




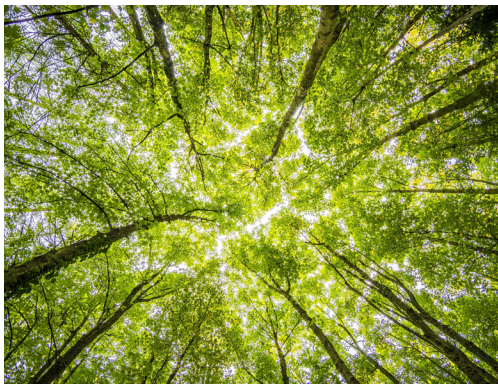

February 2024

CLEAN TRANSPORTATION STANDARD WORK GROUP

REPORT TO THE LEGISLATURE

MINNESOTA

Prepared by:

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The Clean Transportation Standard work group was administered by the Minnesota Departments of Agriculture, Commerce, Transportation, and the Pollution Control Agency.

February 1, 2024

The Honorable Frank Hornstein, Chair
House Transportation Finance & Policy Committee
563 State Office Building
Saint Paul, Minnesota 55155

The Honorable John Petersburg, Republican Lead
House Transportation Finance & Policy Committee
217 State Office Building
Saint Paul, Minnesota 55155

The Honorable Scott Dibble, Chair
Senate Transportation Committee
3107 Minnesota Senate Building
Saint Paul, Minnesota 55155

The Honorable John Jasinski, Ranking Minority Member
Senate Transportation Finance & Policy Committee
2227 Minnesota Senate Building
Saint Paul, Minnesota 55155

The Honorable Erin Koegel, Chair
House Sustainable Infrastructure Policy Committee
445 State Office Building
Saint Paul, Minnesota 55155

The Honorable Mary Franson, Republican Lead
House Sustainable Infrastructure Policy Committee
303 State Office Building
Saint Paul, Minnesota 55155

The Honorable Patty Acomb, Chair
House Climate and Energy Finance & Policy
593 State Office Building
Saint Paul, Minnesota 55155

The Honorable Chris Swedzinski, Republican Lead
House Climate and Energy Finance & Policy
245 State Office Building
Saint Paul, Minnesota 55155

The Honorable Nick Frentz, Chair
Senate Energy, Utilities, Environment, and Climate Committee
3109 Minnesota Senate Building
Saint Paul, MN 55155

The Honorable Andrew Mathews, Ranking Minority Member
Senate Energy, Utilities, Environment, and Climate Committee
2233 Minnesota Senate Building
Saint Paul, Minnesota 55155

MINNESOTA

Re: 2024 Clean Transportation Standard Work Group report

Dear Legislators:

The Minnesota Pollution Control Agency and Departments of Agriculture, Commerce and Transportation are pleased to provide the Clean Transportation Standard Work Group report as required under 2023 Laws of Minn., Ch. 68, Art. 4, Sec. 124.

The 2023 Legislature created the Clean Transportation Standard Work Group to make recommendations and highlight information gaps and opportunities for implementing a Clean Transportation Standard to reduce carbon pollution from transportation fuels in Minnesota. The work group brought together diverse stakeholders to evaluate the potential to reduce the carbon intensity of transportation fuels such as gasoline, diesel, biofuels and electricity. A CTS could be the largest single policy for reducing carbon pollution from transportation in Minnesota.

Please contact Shannon Engstrom, CTS Director, MnDOT, if you have questions or comments about this report: Shannon.engstrom@state.mn.us or 651 366 5098.

Sincerely,

Thom Petersen
Commissioner
Dept. of Agriculture

Grace Arnold
Commissioner
Dept. of Commerce

Nancy Daubenberger, P.E.
Commissioner
Dept. of Transportation

Katrina Kessler, P.E.
Commissioner
Pollution Control Agency

2023-2024
CLEAN TRANSPORTATION
STANDARD WORK GROUP
REPORT

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Legislative Request

This report is issued to comply with 2023 Laws of Minn., Ch. 68, Sec. 124

Sec. 124. **CLEAN TRANSPORTATION FUEL STANDARD WORKING GROUP; REPORT REQUIRED.**

Subdivision 1. **Creation.**

By August 1, 2023, the commissioners of the Pollution Control Agency, transportation, commerce, and agriculture must convene a Clean Transportation Fuel Standard Working Group to study and address information gaps and opportunities related to a clean transportation fuel standard that requires the aggregate carbon intensity of transportation fuel supplied to Minnesota be reduced to at least 25 percent below the 2018 baseline level by the end of 2030, by 75 percent by the end of 2040, and by 100 percent by the end of 2050.

Subd. 2. **Membership.**

(a) Appointments to the working group are made pursuant to Minnesota Statutes, section 15.0597.

(b) Appointments to the working group must include two individuals representing each of the following:

(1) renewable fuel producers;

(2) renewable natural gas and organic waste interests, including at least one local government that manages organic waste;

(3) general farm organizations;

(4) agricultural commodity groups;

(5) conventional transportation fuel producers and retailers;

(6) Tribal governments;

(7) environmental science organizations;

(8) environmental justice organizations;

(9) automotive manufacturers;

(10) forestry interests;

(11) electric utilities or cooperatives;

(12) electric vehicle charging infrastructure companies;

(13) aviation interests;

(14) water quality interests;

(15) a statewide organization of environmental and natural resource organizations;

(16) organizations with expertise in renewable energy and low-carbon transportation fuel policy;

(17) conservation organizations;

(18) organizations representing sustainable agriculture or regenerative biofuels producers;

(19) public health interests; and

(20) labor unions.

Subd. 3. **Administration.**

Appointments and designations to the working group authorized by this section must be completed by July 1, 2023. Public members serve without compensation or payment of expenses. The members of the working group must select a chair from its membership who must not be a commissioner or their designee. Any of the commissioners convening the working group may contract with a third-party facilitator.

Subd. 4. **Report.**

By February 1, 2024, the working group must submit its findings and recommendations to the chairs and ranking minority members of the legislative committees with jurisdiction over transportation and energy policy.

Subd. 5. **Expiration.**

The working group expires on January 1, 2025, or upon submission of the report required under subdivision 4, whichever is earlier.

EFFECTIVE DATE.

This section is effective the day following final enactment.

As requested by Minn. Stat. 3.197: The cost for developing this report was approximately $325,000, which includes staff and consultant time for work group facilitation, technical scenario modeling, report writing and interagency coordination between the four state agencies.

Abbreviations

Frequently used abbreviations are outlined below. A full technical glossary with term definitions can be found in Appendix A.

ASTM	American Society for Testing and Materials, now ASTM International
CARB	California Air Resources Board
CI	Carbon intensity
CCLUB	Argonne National Laboratory's Carbon Calculator for Land Use Change from Biofuels
CCS	Carbon capture and storage
CO_2	Carbon dioxide
COMM	Minnesota Department of Commerce
CTS	Clean Transportation Standard
EER	Energy economy ratio
EJ	Environmental justice
EPA	Environmental Protection Agency
EV	Electric vehicle
GHGs	Greenhouse gases
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
HDV	Heavy-duty vehicle
LCFS	Low carbon fuel standard
LDV	Light-duty vehicle
LCA	Lifecycle assessment
LPG	Liquefied petroleum gas
LUC	Land use change
MDA	Minnesota Department of Agriculture
MDV	Medium-duty vehicle
MJ	Megajoules
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
REC	Renewable energy certificate
SAF	Sustainable aviation fuel
ZEV	Zero emissions vehicle

Executive Summary

Overview and Background

A Clean Transportation Standard (CTS) is a technology and fuel-neutral market-based policy framework that requires carbon intensity reductions for transportation fuels including gasoline, diesel, biofuels, and electricity. When structured and implemented properly, a CTS can reduce transportation greenhouse gas emissions, create green jobs, attract new investments, reduce air and water pollution, and improve soil and water health in Minnesota. A CTS could be the largest single policy for reducing carbon pollution from transportation in Minnesota.

A CTS sets a carbon intensity target that all transportation fuels must achieve. Carbon intensity targets become more stringent over time and encourage innovation and investment in new technologies. Carbon intensity is a measurement of fuel lifecycle greenhouse gas emissions that occur during the production, shipping, and use of the fuel. A CTS reduces greenhouse gas emissions while diversifying the transportation fuel supply.

Conversations regarding a Minnesota CTS started in 2009 when Midwest states convened to discuss a regional clean transportation fuels policy through the Midwest Governors Association. California (2011), Oregon (2016) and Washington (2023) have adopted low carbon or clean transportation fuel standards.

Minnesota already has several policies or practices in place to encourage low carbon fuels. For instance, Minnesota's biodiesel blending mandate is the strongest in the nation, and the state is a national leader with respect to incorporating higher blends of ethanol in gasoline. Minnesota is also a leader in research and development of emerging cropping systems such as winter annual oilseeds that have a lower carbon intensity[1]. Lastly, Minnesota has adopted California's Advanced Clean Cars regulation per Section 177 of the Clean Air Act[2] and is implementing it as Clean Cars Minnesota.

Minnesota also has geographical, industrial, and logistical advantages compared to other states that have adopted and implemented low carbon fuel standards, which will help a CTS succeed. For instance:

- The state's refinery infrastructure provides regulated parties with multiple compliance pathways
- Minnesota has already built out or continues to build production facilities that can move to more advanced biofuel production capabilities
- The state has diverse agricultural production and forestry that can be leveraged to help produce more sustainable biofuels
- Rising electric vehicle adoption rates and supporting programs that can accelerate this trend

1 Learn more about leading research and development of winter-hardy annual and perennial crops at the University of Minnesota's Forever Green Initiative: https://forevergreen.umn.edu/

2 More information about EPA's waiver here: https://www.epa.gov/state-and-local-transportation/vehicle-emissions-california-waivers-and-authorizations

Work Group Process

In spring 2023, the Minnesota Legislature considered the Clean Transportation Standard Act[3] and ultimately directed four state agencies to form the CTS work group[4]. The session law states a CTS should reduce the carbon intensity of fuels by at least 25% by 2030, 75% by 2040, and 100% by 2050 (compared to 2018 levels). The work group met every two to four weeks between July 2023 and January 2024 to discuss modeling outputs and technical analysis of a Minnesota CTS (see Figure 1 below). They also studied and addressed information gaps and opportunities related to a CTS. The engagement process varied for each work group meeting, but each consisted of presentations followed by small group discussions and polling opinions for both modeling scenarios and non-modeling policy recommendations that could be included in a Minnesota CTS. The recommendations outlined in the work group findings chapter were a result of multiple iterations of polling and discussion. Given the expedited timeline of this work group and the many different areas of a CTS that could be discussed, there were a few topics not discussed or were discussed briefly and did not reach work group agreement which are summarized in the 'areas for further exploration' sections throughout this chapter.

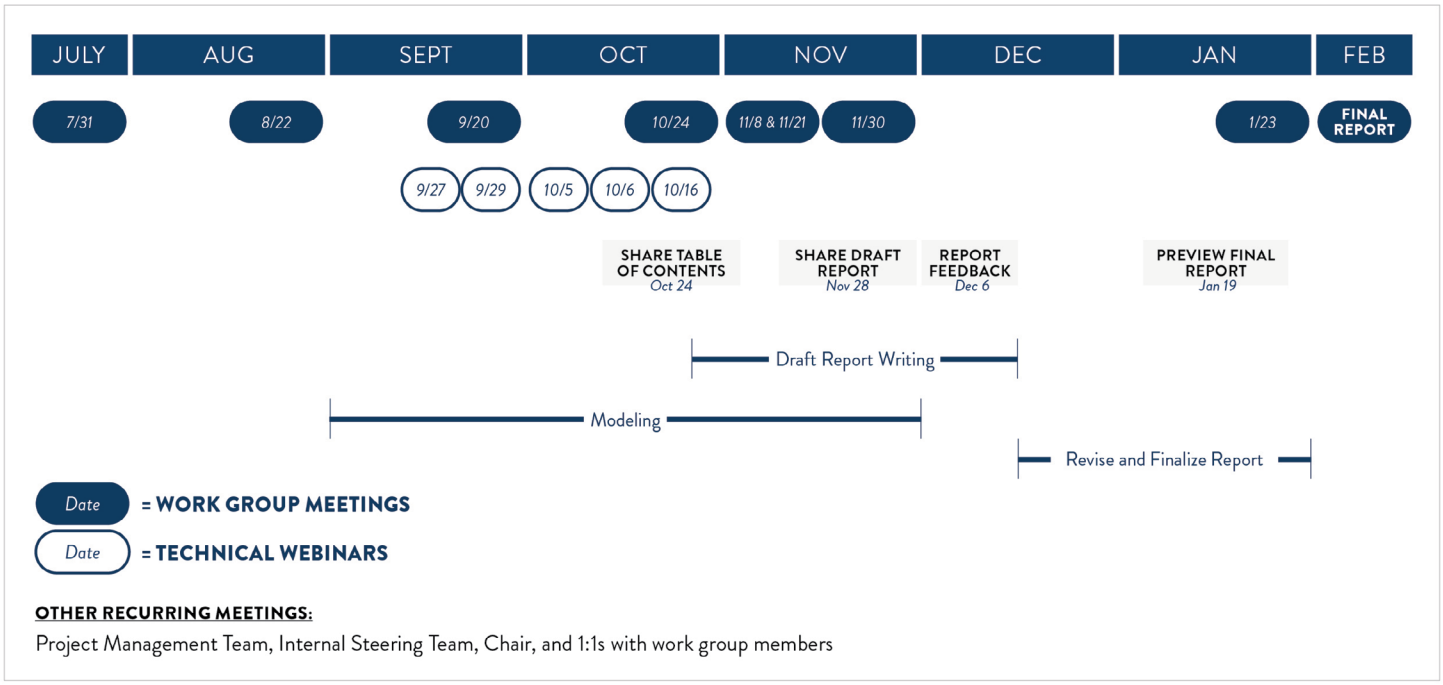

Figure 1. CTS Work Group Timeline

3 Clean Transportation Act (March 2023) bill language: https://www.revisor.mn.gov/bills/text.php?number=SF2584&version=latest&session=ls93&session_year=2023&session_number=0

4 Clean Transportation Standard Work Group mandate: https://www.revisor.mn.gov/bills/text.php?number=HF2887&version=0&session=ls93.0&session_year=2023&session_number=0&type=ccr

Work Group Findings

The work group findings chapter outlines recommendations such as program targets, goals and other requirements on carbon intensity reduction, fuel exemptions and fuel eligibility, and program design considerations for a Minnesota CTS. Additional areas for further exploration are included throughout.

Work group members are interested in a CTS for a variety of reasons. As the work group meetings concluded, the group reflected on the possibility of a CTS in Minnesota by answering the following question:

What is one aspect of a CTS that you feel is most important to Minnesota?

- Transformative emissions reduction
- Comprehensive emissions reduction
- Tailored to Minnesota needs
- The opportunity for diverse economic growth
- Importance of stakeholder engagement
- Opportunity for Minnesota to lead regionally and nationally

Modeling and Technical Analysis

Scenario modeling includes Minnesota-specific fuel consumption data and assumptions for clean fuel strategies in Minnesota. The analysis combined supply, distribution, and production data to determine the baseline carbon intensity of transportation fuels within the state using a 2018 baseline. In short, the scenario modeling is a tool to understand carbon intensity reduction levels that could be achieved under different market conditions and considerations in Minnesota associated with a CTS.

The modeling results demonstrated that the carbon intensity targets included in the law (carbon intensity reductions of 25% in 2030, 75% in 2040, and 100% in 2050) may be very difficult to achieve given what we know today about transportation fuel markets and clean fuel technologies. However, in the nearer term, a moderate case and multiple sensitivity cases demonstrated that Minnesota could achieve carbon intensity reductions of at least 13-17% in 2030 and 40-50% in 2040. Modeling estimates for 2050 range from 67 – 100% by 2050 for both scenarios, but with so much uncertainty between now and 2050 with clean fuel technology development, the work group recommends focusing on 2030 and 2040 targets and making 2050 a goal to be re-evaluated as a target later. Without a CTS, the modeling estimates only a 30% carbon intensity reduction can be achieved by 2050. The scenario modeling assumed that Minnesota's CTS would be implemented similarly to other states with respect to credit and deficit generation. Results were also broken down for each of the clean fuel technologies that we know about today (see Appendix J).

BACKGROUND

Transportation is currently the largest emitter of greenhouse gases (GHGs) in Minnesota, accounting for about 25% of the state's GHG emissions.[5] GHG emissions have been reduced over time, in part, through use of lower carbon fuels, improved federal fuel economy standards and transportation electrification.

The 2023 Legislature created the Clean Transportation Standard (CTS) work group[6] to make recommendations and highlight information gaps and opportunities for implementing a CTS to reduce carbon pollution from transportation fuels in Minnesota. The work group was jointly convened by the Commissioners of Agriculture, Commerce, Transportation, and the Pollution Control Agency with direction to bring together diverse stakeholders and evaluate the potential to reduce the carbon intensity of fuels by at least 25% by 2030, 75% by 2040, and 100% by 2050 (compared to 2018). A CTS could be the largest single policy for reducing carbon pollution from transportation in Minnesota. The Minnesota Climate Action Framework (CAF) envisions a transportation system that is sustainable, resilient to a changing climate, and supports equitable transportation options for all Minnesotans. A CTS could advance some of the Climate Action Framework goals for planning, infrastructure, and education needed for cleaner vehicle and fuel technology, including electric vehicles and biofuels. The CAF recommends increasing the use of clean fuels, including lower-carbon biofuels.

Minnesota is well positioned to implement a CTS due to geographical, industrial, and logistical advantages compared to other states that have adopted and implemented low carbon fuel standards. These advantages arise from the state's refinery infrastructure, mature blending and retail infrastructure for biodiesel and higher blends of ethanol, in-state biofuel production facilities, diverse agricultural production, and a myriad of programs to support transportation electrification, rising electric vehicle adoption rates and the supporting programs that can accelerate that trend.

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5 Minnesota Pollution Control Agency and Department of Commerce. (January 2023). *Greenhouse gas emissions in Minnesota 2005 – 2020.* https://www.pca.state.mn.us/sites/default/files/lraq-2sy23.pdf

6 Clean Transportation Standard Work Group mandate (Sec. 124): https://www.revisor.mn.gov/bills/text.php?number=HF2887&version=0&session=ls93.0&session_year=2023&session_number=0&type=ccr

As this report's modeling illustrates, a CTS would work in tandem with other policies and advance CAF goals to help the state achieve the economy-wide, multi-sector goal of 80% GHG emissions reduction by 2040. Without a CTS, only a 30% carbon intensity reduction by 2050 is possible (see Page 23 for Modeling to Support CTS Work Group).

The four state agencies administering the work group are already collaborating to advance CAF strategies and have a range of expertise and responsibilities related to a CTS:

- Dept. of Agriculture – Water quality, agriculture conservation programs, and biofuels (see Appendix B)
- Dept. of Transportation – Aeronautics, freight, EV charging infrastructure, carbon reduction program, and the State's Multimodal Transportation Plan
- Pollution Control Agency – Air and water quality, greenhouse gas emissions, and animal agriculture policy (see Appendix B)
- Dept. of Commerce – Fueling stations, weights and measures, electrification, utility dockets with the Minnesota Public Utilities Commission (see Page 19 for 2023-24 CTS Work Group)

What is a Clean Transportation Standard?

A CTS is a technology-neutral and fuel-neutral framework that seeks to reduce the carbon intensity (CI) of all transportation fuels including gasoline, diesel, biofuels, and electricity. Carbon intensity[7] is a measurement of lifecycle GHG emissions that includes all stages of fuel production, delivery, and use in a vehicle.

Low carbon fuel standards are attractive to policy makers because they send a clear signal to investors that long-term solutions are needed for lower-carbon and cost-competitive transportation fuels. A CTS sets a carbon intensity target that all transportation fuels must achieve. Carbon intensity target levels decrease over time to encourage innovation and investment in new technologies. A CTS can reduce transportation GHG emissions, create new jobs, attract new investments, reduce air and water pollution, and improve soil and water health in Minnesota.

7 The carbon intensity is reported as grams of carbon dioxide equivalents (CO_2e) per unit of energy in the finished fuel in megajoules (MJ). The carbon intensity includes the CO_2e emissions (i.e., emissions are adjusted for their respective 100-year global warming potentials) from CO_2, CH_4, N_2O, and the carbon fractions of volatile organic compounds (VOC) and carbon monoxide (CO).

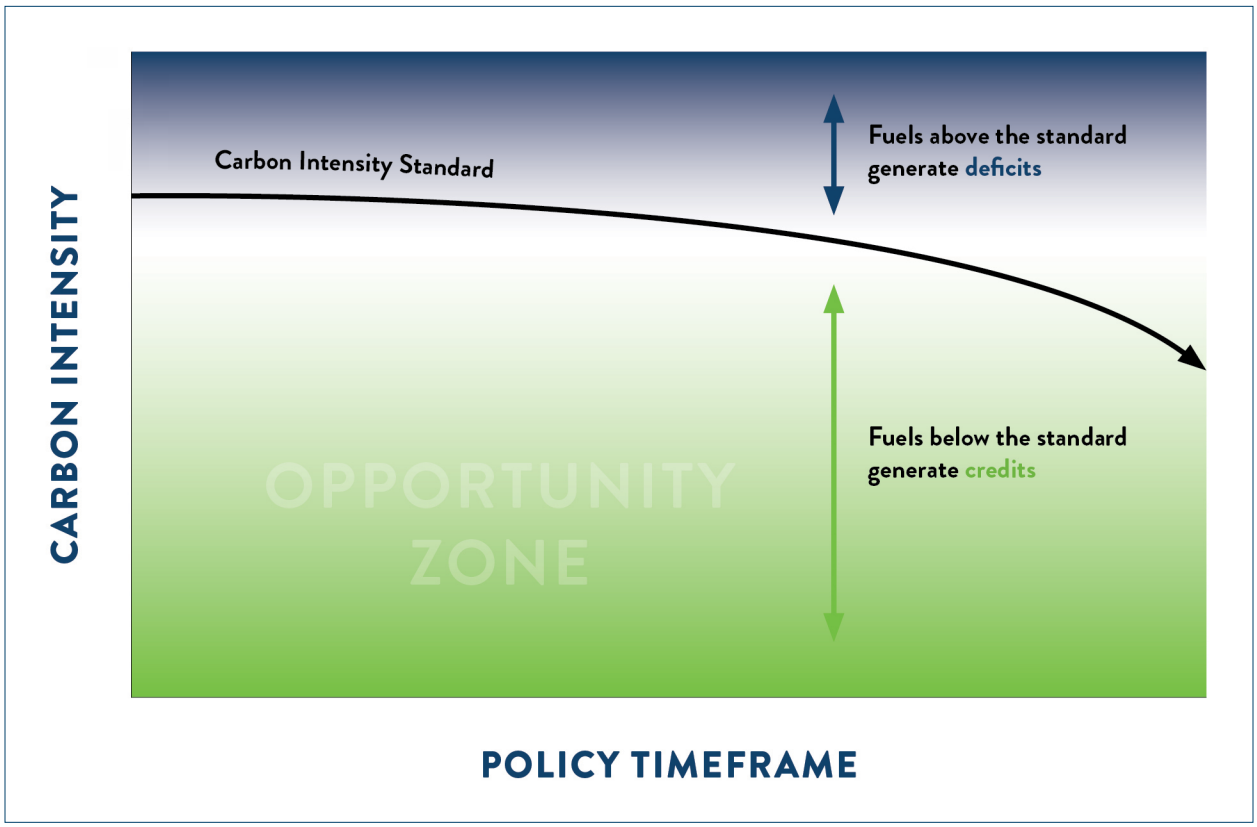

Figure 2: Carbon intensity in relation to policy timeframe. Source: Great Plains Institute.

A CTS regulates those who refine, blend, make or import fuel. A CTS does not apply to fuel retailers like gasoline stations. There are multiple ways parties can meet the standard:

- Blend high carbon intensity petroleum fuels with clean fuel options, like biodiesel and ethanol
- Purchase credits generated by other entities that refine, blend, or make low carbon fuels
- Reduce GHG emissions in the production, processing, and delivery of transportation fuels

Low carbon fuel producers are generally the entities that generate credits used towards compliance. There are other actors in the supply chain that can help generate credits for example, farmers and forestry owners who implement climate smart practices that reduce the carbon intensity of feedstocks. However, low carbon fuel producers and their partners are voluntary program participants and generally need to opt-in to participate in a low carbon fuel standard program.

A credit is generated by a unit of fuel that has a carbon intensity lower than the standard and a deficit is generated by a unit of fuel that has a carbon intensity higher than the standard. The carbon intensity standard changes each year. As a result of this change each year, if a clean fuel carbon intensity does not change in that same year, it will generate fewer credits. Similarly, if a deficit generating fuel carbon intensity does not change in that same year, then it will generate more deficits.

A credit represents one metric ton (MT) of GHG emissions, as reported in carbon dioxide equivalents (CO_2e). For the CTS to be in compliance, participants that generate deficits, such as refiners, must acquire credits to offset deficits for a balance of no less than zero.

A credit or deficit is calculated as a function of several parameters, including:

Amount of fuel	The amount of fuel used in Minnesota's transportation market is one of the primary determinants of the role that the fuel plays in the CTS. The volume of the fuel needs to be converted into common units—this is done by taking the volume of the fuel and converting it into a common unit of energy, megajoules (MJ). The volume of fuel is converted to energy content by multiplying the volume by the energy density of a fuel.
Energy equivalency of fuel	The amount of fuel is adjusted to account for the differences in the efficiency of different vehicle/fuel combinations. This is done with an energy economy ratio (EER) and each fuel used in a particular vehicle is assigned an EER value. The EER is a unitless measure of the efficiency of fuel/vehicle combinations compared to a reference fuel/vehicle combination. For instance, electricity used in a motor to power a vehicle is about 3.4 times more energy efficient than using gasoline in an internal combustion engine. In this case, the EER is 3.4 and this is accounted for in two parts of the calculation: 1) the amount of fuel and 2) the carbon intensity of the fuel.
Carbon intensity of fuel	The carbon intensity of the fuel is a measure of that fuel's performance with respect to GHG emissions, normalized to energy content of the fuel and is reported in units of gCO_2e/MJ.
Carbon intensity of the standard	The carbon intensity of the standard is the benchmark against which the credits or deficits are determined.

There are several credit and deficit calculation examples in Appendix H.

Low Carbon Fuel Standards Around the Country

There is no national clean fuel standard, but California (2011), Oregon (2016), and Washington (2023) have adopted low carbon fuel standards (LCFS) or clean transportation fuel standards (see Appendix C). Legislation has also been proposed in Illinois, Massachusetts, Michigan, New Jersey, New Mexico, New York, and Vermont. States with clean fuel policies all use lifecycle analysis with a declining carbon intensity target to drive innovation and reduce GHG emissions. States have learned from each other, but their policies are unique and reflect state-specific needs and values. Oregon[8] and Washington[9] have each published information about the costs, benefits or potential costs to consumers. A report analyzing the primary drivers of fuel prices in California[10] after ten years into the program showed the primary driver of fuel prices was the cost of crude oil and that renewable fuels under the program provided cost savings relative to petroleum fuels. Low carbon fuel policies in other states have all been authorized by legislation and adopted through rulemaking.

Internationally, clean fuel policies exist in Brazil; British Columbia, Canada; and the European Union. The work group had the opportunity to learn from Oregon and Washington program representatives. These programs have been demonstrated to reduce GHG emissions through compliance with their CI reduction goals.

Several companies currently make low carbon fuels in Minnesota and ship them to California, Oregon, and Washington where they have greater value because of credits generated by clean fuel programs. If a Minnesota CTS were passed, fuel producers may be able to reduce transportation costs and further reduce GHG emissions by keeping low carbon fuels for use in vehicles operating in Minnesota instead of shipping them across the country.

Related Initiatives in Minnesota

A CTS and related policies have been under discussion in Minnesota since at least 2009.

2009: Iowa Secretary of Agriculture Bill Northey convened states to discuss a regional clean transportation fuels policy through the Midwest Governors Association, which sparked a related discussion in Minnesota.

2010 – 2018: Biofuel policies developed and evolved, as well as conversations regarding transportation electrification. Both laid groundwork for stakeholder dialogue on a CTS. Other states developed programs such as the California Low Carbon Fuel Standard in 2011, the Oregon Clean Fuels Program in 2016, and other clean fuels policies under discussion in Canada, Colorado, New York, and Washington.

2019: Great Plains Institute facilitated the Midwestern Clean Fuels Initiative, a group of diverse industry and environmental stakeholders, to identify policy principles captured in the white paper, *A Clean Fuels Policy for the Midwest*.[11] The paper identifies potential benefits of a CTS for the economy and environment and principles for a clean fuels policy.

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8 Oregon Department of Environmental Quality. Annual Cost of the Clean Fuels Program. https://www.oregon.gov/deq/ghgp/cfp/pages/annual-cost.aspx

9 Washington Department of Ecology. (May 2022). Clean Fuel Standard Cost Benefit Analysis Report. https://ecology.wa.gov/getattachment/22790fe6-fc3a-414d-b3ba-036af0975258/20220512CfsCba.pdf

10 Bates & White. (April 2022). Low Carbon Fuel Standards: Market Impacts and Evidence for Retail Fuel Price Effects. https://www.bateswhite.com/newsroom-insight-Low-carbon-fuels-standards-Cain-2022.html

11 Great Plains Institute. (January 2020). A Clean Fuels Policy for the Midwest. https://www.betterenergy.org/wp-content/uploads/2020/01/Clean-Fuels-White-Paper-Final-2.pdf

2019: The Pathways to Decarbonizing Transportation[12] project worked with state and national experts and the public to identify strategies to reduce transportation carbon pollution. The project illustrated how increased vehicle efficiency and lower carbon fuels could get Minnesota almost 80% of the way towards Minnesota's Next Generation Energy Act goals for the transportation sector.

2020: Governor's Council on Biofuels developed a report[13] with recommendations, findings, and conclusions from a nine-month consensus-building process. Topics included E15 (gasoline blended with 15% ethanol) and mid-level blends, biodiesel, and biofuels infrastructure; a LCFS program and more.

2021: Sustainable Transportation Advisory Council formally recommended pursuing a CTS.

2021: Minnesota legislative session sees the Future Fuels Act[14] introduced in the House of Representatives based on principles developed through the Midwestern Clean Fuels Initiative process. The bill had a Senate companion and received a hearing in the Minnesota House.

2021: Governor Tim Walz directed the Dept. of Agriculture (MDA) and Dept. of Transportation (MnDOT) to create a stakeholder process to identify shared goals and opportunities to inform development of a new clean transportation standard and produce a report.[15]

2022: The Governor's Climate Change Subcabinet released Minnesota's Climate Action Framework, a comprehensive plan for how the state can mitigate and adapt to climate change, which includes a recommendation to increase the use of clean fuels via a CTS.

2022: The 20-year Statewide Multimodal Transportation Plan (SMTP)[16] included a goal to reduce GHGs from the state's transportation sector.

2023: Minnesota Senate introduces the Clean Transportation Standard Act,[17] and mandates four agencies convene a Clean Transportation Standard Work Group[18] to identify gaps and opportunities for implementing a CTS.

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12 Minnesota Department of Transportation. (2019). *Pathways to Decarbonizing Transportation*. The agency engaged Minnesotans statewide to identify strategies to reduce transportation climate pollution while promoting economic development, safety, and equity. More information: https://www.leg.mn.gov/docs/2019/other/190966.pdf

13 Minnesota Department of Agriculture. (November 2020). *Governor's Council on Biofuels Report*. https://www.mda.state.mn.us/sites/default/files/docs/2020-11/GovernorsCouncilBiofuelsReport_ExecOrder19-35.pdf

14 Future Fuels Act 2022. (MN House File 2083): https://www.revisor.mn.gov/bills/text.php?number=HF2083&type=bill&version=0&session=ls92&session_year=2021&session_number=0

15 Minnesota Department of Agriculture and Minnesota Department of Transportation. (March 2022). *Clean Fuels Standard in Minnesota Summary Report and Stakeholder Feedback*. https://www.lrl.mn.gov/docs/2022/other/220639.pdf

16 Minnesota Department of Transportation. *2022 Statewide Multimodal Transportation Plan*. https://minnesotago.org/final-plans/smtp-final-plan-2022

17 Clean Transportation Act (March 2023) bill language: https://www.revisor.mn.gov/bills/text.php?number=SF2584&version=latest&session=ls93&session_year=2023&session_number=0

18 Clean Transportation Standard Work Group mandate (2023): https://www.revisor.mn.gov/bills/text.php?number=HF2887&version=0&session=ls93.0&session_year=2023&session_number=0&type=ccr

Related Policies and Programs

Given the cross-agency and cross-industry nature of a CTS, there are several related policies and programs that a CTS will impact or rely on to be successful in Minnesota. The implementation of a CTS in Minnesota would make it the first agricultural dominant state to enact a standard. The work group learned about several of the ecosystem services, water and soil health concerns expressed by several work group members and guest speakers. The Minnesota Board of Water and Soil Resources (BWSR), Minnesota Pollution Control Agency (MPCA), Minnesota Department of Agriculture (MDA) and Minnesota Department of Natural Resources (DNR) have implemented policies and programs related to these concerns. A sample of these policies and programs can be found in Appendix B; this is not an exhaustive list but instead a sample of a broad set of related programs.

2023-24 CTS WORK GROUP

Overview

The 2023 Minnesota Legislature established the CTS work group to study and address information gaps and opportunities related to a clean transportation standard. The work group helped create recommendations for implementing a CTS that would reduce carbon pollution from all transportation fuels including gasoline, diesel, biofuels, and electricity. The development of the work group report was a joint effort by Commissioners and staff of the Departments of Agriculture, Commerce, Transportation, and the Pollution Control Agency.

Interested stakeholders applied to be considered for appointment to the work group through the Minnesota Secretary of State Open Appointments process. As directed by the Legislature, two members were appointed to 20 different stakeholder categories, totaling 40 stakeholders appointed by the four agency Commissioners.

Work group members met to learn, share information, and discuss interests and concerns. The process began with a high-level overview of the CTS, followed by technical and educational presentations about similar programs in other states, industry and academics with expert knowledge, and scenario modeling. Finally, the work group made recommendations on fuel pathways and outlined their overall recommendations and areas for further exploration, summarized in the work group findings chapter.

Work group members were reminded that additional engagement and policy development opportunities beyond this effort would be provided to discuss important details of CTS implementation, including future public engagement, legislative processes, rulemaking, etc.

The work group charter was adopted in August 2023 (see Appendix D). A total of nine work group meetings and five technical webinars were held between July and January 2024. A summary of the meetings can be found in Appendix F. Full meeting summaries including a list of Q & A and attendance from the meetings are included in the report's **Addendum**.

Given the expedited timeline of this work group and the many different issue areas of a CTS that could be discussed, there were a few topics not discussed or discussed briefly that did not reach work group consensus. These areas are outlined in the work group findings chapter.

Similarly, there were many issue areas discussed that were outside of some members' areas of expertise. When members were polled on key issues, members could skip questions or respond with a score of '3 – neutral.'

Although the work group meetings were not required to follow Open Meeting Law, meetings were open to the public and several non-work group members provided feedback and comments for work group consideration. Comments were made at the end of each meeting or sent via email to agency staff to share with the work group. Feedback received can be found at the end of each meeting summary (see report **Addendum**).

Work group members are interested in a CTS for a variety of reasons. As the work group meetings concluded, the group reflected on the possibility of a CTS in Minnesota by answering the following question:

What is one aspect of a CTS that you feel is most important to Minnesota?

- **Transformative emissions reduction**: Modeling shows the transformational ability of a CTS to lower carbon pollution from transportation and agriculture. The scale of opportunity in the near-term is large.
- **Comprehensive emissions reduction**: A CTS is comprehensive enough to advance electrification, continue improvement and evolution of biofuels, and create a space for new fuels.
- **Tailored to Minnesota needs**: Recognition that climate smart agriculture and forestry practices can contribute to lower carbon intensity fuels, which is critical given the importance of these industries to Minnesota.
- **The opportunity for growth**: A CTS would create economic development opportunities for Minnesota by increasing investment in emerging clean fuels and electrification.
- **Importance of stakeholder engagement**: There is continued need for diverse and broad stakeholder engagement for a CTS to be successful.
- **An opportunity for Minnesota to lead**: States around the country are watching Minnesota. Creating a CTS here could be model for the Midwest, tailored to the unique needs of our state and region.

Work Group Collaboration

Table 1: Work Group Members (alphabetized by last name)

First Name	Last Name	Organization	Representing
Paul	Austin	Conservation Minnesota	Conservation organizations
Kaytlin	Bemis *	Minnesota Farm Bureau	General farm organizations
Pierce	Bennett **	Minnesota Farm Bureau	General farm organizations
Carolyn	Berninger*	Great Plains Institute	Renewable energy and low carbon transportation
Amanda	Bilek	Minnesota Corn Growers Association	Agricultural commodity groups
Richard	Biske **	The Nature Conservancy	Conservation organizations
Dan	Bowerson	Alliance for Automotive Innovation	Automotive manufacturers
Matthew	Bruyette	Nature Energy	Renewable natural gas and organic waste interests
Mike	Bull	Allete, Inc./Minnesota Power	Electric utilities or cooperatives
Margaret	Cherne-Hendrick	Fresh Energy	Environmental science organizations
Vallen	Cook	Grand Portage Band of Chippewa	Tribal governments
Colin	Cureton	UMN Forever Green Initiative	Sustainable agriculture or regenerative biofuels producers
Jeff	Davidman	Delta Air Lines, Inc.	Aviation interests
Rodney	De Fouw	Great River Energy	Electric utilities or cooperatives
Suzanne	Goldberg *	ChargePoint, Inc.	EV charging infrastructure companies
Timothy	Gross	Fueling Minnesota	Conventional transportation fuel producers and retailers
Dustin	Haaland	CHS, Inc.	Conventional transportation fuel producers and retailers
Kent	Hartwig	Gevo, Inc.	Aviation interests
John	Hausladen	Minnesota Trucking Association	Automotive manufacturers
Abby	Hornberger	BlueGreen Alliance	Labor unions
Rick	Horton	Minnesota Forest Industries	Forestry interests
Jon	Hunter	American Lung Association	Public health interests

LesLee	Jackson +	Minneapolis Northside Green Zone	Environmental justice organizations
John	Jaimez	Hennepin County, Partnership on Waste and Energy	Renewable natural gas and organic waste interests
Brendan	Jordan **	Great Plains Institute	Renewable energy and low carbon transportation
Ariel	Kagan	Minnesota Farmers Union	General farm organizations
Thad	Kurowski	Tesla, Inc.	EV charging infrastructure companies
Jeremy	Martin	Union of Concerned Scientists	Environmental science organizations
Cyndy	Milda +	Shakopee Mdewakanton Sioux Community	Tribal governments
Sarah	Mooradian	CURE	Water quality interests
Steve	Morse	Minnesota Environmental Partnership	Statewide environmental and natural resource organizations
Marty	Muenzmaier	Cargill, Inc.	Sustainable agriculture or regenerative biofuels producers
Carolina	Ortiz	Comunidades Organizando el Poder y la Acción Latina (COPAL MN)	Environmental justice organizations
Stephanie	Pinkalla *	The Nature Conservancy	Conservation organizations
Kevin	Pranis	Laborers' International Union of North America (LIUNA) Minnesota/North Dakota	Labor unions
Trevor	Russell	Friends of the Mississippi River	Water quality interests
Eric	Schenck	Minnesota Forest Resources Council	Forestry interests
Kathleen	Schuler	Health Professionals for a Healthy Climate	Public health interests
Nate	Schuster **	ChargePoint, Inc.	EV charging infrastructure companies
Mark	Ten Eyck	Minnesota Center for Environmental Advocacy	Statewide environmental and natural resource organizations
Peter	Wagenius +	Sierra Club	Renewable energy and low-carbon transportation
Brian	Werner	Minnesota Biofuels Association	Renewable fuel producers
Bob	Worth	Minnesota Soybean Growers Association	Agricultural commodity groups
Mike	Youngerberg	Minnesota Biodiesel Council	Renewable fuel producers

*Member served for a partial term due to job change or leave and was replaced by a colleague.
**Colleague that replaced work group member.
+ Appointed to work group between August – September 2023.

MODELING TO SUPPORT CTS WORK GROUP

The work group was presented an analysis of Minnesota's transportation fuels market and found that it has a significant carrying capacity for clean fuels. Compliance with a CTS will require a range of investments in low carbon fuel production, retail distribution infrastructure, and advanced vehicle technologies.

Key Minnesota transportation fuel facts include:

- Current state consumption of liquid fossil fuels is 2.4 billion gallons of gasoline and 750 million gallons of diesel annually. Minnesota petroleum-based fuels are primarily refined products from two in-state refineries—Flint Hills Resources' Pine Bend Refinery and Marathon Petroleum's St. Paul Park Refinery.
- Top-ten ethanol producer domestically with a production capacity exceeding 1.4 billion gallons per year.
- Significant biodiesel producer with a production capacity exceeding 80 million gallons per year.
- National leader in consuming higher blends of ethanol in gasoline and has the nation's most aggressive biodiesel blending mandate.
- Zero emission vehicles (ZEVs) grew by 44% in 2021 and 62% in 2022.
- Minnesota has adopted California's Advanced Clean Cars regulation per Section 177 of the Clean Air Act and is implementing it as Clean Cars Minnesota to help meet state greenhouse gas guidelines and increase the number of ZEVs available for purchase.

Scenario Modeling for CTS Compliance

Scenario modeling was used to demonstrate the levels of carbon intensity reduction that could be achieved via a Minnesota CTS under different market conditions and considerations. The scenario modeling was performed using a fleet turnover-based model for light-, medium-, and heavy-duty vehicle fleets in Minnesota. The model includes assumptions regarding fuel economies, vehicle miles traveled, and other key parameters associated with transportation fuel consumption. The modeled compliance scenarios include a mix of vehicle and fuel strategies, and the model tracks the credits and/or deficits generated on a year-over-year basis for each model run.

The modeling included Minnesota-specific carbon intensity estimates for various transportation fuels. It aggregated supply, distribution, and production data to determine the baseline carbon intensity of transportation fuels within the state using a 2018 baseline. The analysis relied on Minnesota-specific assumptions for the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model[19] and was augmented by reviewing currently certified carbon intensities from California's Low Carbon Fuel Standard (LCFS).

The scenario modeling assumed that Minnesota's CTS would be implemented similarly to other states with respect to credit and deficit generation. In other words, petroleum-based transportation fuels (i.e., gasoline and diesel) with a carbon intensity higher than the standard generate deficits; these deficits must be offset on an annual basis by credits generated by lower-carbon fuels. Credits can be banked without holding limits and do not expire based on the year in which they were generated. Figure 3 highlights the ways that deficits and credits are assumed to be generated in the program—note that fuels in the solid filled blue box generate deficits and fuels (or activities) listed in white boxes generate credits in a low carbon fuel policy.

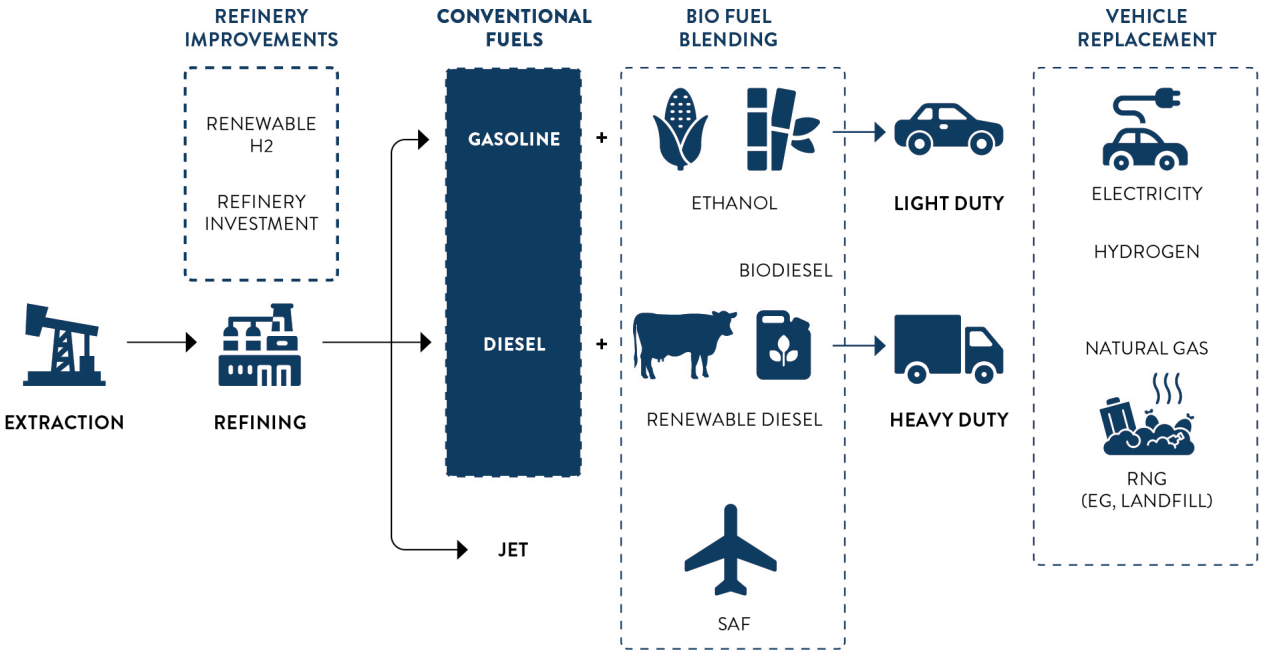

Figure 3. Illustrative Summary of Credit and Deficit Generation in a CTS

Life Cycle Analysis of Transportation Fuels

As noted previously, a CTS program would track carbon intensity reductions, therefore the scenario modeling focused on GHG emission reduction potential. Carbon intensity is a measurement of life cycle GHG emissions that includes all stages of fuel production, delivery, and use in a vehicle. In the context of life cycle analysis (LCA), there are two main types: attributional LCA and consequential LCA. Attributional LCA assesses the global impact share of a product's (e.g., a fuel) life cycle based on the environmentally relevant physical flows to and from the relevant systems. A consequential LCA evaluates the consequential impact to environmentally relevant physical flows of a product based on a particular decision.

The states with existing programs, and the programs in other international jurisdictions, rely on attributional LCA modeling. The work group did not have a substantive discussion of the merits of using an attributional LCA versus consequential LCA underpinning the CTS.

19 Argonne National Laboratory GREET Life-Cycle Model: https://greet.anl.gov/files/greet-model

However, third-party presenters to the work group highlighted that there are models (discussed below) to implement the CTS program using an attributional LCA of GHG emissions across many fuel types, whereas there is no existing model or platform that can be used to implement the CTS using a consequential LCA approach for GHG emissions across many fuel types. Similarly, in the presentation of consequential LCA approaches for other (non-GHG emissions) environmental impacts, it was clear that there are not existing models or platforms that could be readily adopted as part of CTS program implementation.

The LCA modeling was limited to GHG emissions and was done using the GREET model. California, Oregon and Washington use a modified version of the GREET model in their respective program implementation. The GREET model is developed, updated, and maintained by Argonne National Laboratory, a federally funded research and development center under the U.S. Department of Energy. The GREET model is publicly available and has a robust user community.

The GREET model uses an attributional LCA approach (or process-based LCA). This means direct emissions from each phase of the fuel lifecycle contribute to the fuel's carbon intensity. However, stakeholders have argued that many transportation fuels have indirect effects that are not captured in a process-based LCA. Most notably, stakeholders have identified potential increased GHG emissions because of land use change (LUC) that may be linked to crops used for fuel production. The working hypothesis for increased GHG emissions from LUC is based on consequential processes: the increased demand for a particular feedstock for fuel production leads to increased prices for that feedstock. As a result, farmers dedicate a larger share of cultivated land for that feedstock. With the underlying presumption that there is a fixed supply of that feedstock for multiple uses (e.g., fuel, feed, or food), the increased use of the feedstock to make fuel leads to decreased supply for other uses, thereby increasing feedstock prices. In response to these supply-demand and price relationships, some farmers may seek to increase yields, switch crops, or bring non-agricultural lands into production. When this new land is converted, the carbon sequestered in soils and vegetation is released, thereby increasing GHG emissions. This consequential approach to GHG emissions accounting is outside the scope of a process-based LCA. However, Argonne National Laboratory researchers have incorporated a module to account for the GHG emissions from LUC for specific biofuel feedstocks. There are other approaches to quantify this LUC adder (e.g., California modified their version of the GREET model with a different LUC adder for biofuel feedstocks).

The GREET model relies on many data sources, simulations, and collaboration with other organizations and industries. The model is adept at quantifying GHG emissions from the entire supply chain for transportation fuels. **Figure 4** below shows how the lifecycle GHG emissions of ethanol are tracked in the GREET model—capturing GHG emissions (inclusive of CO_2, CH_4, and N_2O) from feedstock cultivation (including fertilizer application), delivery to the biofuel production facility, the energy required to operate the biofuel production facility, delivery to the retail station and ultimately the use of the fuel in a vehicle.

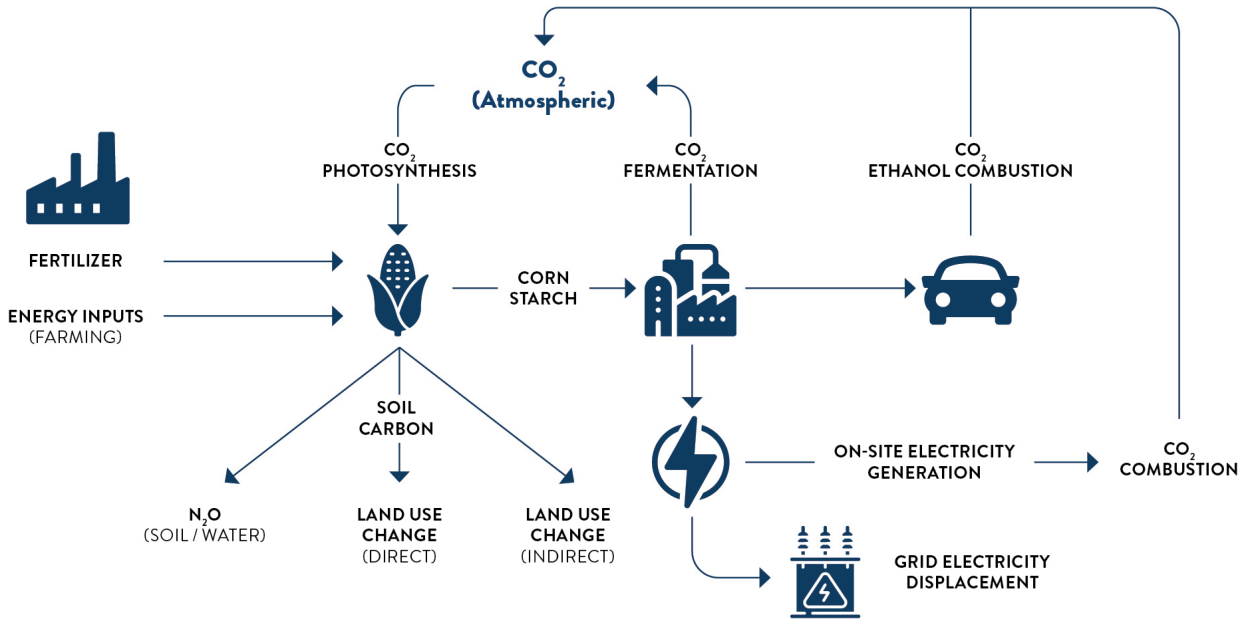

Figure 4. Overview of Lifecycle Analysis of GHG Emissions from Ethanol

Scenario Modeling Results

The scenario analysis results (see Figure 5) included a Business as Usual (BAU) Case, a Moderate Case, and many Accelerated Cases to demonstrate the sensitivity of the carbon intensity reduction targets to specific clean fuel strategies. After accounting for likely clean fuel deployment and advanced vehicle adoption, the results of the scenario analysis suggested the following:

- The carbon intensity targets included in the session law for the work group (25% carbon intensity reduction in 2030, 75% in 2040, and 100% in 2050) may be very difficult to achieve given what is known today about the market and clean fuel technologies.
- In a BAU Case, Minnesota will likely achieve a carbon intensity reduction of 5% in 2030, 15% in 2040, and 30% in 2050.
- In a Moderate Case, Minnesota will likely achieve a carbon intensity reduction of 13-17% in 2030, 40-50% in 2040, and 65-75% in 2050.
- In multiple Accelerated Cases with more optimistic considerations for clean fuel deployment in Minnesota, the state could achieve a carbon intensity reduction of greater than 50% in 2040, and greater than 75% in 2050.
- In an All-In Accelerated Case with an aggressive outlook that aggregates many optimistic assumptions with respect to clean fuel deployment in Minnesota, the state may be able to achieve the targets included in the 2023 session law.

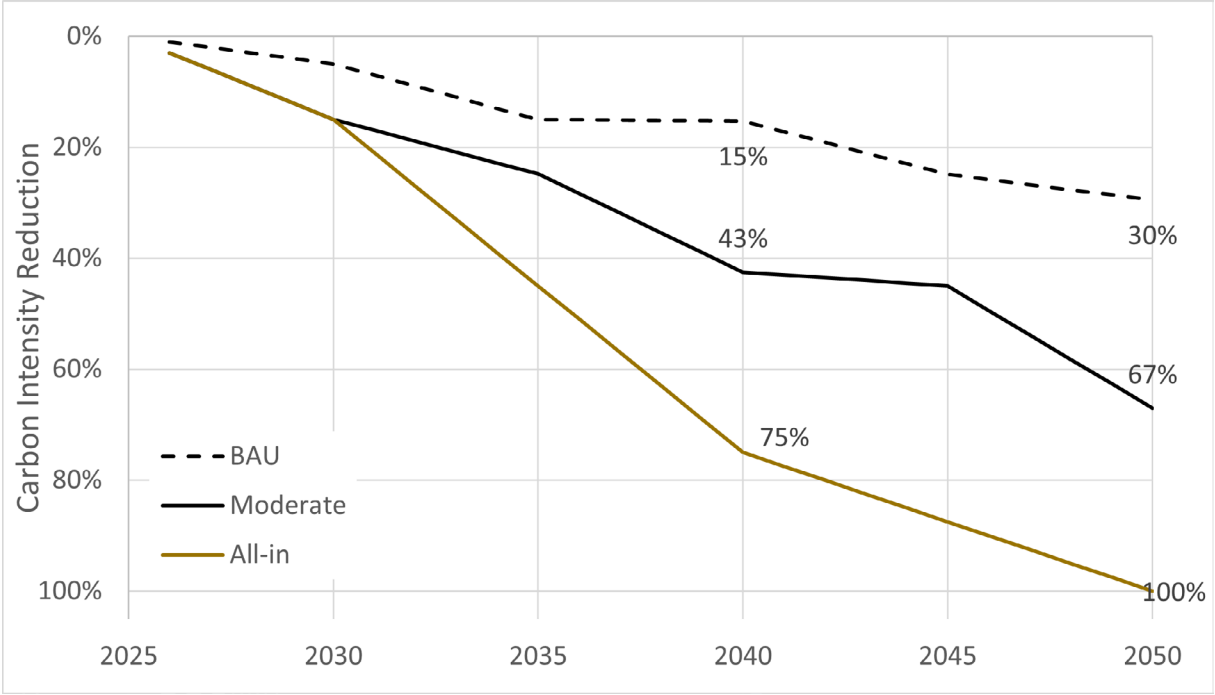

Figure 5: Carbon Intensity Reduction Trajectories for all fuels in MN in the BAU, Moderate, and Accelerated All-In Cases

Figures 6 and 7 below show the compliance trajectory as a function of annual credit (green bars) and deficit (grey bars) generation against the cumulative bank of credits and deficits (blue line). When the blue line has a positive slope, the market is over-performing against the required CI reductions of the CTS, and the availability of low carbon fuels exceeds what is needed for compliance. However, when the blue line has a negative slope, the market is relying on previously banked credits to achieve compliance and the supply of low carbon fuels is assumed to be constrained compared to what is required by the CTS. **Figure 6** shows the results for the Moderate Case and **Figure 7** shows the results for the All-In Case. The y-axis on the left of each graph in the figures below corresponds to annual credit generation (green vertical bars) and annual deficit generation (grey vertical bars). The y-axis on the right of each graph in the figures below corresponds to the cumulative bank of credits (blue line) generated over the life of the program in any given year.

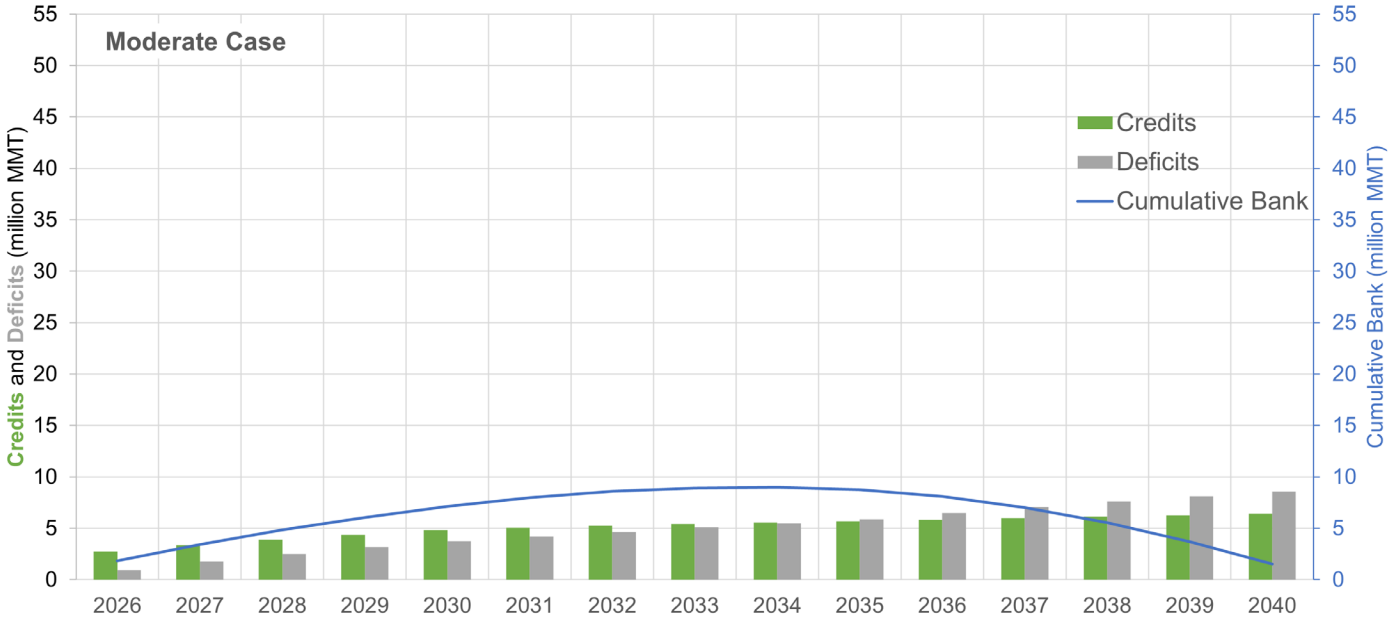

Figure 6: Balance of Deficits and Credits in the Moderate Case

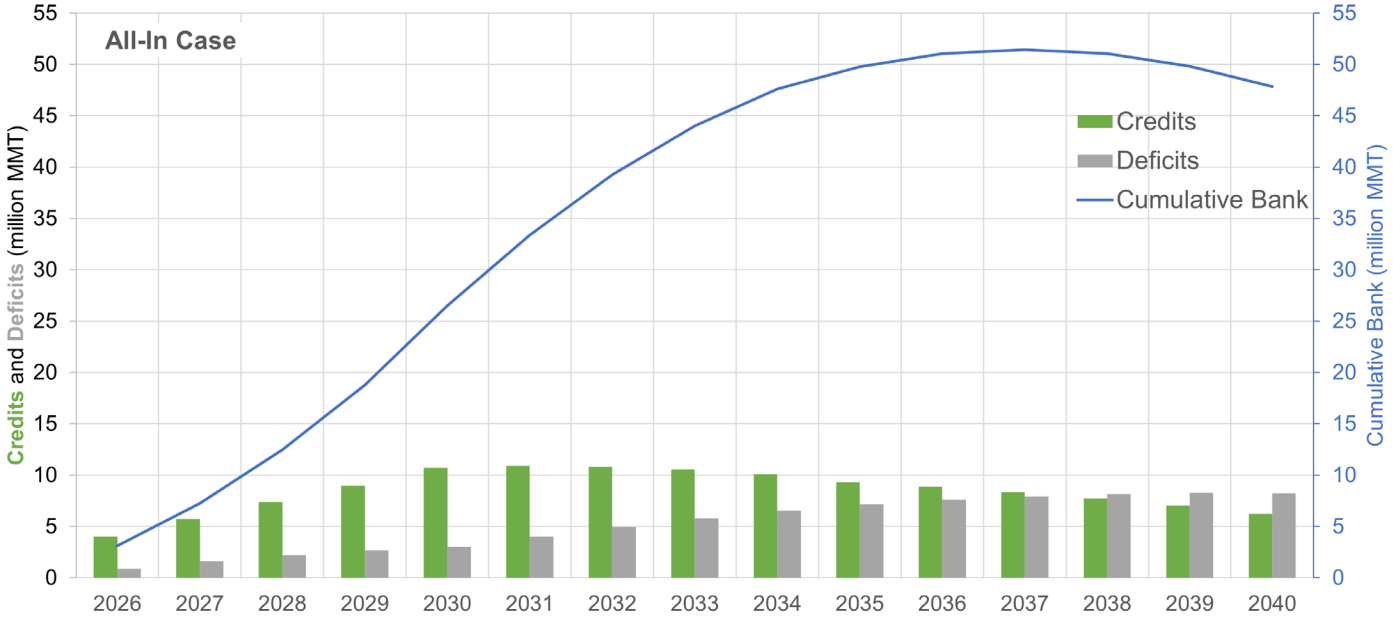

Figure 7: Balance of Deficits and Credits in the All-In Case

Figures 8, 9 and **10** below show transportation energy consumption (in gigajoules, GJ) between 2026 and 2040 for the BAU Case, the Moderate Case, and the All-In Accelerated Case, respectively. These figures show how CTS compliance will likely lead to fuel diversification in Minnesota and an overall decrease in fuel consumption on an energy equivalence basis. A full summary of the modeling scenario results, including a breakdown of the results by fuel type, is included in Appendix I.

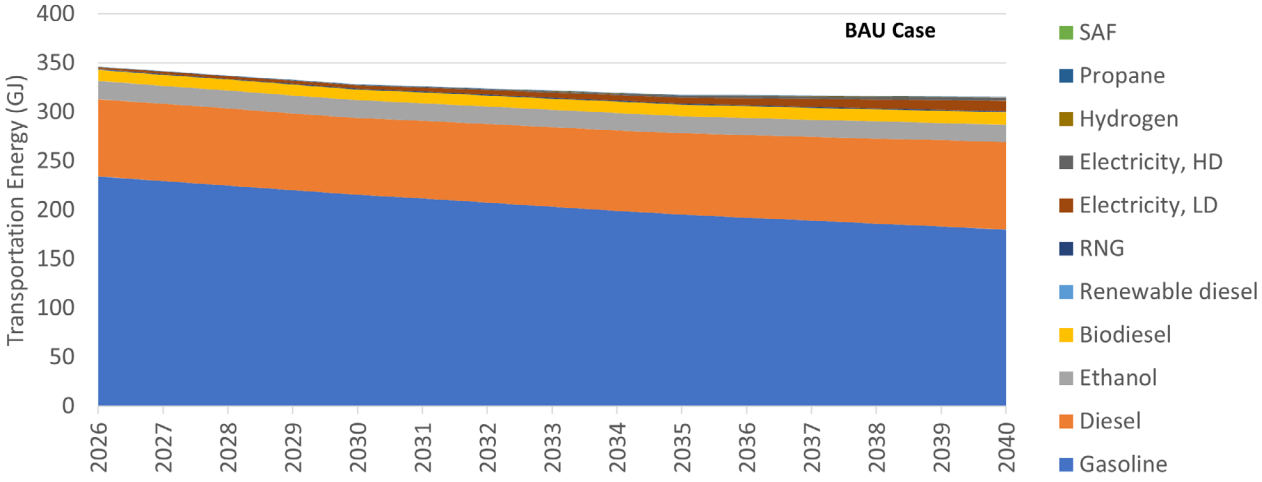

Figure 8: Transportation Energy Consumption (GJ) in the BAU Case

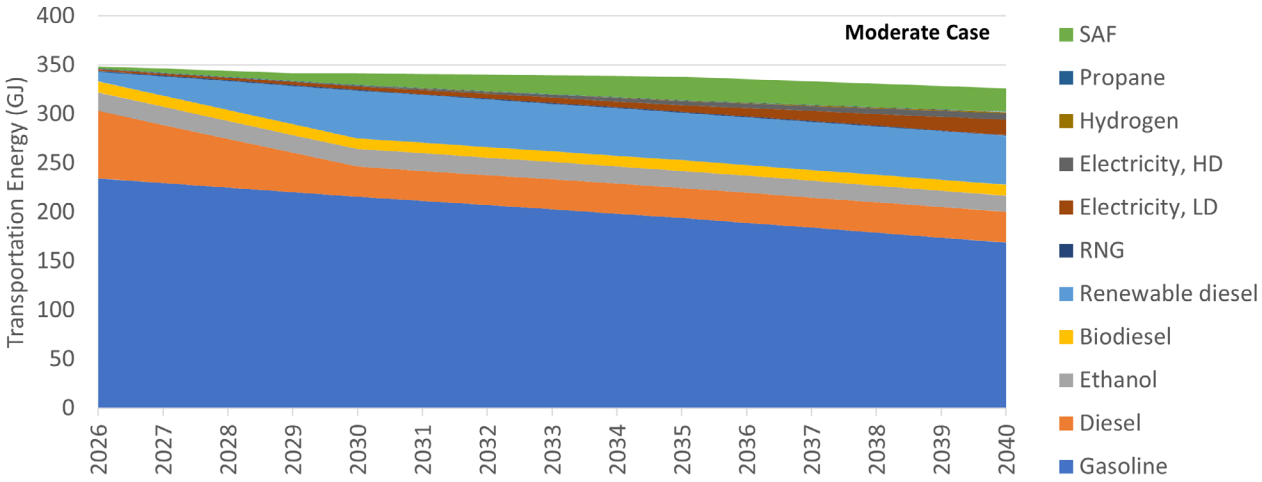

Figure 9: Transportation Energy Consumption (GJ) in the Moderate Case

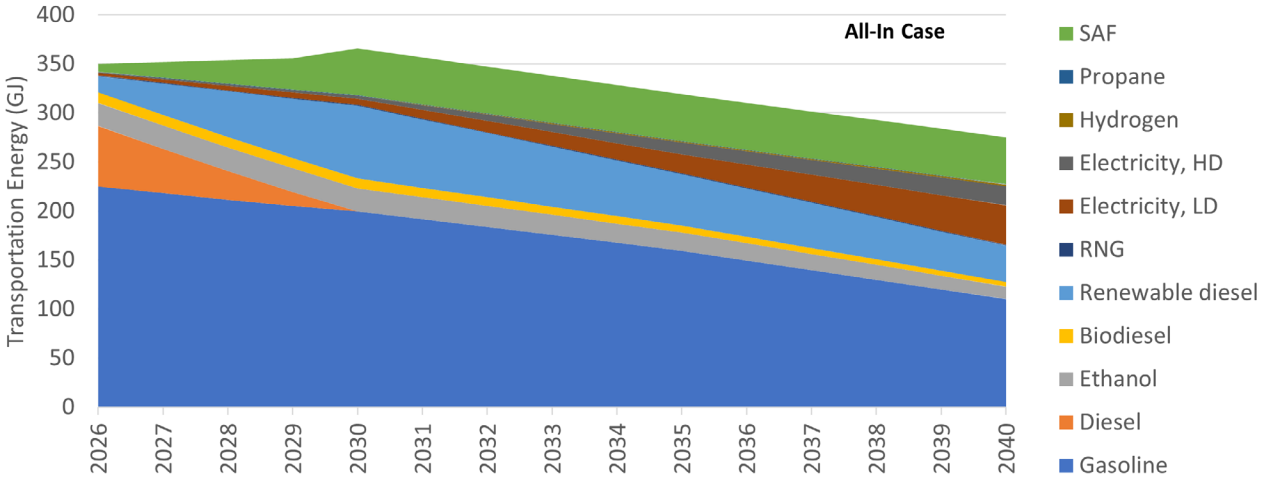

Figure 10: Transportation Energy Consumption (GJ) in the All-In Accelerated Case

WORK GROUP FINDINGS

Approach to Work Group Findings

The work group went through multiple iterations of technical analysis and modeling review, small group discussions, surveys to gather feedback, developed and refined recommendation statements, and identified areas for further exploration. The work group findings are largely recommendations to address information gaps and opportunities related to a CTS. Work group conversations and recommendations assumed a CTS will be implemented.

Work Group Recommendations

The areas of strongest agreement are listed as work group recommendations. These could be included in legislation to set guideposts and boundaries for a CTS. Due to time constraints, some recommendations were explored in small groups before surveying the full group.

The final survey to work group members asked, on a scale of 1 (strongly disagree) to 5 (strongly agree), whether the statement represented the work group's general discussion and sentiment. 31 of the 40 members completed the survey and two members opted not to complete but shared their support of the recommendations via email. 21 of the statements had a median score of 4 out of 5 and two statements with a median score of 3 out of 5. Language was modified slightly to incorporate feedback and an updated version was shared with the work group on December 13, 2023 and again on January 19, 2024. Final adjustments were made to incorporate comments from the December 13, 2023 and January 23, 2024 work group meetings and for readability purposes.

Areas for Further Exploration

As expected, the 40-person work group included many different perspectives, and some topics had less agreement than others. The rectangular boxes included throughout this chapter highlight topics raised by the group that could be discussed during the legislative session, refined through rulemaking or other policy/analytical discussions with stakeholders. Lastly, some members had different opinions about what to include in legislation versus rulemaking.

Work Group Recommendations

The following recommendations could be used as a foundation for a CTS policy.

A. Legislative-Focused

This set of recommendations was developed to provide guidance on selecting feasible carbon intensity reduction targets. As the modeling shows, it will be challenging to achieve the targets as written in the 2023 session law. The work group learned from state program leaders in Oregon and Washington that it will be important for the Legislature to strike a balance between ambitious targets that encourage decarbonization and a program that can achieve compliance. Therefore, the work group considered alternative targets and goals.

A.1 Targets, Goals and Other Requirements on Carbon Intensity Reduction

- A.1.1: As noted in the modeling, the carbon intensity reduction targets written in the charge to the work group will be challenging to achieve. Work group members indicated a range of opinions about the ideal targets, with most work group members agreeing that the targets should be at or somewhere between the Moderate Case and the 2023 session law targets.

CI Reduction Targets/Goals	2030	2040	2050
Moderate Case Targets & Goal	13-17% target	40-50% target	100% goal
2023 Session Law Targets	25% target	75% target	100% target

- A.1.2: Focus on the near-term 2030 and 2040 targets and change the session law 2050 target to a goal. Re-evaluate the targets and goals during program reviews every 3–5 years. The work group used the working definitions of carbon intensity reduction targets and goals in Appendix A.

B. Fuel Exemptions and Fuel Eligibility

This set of recommendations outlines which fuel types should be included in a CTS, along with which fuels and activities can generate credits through certain practices. Tradeoffs inherent with fuel exemptions and fuel eligibility are outlined in Areas for Further Exploration.

B.1 Fuel Exemptions

- B.1.1: Certain fuels and applications are likely to be exempt from a CTS because of state and federal regulatory jurisdiction issues. For instance, conventional jet fuel or aviation gasoline should be an exempted fuel. Similarly, deficit-generating fuels (e.g., gasoline or diesel) used in military applications and any transportation fuel used in locomotives or ocean-going vessels should be exempt. These exemptions could be re-evaluated during future program review periods.

B.2 Liquid Biofuels

- B.2.1: Sustainable Aviation Fuel (SAF) should be an eligible opt-in credit generator.
- B.2.2: Members encourage policymakers to learn from E15 and E85 experiences with infrastructure capacity and constraints. There was a range of perspectives on costs, benefits, rail safety, off ramps, locations, and market considerations.
- B.2.3: Climate smart agriculture and forestry practices that demonstrate verifiable GHG reductions should be eligible to be factored into the lifecycle analysis that yields a fuel's carbon intensity. Farmers/growers and forest landowners/managers who implement these practices should benefit from the credits generated. Climate smart practices should be subject to third-party verification, with verification processes and protocols developed by a state agency or agencies.

B.2 Areas for Further Exploration: Details for reporting and verification of climate smart practices need to be clarified via legislation or during rulemaking.

B.3 Electricity as a Transportation Fuel

- B.3.1: Utility-specific carbon intensity pathways should be allowed as an alternative to a single statewide grid average carbon intensity.
- B.3.2: Renewable energy certificates (RECs), or similar verifiable processes that prevent risk of double counting should be allowed so that CTS regulated parties can demonstrate lower carbon intensity pathways for electricity than the grid average resource mix.

B.4 Additional Credit Generating Opportunities

- B.4.1: Carbon capture and storage (CCS) should be an eligible activity if it is not used for enhanced oil recovery (EOR).
- B.4.2: Refinery improvements and renewable hydrogen used at refineries (e.g., hydrogen produced by an electrolyzer powered by wind, solar or hydropower) should be eligible credit generating activities.

Section B: Areas for Further Exploration

Fuel Eligibility: Off-road vehicles could be considered. Constraints on credit-generating fuels could be implemented to ensure no additional environmental harms e.g., limitations on converting lands to new croplands for feedstock cultivation.

