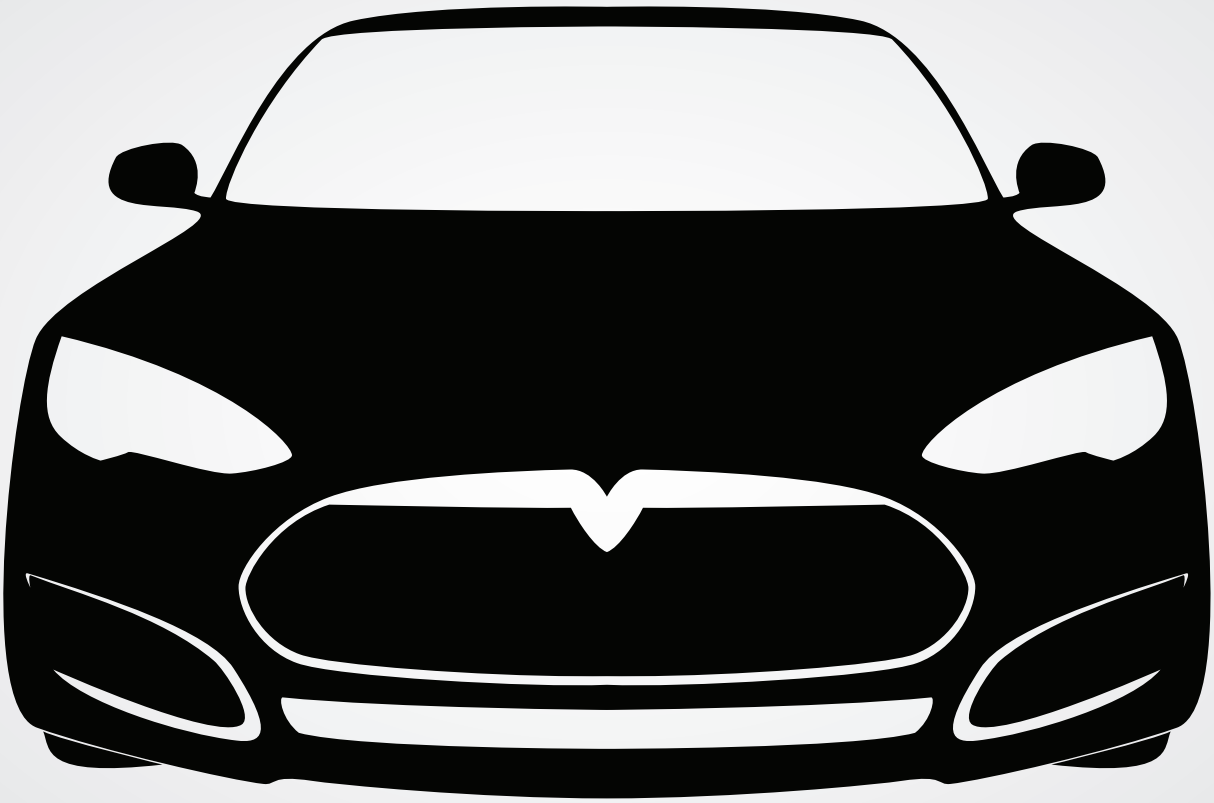
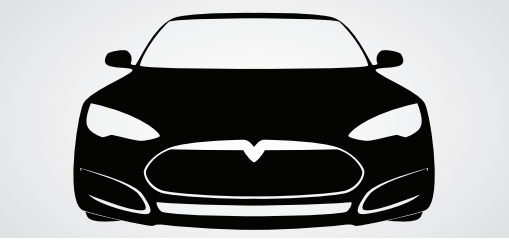
New Jersey's Electric Vehicle Mandate



A High-Cost Boondoggle that Will Wreck the Economy, Harm the Poor, and Have No Impact on Climate.

A Policy White Paper by Affordable Energy for New Jersey

AFFORDABLE ENERGY *For* NEW JERSEY



New Jersey's Electric Vehicle Mandate

A High-Cost Boondoggle that Will Wreck the Economy, Harm the Poor, and Have No Impact on Climate.

Buy an EV, or Else...

As part of New Jersey's desire to transform the state into an "emissions-free" economy, as envisioned by the state's Energy Master Plan (EMP), in January 2020, Governor Murphy signed S2252, which requires a total of 330,000 electric vehicles (EVs) to be on New Jersey roads by 2025 and two million by 2035. According to the Department of Environmental Protection's latest strategic climate action plan, the state will need 4.5 million EVs to meet its climate goals. (By comparison, there were around six million cars and light trucks registered in the state in 2023.) The legislation also provides myriad subsidies for EVs, including up to $5,000 for purchasing EVs whose sticker price is less than $55,000, and installation of thousands of public charging stations by 2025.

When S2252 was signed, New Jersey Department of Environmental Protection (DEP) Commissioner Catherine R. McCabe said, "Today's bill will put more electric vehicles on the road and keep them running throughout the Garden State. This is more than just a win for electric vehicle owners, it is a big leap forward in reducing emissions in New Jersey, giving us cleaner air and helping to reduce the damaging effects of climate change."

Assemblyman Benson, chair of the Assembly Transportation Committee, said that, "Our goal is to get more electric vehicles on the road, which in turn will result in less greenhouse gas emissions that contribute to climate change, more local jobs to put the charging infrastructure in place, and cleaner air for our communities. For a cleaner, healthier state, this new law will put forth strong attainable goals to increase the number of electric vehicles and charging stations in New Jersey."

S2252 requires that 330,000 EVs be on the road by 2025, and two million by 2035.

