Appendices

Appendix 1. Technical Stakeholder Meeting #1 Meeting Notes 38
Appendix 2. Technical Stakeholder Meeting #2 Meeting Notes 58
Appendix 3. Technical Webinar Transcripts 67
Appendix 4. Public Engagement Outreach Methods..... 68
Appendix 5. Public Meeting Agenda..... 69
Appendix 6. Public Engagement Summaries 71
Appendix 7. Individual In-Person Meeting Summaries 97

Minnesota Pathways to Decarbonizing Transportation

Technical Stakeholder Meeting #1

April 18, 2019

Project Overview

1) Multiple agencies are involved in this project: Department of Transportation, Minnesota Pollution Control Agency, MN Environmental Quality Board, Department of Commerce, Department of Agriculture, and McKnight Foundation
2) The project will be focused on surface transportation. Three phases of this project include:
   a) Modeling to understand how to get to our targets. Electrification, biofuels, etc.: where do they get us?
   b) Engaging technical stakeholders. What are some tools we should be using? What policy factors should we consider?
   c) Public outreach. How does the public see decarbonizing the transportation sector? Happening late June, state-wide.
   d) See slides for project calendar

Stakeholder Roles to Transportation Decarbonization Identified

- Advocacy, decarbonization with racial and social equity, works with 100% Campaign
- Biodiesel efforts and platform for renewable products
- Building on knowledge to work with communities
- Community and public engagement
- Electric vehicle community mobility movement
- Electric vehicle policy and adoption
- Electrification markets
- Electrification of transportation, regulatory and programmatic issues related to infrastructure and rates, impacts of policies
- Energy efficiency programs and delivery of renewable natural gas away from transportation sectors to buildings
- Ethanol to decarbonize the transportation system
- Focused on equity and how decarbonization technology can impact communities
- Interested in biofuels, rural communities, and how farmers fit in
- Looking for information on pricing and electrification
- Looking to electrify bus system
- Oversee the state mandate for biofuels and incentive program
- Policy issues

- Promoting bicycle and walking as cost-effective solutions; working with teachers to educate young students.
- Promotion of Ebikes, guinea pigs for shared mobility and electrification
- Public engagement, climate mitigation, and adaptation
- Public support for electrification and expanding transit
- Sharing resources
- Transportation advocacy and public education
- Utility electric vehicle strategies
- Working broadly to decarbonize across the economy and has been involved in the Volkswagen settlement
- Working toward eliminating barriers to advance transportation and electrification
- Working with Duluth for zero emission

Paired discussion:

What are the most important decarbonization strategies that offer the greatest promise for decarbonizing the transportation sector? Pick three.

1) Results: [1]
   a) Infrastructure/Mobility: Autonomous, mobility as a service, solar panels on the highway right-of-way.
   b) Equity/ Air Quality: Pollution reduction, air quality, rural communities
   c) Electric vehicles general: Light duty, charging
   d) Electric vehicles fleets: electrification, corporate
   e) Electric transit
   f) Transit: rural + metro, decarbonize, expand, connect regions and cities
   g) Low Carbon Fuels (Other) Hydrogen, renewable diesel
   h) Biofuels – biodiesel, ethanol, next-gen, renewable natural gas
   i) Education: Bike/walk, greenhouse gas reporting, public education on solutions, network effects, how small communities affect the larger scope, public health impacts
   j) Community design: redesign cities land use planning, density, shorter travel distances
   k) Planning/ VMT: reduce VMT, alternatives to driving, multi-modal
   l) Transportation safety
   m) Carbon taxation: make driving more expensive
   n) Strategies that have a dual purpose: buying electric vehicles and having tariffs that encourage taking transit during the day; time-of-use planning, vehicle electrification/smart grid strategies
   o) Other: Decrease use of single-occupancy vehicles, identify markets opportunities with best greenhouse gas potential, find immediate solutions

[1] These are summarized results. For detailed results, see Appendix B.

What policies are most likely to achieve transportation decarbonization? Pick three.

- Results: [2]
  a) Low emission vehicle/zero-emission vehicle mandates
  b) Electric vehicle charging, planning/investment
  c) Electric vehicle readiness: building codes, comprehensive plans
  d) Carbon tax
  e) Biofuel research
  f) Clean fuel policy/Low carbon fuel standard
  g) Land use/planning: transportation and land use planning, ride sharing, congestion pricing, vehicle miles traveled reduction
  h) Incentives: tax rebates, purchase incentives
  i) Transit funding
  j) Cleaner electricity
  k) Vehicle replacement
  l) State could stop licensing internal combustion engines
  m) Other: public-private partnerships, sector-specific policies, education for public benefits and purchasing and maintenance, require fleets to meet state goals and then tackle public via fleet results, immediate solutions, petroleum replaces goals as a guiding post, fund farm to school food hubs, regulate the ride share and delivery service vehicle emissions, tax negative impacts of fossil fuel.

Presentation on transportation modeling

Full group Q&A on model with E3

- Q: When you are establishing the baseline, some assumptions are already changing now (like electric vehicle penetration). How are you factoring that in the counter-factual scenarios?
  - A: We have created two scenarios: one where nothing is changing, and another compared to the current policy scenarios.
- Q: What assumptions are made about rates of change?
  - A: Reference scenario – using current data about electric vehicle sales
  - Mitigation scenario – depends on how quickly we'll assume those adoptions
- Q: How will modeling incorporate the increase in vehicle sharing and automation that impacts vehicle sales?
  - A: Car sharing often means fewer vehicles, but similar miles are driven. For automation, we must know if these cars are gasoline or electric.
    - *E3 wants feedback on what people want to see in modeling*

[2] These are summarized results. For detailed results, see Appendix B.

- Q: How will this work help communities (smaller then state-level)?
    - A: Analysis will focus on state level because of the scope of data
        - *E3 is looking for feedback on how to incorporate data from small areas*
            - Steering Committee will take this data and see how it can play out across the state. It will help lead us to the next set of questions and answers about smaller communities.
- Q: Is using Energy Information Administration as the data source too conservative?
    - A: E3 is only using this data for Annual Energy Outlook scenarios
- Q: What is the outcome of this work? What is the solution?
    - A: Modeling will result in multiple scenarios; the goal is to lay out the scope of the options and list of opportunities.
- Q: If we have further input, how can we participate outside of today?
    - Future webinars
    - We will share slides, then you will have a short window to send and provide feedback.
    - Stakeholders will have options to provide feedback via email at http://www.dot.state.mn.us/sustainability/pathways.html
- Q: The fast-pace timeframe for the technical piece might be a problem regarding equity.
    - A: Final document will recognize the gap in the process
- Q: How will we capture interactive feedback between measures?
    - A: Full-economy scenarios capture interactive effects
- Q: What strategies are we looking at for reducing vehicle mileage categories?
    - A: We don't have a list yet for MN
        - Possible considerations:
            - Mode shifting (bike, bus, carpool), car-sharing,
            - Some trends show vehicle miles traveled is going down with urbanization, using roads more efficiently, increasing public transit
            - *E3 looking for feedback*
- Q: What are your thoughts about macro-economic trends and relationships in the 2050 projections?
    - Modeling acknowledges the amount of uncertainty
    - E3 assumes no major shifts in the economy
    - Not a macro-economic model
    - E3 focuses on key drivers and runs sensitivities (i.e. increase in UPS via Amazon)
- Q: What are the assumptions around fuel cost?
    - A: Fuel cost in the current model is not a driver and therefore is not reflected. E3 can capture price by seeing how many miles are driven. In the past, E3 has used Energy Information Administration tools
- Q: How would we reflect a low carbon fuels standard in this modeling?

        - A: Modeling will only capture what we tell it to model regarding low carbon fuel standard
            - Can input carbon intensity and number of electric vehicles on the front end
- Q: Do we have a cheat sheet from other locations? Can we learn from other examples?
    - A: E3 does not have this resource but wants to know specific areas stakeholders want to see comparisons.
    - According to E3, these need to be incorporated: Energy efficiency, electrification, and low carbon and gaseous fuels, and how far you push each category
        - *If there are any MN-specific considerations, let E3 know*.
- Q: How do we think about levelized cost? Are we going to think about regional/national areas and other sectors?
    - A: Xcel Energy IRP data is public
    - Could add levelized cost piece down the road if there is interest, but as of now, just focused on transportation
- Q: How recent is the data incorporated, especially in relation to vehicle sales?
    - A: E3 tried to use the most related data: State level comes from Minnesota Pollution Control Agency (emissions and modeling (2016))
    - Federal data comes from Energy Information Administration
- Q: How do we reflect the most recent data, especially high sales of SUV?
    - E3 thinks they have captured this information accurately.
    - E3 will compare any other data that stakeholders suggest and compare it with current data.

Table discussion: Notes from Flipcharts

Q1: Why is this strategy important to you?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Most immediate impact
- Can be done quickly
- Run more hours and use more car fuel than light duty
- Intersection between carbon reduction and equity – visible
- More systemic change
- Political support to expand
- Economic opportunity
    - Specific use case/duty cycle, easy win
- Big bang for the buck
- Centralized fueling for fleets
- Professional drivers matter
- Making connections between cities
- Creates win for rural and urban areas
- Job access
- Heavy duty

- Lower volumes mean fuel transition can take place easier

COMMUNITY DESIGN/PLANNING

- Rural community must be represented
- Improves overall quality of life/more community connectedness that could improve economic developments
- Safer
- Multiple mobility options bring greater choice
- Need to change local land use to lead decarbonization
- Community design has been used to exclude certain groups and can include density, options for mobility, etc. to be more human oriented
- Free public transit = best way to do reparations/coupled with increased cost of driving
- Connection between land use/equity/transportation – core
- Connecting people with nature could be an outcome of different design

ELECTRIC VEHICLES

- "What we buy now" idea, 15-year lifecycle
- Public health impacts
- Benefits electric grid renewables
- Electric vehicle adoption already has momentum, especially for fleets. Lots of opportunity to influence bigger organizations
- Financially viable/customer satisfaction
- Technology already headed in right direction and can help advance electric vehicle technology and vice versa
- Raw materials and life cycle analysis
- Important to address, downstream impacts, copper nickel resource
- Personal impact for individuals
- MN specific issues with driving (winter, distances etc.)
- Fuel security and price stability
- Expanding ideas and innovation to greater MN, not just Twin Cities
- Jobs

BIOFUELS AND OTHER LOW CARBON FUELS

- Economy – produced here, cleaner
- Economy – rural economy
- We have a head start relative to other regions/strategies
- Great potential
- Biodiesel- blends above B20— B30/B40
- Driven by low carbon fuel standard
- Fleets can use
- Impacts without changes to consumer behavior
- Bridge to electric
- Back-up to electric vehicle range anxiety addressor

- Remote charging – B100 generator to charge cars. B100 generators already coupled with PV in certain locations
- Biofuels can mitigate other sectors (e.g. reduce methane)
- Efficiency of biofuel production has improved
- Cover crops – camelina, pennycress; positive looking processing
- Compressed natural gas –methane harvesting, reduce farm emissions
- 70% of California compressed natural gas (CNG) vehicles already on renewable natural gas (RNG)
    - Producers want market without renewable identification number (RIN) regulatory risk
- 32% of CNG market is already RNG
- Can't get renewable diesel; all is going to California
- Interest on renewable diesel in fleets

Q2: How do you envision this strategy playing out between now and 2050?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Transit could bring big growth to electrification
    - Manufacturer support
    - Turnover may be more deliberate
- Heavy duty
    - Mix of fuel cell, biofuels, electrification depending on use case and vehicle miles traveled
- Higher use of transit: growing demand
- Larger public investment: seek bipartisan support
- Transformation of ease of services: connect through apps, planning route online, etc.
- Improve expansion of transit

COMMUNITY DESIGN/PLANNING

- These changes will be expressed in local comprehensive plans
- Achieving these changes will require broad engagement; not just with nay-sayers
- Met Council and local planning tools will help cities makes these cases and decisions and inform local climate action plans
- For greater MN, important that economic value of biofuels and electrification stay/are local
- Strong local economies, strong main streets regional transportation systems
- Rural road design to accommodate bikes
- Single car households becoming more common

ELECTRIC VEHICLES

- With an international carbon trade regime

- Need to consider transportation in the future
- Next 10 years – some sort of transportation standard
- 2025 – half of all vehicles will be electric; part of global trend
- Price of electric vehicles are going down
- Infrastructure increasing
- Trend of autonomous vehicles are electric
- Fleet conversion / bulk buying opportunities
- 2035 – batteries will be twice as energy dense. Less range anxiety issues.
- Impacts on renewable energy sector
- Potential problems
    - Gas prices cause electric vehicle adoption to flatten. Need incentives or regulations
    - Time-of-use rates to be optimized and equitable

BIOFUELS AND OTHER LOW CARBON FUELS

- Engine manufactures must charge technology over time
    - Introduce higher level blends from B40 to B50 and higher (B100)
    - They need credits to manufacture things
- Petroleum companies build renewable diesel plants (starting to happen)
    - Petroleum refineries owns ethanol and biodiesel, investing in alternatives
    - Sell decarbonized fuels
    - Split in refining industry
        - Some participation
        - Some stonewalling
- Agriculture groups are embracing decarbonized biofuels
- Protein is the driver, fuels are secondary (from starch and oil)
    - Will drive starch and oil availability
- Anaerobic digestion – energy solutions for a waste problem
- All organic waste goes to renewable natural gas
    - Eco engineers – resource assessment; biggest potential
- Greens plains – information on protein driving oil availability
- Power to gas; need more data

Q3: What assumptions or datasets do you want to see incorporated in the modeling?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Cost analysis in general, but especially on fuel prices
    - Gas, diesel, electricity
- Tariff implications from utility
- Characteristics that trigger cultural shifts of transit (i.e. costs, route access)
- Assumptions
    - LCFS
    - Renewable diesel

    - Up to class 5 trucks being electric
- Like idea of carbon tax
- Vehicle miles traveled analysis and sensitivity testing
    - Congestion implications
- Impacts of increase in ridesharing and autonomous vehicles on transit
- Impacts of local politics in Midwestern states
- Cleanliness of electric grid

COMMUNITY DESIGN/PLANNING

- Strong vehicle miles traveled (VMT) reduction scenarios
    - Minneapolis = 38% VMT reduction by 2040
    - Minneapolis bike mode share goal of 15% by 2025
- Future statewide building codes require electric vehicle infrastructure
- Shared use vs. owned and ratio of electric vehicles and internal combustion engine vehicles
- Connected autonomous/electric vehicles vs. internal combustion engine vehicles
- Percent urbanization with respect to density
- Consolidation of community resources in greater MN; e.g. hospitals on VMT
- Ridership studies for planned and existing rural transit
- Aging of rural MN population and impact on mobility
- Greater Twin Cities population = younger? and more diverse? immigrants?
- Look at pricing models for other industries and how they impact demand
- E-commerce of sighted data and how that impacts VMT; private sector has lots of data on this and impacts of changing delivery models
    - How fast will this change? Drones
- Access to tourist locations (like state parks)

ELECTRIC VEHICLES

- Need to include carbon pricing scenario by 2035
- Realistic electric vehicle adoption rate
- Multiple scenarios with different adoption rates
- Fleet purchasing (happening now)
- Low carbon fuel standard, 100% standard
- Demographic assumption of population size
- Battery technology limitations and advancements
- Electric vehicle model diversity to fit more MN and implications of this change
- Potential impacts of decreased metro car ownership
- Ideas of future policy (zoning, land use)
- Backlash, level of public acceptance
- Electoral change and implications
- Range of electric vehicle pricing, brackets, and gaps
- Industry trends (e.g. manufacturing)
- “Amazon” of transportation

BIOFUELS AND OTHER LOW CARBON FUELS

- B100? Doable, need more participation from engine manufacturers
- Ethanol; high octane blends (i.e. E25/E30)
- What impacts does renewable fuel standard backsliding have?
- State policy is more of a driver than renewable fuel standard (California Low Carbon Fuel Standard)
- When does E15 become a year-round base fuel? 2025
- Life cycle analysis carbon intensity; not tailpipe
    - GREET model
- Carbon intensity of baseline petroleum. What if we moved from Canadian crude to lower carbon crude?
- Railroads
    - Big market; why are they left out?
    - They will use biodiesel if they get a price break
- New technologies?
    - Corn kernel cellulosic
        - 5-10 % increase productions from each facility
    - eRINs for electric vehicles powered by electricity for biogas

Q4: What questions on this strategy do you hope this analysis will answer for you?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Inform Xcel Energy on number of vehicles for resource planning
- Does sensitivity analysis indicate heavy duty sector is a critical strategy?
- What can scale more quickly? Light or heavy-duty electrification? And what has more impact on decarbonization?
- How much impact will transit have on carbon as it scales, regardless of fuel type?
- What level of investment/service drives the biggest reduction? Are there tipping points?
- Separate transit and heavy-duty modeling
    - Subsidized differently, direct subsidy is greater for transit
    - Offer different benefits
- What will transit/heavy duty look like in 2050?
    - Still unclear on advancements and impacts these will have
    - Leave space for high advancements in these areas
- Sensitivity analysis of transit/fleet for 2035 vs. 2050 and impacts this has; like turnover of diesel to electric
- Which of these sectors will have greatest impacts?
    - Types of fleets
    - Transit

COMMUNITY DESIGN/PLANNING

- Different scenarios articulated and quantified
- Individual family's ability to adopt different strategies
- A clearer understanding of modeling limitations and what additional questions need to be answered; including how all can benefit equity
- A scale of what level of greenhouse gas reductions can come from vehicle miles traveled reductions and the interface between local and state planning
- Where policy intervention is necessary and where the market will work
- Review strategies from past models and what was implemented and why
- Some positions of co-benefits captured including air quality implications are less quantifiable
- Some sense of interplay with electric systems and greater costs to accommodate electrification and greater rates
- A sense of sensitivity and interplay of different strategies

ELECTRIC VEHICLES

- Hope
- Individual choices and steps to take
- What are the tradeoffs of investment?
- How far do we need to go, what is our timeframe?
- What are future implications?
- What are the future drivers?
- How do assumptions rank? How do our decisions about assumptions affect the related outcomes?
- How much does public policy drive this?
- What is the role of state policy?
- Next steps? Stakeholders should be able to evaluate criteria, be transparent with communities, have fluid communications with communities, especially regarding technology and social impacts. Address the question of who needs to be involved and what do they need to say to educate others.
- What are the unintended consequences?
- Market and mandates continue to clarify with model
- How does MN compare to other states? What are our unique choices and options?

BIOFUELS AND OTHER LOW CARBON FUELS

- Does the MN policy framework make new biofuel facilities economically viable?
- Which sectors are most amenable to which fuel? E.g. biodiesel, electric vehicles, renewable natural gas, etc.
- Vehicle turnover – new vehicles allow higher blends; how long does it take to impact the market?
- How can we impact vehicle impact turnover to accelerate adoption of cleaner vehicles?
- How much impact can biofuels have on greenhouse gases? Other pollutants? Location?

- Air quality—where are the biggest impacts? Can we focus there fast?
- Can biofuels be a bridge to electric? How long will it take?
- Do new feedstocks replace or supplement older feedstock?
- Nutrient recycling from anaerobic digestion? Opportunity for farmers and can support more animal agriculture
- Organic waste as a resource
- Do not include cellulosic ethanol from corn stover
- Include wood
- Cover crops as oil seeds, biomass

Closing Thoughts & Next Steps

1) Future webinars are not scheduled yet. Updates will be sent out.
2) Outreach meetings will take place across the state (Twin Cities, Rochester, Duluth, Bemidji, Marshall) in late June. Let us know if you want to be involved.
3) If there are additional data source or targets you think E3 should consider, please email timothy.sexton@state.mn.us
4) Website can be accessed at http://www.dot.state.mn.us/sustainability/pathways.html

Appendix A: Meeting Participants

Name	Organization
In-person Participants	
Amanda Jarrett Smith*	Minnesota Pollution Control Agency
Amy Fredregill	Environmental Initiative
Andrew Twite	Fresh Energy
Ashwat Narayanan	Our Streets
Benjamin Stafford	Clean Energy Economy MN
Bill Dossett	Nice Ride
Carly Gelderman	Great Plains Institute
Cecilia Martinez	Center for Earth, Energy and Democracy
Dorian Grilley	Bicycle Alliance of MN
Erik Bigelow	Center for Transportation and the Environment
Frank Douma	Humphrey School of Public Affairs, University of Minnesota
Heidi Ries	Institute on the Environment, University of Minnesota
Jeffrey Meek	Minnesota Department of Transportation
Jessica Burdette*	Minnesota Department of Commerce
Jessi Wyatt	Great Plains Institute
Jessica Treat	Move MN
Jon Hunter	American Lung Association of MN
Josie Lonetti	Minnesota Farm Bureau
Katelyn Bocklund	Great Plains Institute
Kevin Hennessy	Minnesota Department of Agriculture
Kevin Whelan	MN350

Laurie McGinnis	Center for Transportation Studies, University of Minnesota
Lola Schoenrich	Great Plains Institute
Marcus Grubbs	Minnesota Department of Administration
Margaret Donahoe	Minnesota Transportation Alliance
Margaret Levin	Sierra Club North Star Chapter
Mauricio Leon	Metropolitan Council
Mike Youngerberg	Minnesota Soybean
Mitchell Coulter	Minnesota Corn Growers Association
Nick Mark	CenterPoint Energy
Nick Martin	Xcel Energy
Pat Jones	Metro Transit
Paul Helstrom	Minnesota Power
Paul Schroeder	HourCar
Stephanie Pinkalla	The Nature Conservancy
Stu Lourey	Minnesota Farmers Union
Tim Sexton*	Minnesota Department of Transportation
Tory Clark	Energy and Environmental Economics (E3)
Will Seuffert*	Minnesota Environmental Quality Board
Remote Participants	
Alex Jackson	City of Duluth, Climate Smart Communities
David Bael	Minnesota Pollution Control Agency
Frank Kohlasch	Minnesota Pollution Control Agency
Jason Wetzel	General Motors
Joe Halso	Sierra Club Environmental Law Program
Kevin Bright	City of Rochester, Climate Smart Communities

*Denotes Steering Committee member

Appendix B: Detailed Results

What are the most important decarbonization strategies that offer the greatest promise for decarbonizing the transportation sector? Pick three.

Planning/Vehicle Miles Traveled (reduce VMT, alternatives to driving, multi-modal)

- VMT reduction via planning, public transit, multimodal transportation
- Statewide land use with more focus on transportation – land use nexus
- Land use planning
- Charge real price for parking
- Increase access to alt. modes and mode sharing
- Reduce overall VMT
- Decrease the need for single-occupancy vehicle trips
- Land use planning
- Live closer to work

Community design (redesign cities, land use planning, density, shorter travel distances)

- Land use and community design (and density and mobility)
- Safety, mortality reduction
- Local food infrastructure
- Community design practices
- Expand infrastructure for biking and walking
- Physical activity and health
- Redesign cities and roads to decrease single occupancy vehicle use
- Land use – denser, shorter distances between destinations
- Land use and community design

Education (bike/walk, greenhouse gas reporting, public education on solutions)

- EV education and awareness
- Talk about the possible solutions to educate the public
- Network effects, culture change
- Bike/walk safety education
- Fleets reporting GHG reduction process and telling the story to the public

- Public education
- Education on options and technology available

Transit (rural + metro, decarbonize, expand, connect regions and cities)

- Expand public transit, more high-frequency routes, light rail transit and bus-rapid transit, metro and greater MN
- Fund metro transit everywhere (rural, metro)
- Increase mass transit statewide
- Connecting MN regions and cities with rail and bus services
- Increase public transit options
- Electrify and expand transit
- Transit service expansion, especially in greater MN
- Public decarbonized transportation

EVs – General (light duty EVs, EV charging)

- Discounted EV rates for overnight charging
- Build out public EV charging
- Fund EV infrastructure
- Electrification/increase EVs
- Maximize use of renewable generated by cars
- Decarbonization of the electric grid
- Electrify vehicles
- EV/electric system/smart grid
- Increase vehicle efficiency
- More efficient vehicles
- Increase public awareness of costs/benefits of EVs
- Light duty vehicle electrification
- Electrification of all vehicle types where feasible
- Electrify transportation (cars, bikes, trains, planes, pneumatic tubes)
- Electric

EVs – Fleets

- Fleet electrification (transit, corporate)
- Start with heavy-duty fleet decarbonization

EVs – Transit

- Electrifying transit
- Electrification of transit
- Increased investment in public/transit and alternative modes
- Transit expansion and electrification
- Public transit electrification

- Electrify all transit

Equity/Air Quality (pollution reduction, air quality, rural communities)

- Develop/support local food and access to other goals and services with few miles traveled
- Accelerate equitable transportation to 100% clean renewable energy
- Investing in rural community self-sufficiency
- Integrating air quality and cumulative impacts for decarbonization prioritization
- Increasing EV charging infrastructure especially in highly populated communities

Infrastructure/Mobility (autonomous, mobility as a service, solar panels on highways right-of-way

- Solar panels in highway right-of-way
- Moving to broader adoption of EV, especially for autonomous vehicles
- Inventory of the infrastructure in the state today
- Mobility as service, right price incentives

Biofuels (biodiesel, ethanol, next gen, renewable natural gas)

- Methane capture
- Biofuels as “bridge” away from fossil fuel
- Biofuels blends/tax credit for consumer
- Increase bio fuels through multi-prong approach
- Model biodiesel in heavy duty, tracking of past advances to assure viable future, renewable biogas
- Advanced biofuels
- Next generation biofuels
- EVs and biofuels
- Expand use of cleaner liquid fuels
- Coordinate infrastructure planning for lower carbon fuel options
- Research on next-gen biofuels

Low carbon Fuels (hydrogen, renewable diesel)

- Applied research to work with developing technologies, hydrogen, renewable diesel, EVs
- Accelerate transition to cleaner ways to power vehicles
- Prioritize investment list of decarbonization pathways
- Consider hydrogen fuels for heavy duty fleets

Etc.

- Immediate solutions (starting now)

- Decrease use of single-occupancy vehicles
- Identify market opportunities with best GHG potential

What policies are most likely to achieve transportation decarbonization? Pick three.

Low emission vehicle (LEV)/ Zero emission vehicle (ZEV)

- ZEV state
- State tax credit for EVs
- State policies to increase medium and heavy fleets in state ops, state contractors, other public sector fleets
- ZEV fleet standard for states, see California
- State incentives (such as rebates) to increase adoption rates of EVs
- Electric vehicles purchase rebate
- State adoption of ZEV, LEV standards
- Zero emission vehicle
- ZEV/LEV standard
- ZEV/LEV standard
- Incentivize EVs
- Zero Emission Vehicle policy (ZEV)
- Subsidize growth of electric fleet to reach tipping point
- Low Emission vehicle standard
- Zero Emissions vehicle standards Incentivize EV purchasing via state tax credit + utility rebate
- ZEV/LEV mandates
- State tax credit for electric vehicles new and used State EV tax credit $1500
- Refundable state EV tax credit that includes used vehicles

EV Charging planning/investment

- State/federal funding for charging infrastructure (for public charging)
- Electric price incentives
- Infrastructure planning process
- Optimize time of charging vehicles for renewable
- Require EV infrastructure as part of building codes or building performance standards

EV Readiness (building codes, comprehensive plans)

- Comp plan requirements related to density, EV charging stations, etc.
- Building codes regulated on new development
- EV ready infrastructure building codes EV readiness in building codes

Biofuel research

- Support for infrastructure development for biofuels
- Methane capture for energy use is best
- Greater investment in biofuels research

Carbon Tax

- Externalities in fuel cost
- Carbon tax
- Carbon tax
- Carbon tax/fee and dividend
- Carbon tax on fuels
- Carbon tax and dividend

Clean Fuels Policy/ LCFS

- Create policies to drive investment into infrastructure that reduces carbon
- Low carbon fuel standard, proactive work by DEED to align consumers w/ potential producers in MN
- Develop/adopt carbon intensity measure
- Low carbon fuel standard
- Low carbon fuel standard
- Low carbon fuel standard
- Low carbon fuel standard
- Low carbon fuel standard
- Low carbon fuel standard (declining CI, fuel + technology neutral crediting)
- Carbon value for MN that's recognizes well to wheel values
- Carbon intensity measure (put all technologies on one scale)
- Increase pricing/tax policies where fossil fuels pay more, and biofuels electric fleet pay less

Land Use/Planning (transportation planning, land use planning, ride sharing, congestion pricing, VMT reduction)

- Transportation investment policy; fund more transit, bikes, walk
- Local land use policies that encourage density and affordability along transportation corridors
- Income-based or car-value based per-mile fee on annual vehicle driving
- Incentivize behaviors for sharing rides
- Land use policy
- Promote/allow land use in urban areas that are more conducive to transit, biking, or walking
- Mixed-use high-density zoning + congestion pricing
- Coordinated state-wide land use/transportation planning
- Transportation investment in high density utility hubs
- Incentivize sharing economy including transit/EVs/autonomous/bike

Cleaner electricity (Cleaner EVs)

- 100% clean electricity by 2050
- Incentives for utilities to invest in renewables
- Incentive for electric co-ops using renewables

Incentives (tax rebates, purchasing incentives)

- Incentivize adoption (taxes, rebates) gov/utility
- Regional decarbonizing policy depending on the lay of the region
- Incentive (tac, purchase)
- Use taxes/tax incentives
- Incentives to engage in less carbon intense modes of transportation (rebates, tax breaks)

Transit Funding

- Funding for mass transit
- Free transit
- Increase funding to support transit and other modes

Vehicle Replacement

- Ban internal combustions engine vehicles
- Cash-for-clunkers vehicle buyback to accelerate EV rollout
- Personal “car-free” annual payment stipend (amortize, 10 years)
- Incorporate externalities into fuel prices – full cost of environmental impacts
- Higher tax for combustible engine vehicles
- Stop renewing/issues licenses for internal combustion vehicles

Etc.

