

Electric Vehicle Planning Study

Transportation Advisory Board
April 21, 2021



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Overview

- Why electric vehicles?
- Electric vehicle basics
- State of the electric vehicle market today
- Scaling electric vehicles
- Metropolitan Council Electric Vehicle Planning Study

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Battery Electric Vehicles (BEVs)

BEVs use a battery to store the electric energy that powers the motor. EV batteries are charged by plugging the vehicle into an electric power source. Examples of BEVs include the Nissan Leaf, Chevy Bolt, Tesla Model 3, etc...



Plug-in Hybrid Electric Vehicles (PHEV)

PHEVs are powered by an internal combustion engine that can run on conventional or alternative fuel and an electric motor that uses energy stored in a battery. The vehicle can be plugged into an electric power source to charge the battery. Examples of PHEVs include the Mitsubishi Outlander, Chrysler Pacifica Hybrid, and Chevy Volt.



Hybrid Electric Vehicles (HEV)

HEVs are primarily powered by an internal combustion engine that runs on conventional or alternative fuel and an electric motor that uses energy stored in a battery. These vehicles do not get plugged into an electric power source to charge and are not a focus of Drive Electric MN. A common example of an HEV is the Toyota Prius.

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Benefits of EVs

- Large greenhouse gas emissions reductions.
- Zero tailpipe emissions from BEVs.
 - As a result, improves air quality and reduces public health impacts from transportation.
- Helps states meet climate and energy goals.
- Less maintenance and more fuel savings for consumers and fleets.
- Operation: Fun to drive, smooth, no acceleration lag, QUIET.

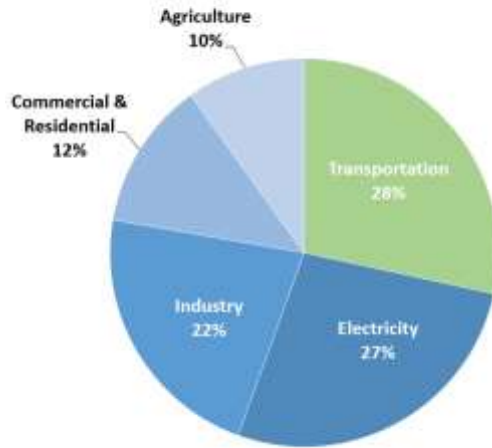


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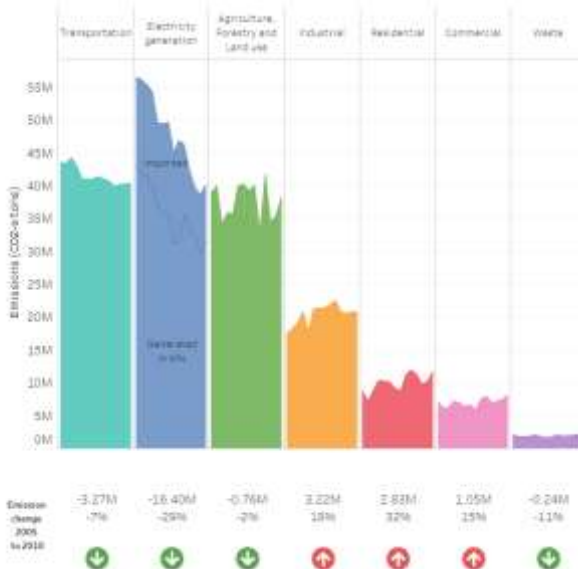
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2018



U.S. Environmental Protection Agency (2020). Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2018

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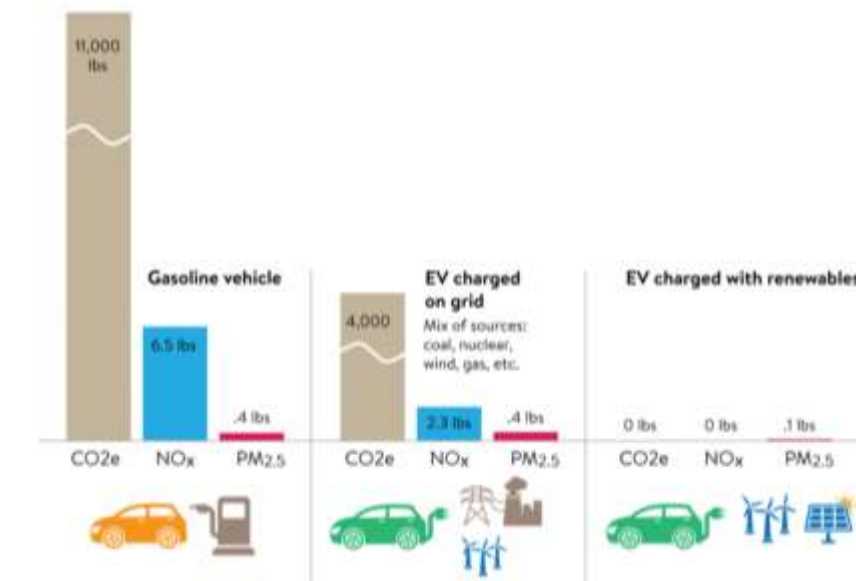


