Fleet Electrification Outlook in Baltimore Gas and Electric's Service Territory

Quantifying and Preparing for the Transition of Commercial Fleets to Electric Vehicles

To proactively prepare the grid for the demand from electric fleets, Baltimore Gas and Electric (BGE) has analyzed the economics, vehicle behavior, and policies driving commercial fleet vehicle electrification. RMI and Atlas Public Policy, with input from BGE, modeled how many electric fleet vehicles BGE's grid will need to support in the coming decades, and where this demand will materialize. This localized vehicle electrification model will help BGE to plan and prepare for localized infrastructure needs and personalized customer offerings to maximize the benefits of fleet electrification for its 1.3 million customers.

BGE Fleet Electrification Snapshot

Policy Drivers

As electric vehicles (EVs) become more affordable, EV adoption will increase. While economics largely drive EV growth, relevant policies include:

- **Maryland's adoption of the Advanced Clean Truck Rule (ACT)**—requires a subset of new trucks be zero emissions by 2035
- **Maryland's electric school bus incentives**—incentivizes electric school bus adoption
- **The Inflation Reduction Act (IRA)** tax credit for EV purchases—substantially improves the economics of electric medium- and heavy-duty vehicles (MHDVs)
- **EPA GHG rules**—encourages manufacturers to sell cleaner and lower emission vehicles
- **Bipartisan Infrastructure Law Incentives**—accelerates electric school and transit bus adoption

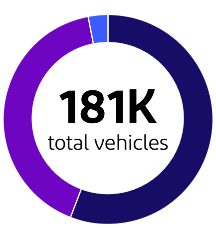
Key Impacts

Uneven loads: Power loads are not uniformly distributed across BGE's service territory. Counties with the greatest anticipated growth could see demand grow by approximately four times between 2030 and 2040. Some zip codes could see additional power demands close to that of a small town by 2040.[1]

Environmental improvements: Fleet electrification could cumulatively reduce CO_2e emissions by 10–17 million metric tons (MMT) between 2024 and 2040.

Public health benefits: Electrifying fleets could reduce emissions of pollutants that harm human health, deliver between $154 and $296 million worth of public health benefits to the people of Maryland by 2040, and reduce premature deaths, including those in disadvantaged communities.

Registered Commercial Fleet[2] Vehicles for BGE



- **56%** Pickups, SUVs, Cars, and Vans
- **41%** Medium-duty vehicle (MDV) and heavy-duty vehicle (HDV)
- **3%** Buses

BGE Counties with Highest Concentration of Fleet Vehicles[3]

County	Total Vehicles	HD Trucks	Additional Electrification Demand by 2030 (MW)
Baltimore	39,000	2,700	24–34
Anne Arundel	37,000	2,600	16–24
Prince George's	27,500	1,400	8–13

Distribution of Fleet Sizes in BGE territory

>7,000 fleets across territory

~44% of fleet vehicles are owned by the largest 100 fleets

19 vehicles in an average fleet, and the median fleet has 8 vehicles

95% of fleets are small fleets with less than 50 vehicles

>11,000 vehicles are in the five largest fleets and are predominantly in the public sector

~9% of fleet vehicles are registered in federally designated disadvantaged communities (DAC)[4]

[1] Typical power needs of a small town is ~20 MW.

[2] Fleets have been defined as two or more vehicles under the same commercial fleet registration name.

[3] Fleet concentration is only one component of load impacts. Others include vehicle efficiency, miles travelled and whether fleets manage charging.

[4] Not all vehicles are attached to addresses. The figure includes vehicles known to be in DACs based on the available address, actual DAC % may be higher.

Grid Impacts of Fleet Electrification

EV fleet load will continue to grow significantly in the future. Our modeling indicates that EVs without managed charging[5] could create a peak load of up to 630 MW in BGE's service territory by 2040, putting pressure on the grid.

Three commercial fleet EV adoption scenarios represent a range of technical and policy pathways:

- **Current Trajectory:** assumes ongoing cost declines and existing policies
- **Advanced Technology and Policy:** more rapid technological improvements, fewer constraints on vehicle and charger supply, and broader adoption of zero-emission policies
- **Limited Technology and Policy:** EV technology improvements spread more slowly and adoption is primarily through economic, and not policy factors

Under the current trajectory, Fleet EV loads could increase from 4 MW in 2024 to 130 MW in 2030. These loads could more than double between 2030 and 2035, and nearly double again by 2040. Counties with the greatest anticipated growth could see loads grow by approximately four times between 2030 and 2040.