- Tax negative impact of fossil fuel
- Regulate the ride share and delivery service vehicle emissions
- Fund farm to school and food hubs
- Petroleum replacement goals as guiding post
- Require fleets to meet state goals and then tackle public via results from fleet
- Education: public benefits; purchase + maintenance
- Public private partnership + congestion pricing
- Sector-specific targeted policies
- Immediate solutions (ones that will work and can be implemented right now)

Minnesota Pathways to Decarbonizing Transportation

Technical Stakeholder Meeting #2

May 16, 2019

Attendees

Name	Organization
Amanda Bilek	Minnesota Corn Growers Association
Amanda Jarrett Smith	Minnesota Pollution Control Agency
Andrew Twite	Fresh Energy
Ben Martin	Minnesota Department of Commerce
Ben Stafford	Clean Energy Economy Minnesota
Bob Patton	Minnesota Department of Agriculture
Brendan Jordon	Great Plains Institute
Carly Gelderman	Great Plains Institute
David Bael	Minnesota Pollution Control Agency
Dorian Grilley	Bicycle Alliance of Minnesota
Ellen Anderson	Energy Transition Lab
Emily Smoak	Minnesota Department of Health
Erika Bigelow	Center for Transportation and the Environment
Frank Douma	Humphrey School of Public Affairs, University of Minnesota
Gabe Mantegna	E3
Jeffrey Meek	Minnesota Department of Transportation

Jeremy Martin	Union of Concerned Scientists
Jessi Wyatt	Great Plains Institute
Jessica Burdette	Minnesota Department of Commerce
Jessica Treat	Move MN
Jon Hunter	American Lung Association
Joshua Houdek	Sierra Club North Star Chapter
Katelyn Bocklund	Great Plains Institute
Kevin Bright	City of Rochester
Lauryn Schothorst	Minnesota Chamber of Commerce
Lola Schoenrich	Great Plains Institute
Marcus Grubbs	Minnesota Department of Administration
Mauricio Leon	Metropolitan Council
Michelle Medina	Minnesota Farmers Union
Nick Mark	CenterPoint Energy
Nick Martin	Xcel Energy
Pat Jones	Metro Transit
Robert Grinstead	Zeus Electric
Sean Gosiewski	Alliance for Sustainability
Siri Simons	Minnesota Department of Transportation
Stacy Miller	City of Minneapolis
Stephanie Pinkalla	The Nature Conservancy
Tim Rudnicki	Minnesota Biofuels Association
Tim Sexton	Minnesota Department of Transportation

Tory Clark	E3
Will Seuffert	Environmental Quality Board

Clarifying Questions

Are things like combined heat and power, cutting reliance on coal, grid, wind, etc. part of the calculations so far?

- E3 has used assumption that reflects the whole state
- Data source for the carbon intensity (CI) of corn/ethanol was taken from a USDA report
  - Report has a low CI compared to California Low Carbon Fuel Standard
  - *Let GPI know if there is a different data source you want to compare*

How does E3 estimate number of stock vehicles; how are we projecting it forward?

- E3 has used state data sources from the Minnesota Department of Transportation and Minnesota Pollution Control Agency's fleet information for a starting point
- Projections used data from the Annual Energy Outlook from the U.S. Energy Information Administration.

How can E3 project electric vehicle data?

- Modeling makes assumptions about stock rollover and uses current data (from 2015) for a starting point with an estimated 15-year life span
  - *Assumption of rate of change for sales; do we think these are the right levels? E3 wants feedback*

Can E3 explain stock rollover? What is the main data source used to inform this part of the modeling?

- Total number of vehicles – state data source
- Lifetime/retirement of vehicle – distribution
- Growth rate and total mileage
- Sales of new vehicles

What is the basis for the VMT reductions (3-5%)? How is this predictable when lifestyles could change drastically?

- E3 notes this is a hard category to project
- Modeling currently include things like ride sharing impacts
- Data source is an academic paper (see appendix in modeling slides) that defines different urban design principals that could increase walkability, public transit, and people moving to urban areas, etc.

Is the biofuel percentage the same for ethanol and biodiesel?

- Assumption shows they are fairly equal in current modeling

What technology was used to account for the biofuel calculation? (did it recognize the technical range is 80-85%?)

- E3 used a combination of technology that would lead to varying goals of blend levels

Does the modeling include ethanol use in heavy-duty vehicles?

- No, modeling does not reflect the use of ethanol in heavy-duty trucks
- *E3 wants feedback on this*

If we didn't reach goals of 70-75% carbon-free electricity by 2025, how would it impact this model? How would modeling compensate with other measures?

- E3 is more focused on 2050; near term target is probably too aggressive
- The "Emission Reduction by Measure" does not include upstream categories

If the electric vehicle technology is better than expected in 2050, does that change the modeling?

- Yes, the amount of biofuel demanded would decrease

Was location included when figuring population projections?

- Data source is from Minnesota State Demographic Center
- E3 has not considered sub state geographies

Is cost considered anywhere in modeling? Will it be added?

- Cost is not included
- Out of scope at this point because of accelerated modeling

Small Group Discussions

Are there specific assumptions you would change?

COMMUNITY DESIGN

- 15-year vehicle fleet turnover is too long based on technology advancements
- MN Department of Transportation's future study predicts 100% autonomous EVs by 2040
- VMT reductions seem small
  - Is this personal-vehicle-use reduction?
  - Should we break down VMT projections by Twin Cities Metro vs. Greater Minnesota?
    - MN Department of Transportation has this data
  - How does cost driving effect VMT?

ELECTRIC VEHICLES

- Baseline maybe too low, but that's okay
  - Tend to lean to more conservative baselines to show what happens without any changes
- Are policies reflected in the assumptions?
  - What is the policy that leads to the 40% reduction goals?
  - Discussion on slide 29: this slide focuses on policy outcomes; not actual policies
- Cost and daily impacts need to be addressed in this phase somehow

BIO-FUELS AND OTHER LOW CARBON FUELS

- Is natural gas used as a vehicle fuel?
    - Nick Mark from CenterPoint can provide data
    - Is renewable natural gas a biofuel?
- Breakdown specifics about which biofuel
- Renewable natural gas is ~30% of compressed natural gas nationally – 60 billion cubic feet (BCF) nationally (CenterPoint total throughput is 170 BCF)
- 20-30% of liquid fuels could be ethanol
- Participant can provide input on ethanol CI
- Include generation emissions for electricity

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Idling time important along with VMT
- Adoption rate of electric transit is not aggressive enough
- What are the assumptions on technology (i.e. batteries)?
- Are Metro Transit's growth goals incorporated?

What seems too aggressive or not aggressive enough?

COMMUNITY DESIGN

- What is being included in the VMT reduction? It seems so small—It's not just the built environment (Price, transit availability, ride share, etc. all affect it)
    - This is where equity fits in
    - Should also look at how this impacts health
    - Should include micro mobility (scooters, bikes, mobility hubs)
        - Scooter data is encouraging
    - It would be helpful to have this analysis on a city and metro region basis
        - Comprehensive plans have goals
        - Could look at driver license data

ELECTRIC VEHICLES

- Light-duty vehicles data seems reasonable
- Medium-duty vehicles seems to track more with the heavy-duty vehicles, but this might not be realistic, they should be closer to the light-duty vehicle projections than the heavy-duty projections.
    - Medium-duty vehicles are still local travel and easier to electrify, especially when fleets begin to electrify and work with utilities
    - Heavy-duty vehicles travel longer distances and are harder to electrify
- 80x50 and 100x50 projections for medium-duty hybrids sales are too aggressive
- 70-75% carbon-free electricity by 2025 is too aggressive

BIO-FUELS AND OTHER LOW CARBON FUELS

- Hybrids not aggressive enough. Mid-class SUVs exist now. Hybrid flex-fuel vehicles
- Not enough focus on rural – longer miles driven
- EVs – are they mostly metro? E.g. shorter trips

- Does VMT really track population? There might be a scenario that results in growing VMT?
- Participant wants to look at assumptions about upstream biofuels emissions

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Not clear on separation between public and private fleets/transit
    - Public may need to be more aggressive
- Biofuels for heavy-duty are not aggressive enough
    - B20 already mandated

What are you most excited about?

COMMUNITY DESIGN

- Exciting to see scenarios that are possible and achievable

ELECTRIC VEHICLES

- Overall seems balanced
- Mixes seem possible

BIO-FUELS AND OTHER LOW CARBON FUELS

- Excited to see that biofuels could be such a large wedge. (slightly skeptical)
- Pathways exists to meet GHG reductions in transportation
- Variety of approaches is key; makes overall goal seem more realistic
- Home-grown fuels can lead to prosperity for rural communities
- Opportunity to engage rural communities
- Opportunity to change discussion about biofuels – unify more biofuels with GHG reduction

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Pathways exists, especially at 100 scenario
- Overwhelmingly difficult but possible
- Outcomes that will result
- Behavioral change
- Technology advancements
- Strategies with dual purpose – EVs as batteries
- Excited we are doing this
- Something in it for all sectors
- Oriented in the right direction

Do the initial results reflect what you envisioned? Why or why not?

COMMUNITY DESIGN

- Surprised it seems to bake in 1950 scenarios
- Thought that the results would include a broad range of VMT reduction strategies and they don't seem to be there

- Disruptive technology is not included. This would be an interesting next step. Telecommuting, vertical farming in metro area, autonomous vehicles (two rollouts of autonomous vehicles)

ELECTRIC VEHICLES

- Not too surprising, in general
- Was surprised by the minimal impact of VMT reductions
- Surprised cost is not included

BIO-FUELS AND OTHER LOW CARBON FUELS

- How does nature fit in? If we scale up biofuels, what is the impact of production practices?
- Co-benefits of certain agriculture practices? E.g. cover crops, biofuel crops
- GHG emissions reductions can also drive pollutant reductions—should be modeled
- Reduced need for petroleum infrastructure, is that tracked?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Expected policy levers associated with results
- What are the economics?
    - What will it cost to make these changes?
    - Will it impact adoption?
- Expected
    - More rapid shift from single occupancy
    - More rapid shift to transit / other modes

Are the results realistic?

COMMUNITY DESIGN

- Yes

ELECTRIC VEHICLES

- Needs to factor in cost and policies to be realistic
- VMT results don't seem realistic; seems like they would have bigger impact
- EV technology and battery advancement is uncertain so it's hard to know if the modeling will be realistic in this area.
- Is end-of-life battery emission incorporated? Does the lifecycle accounting include shipping EV materials to Minnesota?
    - A potential resource could be Energy Storage Association

BIO-FUELS AND OTHER LOW CARBON FUELS

- Nice vision, but we need infrastructure
- Exercise in futility without infrastructure. Combined heat and power, demand-side management, biofuels
- Need to sanity-check if results are plausible
- Electricity sector decarbonization – are we looking carefully enough at what needs to happen?

- Are we accounting for international emissions for imported petroleum (e.g. Alberta Oil Sands)?
- What can we control in the state? What is controlled federally?

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Needs more detail
- Aggressive, but it needs to be
- Change to electric is going to be faster than predicted

Do you have any other feedback that hasn't been addressed thus far?

COMMUNITY DESIGN

- Some regional modeling focusing on metro areas will change the picture, including electricity decarbonization
    - This might help to tease out local and regional or urban/rural strategies
    - Run the modeling by MN Department of Transportation regions
    - Yield more actionable strategies
    - Drivers: population, age demographics/income level, vehicle ownership
    - This might also help identify equity issues
- Origin to destination study for trucking would be interesting
- First mile/last mile freight—how do we figure this out?

ELECTRIC VEHICLES

- Interest in seeing cost, including business as usual scenario
- What mandates will be needed to achieve these goals?
- Concerns about economic impacts
- Concerns for EV technology advancements that could happen quicker than expected
- Group was happy to see scenarios
- Interest in seeing state and national policies impacts, including policies—maybe this is part of the next phase?

BIO-FUELS AND OTHER LOW CARBON FUELS

- Energy security
- Does not tell us which policies but provides some guidance on where to focus. E.g. biofuels, EV charging
- EPA refinery waivers, 2.6 billion gallons drop in biofuel demand
- We don't know what farms will look like in 30 years
- Water – some agriculture practices that benefit water also benefit carbon and nitrous oxide
- Would like to see ethanol move into medium-heavy duty (MIT study)

TRANSIT/ELECTRIC TRANSIT/HEAVY DUTY

- Are we addressing price on carbon?
    - What is the impact on behavior change?
- Document key assumptions for attendees to review—not very clear in presentation
- Wanted: Graph of low-hanging fruit on what we can readily transition

- What are the sensitivities on assumptions?
    - Does VMT really matter?
    - Is idling more important?
    - Examine how long we're keeping vehicles. This might increase with electric vehicles – swap out battery instead of the vehicle.
- What are the key differences between 80x50 and 100x50 scenarios?
    - More details wanted
    - Are we focusing on the right things?

Next Steps

- Technical Stakeholder Meeting #3 via webinar on June 20, 10:00-11:30 am
- Information on public meetings and webinar: http://www.dot.state.mn.us/sustainability/pathways.html
- Send additional feedback via email to Carly Gelderman at cgelderman@gpisd.net and Tory Clark at tory@ethree.com by **May 22, 2019**. Feedback will be incorporated into final modeling results or noted in the final report.

Appendix 3. Technical Webinar Transcript(s)

Technical Stakeholder Webinar Chatroom

Time	Comment
1:04:23	*A couple of years ago, a group of state agencies and the Center for Climate Strategies carried a comprehensive study about decarbonization in the transportation sector in Minnesota. Pathways is not the first study of this kind. The study was named Climate Solutions and Economic Opportunities and it came to very different strategies and estimates for decarbonization. Why do you think your model is more adequate? Particularly about how you modeled reduction in vehicle miles traveled.*
1:32:37	*How is this work being integrated/layered with MnDOT's Connected and Automated Vehicle planning?*
1:41:31	*Based on the community engagement results, it sounds like people want to see additional focus on VMT reduction/community planning related strategies. How will this feedback influence next steps for this work?*
1:42:03	*Capital investment costs vary greatly for different strategies for emission reduction. Is there any research that compares the reduction related to cost? I.e. cost/benefit of investing in electric buses vs low carbon fuels vs bike/walk infrastructure.*
1:47:39	*Can you talk about what's happening in other states regarding this type of work/planning?*
1:53:22	*Will the presentation be posted for us to review?*

Table 9. Chatroom transcript from the technical stakeholder webinar held on Thursday, June 20. Names of individuals have been removed for the sake of privacy.

Q & A Forum

Question
In reference to a presentation last week by Great Plains Institute on decarbonization in the midcontinent. It was admitted that electric buses, heavy-duty vehicles cannot be replaced on a one to one basis. Has any research been done along these lines?
Clarification. ICE engines cannot be replaced on a one to one basis by electric. Too much energy needed for climate control, terrain challenges.
My concern is additional vehicles needed adds to GHG to build these vehicles, heavy duty applications.
are life cycle GHG's considered in this work for biofuels?
If you haven't included full fuel cycle, Life Cycle Accounting for all fuel, including e.v. vehicles, how can you complete this report? It will not be a true representation of how to move forward. Eliminating GHG directly from vehicles doesn't eliminate GHG.
You say that you have not done a cost analysis. Correct me if I am wrong. MN is a business. No business would make an investment of this magnitude without an ROI. Will you complete this as part of your recommendation, so the taxpayers know what will be expected of them? Give them more options? Maybe electrify everything is not the way to go.

Table 10. Transcript of the question and answer portal of the technical stakeholder webinar held on Thursday, June 20. Names of individuals have been removed for the sake of privacy. All questions were answered live.

Appendix 4. Public Engagement Outreach Methods

Public Webinar

Information on the public webinar was sent out by e-mail through the steering committee and some state agency networks, as well as posted on the MnDOT project webpage.

Session	Registered attendees via Eventbrite	Page Views	Actual attendees	% of registered
Public Webinar	47	249	45	96%

Table 11. Public webinar attendance and registration summary

Online Survey

Information and outreach around the online survey was done through e-mail (a combination of steering committee members, and technical stakeholder committee members networks and some state agency mailing lists), social media (across state agencies, including MnDOT, and other organizations), word of mouth, and announcements made at the in-person public meetings.

Online Open Comment Form

Information and outreach around the online survey was done through e-mail (a combination of steering committee members, and technical stakeholder committee members networks and some state agency mailing lists), social media (across state agencies, including MnDOT, and other organizations), word of mouth, and announcements made at the in-person public meetings.

Public Stakeholder Meetings

Information and outreach for the public in-person meetings was conducted through the following mediums:

- e-mail outreach (a combination of steering committee members, and technical stakeholder committee members networks and some state agency mailing lists),
- regional contacts who communicated with their local networks
- social media (across state agencies, including MnDOT, and other organizations),
- word of mouth, and community group organizing by:
    - MN350
    - Sierra Club
    - ISAIAH
    - Climate Generation
- additional announcements made during the in-person public meetings

There was significant organizing done by several notable environmental groups to get people to both attend the in-person meetings and engage with the online feedback opportunities.

Appendix 5. Public Meeting Agenda

In each community, except Minneapolis,two meetings were held in the late afternoon (from 2:30 pm to 4:30 pm), and in the evenings (from 6:00 pm to 8:00 pm).

The agenda of the meetings was the same for each meeting, and resulted in roughly two hours of content:

Introduction to the project (10 minutes)

The introduction to the project was a high-level summary of the Pathways project, the timeline, and scope. This is also the point during the meeting at which the interactive Mentimeter survey software was tested with four icebreaker questions:

1. Where are you coming from today?
2. What's your home zip code?
3. How do you most frequently get around? (multiple choice)
4. Where do you work?

These icebreaker questions served a dual purpose of ensuring that everyone was able to use the interactive survey software later during the meeting, and gathered some demographic data information about the attendees, which corresponded to demographic information gathered in the online survey.

Welcome from local champion or elected official (10 minutes)

At each meeting, a local champion or elected official typically welcomed the participants with their personal motivation or experience with climate and decarbonization work or a summary of why the project was important.

Presentation on the state's emissions and results from the pathways to transportation decarbonization modeling (20 minutes)

Provided an overview of the status of the state's greenhouse gas emissions trajectory, and the motivating data analysis behind MnDOT's commitment to the Next Generation Energy Act goals. It also provides a high-level overview of the modeling that was done by E3, focusing on the 80x50 scenario (synonymous with the Next Generation Energy Act Goals), and directed individuals with a deeper interest in the data or other modeling scenario to the online materials.

Clarifying questions and answers (15 minutes)

There was the opportunity for clarifying questions from the attendees on the modeling presentation. Themes from the questions, as well as general reactions, were recorded and used throughout the engagement to continuously improve the way that the modeling and emissions profile was presented.

Small Table Discussions on opportunities and barriers to reducing greenhouse gas emissions in transportation (15 minutes)

After having a chance to interact with the modeling material and discuss clarifying or high-level questions, people were directed to break out into small group table discussions of 5 – 7 people. The purpose of these table discussions was to collect input on two questions:

1. What do you perceive as opportunities in your community to reducing greenhouse gas emissions in transportation?
2. What do you perceive as barriers in your community to reducing greenhouse gas emissions in transportation?

Everyone was directed to provide up to three opportunities and three barriers on post-it notes, which were then placed on a flip-chart at the center of their tables. These post-it notes were collected and coded as part of the input analysis.

Interactive survey activity using Mentimeter (15 minutes)

Finally, participants were asked to take out their mobile devices to participate in a longer interactive survey, during which the results of the room's responses were shown visually on the presentation screen. The questions asked during this interactive survey mirrored the questions asked in the online survey. However, in the meetings, we were able to give people a chance to share additional detail around their responses for each question or pose follow-up questions to the room if interesting response patterns developed. The results of the interactive survey were all collected and used as part of the insights summary.

Wrap-up and Next Steps (5 minutes)

Finally, participants were thanked for their time and engagement, and provided with information on how to stay up-to-date on the project, and additional engagement opportunities.

Appendix 6. Public Engagement Summaries

Public Webinar

45 attendees participated in the public online webinar on Friday, May 31. The webinar presentation was provided by E3. Participants engaged with the webinar through a live chat room, though questions were reserved until the end of the webinar.

During the question and answer portion, webinar panelists synthesized and addressed the questions from the chatroom discussion. Considerations brought forth during that portion of the webinar included:

- Whether assumptions in the pathways modeling were too aggressive or not aggressive enough

- How systems are inherently integrated and the interplay of one solution with another, including:
    - externalities or consequences of different solutions to reducing greenhouse gas emissions, with emphasis on concern for negative externalities related to solutions like electric vehicle adoption and manufacturing
    - clarification and discussion on the interplay of to what extent measures assumed in the modeling would or could impact the efficacy of another measure

- Appreciation for the webinar and content, coupled with general support for the project

Demographic information was not collected as part of the public webinar. The full chatroom transcript is available below.

Public Webinar Chatroom Transcript

Time	Comment or Question
0:37:13	*Roger, yes the webinar has started. You should be able to hear the presenter*
0:43:55	*On this chart (C02^e over time in our state), has the state identified the reason why transportation-related GHG increased so significantly up until a few years ago? It appears to have significantly outpaced population growth. Would it be related to increased VMT per capita during that time? What are the factors that create VMT? Would additional VMT per capita be induced by highway capacity expansion over that time?*
0:48:25	*Hi panelists -- how concerned are you that the climate models cited in the UN report accurately predict potential disruptions to the climate? In your minds, are we in a crisis?*
0:48:55	*What about public/mass transit, including across the state? Or the efficiency of rail compared to road-vehicles?*
0:49:51	*Thanks for the questions -- we will try to get to as many of these as possible later in the webinar!*
0:51:17	*Do the extremely high GHG emissions of vehicle production count in our transportation emissions?*
0:52:26	*Why is the urban mile reduction so low for the next twelve years? That doesn't seem at all in line with what's happening, let alone IPCC timeline.*
0:52:52	*Why is the focus only on reducing urban VMT? It seems like the nature of MnDOT highway investments subsidizes an increase in rural VMT far more than urban VMT. It seems like there's a large opportunity in *not continuing to subsidize the hobby-farm-drive-20-mi-for-any-trip* lifestyle across rural areas, especially considering that nearly all MN cities are "urban" in terms of land use and built form. Often more so than Minneapolis or St. Paul neighborhoods in terms of proximity to amenities, jobs, etc.*
0:54:06	*^referring to outstate towns/cities that many people consider to be "rural." Even a town of 1,000 may have a downtown with groceries, banks, restaurants, hardware store, etc. etc.*
0:57:33	*I encourage you to think about the huge benefits of mode-shifting to biking!*
0:57:45	*I think the urban miles traveled reduction by 2050 is lower than it needs to be, given the relative costs of continuing to add roadway capacity vs. adding transit, bike, walk capacity/ease of use.*
0:57:54	*And transit/walking!*
0:59:20	*What about not aggressive enough*
0:59:24	*:)*
0:59:35	*If we are relying heavily on switching to electric vehicles, is there any consideration of the other negative externalities of relying on personal vehicles as transportation? As mentioned in another question, these could include the GHG emissions from vehicle production, the energy that will have to be used to recycle the cars that are being discarded if people have to buy a new vehicle, the extremely high amount of deaths on our roads, the fact that many people still will not be able to afford any type of personal car despite decreases in cost?*
0:59:48	*(Or increasing all so we don't flirt with civilization collapse like we are.)*
1:00:13	*Not clear to me that biofuels can grow several-fold and still feed us humans.*
1:00:28	*Do your VMT reduction estimates assume any changes in parking policy? Driving is heavily subsidized when parking is free nearly everywhere.*
1:00:29	*For the biofuels is the energy (often petroleum products) used to produce the fuel factored into its benefits? Similarly, the negative effect it would have on other reduction efforts like agriculture and food production since we would be using so much production land for fuel?*
1:00:33	*I agree a reduction in VMT seems like it's way too small on here. Imagine someone is able to relocate their house or job to change a 15mi commute to a 5mi commute. That's the equivalent of changing an 18 MPG truck to a 54 MPG hybrid in terms of fuel-economy-per-trip.*
1:01:05	*Agree with Russ—looking at the increased food insecurity and weather-related disasters like the extreme flooding we're seeing in our own region makes biofuels seem really questionable.*
1:01:42	*Agree with all the concerns about biofuels.*

1:01:46	*If this process is going to determine which strategies MnDOT takes to reduce carbon emissions, will there be some sort of ROI or similar process that considers co-benefits? For example: by moving people into lower carbon modes of transportation we're also addressing public health issues, inequities in transportation cost and access, street safety, and poor land use planning. Strategies with more co-benefits should be prioritized. Thanks!*
1:01:57	*Does the consideration of biofuels look at the CO2 trade-offs of that same land being used in other ways, e.g. for carbon sequestration or even solar?*
1:02:13	*Agree with Emily -- ROI!*
1:03:25	*So what will MnDOT do with these models?*
1:03:45	*Will there be any meetings in St Paul for those who're transit-dependent—Mpls can be quite a trek!*
1:03:52	*Communities throughout the state need to understand the importance of providing charging facilities for electric vehicles, either as part of development projects, or in public locations. I think this is an area where MnDOT could help with suggested zoning language or other regulatory guidance.*
1:04:58	*Please consider this as official feedback: http://www.startribune.com/we-have-to-get-over-cars-to-save-the-planet/510640872/*
1:05:20	*What are the options of direct action by the state you are considering?*
1:05:43	*Given the very very short timeline we have, how do we balance feedback with actually immediate dropping emissions (which EVs do not to)?*
1:05:47	*Agreed, what will be done with this? There are goals for urban VMT reduction, yet we are still spending hundreds of millions of dollars per year expanding highways in the metro. My boss always says "vision without execution is hallucination" so I hope we figure out how we execute on these goals.*
1:06:05	*Here is the link to the MnDOT website with additional information: http://www.dot.state.mn.us/sustainability/pathways.html*
1:06:24	*So you all know the energy return on investment in ethanol production is a positive 3 units for every unit invested*
1:06:51	*Find the public survey here: https://mndotforms.formstack.com/forms/mndot_pathways_to_reducing_greenhouse_gas_emissions*
1:07:09	*What about the back-and-forth interplay with surface, for example, freight and passenger travel?*
1:07:17	*and food vs fuel has been debunked numerous times. it was a hit job done by big oil against ethanol production.*
1:07:27	*There is no food insecurity caused by biofuel production.*
1:08:33	*Can you please link to that appendix?*
1:08:41	*The idea of banning ICE vehicles by a date certain, as other countries are doing, will no doubt be unpopular, but I would suggest it needs to be on the table to send all the right signals to the marketplace.*
1:08:44	*Ethanol production only utilizes the starch portion of the kernel. All of the fat fiber and protein is resold into feed markets.*
1:09:07	*Yes MN should look at banning ICEs by a date certain*
1:09:20	*Why would we assume VMT needs to grow alongside population?*
1:09:36	*What about making walking less horrible than driving in urban areas? Or, to put it differently, what about MNDOT's role in induced demand?*
1:09:49	*Mn should not ban ICEs.*
1:10:24	*I think an ICE ban misses the point. We need to be focused on a future with fewer cars, rather than concerned with how those cars are powered.*
1:10:40	*I mean, let's do both. But not stop with an ICE ban.*
1:11:19	*So, MNDOT, what are you planning on doing with all this information? what actions can the state take?*

1:12:07	*What about the environmental cost of manufacturing the batteries?*
1:13:02	*MN should work much harder to reduce ICE vehicles. We need to produce electricity from non-GHG sources. Electric vehicles absolutely reduce GHG's, even if powered by coal.*
1:13:20	*What kind of partnerships are possible for MnDOT to help make walking/biking less horrible? MNDOT's presence even in core cities is an active deterrent to those who can choose between driving and other transportation options. I.e. MnDOT is currently an active barrier and safety danger to lower-emission transportation like walking/biking. Can we improve this immediately?*
1:13:47	*I wanted to urge MnDOT to study an action that would be very effective at reducing urban vehicle-miles traveled: reconstructing a segment of I-94 in Minneapolis and Saint Paul (which is at the end of its useful life) as a dedicated transit facility and turning over excess right-of-way for parkland and infill development. This would be extremely effective at reducing VMT, it would cost less than rebuilding the status quo, and it would improve the health of the people who live nearby. Is MnDOT studying this option?*
1:14:19	*Urban vehicle miles is sort of misleading. The real problem is suburban vehicle miles. 95% of suburbanites commute by car.*
1:14:24	*interesting -- thanks Scott!*
1:14:25	*What's the best way to give feedback on mode-share shift?*
1:14:27	*What recommendations on the buildout of protected bike lane networks are planned? That's required for commuters to feel safe to switch to e-bikes and e-scooters. Portland State has research Lessons from the Green Lanes that supports this behavior change.*
1:16:34	*Benefit of easy metro access to carshare/ride-hail, ultimately AV's is to change the economics of transportation choice by reducing the need for car ownership, which changes the cost/trip equation of each trip taken dramatically.*
1:19:17	*I appreciate everybody working on this. Obviously, no easy answers or solutions, but a very critical part of our shared future and something I'm thankful you're working on.*
1:19:46	*Can/will this Decarbonization process suggest specific policy and/or legislative change?*
1:20:20	*Is there anything the governor can do right now? Any policy changes?*
1:20:35	*Unbundling parking lots from buildings in commercial leasing can send the price signaling needed by employers to price employee commuter parking which nudges commuters to shift modes. Did your assumptions include unbundling parking in commercial leasing?*
1:20:46	*The plan should identify if/how state employees are leading way -- what are the incentives to reduce VMT or use electric vehicles provided to state employees and what is the mode share for employee commuting to state offices. What is the transit, carpool, bike, walk incentive provided vs. value of free parking provided to employees?*
1:20:54	*So EVs transfer the immediate GHG emissions of manufacture/production to other places in the world? That seems questionable given that climate breakdown is a global aggregate problem*
1:21:58	*Agree with Matt—thank you to all who's working on this!*
1:22:17	*upstream emissions, in-state or not, point to weighting efficiency more -- much less driving in urban areas.*
1:22:50	*Does that mean not from the production of roads?*
1:23:10	*Will there be a St Paul area meeting for those who are transit-dependent?*
1:24:09	*Thank you!*
1:24:33	*I echo the appreciation for all the effort going into this important work! Thank you!*
1:24:34	*Do you have collaborations with a similar analysis in other states?*
1:24:54	*thanks for the opportunity.*
1:24:58	*Yes, thanks!*
1:25:33	*Whom can we contact to work on immediate improvements to walk/bike areas around MnDOT roads, particularly in Mpls/St Paul?*

1:25:48	*When efforts on these are part of CO2 reductions?*
1:26:59	*Ditto. This process is critical and invaluable. We just hope this will truly lead to bold, effective policy and funding/project priority changes at MnDOT. Thank you!*
1:27:02	*Why not start the rulemaking right now?*
1:27:45	*I suggest that reducing (rather than expanding) highway capacity could be a bipartisan undertaking, particularly once the electorate understands that we don't have the money to maintain what we have let alone build more.*
1:27:46	*Given the timeline we have for RAPID decarbonization to avoid the worst impacts, what is MNDOT doing to work within the physical reality we're in?*
1:28:52	*Thanks, Tory and Tim!*

Table 12. Chatroom transcript from the public webinar held on Friday, May 31. Names of individuals have been removed for the sake of privacy.

Public Webinar Q & A Forum Transcript

Questions
Have you studied or considered alternative fuels like propane?
What types of direct actions is the state considering?
What can the state do immediately?
Do you consider the full fuel cycle in electric vehicles? We still need to MAKE electricity. Electricity is only about 30% efficient from point of production to point of use. It simply moves GHG off roads and to electrical production.
Have you considered the massive rebuild of the electrical grid to handle all these electric vehicles? If everyone plugs in after work, OVERLOAD!
We currently EXPORT approximately 1 million barrels per DAY.
We have plenty to help and to be part of the solution. Current gasoline vehicles can be converted to propane. Do not need to cycle vehicles out through a 15-year life span.
Can we afford to go all electric? Cost of infrastructure. Many good plans have been dashed by not enough funding.
Will MNDOT make recommendations to the state for action?
Minnesota is a business. Need an ROI please. We are fortunate to not have debt in MN. Need to keep it that way.

Table 13. Question and Answer transcript from the public webinar held on Friday, May 31. Names of individuals have been removed for the sake of privacy. All questions were answered live.

Online Survey

The online survey was opened over a three-week period from Wednesday, May 29 through Thursday, June 20 and generated 1,115 responses. The following provides an overview of the responses received from the online survey.

