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Executive Summary

Full Market Vehicle Electrification In New Jersey

The *Opportunities, Impacts, and Net Benefits For* Light-, Medium-, and Heavy-Duty Electric Vehicles

Prepared For ChargEVC By Gabel Associates, Inc.

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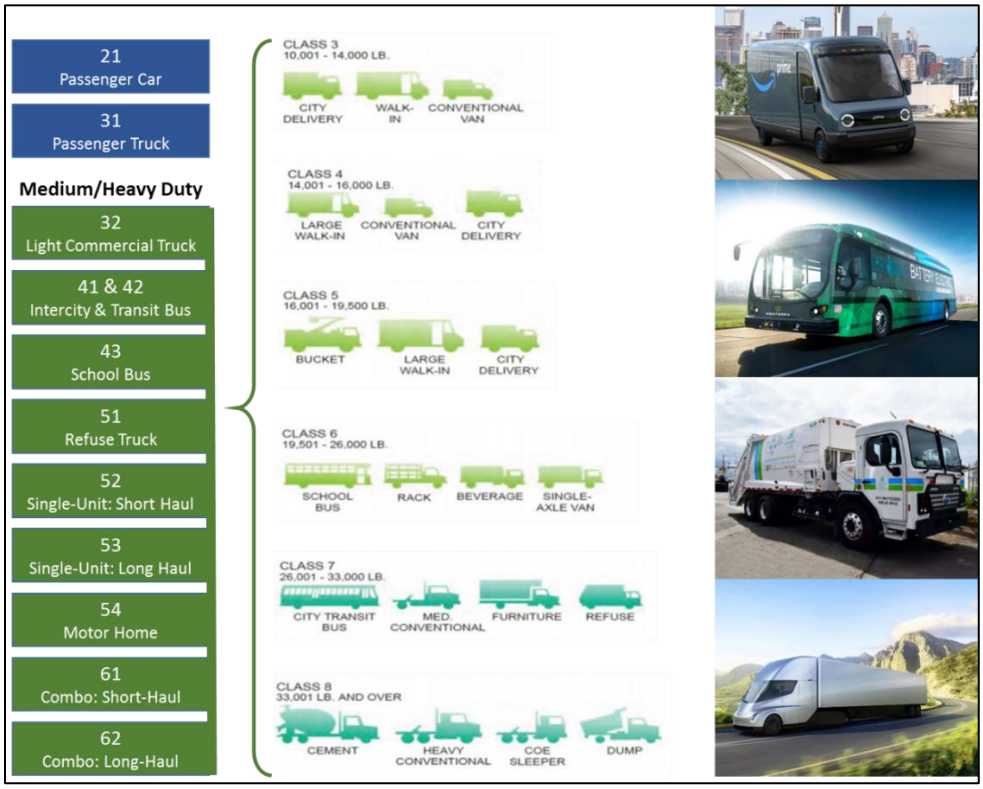
Executive Summary

New Jersey has adopted aggressive goals to improve the quality of life for its citizens through reduced air emissions of all types. These plans include reductions in greenhouse gases (GHG) to mitigate Climate Change impacts, and initiatives to reduce the emission of criteria pollutants that have a profound impact on public and personal health. Transportation is widely recognized as a primary source for these emissions, especially since vehicles create this pollution in high population density areas along roadways and in the communities where people live. The emergence of Plug-In Electric Vehicle (PEV) technology represents a profound opportunity to replace internal combustion engine (ICE) vehicles with advanced new alternatives that reduce transportation-related pollution and also change where those emissions take place. At the same time, PEVs bring other benefits through reduced operating costs, an enjoyable driving experience, and the potential for reduced electricity costs for all ratepayers.

This report summarizes the results of a new study that considers the market-wide potential for vehicle electrification in New Jersey, including projections of potential adoption rates, quantification of a diverse range of transition costs and benefits, and recommendations to inform the design of market development policies. This study considers both light duty vehicles (LDVs), and the full range of medium and heavy-duty diesel vehicles (MHDVs) that contribute especially to criteria pollutants such as Nitrogen Dioxide (NO2) and fine Particulate Matter (PM2.5).

