400	5109

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PD Lot	Police	Police SUV	Ford	Expedition SUV	2013	1	13,301	100-200	-$7,400	5123
PD Lot	Police	Police SUV	Ford	Expedition SUV	2013	1	14,896	100-200	-$7,400	5118
PW Lot	PW-Solid Waste	Refuse Truck	Freightliner	Trash Truck	2017	1	10,645	50-100	-$91,179	SW-011

Table A- 1: Phase One vehicle candidates

Recommended EV Candidates: Phase Two vehicles to be replaced by 2035

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	PW-Electric	Car	Toyota	Corolla Hybrid	2020	1	1,562	less than 50	-$3,952	E-105
PD Lot	Police	Cargo Van - Fullsize	Ford	Econoline Van	2013	1	812	100-200	$5,868	5195
PW Lot	PW-Water	Cargo Van - Fullsize	Ford	Transit Van	2017	1	10,975	less than 50	$5,868	W-028
PW Lot	PW-Water	Cargo Van - Fullsize	Ford	Transit Van	2020	1	6,604	less than 50	$5,868	W-014
Armory	Parks & Recreation	Light-Duty Pickup	Dodge	Ram 1500 Pickup	2017	1	8,878	less than 50	$8,134	PR-015
Armory	Parks & Recreation	Light-Duty Pickup	Ford	F250 Pickup	2018	1	8,878	less than 50	$8,134	PR-022
PR Lot	Parks & Recreation	Light-Duty Pickup	Ford	2021 F-150	2021	1	8,878	less than 50	$8,134	PR-001
PW Lot	Planning & Econ Dev	Light-Duty Pickup	Chevrolet	Colorado Ext Cab Pickup	2020	1	5,375	less than 50	$8,134	PZ-001

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	Planning & Econ Dev	Light-Duty Pickup	Ford	2021 F150 Pickup, Supercab 4x4	2021	1	3,189	less than 50	$8,134	pz-002
PW Lot	Public Works	Light-Duty Pickup	Chevrolet	Colorado	2022	1	8,092	less than 50	$8,134	PW-01
PW Lot	PW-Garage	Light-Duty Pickup	Ford	F250 Pickup	2015	1	4,602	less than 50	$8,134	G-001
PW Lot	PW-Sewer	Light-Duty Pickup	Ford	F350 Super Cab Pickup	2016	1	10,788	less than 50	$8,134	SE-003
PW Lot	PW-Technical Services	Light-Duty Pickup	Chevrolet	Colorado Crew Box Truck	2018	1	7,062	less than 50	$8,134	TS-003
PW Lot	PW-Technical Services	Light-Duty Pickup	Chevrolet	Colorado Crew Cab Pickup	2020	1	10,724	less than 50	$8,134	TS-002
PW Lot	PW-Technical Services	Light-Duty Pickup	Ford	F150 Pickup, Supercab	2020	1	3,400	less than 50	$8,134	TS-001
PW Lot	PW-Water	Light-Duty Pickup	Chevrolet	Colorado Ext Cab Pickup	2019	1	8,784	less than 50	$8,134	W-004
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Crew Cab Dump Body	2022	1	8,364	less than 50	$17,019	PR-003
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Pickup	2006	1	8,364	less than 50	$17,019	PR-023
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Crew Cab Pickup	2019	1	8,364	less than 50	$17,019	PR-005

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	Planning & Econ Dev	Medium-Duty Pickup Truck	FORD	2022 F350	2019	1	4,120	less than 50	$17,019	PZ-003
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	148 F250 4x4 Supercab SRW	2020	1	8,714	less than 50	$17,019	E-115
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	F450 Crew Cab Dump Body	2022	1	3,439	less than 50	$17,019	E-108
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	F550 Dump Truck	2018	1	7,292	less than 50	$17,019	E-112
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F250 Pickup	2012	1	7,042	less than 50	$17,019	S-002
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F450 Pickup	2015	1	13,439	less than 50	$17,019	S-023
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F350 Super Cab Pickup	2019	1	7,849	less than 50	$17,019	S-001
PW Lot	PW-Water	Medium-Duty Pickup Truck	Ford	F450 Dump Truck	2011	1	3,515	less than 50	$17,019	W-008
PW Lot	PW-Water	Medium-Duty Pickup Truck	Ford	F250 Pickup	2019	1	8,499	less than 50	$17,019	W-003
PD Lot	Police	Motorcycle	Harley Davidson	FLHTP	2021	1	87	100-200	$4,403	5197
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Z-Turn Mower	2020	1	900	less than 50	$1,590	PR-052

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
Armory	Parks & Recreation	Off-Road Equipment - Small	Ventrac	Finish Mower, 72"	2018	1	900	less than 50	$1,590	PR-045
Silicato	Parks & Recreation	Off-Road Equipment - Small	Ventrac	Tough Cut Mower	2018	1	900	less than 50	$1,590	PR-046
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	2023 ZD1211L-3-72, Z-turn 72"	2021	1	900	less than 50	$4,840	PR-011
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower, Work Light Kit, Blade	2013	1	900	less than 50	$4,840	PR-039
City Hall	Info Tech	SUV	Toyota	Rav 4 Hybrid	2021	1	3,235	less than 50	-$2,561	IT-001
PW Lot	Public Works	SUV	Toyota	Rav 4 Hybrid	2021	1	3,607	less than 50	-$2,561	PW-02
PW Lot	PW-Electric	SUV	Toyota	Rav 4 Hybrid	2019	1	3,049	less than 50	-$2,561	E-106
PW Lot	PW-Electric	Bucket/Aerial Truck	International	Bucket Truck	2018	1	5,993	less than 50	-$448,551	E-109
PW Lot	PW-Electric	Bucket/Aerial Truck	International	Bucket Truck	2018	1	2,265	less than 50	-$448,551	E-102
PW Lot	PW-Electric	Bucket/Aerial Truck	International	2021 Bucket Truck	2021	1	6,194	less than 50	-$448,551	E-103
Armory	PW-Electric	Dump Truck	International	Truck	2021	1	28,775	less than 50	-$411,002	E-111
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, w/Sprayer	2013	1	50	less than 50	-$4,602	PR-024
PW Lot	PW-Solid Waste	Refuse Truck	Peterbuilt	Trash Truck	2018	1	12,579	50-100	-$91,179	SW-028
PW Lot	PW-Solid Waste	Refuse Truck	Mack	Trash Truck, Rear & Side Loader	2020	1	10,108	50-100	-$91,179	SW-012

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	PW-Streets	Street Sweeper	Freightliner	Street Sweeper	2018	1	3,163	less than 50	-$567,027	S-007

Table A- 2: Phase 2 vehicle candidates

Appendix B – Vehicle Lifetime Total Cost of Ownership and Emissions of Phase One Vehicles

The following tables display estimated lifetime total cost of ownerships for each vehicle type replacement identified in Phase One. All purchase price estimates in each table includes applied incentives and are not reflective of original AEV MSRPs.

	Gas Sedan	Chevrolet Bolt
Purchase Price	$26,000	$19,000
Fuel / Energy Costs	$7,141	$2,263
Maintenance Costs	$9,832	$6,198
EVSE Purchase Costs	$0	$2,500
EVSE Installation	$0	$3,856
EVSE Operating Costs	$0	$8,281
Total	$42,973	$42,098

Table B- 1. Sedan: Lifetime total cost of ownership for AEV sedans compared to equivalent gasoline sedans

	Gas Cargo Van Full-Size	Ford E Transit Cargo Van
Purchase Price	$46,000	$46,245
Fuel / Energy Costs	$17,336	$6,489
Maintenance Costs	$11,935	$7,524
EVSE Purchase Costs	$0	$2,500
EVSE Installation	$0	$3,856
EVSE Operating Costs	$0	$2,789
Total	$75,271	$69,403

Table B- 2. Full-size Cargo Van: Lifetime total cost of ownership for AEV full-size cargo vans compared to equivalent gasoline full-size cargo vans

	Gas Pickup Truck	Ford F 150 Lightning
Purchase Price	$48,000	$42,495
Fuel / Energy Costs	$16,602	$5,887
Maintenance Costs	$15,000	$9,457
EVSE Purchase Costs	$0	$2,500
EVSE Installation	$0	$3,856
EVSE Operating Costs	$0	$7,272
Total	$79,601	$71,467

Table B- 3. Light-Duty Trucks: Lifetime total cost of ownership for AEV light-duty pickup trucks compared to equivalent gasoline pickup truck

	Gas Motorcycle	LiveWire One
Purchase Price	$26,799	$22,799
Fuel / Energy Costs	$103	$23
Maintenance Costs	$1,049	$346
EVSE Purchase Costs	$0	$380
EVSE Installation	$0	$0
EVSE Operating Costs	$0	$0
Total	$27,951	$23,548