Who We Heard From

Through the online survey, the engagement process gathered voluntary demographic information to help understand what voices were at the table during the engagement process. The following provides a summary of the demographics represented by the online survey respondents.

Location

The aggregate online survey responses covered 189 unique zip codes across Minnesota (and in some neighboring states). The map below shows the zip codes across the state from which input from the online survey was received. The survey was able to reach the greatest swath of zip codes, and a large proportion of the state, relative to the other engagement opportunities.

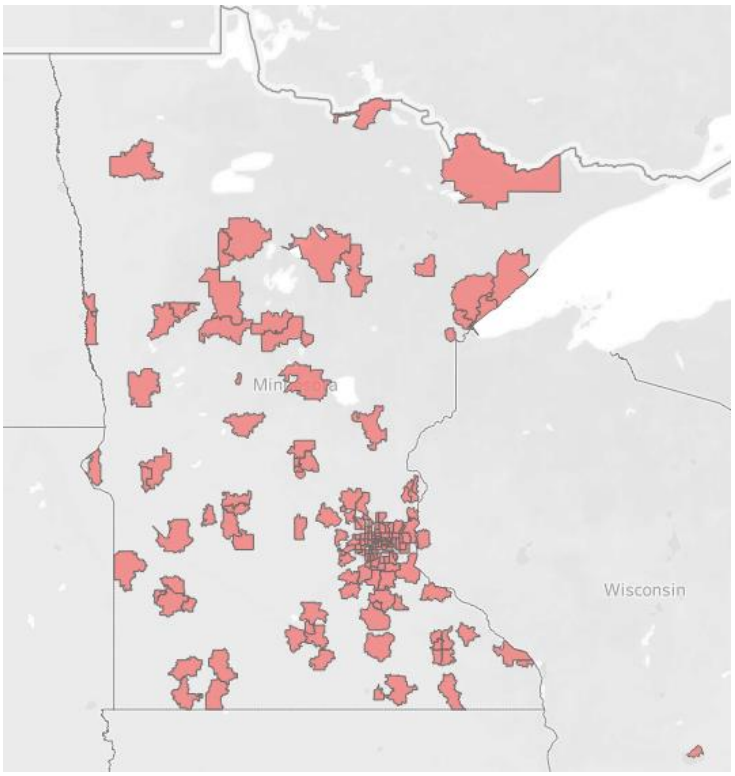


Figure 11. Map of zip codes from which online survey responses were received.

Age

Of the 1,360 combined respondents and participants, the majority were between the ages of 31 and 65 (53%). Almost one-fourth of the remaining participants were over the age of 65. Youth voices were least represented in this engagement, with only 17% of respondents age 30 or under. This breakdown of age is largely consistent with the demographics of the aggregate input received.

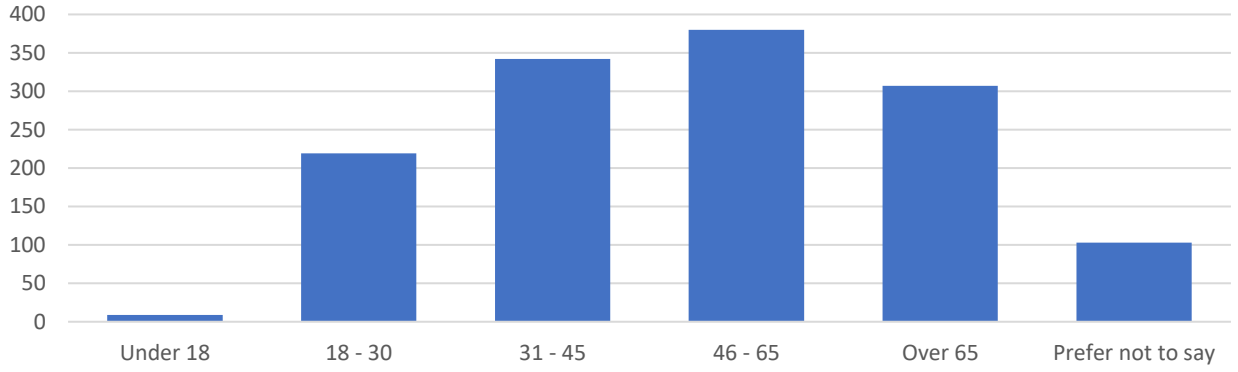


Figure 12. Age of participants that responded to the online survey.

Gender

A slight majority of female voices (48%) over male voices (41%) were represented through this engagement process. Non-binary voices were present (2%) but in the minority; while 9% of participants preferred not to disclose their gender identity. This breakdown is largely consistent with the aggregate input demographics.

Race

Most Minnesotans who engaged with the public stakeholder process in some form identified as White or Caucasian (84%), while 10% preferred not to disclose their race. Only 3% of respondents and participants self-identified as non-white, while 3% identified as multiracial. This racial composite is largely consistent with the aggregate input demographics.

Work

Of respondents who completed the online survey, the majority identified as retired, which is consistent with the overall input demographics. The next three most represented categories included academic institution, business, and self-employed. This was consistent with the aggregate work characteristics.

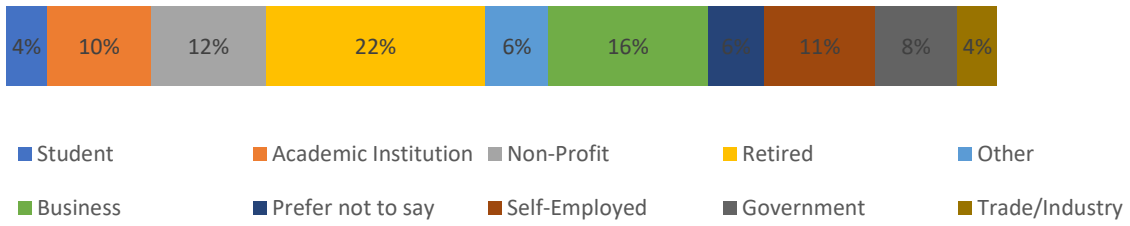


Figure 13. Place of work or vocation for online survey participants.

Mode of Transportation

Of those who engaged with the project, 24% most frequently travel by gasoline vehicle. A large proportion of participants bike (19%), walk (21%), take public transportation (14%) or drive a hybrid vehicle (8%). These results are largely consistent with the aggregate results.

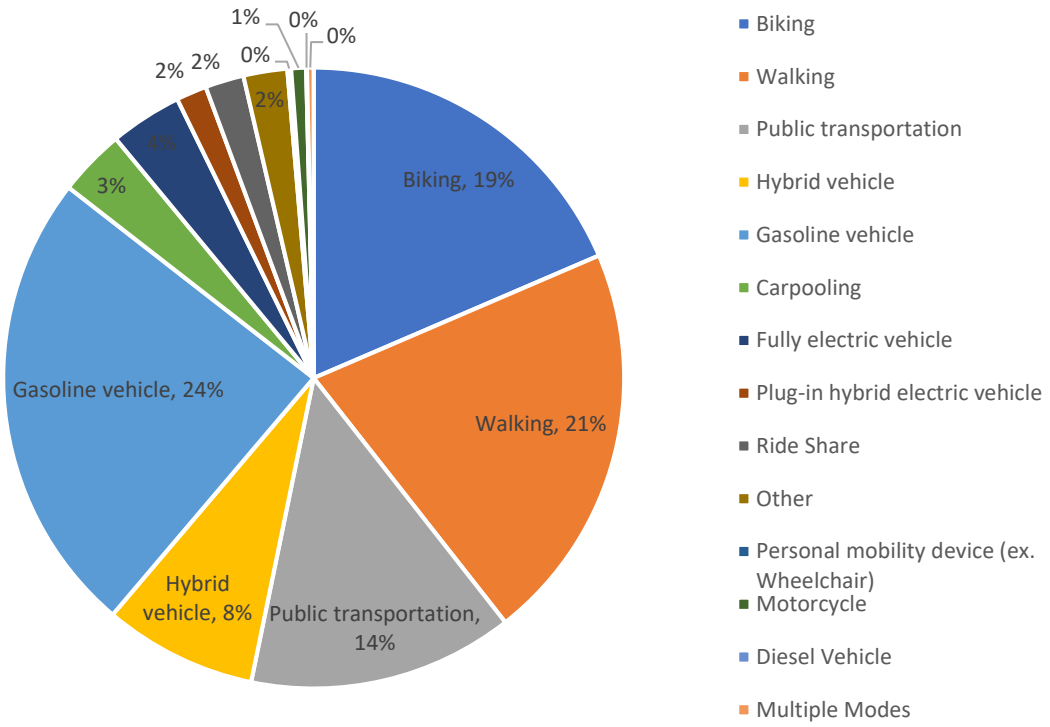


Figure 14. Modes of transportation used most frequently by online survey participants

Co-Benefit

When asked what the most important co-benefits, or additional outcome, from reducing transportation emissions, just under half of participants (35%) responded "Make communities more resilient by reducing the impacts of climate change." Second to that was a tie between "Promote equity and environmental justice" and "improve air quality," each representing 22%. "Provide new or more mobility options", coupled with a combination of "Other," which was often climate change-related, and "support local jobs and businesses" received the least proportion of total votes. This response was largely correlated with the aggregate input results for this question.

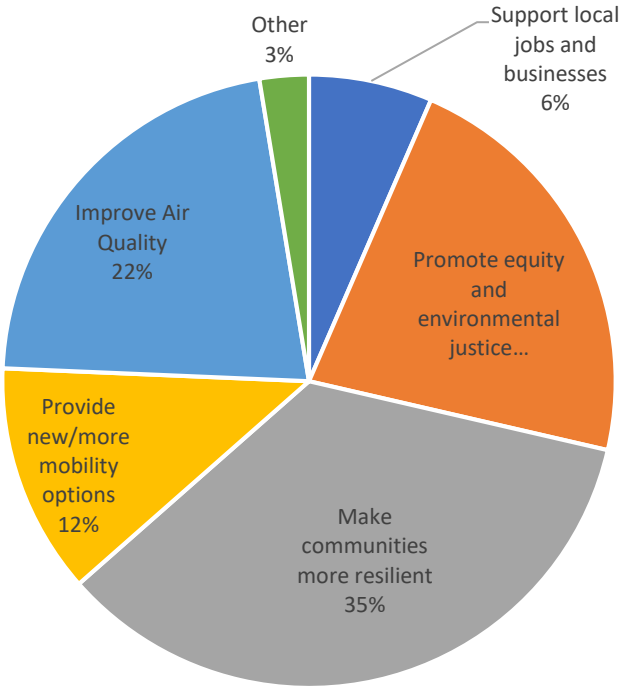


Figure 15. Overview of most important co-benefits, or additional outcomes, from transportation decarbonization identified through all online survey responses

Environmental Justice

Environmental justice emerged as an important theme across the input. When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 92% of respondents noted that it was either "Very Important" (67%) or "Important" (25%). The remaining respondents (8%) noted that they were anywhere from "neutral" to "not at all important."

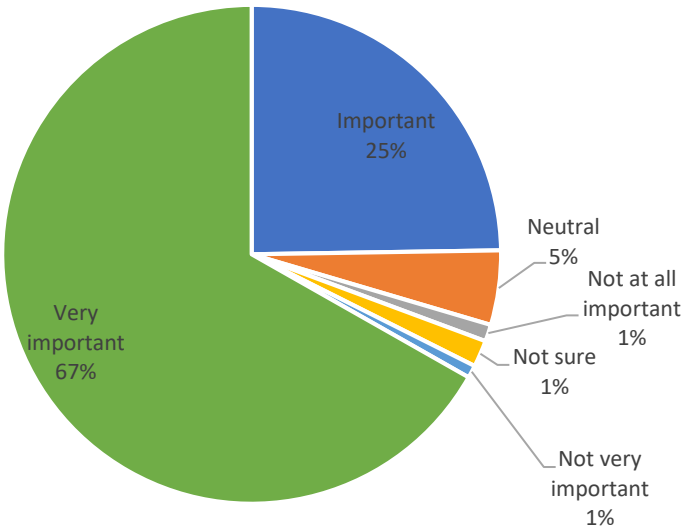


Figure 16. Responses to how important environmental justice should be in this action from online survey responses.

In addition to perceptions of co-benefits and environmental justice, the engagement also probed the perception of different strategies and technologies that were used in the modeling to achieve emissions reductions in surface transportation. The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from "Very Unsupportive" (1) to "Very Supportive" (10), which translated to a scale of 1 to 10.

Strategies and Technologies

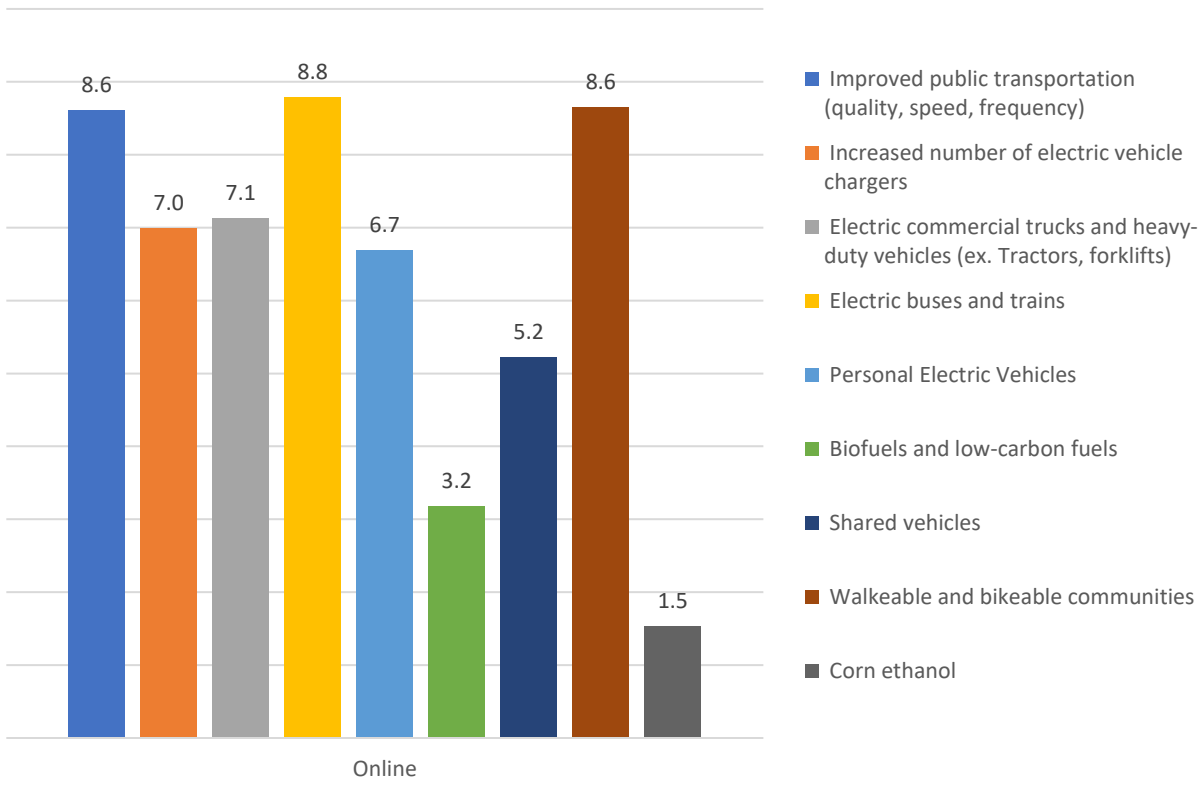


Figure 17. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies explored through the public engagement from online survey responses.

The three strategies and technologies that participants supported were the following:

- Electric buses and trains (8.8 / 10)
- Improved public transportation (quality, speed, frequency) (8.6 / 10)
- Walkable and bikeable communities (8.6 / 10)

A handful of strategies and technologies received moderate support, including:

- Electric commercial trucks and heavy-duty vehicles *(7.1 / 10)*
- Increased number of vehicle chargers *(7.0 / 10)*
- Personal electric vehicles *(6.7 / 10)*

The remaining strategies and technologies received the least support through the aggregate feedback, ranging from "very unsupportive" to "unsupportive" to "neutral."

- Shared vehicles *(5.2 / 10)*
- Biofuels and low-carbon fuels *(3.2 / 10)*
- Corn ethanol *(1.5 / 10)*

Policies

Through understanding the strategies and technologies, participants were asked to express the support they had for each of the following policies, which represent actions pursued in the modeling to reduce GHG emissions in surface transportation. Input was provided by ranking each individual policy from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

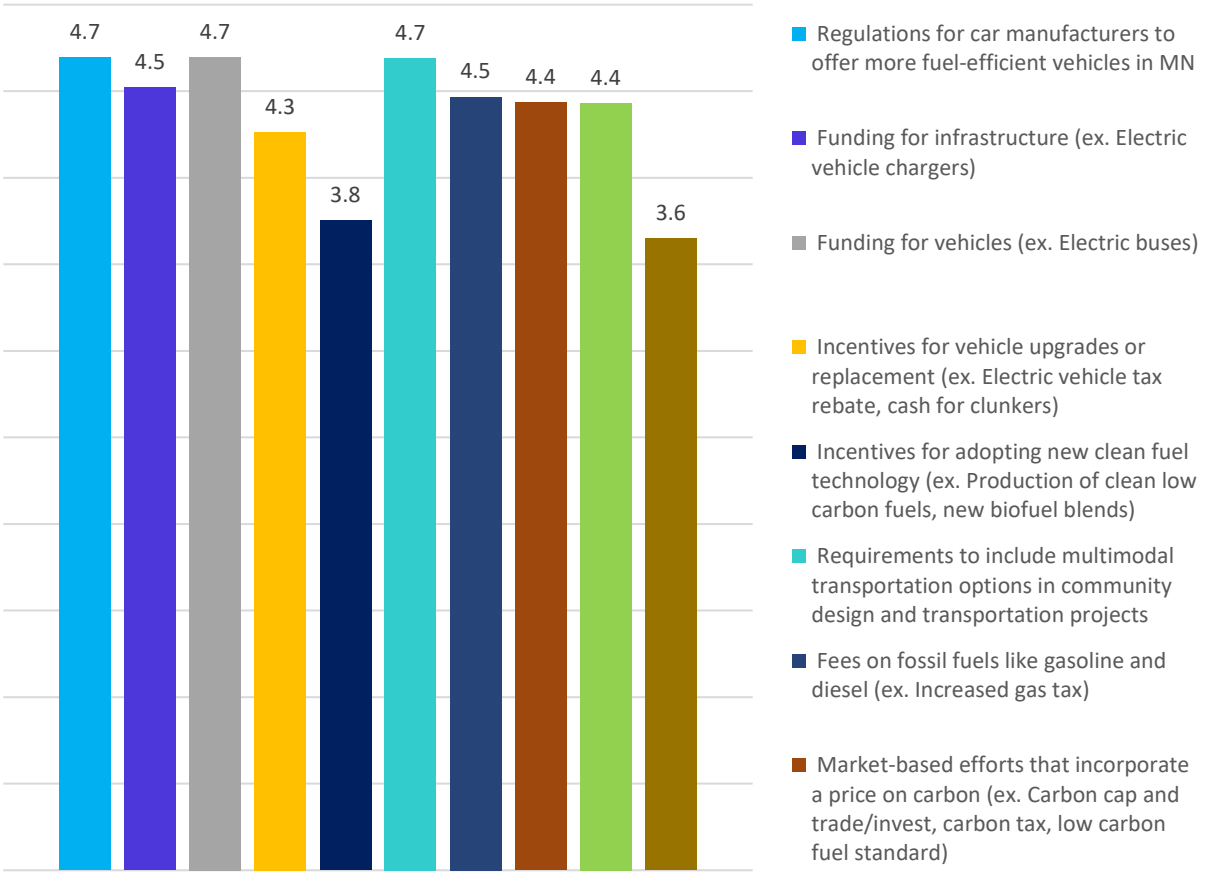


Figure 18. Overview of the relative rank of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" out of 5 from online survey responses.

The policies that received the strongest support across all engagement were:

- Regulations for car manufacturers to offer more fuel-efficient vehicles in Minnesota *(4.6 / 5)*
- Funding for infrastructure (ex. Electric vehicle chargers) *(4.5 / 5)*
- Funding for vehicles (ex. Electric vehicles) *(4.7 / 5)*
- Requirements to include multimodal transportation options in community design and transportation projects *(4.7 / 5)*

Some policies received moderate support, including:

- Fees on fossil fuels like gasoline and diesel (ex. Increased gas tax) *(4.4 / 5)*
- Market-based efforts that incorporate a price on carbon (ex. Carbon cap and trade/invest, carbon tax, low-carbon fuel standard) *(4.4 / 5)*
- Investment in research to develop new technologies (ex. Solar-powered electric vehicle charging stalls, vehicles with higher biofuel blends) *(4.4 / 5)*
- Incentives for vehicle upgrades or replacements (ex. Electric vehicle tax rebate, cash for clunkers) *(4.2 / 5)*

The policies that received neutral ranking included:

- Incentives for adopting new clean fuel technology (ex. Production of clean low-carbon fuels, new biofuel blends*) (3.7 / 5)*
- Investment in research to reduce emissions from biofuels (ex. Ethanol, biodiesel) *(3.6 / 5)*

Online Open Comment Form

The focus of the online open comment form was to allow people another opportunity for feedback outside of the structure of the online survey.

Only four (4) responses were received through the online open comment form.

Each comment suggested specific strategies that should be pursued to achieve GHG emissions reductions, including:

- ZEV Standard
- Vehicle Mile Reduction
- Concurrent electric grid decarbonization
- Partnerships across state agencies and utilities

These comments can be reviewed below. Demographic information was not collected with these open comments.

Time	Comment or Question
6/6/2019 13:11	*https://www.gao.gov/assets/700/698914.pdf* *The GAO recently concluded that:* *The RFS Has Likely Had a Limited Effect on Greenhouse Gas Emissions to Date and Is Unlikely to Meet Its Future Greenhouse Gas Emissions Reduction Goals*
6/12/2019 11:58	*Great opportunity if well managed! Thank you for your efforts and analysis.* *The state can make efforts to decarbonize transportation, but what is being done to ensure the grid and electric load is decarbonized? Not only are the emissions and costs being shifted, this is not a sustainable solution unless that facet is considered. It also seems rate payers are subsidizing this costly shift. State agencies should be working alongside utilities (municipal, coop, and IOUs) and regulators.*
6/16/2019 7:36	*ZEV standard please!*
6/17/2019 10:39	*Focus on vehicle mile reduction as a primary strategy.*

Table 14. Raw online open comments received between Wednesday, May 29th and Thursday, June 20.

Public Meetings

Over nine public listening sessions, MnDOT met with 245 people, representing over 33 different zip codes

Methodology for Assessment

There were many types of input and feedback gathered during the public listening sessions, including written feedback on post-it notes during small group table discussions, electronic information gathered through an interactive survey, verbal feedback through question and answers sessions, and general comments that were captured as notes.

Facilitators and analysts were able to aggregate and draw out high-level themes and ideas that emerged from the engagement process.

Opportunities Identified

Across all public meetings, the greatest opportunities for reducing carbon emissions in the surface transportation sector were identified in the following five categories:

- **vehicle electrification** (personal vehicles, public transportation, and charging infrastructure)
- **public transportation** (expanding options, improving efficiency, and electrification)
- **mobility infrastructure** (improving access to biking and walking, maintaining infrastructure, improving accessibility)
- **community design** (land use decisions like mixed-use development, increasing proximity of people and places, reducing the emphasis of vehicles in development and parking)
- **behavior change** (opting for alternative modes, using existing offerings, increasing ridesharing, purchasing more fuel-efficient vehicles)

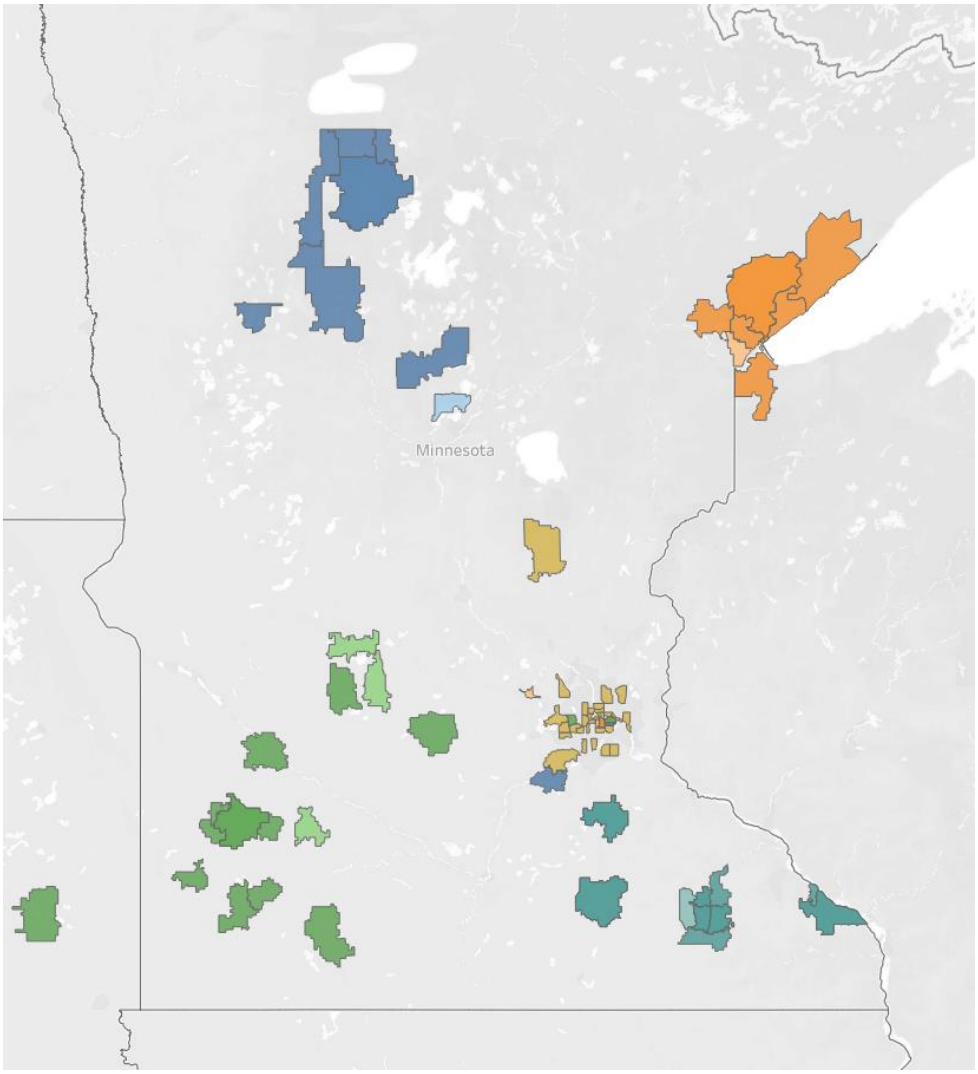
Who We Heard From

The nine (9) meetings were held between Tuesday, June 4 and Wednesday, June 12 in five (5) communities across the state.

During the meetings, the engagement process gathered voluntary demographic information to help understand what voices were at the table during the engagement process. The following provides a summary of the demographics represented by all the public meeting attendees.

Location

The map below outlines the 33 unique zip codes represented at the in-person public meetings; they are largely clustered around the communities in which the meetings were held, but also gathered additional insight from non-adjacent communities. The public meetings generated input predominantly from people in the areas surrounding the city where the meeting was held.



Which Meeting Participants Attended

Marshall

Rochester

Bemidji

Duluth

Minneapolis

Figure 19. Map of zip codes represented at all the in-person listening sessions, color represents which community meeting(s) each zip-code attended.

Age

Of the 245 combined participants, the majority were between the ages of 31 and 65 (53%). Almost one-fourth of the remaining participants were over the age of 65. Youth voices were least represented in this engagement, with 17% of respondents age 30 or under. This breakdown of age is largely consistent with the demographics of the aggregate input received.

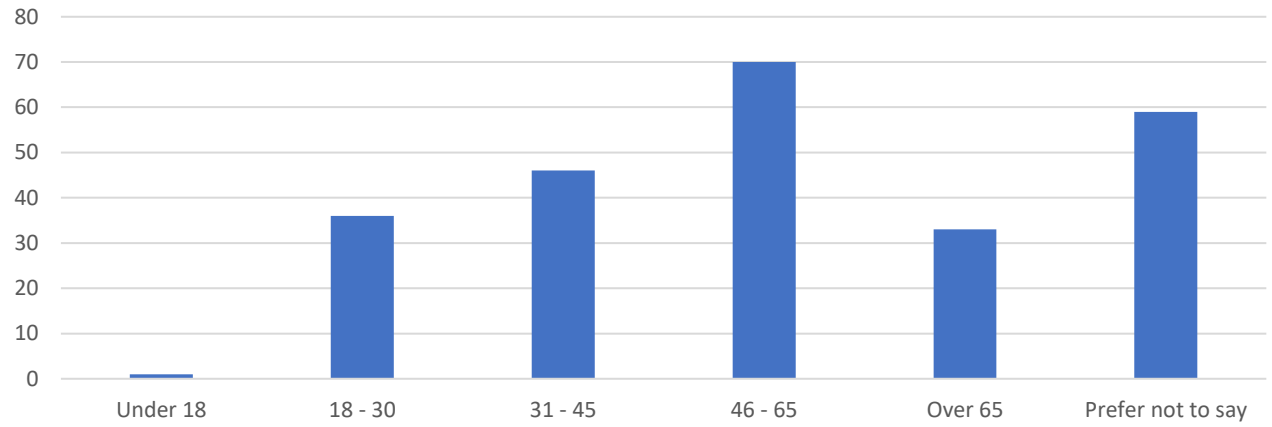


Figure 20. Age of participants across the nine in-person meetings.

Gender

A slight majority of female voices (39%) over male voices (33%) were represented through this engagement process. Non-binary voices were present (2%) but in the minority; while 26% of participants preferred not to disclose their gender identity. This breakdown is largely consistent with the aggregate input demographics.

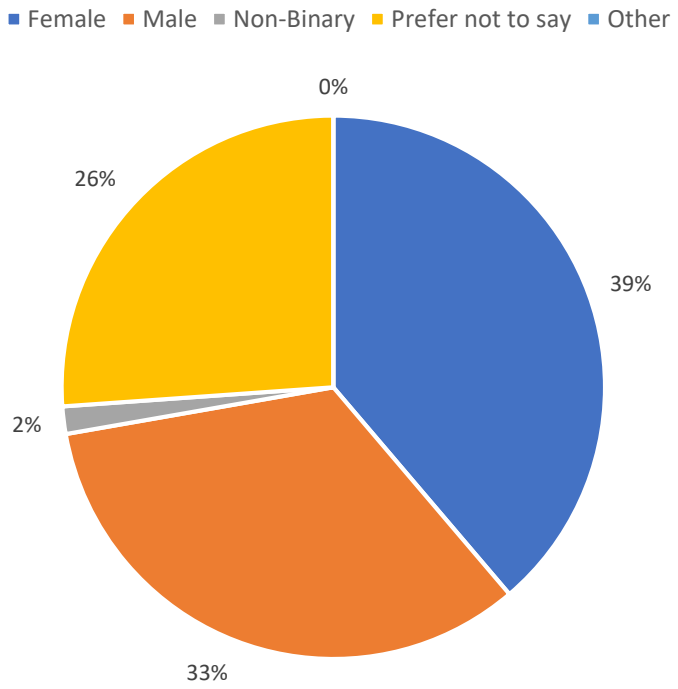


Figure 21. Gender demographics of participants across all nine public meetings

Race

Most Minnesotans who engaged with the public stakeholder process in some form identified as White or Caucasian (70%), while 24% preferred not to disclose their race. Only 5% of respondents and participants self-identified as non-white, while 2% identified as multiracial. This racial composite is largely consistent with the aggregate input demographics, though with a high proportion of participants who preferred not to disclose this information.