Figure Exec_Sum - 1: Scope of The Electrification Study

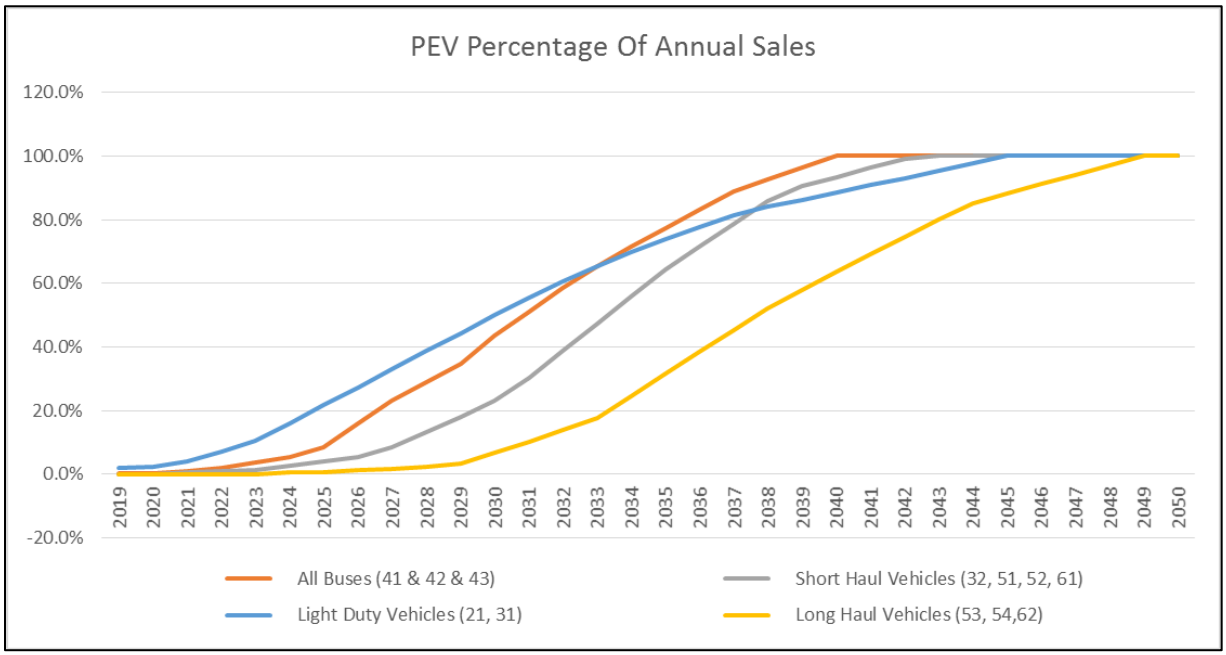


This study was commissioned by ChargEVC, a not-for-profit coalition of automotive retailers, utilities, technology companies, original equipment manufacturers (OEMs), local governments, environmental, community, labor advocates and others working to accelerate the transition to electrically fueled transportation in New Jersey. The study was conducted for ChargEVC by Gabel Associates, a consulting firm with well-established expertise in energy, environmental, utility, and policy research and analysis.

The study provides a statewide perspective on the potential benefits and challenges of electrification of the full market – from small passenger vehicles to buses, delivery trucks, and heavy-duty tractor-trailers. The study identifies a feasible schedule for each vehicle class, quantifies the technical potential for electrification of all types of vehicles, and assesses the net-benefit of a transition of the full on-road vehicle market to plug-in electric vehicles. The study provides projections through 2050, considers the need for new charging infrastructure and the associated grid impacts, and explores the synergy of increased use of renewable energy in the generation power mix with widespread vehicle electrification. The study identifies benefits related to savings in vehicle operating costs, reduced GHG and criteria pollutant emissions (especially in overburdened communities), and the potential for downward pressure on electricity costs that benefits all ratepayers. The study also identifies challenges associated with consumer adoption barriers, the need for vehicle charging infrastructure, and potential impact on the public grid and ways those impacts can be mitigated.

The study includes a detailed assessment of market readiness in all vehicle classes (both LDV and MHDVs), which was combined with a specialized technology dispersion model to determine a realistic vehicle adoption schedule. That schedule, quantified in terms of the percentage of new sales that are electrified each year, is summarized in the chart below.

Figure Exec_Sum – 2: Full Market Vehicle Electrification Schedule for New Jersey



Based on this electrification schedule, the study identifies impacts, opportunities, and challenges. The following highlights summarize the key findings and recommendations:

1) **Electrifying all cars and trucks in New Jersey is a big win:** Based on a comprehensive inventory of both benefits and costs for the full market, the study projects that widespread vehicle electrification (including LDVs and MHDVs) is strongly beneficial through 2050. The state would be justified in pursuing electrification of the full market – including diesel vehicles, as an expansion of existing efforts for LDVs.

