



MEMBERSHIP MEETING SUMMARY

Wednesday, November 8, 2023 (9:30 AM – 12:00 PM)

1003 Discovery Drive | Chisholm, MN 55719

And via Zoom: <https://us02web.zoom.us/j/88401325345>

MEETING OBJECTIVE

VISION | Shaping evolving landscapes for future generations.

MISSION | A regional collaboration that invests in our diverse community by:

- Developing opportunities for dynamic minescapes,
- Preserving lands to sustain current and future mining, and
- Providing resources and education

STRATEGIC DIRECTIONS

1. Optimizing Organization & Communications
2. Investing in Mineland Communities
3. Enhancing Stakeholder Partnerships
4. Educating Partners & the Public

Check out the updated website: www.mvpmn.org

MEETING SUMMARY

- Welcome & Introductions
- Climate Trends & Tools
- Climate Action Framework
- Talon Carbon Sequestration Project
- Green Steel: Clean-Energy and Iron-Based Industries
- Integrated Industrial Decarbonization in Minnesota: Opportunities and Challenges
- Adjourn

WELCOME & INTRODUCTIONS

Welcome & Introductions

Elissa Hansen & Stefanie Sjelin, Facilitators

Elissa Hansen, MVP Facilitator, welcomed attendees and called the meeting to order at 10:01 AM. Hansen and co-facilitator Stefanie Sjelin then led the group in a round of introductions.

Climate Trends & Tools

Peter Boulay, Minnesota Department of Natural Resources (MnDNR) State Climatology Office

Assistant State Climatologist Peter Boulay with the MnDNR State Climatology Office began the session with a virtual presentation on past, present, and future weather trends in Northeast Minnesota. See slides for additional information.

Boulay noted that by utilizing a blend of old and new technologies, what has happened in the past can be applied to the future. Boulay briefly spoke about his interest and background in weather, including 25 years with MnDNR's State Climatology Office working to manage, analyze, and share data and resources on Minnesota's historical climate conditions.

Delving into our region's past climate, Boulay shared a map and photos of Northeast MN in the 1870s. He highlighted the lack of trees from logging-related deforestation with the point being, anytime you change the environment, you change the climate. Boulay provided an overview of historical floods in the Northland, including major floods in July 1909 and September 1947. The MNgage Volunteer Rain Gage Network was later started in the 1970s to monitor Minnesota's rain levels and continues to collect data from citizens throughout the state, including strong representation in Northeastern counties. The compiled data helps to provide a clearer picture of precipitation patterns, better documentation, and planning for future rain events. Boulay also noted that veins of ore tend to follow the same patterns as rainfall.

Boulay next turned to the present climate and briefly introduced the National Oceanic and Atmospheric Administration (NOAA) Atlas, a resource to help predict rain events, noting that the Atlas's 15th edition is currently in production. He spoke about the flood of June 2012, which severely impacted much of Northeast Minnesota with several inches of rain, before transitioning to broader recent rainfall patterns in our region. Boulay noted that 2019 was the wettest year on record in Minnesota, followed by drought in 2020 and 2021 (peak drought in August 2021), then a flood in Spring 2022. Weather in our region also varies county-to-county and even within St. Louis County, and conditions can move from drought to flood very quickly. Boulay shared that statistically, St. Louis County currently has the least drought in the state, and that recent droughts are "wetter" and less severe compared to historical data.

Historical data shows that Minnesota is trending toward significantly warmer temperatures in winter, at night, and "up north." Since record-keeping began in 1895, average winter temperatures have risen over 7° F in Northern Minnesota and are expected to continue to increase approximately half a degree per decade. Drought effects and the loss of extreme cold has several implications for St. Louis County, including an influx of invasive species like Asian beetles and emerald ash borers that normally are killed off by very low temperatures, which in turn harms trees. Boulay also pointed out that Northeast Minnesota has been receiving more snow in recent years, and while snow depth is declining due to quicker melting and less snow cover, there are also more heavy snow events impacting our region.

Shifting to the future of region's climate, Boulay briefly noted that a book published in the 1970s, *Climate Change for the Year 2000*, accurately predicted the per-decade temperature increase, then stated that the weather in early October and November has been much warmer than in the past. This has benefits for travel, but negatively impacts activities like hunting. The trend is expected to continue, with the warmer weather resulting in more rain and less snow on the ground during these months. Boulay noted that Winter 2023-2024 is an El Niño year, following La Niña for the past three years. As a result, we can anticipate a winter that is overall warmer with less precipitation. However, there is still potential for large storms and severe winter weather, and Boulay repeatedly emphasized that we should expect variability.

Looking to the more distant future of 2041-2070, our region can expect to continue to receive more overall precipitation, as well as more heavy precipitation events. Boulay concluded by sharing about the Minnesota Climate Mapping and Analysis Tool (CliMAT), a new interactive online resource from the University of Minnesota. Learn more about CliMAT here: <https://climate.umn.edu/MN-CliMAT>.

Boulay answered questions from the group following the presentation and welcomed attendees to reach out to him directly if they have further climate-related inquiries.

