August 2019

PATHWAYS TO DECARBONIZING TRANSPORTATION IN MINNESOTA

m DEPARTMENT OF TRANSPORTATION

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Minnesota's climate is changing, which already affects our health, environment, and economy, with warmer winters and more precipitation being recorded now and forecast to increase in the future. The Pathways to Decarbonizing Transportation project began a statewide conversation about moving Minnesota towards a low-carbon transportation future to help avoid catastrophic impacts of climate change.

In 2007, the state passed the bi-partisan Next Generation Energy Act (NGEA) that established goals for the state to reduce greenhouse gas (GHG) emissions by 15% below 2005 levels by 2015, 30% by 2025, and 80% by 2050. However, the state did not meet our 2015 goal and we are not on track to meet our future goals. Transportation is now the largest emitter of GHGs in the state. To achieve our GHG reduction goals, state-level action is needed and there are many opportunities for immediate action in the transportation sector.

Pathways was a collaborative effort between the Minnesota Department of Transportation (MnDOT), Environmental Quality Board, Minnesota Pollution Control Agency, Minnesota Department of Agriculture, and the Minnesota Department Commerce.

The purpose of *Pathways* was to explore opportunities for GHG emission reductions from surface transportation: passenger cars and trucks, medium-duty and heavy-duty trucks, buses, motorcycles, and mobile air conditioning. The project had three connected parts:

1. Coordinate with state and national experts to develop a model inputs and assumptions based on their expertise

2. Model future scenarios of GHG emissions

3. Engage with Minnesotans around the state to hear their thoughts on opportunities and challenges for reducing GHG emissions from transportation in their communities.

TECHNICAL STAKEHOLDER INPUT AND MODELING RESULTS

Transportation and energy experts were consulted during two workshops to provide input on effective GHG reduction strategies and identify the best data and assumptions to use in the modeling. Modeling showed that Minnesota can achieve NGEA goals, but 1) immediate action is needed; 2) action is also needed across vehicle classes and sectors; 3) there is no "silver bullet" or single action or sector that alone can achieve our goals.

The project modeled three scenarios:

1 **REFERENCE SCENARIO**
"Business-as-usual," only includes current policies, i.e., no action, and assumes that current federal fuel economy standards will be weakened starting in model year 2021.

2 **80 X 50 SCENARIO (SCENARIO #1: 80 X 50)**
Combination of strategies to achieve the 80% statutory NGEA GHG reduction goal for 2050.

3 **100 X 50 SCENARIO (SCENARIO #2: 100 X 50)**
Combination of strategies to achieve zero emissions from transportation by 2050. To achieve economy-wide GHG reduction goals, transportation may need to compensate for other sectors where targets are harder to achieve. Further, scientific consensus suggests that total decarbonization is needed to avoid the most catastrophic consequences of climate change.

For each scenario, modeling included maintaining current fuel economy standards; reducing vehicle miles traveled in urban areas; increasing adoption of electric vehicles (EVs), hybrids, and biofuels across all vehicle classes; increasing renewable energy to fuel EVs and reducing the carbon impact of biofuels; and eliminating refrigerants with high global warming potential. Modeling did not identify the specific policies or actions needed to achieve the reduction (Figure 1).

Figure 1: Emission reductions by measure, 80x50 scenario

Legend:
- Fuel Economy Standards
- Reduction in Urban Miles Traveled
- Light Duty Electric Vehicles
- Medium Duty Electric and Hybrid Vehicles
- Heavy Duty Electric and Hybrid Vehicles
- Biofuels
- Mobile Refrigerants
- GHG Goals
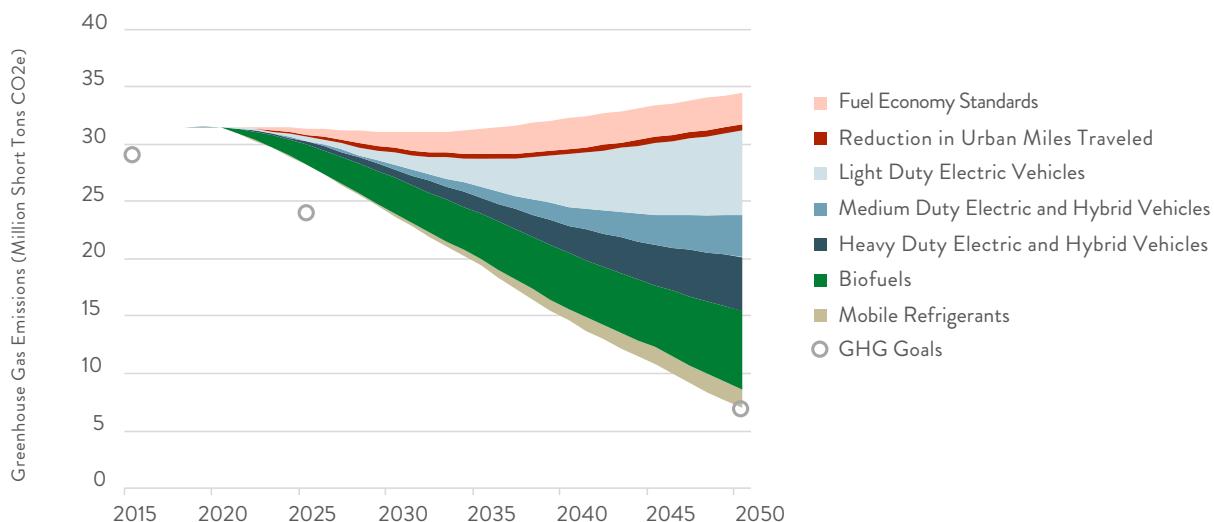
PUBLIC INPUT

The project team held meetings across the state and offered an online survey and webinar to get additional public input and received over 400 comments. The following general themes emerged:

1. There is a climate crisis and swift action across many sectors is needed.

2. More transportation options are needed:

   • More electric vehicle (EV) options at dealerships and more used EVs

   • Safe and accessible walking and biking infrastructure

   • High quality public transportation

   • Electric buses

   • More EV chargers

3. Environmental justice and equity should be at the center of climate action.

4. Both local and statewide solutions are needed. Differences between urban and rural areas should be factored into solutions.

5. Transportation solutions must be integrated with other systems, including energy generation, land use decisions, and other state and local policy.

6. Co-benefits of climate action are critical. Climate policies can and should also lead to healthier, more equitable, resilient, and economically robust communities.

RECOMMENDATIONS AND NEXT STEPS

MnDOT used feedback from technical experts and the public to develop the actions and recommendations in this report. Actions can be taken by MnDOT now and recommendations are meant for consideration by other state agencies and the Governor. These are important first steps, but they are just the beginning. The actions and recommendations in the report alone will not achieve the NGEA GHG goals.

Find Integrated Solutions

Efforts to decarbonize transportation must go beyond a single policy, effort, or agency and will impact other sectors as well, particularly agriculture and electricity generation. Participants were also clear that solutions must focus on equity and environmental justice.

- Sustainable Transportation Advisory Council (STAC): MnDOT will create a new council to advise the state on reducing transportation GHG emissions, while promoting safety, equity, environmental justice, economic development, and multimodal transportation options. STAC will include leaders from state agencies, local government, frontline communities, and the public, private, and nonprofit sectors. (Action)

- Regional collaboration on EV corridors: Minnesota should lead a collaboration with Midwest states to create shared marketing and outreach materials, support interoperability standards, avoid redundancies in charger siting, demonstrate a broader Midwest market for EVs, and increase efficiencies by sharing best practices. (Recommendation)

Build and EV Market and Provide More EV Options

Technical stakeholders, the public, and representatives from Minnesota's largest employers saw the lack of EV options in the marketplace as a major barrier to EV adoption. There was also general dismay about the proposed weakening of fuel economy standards by the federal government.

- Adopt clean car standards: The Governor's Office should encourage MPCA to begin rulemaking for the state to adopt low-emission vehicle standards that maintain fuel economy standards even if the federal government decides to weaken them and to adopt zero-emission vehicle standards that require auto manufacturers to offer more EVs in Minnesota to support consumer choice. (Recommendation)

Promote Biofuels to Reduce GHG Emissions and Support Rural Minnesota

Biofuels are important for Minnesota and modeling showed that action is needed across all vehicle classes and sectors, including increased use of biofuels, to achieve the state's NGEA GHG goals.

- Strengthen Petroleum Replacement Goals: Minnesota should strengthen its Petroleum Replacement Goals (Minn. Stat Sec. 239.7911) through additional mandates and incentives to ensure that higher biofuel blends are available. (Recommendation)

- Expand biofuel infrastructure: Minnesota should provide financial and technical assistance to build out the wholesale and retail infrastructure that will be needed to supply ethanol blends higher than 10% and biodiesel blends higher than 20%. (Recommendation)

- Higher biodiesel blends and renewable diesel: Minnesota should expand the use of biodiesel beyond the 20% summer mandate period, either by extending the mandate into cold weather months or using blends above 20%. Facilitate ways to use renewable diesel, a drop-in diesel fuel replacement, in Minnesota. (Recommendation)

- Carbon impact of biofuels: Minnesota should create incentives for measures, such as production plant improvements and regenerative farm practices, which reduce the carbon impact of biofuels. (Recommendation)

Fund EV Infrastructure

The second highest overall support for state policies to decarbonize transportation was to fund more EV infrastructure around the state.

- Clean transportation funding: MnDOT should help the state plan for the transition to a low carbon transportation system and identify funding for a new competitive funding pilot program to support this transition. The STAC may develop grant criteria, evaluate proposals, and identify successful applicants. (Recommendation)

Provide EV Incentives

Participants supported financial and nonfinancial incentives for EVs in an effort to increase EV adoption in Minnesota, especially for passenger vehicles. Incentives have been especially effective in states that have adopted the Zero Emission Vehicle (ZEV) standard, which brings more EV models into the state than are available in state's without the ZEV standard[22]. Incentives are also useful to help offset the higher cost of an EV compared to a conventional internal combustion vehicle.

- MnPASS incentive: MnDOT will develop and implement a pilot project that provides MnPASS customers who purchase or lease a new or used EV between November 1, 2019, and October 31, 2022, a one-time credit to pay charges for using MnPASS lanes. (Action)

Provide More Transportation Options on Projects

Public comments supported actions that reduce vehicle miles traveled because of their potential to reduce GHG emissions and because of the health, equity, and safety benefits that come from more walkable and bikeable communities.

- Analyze greenhouse gas emissions in transportation projects: Starting on January 1, 2020, MnDOT will analyze GHG emissions from transportation project construction and operations (traffic emissions) as part of the environmental analysis. (Action)

INTRODUCTION

Minnesota Governor Walz has acknowledged the importance of action to address climate change at the state level in light of inaction by the federal government.

"Climate change is an existential threat. We must take immediate action. If Washington is not going to lead, Minnesota will lead." - Minnesota Governor Tim Walz[1]

The climate crisis is already affecting Minnesota and impacts are expected to increase in the future.

"Minnesota's temperatures are changing faster than any state other than Alaska...preliminary data suggest that the decade of 2011 to 2020 will surpass the 1990s as the wettest. It will also be the warmest decade in Minnesota history." - Mark Seeley, Professor Emeritus, University of Minnesota[2]

The federal government's Fourth National Climate Assessment (2018)[1] assessment of the impacts of carbon pollution on the Midwest.

"Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also exacerbate a range of risks to the Great Lakes...Tribal nations are especially vulnerable because of their reliance on threatened natural resources for their cultural, subsistence, and economic needs."

[1]https://www.mprnews.org/story/2019/03/04/walz-carbon-free-electricity-2050
[2]https://www.duluthnewstribune.com/news/science-and-nature/4497988-experts-say-minnesotas-climate-changing-faster-other-states and http://mspmag.com/arts-and-culture/climate-change-minnesota/

Minnesota used to be a national leader in reducing emissions of greenhouse gases (GHGs) that cause climate change. In 2007, the state passed the bipartisan Next Generation Energy Act (NGEA) that established goals for the state to reduce GHG emissions from 2005 levels: 15% by 2015, 30% by 2025, and 80% by 2050.

Since 2007, a combination of state action and market forces helped drive down GHG emissions from the electricity sector by almost 30%. This is a huge success story and an example of how policy can help drive markets, lower costs, create jobs, and reduce emissions. In 2019, there were over 61,000 clean energy jobs in Minnesota with almost 40% of those jobs in Greater Minnesota[3].

Despite significant GHG reductions from the electricity generation sector, Minnesota still did not meet the statewide 2015 emissions goal, is unlikely to meet the 2025 emission goal, and soon the 2050 goal may also be out of reach.

In 2016, transportation became the largest emitter of GHGs in Minnesota. While there was a modest reduction in transportation emissions since 2005, due to federal standards for fuel efficiency and GHG emissions, there are no state polices that focus on reducing transportation GHG emissions[4]. As the federal government plans to weaken fuel economy standards in 2019, the need for state leadership will become even more important.

Intentional state action is needed to meet or exceed NGEA goals for transportation GHG emissions and once again be a leader on climate. State action, combined with market forces, can help create jobs, build new energy markets, increase equitable access to transportation options, and reduce transportation emissions while ensuring that future generations enjoy the clean air, clean water, and economic opportunities many Minnesotans enjoy today. Done right, Minnesota can once again be a leader in reducing GHG emissions, in part, by focusing on the transportation sector.

"Pathways to Decarbonizing Transportation" began a conversation about how Minnesota can move towards a low-carbon transportation future. The report describes the project, analysis, and public input used to identify specific actions the state will take to begin getting Minnesota on track to meet our NGEA targets.

In Minnesota, more varied temperatures, increased precipitation, and the greater frequency of extreme weather events will stress the transportation system and increase the cost of building, operating, and maintaining transportation infrastructure, and impact the way that Minnesotans travel.

[3]Clean Energy Economy Minnesota 2019 Annual Report
[4]The Biodiesel Mandate (Minn. Stat. §239.77), and the Petroleum Replacement Goals (Minn. Stat. §239.7911) promote renewable fuels but were not designed with the intent to reduce GHG emissions.

PROJECT OVERVIEW

Pathways explored strategies to reduce carbon pollution from cars, trucks, and buses in Minnesota and sought input from people around the state on their vision for a low-carbon transportation system of the future. The goal of the *Pathways* project was to assess opportunities and challenges in Minnesota's transportation sector to meet GHG reduction targets from the NGEA, as applied to the surface transportation sector. Emissions goals and progress to-date are described in Figure 2.

Figure 2. Historical GHG Emissions in Minnesota[5] and Next Generation Energy Act Goals
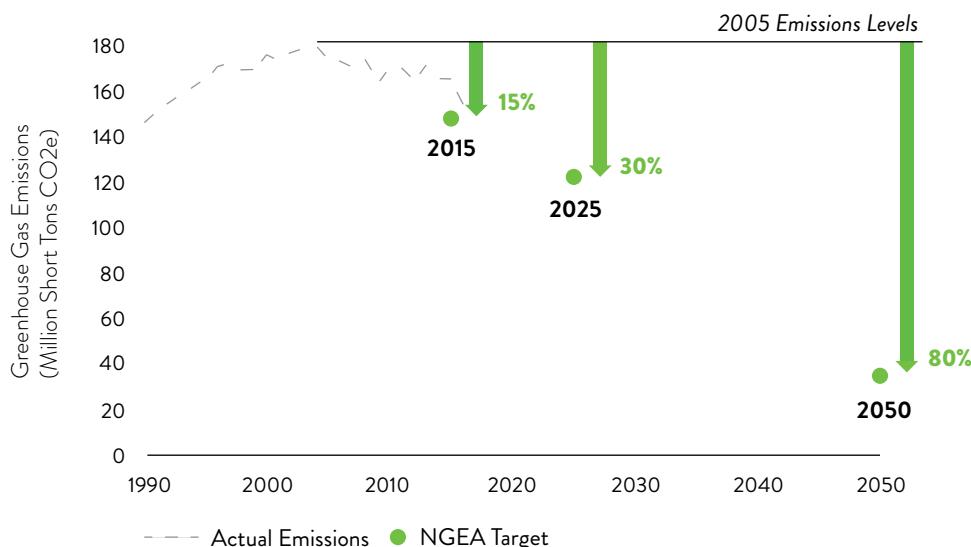
Pathways had three connected parts (see diagram below): 1) coordinate with state and national experts to model inputs and assumptions based on their expertise, 2) model future scenarios of GHG emissions, and 3) engage with Minnesotans around the state to hear their thoughts on opportunities and challenges for reducing GHG emissions from transportation in their communities.

The project was meant to help state agencies identify immediate actions they can take to reduce carbon pollution from transportation in Minnesota and begin a conversation about longer-term strategic approaches to address the problem.

Technical Stakeholder Engagement

Work with technical experts from the public, private, and nonprofits sectors to inform modeling assumptions and strategies that should be considered.

April – June 2019

Modeling

Model different pathways for decarbonizing transportation.

April – May 2019

Public Engagement

Meet with the public at locations around the state to hear their feedback and thoughts on strategies.

May – June 2019

[5]Greenhouse Gas Emissions Inventory, 1990-2016, MPCA: https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data

Project Steering Committee and external advisors

The project was a unique collaboration between the following groups:

- Minnesota Department of Transportation (MnDOT) – project lead
- Environmental Quality Board (EQB)
- Minnesota Pollution Control Agency (MPCA)
- Minnesota Department of Agriculture (MDA)
- Minnesota Department Commerce (Commerce)
- The McKnight Foundation
- Great Plains Institute (GPI)
- Energy and Environmental Economics, Inc. (E3)

All steering committee members actively participated on the project steering committee and their input was treated equally. MnDOT contracted with Energy and Environment Economics (E3) to lead the project modeling and The Great Plains Institute (GPI) to facilitate public and stakeholder outreach. The McKnight Foundation provided technical expertise but no funding. MnDOT funded the project with support from EQB for community engagement.

BACKGROUND

EMISSIONS IN MINNESOTA

The Next Generation Energy Act (NGEA) requires Minnesota to reduce GHG emissions 30% below 2005 levels by 2025 and 80% below 2005 levels by 2050 (Figure 2). The state missed the 2015 target and is not on track to hit future targets in 2025 or 2050.

The most recent MPCA GHG emissions inventory shows that transportation overtook electricity generation to become the largest source of GHG emissions in Minnesota starting in 2016 (Figure 3). This is consistent with recent data from other states (electricity decreasing, transportation increasing) and is expected to continue without state and/ or federal action.

The electricity sector has successfully reduced carbon pollution through a combination of state policy and market drivers that helped reduce the price of renewable energy (e.g., solar and wind) and natural gas and contributed to a 30% reduction in GHG emissions from electricity generation in Minnesota since 2005[6]. In fact, renewable energy is now most frequently the lowest cost source of energy generation[7].

In contrast, transportation GHG emissions decreased 8% from 2005 to 2016, with reductions credited to federal fuel efficiency standards. There was also a temporary dip in emissions when people were driving less during the recession. However, annual transportation emissions began to increase again in 2015 and 2016 as vehicle miles traveled (VMT) increased and people purchased more trucks and SUVs[8]. Preliminary data suggest that transportation GHG emissions have continued to increase since 2016.

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[6]Greenhouse Gas Emissions Inventory, MPCA: https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data
[7]https://www.irena.org/publications/2019/May/Renewable-power-generation-costs-in-2018
[8]According to the Alliance of Automobile Manufacturers, 69% of new vehicle sales in 2018 were light trucks.

Figure 3. Minnesota Emissions by Sector 2005-2016[9]
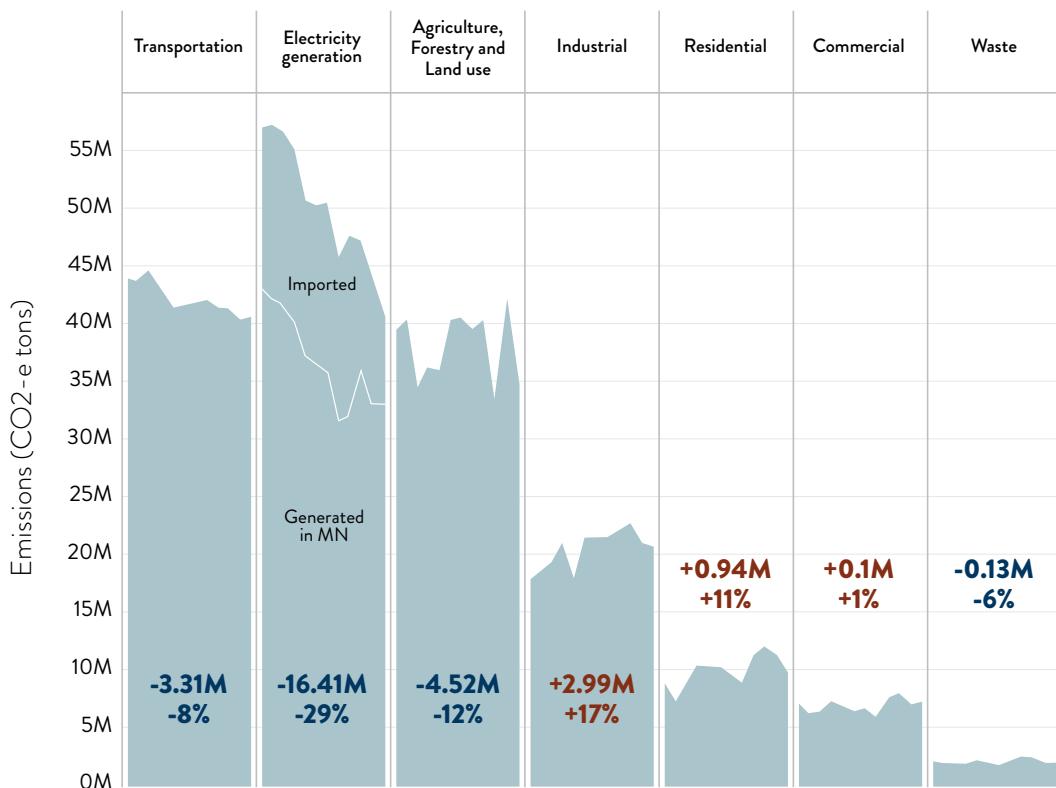
To date, Minnesota has mostly relied on federal standards for fuel efficiency to achieve GHG emission reductions in the transportation sector. The federal government now plans to weaken fuel economy standards starting in model year 2021, which will increase carbon and air pollution from transportation[10].

