

A Road to Clean Travel:

Zero-Emission Vehicle

Policies in Minnesota



Introduction

To meet the challenge of global climate change and stave off catastrophic warming, the United States will have to reduce and eventually eliminate emissions of greenhouse gasses. Recognizing this, the state of Minnesota has advanced aggressive greenhouse gas reduction goals, along with a suite of policies encouraging reductions. The state's electricity generation mix is clean in comparison to many other states, and the shift to clean transportation is long overdue. Emissions from the transportation sector have outpaced those from electricity generation, rising about ten percent in the past five years alone and making transportation the biggest national contributor to climate change.¹ Advances in vehicle fuel efficiency and numerous pushes for urban density and multimodal transit have not prevented this increased pollution. The most feasible solution to the transportation problem— and the only truly complete one— is a gradual shift from internal gasoline combustion to battery-powered vehicles charging on renewable energy.

Electrification for climate purposes also has significant co-benefits to society. Full electrification could insulate the economy from price shocks due to oil and reduce transportation noise. But more important are the human health benefits of reducing criteria pollutants – those major pollutants that accumulate in cities and damage human

health. In the Twin Cities, poor air quality contributes to 2,000 deaths, 400 hospitalizations, and 600 emergency room visits every year.²

The case for vehicle electrification is particularly strong in Minnesota, given the state's investments in lower-carbon energy. Electrification of transportation would compound the carbon reductions from renewable energy portfolio standards while substantially reducing other forms of pollution. But the most ambitious policies promoting electrification have been limited mostly to states on the West Coast and New England. By advancing a clean energy electrification agenda, Minnesota could be a policy leader in the Midwest and the country as a whole.

***Electrifying transportation
will amplify the greenhouse
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air quality***

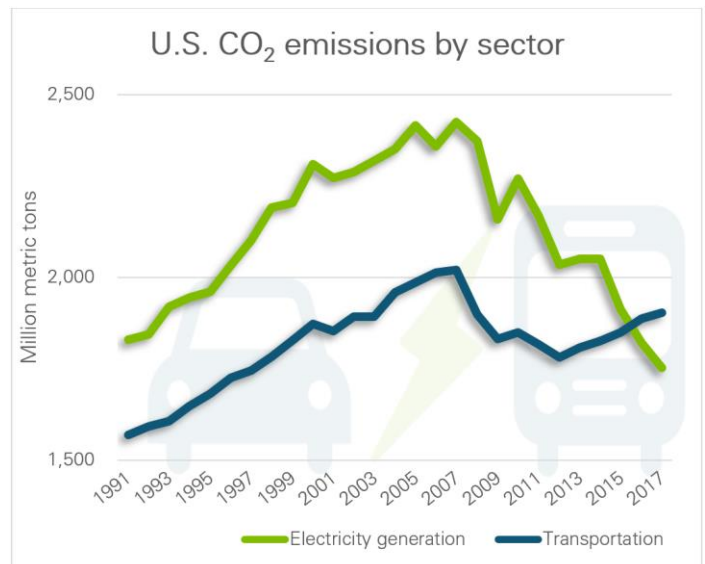
Background

Electric vehicles (EVs) are powered by electricity stored in batteries rather than the typical gasoline-fueled internal-combustion engine (ICE) vehicles. EVs come in two types: full Battery Electric Vehicles, which are powered solely by electricity, and Plug-in Hybrid Electric Vehicles, which rely upon electricity for daily driving needs, but use gasoline for longer trips. This does not include traditional hybrid vehicles, like the Toyota Prius, which have smaller batteries that capture energy from regenerative braking and use it to improve fuel economy but rely upon gasoline or diesel as their primary energy source. Battery EVs are the most common type of zero-emission vehicle (ZEV), although that term is broader and can refer to any vehicle that does not generate tailpipe emissions.

EVs have proliferated in recent years, thanks in large part to dramatic declines in battery costs. According to Bloomberg New Energy Finance, Lithium-ion battery pack costs fell by nearly 80 percent between 2010 and 2017. EVs are already lower in lifetime cost than some variants of diesel vehicles, thanks to the lower fuel and maintenance costs. EVs are also much simpler mechanically than gasoline vehicles, making them less costly to manufacture. As battery costs continue to fall, the up-front cost of an EV will eventually fall below that of a comparable gasoline car, which experts predict will happen within the next six to seven years.³