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Source: Minnesota Pollution Control Agency, <https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data>

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Annual well-to-wheel car emissions by fuel type (12,000 miles compact / midsize car)



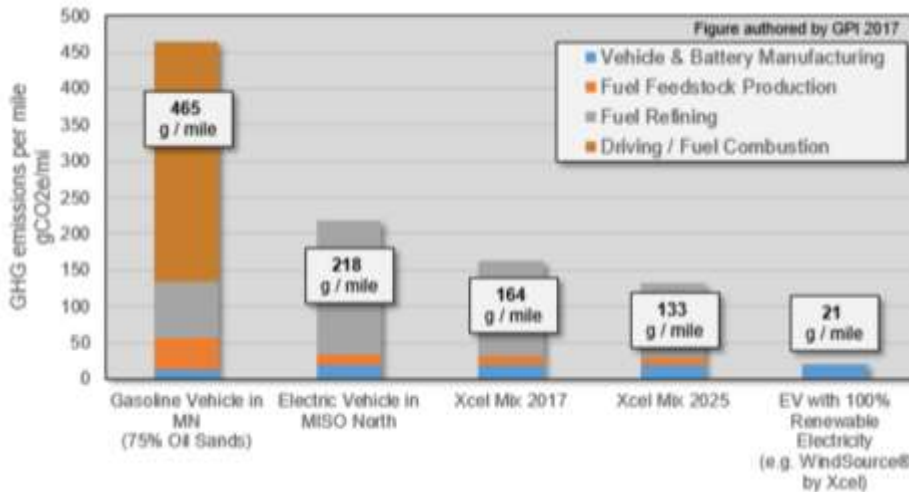
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Source: Minnesota Pollution Control Agency, <https://www.pca.state.mn.us/air/electric-vehicles>



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GHG Emissions: Gasoline vs. Electric in Minnesota



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Source: Great Plains Institute, 2017



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Opportunity for Greenhouse Gas Emissions through EV Adoption by 2030

Electric Grid Mix	% Reduction in Lifecycle GHG Emissions from Gasoline Vehicle	# of Electric Vehicles (% of Passenger Fleet)	Annual Reduction (Tons CO ₂)
Xcel Energy (2025 Mix)	71%	91 thousand (5%)	364 thousand
		274 thousand (15%)	1.1 million
100% Renewable	95%	91 thousand (5%)	487 thousand
		274 thousand (15%)	1.5 million

Note: Remaining emissions associated with 100% renewable electricity mix are attributable to vehicle development, battery, etc. Analysis assumes average annual VMT of 12k miles per vehicle and assumptions around total passenger fleet based on cumulative MN vehicle registrations by 2030 with a 2020 baseline.



9 Source: Great Plains Institute, 2017

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Maintenance Schedule for your 2016 Chevrolet Cruze Limited

Certified Service	10k	20k	30k	40k	50k	60k	70k	80k	90k	100k	110k	120k	130k	140k	150k	160k	170k	180k	190k	200k	
Replace brake fluid (recommended for the vehicle, and performance-oriented vehicles). Check engine oil level per oil fill plate. Change engine oil and filter at intervals.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace passenger compartment air filter (if applicable).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace engine air cleaner filter (or every 4 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace front oil filter and spark plug adjustment.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace rear oil filter. Inspect spark plug boots.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Apply 1/2" oil.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.5L engine only: Replace timing belt, and water pump and thermostat (if applicable) or every 5 years, whichever comes first. (Models 1.5L).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change automatic transmission fluid, if equipped (also recommended change filter, applies to 1.5L).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change manual transmission fluid (applies to 1.5L).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Check and if engine cooling system (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change brake fluid (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change motor fluid (or every 3 years, whichever comes first). Inspect or replace.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inspect suspension control system.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inspect engine coolant (check level for filling, otherwise, check in service booklet) (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Maintenance Schedule for your 2017 Chevrolet Bolt EV