Carbon Capture and Storage (CCS) eligibility: CCS eligibility, concerns about CO_2 pipelines including, but not limited to, safety and other negative externalities. Some pipeline concerns may be addressed with a pending federal rule.

C. Program Design

C. Program Administration and Performance: Evaluation Checkpoints, Credit Tracking & Staffing

The work group developed the following recommendations for the program's administration and performance.

- C.1: Incorporate the best reporting and documentation protocols from other related programs in Minnesota and other state-level low carbon fuel standard programs.
- C.2: Require third-party verification of fuel pathways and reported fuel quantities.
- C.3: Criteria for calibrating targets or goals should be determined for use during a program review period. A stakeholder-based Task Force should provide guidance for periodic program review and include the development or refinement of defined criteria for calibration.

Section C: Areas for Further Exploration

Balance of credits / deficits: During program reviews, adjustments to program targets could be analyzed in the context of the current and projected low carbon fuel supply-demand balances, and how they could impact anticipated compliance for the CTS program.

Off-ramps and deferrals could be built in like with existing biofuel mandates.

Costs and benefits: Consider analyzing the economic impacts associated with CTS implementation that captures the full range of costs and benefits to Minnesota, including potential impacts to consumers. This type of analysis was outside the scope of the work group, but recent estimates were shared by Oregon and Washington state leaders. [20] [21]

20 Washington Department of Ecology. (May 2022). Clean Fuel Standard Cost Benefit Analysis Report. https://ecology.wa.gov/getattachment/22790fe6-fc3a-414d-b3ba-036af0975258/20220512CfsCba.pdf

21 Oregon Department of Environmental Quality. Annual Cost of the Clean Fuels Program. https://www.oregon.gov/deq/ghgp/cfp/pages/annual-cost.aspx

D. Other Policy Considerations

D.1 Community Equity, Health, and Workforce Outcomes

The work group developed the following set of recommendations to consider other important aspects of the CTS.

- D.1.1: Co-benefits, like community health, economic development, and environmental justice (EJ), can advance through a CTS. There was also interest in additional legislative and rulemaking discussions on the opportunities to mitigate any potential negative impacts of a CTS (e.g., unintended consequences due to supply chain resiliency).
- D.1.2: The CTS program may consider how to track equity, health and environmental measures that could be embedded in the program. The measures could focus on outcomes such as emissions reductions, air and water quality, that can be associated with and attributed to program implementation. Clear instructions should guide the reporting process and requirements. Discussion is encouraged with stakeholders to define "equity", "health" and "environmental" measures, and align with other state agency definitions and existing tracking.
- D.1.3: Workforce development components could be incorporated into a CTS such as pathways to the development of jobs, while leveraging, and not duplicating, other existing labor-related programs such as registered apprenticeship pathways.
- D.1.4: Develop a framework to determine investments of credit revenue from residential EV charging to support priority outcomes. The framework should provide guidelines on transportation electrification investments that reduce carbon intensity in the transportation sector across modes in targeted areas. These include demographic categories, income designations, environmental justice (EJ) communities, and/or disproportionately impacted communities.

Section D.1 Areas for Further Exploration

Workforce development: Job pathways and skill development, labor and state training programs, prevailing wage requirements and family-sustaining jobs in the clean fuels sector.

ZEV Infrastructure: Rural vs. urban prioritization, how equity, public health and environmental Justice (EJ) communities are prioritized, and whether a backstop aggregator for residential credits is needed.

Liquid Fuel Infrastructure: A CTS would send a market price signal and potentially create market certainty. Fuel retailers could respond by investing in biofuel infrastructure. The Legislature would need to discuss other funding for biofuel infrastructure.

D.2 Land Use, Climate Smart Agriculture, Forestry, Water and Ecosystem Services

The following set of recommendations were developed to ensure the advancement of co-benefits and minimize any negative environmental and economic externalities that could result from a CTS.

- D.2.1: The land use change (LUC) adder for ethanol made with corn and biomass-based diesel made with soybean oil should be non-zero.
- D.2.2: Although ecosystem services and other impacts related to water, soil, air, wildlife, and beyond are difficult to incorporate directly into the fuel lifecycle assessment (LCA) that will guide a CTS, a well-designed policy can help achieve these co-benefits. Reporting could include tracking for these co-benefits, where feasible (see C.1).

- D.2.3: A CTS should be fuel-neutral and encourage feedstock diversification to enable market actors to maximize GHG emission reductions. Based on information available to the work group, feedstocks like woody biomass and winter annual oilseeds can be used to produce biofuels that would likely yield a lower carbon intensity value than biofuels produced using conventional feedstocks today. These feedstocks may yield co-benefits. For instance, sustainable extraction of woody biomass may help improve forest health and result in co-benefits to local communities. Whereas winter annual oilseeds, such as winter camelina and pennycress, may help improve water quality, soil health and habitat benefits. Biofuels produced using emerging feedstocks would be subject to the same verification requirements as other low carbon fuels.

Section D.2 Areas for Further Exploration

Integrate or strengthen existing **complementary policies and programs to** tackle **environmental considerations** and advance desired outcomes such as air and water quality, soil health, and wildlife habitat). Environmental considerations could include fuel production linked to livestock, new croplands being used for feedstock, climate smart agriculture and forestry practices (and related financial supports), and **measurement and verification** of carbon intensity reduction outcomes. Cropping systems or forestry **feedstocks with the lowest carbon intensity** could be leveraged, such as winter annual oilseeds.[22]

Related Policies and Rules Outside of a CTS

Some non-CTS related policies may need alteration to meet the carbon intensity targets. The work group was not able to discuss these in detail. While not an exhaustive list, several are highlighted below:

- For outcomes in the Accelerated Cases that were modeled as part of the CTS technical analysis, policy modifications may be needed. For example:
  - The federal Renewable Fuel Standard restricts qualifying types of biomass that constrain the eligibility of biofuel production using woody biomass as a feedstock.
  - American Society for Testing and Materials (ASTM) specifications limit SAF blends to 50% by volume with conventional jet fuel. For higher blend rates, ASTM specifications need to change to accommodate up to the 95% SAF blend in the modeling.
- E15 restrictions on sale during summer months currently exist.
- Some work group members suggested exploring environmental guardrails like volumetric caps on habitat conversion protections for the food supply.

22 A recent study by Ecotone Analytics, Friends of the Mississippi River and the University of Minnesota Forever Green Partnership shows that winter camelina and domesticated pennycress may produce up to 5.5 million acres of these winter annual oilseeds in Minnesota by 2050. Both produce oil that can be converted into renewable diesel and jet fuel with lower life cycle GHG emissions. Read the full report: https://fmr.org/CLC-Report.

Depending on the agency that is directed to lead, a few changes to existing policies or statutes may be needed. In this next section we describe a number of those areas and related agencies with existing regulatory roles overlapping with a CTS.

Civil Penalties

The legislature would direct an agency to lead rulemaking and implementation. Depending on the agency directed, the legislature may need to modify existing guidance or create new guidance in statute regarding agency enforcement capabilities and their civil penalty maximums. Civil penalties could be needed due to regulated parties falsely reporting fuel amount or type, or other program compliance issues that would arise during an audit conducted by the agency. The agencies involved in the work group (Agriculture, Commerce, Transportation, Pollution Control Agency) all have varying degrees of enforcement capabilities but the existing civil penalty maximums for each agency are quite different.

The Minnesota Department of Commerce

The Minnesota Department of Commerce has a range of responsibilities that pertain to a CTS. A summary is listed here for context.

The Office of Regulatory Affairs (ORA) at Commerce advocates for a clean, affordable, equitable and reliable energy system that minimizes risks for Minnesota's utility consumers and the environment now and into the future. Abiding by Minnesota statutes, rules and prior orders, ORA investigates and analyzes utility filings before Minnesota's utility decision-making body, the Minnesota Public Utilities Commission (Minnesota PUC), to advocate on behalf of the public interest. ORA examines utility integrated resource plans to ensure that the utilities have enough resources to provide reliable service, and reasonably consider all costs, including expected risks over the long-term plan, social impacts, and pollution costs. In addition, ORA examines utility transportation electrification plans required under Minn. Stat. 216B.1615 to ensure the public interest is served and ratepayer funds are prudently dispatched in utility efforts to facilitate widespread access to publicly available and conveniently located electric vehicle (EV) charging stations.

Commerce is setting up numerous new energy programs passed by the 2023 Minnesota Legislature, including an EV Rebate program. Minnesota's Climate Action Framework shares a vision of the state connected through safe, affordable, and sustainable transportation options. In furtherance of that vision, the EV Rebate program will provide rebates for eligible new and used electric vehicles and plug-in hybrid vehicles.[23]

The Weights and Measures Division protects Minnesota's fuel markets by promoting and ensuring equity, accuracy, and quality by:

- Enforcing Minnesota's weights and measures statute and rules to prevent fraud and ensure the accuracy and safety of fuel pumps; meters used at the terminals, refineries, and airports.
- Enforcing statutory biofuel mandates through records audits, routine sampling, complaint investigation, and fuel testing to ASTM quality standards and Environmental Protection Agency (EPA) volatility and sulfur standards.
- Inspecting fuel pumps and tanks for leaks and product contamination.
- Investigating and responding to complaints related to fuel pricing, advertising, quantity, and quality.
- Inspecting fuel pump credit card readers to ensure they have not been fitted with devices meant to steal consumer credit card information.

23 Minn. Stat. 216C.401 Electric Vehicle Rebates: https://www.revisor.mn.gov/statutes/2023/cite/216C.401?keyword_type=all&keyword=216C.401

Potential Utility Expenditures Linked to a CTS

An area that would most likely fall outside of the CTS, but is related, is the purview of the Minnesota PUC over utility programs and EVs charged in their service territory. Investor-owned utilities need Commission approval to change rates (rates for cooperative and municipal utilities are regulated by processes described in Minn. Stat. 216B.01, 216B.025, and 216B.026). A specific issue the Minnesota PUC would weigh in on in the future would be the eligible use of revenue generated from the sale of credits that could be allocated to utilities on behalf of consumers for residential EV charging, particularly at investor-owned utilities. The Minnesota PUC made a series of findings in its Investigation into EV Charging and Infrastructure (Docket No. E999/CI-17-879[24]) and found electrification of Minnesota's transportation sector is in the public interest. The PUC's Integrated Distribution Planning, a planning process where a utility describes their forward-looking plans, now includes utilities' EV plans. The plans seek to gain a better understanding of the impacts of electric vehicles on the grid system, on utilities, and on customers, as well as how utility regulatory policy can improve upon the transportation charging systems and rates. Several other related policies include:

- Minn. Stat. 216B.02, Subd. 4 exempts entities that sell electricity for EV charging from regulation as a public utility, which allows non-utilities to develop and operate charging infrastructure.
- Minn. Stat 216B.1614 requires each public utility to have a rate specifically designed for EV charging that offers time-of-day or off-peak rates to customers who own EVs.

Electric cooperatives and municipal utilities have a different regulatory structure and oversight than investor-owned utilities. Governance and oversight of these utilities are provided by member-owners and and/or their municipal institutions, other than some of these institutions whose members have elected to be governed by the Minnesota PUC (only Dakota Electric). As such, these utilities may have a different regulatory review regarding EV charging credit revenue. This is something that potentially would be addressed in statute.

As noted previously, the build-out of supporting infrastructure for CTS compliance is incentivized in part by the price signal from the CTS. However, complementary policies like Clean Cars Minnesota that requires deploying ZEVs in the light-duty vehicle (LDV) fleet, will also send market signals regarding fueling infrastructure needed to support EV adoption. Build-out of EV infrastructure is largely outside of a CTS. For example, each state is administering a National Electric Vehicle Infrastructure (NEVI) program through the U.S. Department of Transportation. Minnesota is currently implementing theirs through MnDOT.[25] In 2023, the Minnesota Legislature provided $13.6 million in State General Funds to match the federal NEVI funds for EV infrastructure.

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24 EV Charging and Infrastructure (Docket No. E999/CI-17-879): https://mn.gov/puc/activities/economic-analysis/electric-vehicles/

25 Other future MnDOT EV infrastructure development: MnDOT will complete a statewide Zero Emission Vehicle Infrastructure Needs Assessment by June 2025. The assessment will help establish existing conditions and gaps in EV charging network to guide MnDOT and partners on which corridors and regions to prioritize where infrastructure should be installed to increase the reliability and resilience of the alternative fuel network in Minnesota. This will support statewide efforts to reduce carbon emissions, increase the accessibility and reliability of EV charging throughout Minnesota.

APPENDICES

Appendix A: Technical Glossary[26]

Argonne GREET model: Updated annually, the Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model was created and is maintained by Argonne National Laboratory. The model estimates life cycle energy use and emissions outputs for various vehicle and fuel combinations.[27]

B20: Petroleum diesel blended with 5-20% biodiesel.

Biofuel: Gaseous or liquid fuels developed by converting biomass into liquid fuels. Sources include grassy and woody plants, agriculture or forestry residue, algae, crops (such as corn or soybeans), vegetable oils, organic waste, or animal fats. Two common biofuels are ethanol and biodiesel.[28]

Biologically-based feedstocks: Non-fossilized and biodegradable organic materials from plants, animals, or microorganisms, including by-products and wastes from agriculture and forestry industries, and biodegradable organic fractions of industrial and municipal waste like gases and liquids recovered from decomposition of non-fossilized biodegradable organic material. These do not include materials like peat, coal, petroleum, natural gas, and other products from biologic materials that are not renewable in policy timeframe[29].

Blending requirements: A policy or mandate that requires a certain volume of renewable fuel to replace a portion of petroleum transportation fuel, heating oil, or jet fuel. Examples include the U.S. Renewable Fuel Standard (RFS) and many state biofuel blending mandates.

Carbon capture: A group of technologies that prevent industrial and electric power facility carbon emissions from reaching the atmosphere or remove carbon dioxide (CO_2) from the atmosphere.

Carbon intensity (CI): The lifecycle GHG emissions for a fuel per unit of transportation energy delivered. Calculated by assessing the GHG emissions in the lifecycle or "pathway" of the fuel and is determined by assessing the GHG emissions throughout each stage of the fuel's feedstock production, conversion, and use. Carbon intensity is measured in grams of CO_2-equivalent per mega joule (gCO2CO_2J or g/MJ).

Carbon intensity reduction targets: Set for the fuel standard and used to establish total emission reductions achieved by a CTS. Typically, a percent reduction achieved by a specific year. They would be written into law or set during rulemaking and would be used to determine program compliance.

Carbon intensity reduction goal: Like a target but not codified as part of program compliance until converted to a target during a later program review period.

Carbon capture and storage (CCS): Typically coupled with carbon capture, carbon storage refers to the long-term sequestration of CO_2 in geologic formations or fossil reservoirs.

Clean transportation fuel: fuel that results in lower lifecycle GHG emissions on an energy equivalent basis compared to a reduction baseline.

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26 Portions of the glossary were adopted from the Great Plains Institute's white paper *A Clean Fuels Policy for the Midwest*. Available at https://betterenergy.org/wp-content/uploads/2020/01/Clean-Fuels-Policy-for-the-Midwest.pdf

27 The model is available at Argonne Lab's GREET website: https://greet.es.anl.gov/.

28 US EPA: Biofuels and the Environment: https://www.epa.gov/risk/biofuels-and-environment

29 US EPA. (2014). Framework for Assessing Biogenic CO2 Emissions from Stationary Sources. https://www.epa.gov/sites/default/files/2016-08/documents/framework-for-assessing-biogenic-co2-emissions.pdf

Co-benefits: When a policy or program simultaneously meets several interests or objectives creating positive side effects. In the context of a CTS, co-benefits might include community health and equity, economic development, as well as environmental services, soil, and water benefits.

Community health: Non-clinical approaches for improving health, preventing disease and reducing health disparities from for social, environmental, economic and medical determinants or causes of health. Areas of public health responsibility relevant to this policy area include assuring an adequate local public health infrastructure, promoting healthy communities and healthy behaviors, and protecting against environmental health hazards.[30]

Credit bank: The net stock of credits generated or owed from a market-driven policy, like a CTS. When an alternative fuel pathway generates credits relative to the carbon intensity of the standard, the total credits in the bank increase.

Clean Transportation Standard (CTS): The current name for the low carbon fuel standard policy being discussed in Minnesota. Also known as a low carbon fuel standard (LCFS). It is a rule enacted to reduce carbon intensity in transportation fuels as compared to conventional petroleum fuels, such as gasoline and diesel. It uses market-based mechanisms that allow fuel providers to choose how they will reduce emissions while responding to consumer demand.

Climate Action Framework (CAF): Minnesota's vision for how the state will address and prepare for climate change. It identifies immediate, near-term actions we must take to achieve our long-term goal of a carbon-neutral, resilient, and equitable future for Minnesota.

Decarbonization: The process of reducing the average amount of carbon emissions or carbon intensity in a system (for example, transportation sector) over a period.
E15 and E85: Gasoline blended with 10.5-15% (E15) or 51-85% (E85) ethanol.

Energy economy ratio (EER): A dimensionless value that accounts for the difference in energy density and engine efficiency between electric vehicles and internal combustion engine vehicles when calculating carbon intensity or credit generation.

Environmental Justice (EJ): Identifying and addressing as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies and activities on minority populations and low-income populations.[31]

Electric grid mix: The proportional amount of the energy grid fueled by generation fuels such as natural gas, petroleum, renewables, etc. The grid mix is important to help calculate the carbon intensity or emissions factor of a specific utility or electricity region.

Electric vehicle (EV): A vehicle powered by electricity, generally provided by electric batteries or fuel cells.

Electric vehicle charging station: The fueling infrastructure for electric vehicles that connects the vehicle to an electricity source. Charging stations are characterized by their voltage—Level 1 chargers operate on 120V alternating-current (AC), Level 2 use 240V alternating-current (AC), and DC fast chargers (DCFC) use 480V direct-current (DC). Charger level also informs speed of battery recharge where Level 1 is the slowest and DCFC is the fastest.

Emissions factor: A representative value that relates the quantity of a pollutant released to the atmosphere. These factors are usually expressed as the mass of pollutant divided by a unit mass, volume, distance, or duration of the activity emitting the pollutant, for example kilograms of particulate emitted per megagram of coal burned. For a CTS, the emissions factor is the emissions associated with one mega joule of fuel used. See also, a carbon intensity.

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30 See Minn. Stat. 145A.02 for the full definition of 'public health': https://www.revisor.mn.gov/statutes/cite/145A.02
31 Aligned with definition included in the Minnesota Department of Transportation's Statewide Multimodal Transportation Plan: https://www.dot.state.mn.us/minnesotago/SMTP.html

Enhanced Oil Recovery (EOR): Process that alters the chemical composition of the oil, such as injecting water, chemicals or gases into the reservoir, in order to make it easier to extract.

Equity or Transportation Equity: The benefits and burdens of transportation systems, services and spending are fair and just, which historically has not been the case. Transportation equity requires ensuring underserved communities, especially Black, Indigenous and People of Color, share in the power of decision making.[32]

Fuel pathway: The sequence of production processes used to produce a fuel and acquire or grow the feedstock it is made from. In lifecycle analysis, the fuel pathway is considered on a "well-to-wheels" or "cradle-to-grave" basis, which includes feedstock production or extraction, transportation of feedstock and fuel to the production facility, fuel refining, fuel transportation and distribution, and finally fuel use or combustion. The fuel pathway is used to calculate the carbon intensity of a fuel, which is determined by assessing the GHG emissions throughout each stage of the fuel's production and use.

Greenhouse gas emissions (GHGs): Greenhouse gasses (GHG) are atmospheric gases that contribute to the greenhouse effect through their absorption of solar radiation. Commonly known GHGs are carbon dioxide, methane and ozone.

Land use change (LUC) adder: A value representing emissions resulting from land conversion in response to increased biofuel demand and impacts on global commodity prices and commodity demand.

Lifecycle assessment (LCA): A technique to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.

Nitrous oxide: A greenhouse gas emitted during agricultural and industrial activities, combustion of fossil fuels and solid waste, as well as during treatment of wastewater. Nitrous oxide was 6 percent of US GHG emissions in 2017 according to US EPA, and has a global warming potential of 298 times CO_2. The application of nitrogen fertilizers accounts for most nitrous oxide emissions, and these emissions can be reduced through various agricultural conservation practices.

Nitrate: A compound that naturally occurs and has many human-made sources. Nitrate is in some lakes, rivers, and groundwater in Minnesota. You cannot taste, smell, or see nitrate in water. Consuming too much nitrate can be harmful—especially for babies.[33]

Portfolio approach: Refers to the use of multiple clean fuels or strategies to achieve a policy, social, or environmental goal.

Renewable energy credit (REC): A certificate corresponding to the environmental attributes of energy produced from renewable sources such as wind or solar, or other carbon reducing activities.

Renewable hydrogen: hydrogen gas produced through processes such as electrolysis, utilizing clean and sustainable energy sources like solar, wind, or hydropower, to split water into hydrogen and oxygen, thereby avoiding carbon emissions associated with traditional production methods.

Renewable natural gas: A pipeline quality biogas that has been upgraded to quality purity standards similar to fossil natural gas. Biogas is a mixture of gases produced by the breakdown of organic matter in the absence of oxygen, primarily consisting of methane and CO_2. It can be used interchangeably with conventional natural gas.

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32 Aligned with definition included in the Minnesota Department of Transportation's Statewide Multimodal Transportation Plan: https://www.dot.state.mn.us/minnesotago/SMTP.html

33 Aligned with definition from the Minnesota Department of Health: https://www.health.state.mn.us/communities/environment/water/contaminants/nitrate.html

Appendix B: Sample of Existing State Programs Improving Ecosystem Services, Water and Soil Health on Working Lands

The implementation of a CTS in Minnesota would make it the first agricultural dominant and biofuel producing state to enact a standard. The work group learned about several of the ecosystem services, water and soil health concerns expressed by several work group members. Many of the concerns raised are being addressed by existing policies and programs of the Minnesota Board of Water and Soil Resources (BWSR), Pollution Control Agency (MPCA) and the Departments of Agriculture (MDA) and Natural Resources (DNR). Below is a sample of these policies and programs and it is by no means inclusive of everything being done by each state agency or the state.

The Minnesota Board of Water and Soil Resources

The Minnesota Board of Water and Soil Resources (BWSR) mission is to improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners. With a focus on private lands (76% of the state), BWSR provides targeted planning, implementation, and assessment of conservation delivery; supports implementation of state rules and laws; and delivers conservation programs and projects through local governments.

BWSR has made major improvements throughout the state via funding from the Clean Water Fund, Outdoor Heritage Fund, General Fund, Environment and Natural Resources Fund and other state and federal sources.

In 30 years, they have accomplished:

- 17,500+ conservation practices installed.
- 1,615 Clean Water Fund projects estimated to reduce more than 168,500 tons of sediment per year and prevent more than 178,150 pounds of phosphorus per year entering Minnesota waters.
- 6,881 easements restoring 290,543 acres of wetlands and grasslands.
- 515 local water management plans approved and 243 performance assessments.

The Minnesota Department of Natural Resources

The mission of the Minnesota Department of Natural Resources (DNR) is to work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

The DNR protects and conserves the state's natural resources to provide multiple benefits to Minnesotans, including healthy waters and soils. Specific actions by the DNR that contribute to water and soil health include:

Forest Protection and Management

- Between FY2018 and FY2022, reforested 25,300 acres via natural regeneration and planted an additional 6,000 acres annually on average with tree seedlings and seeds.
- Supplied 3 million tree seedlings in FY2022 to public and private landowners for conservation planting and reforestation.
- Manage 357,000 acres of permanent forest conservation easements.
- Grassland Protection.
- Administered 14,925 acres of prairie bank easements.
- Provided technical assistance to more than 800 landowners on prairie management in FY2022.

Water Resources

- Operate over 1,200 groundwater observation wells to produce monitoring and trend data.
- Produce and maintain a map of public waters and public ditch systems that require permanent vegetation buffers in partnership with the Board of Water and Soil Resources (BWSR), Soil and Water Conservation Districts (SWCDs), Drainage Authorities and other local units of government.
- Operate a stream monitoring network with more than 200 stream gauges, which serves as the backbone of the state's water quality and quantity trend monitoring.
- Oversee development and construction activities in public waters to ensure best management practices are utilized and to provide policy guidance and coordination with other water and wetland resource protection programs.

Statewide Natural Resources Management

- Awarded 87 Conservation Partners Legacy grants for conservation projects that restore, enhance, or protect forests, wetlands, prairies, and habitat for fish, game, and wildlife in FY2022, totaling $10.7 million.
- Provide statewide monitoring of programs that implement Best Management Practices to protect soil, water, and other resources including Site-Level Forest Management Guidelines and DNR's Shoreland Management Program.

The Minnesota Department of Agriculture

The Minnesota Department of Agriculture's (MDA) mission is to enhance all Minnesotans' quality of life by equitably ensuring the integrity of our food supply, the health of our environment, and the strength and resilience of our agricultural economy.

MDA delivers an array of effective and efficient programs with funding from state appropriations (General Fund and Clean Water Fund), federal awards and agreements, industry fees and investments, and other sources.

Relevant water and soil health programs and projects at the MDA include:

- *Minnesota Agricultural Water Quality Certification Program (MAWQCP)*: The state's nation-leading program recently surpassed Governor Walz's goal of 1 million acres certified (as of Oct 30, 2023). 1400 farms certified, implementing over 2700 new practices leading to 141K ton soil and 47K tons sediment saved annually, reducing loss of Nitrogen by 49% and cutting GHG. Leading to higher profits, better debt to asset ratios and better operating expense ratios than non-certified farms.
- *Soil Health Financial Assistance Program*: New or retrofit equipment grants to improve soil health practices and management. First program in the nation and demand has been strong (FY23: $500K available, $6.5M in requests; FY24: $2.375M available, $8.4M in requests).
- *Agriculture and Best Management Practices Loan Program*: Low interest loans to farmers, ag supply businesses, rural landowners, and water quality cooperations for pollution prevention and reductions practices.
- *Minnesota Best Management Practices*: MDA sets specific best management practices to protect the environment while considering economic and technical feasibility factors. Categories include Nitrogen Fertilizer, Pesticide, Turfgrass, Pollinator Habitat, Pest Control without Pesticide.
- *Biofuel Infrastructure Program*: This program provides funding to upgrade fueling infrastructure across the state so that it reaches compatibility with higher blends of ethanol. The grants target small retailers with no more than 10 retail locations in the state.
- *Groundwater Protection Rule*: Minimizes potential sources of nitrate pollution to the state's groundwater and protects our drinking water. The rule restricts fall application of nitrogen fertilizer in areas vulnerable to contamination, and it outlines steps to reduce

the severity of the problem in areas where nitrate in public water supply wells is already elevated.

- *Nitrate in Groundwater*: Produces the Nitrogen Fertilizer Management Plan, the state's blueprint for preventing or minimizing the impacts of nitrogen fertilizer on groundwater.
- *Technical Assistance and On-Farm Demonstrations*: Ensures that current and accurate scientific information is made available and used to address water quality concerns in agricultural areas of Minnesota.
- *Pesticide Monitoring & Assessment*: Groundwater and surface water monitoring has allowed the MDA to increase the number of detectable pesticides, increase the sensitivity of detection of certain pesticides and increase the overall number of samples that can be analyzed on an annual basis, including through the Private Well Pesticide Sampling Project which has tested more 6,300 private wells.
- *University of Minnesota Forever Green Initiative*: Researchers from multiple departments work together to develop new high value commodity crops for conservation purposes that strengthen Minnesota's economy while protecting water, soil, and other natural resources.
- *Bioincentive Program*: Encourages commercial-scale production of advanced biofuels, renewable chemicals, and biomass thermal energy through production incentive payments.
- *Methane Digester Loan Program*: Finances the purchase of necessary equipment and the construction of a system that will use manure to produce electricity. The State of Minnesota has established a revolving loan fund to appropriate funds for this program.

The Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency plays a major role in several areas that influence the levels of nutrients and sediment which leave our landscapes and pollute our water. Three major efforts include: 1) the watershed approach, 2) the nutrient reduction strategy, and 3) regulatory programs. The strategies to address each of these efforts include practices that not only benefit in-state and downstream waters, but also will help to mitigate climate impacts.

1) The watershed approach, funded by Clean Water Fund, is a comprehensive statewide approach that prioritizes, targets, and measures results for improved water quality. MPCA leads water monitoring of every major watershed on a 10-year cycle which allows the state to track progress in attaining water quality goals. MPCA also leads comprehensive data analysis and modeling that yields specific strategies targeted to address pollution problems and protect healthy waters in each major watershed. MPCA's strategy documents are then handed off to local water managers who use them to develop action plans (1W1P).

2) The Nutrient Reduction Strategy, first created in 2014, is a living body of work that involves further defining the problems of nitrogen and phosphorous in our state waters. It sets phosphorus and nitrogen reduction goals and uses the latest science to identify the best strategies to reduce nutrient pollution. Building soil health and continuous living cover on lands are foundational practices in the Nutrient Reduction Strategy (NRS). Progress in attaining goals is measured every 5 years, most recently in 2019. The NRS is currently under revision. With support from 10 collaborators including state and federal agencies and the University of Minnesota, the revision will update, improve, and revise the NRS based on new information, the latest science and learning from the first 10 years of implementation.

3) And finally, MPCA has regulatory authority over certain regulatory programs pollution sources, including feedlots and manure application. Regulations compliment voluntary programs and are the backstop to ensure reductions over the long term. The NRS has informed incremental changes to Minnesota's feedlot permitting, including incorporating requirements to use Rules and permit conditions are linked to manure management practices and vegetative treatment that can improve both water quality and greenhouse gas emissions.

Appendix C: State Comparison Chart

REGULATORY PROVISION	WA CLEAN FUEL STANDARD	OR CLEAN FUELS PROGRAM	CA LOW CARBON FUELS STANDARD
Cost containment mechanisms	Yes. Utilize credit clearance market with a max credit price of $200 per ton ($2018) in clearance market. No credit floor price.	Yes. Utilize credit clearance market with a max credit price of $200 per ton ($2017) in clearance market. No credit floor price.	Yes. Utilize credit clearance market with a max credit price of $200 per ton ($2016) in clearance market. Capped credit prices generally at $200 per ton ($2016). No credit floor price.
Third party verification	No. Rulemaking initiated in December 2023.	Yes. Implemented in 2022 rulemaking.	Yes. Implemented during 2018 rulemaking.
Eligible fuels	Transportation fuels that have a CI less than 80% of 2017 per-unit levels.	Clean fuels with a CI less than standard for gasoline or diesel: bio-based compressed natural gas, bio-based liquefied compressed natural gas, bio-based liquefied natural gas, fossil compressed natural gas, fossil liquefied compressed natural gas, fossil liquefied natural gas, hydrogen or hydrogen blends, liquefied petroleum gas, electricity, and alternative jet fuel.	Alternative fuels that have a CI that meets the CI compliance schedules for each program year until 2020. (17 CCR § 95482). Such fuels include electricity, hydrogen, hydrogen blends, fossil CNG and biofuels.
Key Program Review Periods	Biennial review of "innovative technologies and pathways."	Review of program required to Legislature by 02/01/2022	No formal review required.
Phase in reporting periods	No phase in reporting period.	No phase in reporting period.	2010 was a reporting-only period.
Residential EV charging credit	50% of program revenues of electric utilities must be spent on transportation electrification programs (TEPs). 30% of overall utility revenues must be spent on TEPs in or benefitting federal air quality nonattainment or maintenance status, such areas that existed on the act's effective date, or an area designed by the program administrator (Department of Ecology) as at risk of such status. Other 50% of electric utility program revenues must be spent per Department of Ecology rule.	None specified in rule, except that a backstop generator designated by ODEQ must specify in a plan how it will use the revenue from the sale of credits.	Electric utilities that receive regulatory approval to initiate a statewide point-of-purchase rebate program for EVs, electric utilities must dedicate a specified percentage of credits to funding the program.

Capacity crediting[34]	Qualifying ZEV refueling infrastructure (hydrogen refueling stations and DC fast charging stations for EVs) are eligible to generate credits for dispensing capacity of the station.	No.	Qualifying ZEV refueling infrastructure (hydrogen refueling stations and DC fast charging stations for EVs) are eligible to generate credits for dispensing capacity of the station through 2025.
Enforcement	Penalties under Clean Air Act (RCW 70.94). Penalty money is deposited, along with program fees, into an account created to carry out the Clean Fuels Program.	Violations are treated as Class I or Class II AQ violations, depending on the requirement that was subject of the violation. All penalties issued by ODEQ, including program penalties, are deposited into Oregon's general fund.	Penalties under other CA Air Resources regulations. Penalties for certain types of enforcement actions may only be used for environmental cleanup, prevention, and abatement; other penalties are deposited into state general fund.

34 In addition to generating credits for dispensed electricity or hydrogen, the eligible fueling station (a hydrogen fueling station or DC fast charger) can generate credits based on the capacity of the station or charger minus the quantity of dispensed fuel.

Appendix D: Work Group Charter

Charter: CLEAN TRANSPORTATION STANDARD WORK GROUP

Work group direction from MN session law:

CLEAN TRANSPORTATION FUEL STANDARD WORK GROUP.

Subdivision 1.

Establishment; purpose.

The commissioners of the Pollution Control Agency, Transportation, Commerce, and Agriculture must convene a Clean Transportation Standard work group to study and address:

(1) information gaps and opportunities related to a clean transportation fuel standard that requires the aggregate carbon intensity of transportation fuel supplied to Minnesota be reduced to at least 25 percent below the 2018 baseline level by the end of 2030, by 75 percent by the end of 2040, and by 100 percent by the end of 2050.

Subd. 2.

Membership; chair.

(a) Appointments to the work group are made pursuant to Minn. Stat.15.0597. Appointments to the work group must include two individuals representing the following:

(1) renewable fuel producers;

(2) renewable natural gas and organic waste interests, including at least one local government that manages organic waste;

(3) general farm organizations;

(4) agricultural commodity groups;

(5) conventional transportation fuel producers and retailers;

(6) Tribal governments;

(7) environmental science organizations;

(8) environmental justice organizations;

(9) automotive manufacturers;

(10) forestry interests;

(11) electric utilities or cooperatives;

(12) electric vehicle charging infrastructure companies;

(13) aviation interests;

(14) water quality interests;

(15) a statewide organization of environmental and natural resource organizations;

(16) organizations with expertise in renewable energy and low-carbon transportation fuel policy;

(17) conservation organizations;

(18) organizations representing sustainable agriculture or regenerative biofuels producers;

(19) public health interests; and

(20) labor unions.

(b) Appointments and designations to the work group must be completed by July 1, 2023.

(c) The members of the work group must select a chair from its membership who must not be a commissioner or their designee. Any of the commissioners convening the work group may contract with a third-party facilitator.

Subd. 3.

Administration.

(a) The work group must meet a minimum of six times.

(b) Members serve without compensation or payment of expenses. The commissioner must provide administrative support to the work group.
(c) Appointments and designations to the work group must not include a member of the legislature.

Subd. 4.

Legislative report.
By February 1, 2024, the work group must submit its findings and recommendations to the chairs and ranking minority members of the legislative committees with jurisdiction over transportation and energy policy.

Subd. 5.

Expiration.
The work group expires on January 1, 2025, or upon submission of the report required under subdivision 4, whichever is earlier.

Work Group Process

FACILITATION. Meetings are facilitated jointly by Pollution Control Agency, Transportation, Commerce, and Agriculture and normally last two to four hours. Meetings will end on time and with a clear understanding of assignments and next steps. Extending meeting time is not encouraged and requires consent of a majority of members in attendance using a show of hands or by voice if members attending virtually.

TIMELINESS. Participants strive to meet the deadlines for giving feedback and other participation.

RESPECTFUL COMMUNICATION. Participants recognize that divergent ideas ensure robust recommendations and agree to listen respectfully to all opinions. If they choose, the group may develop other meeting guidelines to facilitate communication.

QUORUM. At least half the members must be present to make final decisions and/or recommendations. Members may send designees on behalf of their respective organizations if they are unable to attend meetings.

FORMAL RECOMMENDATIONS. Formal recommendations will made based on group consensus to the degree possible, and where recommendations are made by a majority the level of support will be noted in the report. Where consensus is not achieved, a description of findings and recommendations will be documented.

OPEN MEETINGS. CTS work group meetings are open to the public and a short time will be allotted at the end each meeting for public comment. If needed, subgroup meetings are also open to the public and people not on the subgroup may attend subgroup meetings. Depending on timing and number of participants, and in consultation with the subgroup meeting facilitators may provide an opportunity for members of the public to address the subgroup.

“BIKE RACK.” Items raised for discussion but not on the agenda may be listed for discussion another time.

RECORD. The facilitator will keep a record of meeting attendees and notes as outlined above. Comments from members will not be attributed without permission and there will be no verbatim record (“minutes”) of meetings.

PUBLIC COMMENT PERIOD. Public input and participation are encouraged. Each meeting shall include a period for public comment so that non-members can provide input on topic(s) discussed during that meeting. Members of the public may also submit comments and questions to the project team.

COMMUNICATION. MnDOT staff support meeting logistics, planning, and communications for all CTS meetings. MnDOT will provide similar support for subgroups if needed.

Appendix E: Work Group Participation

Table 2: Work group meeting dates, locations, and participation

WORK GROUP MEETINGS	LOCATION	PARTICIPATION
July 31, 2023	MnDOT Central Office + virtual option	• 31 work group members • 19 public members • 12 state agency /consultant staff
August 22, 2023	St. Paul Veterans Service Building + virtual option	• 32 work group members • 45 public members • 12 state agency /consultant staff
September 20, 2023	WSB Consulting's office + virtual option	• 35 work group members • 44 public members • 13 state agency /consultant staff
October 24, 2023	WSB Consulting's office + virtual option	• 37 work group members • 38 public members • 14 state agency /consultant staff
November 8, 2023	WSB Consulting's office + virtual option	• 31 work group members • 31 public members • 12 state agency /consultant staff
November 21, 2023	WSB Consulting's office + virtual option	• 31 work group members • 34 public members • 12 state agency /consultant staff
November 30, 2023	Virtual	• 31 work group members • 47 public members • 11 state agency /consultant staff
December 13, 2023	Virtual	• 32 work group members • 28 public members • 11 state agency /consultant staff
January 23, 2024	Virtual	• 26 work group members • 39 public members • 10 state agency / consultant staff

Appendix F: Work Group Meeting Summaries

Full length meeting notes can be found on the in the **Addendum**.[35] High-level meeting summaries are below.

Work Group Meeting #1 – July 31, 2023

The main purpose of this meeting was to provide an overview of CTS material, including discussion on prior stakeholder outreach and themes, as well as what the 2023 CTS process will look like.

It was emphasized at the outset the importance of feedback from the work group as well as ensuring fairness and equity in the process. MnDOT Assistant Commissioner Tim Sexton (MnDOT) provided a comprehensive background on clean fuel efforts in Minnesota, starting with the Pathways to Decarbonization initiative in 2019. Assistant Commissioner Sexton explained there are many ways to reduce carbon intensity via traditional fuels, biofuels, and electricity, for example. MDA Deputy Commissioner Andrea Vaubel (MDA) expanded on the national landscape and offered examples of what clean fuel programs look like in other states, along with some history of clean fuels initiatives in the Midwest. The co-benefits such as clean water, soil health, and improved equity were emphasized, which are things the Minnesota CTS should aim to achieve.

Deputy Commissioner Vaubel (MDA) provided insights into the 2021-2022 MnDOT/MDA stakeholder process, which culminated in a white paper called the *Clean Fuels Standard in Minnesota*, in March of 2022. Common themes from the previous stakeholder process was shared, and mentioned that support for a CTS in Minnesota were expressed across multiple different economic sectors, however, support was contingent upon specific goals for each group.

During the meeting, work group members discussed how to evaluate emerging technologies, potential unintended consequences, and ways to cohesively construct recommendations.

Key Themes

- Gathering outcomes and experiences on how other states have approached clean fuel programs.
- Understanding broad implications of the policy was emphasized, including economic and international aspects.

Work Group Meeting #2 – August 22, 2023

The meeting began with an overview of the Minnesota Climate Action Framework and how it relates to CTS efforts, which was presented by Frank Kohlasch, the Assistant Commissioner for the MN Pollution Control Agency. Next, a comparative analysis was presented of other states that have a CTS or similar policy. Guest speakers include Jeremy Martin from the Union of Concerned Scientists and Cory-Ann Wind from the Oregon Department of Environmental Quality. The meeting also included some administrative items related to the CTS work group, including a charter affirmation and the nomination and approval of Kevin Pranis (LIUNA Minnesota/North Dakota) as the Chair of the work group.

Lastly, a technical overview of the CTS was presented. This overview included a review of baseline conditions for Minnesota, a briefing on the GREET model and Carbon Intensity (CI), and eligible fuel vehicle strategies under Minnesota's program. Finally, work group members split into smaller breakout groups for discussion. At the end of the meeting there was an opportunity for public comments and questions.

35 https://www.dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html

Key Themes

- Minnesota wants to have a CTS that helps all Minnesotans and addresses all the goals that are part of the state's Climate Action Framework (CAF).
- Efficiency in the production of fuels can reduce emissions.
- The lifecycle approach to fuels means CTS can affect a variety of parties associated with transportation fuel production.
- Pollution standards have long-term stability and provide flexibility to adjust as innovation happens. The focus should be on pollution reduction and not specific technology.
- Minnesota should carefully consider the necessary resources to implement a CTS for the state.

Work Group Meeting #3 – September 22, 2023

A technical overview and shared modeling methodology was provided that will be used to provide the work group with necessary information to provide recommendations. The objectives of the meeting were:

- Baseline conditions for Minnesota
- GREET model and Carbon Intensity briefing
- Eligible fuel strategies under Minnesota's program
- Compliance scenario analysis

At the outset, it was noted that roughly 30% of crude oil in the U.S. passes through Minnesota at some point or another. In addition, fuel production in the State of Minnesota includes 2 refineries, 20 ethanol plants, and 3 biodiesel plants. Baseline conditions for Minnesota regarding fuel production were presented, including for light-duty vehicles (gasoline and gasoline substitutes), and medium-duty to heavy-duty vehicles (diesel and diesel substitutes). Numbers were specified as benchmarks for members to compare Minnesota's conditions with other states and to establish a baseline for Minnesota in the plan.

A high-level briefing on carbon intensity followed, noting that carbon intensity is an emission factor. The lifecycle GHG emissions accounting approach includes all the GHG emissions produced or avoided from the production, collection and processing, delivery, and ultimate use of a transportation fuel. To calculate carbon intensity, the whole process must be reviewed, from creating the product and use of the product. For gasoline and diesel fuel, approximately 80% of emissions occur at combustion, with the other 20% occurring during the extraction, refining, and retail stages.

The GREET (Greenhouse gases, Regulated Emissions, and Energy use in Technologies) model is a model that is used under a set of conditions to approximate the average emissions for an average facility, and can be used for both regulatory and non-regulatory processes. The model is an accounting tool with certain modifications required to make it a regulatory tool. The GREET model will be modified to incorporate Minnesota-specific circumstances to determine baseline conditions as well as future scenario models. When using the GREET model, it will be necessary to set boundaries for non-GREET considerations, such as LUC emission calculations, and predictions such as market changes and emerging pathways are difficult to capture in the GREET model.

A range of fuel strategies eligible under Minnesota's program was provided, and examples of how credits could be implemented with upstream reduction, refinery improvements, conventional fuels, biofuel blending, and vehicle replacement was provided. While there are many possible fuel strategies as well as deployment rates and market constraints, the work group must come to agreement in order to develop a range of scenarios which supports better policy-making decisions and can identify potential benefits or risks of different fuel strategies as it relates to success of the program.

Two panelists were introduced to present on other state policies and how those experiences can inform the development of a CTS in Minnesota.

Nikita Pavlenko is the Fuels Program Lead for the International Council on Clean Transportation (ICCT). Nikita mentions that all state fuel standards are built upon the Federal Renewable Fuel Standard. California implemented a LCFS via a technology neutral target. There is also uncertainty in any life cycle assessment (LCA), including direct and indirect LCA emissions, which is an important consideration.

Abbey Brown is the Technical Lead of the Clean Fuel Standard at the Washington State Department of Ecology. She explained that every district in Washington has a carbon intensity score. The state has both deficit generating fuels and credit generating fuels. Entities participating in the program include fuel producers, fuel importers, electric utilities, and others, where they must register, track energy use, and submit quarterly reports to be shared on a market basis for transparency. Capacity credits and advance credits are also offered as part of their program, limited to 5% overall credit generation, with the primary objective being lowering transportation fuel use age. Washington's program requires participants to pay a fee, which was noted to be challenging and a potential roadblock for smaller contributors entering into the program. For electric utilities, they must invest their credit revenue generated into transportation electrification and report on how revenue was spent. If a utility does not opt into the program, a backstop aggregator (non-profit) will collect unclaimed credits from residential EV charging, sell them, and reinvest the revenue into transportation electrification. Abbey concludes with noting that it will be important to balance flexibility and rigor to adapt as fuels and new technologies energy while still maintaining the program, as well as not underestimating the number of staff it will take to help keep such a complex program operating.

The second panel included a group of three people with the intent to share perspectives on liquid transportation fuels regarding opportunities, challenges, and considerations for key industries.

Dan Short is the Fuel and Low Carbon Policy Manager at Marathon Petroleum, a predominantly liquid fuel company with investments in renewable fuels. Dan explained that Marathon has converted refineries to biorefineries in the past, which includes upgrading infrastructure, storage tanks, logistics, energy sources, refinery units, and other improvements.

Tia Sutton is the Senior Policy Advisor at the American Petroleum Institute (API). She notes that SPI members support the investment to grow production for lower carbon intensity energy within the transportation sector, and that an efficient, market and technology-neutral framework is necessary. Tia urged members to consider implications to fuel and feedstock supply and demand, and to include adequate lead time for required parties.

Dustin Haaland is the Director of Trading and Renewable Fuels at CHS. Dustin notes that credit generations should be ahead of credit deficits, and to take into consideration the complications that may arise when moving from policy creating to implementation.

Key Themes

- Benefits need to stay in Minnesota.
- There was interest in developing a working standard.
- There was general support that the policy should be technology based and politically neutral in order for it to pass.
- High interest in keeping people together.
- High interest in balancing priorities and user group impacts.
- There was interest in flexibility to adaptively manage and evaluate the standard.

Work Group Meeting #4 – October 24, 2023

The beginning of the meeting included an overview of the purpose of the CTS work group, key milestones, and meeting objectives. The objectives of the meeting were:

- Build on the webinars in the last month to review webinar content
- Discuss how a CTS might incorporate scenarios modeled and explore alignment on guiding principles
- Continue to co-learn from various perspectives and identify takeaways on priorities for ongoing learning

Next, two draft fuel pathway scenarios were presented. A handout was distributed (see Addendum) for the work group to review background information used in the scenario modeling. The purpose of this discussion was to provide overview of newly modeled fuel pathways to achieve the state's targets based on projected 2018 Carbon Intensity baseline values and for the work group to make recommendations. This is the first iteration of modeling provided to the work group.

Draft results of Scenario 1 modeling was shared, and the work group was informed that a positive slope on the graphs means that low carbon fuel deployment exceeds deficit generation, and that a negative slope means a deficit generation exceeds low carbon fuel deployment and banked credits are needed for compliance. The initial results of Scenario 1 show:

1. Bank builds in early years, largely due to liquid biofuels
2. Credit generation plateaus in 2029
3. Possible non-compliance by 2033
4. Liquid biofuels are deficit generators

Draft results of Scenario 2 were shared. Approximately 30-40% of the results in Scenario 2 can be attributed to liquid biofuels, and about 60-70% attributed to higher electrification. The initial results of scenario 2 show:

1. Bank builds in early years, largely due to liquid biofuels + light duty, zero emission vehicle (LD ZEV)
2. Credit bank plateaus in 2032
3. Possible non-compliance by 2040
4. Liquid biofuels are deficit generators
5. Higher electrification than in Scenario 1

Various carbon intensity projections for California, Oregon, Washington, and British Columbia were shared. The trajectory of the carbon intensity reductions included in statute are different than what has been observed in other low carbon fuel markets. The target values are comparable; the rate at which those targets are to be achieved is not.

Finally, work group members split into smaller breakout groups for further discussion. The purpose of the breakout group was to continue to identify key principles for fuel pathways for a CTS to meet the targets identified by the legislature based on the modeled scenarios presented earlier. Small groups were presented with a list of questions for discussion. Following the small group discussion, the larger group reconvened and shared key themes and takeaways from small group conversations.

Key Themes

- Although there was support for continuing to bring down emissions, the **modeled scenarios** to meet the targets may not be achievable given what is currently known about fuel pathway technology, infrastructure, markets and fuel availability.
- Work group members want the policy to be flexible and provide opportunities to **re-evaluate and adapt** at various horizon points as new technologies emerge in the future.
- The CTS should be considered one tool in a **suite of policies**; it should not be considered the definitive solution to solve all policy challenges that pertain to transportation fuels.
- Members expressed interest in a **fuel-neutral** approach.
- Work group members wanted to continue to explore how **co-benefits** can be advanced through a CTS, perhaps through creative opportunities to support certain **land use practices and climate smart ag**. Climate smart ag could play an important role if verifiable outcomes are advanced and farmers are rewarded if carbon intensity reductions are achieved.
- Some work group members expressed a need for **EV** charging infrastructure investments to be made to achieve faster deployment rates.
- Members expressed a fair amount of agreement that **SAF** should be an eligible credit generator, but desired more information and discussion on the technicalities.
- Many, but not all, work group members support **carbon capture and store** with some caveats such as considerations regarding the life cycle analysis of the carbon capture and store (CCS), community impact, end use, location and permanence of storage. Support expressed for disallowing CCS for Enhanced Oil Recovery (**EOR**) as an eligible credit generator.
- Desire to learn more about assumptions in scenarios as well as seeing **additional scenarios** in future.

Work Group Meeting #5 – November 8, 2023

The objectives of the meeting were to:

- Review timeline and discuss priorities for the next 4 week plus.
- Review and discuss updated fuel pathway scenarios
- Discuss policy considerations to incorporate in work group recommendations.
- Continue to co-learn from various perspectives and identify takeaways on priorities

The second iteration of fuel pathway scenarios was presented, which were updated based on work group feedback during work group meeting #4. An updated modeling memo (see Appendix G) was distributed to the work group to review, which included background information used in the updated scenario modeling. The handout was distributed to work group members three days prior to the meeting to allow work group members to familiarize themselves with the updated fuel pathway scenarios prior to the meeting. The second iteration of the fuel pathways modeling was revised with:

- **A reference case scenario**: Most likely deployment of clean fuels and vehicles out to 2050.
- **Expanded sensitivity cases by fuel type**: Reflect optimistic outlook one bucket at a time. Buckets: ethanol, biodiesel, renewable diesel, SAF, zero emission vehicles in light-duty sector (electricity and hydrogen), zero emission vehicles in heavy-duty sector (electricity and hydrogen).
- **An all-in scenario of all expanded fuel type scenarios**: Reflects combination of optimistic outlooks across all buckets simultaneously.

A few important changes and reminders on the updated modeling memo were mentioned:

- Previously, it was assumed that the program would start January 1, 2025. All modeling has been shifted by one year to January 1, 2026, to allow for ~18 months of rulemaking instead of 6 months.
- All cases presented reflect the higher LUC adder from CARB's 2015 rulemaking. Modeling is flexible and can accommodate a range of values.
- The modeling is used to develop recommendations around a range of carbon intensity targets.

Next, a summary of the reference case was presented. In 2030, the estimated carbon intensity reduction would be in the range of 13% - 17%. In 2040, the estimated carbon intensity reduction would be in the range of 40%-50%. In 2050, the 100% carbon intensity reduction target may be difficult to achieve based on the current transportation fuel market. However, this is a challenging conclusion to assert confidently given the uncertainty regarding the development of expanded use of existing fuels, new feedstocks for fuels, new and novel uses of available feedstocks, and the adoption of new technologies. The ability of the market to achieve a 100% carbon intensity target will depend on a variety of technological developments that are difficult to conceive of today.

For each of the sensitivity analyses, modeling assumptions were modified within a single area of focus: ethanol, biodiesel, renewable diesel, SAF, ZEVs-LD, and ZEVs-HD. Graphs for each fuel type that focused on the carbon intensity trajectory of the program prior to 2040 and presented the near maximum contributions for each can be found in Appendix G.

Next, the "all-in" scenario was discussed, where the carbon intensity reduction was included for all fuel types presented. A 75% carbon intensity reduction by 2040 is reached if all of those fuel type carbon intensity reductions are combined. A 100% carbon intensity reduction by 2050 is reached if all of those fuel type carbon intensity reductions are combined.

Work group members then split into self-selected smaller breakout groups for further discussion. The purpose of the breakouts were to discuss the updated fuel pathway scenarios and to identify recommendations of the work group for the Report to the legislature. Work group members were presented with a list of questions for reflection, and then later the small groups discussed each topic. Following the small group discussion, the larger group reconvened and there was a comment period for work group members followed by a comment period for the public.

Key Takeaways

- There was discussion on moving the first goal out to 2035, with a carbon intensity reduction of approximately 25% as well as adjusting other targets to aim towards achieving outcomes including compliance (credits and deficits are balanced).
- Some work group members suggested focusing on the near term and adjusting periodically such as a review every 5 years.
- General support for the program starting with a year or two of a Reporting Period to create a glidepath.
- Allow SAF as a credit generator and reevaluate creation of deficits down the line.
- Concern with the potential for over production of credits leading to undervaluing credits such as in industries where voluntary credits are generated (air, marine, locomotive).
- Continued support for a fuel neutral approach that also incorporates robust investigation/engagement of certain fuel eligibility such as parameters around renewable hydrogen.
- Support for eligibility of capacity credits for DC fast charging and hydrogen refueling infrastructure with some limits that in particular work to avoid unintended inefficiencies and instead target investments to areas of highest need.
- Off-road electrification applications were generally supported to be eligible to generate credits, but more detail is needed to firm up/frame up specifics.
- General support for RECs being used to create additional carbon intensity pathways for electricity (beyond utility grid mix), assuming no double counting and all RECs are verified.
- Many work group members supported carbon capture and storage (CCS) as an eligible activity with exclusion for EOR, but a few work group members did not support CCS as eligible due to some concerns about CO_2 pipelines such as safety, which may be addressed in upcoming pending rule finalization.
- Re: liquid biofuel blending, work group members expressed a desire to learn from E15 and E85 experience, including adequate infrastructure capacity needs and constraints. They shared a range of perspectives on costs, benefits, rail safety, off ramps, locations, and market considerations.
- Climate Smart Ag and Forestry practices that demonstrate GHG reductions received broad support assuming they demonstrate GHG reductions. Climate smart ag and forestry should be factored into the carbon intensity score. Questions existed around enforcement, reporting and verification.
- The LUC adder for ethanol made with corn and soybean feedstock is non-zero, for forestry could be either positive or negative.

Work Group Meeting #6 – November 21, 2023

The objectives of the meeting included:

- Review and discuss updated modeling.
- Discuss policy considerations to incorporate into work group recommendations.
- As always, continue to co-learn from various perspectives and identify takeaways on priorities.
- Review timeline and discuss priorities for the next 4 weeks plus.

The work group walked through the results of the Mentimeter that was released on November 13th, 2023.

Updates to the modeling were presented, including a new iteration of fuel pathway scenarios. Below are some of the updates made to the 3rd iteration of the modeling:

- Added Business as Usual (BAU) Case for the sake of reference
- Minor changes / updates to modeling
    - 2018 baseline for diesel was adjusted to reflect waivers issued in 2018 for biodiesel blending mandate (went from 12.2% blend rate to 8.3%)
    - Fixed modeling errors e.g., was mistakenly double-counting impacts of CCS deployed at ethanol facilities, renewable diesel volumes were wonky in some years, etc.
    - Biodiesel case was modified to accommodate a higher blend of biodiesel (B50) than contemplated previously
- Nomenclature has been updated
    - o Reference > Moderate
    - o Sensitivity Cases renamed: Expanding Fuel X > Accelerated Fuel X

It was then discussed how credits are applied to EV charging using California as an example. The work group was encouraged to think about the principles they should seek to advance with respect to the use of revenue from residential or at-home EV charging.

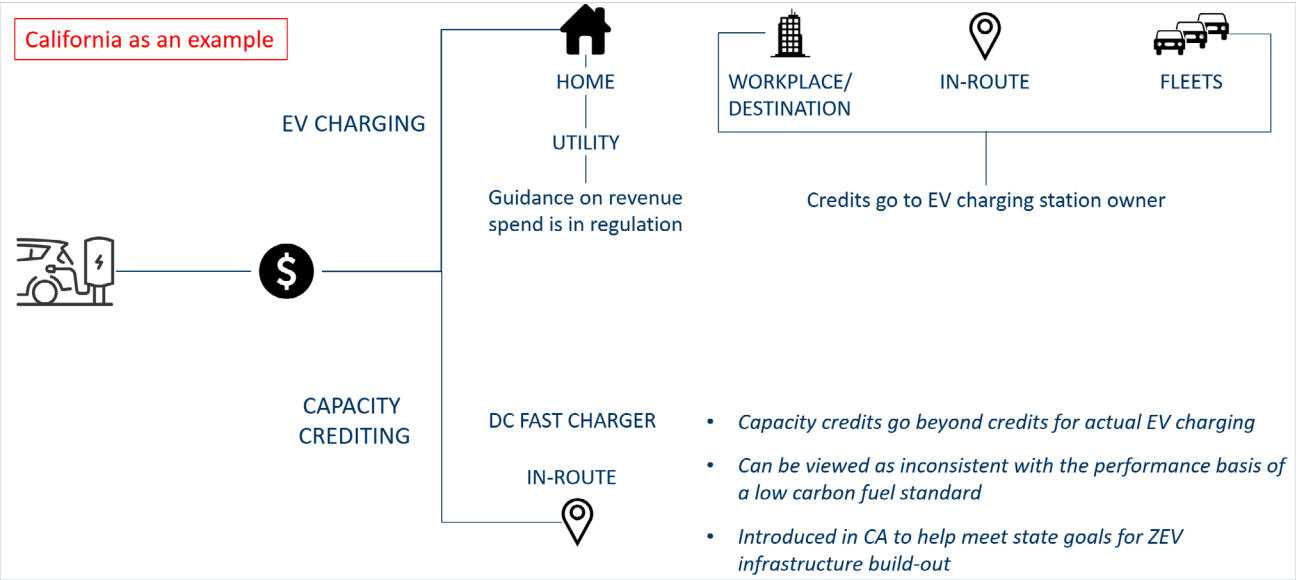

Figure 11: Overview of Credits Generated via EV Charging in California's LCFS Program

Land Use Change (LUC) adder and Climate Smart Practices were presented on next.

LUC Adder (in g/MJ) is applied to fuels produced from a certain feedstock e.g., corn, soybean. Fuel producers cannot reduce the LUC Adder through any action of their own—it is a carbon intensity reduction applied to any fuel pathway from a feedstock that is deemed to have had an impact on LUC.

Climate Smart Practices refers to practices in the agriculture and/or forestry sectors that are determined to have measurable and verifiable GHG emission reductions that can be incorporated in the carbon intensity of an eligible fuel pathway. To date, we have addressed a subset of climate smart practices, like reduced fertilizer application; however, the scope of climate smart practices, and how they should be applied is ultimately up to the work group and would be finalized in rulemaking. This could be a novel component of the CTS because other states have excluded eligibility of these types of practices from consideration.

The carbon intensity score for some pathways will always have a *LUC Adder*, but the carbon intensity score can be reduced through the adoption of *Climate Smart Practices*. In some ways, the LUC Adder is a legacy carbon intensity increase applied for LUC that have already occurred, whereas Climate Smart Practices represent the adoption of improvements that can be incorporated into the carbon intensity score.

A sample of existing state soil and water health programs was presented from the Board of Water and Soil Resources (BWSR) and the MN Department of Agriculture (MDA) focused on land conservation practices; sediment, phosphorous and nitrate reduction; easements of wetlands and grasslands, local water management planning and performance assessments; financing assistance programs for farmers/growers implementing practices; cover crop research efforts such as the Forever Green Initiative; and technical assistance and incentive programs. A preview of some of these programs can be found in Appendix B: Sample of Existing State Programs Improving Ecosystem Services, Water and Soil Health on Working Lands.

Work group members were instructed to fill out a Mentimeter survey before breaking out into small groups and score a number of draft statements. Work group members had the option to join one of the three topics areas shown below:

1. Community health, equity, and workforce in the context of clean fuels
2. Land use, climate smart agriculture, and forestry
3. Program administration and performance (in person only)

The following statements have been adjusted to incorporate detailed notes that resulted from small group discussions and survey results.

COMMUNITY HEALTH, EQUITY AND WORKFORCE

- The work group recommends co-benefits, like community health, economic development, and EJ, should be advanced through a CTS, as well as identifying opportunities to mitigate negative impacts of a CTS related to these same issues, such as unintended consequences for supply chain resiliency to deliver foods, medication, etc. Work group members encouraged discussion to determine potential policy requirements in this area and who is responsible for ensuring these outcomes are met; details will need to be resolved in legislation and rulemaking, guided by diverse stakeholders.
- The work group recommends program reporting include tracking equity and health measures, focused on outcomes, associated with program implementation; clear instructions should guide the reporting process and requirements. Rulemaking, which involves engaging stakeholders, should include clarifying "equity" and "health measures" and aligning with other state agency definitions of those terms.
- The work group recommends future development of a framework for determining investments of credit revenue from EV charging to support outcomes designated as priorities. The framework shall provide guidelines on investments in locations (which could include income designations, EJ communities, and/or disproportionately impacted communities), supply chain and other priorities of greatest need and value to receive those credits.
- The work group recommends considering workforce development program components for a CTS such as pathways to the development of jobs, while leveraging, and not duplicating, other existing current labor-related programs.

LAND USE, CLIMATE SMART AGRICULTURE, AND FORESTRY

- Because ecosystem services and other impacts related to water and soil health, air quality, wildlife, and beyond, are challenging to incorporate into a CTS focused on GHG emission reductions, the work group recommends continuing to evaluate and explore complementary policies and programs that protect water and ecosystem services and advance other impacts.
- The work group supports including 100% woody biomass with lowest carbon intensity feedstock source possible in the modeling. If brought to market and verified (based on the best available science), climate smart forestry practices could be evaluated for eligibility for credit generation.

- Utilization of verified climate smart forestry practices for woody feedstocks in advanced biofuels may help improve forest health and result in co-benefits to local communities, including disadvantaged populations.

PROGRAM ADMINISTRATION AND PERFORMANCE: EVALUATION CHECKPOINTS, CREDIT TRACKING & STAFFING

- The program should look to other programs and states to glean the best reporting and documentation protocols.
- The work group recommends the CTS program should ensure 3rd party verification of fuel pathways and reported fuel quantities.
- There was general support that the CTS should have a program review period every 3-5 years to calibrate carbon intensity reduction targets and goals. Defined criteria for calibration of targets or goals should be determined, such as the level of the credit bank, along with an analysis of co-benefits and co-harms should be woven into the periodic review. Also, a stakeholder-based Task Force should provide guidance on the program review including the development or refinement of defined criteria for recalibration.
- The work group recommends that credit generators and deficit generators should pay an equal program fee.

Work group Meeting #7 – November 30, 2023

The objectives of the meeting included:

- Review timeline and discuss priorities for the next 4 weeks plus.
- Provide overview of draft report to familiarize work group with structure.
- Provide ample desk time and office hour Q & A time for the work group.
- Provide ample time to hear feedback from non-work group members.

This meeting was developed with the intent to give an opportunity for non-work group members to provide feedback. Feedback will be used to develop recommendations based on the work group's discussions. Other aspects of the report such as the modeling and background sections are contextual products for the Legislature's awareness.

An overview of the draft report was presented, and the group discussed how the feedback was developed and structured in the report.

The technical consultant for the work group provided an overview of the modeling process for the report. The modeling was intended to be the supportive, technical backing of the work group's input and expertise to develop a successful CTS policy. The scenario modeling was an iterative process whereby MN-specific information on supply, distribution, and production data were used. The baseline carbon intensity (CI) of transportation fuels within the state was determined using a 2018 baseline.

Scenario modeling demonstrated levels of CI reduction that could be achieved via a Minnesota CTS under different market conditions and considerations. The scenario modeling included fleet turnover and included assumptions regarding fuel economies, vehicle miles traveled, and other key parameters associated with transportation fuel consumption.

The CI targets included in the statute may be very difficult to achieve given what is known today about the market and clean fuel technologies.

- **Business as Usual (BAU) Case**: Likely achieve a CI reduction of 5% in 2030, 15% in 2040, & 30% in 2050.
- **Moderate Case**: Likely achieve a CI reduction of 13-17% in 2030, 40-50% in 2040, and 65-75% in 2050.
- **Accelerated Cases**: Using optimistic considerations for clean fuel deployment in Minnesota, the state could achieve a CI reduction of greater than 50% in 2040, and greater than 75% in 2050.

- **All-In Accelerated Case**: An aggressive outlook that aggregates many optimistic assumptions with respect to clean fuel deployment, the state may be able to achieve the targets included in the statute.

The meeting also included a question-and-answer period for work group members, and an opportunity for non-work group members to provide comments on the process.

Work Group Meeting #8 – December 13, 2023

The objectives of the meeting included:

- Review and discuss draft report survey feedback
- Review and discuss updated draft 'Findings and Recommendations' chapter
- Continue to co-learn from various perspectives and identify takeaways on priorities
- Review timeline and discuss priorities for the next 4 weeks plus

The purpose of the meeting was to learn more about the survey results, hear from work group members in a large group setting, reflect on the results and give everyone an opportunity to hear from each other.

High level results from the survey the work group members completed on December 6th, 2023 were shared.

- 27 out of 31 questions had a median score of 4 (out of 5).
- 21 out of 23 recommendation statements had a median score of 4 (out of 5).
- Staff have reviewed responses by 31 members to all 36 survey questions (1,116 data points + comments)
- ~50% of work group members provided open ended comments for each statement (A – C).
- Section C – largest range of feedback, concerns raised.
- Frequent responses include: didn't have enough time; need more context to statements; rulemaking wasn't discussed; need more language about ecosystem services.
- *Many* lengthy responses in big picture questions ('What is holding you back from supporting the draft recommendations' and 'Is there anything else you'd like to add').

Next, project team members walked through a few of the statements from the draft report, reviewed the feedback received, and shared how the statement was revised based on the feedback. Statements A.1.1, B.2.3, and C.2.3/C.2.3 were discussed.

Moving away from the specific statements above, facilitators allowed work group members to express thoughts on any of the revised statements, and posed a few high-level questions to the work group:

- What do you feel the report recommendations do well?
    - *One work group member believes the Report Recommendation provide clear and easily understood direction.*
    - *It balances a lot of different perspectives, and identifies areas with broad support.*
    - *Given the range of perspectives on the work group, it does a nice job of capturing the range and issues discussed.*
    - *The report summarizes multiple positions of work group members well.*
    - *Generally speaking, the report is a good effort to summarize the conversation. This is a good summary of some of the inflection points in the policy.*

- *Many work group members shared appreciation for the technical modeling.*
- *It captures work group discussions and identifies many areas of broad support.*
- *I believe the process itself has helped many of us better understand this complex policy and the diverse perspectives.*
- *I echo the comments of many here that the recommendations do a very good job of capturing 6 months of intense work and a lot of feedback.*
- *The Report's best impact is to keep this discussion going and provide participants with good information going forward.*
- *This is such important work as the country watches what happens with this policy in the next legislative session. The state has the opportunity to be a pioneer in this space as we work to craft this.*

- Where do you feel the report recommendations reflect the work group discussion the least?
  - *The idea of off ramps under certain circumstances may be missing.*
  - *Regarding the language "many" - what is that threshold?*
    - *Answer: If the median score is 4/5, "many" was the language that was used in the statements. We will try to include this explanation in the report.*
  - *A few work group members feel that B.4.1 carbon capture and storage language leads readers to believe that PHMSA will fix all the problems with CCS. This is not the case. I mentioned concerns with CCS that go beyond safety consideration.*
  - *The report artificially separates environment from EJ in discussion of co-benefits. There was repeated discussion of the need to advance ecological co-benefits, yet this is not included in C.1.1.*
  - *I think it does not capture nuances of table or larger work group discussions very well.*
  - *I haven't seen the feedback I shared (both written and verbally) reflected yet.*
- If you could pick one aspect of a CTS that you feel is most important to Minnesota, what would it be?
  - *Climate smart agriculture.*
  - *Highlighting board stakeholder engagement.*
  - *The diversity that this group brings and everyone working together for a better future for all*
  - *The transformational ability of a CTS to lower CI in transportation and ag. The modeling gives us a much clearer picture of what is possible.*
  - *A fuels policy comprehensive enough to advance electrification and support continued improvement and evolution of biofuels as well as space for new fuels, not yet in market.*
  - *Recognition of climate smart agriculture practices as a contributor to lower carbon-intensity scores for fuel, especially given the importance of agriculture to the State of Minnesota.*
  - *The scale of opportunity in the near-term seems large.*
  - *Key message is that a CTS study promises significant reductions in transportation carbon emissions over the next 15 years.*
  - *Economic development opportunity for Minnesota by increasing investment in emerging clean fuels and electrification.*
  - *Opens opportunities for advancement in many very critical areas, agriculture and electrification being two of them. Especially important considering another work group members' insight that the whole country (maybe world) is watching.*

The meeting also included a question-and-answer period for work group members, and an opportunity for non-work group members to provide comments on the process.

Work Group Meeting #9 – January 23, 2024

The meeting agenda and objectives included:

- Review and discuss final report
- Quiet time to review updated report
- Large group discussion and Q&A
- Review timeline for 2024 legislative session

Facilitators thanked work group members for their time and engagement in this process and reminded the work group members that the key audience of the report is the MN legislature, so the report is meant to be simple and actionable. As such, it required trying to balance brevity and detail which hasn't been easy given the complexity of the subject matter.

A few key changes from the last report were covered:

- Thorough review of all comments from work group members and integration of clarity throughout
- Emphasized key themes in the executive summary for quick reference
- Added callout boxes in findings chapter to integrate further exploration topics so that issues are clustered together
- Cover page design and other graphics to help tell the story
- Addendum additions

Discussion:

1. What are your questions / comments related to the final draft report?
    - *It does a good job of summarizing the policy and the considerations the work group thought through.*
    - *It does a good job of covering the topics and diverse perspectives.*
    - *Does being listed as a work group member imply that we agree with or support the report?*
    - *The draft accurately encapsulates the discussions within the work group meetings that took place in a short timeframe.*
    - *I appreciate how the points for further exploration are laid out.*
    - *Can you remind us of when the work group recommended that CCUS be an eligible activity to generate credits? SAF is on the moderate scenario wedge graph but not the BAU scenario, so appears to generate distortion.*
2. What are the top 3 things you would mention about the CTS to a colleague or the legislature?
    - *Opportunity for MN to lead on climate-smart agriculture for clean fuels.*
    - *Aggressive but achievable compliance curve, climate smart agriculture is included and as tech neutral as possible.*
    - *MN is positioned much differently than other US states with a CTS policy and will have a tailored approach to being a fuel producing state and heavy agriculture state when implementing a CTS.*
    - *Market-based policy to help decarbonize the transportation sector. Cross sector of stakeholder engagement aid in the transition to electrification while at the same time reducing CI for all vehicles.*
    - *The report says that CTS is the largest single source of carbon reduction, but we didn't look at other options, so this statement is inaccurate.*
    - *Overall reduction in carbon and fossil fuel use as a result of policy.*

- *It's not an endorsement of any given fuel/source that may fit within it.*
- *CTS has been an effective policy in other states for reducing CI of fuel supply, it may not be perfect, but it has proven effective. Consider complimentary policies.*
- *Ways for the public to engage.*
- *Bringing 40 representatives together in a civil process and aligning (for the most part) on a meaningful final report.*
- *Get the legislature to give us more time next time,*
- *Climate smart sustainable forestry can be used for a variety of liquid fuel and has the lowest CI.*
- *SAF is opt in fuel.*
- *Including SAF using woody biomass could help accelerate achievement of state emission goals.*

3. Reflecting on the work group process, what went well?
   - *Respectful dialogue between stakeholders.*
   - *Staff leadership and availability throughout the process.*
   - *Stakeholder representation and equal opportunity for input.*
   - *Superb leadership from the MN agencies and facilitators.*
   - *Learned a lot about a low carbon fuel stand from speakers and webinars.*
   - *Opportunity for public comments.*
   - *Once we got going, the in-person meetings were a good opportunity to connect with work group members. The staff were very diligent in keeping the process moving forward.*
4. Reflecting on the work group process, where could we make improvements for future similar processes?
   - *Sometimes if you weren't in a breakout there was no opportunity to weigh in on that topic or know what was talked about (before the final draft report).*
   - *Not necessarily a process improvement, but more time (months not meeting time) with the group to get into more detailed discussions.*
   - *Needed more time for larger groups discussions.*
   - *Legislature to give us more time next time.*
   - *Mentimeter was useful for getting a sense of where people were, but difficult to answer questions on the spot without more information or internal consultation.*
   - *Have experts who could speak to potential negative impacts of a CTS.*
   - *There should be better definition on how the sentiment of the group is measured. Hard to do this on such a short timeframe with 40 diverse members.*
   - *Meet outstate more often.*
5. Other questions/comments
   - *How is the "final" spreadsheet different from the data already posted?*
     - CTS Director responded: The latest spreadsheet incorporates corrections to clerical errors that were caught during quality checks or in response to questions raised by work group members.

- *Draft should include "forestry" more often, especially in conjunction with "agriculture". Will plan on giving Shannon some suggestions. For example, the bottom of page 2 - "MN is well implemented due to…". This does not mention that we have 17 million acres of sustainably maintained forest, and that should be incorporated.*
  - CTS Director responded: Thank you, please feel free to share your specific thoughts on this via email.