Peak Load Growth by Zip Code, 2024–40

County and Zip Code	Average Annual Growth (%)
Baltimore (21227)	39%
Carroll (21157)	37%
Howard (20794)	42%
Prince George's (20772)	35%
Prince George's (20707)	34%

Power loads are not uniformly distributed across BGE's service territory. Peak 2030 power loads from fleet electrification for the Current Trajectory are shown by zip code in Figure 3. Such variable load concentration could lead to potential grid demand hotspots, especially in areas with high fleet concentrations or heavy-duty trucking activity.

[5] A flexible demand strategy that minimizes charging load during peak demand times.

Figure 1: Peak Power Load from Fleet Electrification by Scenario (MW)

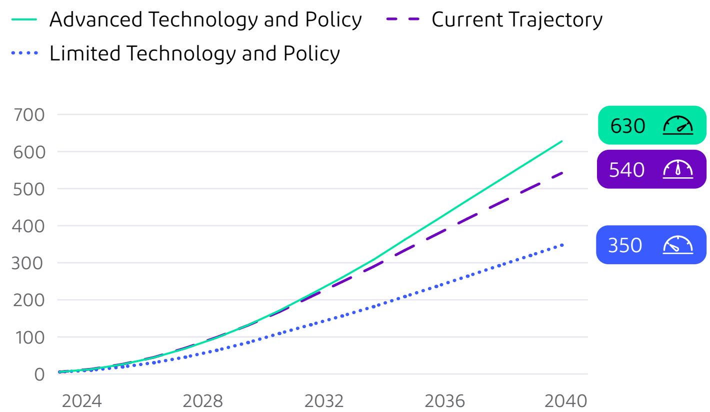


Figure 2: Annual Peak Power Load by Zip Code (MW)

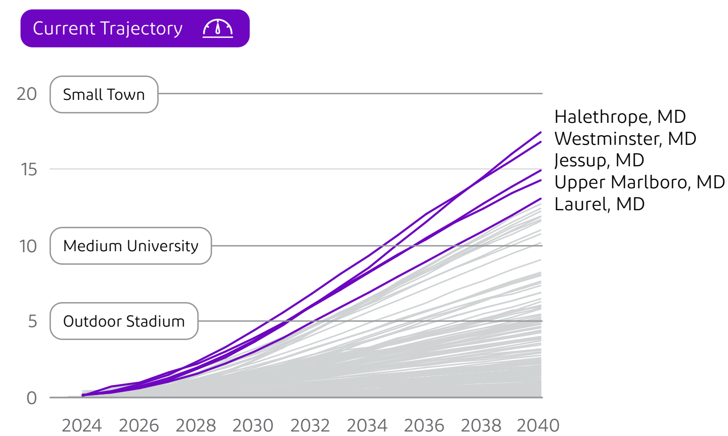
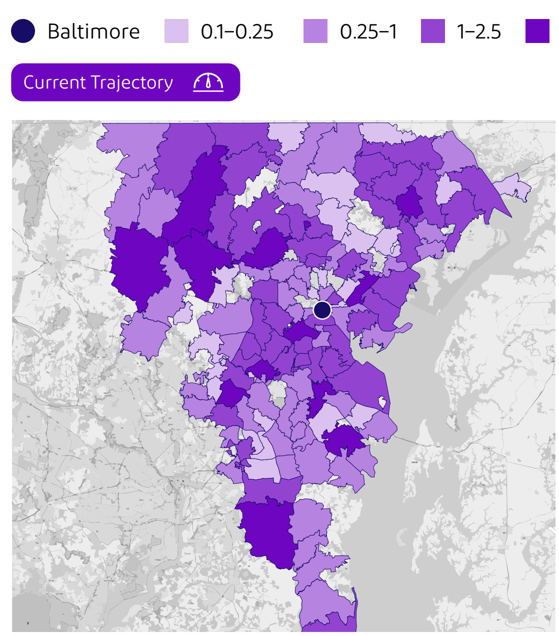


Figure 3: 2030 Peak Power Loads by Zip Code (MW)



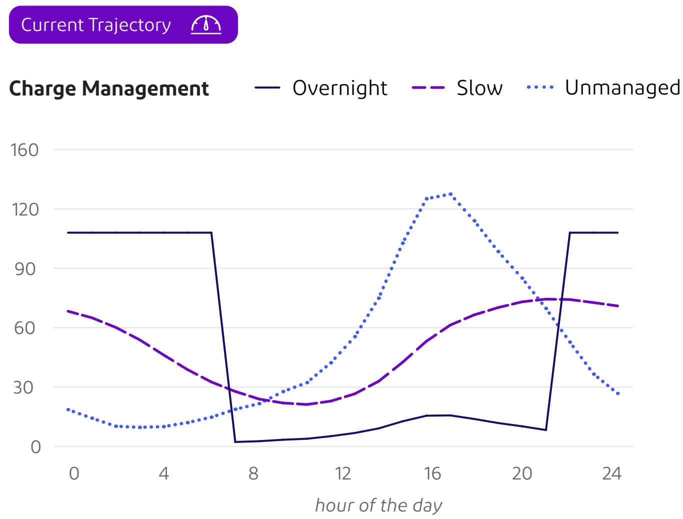
The Effects of Charging Behavior

While EV adoption will influence load growth, so will charging behavior. Although operations vary by fleet and type, many EVs, including fleet vehicles, are expected to be charged immediately after parking, creating a late afternoon peak load. The magnitude of the peak load varies by adoption scenario and is influenced by the number and type of vehicles that electrify. By 2030, electrified fleets without managed charging could add 80–130 MW of peak load.