Table B- 4. Motorcycle: Lifetime total cost of ownership for AEV motorcycle compared to equivalent gasoline motorcycle

	Gas Zero Turn Commercial Mower	Diesel Zero Turn Commercial Mower	OptimusZ 60 Zero Turn Mower
Purchase Price	$12,000	$16,000	$19,500
Fuel / Energy Costs	$11,670	$10,466	$2,541
Maintenance Costs	$1,222	$1,528	$733
EVSE Purchase Costs	$0	$0	$380
EVSE Installation	$0	$0	$0
EVSE Operating Costs	$0	$0	$0
Total	$24,892	$27,994	$23,154

Table B- 5. Mowers: Lifetime total cost of ownership for AEV commercial mower compared to gasoline and diesel commercial mowers

	Gas Gator	John Deere TE 4x2 Electric Gator
Purchase Price	$11,000	$15,500
Fuel / Energy Costs	$187	$41
Maintenance Costs	$329	$198
EVSE Purchase Costs	$0	$380
EVSE Installation	$0	$0
EVSE Operating Costs	$0	$0
Total	$11,517	$16,118

Table B- 6. All Terrian Utility Vehicle: Lifetime total cost of ownership for AEV ATUV compared to gasoline ATUV

	Gas Police Sedan	Ford Mustang Mach-E (AWD)
Purchase Price	$26,000	$53,925
Fuel / Energy Costs	$11,154	$6,761
Maintenance Costs	$15,355	$12,200
EVSE Purchase Costs	$0	$2,500
EVSE Installation	$0	$3,856
EVSE Operating Costs	$0	$7,166
Total	$52,509	$86,408

Table B- 7. Police Sedan: Lifetime total cost of ownership for AEV police sedan compared to gasoline police sedan

	Mid/Full Police Gas SUV	Ford F 150 Lightning Pro (Extended Battery)
Purchase Price	$35,000	$62,495
Fuel / Energy Costs	$23,120	$8,198
Maintenance Costs	$20,889	$9,457
EVSE Purchase Costs	$0	$2,500
EVSE Installation	$0	$3,856
EVSE Operating Costs	$0	$7,272
Total	$79,008	$90,874

Table B- 8. Police SUV: Lifetime total cost of ownership for AEV police light-duty pickup truck compared to gasoline mid/full-size SUV

	Diesel Refuse Truck	Mack LR Electric
Purchase Price	$300,000	$460,000
Fuel / Energy Costs	$215,877	$65,743
Maintenance Costs	$307,192	$204,795
EVSE Purchase Costs	$0	$27,900
EVSE Installation	$0	$62,700
EVSE Operating Costs	$0	$133,110
Total	$823,069	$954,248

Table B- 9. Refuse Truck: Lifetime total cost of ownership for AEV refuse truck compared to diesel refuse truck

Emissions: Total lifetime greenhouse gas and criteria air pollutant emissions for Phase One AEV vehicle recommendations compared to gasoline and diesel vehicles.[25] Note that tire and brake wear (TBW) produce PM emissions for all vehicles.

Total Petroleum and Emission Reduction					
	Units	ICE	AEV	Savings	% Reduction
LD Petroleum Use	Short Tons	17,565	110	17,455	99%
LD GHGs	lbs	9,722	4,045	5,676	58%
CO	lbs	45,248	-	45,248	100%
NOx	lbs	8,828	-	8,828	100%
PM10	lbs	623	537	86	14%
PM2.5	lbs	156	72	84	54%
VOC	lbs	1,414	-	1,414	100%
SOx	lbs	118	-	118	100%

Table B- 10. Total lifetime emission reduction for Phase One vehicles

[25] Motorcycle emissions were not included in emissions analysis due to relatively low lifetime mileage.

Appendix C – Methodology

Fuel Costs

Fuel cost is Milford's estimated fuel cost based on DE average fuel pricing (June 2023) of approximately $3.37 per gasoline gallon and $3.67 per diesel gallon[26].

Electricity Costs

Milford's electric rate class was assumed to be Small General Service Schedule (SGS)[27] for their various buildings and parking facilities. SGS is a standard commercial rate, with volumetric energy costs ($/kWh) and customer services charge set to specific rates per year. Current rates are set to:

All Customers charge: $30.00

All Energy charge (kWh): $0.10918

VEIC estimated that approximately 80% of Milford's EV charging will occur during off-peak hours between 11pm and 6am, with 20% occurring during the day on weekdays (to account for any midday charging opportunities that Milford may choose to utilize). VEIC used SGS year one rate of $0.10918/kWh to reflect this anticipated charging approach, and used this rate for all TCO calculations.

Demand charges associated with EV charging were not estimated or incorporated into TCO analyses or results.

Avoided Maintenance Costs Through Electrification

EV's offer fleets operational savings achieved through reduced fueling and maintenance costs. Based on our analysis, we estimate maintenance savings of 35% for AEVs relative to gasoline and diesel vehicles. Vehicles are assumed to be replaced at vehicle type-specific age lifetime thresholds based on Milford's current fleet operating practices. Current vehicle fuel and maintenance costs were estimated based on defaults utilized from Argonne National Laboratory's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool[28], which also provided additional defaults for replacement vehicles.

[26] AAA Gas Prices
[27] https://www.cityofmilford.com/DocumentCenter/View/4948/2023-2026-Electric-Rates
[28] https://greet.es.anl.gov/afleet_tool

Emissions

Gasoline pollutant emissions are from Argonne National Laboratory's GREET model.[29] Electricity greenhouse gas data is from the EPA's Emission Factors for Greenhouse Gas Inventories[30]

[29](24 lbs CO_{2eq} /gallon gasoline) https://greet.es.anl.gov/

[30] (981 lbs CO_{2eq} / MWh electricity for the New England Region) https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

City of Milford Electric Vehicle Fleet Study - Final Presentation

Benjamin Lake

February 2024

Driven by purpose, committed to impact

VEIC is on a mission to generate the energy solutions the world needs.

- VEIC works with organizations across the energy landscape to create immediate and lasting change
- We serve as an objective partner for our clients as they navigate complex energy challenges
- Every challenge is different, but our commitment is the same: make an impact

Agenda

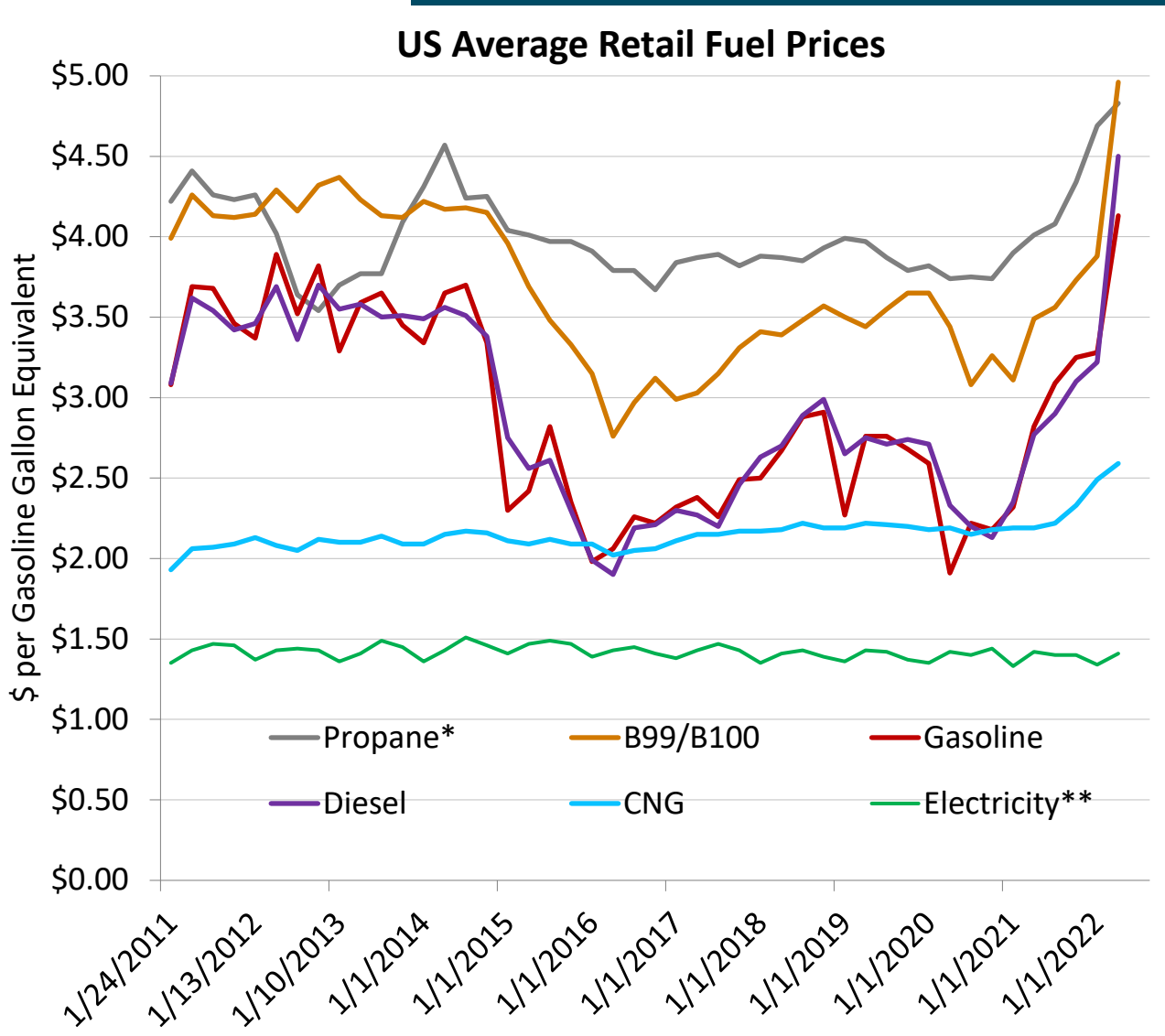
- Background
- EV Study Findings
- Recommendations
- Questions