Feedback from non-work group members was then collected.

- The executive summary will likely just get skimmed at the capitol. Will the executive summary include any costs or just highlight benefits?
  - CTS Director responded: Given we're so early in the concept of this policy, it's extremely challenging to do any sort of cost benefit analysis, and we would need all the details. It is out of scope at this point in the process but will likely be looked at later this spring. We can also look to other states for this information as it relates to costs on consumers, etc.
- People at the ethanol plants should capture CO2 and combine it with hydrogen to triple ethanol output. You then wouldn't have to rely on anyone to stuff CO2 underground.
  - CTS Director responded: Thank you, Dale.

Ample time was allowed for non-work Group members to provide questions and concerns before turning back to any additional feedback from work group members.

- *The statement "a CTS would be largest single policy to reduce transportation in MN" is misleading because if you look at Climate Action Plan for example – VMT has greater emissions reductions than this policy. Also, in regard to the report talking about improving soil water health in MN – this is also misleading because it will reduce impacts if we implement guard rails, but not necessarily improve.*
  - CTS Director responded: Thank you for your comments.
- *Looking at the scenarios, I think there's a missed opportunity. New feedstocks are mentioned in the report, but they're not called out specifically anywhere. Friends of the Mississippi River says we may see a huge growth in these readiness technologies and the report should connect more to that.*
  - CTS Director responded: Thanks for your comment. There is nothing about a CTS program that would prohibit new feedstocks or new clean fuel technologies from being considered as part of the program. Scenario modeling does not to show the world in which people want it to exist but rather to capture what we understand about technology today.
- *I appreciate that the report suggests a cost benefit might be beneficial. Sharing end-user costs as identified by CARB would be within the scope of the work group and would be beneficial for legislators to have visibility too.*
  - CTS Directorresponded directly in the chat that yes, they considered including the cost estimates included in the recent California Air Resources Board (CARB) amendments. After detailed review and discussion with people deeply familiar with these estimates, there is too much uncertainty, skepticism and negative feedback from a broad spectrum of stakeholders about the methodology used for the calculations.

Appendix G: Informational Webinars

As part of the work group, a series of five informational webinars were presented on various topics. The purpose of the webinars was to educate work group members on the technical topics prior to having subsequent discussions about modeling scenarios and potential outcomes and recommendations. The five webinars were open to the public.

The first four technical webinars focused on fuel sources as they pertain to GREET modeling. These sessions include a recorded technical overview and full summary notes which can be viewed on the CTS webpage[36]. Each of the webinars are briefly summarized below.

Technical Webinar 1: Ethanol

Technical webinar 1 was held on September 27, 2023, with 16 work group members present. The webinar addressed three main topics – the 2018 ethanol baseline, carbon intensity of ethanol, and ethanol deployment.

- The ethanol blend rate and carbon intensity are the two factors impacting the 2018 baseline, which will be modeled in GREET
- GREET is not a predictive tool, therefore some assumptions must be made for how ethanol will contribute. There are three types of changes generally considered to reduce the carbon intensity of ethanol: process efficiencies, climate smart agriculture, and carbon capture and storage
    - Overall, ethanol has a range of 1-2% efficiency per year
    - Farmers can change processes to reduce carbon intensity at a higher rate
    - The work group would need to determine the likelihood of farmer participation and what incentives could be offered for participation
- The GREET model can also be used to show what practices have been adopted. The work group would need to look at how much ethanol can realistically be deployed.
    - The E15 market is currently robust, and this may continue
    - E85 consumption has recovered post-pandemic
    - There is also considerable investment in alcohol-to-jet conversions, so the work group would need to identify the role sustainable jet fuel may have in achieving the goals, and if it should generate credits

Technical Webinar 2: Biomass-based Diesel

Technical webinar 2 was held on September 29, 2023, with 19 work group members present. The presentation included addressing three main topics - 2018 biodiesel baseline, carbon intensity of biodiesel, and the deployment of biodiesel in the market. Here, biomass-based diesel is a catch all term for biodiesel renewable diesel.

- The two factors impacting the 2018 baseline are biomass-based diesel blend rate and carbon intensity.
    - The work group will need to decide whether to assume compliance with Biodiesel Content Mandate statute (effective biodiesel blend rate of 12.1% by 2018) or assume no biodiesel in the baseline.

36 https://www.dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html

- The GREET model will be used to determine a carbon intensity baseline for fuel sources. Carbon intensity of biomass-based diesel is assumed to be around 20-35 g/MJ (excluding LUC). GREET is not a predictive tool so some assumptions have to be made for how each fuel source will contribute.
    - There are 3 types of changes that generally considered to reduce the carbon intensity of biomass-based diesel: feedstock mix, process improvements, and climate smart agriculture.
- Data from the MDA suggests about 45% of biodiesel in Minnesota is derived from soybean oil and 55% is other fats, oils, and greases, however, the extent to which a CTS will drive change in feedstock mix is tied to the LUC adder applied to soybeans.
    - It is unlikely the market will achieve compliance without soybean oil.

Technical Webinar 3: Transportation Electrification

Technical webinar 3 was held on October 5, 2023, with 18 work group members present. The webinar included an overview of the state of transportation electrification in Minnesota and across the country. Three main topics relating to transportation electrification and how it pertains to the Minnesota CTS were addressed: 2018 electricity baseline, carbon intensity of electricity along with grid average and changes over time, and EV deployment in the market for light-duty vehicles (LDVs), medium-duty vehicles (MDVs), and heavy-duty vehicles (HDVs).

- 2018 electricity baseline
    - Since the amount of EVs that existed in MN in 2018 was relatively low (around 10,000), incorporating into the baseline carbon intensity will have a little overall impact.
    - The 2018 electricity baseline will be a very fractional amount compared to how much gasoline was consumed.
- The carbon intensity for electricity needs to be adjusted for the energy efficiency ratio (EER) of the vehicle. The EER of the vehicle typically drops the carbon intensity by a factor of 3-5.
    - Incorporate assumptions around compliance with SF4 implementation.
        - Increase renewables to 55% by 2035; 2030: Carbon-free requirement of 80% for public utilities, 60% for others; 2040: Carbon-free requirement of 100% .
- Modeling for EV development is sensitive to several assumptions.
    - LDV assumptions include rate of adoption and vehicle-type split (battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) etc.).
    - MDV and HDV assumptions include rate of adoption and location/distance of travel (e.g. local delivery vehicles vs. long distance or statewide delivery vehicles).
    - Predictions for future EV adoption rates and vehicle-type split vary widely, which makes it challenging to estimate for scenario modeling.
    - The opportunity for EVs is large compared to other fuels due to the grid getting cleaner along with emerging EV technology.

Technical Webinar 4: Other Clean Fuel Activities

Technical webinar 2 was held on October 6, 2023, with 24 work group members present. The following topics and questions were addressed in the webinar:

- Review additional activities that could generate credits.
    - The presentation included an overview of several clean fuel activities and types, including jet fuel, natural gas and renewable natural gas, refinery efficiency / improvements; CCS at refineries, off-road equipment (e.g. electrification of off-road equipment like forklifts, cargo handling equipment, truck refrigeration units, public transportation, etc.), and zero carbon intensity opportunities for electricity application.
- Do these various fuels or activities impact the baseline?
    - It is not required to include hydrogen in the 2018 baseline. Natural gas in MN is low in volume as it relates to transportation fuel, approximately 5-7 million gallons, which will have a low impact on the 2018 baseline. Off-road equipment is rather difficult to incorporate into a baseline due to the niche market and data collection.
- Should these activities be incorporated into the modeling?

Land Use, Water, and Ecosystem Services Webinar

The final webinar was held on October 16, 2023, with 23 work group members present. The webinar included five presentations by the following guest speakers:

- Matt Herman, Senior Director of Renewable Products Marketing at the Iowa Soybean Association, presented on soil and water outcomes along with related considerations that can be advanced by biofuel production.
    - Matt noted that a CTS can be the backbone to a larger agricultural, energy, environmental market, and the inclusion of infield emission reductions into a CTS is consistent with the policy framework and Minnesota's greenhouse gas (GHG) inventory. He also noted that existing private market entities can provide various monitoring, reporting, and verification (MRV) services, and a CTS could create a new market for biomass novel crop systems.
- Dr. Carrie Jennings, Research and Policy Director at Freshwater Society, presented a water-focused perspective on the development of a standard to avoid unintended consequences.
    - Dr. Jennings noted that very few surface water bodies in agricultural wetlands meet water quality standards in the state. Dr. Jennings explained an example where the polluter does not pay (the customers have to pay), and a clean fuel standard could help lead the way to a new agricultural paradigm. Dr. Jennings emphasized not to lose sight of water in the quest for low carbon fuel.
- Dr. Farzad Taheripour, Energy Economist at Purdue University, discussed a lifecycle greenhouse gas model that estimates potential indirect LUC adder from various biofuel expansion scenarios. He provided some background on the theory of Indirect Land Use Change (ILUC) and a literature review.
    - Dr. Taheripour noted how biofuel production has increased the demand for new crop land in the United States which results in deforestation, generating large GHG emissions. Dr. Taheripour noted that the amount of land used for cropland over time has been decreasing. However, corn and soybean cropland area in the United States has been increasing, while other cropland areas have been decreasing.
- Dr. Christine Costello, Industry Ecologist & Engineer at Penn State University provided an overview of her perspectives on Life Cycle Assessments (LCAs) of agricultural supply chains and how to extend LCA frameworks to include water quality, biodiversity, and social justice impacts.
    - Dr. Costello noted that LCAs were not developed for agricultural analysis, but for manufacturing systems, and there is no agreed upon approach to evaluate soil health, biodiversity, or social impacts in LCA. Dr. Costello mentioned that agreement upon specific metrics for these impacts is ultimately a negotiation process for decision makers, in which they may want to combine LCA with other system evaluation processes.

Appendix H: Credit and Deficit Calculations

Table 3: Examples of credit and deficit calculations.

Year of interest	Carbon Intensity (CI) of standard	CI for gasoline and fuels that substitute for gasoline	CI for diesel and fuels that substitute for diesel
2030	25%	74.08	70.98

Application: EV charging

A public EV charging station provider dispenses 10 million kWh of electricity to light-duty vehicles. The calculation below shows how many credits that station will generate. In 2030, the estimated grid average carbon intensity of electricity is 91.10 g/MJ.

$$\text{Fuel Volume} \times \text{Energy Density} \times EER_{displacement} \times (CI_{standard} - CI_{cleanfuel}/EER)$$

10,000,000 kWh x 3.6 MJ/kWh x 3.4 x (74.08 g/MJ – 91.01 g/mJ ÷ 3.4) x 10^{-6} MT/g = **5,788 credits**

Application: Ethanol production

An ethanol facility with a CI of 55.12 g/MJ produces 50 million gallons for blending into the transportation fuel supply in Minnesota. The calculation below shows how many credits will be generated by that ethanol. Note that it is assumed that the EER of ethanol blended into gasoline and used in an ICE is 1.0.

$$\text{Fuel Volume} \times \text{Energy Density} \times EER_{displacement} \times (CI_{standard} - CI_{cleanfuel}/EER)$$

50,000,000 gallons x 81.51 MJ/gal x 1.0 x (74.08 g/MJ– 55.12 g/MJ) x 10^{-6} MT/g = **77,271 credits**

Application: Gasoline production

A refiner produces and distributes for sale in Minnesota 50 million gallons of gasoline (in this case, it is reformulated blendstock for blending, RBOB). The calculation below shows how many deficits the gasoline distributed in Minnesota will generate. Remember that the EER for gasoline in an ICE vehicle will be equal to 1.0 and there is no displacement.

$$\text{Fuel Volume} \times \text{Energy Density} \times (CI_{standard} - CI_{fuel})$$

50,000,000 gallons x 122.48.6 MJ/gal (74.08 g/MJ – 102.00 g/MJ) x 10^{-6} MT/g = **170,982 deficits**

Appendix I: Modeling Overview

Modeling of a Minnesota CTS is driven by the demand for transportation fuel in Minnesota, which is a function of many variables including but not limited to economic growth, vehicle miles traveled, vehicle fleet turnover, and the expected compliance with complementary policies that impact transportation fuel demand (e.g., Minnesota Clean Cars and Biodiesel Blend Mandate). The modeling is initiated using fleet turnover modeling via the U.S. EPA's Motor Vehicle Emission Simulator (MOVES) model to assess the baseline Minnesota vehicle fleet mix. The MOVES3 model reflects the impact of EPA rulemaking efforts such as the Safer Affordable Fuel-Efficient (SAFE) Vehicles Standards; however, it does not consider any zero-emission vehicle (ZEV) technologies, like those required by state-level programs such as the Clean Cars Minnesota' rule. The regulations mandating increased ZEV penetration were incorporated into MOVES3 baseline data to project the future ZEV populations in Minnesota. The fleet turnover and fuel demand functions of MOVES3 were then paired with supply curves for low carbon fuels, including ethanol, biodiesel, renewable diesel, SAF, liquefied petroleum gas (LPG), and renewable natural gas (RNG), used to fuel compressed natural gas (CNG) vehicles.

It was assumed that the MN CTS will be administered in a similar fashion as other low carbon fuel standard programs, whereby a credit is generated by a unit of fuel that has a carbon intensity lower than the standard and a deficit is generated by a unit of fuel that has a carbon intensity higher than the standard. The carbon intensity standard changes each year. As a result of this change each year, if a clean fuel carbon intensity does not change in that same year, then it will generate fewer credits. Similarly, if a deficit generating fuel carbon intensity does not change in that same year, then it will generate more deficits.

GREET Modeling: Minnesota-Specific Carbon Accounting Standards

It was assumed that a Minnesota CTS would be implemented in a similar fashion as programs in place in California, Oregon, and Washington. In other words, fuel volumes (adjusted on an energy basis) would be matched with the carbon intensities of those fuels to determine the balance of deficits and credits in the program. A combination of the Argonne National Laboratory's GREET model and the California modified version of GREET (CA-GREET) was used to develop specific fuel pathways for Minnesota. The key areas that require modification of the GREET model for Minnesota-specific carbon accounting standards include but are not limited to: adjusting for the crude oil sources used and refinery efficiency for the refined products (i.e., gasoline and diesel) that are consumed in Minnesota, the transportation modes and distances to deliver feedstocks for processing or fuels for consumption, changes in the local grid resource mix.

Baseline Carbon Intensity for Minnesota in 2018

A carbon intensity estimate was developed for the 2018 baseline for gasoline and diesel fuel in Minnesota based on available data. For gasoline, E15 sales data from 2018 was reviewed and on average, gasoline sold in Minnesota included 10.15%$_{vol}$ ethanol and 89.85%$_{vol}$ reformulated blend stock for oxygenate blending (RBOB). An estimate for the carbon intensity of RBOB for Minnesota specific conditions was developed based on the mix of crude oil that is refined at Minnesota refiners from 2018. It was assumed that the ethanol blended with RBOB in 2018 was exclusively ethanol from corn. The carbon intensity of gasoline is then dependent on the assumed LUC adder applied to ethanol derived from corn (more information included on the LUC adder in the following sub-section). For illustrative purposes, two values were used as a reasonable representation of the range of expected LUC values. The lower value is taken from ANL's Carbon Calculator for Land Use Change from Biofuels (CCLUB) and the higher value is taken from the 2015 analysis done by the California Air Resources Board (CARB) (2015).

Table 4. Estimated Carbon Intensity Benchmark for Gasoline Fuel in Minnesota in 2018

Fuel	Energy Density MJ/gal	Carbon intensity g/MJ		%Vol
RBOB	122.48	102		89.85%
Ethanol	81.51	47.82		10.15%
LUC Adder		7.39	19.80	
		Benchmark (CCLUB)		Benchmark (CARB2015)
Gasoline	118.38	98.73		99.60

For diesel, it was assumed that ultra-low sulfur diesel (ULSD) is blended with biodiesel in line with Minn. Stat. 239.77, which in 2018 required a 20%$_{vol}$ blend of biodiesel. There are three periods: 1) 5%$_{vol}$ biodiesel from October 1 to March 31, 2) 10%$_{vol}$ biodiesel from April 1 to April 14, and 3) 20%$_{vol}$ biodiesel from April 15 to September 30. In 2018, however, there were several periods of suspension and waivers were issued by the Department of Commerce's Weights and Measures Divisions, including:

- 10-day waiver of the B5 blend requirement starting on 1/25/2018
- 8-day waiver of the B5 blend requirement starting on 3/12/2018
- 9-day waiver of the B10 blend requirement starting on 4/3/2018
- 1 day waiver of the B10 blend requirement starting on 4/5/2018
- 7-day waiver of the B20 blend requirement starting on 5/7/2018
- A suspension of the B20 blend requirement to B10 blend requirement from 5/21/2018 to 6/30/2018.

After adjusting for these waivers and assuming that annual diesel consumption can be divided equally on a monthly basis, the analysis yields a 8.3%$_{vol}$ blend on a weighted average basis for the year. It was assumed that the biodiesel blended with ULSD was exclusively from soybean oil. The carbon intensity for the diesel benchmark is dependent on the assumed LUC adder applied to biodiesel derived from soybean oil. For illustrative purposes, two values were used as a reasonable representation of the range of expected LUC values. The lower value is taken from ANL's Carbon Calculator for Land Use Change from Biofuels (CCLUB) and the higher value is taken from CARB 2015.

Table 5. Estimated Carbon Intensity Benchmark for Diesel Fuel in Minnesota in 2018

Fuel	Energy Density MJ/gal	Carbon intensity g/MJ		%Vol
ULSD	134.47	102		91.7%
Biodiesel	126.13	28.69		8.3%
LUC Adder		9.27	29.10	
		Benchmark (CCLUB)		Benchmark (CARB2015)
Diesel		97.01		98.55

The table below lists the energy density and the carbon intensity values used to initiate the scenario modeling. The carbon intensity values are subject to change over time in the modeling—these values are shown as initial values.

Table 6. Estimated carbon intensity values for Transportation Fuels in Minnesota

Fuel	Energy Density	Carbon Intensity, g/MJ
Ethanol	81.51 MJ/gal	47.82
Biodiesel	126.13 MJ/gal	
Soybean oil		28.69
Distillers corn oil		29.74
Tallow		32.86
Used cooking oil		20.10
Renewable diesel	129.65 MJ/gal	
Soybean oil		32.18
Distillers corn oil		38.35
Tallow		33.43
Used cooking oil		23.39
Woody biomass		8.30
Renewable natural gas	105.5 MJ/therm	
Landfill gas		40
Animal manure		-275
Electricity, 2021		
MN State Average	3.6 MJ/kWh	115.89

Land Use Change as a Carbon Intensity Adder

Since the introduction of policies that promote the use biofuels, there has been concern about potential domestic and international LUC adders that might be associated with the scale up of biofuel feedstock production. More specifically, the competition for productive land may yield shifts in land use to produce food, feed, fiber, and energy, with potential impacts on GHG emissions, biodiversity, and water quality. More specifically, LUC refers to the conversion of land from some other use to biofuel feedstock production. In the context of low carbon fuel standard programs in other states, regulators have exclusively considered the potential GHG emissions impacts of the potential shifts in LUC required to scale biofuel feedstock production. The reader is referred to Appendix G for a summary of the Land Use, Water, and Ecosystem Services Webinar for a broader discussion of the impacts associated with biofuel feedstock cultivation.

The analysis to quantify the potential LUC impact of increased biofuel feedstock production relies on computable general equilibrium models or similar economic models that link crops, biofuels, livestock, and other activities. These models are run with a "policy shock" which represents a significant increase in the use of a biofuel feedstock or feedstocks to meet some increase in biofuel demand attributable to some policy. Any LUC that is observed in the modeling via this policy shock is tabulated and the conversion of land from its previous use to a new use (e.g., biofuel feedstock production) is quantified using another model or module that utilizes soil and biomass carbon stock data for different land types and regions of the world and calculates GHG emission factors for land conversions.

The LUC adder in other low carbon fuel standard programs is reported as the total GHG emissions from the LUC modeling because of increasing the demand for biofuel production using feedstocks by a certain volume (in units of energy). There has been a considerable amount of research regarding LUC adders, and different policy makers have taken different approaches to incorporating these adders into regulatory programs. For the purposes of the modeling exercise only, a low and high value of LUC adders for corn were used to make ethanol and soybean oil used to make biomass-based diesel. These values are meant to illustrate a range of values used in programs today and should not be construed as an endorsement by the work group for one value or another. LUC adders were used from the following sources:

- Detailed Analysis for Indirect Land Use Change, California Air Resources Board, 2015 (CARB 2015), Available online at https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/iluc_assessment/iluc_analysis.pdf.
- Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB), 2021, Argonne National Laboratory, Available online at https://publications.anl.gov/anlpubs/2021/10/171711.pdf.

Lastly, it is important to remember that credits (and deficits) are a function of both the carbon intensity of the fuel and the amount of that fuel being used in the market. Depending on the declining slope of the carbon intensity standard, even with significant carbon intensity improvements and potentially increasing fuel deployment, credit generation may not be as significant as one might otherwise expect.

Appendix J: Compliance Scenario Modeling

Background on Clean Fuel Strategies for Consideration in Minnesota CTS

Minnesota is a leader in deploying clean fuels, with various policies in place that help to promote increased ethanol blending in gasoline, biodiesel blending with diesel, SAF blending, and zero emission vehicle (ZEV) deployment. In the context of a CTS, expanding the volumetric consumption of these and other fuels was considered, while also considering ways to decrease the carbon intensity of the fuel.

ETHANOL

A variety of ways for ethanol blending to generate value in a statewide CTS were considered, including via increased low-level blends of ethanol, process improvements, the deployment of climate smart agriculture, and deployment of carbon capture and storage (CCS).

E15 blending. In most markets, ethanol is blended at 10% by volume with reformulated blend stock for oxygenate blending (RBOB). However, higher blends of ethanol are used in the market today, especially in Minnesota. The EPA has said that any vehicle with model year 2001 or later can use E15. In some regions, E15 blending at terminals is halted and E15 retail sales are subsequently halted on June 1 annually. These constraints are imposed annually during the summer volatility season and relate to concerns of elevated Reid Vapor Pressure. In 2022 and 2023, the Biden Administration granted a series of emergency waivers that allowed E15 to be blended in the summer months. These emergency waivers are designed to help protect consumers from fuel supply constraints under the authority of the Clean Air Act. In 2022, an estimated 1 billion gallons of E15 was sold domestically. E15 blending in Minnesota statewide has increased substantially year-over-year since 2014 as shown in **Figure 12** below.

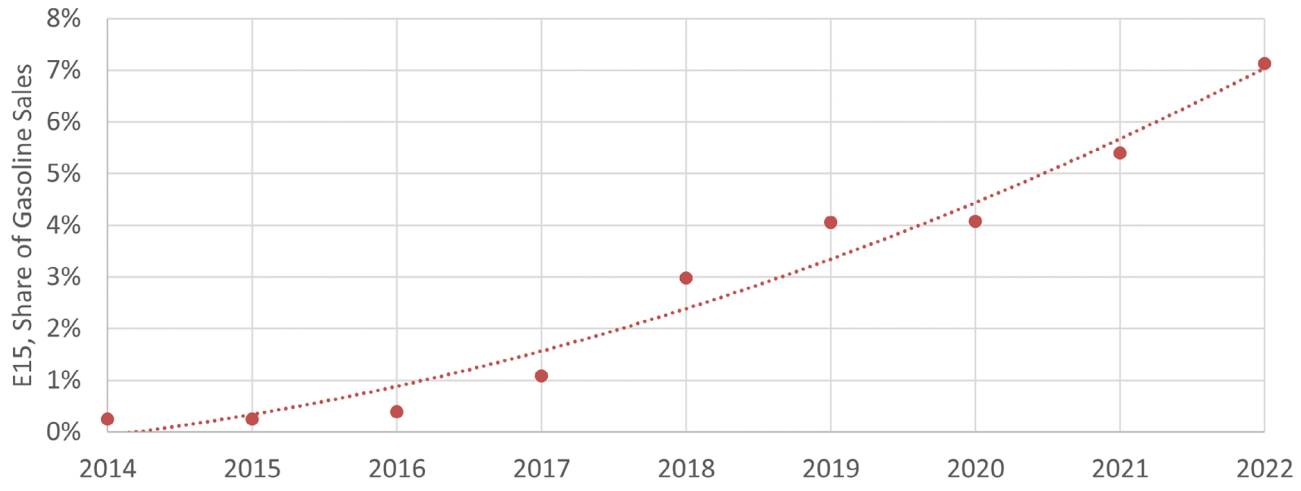

Figure 12. E15 Blends as Share of Gasoline Sales in Minnesota, 2014-2022

It was assumed the rate at which E15 blending has been increasing annually would increase under a CTS by a factor of 50%.

Process improvements. The carbon intensity improvements for ethanol in the California Low Carbon Fuel Standard (LCFS) program are a good proxy for processing improvements that might be achieved in Minnesota over the planning horizon. **Figure 13** below shows a steady decrease over time, noting a decrease from around 73 g/MJ in 2016 to just below 60 g/MJ in 2022. These values include the LUC adder of 19.8 g/MJ and 11.8 for ethanol from corn and sugarcane, respectively. While there are some feedstock switching considerations included in this figure (i.e., feedstocks that yield a lower than corn ethanol production), about 90% of the ethanol in California comes from corn and fiber. The analysis suggests that most of the carbon intensity improvements realized are attributable to process improvements.

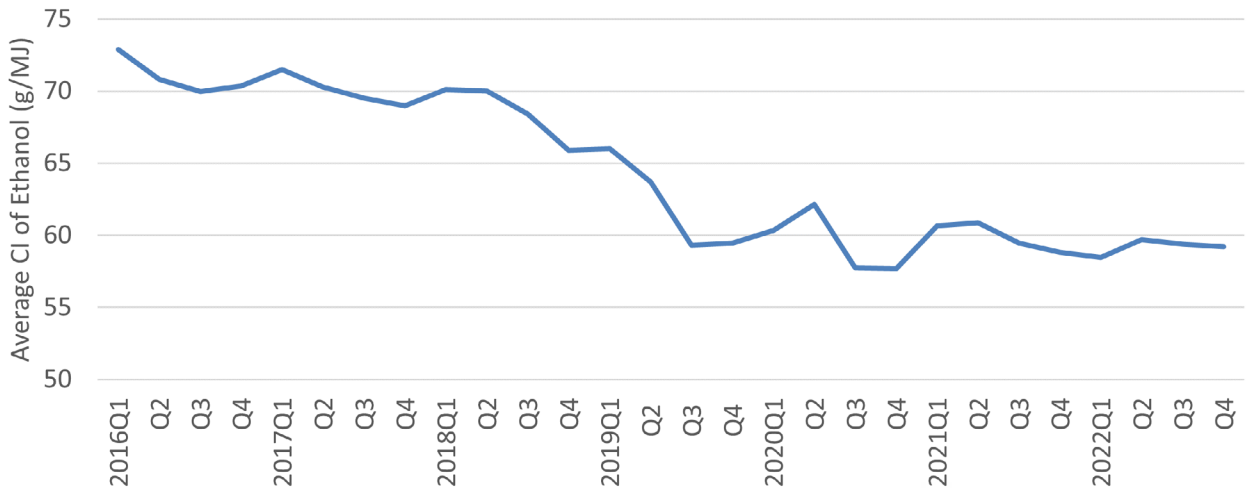

Figure 13. Carbon Intensity of Ethanol in California, 2016-2022

The two main energy input drivers for ethanol production are electricity and natural gas. Ethanol production facilities that are registered in the California LCFS program are currently limited to using the grid average carbon intensity of the jurisdiction from which the ethanol is sourced, unless the electricity is sourced "behind the meter" i.e., on-site at the production facility. For ethanol originating from Minnesota, the grid average carbon intensity of electricity contributes about 10% of the total carbon intensity of the fuel (before accounting for any LUC adder). It was assumed that the carbon intensity of ethanol would decrease over time with grid decarbonization.

It was also assumed that ethanol process efficiencies would yield an additional 1.2% reductions year-over-year in the Moderate Case.

Climate smart agriculture. In this work, climate smart agriculture refers to the greenhouse gas (GHG) emission reductions that can be achieved by implementing certain practices during the cultivation and harvesting of feedstocks that are used to produce clean transportation fuels. In the case of corn, it was assumed carbon intensity reductions consistent with an analysis performed for the United States Department of Agriculture (USDA)[37] referred to as a high efficiency-high conservation (HEHC) projection of the carbon intensity profile of ethanol. That scenario includes carbon intensity reductions from the following:

- Domestic farm inputs and fertilizer N_2O: yield increases and conservation technologies and practices.
- Domestic land use change: reduced tillage decreases soil disturbance during field operations and leaves a large proportion of plant residues on the field.
- Fuel production: process fuel switching to biomass, increased corn to ethanol yield, and other process efficiencies in the ethanol plant.

More specifically, the farm-level adoption of three conservation practice standards (CPSs) was incorporated in the production of corn used to produce ethanol that USDA's Natural Resources Conservation Service (NRSC) has recognized as having GHG benefits. These are:

- Residue and Tillage Management, Reduced Till;
- Nutrient Management: Improved Nitrogen Fertilizer Management; and
- Cover Crops.

37 A Life-Cycle Analysis of the Greenhouse Gas Emissions from Corn-Based Ethanol, available online: https://www.usda.gov/sites/default/files/documents/LCA_of_Corn_Ethanol_2018_Report.pdf

It was assumed that a maximum carbon intensity reduction of 21.6% from the baseline ethanol carbon intensity (i.e., without the LUC adder) could be achieved after accounting for the adoption of agronomic climate smart practices. For reference, the maximum achievable carbon intensity reduction through the implementation of agronomic climate smart practices is about 31%.

Carbon capture and storage (CCS). Ethanol facilities have been targeted for CCS deployment because the purity of the carbon dioxide (CO_2) stream from the fermenters is so high (i.e., 99%). The initial round of CCS investments will likely focus on ethanol production facilities that have accessibility to geological sequestration in close proximity. For instance, Red Trail Energy in North Dakota began CCS in July 2022. The implementation of CCS at ethanol facilities will reduce the carbon intensity of the fuel by around 28 g/MJ based on a review of Red Trail Energy's fuel pathway application to the Oregon Clean Fuels Program.[38] Moving forward, the industry will look to CO_2 pipelines for larger-scale CCS. There are several active investments in this space:

- Summit Carbon Solutions is pursuing a project to carry CO_2 from over 30 ethanol plants through a 2,000-mile pipeline network to a carbon storage site in North Dakota.
- Wolf Carbon Solutions has proposed a 350-mile CO_2 pipeline project in Iowa.
- Battelle and Catahoula Resources announced in 2021 that they will jointly develop solutions for CCS produced at ethanol facilities in Nebraska.

These proposed facilities will face some challenges due to stakeholder concerns about potential CO_2 pipeline safety and the sequestration well integrity liability. However, changes to IRS Section 45Q as part of the Inflation Reduction Act (IRA) will help to address these concerns, with changes summarized here:

- The new Section 45Q increased the tax credit value to $85/ton for captured qualified carbon oxide (QCO) stored in geologic formations, $60/metric ton for the use of captured carbon emissions, and $60/metric ton for QCO stored in oil and gas fields if certain wage and apprenticeship requirements are met.
- The IRA expanded eligibility for CCS by extending the beginning of the construction deadline from before January 1, 2026 to before January 1, 2033.
- The IRA lowered the amount of QCO that projects must capture annually to qualify for Section 45Q credits. More specifically, the IRA modifies the definition of "Qualified Facility" under Section 45Q such that the CCS threshold for all eligible facilities is reduced significantly.
- Other changes to Section 45Q relate to the incentive payment and how it can be applied or transferred. The revised Section 45Q now allows for so-called direct pay through a tax refund, which may help project developers avoid the process of raising tax equity. Taxpayers may also elect to transfer Section 45Q credits to an unrelated taxpayer (for cash and are not included in the transferor's income, nor is it deductible by the transferee).

The implementation of climate smart agriculture practices and CCS are not mutually exclusive and can occur simultaneously. However, the modeling assessed the market share for ethanol as a transition from "average carbon intensity ethanol" in 2026 to a combination of three components: 1) a decreasing carbon intensity of ethanol due to process improvements, 2) deployment of climate smart agriculture practices and CCS, and 3) a combination of climate smart agriculture and CCS ethanol over time.

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38 Oregon Department of Environmental Quality. (December 2023). *Approval of Proposed Red Trail Energy LLC's Tier 2 Application for Ethanol Fuel Pathways With and Without Carbon Capture and Storage.* https://www.oregon.gov/deq/ghgp/Documents/cfpRedTrailCCSdecision.pdf

E85 deployment. Ethanol can also be blended at higher levels with gasoline to make what is referred to as E85, which is generally considered a blend of as much as 85% (by volume) ethanol with 15% gasoline. E85 needs to be consumed in flex fuel vehicles (FFVs). E85 consumption in Minnesota (see Figure 14) has been about 16 million gallons annually since 2011—compared to about 2.5 billion gallons of gasoline consumed annually (i.e., less than 1 percent). Though E85 demand has recovered since 2020 to its pre-COVID levels, the growth trajectory is hampered by fleet turnover, as automobile original equipment manufacturers (OEMs) started reducing FFV offerings in their lineups. The modeling in the Moderate Case assumes that E85 consumption will start to slow and decrease post-2025 because of continued FFV fleet turnover.

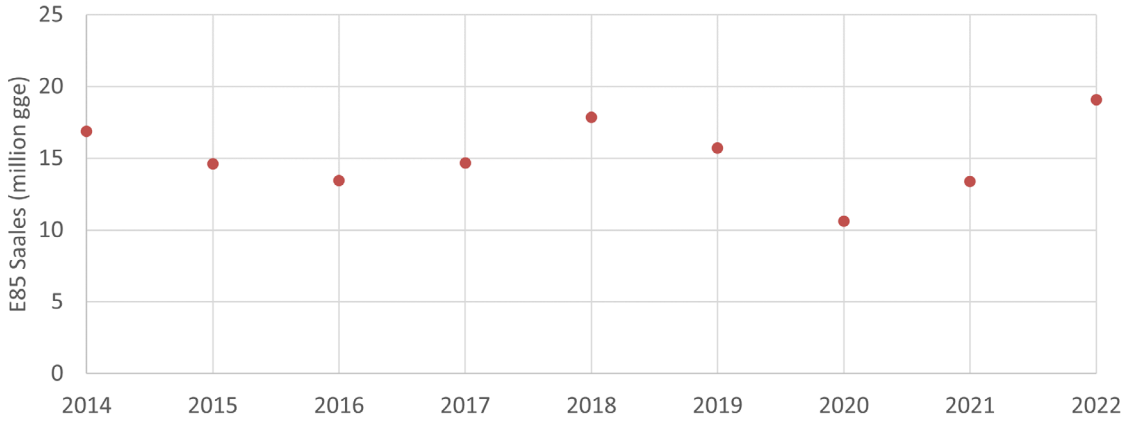

Figure 14. E85 Consumption in Minnesota, 2011-2022

BIODIESEL

Biodiesel is produced via the processing of virgin oils (e.g., soy or canola), byproducts of other processes (e.g., corn oil extracted via corn ethanol production, and waste products like used cooking oil). Minnesota has a biodiesel blending mandate requiring biodiesel blending at prescribed levels at different times of the year:

- April 15 to September 30: 20% blend
- October 1 to March 31: 5% blend
- April 1 to April 14: 10% blend

These requirements were implemented in 2018. Three key areas for credit generation from biodiesel blending were considered: 1) an emphasis on low carbon intensity feedstocks, 2) process improvements, and 3) the implementation of climate smart agriculture practices for any biodiesel produced using soybean oil. It was assumed the blend rate for biodiesel would remain at its current levels.

Low carbon intensity feedstocks. It was assumed that the feedstock mix for biodiesel would shift over time towards low carbon intensity feedstocks like distiller's corn oil, used cooking oil, and tallow. After accounting for the LUC adder, these low carbon intensity feedstocks are generally advantaged in clean fuel markets; however, there are feedstock constraints associated with these feedstocks and there may be competition with other low carbon fuel markets like in California, Oregon, and Washington.

Process efficiency improvements. carbon intensity reductions associated with process efficiencies for biodiesel of 1.2% per year were incorporated, similar to what was employed for ethanol production processes. It was also assumed a reduction in the carbon intensity of biodiesel coincident with a decarbonizing "average grid mix", thereby lowering the carbon intensity further.

Climate smart agriculture. There is not a detailed analysis available today specific to soybean farming regarding the carbon intensity reduction potential from climate smart agriculture practices. However, the USDA has helped to prioritize areas for further study regarding potential carbon intensity reductions for soybean farming, which included reduced and no tillage, cover crops, and conservation crop rotations.

Notably, soybean production has a low level of fertilizer application (~25% of acres) as well as a low fertilizer rate (~18 pounds/acre), meaning that improving Nitrogen fertilization for soybeans will not result in as large of nitrous oxide (N_2O) reduction as that seen from corn. It was assumed that the potential reductions from climate smart agriculture practices would yield a reduction of up to 13.5%-- the combined effects of no tillage and cover crops from ethanol were used as a proxy for what might be feasible for soybean farming.

RENEWABLE DIESEL

Most renewable diesel is produced via the catalytic hydrodeoxygenation of oils (e.g., virgin oils or waste oils) into alkanes and propane, commonly known as hydrotreating or hydrotreated fats and oils (HEFA) processes. This process removes oxygen from the oil, distinguishing it from the traditional trans-esterified fatty acid methyl-ester (FAME) biodiesel. Most producers use a catalytic isomerization technique to improve the stability of renewable diesel, specifically to adjust the cloud point to avoid any problems during operation in cold weather. Renewable diesel is functionally equivalent to conventional diesel, and as such requires no modification or special precautions for the engine. Renewable diesel has garnered the most significant amount of investment from the refining industry over the past 24 months, as evidenced by planned expansions and announced projects representing as much as 6.5 billion gallons of new renewable diesel supply coming online in the next 24 months.

Several areas for credit generation from renewable diesel blending were considered: 1) increased blend rate, 2) an emphasis on low carbon intensity feedstocks, 3) process improvements, and 4) the implementation of climate smart agriculture practices for any renewable diesel produced using soybean oil. It was assumed the blend rate for biodiesel would remain at its current levels.

SUSTAINABLE AVIATION FUEL (SAF)

The modeling assumes that sustainable aviation fuel (SAF) is produced by either hydro processed esters and fatty acids (HEFA) technology or via alcohol-to-jet (ATJ) technology. SAF in the modeling is limited to a maximum of 50% blend per ASTM specifications.

The carbon intensity reductions for SAF via HEFA pathways are implemented in the same way as those that are reported for renewable diesel: carbon intensity reductions associated with process efficiencies for SAF of 1.2% per year were incorporated; it was assumed that the potential reductions from climate smart agriculture practices for the subset of the renewable diesel product that is tied to virgin oils like soybean oil would yield a reduction of up to 13.5%-- the combined effects of no tillage and cover crops from ethanol were used as a proxy for what might be feasible for soybean farming.

NATURAL GAS AND RENEWABLE NATURAL GAS

Natural gas use as a transportation fuel has averaged about 6.4 million gasoline gallons equivalent (million gge) from 2018-2022. The natural gas consumed in Minnesota is compressed natural gas (CNG) and is likely primarily used in niche applications or vocations like refuse haulers, shuttles, buses, or short-haul trucks.

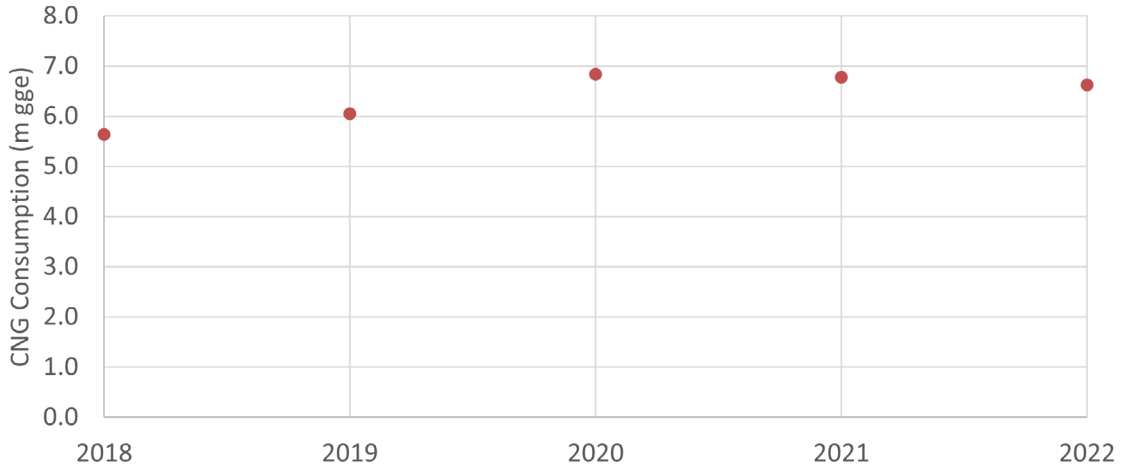

Figure 15. Compressed Natural Gas (CNG) Consumption in Minnesota, 2018-2022

It was assumed that with the implementation of a CTS, most of the natural gas that is consumed as a transportation fuel would be backfilled with renewable natural gas (RNG), and that this transition would happen rapidly because of the modest volumes. Nationwide, most of the RNG used in the transportation industry is derived from landfills. However, California's low carbon fuel market has been shifting towards lower carbon intensity RNG from feedstocks such as the anaerobic digestion of animal manure and from digesters deployed at wastewater treatment plants or water resource recovery facilities (WRRFs). By the end of 2022, for instance, 49% of RNG consumed in California was from lower carbon intensity sources, and most of that was from animal manure (making up 46% of the total).

It was assumed that the Minnesota market will be saturated with low carbon intensity RNG within 2-3 years of program implementation; however, the amount of natural gas consumed as a transportation fuel in the state was not changed.

LIQUEFIED PETROLEUM GAS

Liquefied petroleum gas (LPG) or propane is generally consumed in shuttle buses, school buses, and other niche applications because there are few or no products made available to the broader market. The LPG vehicle market is typically driven by aftermarket conversion systems, whereby dealers or vendors partner with an aftermarket supplier and market the converted systems to fleets. LPG consumption in Minnesota has averaged about 3.7 million gallons per year after excluding the dip in demand in 2020 attributable to COVID stay at-home orders.

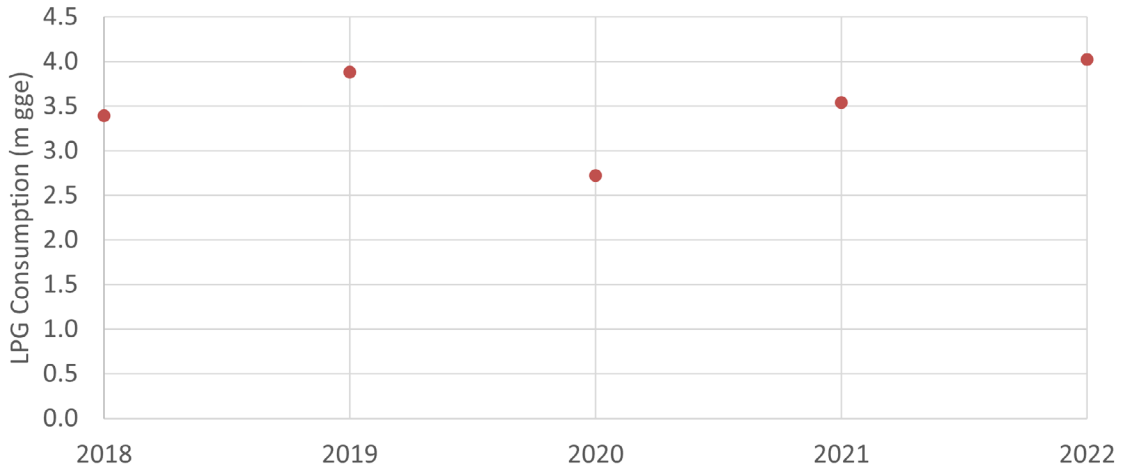

Figure 16. Liquefied Petroleum Gas (LPG)/Propane Consumption in Minnesota, 2018-2022

Although LPG consumption has not increased significantly over the past five years or so, there are significant opportunities to displace fossil LPG with renewable LPG/renewable propane. Renewable propane is generally a byproduct of renewable diesel and/or SAF production. In California, for instance, there are several certified fuel pathways for renewable propane. The modest volumes of fossil propane consumed in Minnesota's transportation fuel sector will likely be backfilled with renewable propane. In the Moderate Case modeling, the renewable propane blend rate was assumed to achieve 100% by 2030.

ZERO EMISSION VEHICLES (ZEVs): LIGHT-DUTY VEHICLES (LDVs)

We used fleet turnover modeling that was developed for a project with the Coordinating Research Council (CRC) to assess fueling infrastructure needs for battery electric vehicles and fuel cell electric vehicles in the light- and heavy-duty sectors (collectively referred to as zero emission vehicles, ZEVs).[39] Vehicle fleet modeling was conducted at the state level to calculate the projected on-road ZEVs by fuel technologies. The U.S. EPA's Motor Vehicle Emission Simulator (MOVES) model was used to assess the baseline national vehicle fleet mix. While the MOVES3 model reflects the impact of EPA rulemaking efforts such as the Safer Affordable Fuel-Efficient (SAFE) Vehicles Standards, it does not consider any ZEV technologies penetration. Recent federal and state regulations mandating increased ZEV penetration into MOVES3 baseline data was incorporated to project the future ZEV populations. A light-duty ZEV sales curves (i.e., percentage of new vehicle sales that are ZEV) was developed by weight class for the contiguous United States (48 states). This trajectory has a vehicle technology distribution (battery electric vehicles, plug-in hybrid electric vehicles, and fuel cell electric vehicles by percent share) applied to it based on state and vehicle type. This modeling incorporates compliance with the Minnesota Clean Cars Standard and assumes organic ZEV sales growth thereafter.

In the Moderate Case, it was assumed that grid average electric mix decreases over time and increases renewable energy deployment from 31% in 2022 to 55% by 2035 and 75% by 2040.

An additional consideration was the ability of the market to match Renewable Energy Credits (RECs) with light-duty EV charging to decrease the carbon intensity of electricity used to power vehicles. California, Oregon, and Washington allow the use of excess RECs (i.e., above and beyond those required to meet any statewide RPS requirements) to decrease the carbon intensity of the electricity. In the Moderate Case, it was assumed that 15% of electricity demand from LDVs will be matched with RECs to achieve a zero carbon intensity.

ZERO EMISSION VEHICLES (ZEVs): HEAVY-DUTY VEHICLES (HDVs)

The same modeling outlined previously for light-duty ZEVs discussed above was used for heavy-duty ZEVs. In this case, the MOVES3 model reflects the impact of EPA rulemakings like the Heavy-Duty Greenhouse Gas Phase 2 Standards. Medium- and heavy-duty (HD) vehicles are considered in parallel. Minnesota is not a signatory to a memorandum of understanding (MOU) that commits to voluntarily accelerating the adoption of HD ZEVs. ZEV adoption (including battery electric and fuel cell electric vehicles) in the medium- and heavy-duty sectors is aligned, but not identical to Xcel Energy forecasts in the Moderate Case. These assumptions yield about 60,000 ZEV trucks in 2040 (about 13-15% of the market).

An additional consideration was the ability of the market to match Renewable Energy Credits (RECs) with electricity used for heavy-duty EV charging to decrease the carbon intensity of electricity used to power HDVs, as discussed previously with respect to LDVs. In the Moderate Case, it was assumed that 15% of electricity demand from HDVs will be matched with RECs to achieve a zero carbon intensity.

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39 ICF for CRC, Assess the Battery-Recharging and Hydrogen-Refueling Infrastructure Needs, Costs and Timelines Required to Support Regulatory Requirements for Light-, Medium-, and Heavy-Duty Zero-Emission Vehicles., CRC Report SM-CR-9, September 2023. https://crcao.org/wp-content/uploads/2023/09/CRC_Infrastructure_Assessment_Report_ICF_09282023_Final-Report.pdf

Business As Usual Case

A carbon intensity trajectory was developed for what is considered the Business as Usual (BAU) Case. In the BAU Case, it was assumed the following:

- No Clean Transportation Standard program in the state of Minnesota.
- E15 blends continue to increase at their current rates.
- E85 blends continue at their current volumes.
- It was assumed that the carbon intensity of ethanol would start at 2022 levels over the course of the analysis with a modest 1.2% decrease in the direct emissions year-over-year (i.e., there was no assumed uptake of climate smart agriculture practices to lower the carbon intensity of ethanol consumed in Minnesota nor was there consideration of carbon capture and storage (CCS) deployment).
- The biodiesel blending mandate remains in place and most of the feedstock used to produce the biodiesel that is consumed in Minnesota is from soybean oil.
- There is no renewable diesel consumed in Minnesota.
- There is no SAF consumed in Minnesota.
- Zero emission vehicles in the light-duty sector are adopted consistent with Minnesota Clean Cars Rule and then modest growth thereafter.
- Zero emission vehicles in the heavy-duty sector are adopted at a rate consistent with projections used in the Moderate Case (see Figure 17).
- The average grid electricity was assumed to decrease over time consistent with Minnesota renewable portfolio standard (RPS); however, no additional options for reducing the carbon intensity of electricity or hydrogen using other technologies were considered.

Figure 17 below summarizes the carbon intensity trajectory consistent with the results of the BAU Case. After accounting for likely clean fuel deployment and advanced vehicle adoption using the assumptions outlined previously in the absence of a CTS, the results of the BAU Case modeling suggest the following:

- 2030: carbon intensity reduction of 5%
- 2040: carbon intensity reduction of 15%
- 2050: carbon intensity reduction of 30%

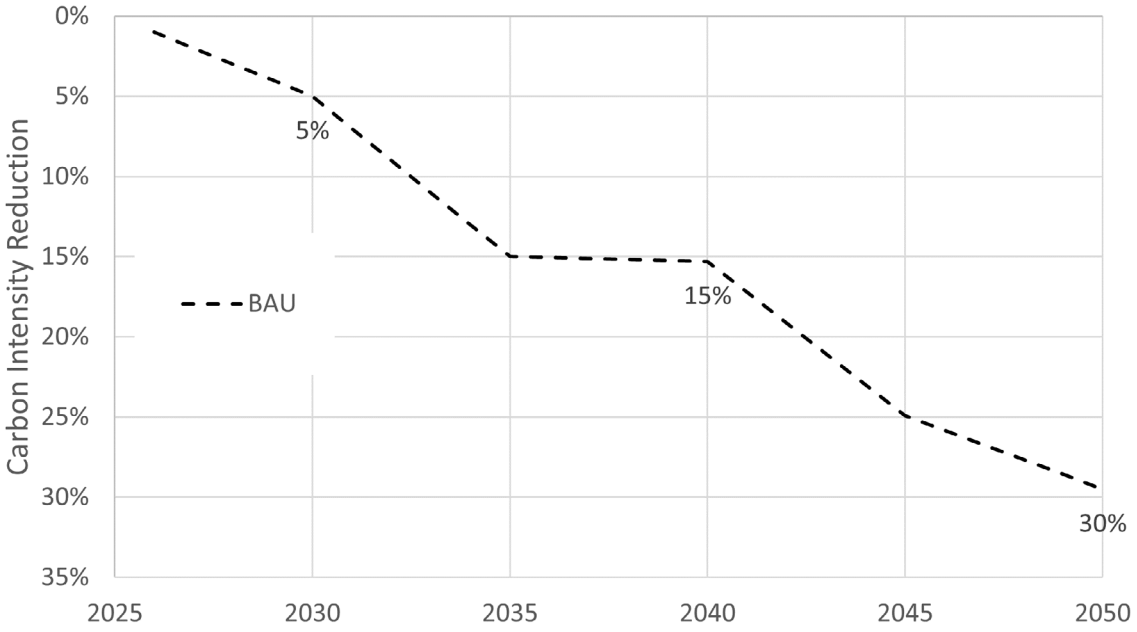

Figure 17. Forecasted Carbon Intensity Trajectory in the BAU Case Modeling

Figure 18 summarizes the credit generation from the various clean fuels considered in the BAU analysis from 2026 to 2040, including ethanol, biodiesel, renewable diesel, SAF, RNG, electricity used in light- and heavy-duty vehicles, hydrogen used in heavy-duty vehicles, and propane.

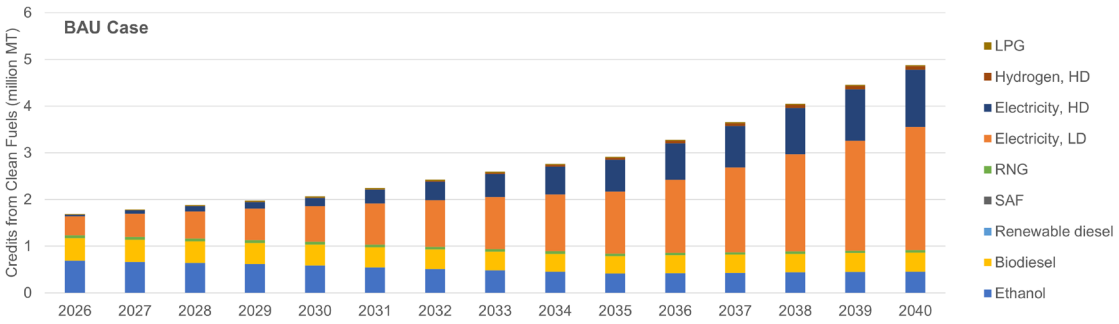

Figure 18: Credit Generation from Clean Fuels in the BAU Case

Moderate Case

A carbon intensity trajectory was developed for what they viewed as the likely deployment of clean fuels and vehicles out to 2050 based on available data today. As noted previously, the modeling used two values as a reasonable representation of the range of expected LUC adders for biofuels produced from corn and soybean oil. For all the scenarios and sensitivity analyses presented in this report, the LUC adder from CARB 2015 was used for both ethanol produced from corn and biodiesel produced from soybean oil. This should not be misconstrued as a stated preference by any Minnesota state agency or the work group. Rather, the analyses sought to present a significant amount of information in a consolidated fashion to facilitate work group discussion. The LUC adders to liquid biofuels derived from crops like corn and soybeans remain an important area of discussion; however, the LUC adder used in the scenario modeling does not make a material impact to the top-level findings discussed below.

Figure 19 summarizes the potential carbon intensity trajectory consistent with the results of the Moderate Case (previously called the 'reference case'). After accounting for likely clean fuel deployment and advanced vehicle adoption using the assumptions outlined previously, the results of the modeling suggest the following:

- 2030: Carbon intensity reduction in the range of 13-17%
- 2040: Carbon Intensity reduction in the range of 40-50%

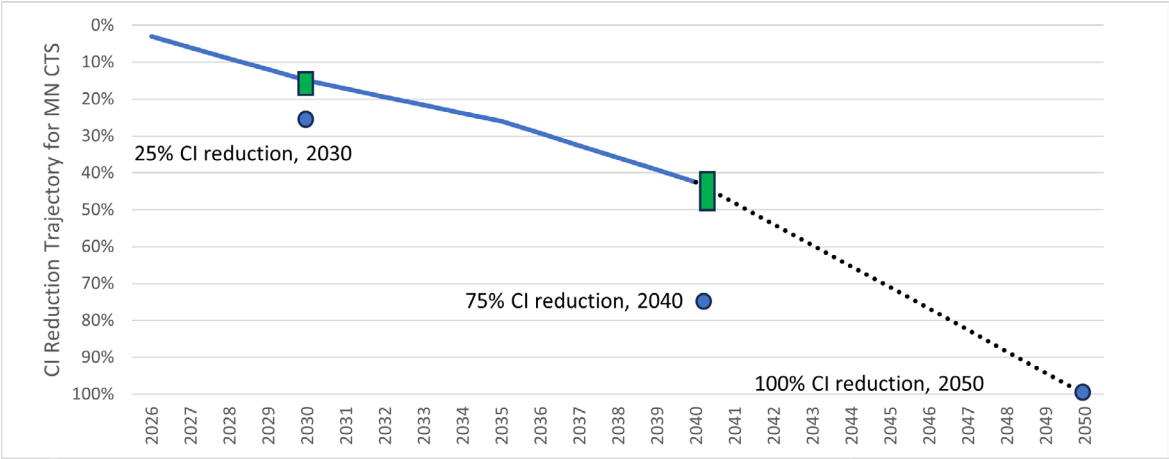

Figure 19. Potential Carbon Intensity Trajectory in the Moderate Case Modeling

The modeling suggests that the 100% carbon intensity reduction target in 2050 is difficult to achieve based on the transportation fuel market today. However, this is a challenging conclusion to assert confidently given the uncertainty regarding the development of expanded use of existing fuels (e.g., E30 blends of ethanol), new feedstocks for fuels (e.g., camelina crops for biodiesel and renewable diesel production), new and novel uses of available feedstocks (e.g., woody biomass), and the adoption of new technologies (e.g., ZEV deployment). There are limitations to modeling a carbon intensity trajectory post-2040. The ability of the market to achieve a 100% carbon intensity target will depend on a variety of technological developments that are difficult to conceive of today.

Figure 20 summarizes the credit generation from the various clean fuels considered in the analysis from 2026-2040, including ethanol, biodiesel, renewable diesel, SAF, RNG, electricity used in light- and heavy-duty vehicles, hydrogen used in heavy-duty vehicles, and propane.

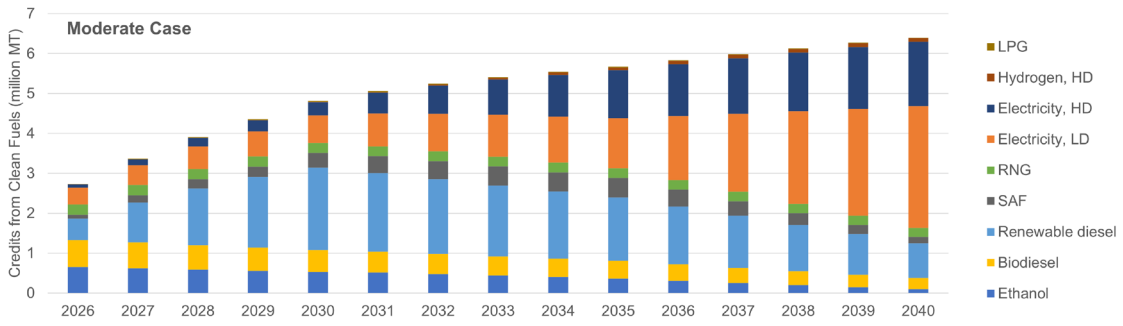

Figure 20: Credit Generation from Clean Fuels in the Moderate Case

Accelerated Cases

ACCELERATED ETHANOL

This accelerated case exclusively considers additional strategies focused on ethanol—via carbon intensity reductions and higher volumes—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

Table 7: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
E15 blending	Accelerated market to entirely E15 by 2032.	E15 penetration is about 30% in 2032	16.2%
Process improvements	Increased process improvements to 5% change per year, and lower grid average electricity.	Process improvements are 1.2% per year	32.4%
Climate smart agriculture	Increased adoption rate to 100% of ethanol market using corn derived from climate smart ag practices. Assumed that carbon intensity decrease is 31%.	The adoption rate is 30% for climate smart ag practices and the carbon intensity decrease is capped at 21.6%.	24.3%
CCS deployment	Increased adoption rate to 100% of ethanol market using CCS by 2040.	The adoption rate for CCS is 30% by 2040.	27.0%
Effective carbon intensity of ethanol	The carbon intensity of ethanol in 2040 is 0 g/MJ before applying the LUC adder in this scenario.		

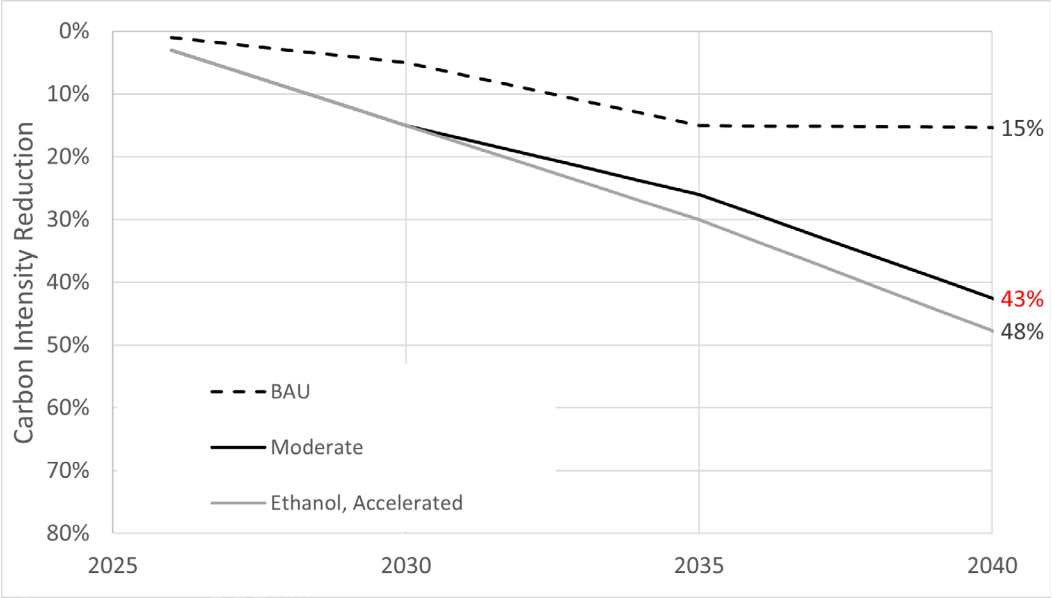

Figure 21. Potential Carbon Intensity Trajectory for MN: Accelerated Ethanol in Scenario Modeling

The modeling suggests that these near-maximum contributions of ethanol yield an additional 5% carbon intensity reduction by 2040 compared to the Moderate Case.

ACCELERATED BIODIESEL

This accelerated case exclusively considers additional strategies focused on biodiesel—via carbon intensity reductions and feedstock blending—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

Table 8: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
Increased blend rate	Increased biodiesel blending from current rates to 50%	Biodiesel blending is limited to 12.16%.	60.8%
Low carbon intensity feedstock deployment	Accelerated market to 95% low carbon intensity feedstocks by 2035.	Low carbon intensity feedstocks represent 75% of the market in 2035.	11.2%
Process improvements	Increased efficiency to 5% change per year, and lower grid average electricity.	Process efficiency improvements are limited to 1.0%.	27.2%
Climate smart agriculture	Increased adoption rate to 100% of biodiesel production using soybeans derived from climate smart agriculture practices. carbon intensity decrease is 20%.	Climate smart ag practices represent 30% of biodiesel fuel supply and the carbon intensity reduction is 13.1%.	0.8%
Effective carbon intensity of biodiesel	The carbon intensity of biodiesel in 2040 is 3-5 g/MJ before applying the LUC adder in this scenario.		

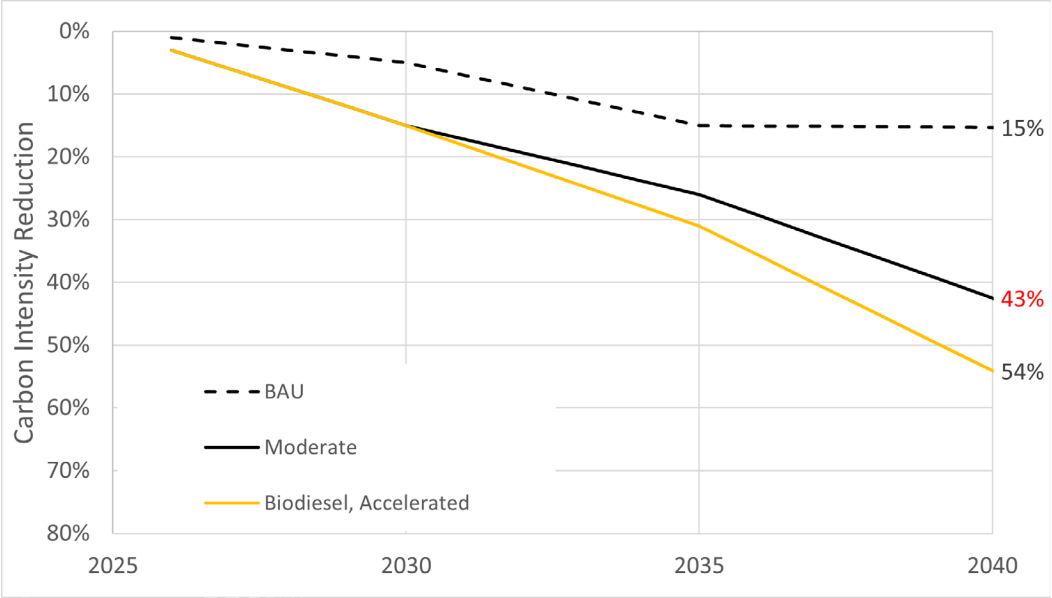

Figure 22. Potential Carbon Intensity Trajectory for MN: Accelerated Biodiesel in Scenario Modeling

The modeling suggests that these near-maximum contributions of biodiesel yield an additional 11% carbon intensity reduction by 2040 compared to the Moderate Case.

It is noted that all diesel engines are warrantied for B5 blends and that most engine manufacturers warranty their engines up to a B20 blend.[40] This scenario assumes that there are changes to this because of technology that enables higher blends to be used, especially in cold weather.

ACCELERATED RENEWABLE DIESEL

This accelerated case exclusively considers additional strategies focused on renewable diesel—via carbon intensity reductions and higher volumes—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

40 Updated information on original equipment manufacturer positions on biodiesel and renewable diesel (as of September 2023), provided by the Clean Fuels Alliance America: https://cleanfuels.org/wp-content/uploads/2023/07/oem-support-summary.pdf

Table 9: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
Increased blend rate	Accelerate market to 100% renewable diesel blend (for non-biodiesel portion of fuel supply).	Market is limited to 60% renewable diesel blend.	52.3%
Process improvements	Increased efficiency to 5% change per year, and lower grid average electricity.	Process improvements are 1% per year.	1.9%
Feedstock switching	Assumed transition to 100% woody biomass renewable diesel production by 2035.	The RD blend is 60% low carbon intensity feedstocks (20-30 g/MJ) 35% RD derived from soybean oil and 5% woody biomass.	45.8%
Effective carbon intensity of renewable diesel	The carbon intensity of renewable diesel in 2040 is 6-8 g/MJ in this scenario and has no LUC adder because it is assumed that all RD is from woody biomass.		

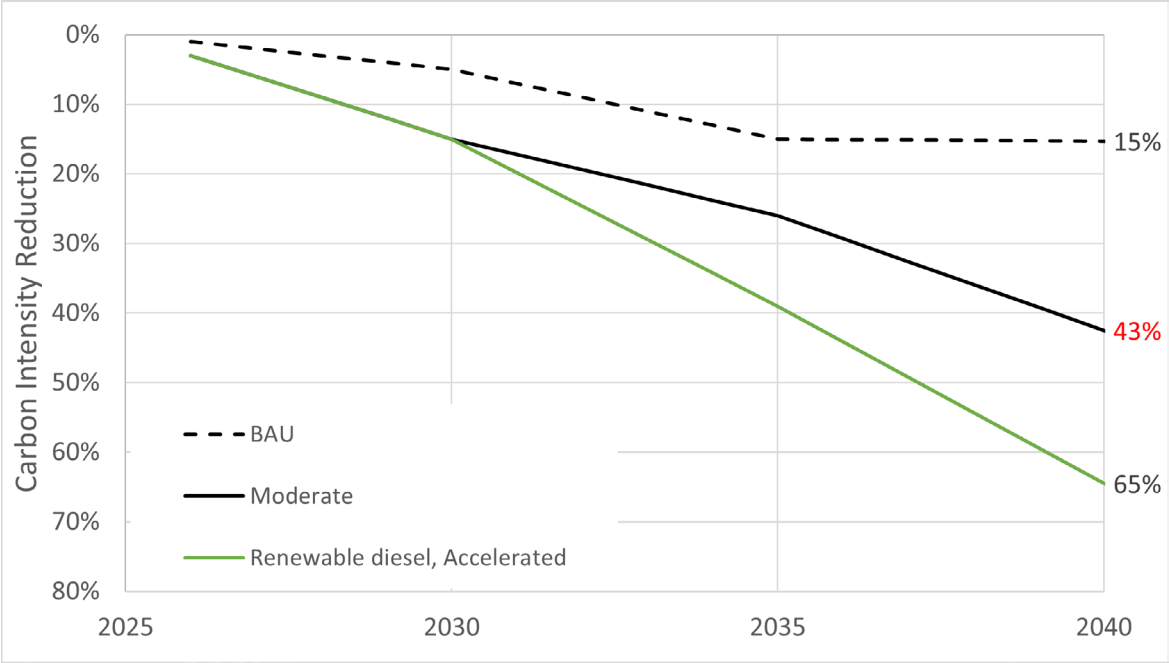

Figure 23. Potential Carbon Intensity Trajectory for MN: Accelerated Renewable Diesel in Scenario Modeling

The modeling suggests that these near-maximum contributions of renewable diesel yield an additional 22% carbon intensity reduction by 2040 compared to the Moderate Case.

It is noted that this case likely requires a policy change with respect to the eligibility of woody biomass in the federal Renewable Fuel Standard program. The RFS program currently limits the types of forest and forest residue products that can be used to produce eligible fuels in the program—and much of the woody biomass in Minnesota does not comply with the current definitions in the program.

ACCELERATED SAF

This accelerated case exclusively considers additional strategies focused on SAF—via carbon intensity reductions and higher volumes—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

Table 10: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
Increased blend rate	Accelerate market to a maximum 50-95% SAF blend.	The market is limited to a 50% blend of SAF.	43.1%
Process improvements	Increased process improvements to 5% change per year, and lower grid average electricity.	Process improvements are limited to 1% per year.	35.3%
Feedstock switching	Assumed transition to low carbon intensity feedstocks by 2035.	The market is a blend of low carbon intensity feedstocks and soybean oil.	21.6%
Effective carbon intensity of SAF	The carbon intensity of SAF in 2040 is about 15 g/MJ in this sensitivity scenario.		

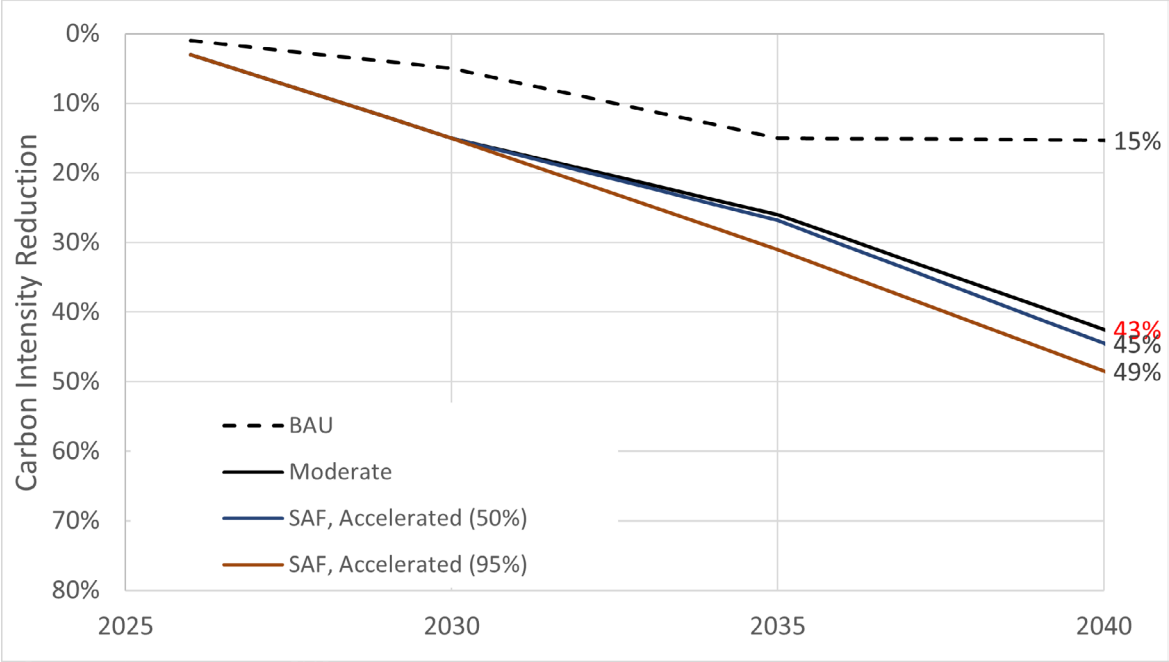

Figure 24. Potential Carbon Intensity Trajectory for MN: Accelerated SAF in Scenario Modeling

The modeling suggests that these near-maximum contributions of SAF yield an additional 2-6% carbon intensity reduction by 2040 compared to the Moderate Case.

It is noted that current ASTM specifications limit SAF blends to 50%. As such, the ASTM specifications would need to be modified to accommodate 100% blends of SAF.