Certified Service	10k	20k	30k	40k	50k	60k	70k	80k	90k	100k	110k	120k	130k	140k	150k	160k	170k	180k	190k	200k	
Replace brake fluid (recommended for the vehicle, and performance-oriented vehicles).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace passenger compartment air filter (if applicable).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace engine air cleaner filter (or every 4 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace front oil filter and spark plug adjustment.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace rear oil filter. Inspect spark plug boots.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Apply 1/2" oil.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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Check and if engine cooling system (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change brake fluid (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Change motor fluid (or every 3 years, whichever comes first). Inspect or replace.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inspect suspension control system.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inspect engine coolant (check level for filling, otherwise, check in service booklet) (or every 3 years, whichever comes first).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Shift2Electric.com



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EV Basics



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EV Basics: Light-duty

- Nearly all new BEVs have ranges over 150 miles—suitable for a lot of use cases
 - Use cases: Commuting, Road trips, Car sharing programs, Fleet, Uber/Lyft, others
- Charging: Need to plug in to a charging station or outlet to refuel
 - Level 1: Slowest charge; 120-volt outlet; 2-5 miles of range per hour (24-60 miles of range if plugged in for twelve hours overnight)
 - Level 2: Faster charge; 240-volt outlet; 10-20 miles of range per hour
 - DCFC: Fastest charge, speeds up to 350kW; typically charges vehicle in 30 minutes or less
- Locating public chargers:
 - PlugShare.com
 - All EVs come with technology to locate chargers for that vehicle



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EV Basics: Medium & Heavy-Duty

- Technology is still nascent
- Most common use cases today: delivery, transit (including school buses)
- Charging technology:
 - Plug-in: Utilize same plug standards as light-duty
 - Overhead: Typically used to charge buses; can output greater power than plug-in
- Further out: long-range semis, garbage trucks, airplanes
 - Currently in demonstration phase



Medium & heavy-duty options for fleets

Class Four: 14,001 to 16,000 lbs.			
City Delivery	Conventional Van	Landscape Utility	Large Walk In
Class Five: 16,001 to 19,500 lbs.			
Bucket	City Delivery	Large Walk In	
Class Six: 19,501 to 26,000 lbs.			
Beverage	Rack	School Bus	Single Axle Van
			Stake Body

Class Seven: 26,001 to 33,000 lbs.			
City Transit Bus	Furniture	High Profile Sems	Home Fuel
Medium Semi Tractor	Refuse	Tow	
Class Eight: 33,001 lbs. & over			
Cement Mixer	Dump	Fire Truck	Fuel
Heavy Semi Tractor	Refrigerated Van	Semi Sleeper	Tour Bus

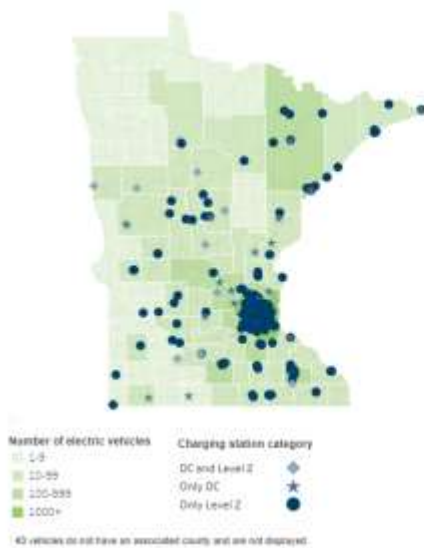


State of the EV Market Today



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Minnesota EV Registrations & Charging Availability



Charging points

Level 2 charger	DC fast charger	Total
953	191	1,144

Total vehicles per Level 2 charger	Total vehicles per DC fast charger
20	58

Vehicles

Battery electric vehicles (BEV)	Plug-in hybrid electric vehicles (PHEV)	Total
11,184	7,605	18,789

[Download data](#)

Last update:
February 13, 2021
Source: MPCA



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Source: Minnesota Pollution Control Agency, <https://www.pca.state.mn.us/air/minnesota-ev-dashboard>

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Minnesota Charging Corridors



Volkswagen Settlement Phase 2
Aims to fund 39 new charging stations along corridors