White/Caucasian	171	70%
Other	2	1%
Asian	3	1%
Black/African-American	3	1%
Hispanic/Latinx	2	1%
Prefer not to say	58	24%
American Indian/Native American	2	1%
More than One Race	4	2%

Table 15. Racial demographics across all nine public stakeholder meetings

Work

Of respondents who completed the online survey, the majority identified as working for the government, which is unique compared to the aggregate input demographics. The next three most represented categories included retired (16%), and non-profit (11%). 26% of participants preferred not to disclose this information.

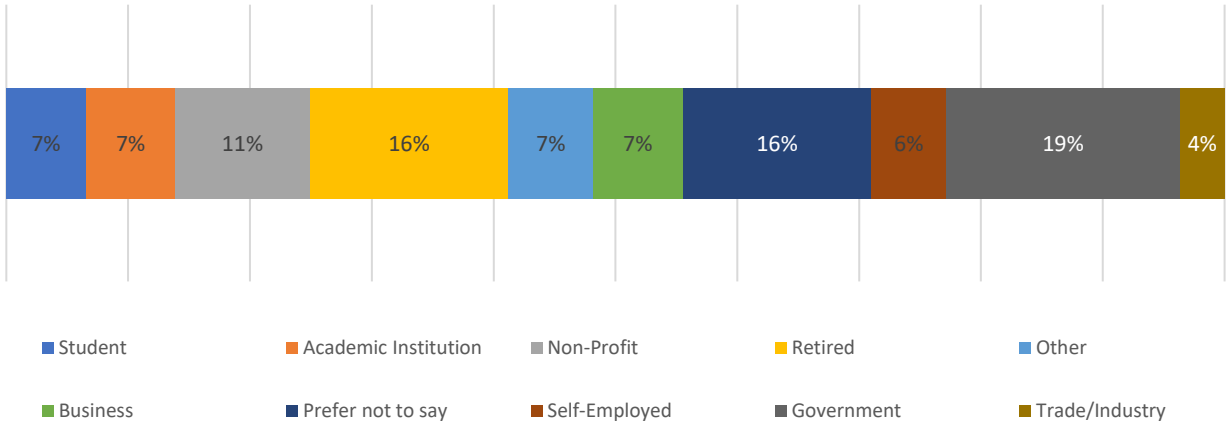


Figure 22. Place of work or vocation for participants across all nine public meetings

Mode of Transportation

Of all participants at public meetings, 35% most frequently travel by gasoline vehicle. A large proportion of participants chose other (23%), multiple modes (13%) and hybrid vehicles (8%).

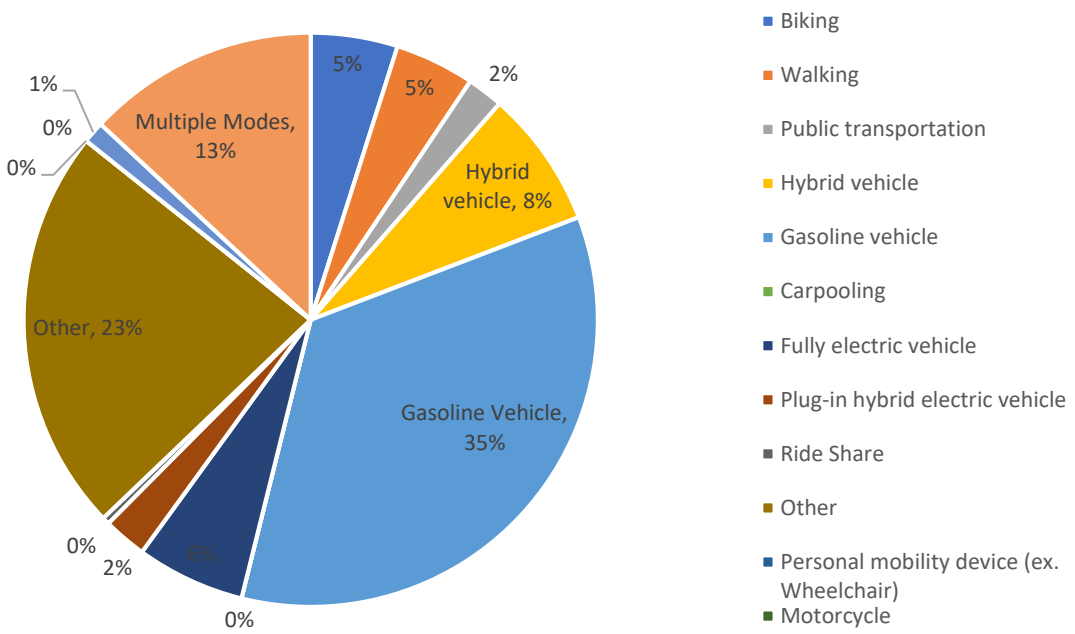


Figure 23. Modes of transportation used most frequently by meeting participants

Participants were asked four questions in each meeting via the Mentimeter survey. Participants responded using their mobile device or printed survey. The following are the overall results across all nine in-person meetings.

Co-Benefits

Participants across the state thought making their community more resilience (37%) was an important benefit of reducing transportation emissions. Promoting equity and environmental justice was the second most common response (31%). Improving air quality ranked third (17%), followed by providing new/more mobility options (9%). This response was largely correlated with the aggregate input results for this question.

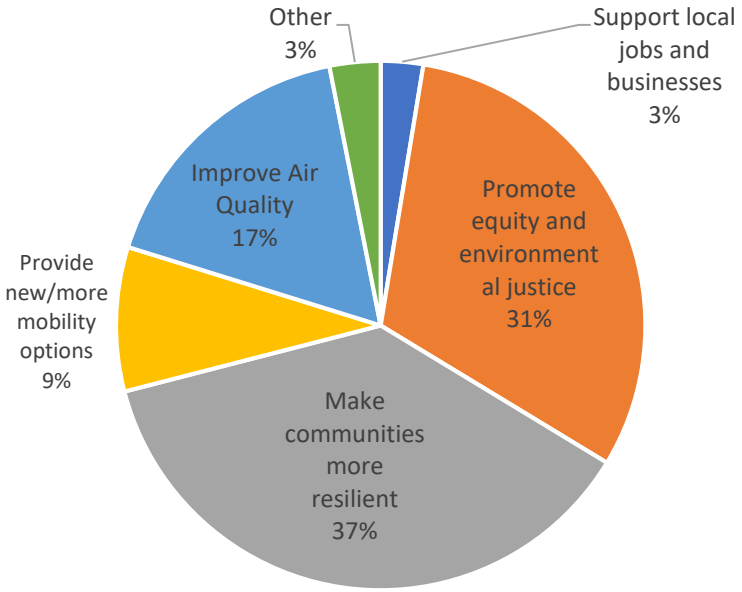


Figure 24. Responses from all the public meetings to the survey question identifying the most important co-benefits of decarbonizing the transportation system.

Environmental justice

Most in-person meeting responses chose "very important" (53%) or "important" (18%) regarding the role of environmental justice shaping action to reduce transportation GHG emission in Minnesota.

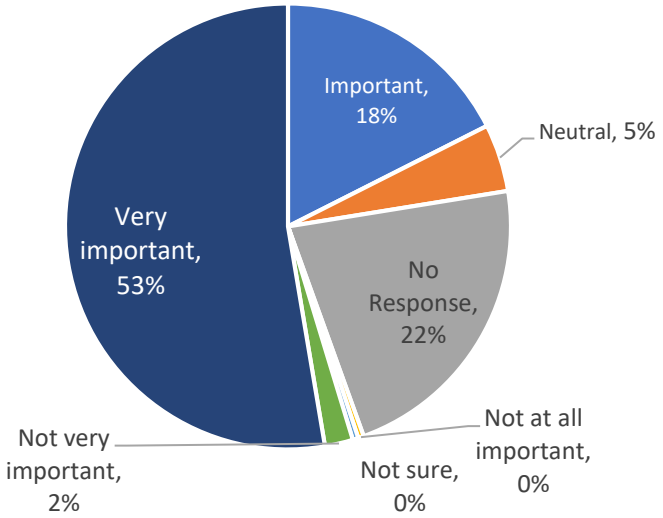


Figure 25. Responses to the survey question on the importance of environmental justice in shaping action, from all public meeting attendees.

Strategies and Technologies

In addition to perceptions of co-benefits and environmental justice, the engagement also probed the perception of different strategies and technologies that were used in the modeling to achieve emissions reductions in surface transportation. The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from "Very Unsupportive" (1) to "Very Supportive" (10), which translated to a scale of 1 to 10.

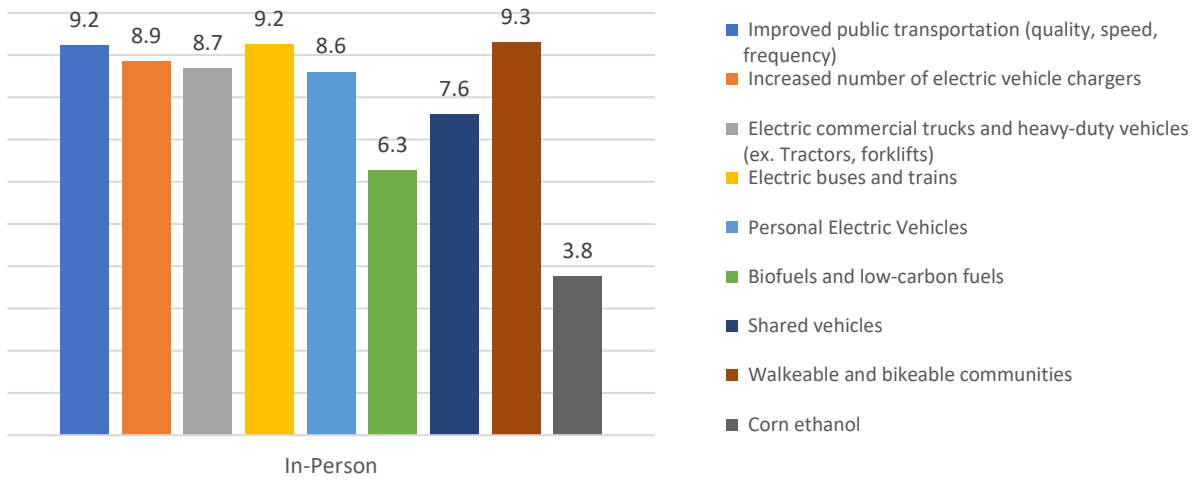


Figure 26. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies explored through the public engagement.

The three strategies and technologies that participants at the public meetings supported were the following:

- Walkable and bikeable communities (9.3 / 10)
- Electric buses and trains (9.2 / 10)
- Improved public transportation (quality, speed, frequency) (9.2 / 10)

A handful of strategies and technologies received moderate support, including:

- Increased number of electric vehicle chargers *(8.9 / 10)*
- Electric commercial trucks and heavy-duty vehicles *(8.7 / 10)*
- Personal electric vehicles *(8.6 / 10)*

The remaining strategies and technologies received the least support through the aggregate feedback, ranging from "very unsupportive" to "unsupportive" to "neutral."

- Shared vehicles *(7.6 / 10)*
- Biofuels and low-carbon fuels *(6.3 / 10)*
- Corn ethanol *(3.8 / 10)*

Policy

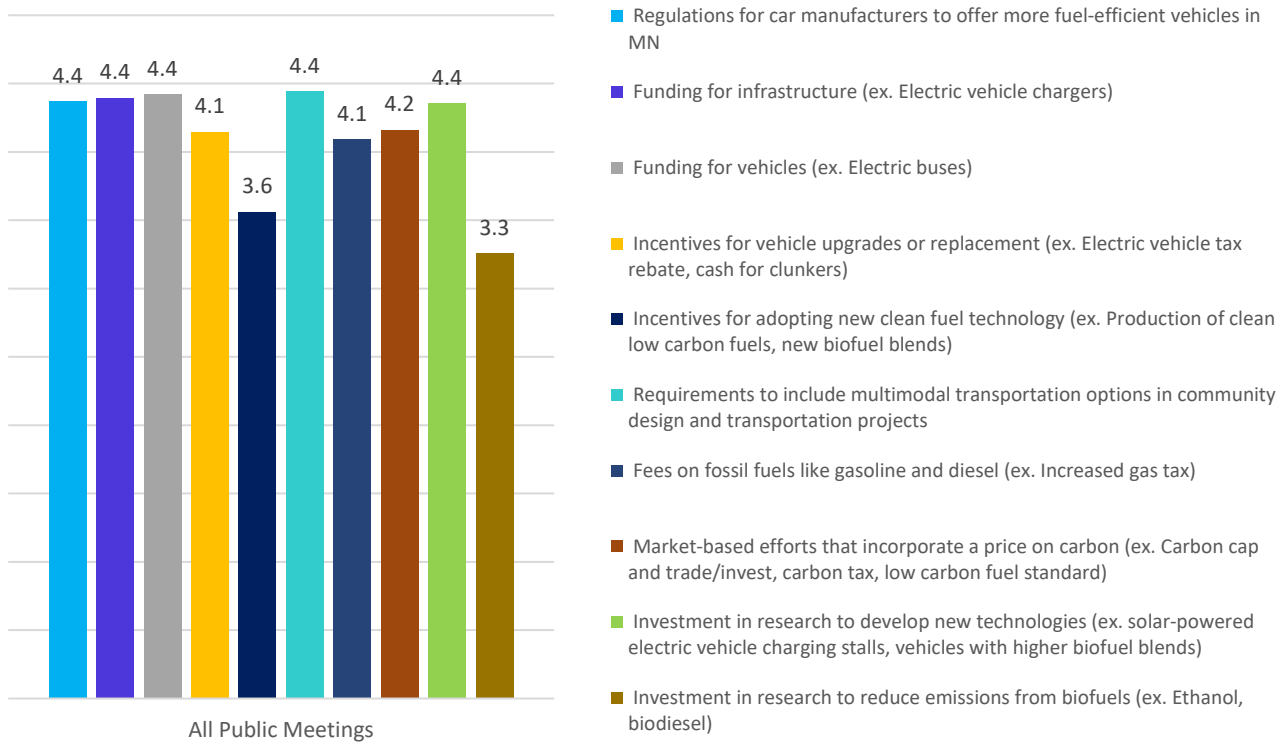


Figure 27. Overview of the relative rank of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" out of 5.

The policies that received the strongest support across all engagement were:

- Regulations for car manufacturers to offer more fuel-efficient vehicles in Minnesota *(4.4 / 5)*
- Funding for infrastructure (ex. Electric vehicle chargers) *(4.4 / 5)*
- Funding for vehicles (ex. Electric vehicles) *(4.4 / 5)*
- Requirements to include multimodal transportation options in community design and transportation projects *(4.4 / 5)*
- Investment in research to develop new technologies (ex. Solar-powered electric vehicle charging stalls, vehicles with higher biofuel blends) *(4.4 / 5)*

Some policies received moderate support, including:

- Market-based efforts that incorporate a price on carbon (ex. Carbon cap and trade/invest, carbon tax, low-carbon fuel standard) *(4.2 / 5)*
- Fees on fossil fuels like gasoline and diesel (ex. Increased gas tax) *(4.1 / 5)*
- Incentives for vehicle upgrades or replacements (ex. Electric vehicle tax rebate, cash for clunkers) *(4.1 / 5)*

The policies that received the lowest relative support, equivalent to a neutral ranking, included:

- Incentives for adopting new clean fuel technology (ex. Production of clean low-carbon fuels, new biofuel blends*) (3.6 / 5)*
- Investment in research to reduce emissions from biofuels (ex. Ethanol, biodiesel) *(3.3 / 5)*

Public Meeting Feedback Forms

Across all nine public in-person meetings, 106 meeting feedback forms were received in total. The following table outlines the number of feedback forms received from each community (two meetings for every community but Minneapolis), as well as the proportion of total meeting feedback forms that the community represents.

Community	Feedback Forms	% of All Meeting Feedback Forms
Bemidji	**19**	**18%**
Duluth	**18**	**17%**
Marshall	**9**	**9%**
Minneapolis	**39**	**37%**
Rochester	**20**	**19%**

Table 16. Summary table of meeting feedback forms by location and percentage of total

Takeaways

- Attendees largely heard about the meetings through a combination of advocacy organizing, state agencies, social media or word-of-mouth.
- 84% of people who provided feedback agreed that the meeting was useful in understanding transportation decarbonization in Minnesota
- 88% felt that the Mentimeter survey tool was easy to use
- Participants largely felt that their questions and concerns were heard (81%), that they were treated with respect (97%), and that their time was well used (88%)
- 57% of participants agreed that the discussion session was about the right length, 35% felt that it was too short

A copy of the meeting feedback form is available below. In addition, a glossary was provided at each meeting to help educate and provide clarification on common terms related to transportation decarbonization, and a “next steps” summary for participants to stay engaged

with the project was provided. A copy of both the glossary and the “next steps” summary is also available below.

Meeting Feedback Form

Meeting Feedback – How are we doing?

MNDOT aims to ensure that engagement with community members is useful and meaningful. Any input provided on what worked and what didn't work will help improve future engagement. Results from feedback will be collected and included in a final MNDOT report at the end of the public meeting period in August 2019. Thank you!

1. How did you hear about this session?
    a. E-mail from a state agency. Which agency: _____
    b. E-mail or notice from an organization. Which organization: _____
    c. Colleague / Work
    d. Social media
    e. Friend
    f. Other: _____

2. Are there other ways that you would like to be notified about future meetings or opportunities for input? Please list them.

3. Thinking about the meeting today, please register your level of agreement with the following statements:

	Agree	Neutral	Disagree	Don't Know
The Power Point presentation was useful in understanding transportation decarbonization in Minnesota				
The Mentimeter electronic polling was easy to use				
I felt that my questions and concerns were heard				
I was treated with respect				
My time was used well				
The discussion portion was too short				
The discussion portion was about right				

4. Any additional feedback on the content or form of the meeting?

5. Are there any additional comments that you would like to share with the meeting organizers on transportation decarbonization in Minnesota? ***Please use back of page to respond.***

Thank you!

Glossary of useful terms and acronyms related to reducing greenhouse gas emissions in transportation

Greenhouse Gas emissions (GHG): A gas such as Carbon Dioxide that contributes to global atmospheric warming through the absorption of infrared radiation.

Technologies

Biodiesel: Biodiesel is defined as a renewable, biodegradable, mono alkyl ester combustible liquid fuel that is derived from agricultural plant oils or animal fats and meets ASTM specification D6751-11b for pure biodiesel (B100). (Reference Minnesota Statutes 239.761 and 239.77)

Electric Vehicle (EV): A broad category that includes all vehicles that are fully powered by Electricity or an Electric Motor.

EVSE (Electric Vehicle Supply Equipment): Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs including BEVs and PHEVs.

Hybrid Electric vehicle (HEV): An HEV utilizes a dual system of electric propulsion and an internal combustion engine.

Internal Combustion Engine (ICE): An ICE is powered by combustible fuel, often petroleum or natural gas products. Most vehicles that you see on the roads today are internal combustion engine vehicles.

Mobile refrigerant: Mobile refrigerants are used during transportation of certain types of freight, to keep cargo cool, and for air conditioning in all types of vehicles. Many modern mobile refrigerants are responsible for potent greenhouse gas emissions.

Plug-in Hybrid Electric Vehicle (P-HEV): PHEVs contain a battery that can be charged with an external electric power source. PHEV's are a mixture of electric vehicles and conventional engine vehicles.

Zero Emission Vehicle (ZEV): A vehicle that emits no exhaust gas from the onboard source of power

Low Emission vehicle (LEV): A motor vehicle that emits relatively low levels of motor vehicle emissions. The term may be used in a general sense, but in some states, like California, it is defined in air quality statutes.

Advanced (also known as Second-Generation) Biofuel: Second-generation biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of non-food biomass. Biomass in this context means plant materials and animal waste used especially as a source of fuel.

Corn Ethanol: Ethanol produced from born biomass; the main source of ethanol fuel in the United States.

Low-Carbon Fuel: A transportation fuel with lower carbon intensity (e.g. lower emissions) than conventional petroleum fuels. The term is often used to describe a type of fuel characterized under a low carbon fuel standard.

Policies

Next Generation Energy Act (2007): Minnesota law passed in 2007 that sets greenhouse gas emission reduction goals across sectors. For transportation, the law sets targets, using 2005 emissions as a starting point, for a 30% reduction by 2025 and an 80% reduction in emissions by 2050.

Minnesota Biofuel Blend Mandate: Minnesota law requiring that all gasoline sold or offered for sale in Minnesota must contain at least 10% corn-based ethanol by volume, or 10% other biofuel authorized by EPA.

Minnesota Biodiesel Blend Mandate: Requires that diesel fuel sold in the state from April through September must be at least 20% biofuel, and at least 5% biofuel during the rest of the year.

Federal Fuel Efficiency Standards: U.S. policy that requires reductions in the average global warming emissions of new passenger cars and light trucks every year. Currently in Phase II, the program requires new passengers and light trucks to achieve the equivalent of 54.5 miles per gallon (mpg) on average by 2025.

Low Carbon Fuel Standard: A low-carbon fuel standard (LCFS) is a law or policy enacted to reduce the carbon intensity (e.g. emissions) in transportation fuels as compared to conventional petroleum fuels, such as gasoline and diesel. In practice, the most common low-carbon fuels are alternative fuels and cleaner fossil fuels, such as natural gas (CNG and LPG).

Minnesota Department of Transportation Pathways to Decarbonization

Next steps and ways to stay informed

Thank you for your participation in today's meeting. We hope you felt that the presentation was useful and that your comments were heard. Please take note of the next steps in the process and ways that you can stay informed and engaged.

For the information listed below and for additional updates see the MnDOT Transportation Pathways to Decarbonization Project webpage at
http://www.dot.state.mn.us/sustainability/pathways.html

- MnDOT and its partners will compile and summarize all input collected today. Meeting and public input summaries will be posted on the MnDOT Transportation Pathways Project website under "Public Stakeholder Meetings".

- You can find updates about the project and summaries of the public input on MnDOT's website.

- For those who could not attend a public meeting, MnDOT is also collecting input and feedback through:
    1. an on-line survey, open through **June 19th** on the MnDOT Transportation Pathways website.
    2. an on-line open comment portal, open through **June 19th**, is also available on the MnDOT website.

- A complete report of both the modeling methodologies and results, as well as the input gathered from the public meetings, the public webinar, the online survey, and the open comment portal, will be finalized and available on the MnDOT webpage in August 2019.

- If you have any further questions, please contact Tim Sexton, MnDOT, timothy.sexton@state.mn.us

- Stay up-to-date on future MnDOT work on decarbonizing the transportation sector at http://www.dot.state.mn.us/sustainability/pathways.html

The purpose of this project is to explore options and gather input on ways that Minnesota can start to think about achieving decarbonization goals in line with the Next Generation Energy Act (2007) reduction targets. We hope that you can stay active and engaged in future conversations on this topic and look forward to any additional thoughts or input that you may have.

Appendix 7. Individual In-Person Meeting Summaries

Minneapolis

One meeting was held in Minneapolis on Tuesday, June 4 from 6:00 pm to 8:00 pm at the Minneapolis Urban League in North Minneapolis.

Who We Heard From

There were 65 attendees who participated in the listening session, in addition to MnDOT staff, state agency staff, and facilitators. The following provides a summary of the demographics represented by the Minneapolis meeting participants.

Location

Most participants came from the Twin Cities metro area or from the east-central region of Minnesota.

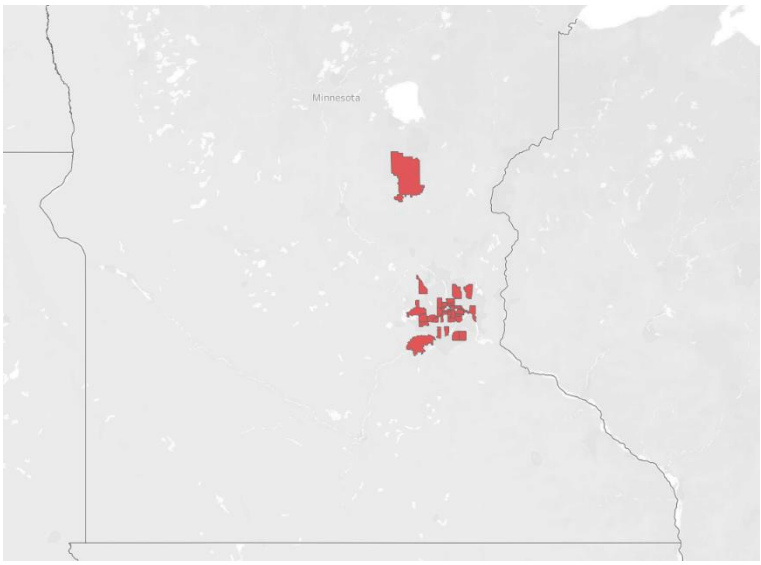


Figure 28. Map of zip codes represented by participants of the Minneapolis meeting.

Age

Of the 65 responses to the in-meeting survey, 48% of participants were between the ages of 31 and 65 years old. Those over 65 years old represented 17% of the group, as did those between the ages of 18-31 years old. This breakdown of age is largely consistent with the demographics of the aggregate input received

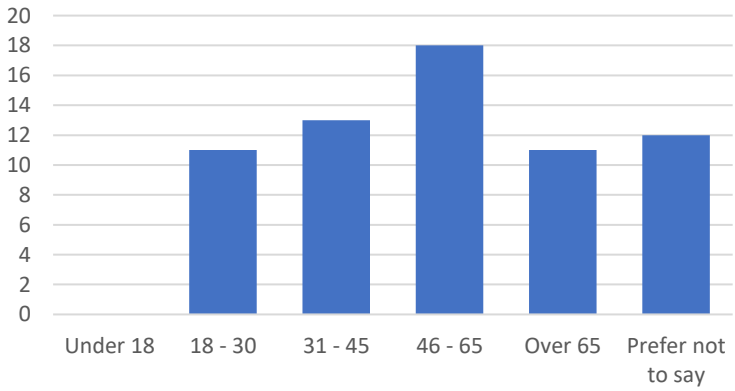


Figure 29. Age of participants at the Minneapolis meeting.

Gender

Females represented 46% of the participants while males accounted for 32%. Additionally, 18% of participants preferred not to say their age. Only 3% of individuals identified as non-binary. The gender demographics are largely consistent with the aggregate input demographics.

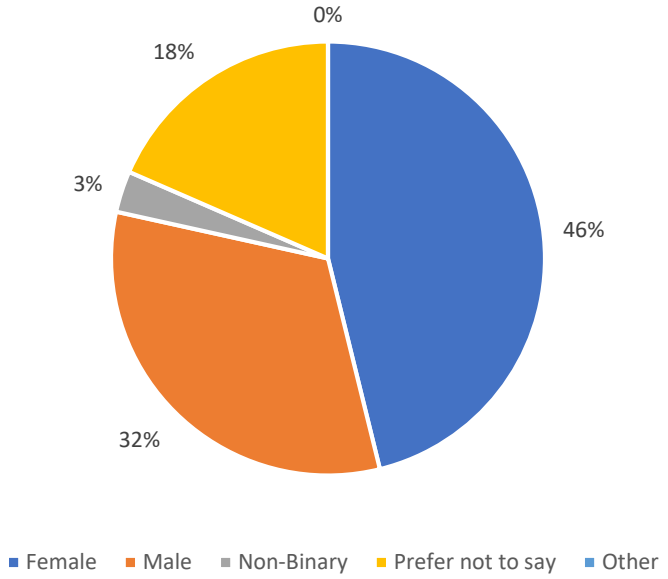


Figure 30. Gender demographics at the Minneapolis meeting

Race

Most participants at the Minneapolis meeting identified as White/Caucasian (78%). 20% of participants preferred not to say. 1% of participants identified at Asian. The racial demogrpahics are largely consistent with the aggregate input demographics.

White/Caucasian	51	78%
Other	0	0%
Asian	1	2%
Black/African-American	0	0%
Hispanic/Latinx	0	0%
Prefer not to say	13	20%
American Indian/Native American	0	0%
More than One Race	0	0%

Table 17. Race demographics for Minneapolis meetings participants.

Vocation / Work

Of the participants at the Minneapolis meeting, the majority identified as working for the government. Other high-ranking work categories included that that are retired (17%), self-employed (11%) and employed by a non-profit (11%). This was similar to the aggregated input, however, those results showed retired participants as the highest ranking category, whereas Minneapolis participants have stronger representation from government employees.

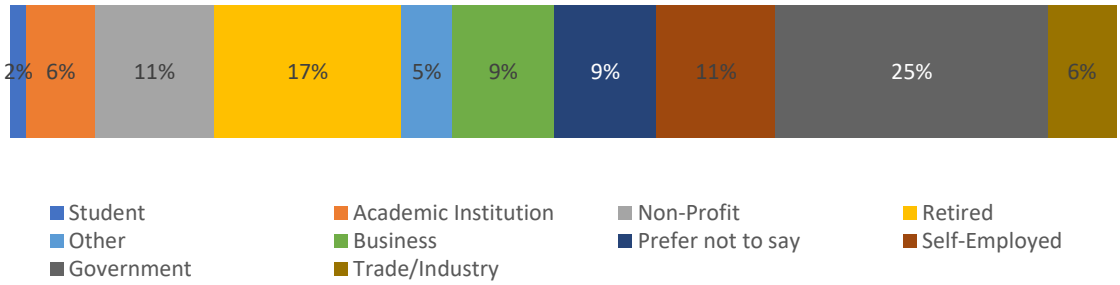


Figure 31. Place of work or vocation for participants at the Minneapolis meeting.

Mode of Transportation

Participants responded to the survey question: How do you most frequently get around? Participants chose gasoline vehicle (32%) most often, followed by other (18%) and multiple modes (17%). These results are largely consistent with the aggregate results.