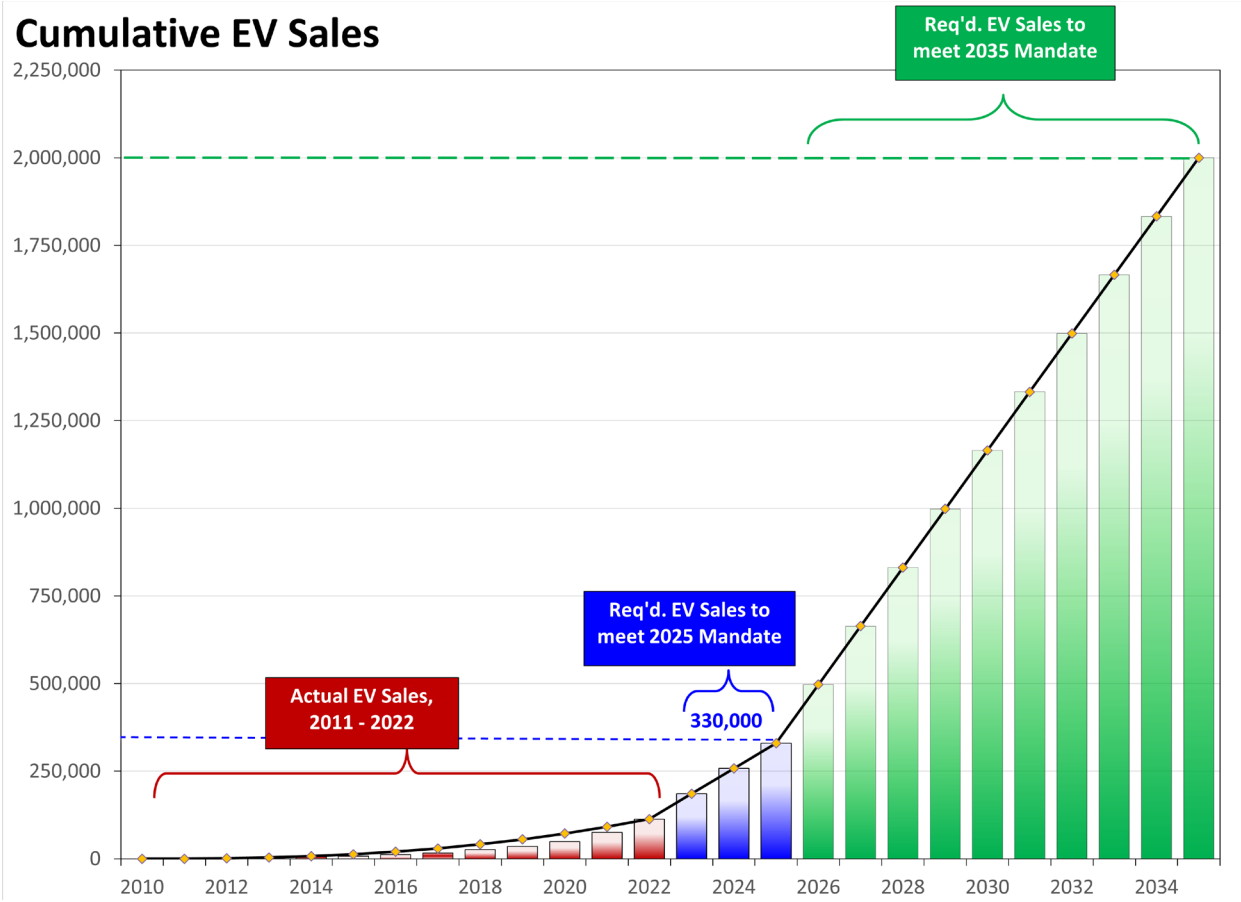
At the end of June 2023, there were 107,000 EVs in the state, less that 2% of all registered vehicles.

Through June 2023, about 107,000 EVs have been sold in the state. Sales of all EVs accounted for about five percent of the 1.5 million vehicles sold in 2022. But EVs still only account for less than two percent of all registered vehicles in the state.

It's true that EV sales in the state have increased each year. In 2022, about 31,000 EVs – mostly Teslas – were purchased. But meeting the 2025 mandate will require New Jerseyans to purchase over 200,000 EVs over the next two years, an average of 100,000 EVs each year, over three times the amount purchased in 2022 (Figure 1). And to meet the 2035 mandate, New Jerseyans will have to purchase over 200,000 EVs every year, even if the 2025 target is met.

One problem with meeting these mandates is that EVs are a lot more expensive than internal combustion vehicles (ICVs). The average price of an EV sold in 2022 was over $55,000 – which just happens to be the cut off price for receiving the state subsidy of up to $5,000. That average EV sale price was $9,500 higher than the average price of a new ICV , according to a new JD Power report. And, thanks in part to supply chain issues, prices for both types of vehicles are going up – fast.

Figure 1: Actual and Projected EV sales, 2011-2035

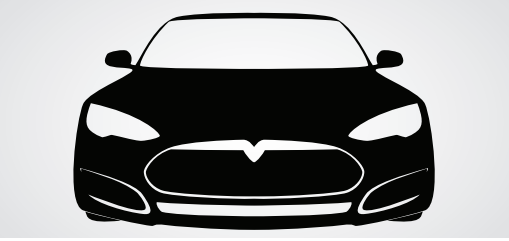


So what happens if New Jerseyans decide not to purchase enough EVs to meet the state mandate? Will the governor change the rules and force consumers and businesses to buy vehicles they don't want?

The state's Department of Environmental Protection (DEP) advocates just that. In October 2020, the agency called for a complete ban on the sale of new internal combustion vehicles (ICVs) by 2035 – the same ban California governor Newsom mandated via Executive Order last year.[1] The DEP claims this ban will be needed if the state is to meet its greenhouse gas reduction goal of reducing carbon dioxide (CO2) emissions 80 percent below 1990 levels by 2050. In fact, the DEP's most recent strategic plan calls for 4.5 million EVs by 2035, more than twice as many as the state's mandate.

If proponents are to be believed, the current EV mandate and the DEP's proposed ban on new ICV sales will allow New Jersey to fight off climate change, while strengthening the state's economy. Indeed, S2252 itself proclaims that "plug-in electric vehicles with longer ranges are now widely available at a lower cost and present a viable alternative to vehicles fueled by fossil fuels … vehicle electrification offers a wide range of benefits, such as improved air quality, reduced greenhouse gas emissions, and savings in motor vehicle operating costs for vehicle owners."

1 Currently, nine states have banned the sale of new ICVs after 2035: California, Connecticut, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Washington state. Other states that have adopted ACC II are considering such bans.

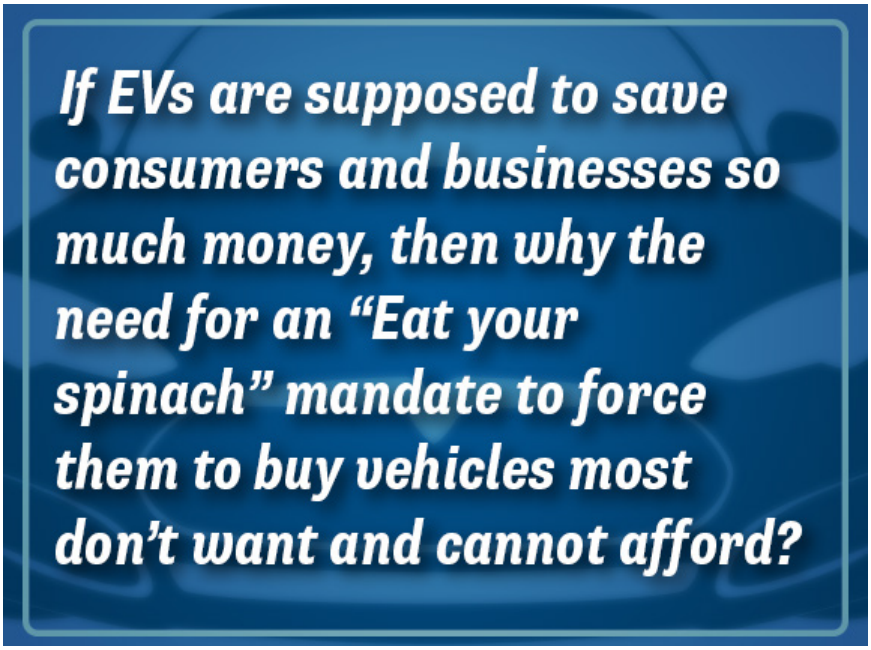


ChargeEVC, another EV cheerleader group stated, "Electrifying all cars and trucks in New Jersey is a big win."[2] And an earlier report issued by this same organization claims that rapid adoption of EVs, which the report referred to as a "Transformation" case, would save New Jersey consumers $2.9 billion by 2035 and over $17 billion by 2050, plus provide environmental benefits worth far more.[3]

So, supposedly EVs are a "big win" for New Jersey consumers and businesses, which will save them billions of dollars. And, supposedly EVs are a "big win" for the environment, too. If true, then why did the legislature and Governor Murphy need to impose an "eat your spinach" mandate for EVs? Why does the DEP want to ban on sales of new ICVs? Why does the Commissioner of the DEP insist that banning the sale of gas-powered cars"opens" customer choice? And what does the Governor intend to do if New Jerseyans don't want to buy all of the EVs he has decreed are good for them? What does the Governor intend to do for poor families who cannot afford any type of new car, much less an expensive EV?