ACCELERATED ZERO EMISSION VEHICLE (ZEV) DEPLOYMENT IN LIGHT-DUTY VEHICLES (LDVS)

This accelerated case exclusively considers additional strategies focused on light-duty ZEV deployment—via increased ZEV penetrations and carbon intensity reductions for electricity and hydrogen—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

Table 11: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
Increased ZEV adoption	Accelerated market to 68% new ZEV sales by 2035 and 100% new ZEV sales by 2040.	Market is 51% new ZEV sales by 2035 and 88% new ZEV sales by 2040.	71.8%
Grid decarbonization	Assumed that the grid achieves a carbon intensity of near 0 g/MJ by 2040.	The grid achieves a carbon intensity of about 42 g/MJ in 2040.	27.9%
Zero carbon intensity (via REC matching)	Assumed that 30% of the market achieves zero carbon intensity via REC matching.	Assumed that 15% of the market achieves zero carbon intensity via REC matching.	0.3%

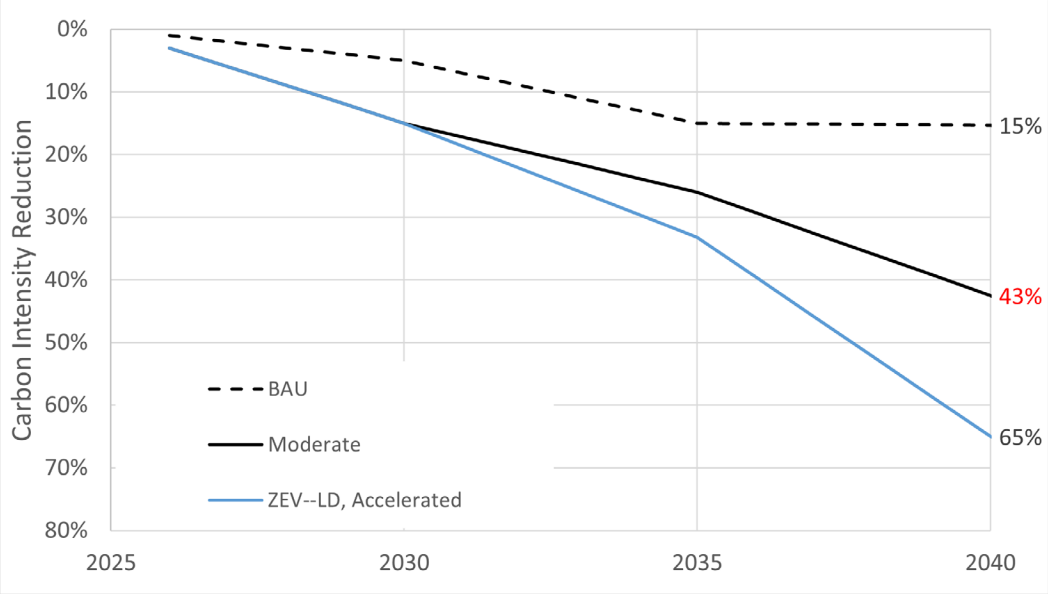

Figure 25. Potential Carbon Intensity Trajectory for MN: Accelerated LD ZEV in Scenario Modeling

The modeling suggests that these near-maximum contributions of light-duty ZEVs with a decarbonized grid by 2040 yields an additional 22% carbon intensity reduction by 2040 compared to the Moderate Case.

ACCELERATED ZERO EMISSION VEHICLE (ZEV) DEPLOYMENT IN HEAVY-DUTY VEHICLES (HDVS)

This accelerated case exclusively considers additional strategies focused on heavy-duty ZEV deployment—via increased ZEV penetrations and carbon intensity reductions for electricity and hydrogen—that will change the carbon intensity trajectory of a potential CTS in Minnesota.

Table 12: A description of various strategies implemented for sensitivity analysis.

Strategies Implemented for Sensitivity Analysis	Description	Difference from M/oderate Case	% Contribution to Additional CI Reductions
Increased EV adoption	Accelerated market to an adoption trajectory that matches the Advanced Clean Truck rule with ZEVs reaching about 40% of HDVs in 2040.	ZEVs reach about 15% of HDVs in 2040.	66.4%
Grid decarbonization	Assumed that the grid achieves an effective 0 g/MJ carbon intensity by 2040.	The grid achieves a carbon intensity of about 42 g/MJ in 2040.	32.9%
Zero carbon intensity (via REC matching)	Assumed that 30% of the market achieves zero carbon intensity via REC matching.	Assumed that 15% of the market achieves zero carbon intensity via REC matching.	0.7%

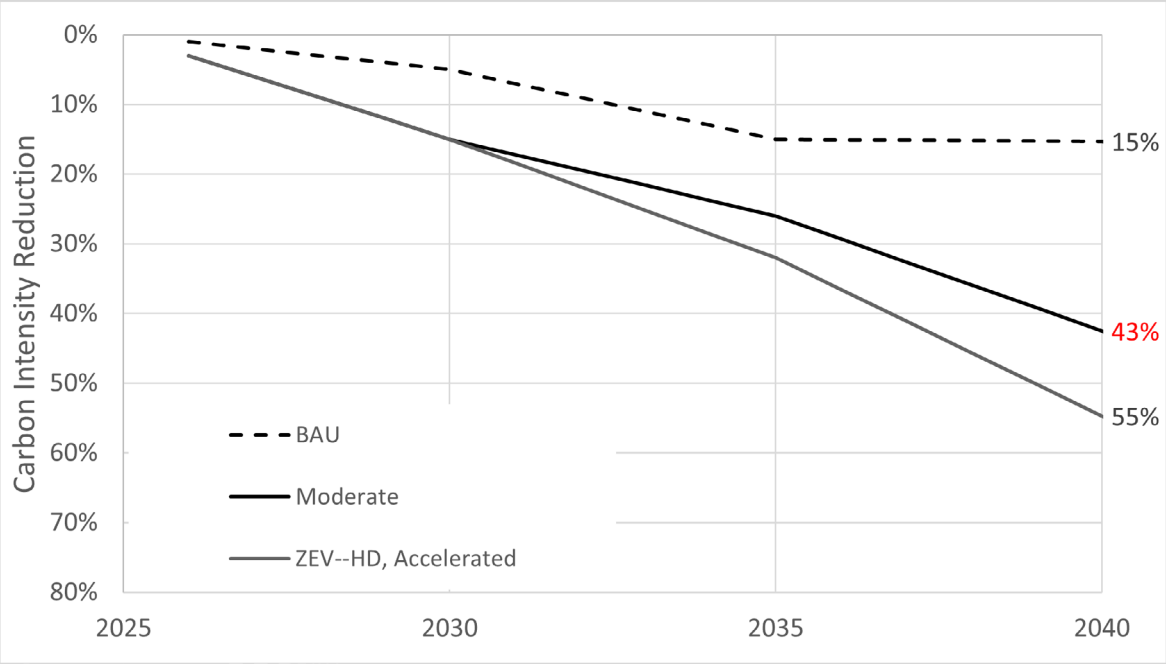

Figure 26. Potential Carbon Intensity Trajectory for MN: Accelerated HD ZEV Considerations in Scenario Modeling

The modeling suggests that these near-maximum contributions of heavy-duty ZEVs with a decarbonized grid and zero carbon intensity hydrogen by 2040 yields an additional 12% carbon intensity reduction by 2040 compared to the Moderate Case.

ALL-IN ACCELERATED CASE

This accelerated case considers all of the strategies outlined in the previous sub-sections and summarized here:

Table 13: A description of various strategies implemented.

Strategies Implemented	Description
E15 blending	Accelerated market to entirely E15 by 2032.
Process improvements	Increased efficiency to 10% change per year, and lower grid average electricity.
Climate smart agriculture	Increased adoption rate to 100% of ethanol market using corn derived from climate smart ag practices. Assumed that carbon intensity decrease is 31%.
Carbon capture and storage deployment	Increased adoption rate to 100% of ethanol market using CCS by 2040.
Low carbon intensity feedstock deployment	Accelerated market to 95% low carbon intensity feedstocks by 2035.
Process improvements	Increased efficiency to 10% change per year, and lower grid average electricity.
Climate smart agriculture	Increased adoption rate to 100% of biodiesel production using soybeans derived from climate smart ag practices. Assumed that carbon intensity decrease is 20%.
Effective carbon intensity of biodiesel	The carbon intensity of biodiesel in 2040 is 3-5 g/MJ before applying the LUC adder in this scenario.
Increased blend rate	Accelerated market to 100% renewable diesel blend (for non-biodiesel portion of fuel supply).
Process improvements	Increased efficiency to 5% change per year, and lower grid average electricity.
Feedstock switching	Assumed transition to 100% woody biomass renewable diesel production by 2035.
Effective carbon intensity of renewable diesel	The carbon intensity of renewable diesel in 2040 is 6-8 g/MJ in this scenario and has no LUC adder because it is assumed that all RD is from woody biomass.
Increased blend rate	Accelerate market to a maximum 50% SAF blend.
Process improvements	Increased efficiency to 5% change per year, and lower grid average electricity.
Feedstock switching	Assumed transition to low carbon intensity feedstocks by 2035.
Effective carbon intensity of SAF	The carbon intensity of SAF in 2040 is about 15 g/MJ in this sensitivity scenario.
Increased ZEV adoption	Accelerated market to 100% new ZEV sales by 2040.
Grid decarbonization	Assumed that the grid achieves an effective 0 g/MJ carbon intensity by 2040.
Zero carbon intensity (via REC matching)	Assumed that 30% of the market achieves zero carbon intensity via REC matching.
Increased EV adoption	Accelerated market to an adoption trajectory that matches the Advanced Clean Truck rule.
Grid decarbonization	Assumed that the grid achieves an effective 0 g/MJ carbon intensity by 2040.
Zero carbon intensity (via REC matching)	Assumed that 30% of the market achieves zero carbon intensity via REC matching.

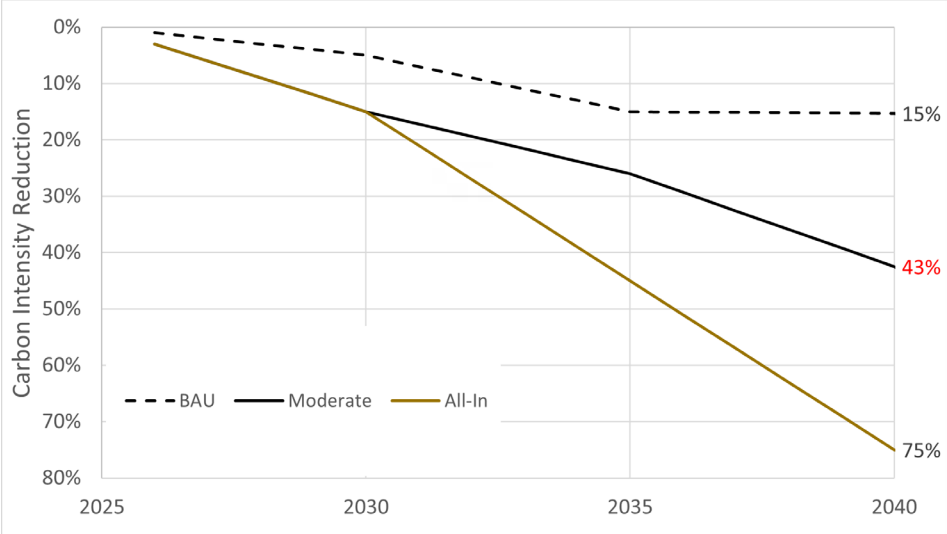

Figure 27. Potential Carbon Intensity Trajectory for MN in an "All-In Accelerated" Scenario

Figure 28 below shows the credit generation by fuel type over time in the All-In Accelerate Case from 2026 to 2040.

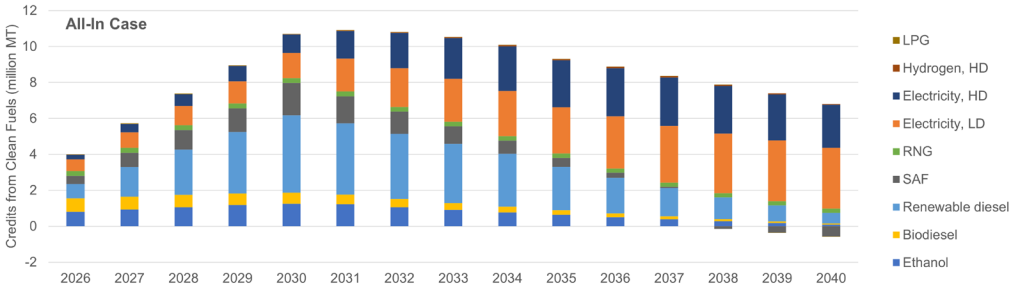

Figure 28: Clean Fuel Credit Generation in the All-In Accelerated Case

It is noted that the "All-In Accelerated" sensitivity case would achieve a 100% carbon intensity reduction in 2050 compared to a 67% carbon intensity reduction achieved in the Moderate Case, and 23% carbon intensity reduction in the BAU Case (see Figure 29 below).

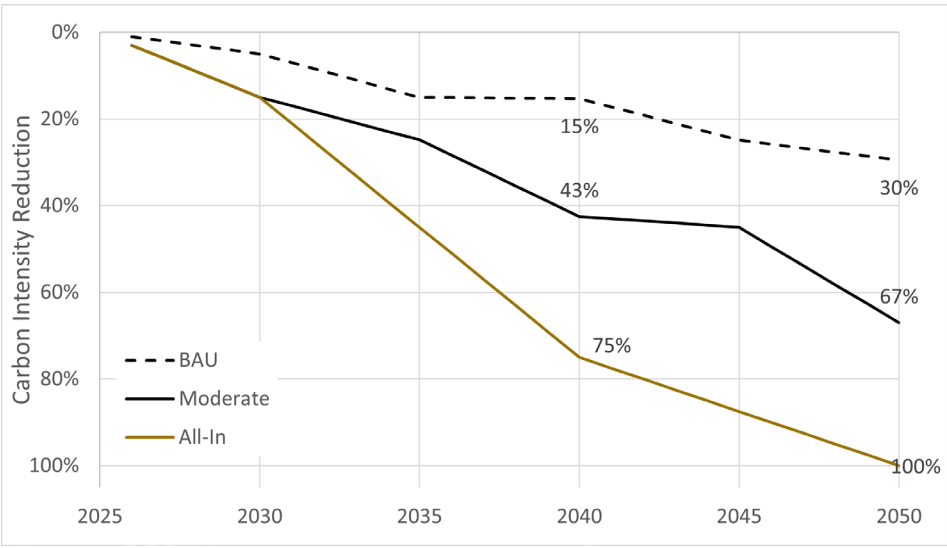

Figure 29. Potential Carbon Intensity Trajectory for MN in BAU, Moderate, and "All-In Accelerated" Cases

Appendix K: Residential EV Charging Credit Revenue Estimates

Low carbon fuel standards in other states identify investor-owned utilities (IOUs) and other load serving entities as the credit-generating entity for residential light-duty EV charging. The reasons for this are: It is impractical for EV drivers to claim the value associated with EV charging because of the administrative burden of so many additional individual program participants, with relatively few credits generated per EV, and getting access to the data for reporting is non-trivial. For these reasons, IOUs and other load serving entities have been identified as the credit-generating entity. States with low carbon fuel standards have also adopted regulatory language and accompanying guidance that directs how IOUs can invest the revenue generated from the sale of credits linked to residential EV charging.

In consideration of this type of regulatory structure, whereby IOUs and/or other load serving entities are directed to spend revenue generated via credits linked to residential EV charging (see work group recommendation D.1.4), the work group was provided with the revenue estimates shown in Table 14 (shown in millions of dollars). These revenue estimates are based on the results of the Moderate Case and the following assumptions: a) 70% of light-duty EV charging occurs at home and b) that credits in the Minnesota CTS will trade at $50/ton, $100/ton or $150/ton in any given year (on a nominal basis).

Table 14. Estimated annual revenue generated from residential EV charging ($ millions, nominal)

CTS Credit Price	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
$50/t	$15	$17	$20	$22	$24	$29	$33	$37	$40	$44
$100/t	$29	$35	$40	$44	$48	$57	$66	$74	$81	$88
$150/t	$44	$52	$60	$66	$73	$86	$98	$110	$121	$132

In the Moderate Case for 2030, if CTS credit prices trade in the range of $50-150/ton and using the assumptions listed above, then revenue from the sale of credits generated via residential charging of light-duty EVs would be in the range of $24-$73 million. The revenue increases in this analysis as the light-duty EV population is assumed to increase (see Appendix J for more information on assumed light-duty EV adoption rates) because the share of charging that occurs at home(s) is assumed to be constant at 70%.

ADDENDUM

Table of Contents

Work Group Meeting #1 – July 31, 2023

Date: July 31, 2023
Time: 12:30 – 2:30pm
Minutes prepared by: WSB Consulting
Location: 395 John Ireland Blvd, St. Paul (MnDOT Central Office) and Teams Meeting

Meeting Summary

Welcome and Opening Remarks

- Commissioner Tim Sexton (MNDOT) welcomed all participants and provided an overview of the meeting's agenda.
- The Clean Transportation Standard (CTS) Internal Steering Committee and Working Group members took turns introducing themselves, ensuring everyone was familiar with the key stakeholders involved.
- Bob Gollnik (WSB) reviewed the purpose of the meeting, objectives, logistics and etiquette with the group.

Clean Transportation Standard Overview

- Bob Gollnik (WSB) explained the technical work involved in the CTS and emphasized the importance of feedback from the working group to ensure fairness and equity in the process.
- Amber Dallman (MnDOT) reminded everyone to submit their oaths of office to formalize their participation.
- Commissioner Sexton (MnDOT) provided a comprehensive background on clean fuels efforts in Minnesota, starting with the Pathways to Decarbonization initiative in 2019. He explained that the CTS aimed to set a target for carbon intensity, allowing participants to generate credits if below the target or buy credits if exceeding it. The different ways to reduce carbon intensity, such as through traditional fuels, biofuels, and electricity, were discussed, along with examples from various sectors.
- Commissioner Andrea Vaubel (MDA) expanded on the national landscape, offering examples of clean fuel programs from other states in the US and the history of clean fuels initiatives in the Midwest. She highlighted co-benefits such as cleaner water, soil health, and improved equity, emphasizing that the CTS should aim to achieve these benefits in the "Minnesota way."

Prior Stakeholder Outreach and Themes

- Commissioner Vaubel (MDA) provided insights into the 2021-2022 MNDOT/MDA Stakeholder Process, which culminated in a white paper called "Clean Fuels Standard in Minnesota" in March 2022.
- Amy Fredregill (WSB) shared common themes from the previous stakeholder process and mentioned that support for a CTS in Minnesota was expressed across different economic sectors. However, she noted support was contingent on specific goals for each group.

2023 CTS Process

- Bob Gollnik (WSB) then reviewed the 2023 process, urging the working group to consider the formation of subgroups and defining their structure. The timeline for the next six months was outlined, including monthly work group meetings, monthly subgroup meetings, and a monthly interagency steering team. He discussed the objectives for technical analysis and the goals of the work group.
- During the meeting, the working group members raised various questions and concerns about the process of coming together around recommendations for the Clean Transportation Standard (CTS) and how to adopt those recommendations with 40 members.
- Members also discussed how to evaluate emerging technologies, potential unintended consequences, and ways to connect recommendations cohesively.
- Members agreed that gathering information on how other states have approached clean fuels programs and share experiences and outcomes to learn from each other. The importance of understanding the policies' broader implications, including economic and international aspects, was also highlighted.

Public Open Comment

- The meeting allowed time for open comments from the public. Attendees were given the opportunity to express their thoughts and concerns regarding the CTS process.
- No members of the public came forward to comment.

Next Steps

- WSB will work on one-pagers detailing what other states have done regarding clean fuels programs.
- Monthly meetings will continue, and additional meetings may be scheduled before the end of the year.
- A chair for the working group will be nominated at the next working group meeting.
- The possibility of having a half-day workshop was discussed.
- Subgroups will be formed to work on specific topics.

Next Meeting

Date: TBD
Time: TBD
Location: TBD and Zoom Meeting

Attendance

Work Group Members

Present	First Name	Last Name	Organization
In-person	Paul	Austin	Conservation Minnesota
In-person	Kaitlyn	Bemis	MN Farm Bureau
In-person	Carolyn	Berninger	Great Plains Institute for Sustainable Development
In-person	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
In-person	Matthew	Bruyette	Nature Energy
In-person	Mike	Bull	Allete/MN Power
In-person	Margaret	Cherne-Hendrick	Fresh Energy
Virtual	Vallen	Cook	Grand Portage Band of Chippewa
In-person	Colin	Cureton	UMN Forever Green Initiative
In-person	Jeff	Davidman	Delta Air Lines, Inc.
In-person	Rodney	De Fouw	Great River Energy
Virtual	Suzanne	Goldberg	ChargePoint
In-person	Timothy	Gross	Fueling Minnesota
In-person	Dustin	Haaland	CHS, Inc.

In-person	Kent	Hartwig	Gevo, Inc.
In-person	John	Hausladen	Minnesota Trucking Association
In-person	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
In-person	Jon	Hunter	American Lung Association
In-person	John	Jaimez	Hennepin County
In-person	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
Virtual	Jeremy	Martin	Union of Concerned Scientists
In-person	Sarah	Mooradian	CURE (Clean Up the River Environment)
In-person	Steve	Morse	Minnesota Environmental Partnership
In-person	Marty	Muenzmaier	Cargill, Inc.
In-person	Carolina	Ortiz	COPAL
In-person	Stephanie	Pinkalla	The Nature Conservancy
In-person	Kevin	Pranis	Liuna Minnesota/North Dakota
In-person	Trevor	Russell	Friends of the Mississippi River
Virtual	Eric	Schenck	Minnesota Forest Resources Council
In-person	Kathleen	Schuler	Health Professionals for a Healthy Climate

Virtual	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
In-person	Brian	Werner	Minnesota Biofuels Association
Virtual	Bob	Worth	Minnesota Soybean Growers Association
In-person	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant staff

Present	First Name	Last Name	Organization
In-person	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
In-person	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
In-person	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
In-person	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
In-person	Amber	Dallman	MN Dept of Transportation
In-person	Megan	Lennon	MN Dept of Agriculture
In-person	Amy	Fredregill	WSB – CTS Consultant
In-person	Bob	Gollnick	WSB – CTS Consultant
In-person	Karli	McElroy	WSB – CTS Consultant

In-person	Samantha	Watson	WSB – CTS Consultant
In-person	Noel	Mills Ford	WSB – CTS Consultant
Virtual	Chevelle	Kazmierczak	WSB – CTS Consultant

Members of the Public

Name	**Organization (if applicable)**
Brendan J.	GPI
John R.	Cozen Public Strategies
Joseph B.	
Cory B.	
Dallas G.	
Dave J.	
Elliott B.	
Jake H.	
Donovan H.	
Jean W.	
P.	
Sam O.	

Philip S.	
Bennett S.	
Stephanie G.	
Tim S.	
Ward E.	
Yan F.	

Work Group Meeting #2 – August 22, 2023

Date: August 22, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting
Location: Veterans Service Building, 20 W. 12th St., Saint Paul, MN 55155 and hybrid option available

Meeting Summary

Welcome and Introductions

Tim Sexton (MnDOT) thanked attendees for committing time and thought to participating and explained this is a collaborative effort. Bob Gollnik (WSB) provided an overview of the agenda and introduced the guest speakers. Tim introduced Shannon Engstrom, the new MnDOT CTS Director who provided an overview of her background and shared her enthusiasm for the project.

Bob Gollnik (WSB) provided a recap of the July work group meeting and the intervening survey results. The survey requested feedback on specific topical areas pertaining to CTS legislation. A total of 22 work group members participated in the survey and future work group content will be tailored to the responses. Survey results will be shared with work group members following the meeting.

New work group members were offered an opportunity to introduce themselves.

Climate Action Framework Overview

Frank Kohlasch, Minnesota Pollution Control Agency (MPCA), provided an overview of the state's Climate Action Framework (CAF) and explained how it relates to CTS efforts. As part of the CAF, the goal and climate vision for Minnesota is to reduce emissions (become carbon neutral by 2050), create resiliency for how the climate is changing and increase equity. Frank noted that action must be accelerated to address a changing, warmer and wetter climate in Minnesota.

Q & A: Frank responded to questions from the group.

Question: For a Clean Transportation Standard, how does this relate to the priorities of the government and are there any bills in place?

Answer: Minnesota wants to have a clean transportation standard that helps all Minnesotans and addresses all the goals in place. MPCA and other agencies are working on critical elements that would go into a Clean Transportation Standard for Minnesota.

Question: Is anyone thinking about the impacts of electrification on the grid and the expansion?

Answer: The Utilities Commission has a direct responsibility to ensure this. It is clear officials don't want to sacrifice clean electricity. Minnesota power is exploring how they can manage their equipment as we move forward to what is needed with energy.

Question: Are we thinking about additional electric charging and stations throughout the state/Midwest?

Answer: This is happening on multiple levels. MPCA is exploring ways to use Federal funds. The utility companies are also being asked to consider how they are going to meet the clean energy demand.

Question: What about the work force, how will we transition? Is the quality of the jobs being addressed?

Answer: A workforce analysis for the clean economy will happen soon. Clean energy workforce positions are good jobs to support families and provide a living wage for the economy.

Comparative Analysis

Guest Speaker: Jeremy Martin, Union of Concerned Scientists (UCS)

Jeremy Martin (UCS) provided an overview of work being done by his organization, beginning with a description of what is meant by the terms 'clean', 'transportation' and 'standard'. Jeremy explained that fuel policies are lifecycle-based, and that clean fuel standard discussions are happening in multiple states throughout the country, and in the United States Congress.

Key themes covered in the presentation included:

- It is important to consider different kinds of fuel.
- Efficiency in the production of fuels can reduce emissions.
- The lifecycle approach to fuels means clean transportation standards can affect a variety of parties associated with transportation fuel production.
- The clean fuel policy design can determine how various parties are impacted. It is critical to consider policy goals. Pollution standards have long-term stability and provide flexibility to adjust as innovation happens. The focus should be on pollution reduction and not specific technology.
- The policy should reflect the values and priorities of Minnesota. The group should advise the legislature on clear goals so regulators can keep the policy moving forward. The policy should leave room for adjustment and not be considered a one-time event.

Guest Speaker: Cory Ann Wind, Oregon Department of Environmental Quality (DEQ)

Cory Ann Wind (Oregon DEQ) provided an overview of how the State of Oregon has designed and implemented a Low Carbon Fuel Standard for the State. Cory Ann noted that the program took several years to design and program implementation began in 2016. In Oregon, the clean fuels market helps to provide funds to low carbon fuel companies from the higher carbon fuel companies. Cory Ann described how the system provides multiple co-benefits associated with clean fuel standards and noted that Minnesota should carefully consider the necessary resources to implement any such policy.

Guest Speaker Q & A

Cory Ann and Jeremy responded to questions from the group.

Question: Would we expect the credit impact to change significantly in the coming years? For example, if twice as many people drive EVs, is that likely to change credit impact or does it likely stay consistent?

Answer: Jeremy responded that we could look at this from the credit balance side, and that the state needs to be able to adjust the targets because it's impossible to guess accurately exactly what the future will be like. Cory Ann noted you need to keep an eye on the market and regulation. Oregon created models for how they predict the market to evolve, and they keep an eye on the market by doing quarterly reviews.

Question: Has CA, OR, or WA examined or modeled a fuel standard with a 100% carbon intensity reduction by 2050? How is carbon intensity applied to electric providers? Is anyone who produces renewable energy credited, like a homeowner, or is that not considered a transportation fuel?

Answer: Cory Ann said that each utility has an individual carbon intensity. Anything charged at a residence is not given to the citizen directly but through the Utility.

Question: Related to a net neutrality goal for Minnesota, what does carbon neutral look like for a CTS?

Answer: Cory Ann noted that Oregon hasn't contemplated what a carbon neutral state would look like. She said that California is doing this right now and Oregon is closely watching what California does. The process won't be completed overnight, and it will take several decades. Jeremy added that as most vehicles are going toward zero emission technology, agencies need to think how this will impact the clean transportation standard.

The project team noted that additional questions can be submitted and will be forwarded on to the speakers with responses listed on the project website.

Work Group Administration

Bob addressed the draft Work Group Charter Affirmation and the Chair nomination.

Charter nominations: The materials had previously been circulated for comment and the work group discussed minor adjustments to the Charter. The work group had a favorable opinion on the draft charter and requested that rather than a majority goal for recommendations, a consensus should be pursued. Further conversation resulted in an addition to the language that provided an opportunity to include a description and details regarding any areas where the group could not reach consensus. Bob held a voice vote and all members voted in favor of accepting the charter with recommended language changes.

Selecting a chair: As a next order of business, Bob presented the guidelines and expectations of the chair, and nominees that had been submitted via online poll. The group also had an opportunity to submit a paper ballot during the beginning of the meeting. Each of the four nominees were allowed an introductory statement and the group was encouraged to submit anonymous votes via a Mentee survey. Online work group attendees voted via direct message with Noel Mills-Ford (WSB).

Kevin Pranis (LIUNA Minnesota/North Dakota), received the highest number of votes and was announced chair. The group agreed that a vice-chair discussion should be an agenda item for the subsequent September work group meeting.

Public Comment Period

Question: Will the presentation be available online? How does the public comment?

Answer: Tim responded that the presentation deck will be available online, and that public comments can be submitted to sustainability.dot@state.mn.us. Bob reiterated that the project website includes meeting materials and additional resources. Information was included on the PowerPoint slides and the website is located at: https://www.dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html

Comment: Another commenter noted that people tend to expect too much from a clean transportation standard, and further that there is a tendency to make things complex. The commenter stated that the group needs to understand in the beginning there are not many funds available, and that the funds will grow in time.

Wrap-up

- Bob Gollnik summarized meeting themes and thanked participants for patience and participation. Bob noted that additional guest speakers will be fielded for future work groups and that speaker suggestions are also welcome.
- Bob also noted that Philip Sheehy will provide an overview of technical analysis portions of GREET modeling and present scenarios and assumptions based on Minnesota fuel conditions.
- Poll results were displayed for preferred meeting times in the upcoming months and discussed among the group. The next meeting was targeted for 9/20 or 9/28 in the afternoon to best accommodate members traveling from out of the metro area. Bob inquired about any significant conflicts regarding the preferred dates in the following months and none were noted.

Attendance

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	Matthew	Bruyette	Nature Energy
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Virtual	Colin	Cureton	UMN Forever Green Initiative
In-person	Jeff	Davidman	Delta Air Lines, Inc.
In-person	Rodney	De Fouw	Great River Energy
In-person	Leslee	Jackson	Midwest Building Decarbonization Coalition
	Suzanne	Goldberg	ChargePoint
Virtual	Timothy	Gross	Fueling Minnesota
In-person	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.
	John	Hausladen	Minnesota Trucking Association
In-person	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
In-person	Jon	Hunter	American Lung Association
In-person	John	Jaimez	Hennepin County
In-person	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
Virtual	Jeremy	Martin	Union of Concerned Scientists
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
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In-person	Marty	Muenzmaier	Cargill, Inc.
	Carolina	Ortiz	COPAL
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	Bob	Worth	Minnesota Soybean Growers Association
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In-person	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
In-person	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
In-person	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
In-person	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Agriculture
In-person	Shannon	Engstrom	CTS Director, MN Dept of Transportation
In-person	Amy	Fredregill	WSB – CTS Consultant
In-person	Bob	Gollnik	WSB – CTS Consultant
In-person	Samantha	Watson	WSB – CTS Consultant
In-person	Noel	Mills Ford	WSB – CTS Consultant
Virtual	Chevelle	Kazmierczak	WSB – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Adrienne B	AFPM
Andrea W	MN Truck
Andy P	Fredrikson
Bennett S	Fredrikson
Bobby W	Chevron
Brett W	Flint Hills Resources
Brian R	BP Pulse Fleet
Cassandra F	AMP Americas
Chandra H	Clean Energy Economy MN
Colin M	UC-Davis
Cory B	
Cristina C	Neste
Dallas G	Growth Energy

Dana A	RNG Coalition
Daniel D	Stinson, LLP
Daniel S	State of Minnesota
Dean T	Plugin America
Donovan H	Faegre Drinker
Elliott B	Argus
Ender Reed	Neste
Gary Kay	Cargill
George Damian	Clean Energy Economy MN
Gino L	PDDM Solutions
Ian M	Park Street Public
Jake H	CHS
Janie K	
Jessica N.	American Biogas Council
Jin Wook R	UC-Davis
Joe B	Winthrop
Joe S	Cook Strong Sellwood
Joel W	UC-Davis
Jon C	Archaea Energy
Julie W	UC-Davis
Kimberly S	
Lauren W	Stinson
Mariem Z	GPI
Marshall J	Smart Policy Group
Mike Karbo	API
Sam Owen	Capstone
Sarah P	Psick Capitol Solutions
Sarah R	
Sherrie M	NGV America
Terry R	Marathon Petroleum
Ward E	
Zach S	Ainsley Shea

Work Group Meeting #3 – September 20, 2023

Date: September 20, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting
Location: WSB Office, 701 Xenia Ave S, Unit 200, Golden Valley, MN 55416, and hybrid option available

Meeting Summary

Welcome & Project Overview

Amy Fredregill (WSB) thanked everyone for joining and for participating in the premeeting activity. Amy reviewed the meeting agenda and objectives. Housekeeping for both in person and online participants was reviewed.

Shannon Engstrom (MnDOT) thanked everyone for joining and introduced herself. She welcomed the new Work Group members and provided an opportunity to introduce themselves.

Shannon provided a reminder that the full list of CTS members is listed online. She reviewed the Work Group schedule. Shannon touched on the importance of Work Group engagement and offered to meet with members 1:1. The Chair, Kevin Pranis, is also willing to meet 1:1 with members.

Tim Sexton (MnDOT) explained that the steering team discussed the vice chair position, and a decision was made to move forward without a Vice Chair because there was not a clearly defined role and the role was not listed in statute. In leu of electing a Vice Chair, everyone will have an opportunity to weigh in on the direction of the work group meetings to ensure it reflects what Work Group members feel is important.

Shannon shared details on an upcoming Center for Climate and Energy Solutions (C2ES) roundtable.

Question: Who will start writing the report and what will initially be included?

Answer: Shannon explained that WSB will draft the report, using content from the Work Group discussions. An outline is forming and a draft will be shared later in the work group progress. A timeline will be shared during the October 24 work group meeting.

Shannon explained the key takeaways from the previous meetings.

Kevin Pranis, Chair, introduced himself. He represents the Minnesota/North Dakota LIUNA and shared the various sectors members work in. As Chair he would like to get as much consensus as possible within the Work Group to help move the initiative forward in legislation. Pending his schedule and availability, he is able to meet with work group members outside of meetings.

CTS Technical Overview & Discussion

Guest Speaker: Phil Sheehy, Director, Transportation and Energy, ICF

Provided a high-level overview of the technical analysis and modelling methodology that will be used for the CTS Work Group recommendations to build on in the small group sessions by fuel type.

- Baseline conditions for Minnesota
- GREET model and Carbon Intensity briefing
- Eligible fuel strategies under Minnesota's program
- Compliance scenario analysis

Phil Sheehy (ICF) explained the role of ICF is to identify and explain fuels so Work Group members can understand. He shared the baseline conditions for Minnesota regarding fuel production, light-duty vehicles (gasoline and gasoline substitutes), and medium-duty to heavy-duty vehicles (diesel and diesel substitutes). Numbers were specified as benchmarks for members to compare Minnesota's conditions with other states and to establish a baseline for Minnesota in the plan.

Phil provided a briefing on the GREET model and carbon intensity. Carbon intensity is an emission factor. When greenhouse gas emissions are reported, they are the product of fuel use. The lifecycle GHG emissions accounting approach is accounting for all the GHG emissions produced or avoided from the production, collection and processing, delivery, and ultimate use of a transportation fuel. To calculate the carbon intensity, you must review the whole process from creating the product and use of the product. With gasoline or diesel fuel, about 80% of emissions occur at combustion.

GREET stands for **G**reenhouse gases, **R**egulated **E**missions, and **E**nergy use in **T**echnologies. This is a model that is used under a set of conditions to approximate the average emissions for an average facility. GREET is used for regulatory and non-regulatory processes. This model is used to support regulation in other markets. The model is an accounting tool and there are certain modifications required to make it a regulatory tool.

Phil provided eligible fuel strategies under Minnesota's program. He explained how credits could be implemented with upstream reduction, refinery improvements, conventional fuels, biofuel blending, and vehicle replacement. A broad picture was painted for Working Group members to decide what factors should be eligible for credits.

He explained clean fuel scenario modeling and how a scenario analysis can show how things can be developed to determine realistic outcomes. The baseline fuel conditions and land use change for the Work Group must be below the 2018 baseline level and meet other specified criteria.

Panel 1: State Policy Comparative Analysis

Amy introduced the panelists. She explained they will help the Work Group learn about other state policies and how those experiences can inform the development of a CTS in Minnesota.

Panelist: Nikita (Nik) Pavlenko, Fuels Program Lead, International Council on Clean Transportation (ICCT)

Nik presented how fuel policies work and best practices based on past research. ICCT is an independent, non-profit research organization. ICCT has worked on low carbon and fuel standards for many years, like the one being considered for Minnesota. All the state fuel standards are built on the Federal Renewable Fuel Standard. He showed how California implemented a low carbon fuel standard via a technology neutral target. California is receiving many contributions from electricity. Over the last few years, there has been an incentive to decrease the emissions created by ethanol.

It is important to consider uncertainty in any Life Cycle Assessment (LCA). This includes uncertainty in indirect LCA emissions. Uncertainty shouldn't be the driving force, but it should be a consideration. Some LCA's include emissions and credits based on an assumption of the world outside of the LCA.

Panelist: Abbey Brown, Technical Lead, Clean Fuel Standard, Washington State Department of Ecology

Abbey explained how the program in Washington is set in statute. Any change to the statute requires a legislative change. The State of Washington heard strong stakeholder feedback that carbon reduction should be done as quickly as possible. Washington has deficit generating fuels and credit generating fuels. Every district in the State has a carbon intensity score. Fuel producers, fuel importers, electric utilities, and other entities participate in the credit program. To participate they register, track energy use, and submit quarterly reports. Information is shared on a market basis for transparency so other organizations can make decisions.

Capacity credits and advance credits are offered. These are limited to 5% of overall credit generation. The primary objective is to lower transportation fuel usage as this will have the largest impact on carbon reduction.

Washington's program is required to collect a program participation fee. This has been a challenge with the program and is potentially preventing small contributors from entering the program. If a utility does not opt into the program, a backstop aggregator will collect unclaimed credits from residential EV charging.

Abbey recommends learning from other states to determine what works well, what doesn't and what can be improved. Be adaptive because fuels and technologies rapidly change. Understand the technical complexity of the program requires staff.

Panel 2: Industry Perspectives

Amy introduced the second group of panelists. The goal with the second panel was to hear from a range of perspectives in liquid transportation fuels regarding opportunities, challenges and considerations for key industries.

Panelist: Dan Short, Fuels and Low Carbon Policy Manager, Marathon Petroleum

Marathon is predominantly a liquid fuel company. They have significant investments in renewable fuels. They have experience in credit programs and converting refineries to biorefineries. It is a major decision when converting a refinery to a biorefinery. Chemical configurations need to happen on the back end. Typically, upgrades are needed to infrastructure, including storage tanks, logistics, energy sources, and refinery units.

Dan shared it is key to make sure CTS is making investments in the state. The details matter in low carbon fuel programs such as annual reduction targets, qualifying fuels and feedstock pathways, and the approach to lifecycle methodology.

Panelist: Tia Sutton, Senior Policy Advisor, American Petroleum Institute (API)

At API, members have found the following considerations to be important:

- Support and incentivize investment to grow production of lower carbon intensity energy used for transportation.
- Enable a flexible array of compliance mechanisms with current and future technologies.
- Develop a framework that is efficient, market-neutral, and energy- and technology-neutral.
- Consider implications to fuel and feedstock supply and demand.
- Include adequate lead time for the required parties and the state agency that will be implementing the program.

Panelist: Dustin Haaland, Director, Trading and Renewable Fuels, CHS

CHS is an agricultural and energy cooperative. Core businesses for CHS are in energy, agronomy, and global and grain processing.

The regulatory readiness with these programs is critical. It takes time to get the reporting and math correct. Credit generations should be ahead of the credit deficits. Take into consideration the bumps along the way that happen from policy creation to implementation.

It is important to consider as fueling and energy solutions are provided, there are cost impacts to gasoline and diesel fuel.

Discussion & Reflection

Amy explained the breakout group discussion topics. Based on what was heard from panels, virtual and in person small group discussions happened to identify key principles for CTS and how these perspectives can inform the development of Minnesota state policy.

Each small group had a note taker, and all notes were summarized below.

Key Themes and Lingering Questions

Development

- How do we make sure aggressive GHG goals in the state are in line with the scenarios we are developing? And larger federal scaffolding that is now in place, e.g. new EPA tailpipe standards for all vehicle types?
- Concerns about getting the model 'right' and differing views on what that looks like. How do we determine what priorities are important for Minnesota?
- Washington program built in a pause for evaluation. Important to be flexible/have a timeline.
- Getting the program started w/o worrying about everything it might impact
- Rulemaking might take a long time
- Need to balance agriculture/water quality interests
- Expecting industry to deliver, underestimate cost and lead time
- Program administration fees for credit generators and deficits to support
- What is fastest path to elect and role of CTS?

Implementation

- Is it possible to do advance credits now (early) before CTS goes into effect?
- What level of detail and accuracy is needed?
- How to ensure no harm to ecosystem health? How and what data is needed to ensure that
- Picking a small number of priorities for cost effectiveness

Evaluation

- 3 year pause for assessment (Washington State) – what's included and what do they hope to learn?
- No strong feelings about methods, but agreement with assessment (adaptive management)
- Potential for incentives for crops and other inputs/outputs that have co-benefits
- Important to support farmers in MN, investing in electrification esp. in disadvantage communities, benefits of broad approach.
- Important to look at the implications of lifecycle approach (how we do the accounting etc.) what are the outcomes we want in MN
- How to improve policy as it evolves and learn more or need more data

Work Group Process

- Missing content in WG meetings to date: When we will discuss the missing pieces: water, air, conservation challenges as part of biofuels? Need to discuss direct land use challenges and impacts for all stakeholders? How are we thinking about low carbon fuels (electricity)?

- Concerns about timeline: How do we consider the timeline of converting facilities in the structure of a CTS? How do we consider scenarios that are 'accurate' and with technology that isn't yet adopted?
- More information on assumptions about EV adoption and connection to CTS (especially capacity and advance)

Areas of Consensus

- Benefits needs to stay in Minnesota.
- High *interest* in developing a working standard
- Agreement that the key strategy for getting this kind of policy passed: should be technology based, politically neutral.
- High *interest* in keeping people together.
- High interest in balancing priorities and user group impacts.
- Interest in flexibility to adaptively manage and evaluate the standard

Public Comment Period

The work group included a public comment period. No comments were received.

Amy reminded the public that comments can also be submitted by emailing Sustainability.dot@state.mn.us.

Additionally, a link to the CTS webpage was provided: dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html.

Closing & Next Steps

Andrea Vaubel (MN Dept. of Agriculture) thanked the speakers and participants for taking time to attend and share their insights. Additionally, she thanked members for the time they are dedicating outside of the Work Group meetings to move things forward. In person attendees were asked to leave questions or comments on the comment cards provided at the tables. Lastly, she extended the opportunity to meet 1:1 with members outside of the Work Group meetings.

Shannon thanked everyone for joining and reminded the members she is also available for 1:1 conversation and is happy to answer any questions.

Amy provided the last closing remarks. She provided a reminder for the upcoming technical group webinars that will be led by Phil Sheehy and the October meetings. The next Work Group meeting will have a similar format and will be held on Oct. 24, 2023. Attendees were asked to participate in the meeting feedback survey by using the QR code on the screen. Lastly, Shannon Engstrom's contact information was provided: shannon.engstrom@state.mn.us.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
In-Person	Paul	Austin	Conservation Minnesota
Virtual	Kaytlin	Bemis	MN Farm Bureau
Virtual	Carolyn	Berninger	Great Plains Institute for Sustainable Development
In-Person	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
	Matthew	Bruyette	Nature Energy
Virtual	Mike	Bull	Allete/MN Power
In-Person	Margaret	Cherne-Hendrick	Fresh Energy
	Vallen	Cook	Grand Portage Band of Chippewa
Virtual	Colin	Cureton	UMN Forever Green Initiative
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
	Rodney	De Fouw	Great River Energy
Virtual	Leslee	Jackson	Midwest Building Decarbonization Coalition
	Suzanne	Goldberg	ChargePoint
Virtual	Timothy	Gross	Fueling Minnesota

In-Person	Dustin	Haaland	CHS, Inc.
In-Person	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
In-Person	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	John	Jaimez	Hennepin County
In-Person	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
Virtual	Jeremy	Martin	Union of Concerned Scientists
In-Person	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
In-Person	Steve	Morse	Minnesota Environmental Partnership
In-Person	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
In-Person	Stephanie	Pinkalla	The Nature Conservancy
In-Person	Kevin	Pranis	LIUNA Minnesota/North Dakota
In-Person	Trevor	Russell	Friends of Mississippi River

Virtual	Eric	Schenck	Minnesota Forest Resources Council
In-Person	Kathleen	Schuler	Health Professionals for a Healthy Climate
In-Person	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
In-Person	Brian	Werner	Minnesota Biofuels Association
Virtual	Peter	Wagenius	Sierra Club North Star Chapter
	Bob	Worth	Minnesota Soybean Growers Association
In-Person	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
In-Person	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
In-Person	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
In-Person	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
In-Person	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
In-Person	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation

In-Person	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
In-person	Shannon	Engstrom	CTS Director, MN Dept of Transportation
Virtual	John	Fleming	Planner, Aeronautics Office, MN Dept of Transportation
In-Person	Amy	Fredregill	WSB – CTS Consultant
In-Person	Bob	Gollnik	WSB – CTS Consultant
In-Person	Sammantha	Watson	WSB – CTS Consultant
In-Person	Noel	Mills Ford	WSB – CTS Consultant
Virtual	Chevelle	Kazmierczak	WSB – CTS Consultant

Members of the Public

Present	Name	Organization (if applicable)
Virtual	Abbey Brown	Washington State Dept of Ecology
Virtual	Nikita Pavlenko	ICCT
In-person	Dan Short	Marathon Petroleum
Virtual	Tia Sutton	American Petroleum Institute (API)
In-person	Dan Dwight	Stinson, LLP.
In-person	Jeremy Estenson	Taft

In-person	Melissa Kahn	Fredlaw
In-person	Kate Klossner	Marathon Petroleum
In-person	Andrew Duerr	MN Biodiesel Council
In-person	Matthew Lemke	Koch Companies Public Sector
Virtual	Terry Riesen	
Virtual	Jake Peterson	
Virtual	Ty McLean	
Virtual	Melissa Partin	
Virtual	Jane Sadler	
Virtual	Dave Wager	
Virtual	Innocent Eyoh	
Virtual	Tammi Hagen	
Virtual	Elliott Blackburn	
Virtual	Lydia Underdahl	
Virtual	Mike Karbo	
Virtual	Patrick Murray	
Virtual	Donovan Hurd	
Virtual	Gary Kay	

Virtual	Ian Marsh	
Virtual	Molly Jansen	
Virtual	Connor Cox	
Virtual	Mattie Anders	
Virtual	Craig Schoenfeld	
Virtual	Joe Sellwood	
Virtual	Kim Scott	
Virtual	Fang Yan	
Virtual	Jake Hamlin	
Virtual	Sam Owen	
Virtual	Brett Webb	
Virtual	Julia Donnelly	
Virtual	George Damian	
Virtual	Chandra Her	
Virtual	Dan Smading	
Virtual	Brendan Jordan	
Virtual	Joel Wessman	
Virtual	David Sullivan-Nightengale	

Virtual	Tom Freeman	
Virtual	Sherrie Merrow	

Work Group Meeting #4 – October 24, 2023

Date: October 24, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting
Location: WSB Office, 701 Xenia Ave S, Unit 200, Golden Valley, MN 55416, and hybrid option available

Meeting Summary

Welcome & Project Overview

Amy Fredregill (WSB) thanked everyone for joining and for participating in the five webinars that were hosted over the past month. Amy also reviewed the meeting agenda and objectives.

Meeting objectives included:

- Review timeline and discuss priorities for the next 6 weeks+
- Review and discuss fuel pathway scenarios modeled by ICF consulting
- Discuss how a MN CTS might incorporate scenarios modeled
- Continue to co-learn from various perspectives and identify takeaways on priorities for ongoing learning

Housekeeping for both in person and online participants was reviewed.

Shannon Engstrom (MnDOT) thanked everyone for joining. Shannon thanked Carolyn and Suzanne who are stepping away from the Work Group. Thank you to both of them for their time and effort in the Work Group. The Work Group welcomed two new members - Brendan Jordan from the Great Plains Institute and Nate Schuster from ChargePoint.

Next Shannon walked through the timeline, which is marching forward to a February 1st, 2024, deadline for a final report to the legislature. Shannon requested that Work Group members put a reminder on their calendars during the window of Nov 28- Dec 6 for reviewing the draft report and providing comments. There is a Work Group meeting on November 30th where we will review the draft report and answer any questions.

Shannon showed the draft table of contents for the draft report to give participants a sense of what to expect. Shannon asked for feedback on the draft table of contents and encouraged people to provide comments. Shannon acknowledged that we are at the mid-point of the project. At this meeting, we are starting to get into the recommendations portion of the project.

Shannon introduced Tim Sexton (MnDOT), who shared a few comments as a member of the steering team. He expresses appreciation for the entire Work Group. And acknowledged that everyone is coming into this Work Group with different experiences and understanding. The purpose of today is to start focusing on what the recommendations may look like for the CTS. While focusing on the areas the legislation is pointing us, clarifying question are welcomed today (i.e., what is already being addressed and where this goes next, what needs to be part of this process moving forward and acknowledging where there needs to be more conversation). Tim acknowledged that we will not figure everything out for the CTS, however, the intent is to find trust in where we are going and making sure we are clarifying what still needs to be resolved.

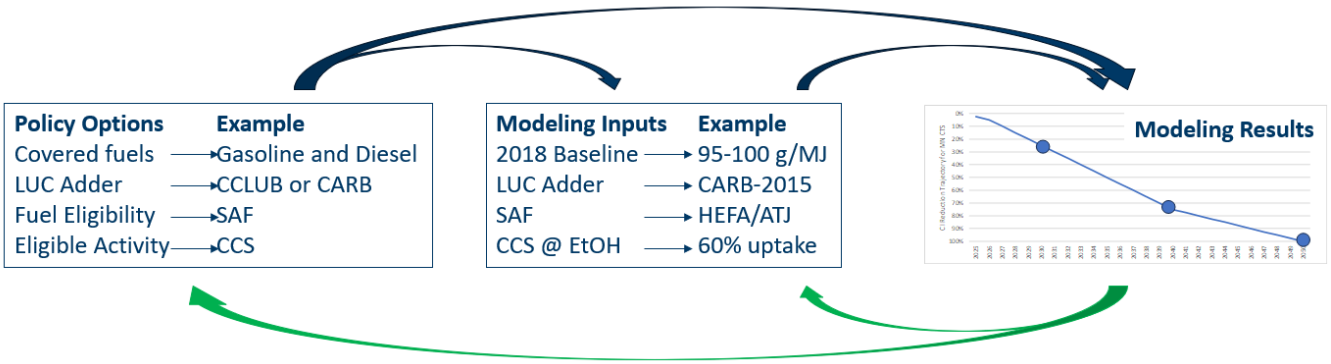
Tim turned it back over to Shannon. Shannon mentioned that we have 40 Work Group members, and we do not expect everyone to understand all of the technical aspects of today's draft scenario analysis review. Shannon encouraged Work Group members to flag down agency or consultant staff if anyone if they have clarifying questions. They can also connect with Shannon 1:1 after the meeting if they still need clarity.

Amy introduced Philip Sheehy (ICF) and turned to him for his draft scenario modeling presentation.

Discuss DRAFT Fuel Pathway Scenarios

Presented by Philip Sheehy, Director, Transportation and Energy, ICF Consulting

Philip started by emphasizing that ICF is a resource for the Work Group, and reminded the Group that ICF is not deterministic and will not tell them how to develop the Minnesota CTS. It is up to the Work Group to review the draft scenarios, provide comments and feedback in order for ICF to revise the scenarios prior to the next meeting on Nov. 8.



The items shown on the left in the above figure are policy options that could be incorporated into the CTS, such as policy options, LUC Adder, fuel eligibility, and eligible activity. The box to the right shows the modeling inputs, which are used to develop modeling results. What Philip is presenting today is the first iteration of this. This is a very fast process, so feedback is necessary to narrow down the modeling.

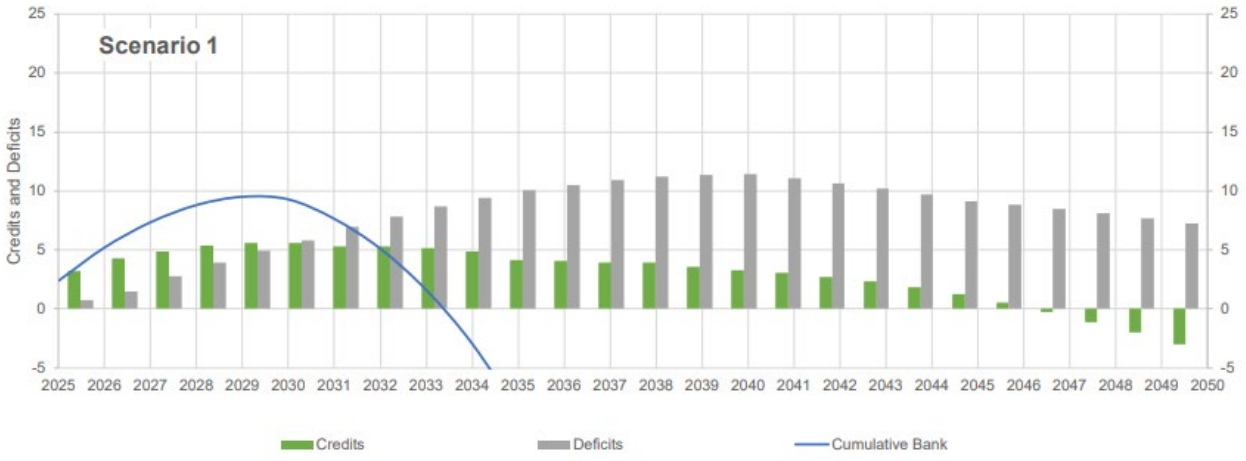
Philip then discussed the 2018 baseline. There are two potential benchmarks for the Land Use Change (LUC) adder – CCLUB or CARB2015. The baseline for gasoline is 99-100 g/MJ, and diesel is 95-97 g/MJ. Diesel is a little lower because it's a slightly higher blend rate than ethanol. The draft result that Philip is presenting is using the

CCLUB value benchmark, but that was not an endorsement for CCLUB. Philip is also not assuming jet fuel is a regulated fuel.

Next, Philip presented a summary of modeling assumptions. The table below shows various clean fuel deployment and the initial assumptions for each fuel type. There is more detail that was provided in the pre-read memo that was shared by Shannon and developed by Philip and the ICF team.

Philip then provided a primer of graphical results and explained that a positive slope on the graphs means that low carbon fuel deployment exceeds deficit generation, and that a negative slope means a deficit generation exceeds low carbon fuel deployment and banked credits are needed for compliance. Philip shared the draft results of scenario 1 (see graph below). The initial results of scenario 1 show:

1. Bank builds in early years, largely due to liquid biofuels
2. Credit generation plateaus in 2029
3. Possible non-compliance by 2033
4. Liquid biofuels are deficit generators

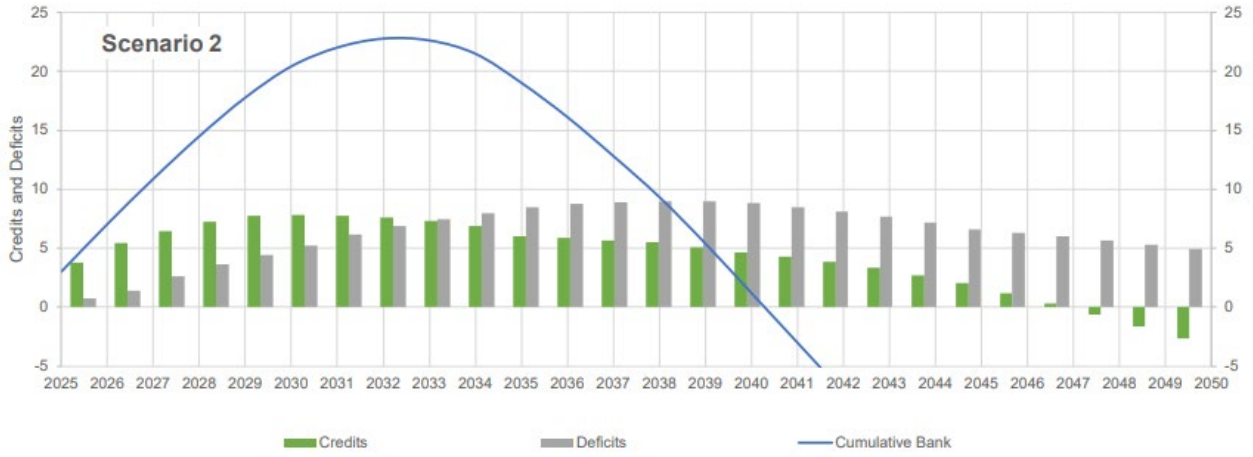


ICF Assessment of Scenario 1

Scenario	2030 Target 25% CI reduction	2040 Target 75% CI reduction	2050 Target 100% CI reduction
1	☑	☒	☒

Philip then shared the draft results of scenario 2 (see graph below). The initial results of scenario 2 show:

1. Bank builds in early years, largely due to liquid biofuels + LD ZEV
2. Credit bank plateaus in 2032
3. Possible non-compliance by 2040
4. Liquid biofuels are deficit generators
5. Higher electrification than in scenario 1

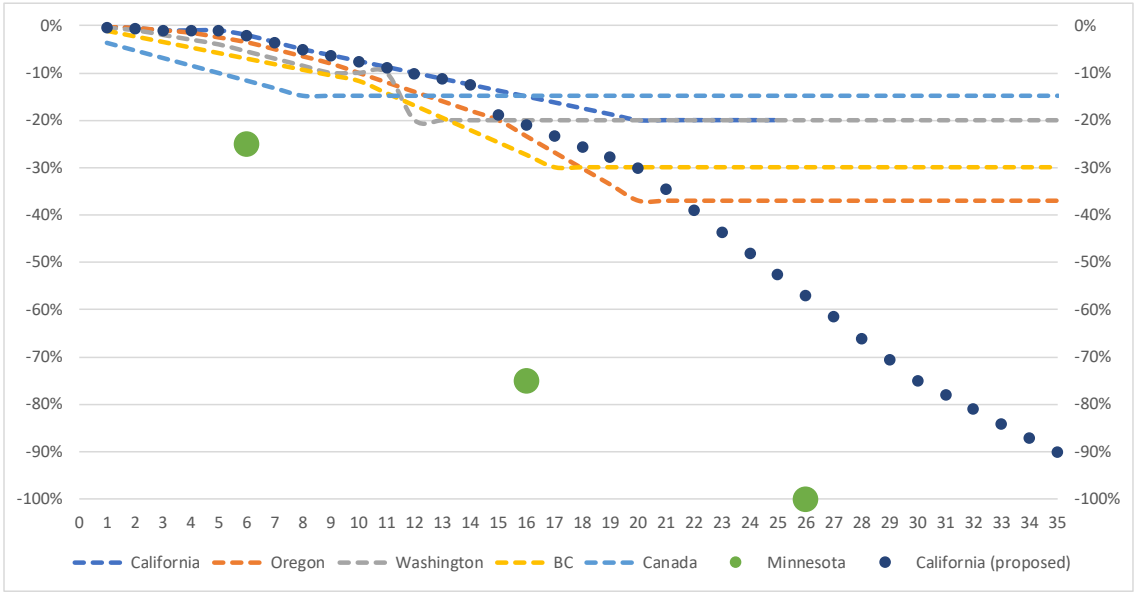


ICF Assessment of Scenario 2

Scenario	2030 Target 25% CI reduction	2040 Target 75% CI reduction	2050 Target 100% CI reduction
2	☑	☑	☒

About 30-40% of these results in Scenario 2 could be attributed to liquid biofuels, about 60-70% attributed to higher electrification.

Next, Philip shared a graph that showed various CI projections for other states (California, Oregon, Washington, and British Columbia). The trajectory of the CI reductions included in statute are different than what has been observed in other low carbon fuel markets. The target values are comparable; the rate at which those targets are to be achieved is not. The chart is normalized to year 0 (whenever the program started).



Philip handed it over to Amy who explained that Work Group members will have until Thursday the 26th to submit questions.

Guest Speaker Q & A

Philip responded to clarifying questions from the Work Group.

Materials about electric truck charging referenced during the Q & A are attached (see Attachments 2 – 4).

Reflection & Small Group Discussions on Fuel Pathways

The Work Group was given 5 minutes to individually reflect on the draft scenarios and modeling shown today, before they moved into groups of four to discuss and populate feedback/questions in the Google application, Jamboard. The following discussion questions were provided:

1.
    a. Agree or disagree. The program design CI reduction targets at 2030, 2040, 2050 are achievable and appropriate.
    b. What policy changes could be made to improve the probability of creating a CTS program in compliance?
2. Agree or disagree. The Work Group recommends that Sustainable Aviation Fuel (SAF) generates credits and that jet fuel is a deficit generator in a MN Clean Transportation Standard.
3. Agree or disagree. Carbon capture and storage (CCS) currently plays a major role in the CI trajectory for ethanol in ICF modeling. Should CCS be eligible to generate credits?
4.
    a. Most of the modeling has focused on Electric Vehicle (EV) deployment. Are the deployment rates reasonable for light-duty EVs? Why/why not?
    b. Are the deployment rates for heavy duty EVs reasonable? Why/why not?
5. Climate smart agriculture practices also play a significant role in the CI trajectory for liquid biofuels in ICF modeling. Should this type of farm-level activity be eligible to generate credits? Why/why not? Thoughts on who should get the credits?
6. Renewable diesel is expected to be blended in Minnesota due to CTS, while biodiesel blends are maintained consistent with statute. There is also a focus on waste feedstocks in ICF modeling. Are these reasonable assumptions?
7. What would you refine in ICF's modelled scenarios to enable formulating Work Group recommendations? Are there any other major variables ICF should include or modify in the modeling/technical analysis?

Report Back & Synthesis

The Jamboard will be kept open until Thursday the 26th for Work Group members to drop in more comments and ask any remaining questions.

There will be a questionnaire launched next week to gather more feedback before the November 8th meeting. If there are questions for Philip, please email them to Shannon at: Shannon.Engstrom@state.mn.us.

Below are general comments from the breakout groups regarding the provided discussion questions above.

1A & B. Agree or disagree. The program design CI reduction targets at 2030, 2040, 2050 are achievable and appropriate. What policy changes could be made to improve the probability of creating a CTS program in compliance?

- 2030 is achievable but would need some adjustments
- Revisit target goals on an ongoing basis (i.e., every 4-5 years)
- The trajectory is very aggressive, even if everything went really well. 2030 looks achievable, but mostly because you're burning through many of your credits. It's clear that 2040+ will be challenging

2. Agree or disagree. The Work Group recommends that Sustainable Aviation Fuel (SAF) generates credits and that jet fuel is a deficit generator in a MN Clean Transportation Standard

- Many groups broadly agreed, but requested more information to be certain
- Some agreed about the concept, but noted that if aviation does not generate deficits, it should have a limit on credits to ensure they cover their costs
- Some disagreed that jet fuel should be a deficit generator
- Comment on Federal law: doesn't allow for states to regulate jet fuel. Needs to be an allowable credit generator. CA, OR, WA have SAF as a voluntary credit generator due to limits in federal law.

3. Agree or disagree. Carbon capture and storage (CCS) currently plays a major role in the CI trajectory for ethanol in ICF modeling. Should CCS be eligible to generate credits?

- Many groups thought that carbon capture and storage should be included, but there was too much uncertainty in the modeling assumptions/inputs to be certain
- One concern is whether it would be used for enhanced oil recovery or not

4A. Most of the modeling has focused on Electric Vehicle (EV) deployment. Are the deployment rates reasonable for light-duty EVs? Why/why not?

- Some groups thought they were aggressive
- Many groups agreed they were reasonable with equal development of charging infrastructure
- Some groups noted that legislative intervention may be necessary to spur faster deployment
- It was noted that there should be some sort of check in to evaluate the value of the program and maybe readjust targets as things progress. Technology changes are non-linear.

4B. Are the deployment rates for heavy duty EVs reasonable? Why/why not?

- It was noted that the policies should be technology-neutral. There should be some kind of off-ramp solution. If things don't go as planned, there is a way to maneuver through.

5. Climate smart agriculture practices also play a significant role in the CI trajectory for liquid biofuels in ICF modeling. Should this type of farm-level activity be eligible to generate credits? Why/why not? Thoughts on who should get the credits?

- Some groups agreed, but is there equipment available that will be necessary for famers to deploy these practices? MN could lead in this space, and that could spark additional efforts around the country.
- It was noted that something that should be considered with carbon crediting for farmers - farmers currently can't get credit with climate smart practices. So, the ones that are currently doing it are not getting credits, just the newer ones

- It was noted that for tribes, land uses are in a trust so tribes do not get any financial incentives like other farms do

6. Renewable diesel is expected to be blended in Minnesota due to CTS, while biodiesel blends are maintained consistent with statute. There is also a focus on waste feedstocks in ICF modeling. Are these reasonable assumptions?

- Many groups agreed that renewable diesel is reasonable, but that E15 is a fuel that comes with a lot of challenges. Thinking of targets in the future, there are lots of host of challenges, and time is mostly the problem
- One group suggested that one thing that should be in the model is higher blends. Improvements can be made for winter-grade product

7. What would you refine in ICF's modelled scenarios to enable formulating Work Group recommendations? Are there any other major variables ICF should include or modify in the modeling/technical analysis?

- Amy read some of the comments from Jamboard out loud; no additional comments from Work Group members

Work Group Comment Period

After sharing out small group feedback, the Work Group was granted time to provide comments. High-level comments are captured below.

- We are spending a lot of time focusing on the model, which is based on carbon intensity. I'm still looking at how do we maximize the co-benefit and water quality. A) this should be looked at in modeling. For example, Friends of the Mississippi released a report called Putting Down Roots. We should look at some of that data and incorporate it. B) We should look at other incentives. The model is just the model, not the policy.
- One thing that often doesn't get brought into modeling scenarios is impacts to workers. We need to ensure that workers have what they need, whether that is on-site storage or through pipeline. What are the community benefits that ensure that workers are taken care of?
- We understandably are spending a lot of time on fuel standard, but not looking at other types of policies. A lot of our analysis has been based on a snapshot of today's markets, but there is a potential for woody biomass to be a feedstock in the future. We need to bring some of those future alternatives to the analysis.
- When you model anything into the future, it's difficult to predict, but the role of technical change is often significant and nonlinear. Developments of new feedstocks and other technologies are not guaranteed but are likely if there is significant policy and market pressure for them to be developed. I would love to see scenarios that incorporate a higher R&D spend leading to jumps in CI reduction
- Great Plains Institute is submitting a letter with some specific policy design considerations (see Attachment 1).
- Thank you for the opportunity to reintroduce hydrogen into the conversation. This is a high potential for this. The policy is best if it recognizes that EV policy velocity will vary by sector. So light duty, medium duty, and heavy duty will vary dramatically.

- We should include the role of reducing vehicle miles traveled (VMT), public transit, acceleration of EV sales and so on.
- Has this group looked at the proposed bill from last spring?
- A suggestion was made to circulate the legislative language so Work Group members know exactly what was included in the bill in the 2023 session: SF 2584 Clean Transportation Standard Act. Language can also be referenced in the Charter provided to Work Group members.

Comment Period

- United Steelworkers Union Local 662 members are concerned with legislation and potential negative impact of the union members. A representative mentioned that 600 members have very good paying jobs, and we want to make sure that those opportunities are not lost.
- A verbal and written comment was received: "I'm a retired chemist from Maplewood, Minnesota. I argue that Minnesota state and local governments must set an example by capturing their own carbon dioxide greenhouse gas emissions, building the infrastructure to combine that CO2 with "green hydrogen" from the Minnesota Heartland Hydrogen Hub that the Department of Energy just funded, and convert the CO2 (and hydrogen) to low carbon intensity (CI) renewable fuels, such as ethanol, renewable diesel, and sustainable aviation fuel (SAF), which could be blended with current fuels to lower their carbon intensity. That conversion can be done with existing technologies that have already been proven at scale, as I have explained in my written comments to the Minnesota Pollution Control Agency. I am working with my state representative and senator to present a bill to fund a Front-End Engineering Design (FEED) study for two possible CO2 "recycling" plants, one in the Twin Cities (for the Metro Wastewater sludge incinerators) and one in Greater Minnesota (for converting CO2 from corn ethanol plants into additional low carbon intensity ethanol or other fuels.). For example, this could piggyback on the "green ammonia" fertilizer plant that will be built with the University of Minnesota – Morris as part of the Heartland Hydrogen Hub project. UM-Morris has a high Native American student population that could share in high tech job training at the plant."

Public comments can also be submitted by emailing Sustainability.dot@state.mn.us. Additionally, a link to the CTS webpage was provided: dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html.

Closing & Next Steps

Shannon Engstrom thanked all of the Work Group and public members for being at the meeting, and for those that helped. She notes that we are in the middle of divergence and convergence phases of this work and this can be a challenging stage, so everyone's patience is appreciated. If you have any clarifying questions on the modeling for Philip Sheehy (ICF), please send them to Shannon at shannon.engstrom@state.mn.us. Shannon thanked everyone for joining and reminded the members she is also available for 1:1 conversation and is happy to answer any questions.

Kevin (Chair) shared his perspective. She reminds everyone that we need this as a skeleton for a policy proposal. The first thing we have to do is have a skeleton that states how fast we are reducing carbon. If we can agree on a general skeleton, then we can move forward to other elements. Could we conceivably make it to 2030 or 2040 with our current technologies? If we have additional technologies, then that could make things even better. However, we first need the policy, then we can get to some of the other things such as co-benefits.

Amy provided the last closing remarks. She provided a reminder for Work Group members to mark their calendars for the end of November and early December to set aside some time to review the draft report. As a general reminder, send in final comments on Jamboard by this Thursday the 26th and provide comments to Philip about the modeling inputs by this Friday the 27th. The next Work Group meeting will have a similar format and will be held on November 8th, 2023. Lastly, Shannon Engstrom's contact information was provided: shannon.engstrom@state.mn.us.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
In-Person	Paul	Austin	Conservation Minnesota
In-Person	Kaytlin	Bemis	MN Farm Bureau
Virtual	Carolyn	Berninger	Great Plains Institute for Sustainable Development
In-Person	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
In-Person	Matthew	Bruyette	Nature Energy
In-Person	Mike	Bull	Allete/MN Power
In-Person	Margaret	Cherne-Hendrick	Fresh Energy
Virtual	Colin	Cureton	UMN Forever Green Initiative
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
In-Person	Timothy	Gross	Fueling Minnesota
In-Person	Dustin	Haaland	CHS, Inc.
In-Person	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
In-Person	Abby	Hornberger	BlueGreen Alliance

In-Person	Rick	Horton	Minnesota Forest Industries
In-Person	Jon	Hunter	American Lung Association
In-Person	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	John	Jaimez	Hennepin County, Partnership on Waste and Energy
In-Person	Brendan	Jordan	Great Plains Institute (GPI)
Virtual	Ariel	Kagan	Minnesota Farmers Union
In-Person	Thad	Kurowski	Tesla
In-Person	Steve	Morse	Minnesota Environmental Partnership
In-Person	Marty	Muenzmaier	Cargill, Inc.
Virtual	Jeremy	Martin	Union of Concerned Scientists
Virtual	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
In-Person	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Carolina	Ortiz	COPAL
Virtual	Stephanie	Pinkalla	The Nature Conservancy
In-Person	Kevin	Pranis	Liuna Minnesota/North Dakota
Virtual	Eric	Schenck	Minnesota Forest Resources Council
In-Person	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Nate	Schuster	ChargePoint
In-Person	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy

Virtual	Peter	Wagenius	Sierra Club
In-Person	Brian	Werner	Minnesota Biofuels Association
In-Person	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
In-Person	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
In-Person	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
In-Person	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
In-Person	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
In-Person	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
In-Person	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
In-person	Shannon	Engstrom	CTS Director, MN Dept of Transportation
Virtual	Philip	Sheehy	ICF – Consultant
Virtual	Fang	Yan	ICF – Consultant
In-Person	Mattie	Anders	WSB – Consultant

In-Person	Connor	Cox	WSB – Consultant
In-Person	Amy	Fredregill	WSB – CTS Consultant
In-Person	Noel	Mills Ford	WSB – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Carolyn Berninger	Great Plains Institute
Clovis Curl	
Andrew Duerr	MN Biodiesel Council
Dan Dwight	Stinson, LLP.
Brian Ecker	
Zack Eichten	Taft
Jeremy Estenson	
Dallas Fischer	Fueling MN
Dallas Gerber	
Vince Gunaca	United Steelworkers (USW) Local 662
Jake Hamlin	CHS
Todd Hill	
Jessica Hoffmann	

Molly Jansen	
Mike Karbo	American Petroleum Institute (API)
Kate Klossner	Marathon Petroleum (MP)
Matthew Lemle	FITR
Per Lundmark	
Dale Lutz	
Ian Marsh	
Whitney Mason	
Holly Mayton	
Addie Miller	
Jesse Nowicki	
Scott Olson Laboda	
Jake Peterson	
Sarah Psick	
Terry Riesen	
Cacie Russell	
Craig Schoenfeld	
Kimberly Sscott	
Joe Sellwood	

Bennett Smith	
David Sullivan-Nightengale	
Alex Trunnell	
Jean Wagenius	
Mariem Zaghdoudi	

Attachment 1: Future Fuels Coalition letter from Great Plains Institute

October 20, 2023

Dear Chair and members of the Clean Transportation Standard Work Group,

The Future Fuels Coalition is a diverse group of stakeholders that has been working to advance a Minnesota clean transportation standard. The Coalition is facilitated by the Great Plains Institute and represents environmental groups, automakers, renewable fuel producers, science-based organizations, electric and alternative vehicle consumer organizations, counties, electric utilities, non-profit clean energy organizations, electric vehicle charging companies, and more.