Background

- Energize Delaware Grants for Local Government EV Fleets Program
  - Feasibility Studies
  - Qualifying Electric Vehicles
  - Charging Stations, Utility Upgrades, Installations and Related Costs
- Study of City of Milford's fleet for EV deployment over next ~3-12 years

Benefits of EVs

- Cheaper to run
  - Electric vehicles are less expensive to fuel, more efficient, and have lower maintenance costs compared to gasoline and diesel
- Longer maintenance intervals
- Fuel price stability
- Better for the environment, staff and public health



*Electricity prices are reduced by a factor of 3.5 because electric motors are approximately 3.5 times as efficient as internal combustion engines

Other Considerations

- Winter Performance
  - Traction – better than most front-wheel drive vehicles due to evenly-distributed battery weight; some models available with AWD
  - Range – can decrease as much as 40% on coldest days
- Safety
  - EVs are generally safer than conventional vehicles – larger, more robust crumple zones, and dramatically lower risk of fire vs. gasoline

Study Approach

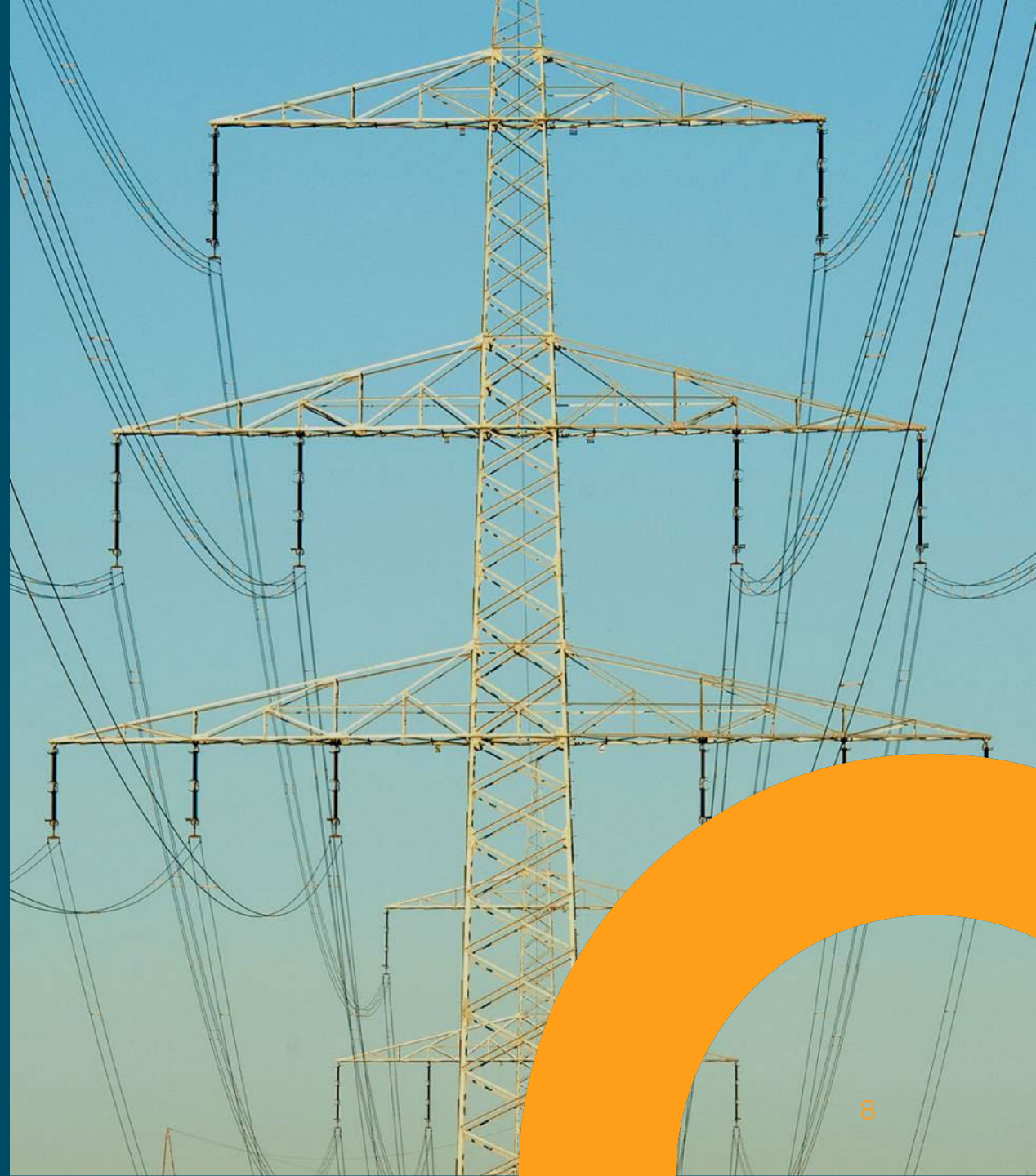
Vehicle Fleet

- Observed: Fleet composition, age, current odometer
- Estimated: vehicle lifetime, fuel consumption, annual mileage, daily max mileage
- Defaults: fuel economy and per-mile maintenance costs
- Operational needs
- Vehicles identified for near-term replacement

Facilities

- Parking Locations

Study Findings



Overview

Current Fleet

- 108 vehicles & mowers identified by Milford for inclusion in fleet analysis
- 7 overnight parking locations
- Milford owns entire fleet

74 light and medium-duty vehicles are preliminary candidates for electrification using the following criteria:

- Known or anticipated market availability of comparable plug-in options, and
- Anticipated vehicle replacement by end of 2026 (Phase 1) and 2035 (Phase 2)