Under a managed charging strategy where 80% of fleets manage their charging by spreading it over a longer time window ("slow" in Figure 4), peak load is reduced to approximately half. Even with slow charging, EVs will still create significant late afternoon load. In the "overnight" charging strategy, in which 80% of fleets prioritize charging from 9 p.m. to 7 a.m., peak load is lowered by roughly 15% and significantly shifts charging to off-peak windows[6], effectively reducing coincident peak load[7] by 85%.

Managed charging can save customers money and improve their operations while also reducing the costs of grid build-out for all customers. However, the flexibility of fleets to shift operations and deploy managed charging as well as the overall demand requirement on the grid are still important considerations. Collaboration between BGE and fleet owners is important to assess options like charging management and other technology solutions (e.g., on-site batteries) that could be leveraged.

Figure 4: 2030 Load Curves for BGE Under Current Trajectory Scenario (MW)



[6] Vehicles unable to participate because they needed more energy than they could absorb during the off-peak window create the small power load observed in the late afternoon.

[7] Referencing fleet load coincident with utility's historical 2023 peak load hour.

Modeled Environmental and Public Health Benefits

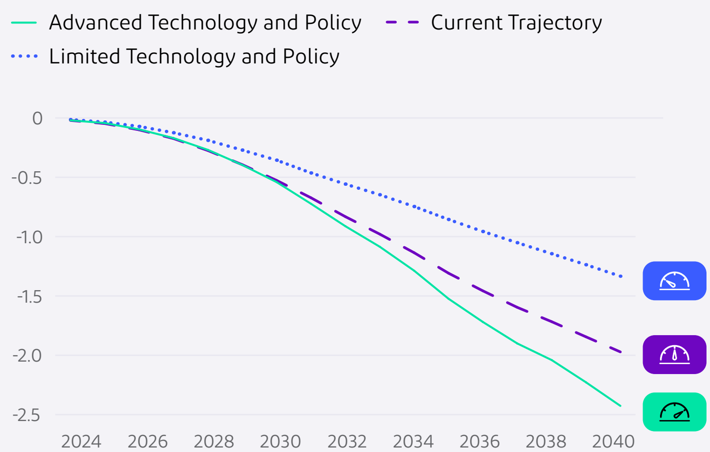
Fleet electrification could reduce as much as 17 million metric tons (MMT) of cumulative CO_2e emissions between 2024 and 2040 in BGE's territory under these scenarios. Emissions reductions include fuel refining and take into account increased emissions from power plants.

How Fleet Electrification Benefits Public Health

In addition to CO_2e reductions, electrifying fleets within BGE territory will shrink emissions of pollutants that harm human health, such as nitrogen oxides and particulates. Fleet electrification could deliver up to $296 million in public health benefits to the people of Maryland by 2040. This includes preventing up to 33 premature deaths and as many as 134 asthma incidences. Approximately $42 million of the public health benefits will be delivered in disadvantaged communities.

Note that because fleet vehicles often travel out of state, emissions from refining and electricity generation may occur out of state. As air pollution is not restricted to state boundaries, electrification of fleet vehicles in BGE's service territory also positively impacts public health in other states beyond Maryland's borders.

Figure 5: Greenhouse Gas Emissions Reductions (MMT CO_2e)



Fleet Electrification Public Health Benefits in Maryland by 2040

Advanced	Current	Limited
Total Health Benefits (NPV$)[8]		
$296M	$276M	$154M
Avoided Premature Deaths		
33	30	15
Avoided Asthma Incidences		
134	125	58

[8] Net present value of future cash flows at a 2% discount rate.