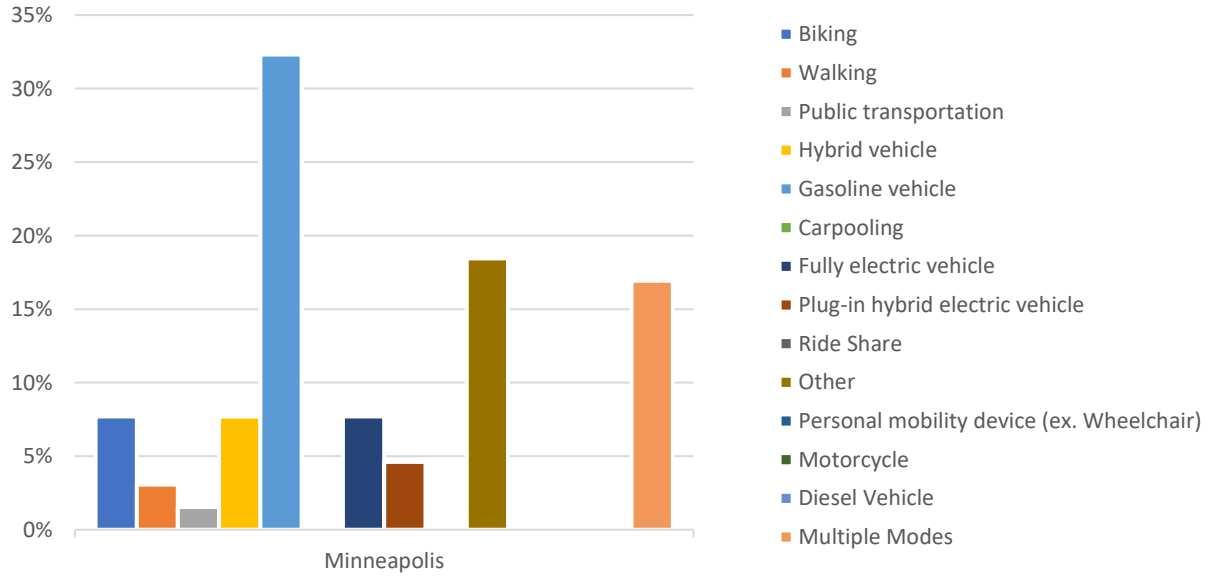


Figure 32. Modes of transportation used most frequently used by Minneapolis meeting participants.

Co-benefits

Participants at the Minneapolis meeting ranked "Make communities more resilient" first (39%), followed by "improve air quality" (33%). "Provide new/more mobility options" was the third most common response (17%). These results are largely consistent with the aggregate results.

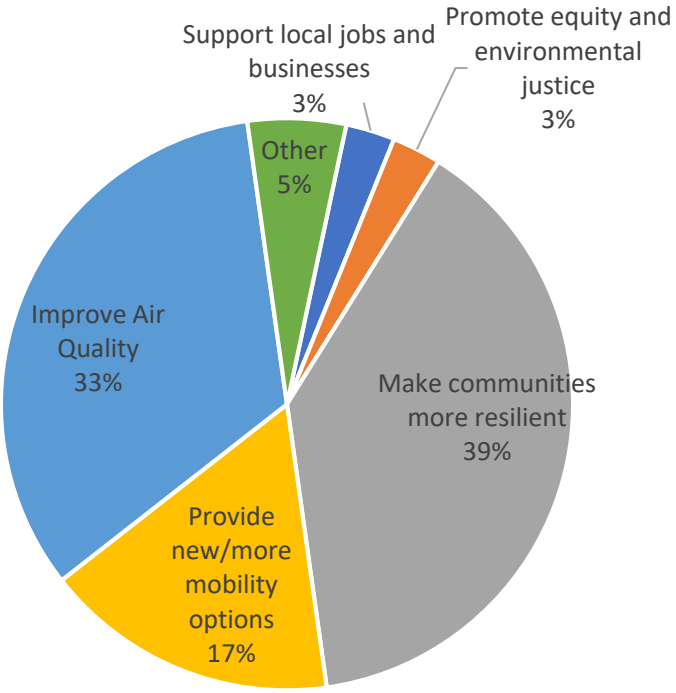


Figure 33. Responses from all the Minneapolis meeting survey question identifying the most important co-benefits of decarbonizing the transportation system.

Environmental Justice

When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 81% of all respondents noted that it was either "Very Important" (69%) or "Important" (12%).

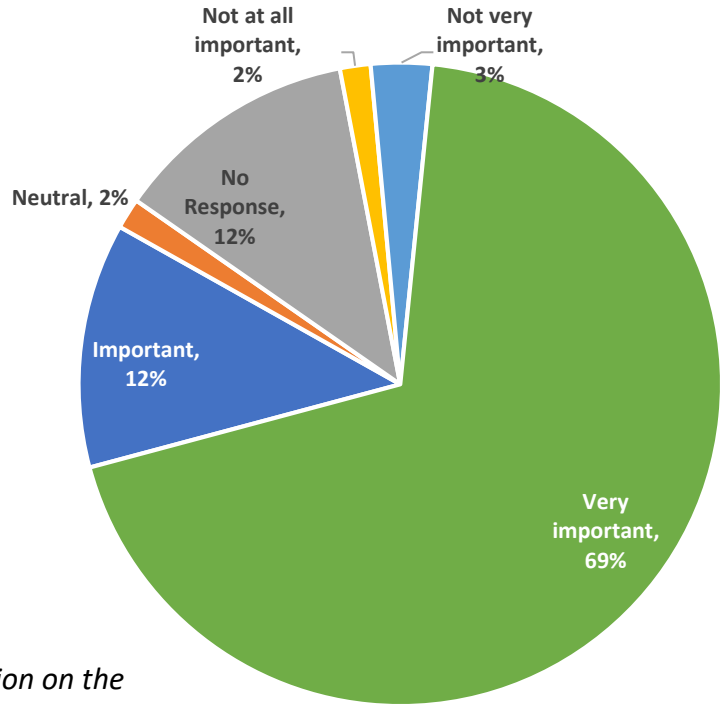


Figure 34. Responses to the survey question on the importance of environmental justice in shaping action, from Minneapolis meeting participants.

Opportunities

At each public meeting, participants were able to share opportunities identified through three post-it notes, as well as through the live mentimeter polling exercise. The results for Minneapolis identified that the top three most popular opportunity sectors included public transportation (18%), vehicle electrification (15%), and mobility infrastructure (11%).

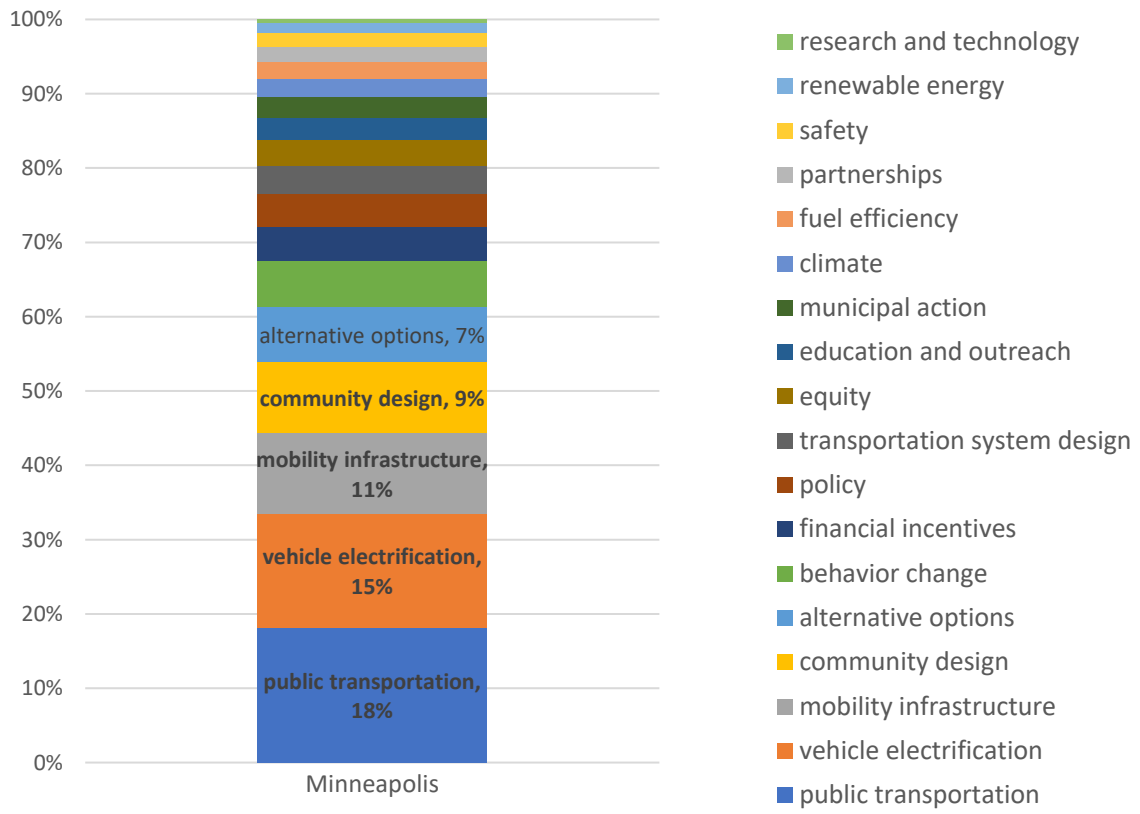


Figure 35. Breakdown of opportunities (collected through post-it notes / small group discussion and live survey activity) from the Minneapolis public meeting

Strategies and Technologies

The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from “Very Unsupportive” (1) to “Very Supportive” (10), which translated to a scale of 1 to 10.

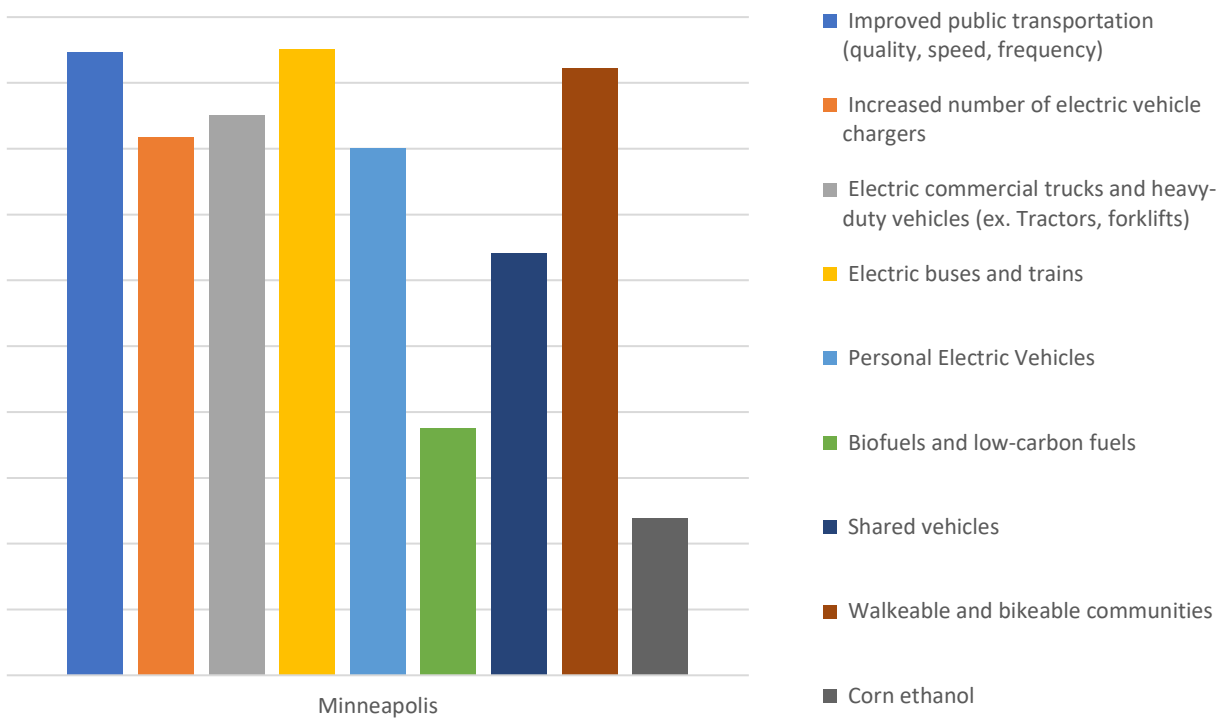


Figure 36. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies from Minneapolis meeting participants.

Policies

Input was provided by ranking individual policy options from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

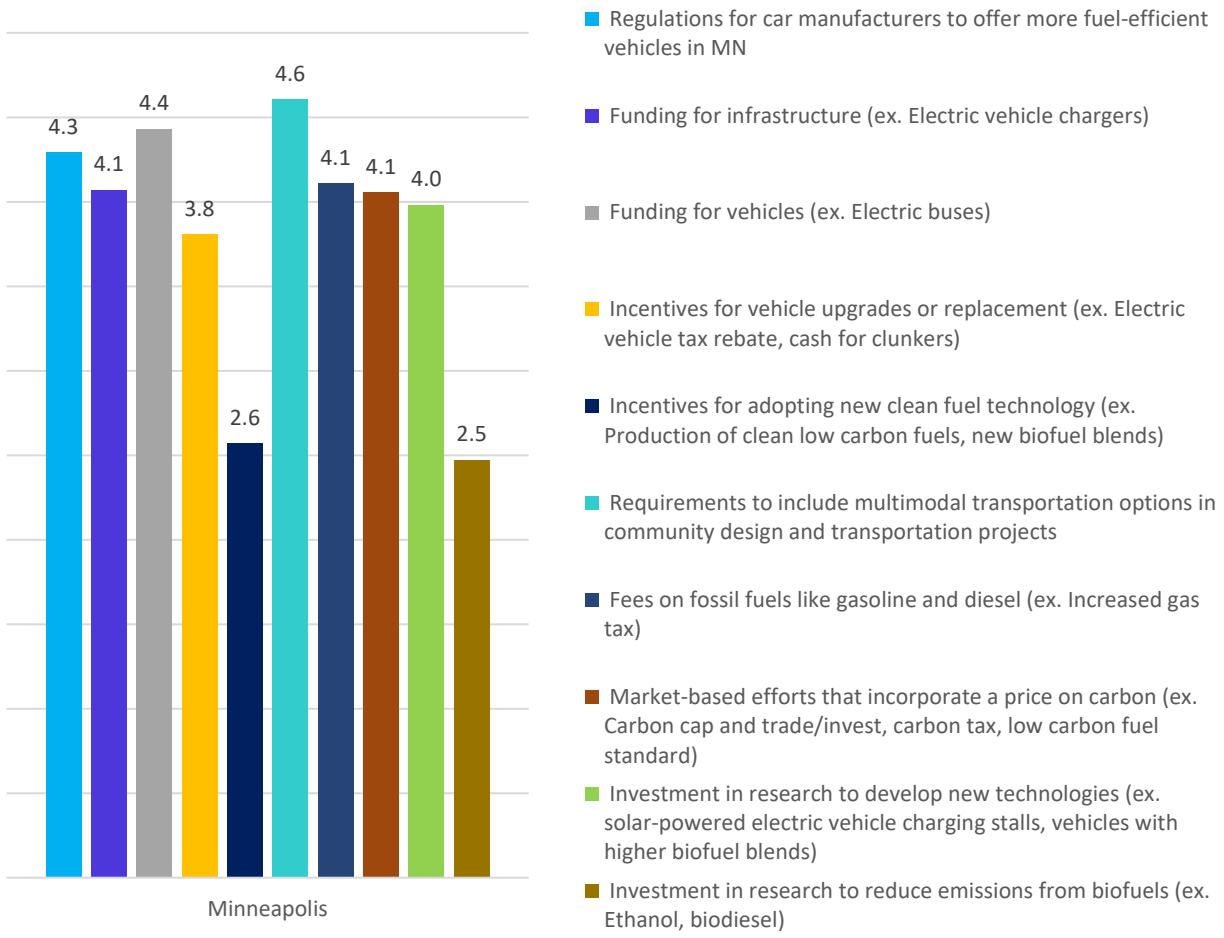


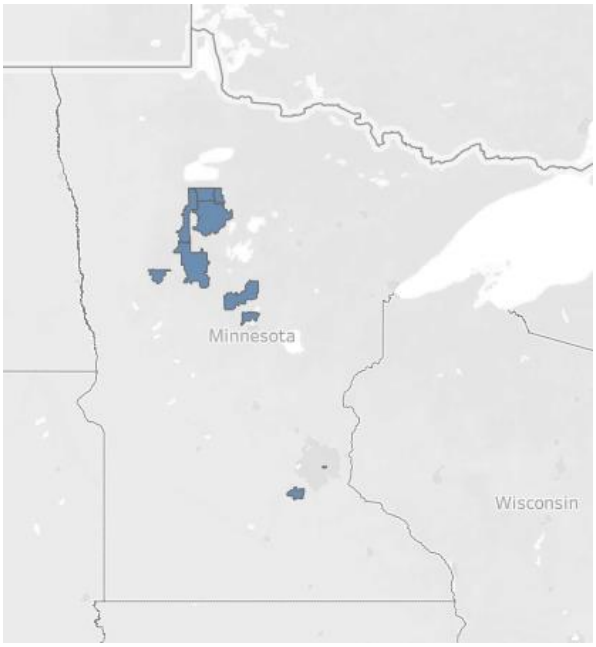
Figure 37. The relative rank (1-5) of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" from Minneapolis participants.

Bemidji

Two meetings were held in Bemidji on Wednesday, June 5 from 2:30 pm to 4:30 pm and from 6:00 pm to 8:00 pm at Bemidji State University in the Crying Wolf Room.

Between the two meetings, there were 41 attendees who participated in the listening sessions, in addition to a handful of MnDOT staff, state agency staff, and facilitators. Of those participants, eight attendees opted to either not participate in the interactive survey, or to take a paper version of the survey.

Location



The map shows the unique zip codes of attendees to the Bemidji public meetings. Most attendees came from Bemidji or the surrounding area. A few participants came from other parts of the state.

Figure 38. Map of zip codes represented at the Bemidji meeting.

Age

Participants from the Bemidji meetings were largely between the ages of 46 and 65. There were no participants present under the age of 18.

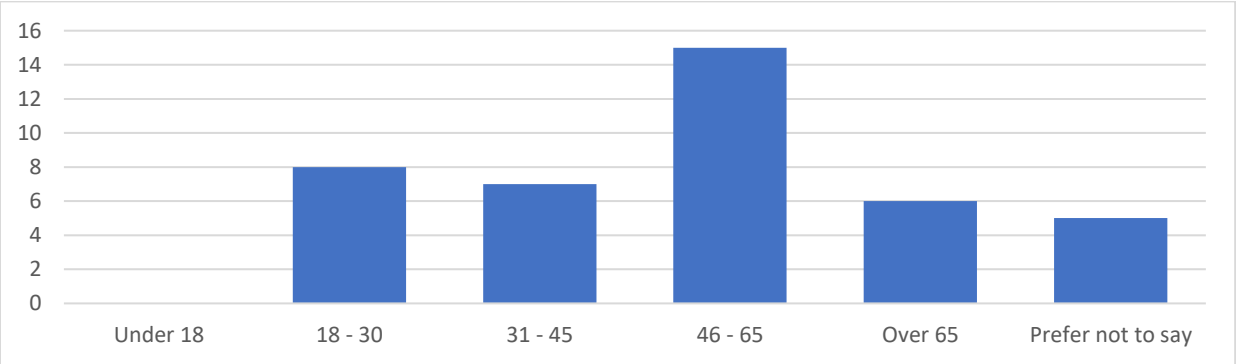


Figure 39. Age of participants at the Bemidji meetings.

Gender

Participants at the Bemidji meetings identified as male (41%) and female (44%). 12% of participants preferred not to say their age, while a small proportion identified as non-binary or other.

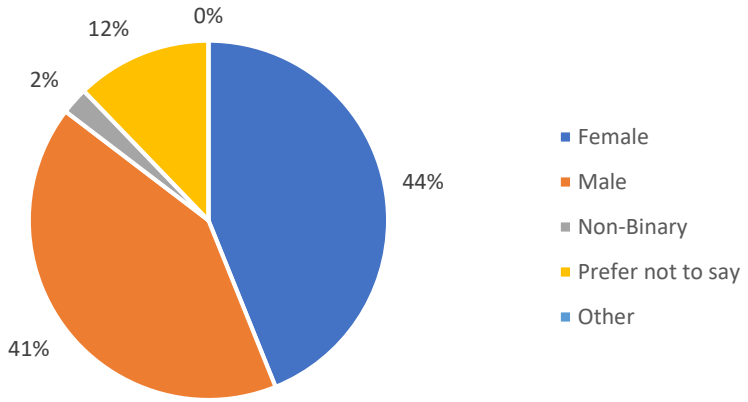


Figure 40. Gender demographics of participants at the Bemidji meetings.

Race

White/Caucasian	31	76%
Other	1	2%
Asian	1	2%
Black/African-American	0	0%
Hispanic/Latinx	0	0%
Prefer not to say	5	12%
American Indian/Native American	2	5%
More than One Race	1	2%

Most participants from the Bemidji meeting identified as white/Caucasian (76%), while 12% preferred not to disclose. The remaining 12% of participants identified as non-white, other, or multiracial.

Table 18. Racial demographics of Bemidji meeting participants.

Vocation / Work

One in five participants in the Bemidji community identified as retired (20%). People who

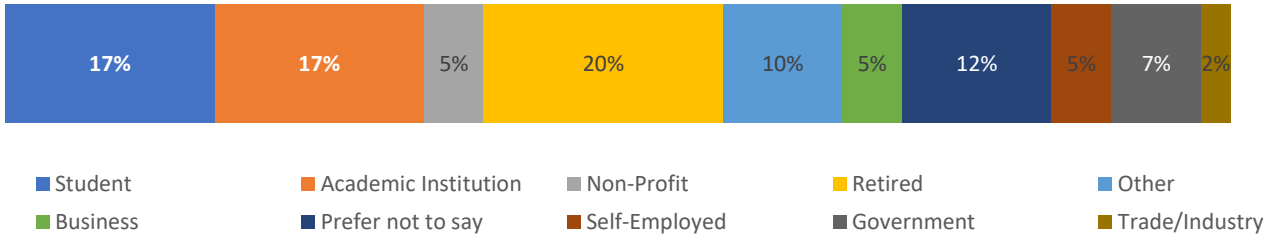


Figure 41. Place of work or vocation for Bemidji meeting participants

Mode of Transportation

Participants responded to the question: How do you most frequently get around? Participants chose gasoline vehicles (44%) most often, followed by fully electric vehicles (12%). Tied for third was other (10%) and walking (10%).

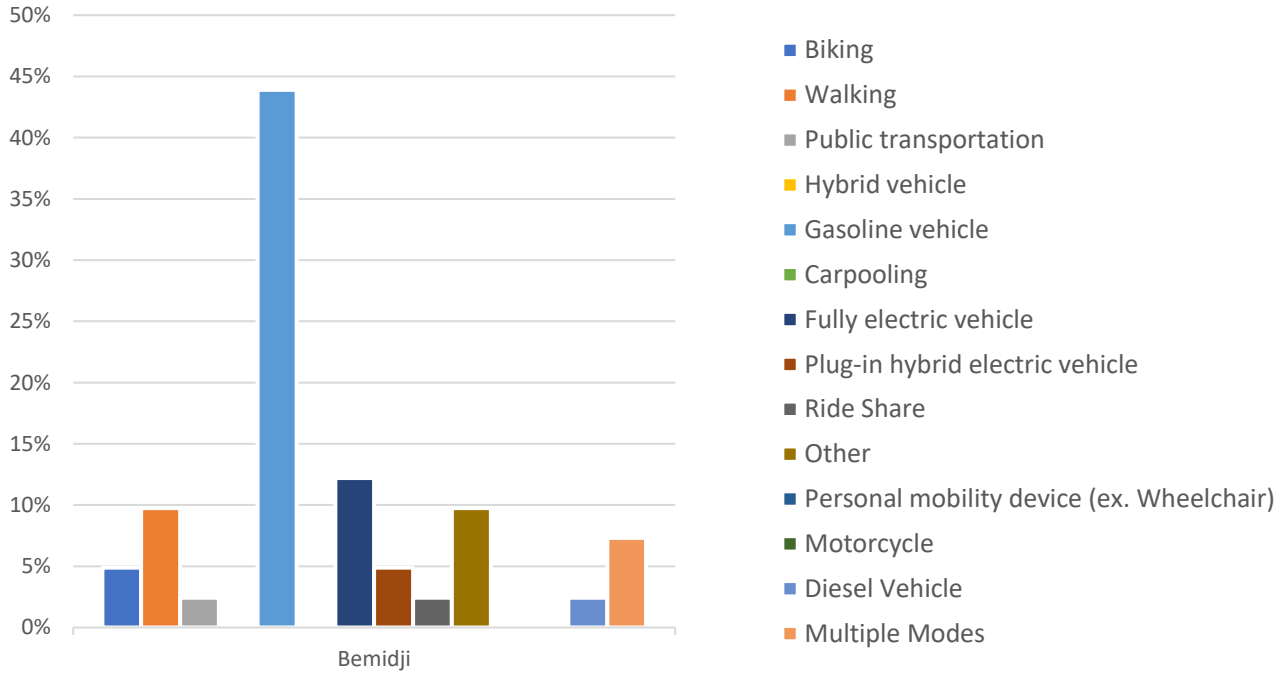


Figure 42. Modes of transportation used most frequently by Bemidji meeting participants

Co-Benefits

When asked what the most important co-benefits to reducing GHG emissions from transportation, respondents chose “Make communities more resilient by reducing impacts of climate change” most frequently (67%), second to “promote equity and environmental justice” which was identified by 19% of respondents.

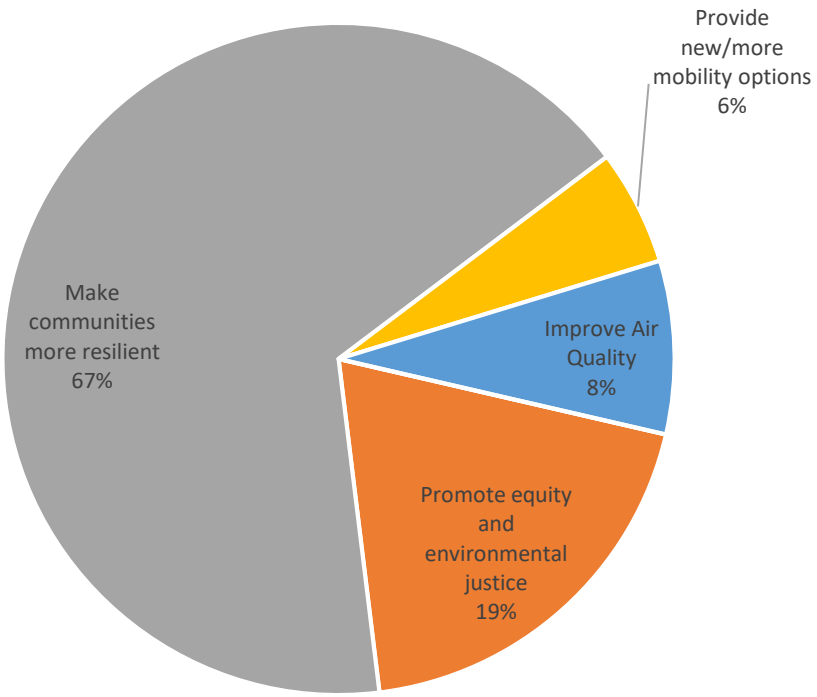


Figure 43. Responses from all the Bemidji meetings to the survey question identifying the most important co-benefits of decarbonizing the transportation system.

Environmental Justice

When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 80% of all respondents noted that it was either "Very Important" (68%) or "Important" (12%). The remaining respondents noted that they were anywhere from "neutral" to "not at all important."

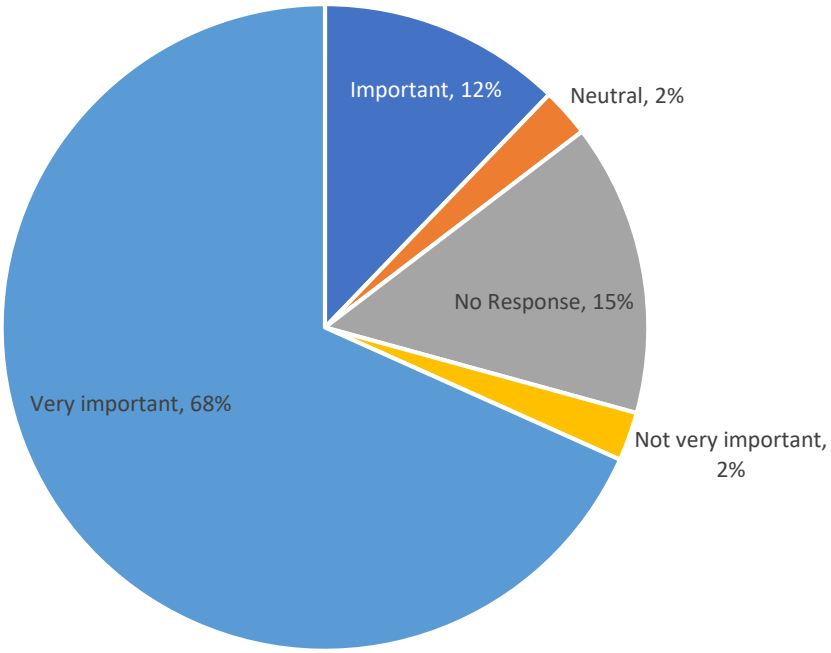


Figure 44. Responses to the survey question on the importance of environmental justice in shaping action, from Bemidji meeting participants.

Opportunities

At each public meeting, participants were able to share opportunities identified through three post-it notes, as well as through the live mentimeter polling exercise. The results for Minneapolis identified that the top three most popular opportunity sectors included behavior change (16%), mobility infrastructure (15%), and vehicle electrification (11%).

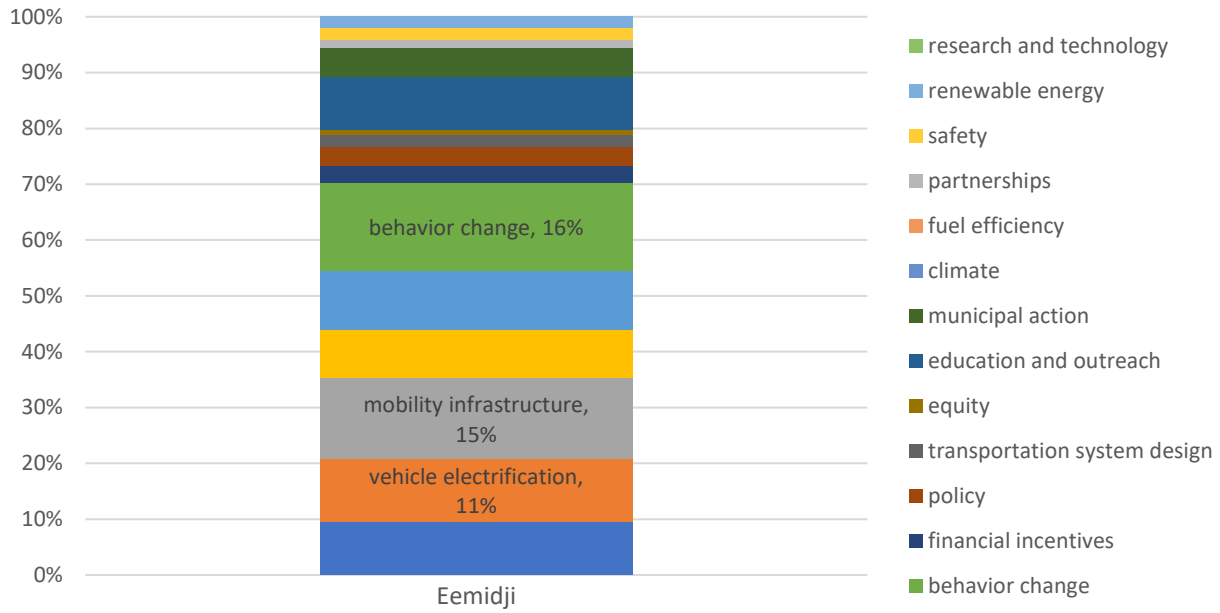


Figure 45. Breakdown of opportunities (collected through post-it notes / small group discussion and live survey activity) from the Bemidji public meeting

Strategies and Technologies

The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from "Very Unsupportive" (1) to "Very Supportive" (10), which translated to a scale of 1 to 10.