Operational Details and Considerations

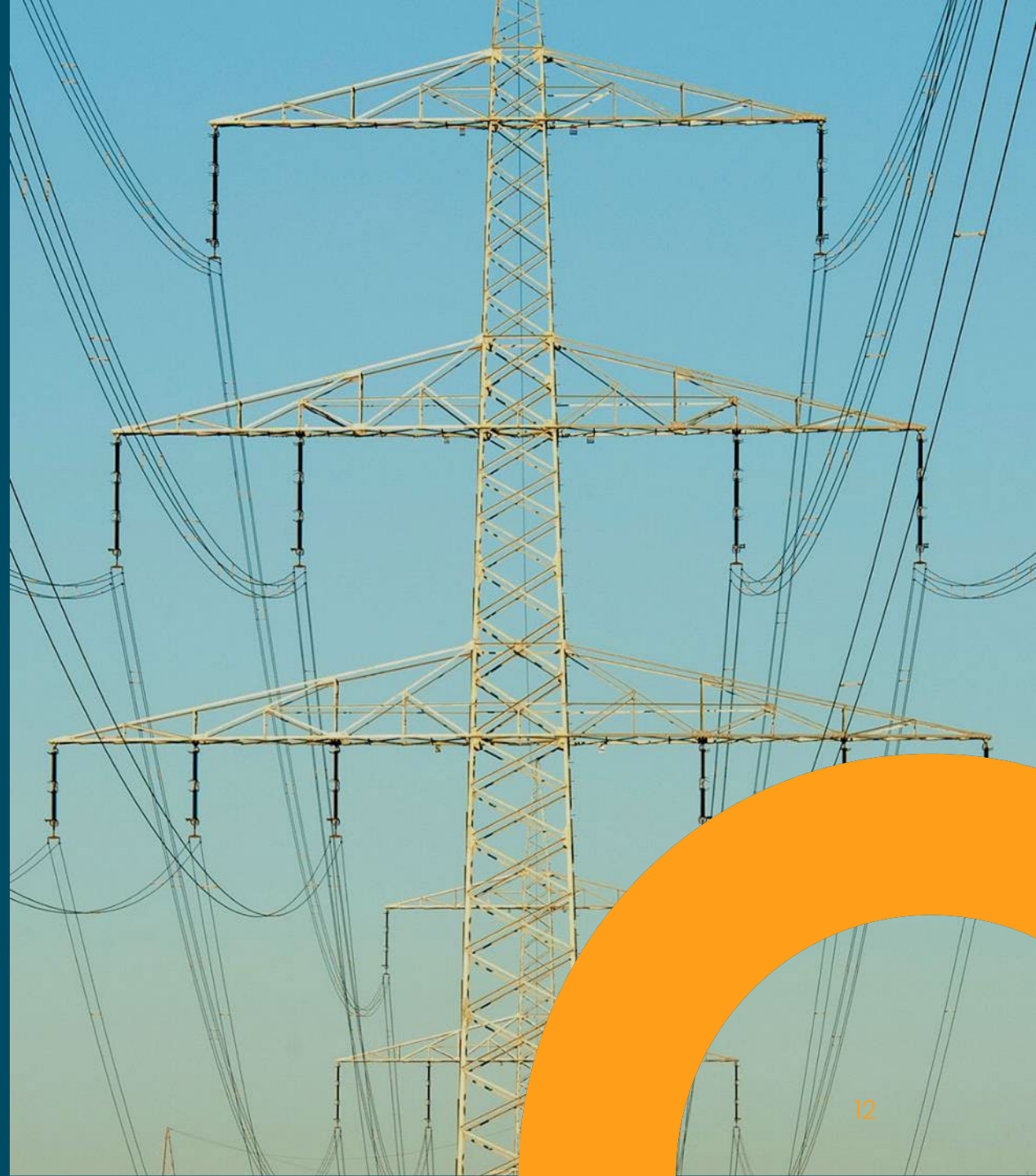
- All of Milford's vehicles included in the study are parked at City owned locations.
  - PW Lot, PD Lot, Armory, City Hall, CS Lot, PR Lot, Silacato
- Vehicles are assigned to specific departments.
- Vehicle travel is majority in-state and in the case of facilities vehicles, on city properties.
- Milford's vehicle inventory spans multiple departments with vehicle ranges and capabilities dependent on specific department needs.
- For the police department, vehicles only used for administrative purposes were considered for EV candidate replacements.
- Most vehicles identified as potential EV candidates are typically used for a single shift per day.
- Milford replaces vehicles on an as-needed basis and provided estimated replacement year of vehicles included in the study.

Preliminary EV Candidates
Estimated Operating Costs (Phase One Only)

Vehicle Type	Average Annual mileage	Estimated Fuel Economy (mpg)	Annual Fuel Cost per Vehicle (estimated)	Annual Maintenance Cost Per Vehicle (estimated)	Operating Cost per Mile ($/mile)
Car	5,042	31	$549	$756	$0.3
Cargo Van - Fullsize	3,966	10	$1,336	$920	$0.6
Light-Duty Pickup	8,060	19	$1,454	$1,314	$0.3
Motorcycle	87	43	$7	$70	$0.9
Riding Mower (Gas and diesel)	900 hrs	0.34	$8,921	108	$10
Maintenance Utility Vehicle (Gator)	50 hrs	17	$10	24	$0.7
Police Car	8,300	31	$904	$1,917	$0.3
Police SUV	11,391	19	$2,055	$1,857	$0.3
Refuse Truck	11,111	2	$23,986	$34,132	$5.2

1. The sedans, cargo vans full-size, light-duty pickup trucks, gators, police sedans and SUVs identified above operate on gasoline, while the refuse truck and some mowers operate on diesel.
2. Current annual fuel cost uses AAA's DE State Average State Fuel Prices in June 2023 and assumes $3.37 per gallon of gasoline and $3.67 per gallon of diesel.
3. Estimated annual refuse truck maintenance cost is sourced from AFLEET.

Recommendations

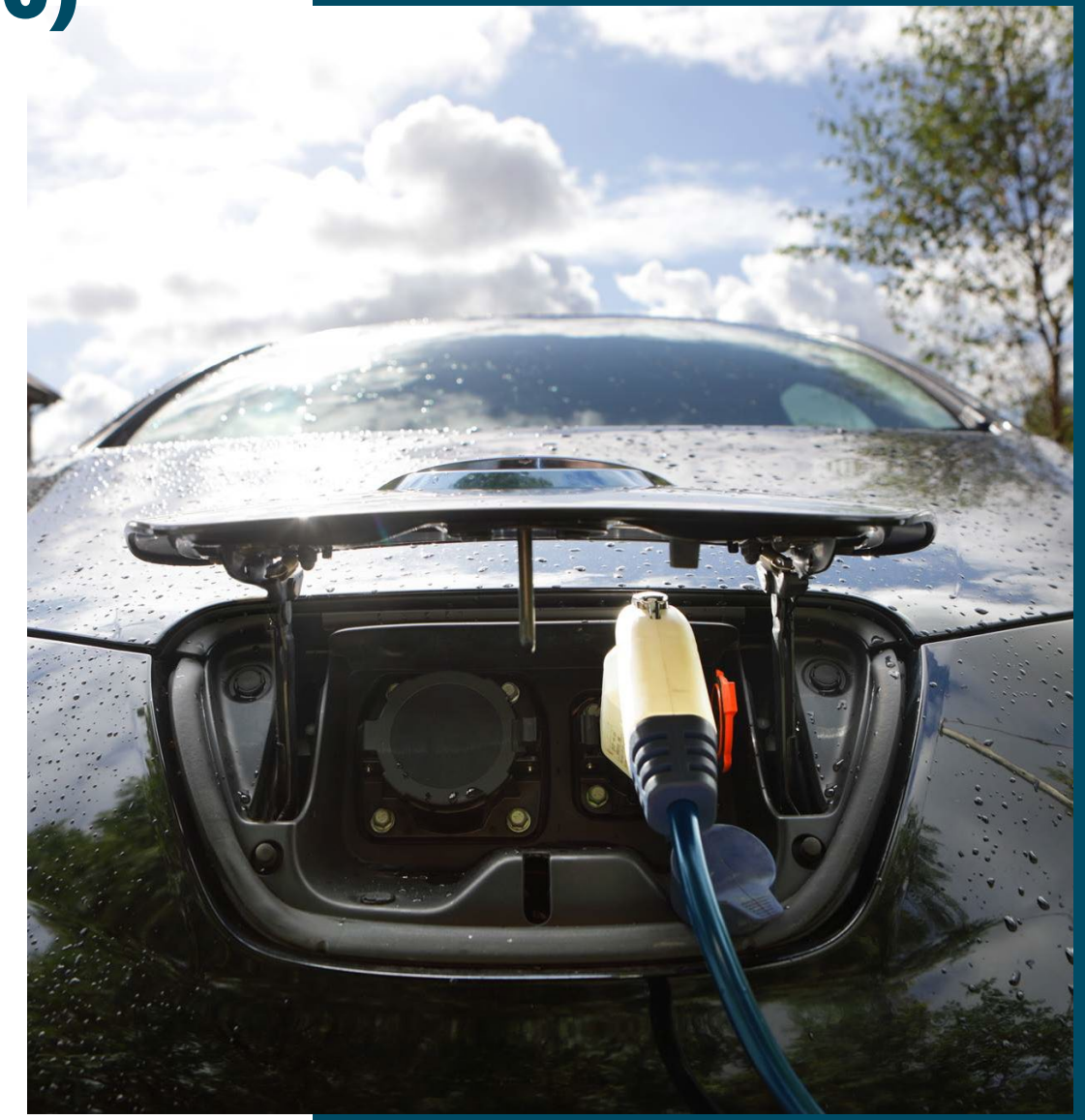


Vehicles – Phase 1 (2023-2026)

Replace 29 current fleet vehicles with all-electric equivalents over the next 3 years.