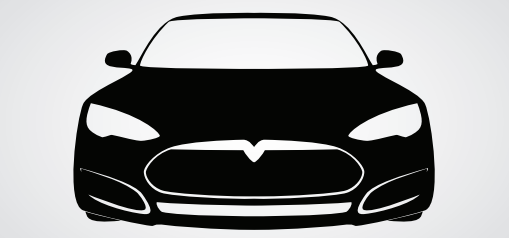
New Jersey consumers and businesses are not stupid. They know the types of vehicles that will best meet their needs, whether a pickup truck that can haul a trailer full of horses or a minivan to haul their children to school. They know that, despite all of the subsidies on offer, EVs will cost them plenty. They know that EVs don't work well in extreme cold and heat. They know that, when a hurricane knocks out the electricity for days, they won't be able to recharge their EVs and will be stranded.

Why not allow New Jerseyans to make their own decisions about the cars and trucks they drive? Those who want to buy an EV can do so. And those that don't want to buy an EV should be able to make that choice, too.



2 Charge EVC, "Full Market Vehicle Electrification in New Jersey: The Opportunities, Impacts, and Net Benefits for Light-, Medium-, and Heavy-Duty Electric Vehicles," October 7, 2020 (ChargeEVC 2020), p. 6.

3 Charge EVC, "Electric Vehicles in New Jersey: Costs and Benefits," January 26, 2018 (ChargeEVC 2018), pp. 3-4.



Show Us the Money: The High Cost Of New Jersey's Electric Vehicle Mandate

When the Energy Master Plan (EMP) was released in late 2019, Governor Murphy promised that the state would prepare an estimate of the costs to implement it. Although Rutgers University prepared an analysis of the EMP's estimated costs, that analysis was never released. Instead, last year, the state announced it would redo the analysis. A new cost estimate is not due until sometime in 2024.

One reason for the delay is that the EMP's promises that the state's economy will be transformed at little or not cost are so much hot air. One component of the EMP is complete electrification of the transportation sector, especially adopting electric vehicles. Towards that goal, as discussed in our previous report, S2552 mandates at least 330,000 EVs on New Jersey roads by 2025 and two million my 2035. The legislation also provides a veritable smorgasbord of subsidies to achieve those EV targets. Those subsidies primarily will benefit the wealthy, who can afford high-priced EVs, while being paid for everyone else.

The costs to New Jerseyans include:

i. A $5,000 per vehicle state subsidy, now capped at $30 million per year, for EVs costing no more than $55,000 (as well as the $7,500 federal tax credit for purchasing an EV);[4]
ii. Foregone sales tax revenues because the state exempts EVs from sales taxes;
iii. Loss of state gasoline tax revenues used to maintain roads and highways, and loss of federal gasoline tax revenues;
iv. Building a taxpayer-subsidized charging infrastructure, including 1,400 new Level II charging stations and 400 high-voltage DC charging stations;
v. Subsidies for residential and workplace charging stations;
vi. Costs to upgrade electric utility local distribution systems to enable them handle the increased loads caused by home and commercial charging (especially as the state simultaneously pursues huge increases in rooftop solar installations), which will be recovered through higher electric rates; and
vii. Loss of highway tolls because EVs are entitled to a 10% discount on toll charges.

The state is also planning to replace all transit buses with more costly electric ones, which will require further taxpayer investments.

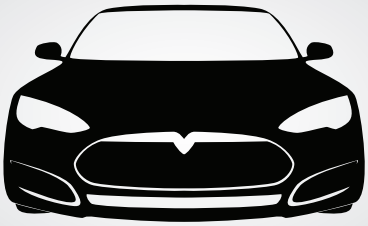
The EV Purchase Subsidy

The $5,000 per vehicle subsidy is currently limited to $30 million per year for ten years, for a total of $300 million, enough for 60,000 qualifying EVs – less than 20% of the 2025 mandate and less than one-half of one percent of the 2035 mandate.[5] If the state were to subsidize all of the EVs needed just to meet the 2025 mandate, the cost to New Jersey taxpayers would be over $1.6 billion. Given EV sales through 2021 and the rapid increases in EV prices, its unlikely the mandates will be met without expanding the subsidy.

Similarly, the additional cost just to meet the 2025 mandates could be another $2.25 billion, assuming all EVs purchased were able to claim the $7,500 tax credit. If continued through 2035, that federal tax credit would amount to $15 billion.

4 US taxpayers will also bear some of the costs of the NJ mandate because of the federal tax credit for EVs and the additional costs of financing even higher deficits.

5 In 2020, the state cut total spending from the $30 million authorized to $16 million because of budget shortfalls. The Murphy Administration has restored the funding to $30 million and is considering increasing it.



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Because EVs are exempt from the state sales tax, meeting the mandate will cost state taxpayers $4 billion by 2025 and $58 billion by 2035.

Lost Sales Tax Revenues

The largest single direct state cost of the EV mandate will be the loss of sales tax revenues because, unlike purchasers of conventional vehicles, EV purchasers are exempt from paying the state sales tax. Based on the current sales tax rate of 6.625%, and assuming the $55,000 average cost of all EVs purchased in the state increases at an assumed rate of inflation of 2% per year, the cumulative loss of sales tax revenues from meeting the 2025 mandate will be almost $4 billion. By 2035, the state sales tax revenue loss will be almost $58 billion. These losses surely will be recouped by the state by raising other taxes and fees, most of which will be paid by non-EV owners.

Lost Fuel Taxes Used to Maintain New Jersey Roads and Highways

EVs don't pay fuel taxes. Hence, meeting the mandate will reduce state fuel tax collections that are used to maintain roads and highways. In October 2020, the state raised the Petroleum Products Gross Receipt (PPGR) tax on gasoline to 31.8 cents/gallon.[6] Coupled with the 10.5 cent/gallon motor fuel tax, total state taxes per gallon of gasoline are 42.3 cents. (There is also a federal gasoline tax of 18.4 cents/gallon, so New Jersey motorists now pay a total of 60.7 cents/gallon of gasoline.)

The state's target amount for annual motor fuel tax collections is just over $2 billion. According to data published by the U.S. Energy Information Administration, motor gasoline sales in the state for transportation totaled about 3.45 billion gallons in 2021.[7] Determining the loss of gasoline tax revenues is difficult because there are limited data on the driving habits of EV owners.[8] Nevertheless, we can develop some estimates of lost gasoline tax revenues per year.

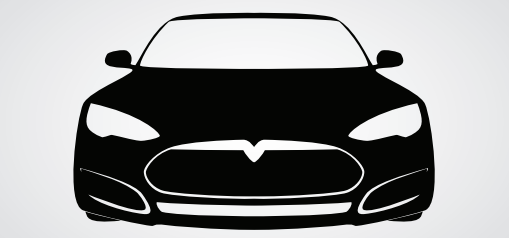
For example, if there are 330,000 EVs in 2025, roughly 5% of total vehicles registered in the state, and on average those EVs travel the same number of miles per year as all vehicles, then a first approximation of the loss of gasoline tax revenues would be just over 5% of

EVs don't pay fuel taxes used to maintain roads and highways. Cumulative losses to the state would be over $4.5 billion by 2035.