MULTI-AGENCY AND MULTI-SECTOR COLLABORATION

Like other complex challenges facing Minnesota, reducing transportation GHG emissions will require collaboration among state agencies to leverage the different expertise, resources, capacity, authority, and relationships that exist across the state enterprise. Likewise, collaboration with the private, nonprofit, and philanthropic sectors will be important as they can provide critical innovation, expertise, investment, and organizing.

Pathways is an example of a successful collaboration between agencies and sectors. The project brought together sister agencies with the private sector (E3), nonprofit sector (GPI), and philanthropic sector (McKnight) to address the multidisciplinary and multi-sectoral challenge (and opportunity) of reducing GHGs from transportation.

> A low-carbon transportation system of the future will have strong connections between transportation stakeholders and agricultural groups, utilities, businesses, environmental groups, local jurisdictions, community organizations, and other less traditional transportation partners.

[9]2016 MPCA Greenhouse Gas Inventory
[10]MnDOT/MPCA submitted joint comments to oppose the euphemistic "SAFE" rule that recklessly ignores science, legal process, and public health; unnecessarily increases vehicle ownership costs; and discourages automotive innovation.

THE MNDOT ROLE

Pathways was a collaborative effort but MnDOT served as the project lead because of the agency's role related to transportation, energy, and emissions.

Minnesota statute 174.01 outlines 16 goals for the MnDOT to administer for the transportation sector in Minnesota. Six of the goals relate to energy, the environment, and reducing carbon pollution from transportation, as described below.

10) Ensure that the planning and implementation of all modes of transportation are consistent with the environmental and energy goals of the state

11) Promote and increase the use of high-occupancy vehicles and low-emission vehicles

13) Increase use of transit as a percentage of all trips statewide by giving highest priority to the transportation modes with the greatest people-moving capacity and lowest long-term economic and environmental cost

14) Promote and increase bicycling and walking as a percentage of all trips as energy-efficient, nonpolluting, and healthy forms of transportation

15) Reduce greenhouse gas emissions from the state's transportation sector

16) Accomplish these goals with minimal impact on the environment

In 2017, MnDOT also voluntarily applied NGEA emission goals to the transportation sector in the Statewide Multimodal Transportation Plan and the MnDOT Sustainability Report,[11] which also included GHG reduction targets for agency operations (e.g., fleet fuel use, building energy) and for the state highway construction program. MnDOT was the first state department of transportation in the U.S. to adopt such ambitious goals, but has made limited progress since 2017, largely because the path forward was unclear.

[11]MnDOT also applied the NGEA emission reduction targets to all agency energy use and to emissions from the state highway construction program
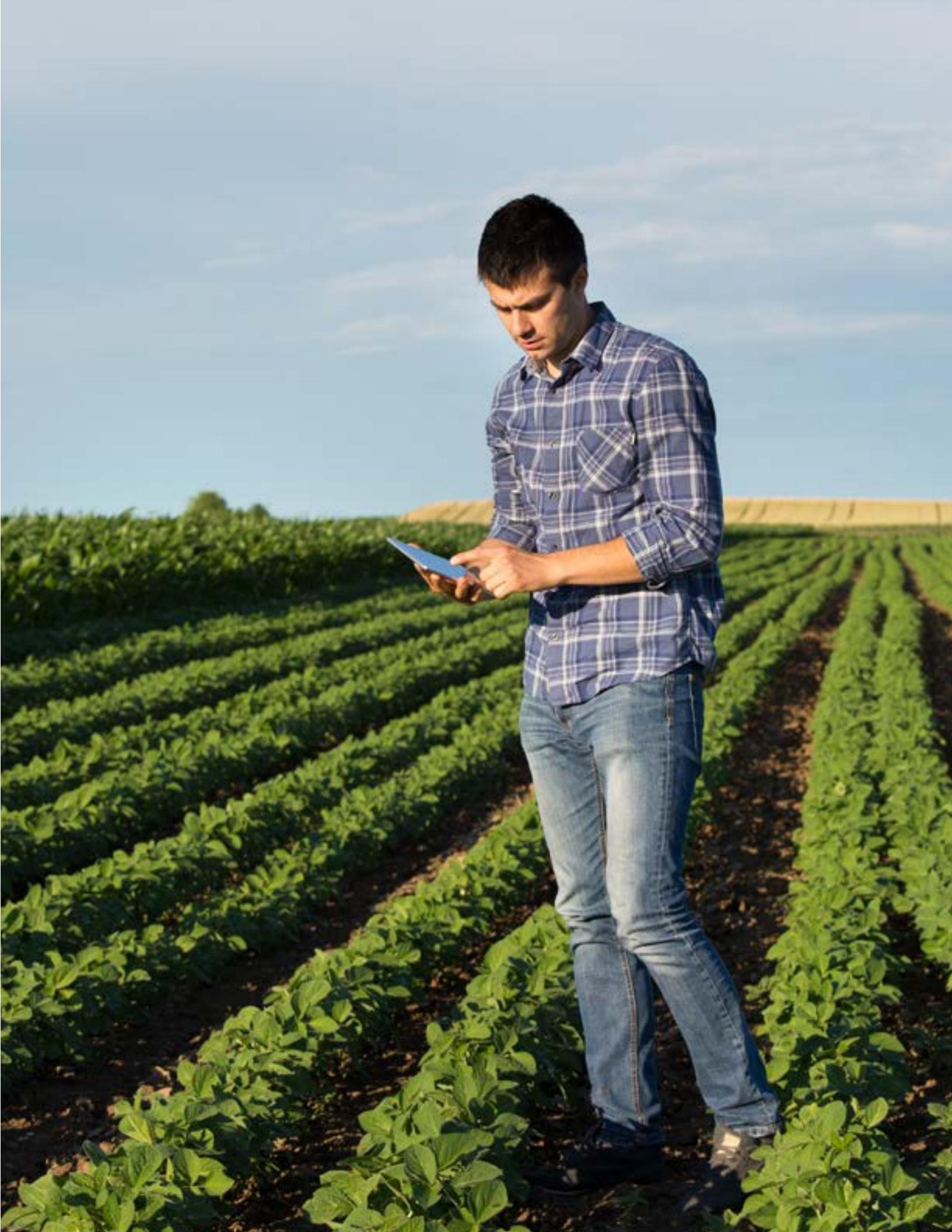
PATHWAYS TO DECARBONIZING TRANSPORTATION – PROJECT DESIGN

Pathways included technical analysis and public input to understand the variety of statewide and local opportunities and challenges for Minnesota in reducing GHGs from transportation. This section of the report describes the scope and process of the project.

SCOPE

More than 70% of transportation GHG emissions in Minnesota are from light-duty passenger cars and trucks, medium-duty trucks, and heavy-duty trucks. These sources, along with buses, motorcycles, and mobile air conditioning are considered "surface transportation" or "on-road transportation" and were the focus of the *Pathways* project (Figure 4). The project included emissions from the tailpipes of vehicles and from upstream sources like biofuel feedstocks and electricity used to power EVs.

This project did not include aviation, marine, heavy rail, pipelines, or military emissions. These are important and, in some cases, growing sources of transportation emissions, but they tend to have a different group of stakeholders, emission reduction strategies, and funding opportunities/constraints than surface transportation.

Pathways had a limited timeframe (5 months), so the team focused on surface transportation since it is the largest source of transportation carbon pollution in Minnesota.

Figure 4. Minnesota Emissions Profile
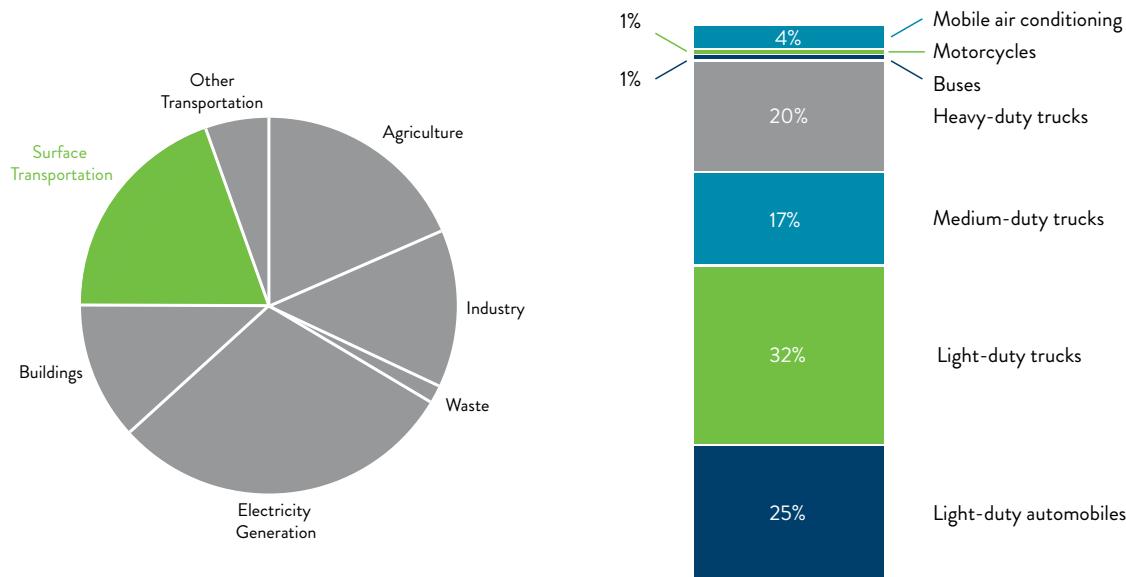
FORMAT

Pathways had three interconnected parts. Each will be discussed in the following sections.

1. Technical Stakeholder Engagement

Coordinate with state and national technical experts from the public, private, and non-profit sectors to inform the assumptions, data sources, and strategies to model.

2. Modeling

Model strategies that work together to meet NGEA targets for transportation GHG emissions.

3. Public Engagement

Listen to the public to hear their vision for a low-carbon transportation system and get feedback on the modeled strategies.

Building on previous work

To date, the state of Minnesota has published two economy-wide climate planning analyses: Minnesota Climate Change Advisory Group Final Report (MCCAG, 2008) and Climate Solutions and Economic Opportunities (CSEO, 2016). Since the 2016 CSEO analysis was published, the transportation sector has become the largest source of GHG emissions, and the market for electric vehicles has changed dramatically. The *Pathways* analysis built off of this work by isolating the transportation sector, modeling out to 2050, and going into greater depth exploring strategies and gathering input from technical experts.

As it relates to the transportation sector, CSEO presented Minnesota's GHG inventory, described policy options, and included strategies related to improved public transit, smart city design, bike-able communities, mobile refrigerants, electric vehicles, advanced biofuels production, and in-state biofuel consumption.