The Future Fuels Coalition is invested in reducing greenhouse gas emissions from Minnesota's highest-emitting sector, transportation, which is why we have been working on advancing a clean transportation policy for the last three years. We believe that a clean transportation standard designed based on the principles outlined in the Midwestern Clean Fuels Policy Initiative's white paper A Clean Fuels Policy for the Midwest, and our frameworks for including farm-level greenhouse gas emissions and electric vehicle credit generation in clean fuels policies, can be an effective policy to achieve Minnesota's climate goals while providing the following benefits:

- Large net-positive and equitable economic impacts for the state through increased investment in a broad portfolio of cleaner fuels, including ethanol, biomethane, biodiesel, other biofuels, electricity, and charging infrastructure.
- Benefits for consumers through market access for clean fuels that are often lower cost or a better value than conventional fuels but currently face barriers to entry in the marketplace.
- Equitable access to clean transportation for all Minnesota communities.
- Increased investment in cleaner fuels for all types of vehicles and a more innovative and prosperous clean fuels sector, spurring consumer demand for cleaner products.
- A technology- and fuel-neutral, performance-based approach that expands the fuel market and rewards the cleanest fuels, without having government pick winners and losers.
- Reduced air pollution and increased health benefits, particularly in areas that have been disproportionately impacted by transportation pollution.
- Economic incentives and market demand to maximize the resource value of organic waste (including manure, biosolids, and food waste), reducing the climate impacts of organic waste, and supporting counties' efforts to achieve state-mandated recycling goals.
- Increased energy independence by relying less on imported resources and more on state resources.
- Reduced greenhouse gas emissions in the two largest emitting sectors of transportation and electricity as well as in the agricultural sector.
- A potential to support voluntary farmer-led efforts to invest in and adopt agricultural conservation practices that benefit soil health and water quality and reduce farm-level greenhouse gas emissions.

Minnesota has long been a leader in clean fuels innovation, and we have an opportunity to keep the state at the forefront by adopting the first clean transportation standard in the Midwest.

We would like to emphasize the many years of work by a wide range of stakeholders to think through details of policy design and impacts of a policy on various sectors. We urge the Work Group to take this extensive experience into account in making recommendations. We stand ready to support the Clean

Transportation Work Group in developing recommendations for structuring and implementing a Minnesota clean transportation standard.

Sincerely,

Alliance for Automotive Innovation

American Biogas Council

American Coalition for Ethanol

Amp Americas

Audi

ChargePoint

Christianson PLLP

Clean Energy Economy Minnesota

Coalition for Renewable Natural Gas

Electrify America, LLC

EVgo

FreeWire

Gevo

General Motors

GNA

Renewable Fuels Association

Rivian

NGVAmerica

Oberon Fuels

Partnership on Waste and Energy

Plug In America

Tesla

Union of Concerned Scientists

Attachment 2: Forecasting EV Adoption by Xcel Energy

Attachment 3: Charging Infrastructure Challenges for the U.S. Electric Vehicle Fleet by ATRI

Attachment 4: Understanding the CO2 Impacts of Zero Emission Trucks by ATRI

FORECASTING EV ADOPTION

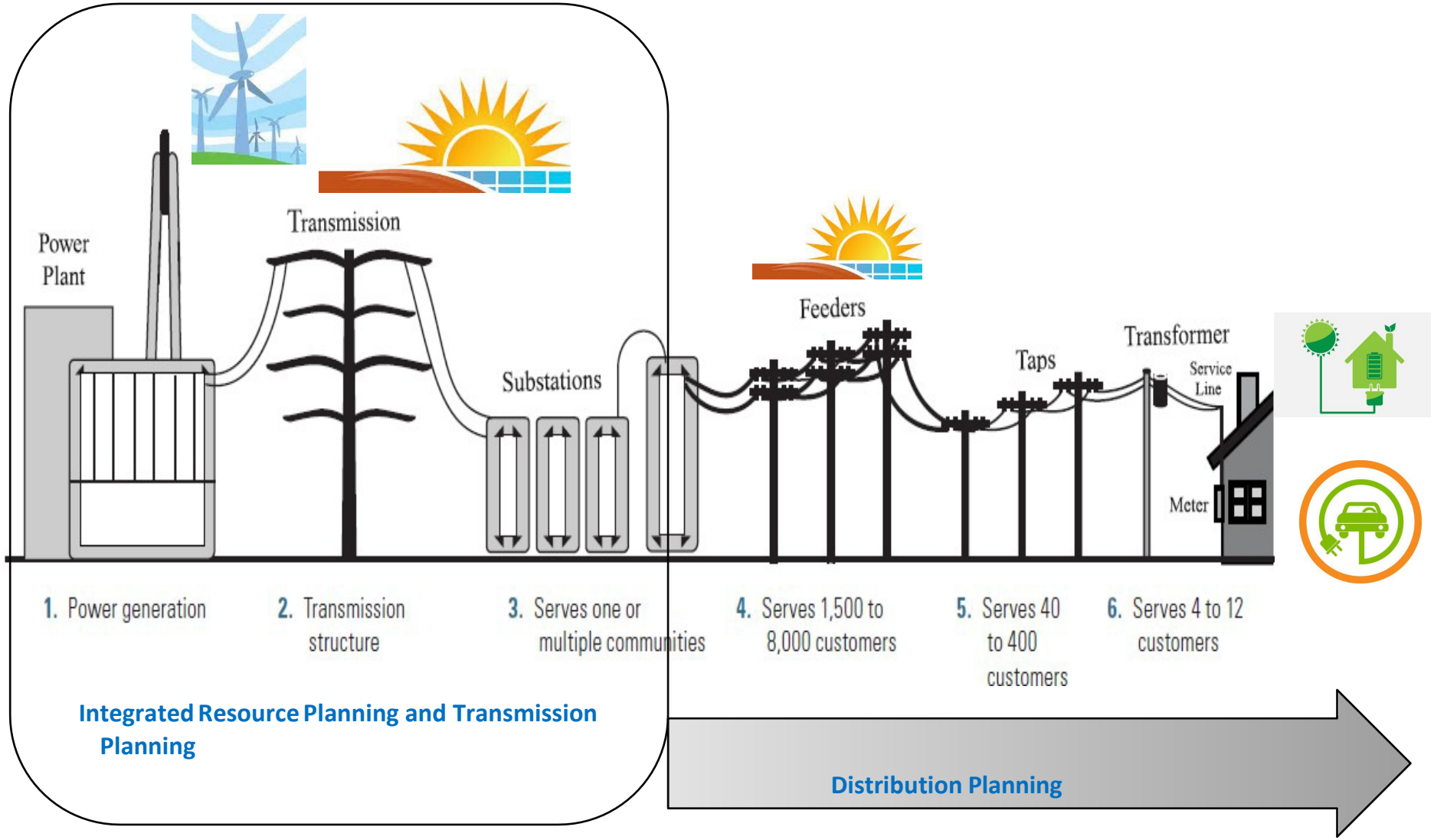
Paul Vaynshenk | Distribution Planning Engineer

09/27/2023

AGENDA

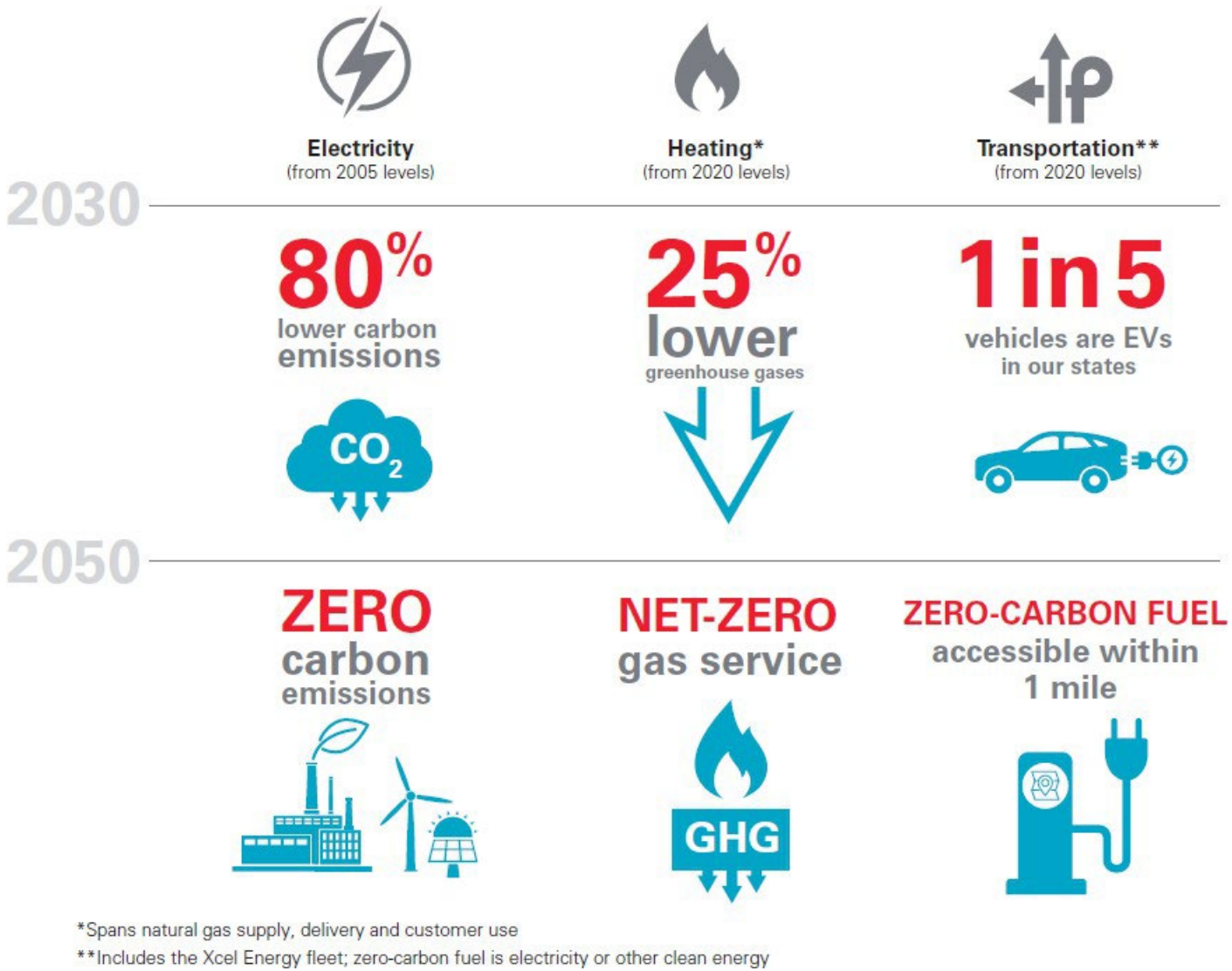
1. Power Grid Basics
2. EV Introduction
3. Distribution Planning For EV's - Deep Dive
4. State of EV Adoption
5. Looking forward
6. Q&A

Electric Power System Planning



Xcel Energy Net-Zero Energy Provider by 2050

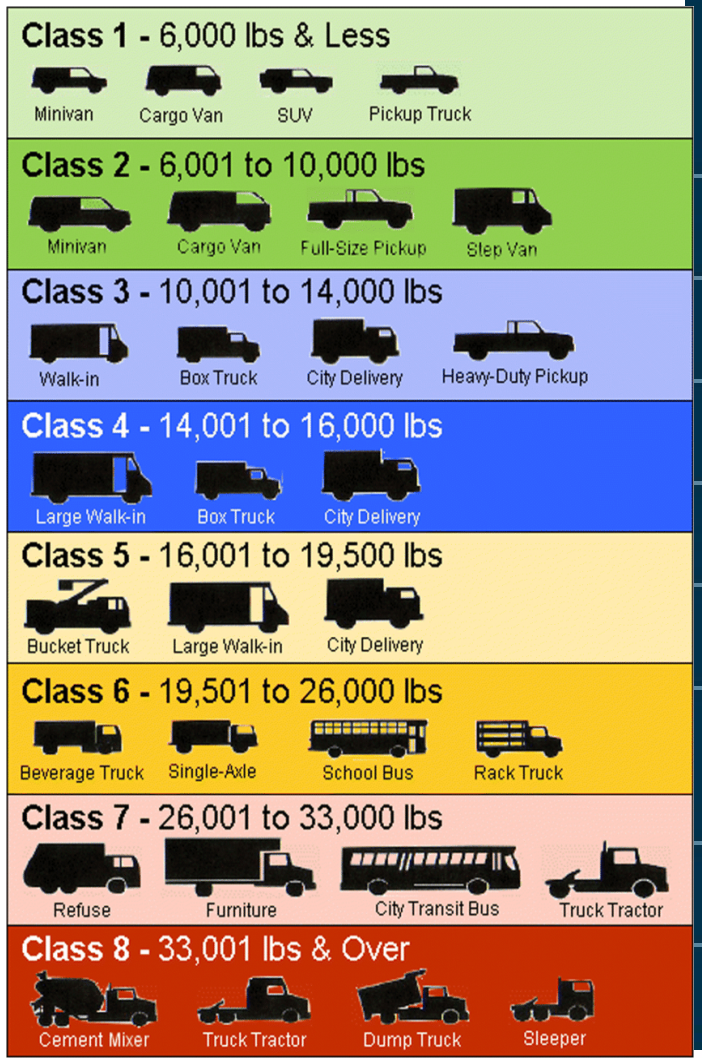
Goals that cover all the ways our customers use energy



*Spans natural gas supply, delivery and customer use

**Includes the Xcel Energy fleet; zero-carbon fuel is electricity or other clean energy

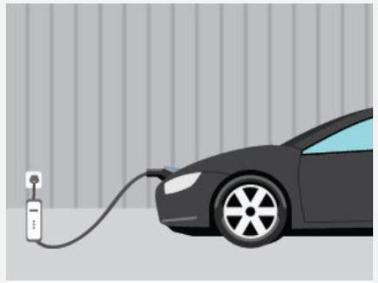
Federal Highway Administration – Vehicle Weight Classifications



Gross Vehicle Weight Rating (lbs)	Federal Highway Administration	
	Vehicle Class	GVWR Catagory
<6,000	Class 1: <6,000 lbs	Light Duty <10,000 lbs
10,000	Class 2: 6,001 – 10,000lbs	
14,000	Class 3: 10,001 – 14,000 lbs	Medium Duty 10,001 – 26,000 lbs
16,000	Class 4: 14,001 – 16,000 lbs	
19,500	Class 5: 16,001 – 19,500 lbs	
26,000	Class 6: 19,501 – 26,000 lbs	
33,000	Class 7: 26,001 – 33,000 lbs	Heavy Duty >26,001 lbs
>33,000	Class 8: >33,001 lbs	

EV Charger Types

AC Level 1



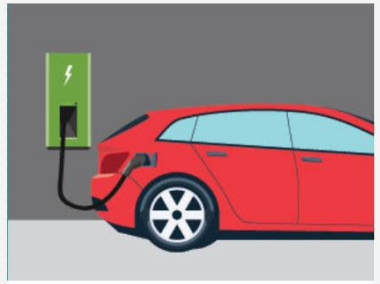
VOLTAGE:
120V 1-Phase AC

AMPS:
12-16 Amps

CHARGING LOADS:
1.4 to 1.9 kW

CHARGE TIME FOR VEHICLE:
3-5 Miles of Range Per Hour

AC Level 2



VOLTAGE:
208V or 240 V 1-Phase AC

AMPS:
12-80 Amps (Typ. 32 Amps)

CHARGING LOADS:
2.5 to 19.2 kW (Typ. 6.6 kW)

CHARGE TIME FOR VEHICLE:
10-20 Miles of Range Per Hour

DC Fast Charge

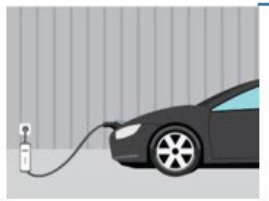
VOLTAGE:
208V or 480V 3-Phase AC

AMPS:
<200 Amps (Typ. 60 Amps)

CHARGING LOADS:
<150 kW (Typ. 50 kW)

CHARGE TIME FOR VEHICLE:
80% Charge in <30 Minutes

Types of EV Charging

		Range	Application
Level 1		2 to 5 miles of range per hour	• Single Family Homes • Multi-Unit Residential • Condos
Level 2		10 to 30 miles of range per hour	• Single Family Homes • Multi-Unit Residential • Workplace • Fleet • Public
Level 3 (Direct Current Fast)		150 to 350+ miles of range per hour	• Fleet • Public • Multi-Unit Residential

EV Ecosystem and Terminology

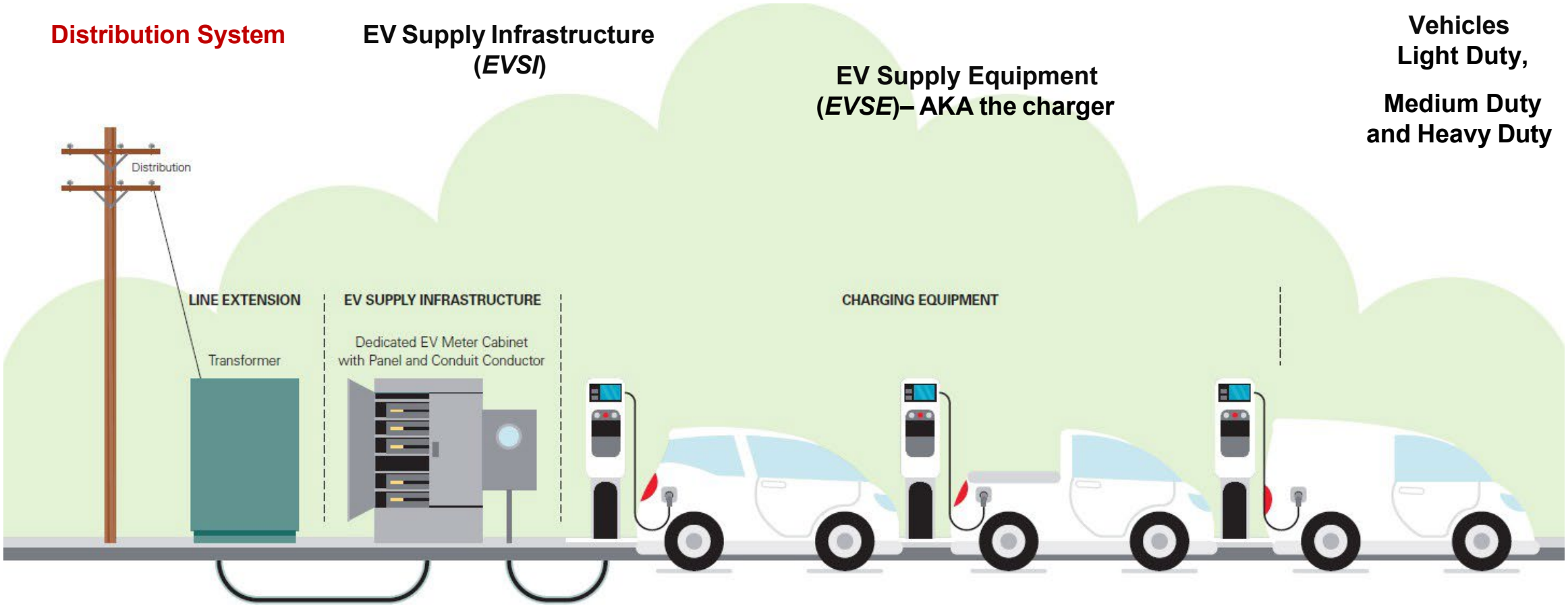
Distribution System

EV Supply Infrastructure (*EVSI*)

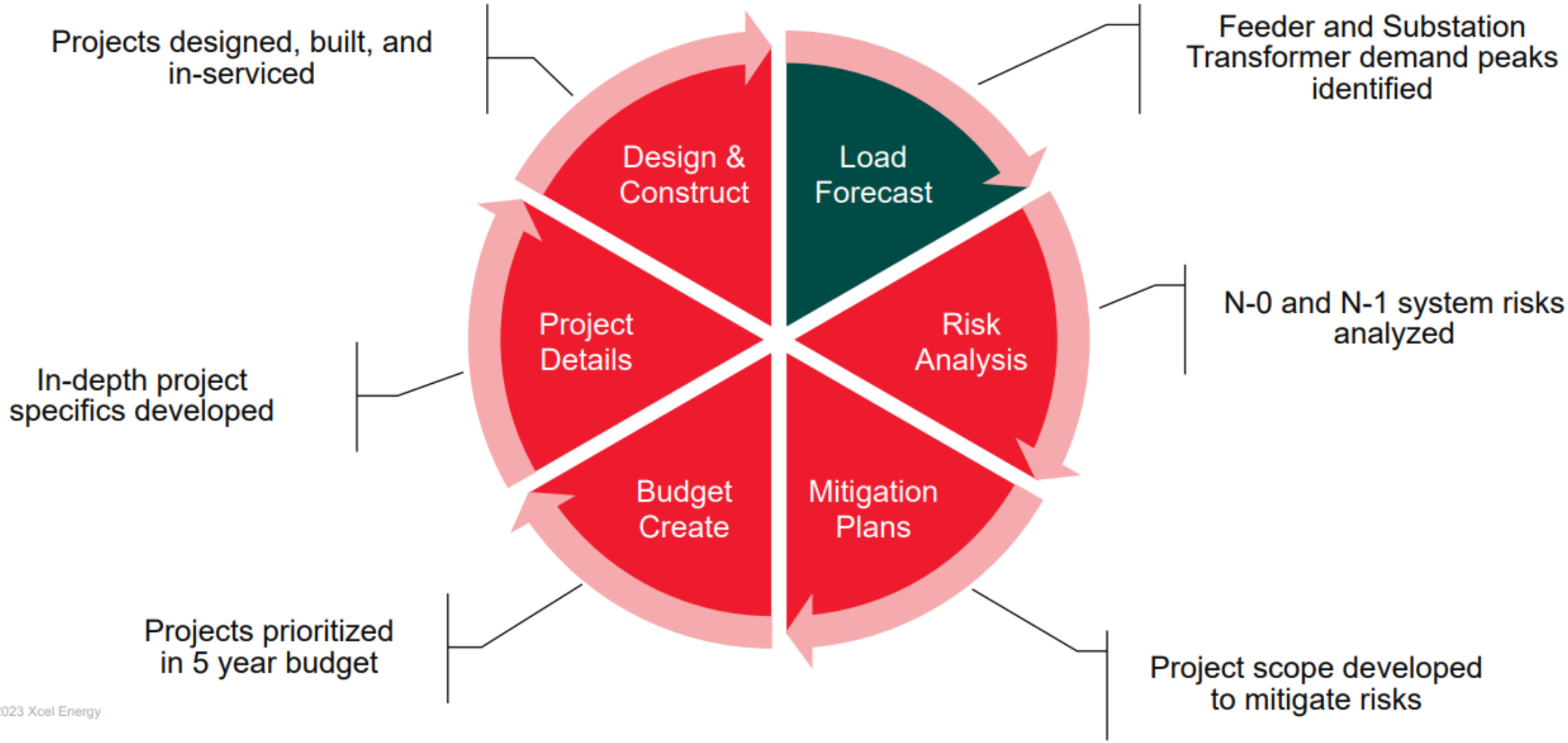
EV Supply Equipment (*EVSE*)– AKA the charger

Vehicles Light Duty,

Medium Duty and Heavy Duty



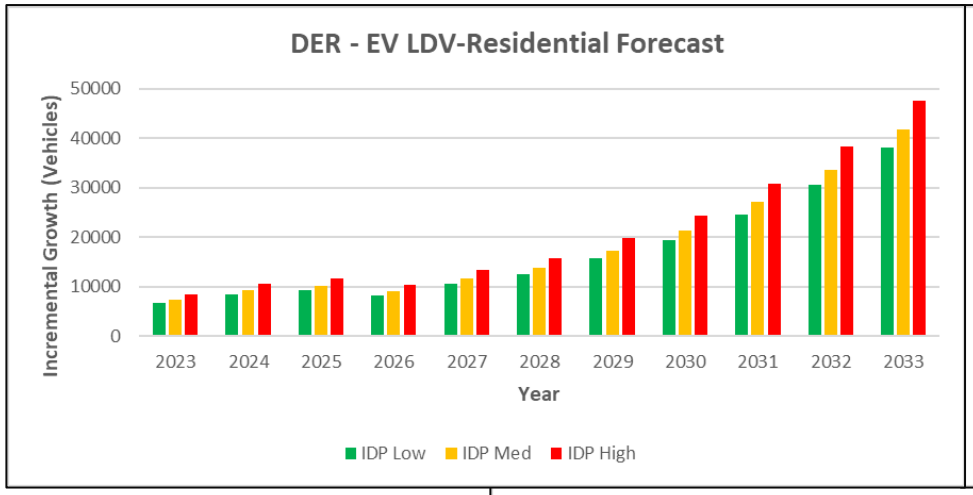
Distribution Planning Process Review

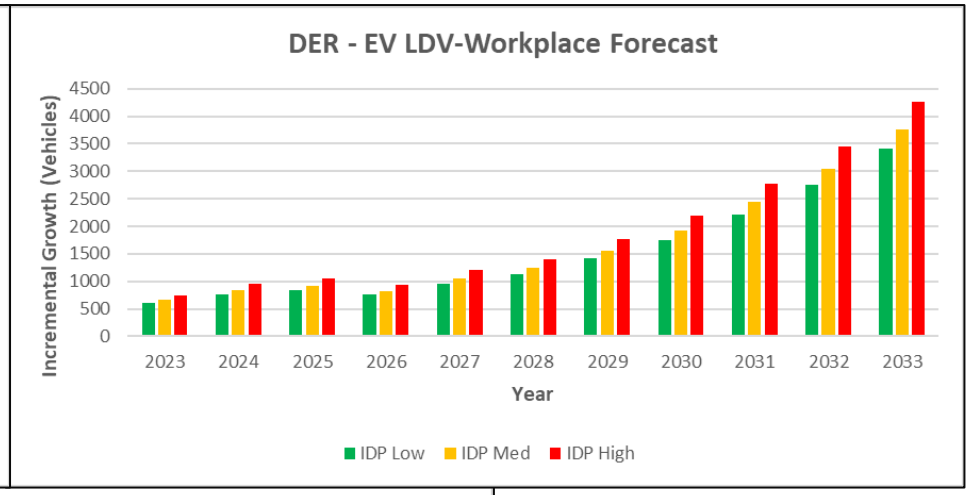


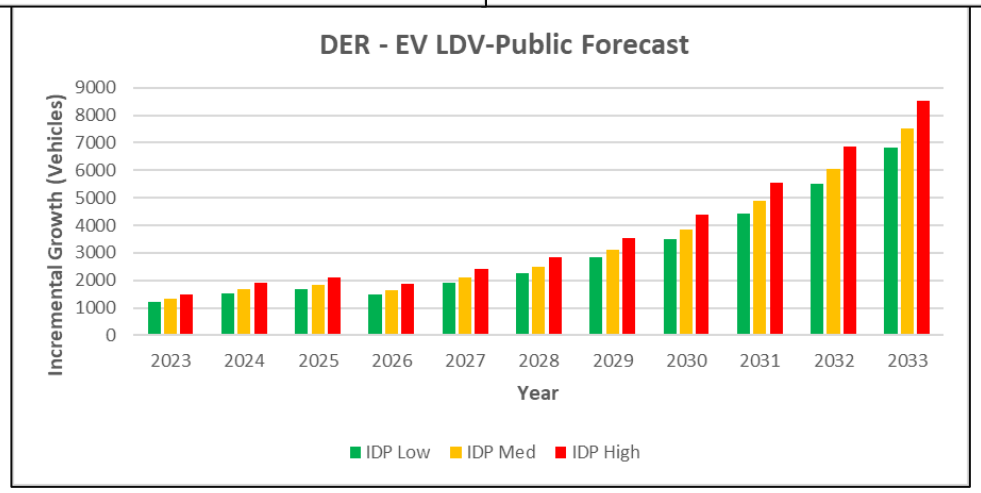
Load Forecast

- **Objective:** Identify future distribution system peak loading based on known and anticipated load growth
- Forecast up to 30 years into the future, years 2-5 are focus for analysis
- Forecast developed for each feeder circuit and substation transformer
  - Location specific – *where* is the load growth expected to occur
- Layer impacts of multiple different high-level forecasts into distribution forecast
  - Traditional load growth forecast
  - EV forecasts
  - Building Electrification forecast
  - Solar forecasts, etc.

DER Forecasts – *Electric Vehicles – Light Duty Vehicles*







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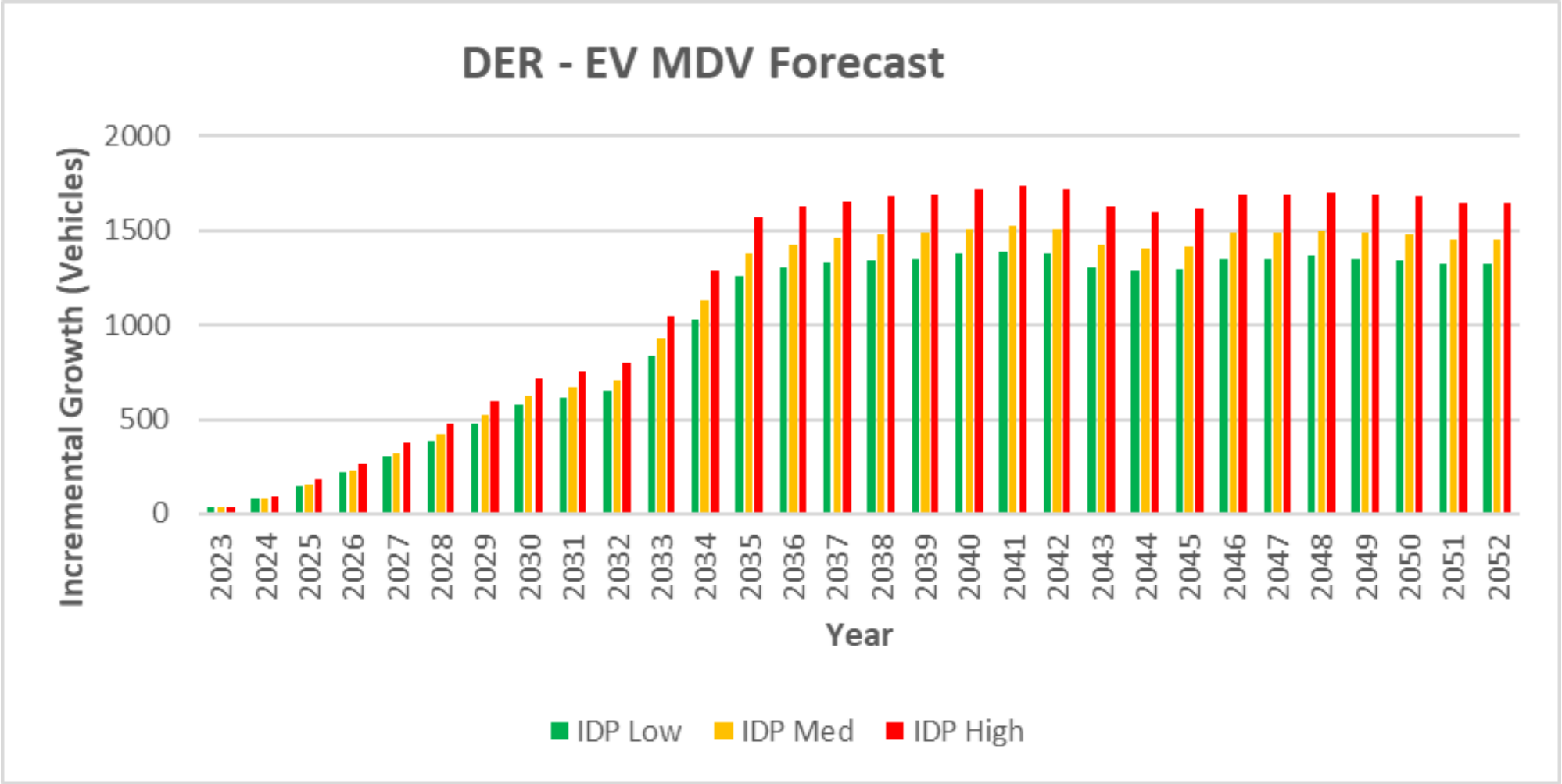
DER Forecasts – *Electric Vehicles – Medium Duty Vehicles*



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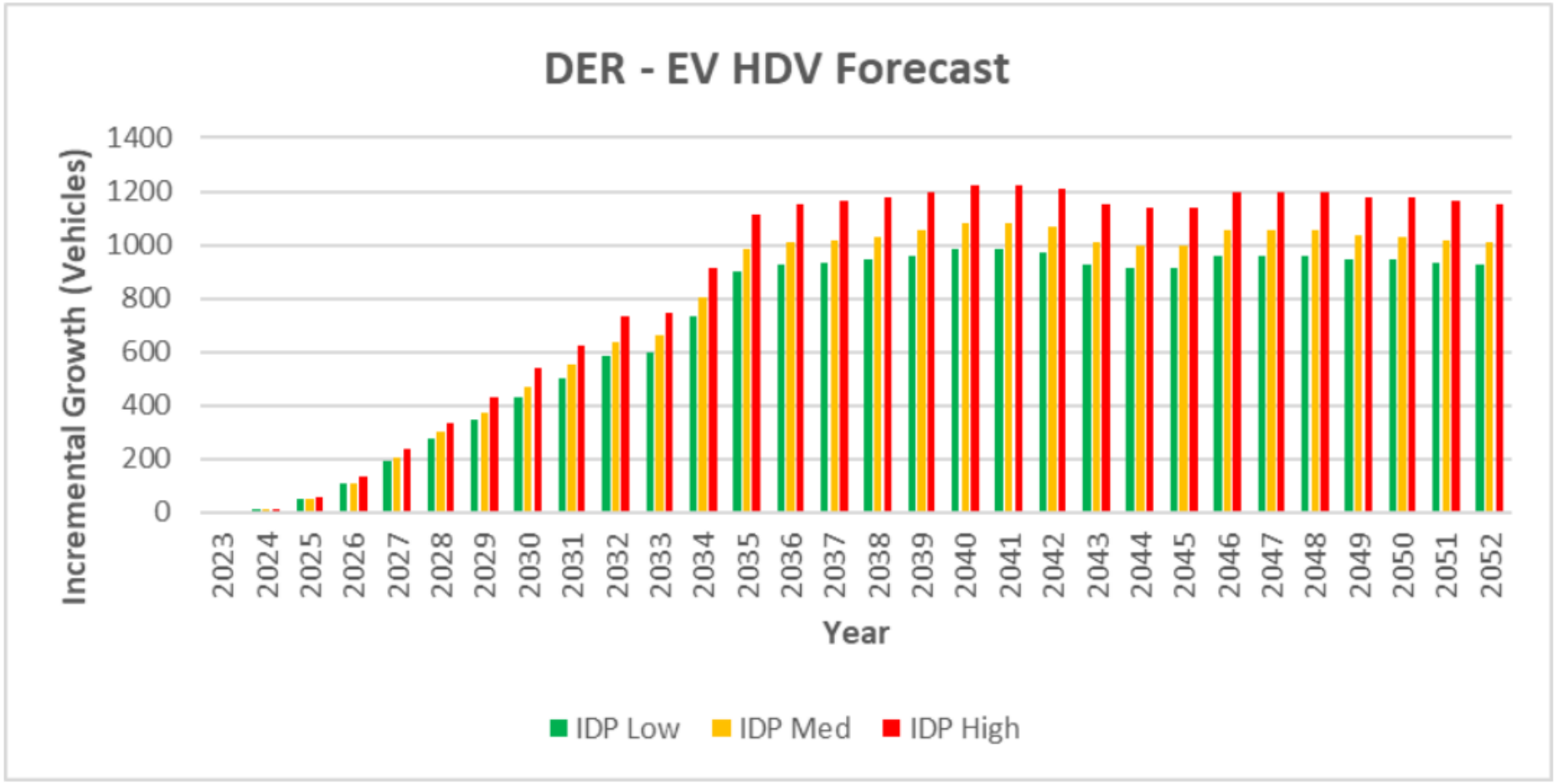
DER Forecasts – *Electric Vehicles – Heavy Duty Vehicles*



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How Forecasts Come Together

- Forecasting layers are merged as different scenarios
- Example scenario setup:

MN Base

- TLY Shape
- Adjustments
- Corporate Forecast

MN Base DER

- TLY Shape
- Adjustments
- Corporate Forecast (EE, DSM)
- EV Forecast (LDV, MDV, HDV)
- Beneficial Electrification (Residential)
- Battery (Behind the Meter)
- Solar (CSG, Rooftop)

MN Base DER +10%

- TLY Shape
- Adjustments
- Corporate Forecast
- EV Forecast +10%
- Beneficial Electrification +10%
- Battery +10%
- Solar +10%

MN Base DER +25%

- TLY Shape
- Adjustments
- Corporate Forecast
- EV Forecast +25%
- Beneficial Electrification +25%
- Battery +25%
- Solar +25%

How Forecasts Come Together

- For each of the scenarios:
  - Merges the load growth from all the adoption points identified
  - Aggregate all the data to the feeder/substation transformer levels
- Example forecast:

Node Name	NodeID	2024 Peak Load	2025 Peak Load	2026 Peak Load	2027 Peak Load	2028 Peak Load	2029 Peak Load	2030 Peak Load	2031 Peak Load	2032 Peak Load	2033 Peak Load	2034 Peak Load	2035 Peak Load	2036 Peak Load	2037 Peak Load
Substation 1	SUB1	40335	40335	40403	40560	40573	40573	40573	40573	40573	40573	40573	40694	40831	40903
SUB1_13.8 kV	SUB1_13.8 kV	40335	40335	40403	40560	40573	40573	40573	40573	40573	40573	40573	40694	40831	40903
Substation 1 115/13.8 kV TR1	SUB1_TR1	29536	29536	29549	29690	29697	29697	29697	29697	29697	29697	29697	29779	29848	29892
Substation 1 115/13.8 kV TR2	SUB1_TR2	15621	15621	15684	15697	15703	15703	15703	15703	15703	15703	15703	15745	15822	15853
Substation 1 115/13.8 kV FDR061	FDR061	8930	8930	8934	8977	8982	8982	8982	8982	8982	8982	8982	8994	9012	9018
Substation 1 115/13.8 kV FDR062	FDR062	11994	11994	12001	12007	12008	12008	12008	12008	12008	12008	12008	12053	12095	12106
Substation 1 115/13.8 kV FDR063	FDR063	11201	11201	11205	11328	11330	11330	11330	11330	11330	11330	11330	11363	11379	11412
Substation 1 115/13.8 kV FDR081	FDR081	5814	5814	5818	5820	5824	5824	5824	5824	5824	5824	5824	5852	5882	5886
Substation 1 115/13.8 kV FDR082	FDR082	7780	7780	7786	7789	7790	7790	7790	7790	7790	7790	7790	7794	7825	7841
Substation 1 115/13.8 kV FDR083	FDR083	5831	5831	5875	5880	5881	5881	5881	5881	5881	5881	5881	5887	5893	5897
Substation 1 115/13.8 kV FDR084	FDR084	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Substation 2	SUB2	36623	36623	36652	36669	36679	36679	36679	36679	36679	36679	36679	36752	36886	37030
SUB2_13.8 kV	SUB2_13.8 kV	36623	36623	36652	36669	36679	36679	36679	36679	36679	36679	36679	36752	36886	37030
Substation 2 115/13.8 kV TR1	SUB2_TR1	17211	17211	17224	17232	17235	17235	17235	17235	17235	17235	17235	17271	17351	17427
Substation 2 115/13.8 kV TR2	SUB2_TR2	22295	22295	22309	22319	22325	22325	22325	22325	22325	22325	22325	22361	22410	22475
Substation 2 115/13.8 kV FDR061	FDR061	7004	7004	7008	7010	7011	7011	7011	7011	7011	7011	7011	7020	7026	7031

What We Do With The Forecast Results

Delicate balance to strike:

- Known Peak Load Growth
  - Minimum requirement for investment
- Speculative Peak Load growth
  - Balance proactive investment against risk of stranded assets

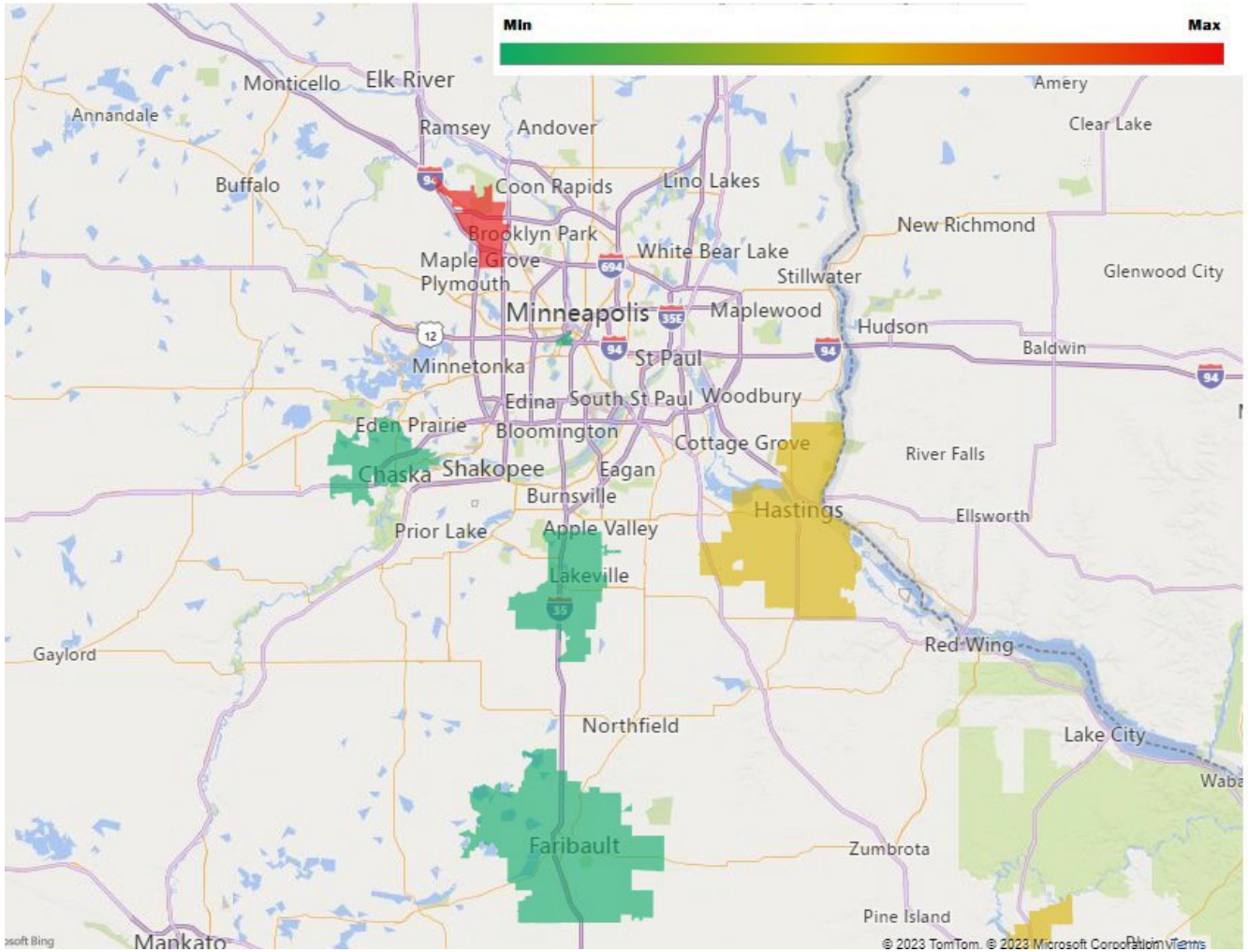
Where are you investing in the system?

- Choosing “no regrets” proactive projects
- Prioritizing projects appropriately to meet customer and grid needs
- Maintaining safety and operational excellence
- Accounting for lead times in project planning

Processes are evolving

Current Adoption Trends

- Using MNDOT vehicle registration data from July 2023, within MN Xcel service territory we have:
  - 34k LDV EV's (effectively 1% EV penetration)
  - 9 MDV EV's (effectively <1% EV penetration)
  - 11 HDV EV's (effectively <1% EV penetration)
- Some things to consider:
  - A lot more LDV EV models available on market, MDV/HDV tech largely still in development
  - Each state has different policies impacting adoption



Planning Predictions

- New technology (MDV, HDV) is hard to forecast simply because there is little data to support customer behaviors & trends
- Concept of a gas station/rest stop changes to accommodate longer charging times
- Long haul trucking has different grid impacts from DCFC compared to LDV
- Dedicated EV charging sites take a large amount of load, depending on the scope/location, it could take entire substation's capacity
  - Also takes a lot of land, these sites more likely to be in suburbs & rural areas (sometimes smaller substations)
- Long lead times on equipment extends project timelines
  - Depending on supply chain: service transformers can be 1+ year out, substation transformers can be 3+ years out

LOOKING FORWARD

- EV's are complicated to plan for
- MDV/HDV Technology still new and needs time to grow and mature
- Intelligent forecasting methods will grow with more EV adoption
- Xcel is currently addressing current system capacity constraints and future capacity constraints to accommodate EV adoption
- Collaboration opportunity: reach out to Xcel as soon as possible
  - Mutually beneficial: helps both sides account for capacity constraints & long lead times

NEW REPORT!

ATRI American Transportation Research Institute

Charging Infrastructure Challenges for the U.S. Electric Vehicle Fleet

New research from the American Transportation Research Institute (ATRI) provides an assessment of the infrastructure needs for electrification of the U.S. vehicle fleet, with an emphasis on the trucking industry. This analysis focuses on three infrastructure components that may prove challenging for electrifying the nation's vehicle fleet:

1. **U.S. Electricity Supply and Demand**
2. **Electric Vehicle Production**
3. **Truck Charging Requirements**

CHALLENGE #1
U.S. Electricity Supply and Demand
- Electricity Production
- Power Grid
- User Demand

CHALLENGE #2
Electric Vehicle Production
- Mining
- Raw Materials
- Country of Origin
- Environment/ Social Issues

CHALLENGE #3
Truck Charging Requirements
- Parking
- Charging
- Costs

ATRI's research identified key findings in each of these three infrastructure components.

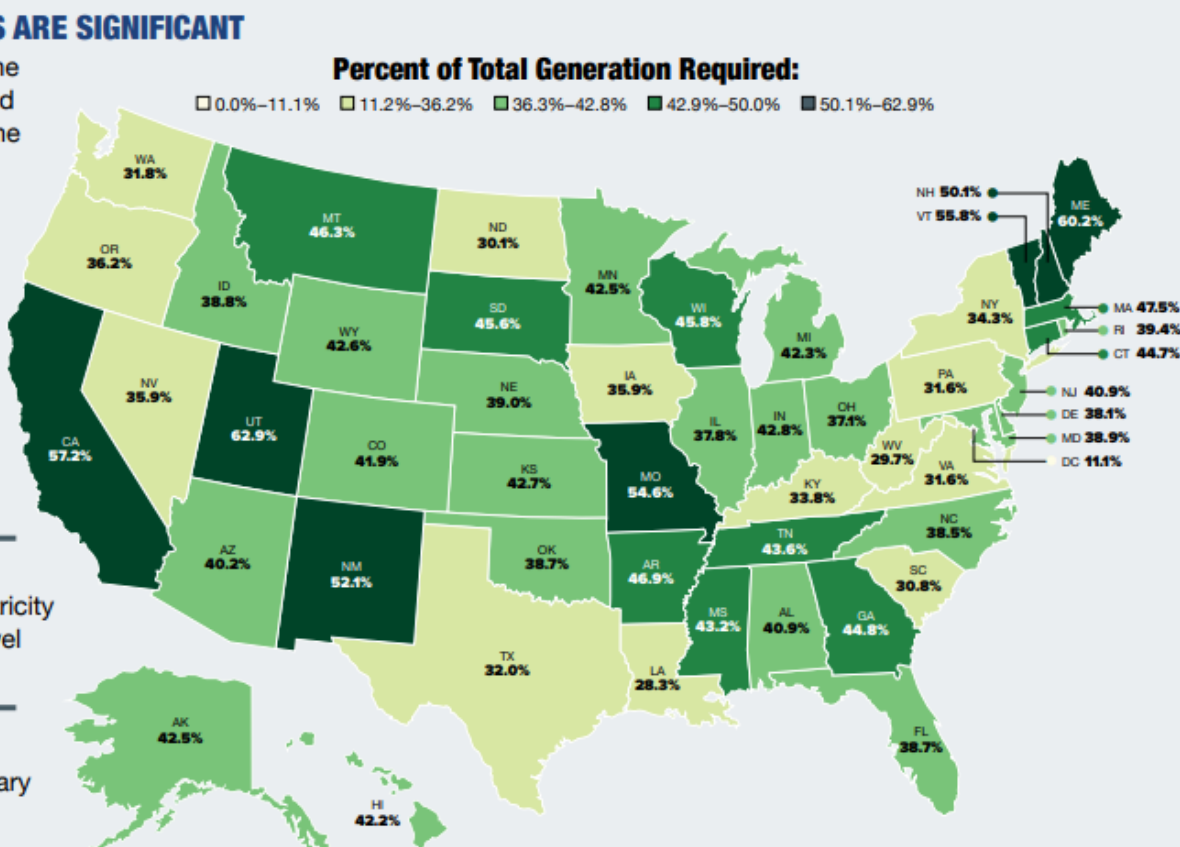
ELECTRICITY NEEDS ARE SIGNIFICANT

Full electrification of the U.S. vehicle fleet would require a large percentage of the country's existing electricity generation including:

- 26.3 percent for passenger cars and trucks
- 14 percent for all freight trucks, including 10.6 percent for long-haul trucks
- 40.3 percent for all vehicles

Some states would need more than 50 percent of current electricity generation to meet vehicle travel needs (see map at right).

Large-scale infrastructure investment would be a necessary precursor to electrification.



Key Findings

Continued

BATTERY MATERIALS DOMINATE BATTERY ELECTRIC VEHICLE (BEV) VIABILITY

Tens of millions of tons of cobalt, graphite, lithium and nickel will be needed to replace the existing U.S. vehicle fleet, placing high demand on raw materials.

Depending on the material, this represents:

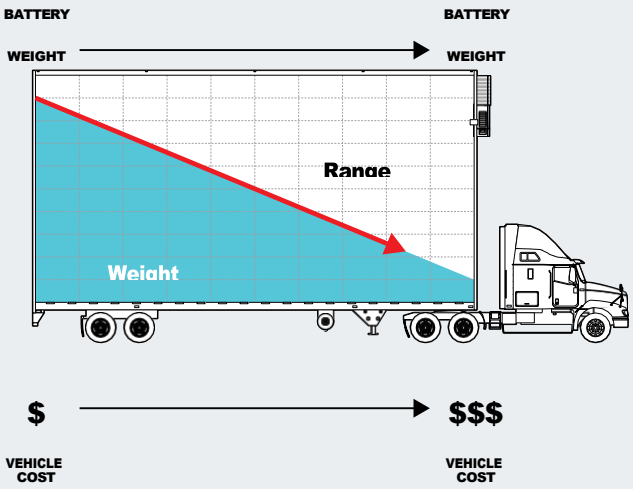
- 6.3 to 34.9 years of current global production.
- 8.4 to 64.4 percent of global reserves.

BEV production has considerable environmental and social impacts:

- Mining and processing produce considerable CO_2 and pollution issues.
- In some operations, a minimum of one million gallons of water must be utilized to produce a single pound of lithium.
- Exploitation of labor is common in some source countries.

BEV TRUCK CONUNDRUM

Battery weight increases price and vehicle range, but decreases cargo revenue weight. Ultimately more BEV trucks will be needed on already congested roadways to haul the same amount of freight.



TRUCK CHARGING AVAILABILITY WILL BE THE TRUCK PARKING CRISIS 2.0

Using today's truck and charging requirements, more chargers will be needed than there are parking spaces.

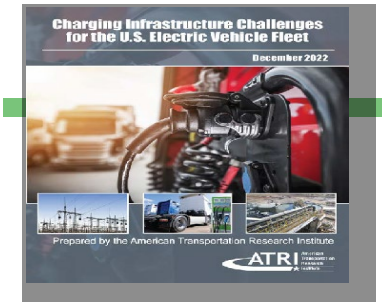
Regardless of advances in battery capacity or charge rates, BEV charging will be limited by federal Hours-of-Service rules for drivers and parking availability.

Initial equipment and installation costs at the nation's truck parking locations will top $35 billion, based on average per-unit purchase and installation costs of $112,000.

Additionally, to understand the truck parking challenges, ATRI quantified the truck charging needs at a single rural rest area, which would require enough daily electricity to power more than 5,000 U.S. households.

Other barriers include laws preventing commercial charging at public rest areas and the remoteness of many truck parking locations

In the near term there are discrete applications for BEV trucks. Local and regional truck operations that rely on shorter trips and return the truck to terminals for nightly charging are feasible today. In the absence of public policies that mandate the purchase of these BEVs, carriers themselves will have to decide if the costs and benefits of a BEV truck fit well with their business models. And those decisions will be conditioned on truck costs, shipper/freight requirements, and access to abundant and inexpensive electricity. Issues arise however if any one or more of these decision-making inputs is not viable.



Producing BEV trucks that meet carriers' operational requirements, including impacts on operations and balance sheets and providing ample charging, must be addressed by the entire supply chain. Utilities must ensure that expanded electrification is feasible as well. It is inappropriate, however, to place these burdens squarely on motor carriers.

ATRI American Transportation Research Institute

NEW REPORT!

Understanding the CO_2 Impacts of Zero-Emission Trucks

New research from the American Transportation Research Institute (ATRI) analyzed the environmental impacts of Class 8 zero-emission trucks (ZETs). The research utilized federal and industry-sourced data to identify and compare full life-cycle CO_2 emissions for a range of truck types:

- Internal combustion engine (ICE) trucks powered by diesel
- Battery electric vehicle (BEV) trucks powered by electricity
- Fuel cell electric vehicle (FCEV) trucks powered by hydrogen

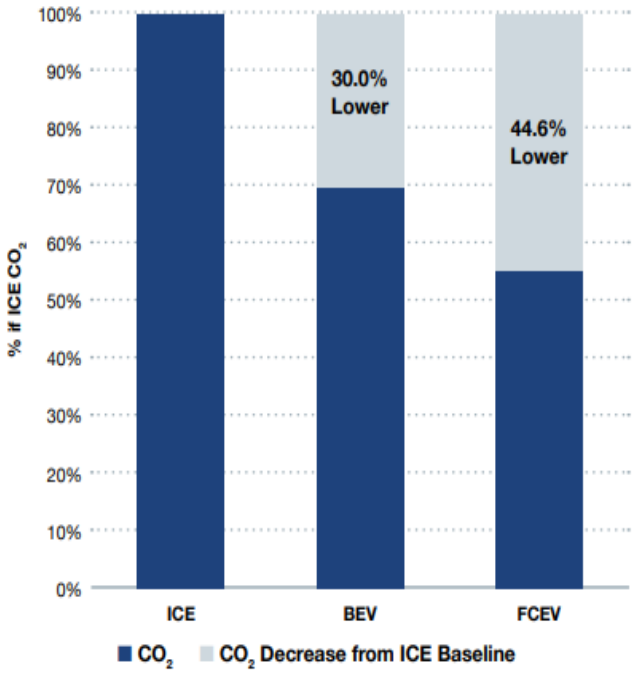
ATRI's analysis compared CO_2 emissions across the full vehicle life-cycle:

- Vehicle production
- Energy production and consumption
- Vehicle disposal/recycling

The study found that full life-cycle CO_2 emissions for the battery electric truck would only generate 30 percent fewer emissions than the standard diesel truck.

The marginal environmental benefits of electric trucks are due, in large part, to lithium-ion battery production – which generates more than six times the carbon of diesel truck production. ATRI's research concludes that hydrogen fuel cell trucks (FCEV) are ultimately the most environmentally friendly truck type, although the technology is not presently feasible for long-haul operations.

Lifetime CO_2 Emissions for Class 8 Diesel Truck (ICE) vs BEV & FCEV



Realities of Zero-Emission Trucks

VEHICLE COST

ZET vehicle costs will be a strong barrier to entry. While a new Class 8 diesel truck tractor may cost roughly $135,000 to $150,000, the purchase price of a new Class 8 BEV can be as much as $450,000. The same issue will likely impact the FCEV. Estimates for fuel cell truck costs range from $200,000 to $600,000 with 60 percent of the overall cost solely credited to the fuel cell propulsion system.

SOURCING OF MATERIALS AND SUPPLY CHAIN ISSUES

There are several key raw materials needed for lithium-ion batteries; depending on the battery chemistry, these might include lithium, graphite, cobalt, manganese and nickel. While these materials are critical for batteries and for the production of a large BEV national fleet, the U.S. is almost entirely dependent on other countries for these materials. Over the past decade, the U.S. has imported nearly 100 percent of the critical minerals needed for battery production from countries including China, Australia, Chile and the Democratic Republic of Congo.

REFUELING INFRASTRUCTURE

There currently is no U.S. network where over-the-road trucks can stop for rest breaks and recharging at the same time. In a forthcoming report, ATRI is documenting the infrastructure requirements of a nationwide truck charging network and the electricity sector's ability to power the U.S. truck fleet.

BATTERY LIFE

It is well understood that lithium-ion batteries begin to slowly degrade once the charging and discharging process commences, and battery degradation is greatly influenced by the number of charge cycles. Separate from the number of charging cycles, there is evidence that the *rate* at which a BEV is charged could impact battery life. Because of operational constraints – such as driver hours-of-service – and the large energy capacity of a truck battery, faster charging may be necessary.

Realities of Zero-Emission Trucks

Continued

BATTERY PERFORMANCE

Ambient temperatures can affect the battery performance of electric vehicles. Cold weather slows the chemical and physical reactions that make batteries work, leading to longer charging times and a temporary reduction in range. Conversely, higher temperatures generally lead to faster chemical and physical reactions.

In addition, low or elevated temperatures can initiate the use of electric air conditioning or heating systems, which can draw significant amounts of battery power – with an accompanying reduction in driving range.

Topography also has a strong influence on energy consumption and battery operation as well. On an uphill grade, all vehicles expend more energy than when traveling on level ground. Energy consumption for electric vehicles tends to steadily increase as road grade increases.

BATTERY WEIGHT AND CARGO CAPACITY

Battery weight may substantially limit the long-haul capabilities of a BEV, leading to a need for more BEV vehicles to carry the same amount of cargo. Those carriers operating closer to the maximum allowable weight will likely have to modify their operations if they wish to use long-haul battery electric vehicles.

Vehicle, Trailer and Cargo Weight

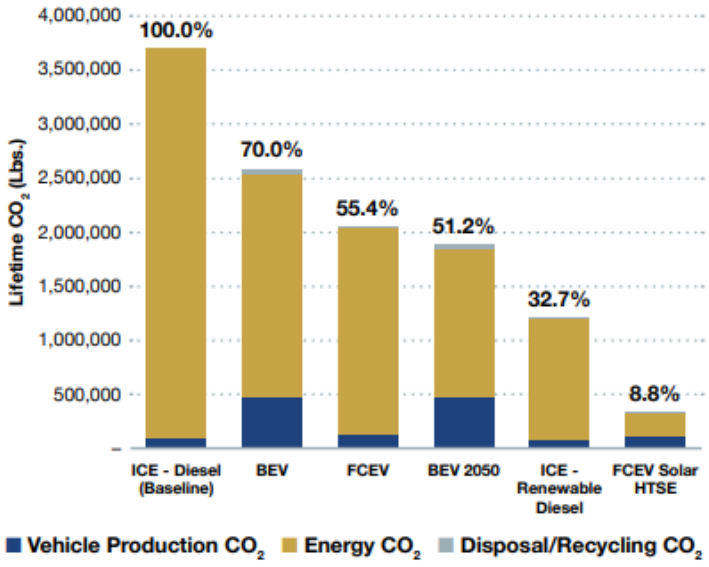
WEIGHT TYPE (lbs.)	ICE	BEV	FCEV
Tractor Weight	18,216	32,016	21,337
Trailer Weight	11,264	11,264	11,264
Average Cargo Weight	32,811	32,811	32,811
Total Weight	**62,291**	**76,091**	**65,412**
Remaining Available Cargo Weight	17,709	3,909	14,588

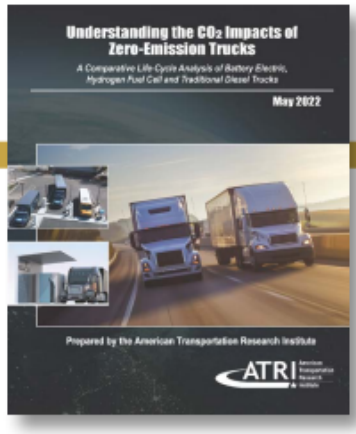
Reducing CO_2 Truck Emissions

ATRI's analysis concludes by identifying additional strategies that can reduce CO_2 truck emissions for all three energy sources – diesel, electricity and hydrogen. For example, renewable diesel could decrease CO_2 emissions to only 32.7 percent of a standard diesel engine without requiring new infrastructure or truck equipment. Hydrogen sourced from solar-power electricity could enable hydrogen fuel cell trucks to emit only 8.8 percent of the baseline diesel CO_2.

Overall, the three truck types studied in this report have a pathway for lowering CO_2 emissions in the coming decades. Research is needed to improve upon CO_2 reduction efforts, and specifically to lower energy source CO_2. While public policy is currently focused on moving the industry toward BEV, this research shows that even greater truck CO_2 emission reductions can be achieved through other approaches.

Potential CO_2 Emissions Reduction Options





For a copy of the full report, please visit ATRI's website at TruckingResearch.org

ATRI American Transportation Research Institute

Work Group Meeting #5 – November 8, 2023

Date: November 8, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting
Location: WSB Office, 701 Xenia Ave S, Unit 200, Golden Valley, MN 55416, and hybrid option available

Meeting Summary

Welcome & Project Overview

Amy Fredregill (WSB) thanked everyone for joining the fifth Work Group meeting. Amy reviewed the meeting agenda and objectives.

Meeting objectives included:

- Review timeline and discuss priorities for the next 4 weeks+
- Review and discuss updated fuel pathway scenarios modeled by ICF consulting
- Discuss policy considerations to incorporate in Work Group recommendations
- Continue to co-learn from various perspectives and identify takeaways on priorities

Housekeeping for both in person and online participants was reviewed. Next, Amy went over some Work Group meeting guidelines for the Group to follow during the meeting.

Shannon Engstrom (MnDOT) thanked everyone for joining and introduced herself. Shannon thanked Stephanie Pinkalla, from The Nature Conservancy, who is leaving the Work Group as she is on maternity leave. Shannon welcomed Richard (Rich) Biske, the Protection Director from The Nature Conservancy, who is joining the Work Group in Stephanie's place. She also thanked her colleagues and team members from MnDOT and the consulting team for their hard work preparing for today's meeting.

Next Shannon walked through the timeline, which is marching forward to a February 1st, 2024, deadline for a final report to the legislature. Shannon requested that Work Group members put a reminder on their calendars during the window of Nov 28- Dec 6 for reviewing the draft report and providing comments. There is a virtual Work Group meeting on November 30th to review the draft report and answer any questions. The next Work Group meetings are scheduled for November 21st (in person), November 30th (virtual), and December 13th (virtual). Shannon mentioned that she is available for 1:1 conversations with any Work Group members, especially if they feel like their feedback is not being heard.

Next, Amy discussed takeaways from the October 24th Work Group meeting, followed by an opportunity for Work Group members to provide feedback:

- Although there was support for continuing to bring down emissions, the **modeled scenarios** to meet the targets may not be achievable given what is currently known about fuel pathway technology, infrastructure, markets and fuel availability
- WG members want the policy to be flexible and provide opportunities to **re-evaluate and adapt** at various horizon points as new technologies emerge in the future
- The CTS should be considered one tool in a **suite of policies**; it should not be considered the definitive solution to solve all policy challenges that pertain to transportation fuels
- Members expressed interest in a **fuel-neutral** approach
- WG members wanted to continue to explore how **co-benefits** can be advanced through a CTS, perhaps through creative opportunities to support certain **land use practices and climate smart ag.** Climate smart ag could play an important role if verifiable outcomes are advanced and farmers are rewarded if CI reductions are achieved
- WG expressed a need for **EV** charging infrastructure investments to be made to achieve faster deployment rates
- Members expressed a fair amount of agreement that **SAF** should be an eligible credit generator, but desired more information and discussion on the technicalities
- General support for **CCS** with some caveats such as LCA, community impact, end use, location and permanence of storage. Support expressed for disallowing CCS for **EOR** as an eligible credit generator
- Desire to learn more about assumptions in scenarios as well as seeing **additional scenarios** in future

Some Work Group members expressed disagreement with a few of the draft statements. Upon reviewing the jamboard results from the October 24 meeting, the statements remain as written.

Next, Amy walked through the report's outcomes and recommendations chapter outline. Amy reminded the Group again to mark their calendars for November 28th-December 6th to review the draft report.

Amy introduced Philip Sheehy (ICF) and turned to him for his modeling presentation.

Philip thanked the Group for having him in person at the meeting. First, he reminded the Work Group that the scenario modeling is meant to be an iterative process, whereby policy options and modeling assumptions drive the results. The (draft) results then inform potential modifications to the policy considerations and modeling assumptions/inputs. ICF is presenting the second iteration of this process.

Philip shared previous observations from the modeling. The modeling suggests that the first iteration of the modeling was difficult to achieve. ICF reformulated the approach to the modeling based on feedback from Work Group members in the last meeting on October 24th. Next, Philip presented updated modeling considerations:

- **Develop a Reference Case**: Reflect ICF's view on most likely deployment of clean fuels and vehicles out to 2050.

- **Develop Sensitivity Cases**: Reflect optimistic outlook one bucket at a time. Buckets: ethanol, biodiesel, renewable diesel, renewable jet fuel, zero emission vehicles in light-duty sector (electricity and hydrogen), zero emission vehicles in heavy-duty sector (electricity and hydrogen)
- **Develop an All-In Case**: Reflects combination of optimistic outlooks across all buckets simultaneously.

Next, Philip presented some differences in the updated modeling:

- **Shifted Start Year of Program:** Previously, we assumed that the program would start Jan 1, 2025. Shifted all modeling by 1 year to Jan 1, 2026 to allow for ~18 months of rulemaking instead of 6 months.
- **Land Use Change (LUC) Adder**: All cases presented today reflect the higher LUC adder from CARB's 2015 rulemaking. Modeling is flexible and can accommodate a range of values. This should not be construed as a preference on the part of ICF, WSB, or Minnesota state agencies.
- **Develop Recommendations for CI Targets**: ICF modeling is used to develop recommendations around a range of CI targets.

Clean Fuel Bucket	Initial Assumptions
Ethanol	• E15 Blending • Process improvements and Carbon Capture and Storage (CCS) • Climate smart ag: Conservation Stewardship Program (CSP) implementation
Biodiesel	• No changes to blend rate • Process improvement, feedstock changes, climate smart ag
Renewable diesel	• Increased blend rate • Process improvement, feedstock changes, climate smart ag
Renewable jet fuel	• Increased blend rate • Process improvement, feedstock changes, climate smart ag
Renewable natural gas	• Mix of RNG feedstocks assumed: a) landfill gas and b) animal manure
Liquefied petroleum gas	• Assumed transition to renewable propane
ZEVs, light-duty	• Deployment in line with MN Clean Cars + growth thereafter • Decarbonizing grid + book-and-claim (renewable energy certificate (REC) retirement)
ZEVs, heavy-duty	• Moderate adoption of ZEVs in MD/HD sectors • Decarbonizing grid + book-and-claim (REC retirement)

Q & A with Philip Sheehy

Next, Philip took comments and answered questions from the Work Group:

- In the pre-read memo on page 5, the biodiesel blending rate from April 15 to September 30 was stated at 15% but it is actually a 20% requirement.
    - Philip noted this was a typo in the pre-read and will be updated. The data reflects 20%.
- The modeling doesn't take into account infrastructure deployment rate.
    - Philip noted that there are constraints imposed on infrastructure deployment in the Reference Case, and that these same constraints are muted in the sensitivity cases.
- Thank you for including Woody Biomass into the modeling, however, it still feels like a missed opportunity. With renewable diesel, it is a drop-in replacement, and could be 100% replacement.
    - There was a misunderstanding regarding the differences between the blending constraints imposed for renewable diesel and biodiesel. To be clear, there were no blending constraints imposed on renewable diesel and this is reflected in the results.
- Was the LUC adder applied to woody feedstocks?
    - No
- Did you say that under this modeling the assumption is that ethanol production overall would increase?
    - No. There are no increases in ethanol production in the modeling. The modeling accounts for an increase in the blend rate of ethanol with gasoline (from E10 to E15); however, while the blend rate is increasing, the demand for gasoline is decreasing due to efficiency gains (i.e., fuel economy improvements) and transportation electrification. Even with higher blend rates for ethanol, the overall ethanol consumption as a fuel blended with gasoline decreases over time.
- What was updated regarding ZEV heavy duty?
    - The previous round of modeling was built to achieve aggressive targets. Philip estimated that the revised modeling used a deployment outlook that is about 25% of what was presented previously.
- In the data for the reference case, renewable diesel numbers jump around.
    - Philip noted this was a typo and it will be updated.
- The land use change adder is not applied to woody biomass as a feedstock. Forestry is a net negative sector for carbon emissions. Conceivably, converting more land to forest would be a net land use subtractor, not an adder. What is the impediment of taking that conceptual idea into an application process?
    - That pathway assumes a certain availability of woody biomass. If it's a purpose grown woody biomass, that would be treated differently in GREET. If you're converting land, it's unlikely that it can get lower than the carbon intensity included in the modeling, which was 8 g/MJ.
- Will novel feedstocks like camelina have a land use change adder?
    - Philip understands that they would not have a land use change adder.
- It was mentioned that allowing credit generation for early action should be considered. Instead of stating that early action is part of the baseline, provide credits for that action. Ethanol blends are a good example, like E15.

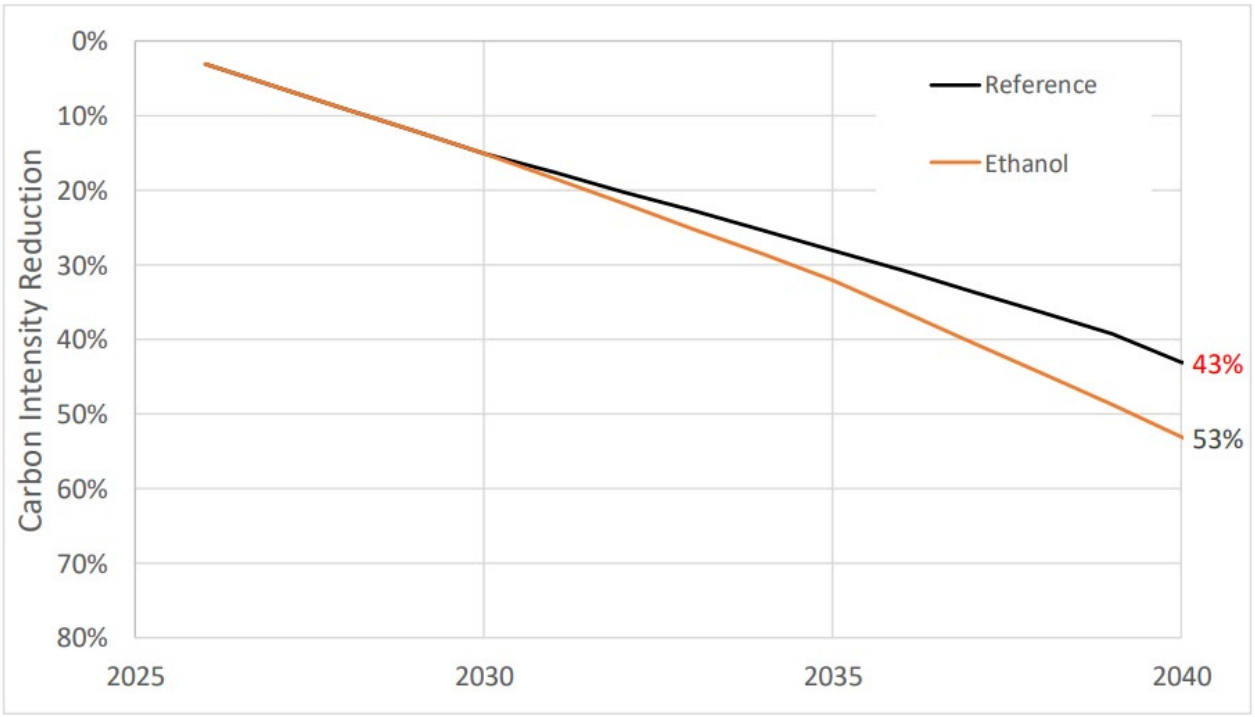
Review Updated Draft Fuel Pathway Scenarios

Next, Philip presented a summary of the reference case. In 2030, the recommended CI reduction would be in the range of 13%-17%. In 2040, the recommended CI reduction would be in the range of 40%-50%. In 2050, the 100% CI reduction target in 2050 may be difficult to achieve based on what we understand about the transportation fuel market today. However, this is a challenging conclusion to assert confidently given the uncertainty regarding the development of expanded use of existing fuels, new feedstocks for fuels, new and novel uses of available feedstocks, and the adoption of new technologies. The ability of the market to achieve a 100% CI target will depend on a variety of technological developments that are difficult to conceive of today.