Electrifying the Future Together

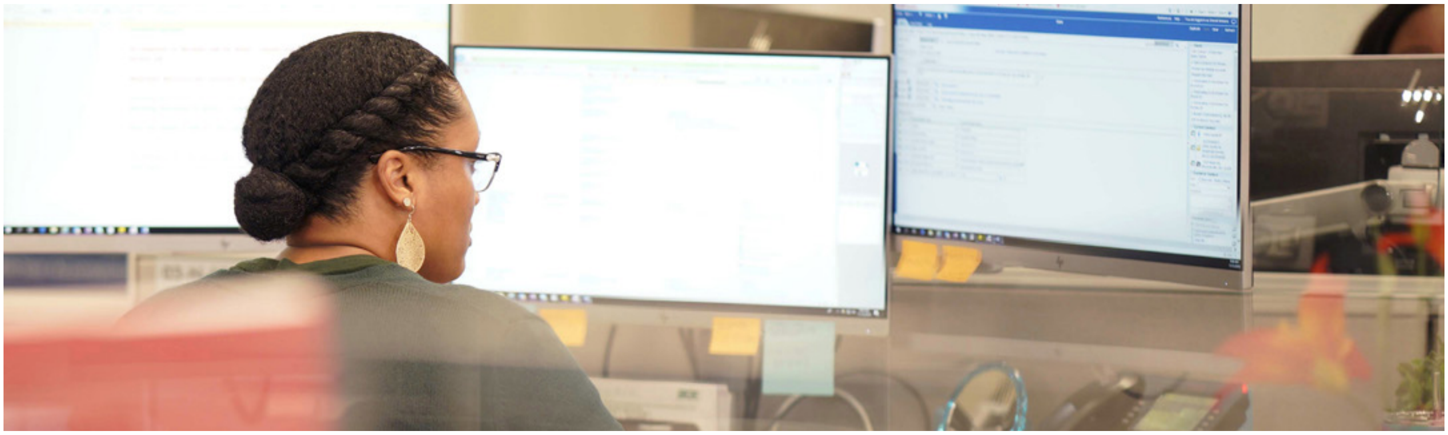
BGE's service territory has strong electrification potential. Public policy supports electrification. 58 private fleets—comprising 31,000 vehicles—have sustainability targets that include electrification. Approximately 30 thousand government vehicles are in the territory and are prime targets for electrification, as public vehicles often face state/federal sustainability or electrification goals and benefit from state or federal funding.

> **Scenario modeling shows an expected 7,400 new fleet electric vehicles add 24 MW of peak load within two years and up to 130 MW by 2030.**

These analyses are being used to identify the anticipated magnitude and likely locations for future load growth and will help BGE prepare for that growth by:

- Designing customer programs (e.g. managed charging, make-ready) and rates that simplify fleet electrification, shift load to off-peak periods (where duty cycles allow), and make the transition to EVs more affordable for customers.
- Planning and exploring targeted, proactive capacity additions, technology solutions like batteries and vehicle-to-grid (V2G), and directing some load to charging hubs to accommodate expected growth.
- Expanding customer outreach and education, and enhancing tools and analytics to prepare for and facilitate customer fleet electrification.
- Identifying opportunities to accelerate and improve fleet service model.
- Engaging as an Exelon company in national partnerships and coalitions with the power sector, car manufacturers, and fleet owners to reduce barriers and accelerate the market transformation.[9]

[9] Exelon is engaged in EPRI's EV2Scale, EEI National Electric Highway Coalition, and CALSTART Zero Emission Corridor Study for the I-95 corridor.



Methodology Overview

Vehicle data[10] was utilized as an input to develop a baseline fleet footprint, which was then validated, cleaned, and enriched prior to its use as the starting stock for the vehicle adoption model.

EV adoption forecasts were produced using a vehicle stock rollover model, which takes into account the fleet footprint database, vehicle retirement rates, vehicle mileage, and total cost of ownership assessments by vehicle type and county. The model then layers in top-down policy requirements to produce EV adoption forecasts, which consider both economic and policy drivers.

Truck activity was determined by using vehicle travel data. Geotab provides a robust platform for identifying differences in fleet behavior across geographic areas. It can assess where vehicles are domiciling in fine detail and aggregate the information across a county. Knowing when and where vehicles stop, how far they travel in a day, and how long they are parked form the basis of evaluating fleet power needs.

Zip code-level population forecasts were combined with their respective county profiles for driving activity to calculate the energy needed and determine the power loads to meet those fleet needs. By varying the EV populations through the stock rollover model, it is possible to compare load trends across the three scenarios, while also assessing the impact of charge management strategies.

The emissions model takes the vehicle stock outputs of the stock rollover model and calculates the associated greenhouse gas and air pollutant emissions as compared to a limited electrification baseline. The model accounts for emissions from tailpipes, fuel refining, and electricity generation. Air pollutant emissions changes (such as NO_X and $PM_{2.5}$) are then passed to EPA's Co-benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA). COBRA estimates how those emissions changes translate into avoided illness and death and provides monetized social benefit estimates for avoided health impacts.

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Figure 6: 2030 TCO Breakdowns BEV vs ICE (thousands)