TECHNICAL STAKEHOLDER ENGAGEMENT

The steering committee worked together to identify state and national experts to participate in the *Pathways* project and inform the analysis, modeling, and assumptions about potential strategies and pathways to reducing GHG emissions from transportation in Minnesota. The stakeholders helped identify relevant data and resources, clarify assumptions about technology innovation and market penetration, and address Minnesota-specific opportunities and constraints and support assumptions used in the modeling. This input was critical to ensuring that the analysis and modeling was current, relevant, and realistic.

Technical stakeholders came from Minnesota cities, automobile manufacturers, the University of Minnesota, agricultural associations, transit providers, utilities, state agencies, and environmental advocacy organizations. Over fifty organizations and state agencies participated in at least one *Pathways* meeting (See Appendices 1, 2, and 3). Across the three technical stakeholder meetings, there were 106 unique attendees, including facilitators and agency staff. E3 used the input to model scenarios.

Technical stakeholders had the opportunity to provide feedback at three meetings – two in-person and one webinar (Figure 5) facilitated by GPI. During each meeting, E3 shared a detailed modeling presentation and GPI facilitated discussion to collect input from the technical stakeholders.

Figure 5. Timeline: Technical Stakeholder Engagement
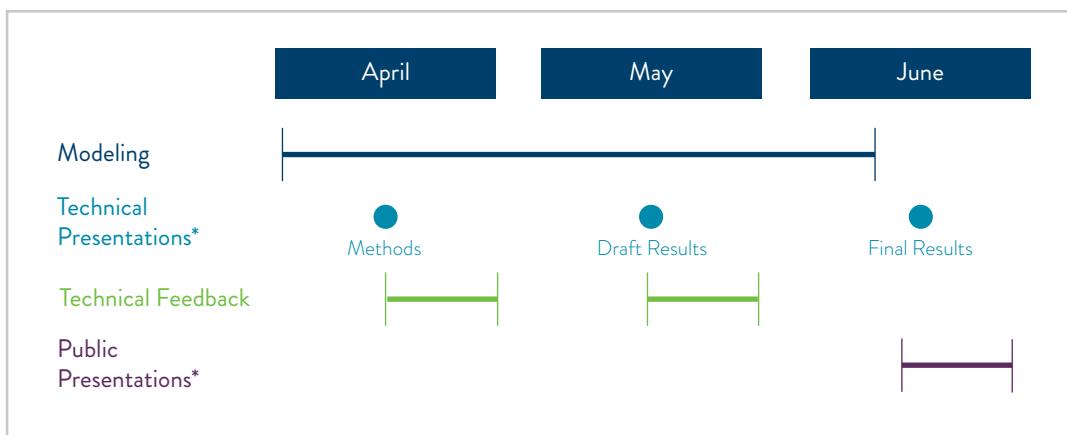
OUTCOMES FROM TECHNICAL STAKEHOLDER MEETINGS

The goal of technical engagement was not to arrive at consensus around policy recommendations, but rather to collect data, resources, and technical consideration for a wide range of potential climate actions.

The following are some broad conclusions and areas of general agreement from the technical stakeholder group. Details and technical feedback from the technical stakeholder meetings are in Appendices 1, 2, and 3.

Conclusions from Technical Stakeholder Meetings:

1. Take action across all sectors (e.g., biofuels and EVs)

2. More biofuel and EV infrastructure is needed

3. Broad support for action

- **Stakeholders were generally positive about the scenarios and the mix of fuels presented** and there was overall support for the modeled pathways. Stakeholders wanted "scenarios that are possible and achievable" and "something in it for all sectors." The group saw a role for a wide variety of actions across many parts of the transportation system to achieve the state's goals.

- **More biofuel and electric vehicle (EV) charging infrastructure is needed.** The lack of EV chargers and "biofuel infrastructure" came up several times and participants commented that the modeling is an "exercise in futility without infrastructure." Participants did not clarify specifics about biofuel infrastructure, but the project team understands "biofuels infrastructure" to mean fuel pumps, tanks, and blending equipment for higher biofuel blends: equipment compatible with ethanol blends higher than 10% and biodiesel blends higher than 20%.

- **There was broad support for decarbonizing transportation.** There was clear excitement about the project from technical stakeholders and a consensus that pathways exist to meet emission reduction goals in the transportation sector.

Opinions were mixed about whether the modeling was too aggressive or not aggressive enough, including, the projections for medium-duty hybrid sales, adoption rate of electric transit, and timelines for transitioning to carbon-free electricity.

Some stakeholders were also unsure if the model results were realistic without more information about costs, benefits, and specific policy details, which were not part of the modeling. These questions were intentionally omitted to avoid debate on the merits, political feasibility, or potential costs of a specific policy solution during the technical discussion. For most of the strategies to reduce emissions, multiple policy levers could be pulled individually or in combination to realize GHG reductions. Similarly, there are wildly variable costs depending on how the policies are implemented.

Summaries from individual technical stakeholder meetings are available in Appendix 1, Appendix 2, and Appendix 3..

Pathways Technical Stakeholder Meeting #1

MODELING

Modeling was important to the *Pathways* project to ground the conversation in a concrete analysis. Modeling allowed participants in the process to explore opportunities and challenges, see the GHG impact of different strategies, understand when strategies need to occur, and think about how strategies could be combined.

Modeling helped:

- Evaluate opportunities and challenges to reduce transportation carbon pollution
- Clarify which actions achieve the greatest emissions reductions
- Identify critical timing for different actions
- Capture interactions between measures and sectors
- Explore if/how/which strategies can be combined

MODELING SHOWED THAT ACTION IS NEEDED ACROSS ALL VEHICLE CLASSES AND SECTORS AND THAT NO ONE ACTION OR SECTOR CAN ACHIEVE OUR GOALS ALONE.

MODEL OVERVIEW

MnDOT contracted with E3 to use their PATHWAYS model for the analysis. The PATHWAYS model is an economy-wide infrastructure-based GHG and energy analysis tool (Figure 6). The model captures "infrastructure inertia" reflecting lifetimes and vintages of buildings, vehicles, and equipment; models physical energy flows within all sectors of the economy; and allows for comparison between user-defined scenarios.

Figure 6. PATHWAYS Modeling Framework
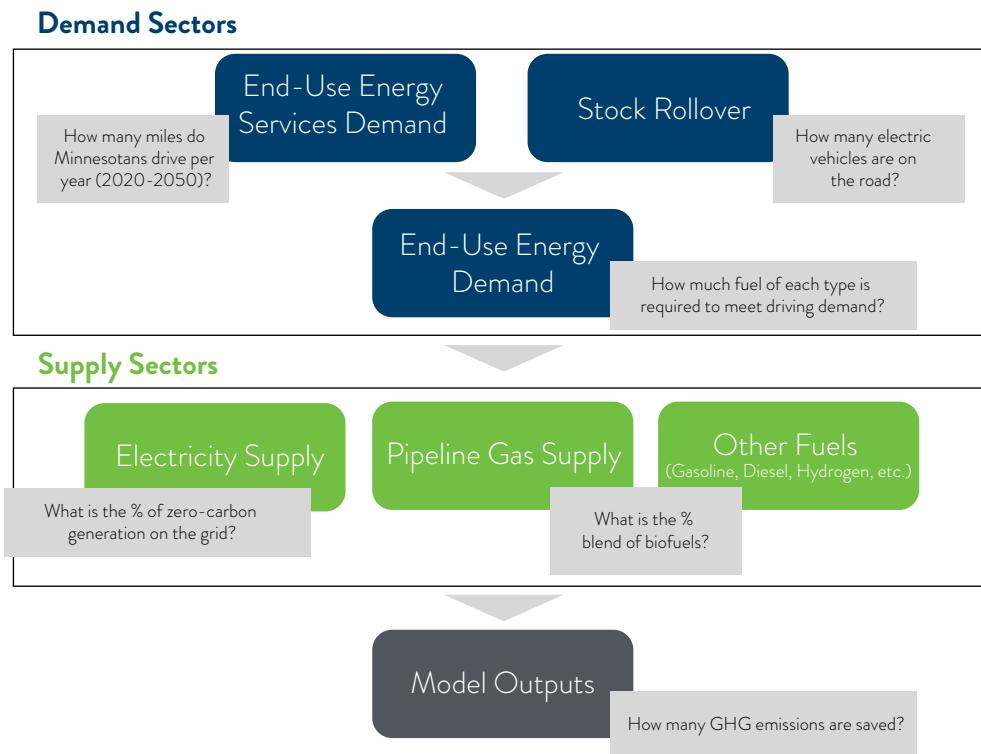
The PATHWAYS model does not describe how the modeled strategies would be implemented. For instance, the model indicates how many electric vehicles might need to be on the road by a certain date to achieve the emission reduction goals but does not say what specific policies or incentives are needed to get there.

MODELED SCENARIOS

Technical stakeholders provided input throughout the modeling process to identify the most important decarbonization strategies to reduce transportation carbon pollution, develop and review assumptions, and offer feedback on draft results (Figure 7).

Three scenarios were modeled (below): one no-action alternative and two pathways to meet or exceed the NGEA targets for Minnesota's surface transportation sector.

1 **REFERENCE SCENARIO**
Business-as-usual scenario that includes current policies – i.e., no action. The scenario assumes that current federal fuel economy standards will be weakened starting in model year 2021.

2 **80 X 50 SCENARIO (SCENARIO #1: 80 X 50)**
Combination of strategies to achieve the 80% statutory NGEA GHG reduction goal for 2050.

3 **100 X 50 SCENARIO (SCENARIO #2: 100 X 50)**
Combination of strategies to achieve zero emissions from transportation by 2050 that were explored for two reasons:

1) Transportation may need to reduce emissions more than 80% to compensate for other sectors not being able reach the targets.

2) Scientific consensus suggests that complete decarbonization is needed to avoid the most catastrophic consequences of climate change.

Figure 7. Total Surface Transportation Emissions by Scenario
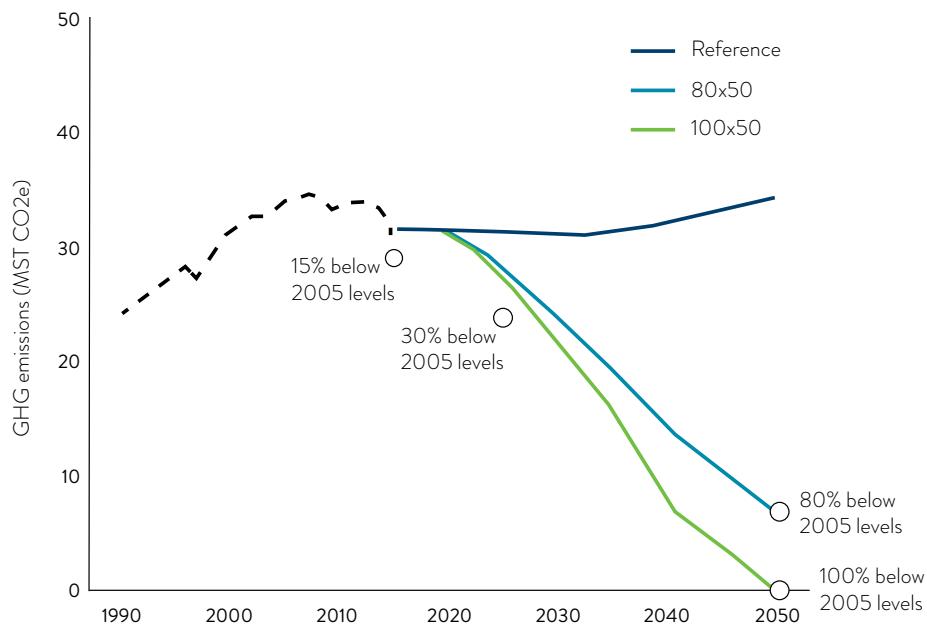
Modeled strategies to reduce transportation carbon pollution

1. **Improve vehicle efficiency** – e.g., promote driving vehicles that pollute less per mile and driving fewer miles each year, especially in urban/suburban areas with transit, walking, and biking options

2. **Increase vehicle electrification** – e.g., promote sales of light, medium, and heavy-duty of EVs

3. **Use more low-carbon fuels** – e.g., support development of advanced biofuels, leverage cleaner electricity for transport

4. **Stop using mobile refrigerants with high global warming potential (GWP)** – e.g., support federal regulation of refrigerants with high GWP[12].