2) **There is a strong synergy between vehicle electrification, increased renewable energy use, and proactive management of grid impacts:** The best-case scenario is when managed charging is widely deployed, and vehicle electrification is coupled with increased renewable energy ("RE") use. **In that case, benefits exceed costs by a factor of 4.12 through 2050, and electrification delivers nearly $100B in net benefit to New Jersey residents after considering costs.**

3) **The benefits from vehicle electrification are substantial, and impact everybody:** Electrification benefits include savings from reduced operating expenses for PEV owners, reduced GHG and criteria pollutant emissions (especially in the high-RE case), and downward pressure on electricity rates for all ratepayers when grid impacts are managed proactively**. Vehicle electrification creates substantial benefits for numerous stakeholders – including New Jersey residents that do not own a PEV, and especially overburdened communities that will benefit from cleaner air.**

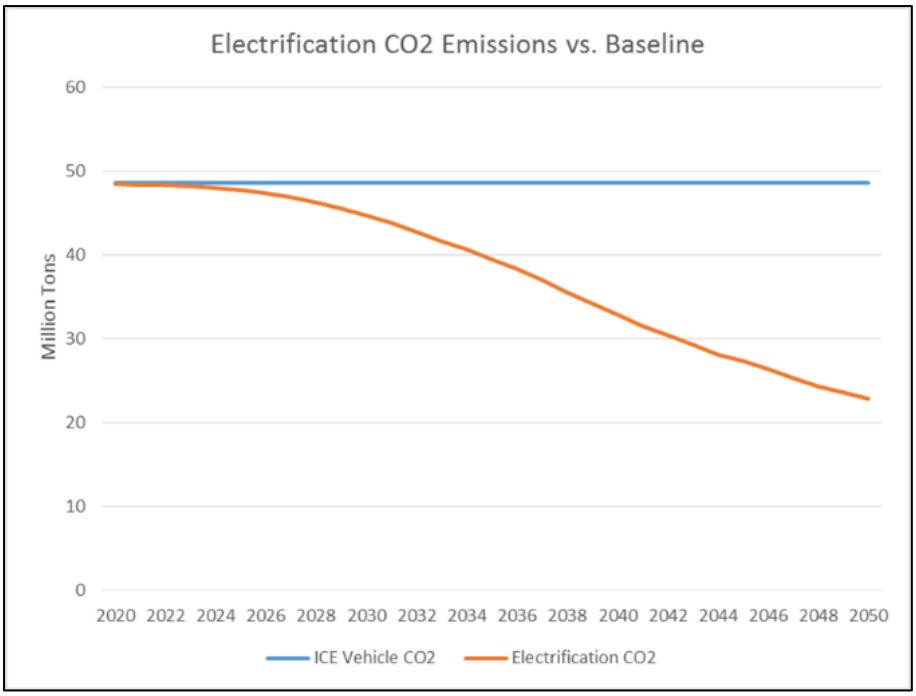
4) **The transition to plug-in electric vehicles cost less than the continued use of traditional vehicles.** The vehicle-oriented costs of the electrification are a critical factor. Focusing on the costs of vehicle purchases, fueling, and maintenance, the vehicle electrification scenario is less expensive (on both a nominal sum and net present value basis) than the continued purchase and use of traditional ICE vehicles – by nearly $140B (nominal sum).

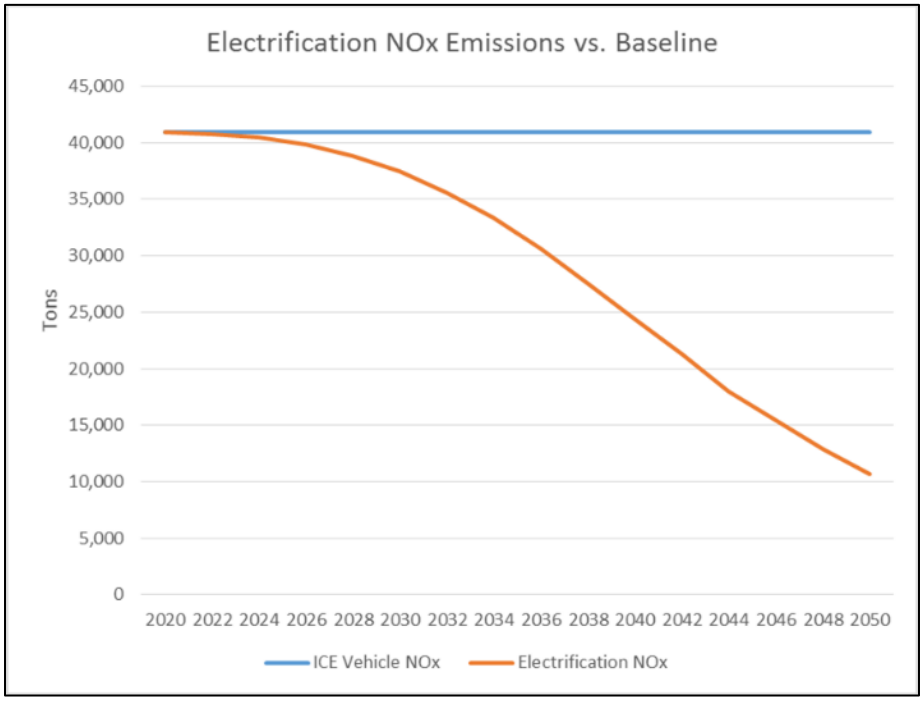
5) **The MHDV segments are extremely diverse, and goal setting and planning is best pursued at a granular "vehicle class" level. Some types of vehicles are ready to electrify relatively quickly – with local delivery vehicles, refuse trucks, and non-school buses being primary opportunities. Other segments, especially school buses and long-haul vehicles, will require targeted market development support to electrify rapidly.**