6 New Jersey Dept. of the Treasury, "Treasury Announces Change in Gas Tax Rate Effective October 1," News Release, August 28, 2020.

7 U.S. EIA, State Energy Data System, Table F3: Motor gasoline consumption, price, and expenditure estimates, 2019. Multiplying the reported motor gasoline consumption value for transportation of 89,260,000 barrels by 42 gallons/barrel = 3.75 billion gallons.

8 For example, a recent study estimated that EV drivers in California logged an average of just 5,300 miles per year, compared with about 11,500 for all cars and light trucks. Fiona Burlig, et al., "Low Energy: Estimating Electric Vehicle Electricity Use," Energy Policy Institute at the University of Chicago, Working Paper No. 2021-17, February 2021 (Burling, et al.).



$2 billion, or about $110 million. By 2025, the cumulative loss of state gasoline taxes would be almost $380 million and by 2035, the cumulative loss would total over $4.5 billion.

Assuming New Jersey continues to respond to the loss of revenues by raising gasoline taxes as it did last year, ICV owners will be forced to subsidize typically wealthier EV owners to an even greater extent. Furthermore, EVs result in a loss of federal gasoline tax revenues. Using the same assumptions, the cumulative loss in federal gasoline tax revenues would be $137 million by 2025 and $1.6 billion by 2035.

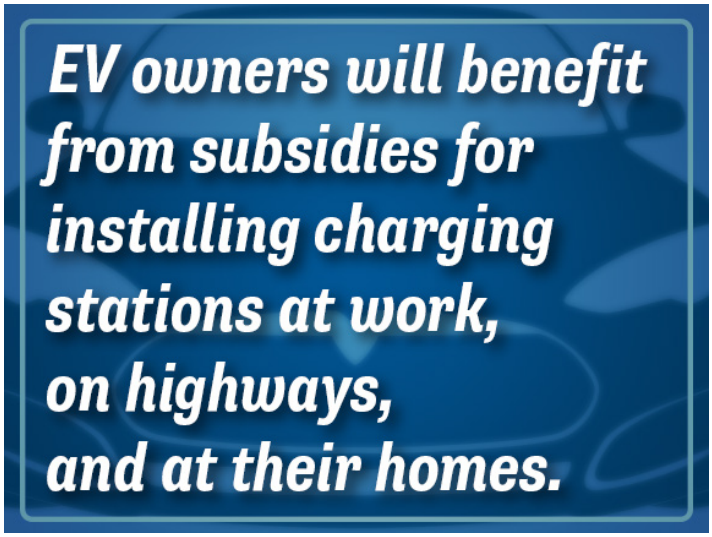
Subsidies for Public Charging Stations

S2252 also calls for building a network of public charging stations – 400 DC "fast" charging stations that can charge most EVs in less than one hour and 1,000 "Level 2" charging stations that can charge an EV in 5-8 hours – all to paid for by taxpayers.[9] Data published by Southern California Edison (SCE) for its "Charge Ready" program show that, through December 2020, the average installed cost of a Level 2 charging station has been just over $14,000 per charging port.[10]

The average cost of a DC fast charging station (DCFC) is between $4,000 and $50,000 per port, with a typical installed cost of between $50,000 and $150,000 per station.[11] For example, Austin Energy's two-unit Seaholm public DCFC stations had a reported installed cost of $105,823, or $52,912 per port.[12]

Although S2252 does not specify how many ports each station should have. If we assume an average cost of $100,000 for each DCFC station, that implies a cost of $40 million. The cost for installing 1,000 Level 2 charging stations would be around $20 million, assuming an average cost of $20,000 each.

Of course, most EV homeowners will want to install their own chargers. Assuming a low-end cost of $650/installation, as estimated by the Rocky Mountain Institute,[13] and assuming that 75% of EV purchasers own their own homes, the cost of installing residential chargers for 300,000 EVs would be around $200 million and the cost for installing chargers for two million EVs would be $1.3 billion.



S2252 also provides for a $500 credit for residential homeowners who install EV chargers. If 75% of the new EVs are purchased by homeowners, then the cost of the credit for the to meet the 2025 mandate would be $113 million and about $750 million to meet the 2035 mandate.

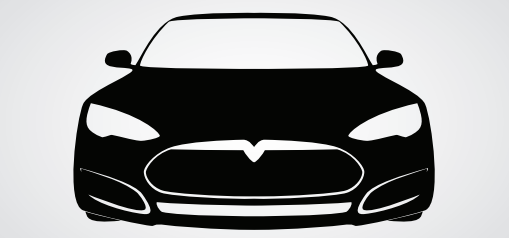
9 A high-voltage DC charging station can charge an EV to 80% capacity in 15 minutes to one hour; the higher the voltage, the faster the charge (and the faster battery life decreases.) A Level 2 charger takes 3-8 hours to recharge an EV.

10 Southern California Edison, "Charge Ready Pilot Program Quarterly Report for Fourth Quarter 2020," March 1, 2021, p. 19.

11 US DOE, "Costs Associated with Non-Residential Electric Vehicle Supply Equipment," November 2015, p. 17. See also, Michael Nicholas, "Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas," Intl. Council on Clean Transportation, Working Paper 2019-14, August 2019.

12 Austin Energy FOIA Response.

13 Josh Agenbroad, "Pulling back the veil on EV charging station costs," Rocky Mountain Institute, January 5, 2019.



Costs to Upgrade Local Electric Utility Systems

If thousands of New Jerseyans are charging their EVs at home, the state's electric utilities will need to upgrade their local distribution systems (the poles, wires, and substations needed to deliver power to customers) to handle the additional loads.[14] A 2019 study by the Boston Consulting Group estimated additional costs of between $1,700 and $5,800 in distribution system upgrade costs per EV.[15] Hence, meeting the 2025 mandate translates into utility upgrade costs of between $560 million and $1.9 billion. Meeting the 2035 mandate will mean upgrade costs between $3.4 billion and $11.6 billion. Using an average of the per-EV upgrade costs, the upgrade costs will be around $1.2 billion in 2025 and $7.5 billion by 2035.

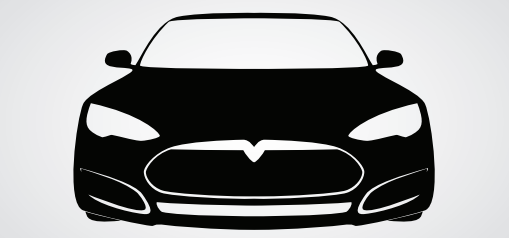
But EV owners won't be required to pay for those upgrades. Instead, they will be paid for by all ratepayers. Thus, millions of New Jerseyans, including lower income consumers who cannot afford to purchase an EV, will be forced to subsidize higher-income consumers who purchase EVs.[16]

...millions of New Jerseyans, including lower income consumers who cannot afford to purchase an EV, will be forced to subsidize higher-income consumers who purchase EVs.

14 For a discussion of impacts of EV charging on electric distribution, see Robert Bass and Nicole Zimmerman, "Impacts of Electric Vehicle Charging on Electric Power Distribution Systems," OTREC-SS-731. Portland, OR: Transportation Research and Education Center (TREC), 2013.