For each of the sensitivity analysis, ICF modified modeling assumptions within a single area of focus: ethanol, biodiesel, renewable diesel, renewable jet fuel, ZEVs-LD, and ZEVs-HD. Philip presented graphs for each fuel type that focused on the CI trajectory of the program prior to 2040 and presented the near maximum contributions for each. Each graph and their CI reduction results are shown below:

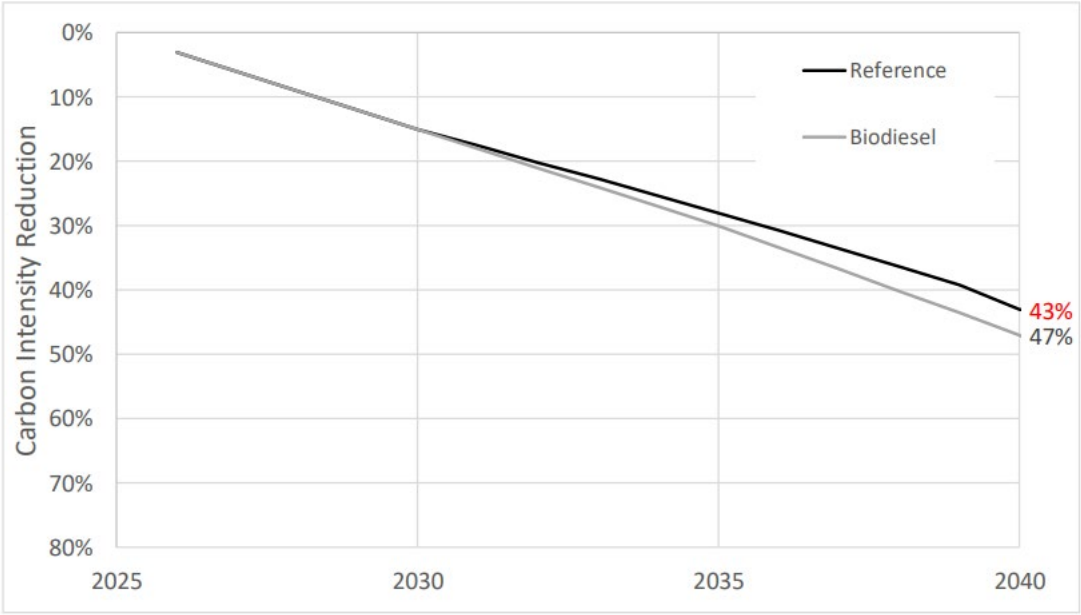
Expanding Ethanol:

Near-maximum contributions of ethanol yield an additional **10% CI reduction** by 2040 compared to the reference case.



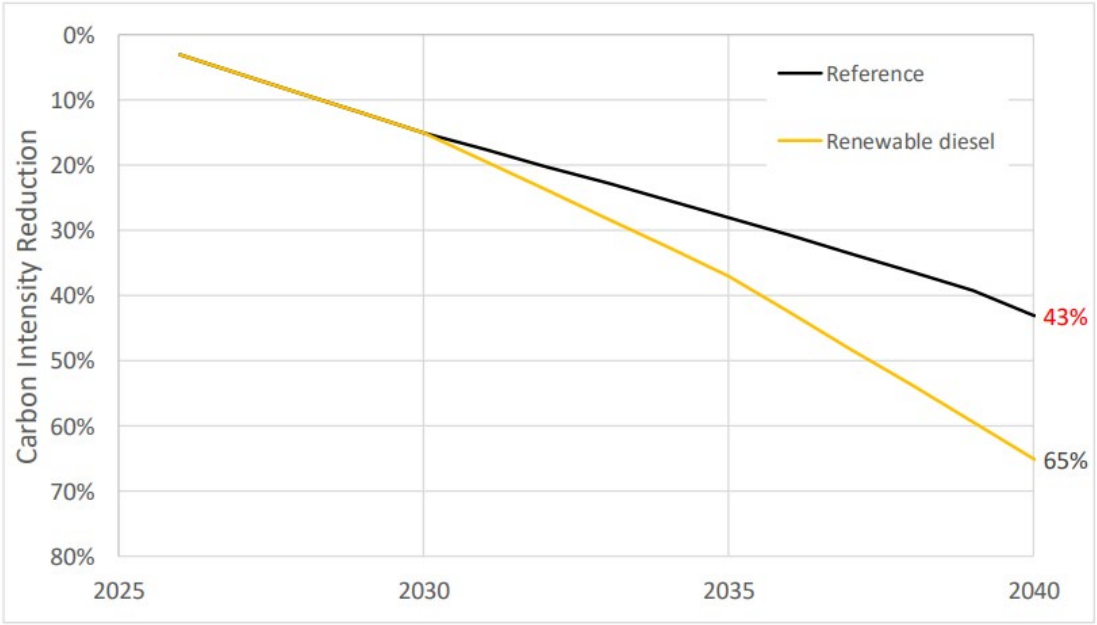
Expanding Biodiesel:

Near-maximum contributions of biodiesel yield an additional **4% CI reduction** by 2040 compared to the reference case.



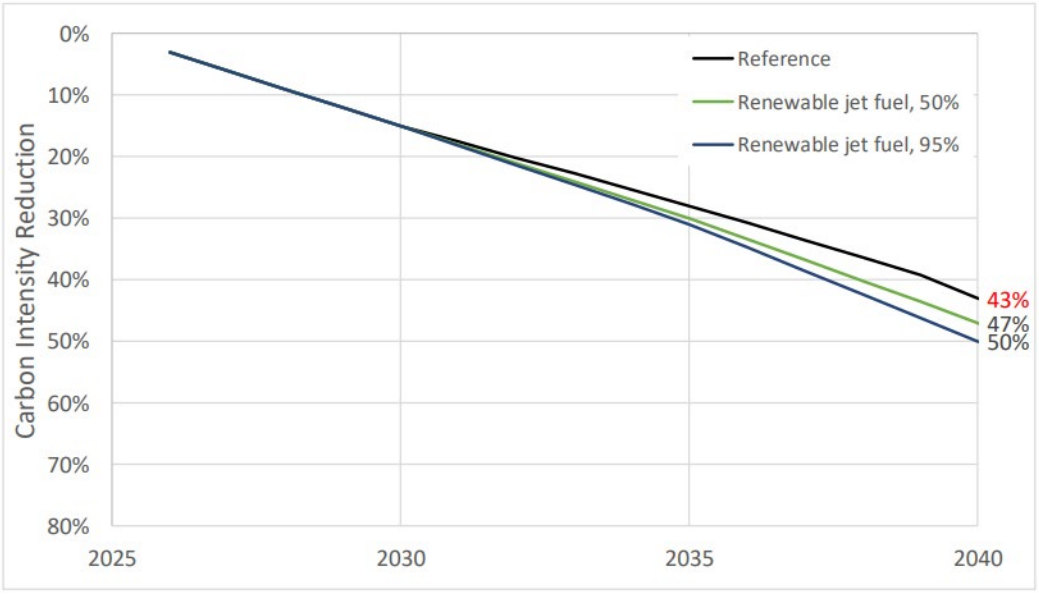
Expanding Renewable Diesel:

Near-maximum contributions of renewable diesel yield an additional **22% CI reduction** by 2040 compared to the reference case.



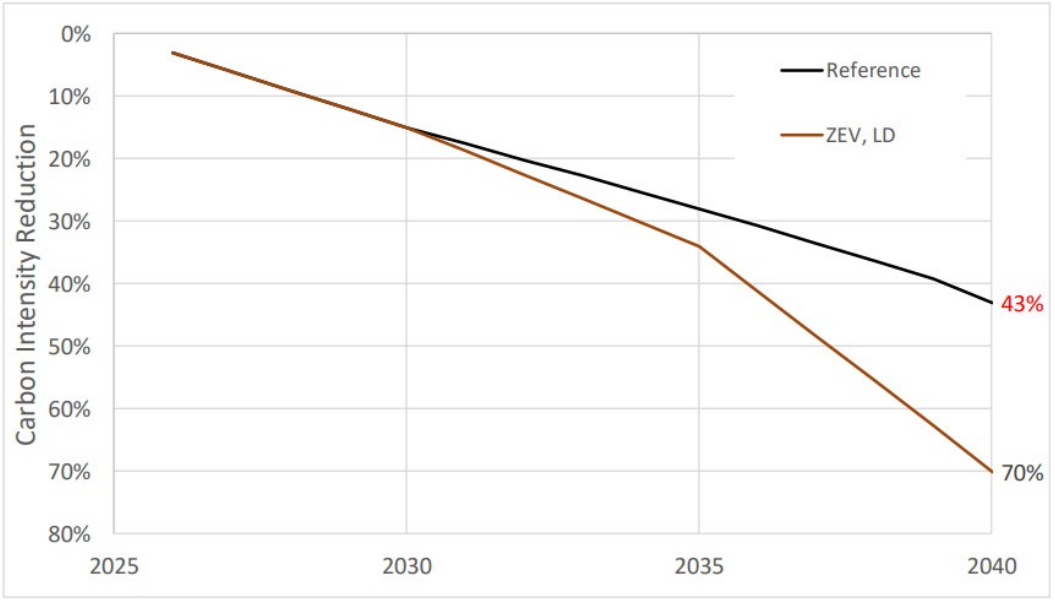
Expanding Renewable Jet Fuel:

Near-maximum contributions of renewable jet fuel yield an additional **4-7% CI reduction** by 2040 compared to the reference case. *Note: "Renewable jet fuel" is used interchangeably with sustainable aviation fuel (SAF). These are the same thing, but the Work Group is moving towards using the term renewable jet fuel.*



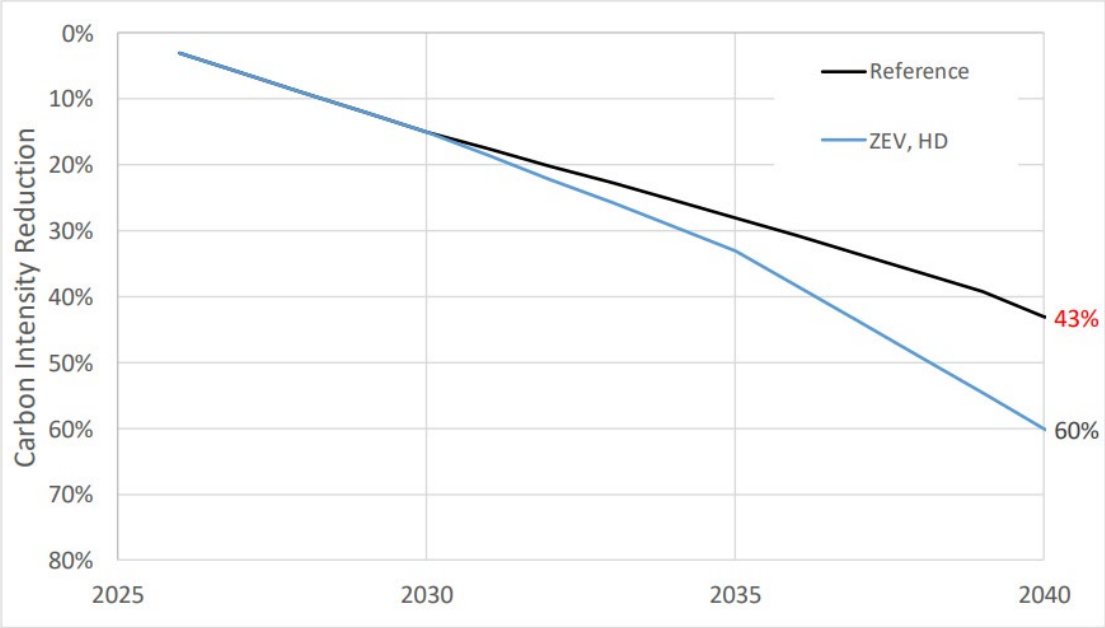
Expanding Zero Emission Vehicles (ZEVs), Light Duty (LD):

Near-maximum contributions of ZEVs-LD yield an additional **27% CI reduction** by 2040 compared to Ref Case.



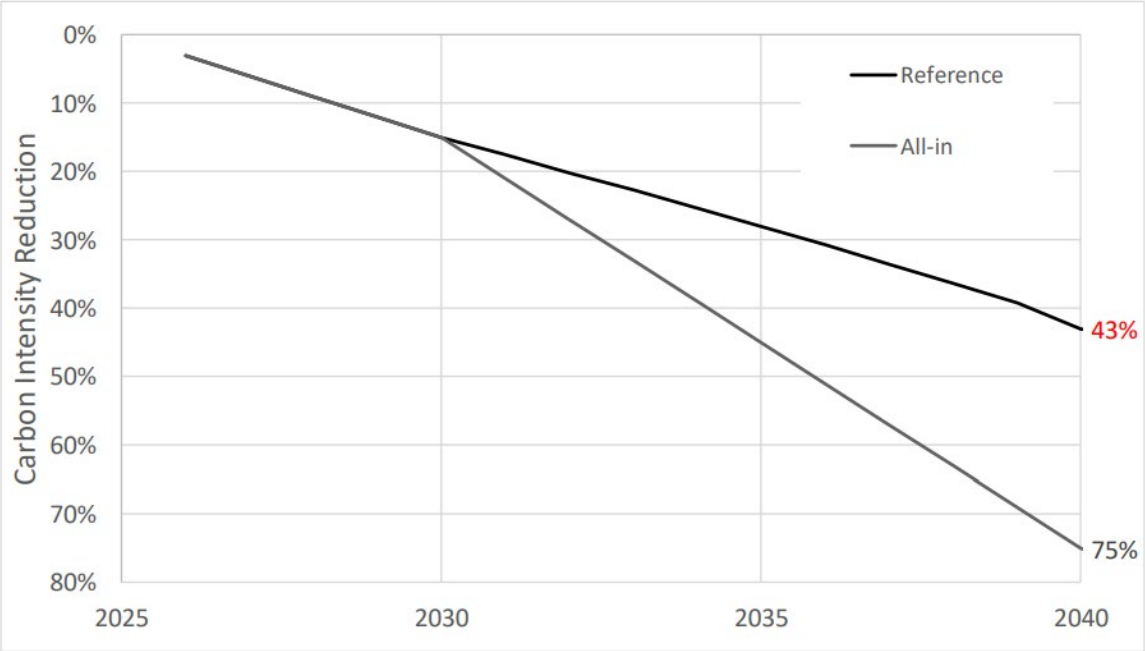
Expanding Zero Emission Vehicles (ZEVs), Heavy Duty (HD):

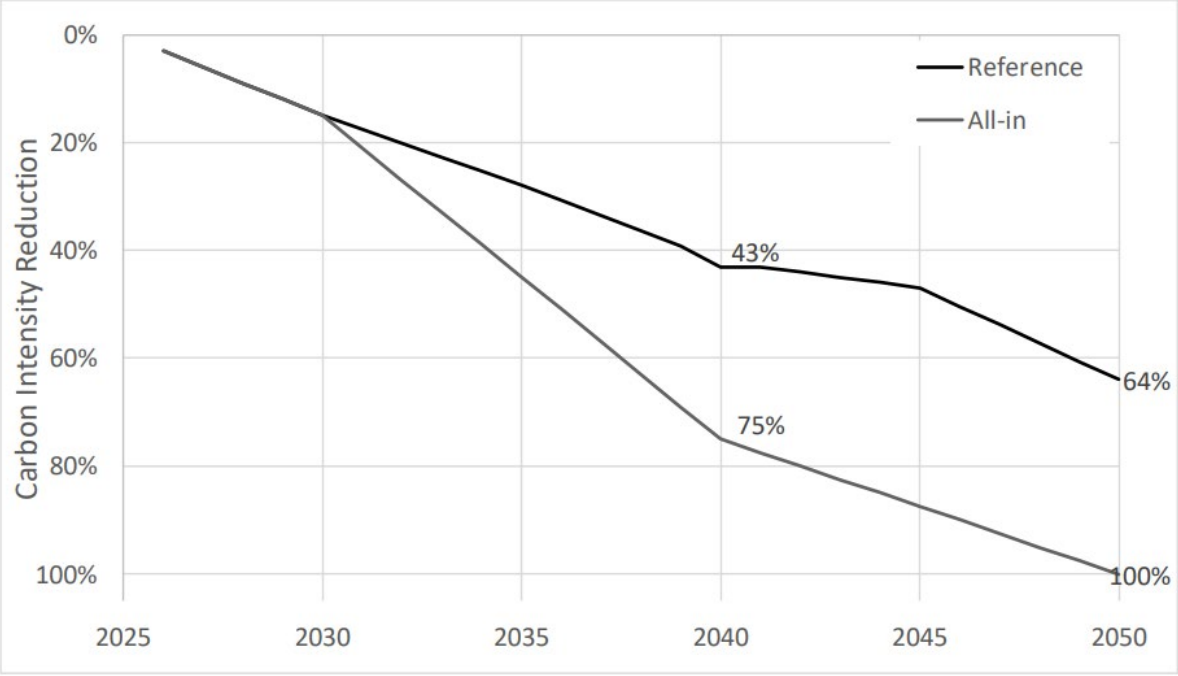
Near-maximum contributions of ZEVs-HD yield an additional **17% CI reduction** by 2040 compared to the reference case.



Scenario Recap

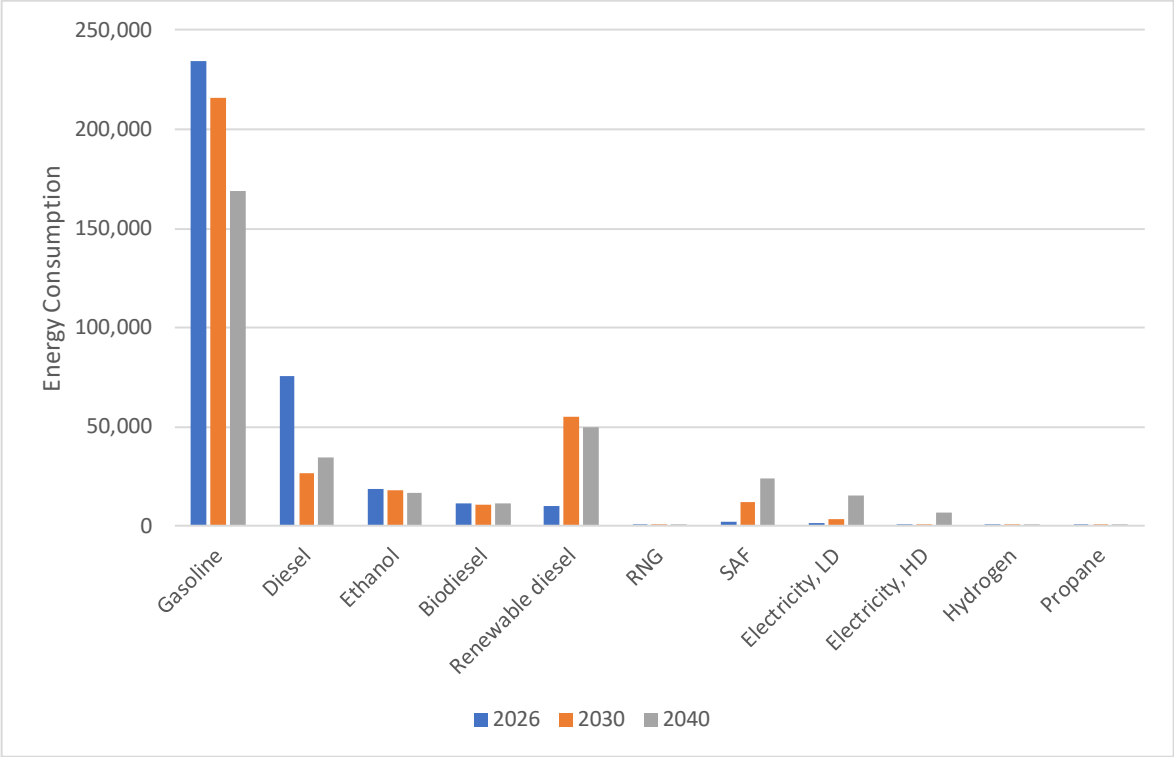
Next, Philip discussed the "all-in" scenario where the CI reduction was included for all fuel types presented above. A 75% CI reduction by 2040 is reached if we stack all of those fuel type CI reductions. A 100% CI reduction by 2050 is reached if we stack all of those fuel type CI reductions.



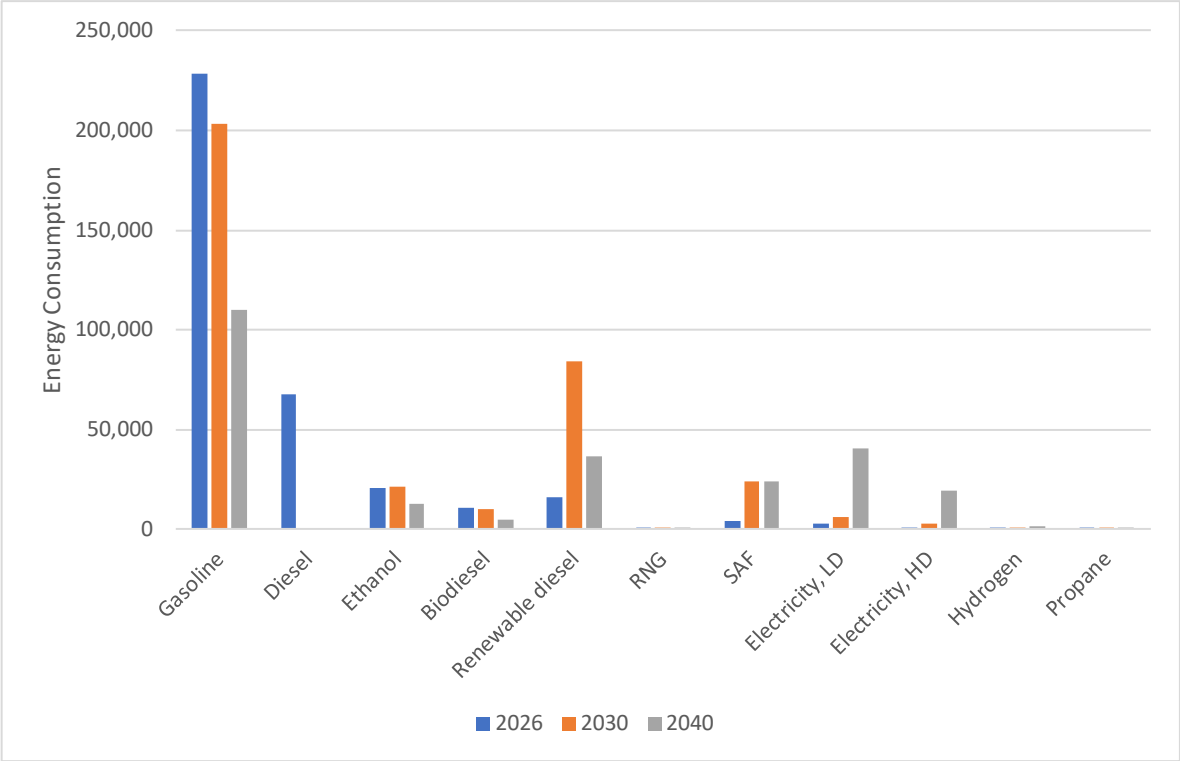


Finally, Philip presented an overview of the fuel mix changes.

Reference Case



All-In Case



Work Group Member Modeling Comments

Next, Work Group members provided some comments and questions.

- It was noted that there is a lot to dwell on in the fuel mix changes.
- A Work Group member mentioned that renewable diesel today is coming in by rail. So you are competing with the renewable diesel from other states, and also the rail capacity from other states.
- Another Work Group member proposed that maybe the first goal should be 2035 so you have a longer runway. Having it at 2030 is not realistic, because by the time this becomes legislation it will be maybe only 5 years or so.

Discussion and Reflection

The Work Group was given 5 minutes to individually reflect on the questions that were provided in a handout before they moved into small groups to discuss and populate feedback via Mentimeter results. Due to unforeseen technical issues, the Mentimeter did not work for Work Group members. The Work Group then split into small groups for discussion on the same questions. The goal of the small group discussion was for Work Group members to develop recommendations by modifying the original statements/questions below on key decision policy variables for a MN CTS.

Small group topics and discussion questions were as follows:

- Group 1 – Renewable Jet Fuel, Scenarios and Miscellaneous
    - **Question**: Based on the modeling, which carbon intensity reduction targets do you support?
        Option A. Existing targets from May 2023 statute
        Option B. Reference case target bands and 2050 goal
        Option C. Something else
    - **Question**: Work Group recommends changing the 2050 target to a goal and sets a target at a future milestone as program and market progress is reviewed.
    - **Question**: The WG recommends that fuels consumed by air, marine, and locomotive are voluntary credit generators for now given federal regulation restrictions.
    - **Question**: The WG recommends that refinery improvements and renewable hydrogen used at refineries are eligible to generate credits.
    - **Question**: The Work Group recommends that Renewable Jet Fuel be an eligible opt-in credit generating fuel.
- Group 2 – ZEVs
    - **Question**: The WG recommends that publicly accessible DC fast charging and hydrogen refueling infrastructure be eligible for infrastructure credits (based on the capacity of the fueling station minus the quantity of dispensed fuel).
    - **Question**: WG recommends that off-road electrification applications be eligible to generate credits.
    - **Question**: Zero CI pathways for electricity (using renewable energy certificates (RECs) or similar approaches) should be allowed in a Minnesota Clean Transportation Standard. (The modeling

used a grid decarbonization rate that is compliant with MN's Renewable Portfolio Standard (RPS). They also included zero CI electricity pathways that presumably would be satisfied using Renewable Energy Certificates (RECs), thereby achieving a lower than the grid average CI)

- Group 3 – CCS & Biofuels
    - **Question**: The WG recommends that CCS (with constraints) be an eligible activity; specifically, CCS for EOR is excluded.
    - **Question**: The potential for liquid biofuel blending into the transportation fuel mix is adequately represented in the CTS modeling that has been presented.
- Group 4 – Climate Smart Ag/Forestry & Land Use
    - **Question**: Ag practices that demonstrate GHG reductions, such as climate smart ag, are eligible credit generating activities.
    - **Question**: The Work Group recommends that farmers/growers be the reporting entity and generator of the CTS credits for the agricultural practices that are implemented for GHG emission reductions in the CTS.
    - **Question**: The LUC adder for ethanol and other purpose grown crops is non-zero.
    - **Question**: WG recommends an LUC adder ranging from the values used by ANL's CCLUB model and CARB's internal modeling from the 2015 rulemaking.
    - **Question**: The WG has identified LUC for further consideration

Due to the technical difficulties, a revised Mentimeter survey was shared with Work Group members following the meeting.

Work Group Comment Period

- A Work Group member mentioned that a cost-benefit analysis may be useful to help add context to the immediate impact to fuel prices and other consumer prices.
- Knowing the value of the credits would help inform recommendations.
- A Work Group member wanted to know what the value of this program is to accelerate electrification.
- It was mentioned that there may be merit to having utilities capture revenue, and wanted to know where and how investments are made.
- A Work Group member noted that equity must be considered in this conversation. If credits are only given to individuals or groups that can afford EVs and EV chargers, then we will be missing an opportunity for environmental justice for lower income groups, tribes etc., which is a key equity pillar.
- If we have ideas that have different scenarios or innovative solutions, who should we share that with?
    - Shannon Engstrom, Clean Transportation Standard Director, at shannon.engstrom@state.mn.us
- Is there a philosophy you can share from other states, or generalizations of approaches that have been used for who gets the subsidy?
    - Philip notes that in general, the regulated party tends to be the entity that is viewed as the area that needs the subsidy to advance the use of that fuel.

Public Comment Period

- The following comment was shared verbally and via written form:
    - Reaching the target of a 100% decrease in transportation carbon intensity (CI) by 2050 will require that we electrify the fuels themselves. This allows a generation for the gradual transition from growing energy crops to using agricultural land only for food for the growing population. It reduces the potential loss of natural vegetation carbon storage and wildlife habitat from land use changes. It also allows time to build the infrastructure for capturing and "recycling" of carbon dioxide (CO2) from remaining sources, by combining it with "green hydrogen" through "artificial photosynthesis," to produce "electrofuels" for the remaining applications that cannot be electrified.
    - For example: Achieving the goal of net zero CO2 equivalent emissions by 2050:
        - Producing cement inherently releases CO2
        - Intercontinental flights will always require the high energy density of hydrocarbon fuels
        - We can address these issues together by capturing the CO2 and reacting it with "green hydrogen," produced using renewable energy, to store that renewable energy as renewable jet fuel.
    - Establishing infrastructure like that needed for the above processes requires a long lead time. We would need to build additional wind and solar, transmission lines, water electrolyzers for hydrogen production, CO2 capture facilities, CO2-to-fuels facilities, and infrastructure for handling the fuels produced. We need to start planning and building now, if we are to have these in place by 2040, in time to take us the rest of the way to a 100% decrease in Minnesota transportation carbon intensity.
- What is this program going to generate in terms of EV investments? Do we have projections?
    - Philip noted that we do not at this time.

Public comments can also be submitted by emailing Sustainability.dot@state.mn.us. Additionally, a link to the CTS webpage was provided: https://www.dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-group.html.

Closing & Next Steps

Shannon Engstrom (MnDOT) thanked all the Work Group members for participating at the meeting, and for those that helped prepare for the meeting. She reminded everyone that the next Work Group meeting will have a similar format and will be held on Nov. 21, 2023. She encouraged everyone to bring their ideas, solutions and recommendations to that meeting. Shannon thanked everyone for joining and reminded the members she is also available for 1:1 conversation and is happy to answer any questions via email or phone. You can email Shannon at shannon.engstrom@state.mn.us.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
In-Person	Paul	Austin	Conservation Minnesota
Virtual	Kaytlin	Bemis	MN Farm Bureau
In-Person	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Richard	Biske	The Nature Conservancy
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Mike	Bull	Allete/MN Power
Virtual	Colin	Cureton	UMN Forever Green Initiative
In-Person	Rodney	De Fouw	Great River Energy
In-Person	Leslee	Jackson	Midwest Building Decarbonization Coalition
In-Person	Timothy	Gross	Fueling Minnesota
In-Person	Dustin	Haaland	CHS, Inc.
In-Person	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
In-Person	Abby	Hornberger	BlueGreen Alliance
In-Person	Rick	Horton	Minnesota Forest Industries

In-Person	Jon	Hunter	American Lung Association
In-Person	John	Jaimez	Hennepin County
Virtual	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
In-Person	Jeremy	Martin	Union of Concerned Scientists
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
In-Person	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
Virtual	Kevin	Pranis	LIUNA Minnesota/North Dakota
In-Person	Trevor	Russell	Friends of Mississippi River
In-Person	Eric	Schenck	Minnesota Forest Resources Council
In-Person	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Nate	Schuster	ChargePoint
In-Person	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
In-Person	Brian	Werner	Minnesota Biofuels Association
Virtual	Peter	Wagenius	Sierra Club North Star Chapter

Agency and Consultant Staff

Present	First Name	Last Name	Organization
In-Person	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
In-Person	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
In-Person	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
In-Person	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
In-Person	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
In-Person	Darin	Broton	MN Pollution Control Agency
In-Person	Paul	Beamer	MN Dept of Agriculture
In-person	Shannon	Engstrom	CTS Director, MN Dept of Transportation
In-Person	Mattie	Anders	WSB – CTS Consultant
In-Person	Amy	Fredregill	WSB – CTS Consultant
In-Person	Noel	Mills Ford	WSB – CTS Consultant
In-Person	Philip	Sheehy	ICF – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Kimberly Scott	UCS
Dallas Fischer	Fueling MN
Dale Lutz	
Laura Piotrowski	
Lauren Weaver	
Terry Riesen	
Jake Peterson	
Vince Gunaca	
Daniel Saunders	
Ian Marsh	
Jake Hamlin	
Jessica Hoffman	
Adam Diamond	
Jean Wagenius	
Marsha Anderson	
Donovan Hurd	

Ian Marsh	
Alex Trunnell	
Mike Karbo	
Sarah Psick	
Tammi Hagen	
Jeremy Estenson	
Per Lundmark	
Lydia Campbell	
Thomas Brennan	
Jen Baptist	
Paul Cassidy	
Dan Smading	
Mariem Zaghdoudi	
Cacie Russell	
Dean Taylor	

Attachment 1: From work group member, Timothy Gross: E15 upgrade estimates shared with Governor's Council on Biofuels Sept 24, 2020

DEPARTMENT OF AGRICULTURE

Governor's Council on Biofuels - Infrastructure Subcommittee

September 24, 2020 Meeting

9:00 a.m. to noon
Webex Video Conference

Agenda

9:00 a.m.
Welcome, introductions, and overview of agenda
Bob Patton, Energy and Environment Supervisor, MDA

9:30 a.m.
Presentation on E15 upgrade estimates
Nate Blasing, Tanks Unit Supervisor, MPCA

10:00 a.m.
Discussion of need and cost

11:45 a.m.
Public Comment

12:00 p.m.
Adjourn

ESTIMATES FOR E15 UPGRADES

Approximate number of federally regulated UST facilities - 3,900
Approximate number of Federally Regulated UST Tanks-13,000

Approximate number of Federally Regulated UST sites that store gasoline (excludes sites that only store diesel) - 3500
Approximate number of Federally Regulated UST Tanks that store gasoline - 7,140

Estimate that 15% of the sites will be compatible with E15 as they were installed or upgraded within the last 5 years.

Estimate that 85% or greater of current facilities would currently not be able to demonstrate compatibility for E-15 (Entire tank system including dispensers).

Estimate 30% of current tanks in use currently would not be compatible for E-15. (Early generation fiberglass and old bare steel tanks). This would require replacement of tanks, piping and dispensers. Most sites have all tanks in same tank basin so all tanks would most likely need replacement.
Costs below also include costs of removal of old tanks 30%
of 3,500 sites =1,050 sites needing total replacement.
Average of 3 tanks per sites X $160,000 per tank =$480,000 for each site
Total statewide costs $480,000 X 1,050 = **$504,000,000**

Estimate that 35% of sites do not have piping compatible with E15. (Steel pipe and early generation flex piping.) In this estimate tanks are compatible and do not require replacement. Replacement of tank tops and piping up to the dispensers. Since all piping is typically in same trench, all piping would most likely be replaced.
35% of 3,500 sites =1,225 sites needing new tank tops and piping to dispensers.
Average of 3 pipe runs per site x 50,000 per pipe= $150,000 per site
Total statewide costs $150,000 x 1,225 **=$183,750,00**

Estimate that 20% of sites would need some sort of upgrading of equipment other than tanks, piping or dispensers. Examples of this would be submersible pumps, probes, drop tubes, spill buckets, dispenser hanging hardware etc. This could range from $1,000 to $10,000 per tank storing E15
20% of 3500 sites= 700 sites needing some other upgrades
Average of 2 tanks per site at $1,000 to $10,000 per site= $2,000 to $20,000 per site
Total statewide costs $2,000 to $20,000 per site x 700 sites= **$1,400,000 to $14,000,00**

DISPENSER COSTS-

25,000 gasoline dispensers statewide (average of 7 gasoline dispensers per site)

Existing infrastructure=
70% Gilbarco dispensers= 17,500
20% Wayne dispensers= 5,000
10% other dispensers= 2,500

50% of Gilbarco not compatible with E15 = 8,750 50%
of Wayne not compatible with E15 = 2,500 50% of
other not compatible with E15 = 1,250

Guesstimate- 75% of 8,750 Gilbarco dispensers can retro fit @ $3,000 = $19,687,500
Guesstimate -75% of 2,500 Wayne dispensers can retro fit@ $3,000 = $5,625,000
Dispenser retro fit cost= **$25,312,500**
(did not include "other brand dispensers in cost)

25% of 8750 Gilbarco need new dispenser @ $20,000 =	$35,000,000
25% of 850 Wayne need new dispenser@ $20,000 =	$12,500,000
New dispenser cost=	**$47,500,000**

*These are only retail dispenser numbers, non-retail dispenser numbers not included.

ETHANOL

Started working with facilities in 2012 on compatibility
Currently 435 tank systems storing E-85
Currently 218 tank systems storing E-15

TANK REMOVAL COSTS *(LARGEST RISK BUT LOWER FREQUENCY)-*

Pull tanks that were installed prior to 1980 (gas and diesel) = 500
Estimate that average facility has 2.5 tanks (500/2.5) = 200 Removal cost $15,000/facility = 250 x $15,000 = $3,000,00

Pull tanks that were installed prior to 1990 (gas and diesel) = 1000
Estimate that average facility has 2.5 tanks (1000/2.5) = 400
Removal cost $15,000/facility = 400 x $15,000 = 6,000,00

Realistically 10 yrs
Franklin Fuel thinks they could keep up

Ensure infrastructure plan is workable and equitable for retailers

{LK) Give retailers a timetable
{TG) Provide direction to retailers for when they are updating infrastructure
{KK) Ensure that each station knows what is expected of them and when, so that they can comply
{KK) Signal to station owners, agencies, and all parties on what they need to do
{GV) Ensure that, whatever timelines are set, the change is equitable, and we don't drive retailers out of the market or advantage some over others
{SH) Prevent the historic challenges faced to biodiesel in terms of getting to the marketplace {i.e. ensure enough equipment at the terminals)
{KK) Ensure timeframe is reasonable; be constructively impatient and realistically urgent
{TG) Create an environment that allows all service station members the ability to sell higher blends through funding and fair timelines
{TP) Learn from biodiesel
{GA) Consider natural cycle of infrastructure replacement
{KK) Consider that each station is at its own place in terms of compatibility

Fund in a way that is sustainable, fair, pragmatic, and benefits the public

{AB) Think creatively about investments and financing, explore all options
{LK) Need a funding mechanism to help retailers
{TG) Stakeholders that benefit from increased biofuels should have a role in funding mechanisms
{KK) Include all interests in a long-term plan to ensure it is sustainable and future proof
{KK) Consider the amount of state dollars that are going to help with sales
{TP) Focus on bigger picture and what we can do economically for our State
{GV) Those needing upgrades needs funds immediately
{KK) Ensure good coverage across the State
{TP) Be realistic

Plan for biofuels/higher blends of the future

{AB) Prepare for higher blends in the future
{GA) Consider what state of biofuels will be in 5-10 years
{GA) Set targets for current and future infrastructure needs
{LK) Determine if we want to plan for staying at EIS, or plan for moving to more advanced ethanol products
{LK) Evaluate sites currently EIS-compatible to ensure compatibility for additional blends
{KK) Interested in long term goal as much as possible
{TP) Focus on EIS with an eye to the future

Increase use of biofuels to meet Petroleum Replacement Goals and realize benefits

{AB) Grow use of ethanol and biofuels
{AB) Build out infrastructure to meet petroleum replacement goals
{GV) State and economy will benefit from higher levels of ethanol blending
{KK) Recognize the human health, climate change, and air quality benefits for moving to EIS

Replace old and possibly harmful infrastructure

{AB) Replace aged infrastructure as well as noncompliant infrastructure

{KK) Consider groundwater and drinking water protection when looking at tanks compatible for biofuels

{GA) Consider what infrastructure will be obsolete

Ensure that EIS/higher blends are sold after infrastructure investment

{GA) Incentivize purchase of EIS so infrastructure is not wasted

{LK) Ensure that retailers are committed to selling EIS or E30

Tank system installation bids for higher Ethanol Blends

The following bids consist of costs to install 3- 10,000 gallon tanks, 100 ft of piping, and 6 dispensers that would be E-15/25 compatible which is deemed as an average sized tank facility.

1. Contractor A= $591,100
2. Contractor B = $575,960
3. Contractor C = $603,708
4. Contractor D = 2- 14,000 gallon tanks and piping=

$448,063 Average cost for 3 tank systems= **$590,223**

The following is additional costs that would be needed in order to make the tank system compatible with E-30/85 which the upgrade costs are mainly related to dispensers and hanging hardware.

A. Contractor A- $60,000
B. Contractor B - $66,000
C. Contractor C - $72,210
D. Contractor D - $57,000

Average cost to upgrade dispensers/hanging hardware for E-30/85 = **$63,803**

Work Group Meeting #6 – November 21, 2023

Date: November 21, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting
Location: WSB Office, 701 Xenia Ave S, Unit 200, Golden Valley, MN 55416, and hybrid option available

Meeting Summary

Welcome & Project Overview

Shannon Engstrom (CTS Director, MnDOT) introduced herself and thanked everyone for joining the sixth Work Group meeting. Shannon reviewed the meeting agenda and objectives.

Meeting objectives included:

- Review and discuss updated modeling by ICF consulting
- Discuss policy considerations to incorporate into Work Group recommendations
- As always, continue to co-learn from various perspectives and identify takeaways on priorities
- Review timeline and discuss priorities for the next 4 weeks+

Next, Shannon discussed takeaways from the November 8th Work Group meeting and provided an opportunity for to react to the takeaways. Comments from Work Group members on the key takeaways are noted in sub-bullets below with "***WG member comment***":

- There was some discussion on moving the first goal out to 2035, with a CI reduction of approximately 25% as well as adjusting other targets to aim towards achieving outcomes including compliance (credits and deficits are balanced).
- Some Work Group members suggested focusing on the near term and adjusting during a review every 5 years.
- General support for the program starting with a year of a Reporting Period to create a glidepath, noted this will delay CI reduction by 1 year.
- Concern that credit generation in certain applications (e.g., renewable jet fuel) in which there is not countervailing deficit generation (e.g., by conventional jet fuel) may lead to supply-demand imbalance and decrease credit pricing.

    - ***WG member comment***: The only modeling we've seen has been a credit build, and then there has been a hump – in either 2032 or 2035. The other bookend would be about dipping into deficits. (Note: This was the case with the initial modeling results presented on Oct. 24 (V1). The moderate case presented today achieves a balance of credits and deficits.)
- Continued support for a fuel neutral approach that also incorporates robust investigation/engagement of certain fuel eligibility such as parameters around renewable hydrogen.
    - ***WG member comment***: There is not unanimous support from the Work Group on this.
- Off-road electrification applications were generally supported to be eligible to generate credits, but more detail is needed to firm up/frame up specifics.
- General support for RECs being used in low CI pathways for electricity (beyond "average resource grid mix"), assuming no double counting and all RECs are verified.
- Many WG members supported carbon capture and storage (CCS) as an eligible activity with exclusion for enhanced oil recovery (EOR), but a few WG members did not support CCS as eligible due to some concerns about CO2 pipelines such as safety, which may be addressed in upcoming pending rule finalization.
    - ***WG member comment***: Change "such as" to "including, but not limited to safety"
- Re: liquid biofuel blending, WG members expressed a desire to learn from E15 and E85 experience, including adequate infrastructure capacity needs and constraints. They shared a range of perspectives on costs, benefits, rail safety, off ramps, locations, and market considerations.
- Climate smart agriculture and forestry practices that can demonstrate GHG reductions received broad support. Climate smart agriculture and forestry should be factored into the CI score. Discussion and questions around reporting and verification.
- The land use change (LUC) adder for ethanol made with corn and soybean feedstock should be non-zero.

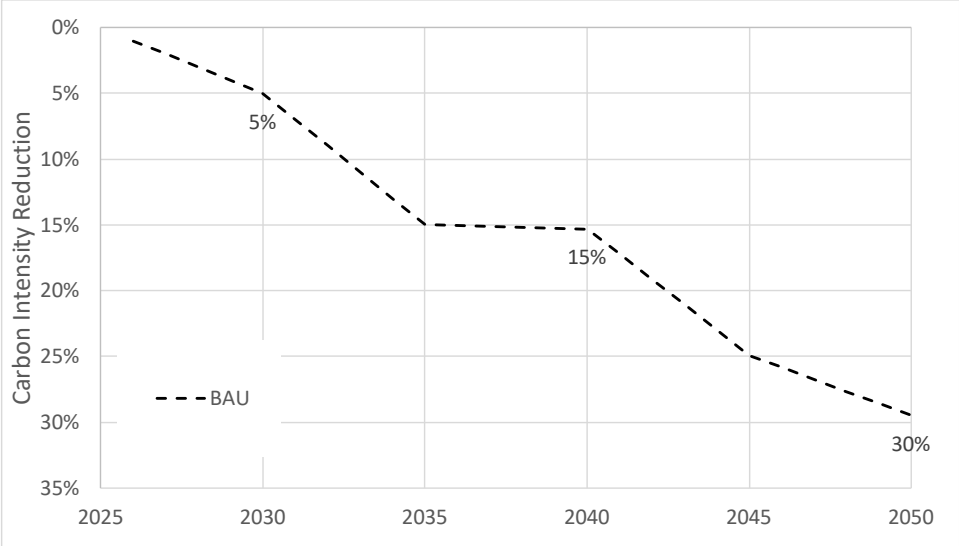
Next, Shannon walked through the November 8th meeting Mentimeter poll results. Work Group members scored a number of draft statements on a scale of 1 (disagree) to 5 (agree). The original survey tool scale was the opposite, and the results were transposed to show the results on the corrected scale. The draft statements and their respective scores are shown in the table below. N = number of member responses to each statement

Draft Statements – November 8 Work Group Meeting Mentimeter Results	N	Weighted Average Score (1 – 5, disagree to agree)
The Work Group recommends changing the **2050 target to a goal** and re-evaluating at a later program review period	28	4.1
The Work Group agrees that fuels consumed by **typically federally exempt parties** should be **exempt from being deficit generators for now**	28	4.0
The Work Group recommends that **refinery improvements and renewable hydrogen used at refineries** are eligible to generate credits	26	4.1
The Work Group recommends that **renewable jet fuel be an eligible opt-in credit generating fuel**	25	4.3
The Work Group recommends that **publicly accessible DC fast charging and hydrogen refueling infrastructure** be eligible for infrastructure credits	25	4.0
The Work Group recommends that **off-road electrification** applications be eligible to generate credits	25	4.2
Zero carbon intensity (CI) pathways for electricity (using renewable energy certificates (RECs) or similar approaches) should be allowed in a standard	26	4.0
The Work Group recommends that **carbon capture and storage (CCS)** (with constraints) be an eligible activity; specifically, CCS for EOR is excluded	27	3.9
The Work Group recommends ag practices that demonstrate GHG reductions, such as **climate smart ag practices, be eligible credit generating activities**	27	4.2
The Work Group recommends that **farmers** that implement smart ag practices **should receive a benefit** from the credits generated by refiners/producers	27	4.2
The Work Group recommends a **land use change adder** between the values used by ANL's CCLUB model and CARB's internal modeling from the 2015 rulemaking	27	3

Next, Shannon introduced Philip Sheehy (ICF) and turned the presentation over to him.

Review Updated Draft Fuel Pathway Scenarios

Philip Sheehy (ICF consulting, and a technical consultant for the Work Group) presented an overview of the updated CTS technical modeling. He reminded the Work Group that the intent of the modeling work is for it to be an iterative process -- identify policy options, develop draft modeling, present the results, request feedback from Work Group members and solicit questions, then make modifications based on Work Group member feedback. In previous meetings, one of the key takeaways is that the carbon intensity reduction targets in the May 2023 statute for the Work Group may be challenging to meet.



Next, Philip presented an overview of some of the updates made to the 3rd iteration of the modeling, as follows:

- Added Business as Usual (BAU) Case for the sake of reference
- Minor changes / updates to modeling
    - 2018 baseline for diesel was adjusted to reflect waivers issued in 2018 for biodiesel blending mandate (went from 12.2% blend rate to 8.3%)
    - Fixed modeling errors e.g., was mistakenly double-counting impacts of CCS deployed at ethanol facilities, renewable diesel volumes were wonky in some years, etc.
    - Biodiesel case was modified to accommodate a higher blend of biodiesel (B50) than contemplated previously
- Nomenclature has been updated
    - Reference > Moderate
    - Sensitivity Cases renamed: Expanding Fuel X > Accelerated Fuel X

After accounting for likely clean fuel deployment and advanced vehicle adoption using the assumptions outlined previously in the absence of a CTS, the draft results of the business as usual (BAU) case modeling suggest the following:

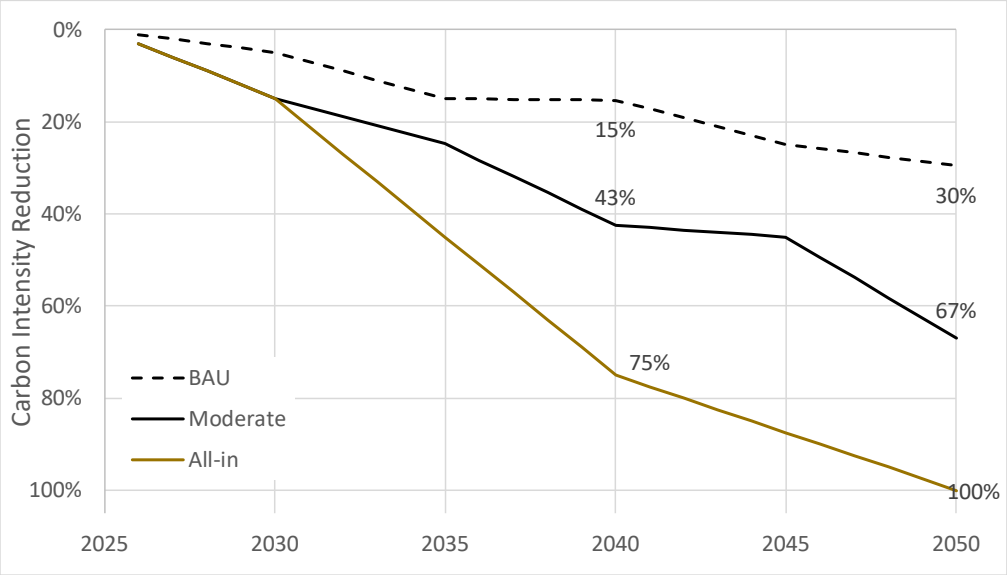
- 2030: CI reduction of 5%
- 2040: CI reduction of 15%
- 2050: CI reduction of 30%

The draft results of the business as usual (BAU) Case, the moderate case, and the all-in accelerated case suggest the following:

- All-In Accelerated Case:
  100% CI reduction in 2050
- Moderate Case:
  67% CI reduction in 2050

- BAU Case:
  CI reduction of 30% in 2050

Next, Philip presented the impact of the 2018 baseline considerations. He discussed what happens to credit generation if the 2018 baseline excludes or modifies biofuel blending considerations.



Moderate Case	Ethanol	Biodiesel	CI Reduction in 2040
Moderate, MN blend rates	10.15%	8.3%	42.5%
Moderate, national blend rates	10.07%	4.5%	43.5%
Moderate, no biofuels	0%	0%	44.1%

Philip discussed how ethanol is modeled in the CTS. The blue bar shows ethanol consumption in gasoline in the moderate case. It leads to a decrease over time, due to a variety of pressures (efficiency, electrification). The modeling assumes ethanol blend rate continues to increase. A higher blend rate does not always mean higher volumes consumed. Ethanol is likely to be a viable feedstock for renewable jet fuel consumption via alcohol-to-jet fuel pathways. Modeling constrained by total ethanol consumption at 2018 ethanol consumption (~270 Mgal).

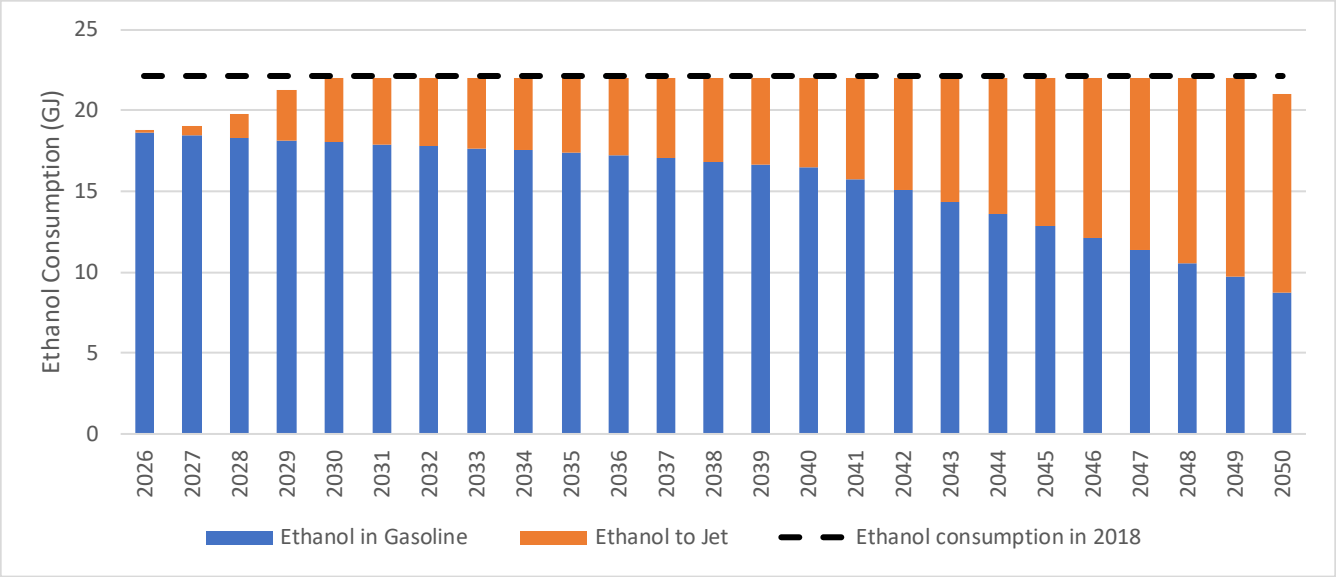


Figure 1: Ethanol Consumed in Moderate Case

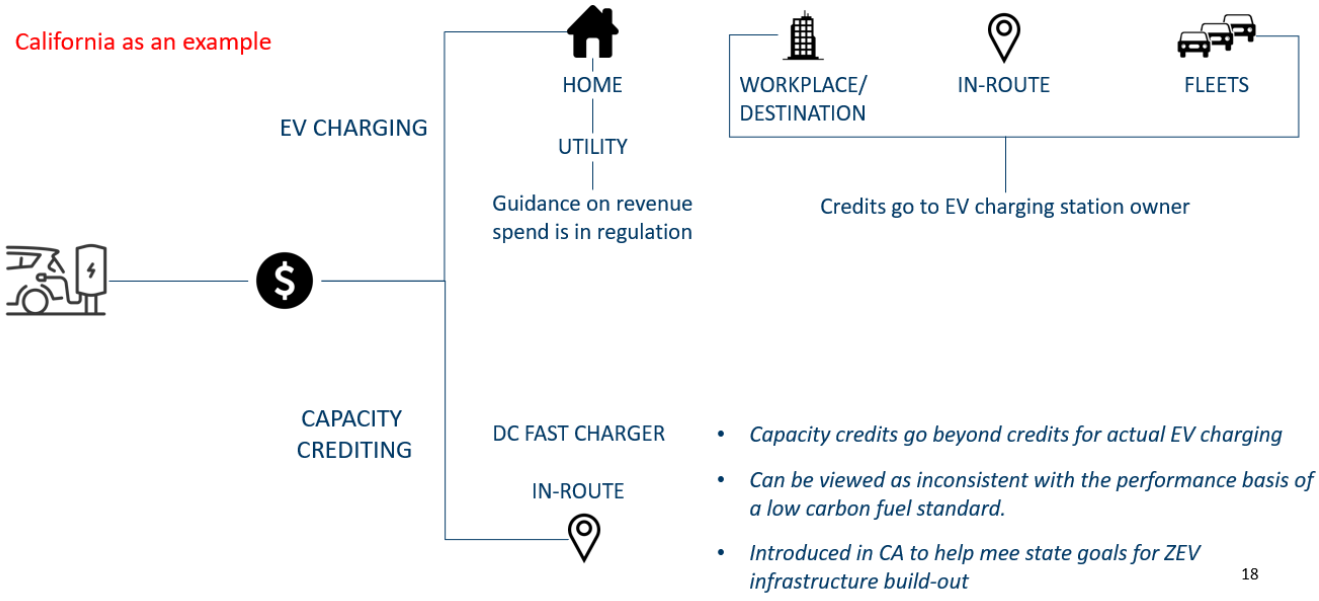
Q & A

Next, Philip Sheehy (ICF Consulting) took comments and answered questions from the Work Group:

- Where do you get the 270 million gallons/year in 2018? And what are our figures now?
    - There is a state energy database. MN reports on E15 consumption. Dept of commerce publishes data on E15. They also make estimates. The 270 million gallons/year is an estimate based on E10 + E15 and how much gasoline was consumed.
- How does a CTS work in a moderate scenario?
    - The black line achieves compliance. This trajectory of the moderate case would keep the program in a healthy balance of credits.
- Infrastructure build out will be key if projections follow the trend line. The conversion of medium and heavy trucks. Almost 16,000 chargers would need to be installed every month between now and 2032. In your modeling, where does charging infrastructure. The moderate
    - ICFs modeling does not consider how much infrastructure may or may not be needed. The modeling simply considers the. We have not assumed that we've moved to Phase 3 of the medium and heavy duty. This program cannot answer all of those questions.
- Question about electric grid – as we look at where solar panels are going out on the landscape. Is there actually land use change from agriculture for solar panels out in rural areas.
    - The land use change adder are global adders applied to those fuels. They are not Minnesota adders. Broadly speaking, it is de minimus in terms of land use change.
- The light and medium duty EV adoption in the moderate case. MN has a target of 100% renewable electricity generation by 2040 (yielding a carbon intensity of 0 g/MJ). Might want to build that into the modeling.
    - You can include it in the moderate case, but we did not. But there is no harm in including that.

Presentation from Philip Sheehy, ICF consulting

Next, Philip discussed how credits are applied to EV charging using California as an example. He encouraged the Work Group to think about the principles they should seek to advance with respect to the use of revenue from residential or at-home EV charging.



Next, Amy Fredregill (WSB) introduced some discussion topics for groups:

- Program reporting could include tracking equity outcomes and health measures associated with program implementation
- Credit revenue investments could be focused on achieving certain public outcomes such as EV charging in EJ/disadvantaged communities
- Workforce development program components could be considered such as support for apprenticeship pathways
- Others?

Question: How do we estimate the amount of EV home chargers if someone doesn't report that they have an EV charger and does not have a separate EV charging meter? For example, if they just plug in a Level 2 EV charger to a 240 Volt outlet and therefore the power used to charge their EV is just part of their regular electric meter.

- In California, the regulator (California Air Resources Board, CARB) follows a series of steps to estimate credits generated from non-metered EV charging. In the first step, CARB estimates the total number of EVs statewide using vehicle registration data. In the second step, CARB allocates the EV population to each utility's service territory according to statistics from the California Vehicle Rebate Project (CVRP). In the third step, CARB uses the best available data to estimate daily average EV use. CARB currently uses data reported by entities as part of what is referred to as incremental residential charging, whereby

regulated parties must submit dispensed electricity per vehicle. Previously, CARB used a subset of submetered EVs to estimate EV charging each quarter. [1]

Land Use Change (LUC) Adder vs. Climate Smart Practices

Philip Sheehy presented on Land Use Change (LUC) Adder vs. Climate Smart Practices.

LUC Adder (in g/MJ) is applied to fuels produced from a certain feedstock e.g., corn, soybean. Fuel producers cannot reduce the LUC Adder through any action of their own—it is a CI reduction applied to any fuel pathway from a feedstock that is deemed to have had an impact on land use change.

Climate Smart Practices refers to practices in the agriculture and/or forestry sectors that are determined to have measurable and verifiable GHG emission reductions that can be incorporated in the carbon intensity of an eligible fuel pathway. To date, we have addressed a subset of climate smart practices, like reduced fertilizer application; however, the scope of climate smart practices, and how they should be applied is ultimately up to the Work Group and would be finalized in rulemaking. This could be a novel component of the CTS because other states have excluded eligibility of these types of practices from consideration.

The CI score for some pathways will always have a *LUC Adder*, but the CI score can be reduced through the adoption of *Climate Smart Practices*. In some ways, the LUC Adder is a legacy CI increase applied for land use changes that have already occurred, whereas Climate Smart Practices represent the adoption of improvements that can be incorporated into the CI score.

State Soil and Water Health Programs

Next, Amy Fredregill presented a sample of existing state soil and water health programs from the Board of Water and Soil Resources (BWSR) and the MN Department of Agriculture (MDA) focused on land conservation practices; sediment, phosphorous and nitrate reduction; easements of wetlands and grasslands, local water management planning and performance assessments; financing assistance programs for farmers/growers implementing practices; cover crop research efforts such as the Forever Green Initiative; and technical assistance and incentive programs. The full list of programs and policies can be found on slides 22 – 25 of the Nov. 21 meeting presentation posted on the CTS webpage.

These program summaries are meant to be a preview. Additional information about policies and programs from the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (DNR) will be included in the draft report.

Next, Amy presented an overview of the discussion framework and an overview of the remainder of the meeting. The project team has presented three discussion topics as follows for the small groups:

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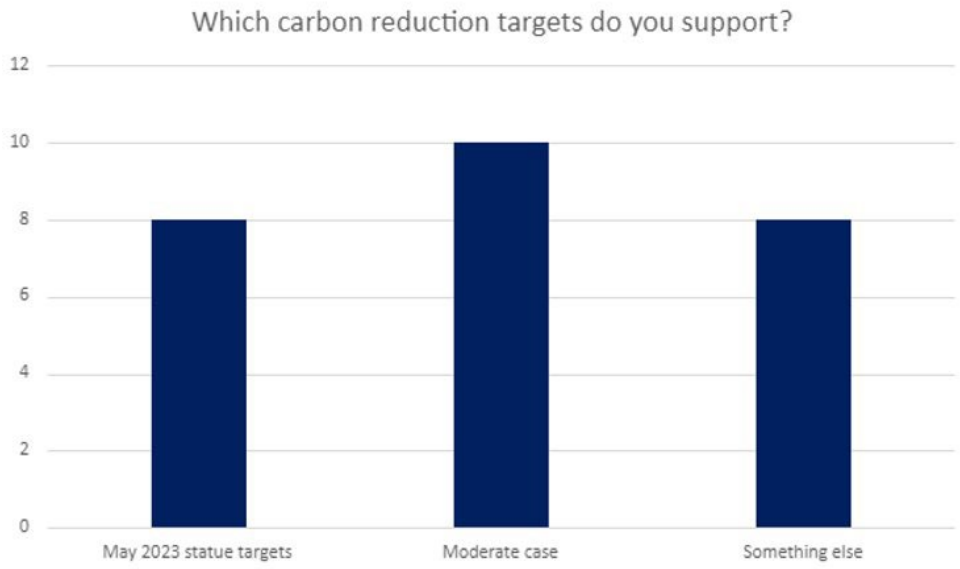
[1] CARB, Methodology for Calculating Base Credits for Non-metered Plug-in Electric Vehicle (PEV) Charging, updated Feb 2023. Available online: https://ww2.arb.ca.gov/sites/default/files/2023-02/Non-meteredBaseCreditsMethodology_2023update.pdf

1. Community health, equity, and workforce in the context of clean fuels—production, infrastructure, and consumption
2. Land use, climate smart agriculture, and forestry
3. Program administration and performance *(in person only)*

Work Group Discussion for Findings and Recommendations

Work Group members were instructed to fill out a Mentimeter survey before breaking out into small groups and score a number of draft statements on a scale of 1 (disagree) to 5 (agree). The draft statements and their respective scores are shown in the table below. N = number of work group member responses to each statement.



Draft Statements – November 21 Work Group Meeting Mentimeter Results (N = 26)	Weighted Average Score (1 – 5, disagree to agree)
The WG recommends the CTS program should have a **program review period every 3-5 years**	4.1
The WG supports using the Argonne National Laboratory **(ANL) CCLUB land use change (LUC) adder** values and methodology	3.3
The WG supports **continued exploration of how co-benefits, such as community health, economic dev, and EJ,** can be advanced through a CTS	4.0
The WG recommends program reporting could include **tracking equity and health measures** associated with program implementation	3.7
The WG recommends future dev of a **framework for determining investments of credit rev from EV charging into "strategic EV charging infrastructure"**, including consideration of location such as investments being made in utility service territory. Framework shall provide guidelines on investments in locations (which could include income designations, EJ communities, disproportionately impacted communities), supply chain and other priorities of greatest need/value to receive those credits	3.5
The WG recommends considering **workforce development program components** such as support for apprenticeship pathways	3.3
Because ecosystem services and other co-benefits are challenging to incorporate into a CTS focused on GHG emission reductions, the WG recommends **continuing to explore complementary policies and programs that protect water and ecosystems** and advance co-benefits	3.7
The Work Group supports including **100% woody biomass in the modeling**, and if brought to market and verified, climate smart forestry practices should be eligible for credit generation	3.4
Utilization of **climate smart forestry practices for woody feedstocks** in advanced biofuels may help improve forest health and result in co-benefits to local communities including disadvantaged populations	3.7

Draft Statements – November 21 Work Group Meeting Mentimeter Results (N = 26)	Weighted Average Score (1 – 5, disagree to agree)
The program **should follow reporting and documentation protocols** used in other states such as the program reporting tool to assist with efficiencies between states/Use other state's reporting and documentation protocol instead of starting new reporting mechanism	3.6
The WG recommends the CTS program should ensure **3rd party verification** of fuel pathways and reported fuel quantities	4.3
The WG recommends the CTS should have a **program review period every 3-5 years** to calibrate CI reduction targets and goals	4.0
The WG recommends that regulated parties s**hould not pay a program fee**	3.2

Following the survey, Work Group members picked a small group to join based on one of the three topics areas shown above. The small groups discussed the results of the Mentimeter survey.

- **Community health, equity and workforce**
    - The WG recommends co-benefits, like community health, economic development, and environmental justice, should be advanced through a CTS, as well as identifying opportunities to mitigate negative impacts of a CTS related to these same issues, such as unintended consequences for supply chain resiliency to deliver foods, medication, etc. WG members encouraged discussion to determine potential policy requirements in this area and who is responsible for ensuring these outcomes are met; details will need to be resolved in legislation and rulemaking, guided by diverse stakeholders.
    - The Work Group recommends program reporting include tracking equity and health measures, focused on outcomes, associated with program implementation; clear instructions should guide the reporting process and requirements. Rulemaking, which involves engaging stakeholders, should include clarifying "equity" and "health measures" and aligning with other state agency definitions of those terms.
    - The Work Group recommends future development of a framework for determining investments of credit revenue from EV charging to support outcomes designated as priorities. The framework shall provide guidelines on investments in locations (which could include income designations, EJ communities, and/or disproportionately impacted communities), supply chain and other priorities of greatest need and value to receive those credits.

    - The Work Group recommends considering workforce development program components for a CTS such as pathways to the development of jobs, while leveraging, and not duplicating, other existing current labor-related programs.
- **Land use, climate smart agriculture, and forestry**
    - Because ecosystem services and other co-impacts related to water and soil health, air quality, wildlife, and beyond, are challenging to incorporate into a CTS focused on GHG emission reductions, the WG recommends continuing to evaluate and explore complementary policies and programs that protect water and ecosystem services and advance other co-impacts.
    - The Work Group supports including 100% woody biomass with lowest CI feedstock source possible in the modeling. If brought to market and verified (based on the best available science), climate smart forestry practices should be evaluated for eligibility for credit generation.
    - Utilization of verified climate smart forestry practices for woody feedstocks in advanced biofuels may help improve forest health and result in co-benefits to local communities, including disadvantaged populations.
- **Program administration and performance: Evaluation checkpoints, credit tracking & staffing**
    - The program should look to other programs and states to glean the best reporting and documentation protocols.
    - The Work Group recommends the CTS program should ensure 3rd party verification of fuel pathways and reported fuel quantities.
    - There was general support that the CTS should have a program review period every 3-5 years to calibrate CI reduction targets and goals. Defined criteria for calibration of targets or goals should be determined, such as the level of the credit bank, along with an analysis of co-benefits and co-harms should be woven into the periodic review. Also, a stakeholder-based Task Force should provide guidance on the program review including the development or refinement of defined criteria for recalibration.
    - The Work Group recommends that credit generators and deficit generators should pay an equal program fee.

Public Comment Period

The meeting included a public comment period. One comment was verbally and electronically shared.

"I'm Dale Lutz, a retired chemist, and I'm here for the children, who are not represented in this Work Group. My grandsons will likely be alive in the year 2100 to witness the disaster we left for them, and to curse us for having seen it coming and not doing enough to stop it while we still could. There is a saying, "We don't inherit the Earth from our ancestors, we borrow it from our children." A related Native American saying is, "When the Last Tree Is Cut Down, the Last Fish Eaten, and the Last Stream Poisoned, You Will Realize That You Cannot Eat Money." The pre-read document says on page 12, "The ability of the market to achieve a 100% CI target will depend on a variety of technological developments that are difficult to conceive of today." However, the necessary technologies, such as electrofuels from captured CO2 and green hydrogen, already exist. They just need to be rapidly deployed at scale. Thank you for your efforts to address this critical issue."

He also shared additional materials for the Work Group's review. **See Appendix A.**

Public comments can also be submitted by emailing Sustainability.dot@state.mn.us. Additionally, a link to the CTS webpage was provided: dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-Group.html.

Work Group Comment Period

The meeting included a Work Group comment period.

A WG member asked about the purpose of sustainable aviation fuel (SAF) being a credit generator (and not a deficit generator) if it seems the SAF market will be mostly accelerated by the federal and state tax incentives. What is the purpose for allowing credits in the CTS for SAF?

There was discussion after about the fact that the SAF tax credit is time bound.

Closing & Next Steps

Shannon Engstrom thanked all of the Work Group members for being at the meeting, and for those that helped prepare for the meeting. She reminded everyone that the next Work Group meeting will be held on Nov. 30, 2023, and is virtual only. The main purpose of that meeting is to walk through the draft report they will receive via email on Nov. 28. There will be time to discuss the report, digest the content and ask questions of the state agency and consulting staff or fellow Work Group members. There will also be an extended non-Work Group member comment period. She encouraged everyone to bring their ideas and questions to that meeting.

Next Shannon walked through the CTS timeline and once again requested that Work Group members put a reminder on their calendars during the window of Nov 28 - Dec 6 for reviewing the draft report and providing comments via a survey which was shared on slide 38. The final Work Group meeting is scheduled for December 13, which will also be virtual only. An updated Outcomes and Recommendations chapter will be shared with Work Group members ahead of the Dec. 13 meeting to discuss and revise during the meeting. The final report will be distributed to Work Group members once completed, and the timing is to be determined.

Shannon shared an overview of the survey that will be distributed to Work Group members. The survey will ask Work Group members for their level of agreement on the overall report, on each section of the draft report, and on each individual recommendation statement in the report.

- Question: I thought we were moving away from the term “Recommendation”, and using “consensus statements” instead?
    - The recommendation statements are the statements when we felt there was strong consensus. We have modified the wording of the statements to be representative of the general sentiment we have heard. We are continuing to take a pulse on whether we are getting closer to the right wording via the Mentimeter surveys.
- Question: Thinking back to the legislative mandate, the mandate was to find opportunities and gaps. Is the report going to be structured in that fashion?

- Yes, it will have recommendation statements based on what the Work Group has discussed, and we will also have a list of gaps or "future considerations". It will flesh out what we discussed and what are some additional areas that are gaps or future opportunities.

The November 30 meeting will include a summary of the report and a presentation that will be posted on the CTS webpage. The meeting will also include a longer time frame for non-Work Group members to ask questions or provide feedback to Work Group members.

Next, Kevin Pranis, the Work Group Chair, shared some closing remarks. He reminded Work Group members that their charge is not to create a policy, it's to develop a set of recommendations for the legislature. The more we can settle on recommendations, the easier it will be for the legislature to develop the policy. He encouraged the group to close in on the topics that the Work Group can recommend. When the survey is distributed to the group, Kevin mentioned that there are some recommendations that will be no-brainers for the group, but there will be some areas that we have less agreement on. He encouraged Work Group members to think about whether the statement reflects the group as a whole, rather than reflects the personal policy priorities of any individual in the Work Group. If the statements reflect the group's general standpoint, he encouraged members to support those statements even if the statement is stronger or weaker than you would personally like to see.