- **Sedans, full-size cargo van, LD pickup trucks, motorcycles, riding mowers, all-terrain utility vehicles, administrative police sedans and SUVs, and a refuse truck**

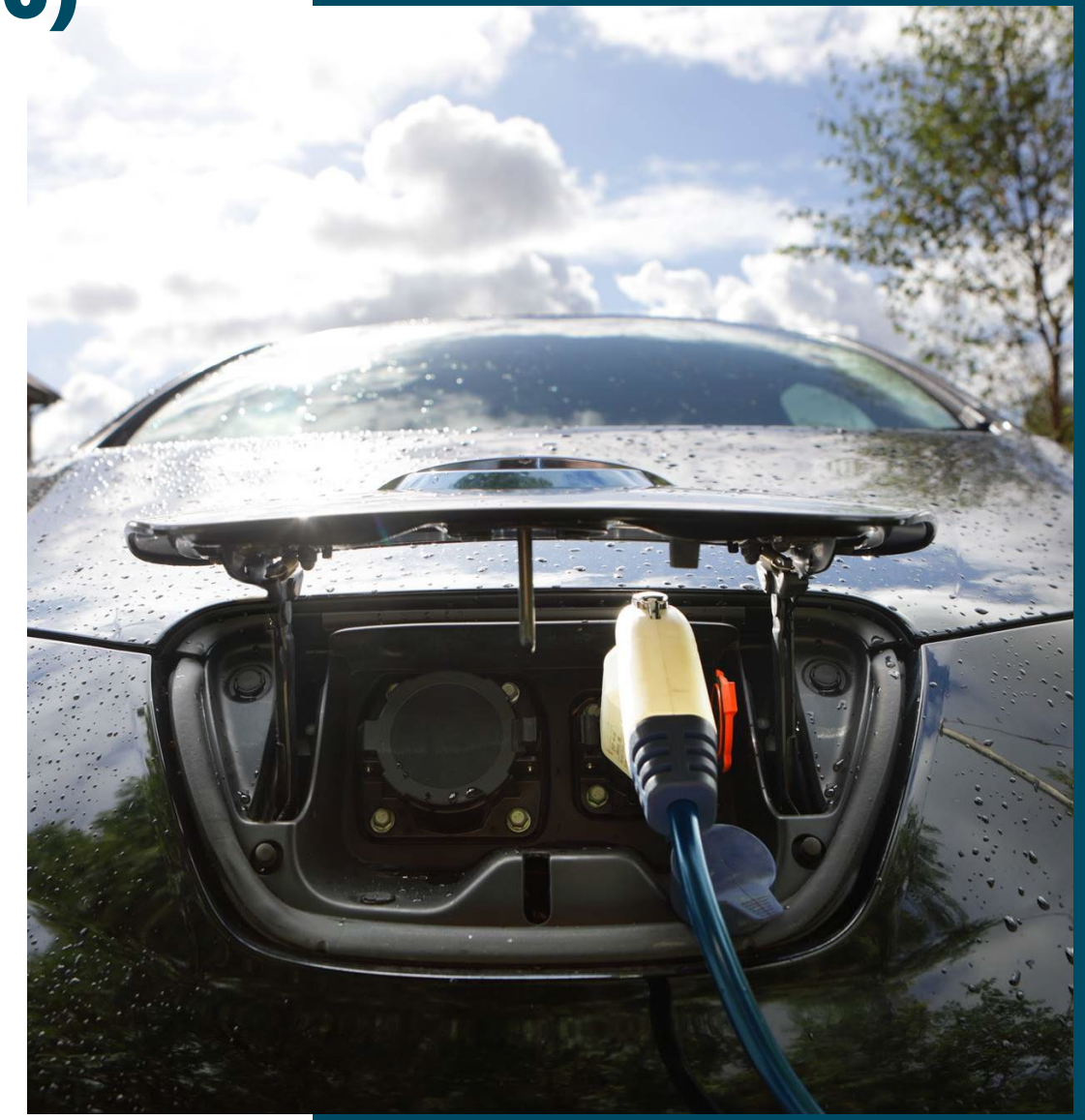
Sixteen of the 29 recommended Phase One replacement AEVs are projected to offer **a total lifetime savings of $75,000** compared to existing ICE vehicles over their lifetime after accounting for estimated vehicle and charging station capital and operating costs, and available incentives.



Vehicles – Phase 1 (2023-2026)

The remaining 13 recommended Phase One vehicles are projected to result in increased total lifetime ownership costs relative to existing ICE vehicles and would require additional subsidy or incentives to break even. These 13 vehicles are projected to cost an additional $221,000 over their lifetime.

These 29 vehicles are also projected to **reduce** lifetime carbon emissions by approximately **5,700 short tons (58%)** and criteria air pollutants by approximately **28 short tons (99%)** relative to existing ICE vehicles.



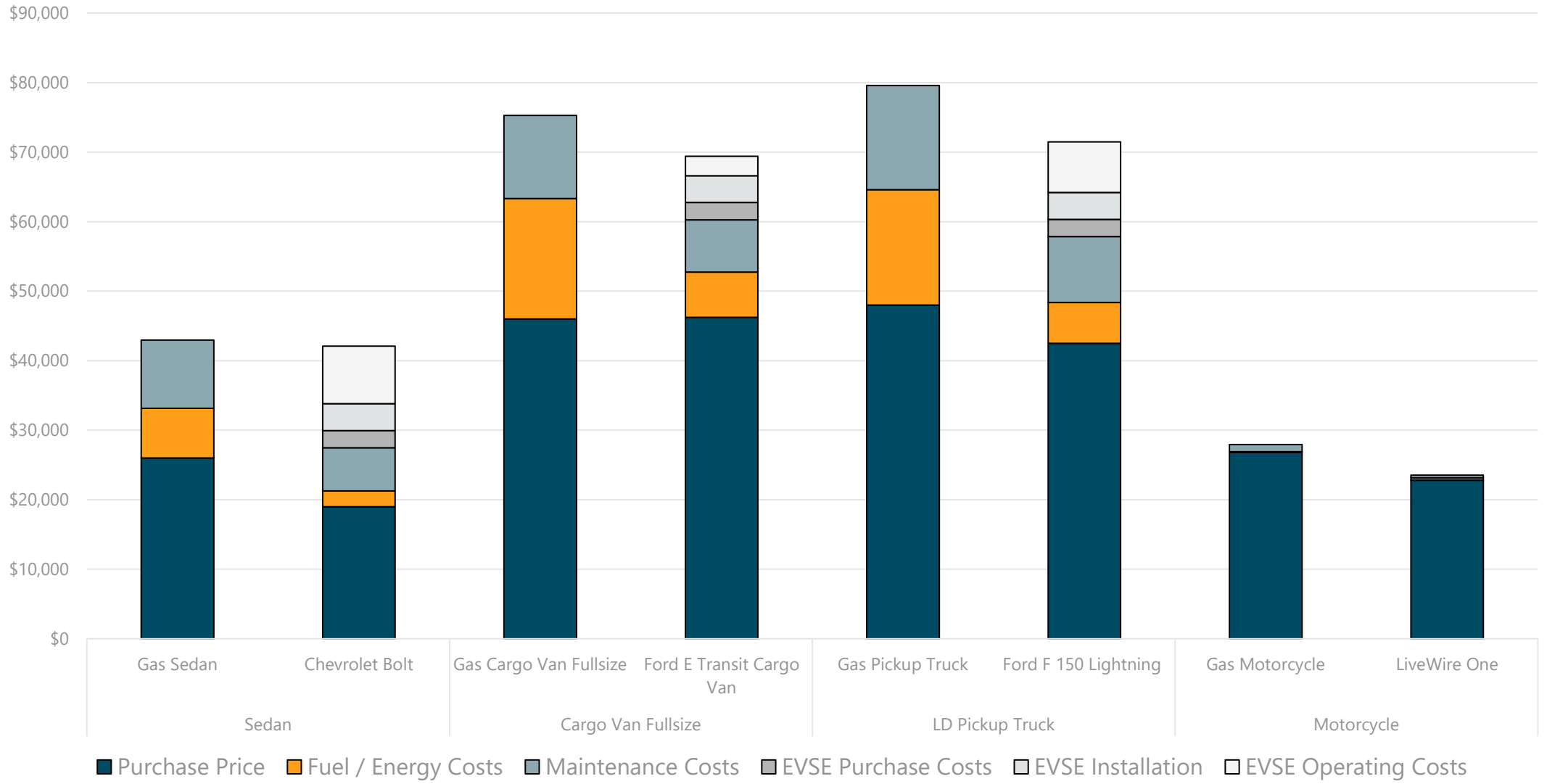
Example Recommended All Electric Vehicles