15 Anshuman Sahoo, et al., "The Costs of Revving Up the Grid for Electric Vehicles," Boston Consulting Group, December 20, 2019.

16 Still another issue is the EMP's call for massive increases in rooftop solar installations on residential homes. Local distribution systems are designed to take power generated from a central station and distribute outward to homes and businesses. They were not designed to have decentralized power emanating from everywhere. Although some amounts of rooftop solar can be accommodated on circuits, accommodating large quantities (say most of the homes along a given circuit) require upgrades to ensure that local distribution systems are safe and reliable. In some cases, those upgrades are inexpensive; in other cases, they are costly, perhaps $500,000 per circuit. See Kelsey Horowitz, et al., "The Cost of Distribution System Upgrades to Accommodate Increasing Penetrations of Distributed Photovoltaic Systems on Real Feeders in the United States," National Renewable Energy Laboratory, April 2018.



Adding Up the Direct Costs

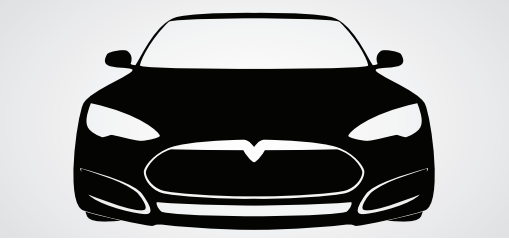
In total, under conservative assumptions, the direct costs of the state EV mandate could total $8.1 billion by 2025 and over $87 billion by 2035 (Table 1). Excluding the costs to the federal government, the direct costs to New Jersey alone would be about $5 billion by 2025 and $70 billion by 2035 – over $7,600 for each of the state's 9.2 million residents and $35,000 for each of the mandated two million EVs.

Table 1 Estimated Direct Costs of the EV Mandate

Item	Cumulative Costs through 2025 ($)	Cumulative Costs through 2035 ($)
State EV Tax Credit (S2252)[1]	$166,000,000	$300,000,000
Federal EV Tax Credit[2]	$2,250,000,000	$15,000,000,000
Forgone State Vehicle Sales Taxes[3]	$3,880,000,000	$57,957,000,000
Forgone State Gasoline Tax Collections[4]	$299,000,000	$3,845,000,000
Forgone Federal Gasoline Tax Collections[5]	$137,000,000	$1,647,000,000
Public Charging Systems Subsidies[6]	$60,000,000	$60,000,000
State Residential Charger Credit (S2252)[7]	$113,000,000	$750,000,000
Local Distribution System Upgrade Costs[8]	$1,238,000,000	$7,500,000,000
Total	**$8,143,000,000**	**$87,040,000,000**

Notes

1 Based on $30 million/year, except $16 million in 2020.
2 Based on $7,500 per BEV; subsidy assumed to be extended indefinitely.
3 Based on current state income tax rate of 6.625% and average BEV price of $40,000 in 2020, escalating at 2% per year for inflation.
4 Based on currect state gasoline tax of 43.2 cents/gallon and target annual revenues of $2 billion.
5 Based on current federal gasoline tax of 18.4 cents/gallon.
6 Based on cost of installing 400 DC ($100,000 each) and 1,000 Level 2 charging stations ($20,000 each) by 2025. No further charging stations thereafter.
7 Credit of $500 per residential charger. Assumes 75% of purchases are homeowners.
8 Based on average distribution system upgrade cost of $3,750 per BEV.



Show Us the Money

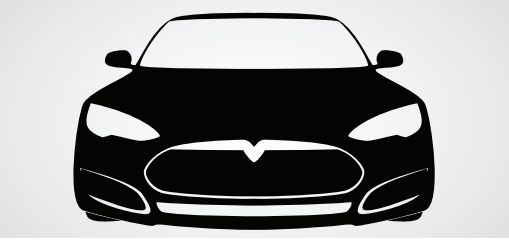
The billions of dollars the state intends to shower onto EV owners, which could reach $70 billion by 2035, will need to be recouped – unless one believes the state will simply cut government spending by the amount of all of the subsidies. The money will come from higher taxes – income, sales, and gasoline – to compensate for lost tax revenues. Sales and gasoline taxes are regressive, falling most heavily on those who can least afford them. And when states raise income tax rates, wealthy residents often leave for lower-tax states.

Higher taxes will raise the cost of goods and services. For example, the dollar per gallon increase in gasoline prices over the past year has raised the cost of transporting goods across the country, fueling inflation.

Higher electricity prices to pay for system upgrades will increase the cost of doing business in the state and reduce the competitiveness of state businesses relative to out-of-state entities. Coupled with the EMP's electrification mandates for all buildings, and the move towards 100% renewable electricity with for more solar and, especially, offshore wind generation, electricity prices in the state will be pushed even higher. This will mean reduced economic growth and fewer jobs, as businesses relocate out of state, just as many have left high-tax California for lower-tax states like Texas.

The myriad subsidies will not be paid for by the EV fairy; they will be borne primarily by lower incomes residents and small businesses, who can least afford them.

That's just wrong.



Benefit the Environment...Not so Much

When S2252 was signed by the Governor, DEP Commissioner Catherine R. McCabe claimed that the electric vehicle (EV) mandate would be a "win for electric vehicle owners" and would "reduce the damaging effects of climate change." There is no doubt that the lavish subsidies the state is bestowing, which will be paid for, in large measure, by lower-income New Jersey residents, will be a "win" for EV owners. But claims that the EV mandate will provide significant environmental benefits in the form of reductions in pollutants and CO_2 emissions are unsupported and, given the generation mix for the foreseeable future, incorrect. For the foreseeable future, the EV mandate will increase air pollution, while the reduction in CO_2 emissions will be negligible.

Many proponents call EVs pollution-free. It's true that a battery-powered vehicle like Tesla doesn't have a tailpipe spewing smoke. But EVs are not pollution-free. Rather, the pollution emitted by EVs is indirect: it comes from the generating plants that provide the electricity used to charge them.

These claims of environmental nirvana are based on a fundamental error: they compare new EVs to the existing New Jersey vehicle fleet. Instead, the true comparison must be between EVs and new internal combustion vehicles (ICVs): a consumer who has made a decision to purchase a new vehicle must choose between an EV and an ICV.[17]

But it turns out that, because new ICVs emit so little air pollution and must meet the U.S. Environmental Protection Agency's (EPA) stringent CO_2 emissions limits that, when compared with the pollution and CO_2 emissions of the generating plants that supply New Jersey with electricity, EVs will "pollute" **more** than ICVs and reduce CO_2 emissions by a negligible amount.

New ICV Emissions Standards

In 2014, EPA established so-called "Tier 3" emissions standards, which already have reduced the amount of sulfur in gasoline – thus reducing sulfur dioxide (SO_2) emissions – and reduced allowable vehicle particulate and NOx emissions.[18] In December 2021, EPA established new, more stringent CO_2 emissions standards for new cars and trucks.[19] The new standards for 2026 are shown in Table 2.

Because of the mix of generating resources used to charge them, EVs in New Jersey will be more polluting than new internal combustion vehicles.

For an average ICV driven 10,000 miles per year, the annual emissions would be 0.66 pounds of NOx, 0.02 pounds of SO_2, 0.06 pounds of particulates, and about 2.1 tons of CO_2. (For 2026, the new EPA CO_2 emissions standards assume about 17% of vehicles will be "zero-emission" EVs. Hence, the CO_2 emissions for the remaining 83% of ICVs will be around 194 gm/mile, corresponding to about 46 mpg.)[20]

17 It is also possible that a consumer faced with a choice solely between a new EV and keeping his existing vehicle would choose the latter. In such a scenario, the EV mandate may have exactly the opposite effect of what the mandate is designed to achieve.