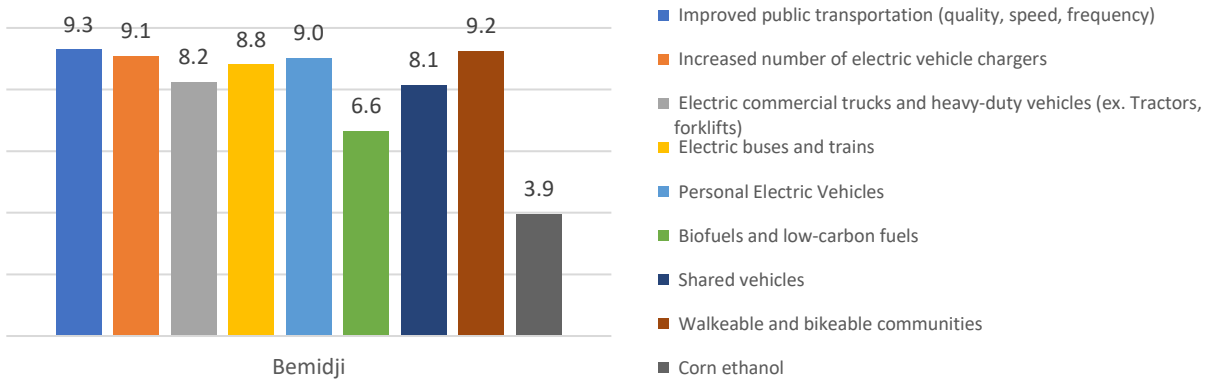


Figure 46. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies from Bemidji meeting participants.

Policies

Input was provided by ranking individual policy options from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

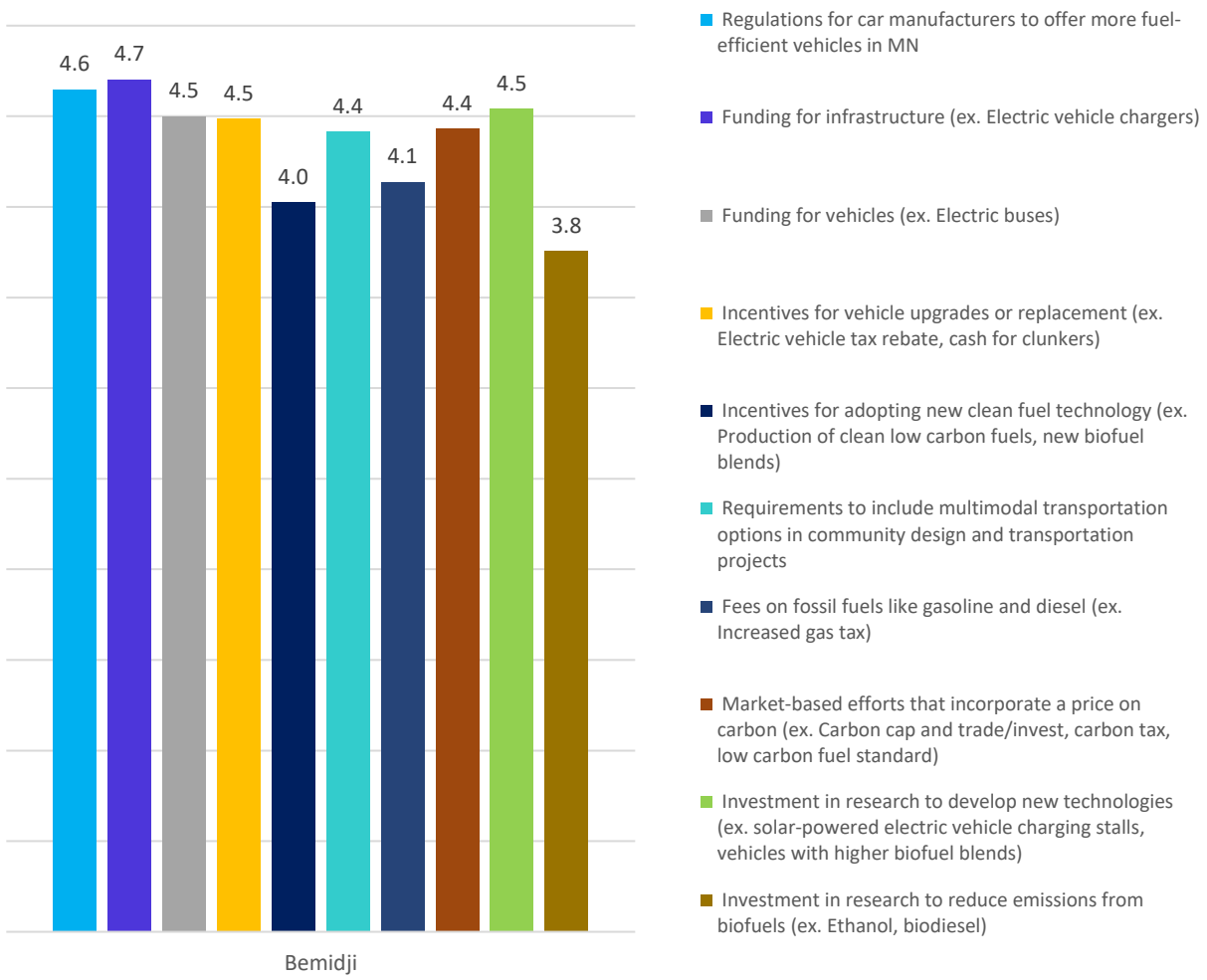


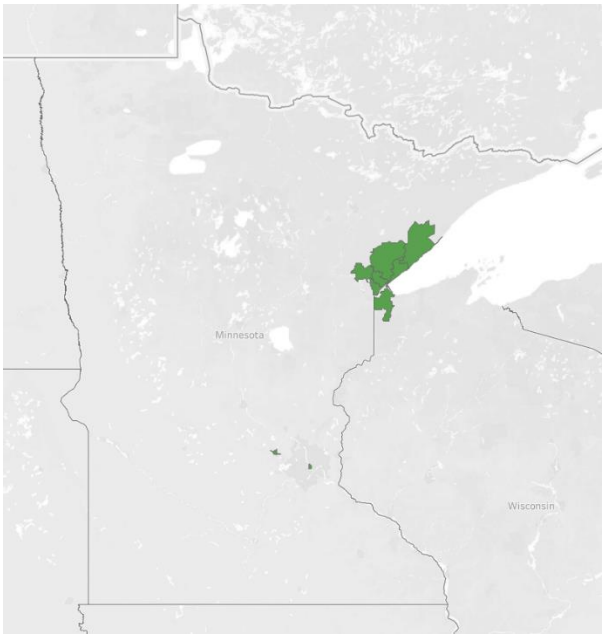
Figure 47. The relative rank (1-5) of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" from Bemidji meeting participants.

Duluth

Two meetings were held in Duluth on Thursday, June 6 from 2:30 pm to 4:30 pm and from 6:00 pm to 8:00 pm at the American Indian Community and Housing Organization.

Between the two meetings, there were 46 attendees who participated in the listening sessions, in addition to a handful of MnDOT staff, state agency staff, and facilitators. Of those participants, five attendees opted to either not participate in the interactive survey, or to take a paper version of the survey.

Location



Most participants came from Duluth or a nearby community**.**

Figure 48. Map of zip codes represented at all the Duluth meetings.

Age

The largest age bracket who engaged in the Duluth community was between 46 and 65. There were no participants under the age of 18.

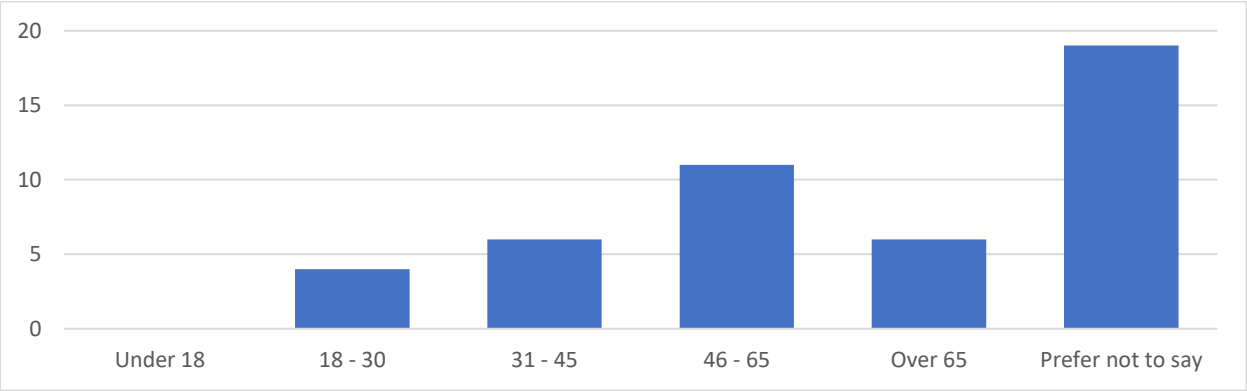


*Figure 49**.** Age of participants at the Duluth meetings.*

Gender

48% of participants preferred not to say their age. Females represented 35% of responses and males represented 17%.

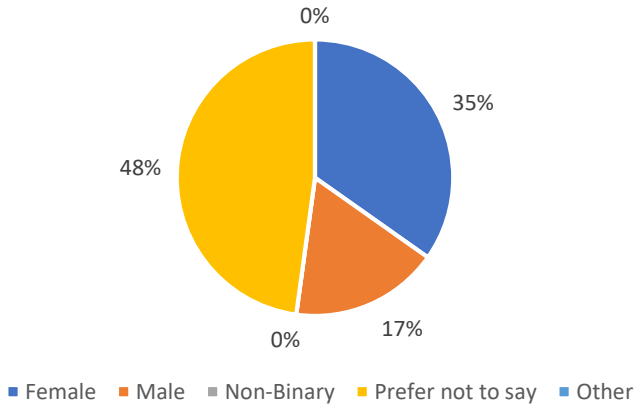


Figure 50. Gender demographics of participants at the Duluth meetings.

Race

50% of participants in Duluth identified as white/Caucasian. 41% of participants preferred not to say, 7% identified as more than one race, and 2% identified an Asian.

White/Caucasian	23	50%
Other	0	0%
Asian	1	2%
Black/African-American	0	0%
Hispanic/Latinx	0	0%
Prefer not to say	19	41%
American Indian/Native American	0	0%
More than One Race	3	7%

Table 19. Race demographics of Duluth meeting participants.

Vocation / Work

30% preferred not to say. Of those that shared where they worked, 22% worked for a non-profit, 17% worked for the government, and 15% were retired.

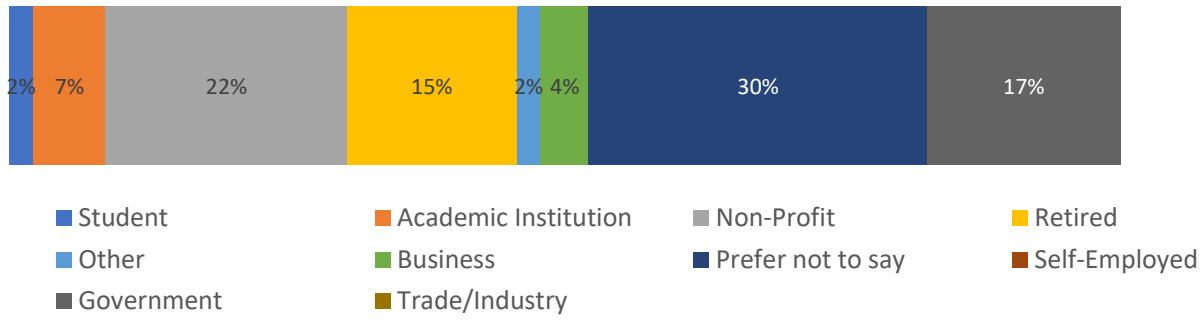


Figure 51. Place of work or vocation for Duluth meeting participants.

Mode of Transportation

Participants chose other (43%) most often, followed by gasoline vehicles (28%).

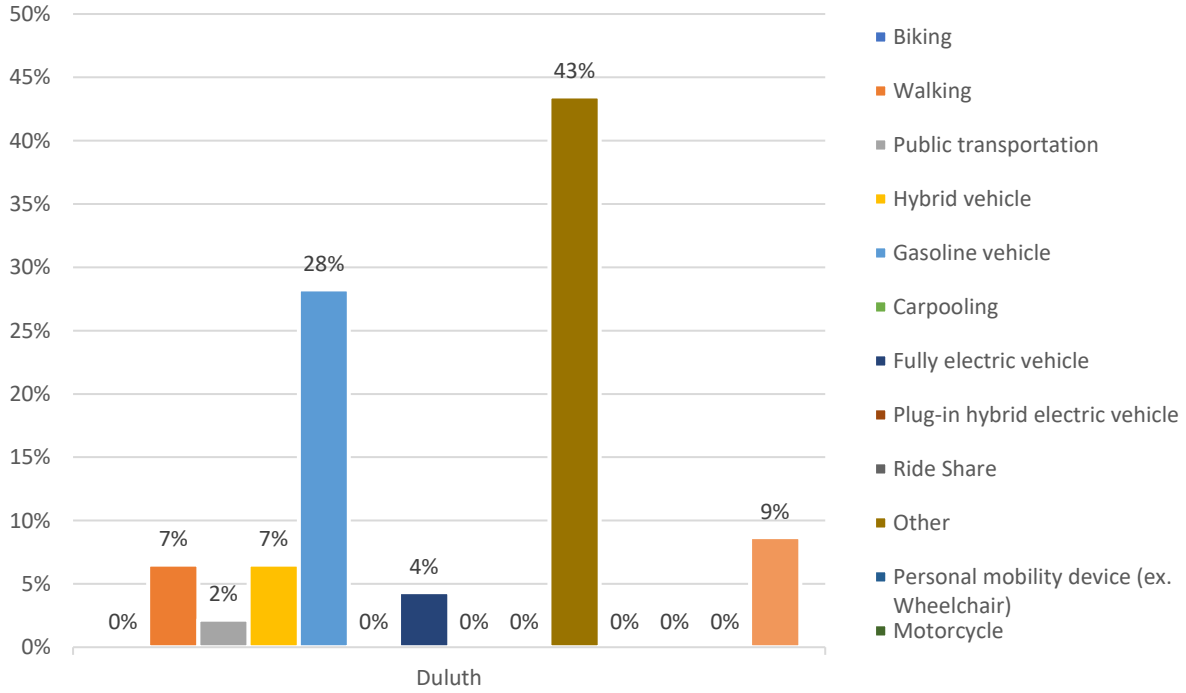


Figure 52. Modes of transportation used most frequently by Duluth meeting participants

Co-Benefits

Participants at the Duluth meeting ranked "Make communities more resilient" first (41%), followed by "promote equity and environmental justice" (28%), while "improve air quality" (17%) was third. These results are largely consistent with the aggregate results.

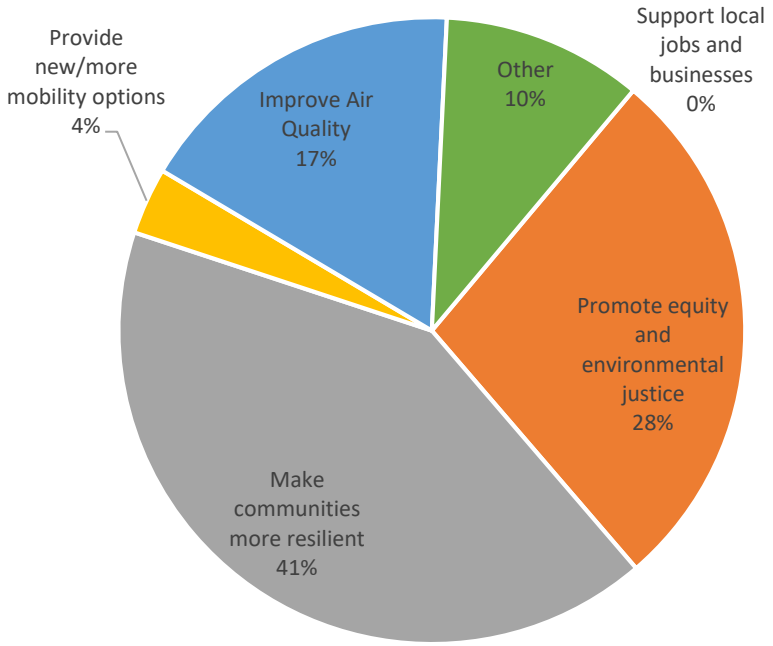


Figure 53. Responses from all the Duluth meetings to the survey question identifying the most important co-benefits of decarbonizing the transportation system.

Environmental Justice

When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 61% of all respondents noted that it was either "Very Important" (41%) or "Important" (20%). 37% of respondents preferred not to respond. This was the lowest total proportion of respondents for a community that identified environmental justice as "important" or "very important."

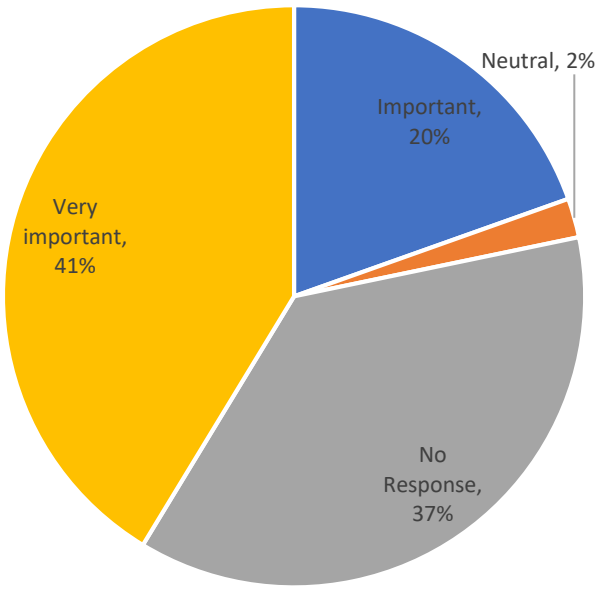


Figure 54. Responses to the survey question on the importance of environmental justice in shaping action, from Duluth meeting

Opportunities

At each public meeting, participants were able to share opportunities identified through three post-it notes, as well as through the live mentimeter polling exercise. The results for Minneapolis identified that the top three most popular opportunity sectors included vehicle electrification (17%), public transportation (16%), and mobility infrastructure (13%). This was largely consistent with aggregate input results.

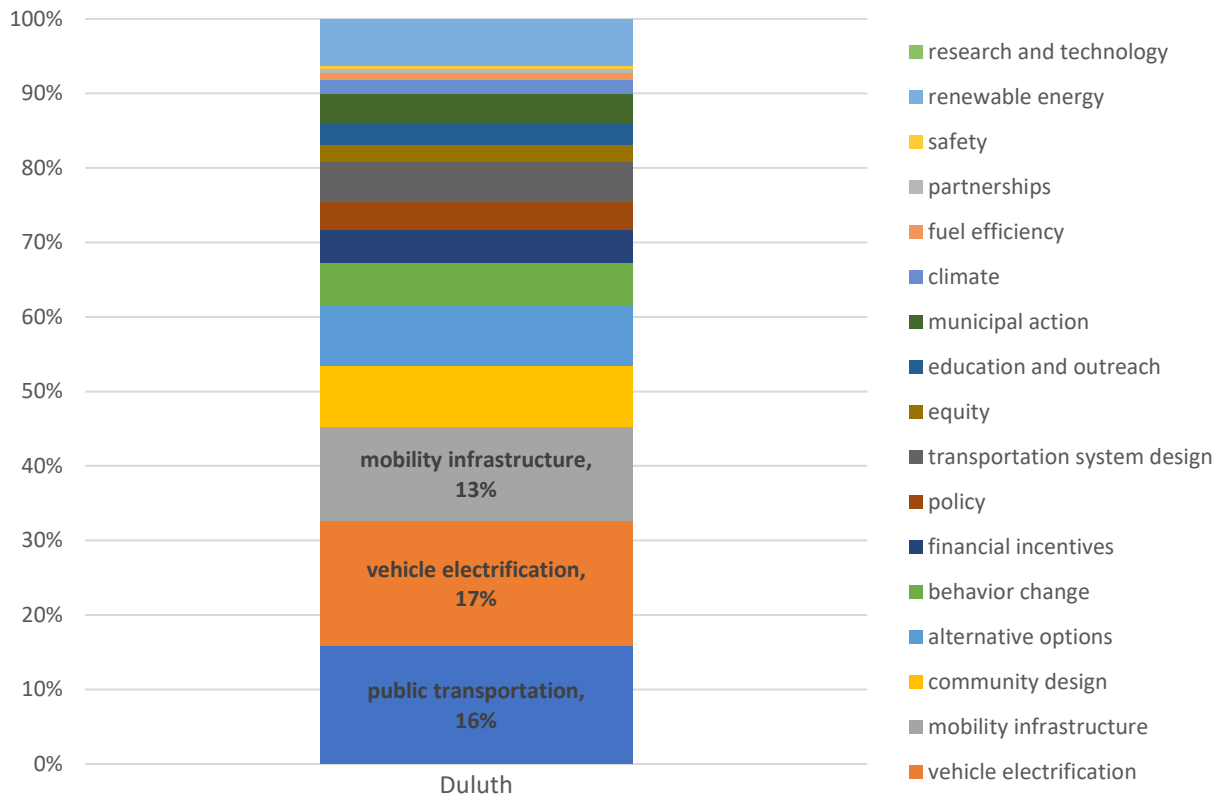


Figure 55. Breakdown of opportunities (collected through post-it notes / small group discussion and live survey activity) from the Duluth public meeting

Strategies and Technologies

The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from “Very Unsupportive” (1) to “Very Supportive” (10), which translated to a scale of 1 to 10.

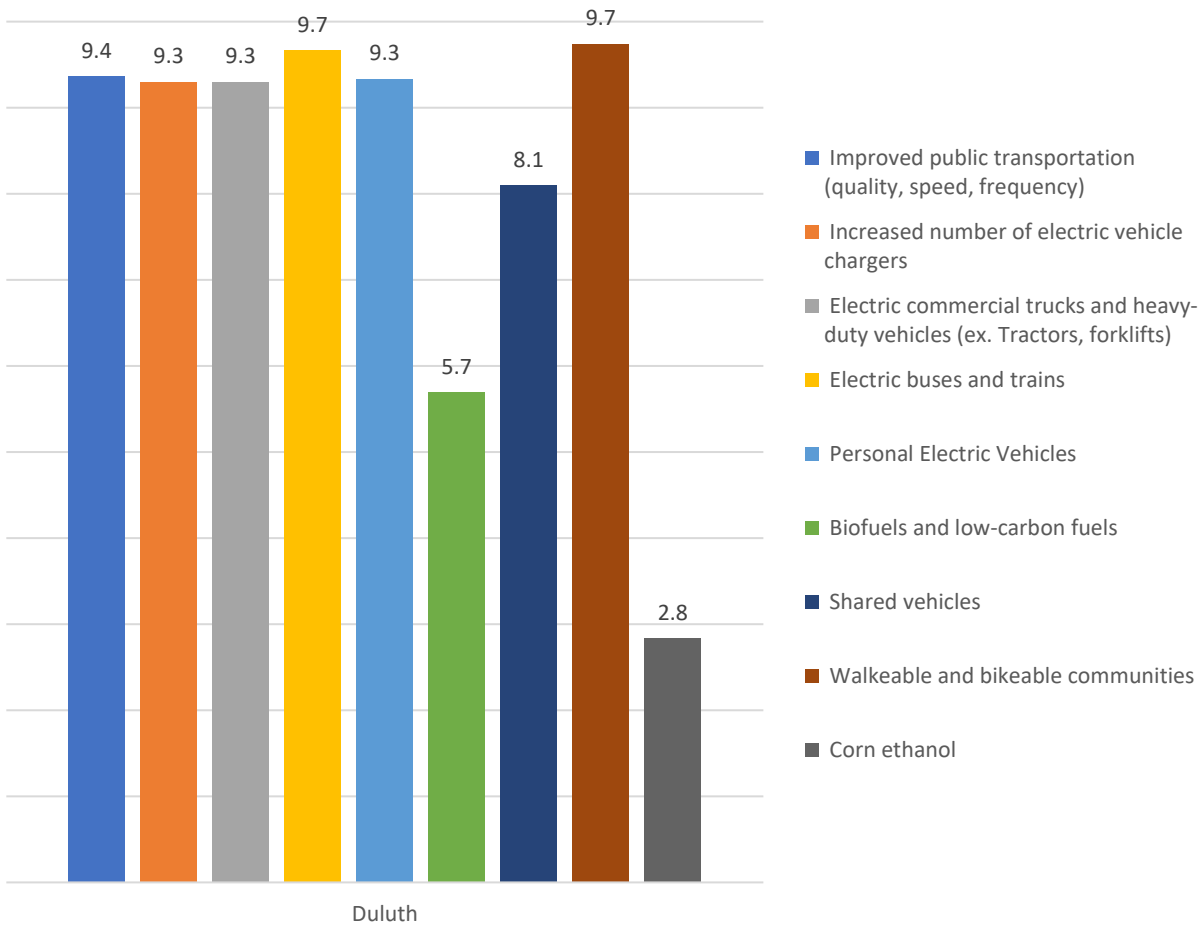


Figure 56. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies from Duluth meeting participants.

Policies

Input was provided by ranking individual policy options from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

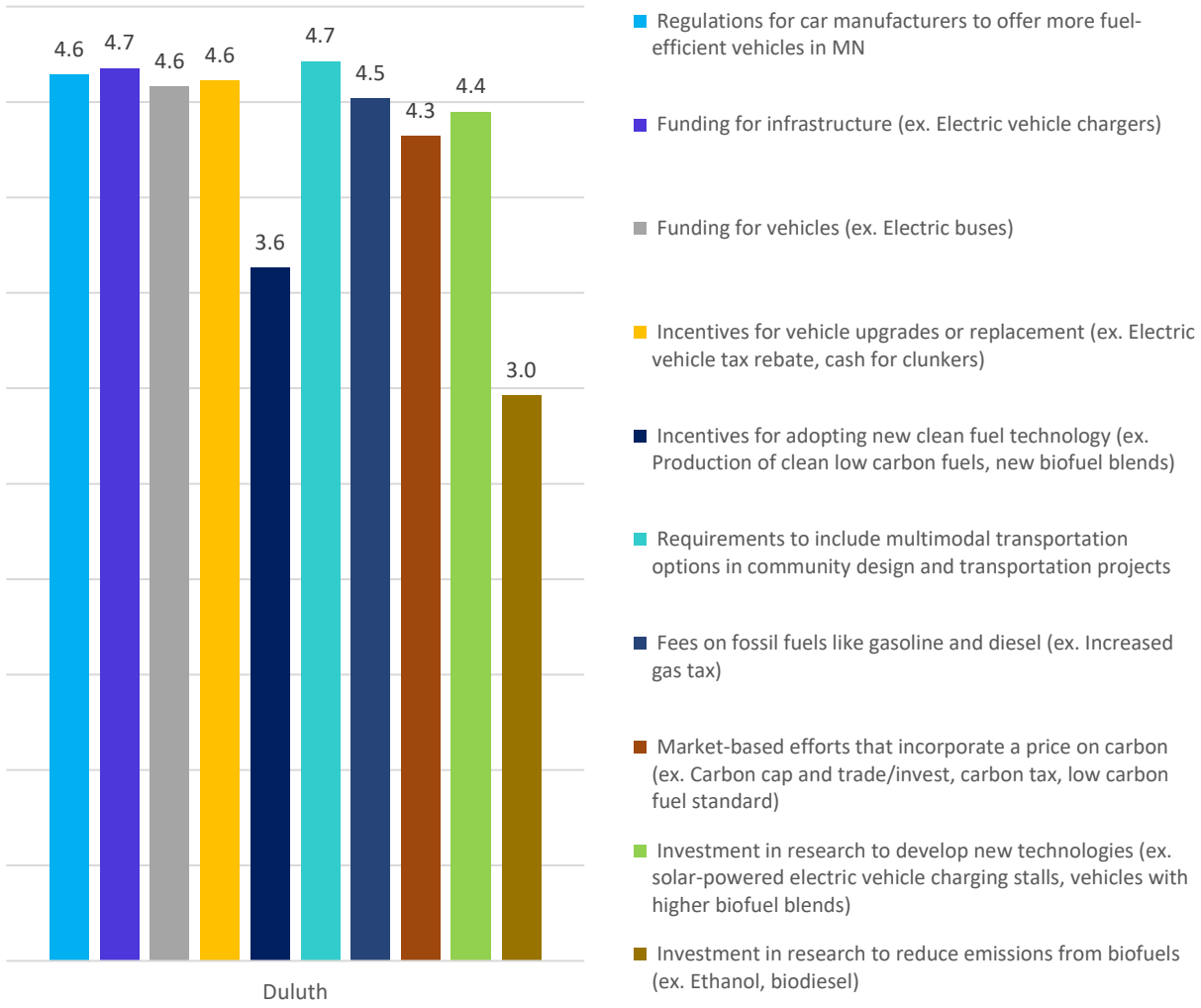


Figure 57. The relative rank (1-5) of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" from Duluth meetings participants.

Meeting Notes

Public Meeting Notes: DULUTH 1

CLARIFYING Q&A

- It's important for MnDOT to collaborate and work in partnerships to achieve these goals
- Comment that ridership and carsharing might not reduce VMT

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: Current challenges…?

Participants answered:

- [for "Other"]: "MnDOT connects cities, A to B, no matter the distance, without getting a new focus from MNDOT – who has largely contributed to the climate crisis – we can't solve it"
- [for "Other"]: Lack of teeth for the policy – specifically carbon policy. Nothing forces action.
- Some conversation and concern around the range and seasonal viability of electric vehicles
    - Response from Tesla owner on his testimonial with his Tesla for 4 years – cost-efficient and no problem with range

PROMPT: How do folks get over winter barriers?

- Other drivers are barriers to bikers
- Increase in public transit ridership during extreme events (from DTA)
- Tax on something to generate revenue to clear sidewalks for older folks, folks with disability or mobility concerns
- Some of the bus stops are unusable in winter from the snow and ice

PROMPT: Which strategy … would you support?