MODELING ASSUMPTIONS BY SCENARIO

The following assumptions were included in the modeling for two scenarios that meet or exceed the NGEA goals (Table 1) based on feedback from technical stakeholders.

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[12]GWP is a measure of how much energy the emissions of 1 ton of gas will absorb over a given period of time, relative to the emissions of 1 ton carbon dioxide (CO_2)

Table 1: Modeled Assumptions for 80 x 50 and 100 x 50 Scenarios

MEASURE		Assumptions by Scenario	
		80 x 50	100 x 50
LIGHT DUTY VEHICLES	Federal Fuel Economy Standards	Extended through 2026	
	LDV EV Sales[13]	40% sales by 2030, 80% by 2050	60% by 2030, 100% by 2040
	LDV VMT Growth (Metro VMT ~50% Statewide VMT)	-3% statewide by 2030, -5% by 2050	-5% statewide by 2030, -10% by 2050
MEDIUM DUTY VEHICLES	MDV EV + Hybrid Sales	40% sales by 2030, 80% by 2050	50% sales by 2030, 100% by 2050
	MDV VMT Growth	1.4% 2016-2050	1.4% 2016-2050
HEAVY DUTY VEHICLES	HDV EV + Hybrid Sales	40% sales by 2030, 80% by 2050	50% sales by 2030, 100% by 2050
	HDV CNG[14] Vehicle Sales	6.5% sales by 2030	6.5% sales by 2030
	HDV VMT Growth	1.4% 2016-2050	1.4% 2016-2050
BUSES	Electric Buses	50% BEV sales by 2030	50% sales by 2030 (100% BEV)
	CNG Buses	7.5% sales by 2030	7.5% sales by 2030
	Bus VMT Growth	1.4% 2016-2050	1.4% 2016-2050
BIOFUELS	Ethanol	20% blend by 2030, 55% by 2050	20% blend by 2030, 100% by 2050
	Ethanol Carbon Intensity	CI declines to -58% by 2030	Declining CI to carbon-neutral by 2050
	Biodiesel	20% blend by 2030, 55% by 2050	20% blend year-round by 2030, 100% by 2050
	Biodiesel Carbon Intensity	CI declines to -25% by 2030, 50% by 2050	Declining CI to carbon-neutral by 2050
ELECTRICITY	Electricity	90% zero-carbon generation statewide by 2050	100% zero-carbon generation statewide by 2050
RVS	Biofuels for RVs	20% blend by 2030, 55% by 2050	20% blend by 2030, 100% by 2050
MOTORCYCLES	Electric Motorcycles	50% motorcycles electric by 2050	100% motorcycles electric by 2050
MOBILE REFRIGERANTS	Lower GWP Refrigerants	Low GWP refrigerant in all new vehicles by 2035	Low GWP refrigerant in all new vehicles by 2025

[13]In April 2019, EVs were <1% of total vehicle sales (Atlas EV Hub).
[14]Compressed natural gas

SCENARIO 1:
80% REDUCTION IN CARBON POLLUTION BY THE YEAR 2050 ("80 x 50")

Figure 8 shows how improvements in vehicle efficiency, electrification, mobile refrigerants, and use of low-carbon fuels could be combined to reduce transportation GHG emissions 80% by 2050. In the 80 x 50 scenario, the largest GHG emission reductions would come from electrifying light-duty vehicles.

Figure 9 shows the emissions that remain in each transportation "subsector" after the modeled emission reductions have occurred.

SCENARIO 2:
100% REDUCTION IN CARBON POLLUTION BY THE YEAR 2050 ("100 x 50")

Like the 80 x 50 scenario, the 100 x 50 scenario relies on improvements in efficiency, electrification, mobile refrigerants, and low-carbon fuels to reduce transportation GHG emissions. Where the 100 x 50 scenario is different is that it doesn't rely as heavily on light duty vehicle emissions reductions since there must be substantial reductions in all parts of surface transportation to fully decarbonize the sector (Figure 8).

Figure 8. Emissions Reductions by Strategy Area
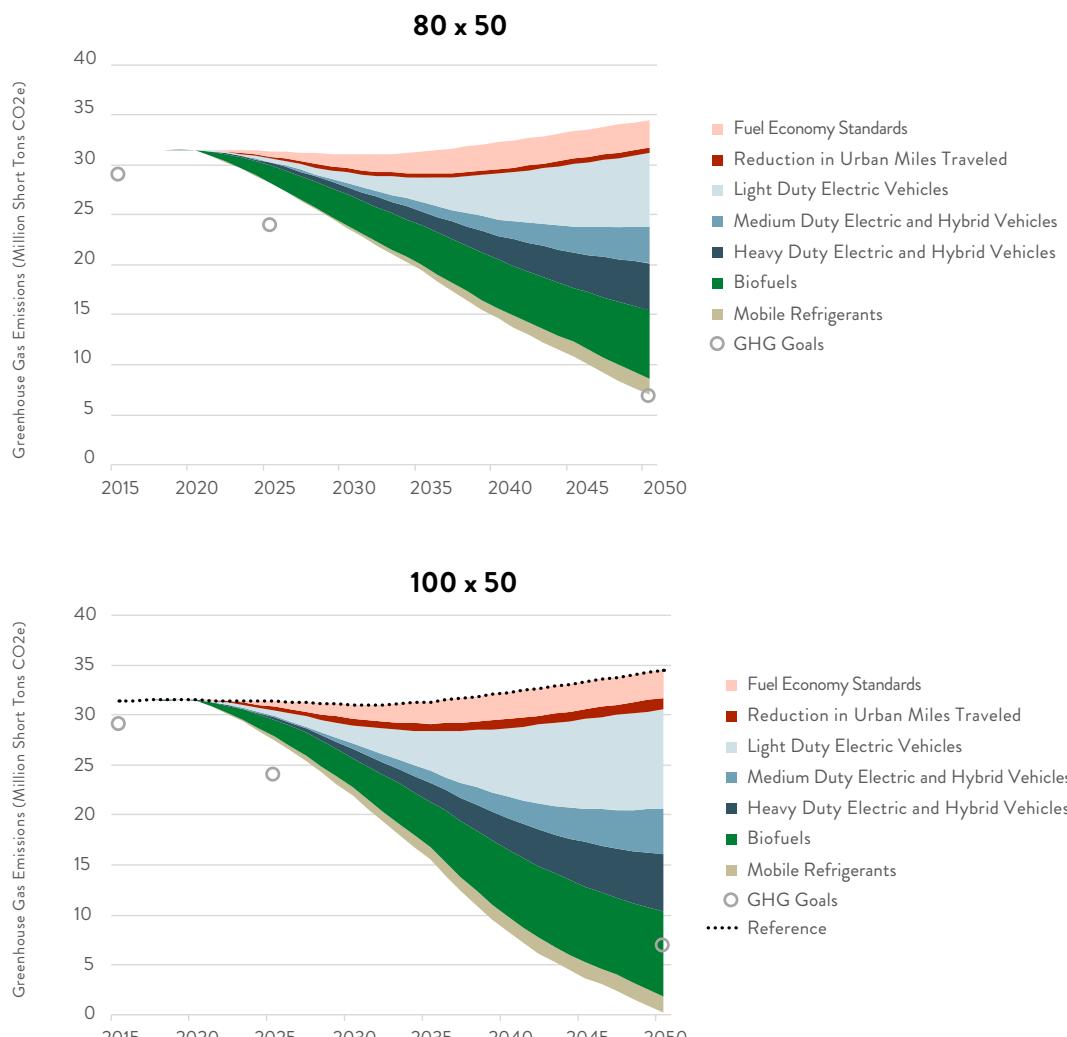
Figure 9. Remaining emissions by surface transportation "subsector"

80 x 50

100 x 50
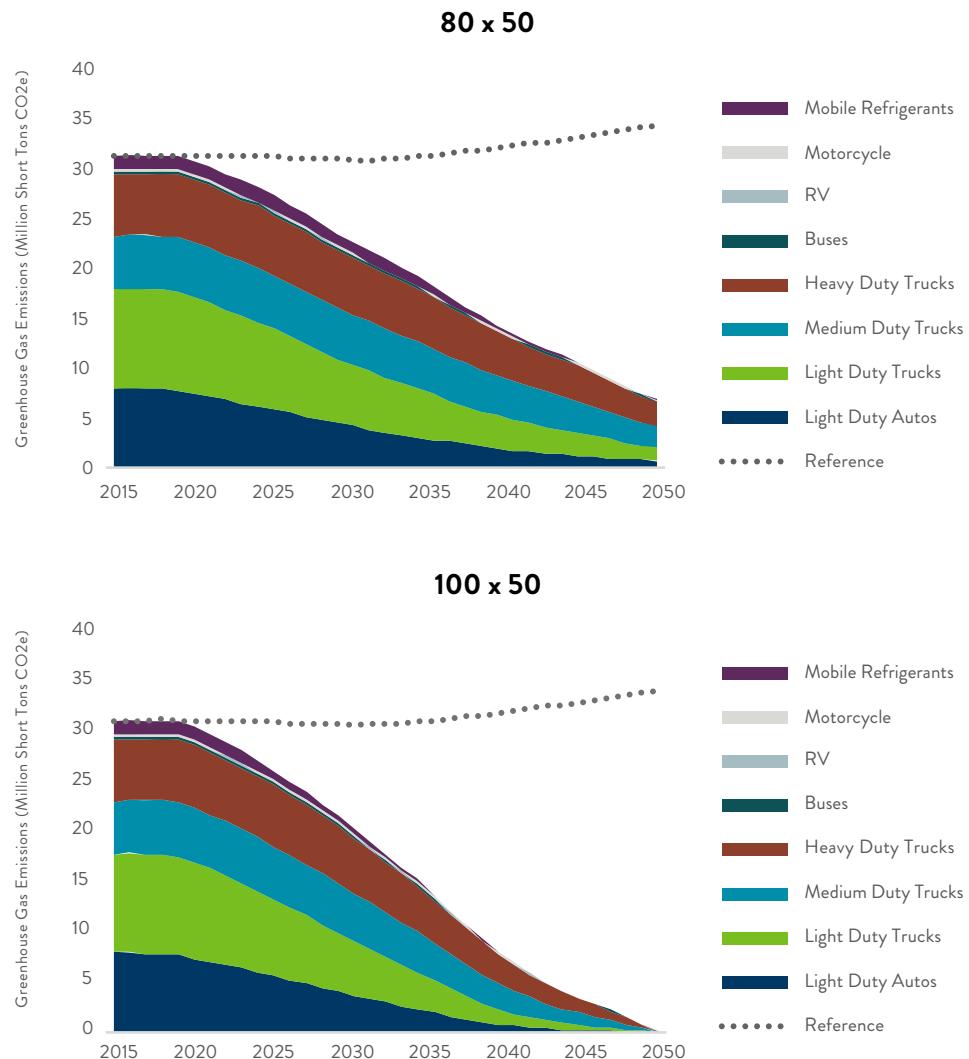
VMT METHODOLOGY

The basis for the VMT modeling was a paper from the 2009 report: *Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*[15] that based the reduction of miles traveled on shortening the length and number of vehicle trips in an urban area, which could be done through strategies like funding transit and active transportation (walking, biking) options and supporting denser mixed-use development.