18 EPA, "Final Rule for Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards," April 28, 2014.

19 EPA, "Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards: Final Rule," December 20, 2021.

20 This is just simple algebra: (0.83) x (CO_2-ICV) + (0.17) x 0.0 = 161, which means that CO_2-ICV = 161 / 0.83 = 194. According to the US EPA, when burned, one gallon of gasoline emits 8,887 grams of CO_2. So, to determine the average mpg, we calculate 8,887 / 194 = 45.8 mpg

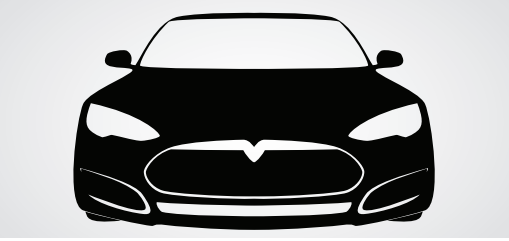


Table 2: New ICV Emissions Rates – 2026

Emission	Rate (grams per mile)
CO_2 (1)	161
NO_X (2)	0.03
SO_2 (3)	0.001
Particulates	0.003

Notes

(1) EPA Final Rule, fleet average, equivalent to 55 mpg.
(2) Tier 3 standard fully implemented in 2025.
(3) Based on Tier 3 gasoline sulfur content standard of 10 parts-per-million, as of 2017. Conversion to grams/mile based on relative molecular weights of SO_2 vs sulfur (64 vs 32), weight of gasoline (6.07 pounds/gallon), and 55 mpg average required to meet CO_2 standard.

Emissions from New Jersey's Electricity Supply

To compare new ICV emissions rates with those of EVs, one must determine the mix of generating resources that providing the electricity used to recharge the EVs. New Jersey is a member of PJM, which coordinates the operation of generating plants throughout 13 mid-Atlantic states and the District of Columbia. This coordination benefits the member states because it ensures that electricity supplies will be far more reliable than any individual utility "going it alone" and results in lower wholesale market prices.

Unless New Jersey withdraws from PJM (something the state's Energy Master Plan recommends the Board of Public Utilities study), the "cleanliness" of the electricity that will be used to charge New Jersey EVs will depend on the generating plants in PJM that provide the electricity for those vehicles when those batteries are charged.

When an EV is plugged into a charger, the demand for electricity increases. That electricity is provided by whatever generating resources are "on the margin" at the time, that is, the generating resources are called on by PJM to produce the additional electricity needed to charge an EV.

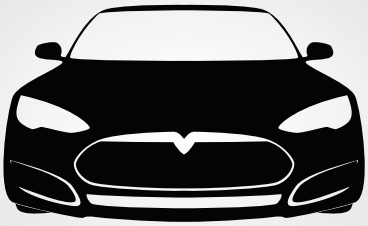
PJM has published marginal emissions rates for both on-peak (during the day) and off-peak hours, for CO_2, NOx, and SO_2 emissions (Table 3). The emissions rates shown in the table have decreased since 2015, the result of decreasing reliance on coal-fired power plants and greater reliance on natural gas-fired ones.

To determine emissions per MWh of useful electricity to an EV battery, the rates in Table 3 must be increased for two reasons. First, transmission and distribution system losses in PJM consume about 5% of the electricity generated.[21] Second, batteries and related electrical components in an EV are not 100% efficient. Rather, they lose about 25% of the electricity used to charge them.[22] So, the actual emissions rates for each kilo-

Emissions from NJ EVs depend on the mix of generating resources in PJM, especially the generators that run at night when most EVs are charged.

21 Source: US EIA, Frequently Asked Questions, "How much electricity is lost in electricity transmission and distribution in the United States?" November 18, 2019. See also, US EIA, State Energy Data Profile, New Jersey, Table 10, Supply and Disposition of Electricity. Average losses in NJ are calculated as 5.02%.

22 Total losses from battery charging also depend on the current at which a battery is charged. See, e.g., Elpiniki Apostolaki-Iossifou, et al., "Measurement of power losses during electric vehicle charging and discharging," *Energy* 127 (May 2017), pp. 730-742.



watt-hour (kWh) of electricity used by an EV are around 30% higher than the emissions rates shown in Table 3.[23]

Similar to an ICV's fuel efficiency, an EV's emissions depend on how much electricity it uses per mile travelled. That amount, in turn, depends on the type of EV driven and also the weather (battery efficiency is at a maximum around 70 degrees Fahrenheit and decreases when the weather is cold or hot) and whether the vehicle's heating or cooling systems are being used.[24]

Recent testing by the American Automobile Association found that actual EV energy consumption varied between 0.22 kWh/mile and over 0.50 kWh/mile, depending on ambient air temperature and whether the vehicle's HVAC system was being used.[25] Given this wide range, and the fact that drivers are likely to use their HVAC systems during New Jersey winters and summers, we use 0.30 kWh/mile as a conservative average energy consumption value.

Table 3: PJM 2022 Marginal Emissions Rates

Emission	On-peak Emissions Rates (pounds/MWh)	Off-peak Emissions Rates (pounds/MWh)	System Average (pounds/MWh)
CO_2	1,041	976	811
NOx	0.79	0.54	0.33
SO_2	0.27	0.29	0.44

Source: PJM, "2018 – 2022 CO2, SO2 and NOX Emission Rates," April 2023.

Most EVs are charged at night, when electricity demand is lowest.[26] Assuming New Jersey recharging behavior is the same, then the lower "off-peak" PJM emissions rates shown in Table 3 will apply in determining BEV emissions rates.

Combining the PJM marginal emissions data in Table 3 and the EPA Tier 3 emissions limits for new ICVs in Table 2, we can compare the annual emissions of SO_2, NOx, and CO_2 of a typical BEV and ICV (Figure 2).[27], [28]

As Figure 2 shows, based on the 2022 PJM emissions rates, a BEV will "emit" almost 100 times more SO_2 versus a new ICV. A BEV will also emit over twice as much NOx. And, based on PJM marginal emissions, the annual reduction in CO_2 emissions between a BEV and an average 2026 ICV would be only 0.47 tons. Even if the lower PJM system averages are used, rather than the marginal emissions values, the reduction in CO_2 per year would be only 0.87 tons.

Figure 3 shows the resulting annual differences in emissions assuming there two million EVs mandated by 2035 are on New Jersey roads. BEVs would result in an additional 1,300 tons of SO_2 and 750 tons of NOx, while reducing CO_2 emissions by less than one million tons. (By comparison, New Jersey's overall CO_2 emissions in 2019 were about 98 million tons.)[29]

Critics of this analysis may claim that the NJ electric generating mix eventually will consist solely of emissions-free renewable resources, nuclear power, and

23 One megawatt-hour (MWh) = 1,000 kWh.

24 For example, a study of a 2014 Nissan Leaf determined its maximum efficiency was 0.30 kWh/mile within a temperature range of 60 °F to 70 °F. At temperatures of 0 °F and 100 °F, the car used 0.46 kWh/mile. Tugce Yuksel and Jeremy Michalek, "Effects of Regional Temperature on Electric Vehicle Efficiency, Range, and Emissions in the United States," *Environmental Science & Technology* 49 (February 2015): pp. 3974–80

25 American Automobile Association, "AAA Electric Vehicle Range Testing: AAA proprietary research into the effect of ambient temperature and HVAC use on driving range and MPGe," February 2019. AAA tested five different vehicles.