Participants answered:

- Prioritize whichever strategy has the biggest impact
- Prioritize PEVs, which you can do quickly because we already have the technology

PROMPT: [when results of the mentimeter survey showed relatively lower support for corn ethanol as a strategy] Why anti-corn ethanol?

Participants answered:

- Associated emissions with growing are too high
- Increasing biofuel blend decreases fuel efficiency
- Subsidies for ethanol are too high – "if we took that money and gave it to these other sectors, we could all just go home."

PROMPT: What are the most important additional co-benefits?

Participants answered:

- It's a social structure – healthier communities, then we see all these things trickle, and MnDOT is <u>us</u> – they follow direction from Minnesotans
- Often thrown environmental justice out as a term, and don't clarify what it means, which does it a disserve [followed by a discussion on what environmental justice meant to the folks in the room, and why it was or was not important to this work]
    - Most felt it was important, and it was related to ensuring that the benefits of GHG reductions are distributed equally

PROMPT: Other Comments?

- We want emissions standards – feds want to lower and that's insane. They should be strict and fixed [standards] – it doesn't make sense to go backwards.
- We should be strategic about *which* strategy we employ *when,* get the most bang for your buck
- Also note that utilities can make money on new [EV, DER, etc.] infrastructure, especially renewables
- Regulation for car manufacturers; [they currently] use #s as a goal for allotment, but they aren't hitting them – how do we enforce that?

Public Meeting Notes: DULUTH 2

CLARIFYING Q&A

- Questions about biofuels:
    - Are they beneficial? What about competition with food?
- Manufactured cars have emissions
- What is my best opportunity to reduce emissions?
- What can we do? Are these policies feasible
    - What can I do in my lifetime, especially for older folks

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: What do you think of when you think of "lack of public transportation options" – What would you like to see?

Participants answered:

- There's such car culture in MN, it's possible to build community's and entire states without that

PROMPT: What are the opportunities?

Participants answered:

- Accessible, dense communities – we could be so innovative and ambitious with our public transportation options – especially with things like high-speed rail and other modes
- In Toronto, everything was built around the community – everything is accessible and connected and it's easy to get around and get places
- I use public transportation almost all the time. I do have a car that I drive, just because of timing, but when I go to MPLS I take a bus, it's much more convenient – and once you get to MPLS there are buses that go out to where I want to go. I don't know if it's a lack of public transportation or a lack of people wanting to use it.
- If you live in the suburbs of Duluth, there's no bus or public transportation option to even get to Duluth get downtown to connect to more public transit

PROMPT: What are the barriers?

Participants answered:

- Afternoon, it was a lot of weather-related barriers – but there are more thoughts in the evening, including electric utility carbon intensity
- How much would you support the following tech and strategies
- *confusion on whether low carbon fuels include electricity or not
- *confusion on what is captured under shared vehicles – explain all the things that fall under it

PROMPT: What additional co-benefits are important to you?

Participants answered:

- I want to see FEWER KIDS WITH ASTHMA. Particulate matter from trucks and vehicles is epidemic, especially in urban areas. We see so much money spent on hospitalizations for hospitals – and it affects everyone. There is some integration – and that promotes equity for everyone.
- Environmental justice is important. I don't know how that is applied here [with pathways to decarbonization], but it's important.

PROMPT: Are there policies anyone thinks might be effective that they didn't see up there?

- It's up there – it's market-based efforts, generally speaking, not just with transportation, 2/3 of the energy we consume is in the stuff we buy – it's not sensible to us, it's the gas, etc. and unless you put some kind of pricing mechanism into this mix, business is not going to get the pricing signals it needs to change its ways
- Air travel isn't included – but it's important

PROMPT: Final comments?

- One of the things we underestimated is the viral nature of technology – a year ago, I didn't know anyone with an EV and now I know >5. It's the same type of things that happens with solar – and soon it virally starts to infect the neighborhood – e.g. diffusion of innovation

Marshall

Two meetings were held in Marshall on Tuesday, June 11 from 2:30 pm to 4:30 pm and from 6:00 pm to 8:00 pm at the Marshall Municipal Utilities in the Conference Room.

Between the two meetings, there were 42 attendees who participated in the listening sessions, in addition to a handful of MnDOT staff, state agency staff, and facilitators. Of those participants, three attendees opted to either not participate in the interactive survey, or to take a paper version of the survey.

Location

Most meeting participants came from the Marshall area and from the southwest region.

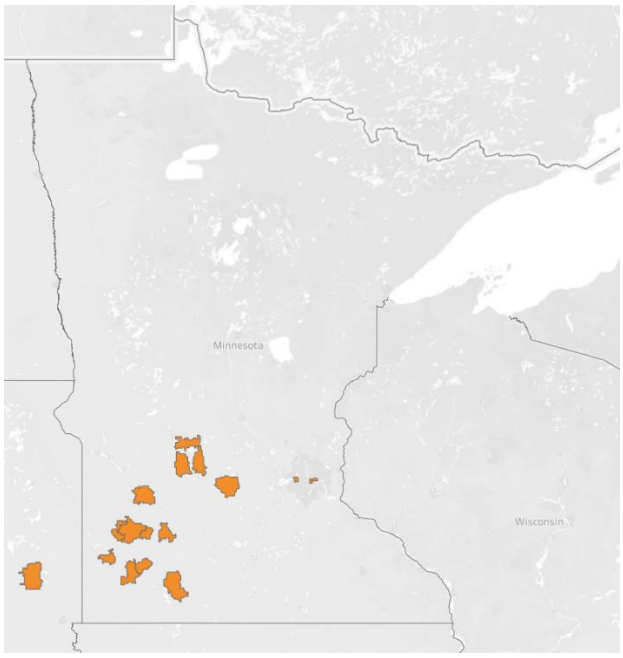


Figure 58. Map of zip codes represented at the Marshall meetings.

Age

Most participants at the Marshall area meeting were between the ages of 31 and 65, somewhat younger than the typical age distribution for the public meetings in this process. Participants also included those under the age of 18, as well as those over age 65.

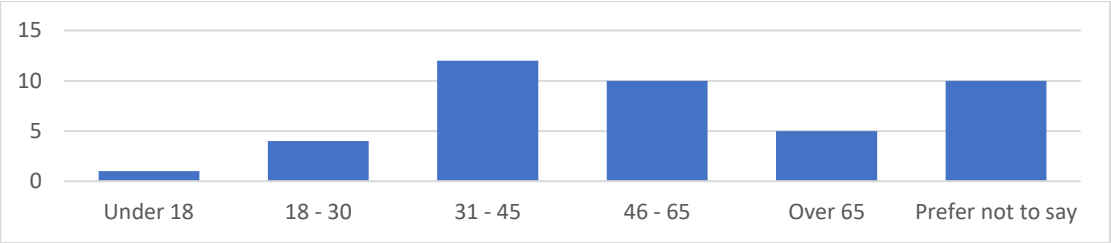


Figure 59. Age of participants at the Marshall meetings

Gender

The Marshall area meetings had 50% of participants identify as male. Females represented 24%, and 26% of participants preferred not to say.

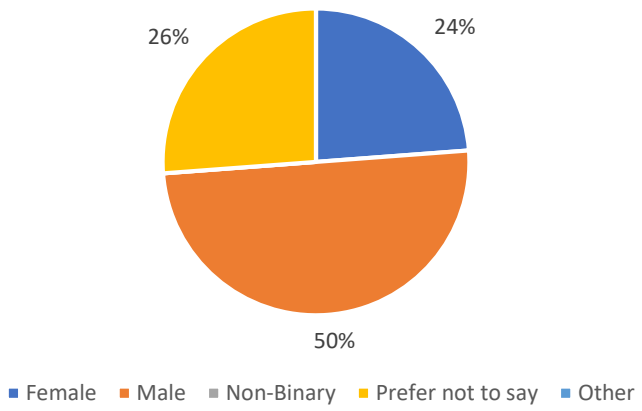


Figure 60. Gender demographics of Marshall meeting participants.

Race

Most participants identified themselves as white/Caucasian (74%). 21% of participants preferred not to say and 2% identified as black/African-American.

White/Caucasian	31	74%
Other	0	0%
Asian	0	0%
Black/African-American	2	5%
Hispanic/Latinx	0	0%
Prefer not to say	9	21%
American Indian/Native American	0	0%
More than One Race	0	0%

Table 20. Race demographics for participants in Marshall meetings

Vocation / Work

The highest proportion (21%) of participants at the Marshall meetings worked for the government, 14% were retired, 14% worked in business.

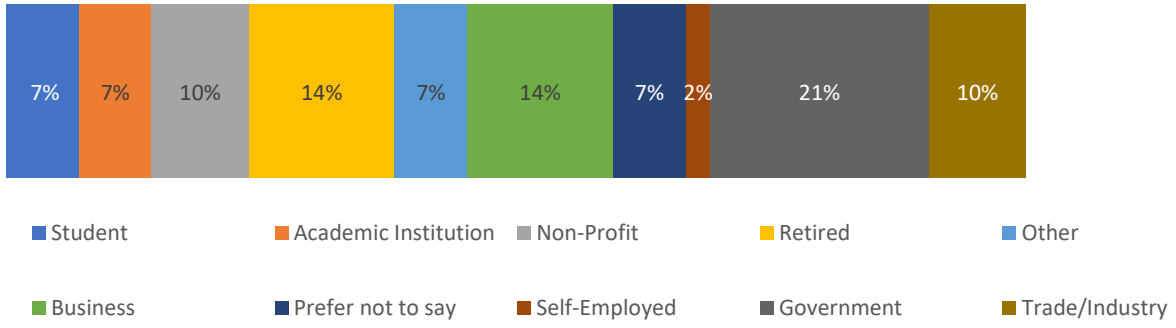


Figure 61. Place of work or vocation for Marshall meeting participants.

Mode of Transportation

Participants responded to the question: How do you most frequently get around? Participants chose gasoline vehicle (57%) most often, followed by other (14%). 12% of participants chose multiple modes, which often included a vehicle, some public transportation, or a combination of biking and walking.

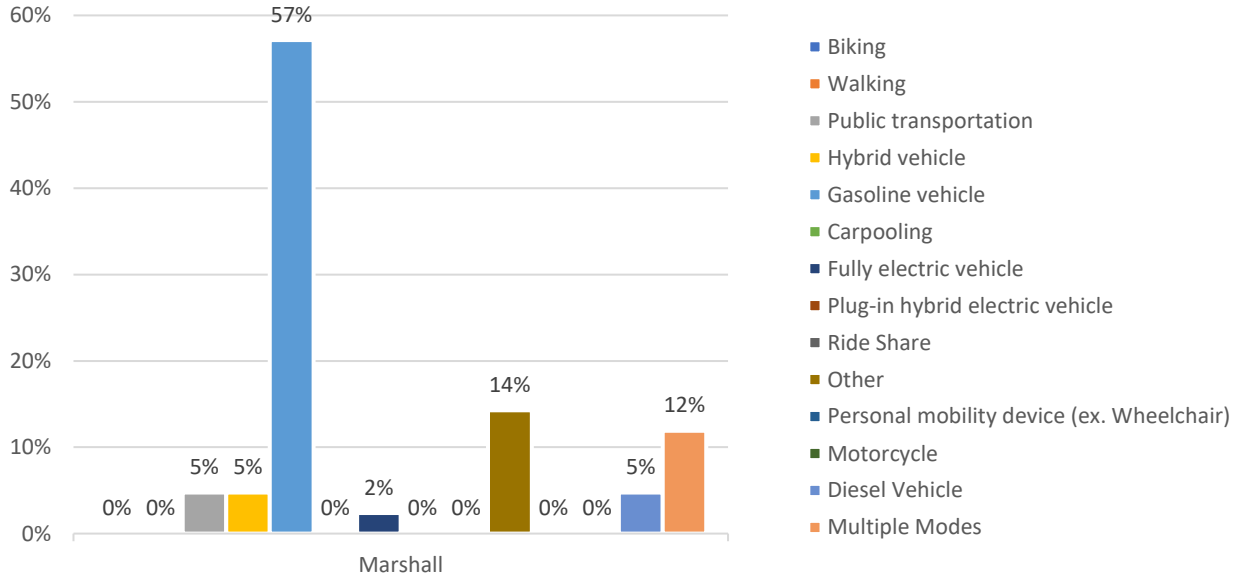


Figure 62. Modes of transportation used most frequently by Marshall meeting participants

Co-benefits

Participants at the Minneapolis meeting ranked "Make communities more resilient" first (37%), followed by "promote equity and environmental justice" (28%). "Provide new/more mobility options" was the third most common response (13%). These results are largely consistent with the aggregate results.

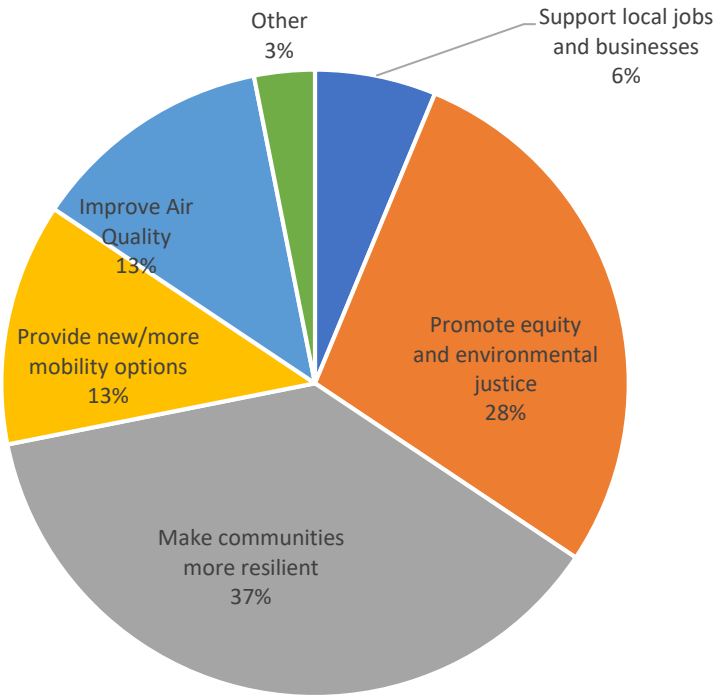


Figure 63. Responses from Marshall meeting participants to the survey question identifying the most important co-benefits of decarbonizing the transportation system.

Environmental Justice

When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 81% of all respondents noted that it was either "Very Important" (69%) or "Important" (12%).

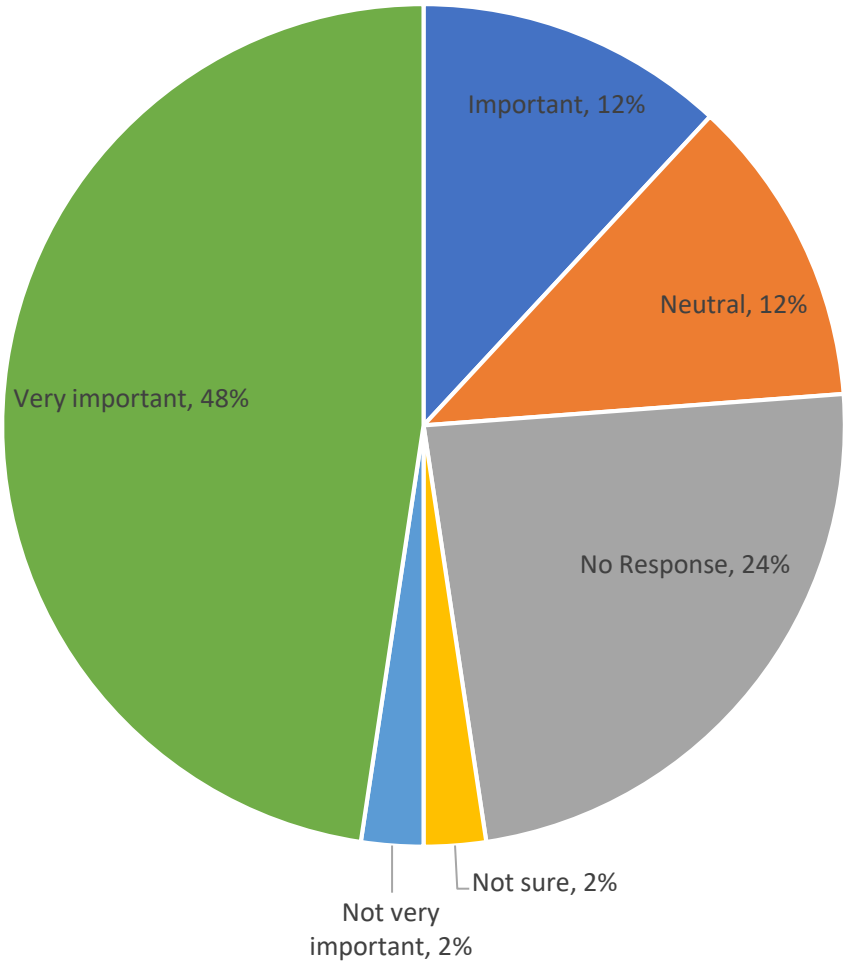


Figure 64. Responses to the survey question on the importance of environmental justice in shaping action, from Marshall meeting participants.

Opportunities

At each public meeting, participants were able to share opportunities identified through three post-it notes, as well as through the live mentimeter polling exercise. The results for Marshall identified that the top three most popular opportunity sectors included vehicle electrification (20%), public transportation (16%), and biofuels and alternative options (13%). There were a higher proportion of participants in Marshall meetings that identified biofuel as an opportunity.

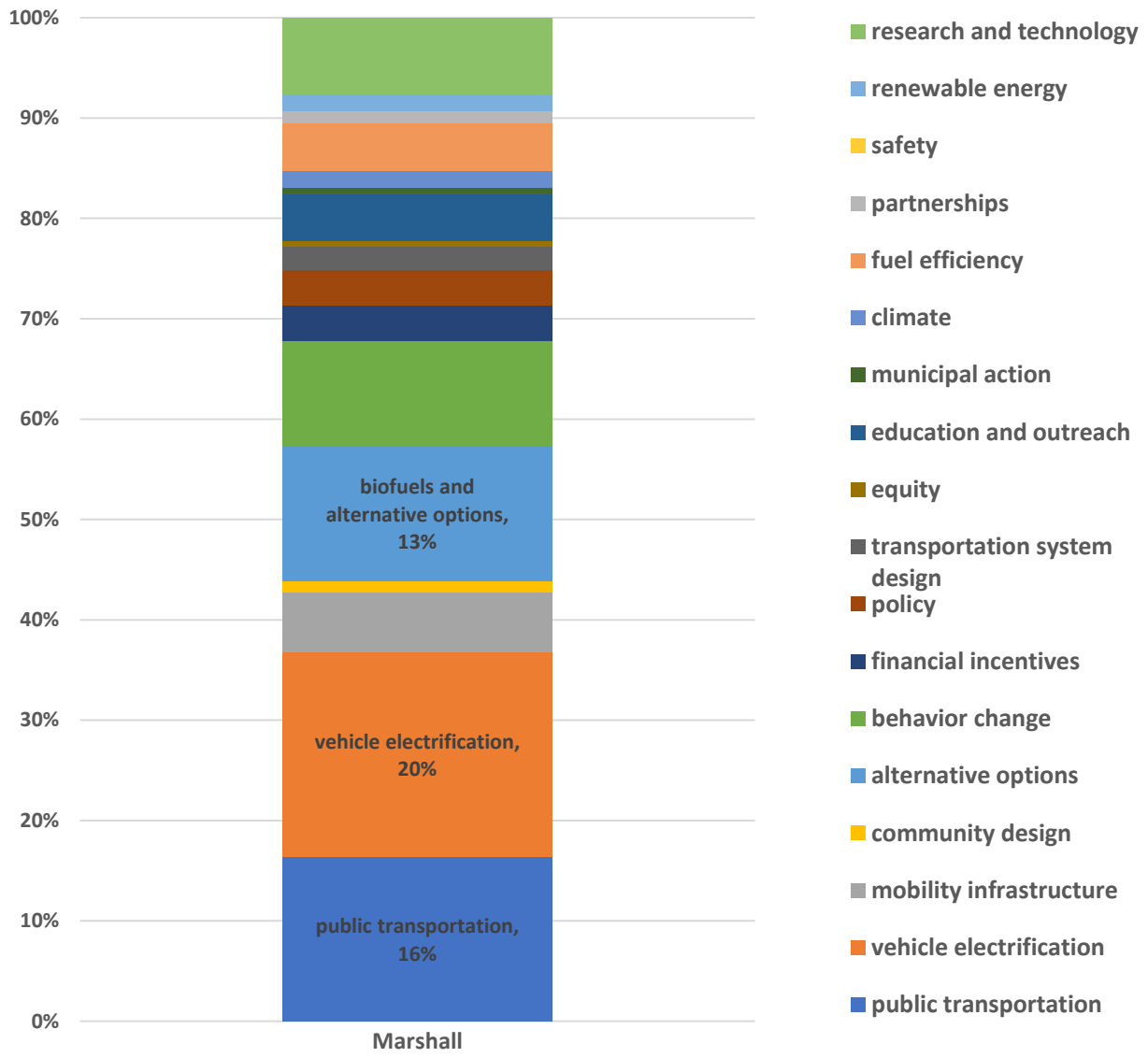


Figure 65. Breakdown of opportunities (collected through post-it notes / small group discussion and live survey activity) from the Minneapolis public meeting

Strategies and technologies

The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from “Very Unsupportive” (1) to “Very Supportive” (10), which translated to a scale of 1 to 10.

The Marshall meeting(s) had the highest relative support expressed for both the “biofuels and low-carbon fuels” as well as the “corn ethanol” option under strategies and technologies – both received at least moderate to high support, despite also receiving the lowest scores. While the community meeting expressed support for these options, the strategy with the highest support was walkable and bikeable communities.

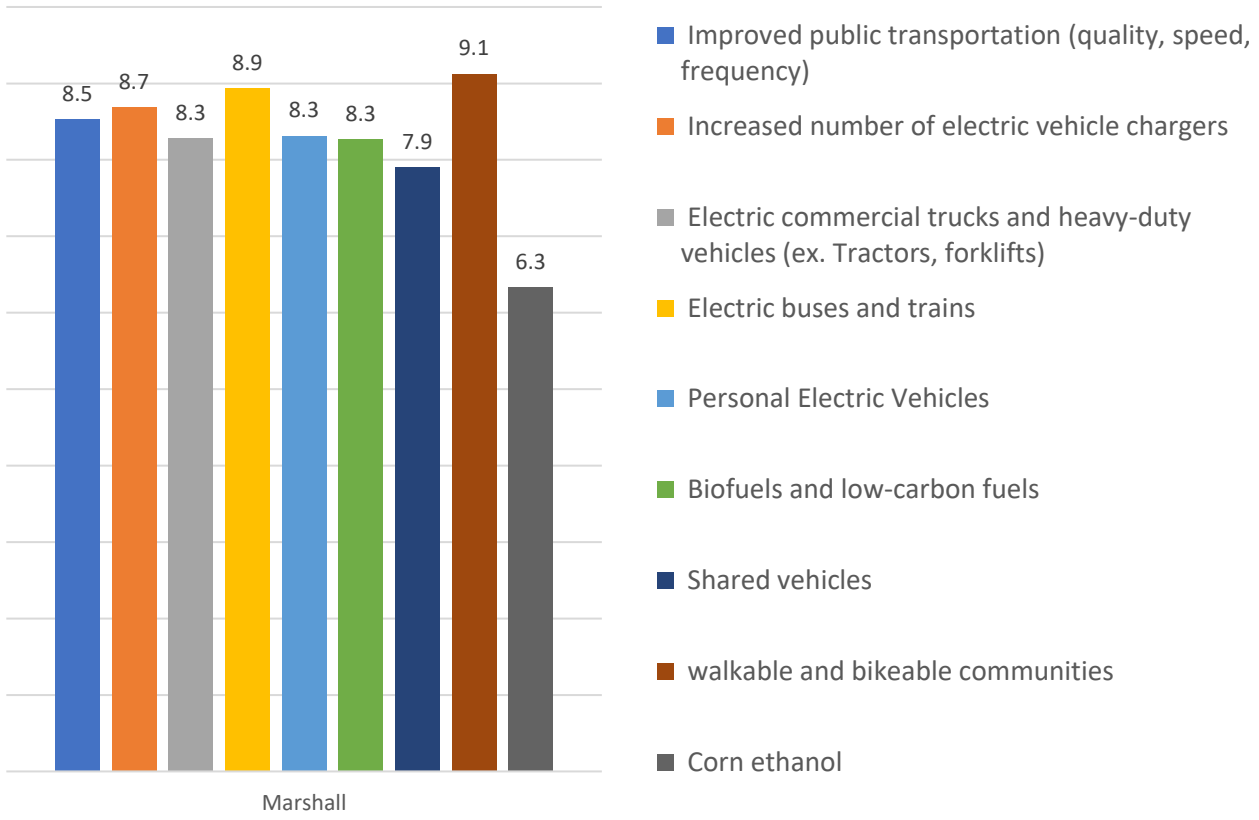


Figure 66. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies from Marshall meeting participants.

Policies

Input was provided by ranking individual policy options from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

Of the policies discussed, the results from the Marshall meeting also departed somewhat from the aggregate results. There was much stronger support for "investment in research to reduce emissions from biofuels (ex. Ethanol, biodiesel)" than other communities.

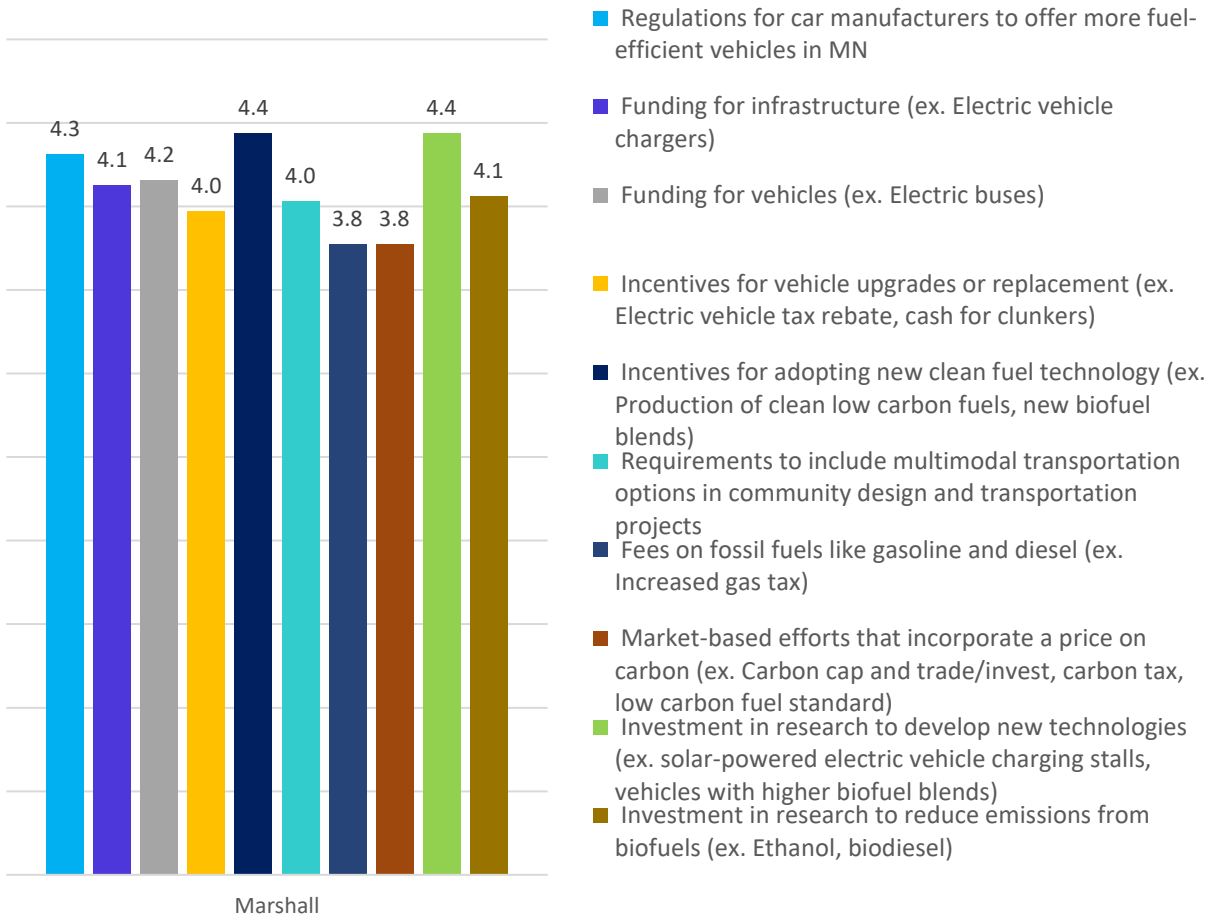


Figure 67. The relative rank (1-5) of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" from Marshall meeting participants.

Meeting Notes

Public Meeting Notes: MARSHALL 1

CLARIFYING Q&A

- Questions on some clarifying assumptions in the modeling, like VMT reduction
- Questions on how the model thinks about biofuels and what it assumes
    - Is that reasonable to assume it's constant year-round when there is seasonal viability for different blends?

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: What transportation would you be looking for? [when results showed that they wanted more public transportation options]

Participants answered:

- There are 5-6 options, ADA, ped, bike, taxi, call for transit, rideshare – but there's an opportunity to improve for all of those

PROMPT: What opportunities are there for decarbonizing transportation?

Participants answered:

- Regional bike – willing to bike ~6 miles, but it's unsafe; districts are currently working on bike plans
- In 1k to 5k [population] communities, the industry is on the edge, and with bike connections, people could bike to work, but SAFETY is a big concern
- Mental change [is necessary] from bike as recreation to bike as commuting culture
- Difficult to design public transit infrastructure
    - Bike/ped connectivity
    - Narrow roads where it's difficult to pass
- Incentives to carpool or take bus
    - Bike racks on public buses
- Community vehicles to rent/access – frequent availability, especially able to rent larger vehicles like trucks which you only need occasionally, but everyone [in SW] has one because they do need them sometimes.

PROMPT: What barriers are there for decarbonizing transportation?

Participants answered:

- Cost: of what and to whom
- Vehicle cost – if electric cost less, you'd buy
    - Upfront + overall cost + distance of trips; often people aren't considering the full life cost of the vehicle, the upfront is the barrier
- A concern with attracting jobs and economic development is that growing industry does not equal additional transportation [at present]

PROMPT: Which technologies/strategies do you support…?

Participants answered:

- [For corn ethanol and biofuels] When Marshall residents go to the city, there are not a lot of ethanol charging stations, whereas every community has ethanol and E-85 in the SW; it's a big part of the expectation

PROMPT: Which additional co-benefit is most important?

Participants answered:

- [For "Other"]: healthy and more active lifestyles and communities
- Air quality is important. Transition to cleaner fuels hasn't really been noticeable.
    - Anecdote: "old car show comes to town, and the smell in the community reminds you how bad it used to be. Highlighting that the community is important."

PROMPT: How important is environmental justice?

Participants answered:

- Environmental justice is an opportunity for all versus just a few people who can afford it
    - For example, those most impacted benefit the most from any changes that we're making
    - For example, without environmental justice, big polluters benefit, so public policy dictates for the masses that there isn't an incentive to pollute

PROMPT: Which policies do you support?