Poor air quality contributes to two thousand deaths in the Twin Cities annually

Governments see the possibility for reductions in carbon and other pollutants without direct challenge to entrenched transportation patterns and industries, and they have seized upon the change. The United States has offered generous subsidies to the sale of new EVs, and many states have



added subsidies of their own. California's Air Resources Board has adopted a policy known as the Zero Emissions Vehicles (ZEV) standard, an addendum to the state's vehicle mileage standards which requires auto manufacturers to sell an increasing amount of zero-emission vehicles over time. Nine other states have signed on to the ZEV standards as well. But all of this is minor relative to changes happening overseas: many countries have announced bans of new gasoline and diesel vehicle sales in the coming decades,⁴ and China's investments in electric public transit have already reduced gasoline demand by as much as the entire nation of Greece.⁵

Industry has responded accordingly to the technological and policy shifts with bold goals to advance electric vehicles. General Motors has spoken about a "zero-emission future" and plans to introduce twenty electric models over the next five years. Not to be outdone, VW has promised thirty electric models, and Ford forty. Volvo has gone even further, pledging that all of its new cars would be electric by 2020.⁶ These developments, if followed through, can make electric vehicles as accessible as internal-combustion vehicles, and shift individual and corporate vehicle use away from fossil fuels.

While technological advances have put electric vehicles on the precipice of major progress, hurdles persist. Though battery costs are falling, EVs still cost considerably more upfront than a comparable gasoline car. Electric vehicles need adequate charging station availability in order to match the wide availability of gasoline fueling stations for internal-combustion vehicles.

Leadership from the public sector can spur transportation electrification, maximize its climate benefits, and ensuring social and economic justice in the process and outcomes.



Electrification

The benefits of electrification come from the reductions in pollution and its health and environmental consequences. Gasoline is a major driver of climate change; efficiency measures and biofuels haven't changed the fundamentals about our cars. In addition, gasoline combustion produces criteria pollutants, such as nitrogen oxides, sulphur dioxide, carbon monoxide, and particulate matter, which harm public health. Poor air quality contributes to two thousand deaths in the Twin Cities annually and sends many more to the hospital with ailments like heart disease, cancer, and respiratory disease.⁷ Most troublingly, the costs of this pollution are not distributed equally; they fall disproportionately on children, the elderly, economically disadvantaged communities, and communities of color. Counting all of the health and environmental consequences of gasoline and diesel emissions produces startling results. Earth scientists have put the social cost at \$3.80 per gallon of gasoline and \$4.80 per gallon of diesel, even with discounting of future effects, where climate chaos will be most catastrophic. In contrast, the social costs of electrical energy are quite low: \$0.30/kWh for coal energy, and \$0.15/kWh for natural gas energy.⁸ Coal and natural gas, together, make up about 40% of Xcel Energy's electricity generation, and their share is falling. The numbers can be higher for greater Minnesota customers, but lifecycle carbon emissions from EVs in greater Minnesota are still roughly half of the average gasoline car, and unlike gas cars, EV emissions will only go down over the life of the car, as electricity generation becomes cleaner.

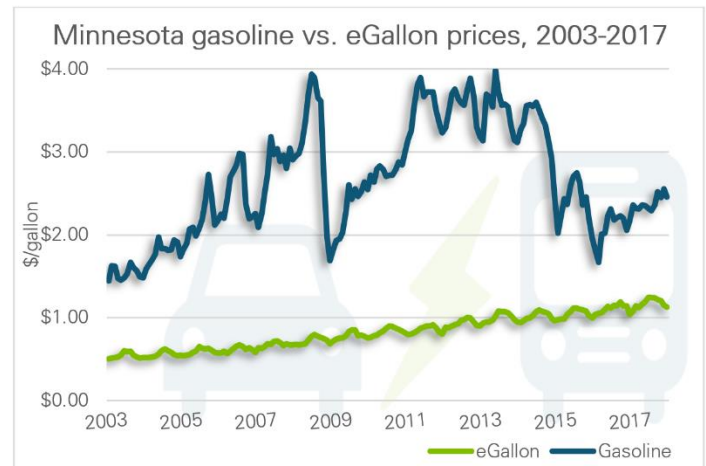
Electric vehicles produce other benefits which are hard to quantify, but worth consideration. Electrification insulates customers from the price shocks that can come from gas-powered travel. The variety of electrical generation options can prevent economic dependence on oil production, whether foreign or domestic, as the sole way to power transportation. Electric vehicles are also substantially quieter than conventional vehicles, allowing cities and highway corridors to cut down on noise pollution.

Policy Recommendations

Minnesota could go far towards promoting electrification with simple and low-cost policy decisions.

Enact ZEV Standard Under California's Zero Emissions Vehicles (ZEV) policy, part of the alternative gas mileage standards propagated by the California Air Resources Board, automakers are required to obtain a certain number of ZEV credits, based on their designation as a "large" or "intermediate" auto manufacturer; smaller manufacturers are exempt. Individual cars sold may earn up to four credits, depending on the level of electrification (partial or full). Companies without sufficient credits are fined five thousand dollars per credit. These credits may be bought and sold – companies that manufacture more than their needed quantity of ZEVs can sell credits to companies that don't. This creates a bounded set of market incentives that avoid moving too far in either direction. The automotive industry as a whole is asked to produce ZEVs, with flexibility as to which companies produce the vehicles, and with an upper limit of \$20,000 on how much social value can come from an electric car's production.