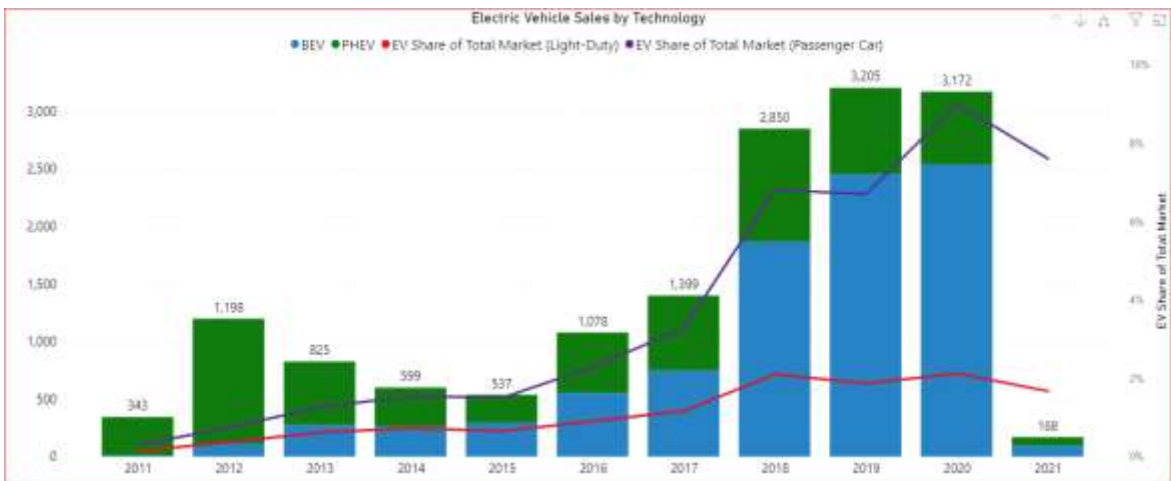
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Source: Minnesota Pollution Control Agency, <https://www.pca.state.mn.us/sites/default/files/aq-mvp2-35c.pdf>



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Minnesota EV Sales



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Source: Atlas Public Policy EV Hub, 2021



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Big EV Commitments

G.M. Will Sell Only Zero-Emission Vehicles by 2035

The move, one of the most ambitious in the auto industry, is a piece of a broader plan by the company to become carbon neutral by 2040.

FORD EUROPE GOES ALL-IN ON EVS ON ROAD TO SUSTAINABLE PROFITABILITY; COLOGNE SITE BEGINS \$1 BILLION TRANSFORMATION

Volvo Plans to Sell Only Electric Cars by 2030

The Swedish company would phase out internal combustion engine vehicles faster than other automakers.

Xcel Energy's new electric vehicle vision to save customers billions while delivering cleaner air

Transitioning 20% of all vehicles to electric by 2030 will reduce carbon emissions and save customers billions in fuel costs

From Amazon To FedEx, The Delivery Truck Is Going Electric

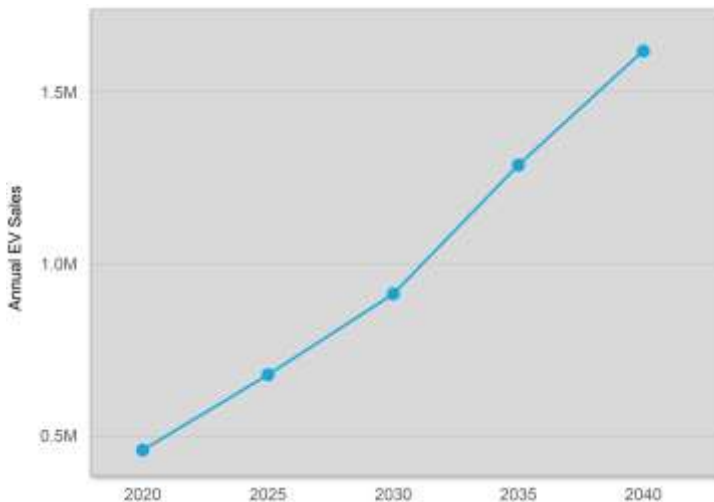
News 12/2020 6:44 AM ET



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US Annual EV Sales Forecast, 2020-2040



Actual 2020 EV sales
 US: 306 thousand
 MN: 3 thousand

Current Automobiles
 US: 109 million
 MN: 1.8 million

Annual Sales
 US: 16.8 million
 MN: 250 thousand

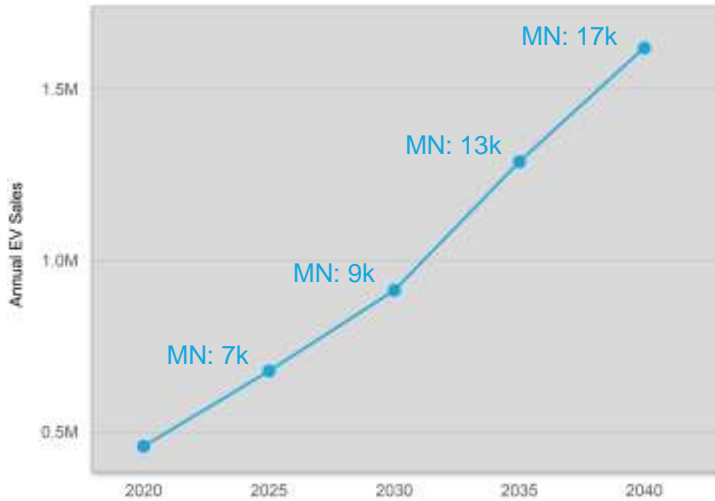
Source: GPI Analysis based on EIA AEO 2020