Chevy Bolt EV

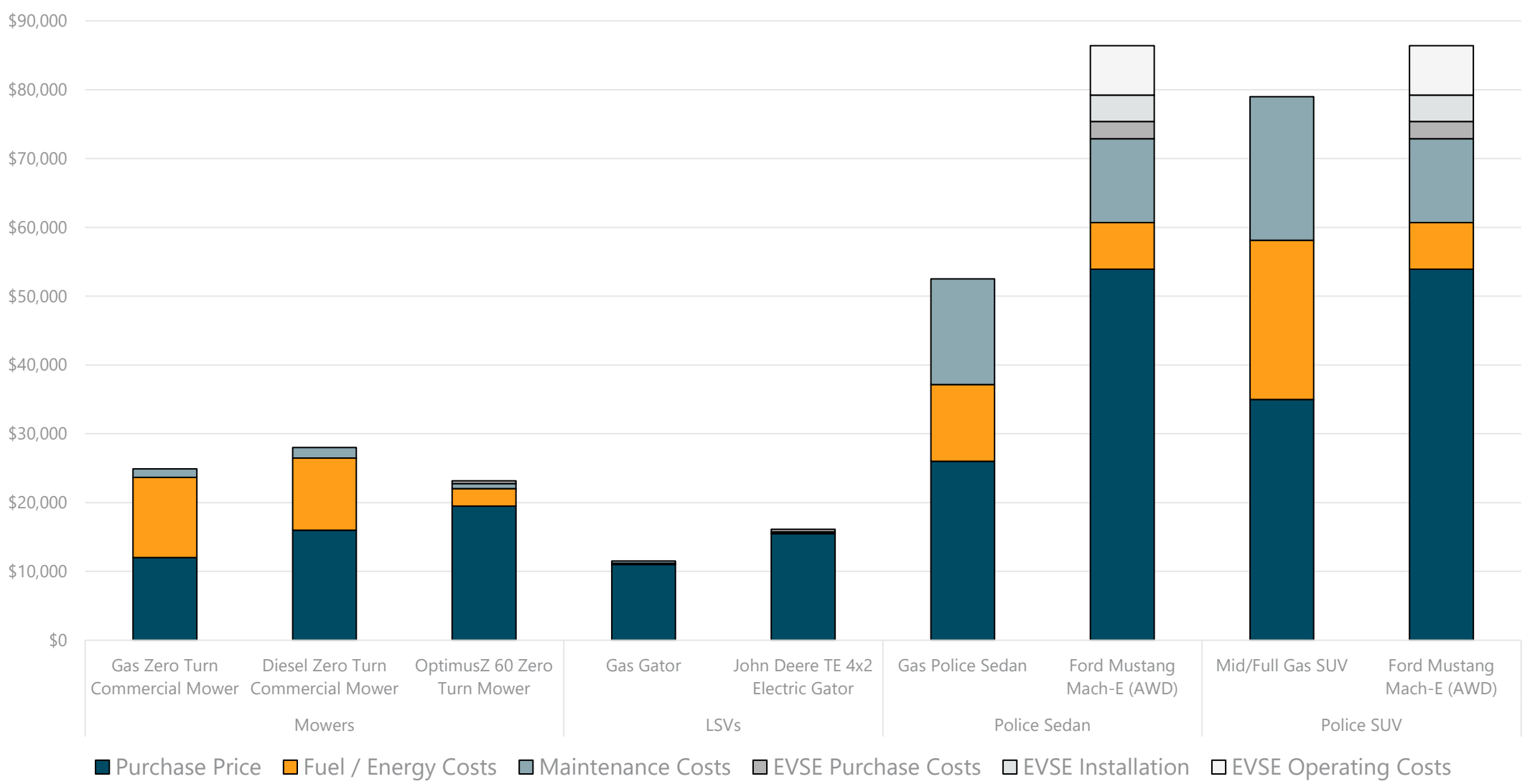
Ford F-150 Lightning

Ford E-Transit

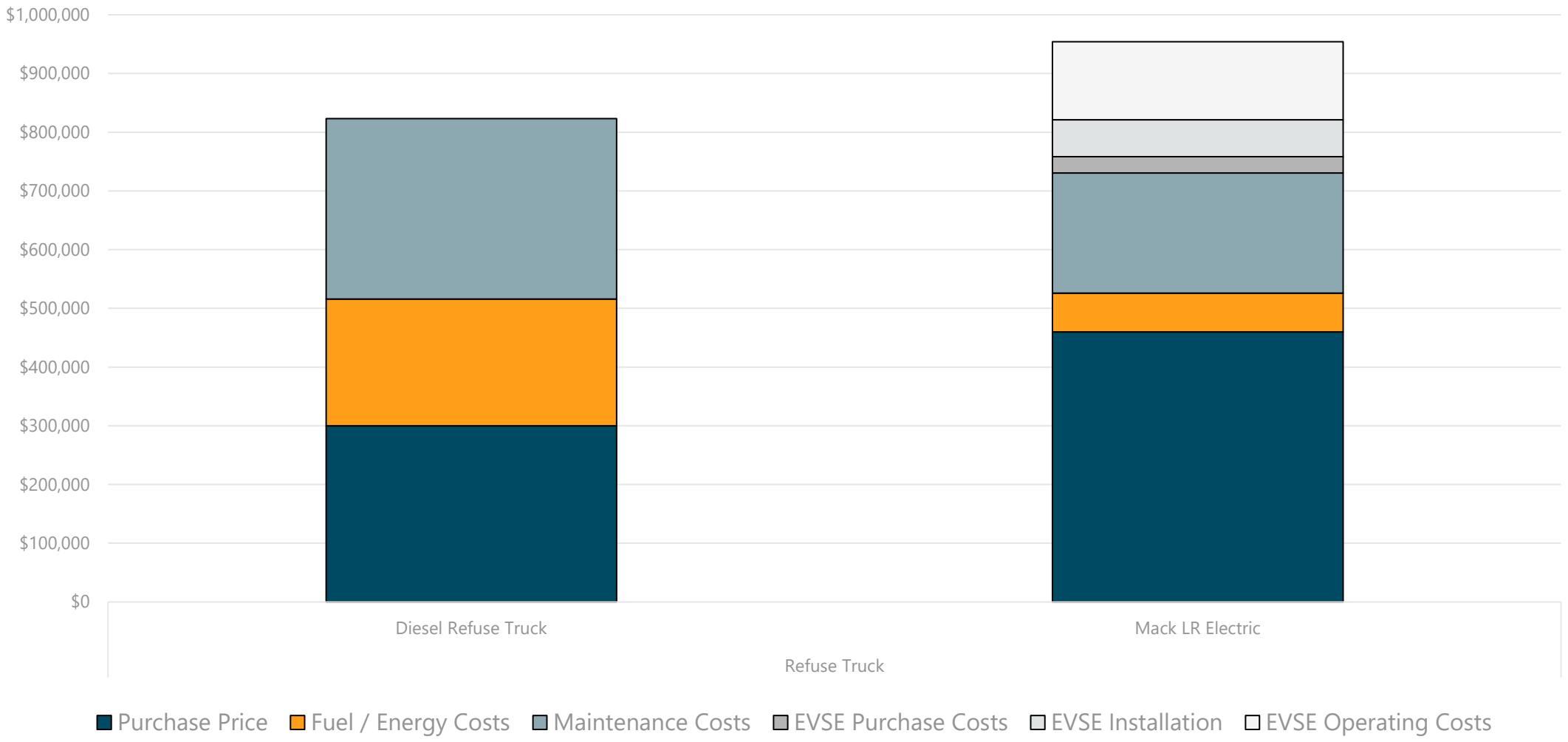
Phase One – Lifetime Total Cost of Ownership



Phase One – Lifetime Total Cost of Ownership Cont.



Phase One – Lifetime Total Cost of Ownership Cont.



Vehicles - Phase Two (2024-2035)

Replace 45 ICE vehicles with all-electric equivalents

- **Hybrid sedans and SUVs, cargo vans, LD and MD pickup trucks, motorcycles, riding mowers, all-terrain utility vehicles, and HD refuse trucks and a street sweeper (Appendix)**

These replacements can occur within a nine-year period (2027-2035) due to vehicle replacement schedules and anticipated market availability.

Recommended Phase Two AEV replacements are projected to add additional significant lifetime costs and reduce overall carbon emissions.

Charging Stations

Charging Stations - Install up to 53 additional charging station ports over the next 3-12 years.

- Each light-duty AEV should have a dedicated Level 2 charging station port
- Each heavy-duty AEV should have a dedicated Level 3 or DC fast charging station port
- Consider installing electrical infrastructure to support all likely future EV charging but install EVSE only for near-future needs.

Equipment

- Choose more basic, lower cost Level 2 chargers
- If networked: provide Wi-Fi instead of cellular subscription
- As-needed maintenance vs. extended warranty

Charging Stations

Location Selection

- City of Milford's recommended vehicles for EV replacement are parked overnight at City owned locations
- Work with City Staff and Delaware Municipal Electric Corporation (DEMEC) to assess existing electrical infrastructure and develop plans for purchase and installation.
- Consider dual-port units if City of Milford anticipates adding additional EVs to department fleets parking at these locations over the next 3-12 years (or wishes to have an extra port available for guest or employee use).

Funding Opportunities

Energize Delaware Grants for Local Government EV Fleets- $175,000 per municipality for police and other first-responder AEVs and related EVSE only.

DE Clean Vehicle Rebate – $2,500 per AEV

DNREC EV Charging Station Rebate- $2,500 for single port and $5,000 for dual port for a total of 10 ports (or 5 dual ports).