[15]Transportation Research Board and National Research Council. 2009. Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions -- Special Report 298. Washington, DC: The National Academies Press. https://doi.org/10.17226/12747.

The biggest surprise from the modeling was that the biggest GHG emissions reductions were from changes to vehicles and fuels and that reducing vehicle miles traveled would a limited direct impact on GHG emissions, especially when more people are traveling in ultra-low emission vehicles. Across the state, Minnesotans still expressed a strong desire for transportation options, including biking, walking, and transit, for reasons that included safety, community cohesion, aging in place, and overall quality of life.

The model shows a combination of strategies that could be combined to achieve the NGEA GHG targets, but does not propose specific actions or policies to pursue. However, some tactics were discussed during conversations with technical stakeholders and the public to give them a sense of how other states and communities have thought about these strategies (Table 2).

Table 2. Modeling and Implementation

Model strategy	Example tactics to reduce transportation carbon pollution
Improve fuel economy	• Federal or state vehicle efficiency standards
Reduce driving and VMT	• Smart, dense city design • Neighborhoods built for biking, walking, and rolling • Carpooling incentives • Improved public transit
Increase electric vehicle sales	• Consumer rebates • State vehicle targets • Public and workplace charging stations
Reduce the carbon intensity of biofuels	• Regenerative agricultural and soil practices • Process efficiency • Low-carbon fuel standard
Increase lower-carbon electricity generation	• Clean electricity standards • Utility greenhouse gas reduction goals • Retire coal plants

PUBLIC ENGAGEMENT

Public engagement was a core tenet of the *Pathways* project. The team wanted to ensure that any climate and transportation actions that might come out of this work would be informed by the people who would be affected by those actions. Engagement is particularly important for this project because every Minnesotan interacts with the transportation system and climate change already impacts, or will in the future, every Minnesotan through effects to our health, economy, and environment.

Following the modeling and initial technical stakeholder engagement, the project reached out to communities throughout the state, major corporations, and tribal representatives in June and July 2019.

The goal of public outreach was threefold:

1. *Share* information about progress towards GHG targets, strategies for reducing transportation carbon pollution, and a potential path to achieve state GHG targets for surface transportation.

2. *Listen* to input about decarbonization options, either those modeled or new ideas, about differences around the state, and about how Minnesotans around the state envision a low-carbon transportation system of the future for their community.

3. *Establish recommendations* for future actions by MnDOT and other state agencies based on the needs and desires of Minnesotans.

A full report out on the public engagement process is available in Appendices 4-7.

PUBLIC ENGAGEMENT PROCESS

The *Pathways* team tried to encourage as much participation as possible for the public meetings, webinar, and online surveys which were marketed through a variety of channels, including:

1. Agency emails and newsletters

2. Outreach through local networks, including Drive Electric Minnesota, Bio-economy Coalition, agricultural groups, and GreenStep cities

3. Advocacy groups promoted meetings and supported attendance.

4. Social media

5. The MnDOT Sustainability webpage housed all the meeting information, including presentation materials, the online survey link, and project updates[16]

The *Pathways* team hosted nine public meetings throughout the state, a live and recorded webinar, an online survey, and an open online comment form to give members of the public an opportunity to shape the potential pathways to reduce carbon pollution from transportation in Minnesota (Figure 10). The *Pathways* team also participated in additional targeted listening sessions with the Sustainable Growth Coalition and with representatives from Minnesota tribes.

Figure 10. Map of public meeting locations

Webinar, May 31st
12:00 pm – 1:00 pm
Register at mndot.gov/sustainability/pathways.html

Twin Cities, June 4th
6:00 pm – 8:00 pm
Minneapolis Urban League

Bemidji, June 5th
2:30 pm – 4:30 pm & 6:00 pm – 8:00 pm
Hobson Memorial Union, BSU

Duluth, June 6th
2:30 pm – 4:30 pm & 6:00 pm – 8:00 pm
American Indian Community Housing Organization

Marshall, June 11th
2:30 pm – 4:30 pm & 6:00 pm – 8:00 pm
Marshall Municipal Utilities

Rochester, June 12th
2:30 pm – 4:30 pm & 6:00 pm – 8:00 pm
Mayo Civic Center

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[16]http://www.dot.state.mn.us/sustainability/pathways.html

Using different engagement methods helped the *Pathways* team hear from different communities and groups of people from around the state.

Public Webinar: The webinar included a presentation of the model inputs and outputs. Participants were encouraged to ask questions verbally and through a chatroom function.

Online Survey: The steering committee worked with public engagement staff from MnDOT, EQB, and MPCA on a 15-question public survey to capture information on Minnesotans' attitudes and opinions about reducing transportation GHG emissions.

Online Open Comment Form: An open comment form was available for the public to submit written long-form feedback.

In-Person Public Meetings: Nine public meetings were held in five cities across the state: Minneapolis, Bemidji, Duluth, Marshall, and Rochester. The communities represent regional hubs around the state and included five of the eight different MnDOT districts. Meetings included a presentation on the project and modeling, online surveying using Mentimeter, and small group discussions (Figure 10).

Targeted outreach: The team participated in two targeted listening sessions with the Sustainable Growth Coalition and with Minnesota tribes to get feedback from these two groups that were not otherwise represented in the feedback.

PUBLIC ENGAGEMENT BY OUTREACH METHOD

Table 3 provides a summary of public engagement by method. Studio 1 TV: Marshall's community access channel, also filmed one of public meetings which is available to view in their online archives[17]. The project team did not collect identifying information so there is no way to determine if individuals provided feedback through multiple forums.

Table 3. Summary of Public Engagement by Responses/Participants

Online survey responses	Online comments	Webinar attendees	In-person meeting attendees
1,115	4	53	280

PUBLIC ENGAGEMENT DEMOGRAPHICS

People providing comments and participants at public meetings had the option to provide self-identified demographic information. In all situations, this was optional information. There was a similar age, gender, and racial breakdown at the public meetings and with the survey respondents.

- *Age* – The majority of the respondents self-identified their age between 31 and 65 (53%). Youth voices were least represented, with only 17% of respondents self-identifying as age 30 or younger.

- *Gender* – There was a small majority of self-identified female voices (48%) compared to male (41%) and non-binary voices (2%). 9% of participants preferred not to disclose their gender identity.

- *Race* – Most people who engaged with the public stakeholder process self-identified as White or Caucasian (84%) and 10% preferred not to disclose their race. Only 3% of participants self-identified as non-white and another 3% identified as multiracial.

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[17]http://media.studio1.smsu.edu/CablecastPublicSite/show/3905?channel=1

- *Occupation* – Employment type was the most diverse demographic indicator. People self-identifying as "retired" were the largest group of participants followed by business (14%), non-profits (11%), and self-employed and government (10%).

- *Location* – In-person meetings and online survey encouraged input from around the state. *Pathways* received feedback from people in 222 ZIP codes (Figure 11). Comments from people living near in-person meeting sites were mostly received during meetings. Online comments tended to be from people living further from the meeting locations.


Left: Small group discussions in Marshall.

Right: Welcome address from the City of Duluth

Figure 11. Pathways Public Stakeholders by ZIP Code
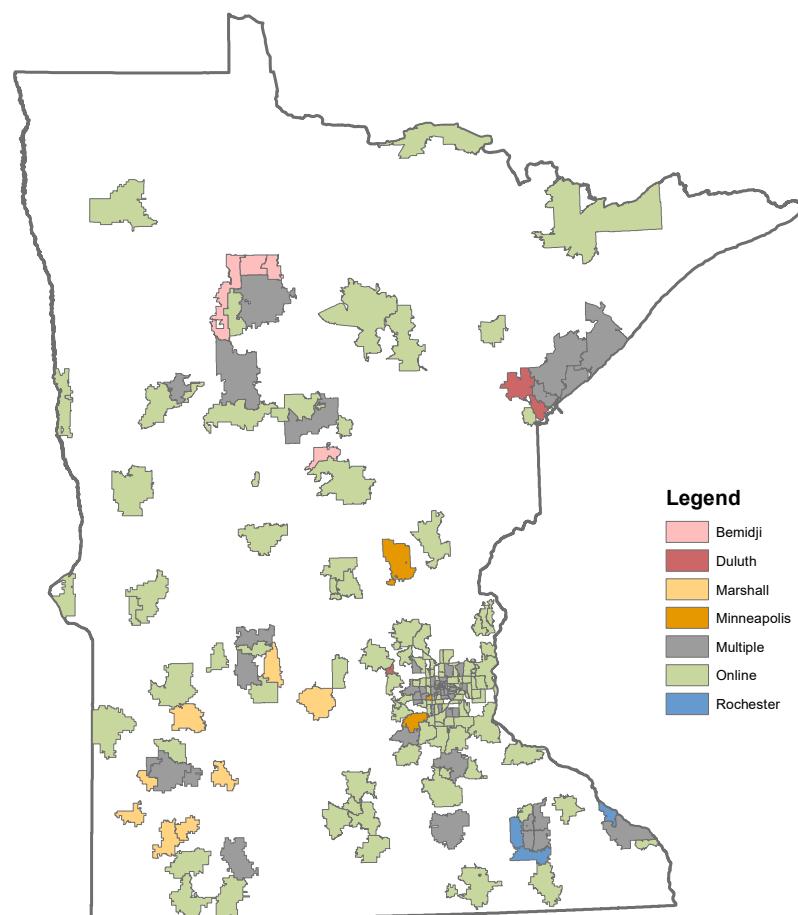
PUBLIC MEETING FORMAT

1. Public meetings started with a welcome from one of the agency partners; either MnDOT, MPCA, or Commerce. When possible, there was also a local welcome. For example, Mayor Kim Norton opened the Rochester meetings.

2. MnDOT and GPI provided project context and walked through the modeling assumptions and results and provided time for questions.

3. Attendees divided into small groups to discuss opportunities and barriers to a low-carbon transportation system in their communities. Participants were asked to write down three responses to each question on sticky notes.

4. Participants used computers or smart phones to respond to a series of questions using the online survey tool: Mentimeter. For participants who did not have a smart phone, staff loaned them smart phones, a laptop computer, or provided a paper survey so that all attendees could participate.