In closing, Shannon thanked everyone for joining the meeting and reminded the Work Group members that she is also available for 1:1 conversation and is happy to answer any questions. You can email Shannon at shannon.engstrom@state.mn.us.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
In-Person	Paul	Austin	Conservation Minnesota
Virtual	Kaytlin	Bemis	MN Farm Bureau
In-Person	Richard	Biske	The Nature Conservancy
In-Person	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Matthew	Bruyette	Nature Energy
In-Person	Mike	Bull	Allete/MN Power
Virtual	Colin	Cureton	UMN Forever Green Initiative
In-Person	Jeff	Davidman	Delta Air Lines, Inc.
In-Person	Rodney	De Fouw	Great River Energy
Virtual	LesLee	Jackson	Northside Green Zone
In-Person	Timothy	Gross	Fueling Minnesota
In-Person	Dustin	Haaland	CHS, Inc.
In-Person	Kent	Hartwig	Gevo, Inc.
In-Person	John	Hausladen	Minnesota Trucking Association
In-Person	Abby	Hornberger	BlueGreen Alliance

In-Person	Jon	Hunter	American Lung Association
In-Person	John	Jaimez	Hennepin County
In-Person	Brendan	Jordan	Great Plains Institute
In-Person	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
Virtual	Jeremy	Martin	Union of Concerned Scientists
In-Person	Sarah	Mooradian	CURE (Clean Up the River Environment)
In-Person	Steve	Morse	Minnesota Environmental Partnership
In-Person	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
In-Person	Kevin	Pranis	LIUNA Minnesota/North Dakota
In-Person	Trevor	Russell	Friends of Mississippi River
Virtual	Nate	Schuster	ChargePoint
In-Person	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
Virtual	Brian	Werner	Minnesota Biofuels Association
In-Person	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Tim	Sexton	Assistant Commissioner, MN Dept of Transportation
In-Person	Valare	Falkner	Deputy Director, MN Dept of Commerce
In-Person	Amber	Dallman	Director, Office of Sustainability and Public Health, MN Dept of Transportation
In-Person	Carolyn	Caffrey	Office of Sustainability and Public Health, MN Dept of Transportation
In-Person	Megan	Lennon	Energy and Environment Section Supervisor, MN Dept of Transportation
In-person	Shannon	Engstrom	CTS Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Philip	Sheehy	ICF – CTS Consultant
Virtual	Fang	Yan	ICF – CTS Consultant
In-Person	Amy	Fredregill	WSB – CTS Consultant
In-Person	Mattie	Anders	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant
Virtual	Connor	Cox	WSB – CTS Consultant

Members of the Public

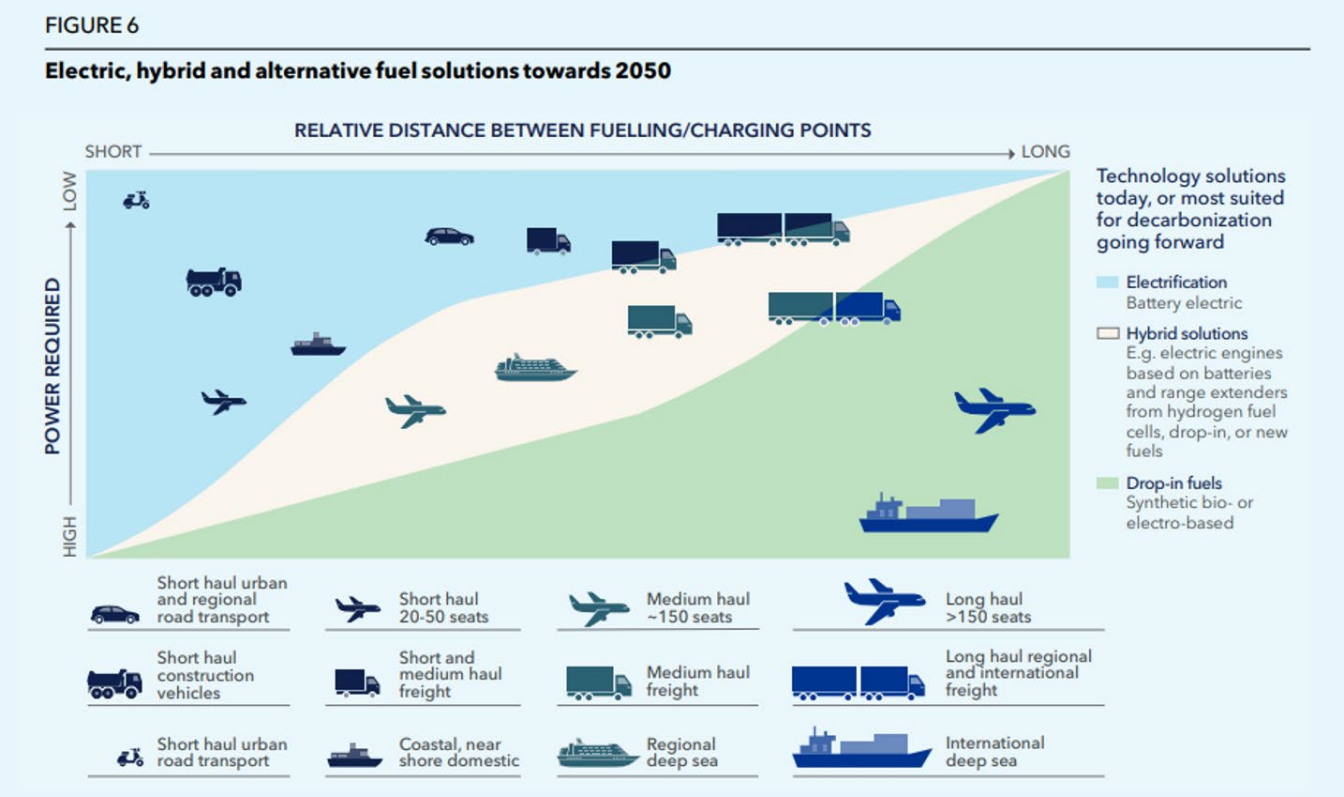
First Name	Last Name
Ellen	Anderson
Tom	Brennan
Natalie	Burdick
George	Damian
Dan	Dwight
A.J.	Duerr
Jeremy	Estenson
Dallas	Gerber
Vince	Gunaca
Jake	Hamlin
Todd	Hill
Donovan	Hurd
Molly	Jansen
Kent	Kaiser
Mike	Karbo
Kate	Klossner
Matthew	Lemke
Per	Lundmark
Dale	Lutz
Ian	Marsh
Whitney	Mason
Sherrie	Merrow
Patrick	Murray

Mark	Nisley
Jesse	Nowicki
Melissa	Rahn
Cacie	Russell
Daniel	Saunders
Craig	Schoenfeld
Kimberly	Scott
Joe	Sellwood
Dan	Smading
Bennett	Smith
Mariem	Zaghdoudi

Appendix A: Additional background materials to Work Group consideration shared by Dale Lutz, retired chemist (non-work group member)

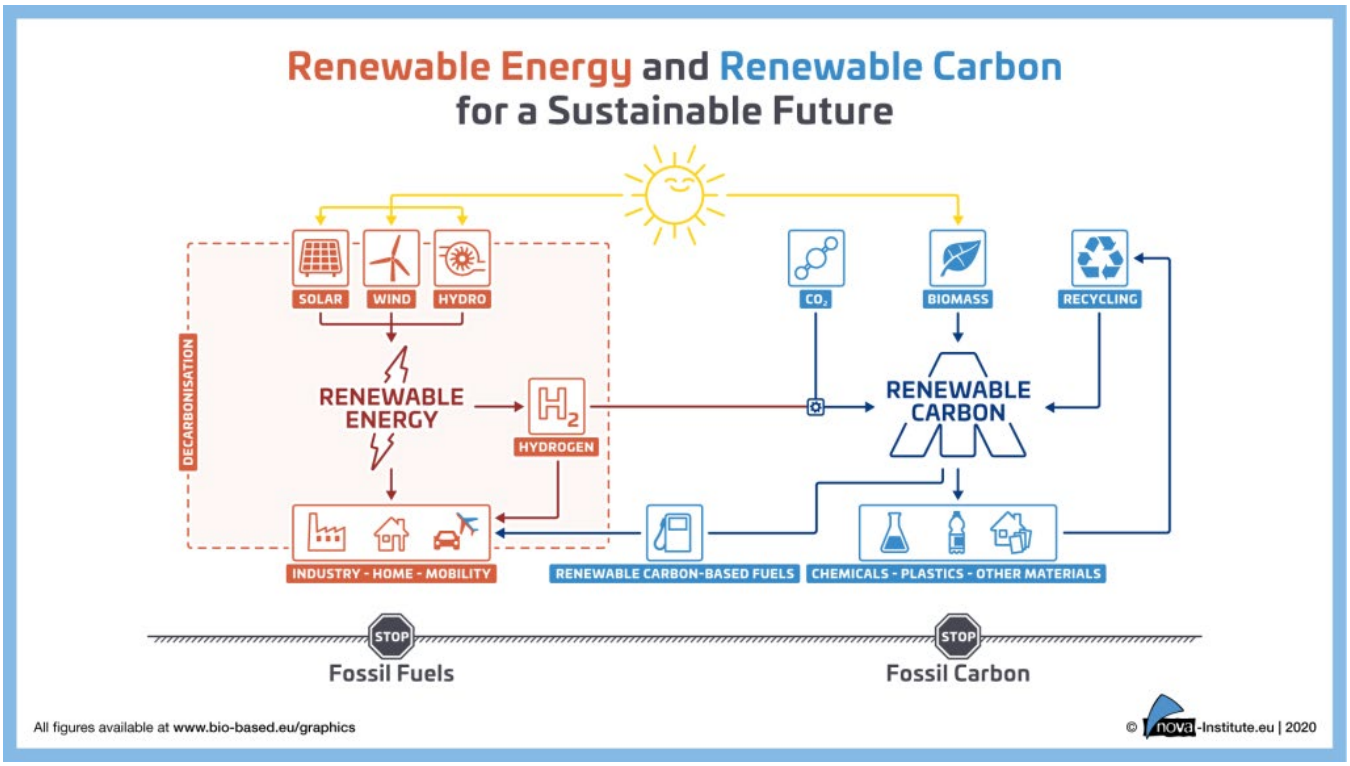
To help the Work Group understand how "electrofuels" can allow Minnesota to reach the charter target of a 100% reduction in transportation carbon intensity by 2050, the group members, staff, and modelers need to see and consider at least the two diagrams below.

The first figure below is from the Executive Summary of the new DNV report "Transport in Transition". It shows three classes of powered vehicles that would be needed to minimize the carbon intensity of transportation. Vehicles with low power requirements and relatively short distances between fueling/charging points can be completely electrified. Intermediate vehicles requiring more power and/or longer distances between fueling/charging points can use hybrid systems with batteries and efficient electric engines, but with quick refueling range extenders like hydrogen fuel cells or generators using low CI "drop-in" replacement fuels, like biofuels or "electrofuels" (synthesized from captured CO2 and green hydrogen.) Vehicles requiring maximum power and distance, such as intercontinental flights will always require the high energy density of hydrocarbon fuels, so they will need these drop-in replacement fuels, like electrofuels.



The second figure, below, is from the home page of the Renewable Carbon Initiative. It shows how we can decarbonize our society, by using renewable energy to recycle all of the carbon that is already above the ground, leaving fossil fuels underground. As indicated in the DNV figure above, there will still be applications like long distance jet travel that will require hydrocarbon fuels. These can be "electrofuels" made from captured CO2 and green hydrogen, as indicated by the airplane at the lower left that is half brown and half blue. Electrofuels provide the additional benefit of providing long-

term storage of intermittent wind and solar energy, which can be used to stabilize the electrical grid when it has a high percentage of intermittent renewables.



There is more discussion of electrofuels (or power-to-liquids) in the email chain below. I would argue that biofuels will always have a higher carbon intensity than electrofuels, because fuel will be needed for the farm equipment that plants and harvests the biomass, and fertilizer will be needed for crops (although the "green ammonia" project with the Heartland Hydrogen Hub can significantly reduce the CI of fertilizers.)

Appendix B: Letter from Low Carbon Fuel Coalition

November 14, 2023

Dear Chair and members of the Clean Transportation Standard Work Group,

Thank you for your hard work and shared commitment to thoroughly evaluate and ultimately make recommendations for a Clean Transportation Standard (CTS) program in Minnesota.

We are submitting this letter on behalf of the Low Carbon Fuels Coalition (LCFC) and its members to document broad industry support for a CTS. The LCFC is a technology-neutral industry association supporting CTS programs across the country. The following comments reflect the consensus view among our membership of optimal policy design to effectively and expeditiously decarbonize transportation, while providing the greatest benefits to climate, the state economy, stakeholders and consumers.

CTS policies have a proven track record of success reducing greenhouse gases (GHGs) in transportation. Established programs in California, Oregon and British Columbia have significantly reduced both carbon intensity and total GHGs, and Washington state is seeing progress in its first year. Equally important, these programs have demonstrated the broad benefits that can be realized in other states like Minnesota that enact similar policies.

The key attribute for success of a CTS is fuel technology neutrality, so that all fuel pathways are measured by the same standard—lifecycle carbon intensity. Accounting for the full lifecycle carbon intensity, including upstream emissions and land use change, is critical to instill confidence and ensure the integrity of the program. The U.S. Department of Energy's Argonne National Labs Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model is the gold standard for both its transparency and its scientific rigor.

A technology-neutral policy design that relies on rigorous measurement and carbon accounting has several important implications for the long-term functioning and success of the program. Specifically, a technology-neutral approach:

- **Builds in flexibility.** A CTS should be designed to adapt to changing market conditions and innovation. As new feedstocks become viable, production processes evolve, and practices such as precision agriculture are adopted, the program should credit developments that further reduce carbon emissions.
- **Maximizes carbon reductions.** Given the scale of GHG reductions needed to forestall worsening effects of climate change, no options should be off the table that can lower carbon emissions. An all-of-the-above approach encourages decarbonization investments for both the short and long term to sustain the success of the CTS program.
- **Accelerates carbon reductions.** GHG reductions today are worth far more than GHG reductions in the future, so ambitious decarbonization cannot wait until future breakthroughs. A CTS should incentivize deployment of all market-ready fuels that can immediately reduce carbon emissions in transportation. Fully including current fuel producers also provides a strong signal to further increase efficiency and quickly decrease carbon intensity in order to remain viable in these programs.
- **Accounts for current and projected market realities.** A CTS must provide options for the vehicles of today AND tomorrow. Light-duty vehicle manufacturers are moving aggressively to electrify and infrastructure is expanding. However, even if EPA's ambitious vehicle tailpipe GHG proposal is fully realized, 75% of passenger vehicles on the road will still use liquid fuels in 2032. Harder-to-electrify sectors like heavy duty, aviation and marine will take even longer to evolve. A CTS should not cede the liquid fuel market for decades by precluding or selectively limiting lower-carbon liquid fuels from the outset.
- **Facilitates economies of scale.** An all-of-the-above approach allows for innovation and emerging technologies to shift the deployment of feedstocks and fuels over time to reduce costs and maximize carbon reductions. For example, renewable diesel and sustainable aviation fuels can be produced in the same facilities, with relative yields variable based on policy incentives and market demand. Similarly, fuels like ethanol can be re-deployed as alcohol-to-jet fuel. Allowing iterative use of low-carbon feedstocks and fuels provides long-term market confidence for largescale investments.
- **Reduces regulatory burden and cost.** To avoid undue regulatory burden and cost on either the state governing agency or clean fuels industry, it is critical that all fuels are held to the same standard—carbon intensity.
- **Minimizes consumer impact and cost.** Driving is fundamental to Minnesotans' everyday lives. A CTS minimizes disruption by encouraging use of cleaner fuels for vehicles already on the road while fostering fuels to power the cars and trucks of tomorrow. Further, the fuels of today can be cleaner AND cheaper once the market is decoupled from dependence on petroleum. Electricity is already independent of the oil market and significantly cheaper on a cost per mile basis. When oil prices raise gasoline prices, high ethanol blends (E85) in California have been up to $2.50 per gallon cheaper than gasoline at the pump. Renewable diesel and biodiesel—which now account for more than 50% of the diesel used in California—have also offered discounts to conventional diesel in the heavy-duty sector.

In addition to these favorable attributes of a technology-neutral approach, CTS policies reduce on-road pollution emissions and the attendant human health effects. Various studies have quantified the benefits and cost savings of reduced pollution due to CTS programs, as well as the implications for environmental justice and equity by reducing pollution exposure disparities based on race and income.[1]

[1] Two representative studies are "Driving California Forward" by the Environmental Defense Fund and the American Lung Association at https://www.edf.org/media/report-california-fuels-policies-save-state-residents-over-10-billion-health-economic- costs and the UC Davis study "Modeling expected air quality impacts of Oregon's proposed expanded clean fuels program" at https://www.sciencedirect.com/science/article/pii/S1352231023000080

CTS programs also promote energy security by reducing reliance on oil. Petroleum dominance in transportation has had significant consequences for U.S. national security and energy independence, as well as for the economy when high transportation costs raise the price of goods and services and gas price spikes hit family budgets. A CTS can mitigate cost impacts in Minnesota by diversifying both the fuels in use and the feedstocks used to produce them.

A technology-neutral CTS is a proven policy to effectively decarbonize transportation while maximizing benefits to the state economy, job creation, health, and drivers at minimum cost. Minnesota already has a thriving biofuels economy. A CTS, coupled with the forthcoming incentives including in the Inflation Reduction Act, can establish Minnesota as a primary beneficiary and regional leader in the broader clean fuels industry. The LCFC encourages the Clean Transportation Work Group to base its recommendations on the attributes that have been instrumental in driving the success of existing programs. Primary amongst those attributes is a technology-neutral approach.

Sincerely,

Low Carbon Fuels Coalition

Adelante Consulting American
Airlines American Biogas
Council Bayer
Carbon Engineering Clean
Energy Fuels Darling
Ingredients e-Mission
Control Fidelis New
Energy Fulcrum
Bioenergy Gevo
Infinium Indigo
Life Cycle Associates Neste
Novozymes Oberon Fuels
Pearson Fuels
SCS Global Systems SHV
Energy Velocys

Appendix C: Letter from Minnesota Propane Association

MINNESOTA PROPANE ASSOCIATION

November 16, 2023 Minnesota Clean Transportation Working Group

Minnesota Department of Transportation 395 John
Ireland Blvd
St. Paul, MN 55155

Re: Minnesota Clean Transportation Working Group

COMMENTS OF THE MINNESOTA PROPANE ASSOCIATION

On behalf of the Minnesota Propane Association (MPA), which represents propane marketers, suppliers, distributors, and equipment manufacturers across the state, we appreciate the opportunity to provide comments on key programmatic components the working group should consider as it coalesces around a set of recommendations to present to the Legislature regarding the adoption of a Clean Transportation Standard (CTS). The propane industry, both as a user and provider of vehicle fuels, has a direct interest in this issue. In 2022, Minnesota's propane marketers sold 12 million gallons of propane to consumers for use in internal combustion applications. This included on-road vehicles such as school buses and commercial fleets, and off-road engine applications like forklifts.

Our industry has gained experience in California and Oregon that can provide insights into an equitable and carbon-focused programmatic design that can limit the impacts for consumers while providing the incentive to bring lower carbon fuels to market at a pace that recognizes the need to build new fuel production capacity. Although the final scope and the exact degree of granularity to which any specific recommendations will be detailed, has yet to be determined, MPA would like to emphasize some important points regarding the overall structure of a CTS.

I. Energy Neutrality

The underlying premise of any CTS is to reduce greenhouse gas (GHG) emissions. As such, the program should be energy agnostic and should not favor or show preference for any particular type of vehicle fuel

- electron or molecule. The working group's focus should be on the carbon intensity (CI) of the GHG emissions. The inherent flexibility of an energy-neutral policy will incentivize innovation and competition
- both are needed to achieve the pace and scale of emission reductions the state desires. As alluded to during previous working group meetings, the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model underpinning the CTS needs to be specific to Minnesota and fairly and completely capture all associated efficiencies and emissions associated with each type of transportation fuel, whether it is a primary or secondary energy source.

II. Emission Reduction Targets

We understand that the Legislature has instructed the working group to study a CTS that requires aggregate carbon emissions to be reduced, from a 2018 baseline level, by at least 25 percent by the end 2030, 75 percent by the end 2040, and 100 percent by the end of 2050.[1] MPA believes, however, it also would be prudent to highlight the varying views that have been expressed by members of this working group on the degree to which those benchmarks are realistic and feasible. Numerous economic and geopolitical factors, not to mention basic market forces such as supply and demand, may individually or collectively impact the achievability of those reduction benchmark targets.

Furthermore, the working group should be clear on just how aggressive Minnesota's reduction timetable is (starting at program inception) compared to other states, such as Oregon, with more established programs. Rather, a phased-in approach that includes a reasonable decrease, on an annual basis, of aggregate carbon emissions would be more practical. Program ambition should be steady with a gradual ramp-up. In regard to infonnation gaps to be filled for legislators, these items are important.

III. Opt-in Coverage for Forklifts

While there has been some discussion on off-road equipment, it has not been a core focus of the working group. However, given the prevalence of forklifts in Minnesota, it would make sense for this particular application to be further examined because it presents real opportunities to reduce emissions and improve air quality across the transportation sector. For example, both California's Low Carbon Fuel Standard,[2] and Oregon's Clean Fuels Program provide coverage opportunities for forklifts.[3] Fuel retailers should be able to voluntarily opt in to coverage and generate credits through the sale of qualifying fuel for forklift applications in the state's CTS marketplace. This will incentivize the market adoption of cleaner and less carbon-intensive forklift fuels and accelerate a transition away from legacy fuels, such as gasoline and diesel.

IV. Conventional and Renewable Propane CI Scores

Critically, both conventional propane and renewable propane need to be assessed and assigned carbon intensity scores from the State of Minnesota to participate in this market. We certainly appreciate the fact that, as the working group has progressed, the underlying technical modeling has been updated to include propane and renewable propane, even if the estimated aggregate energy consumption between 2026-2040 is on the low side. At MPA, we certainly believe renewable propane will see considerable market growth in the transportation sector if a CTS is ultimately implemented. To the extent that this working group makes any specific recommendations regarding the suite of fuels that should be assigned CI scores at the program's inception, it should include both conventional propane and renewable propane - the CI scores of which will vary depending on production sources and feedstocks. Given the importance of accurate and fair CI assessments for all CTS fuels, this group should endorse some basic principles, including:

- The underlying inputs and methodology used to calculate complete CI scores and applicable Energy Efficiency Ratios (EER) for each energy source should be done in an open and transparent process by the applicable state agencies.
- State officials should, to the greatest extent possible, directly engage with industry representatives during the initial regulatory drafting process regarding underlying assumptions, input data, and methodology that will be utilized to produced initial CI and EER scores.

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[1] http,:..www.rcvisor.inn.gov/biIls/tcxt.php?number-HF2887&vcrsion=O&session=)s93.O&session_vear=2023&scssion_numbe1=0&typ1.=ccr&IOJ: mat=rdf

[2] *Proposed Zero-Emission Forklift Regulation Standardized Regulatory Impact Assessment,* California Air Resources Board, (April 5, 2023), hnps:. 'dof.ca.gov1wp-contcnt/uploadslsitcs 352/2023/04/ZE-Forklili-SRIA-to-DOF.pdf

[3] *Clean Fuels Program Overview,* Oregon Department of Environmental Quality. https:, www.oregon.gov,deq ghgp cfp pages,cfp-ovcrview.aspx

- Stakeholders and the general public should be given sufficient time to review the CI and EER inputs and data and provide comment for regulatory consideration.
- All potential updates and revisions to the underlying data, inputs, methodology, or other necessary information relied upon by state regulators should be conducted in an open process that is subject to direct engagement by stakeholders and the public.

These principles will ensure the carbon intensity score and energy efficiency ratio attached to each fuel source is accurate and based on data that is sound and assumptions that are fair. The Minnesota Propane Association, just like all other stakeholder groups, deserves the opportunity to review the infonnation upon which the regulation will be structured and provide subsequent input.

V. Conclusion

The final group recommendations should reflect areas of broad consensus from all stakeholders and group participants, including an emphasis on fuel fairness in programmatic structure, transparency in the regulatory process, and an opportunity for direct stakeholders and the general public to be engaged in future proceedings and provide input and information for regulatory evaluation and consideration.

Thanks again for the opportunity to provide comments, and I look forward to future CTS working group meetings.

Respectfully submitted,

Dave Wager
Executive
Director
Minnesota Propane Association

12475 273rd Ave. **NW**
Zimmerman, MN
55398
dave@mnpropane.org
Telephone: 763-633-
4271

Work Group Meeting #7 – November 30, 2023

Date: November 30, 2023
Time: 1:00 – 3:00 p.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Meeting Summary

Welcome & Project Overview

Shannon Engstrom (CTS Director, MnDOT) introduced herself and thanked everyone for joining the seventh Work Group meeting. Shannon reviewed the meeting agenda and objectives:

- Review timeline and discuss priorities for the next 4 weeks+
- Provide overview of draft report to familiarize Work Group with structure
- Provide ample desk time and office hour Q & A time for the Work Group
- Provide ample time to hear feedback from non-Work Group members

Next, Shannon walked through the draft report timeline for the next few weeks. She reminded WG members that the survey is due at midnight on December 6. The survey feedback will then be used to make modifications to the Findings and Recommendations chapter between then and December 12. The revised Findings and Recommendations chapter will be shared with the Work Group prior to the December 13 meeting for discussion. Shannon informed the Work Group that there will be a meeting with the Group Chair, Kevin Pranis, to discuss draft report feedback. Finally, she reminded the Work Group that the state agencies will make the final content decisions regarding the report.

Shannon reminded everyone that the intent of the feedback survey is to gather input on where the Work Group members stand on the first draft of the report and highlighted the necessity for the feedback survey. She urged the Work Group to devote some time to providing their thoughts.

Takeaways from the November 21 Work Group meeting were mentioned, which are also located in the meeting summaries posted to the CTS webpage.

Next, Tim Sexton (Assistant Commissioner, MnDOT) thanked the Work Group members for their time and effort engaging in this process. The challenge of the report is to balance brevity and technical complexity, and the Work Group was reminded that the audience for the report is the Minnesota Legislature. The report is intended

to represent the broader group, and to capture the overall sentiment of the Work Group while reflecting the best interest of all the stakeholders involved.

Draft Report Overview

This meeting was developed with the intent to give an opportunity for non-Work Group members to provide feedback. Amy Fredregill (WSB Consulting) reminded the Work Group of their roles and responsibilities – to guide scenario development with the modeling and outlining gaps and opportunities with implementing a CTS policy in MN. Feedback will be used to develop recommendations based on the Work Group's discussions. Other aspects of the report such as the modeling and background sections are contextual products for the Legislature's awareness.

Amy then presented an overview of the draft report, and discussed how the feedback was developed and structured in the report. The process was divided into two areas:

Legislative: Work Group Recommendations	**Rulemaking**: Gaps and Barriers and Opportunities for Further Exploration
• Areas of more agreement such as Mentimeter results for statements that are > 4.0, if the statements had been polled through Mentimeter • Other Key Takeaways we reviewed in the slides during WG meetings where there were no concerns raised • These are the framework for future legislation to set guideposts for a CTS and its intended outcomes	• Areas with less agreement/clarity. Would benefit from more and broader engagement • Describes range of perspectives • Gaps and Barriers vs. Opportunities • Related and complementary policies

Review Fuel Pathway Modeling

Philip Sheehy (ICF Consulting and the technical consultant for the Work Group) provided an overview of the modeling process for the report. The modeling was intended to be the supportive, technical backing of the Work Group's input and expertise to develop a successful CTS policy. The scenario modeling was an iterative process whereby MN-specific information on supply, distribution, and production data were used. The baseline carbon intensity (CI) of transportation fuels within the state was determined using a 2018 baseline.

Scenario modeling demonstrated levels of CI reduction that could be achieved via a Minnesota CTS under different market conditions and considerations. The scenario modeling included fleet turnover and included assumptions regarding fuel economies, vehicle miles traveled, and other key parameters associated with transportation fuel consumption.

The CI targets included in the statute may be very difficult to achieve given what is known today about the market and clean fuel technologies.

- **Business As Usual (BAU) Case**: Likely achieve a CI reduction of 5% in 2030, 15% in 2040, & 30% in 2050.
- **Moderate Case**: Likely achieve a CI reduction of 13-17% in 2030, 40-50% in 2040, and 65-75% in 2050.
- **Accelerated Cases**: Using optimistic considerations for clean fuel deployment in Minnesota, the state could achieve a CI reduction of greater than 50% in 2040, and greater than 75% in 2050.
- **All-In Accelerated Case**: An aggressive outlook that aggregates many optimistic assumptions with respect to clean fuel deployment, the state may be able to achieve the targets included in the statute.

Break Time to Review Draft Report

Work Group members were given 15 minutes of quiet time to review the report and prepare for the Q&A portion of the meeting.

Open Q & A for Work Group Members

Next, Amy Fredregill (WSB Consulting) and Phill Sheehy (ICF Consulting) took comments and answered questions from the Work Group:

- **Question**: I don't remember any Work Group discussion about rulemaking, and/or what issues are appropriate for rulemaking vs legislation. That should be clearer in the report, since rulemaking wasn't a Work Group recommendation.
    - **Tim:** We can make tweaks. Dividing the recommendations into legislative and rulemaking was an effort to make the report more actionable for the MN Legislature audience. We can clarify there are different ways to define those areas in the report, *one* of which is rulemaking.
- **Question**: Unresolved issues can also be decided by the legislature. Just because there is no consensus in this group does not mean the issue needs to be addressed by rulemaking.
    - **Shannon**: Understood, we will revise the language in the report to make it clear unresolved issues does not imply they must be decided during rulemaking.
- **Question**: Regarding the potential for rulemaking, who is the state agency taking the lead on that?
    - **Shannon**: The Legislature would need to appoint an agency. Feel free to provide feedback regarding this in the survey.
- **Question**: On page 10, it states that CFS legislation has been introduced in Illinois, New Mexico, and New York. Noting that CFS legislation has also been introduced in Michigan, Vermont, and Massachusetts (and MN).
    - **Amy**: Yes, we were planning to check the latest just before publishing. Thank you for sharing this. We will update the report to reflect that.
- **Question**: Are all of these statements based on the feedback from November 21 and 13? One of issues I found was that I put a response in and could not go back and edit. Is there inherent bias? I wasn't' sure how to answer given my lack of expertise in certain areas.
    - **Shannon**: The surveys were to get a pulse where Work Group was at, and are by no means a final assessment. I am open to providing clarity on certain topics here or after this meeting. It is

our intent to further refine the statements in this draft report. Please utilize the comment box in the survey to provide feedback on how you're answering questions.

- **Question**: Jeremy at UCS had shared some materials on how Oregon addressed equitable EV infrastructure investments. Might we consider incorporating by reference? https://apps.puc.state.or.us/orders/2018ords/18-376.pdf
    - **Amy**: Thanks for sharing. We are trying hard to balance brevity and detail in the report, but we will try to incorporate this.
- **Question**: Is it possible to consider a more robust discussion of rulemaking? Small discussions talked about verification, enforcement, etc., which was always kicked to rulemaking. We might benefit from more discussion on what rulemaking is.
    - **Shannon**: We can clarify this better in the report. Take a look at page 22 where we discuss what came out of conversations, etc., and please provide comments in the survey if we're missing anything else.
- **Question**: Could we also bring back the skip question button on mentimeter? Like Kathleen said, some questions I am not able to weigh in on because of lack of expertise or position.
    - **Amy**: We added a comment box in the survey so you can add any caveats or explanation for your response. Also, selecting a 3 on the likert scale is technically neutral, which you could utilize as well.
- **Question**: What is definition of Clean Fuels infrastructure as used in the Fueling Barriers section on page 23? Where did we have this discussion? It's dangerous to include statements from only a few people in the report.
    - **Shannon**: This was something that came in through the mentimeter results. We can certainly provide a definition of fuel infrastructure. Just a reminder as well that the intent of the mentimeter was to capture wholistic feedback from the Work Group.
- **Question**: Regarding conversations on cost benefit analysis - I know it's happened in subgroups, but was this agreed upon by the whole group? We maybe didn't get the full opportunity to talk about this.
    - **Shannon**: Comments were made about a cost benefit analysis to the entire Work Group on Nov 21 and we captured that, and it was also discussed in the program administration small group. This is a hard topic to fully discuss without final direction from Legislature.
- **Question**: Regarding land use on page 21, the whole section reads odd to me. If we're talking about environmental wellbeing, it reads like we don't know who is responsible. Shouldn't it be the Pollution Control Agency and Health Department that are directing the health and pollution assessments (see C.1.2)?
    - **Shannon:** Statement C.1.2 (tracking equity and health outcomes) was an idea posed to the Work Group that received support. This would be something the CTS program could track and would likely partner with the relevant state agencies to conduct this tracking.
    - **Frank**: In addition, within the rulemaking process within the statement of need and reasonableness support document and technical report, you can do additional analysis of what we're previously done and can create definitions in rulemaking about additional measures. These can include items like what we are discussing here.
- **Question**: On the question of methodologies for a lifecycle analysis (including what is in scope), you could cite the National Academy report that goes into that complicated topic in great detail:

https://www.nationalacademies.org/our-work/current-methods-for-life-cycle-analyses-of-low-carbon-transportation-fuels-in-the-united-states

  - **Amy:** Thank you, please note and share these with us in the survey.
- **Question:** I feel that some legislators will want to know how this is going to impact consumers. Will it result in higher "costs at the pump"? Perhaps we can show the results from CA, WA and OR.
  - **Shannon:** Yes, we could reference other state analyses that are done. Oregon for example conducts an analysis annually that shows the average cost of the Clean Fuels Program[2] per gallon of E10 for 2022: $0.0692 or 6.92 cents per gallon of E10. Washington also conducted their own Cost Benefit Analysis in May 2022.[3]
- **Question**: Would any role for Investor-owned Utilities (IOUs) in EV investment require including the PUC in the rule making and/or legislation?
  - **Unanswered during the meeting due to time:** As noted in the report, the MN Public Utilities Commission (MPUC) would need to weigh in on the eligible use of revenue generated from the sale of credits that could be allocated to utilities on behalf of consumers for residential EV charging, particularly at investor-owned utilities.

Feedback from non-Work Group Members

Next, Amy Fredregill (WSB Consulting) discussed ongoing feedback mechanisms for non-Work Group members. As this process is not legally required to follow open meeting laws, we're trying to capture as much feedback as possible.

- **Question**: How will members of public be able to submit comments and feedback?
  - **Shannon**: Thanks for your question – you're welcome to provide comments today (right now). The Nov 30 slide deck is already posted on the CTS webpage. Feel free to send me emails with feedback as well addressed to the full Work Group.
- **Comment**: I'm Dale Lutz, a retired chemist. Today is the start of the 28th United Nations' international Congress of the Parties (COP28), advancing the world's efforts to address climate change. The first Global Stock take of our progress on reducing greenhouse gas emissions shows that we are way behind where we need to be. I encourage the work group members, staff, and modelers to review the public comments and Appendix A from your November 21 meeting summary. They show how recommendations for urgent action from this group can contribute to a sustainable future for everyone. Quickly building the infrastructure to capture unavoidable CO2 emissions and convert them to electro fuels, using green hydrogen, will be a critical part of the solution.
  - **Amy**: Thank you for your comment.

[2] https://www.oregon.gov/deq/ghgp/cfp/pages/annual-cost.aspx

[3] https://ecology.wa.gov/getattachment/22790fe6-fc3a-414d-b3ba-036af0975258/20220512CfsCba.pdf

- **Comment from Plug in America representative**: Give flexibility to agency in charge, to add capacity credits at later date, for example. There are thoughts here that a LCFS can't do everything, which is true, so this should be framed in bigger picture such as what the other tools in the toolkit are.
    - **Amy**: Thank you for your comment.
- **Question**: Where can Nongroup members get a draft copy of the report that work group members received?
    - **Shannon**: We are still discussing a number of things with Work Group members, so the draft report is for Work Group members only at this point. However, there will be a preview of the final report for everyone in mid-January and the report will be made public when shared with the Legislature Feb 1, 2024.

Wrap-Up and Closing Remarks

Shannon Engstrom (CTS Director) and Kevin Pranis (Work Group Chair) thanked all of the Work Group members for being at the meeting, and for dedicating time to this work. She reminded everyone that the next Work Group meeting will be held on December 13, 2023, and is virtual only. There will be time to discuss the report and ask questions from the state agency and consulting staff or of fellow Work Group members.

Comments can also be submitted by emailing Sustainability.dot@state.mn.us. Additionally, a link to the CTS webpage was provided: dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-Group.html.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Paul	Austin	Conservation Minnesota
Virtual	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Richard	Biske	The Nature Conservancy
Virtual	Mike	Bull	Allete/MN Power
Virtual	Margaret	Cherne-Hendrick	Fresh Energy
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
Virtual	Rodney	De Fouw	Great River Energy
Virtual	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone

Virtual	John	Jaimez	Hennepin County, Partnership on Waste and Energy
Virtual	Brendan	Jordan	Great Plains Institute (GPI)
Virtual	Ariel	Kagan	Minnesota Farmers Union
Virtual	Thad	Kurowski	Tesla
Virtual	Jeremy	Martin	Union of Concerned Scientists
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Kevin	Pranis	Liuna Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of the Mississippi River
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Nate	Schuster	ChargePoint
Virtual	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
Virtual	Peter	Wagenius	Sierra Club
Virtual	Brian	Werner	Minnesota Biofuels Association
Virtual	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Tim	Sexton	CTS Internal Steering Team Assistant Commissioner, MN Dept of Transportation
Virtual	Valare	Falkner	CTS Internal Steering Team Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	CTS Internal Steering Team Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Carolyn	Caffrey	Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Megan	Lennon	CTS Internal Steering Team Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Frank	Kohlasch	CTS Internal Steering Team Assistant Commissioner, MN Pollution Control Agency
Virtual	Shannon	Engstrom	CTS Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Philip	Sheehy	ICF – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant

Members of the Public

First Name	Last Name
Kathleen Doran-Norton	LWVMN
Amy Talarico	Field Advantage
Ashley Hughey	Woodside Energy
Bennett Smith	Fredrikson
Brett Webb	Flint Hills Resources
Chhavi Dhingra	WSB
Craig Schoenfeld	Valero Renewables
Dale Lutz	Self (retired chemist)
Dallas Fischer	Fueling Minnesota
Daniel Dwight	Stinson, LLP
Daniel Gonzalez	Center for Transportation and the Environment
Daniel Saunders	MnDOT
David Sullivan-Nightengale	Intertek
Dean Taylor	Plug In America
Donovan Hurd	Faegre
Eduardo Barrientos	EMPS
Elliott Blackburn	Argus Media
Hannah Wind	Cozen O'Connor Public Strategies
Holly Mayton	John Deere
Ian Marsh	PSP
Jake Hamlin	CHS Inc.
Jean Wagenius	Retired
Jeremy Estenson	Taft Advisors

Jessica Hoffmann	RPMG
joe marble	MN House of Reps GOP Staff
Joe Sellwood	Cook Strong Sellwood
Joel Wessman	Consulate General of Canada
Julia Silvis	GREATER MSP
Kate Klossner	Marathon Petroleum Corp
Katie Stonewater	bp
Kent Kaiser	Domestic Policy Caucus
Kimberly Scott	Union of Concerned Scientists
Laura Piotrowski	RPMG LLC
Lydia Campbell	Taft Advisors, LLC
Mark Nisley	Minnesota House of Representatives
Marsha Anderson	MN Department of Transportation
Matthew Lemke	FHR
Melissa Partin	MCEA
Mike Karbo	American Petroleum Institute
Per Lundmark	GNA/TRC
Sarah Psick	Psick Capitol Solutions
Sherrie Merrow	NGVAmerica
Tammi Hagen	Headwaters Regional Development Commission
Terry Riesen	MPC
Thomas Brennan	FHR
Todd Hill	Hill Capitol Strategies
Vince Gunaca	United Steelworkers

Work Group Meeting #8 – December 13, 2023

Date: December 13, 2023
Time: 1:00 – 4:00 p.m.
Minutes prepared by: WSB Consulting and MnDOT
Location: Zoom.

Meeting Summary

Welcome & Project Overview

Shannon Engstrom (CTS Director, MnDOT) introduced herself and thanked everyone for joining the eighth and last Work Group meeting. Shannon reviewed the meeting agenda and objectives:

- Review and discuss draft report survey feedback
- Review and discuss updated draft 'Findings and Recommendations' chapter
- Continue to co-learn from various perspectives and identify takeaways on priorities
- Review timeline and discuss priorities for the next 4 weeks+

The purpose of the meeting was to learn more about the survey results, hear from Work Group members in a large group setting, reflect on the results and give everyone an opportunity to hear from each other. Shannon provided some high-level discussion questions for the Work Group to keep in mind throughout the meeting:

- What do you feel the Report Recommendations do well?
- Where do you feel the Report Recommendations reflect Work Group discussion the least?
- Anything else you would like to mention for the Work Group's consideration that was not already included in your survey response or discussed today?
- Can you live with these Recommendations? Thumbs up/emoji's

For the sake of time, two statements will be discussed at today's meeting, including specific feedback and how statements were revised based on that feedback. These will be discussed in detail later in the meeting.

Next, Kevin Pranis (Work Group Chair) thanked the Work Group members for their time and effort with this project, how important it is, and reflected on everything that the Work Group has accomplished over the past 5 months.

Shannon then reminded the Work Group members that the report is actionable for the Legislature, and as such, requires trying to balance brevity and detail which hasn't been easy given the complexity of the subject matter.

The process itself was complex, and the deliverable reflects the best we could with constraints we were under include timeline, number and diversity of stakeholder perspectives, and scope. The Work Group was also reminded that a CTS is not the only decarbonization strategy, and is instead, one tool in the tool box. Shannon ended with reminding the Work Group that the state agencies will have the final say for the report, and to feel free to email her at Shannon.engstrom@state.mn.us if anyone has any questions. The Work Group will meet again on January 23rd, 2024 from 1-2 PM CST to view the final report and see what will be delivered to the legislature.

Draft Report Feedback Overview

Amy Fredregill (WSB Consulting) thanked Work Group members for their time and engagement in the process, and shared high level results from the survey the Work Group members completed on December 6th, 2023.

- 27 out of 31 questions had a median score of 4
- 21 recommendation statements had a median score of 4
- Staff have reviewed responses by 31 members to all 36 survey questions (1,116 data points + comments)
- ~50% of WG members provided open ended comments for each statement (A – C)
- Section C – largest range of feedback, concerns raised
- Frequent responses include: didn't have enough time; need more context to statements; rulemaking wasn't discussed; need more language about ecosystem services
- *Many* lengthy responses in big picture questions ('What is holding you back from supporting the draft recommendations' and 'Is there anything else you'd like to add')

Amy then discussed some of the high-level comments that were received in the most recent survey.

Comment	Action
Uncertainty whether statements based on **small group vs large group discussion**	**Add clarity** that small and large groups discussion informed statement drafting and revision before all members polled
The WG's charge to identify 'gaps and opportunities' is not incorporated into language clearly	**Add clarity** that entire WG process was focused on gaps and opportunities via modeling and discussion.
Climate smart forestry consolidation to be consistent	Recommendations were consolidated

"We did not discuss Rulemaking"	Clarify nature of discussion and that anything mentioned for rulemaking is list of ideas without consensus
Clarify purpose of polling throughout process	Polling helped gather quantitative and qualitative feedback between meetings to meet legislative deadline
Statement was not in a previous poll	Correct, a few statements stemmed from the Nov. 21 meeting so therefore could not be included until the Nov 28 poll

Median scores of all 32 questions were then summarized. All but two statements had a median score of 4, while statements C.2.3 and C.2.4 received a median score of 3.

Key clarifications were also addressed such as:

- Adding definitions for "Target" versus "Goal" in the report
- Clarifying that Work Group conversations were not focused on whether Minnesota should implement a Clean Transportation Standard, but instead, what a CTS should look like if the Legislature decides to move forward and implement a CTS
- Referring to the modeling section in the Legislative section for recommendation statements (A.1.1 – A.1.4)

'Findings and Recommendations' Chapter Update & Discussion for Work Group Members

After a short break to review the revised statement handout Shannon Engstrom (CTS Director, MnDOT) sent Work Group members the morning of 12/13, Amy Fredregill (WSB Consulting) walked through a few statements, the feedback received, and how the statement was revised based on the feedback. Statements A.1.1, B.2.3, and C.2.3/C.2.3 were discussed.

A.1.1

Score = 4/5

Original statement: After reviewing modeling results the Work Group members indicated a preference for carbon intensity reduction targets in line with the following:

- Carbon intensity reduction targets somewhere between the bands of the Moderate Case and the Statutory Targets (13 of 28 Work Group members)

- Carbon intensity reduction targets in line with the Moderate Case bands of 13-17% by 2030, 40-50% by 2040, and 100% goal by 2050 (8 of 28 Work Group members)
- Carbon intensity reduction targets identical to the Statutory Targets of 25% by 2030, 75% by 2040, and 100% by 2050 (7 of 28 Work Group members)

REVISED STATEMENT: After reviewing modeling results, most Work Group members acknowledged the challenge of meeting the carbon intensity reduction targets written into the statute and charge of the Work Group. Work Group members indicated a range of opinions about the ideal targets, with most Work Group members agreeing that the targets should be somewhere between the Moderate Case and the Statutory Targets.

Carbon intensity reduction targets somewhere between the bands of the Moderate Case and the Statutory Targets:

- Moderate Case: 13-17% by 2030, 40-50% by 2040, and 100% goal by 2050
- Statutory Targets: 25% CI reduction by 2030, 75% reduction by 2040 and 100% CI reduction by 2050

Discussion:

- One Work Group member had concerns with the language "most" - 13 of 28 is not most.
    - Shannon: This statement actually received support from more than 13 members – there are actually just a few people who believe it should be outside of those options. The language will be revised here to better reflect this.
- More of a statement than a question - Section A travels together and acknowledges we don't really know how we're going to get to the 2050 goal. This is true
- One Work Group members thought A.1.2 statement could lead to misinterpreting – 2050 target in *STATUTE*: I think we really mean "session law"
    - Shannon: this refers to the Work Group law targets. We will go through and make sure that language is being used consistently.

B.2.3

Score = 4/5

Original statement: Climate smart agriculture and forestry practices that demonstrate verifiable GHG reductions received broad support. Climate smart agriculture and forestry should be factored into the CI score. Additional discussion is recommended around reporting and verification. The Work Group recommends that farmers that implement climate smart agricultural practices should receive a benefit from the credits generated by refiners/producers.

REVISED STATEMENT: Many Work Group members support allowing climate smart agriculture and forestry practices that demonstrate verifiable GHG reductions be factored into the fuel pathway CI scores. There was

also agreement that farmers/growers who implement smart agricultural practices should benefit from the credits generated. Many Work Group members recommend that farmers and forest landowners/managers that implement climate smart practices are verified by a third party which has state agency oversight. Details for reporting and verification would need to be clarified via statute or during rulemaking.

Discussion:

- Regarding forestry, there are three entities in MN that certify this type of verification. In Wisconsin, there is a program tied with their privately enforced stewardship that also certifies their private forestland owners. This might be something MN wants to consider.
- There are other third parties that exist in this space that are able to certify climate smart agriculture practices in the US and internationally.
- There are many third-party verifiers for climate-smart agriculture particularly for voluntary climate inventories in food/agriculture companies. USDA is also putting $300 million into monitoring, reporting and verification science and frameworks for climate-smart agriculture - so more to come in future years as well.
- There are third parties that use a USDA model, mostly a practice-based model but does calculate carbon emission reductions from practices.
- How are verification services typically funded? Fees? Cost of doing business? Program credibility is critical to our shared success. We think it's important to include (a) public access to anonymized data and (b) a penalty structure that keeps everyone playing by the rules. Strong agency oversight and some measures of public transparency are important for credibility.
- There should be language around enforcement as well, e.g. penalties for inaccurate reporting and adjustments of debit/credit for noncompliance.
- The second sentence is only referring to agriculture and not to forest landowners and climate smart forestry practices
- Should it say "climate smart" vs "smart" in line 3?
- This goes beyond verifications and involves how the program is set up and the deal struck between producer and biofuels entity, transparency, etc. There are too many unknowns. This shouldn't be punted to rulemaking, but may be better discussed as an opportunity or gap in the report, given there's a huge gap in how you do it. Also, should agriculture and forestry be separate statements?
- Enforcement and penalties is a very valid discussion. It also applies to other topics besides climate smart agriculture and forestry as well.
- Who will pay the cost for the modifications? and what impacts will they make in the forest production making liquid fuel? Transportation risk?

C.2.3 (now combined with former C.2.4)

Score = 3/5

Original statement: The Work Group supports including 100% woody biomass with lowest CI feedstock source possible in the modeling. If brought to market and verified (based on the best available science), climate smart forestry practices should be evaluated for eligibility for credit generation.

C.2.4

Score = 3/5

Original statement*: Utilization of verified climate smart forestry practices for woody feedstocks in advanced biofuels may help improve forest health and result in co-benefits to local communities including disadvantaged populations.*

REVISED *AND COMBINED* STATEMENT: The Work Group discussed a fuel-neutral CTS that encourages feedstock diversification that enables market actors to maximize GHG emission reductions. Based on information available to the Work Group, feedstocks like woody biomass and winter annual oilseeds can be used to produce biofuels that would likely yield a lower carbon intensity value than biofuels produced using conventional feedstocks today. These feedstocks may yield co-benefits. For instance, sustainable extraction of woody biomass may help improve forest health and result in co-benefits to local communities. Whereas winter annual oilseeds (such as winter camelina and pennycress) may help improve water quality, soil health and habitat benefits. Biofuels produced using emerging feedstocks like woody biomass or winter annual oilseeds would be subject to the same verification requirements as other low carbon fuels.

Discussion:

- A few Work Group members were glad to see the inclusion of winter annual oilseeds.
- Given the prior discussion around verification and noncompliance penalties around climate smart agriculture, we should be consistent with those principles for winter annual oilseeds as well.
    - Shannon: Thanks, the last sentence implies they would follow the same verification requirements.

Moving away from the specific statements above, Amy allowed Work Group members to express thoughts on any of the revised statements, and posed a few high-level questions to the Work Group:

- What do you feel the report recommendations do well?
    - One Work Group member believes the Report Recommendation provide clear and easily understood direction.
    - It balances a lot of different perspectives, and identifies areas with broad support.
    - Given the range of perspectives on the work group, it does a nice job of capturing the range and issues discussed.
    - The report summarizes multiple positions of Work Group members well.
    - Generally speaking, the report is a good effort to summarize the conversation. This is a good summary of some of the inflection points in the policy.
    - Many Work Group members shared appreciation for Phil's modeling.
    - It captures Work Group discussions and identifies many areas of broad support.

    - I believe the process itself has helped many of us better understand this complex policy and the diverse perspectives.
    - I echo the comments of many here that the recommendations do a very good job of capturing 6 months of intense work and a lot of feedback.
    - The Report's best impact is to keep this discussion going and provide participants with good information going forward.
    - This is such important work as the country watches what happens with this policy in the next legislative session. The state has the opportunity to be a pioneer in this space as we work to craft this.
- Where do you feel the report recommendations reflect the Work Group discussion the least?
    - The idea of off ramps under certain circumstances may be missing.
        - Shannon: Thanks, we will look back in the report and see how we've currently captured that.
    - Regarding the language "many" - what is that threshold?
        - Shannon: If the median score is 4/5, "many" was the language that was used in the statements. We will try to include this explanation in the report.
    - A few Work Group members feel that B.4.1 CCS language leads readers to believe that PHMSA will fix all the problems with CCS. This is not the case. I mentioned concerns with CCS that go beyond safety consideration.
    - The report artificially separates environment from environmental justice in discussion of co-benefits. There was repeated discussion of the need to advance ecological co-benefits, yet this is not included in C.1.1.
    - I think it does not capture nuances of table or larger Work Group discussions very well.
    - I haven't seen the feedback I shared (both written and verbally) reflected yet.
- If you could pick one aspect of a CTS that you feel is most important to Minnesota, what would it be?
    - Climate smart agriculture.
    - Highlighting board stakeholder engagement.
    - The diversity that this group brings and everyone working together for a better future for all
    - The transformational ability of a CTS to lower CI in transportation and ag. The modeling gives us a much clearer picture of what is possible.
    - A fuels policy comprehensive enough to advance electrification and support continued improvement and evolution of biofuels as well as space for new fuels, not yet in market.
    - Recognition of climate smart agriculture practices as a contributor to lower carbon-intensity scores for fuel, especially given the importance of agriculture to the state of MN.
    - The scale of opportunity in the near-term seems pretty large.
    - Key message is that a CTS study promises significant reductions in transportation carbon emissions over next 15 years.
    - Economic development opportunity for Minnesota by increasing investment in emerging clean fuels and electrification.
    - Opens opportunities for advancement in many very critical areas, agriculture and electrification being two of them. Especially important in light of another Work Group members' insight that the whole country (maybe world) is watching.

Feedback from Work Group Members

Amy Fredregill (WSB Consulting) teed up open ended Work Group member feedback. Shannon reminded Work Group members that this is the last time they're meeting until January 2024, and encouraged people to engage in the discussion.

- Environmental impacts are not reflected in the report as much as they should be – what are the impacts, especially woody biomass, as well as inclusion of any solutions we may have.
- We appreciate everyone on the team and Work Group members who have devoted so much time

Feedback from non-Work Group Members: Amy Fredregill (WSB Consulting)

Amy Fredregill (WSB Consulting) opened up the discussion for non-Work Group members to provide thoughts, continuing the ongoing feedback mechanisms for public members to engage in this process. Amy reminded the Work Group that this process has included engagement with the public though it is not required by law. Shannon reminds them that the purpose of the meeting today is to gauge high level feedback on the revised statements.

- (Marathon petroleum) to Eric Schenck's comment about refinery conversion - While yes, it is possible to convert refineries, it is not without significant cost and conversions would be based on how a CTS is structured and how individual refineries would be impacted. We spoke about this in an early meeting with the work group.
- Can public members have a copy of the revised report that was shared today?
    - Shannon: Thanks. As my note earlier stated, this document is to remain internal with the Work Group at this point, as it's still in draft form.
- Today, at the United Nations' 28th climate Congress of the Parties (COP28), the nearly 200 "Counties agreed to transition away from fossil fuels 'in a just, orderly and equitable manner' while 'accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science,'" according to the Washington Post. Establishing and implementing an ambitions CTS is one way for states like MN to lead this transition. https://www.washingtonpost.com/climate-environment/2023/12/12/cop28-climate-summit-negotiatons-dubai/ Thank you all for your important contributions.
- (Marathon petroleum) in addition to being an FF producer, we are also a renewable fuel producer and therefore a potential credit generator within a CTS. There were some comments today about the diversity of feedstocks and climate smart agriculture practices, which Marathon supports. There are some contradictions in the modeling and the statements though, and how the vast majority of programs exist within the US today. For example, SAF and how those requirements would have to change in order to meet CTS requirements. Minnesota can't build a fuels program that's an island, and if it's only good for Minnesota, it won't benefit the vast majority of producers.
- (Plug in America) We have room for non-Work Group comments in the report - can you include the work GPI completed on smart agriculture?

Ample time was allowed for non-Work Group members to provide questions and concerns.

Wrap-Up and Closing Remarks

Shannon Engstrom (CTS Director, MnDOT) thanked all of the Work Group members for being at the meeting, and for dedicating time to this work. She reminded everyone that the next time the Work Group will meet is on January 23rd, 2024, from 1-2PM CST and will be virtual only.

Comments can also be submitted by emailing Sustainability.dot@state.mn.us. Additionally, a link to the CTS webpage was provided: dot.state.mn.us/sustainability/clean-transportation-fuel-standard-working-Group.html.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Mike	Bull	Allete/MN Power
Virtual	Kaytlin	Bemis	MN Farm Bureau
Virtual	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Richard	Biske	The Nature Conservancy
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Margaret	Cherne-Hendrick	Fresh Energy
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
Virtual	Rodney	De Fouw	Great River Energy
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	Brendan	Jordan	Great Plains Institute (GPI)

Virtual	Zachary (replacing Thad)	Kahn	Tesla
Virtual	Ariel	Kagan	Minnesota Farmers Union
Virtual	Jeremy	Martin	Union of Concerned Scientists
Virtual	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
Virtual	Kevin	Pranis	Liuna Minnesota/North Dakota
Virtual	Trevor	Rusell	Friends of the Mississippi River
Virtual	Eric	Schenck	Minnesota Forest Resources Council
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Nate	Schuster	ChargePoint
Virtual	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
Virtual	Peter	Wagenius	Sierra Club
Virtual	Brian	Werner	Minnesota Biofuels Association
Virtual	Mike	Youngberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Tim	Sexton	CTS Internal Steering Committee Assistant Commissioner, MN Dept of Transportation
Virtual	Valare	Falkner	CTS Internal Steering Committee Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	CTS Internal Steering Committee Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Carolyn	Caffrey	Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Megan	Lennon	CTS Internal Steering Committee Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Frank	Kohlasch	CTS Internal Steering Committee Assistant Commissioner, MN Pollution Control Agency
Virtual	Shannon	Engstrom	CTS Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Philip	Sheehy	ICF – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant

Members of the Public

First Name	Last Name
Tiffanie Connelly	CHS
Daniel Dwight	Stinson, LLP
Dallas Gerber	Growth Energy
Bentley Graves	Minnesota Chamber of Commerce
Vince Gunaca	United Steelworkers
Jake Hamlin	CHS Inc.
Jessica Hoffmann	RPMG
Jack Huntington	CMS
Donovan Hurd	Faegre
David Johnson	Faegre Drinker
Kent Kaiser	Domestic Policy Caucus
Matthew Lemke	FHR
Dale Lutz	Retired chemist
Joe Marble	Minnesota House of Representatives
Ian Marsh	PSP
Joseph Medina	Ever Cat Fuels, LLC
Mark Nisley	Minnesota House of Representatives
Sam Peyton	ONEOK
Laura Piotrowski	RPMG LLC
Lauren Reller	Stinson LLP
Terry Riesen	MPC
Cacie Russel	GNA
Craig Schoenfeld	Valero

Kim Scott	Union of Concerned Scientists
Joe Sellwood	Cook Strong Sellwood
Dan Smading	Flint Hills Resources
Stefanie Tanenhaus	Citadel
Dean Taylor	Plug In America

Appendix A: Letter from the American Petroleum Institute

Mike Karbo
Associate Director, Midwest Region
445 Minnesota Street, Suite 1500 St. Paul MN 55401
karbom@api.org

December 6, 2023

Minnesota Department of Transportation
395 John Ireland Blvd. St.
Paul, MN 55155

Delivered electronically to: shannon.engstrom@state.mn.us

RE: Minnesota Clean Transportation Standard

Introduction

Thank you for the opportunity to comment on the Minnesota Department of Transportation (MnDOT) Clean Transportation Standard (CTS) Work Group report. The American Petroleum Institute (API) represents all segments of America's natural gas and oil industry, which supports more than 11 million U.S. jobs. Our nearly 600 members produce, process, and distribute the majority of the nation's energy. Further, the natural gas and oil industry is responsible for 170,000 jobs in Minnesota and $13 billion of labor income, along with $24.6 billion in value added to economic activity[1] while supplying 99 percent of the transportation fuels in Minnesota. API and its members commit to delivering solutions that improve air quality and the goal of reduced emissions across the broader economy. The Minnesota Legislature authorized the creation of the CTS Work Group to prepare recommendations for implementing the CTS, including the development of performance-based incentives to reduce carbon emissions from transportation fuels. As the trade association representing the natural gas and oil industry, API is uniquely positioned to think about energy solutions, safety, and innovation for the next generation. API respectfully requests consideration of the following comments as MnDOT goes through the process of preparing its recommendations, and soliciting and considering public input and feedback.

Reliable and Affordable Energy is Needed

Liquid transportation fuels including gasoline, diesel and jet fuel will continue to be used for decades to come, and identifying the opportunities to use lower carbon fuels will be key to

[1] "Impacts of the Oil and Natural Gas Industry on the US Economy in 2021," Prepared for American Petroleum Institute by PWC, April 2023, Table B-1, https://www.api.org/-/media/files/policy/american-energy/pwc/2023/api- pwc-economic-impact-report-2023.

reducing greenhouse gas (GHG) emissions from the transportation sector in the near term and into the future. API's members are applying their abilities and resources to help develop emission reduction policies in the transportation sector in a manner that allows consumers in Minnesota, and throughout the U.S., the ability to choose the technology that best meets their needs.

API members have made and continue to make significant investments in new technologies that reduce carbon emissions in transportation, including: stand-alone production and coprocessing of bio-feedstocks to make renewable fuels, renewable fuel blends and sustainable aviation fuel; manufacturing of low-carbon ethanol; manufacturing of renewable natural gas from wastewater, landfill gas, and biodigesters at farms as fuel for compressed natural gas vehicles; production of blue and green hydrogen for transportation and stationary applications including building infrastructure; direct air carbon capture; carbon capture and sequestration of CO_2; development of advanced plastics to meet auto industry standards and consumer expectations while reducing emissions and improving vehicle efficiency by light-weighting; and installation of electric vehicle charging stations.

Low Carbon Fuel Policy

API supports global action that drives emissions reductions and economic development, including federal policies to reduce carbon emissions that apply across all sectors of the economy. Specifically for transportation, API supports federal policies that are technology-neutral and lifecycle-based that drive GHG emission reductions using a holistic approach for fuels, vehicles, and infrastructure systems with the goal of allowing the marketplace to determine the best mix of fuels to achieve the program targets.

We believe that where low carbon fuel standards are concerned, such standards should be enacted through the federal legislative branch. However, while API's ultimate position on an individual state low carbon fuel program will depend on the specifics of the overall program, if a new state program is proposed, it is critical for the design and function of that program to be harmonized and interoperable with other federal and state programs (e.g., RFS, existing state incentive programs).

Program Considerations

There are critical philosophies and principles that must be considered in designing a low carbon fuels program, some of which are highlighted below. Such a program should:

- Support and incentivize investments to grow production of lower carbon intensity (CI) energy used for transportation.
- Address carbon reductions—
    1) With standards that decline over time.

2) Using predictable CI reductions for transportation fuels (gasoline, diesel, and the fuels that replace them).
3) Including periodic reviews and updates.
4) Utilizing the most accurate and up-to-date data available.

- Enable a flexible array of compliance mechanisms with current and future technologies.
- Create a framework that is efficient, market-neutral, and fuel- and technology-neutral.
- Consider implications to fuel and feedstock supply and demand outside of the state.
- Enable synergistic co-existence with other federal and state programs.

With regard to specific program design elements, for better program implementation and to minimize negative impacts and unintended consequences, we note the following items for your consideration.

First, a low carbon fuel standard program should be designed with a phased implementation timeline that allows for the thoughtful development of regulation with stakeholder input, addressing issues ranging from compliance strategies to staffing to software. A rushed program that does not allow sufficient time for the regulatory agency to thoughtfully develop and promulgate a rulemaking – including adequate time for a public participation process for stakeholders to provide comment and for the agency to properly consider that input – could result in a flawed program.

Similarly, resource needs must be considered over the life of the program, not just at promulgation. Existing state low carbon fuel programs have faced significant challenges, which are negatively impacting those programs, due to resource constraints. Agency staff and infrastructure were not fully equipped to stand up and implement the program requirements in the timeframe and manner set out by the program, and have resulted in continued delays in pathway approvals and other program implementation elements, impacting the supplying of lower-carbon intensity fuels to the consumer. Even if Minnesota were to simply adopt another state's existing program, insufficient resources (including both personnel and infrastructure) would have a deleterious effect on the program.

Additionally, a low carbon fuel program should also be designed to include periodic program reviews that use the best available scientific data and ensure program effectiveness. Reviews should assess the anticipated and real costs of the program, including costs to the consumer, and analyze GHG emission reductions resulting from the program. Further, a program should include defined off-ramps (e.g., program deferral, waivers, etc.) that can be objectively and timely implemented to avoid potential disruption to supply and consumer impacts. Such off-ramps could be needed in certain instances, such as unavailability of feedstock and/or fuel, exceedance of predetermined program costs, or a failure to achieve the established program goals.

Further, a program should be designed to include clear obligations with efficient and transparent compliance mechanisms that allow all feedstocks and pathways to compete, to ensure successful implementation and minimize market disruptions.

Public Participation Process

The CTS Work Group was envisioned to prepare recommendations for the development and implementation of a clean fuel standard in Minnesota. We note that, during the selection process, neither of the two refiners in the state and none of API's members that supply nearly half of all finished fuels sold in the nation were selected to participate in the Work Group. API members have many years of experience participating in existing states' low carbon fuel standard programs from which to draw perspectives and experience. Further, the API member companies with operations in Minnesota could have provided state-specific expertise to the Work Group. Unfortunately, our lack of formal participation in the complete process limited our ability to contribute such information.

While we are grateful that we were invited to participate in one meeting, we were given only seven minutes to convey our thoughts about the program. As expressed in our letter to the Governor's office regarding the Working Group selection process, it is extremely concerning that stakeholders with significant expertise with low carbon fuel standards – and who would be directly impacted by the CTS – were omitted from formal participation in the Working Group. This will in turn result in a significant deficiency in the Working Group's findings and recommendations, as critical policy expertise and guidance from a stakeholder group that is essential to the functioning of a low carbon fuel standard is lacking.

Equally concerning is the overall process. There has been a significant lack of transparency, and an insufficient amount of time has been provided for public input – especially for those stakeholders who are not a part of the Work Group. The Work Group released its 86-page draft report on November 30, 2023, with a comment due date of December 6, 2023. That timing provided the public with only five business days to review recommendations for a program that will have significant impacts on the fuel market and the citizens of Minnesota when introduced.

While we recognize there will be an opportunity to comment throughout the rulemaking process, this initial report lays the foundation for the legislation that will drive how the rules are developed, and we were excluded from the process. We urge MnDOT to provide additional time for public review and comment on the draft report prior to its delivery to the Minnesota legislature. Additionally, when a rulemaking is ultimately promulgated, it is imperative that adequate time for public review be provided to ensure that all considerations are taken into account, following the procedures set out by the Minnesota Administrative Procedure Act.

Specific Comments on the CTS Work Group Draft Report

We offer the following specific comments on the Work Group's draft report:

- As noted above, a fuel- and technology-neutral standard that allows all technologies to contribute is necessary for the program to be successful. While the draft report indicates that the Work Group did not have full support for i) a fuel-neutral program, and ii) certain technologies and feedstocks (due to concerns over their carbon intensities), the program must create a level playing field and not pick winners or losers, which could impede the program goals of expeditious carbon emission reductions across the entire transportation sector. All fuels, feedstocks, and technologies should be eligible and treated equally. For instance, in Section C.2, rather than stating that land use change (LUC) should be non-zero for corn and soybean biofuels specifically, these feedstocks should not be handled differently from other crop feedstocks.
- The CTS program objective should focus on carbon intensity reduction in the transportation sector. Section C.1 focuses on many items that are not directly related to reduction of GHG emissions from transportation and would increase the complexity and resource burden of the program – both on regulated parties, and on the state in implementing the program. Items such as co-benefits and infrastructure incentives should be addressed separately, outside the CTS. As such, any provisions that alter or limit the fundamental principle of GHG emission reductions from the transportation sector, although important, should be addressed through other policy instruments by the state separate from the CTS – and the draft report rightfully notes that there are likely other state programs that may address these measures. Once the program begins, program assessments and reporting measures can help to identify if the program is meeting its stated goals; and if there are any co-benefits, those can be independently addressed at that time.
- As previously stated, providing adequate time for both the rulemaking process and program implementation are also paramount. The draft report indicates a program start date of January 1, 2026. Sufficient time to complete the legislative and rulemaking processes, as well as ample leadtime for implementation must be considered in setting the program start date. We strongly recommend adjusting the timeline to allow the program to be set up properly, rather than presuming that key steps can be completed prior to the start date. Further, the targets noted for the program would need to be adjusted if implementation is later than assumed in the draft report. A rushed program will not necessarily result in earlier emissions reductions, especially if it results in a flawed or under-resourced program.
- We are concerned that the statutory goals are unachievable, as indicated by the modeling performed for the draft report. Additionally, no set of modeling scenarios received a majority of the Work Group's approval, as the draft report shows that over 30% of the members did not vote on any option nor expressed a preference. When a

CTS program is ultimately promulgated, program targets should be based on data-driven models, and further analysis and determination of a program baseline should take into consideration vehicle GHG regulations that are currently being considered by the U.S. Environmental Protection Agency and the Department of Transportation (as those programs are anticipated to be finalized in early 2024).

- The draft report notes a recommendation of "adjusting the targets and goals during a review process every 3-5 years." We support periodic program reviews and adjustment of the standards if warranted by review, as stated above; however, it is imperative that any mid-program adjustments provide adequate leadtime for changing the standards and implementation.
- The Work Group identified a number of items with less clarity/agreement or that need further exploration. Not only are these items significant, but there are simply too many items that are left to be "clarified" or "resolved" in future legislation and/or rulemaking – we are concerned that a draft report with so many uncertainties does not provide legislators sufficient direction in determining a path forward. This further highlights the complexity of a low carbon fuel standard, and underscores the need to not rush the development process.
- The draft report acknowledges other state LCFS programs and recommends that a future CTS program look to those existing programs – e.g., utilizing reporting tool and documentation protocols from other states – to improve Minnesota's transition. However, the analysis on impacts of a program in Minnesota, and lessons learned from existing state programs, is inadequate. For example, the draft report does not address resource needs (including personnel), which, as noted above, could have a significant impact on the program.
- As previously mentioned, we recommend that a CTS program be able to co-exist, or at least not be in conflict, with existing federal and state programs. Section C.2 addresses items that would conflict with the federal Renewable Fuel Standard (RFS) program, which would create confusion for obligated parties.
- We have significant concerns with several items in the draft report, many of which we did not have sufficient time to review and comment on. API members have significant experience and expertise where we could provide input on technical details of the program (e.g., design of the credit program, treatment of vehicle-related efficiencies, market-related mechanisms and reporting, etc.), and we would welcome the opportunity to further engage.
- The following typographical errors should be corrected:
    - p. v, "Abbreviations": The draft report defines ASTM as an abbreviation for "American Society for Testing and Materials;" however, the organization was

renamed "ASTM International" in 2001[2] to reflect the fact that ASTM standards are international. Thus, "ASTM" is the abbreviation for "ASTM International."

- p. 6, Overview and Background: This sentence should read "A Clean Transportation Standard sets a carbon intensity target that all transportation fuels must achieve."
- p. 17: Figure 5 should be Figure 4.

Conclusion

Thank you for the opportunity to share our feedback. API stands ready to provide information on best practices by the industry with respect to low carbon fuel standard programs. API members are applying their abilities to solve the complex challenges of carbon emissions reductions in the transportation sector in a manner that will provide affordable and reliable products for consumers in Minnesota, and nationwide, while meeting the policy objectives of reducing transportation emissions. To that end, API welcomes discussion on viable solutions to the dual challenge of ensuring reliable and affordable energy supplies to support economic growth and human prosperity, while advancing the policy objectives of reducing transportation emissions. If we can be of any assistance on this or any other legislative mater, please do not hesitate to contact us.

Respectfully submitted,

Mike Karbo
Associate Director, Midwest Region
American Petroleum Institute

[2] *See* https://www.astm.org/about/overview/detailed-overview.html.

Appendix B: Letter from select Minnesota Environmental Partnership members on the CTS Work Group: Steve Morse, Sarah Mooradian, Trevor Russell, Kathleen Schuler and Mark Ten Eyck

Monday, December 11th 2023

Shannon Engstrom
Clean Transportation Standard Director
Minnesota Department of Transportation
395 John Ireland Boulevard
St. Paul, MN 55155

Dear Shannon and Clean Transportation Fuel Standard Work Group,

We, the undersigned organizations who are members of the Clean Transportation Fuel Standard (CTS) Work Group, wish to express our gratitude to you and your agency colleagues for your efforts to lead the Work Group and bring forward the November 28th draft report.

We recommend modifying the draft report to provide additional clarity and specificity regarding priority environment, justice, labor and climate-smart agricultural elements in a proposed Clean Transportation Standard in Minnesota.

We hope you will consider adding language reflecting support for the following positions to the final Work Group report.

1. **Highlighting vehicle electrification:** A key outcome of the proposed CTS is to accelerate the electrification of Minnesota's transportation vehicle fleet. The state should develop a hierarchy of strategies for decarbonization of the transportation sector. At a minimum, this report should contain language that states that it is the goal of a Clean Transportation Standard to accelerate the transition to electric vehicles within the state to the extent practicable. The report can be strengthened by emphasizing the following:

    a. **Prioritizing electrification Investments:** Investments in fueling infrastructure made possible by a CTS should focus on vehicle electrification (public and residential chargers) and rebates on the purchase of EVs (new and used).

    b. **Equitable electrification**: A majority of credits generated from electric fuels sold by public utilities should be dedicated specifically to support transportation electrification for the primary benefit of environmental justice communities[1], low-income communities, tribes and rural communities. This should be included in legislation authorizing a CTS, not be left to rulemaking.

    c. **Highlighting the scale of electrification investments:** The report should include estimates of credit revenue available for electric vehicle charging infrastructure and purchase rebates of between $15-$44M/yr in year one and increasing to $44-$132M/yr by 2035. While these estimates are preliminary, the potential for the CTS to direct a significant dedicated funding stream to electrification is a key benefit of the policy and should be a more prominent part

[1] As defined in **§116.065**

of the report.

2. **Climate Smart Agriculture**: Farm-level "climate-smart agriculture" practices and in-field carbon sequestration assumptions should be established pursuant to a defined process, subject to significant oversight, including annual third-party verification, biennial state reporting with public access to anonymized county-level data for each participating credit-generating facility, and clear penalties for inaccurate reporting. There must also be procedures for adjusting debit/credit transactions for noncompliance.

3. **Winter Annual Oilseeds**: Winter annual oilseeds under development through the University of Minnesota Forever Green Initiative, including winter camelina and pennycress, have the potential to serve as a low-carbon feedstock while providing excellent water quality, soil health and habitat benefits. As described in "Putting Down Roots: Analyzing the economic and environmental benefits of continuous living cover for Minnesota's farmers, water and climate" report produced by Friends of the Mississippi River, the Forever Green Partnership and Ecotone Analytics, a 'medium adoption scenario' shows the potential for up to 5.5 million acres of winter annual oilseeds on Minnesota croplands by 2050 (without displacing summer annual crops like corn and soybeans). Given the potential for these feedstocks to provide low-carbon drop-in fuel for diesel and jet engines, winter annual oilseeds should be highlighted in the Work Group report.

4. **Preventing Indirect Land Use Change**: For biofuels to be truly sustainable, they must be produced without deforestation or grassland conversion. The report should specify the importance of explicit prohibitions on the generation of credits from fuels derived from feedstocks grown on croplands without at least 5 consecutive years of cropping history prior to the establishment of the rule. This language should be included in legislation authorizing a CTS, not left to rulemaking.

5. **Environment & Environmental Justice:** The environment, equity and health are all interconnected. Ecosystem services as well as harmful impacts to water, soil, air, wildlife, and beyond, are important considerations that affect environmental and human health that should be incorporated into a CTS. The value and need for maximizing environmental co-benefits was discussed frequently going back to the Work Group's original meeting. It is important that the report recognize this interconnectedness and these issues be equally addressed throughout the report.

6. **Program fees & administration:** Experience in other states demonstrates the importance of having adequate funding to administer CTS programs. The costs of developing and implementing a large climate-smart agriculture program in Minnesota, which these other states do not have, will likely generate additional funding needs. To the degree possible, these administrative costs should be funded by the parties executing debit/credit transactions, not by the general public. In no case should CTS funding rely on dedicated environmental funds.