Example per vehicle EV Capital and Operating budget

Vehicle Recommendations	Chevrolet Bolt replacing Gasoline Sedan	Ford F 150 Lightning replacing LD Gasoline Pickup Truck	AEV Zero Turn Commercial Turf replacing Gasoline Mowers	Chevrolet Bolt replacing Gasoline Police Sedan	Ford Mustang Mach E- (AWD) replacing Gasoline Police SUV
One-time Upfront Capital Costs					
Purchase Premium	$7,000	$5,505	-$7,500	$7,000	-$18,925
EVSE Capital Cost	-$6,356	-$6,356	-$380	-$6,356	-$6,356
Total Upfront Cost	$644	-$851	-$7,880	$644	-$25,281
Annual Operating Costs					
Electricity/Fuel Cost	-$174	-$516	-$238	-$287	-$601
Avoided Vehicle Maintenance	$279	$486	$43	$460	$772
Avoided Fuel Cost	$375	$939	$794	$618	$1,454
EVSE Operating & Maintenance Costs	-$637	-$637	$0	-$637	-$637
Total Annual Operating Cost Savings	$18	$787	$837	$441	$1,589
Lifetime Savings					
Lifetime Operating Cost Savings	$231	$8,986	$9,470	$5,438	$17,881
Net Lifetime Savings	$875	$8,134	$1,590	$6,082	-$7,400

Budget- Charging Stations

Per Port	Level 1 Single Station	Level 2 Parking Garage	Level 2 Curbside Single Station	DC Fast: 50 kW
Purchase Cost	$380	$2,500	$2,500	$27,900
Installation Cost	$0	$3,856	$7,000	$62,700
Annual Maintenance	$0	$250	$250	$14,790
Annual Network Fees	$0	$387	$387	$387
Total Cost (rounded)	**$380**	**$6,995**	**$10,135**	**$105,775**

Comparative Costs of Level 1,2 and 3 (DC Fast) EVSE

Emission Reductions- Carbon

If all 29 vehicles are replaced with recommended AEVs, they will **reduce lifetime carbon emissions by 5,676 short tons (58% savings)**

Total Petroleum and Emission Reduction					
	Units	ICE	AEV	Savings	% Reduction
LD Petroleum Use	Short Tons	17,565	110	17,455	99%
LD GHGs	lbs	9,722	4,045	5,676	58%
CO	lbs	45,248	-	45,248	100%
NOx	lbs	8,828	-	8,828	100%
PM10	lbs	623	537	86	14%
PM2.5	lbs	156	72	84	54%
VOC	lbs	1,414	-	1,414	100%
SOx	lbs	118	-	118	100%

Implementation Plan

Establish goals around EV replacement rates – Milford should determine how many of the recommended vehicles they intend to replace with EVs. This will provide staff with the support needed to develop budgets and schedule EV and EVSE deployment over the next three years.	**Q1 to Q2 2024**
Engage with DEMEC on EVSE installations – DEMEC staff will be able to advise on specific site considerations (including electric rate structure and demand), qualified vendors, and EVSE.	
Work with DEMEC, proceed with EVSE purchase and installation to support planned specific AEVs.	**Q2 to Q3 2024**
Schedule specific EV acquisitions to coincide with or shortly follow planned EVSE availability – AEVs require operational charging stations, and procurement/delivery should be coordinated with EVSE deployment.	
Procure EVs – Review and confirm any available vehicle purchase incentives, and investigate procurement options, especially if seeking to procure multiple identical EVs at a discount.	
Deploy EVs (ongoing)	**Q3 to Q4 2024**
Evaluate performance and purchase additional EVs as appropriate (ongoing) – following initial EV and EVSE deployments, staff can evaluate the performance of the various EVs to ensure they are meeting operational needs and achieving predicted cost savings, which will lay the groundwork for wider EV deployment in future years.	**Q1 2025+**

Questions?

Contact

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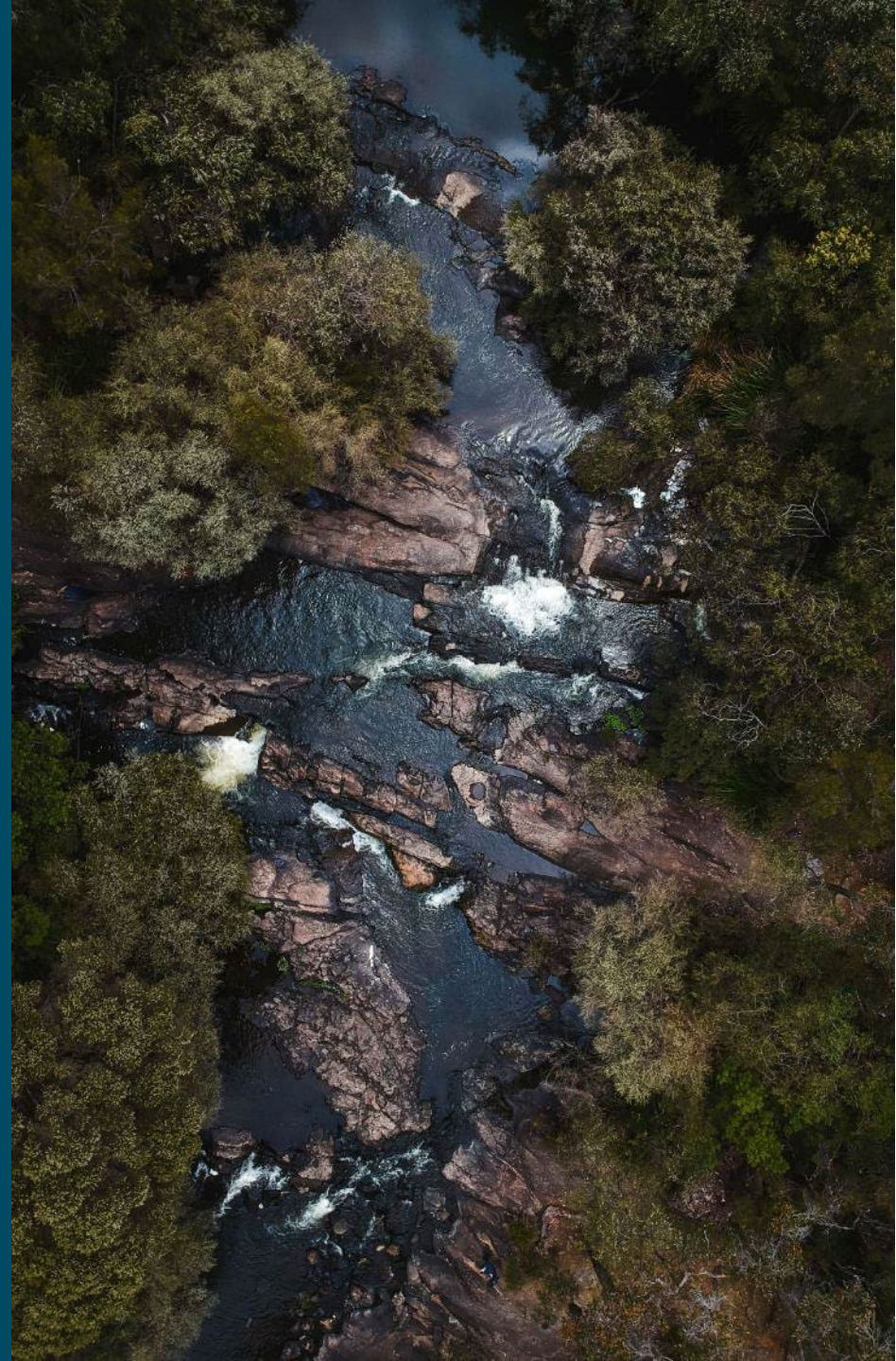
Thank you



Appendix

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 1

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
CS Lot	C/S	Car	Toyota	Camry	2011	1	6,567	less than 50	$875	F-001
PD Lot	Police	Car	Dodge	Stratus	2006	1	3,516	100-200	$875	5127
PR Lot	Parks & Recreation	Cargo Van - Fullsize	Ford	Econoline Van	2014	1	812	less than 50	$5,868	PR-006
PW Lot	PW-Water	Cargo Van - Fullsize	Dodge	Sprinter 3500 Cargo Van	2006	1	626	less than 50	$5,868	W-029
Armory	Parks & Recreation	Light-Duty Pickup	Dodge	Ram 1500 Pickup	2017	1	8,878	less than 50	$8,134	PR-041
PD Lot	Police	Light-Duty Pickup	Dodge	Ram	2004	1	8,352	100-200	$8,134	5185
PW Lot	PW-Electric	Light-Duty Pickup	Dodge	Ram 1500 Pickup Quadcab	2017	1	15,026	less than 50	$8,134	E-101
PD Lot	Police	Motorcycle	Harley Davidson	Motorcycle	2004	1	88	100-200	$4,403	5196
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Stand Up Mower, Z-Turn	2019	1	900	less than 50	$1,590	PR-050
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Stand Up Mower, Z-Turn	2019	1	900	less than 50	$1,590	PR-051
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Mower	2004	1	900	less than 50	$4,840	PR-018

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 1 Cont.