5. Verbal feedback, sticky notes, and Mentimeter survey responses were captured and used to inform the actions in the final section of this report.

PUBLIC FEEDBACK – OVERALL THEMES

The following themes emerged around priorities for decarbonizing transportation:

1. **There is a climate crisis and swift action is needed to reduce emissions.**

2. **Transportation solutions must be integrated with other systems**, including energy generation, land use decisions, and other state and local policies.

3. **Environmental justice and equity should be in the forefront of climate actions** and help shape strategies to reduce transportation GHG emissions.

4. **More transportation options are needed**, including the following:

   - More electric car options at dealerships and a more robust used EV market

   - More EV charging infrastructure

   - Walking and biking infrastructure that is safe and accessible

   - High quality public transportation to reduce the need to drive alone

   - Electric buses

5. **Regional and statewide solutions are needed.** Strategies may be different for urban and rural areas.

# PUBLIC FEEDBACK – STRATEGIES FOR REDUCING TRANSPORTATION GHG EMISSIONS

Participants rated strategies for reducing transportation GHG emissions using Mentimeter online polling and the online survey. The following strategies received strong support from participants as indicated by an average score of 8.9 out of 10, on a scale of 1 (low) – 10 (high).

- Improve public transportation
- Design and encourage walkable and bikeable communities
- Promote electric buses and trains

Participants also supported increasing personal electric vehicles, electric vehicle chargers, and electrifying commercial and heavy-duty vehicles and shared vehicles.

There was less support for biofuels/low-carbon fuels, and corn ethanol, which received average scores of 3.7 and 2.0, out of 10, respectively. In discussions during in-person meetings, there were lots of questions about biofuels and impacts to water quality. When facilitators discussed opportunities for advanced biofuels, regenerative agriculture, and other land use practices to reduce the carbon impact of biofuels and support water quality, participants were much more supportive. There was also broad recognition of the value in creating a biofuel market for Minnesota farmers in light of recent tariffs and flooding. Figure 12 highlights the level of support for the strategies described above.

Figure 12. Public scoring results for transportation decarbonization strategies (10 = support)
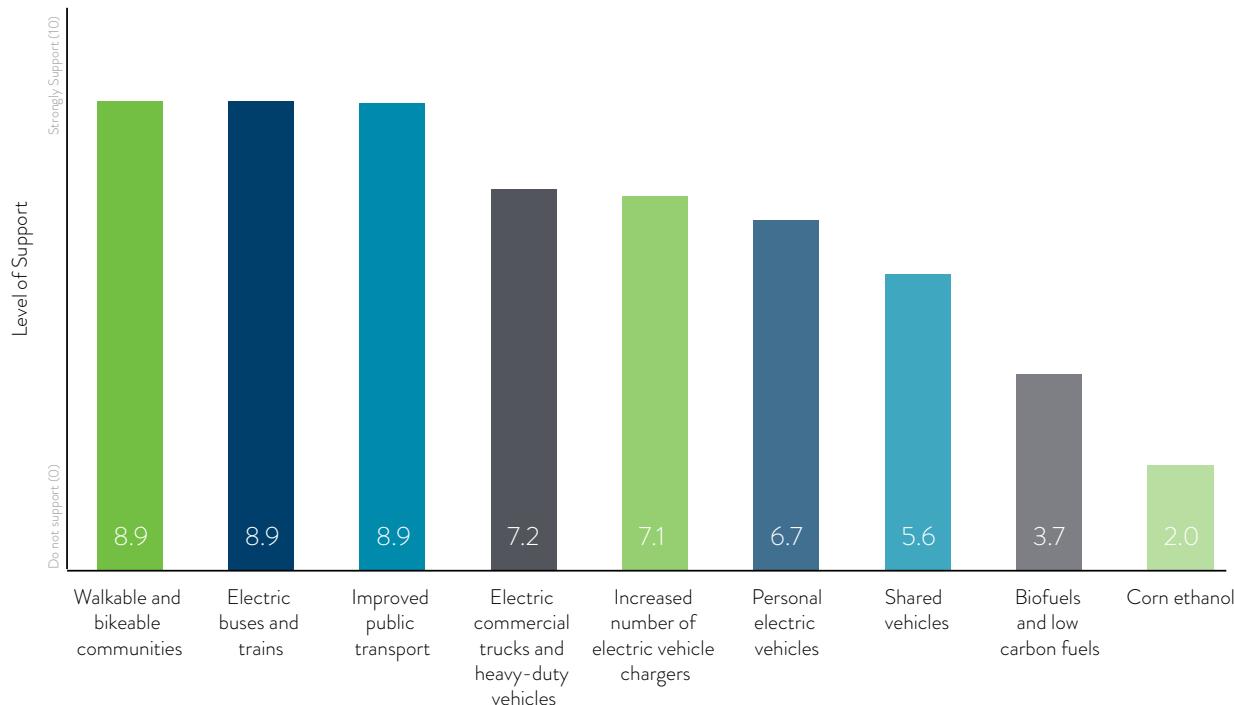
PUBLIC FEEDBACK – STRATEGIES OPTIONS

Meeting participants also provided input on potential strategies that could be used to achieve the modeled GHG emission reductions. While the degree of support varied by strategy, there was still support for all of the options presented and the team heard a lot about the need for an "all of the above" approach to decarbonizing transportation. Figure 13 describes public feedback on the strategies to reduce transportation GHG emissions.

Participants very strongly supported the following strategies:

- Requirements for car manufacturers to offer more fuel-efficient vehicles in Minnesota
- Additional funding for EV and biofuel infrastructure
- Additional funding for EVs (e.g., rebates and incentives for cars and chargers)
- Requirements to include multimodal transportation options in community design

There was also strong support for the following strategies:

- Fees on fossil fuels like gasoline and diesel (e.g., increased gas tax)
- Market-based efforts to incorporate a price on carbon (e.g., carbon cap and trade/invest, carbon tax, low-carbon fuel standard)
- Investment in research to develop new technologies (e.g., solar-powered EV charging, vehicles with higher biofuel blends)
- Incentives for vehicle upgrades or replacements (e.g., EV tax rebate, "cash for clunkers")

Support for the following strategies was more variable:

- Incentives for adopting new clean fuel technology (e.g., production of low-carbon fuels, new biofuel blends)
- Investment in research to reduce emissions from biofuels (e.g., ethanol, biodiesel)

Figure 13. Public support for strategies to decarbonize transportation (5 = support)

Average: 4.2
Market based efforts that incorporate a price on carbon
Incentives for vehicle upgrades or replacement
Fees on fossil fuel like gasoline and diesel

Average: 4.4
Funding for vehicles
Funding for infrastructure
Regulations for car manufacturers to offer more fuel-efficient vehicles in Minnesota

Average: 3.6
Incentives for adopting new clean fuel technology

Average: 4.5
Requirements to include multimodal transportation in community design and transportation projects

Average: 3.3
Investment in research to reduce emissions from biofuels (i.e. ethanol, biodiesel)

Do not support (1)   Neutral (3)   Strongly support (5)

PUBLIC FEEDBACK - ENVIRONMENTAL JUSTICE AND DECARBONIZING TRANSPORTATION

Environmental justice emerged as an important theme during public engagement. Participants conveyed that it was "Very Important" (64%) or "Important" (22%) that environmental justice shapes action to reduce transportation GHG emissions.

PUBLIC FEEDBACK – OTHER CO-BENEFITS DECARBONIZING TRANSPORTATION

Participants were asked to identify the "most" important co-benefit of decarbonization (Figure 14). The top two responses were "Make Communities more resilient to climate change" (42%) and air quality improvements (24%). Participants generally found it difficult to choose only one additional benefit of reducing GHG emissions from surface transportation and expressed that, when done right, there should be many co-benefits to communities.

Figure 14. The "most" important co-benefits from reducing transportation carbon pollution
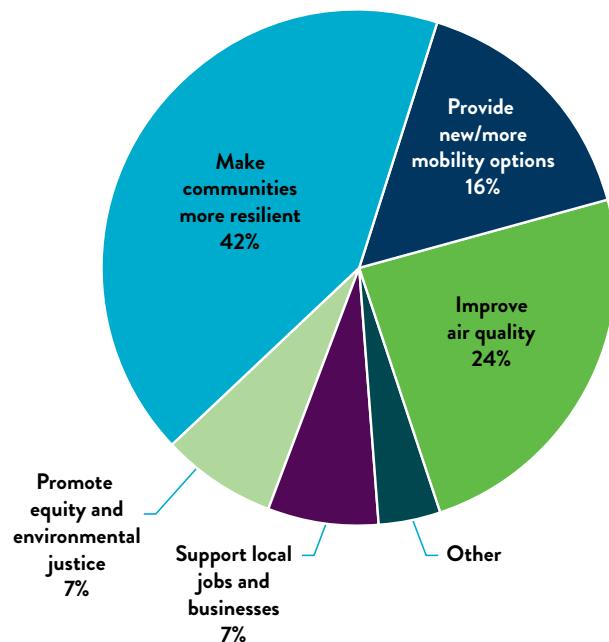
OUTCOMES AND RECOMMENDATIONS

Technical stakeholders and public participants very clearly stated that they believed there is climate crisis, they were excited about the state showing leadership through the *Pathways* project, and they expected state government to take action now. While there were some differences in opinions about the best path forward or how efforts should be prioritized, there was also a general sense that an all of the above approach was needed. This was especially reflected during the public meetings where there was a general sense of urgency for action reflected by the participants. There was also less familiarity with the various strategies and policies that have been used in other states.

Survey responses showed strong support for EVs, especially for passenger cars, trucks, and buses. Regulations, new investment, and incentives for EVs and EV chargers all had strong support and there was visible excitement about all of these tools during the in-person meetings.

Transit, transportation options, and creating more bikeable and walkable communities was also a theme that emerged as being very important to people around the state, even if the impact on GHG emissions might be less than some of the other strategies discussed. Many participants from around the state, in the urban and rural communities, described their vision of a low-carbon transportation system as having lots of transportation options that do not prioritize single occupancy vehicle travel.

Another key takeaway was that there were mixed feelings about biofuels, especially corn ethanol, but the numeric feedback around biofuels tells an incomplete story. The surveys (web-based and during in-person meetings) were given prior to discussion about the strategies. As discussed previously, there were perceptions about biofuels that led people to rate them lower in the survey. However, during the in-person meetings, the team led discussions about the potential for new biofuel markets to support farming practices that reduce carbon impact, have regenerative soil and water quality benefits, and support rural economies. Following these discussions, along with conversations about the impact of tariffs and climate change on farmers, the participants were much more supportive of biofuels being part of a low carbon transportation future.

Finally, it was clear from the *Pathways* project that Minnesotans expect action from the state and are not concerned about the traditional roles and responsibilities of state agencies. Participants frequently discussed the need for integrated solutions and there was very little discussion from public or the technical stakeholders about specific roles for different state agencies. Instead, there was an expectation that state government agencies must work together if Minnesota is going to do its role to avoid the most catastrophic consequences of climate change.