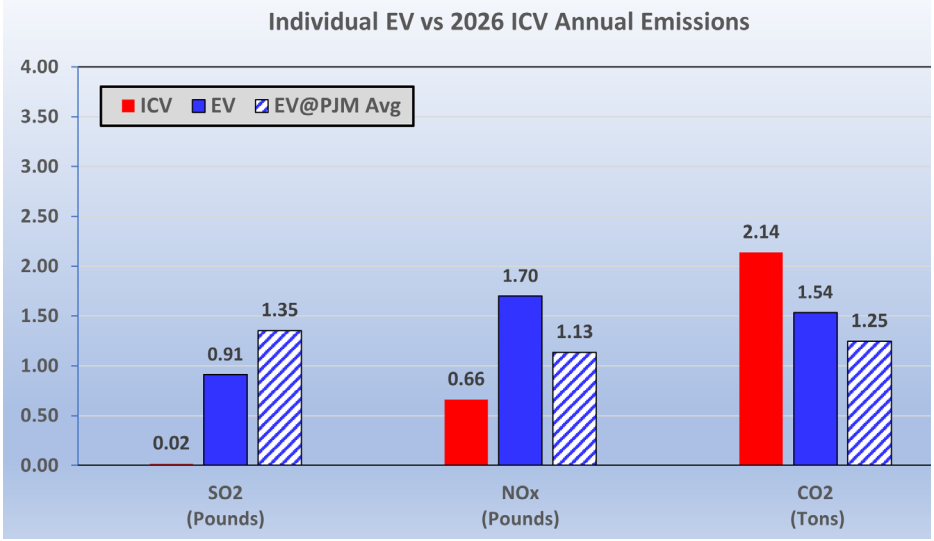
26 Fiona Burlig, et al., "Low Energy: Estimating Electric Vehicle Electricity Use." *AEA Papers and Proceedings*, May 2021, pp 430-35.

27 PJM does not publish data on particulate emissions. But the 2020 ChargeEVC report admits EVs will increase particulate emissions.

28 The emissions from a plug-in hybrid vehicle would depend on the number of miles driven while the internal combustion engine is operating versus when the vehicle is powered by its battery. In general, a PHEV will emit less SO_2 and NOx, but more CO_2 than an EV.

29 New Jersey DEP, "Statewide Greenhouse Gas Emissions Inventory," December 2022.

Figure 2: Annual Emissions - BEV vs. New ICV (2026)



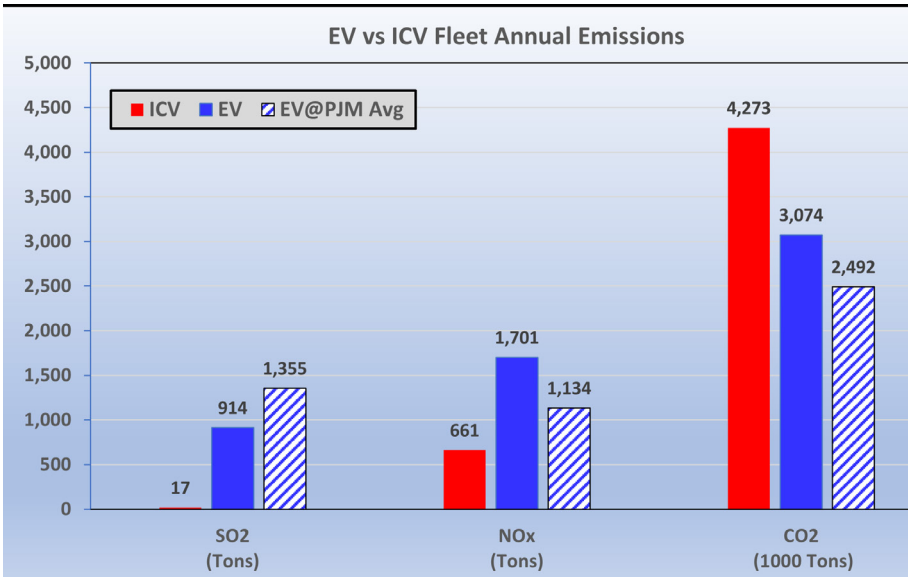
battery storage. But as long as New Jersey belongs to PJM, the emissions from EVs in the state will reflect the marginal generating units in PJM as a whole. Given the physics of intermittent generation and the need for significant resources to ensure electricity is always available, PJM's generating resource mix will not be emissions-free for decades, if ever.

Critics may also claim that New Jersey will soon transition to a 100% "green" electric system, or that those millions of EVs will be charged with rooftop solar panels coupled with battery storage (because most EVs will be charged at night). This is an unrealistic fantasy.

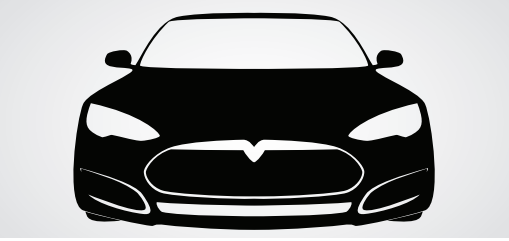
Assuming no additional nuclear generating plants are constructed in the state (and in PJM) would mean a generating system comprised almost entirely of wind and solar power. However, because wind and solar power are inherently intermittent, such a power system would require huge quantities of battery storage to ensure electricity is available when the wind doesn't blow and the sun doesn't shine. But unless there are technological leaps in battery technology, coupled with significant reductions in battery costs, it will be physically and financially impossible to provide any significant quantity of battery storage to back up intermittent wind and solar.[30]

Nevertheless, to evaluate the magnitude of the emissions reductions from EVs, suppose we assume that all of the electricity used to charge EVs is emissions-free by 2035. Then the total reduction in SO2, NOx, and CO2 emissions would be the avoided ICV values shown in Figure 3. (By comparison, total state

Figure 3: Emissions Differences, Based on Two Million BEVs



30 There are many claims of "revolutionary" new battery technologies, based on laboratory work. But transferring a laboratory experiment into a commercially viable battery is difficult. All batteries must trade-off three factors: cost, storage capacity, and lifetime. See, e.g. Battery University, "BU-205: Types of Lithium Ion," February 11, 2021, and "BU-212: Future Batteries," September 8, 2020. In December 2020, a new "breakthrough" was announced: the lithium-metal battery (discussed in BU-212) is claimed to have almost double the range of existing batteries and can be recharged in just 15 minutes. See Katie Fehrenbacher, "A new EV battery shows big promise," Driving Change, December 8, 2020.



SO2 emissions were about 2,900 tons in 2019, total NOx emissions were about 110,000 tons, and total CO2 emissions were about 98 million tons.)[31]

As shown in Figure 3, the reduction in CO2 emissions – the primary rationale for the EV mandate – would be the 4.3 million tons of ICV CO2 emissions avoided. By comparison, in 2022 energy-related world CO2 were just over 34 billion metric tons (38 billion short tons).[32] So, even assuming a 100% emissions-free electricity mix in 2035, the reduction in CO2 emissions would be equivalent to 1.0 hour of world CO2 emissions.[33]

Even if we assumed all EVs purchased in the state from this year through 2035 were all powered by zero-emission electricity and that the fuel efficiency of the average new ICV did not increase beyond 35 mpg, the overall reduction in CO2 between 2023 and 2035 would be around 28 million tons – about 7 hours of 2022 world CO2 emissions.