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower	2013	1	900	less than 50	$4,840	PR-008
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower	2015	1	900	less than 50	$4,840	PR-020
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2	2004	1	50	less than 50	-$4,602	PR-013
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2	1999	1	50	less than 50	-$4,602	PR-010
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, 4x2 (Cemetery)	2007	1	50	less than 50	-$4,602	PR-029
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator	1989	1	50	less than 50	-$4,602	PR-034
PD Lot	Police	Off-Road Equipment - Small	John Deere	Gator	2016	1	50	less than 50	-$4,602	5184
PW Lot	PW-Sewer	Off-Road Equipment - Small	Kubota	Lawn Mower	1994	1	900	less than 50	$4,840	SE-019
PW Lot	PW-Sewer	Off-Road Equipment - Small	Kubota	Mower F3060	2011	1	900	less than 50	$4,840	SE-010
PW Lot	PW-SEWER	Off-Road Equipment - Small	Kubota	Mower w/plow	2015	1	900	less than 50	$4,840	SE-025
PD Lot	Police	Police Car	Ford	Crown Victoria	2010	1	8,638	100-200	-$34,071	5104
PD Lot	Police	Police Car	Ford	Crown Victoria	2011	1	9,321	100-200	-$34,071	5108
PD Lot	Police	Police Car	Ford	Crown Victoria	2011	1	6,941	100-200	-$34,071	5114
PD Lot	Police	Police SUV	Ford	Expedition SUV	2010	1	6,824	100-200	-$7,400	5101
PD Lot	Police	Police SUV	Ford	Expedition SUV	2011	1	10,544	100-200	-$7,400	5109

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 1 Cont.

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PD Lot	Police	Police SUV	Ford	Expedition SUV	2013	1	13,301	100-200	-$7,400	5123
PD Lot	Police	Police SUV	Ford	Expedition SUV	2013	1	14,896	100-200	-$7,400	5118
PW Lot	PW-Solid Waste	Refuse Truck	Freightliner	Trash Truck	2017	1	10,645	50-100	-$91,179	SW-011

Preliminary EV Candidates Due for Replacement by Department and Model- Phase 2

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	PW-Electric	Car	Toyota	Corolla Hybrid	2020	1	1,562	less than 50	-$3,952	E-105
PD Lot	Police	Cargo Van - Fullsize	Ford	Econoline Van	2013	1	812	100-200	$5,868	5195
PW Lot	PW-Water	Cargo Van - Fullsize	Ford	Transit Van	2017	1	10,975	less than 50	$5,868	W-028
PW Lot	PW-Water	Cargo Van - Fullsize	Ford	Transit Van	2020	1	6,604	less than 50	$5,868	W-014
Armory	Parks & Recreation	Light-Duty Pickup	Dodge	Ram 1500 Pickup	2017	1	8,878	less than 50	$8,134	PR-015
Armory	Parks & Recreation	Light-Duty Pickup	Ford	F250 Pickup	2018	1	8,878	less than 50	$8,134	PR-022
PR Lot	Parks & Recreation	Light-Duty Pickup	Ford	2021 F-150	2021	1	8,878	less than 50	$8,134	PR-001
PW Lot	Planning & Econ Dev	Light-Duty Pickup	Chevrolet	Colorado Ext Cab Pickup	2020	1	5,375	less than 50	$8,134	PZ-001

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 2 Cont.

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	Planning & Econ Dev	Light-Duty Pickup	Ford	2021 F150 Pickup, Supercab 4x4	2021	1	3,189	less than 50	$8,134	pz-002
PW Lot	Public Works	Light-Duty Pickup	Chevrolet	Colorado	2022	1	8,092	less than 50	$8,134	PW-01
PW Lot	PW-Garage	Light-Duty Pickup	Ford	F250 Pickup	2015	1	4,602	less than 50	$8,134	G-001
PW Lot	PW-Sewer	Light-Duty Pickup	Ford	F350 Super Cab Pickup	2016	1	10,788	less than 50	$8,134	SE-003
PW Lot	PW-Technical Services	Light-Duty Pickup	Chevrolet	Colorado Crew Box Truck	2018	1	7,062	less than 50	$8,134	TS-003
PW Lot	PW-Technical Services	Light-Duty Pickup	Chevrolet	Colorado Crew Cab Pickup	2020	1	10,724	less than 50	$8,134	TS-002
PW Lot	PW-Technical Services	Light-Duty Pickup	Ford	F150 Pickup, Supercab	2020	1	3,400	less than 50	$8,134	TS-001
PW Lot	PW-Water	Light-Duty Pickup	Chevrolet	Colorado Ext Cab Pickup	2019	1	8,784	less than 50	$8,134	W-004
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Crew Cab Dump Body	2022	1	8,364	less than 50	$17,019	PR-003
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Pickup	2006	1	8,364	less than 50	$17,019	PR-023
Armory	Parks & Recreation	Medium-Duty Pickup Truck	Ford	F350 Crew Cab Pickup	2019	1	8,364	less than 50	$17,019	PR-005

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 2 Cont.

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
PW Lot	Planning & Econ Dev	Medium-Duty Pickup Truck	FORD	2022 F350	2019	1	4,120	less than 50	$17,019	PZ-003
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	148 F250 4x4 Supercab SRW	2020	1	8,714	less than 50	$17,019	E-115
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	F450 Crew Cab Dump Body	2022	1	3,439	less than 50	$17,019	E-108
PW Lot	PW-Electric	Medium-Duty Pickup Truck	Ford	F550 Dump Truck	2018	1	7,292	less than 50	$17,019	E-112
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F250 Pickup	2012	1	7,042	less than 50	$17,019	S-002
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F450 Pickup	2015	1	13,439	less than 50	$17,019	S-023
PW Lot	PW-Streets	Medium-Duty Pickup Truck	Ford	F350 Super Cab Pickup	2019	1	7,849	less than 50	$17,019	S-001
PW Lot	PW-Water	Medium-Duty Pickup Truck	Ford	F450 Dump Truck	2011	1	3,515	less than 50	$17,019	W-008
PW Lot	PW-Water	Medium-Duty Pickup Truck	Ford	F250 Pickup	2019	1	8,499	less than 50	$17,019	W-003
PD Lot	Police	Motorcycle	Harley Davidson	FLHTP	2021	1	87	100-200	$4,403	5197
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Z-Turn Mower	2020	1	900	less than 50	$1,590	PR-052

Preliminary EV Candidates Due for Replacement by Department and Model - Phase 2 Cont.

Overnight Parking Location	Department	Vehicle Type	Make	Model	Year	Qty	Average Annual Mileage	Estimated Maximum Daily Mileage	Lifetime AEV Savings	ID
Armory	Parks & Recreation	Off-Road Equipment - Small	Ventrac	Finish Mower, 72"	2018	1	900	less than 50	$1,590	PR-045
Silicato	Parks & Recreation	Off-Road Equipment - Small	Ventrac	Tough Cut Mower	2018	1	900	less than 50	$1,590	PR-046
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	2023 ZD1211L-3-72, Z-turn 72"	2021	1	900	less than 50	$4,840	PR-011
Armory	Parks & Recreation	Off-Road Equipment - Small	Kubota	Riding Mower, Work Light Kit, Blade	2013	1	900	less than 50	$4,840	PR-039
City Hall	Info Tech	SUV	Toyota	Rav 4 Hybrid	2021	1	3,235	less than 50	-$2,561	IT-001
PW Lot	Public Works	SUV	Toyota	Rav 4 Hybrid	2021	1	3,607	less than 50	-$2,561	PW-02
PW Lot	PW-Electric	SUV	Toyota	Rav 4 Hybrid	2019	1	3,049	less than 50	-$2,561	E-106
PW Lot	PW-Electric	Bucket/Aerial Truck	International	Bucket Truck	2018	1	5,993	less than 50	-$448,551	E-109
PW Lot	PW-Electric	Bucket/Aerial Truck	International	Bucket Truck	2018	1	2,265	less than 50	-$448,551	E-102
PW Lot	PW-Electric	Bucket/Aerial Truck	International	2021 Bucket Truck	2021	1	6,194	less than 50	-$448,551	E-103
Armory	PW-Electric	Dump Truck	International	Truck	2021	1	28,775	less than 50	-$411,002	E-111
Armory	Parks & Recreation	Off-Road Equipment - Small	John Deere	Gator, w/Sprayer	2013	1	50	less than 50	-$4,602	PR-024
PW Lot	PW-Solid Waste	Refuse Truck	Peterbuilt	Trash Truck	2018	1	12,579	50-100	-$91,179	SW-028
PW Lot	PW-Solid Waste	Refuse Truck	Mack	Trash Truck, Rear & Side Loader	2020	1	10,108	50-100	-$91,179	SW-012
PW Lot	PW-Streets	Street Sweeper	Freightliner	Street Sweeper	2018	1	3,163	less than 50	-$567,027	S-007