P R E S E N T A T I O N

Climate Action Framework

Kate Knuth, Minnesota Pollution Control Agency (MPCA)

Next, Kate Knuth, Climate Director with the MPCA, shared a virtual presentation on the Climate Action Framework, which serves as a guide for how to effectively approach climate action in Minnesota. See slides for more information.

Participants can also review the full Climate Action Framework here: <https://climate.state.mn.us/sites/climate-action/files/Climate%20Action%20Framework.pdf>.

Knuth began by highlighting the structure of the Climate Change Subcabinet responsible for the Climate Action Framework. The Subcabinet, comprised of 15 representatives from various state agencies, departments, and boards, was assembled by Governor Walz and is advised in its duties by the state's Advisory Council on Climate Change. Providing context for why such a framework is necessary, Knuth noted that it aims to create a bold vision for Minnesota moving forward, invites conversations about addressing climate change, ensures accountability, helps to organize and share thinking, and catalyzes action across sectors. Climate change broadly impacts the economy, geography, and daily lives throughout our state and region. As such, lots of work was put into the Climate Action Framework, and it was developed in close partnership with various stakeholders and government-to-government forums, including Tribal governments.

Stating Minnesota's vision for the Climate Action Framework, Knuth noted that each aspect is of equal importance:

1. **Carbon-neutrality:** Substantially reduce greenhouse gas (GHG) emissions and balance GHG emissions with carbon storage by 2050.
2. **Resiliency:** Ensure our state's communities, businesses, and natural environment can prepare for, respond to, recover from, and thrive in the face of climate-related challenges.
3. **Equity:** Acknowledge and address systemic disparities that cause certain communities to disproportionately experience climate-related impacts, distribute costs and benefits fairly, and invite meaningful planning participation.

Knuth then gave an overview of the framework's new targets to reduce GHG 50% by 2030, reach net zero emissions by 2050, and prioritize resilience investment over the next 10 years. She highlighted that the resource is not just for state government use, but rather, our response to climate change requires action by all levels of government, businesses, nonprofits, and individuals. The Climate Action Framework's six overarching goal areas focus on clean transportation, climate-smart natural and working lands, resilient communities, clean energy and efficient buildings, healthy lives and communities, and clean economy; each goal has corresponding initiatives and action items.

The Climate Action Framework just passed its one-year anniversary and has made lots of progress in that time, including significant policy progress toward reaching 100% clean energy by 2040. There has been budget progress regarding the interagency climate budget under the Walz administration, and 11 out of the 15 subcabinet agencies have submitted budget proposals supporting all framework goals. State employees from all agencies have also been stepping up to help operationalize investment. Federal funding has progressed via funding through the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA). Knuth noted that formula and competitive funding is available across multiple agencies, as well as state interagency cooperation to track grant opportunities and secure federal funding.

After the presentation, Knuth fielded comments and questions from the group, and invited meeting participants to reach out through email at any point, especially with questions relating to industrial decarbonization.

P R E S E N T A T I O N

Green Steel: Clean-Energy and Iron-Based Industries

Michael Overend, Northland Chapter of the Citizens Climate Lobby (CCL)

Michael Overend, a veterinarian by trade and a representative from the MN Northland Chapter of the Citizens' Climate Lobby (CCL), then gave a presentation on the transformative potential of a clean energy economy for our region. Overend shared five key opportunities, underscoring clean energy as not just a chance to mitigate climate impacts but also for the economy. See slides for more detailed information.

Overend stressed the urgency, reality, and human impact of climate change, noting there is hope if we act quickly. Despite increasing political will toward a livable world, the statistics Overend shared were stark: over 60% of global industrial power is derived from fossil fuels, with steel production accounting for 7% of worldwide greenhouse gases (GHG). Overend presented beneficial electrification as a solution that can preserve and create many jobs while reducing pollution.

The Iron Range, with its intersection of cost-effective industry and abundant resources, stands poised as an ideal candidate for this beneficial electrification. The industry's momentum is shifting towards clean energy, and the Iron Range's mining communities have unique opportunities in this regard. The significance of the Iron Range was underlined by the massive funding opportunities at both federal and state levels, with "steel in the ground" investments aimed at leveraging private capital for community benefit that need to be seized by 2032.

Overend also noted that wind, solar, and hydro sources are projected to triple in the next decade, providing power without pollution on an unprecedented scale. Mines offer utility-scale opportunities that could impact the region and beyond. The Department of Energy's (DOE) historic \$1B award to Minnesota for the Heartland Hydrogen Hub in October 2023 was highlighted as a cornerstone for the decarbonization of industries across Minnesota. With the right actions, Minnesota could become a leader in clean energy, but the window to outpace other states is narrow.

Technology advancements in iron and steel, such as in blast furnaces, basic oxygen furnaces, and electric arc furnaces, suggest a burgeoning demand for steel, particularly of the low-carbon variety. Overend stated this demand is not only driven by the necessity to revitalize manufacturing but also by consumers' growing preference for green products. This past August was also the one-year anniversary of the Inflation Reduction Act (IRA), an event marked by billions in awarded funding, new job creation, and a surge in bipartisan support for clean energy initiatives.