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Correlating EV Sales Forecast for MN



Actual 2020 EV sales

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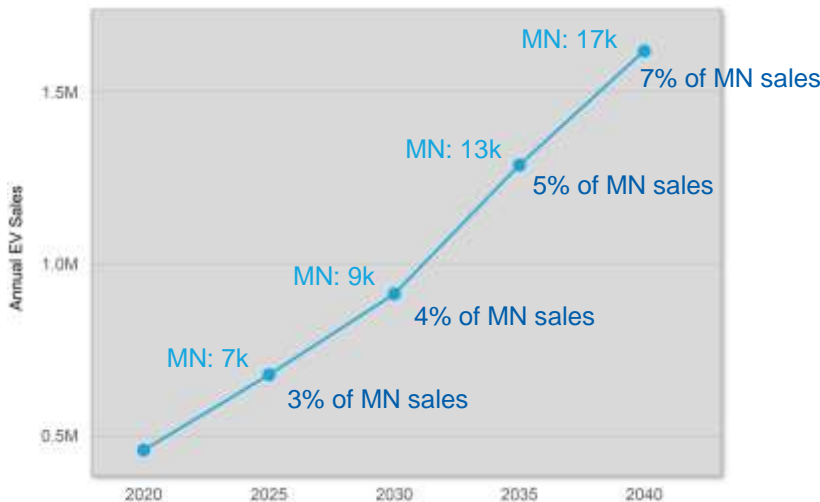


Source: GPI Analysis based on EIA AEO 2020

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Correlating EV Sales Forecast for MN



2030:

91 thousand cumulative EVs in MN, out of ~2 million automobiles

< 5% of MN fleet



Source: GPI Analysis based on EIA AEO 2020

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Scaling EVs—Pillars of Success



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Public Policy

- Policies include HOV lane access, EV rebates, low carbon fuel standard, LEV/ZEV, infrastructure rebates and grants, and more
- Minnesota is behind other states when it comes to supportive EV policy
 - Ranked 12th in State Transportation Electrification Scorecard by American Council for an Energy-Efficient Economy. **39.5/100 score.**



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Vehicle Availability

- MN offers 48 EV models compared to 66 offered in other states
 - 19 are BEV; 29 are PHEV
- Consumers want greater selection (body style, trims, colors)
 - More EVs are coming including trucks, vans, SUVs
 - 8 BEV pickups coming in 2021-2022
 - 24 SUVs coming 2021-2024 (mostly BEVs)
- Fleets need more medium & heavy-duty options



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Charging Stations

- Lack of charging in multi-unit dwellings means tenants cannot switch over to EVs
- Correlation has been shown between access to public charging and EV adoption—more public charging stations are needed
- More charging stations provide greater comfort to travelers



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Utility EV Programs

- Common programs include deploying charging infrastructure, supporting fleet adoption, specialized EV rates, and educating consumers
- Lower cost for charging reduces fueling cost and encourages shift to EV



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EV Ready Cities

- **Policy:** acknowledge EV benefits and support development of charging infrastructure
- **Regulation:** implement development standards and regulations that enable EV use
- **Administration:** create transparent and predictable EV permitting processes
- **Programs:** develop public programs to overcome market barriers
- **Leadership:** demonstrate EV viability in public fleets and facilities



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Metropolitan Council EV Planning Study



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Study Goals

- Identify strategies to accelerate EV adoption in the Twin Cities as a way to reduce greenhouse gas emissions and improve public health
- Guide future investments, policies, and other work to accelerate EV adoption for the Met Council and partner agencies
- Inform the 2040 Transportation Policy Plan and other investment and policy proposals
- Deliver final products by December 2021



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Planned Engagement

- Technical Advisory Committee consisting of industry, NGOs, academia, local government, state agencies, and others
- Fleet managers as part of fleet analysis
- Interviews with equity groups
- Webinar



Planned Outcomes

- EV white paper
 - EV landscape
 - Data analysis on travel patterns, vehicles, streetlight data, public awareness
 - Fleet analysis
- EV use case identification and evaluation
- EV charging needs assessment for Twin Cities
- Identification and recommendation of strategies to help Twin Cities scale EV adoption and improve public health, including an equity analysis
- Summary report and presentation



Questions?