RECOMMENDATIONS AND ACTIONS FOR THE STATE OF MINNESOTA

As described in previous sections, most of the public feedback was about the goals, strategies, and outcomes for decarbonizing transportation and not about specific policies or the framework for potential regulations or incentives. For example, we heard that Minnesotans wanted to decrease the carbon impact of biofuels and increase EV chargers around the state, but there was less input about preferences for components of a low-carbon fuel standard or the best way to structure EV charging incentives to promote geographic equity.

MnDOT used the public feedback to develop a combination of actions the state can commit to take now and recommendations for state agencies and the Governor's Office to consider taking in the future. Actions can be taken with existing agency authority. MnDOT recognizes that these actions and recommendations are an important first step but that even more will be needed to reduce transportation carbon pollution and meet our NGEA GHG goals.

FIND INTEGRATED SOLUTIONS

Participants clearly indicated that efforts to decarbonize transportation must go beyond a single policy, effort, or agency and that efforts to decarbonize transportation will impact other sectors as well, particularly the next two largest emitters of GHG emissions in Minnesota: agriculture and electricity generation. Participants also were clear that solutions must focus on equity and environmental justice.

The following actions and recommendations were developed based on feedback from the *Pathways* project that recommended integrated solutions to decarbonizing transportation and the broader economy.

Sustainable Transportation Advisory Council (STAC) – Action

MnDOT is the principal transportation agency to develop, implement, administer, consolidate, and coordinate state transportation policies, plans, and programs, but a broad coalition of stakeholders is needed to help the agency make progress towards achieving the agency's multimodal vision and statutory goals to reduce energy and emissions, promote low-emission vehicles, and reduce greenhouse gas emissions from the transportation sector .

MnDOT will create a new Sustainable Transportation Advisory Council (STAC) to build on *Pathways* and advise the agency on actions to make progress towards the agency goals and statutory requirements to reduce carbon pollution, while working to promote safety, equity, environmental justice, and economic development. The STAC will include leaders from other state agencies, local government, frontline communities, and the public, private, and nonprofit sectors.

Regional Collaboration on EV Corridors – Action

Collaboration with other states came up during discussions in the in-person public meetings, but was not a component of the survey or a major part of the broader discussion around EV policy. Participants recognized that the same buildout of EV infrastructure needed in Minnesota also needs to happen in neighboring states to allow convenient travel by EV throughout the Midwest and remove this barrier to EV adoption. Minnesota is already a Midwest leader for EVs as the first state in the U.S. to sign an interstate (I-94) as an EV Charging Corridor and one of the first states to establish a state "EV Vision."[18] Minnesota will initiate an effort to collaborate with other Midwest states to create shared marketing and outreach materials, support interoperability standards, avoid redundancies in charger siting, demonstrate a broader Midwest market for EVs, and generally increase efficiencies by sharing lessons learned and best practices.

[18]Accelerating Electric Vehicle Adoption: A Vision for Minnesota (2019)

BUILDING AN EV MARKET AND PROVIDE MORE EV OPTIONS

Technical stakeholders, the public, and representatives from Minnesota's largest employers all highlighted the need for more EV options in the marketplace and saw this as a barrier to EV adoption. There was also general dismay from public meeting participants about the proposed weakening of fuel economy standards by the federal government and the impact that would have on GHG emissions.

Clean Car Vehicle Standards – Recommendation

Minnesota could pursue rulemaking to adopt Low Emission Vehicle Standards (LEV) and Zero Emission Vehicle (ZEV) standards. Thirteen states and the District of Columbia have adopted the LEV standard and 10 states have adopted the ZEV standard[19]. LEV and ZEV would reduce carbon pollution while reducing exposure to air pollution, especially for communities living near major roadways. Major roadways often run along and through communities of concern for environmental justice; reducing tailpipe emissions from vehicles will reduce exposure to harmful air pollution in these vulnerable communities.

The LEV standard requires improved fuel economy (miles per gallon) for all passenger vehicle types, from SUVs and pickup trucks to cars. The standard is different depending on the vehicle size but applies to all vehicle types and will save Minnesotans money, regardless of what vehicle they choose to buy. The LEV standard applies to GHG emissions and other air pollutants for light-duty vehicles. LEV standards currently align with federal fuel efficiency standards, but the federal standards are expected to be weakened through a new rule that is likely to be finalized this fall.

The ZEV standard is about consumer choice. It requires auto manufacturers to deliver a certain number of ultralow-emitting vehicles each year, including battery electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen-fueled vehicles for sale in a ZEV state. Adopting the ZEV standard will give Minnesotans access to more EV models that can better fit their budgets, preferences, and business needs. For example, in January 2019, there were 43 different EV models on the market but only 19 were available in Minnesota[20].

Adopting the LEV/ZEV standards could be done through MPCA rulemaking. The rulemaking process involves significant opportunities for public feedback and could take 18 to 24 months to complete.

[19]New Mexico is expected to adopt LEV/ZEV soon, bring the total number to 14 states and DC (LEV) and 11 states (ZEV).
[20]Per January 2019 Fresh Energy policy brief

PROMOTE BIOFUELS TO REDUCE GHG EMISSIONS AND SUPPORT RURAL MINNESOTA

In discussions with the public, many participants wanted to find pathways that included biofuels. The modeling also showed that action is needed across all vehicle classes and sectors, including increased use of biofuels, in order to achieve the state's goals. There was additional support for biofuels when the project team discussed opportunities for advanced biofuels and lower carbon biofuel production to create new markets for farmers and particular interest in conversations about how new biofuel markets could help fund farming practices with water quality benefits (e.g., cover crops).

Strengthen Petroleum Replacement Goals – Recommendation

The legislature should consider strengthening Minnesota's Petroleum Replacement Goals (Minn. Stat Sec. 239.7911) through additional mandates and incentives to ensure that higher biofuel blends are available.

Expand biofuel infrastructure – Recommendation

Minnesota should provide financial and technical assistance to build out the wholesale and retail infrastructure (particularly tanks and pumps) that will be needed to supply ethanol blends higher than 10% and biodiesel blends higher than 20%.

Higher biodiesel blends and renewable diesel – Recommendation

Minnesota should expand the use of biodiesel beyond the 20% summer mandate period, either with higher blends into cold weather months or with higher blends. Facilitate ways to use renewable diesel, a drop-in diesel fuel replacement, in Minnesota.

Reduce the carbon impact of biofuels – Recommendation

Minnesota should create incentives for measures, such as production plant improvements and farm practices, which would reduce the carbon impact of biofuels.

Photo: Minnesota Corn Growers Association

FUND EV INFRASTRUCTURE

The second highest overall support was for strategies that fund more EV infrastructure around the state. The MPCA committed 15% (the maximum allowed under the settlement) of the first phase (2018-2019) of the state's Volkswagen settlement funds to EV charging infrastructure. MPCA is drafting a plan for the second phase of funding and may commit 15% of those funds to EV charging as well. However, additional EV charging will still be needed around the state as more light-, medium-, and heavy-duty vehicle options become available and enter the Minnesota market.

Clean Transportation Funding Pilot Program – Recommendation

Additional funding for EV charging infrastructure light-, medium-, and heavy-duty vehicles is needed to support increased adoption of EVs in the personal, public, and corporate fleets in Minnesota. Additional funding could also help Minnesota pilot new clean transportation technologies and help fund the adoption of existing clean transportation technology in communities that cannot afford the current cost premium on some new low carbon technologies. MnDOT should identify funding for the new pilot program and the new STAC should develop criteria, score project applications, and identify successful applicants. The program should be funded for at least three years to support the transition to a low carbon transportation system.

PROVIDE EV INCENTIVES

Participants supported financial and nonfinancial incentives for EVs in an effort to increase EV adoption in Minnesota, especially for passenger vehicles. A number of other states have adopted incentives that include point-of-sale rebates, state tax credits, and free access to carpool lanes for EV drivers. The most frequently cited example of a non-financial incentive comes from California where EVs can use the high-occupancy vehicle lane with a single driver. Incentives have been especially effective in states that have adopted the (ZEV) standard which brings more EV into the state than are available in state's without the ZEV standard[21]. Incentives are also useful to help offset the higher cost of an EV compared to a conventional internal combustion vehicle.

MnPASS Incentive – Action

MnDOT will develop and implement a pilot project that provides MnPASS customers who purchase or lease a new or used EV between November 1, 2019, and October 31, 2022, a one-time toll credit in their account to pay toll charges for using MnPASS lanes. Individuals who purchase a new battery electric vehicle (BEV) will receive a credit of $250 while individuals who purchase a new plug-in hybrid electric vehicle (PHEV) will receive a credit of $125.

The incentive amount is based on the amount an average regular MnPass user spends each year. The incentive program has the dual benefit of encouraging the purchase of zero emission EVs and creating new MnPASS users. One obstacle to higher MnPASS usage has been getting people to register.

PROVIDE MORE TRANSPORTATION OPTIONS ON PROJECTS

Public comments were very supportive of actions that reduce vehicle miles traveled because of their potential to reduce GHG emissions and because of health, equity, and safety benefits that come from more walkable and bikeable communities.

Analyze greenhouse gas emissions in transportation projects – Action

One way to better understand transportation GHG emissions, and ways to reduce them, is evaluate emissions from the construction and operation of transportation facilities. Starting on January 1, 2020, MnDOT will analyze GHG emissions for project construction and operations (traffic emissions) as part of the Minnesota Environmental Policy Act (MEPA) documentation for transportation projects. During fall 2019, MnDOT will develop internal guidance for the evaluation and coordinate training to support the MnDOT District staff who will prepare the analysis.

Once MnDOT analyzes emissions from project, the agency will have better information to inform project planning and design about ways to reduce emissions from transportation project construction and operations. For example, one method for reducing emissions from the transportation system may be to provide more transit, biking, and walking infrastructure where appropriate.

[21]E.g., only 19 EV models are available in Minnesota compared to 45 models available in California.

CONCLUSIONS

Minnesota's climate is changing. It is already affecting the lives and health of Minnesotans, as well as our environment, our infrastructure, and our economy. Minnesota has long been committed to doing our part to reduce the GHG emissions that are causing our climate to change, but we must do more and we must do it now.

We need to take action across all parts of our economy and transforming our transportation sector is a critical part of the transition. The *Pathways* project launched a conversation about what Minnesotans want from a clean transportation future. The project team met with technical experts to understand what was possible and met with the public to understand what was important to them.

Through the *Pathways* project, Minnesotans outlined a vision for a just and equitable transportation system that integrates many ways of traveling – walking, rolling, biking, transit, and driving. Minnesotans made a strong call for the rapid electrification of our transportation system, including for passenger vehicles, transit, and freight. Minnesotans want the state to explore opportunities to support rural communities with biofuels and to create new markets for farmers. And Minnesotans want the state to take action now.

The *Pathways* project used feedback from technical experts and the public to develop the actions and recommendations in this report. These are important first steps, but they are just the beginning and the actions and recommendations in the report alone will not achieve the NGEA GHG goals. New and creative solutions are needed moving forward to jointly address climate change and equity challenges. The state must continue this conversation and continue exploring opportunities to reduce carbon pollution from transportation. By working together across industries and sectors and alongside Minnesotans from around the state, we can achieve our clean transportation future together.