Participants answered:

- Talk to car manufacturers! They make choices for consumers.
    - Anecdote: I had a flex fuel vehicle, replace it, run it on E30, but no longer flex fuel. Car manufacturers think you need to be 50 or more vehicles to get a flex fuel, but vehicles are typically already ready for flex fuel / to accept the fuel DESPITE NOT being sold that way. It just doesn't make sense. Manufacturers are a huge barrier to the market for cleaner / better vehicles.

Public Meeting Notes: MARSHALL 2

CLARIFYING Q&A

- How do you balance convenience with cost to the environment?
    - Anecdote: ridership and cost justification, if nobody takes the bus, then the investment isn't worth it

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: What opportunities are there for decarbonizing transportation?

Participants answered:

- Fun self-driving rideshare options
- Public transit that honestly serves the community in those areas – how do we make it easier to replace driving?

PROMPT: What barriers are there for decarbonizing transportation?

Participants answered:

- Entrenched habits: if you decide, for example, to invest and create public transit, but people don't know about it, they won't use it
    - You need to also motivate a behavior change
- We're trying to replace one-for-one, example car to bus, that's not maybe realistic – we need change and matching across systems to make the whole system work – you need to change the whole approach
- We take too much notice of the clock, we need to be more flexible, which would support transportation, for example, like little buses to get people from small towns to bigger towns for work

PROMPT: Which technologies/strategies do you support…?

Participants answered:

- [Follow up question: is there anything you <u>don't</u> favor? When responses were all positive]: We favor them all; we want them all now
- Model of responsible stewardship – anything you can do to reduce total vehicles on the road, the total impact should be prioritized.
    - How do we change our culture so that owning a car isn't a gateway to the middle class?
    - [Some disagreed] – the environmental cost associated with EV manufacturing, etc. has impacts – pursuing other options to stop increasing carbon footprint [across sectors] should be prioritized
    - "I would prefer a society where I don't have to live in a huge metro to not have a car, and still can get around, get to work, etc."
- In rural areas, electric bus and train is a good concept, but not likely to be feasible, so personal EV PLUS charging infrastructure is most feasible

PROMPT: Which policies do you support…?

[When there was support for shared vehicles, and conversation around shared vehicles, follow up question: how do you envision shared vehicles in SW MN?]

Participants answered:

- Full self-driving ride share – "I would put my Tesla in [that program for use] – especially if there's a cost incentive, like something to offset the cost of the vehicle itself to the owner
- Zip car model could work, versus Uber or Lyft, which incentivizes people to sit in their car and let it idle.
- When I envision people coming in to work in Marshall, some platform for coordinating rides for folks coming to town – some platform for communities

PROMPT: Which co-benefits are most important…?

Participants answered:

- It's very difficult to choose any "one" – they're all important

PROMPT: How important is environmental justice?

Participants answered:

- I think everybody wants better fuel efficiency
- "My new country here, I am aware when I compare the US to Europe – and realize the cost of gas compared to those countries? You don't even "know" what high gas taxes are. In car industry [in Europe, because of the high gas tax] they don't have high gas guzzlers on the market, and we also need to pay for our roads and bridges, because we don't want to die on them… but the current system favors winners and losers, and that needs to change.

Rochester

Two meetings were held in Rochester on Wednesday, June 12th from 2:30 pm to 4:30 pm and from 6:00 pm to 8:00 pm at the Rochester Civic Center in the American Legion Room.

Between the two meetings, there were 51 attendees who participated in the listening sessions, in addition to a handful of MnDOT staff, state agency staff, and facilitators. Of those participants, two attendees opted to either not participate in the interactive survey, or to take a paper version of the survey.

Location

Most participants came from the Rochester area and southeast region of the state.

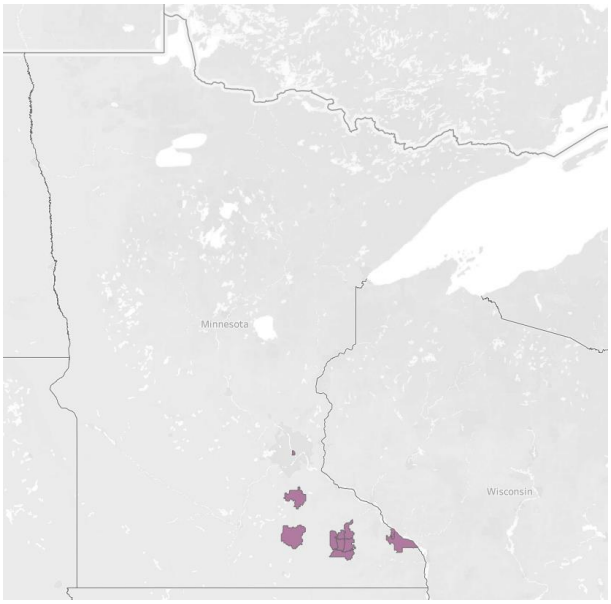


Figure 68. Map of zip codes represented at the Rochester meetings.

Age

Most participants at the Marshall area meeting were between the ages of 46 and 65. There was no one under the age of 18, and 25% of participants preferred not to disclose their age.

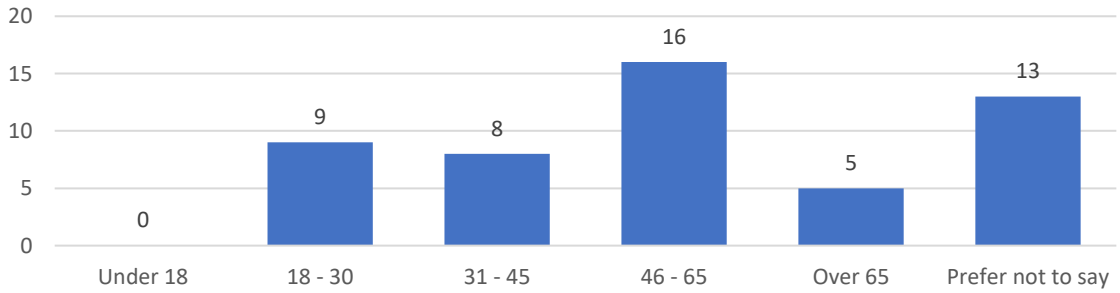


Figure 69. Age of the participants at the Rochester meeting.

Gender

41% of participants at the Rochester meetings identified as female. 29% identified as male, 27% preferred not to say, and 2% identified as non-binary.

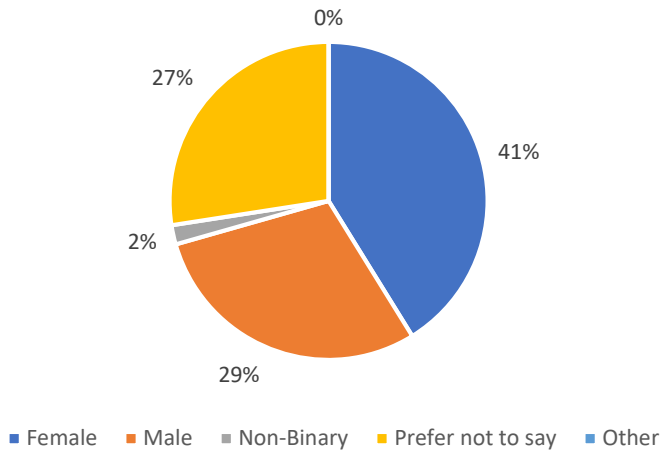


Figure 70. Gender demographics of Rochester meeting participants.

Race

Most participants at the Rochester meeting identified at white/Caucasian. 12% preferred not to say, 4% identified as Hispanic/Latinx, 2% black/African-American.

White/Caucasian	35	69%
Other	1	2%
Asian	0	0%
Black/African-American	1	2%
Hispanic/Latinx	2	4%
Prefer not to say	12	24%
American Indian/Native American	0	0%
More than One Race	0	0%

Table 21. Race demographics for Rochester meeting participants

Vocation / Work

22% of participants at the Rochester meetings worked for the government. 20% preferred not to say, and 16% were retired.

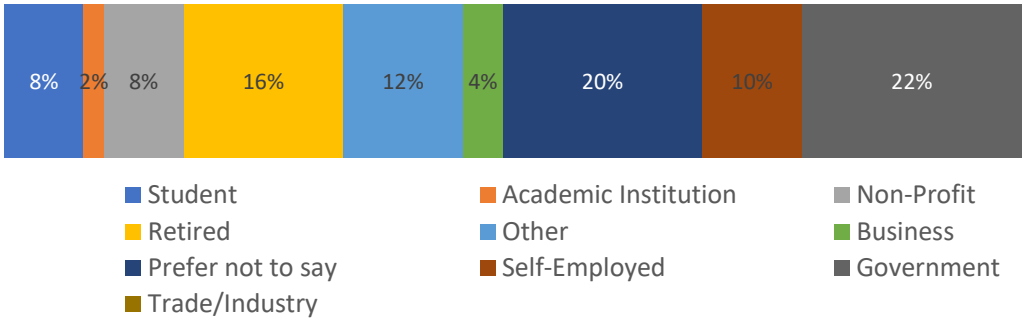


Figure 71. Place of work or vocation for Rochester meeting participants

Mode of Transportation

Participants responded to the question: How do you most frequently get around? Participants chose other (27%) most often, followed by hybrid electric vehicles (18%), gasoline vehicles (18%), and multiple modes (18%). These results differ somewhat from the aggregate results in that a higher proportion of attendees drove hybrid electric vehicles (the same proportion that drove gasoline vehicles).

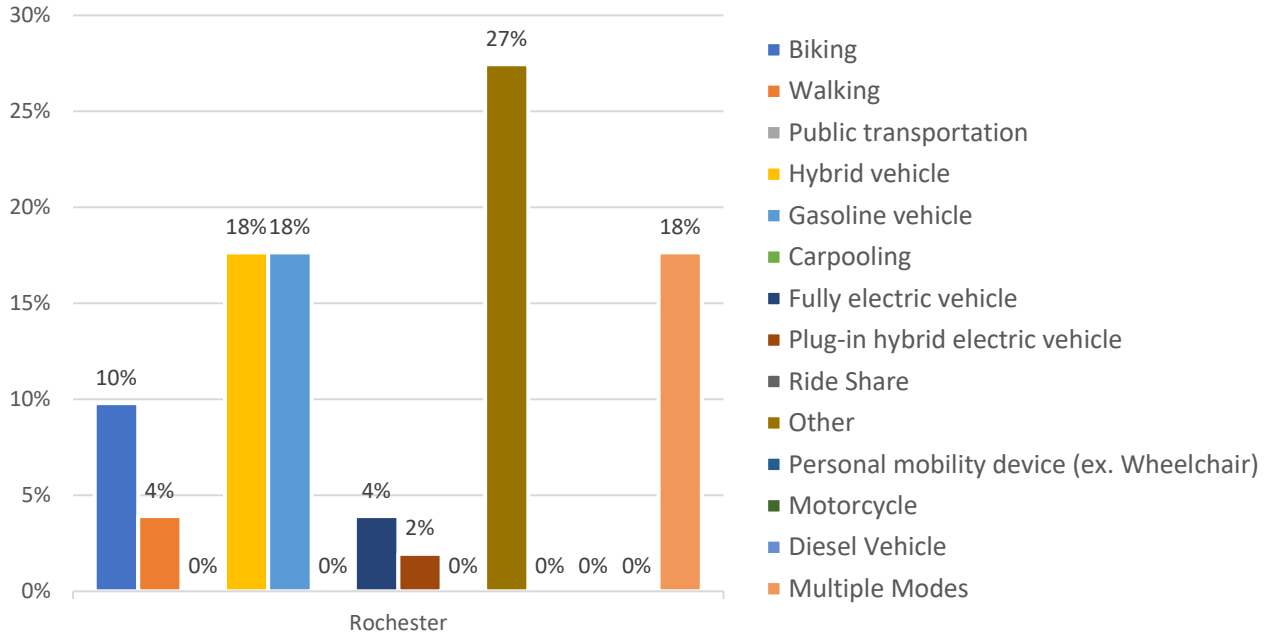


Figure 72. Modes of transportation used most frequently by Rochester meeting participants

Co-Benefits

Participants at the Minneapolis meeting ranked "Make communities more resilient" first (39%), followed by "improve air quality" (33%). "Provide new/more mobility options" was the third most common response (17%). These results are largely consistent with the aggregate results.

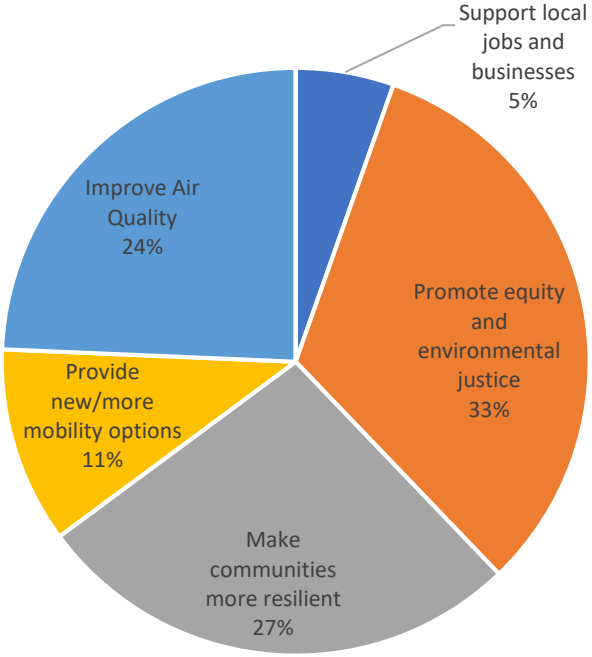


Figure 73. Responses from all Rochester meeting participants to the survey question identifying the most important co-benefits of decarbonizing the transportation system

Environmental Justice

When asked to identify how important participants felt it was that environmental justice shape action to reduce transportation GHG emissions, 64% of all respondents noted that it was either "Very Important" (33%) or "Important" (31%), one of the lowest total proportions from all communities. One quarter (25%) of respondents preferred not to disclose.

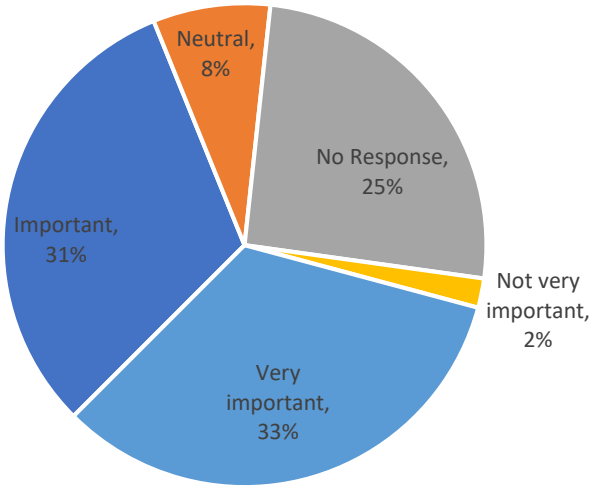


Figure 74. Responses to the survey question on the importance of environmental justice in shaping action, from Rochester meeting participants.

Opportunities

At each public meeting, participants were able to share opportunities identified through three post-it notes, as well as through the live mentimeter polling exercise. The results for Minneapolis identified that the top five most popular opportunity sectors included public transportation (18%), a three-way tie for second most popular between vehicle electrification, community design, and biofuels and alternative options (all with 11%), and a two-way tie for third most popular between behavior change, and mobility infrastructure (both with 9%).

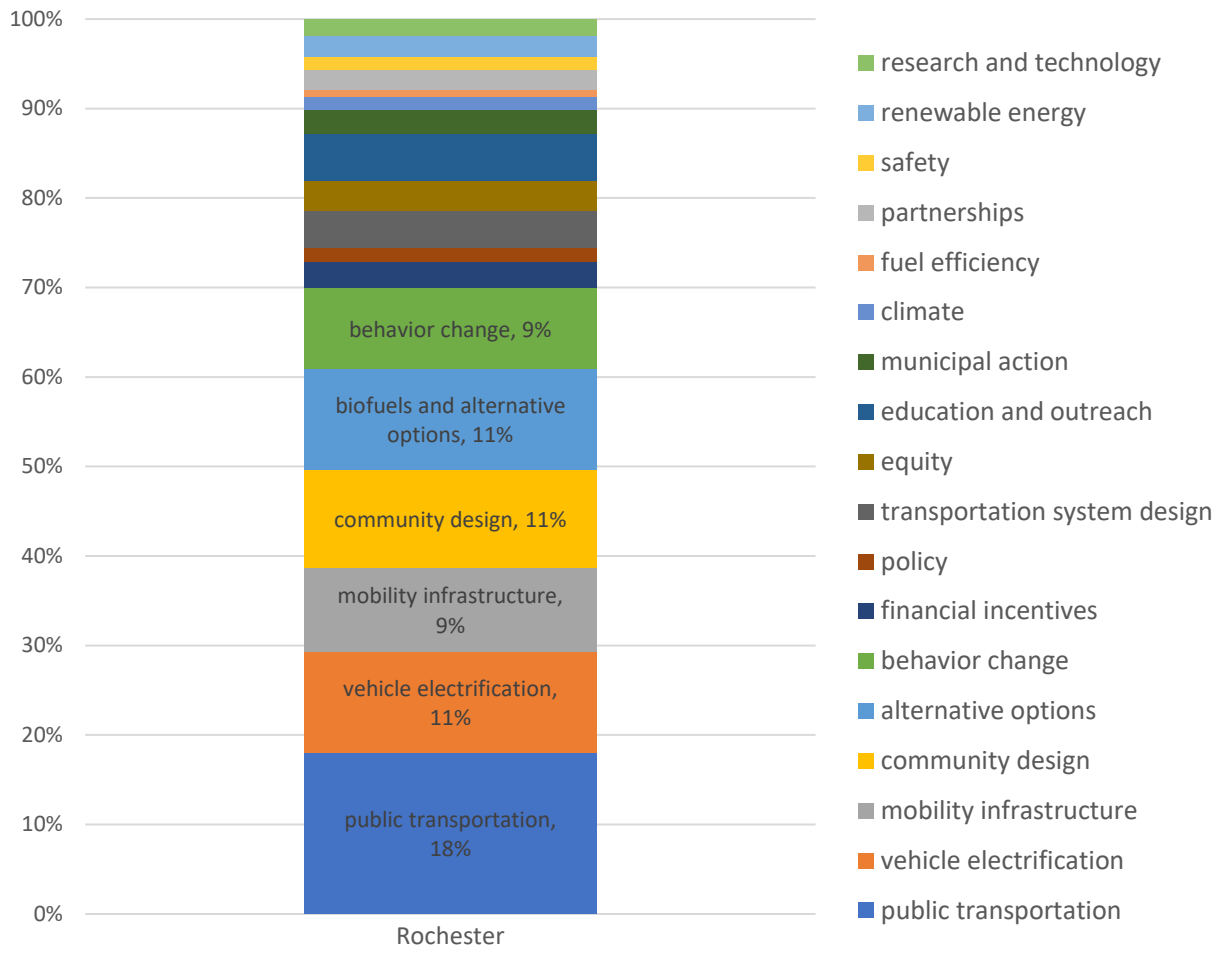


Figure 75. Breakdown of opportunities (collected through post-it notes / small group discussion and live survey activity) from the Rochester public meeting

Strategies and Technologies

The following provides the relative support or lack of support for nine strategies and technologies. The scale ranged from “Very Unsupportive” (1) to “Very Supportive” (10), which translated to a scale of 1 to 10.

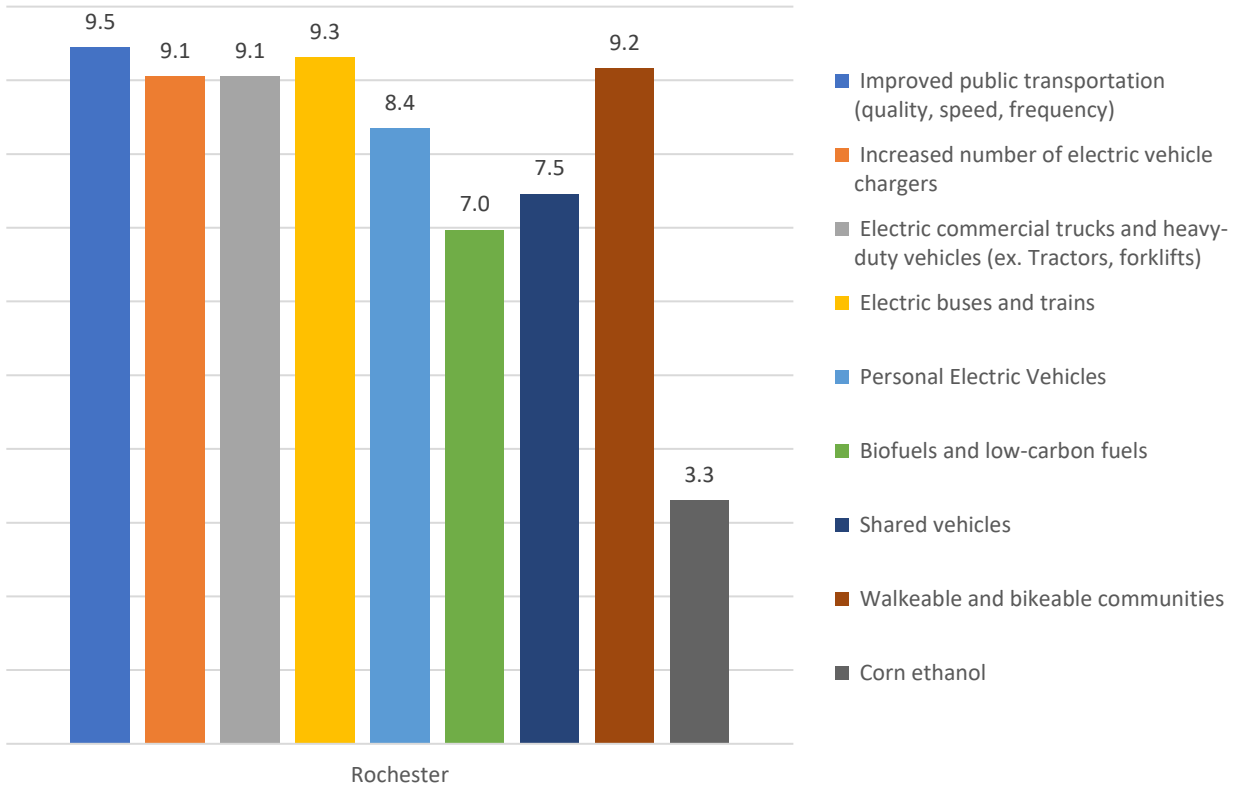


Figure 76. Individual support (by numeric ranking from 1 to 10) for various strategies and technologies from Rochester meeting participants.

Policies

Input was provided by ranking individual policy options from "Very Unsupportive" (1) to "Very Supportive" (5), which translated to a scale of 1 to 5. Though the results for individual policies vary, no policies received a ranking below "neutral," indicating that most policies presented were at least palatable.

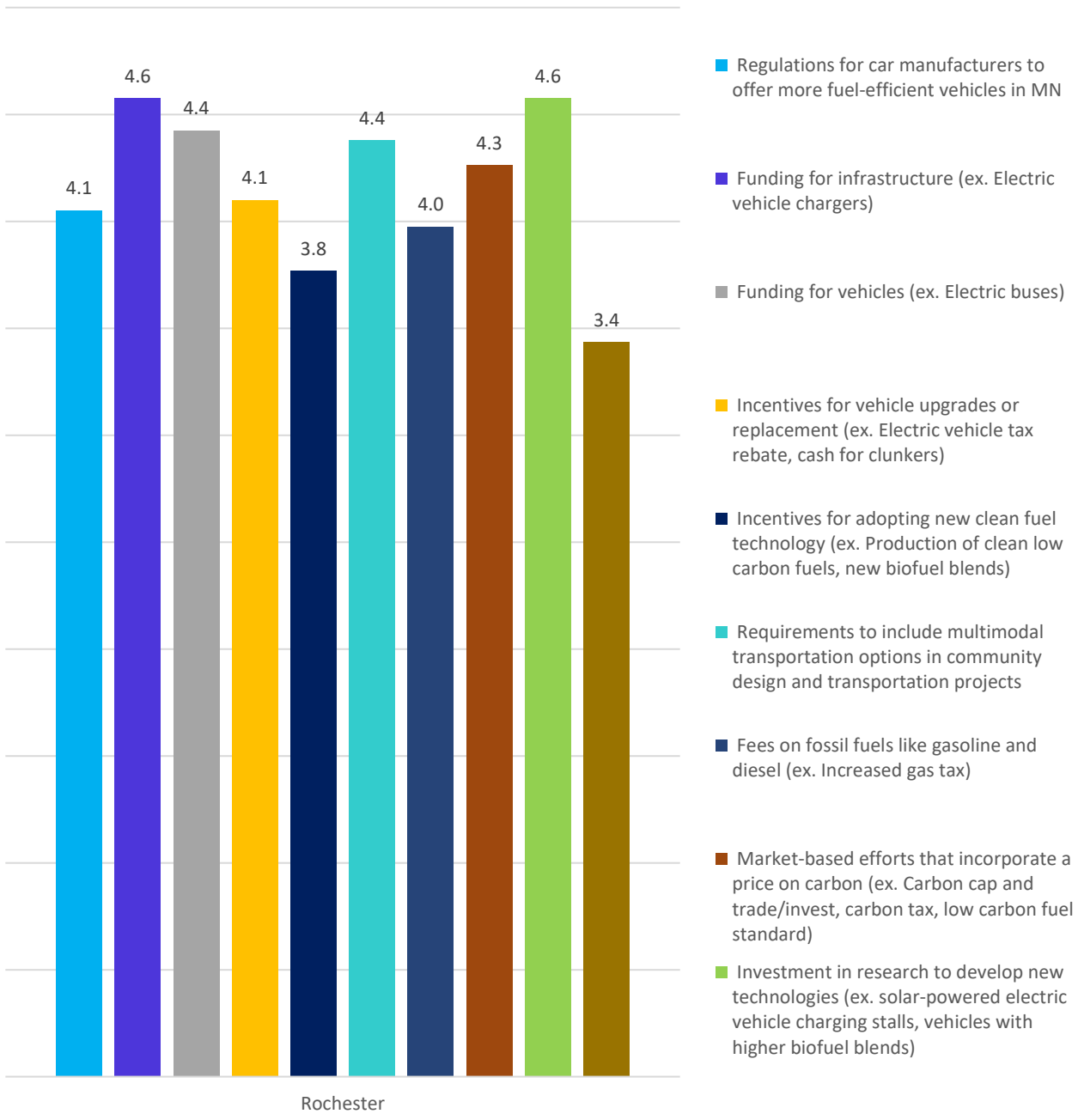


Figure 77. The relative rank (1-5) of policies presented during engagement ranging from "Very Unsupportive" to "Very Supportive" from Rochester participants.

Meeting Notes

Public Meeting Notes: ROCHESTER 1

CLARIFYING Q&A

- Comment: It's getting away from coal and oil; it's a whole system-wide change
- Question: Does biofuel include biodiesel? Yes, but could also be other biomass

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: What are the biggest challenges?

Participants answered:

- [For "Other]: consumer habits, like SUVs, trucks, etc.
- [For "Other]: fear of change
- [For "Other]: convenience factor for public transportation, especially in Minnesota winters

PROMPT: Which technologies/strategies do you support…?

Participants answered:

- Don't support car culture; cars don't belong downtown, they take up a lot of space – we need a road diet. Where are all these cars going when they come into Rochester? How do we get them on a tram or a bus into town?
- Air quality is also a concern, PEVS are necessary for rural, not necessary for urban

PROMPT: Which co-benefits are most important…?

Participants answered:

- Comment: [someone] surprised that air quality got so many votes when we have good AQ
  - But as a cyclist on the road, that tailpipe is not so great
  - Would also be inclusive of GHGs

PROMPT: Which policies do you support…?

Participants answered:

- If we strategically paired more efficient new vehicles + cash for clunkers, then they both work and better
  - E.g. policy option #1 creates opportunities for other things
- "I'm a firm believer in the gas tax – money is how you push programs, but I scored it low because a lot of programs target those who can't afford it. I support it because I can afford it, but the last thing I want it to additionally burden folks who cannot."
- "I scored research for biofuels low because my field is water resources and water scarcity are a big concern with how intensive biofuel processing is"
- Comment: Requiring rural versus urban versus suburban to address this problem differently is important – they face different challenges.

Public Meeting Notes: ROCHESTER 2

CLARIFYING Q&A

- Comment: It's getting away from coal and oil; it's a whole system-wide change
- Question: Does biofuel include biodiesel? Yes, but could also be other biomass, like bio-algae, switchgrass, etc.
- How feasible and to what extent for trucks to electrify? Lots is the answer, example – semis and garbage trucks can electrify right now
- What are the trade-offs of all the upstream emissions and externalities associated with, for example, full electrification?
- What's the difference between biofuel and corn ethanol?
    - Considerations are often different, such as the impact on food systems, CO2, weather and climate, third-world interactions and geopolitics to a degree

MENTIMETER DISCUSSION *[directly related to specific mentimeter questions]*

PROMPT: Which co-benefits are most important…?

Participants answered:

- It felt like it was hard to choose
- One additional benefit is a quieter community, cars and trucks are loud, alternatives like walking and biking and electric vehicles are all quieter

PROMPT: What are the biggest challenges?

Participants answered:

- A lot of [the challenges in the mentimeter question] don't make sense to me… I said a lack of public transportation because that's what made sense
- [For "Other"]: Motivate public to do things that are positive; for example, this new EV tax on something that's part of the solution? That's not the answer
- [For "Other"]: I can't separate a lot of these, for example people in historically marginalized areas must live in places with low air quality, and where do the boundaries exist between the two, if at all? They're all connected.
- "I answered environmental justice because it ties equity into the conversation. Equity in transportation [is a challenge] plus many people's lack of understanding or interest [in addressing it]

PROMPT: What are the barriers?

Participants answered:

- I noticed a defeatist attitude by a lot of people – well if you don't participate in trying to create change, it won't happen
- It's not even in the consciousness to do things a new way for most people

- The problem of climate change is posted on personal behavior change – when it should be more on systemic change to make things practical. The tragedy of the common's mentality is a barrier.
- We also live in fear, example of water: we don't trust our public servants, when are we going to start creating a culture of trust?

PROMPT: How important is environmental justice?

Participants answered:

- If environmental justice shapes, including in modeling how action does or doesn't impact environmental justice
    - "[The question] is shaped in a way that is intentionally ambiguous, which means nothing happens at the state, especially because it's controversial. I'm glad you brought it up, but I want to actually see it."
- I don't think you can drop [environmental justice] – example, the train from Rochester to Saint Paul is going to be an elite group of people; it's going to make Rochester a great place to live, but what does that *actually* mean for environmental justice communities?

PROMPT: Which policies do you support…?

Participants answered:

- Comment: Right now, in the US House there is a bill (HR763) called the US Carbon Dividend Fee, and it means that there's an increase every year, and that fee is distributed as a dividend to every household in the US. This is the type of policy we should be supporting.