7. **Prohibiting credit from CCS used for EOR:** Prohibitions on the use of captured CO_2

for enhanced oil recovery and other fossil fuel extraction should be included in legislation authorizing a CTS, not be left to rulemaking.

8. **Fair labor practices:** Laborers and mechanics performing work on a project funded with revenue earned by a utility from the sale of credits resulting from the utility's generation of electricity as a transportation fuel must be paid the prevailing wage rate for the work as defined in section 177.42, subdivision 6 and subject to the requirements and enforcement provisions of sections 177.30 and 177.41 to 177.45.

9. **Addressing concerns about feedlot expansion or consolidation:** The CTS should prohibit the generation of credits from Renewable Natural Gas (RNG) produced from any new or expanded agricultural livestock production facility, or at an agricultural livestock production facility that increases the number of animal units at the facility primarily for the purpose of producing renewable natural gas.

10. **GREET Model comments**: There should be more background on the GREET model (including its strengths and weaknesses, including identification of key ecological co-benefits and harms that are not addressed by the model), a justification for choosing this model, and a brief comparison with other available models.

<u>Concerns regarding the Work Group Process</u>

1) **Purpose & Background:** The stated purpose of the Work Group, as defined in the enabling law, is “to study and address information gaps and opportunities related to a clean transportation fuel standard.” A report must be submitted by February 1, 2024, that details the Work Group’s “findings and recommendations.” Nowhere in the enabling law is language suggesting that the purpose of the Work Group is to “make recommendations for implementing a CTS,” nor to make “recommendations on fuel pathways,” recommend topics for rulemaking or future legislation. The report from the Work Group should accurately describe the Work Group’s purpose.

2) **Surveys:** Some of our groups have several concerns about the surveys used in Work Group meetings to evaluate agreement among members on various topics. Some questions were phrased so that it was difficult to provide a clear response. For example, some felt they could not answer the question because they disagreed with its premise (i.e. that co-benefits are difficult to measure). Others felt that they could not answer because they lacked expertise on the subject at issue. Some in our group also felt the questions were leading.

   Some of our groups are also concerned with the survey process and how the voting is interpreted and used in the draft report. Appendix D provides a summary that includes the specific questions asked and information on responses for the November 13th and 21st surveys. Concerningly, a sizable number of members did not participate in these surveys and space was not provided to explain the reasoning for the votes that were entered. As a result, it is difficult to say with confidence that the statements in the draft report represent the “general sentiment” of the entire work group.

3) **Topics Discussed:** Throughout the Work Group process, several members emphasized the importance of discussing the potential environmental and human health impacts of a CTS. Our groups feel that this essential element was inadequately addressed. Little to no in-depth discussions of the environmental and human health impact - both positive and negative - of a CTS were had by the Work Group. Instead, members were given the option of attending a virtual technical webinar on “Land Use, Water, and Ecosystem Services.” Of the four presenters, only one, Dr. Carrie Jennings, provided clear, detailed information about how the production of crops for biofuel impacts water quality in Minnesota.

Thank you for considering these perspectives as you complete the Clean Transportation Standards Work Group report. We look forward to working with you to advance clean, sustainable, and equitable transportation policy in Minnesota.

Sincerely,

Steve Morse, Executive Director
Minnesota Environmental Partnership

Sarah Mooradian, Government Relations & Policy Director
CURE MN

Trevor Russell, Water Program Director
Friends of the Mississippi River

Kathleen Schuler, MPH
Policy Director
Health Professionals for a Healthy Climate

Mark Ten Eyck
Minnesota Center for Environmental Advocacy

Appendix C: Exxon Mobil letter dated December 19, 2023

December 19th, 2023

Office of the Governor
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LIUNA Minnesota & North Dakota
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Delivered electronically to: brandon.kasprick@state.mn.us
shannon.engstrom@state.mn.us
kpranis@liunagroc.com

Re: Minnesota Clean Transportation Standard

Exxon Mobil Corporation ("ExxonMobil") appreciates the opportunity to submit these comments to the draft report by the Minnesota Clean Transportation Standard (CTS) Working Group. ExxonMobil is one of the world's largest integrated fuels, lubricants, and chemicals companies and through our Product Solutions business, we are developing lower emissions fuels and the energy products that improve quality of life and help meet society's evolving needs.

ExxonMobil strives to play a leading role in the energy transition. With advances in technology, the support of clear and consistent government policies, and the development of market-driven mechanisms, we expect to achieve net-zero operated Scope 1 and Scope 2 greenhouse gas (GHG) emissions by 2050.[1] From 2022 to 2027 we're now pursuing more than $20 billion of lower-emissions opportunities, an increase of over $3 billion from the $17 billion we disclosed at last year's corporate plan. Of our total investment in lower-emission opportunities, about half is focused on reducing emissions in facilities that we operate to support our 2030 greenhouse gas emission-reduction plans. The other half will build our Low Carbon Solutions business with third-party customers, including new opportunities in lithium, hydrogen, biofuels, and carbon capture and storage.[2] Lowering societal GHG emissions, especially from hard-to-decarbonize sectors will require a multitude of technologies and approaches. For the transportation sector, we believe that bio and renewable fuels, hydrogen-based fuels, and carbon capture and storage will play an

[1] ExxonMobil Advancing Climate Solutions 2023 Progress Report (2023), page 5
[2] ExxonMobil Corporate Plan December 2023 (url: https://investor.exxonmobil.com/news-events/corporate-plan-update)

important role.

ExxonMobil believes a well-designed lower-carbon fuel standard (LCFS) could effectively help enable GHG emission reductions from vehicles, both in-use and new, if the program:

- Is lifecycle GHG-emission based, technology neutral, has a credit trading system, and does not restrict consumer choice.
- Provides a clear and durable market signal for investments in the production of lower carbon fuels that are used for transportation.
- Credits are generated from lower carbon fuel pathways – such as the production of biofuels (e.g., ethanol, renewable gasoline, biodiesel, renewable diesel, renewable natural gas, and renewable gasoline and renewable diesel generated from co-processing with fossil fuels) or from projects resulting in lower GHG emissions in fuel production – such as carbon capture and sequestration and innovative crude production.
- Is designed with federal pre-emption being a guiding principle, if a federal LCFS program is established, and is interoperable and co-compliant with existing federal and state programs.

ExxonMobil respectfully submits the comments below to the draft report by the Minnesota Clean Transportation Standard Working Group:

- We strongly believe that a fuel-neutral and technology-neutral standard that is market-based, would foster innovation and competition across all technologies and could ultimately help encourage more effective and lower cost solutions for consumers and businesses to drive emissions reduction for in-use and new vehicles. All fuels, feedstocks, and technologies should be eligible and treated equally. For instance, on the LUC section, corn and soybean should not be handled differently from other crop feedstocks. Rather than stating that LUC should be non-zero for corn and soybean biofuels specifically, we suggest rephrasing as “The indirect land use change (ILUC) emissions of all non-waste or residue feedstocks should be calculated and included in the carbon intensity.”
- The draft report notes a recommendation of “adjusting the targets and goals during a review process every 3-5 years.” We suggest establishing a periodic review process of the CTS, starting in the third year after program implementation and every three to five years thereafter. The program should be reviewed and adjusted if deemed necessary to achieve the program goals taking into consideration the cost of compliance, technologies available to achieve the standards, and the need to maintain transportation fuel quality and availability in the state. Reviews should be made with consultation of an advisory committee composed of relevant stakeholders including but not limited to in-state and out-of-state producers of transportation fuels, and fuel distributors.
- We suggest adding some guidelines on what model (e.g., Argonne National Lab.

GREET model) and version of the model to use for determining carbon intensity values given that models such as GREET are periodically updated. The standard should specify that key methodology choices and assumptions within the model used should be adopted based on recommendations by a team of experts in the field.

- We support inclusion of a technology neutral mechanism for the generation of credits, that includes additional credit opportunities such as "project" credits. Credit opportunities should not be expressly excluded. The CTS program should enable the ability to generate "project" credits from technologies that reduce carbon intensity of fuels used in transportation such as, but not limited to, carbon capture and sequestration that is applied to fuel production, facility investment projects to reduce carbon emissions, and regenerative farming practices.
- The report highlights that credit calculation needs to account for an energy economy ratio (EER); we believe that this should be avoided, as vehicle efficiency should be accounted for / is already accounted for in vehicle standards, not in a low carbon fuel standard. The report also indicates that an electric vehicle (EV) credit aggregator program should be explored. An LCFS is a market mechanism to incentivize the production of lower carbon fuels to reduce life-cycle GHG emissions from in-use and new vehicles. If growing electric vehicle sales is the objective, other policy instruments may be more effective (e.g., tax credits to end consumer). The use of technology forcing policies, such as the use of EER or EV credit aggregators, may result in market distortion.
- The draft report indicates that credits "can be banked without holding limits and do not expire based on the year in which they were generated." Credits should have unlimited life both to avoid market disruptions and to allow program goals to be met without creating an excessive burden on the consumer due to global and/or regional market dynamics, especially during severe market disruptions, severe market liquidity issues and severe economic harm. However, implementing holding limits based on a multiplier of a market participant's obligation or similar factor(s) is a good policy structure to enable credit market liquidity and prevent market manipulation.
- The report identifies federal policy barriers for accelerated scenarios. Among these, it should be noted that current federal tax policies, such as the Clean Fuels Production credit (26 U.S.C. § 45Z), exclude co-processing, creating an unlevel playing field in the production of lower carbon fuels. Coprocessing can help the government achieve its ambition to reduce CO_2 emissions in transportation by increasing production of biofuels more quickly, including sustainable aviation fuel. The CTS should also allow for the generation of credits under any overlapping federal fuels regulation, current and future, including but not limited to Renewable Identification Number credit generation under the federal Renewable Fuel Standard.
- The draft report also indicates that additional funding and policy support is needed for infrastructure, especially for EV charging and E15, and as such recommend measures such as capacity/infrastructure credits. We believe fuel/energy dispensing infrastructure should be incentivized separately from a lower carbon fuel standard. If

expanding alternative fuel/energy dispensing infrastructure is the objective, other policy instruments may be better suited (e.g., tax and direct grant incentives.)

- Consider allowing up to 2 years for the rule to be completed and up to 1-2 years for the rule to go into effect after the rule has been promulgated.
- Consider adding provisions on potential emergency waivers in case of fuel supply shortages in the state that are, or are likely to be, of significant scope and duration, and of an emergency nature; and causes, or may cause, major adverse impact on public health, safety, or welfare or on the economy.

We welcome the opportunity to work with the Working Group and the Governor's Administration to share in greater detail our views on the program.

Thank you for your consideration of these comments. Respectfully

submitted,

Erik Woehrmann ExxonMobil
Midwest State Government Relations

Work Group Meeting #9 – January 23, 2024

Date: January 23, 2024
Time: 1:00 – 2:00 p.m.
Minutes prepared by: WSB
Location: Zoom

Meeting Summary

Welcome: Shannon Engstrom, CTS Director, MnDOT, and Kevin Pranis, Work Group Chair

Shannon Engstrom (MnDOT) introduced herself and thanked everyone for joining the final work group meeting. Kevin Pranis thanked all the work group members for their time and dedication to the work group. Shannon reviewed the meeting agenda and objectives:

- Review and discuss final report
- Quiet time to review updated report
- Large group discussion and Q&A
- Review timeline for 2024 legislative session

It was also mentioned that Kaytlin Bemis with MN Farm Bureau is no longer with the work group due to a job change, so there is a new seat vacancy for 'general farm organizations' open for applications until January 30, 2024. See the Secretary of State's website for details.

Shannon mentioned that work group members should have seen an email from her last week with the updated report and agenda for today. She reminded the work group that there is an internal deadline on January 25 to incorporate additional feedback, because the report will move to final design before being delivered to the Legislature on February 1, 2024.

Final Report Overview: Amy Fredregill, WSB Consulting

Amy thanked work group members for their time and engagement in the process. Amy then reminded the work group members that the key audience of the report is the MN Legislature, so the report is meant to be simple and actionable. As such, it required trying to balance brevity and detail which is not always easy given the complexity of the subject matter.

A few key changes from the last draft report were discussed:

- Thorough review of all comments from work group members and integration or clarity throughout
- Emphasized key themes in the executive summary for quick reference
- Added callout boxes in findings chapter to integrate further exploration topics so that issues are clustered together
- Cover page design and other graphics to help tell the story
- Addendum additions

An overview of the Executive Summary was presented:

- CTS would be the largest single policy for reducing carbon emissions from transportation in MN
- CTS provides a fuel neutral approach to reducing emissions
- CTS would expand clean fuel technologies
- Scenario modeling shows 3 future fuel pathway scenarios in MN:
    - Business-as-usual
    - Moderate
    - Accelerated
- Work group findings could be for the Legislature to take up in legislation, rulemaking and/or other future policy discussions

Quiet Time to Review Report

Work group members were given 5 minutes to review the report and brainstorm any final thoughts or questions. A few discussion questions were presented for people to reflect on:

- What are your questions / comments related to the final draft report?
- What are the top 3 things you would mention about the CTS to a colleague or the legislature?
- Reflecting on the work group process, what went well?
- Reflecting on the work group process, where could we make improvements for future similar processes?
- What part of the work group process and report are you most excited about, engaged in and hope to stay engaged in?

Large Group Discussion Q&A: Shannon Engstrom and Amy Fredregill

The meeting then moved into a discussion with the prompted questions above, but all comments and questions were welcomed. A mentimeter survey was used to anonymously gather feedback (see Appendix B).

1. What are your questions / comments related to the final draft report?
    - *It does a good job of summarizing the policy and the considerations the work group thought through.*
    - *It does a good job of covering the topics and diverse perspectives.*
    - *Does being listed as a work group member imply that we agree with or support the report?*

    - Shannon responded: We tried to do our best to summarize perspectives from a very diverse group of work group members and used the iterative polling and the feedback survey for draft report to gather your perspectives. If you feel the report does not capture the work group's sentiment, please continue sharing your thoughts with us. Our door is always open.
- *The draft accurately encapsulates the discussions within the work group meetings that took place in a short timeframe.*
- *I appreciate how the points for further exploration are laid out.*
- *Can you remind us of when the work group recommended that CCUS be an eligible activity to generate credits? SAF is on the moderate scenario wedge graph but not the BAU scenario, so appears to generate distortion.*
    - Philip (work group's technical consultant) and Shannon responded: The work group was polled about CCUS in one of the earlier survey polling and the statement was continually revised to incorporate caveats for inclusion. Regarding SAF inclusion in BAU, we went back and forth on including this or not. If you feel strongly it should be included, please let us know.

2. What are the top 3 things you would mention about the CTS to a colleague or the legislature?
    - *Opportunity for MN to lead on climate-smart agriculture for clean fuels.*
    - *Aggressive but achievable compliance curve, climate smart ag is included and as tech neutral as possible.*
    - *MN is positioned much differently than other US states with a CTS policy, and will have a tailored approach to being a fuel producing state and heavy agriculture state when implementing a CTS.*
    - *Market-based policy to help decarbonize the transportation sector. Cross sector of stakeholder engagement aid in the transition to electrification while at the same time reducing CI for all vehicles.*
    - *The report says that CTS is the largest single source of carbon reduction, but we didn't look at other options, so this statement is inaccurate.*
    - *Overall reduction in carbon and fossil fuel use as a result of policy.*
    - *It's not an endorsement of any given fuel/source that may fit within it.*
    - *CTS has been an effective policy in other states for reducing CI of fuel supply, it may not be perfect, but it has proven effective. Consider complimentary policies.*
    - *Ways for the public to engage.*
    - *Bringing 40 representatives together in a civil process and aligning (for the most part) on a meaningful final report.*
    - *Get the legislature to give us more time next time.*
    - *Climate smart sustainable forestry can be used for a variety of liquid fuel and has the lowest CI.*
    - *SAF is opt in fuel.*
    - *Including SAF using woody biomass could help accelerate achievement of state emission goals.*
3. Reflecting on the work group process, what went well?
    a. *Respectful dialogue between stakeholders.*
    b. *Staff leadership and availability throughout the process.*
    c. *Stakeholder representation and equal opportunity for input.*
    d. *Superb leadership from the MN agencies and facilitators.*
    e. *Learned a lot about a low carbon fuel stand from speakers and webinars.*
    f. *Opportunity for public comments.*
    g. *Once we got going, the in-person meetings were a good opportunity to connect with work group members. The staff were very diligent in keeping the process moving forward.*

4. Reflecting on the work group process, where could we make improvements for future similar processes?
    a. *Sometimes if you weren't in a breakout there was no opportunity to weigh in on that topic or know what was talked about (before the final draft report).*
    b. *Not necessarily a process improvement, but more time (months not meeting time) with the group to get into more detailed discussions.*
    c. *Needed more time for larger groups discussions.*
    d. *Legislature to give us more time next time.*
    e. *Mentimeter was useful for getting a sense of where people were, but difficult to answer questions on the spot without more information or internal consultation.*
    f. *Have experts who could speak to potential negative impacts of a CTS.*
    g. *There should be better definition on how the sentiment of the group is measured. Hard to do this on such a short timeframe with 40 diverse members.*
    h. *Meet outstate more often.*

Other Questions and Comments

- *How is the "final" spreadsheet different from the data already posted?*
    - Shannon responded: The latest spreadsheet incorporates corrections to clerical errors that were caught during quality checks or in response to questions raised by work group members.
- *Draft should include "forestry" more often, especially in conjunction with "agriculture". Will plan on giving Shannon some suggestions. For example, the bottom of page 2 - "MN is well implemented due to…". This does not mention that we have 17 million acres of sustainably maintained forest, and that should be incorporated.*
    - Shannon responded: Thank you, please feel free to share your specific thoughts on this via email.

Feedback from non-Work Group Members: Amy Fredregill, WSB Consulting

Amy opened up the discussion for non-Work Group members to provide thoughts, continuing the ongoing efforts to collect feedback from public members as well as the work group.

- Jake Peterson*: Amy is correct that executive summary will just get skimmed at the capitol. Will the executive summary include any costs or just highlight benefits?*
    - Shannon responded*:* It is challenging to do an assessment any potential costs to consumers without the final program targets and requirements that legislation would provide. It is out of scope at this point in the process but could be considered for rulemaking. In the report, we included references to both Oregon and Washington program's estimated costs to consumers.
- Dale Lutz*: People at the ethanol plants should capture CO_2 and combine it with hydrogen to triple ethanol output. You then wouldn't have to rely on anyone to stuff CO_2 underground.* (See Appendix A for Dale Lutz's full written statement)
    - Shannon responded: Thank you, Dale.

Ample time was allowed for non-Work Group members to provide questions and concerns.

Feedback from Work Group Members: Amy Fredregill, WSB Consulting

Amy opened the floor for any comments or questions from work group members.

- *The statement "a CTS would be largest single policy to reduce transportation in MN" is misleading because if you look at Climate Action Plan for example – VMT has greater emissions reductions than this policy. Also, in regard to the report talking about improving soil water health in MN – this is also misleading because it will reduce impacts if we implement guard rails, but not necessarily improve.*
    - Shannon responded: Thank you for your comments.
- *Looking at the scenarios, I think there's a missed opportunity. New feedstocks are mentioned in the report, but they're not called out specifically anywhere. Friends of the Mississippi River says we may see a huge growth in these readiness technologies and the report should connect more to that.*
    - Shannon and Philip responded: Thanks for your comment. There is nothing about a CTS program that would prohibit new feedstocks or new clean fuel technologies from being considered as part of the program. Scenario modeling does not to show the world in which people want it to exist but rather to capture what we understand about technology today. Shannon will follow-up to discuss.
- *I appreciate that the report suggests a cost benefit might be beneficial. Sharing end-user costs as identified by CARB would be within the scope of the work group and would be beneficial for legislators to have visibility too.*
    - Shannon responded directly in the chat that yes, they considered including the cost estimates included in the recent California Air Resources Board (CARB) amendments. After detailed review and discussion with people deeply familiar with these estimates, there is too much uncertainty, skepticism and negative feedback from a broad spectrum of stakeholders about the methodology used for the calculations.

Wrap-Up and Closing Remarks: Shannon Engstrom, CTS Director, and Tim Sexton, Assistant Commissioner, MnDOT

Shannon Engstrom thanked all of the work group members for joining the meeting, and for dedicating time to the work group. She reminded everyone that we are wrapping up the report by January 31st. Stay tuned to see how this CTS conversation unfolds during the MN legislative session this spring.

Tim Sexton then closed with sharing his appreciation to the work group for the dedication they showed. As well as his appreciation for colleagues in the departments of agriculture, commerce and the MN pollution control agency.

Any further comments or questions can be submitted to Shannon Engstrom, CTS Director (Shannon.engstrom@state.mn.us) or by emailing MnDOT's office of sustainability and public health (Sustainability.dot@state.mn.us). Additionally, a link to the CTS webpage was shared.

Attendance

Work Group members

Present	First Name	Last Name	Organization
Virtual	Paul	Austin	Conservation Minnesota
Virtual	Mike	Bull	Allete/MN Power
Virtual	Richard	Biske	The Nature Conservancy
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Margaret	Cherne-Hendrick	Fresh Energy
Virtual	Colin	Cureton	UMN Forever Green Initiative
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
Virtual	Rodney	De Fouw	Great River Energy
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	Ariel	Kagan	Minnesota Farmers Union

Virtual	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Kevin	Pranis	Liuna Minnesota/North Dakota
Virtual	Eric	Schenck	Minnesota Forest Resources Council
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Nate	Schuster	ChargePoint
Virtual	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
Virtual	Peter	Wagenius	Sierra Club
Virtual	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and consultant staff

Present	First Name	Last Name	Organization
Virtual	Tim	Sexton	CTS Internal Steering Committee Assistant Commissioner, MN Dept of Transportation
Virtual	Valare	Falkner	CTS Internal Steering Committee Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	CTS Internal Steering Committee Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Carolyn	Caffrey	Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Megan	Lennon	CTS Internal Steering Committee Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Shannon	Engstrom	CTS Director, Office of Sustainability and Public Health, MN Dept of Transportation
Virtual	Philip	Sheehy	ICF – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Samm	Watson	WSB – CTS Consultant

Members of the public

First Name	Last Name
Andi Barker	MnDOT
Bennett Smith	Fredrikson
Bob Ryan	United Steelworkers Union
Butch Frey	BP
Christian Robinson	SEMA
Craig Schoenfeld	Valero
Dale Lutz	Retired
Dallas Fischer	Fueling MN
Daniel Dwight	Stinson, LLP
Fatema Haji-Taki	MnDOT
Donovan Hurd	Faegre Drinker
Elliott Blackburn	Argus Media
Hayley Book	Shell USA
Hunter Pederson	Minnesota Senate
Jack Huntington	Pro Publica
Jake Hamlin	CHS Inc.
Jake Peterson	NPGA
Jean Wagenius	Retired
Joe Marble	MN house GOP research
Joe Sellwood	Cook Strong Sellwood
Josh Sonnenfeld	BlueGreen Alliance
Kate Klossner	Marathon Petroleum
Kathleen Doran-Norton	LWVMN

Kent Kaiser	Domestic Policy Caucus
Laura Piotrowski	RPMG LLC
Lewis	Health Equity First
Mark Nisley	Minnesota House of Representatives
Matthew Lemke	FHR
Melissa Rahn	Fredrikson & Byron
Mike Karbo	American Petroleum Institute
Paul Thompson	Cool Planet/ Elders Climate Action
Paul Cassidy	Stinson LLP
Sam Harris	UNFI
Sarah Psick	Psick Capitol Solutions
Stefan Mitrovic	Shell
Terry Riesen	MPC
Tiffanie Connelly	CHS Inc.
Timothy Heck	Marathon Petroleum
Vince Gunaca	USW

Appendix A: Letter from Dale Lutz dated 01/23/24 – Ethanol Plant CO2 Recycling

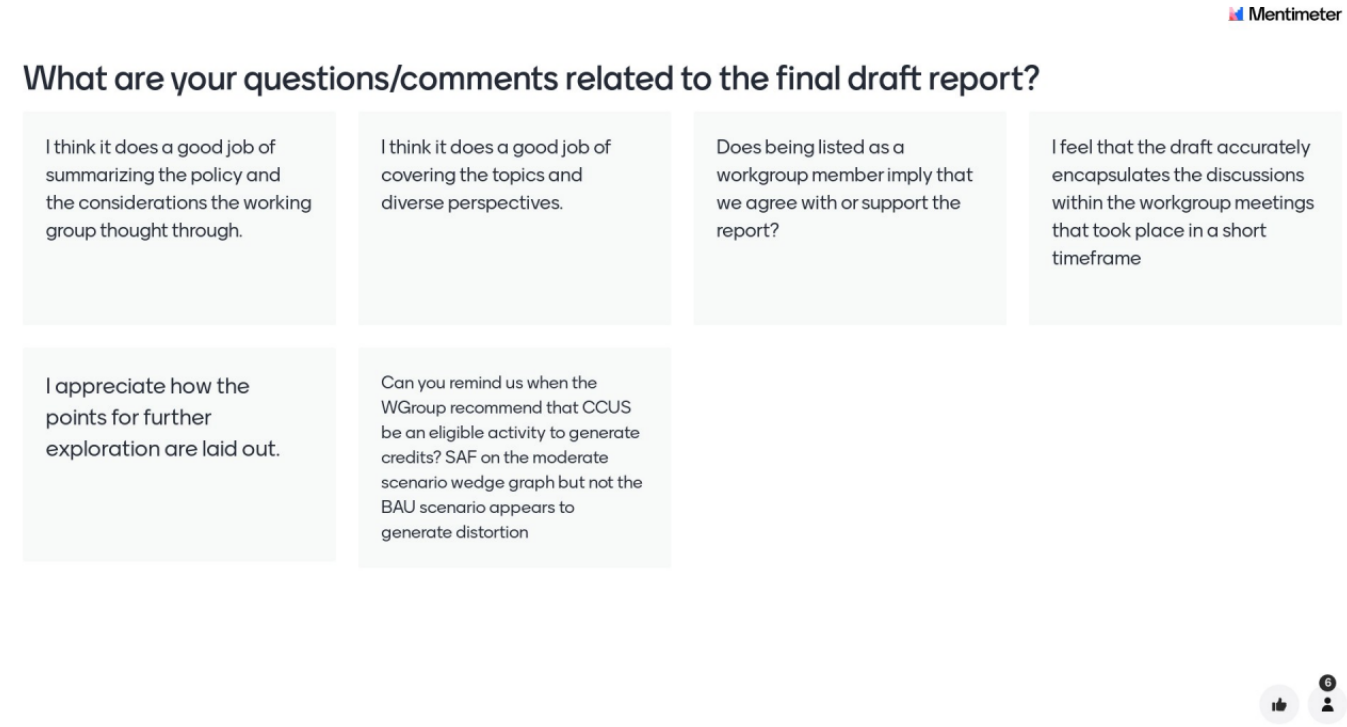
Ethanol Plant CO2 Recycling – Supplement to Dale Lutz's Verbal Comment 1/23/24

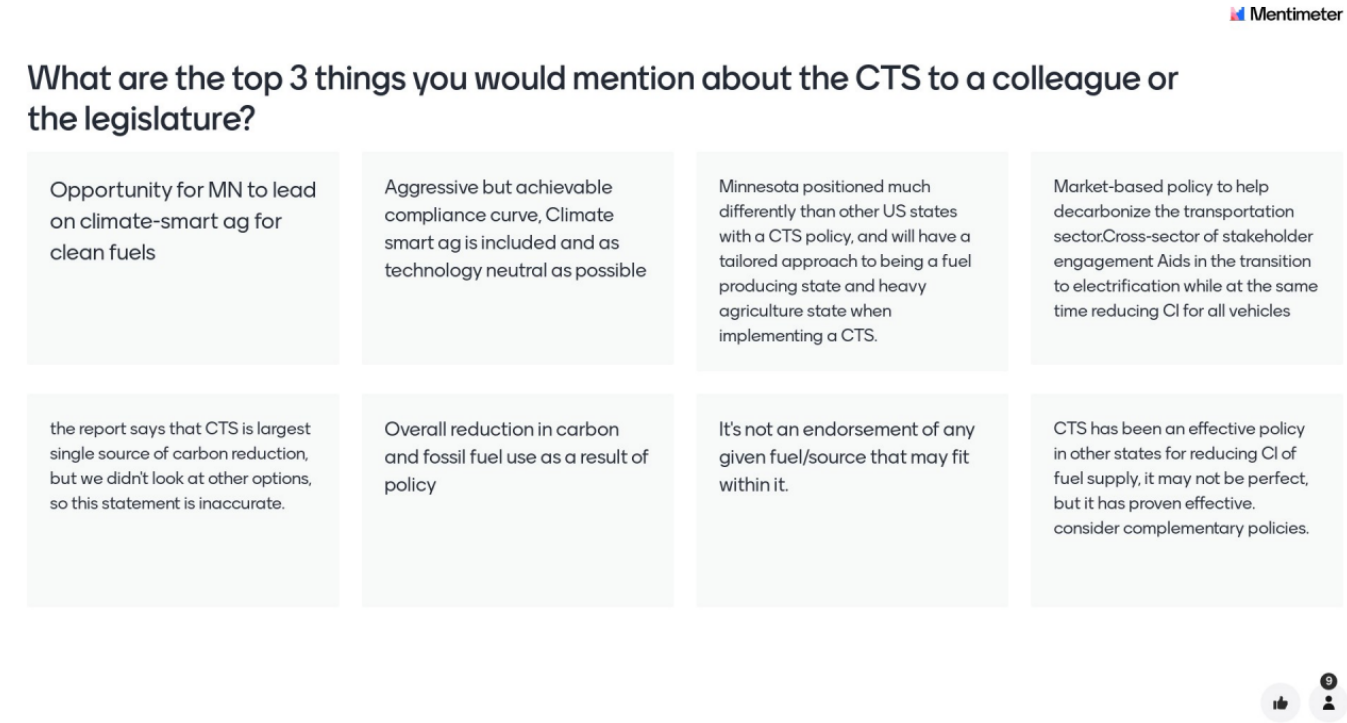
The ethanol plant owners should be aware that they can capture their CO2 emissions and "recycle" them to ethanol, using existing technology to combine the CO2 with low-carbon-intensity hydrogen from water electrolyzers powered by renewable energy. This could triple the amount of ethanol produced from a given amount of corn, reducing the carbon intensity (CI) of the "bonus" or blended ethanol, and minimizing the land use adder penalty.

To enable this process, a "CO2 recycling" facility could be established in western Minnesota, funded by either the state legislature, a private co-op, or a public/private partnership. The facility could qualify for both the federal 45V hydrogen production tax credit and the 45Z ethanol production tax credit. 45Q tax credits for CO2 utilization might also be possible under section 1.45Q-4 (a) (3). The state could provide incentives and financial support for ethanol plants to install CO2 capture equipment. The CO2 would be liquified and transported to the CO2 recycling facility in cryogenic transport trailers, like those available through Chart Industries, Inc. This would avoid the need to build CO2 pipelines that would be opposed by landowners over concerns about safety, loss of land productivity, potential aquifer breaches, possible takings through eminent domain proceedings, etc.

The low carbon intensity ethanol (or sustainable aviation fuel made from it) could be blended with conventional fuels to build credits under the proposed Clean Transportation Standard and achieve the 2023 Session Targets, if construction of this infrastructure is started now. The facilities could be in operation in time to allow achievement of the challenging 2040 and 2050 targets. A starting point would be to select an engineering firm to do a Front-End Engineering Design (FEED) study to do the initial planning, permitting, etc., before a decision is made to invest the significant capital needed for construction.

Appendix B: Mentimeter Results





Mentimeter

What are the top 3 things you would mention about the CTS to a colleague or the legislature?

Ways for the public to engage

Bringing 40 representatives together in a civil process and aligning (for the most part) on a meaningful final report.

Get the legislature to give us more time next time! :)

9

Mentimeter

Reflecting on the work group process, what went well?

Respectful and open dialogue between stakeholders

Staff leadership and availability throughout the process - thank you Shannon, Amy & all!

Superb leadership from the MN agencies and facilitators

Learned a lot about a low carbon fuel stand from speakers and webinars.

opportunity for public comments

Once we got going, the in person meetings were a good opportunity to connect with Working Group members. Staff was very diligent on keeping the process moving forward.

5

Mentimeter

Reflecting on the work group process, where could we make improvements?

Sometimes if you weren't in a breakout, there was no opportunity to weigh in on that topic or know what was talked about (before the final draft report)

Not necessarily a process improvement, but more time (months not meeting time) with the group to get into more detailed discussions

Probably needed more time for larger groups discussions.

Get the Legislature to give us more time next time! :)

+++ needed more time

Mentimeter was useful for getting a sense of where people were, but difficult to answer questions on the spot without more information or internal consultation

Have experts who could speak to the potential negative impacts of a CTS.

There should be better definition on how recommendations will be made and how the sentiment of the group is measured. Hard to do this on such a short timeframe w/ 40 diverse members

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Appendix C: Letter from the Nature Conservancy dated January 29, 2024

The Nature Conservancy in Minnesota, North Dakota, South Dakota

1101 West River Parkway, Suite 200

Minneapolis, MN 55415-1291

tel (612) 331.0700

fax (612) 331.0770

nature. org

January 29, 2024 Shannon

Engstrom
Clean Transportation Standard Director
Minnesota Department of Transportation 395
John Ireland Boulevard
St. Paul, MN 55155

RE: Response to the Clean Transportation Fuel Standard Work Group Recommendations Dear Shannon,

The Nature Conservancy appreciates the opportunity to participate in the Clean Transportation Fuel Standard Work Group and to comment on the "Clean Transportation Fuel Standard Work Group Report, January 2024" agency recommendations. We are supportive of the concept of establishing a Clean Transportation Fuel Standard for the state of Minnesota and appreciate the Work Group's recommendations for the 2030 and 2040 targets along with the 2050 goal.

The Nature Conservancy is a global organization dedicated to conserving the land and waters on which all life depends. Guided by science, we create innovative, on-the-ground solutions to our world's toughest challenges so that nature and people can thrive together. In Minnesota, we value collaboration with our partners in local communities, government, business, and the private sector among others as we work together to address the dual crises of climate change and biodiversity loss.

As conservation is the backbone to our work, we appreciate engaging on the opportunity to shape a Clean Fuel Transportation Standard (CTS) for the state of Minnesota that emphasizes protection of our natural resources while mitigating carbon emissions in the transportation sector. Due to the dual threat of climate change and biodiversity loss, we are invested in ensuring a CTS adequately incorporates considerations and promotes positive outcomes for carbon, biodiversity, water, food security, and equity. Without adequate environmental integrity in the production of clean fuels there is a significant risk of unintended impacts on water quality, water availability, habitat, biodiversity and ecosystem services.

Therefore, we strongly recommend the state develop an Environmental Integrity (EI) score to be implemented in conjunction with a Carbon Intensity (CI) score to account for CTS impacts to the

environment alongside carbon intensity. Current CI monitoring policies and procedures do not yet effectively protect natural resources. An EI score should incentivize the adoption of regenerative agriculture practices, including for example: no or reduced tillage, cover crops, advanced nutrient management, diversified crop rotations, and edge of field practices. These practices provide environmental benefits independent of any effect they may have on carbon. A CTS should simultaneously incentivize fuels with the lowest CI scores and the highest EI scores, which should be measured independently and be traceable to the feedstock source.

The existing monitoring conducted by the Minnesota Pollution Control Agency (MPCA), Department of Natural Resources (DNR), and Minnesota Department of Agriculture (MDA) provides a starting point to monitor and evaluate environmental impacts. Minnesota has one of the most robust water quality/quantity and monitoring systems in the country, and while other states that have implemented a CTS have struggled with the EI component, Minnesota is already well poised to develop and implement this practice. Finally, we recommend verification of ecosystem services and other impacts be conducted by a third party with state agency oversight using much of the data currently available from the aforementioned agencies to determine the baseline when developing the EI score.

A key priority for TNC in the development of a CTS is preventing unintended consequences of land use change. Land use changes, and the resulting greenhouse gas emissions, are difficult to accurately and consistently estimate in life-cycle assessments. However, for biofuels to be truly sustainable, they must be produced without deforestation, wetland loss, or grassland conversion. Eligibility for credits should be limited to feedstocks produced on lands with a documented cropping history prior to an agreed upon date, at a minimum no later than 2018 to be consistent with USDA Sodsaver and CRP rules.

Finally, TNC recommends a CTS commit to Environmental Justice. Environment, equity, and health are all interconnected. With proper attention to identifying ecosystem services, benefits, and impacts while also mitigating harmful impacts to our water, soil, air, wildlife, and beyond, the CTS can support health equity for marginalized communities most impacted by environmental degradation.

To appropriately cover the costs associated with implementing and administering a CTS including a verification system, TNC recommends this funding come from debit and credit transactions and not from the public or dedicated environmental funds.
Thank you for your time and attention to TNC's recommendations for developing a CTS. We appreciate the opportunity to comment on this initiative and look forward to continued partnership.

Sincerely,

Richard L. Biske
Director of Water and Land Protection The Nature Conservancy MN-ND-SD

Technical Webinar #1: Ethanol

Date: September 27, 2023
Time: 11:00 – 11:45 a.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Webinar Summary

Introduction

Shannon Engstrom (MnDOT) thanked everyone for joining and provided a reminder this meeting will be recorded. She reviewed the meeting agenda and shared an overview of the Work Group. This included what the Work Group has been tasked with, their overall role and responsibilities. Shannon shared a list of upcoming CTS Work Group events.

Ethanol Technical Overview

Guest Speaker: Phil Sheehy, Director, Transportation and Energy, ICF

Phil Sheehy (ICF) introduced himself. He is providing technical support for the Work Group. He encouraged participants to provide feedback to help advance the initiatives of the Work Group. Phil addressed three main topics:

- 2018 Baseline: Ethanol consumption in Minnesota
- Carbon intensity of ethanol: Process efficiencies, Climate smart agriculture, CCS Deployment
- Ethanol Deployment: Blends, Alcohol-to-Jet

Ethanol blend rate and carbon intensity are the two factors impacting the 2018 baseline.. Phil shared data for monthly mid-blends to review mid-blend stations and the total volume of ethanol reported based on various blends.

The first piece is to review how much ethanol is blended into the fuel. The second piece is to review the carbon intensity. The GREET model will be used to determine a carbon intensity baseline for ethanol. Other jurisdictions with clean fuel standards have used different models and approaches, each showing different results.

Phil shared three models that are used to estimate responses based on ethanol production. GREET is not a predictive tool so some assumptions have to be made for how ethanol will contribute. There are three types of changes that ICF generally considers to reduce the carbon intensity of ethanol: process efficiencies, climate smart agriculture, and carbon capture and storage.

Overall, ethanol has a range of 1-2% efficiency per year. Farmers can change processes to reduce carbon intensity at a higher rate. The Work Group would need to determine the likelihood of farmer participation and what incentives could be offered for participation.

The GREET model can be used to show what practices have been adopted. Then the Work Group would need to look at how much ethanol can be deployed. Right now, the E15 market is robust, and this could be assumed to continue. Consumption for E85 has recovered post-pandemic. There is considerable investment interest in alcohol-to-jet conversions. The Work Group would need to think about the role of sustainable jet fuel in achieving clean standard goals and if it should be included for credits.

Work Group Q & A

Bob Gollnik (WSB) facilitated Work Group questions during an unrecorded question and discussion period. He noted non-Work Group members will have an opportunity to comment during an unrecorded public comment period at the end of the meeting and comments or questions can also be directed to sustainability.dot@state.mn.us.

A high-level summary of Q & A from technical webinars will be posted on the CTS webpage.

Public Comment Period

No comments were received.

Closing & Next Steps

Shannon (MnDOT) thanked everyone for joining and let everyone know content from this meeting would be added to the CTS website. Next, she provided another overview of upcoming meetings. Lastly, she shared her contact information and asked folks to participate in the post-meeting survey.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Paul	Austin	Conservation Minnesota
	Kaytlin	Bemis	MN Farm Bureau
	Carolyn	Berninger	Great Plains Institute for Sustainable Development
	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Matthew	Bruyette	Nature Energy
Virtual	Mike	Bull	Allete/MN Power
	Margaret	Cherne-Hendrick	Fresh Energy
	Vallen	Cook	Grand Portage Band of Chippewa
	Colin	Cureton	UMN Forever Green Initiative
Virtual	Jeff	Davidman	Delta Air Lines, Inc.
	Rodney	De Fouw	Great River Energy
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Dustin	Haaland	CHS, Inc.
	Kent	Hartwig	Gevo, Inc.

	John	Hausladen	Minnesota Trucking Association
Virtual	Abby	Hornberger	BlueGreen Alliance
	Rick	Horton	Minnesota Forest Industries
	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	John	Jaimez	Hennepin County
	Ariel	Kagan	Minnesota Farmers Union
	Thad	Kurowski	Tesla
	Jeremy	Martin	Union of Concerned Scientists
	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
	Carolina	Ortiz	COPAL
Virtual	Stephanie	Pinkalla	The Nature Conservancy
	Kevin	Pranis	LIUNA Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of Mississippi River
	Eric	Schenck	Minnesota Forest Resources Council
	Kathleen	Schuler	Health Professionals for a Healthy Climate

	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
	Brian	Werner	Minnesota Biofuels Association
Virtual	Peter	Wagenius	Sierra Club North Star Chapter
	Bob	Worth	Minnesota Soybean Growers Association
	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and consultant staff

Present	First Name	Last Name	Organization
	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
Virtual	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
Virtual	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Shannon	Engstrom	CTS Director, MN Dept of Transportation

Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Bob	Gollnik	WSB – CTS Consultant
	Samantha	Watson	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant
Virtual	Chevelle	Kazmierczak	WSB – CTS Consultant

Members of the public

Name	**Organization (if applicable)**
Jake Hamlin	CHS, inc.
Peter LaFontaine	Friends of the Mississippi River
Mattie Anders	WSB

Technical Webinar #2: Biomass-based Diesel

Date: September 29, 2023
Time: 11:00 – 11:45 a.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Webinar Summary

Introduction

Shannon Engstrom (MnDOT) thanked everyone for joining and provided a reminder this meeting will be recorded. She reviewed the meeting agenda and shared an overview of the Work Group. This included what the Work Group has been tasked with, their overall role and responsibilities. Shannon shared a list of upcoming CTS Work Group events.

Biomass-based Diesel Technical Overview

Guest Speaker: Phil Sheehy, Director, Transportation and Energy, ICF

Phil Sheehy (ICF) introduced himself. He is providing technical support for the Work Group. He encouraged participants to provide feedback to help advance the initiatives of the Work Group. Phil addressed three main topics:

- 2018 Baseline: Biodiesel consumption in Minnesota
- Carbon intensity of biodiesel: Feedstock mix, Process efficiency, Climate smart agriculture (feedstock specific)
- Deployment in the Market: Biodiesel, Renewable diesel, and Renewable jet fuel

Phil explained that biomass based diesel is a catch all term for biodiesel renewable diesel: consisting of an oil feedstock, and that could be from a variety of sources, and turning it into a fuel, and the product is slightly different than conventional diesel. Biodiesel is chemically equivalent to conventional diesel, but biomass-based jet fuel has a slightly different formulation.

Biomass based diesel blend rate and carbon intensity are the two factors impacting the 2018 baseline. The Work Group will need to decide whether to assume compliance with Biodiesel Content Mandate statute (effective biodiesel blend rate of 12.1% by 2018) or assume no biodiesel in the baseline. Phil noted that in Minnesota, No. 2 biodiesel has seasonal blend requirements (5% from October 1 to March 31, 10% from April 1 to April 14, and 20% from April 15 to September 30).

Carbon intensity (CI) of biomass-based diesel was discussed and explained to be straightforward at around 20-35 g/MJ (excluding LUC). An overview of California, Oregon, and Washington approaches to LUC was discussed. Other jurisdictions with clean fuel standards have used different models and approaches, each showing different results.. The GREET model will be used to determine a carbon intensity baseline for fuel sources.

Land Use Change (LUC) model is relevant to the baseline. Phil shared three models that are used to estimate responses based on biomass-based diesel production. GREET is not a predictive tool so some assumptions have to be made for how each fuel source will contribute. There are 3 types of changes that ICF generally considers to reduce the CI of biomass-based diesel: a) feedstock mix, b) process improvements, and c) climate smart agriculture. Phil clarified that slides refers to the CI of biomass-based diesel before considering a LUC adder.

Phil discussed data from the Minnesota Department of Agriculture which suggests that about 45% of biodiesel in Minnesota is derived from soybean oil and 55% is other fats, oils, and greases. The extent to which a CTS will drive a change in feedstock mix is likely tied to the LUC adder applied to soybean. Phil noted that regardless of the LUC adder, it is unlikely that the market will achieve compliance without soybean oil.

Phil closed by discussing carbon intensity points pertaining to soybean production and how process improvements could reduce carbon intensity. Several examples were provided based on work that ICF has done with the US Department of Agriculture. Phil also discussed various production, supply, and process assumptions that will need to be decided by the work group to be incorporated into the GREET model.

Work Group Q & A

Shannon facilitated Work Group questions during an unrecorded question and discussion period. She noted non-Work Group members will have an opportunity to comment during an unrecorded public comment period at the end of the meeting and comments or questions can also be directed to sustainability.dot@state.mn.us.

Phil responded to questions from the group. A high-level summary of Q & A from technical webinars will be posted on the CTS webpage.

Public Comment Period

No comments were received.

Closing & Next Steps

Shannon (MnDOT) thanked everyone for joining and let everyone know content from this meeting would be added to the CTS website. Next, she provided another overview of upcoming meetings. Lastly, she shared her contact information and asked folks to participate in the post-meeting survey.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
	Paul	Austin	Conservation Minnesota
Virtual	Kaytlin	Bemis	MN Farm Bureau
	Carolyn	Berninger	Great Plains Institute for Sustainable Development
	Amanda	Bilek	Minnesota Corn Growers Association
	Dan	Bowerson	Alliance for Automotive Innovation
Virtual	Matthew	Bruyette	Nature Energy
Virtual	Mike	Bull	Allete/MN Power
	Margaret	Cherne-Hendrick	Fresh Energy
	Vallen	Cook	Grand Portage Band of Chippewa
	Colin	Cureton	UMN Forever Green Initiative
	Jeff	Davidman	Delta Air Lines, Inc.
	Rodney	De Fouw	Great River Energy
	Timothy	Gross	Fueling Minnesota
Virtual	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.

Virtual	John	Hausladen	Minnesota Trucking Association
Virtual	Abby	Hornberger	BlueGreen Alliance
	Rick	Horton	Minnesota Forest Industries
Virtual	Jon	Hunter	American Lung Association
	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	John	Jaimez	Hennepin County
	Ariel	Kagan	Minnesota Farmers Union
	Thad	Kurowski	Tesla
	Jeremy	Martin	Union of Concerned Scientists
	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
Virtual	Stephanie	Pinkalla	The Nature Conservancy
Virtual	Kevin	Pranis	LIUNA Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of Mississippi River
Virtual	Eric	Schenck	Minnesota Forest Resources Council
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate

	Mark	Ten Eyck	Minnesota Center for Environmental Advocacy
	Brian	Werner	Minnesota Biofuels Association
Virtual	Peter	Wagenius	Sierra Club North Star Chapter
	Bob	Worth	Minnesota Soybean Growers Association
Virtual	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
Virtual	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Shannon	Engstrom	CTS Director, MN Dept of Transportation

Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Bob	Gollnik	WSB – CTS Consultant
	Sammantha	Watson	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant
	Chevelle	Kazmierczak	WSB – CTS Consultant

Members of the Public

Name	**Organization (if applicable)**
Alex Yauk	
Terry Riesen	
Kate Klossner	
Lydia Campbell	
Peter LaFontaine	
Jeremy Estenson	
Mattie Anders	WSB

Technical Webinar #3: Transportation Electrification

Date: October 5, 2023
Time: 8:00 – 9:15 a.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Webinar Summary

Introduction

Shannon Engstrom (MnDOT) thanked everyone for joining and provided a reminder this meeting will be recorded. She reviewed the meeting agenda and shared an overview of the Work Group. This included what the Work Group has been tasked with, their overall role and responsibilities. Shannon shared a list of upcoming CTS Work Group events.

Transportation Electrification Technical Overview

Guest Speaker: Phil Sheehy, Director, Transportation and Energy, ICF

Phil Sheehy (ICF) introduced himself. He is providing technical support for the Work Group. He encouraged participants to provide feedback to help advance the initiatives of the Work Group. Phil addressed three main topics as it relates to what transportation electrification may look like, and how to incorporate it into the report:

- 2018 electricity baseline in MN
- Carbon intensity of electricity, along with grid average and changes over time
- Electric vehicle (EV) development in the market for both light-duty vehicles and medium and heavy-duty vehicles

Phil mentions that part of this work will involve estimating the 2018 baseline in terms of the carbon intensity of gasoline and fuels associated with gasoline. He notes there were roughly 10,000 EVs in the state. Since the amount of EVs that existed in 2018 was relatively low, incorporating this into the baseline carbon intensity (CI) will have a little overall impact. Phil also mentions that this will require some assumptions about how much electricity was consumed for those vehicles, for example. In 2018, the CI of in-state electricity in MN was around 190 g/MJ.

It's mentioned that the energy economy ratio (EER) of the vehicle is accounted for when estimating the carbon intensity for electricity, which typically drops the CI by a factor of 3-5. Phil notes this will be captured in the report. Senate File 4 is also mentioned for consideration when discussing carbon free resources. This will including taking the carbon intensity today and assuming compliance with that regulation which requires renewable content of 55% by 2035, carbon-free requirements of 80% for public utilities and 60% for others by 2030, followed by 100% carbon-free requirements by 2040. Assuming this, the CI will go down accordingly. Phil

notes that these assumptions will keep the electricity grid in the state of Minnesota in mind. Additionally, the trajectory of electricity assumes a linear decrease, however, actual implementation will likely look different.

Modeling for light-duty EV development is sensitive to assumptions around the uptake of EVs in terms of rate of adoption and vehicle-type split, which poses the question about what the role of EVs and electricity play in CI targets and how they will be achieved. Phil notes that the growth of EVs involves the displacement of other fuels, which may reduce the opportunity for blending ethanol or biomass-based diesel, for example. This will be something the Work Group will need to consider in their recommendations. It is generally assumed that regulatory drivers will be followed in the process – such as Clean Cars MN Rule and the federally proposed Multi-Pollutant Emissions Standard – regulations which will likely boost the adoption of EVs. The objective here, Phil notes, is to outline a few trajectories for EVs as a benchmark to see how this market will evolve. Phil also mentions that other states have used blanket EER values, which is something the Work Group could further analyze. Overall, the modeling can either show accelerated adoption rate of EVs following regulatory reasons, or regulations following consumer demand.

Modeling for heavy-duty vehicles is sensitive to assumptions around uptake of EVs and location. Some heavy-duty vehicles drive specific patterns at different scales that are more optimal for adopting EV solutions than others. Phil notes that if this is to be included in the modeling, location and distance of that vehicle or fleet should be considered. For example, Phil notes that a delivery box truck at a local level would be easier to electrify than a Class 8 truck that involves state-wide travel. Overall, the Work Group will need to think about location specific matters when deciding on what to model. Phil also notes the regulatory drivers for heavy-duty EV deployment are not as strong in MN today compared to light-duty EVs. The opportunity for EVs is large compared to other fuels due to the grid getting cleaner along with emerging EV technology. Phil concludes with final thoughts about modeling the role of EVs as they substantially grow over time, what the rate of adoption will be, and complying with current regulations in contrast to a much faster uptake than just the regulatory drivers with respect to other low carbon fuels.

Work Group Q & A

Shannon Engstrom facilitated Work Group questions during an unrecorded question and discussion period. She noted non-Work Group members will have an opportunity to comment during an unrecorded public comment period at the end of the meeting and comments or questions can also be directed to sustainability.dot@state.mn.us.

Phil responded to questions from the group. A high-level summary of Q & A from technical webinars will be posted on the CTS webpage.

Public Comment Period

Dean Taylor from Plug in America mentioned: all of this conversation will go into helping determine the CTS target for CI reductions from gasoline and diesel in one or more future years, and notes that the Legislature or agency can change this target a few years later - up or down, which has happened in other states.

Closing & Next Steps

Shannon (MnDOT) thanked everyone for joining and let everyone know content from this meeting would be added to the CTS website. Next, she provided another overview of upcoming meetings. Lastly, she shared her contact information and asked folks to participate in the post-meeting survey.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Mike	Bull	Allete/MN Power
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Rick	Horton	Minnesota Forest Industries
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	Thad	Kurowski	Tesla
Virtual	Cyndy	Milda	Shakopee Mdewakanton Sioux Community
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)

Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Kevin	Pranis	LIUNA Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of Mississippi River
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Peter	Wagenius	Sierra Club North Star Chapter

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
Virtual	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
Virtual	Shannon	Engstrom	CTS Director, MN Dept of Transportation
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Connor	Cox	WSB – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Bob	Gollnik	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant

Virtual	Phil	Sheehy	ICF – CTS Consultant
Virtual	Fang	Yan	ICF – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Jake Hamlin	CHS, inc.
Peter LaFontaine	Friends of the Mississippi River
Elliott Blackburn	Argus Media
Lydia Campbell	Taft Advisors
Daniel Dwight	Stinson, LLP
Dallas Fischer	Fueling Minnesota
Ian Marsh	Park Street Public, LLC
Alexandria Reed	
Terry Riesen	Marathon Petroleum Corp.
Nate Schuster	Charge Point
Dan Smading	Flint Hills Resources
Nathan Stockman	Flint Hills Resources
Dean Taylor	Plug In America

Technical Webinar #4: Other Clean Fuel Activities

Date: October 6, 2023
Time: 10:30 – 11:15 a.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Webinar Summary

Introduction

Shannon Engstrom (MnDOT) thanked everyone for joining and provided a reminder this meeting will be recorded. She reviewed the meeting agenda and shared an overview of the Work Group. This included what the Work Group has been tasked with, their overall role and responsibilities. Shannon shared a list of upcoming CTS Work Group events.

Other Clean Fuel Activities Overview

Guest Speaker: Phil Sheehy, Director, Transportation and Energy, ICF

Phil Sheehy (ICF) introduced himself. He is providing technical support for the Work Group. He encouraged participants to provide feedback to help advance the initiatives of the Work Group. Phil addressed three main topics:

- Review additional activities that could generate credits
- Do these fuels or activities impact the baseline?
- Should these activities be incorporated into the modeling?
- Activities covered: hydrogen (part of electrification), jet fuel, natural gas and renewable gas, refinery efficiency/improvements, off-road equipment, infrastructure crediting, and zero carbon intensity (CI) for electricity applications

Phil notes that hydrogen should have been included in the discussion related to transportation electrification. Hydrogen fuel cell vehicles are a viable path towards ZEV compliance in both light-duty vehicle and heavy-duty vehicle sectors. It is not required to include hydrogen in the 2018 baseline, and the carbon intensity trajectory of hydrogen is generally tied to requirements or assumptions around a transition to hydrogen from SMR of renewable natural gas or electrolysis. Phil mentions that if hydrogen is used in the baseline, the Work Group will need to figure out if and how the determined guideposts can be achieved.

Phil adds a disclaimer that he is not an expert in jet fuel, and this information should not be construed as legal advice. In some instances, including jet fuel in CTS has caused concern because of jurisdictional considerations. For example, California and Oregon allowed alternative fuel to generate credit, but at same time did not regulate it. The work group will have to determine if sustainable aviation fuel (SAF) will simply be a credit

generating activity with conventional jet fuels creating deficits, and if it will be regulated under the CTS. Phil also mentions that MN recently passed a SAF tax credit equal to $1.50/gal.

Natural gas in MN is low in volume as it relates to transportation fuel, approximately 5-7 million gallons, which will have a low impact on the 2018 baseline. A considerable amount of transportation-related natural gas in other states has already been displaced by renewable natural gas (RNG) due to renewable fuel standards. The CI of RNG depends on feedstock which can be reduced by avoiding flaring emissions at landfills and methane emissions at dairies. Credits will be administered accordingly by avoiding emissions at landfills and dairies. RNG from animal manure is often produced at concentrated animal feeding operations (CAFOs).

Greenhouse gas emissions reductions can be achieved at refineries and are an eligible credit generating activity. MN has two refineries - Pine Bend and St Paul Park. If there are refinery efficiencies or improvements to these two locations, the Work Group will need to decide if it can generate credits. The credit generating eligibility of anything that occurred between 2018 and the promulgation of the standard would need to be considered as part of the regulation development. There are many ways that refineries can reduce GHG emissions via efficiency improvements, renewable energy development, renewable hydrogen, or CCS. The Work Group will need to decide whether to include this or not, and if so, quantify the number of generated credits.

Off road equipment is generally focused on electrification of off-road equipment like forklifts, cargo handling equipment, truck refrigeration units, public transportation, etc., though Phil notes this is rather difficult to incorporate into a baseline due to the niche market and data collection.

The underlying principle of infrastructure crediting is that the station owner/operating bears risk at the outset of infrastructure deployment due to low utilization of the asset. The regulator allows refueling stations to generate credits for a pre-determined period, using the capacity of the station rather than the actual utilization. Phil notes this will not be included in the first round of modeling from ICF due to assumptions around infrastructure.

Electricity generates credits based on the grid average which can be statewide or utility specific. Modeling will use the statewide average to avoid making judgements about where EVs will be deployed and at what rate. The administrator of the program can enable regulated parties that generate credits from electricity to increase credit generation by matching excess RECs with electricity to lower the CI of the fuel. Phil notes that at the outset, there will be an opportunity to find excess RECs, then as the grid decarbonizes and requires more renewable energy itself, creating a zero CI pathway for electricity. Modeling will include the most accurate light-duty, medium-duty, and heavy-duty vehicle data possible, and it can show how many additional credits will be generated if a zero CI prevision were incorporated.

Work Group Q & A

Shannon Engstrom facilitated Work Group questions during an unrecorded question and discussion period. She noted non-Work Group members will have an opportunity to comment during an unrecorded public comment period at the end of the meeting and comments or questions can also be directed to sustainability.dot@state.mn.us.

Phil responded to questions from the group. A high-level summary of Q & A from technical webinars will be posted on the CTS webpage.

Public Comment Period

No comments were received.

Closing & Next Steps

Shannon (MnDOT) thanked everyone for joining and let everyone know content from this meeting would be added to the CTS website. Next, she provided another overview of upcoming meetings. Lastly, she shared her contact information and asked folks to participate in the post-meeting survey.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Carolyn	Berninger	Great Plains Institute for Sustainable Development
Virtual	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Matthew	Bruyette	Nature Energy
Virtual	Mike	Bull	Allete/MN Power
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	John	Hausladen	Minnesota Trucking Association
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	John	Jaimez	Hennepin County
Virtual	Thad	Kurowski	Tesla
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)
Virtual	Steve	Morse	Minnesota Environmental Partnership

Virtual	Marty	Muenzmaier	Cargill, Inc.
Virtual	Carolina	Ortiz	COPAL
Virtual	Stephanie	Pinkalla	The Nature Conservancy
Virtual	Kevin	Pranis	LIUNA Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of Mississippi River
Virtual	Eric	Schenck	Minnesota Forest Resources Council
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Peter	Wagenius	Sierra Club North Star Chapter
Virtual	Mike	Youngerberg	Minnesota Biodiesel Council

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Elizabeth	Croteau-Kallestad	
Virtual	Amber	Dallman	Office of Sustainability and Public Health Director, MN Dept of Transportation
Virtual	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
Virtual	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency

Virtual	Megan	Lennon	CTS Project Management Team, Energy and Environment Section Supervisor, MN Dept of Transportation
Virtual	Shannon	Engstrom	CTS Director, MN Dept of Transportation
Virtual	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
Virtual	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture
Virtual	Phil	Sheehy	ICF – CTS Consultant
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Connor	Cox	WSB – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Bob	Gollnik	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Lydia Campbell	Taft Advisors
Daniel Dwight	Stinson, LLP
Jeremy Estenson	

Dallas Fischer	Fueling Minnesota
Dallas Gerber	
Jessica Hoffmann	
Peter LaFontaine	Friends of the Mississippi River
Ian Marsh	Park Street Public, LLC
Jake Peterson	
Terry Riesen	Marathon Petroleum Corp.
Dan Smading	Flint Hills Resources
Bennett Smith	
Nathan Stockman	Flint Hills Resources

Technical Webinar #5: Land Use, Water and Ecosystem Services

Date: October 16, 2023
Time: 3:00 – 5:00 p.m.
Minutes prepared by: WSB Consulting
Location: Zoom

Webinar Summary

Introduction

Shannon Engstrom (MnDOT) thanked everyone for joining and provided a reminder this meeting will not be recorded. Shannon shared a list of upcoming CTS Work Group events and also gave an overview of the past CTS Work Group events and webinars. She reviewed the meeting agenda and shared an overview of the Work Group. This included what the Work Group has been tasked with, their overall role and responsibilities. Shannon also provided an overview of the CTS Work Group timeline. Work Group members were notified that they should set aside some time in early December to review the draft CTS report. Shannon and the team will give work group members a heads up when this review window will be.

Land Use, Water and Ecosystem Services Overview

C2ES Event Overview

Shannon shared takeaways from the event organized by Council on Climate and Energy Solutions (C2ES). Shannon noted a key point from the event was including rail in the CTS conversation, as well as environmental justice opportunities. Kevin Pranis (Chair) also noted that the event included discussions around defining climate smart agriculture in the state. Kevin also recapped the discussion around markets and clean investment signals, including the need for there to be at least 15 years of business surrounding new strategies, and that tension between markets work better if there's some alignment.

Shannon mentioned the objective of the webinar today, which included discussing key land use considerations related to development of a CTS in Minnesota, water quality and quantity, air quality, and other ecosystem services and potential indirect land use impacts. Shannon emphasized that boundaries will need to be drawn to determine what is and isn't included in the modeling component, in order to develop a CTS in the timeframe allotted and that is feasible to regulate.

Panelist: Matt Herman, Senior Director of Renewable Products Marketing, Iowa Soybean Association

Matt Herman introduced himself before presenting on soil and water outcomes along with related considerations that can be advanced by biofuel production, and believes a CTS is an opportunity to increase conservation agricultural purposes.

Matt emphasized the need to use a combination of conventional abatement technology, lower emitting technology, and carbon removal technology to reach the goals outlined in the Paris Agreement. Soybeans are grown locally and are being exported mostly to international markets (China imports 69% of US soybeans). Most of its growth is due to growing animal protein demand. Due to this, there is a growing emphasis for expanding soybean processing in the US. Matt also notes that more value chain participants in both directions are participating in voluntary programs such as the Greenhouse Gas Protocol and Science Based Targets Initiative, among others. Matt states that activities on these farms impact scope accounting and supply chains of agricultural processors of food and feed companies throughout the value chain and mentions that solutions to reduce emissions are not going to be the same for every crop or fuel type.

Matt states that if Minnesota is looking to develop a more sustainable food, feed, fuel, and fiber market, it should be made easier for farmers to change their methods. Existing federal cost sharing programs exist, though many of them are complex and understaffed, making it difficult for farmers to enroll. Matt notes that a CTS can create local market opportunities for crop residues and forages, and can expand existing private eco-system service markets:

- Feedstock carbon intensity reductions
- Infrastructure credits (similar to California's or British Columbia's program)
- 'Part 3 agreements' (similar to British Columbia's program)

Additionally, there are challenges with monitoring, reporting, and verification (MRV) in terms of measured versus modeled impacts which require high transaction costs, carbon sequestrations versus CO2e avoidance, ensuring farmer returns, existing federal programs and dollars such as the Farm Bill, and inclusion of novel practices.

Matt concludes his presentation with:

- Clean transportation standards can be the backbone to a larger agricultural, energy, environmental market
- Inclusion of infield emission reductions into a CTS is consistent with the policy framework and Minnesota's greenhouse gas (GHG) inventory
- Existing private market entities can provide various MRV services, and a CTS could create a new market for biomass novel crop systems

Panelist: Dr. Carrie Jennings, Research and Policy Director, Freshwater Society

Dr. Carrie Jennings introduced Freshwater Society before providing water-focused perspectives on the development of a standard to avoid unintended consequences. Dr. Jennings noted that very few surface water

bodies in agricultural wetlands meet water quality standards in the state, and emphasized the importance drainage pipes have on water tables as they don't let water tables rise to normal levels. This has an effect on river systems that surround drain tiles by widening waterways and increasing the flow of water within them. This is due to more water running off farmlands and less water being returned to the atmosphere through plants. Dr. Jennings mentions that land, homes, and soil is physically lost to river widening, and rivers are becoming less hospitable to aquatic life.

Dr. Jennings continues, noting that crops such as alfalfa, small grains, and hay have also changed since the 1930's with consequences for water quantity and quality, while corn and soybeans mostly dominate the landscape now which has its own implications. Water coming off these crops results in an increase of Nitrogen in nearby water systems, creating unsafe and undrinkable water in many parts of the state.

Dr. Jennings finishes with noting that soil is actually the biggest terrestrial store of carbon, and that the University of Minnesota has ongoing studies on regenerative agriculture, specifically Forever Green Alliance research which studies other plants that could be considered for widespread biofuel use. Dr. Jennings ends with emphasizing not to lose sight of water in the quest for low carbon fuel.

Panelist: Dr. Farzad Taheripour, Energy Economist, Purdue University

Dr. Farzad Taheripour introduced himself and prepared to discuss a lifecycle GHG model that estimates potential indirect land use changes from various biofuel expansion scenarios. He provided some background on the theory of Indirect Land Use Change (ILUC) and a literature review.

Dr. Taheripour presents on how biofuel production has increased the demand for new crop land in the United States which results in deforestation, generating large GHG emissions. In the early 2000's, lifecycle analyses (LCAs) estimated emissions from corn ethanol were around 60-65 gCO2e/MJ. Several papers in the late 2000's began arguing that producing corn ethanol will generate large ILUC, and that earlier papers ignored market mediated responses.

Dr. Taheripour notes that the amount of land used for cropland over time has been decreasing. However, corn and soybean cropland area in the United States has been increasing, while other cropland areas have been decreasing, and there's a lot of unused cropland. The difference between the amount of cropland and the harvested area is quite large. Dr. Taheripour mentions that there has been a drastic improvement in the yield of corn over time. Between 2000-2022 corn yield has increased by nearly 30%. This increase has led to about 105 billion gallons of ethanol and 318 million metric tons of distiller's dried grains with soluble (DDGS). Between 2000-2022 soybeans have increased by over 25%, which is about 18.5 billion gallons of soy biodiesel and 255 million metric tons of soy meal. Overall, the US net export of agricultural products has continued to grow with the exception of a few drought years.

There have been efficiency gains in meat production over time as well, which means pork and poultry production are increasing. The population has increased by about 1% over time while crop production has increased by 1.6%, meaning that we are producing more food than we can consume. Dr. Taheripour mentions that food consumption across the world has been increasing steadily over the years, with the projected ILUC values for US corn and soy biodiesel being a downward trend.

Lastly, Dr. Taheripour shared some conclusions from his presentation:

- The US historical observations:
    - Do not confirm major land use changes due to agricultural activities
    - Do not confirm major systematic declines in US net exports of agricultural products
    - Do not confirm major reductions in food consumption
    - Do not confirm major changes in LULUCF net carbon stock changes
- Counter factual hypothetical modeling practices that estimate high ILUC values do not reflect reality.

Panelist: Dr. Christine Costello, Industry Ecologist & Engineer, Penn State University

Dr. Christine Costello introduced herself to the Work Group and noted her enthusiasm for this challenging project. Dr. Costello began providing an overview of her perspectives on Life Cycle Assessments (LCAs) of agricultural supply chains and how to extend LCA frameworks to include water quality, biodiversity, and social justice impacts.

Dr. Costello notes that biophysical/hydrological/atmospheric modeling has been used to support the best environmental decision-making. LCA is an analysis of the environmental (social and/or economic) consequences of an activity or product throughout its life cycle from raw material acquisition through production, use, end-of-life treatment, recycling, and final disposal. There are four major phases of the life cycle assessment framework:

- Goal and scope definitions
- Inventory analysis
- Impact assessment
- Interpretation

Dr. Costello emphasized that the goal and scope process of an LCA is usually overlooked and is a very important component. Life cycle inventory is the step of data collection regarding the system in question. Materials and energy flows are determined for all steps of the process, product, and service. In agriculture, Dr. Costello noted that some relevant flows occur in soils and exhibit a high degree of variability, making it challenging to create simplistic multipliers as commonly found in fossil-based, manufacturing systems. Carbon intensity scoring is creating a desire to estimate with greater spatial specificity. LCAs were created not just for carbon emissions – but to consider multiple impacts simultaneously.

There are multiple life cycle impact assessment methodologies, all with a major goal to be able to consider multiple impacts simultaneously, however, Dr. Costello noted that there is no university accepted method for impacts to soil health or biodiversity. Efforts to account for social impacts exist. Generally, impacts and impact assessments should be developed with the communities that are impacted.

Dr. Costello states that life cycle impact assessment is backed by science and data, though it was developed for a global or national system. She also notes that LCAs were not developed for agricultural analysis, but for manufacturing systems, and there is no agreed upon approach to evaluate soil health, biodiversity, or social impacts in LCA. Dr. Costello mentions that agreement upon specific metrics for these impacts is ultimately a negotiation process for decision makers, in which they may want to combine LCA with other system evaluation processes.

Reflections: Phil Sheehy, ICF

Phil Sheehy from ICF provided his feedback on the topics presented by the panelists, and while important, noted that much of this information is not included in the analysis modeled by GREET which is an attributional approach, and not a consequential approach. A consequential approach is challenging to regulate which is why GREET is used as the base for CA, OR and WA standards.

Guest Speaker Q & A

Shannon Engstrom facilitated Work Group questions during an unrecorded question and discussion period. She noted non-Work Group members will have an opportunity to comment during the public comment period at the end of the meeting and comments or questions can also be directed to sustainability.dot@state.mn.us.

Panelists responded to questions from the group.

Public Comment Period

Question: Anonymous – Could Dr. Jennings speak on how we monetize clean water incentives on farms? Or even how we track the results by farm? Some of the crops she was talking about aren't commercialized, or require expensive new equipment, or significant financial risk to transition. It's a hard case to make to a farmer that is near retirement, much like adopting other practices for corn and soy that reduce tillage and fertilizer use.

Answer: Dr. Jennings – There are two new State programs that monetize these incentives for farmers, 1) the water quality and storage program and 2) soil health program. There are direct payments to farmers for water quality and storage practices where they reduce peak flow in their watersheds where they farm. There is $17 million in the program this year, so we will pay farmers to hold back water, ideally between April and June.

Closing & Next Steps

Shannon (MnDOT) thanked everyone for joining and let everyone know content from this meeting would be added to the CTS website. Next, she provided another overview of upcoming meetings. Lastly, she shared her contact information and asked folks to reach out if they had any questions.

Attendance

Work Group Members

Present	First Name	Last Name	Organization
Virtual	Paul	Austin	Conservation Minnesota
Virtual	Kaytlin	Bemis	MN Farm Bureau
Virtual	Carolyn	Berninger	Great Plains Institute for Sustainable Development
Virtual	Amanda	Bilek	Minnesota Corn Growers Association
Virtual	Matthew	Bruyette	Nature Energy
Virtual	Mike	Bull	Allete/MN Power
Virtual	Timothy	Gross	Fueling Minnesota
Virtual	Dustin	Haaland	CHS, Inc.
Virtual	Kent	Hartwig	Gevo, Inc.
Virtual	Abby	Hornberger	BlueGreen Alliance
Virtual	Jon	Hunter	American Lung Association
Virtual	LesLee	Jackson	Minneapolis Northside Green Zone
Virtual	Ariel	Kagan	Minnesota Farmers Union
Virtual	Jeremy	Martin	Union of Concerned Scientists
Virtual	Sarah	Mooradian	CURE (Clean Up the River Environment)

Virtual	Steve	Morse	Minnesota Environmental Partnership
Virtual	Carolina	Ortiz	COPAL
Virtual	Kevin	Pranis	LIUNA Minnesota/North Dakota
Virtual	Trevor	Russell	Friends of Mississippi River
Virtual	Eric	Schenck	Minnesota Forest Resources Council
Virtual	Kathleen	Schuler	Health Professionals for a Healthy Climate
Virtual	Peter	Wagenius	Sierra Club North Star Chapter
Virtual	Brian	Werner	Minnesota Biofuels Association

Agency and Consultant Staff

Present	First Name	Last Name	Organization
Virtual	Valare	Falkner	CTS Internal Steering Committee, Deputy Director, MN Dept of Commerce
Virtual	John	Flemming	
Virtual	Frank	Kohlasch	CTS Internal Steering Committee, Assistant Commissioner, MN Pollution Control Agency
Virtual	Shannon	Engstrom	CTS Director, MN Dept of Transportation
Virtual	Tim	Sexton	CTS Internal Steering Committee, Assistant Commissioner, MN Dept of Transportation
Virtual	Andrea	Vaubel	CTS Internal Steering Committee, Deputy Commissioner, MN Dept of Agriculture

Virtual	Phil	Sheehy	ICF – CTS Consultant
Virtual	Mattie	Anders	WSB – CTS Consultant
Virtual	Connor	Cox	WSB – CTS Consultant
Virtual	Amy	Fredregill	WSB – CTS Consultant
Virtual	Noel	Mills Ford	WSB – CTS Consultant

Members of the Public

Name	Organization (if applicable)
Mark Bunch	Marathon Petroleum Corp.
Lydia Campbell	Taft Advisors
Jon Costantino	
George Damian	
Daniel Dwight	Stinson, LLP
Jeremy Estenson	
Victoria Flowers	
Dallas Gerber	
Jake Hamlin	
Chandra Her	

Donovan Hurd	
Mike Karbo	
Matthew Lemke	
Jesse Nowicki	
Brent Pace	
Terry Riesen	Marathon Petroleum Corp.
Katie Stonewater	
Jean Wagenius	