Minnesota could adopt California's standards, including the ZEV standard, through rule-making, executive action, or legislative mandate. In doing so, they would join ten other states that have enacted the standards. This would also begin to bring electric models to Minnesota markets at consumer prices at a pre-set rate, allowing greater planning for accompanying infrastructure.



Electrify Fleets Cities, counties, and school districts can begin to cut emissions and "lead by example" through the electrification of their vehicle fleets. EVs have considerably lower fuel and maintenance costs, and in many applications EVs will have a lower total cost of ownership than a comparable gasoline car. Given the current market, not all vehicles can be efficiently replaced with electric alternatives (e.g. garbage trucks), and other vehicles may

require changes in use patterns for electrification to be viable (e.g.: police cars).⁹ However, new models are being added every year, and the vehicles already available on the market can make real progress in decarbonizing local government operations and improve the health of vehicle operators and passengers.

The benefits and opportunities are especially pronounced for public transit. Because of their heavy use of fuel, buses can save more money through electrification than light-duty vehicles, and a variety of models of electric buses are available to local governments. A Columbia University study for New York City found that electric buses would cost slightly less over their lifetime than conventional buses, and that each would save \$1.4 million in social costs.¹⁰

Invest in charging infrastructure As of this writing, Minnesota has fewer than seven hundred public charging stations statewide.¹¹ The relatively sparse availability of EV charging infrastructure relative to gasoline refueling infrastructure (gas stations) makes some potential EV owners skittish about replacement, even when costs are comparable – a phenomenon known as “range anxiety.” This has resulted in something of a catch-22 for the market. Potential purchasers of EVs are scared off by the lack of charger availability, but the low adoption rate of EVs, and the low cost of vehicle charging, removes any incentive to build chargers themselves. Neither side can move on its own. Studies have confirmed that lack of charging infrastructure is a substantial barrier to market development.¹²

The United States did not adopt cars *en masse* through technological development alone; they became prominent through investment in highway infrastructure to support them. In the same way, government should not wait for technology to shift our infrastructure out of its entrenched ways; rather, it should invest in the infrastructure for the system it wishes to see. The scale of change and cost required in a short period of time, and the need for coordination in this change, puts the funding of charging infrastructure within the proper role of government.

Policy Recommendations

1. Enact Zero-Emission Vehicle Standard
2. Electrify city, county, and school fleets
3. Build out charging infrastructure
4. Adopt time-of-use electric rates
5. Adopt financing models that allow payback of capital over time



Time-of-use rates Under a time-of-use rate structure, consumers pay different prices for charging vehicles at different times of the day. This keeps them from plugging in a vehicle in the early evening, when the grid has its highest demand. Instead, drivers are incentivized to charge overnight, when grid demand is typically lowest. Customers on Xcel Energy’s EV rate have shifted 92 percent of their charging to overnight hours.¹³ By shifting the time of use, these special EV rates can not only manage load for grid providers, but also increase the use of renewable technologies. For-profit utilities in Minnesota are already required to do this, but these plans could be expanded to cover all customers – particularly those served by municipal utilities.

Financing models The private sector must work to manage the upfront cost of electric vehicles so that customers can reap the long-term financial benefits. Some vehicle manufacturers have begun providing built-in financing for vehicles to allow for lower down payments and more gradual cost recovery. Utilities could also explore tariff-based financing, in which the utility provides capital paid back with charges on a utility bill.

Conclusion

Electrifying the transportation sector may require action by multiple levels of government. And their work will be made more complicated by a climate of uncertainty and confusion. Working together, governments can send clear signals to automotive markets and give investors confidence to move forward with technologies that support climate and human health. Transitioning to electric vehicles is relatively low-cost especially when accounting for all the financial, environmental, and health benefits. Combined with renewable portfolio standards, electrification of transportation could be a game changer for Minnesota’s climate change planning and the health of its residents.

About Coalition for Clean Transportation

The Coalition for Clean Transportation, launched in 2018, is committed to the belief that climate action requires advancing proactive solutions and industry-wide shifts towards cleaner, healthier alternatives. We're organizing ordinary folks and communities for clean air, a stable climate, and a just economic transition from our dirty fuel economy.



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- ⁴ New gasoline and diesel vehicle sales will be banned in [Norway](#) beginning in 2025, in [India](#) and [Holland](#) beginning in 2030, in [Scotland](#) beginning in 2032, and in [France](#) and the [United Kingdom](#) beginning in 2040.
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