6) **Both LDVs and MHDVs reduce toxic emissions across-the-board, but in different ways.** LDVs generate the majority of GHG reductions, fuel cost savings, and downward pressure on rates. Electrified MHDVs also reduced GHG emissions, but have the largest impact on the reduction of criteria pollutants near travel zones. The study clarifies that vehicle electrification is justified as both a GHG reduction program and a public health initiative for which there are significant equity considerations. These improvements are amplified when vehicle electrification is coupled with increased renewable energy use. **Toxic vehicle-induced emissions in urban areas and along roadways will be virtually eliminated on an absolute basis, especially for overburdened**

communities. In all cases, even when considering net emission changes on a regional basis (i.e. after accounting for emission increases at power plants), Carbon Dioxide (CO2) drops by 74% and Nitrogen Oxide (NOx) drops by 85% (for the high renewable energy scenario).

Figure Exec_Sum – 3: Net Emission Reductions from Full Market Vehicle Electrification





7) **Vehicle electrification presents huge opportunities for the grid, but also significant challenges that need to be addressed proactively.** At high levels of electrification, as much as 30% of all electricity use will be for charging vehicles. This new load will have a transformative impact on the grid and represents an opportunity to optimize overall loading since PEV charging can be a "dispatchable load" in some segments. Without proactive planning and impact mitigation, however, vehicle electrification could force significant grid reinforcement and increased electricity costs for all ratepayers.

8) **LDVs and MHDVs will impact the grid in very different ways.** LDVs will create a large number of small charging loads (increasing average residential consumption by about 50%), the impact of which will be significant unless mitigated proactively through a combination of technology and rate design solutions under managed charging programs. The charging impacts from MHDVs are potentially very large (due to the need for very high-power infrastructure for some vehicle classes, especially long-haul), but those load points are relatively small in number and therefore more manageable. Several mitigation strategies exist for those MHDV vehicle classes, including integrated storage, smart charge scheduling, and en-route charging where applicable. High power DCFC (150 – 350 KW) chargers are especially valuable because they can serve the needs of both the LDV and some MHDV segments (i.e. dual use infrastructure).

9) **Electricity pricing, and the structure of that pricing, has a strong impact on vehicle charging and infrastructure investment behaviors.** Existing tariff designs may be missing desired inducements, or may create barriers to charging infrastructure investment. Commonly used residential tariffs typically don't encourage the off-peak charging that is most optimal. The demand charges associated multi-family, workplace, fleet, and public charging applications can make investment economics challenging, especially during early market phases when utilization is lower. Those impacts will be even more impactful for the higher-powered charging solutions that will be needed by many MHDVs. At the same time, serving these new charging-induced loads could change the cost of service for utilities providing that power, which needs to be a consideration in the allocation of costs and overall rate design. **Balancing the needs of the PEV market for supportive rate designs (and other economic incentives) with the needs for fair cost allocation and recovery will be a key policy priority as the market matures.**

10) **The study identified key barriers to electrification of the full market and proposed a next generation plan that focuses on top priorities.** The analysis included the identification of key adoption barriers, and those barriers vary significantly by vehicle class. A next generation "market development plan" has been developed to identify the priorities of greatest need, and to provide detailed "working assumptions" about electrification costs. The net benefits noted above include the potential costs of those potential market development initiative. Priorities for this next generation program include (some of these already exist, some are new):

    1. **Electric School Bus Program** – to improve equitable access to PEV benefits by addressing first-cost barriers, especially in overburdened communities.

2. **NJ Transit** – to address charging infrastructure needs in support of the electrification goals established in New Jersey's January 2020 EV law (P.L. 2019. C.362).

3. **LDV Rebate Program** – to address first-cost issues in the LDV segment, and to ensure attainment of the vehicle adoption goals established in the EV law.

4. **Charging Infrastructure -** a package of initiatives that provide the charging infrastructure needed across multiple segments, with a priority on new programs for diesel displacement opportunities:
    a) Residential managed charging initiative (to mitigate grid impacts).
    b) LDV high power public charging initiative (to increase LDV adoption).
    c) Multi-family EV access program (to ensure equitable access).
    d) Commercial charger program (workplace and fleet, including MH-duty).
    e) High power charging for long haul segments (at truck stops).
    f) Consumer education and awareness campaign.