At an estimated cost to New Jerseyans of $70 billion, as discussed previously, the average cost of CO2 reduced under this best-case scenario would be about $2,600/ton. By comparison, estimates of the "social cost of carbon" – i.e., the estimated economic damage caused by CO2 emissions – have been estimated to be $50/ton in 2020, rising to $82/ton in 2050.[34]

Eliminating the equivalent of a few hours of world CO2 emissions between now and 2035 under a best-case scenario will not "reduce the damaging effects of climate change" in any measurable sense. Forcing New Jersey residents and businesses to spend over $70 billion to achieve such a result is senseless.

Under a best-case scenario with EVs powered by 100% emissions-free electricity, the 2035 mandate would reduce annual NJ CO2 emissions by the equivalent of one hour of world CO2 emissions.

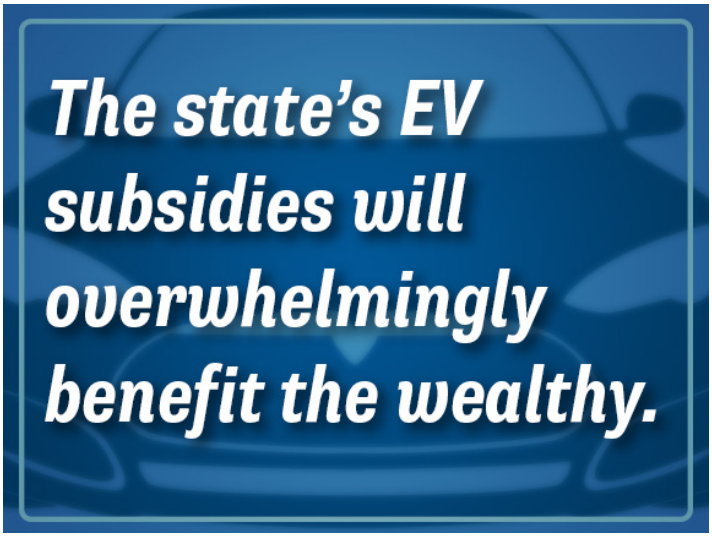
31 US EPA, State Annual Emissions Trend, 1990 – 2019.
32 Energy Institute Statistical Review of World Energy 2023. One metric ton = 1.1 short tons.
33 Calculated as: (4.3 million) / (37.8 billion / 8,760 hours) = 0.98 hours.
34 U.S. Government Accountability Office, "Social Cost of Carbon: Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis," GAO-20-254, June 2020.

The Poor Will Pay

The 2019 Energy Master Plan (EMP) discusses the importance of environmental justice and equity, especially for low-income communities. Yet, the primary beneficiaries of S2252's electric vehicle mandate and the numerous subsidies the state is offering to achieve the 200,000 EV requirement by 2025 and the two million EV requirement by 2035 will be higher-income residents who can afford to purchase EVs.

A nationwide survey of BEV and PHEV owners in 2017 by CarMax found that 56% had household incomes of at least $100,000 and 17% had household incomes of at least $200,000.[35] A 2017 survey in Maryland found that over 80% of respondents had household incomes over $100,000.[36] More recently, a June 2021 report issued by the Electric Vehicle Council found that, "The top demographic of 2019 EV owners are middle-aged white men earning more than $100,000 annually with a college degree or higher and at least one other vehicle in their household."[37]

There is a stark dichotomy between the EMP's lofty statements about environmental justice and assisting low-income communities and the state's providing billions of dollars in direct and indirect subsidies for high-income EV owners.



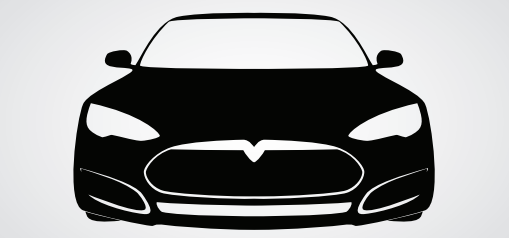
As discussed above, the total costs to achieve S2252's EV mandates, in terms of foregone sales and gasoline taxes, public charging stations, subsidies for residential charging stations, and expenditures to bolster the electric grid could easily total $70 billion by 2035.

The $70 billion cost of the EV mandate will not come from the EV Fairy; it will from the state's residents and businesses. The most likely sources of that money will be higher income, sales taxes, and gasoline taxes. Sales and gasoline taxes are regressive, that is, their burden falls disproportionately on lower income consumers. Lower-income consumers who cannot afford an EV will thus pay more to support higher-income EV owners.

Higher electric rates will exacerbate energy poverty, especially as the state pursues other green energy policies, such as mandatory building electrification and construction of 9,000 MW of offshore wind.[38] Again, it will be lower-income consumers for whom the burden of those higher rates falls most heavily.

Of course, the EMP also proposes subsidies for low-income consumers. But if the subsidies are funded with higher sales and gasoline taxes, and higher electric rates, the state effectively will take money from these consumers and then return some of it back to them. That is not a rational economic strategy.

35 CarMax, "2017 Hybrid and Electric Cars Survey," July 18, 2017.
36 Z. Andrew Farkas, et al., "Environmental Attributes of Electric Vehicle Ownership and Commuting Behavior in Maryland: Public Policy and Equity Considerations," Morgan State University, August 2018, p. 15.
37 Electric Vehicle Council, "EV Consumer Behavior," June 2021.
38 Affordable Energy for New Jersey, "Natural Gas: Crucial for New Jersey's Energy and Economic Future," September 2020.



Job Losses: The Working Class Will Be Hardest Hit

Using unrealistically optimistic cost assumptions, the EMP estimates New Jerseyans will pay at least $2 billion more per year for energy. Those higher costs, which include the myriad subsidies for EVs, will ripple through the state's economy. Because virtually all goods and services require energy, when energy costs increase, prices increase. The same effects can be seen today with higher prices for gasoline, natural gas, and electricity nationwide. These higher prices have led to surging inflation that is inflicting economic harm on the nation, especially working class Americans.

The massive state subsidies for EVs needed to meet New Jersey's EV mandate will have a similar impact. Higher gasoline and sales taxes, coupled with higher electricity prices, will raise the costs of goods and services in the state. Electric-intensive businesses will be hardest hit. As these businesses become less competitive relative to out of state rivals, some will leave the state, taking jobs and income with them. For example, Germany, which now has the highest electricity prices in Europe, has seen manufacturers flee for lower-cost countries. Similarly, businesses continue to flee California because of that state's high and increasing energy prices.

The regressive nature of the higher taxes and electricity prices that will be needed to recoup the costs of the EV mandate will harm lower-income New Jerseyans, especially low-income communities.

The inequity of forcing working class New Jerseyans to subsidize the EVs purchased by the wealthy will not be solved through more subsidies for the former, because they will end up paying for the subsidies themselves.

State lawmakers should not view that as a reasonable and fair tradeoff.

The high costs of the EV mandate, and the resulting increase in prices throughout the state economy, will cause some businesses to relocate to less costly states, taking jobs and income with them.