Overend distilled the vast potential for clean energy in our region into five key opportunities:

1. Green direct reduced iron (DRI): The potential of green DRI, produced with on-site hydrogen, was presented as a game-changer for low-emission steelmaking and a gateway to pioneering iron-air battery technology.
2. Decarbonized "green" steel production: Molten oxide electrolysis (MOE) for carbon-free steel, a method poised for commercialization by 2025, converts mining by-products into resources and meets infrastructure demands.
3. Geographic-feature energy storage: Abandoned mines could serve as sites for large-scale energy storage, with pumped hydrogen and compressed air energy storage offering solutions for consistent, 24/7 reliable power. The Natural Resources Research Institute (NRRI) has identified 9 potential sites on the Iron Range for pumped hydrogen storage.
4. Form Energy's iron-air battery utility-scale solution to wind and solar: Compared to conventional batteries, the iron-air battery can last for 100 hours instead of four and costs 1/10 the price. They are modular, easily scaled, and can be placed anywhere on the grid. Demand for iron-air batteries is massive and expected to continue growing.

At this time, Jeff Borling of Great River Energy also provided the following article links in the meeting Zoom chat for participants who wish to learn more about iron-air batteries:

- <https://www.mprnews.org/story/2023/02/10/rusty-batteries-could-hold-key-to-carbonfree-power-future>
- <https://greatriverenergy.com/company-news/battery-project-includes-minnesota-flair/>

5. Sulfate mitigation reduces environmental impact: Environmentally conscious and cost-effective sulfate mitigation strategies using bacteria in the soil and green DRI pellets can help convert sulfate to iron sulfide, a valuable by-product.

In wrapping up, Overend again highlighted the interconnectedness of combating climate change with industrial growth,

access to resources, and unfolding economic opportunities. Reiterating the unique opportunity that green energy represents for the Iron Range; he issued a call to action for leaders and citizens to unite in laying down the green steel infrastructure that will support jobs and foster a healthier environment.

Overend addressed questions from the group following his presentation.

P R E S E N T A T I O N

Integrated Industrial Decarbonization in Minnesota: Opportunities and Challenges

Rolf Weberg, Natural Resources Research Institute (NRRI)

Rolf Weberg, Executive Director at NRRI, provided a presentation on the opportunities and challenges of integrated industrial decarbonization within Minnesota. See slides for more information.

Industrial decarbonization is an urgent opportunity rather than just a response to climate change, which the Department of Energy starkly terms a "climate crisis." Weberg emphasized that Minnesota must seize the current decarbonization opportunity or risk losing it, much like with the mining industry. He then gave information on an energy action plan for Duluth, led by research from Dr. Jennifer King, which saw four national labs conducting a study on the most cost-effective locations for green steel production and decarbonization. Initially, northeastern Minnesota was not part of the study, but upon inclusion, it was identified as the most optimal location for low-cost green steel production.

Key insights shared by Weberg included:

1. Minnesota's recognition as an ideal place for clean industrial applications, leveraging low-cost renewables, potential for hydrogen geological storage, and existing infrastructure with raw materials.
2. The transformative nature of the IRA allows for stacking a combination of production and investment tax credits.
3. The importance of co-locating hydrogen production with its end use, such as in steel production, to ensure the lowest electricity costs.
4. The cost-effectiveness of hybrid systems combining wind, solar, and storage.

Minnesota's resources and people were acknowledged as strengths, yet Weberg noted these advantages are not always fully utilized. Now, with significant investment from the DOE and collaboration with the Hydrogen Hub in Chicago, Minnesota has a chance to lead in clean energy integration. Weberg then delineated how clean energy can transform industrial production, discussing the grid and hydrogen use models, and the levelized cost of steel (LCOS). The IRA was again highlighted as a key factor in keeping green energy affordable, offering a critical but limited window that extends only until 2035. The discussion transitioned to Minnesota's unique positioning, possessing ample key assets co-located in-state, and emphasized the need for a "Minnesota Community" approach to ownership. Weberg noted that 40% of funding is directed to historically overlooked communities.

Three lenses were outlined as essential for successful climate carbon industrial decarbonization: communities, economy, and technology. Weberg stressed that environmental and social justice must be integral to these efforts, or they are doomed to fail. Focusing on the iron and steel industry, Weberg contrasted today's CO2 reduction achievements with tomorrow's potential, including producing iron products for the electric arc furnace market while continuing to serve the blast furnace market. The goal is not to remove carbon from steel but to ensure emissions are carbon-free, which is complex yet crucial.

Weberg then provided three scenarios for Minnesota's green steel future:

1. Converting blast furnaces to hydrogen blending, with Minnesota providing specially designed iron feedstocks.
2. Producing green iron products for electric arc furnaces, with Minnesota producing green iron products. Weberg noted two DOE grants are currently in progress.
3. A one-step conversion of ore to green iron units or steel, utilizing lower-grade ores to reduce byproducts, with

Minnesota engaging and supporting these opportunities.

An industrial decarbonization and cross-sector integration chart was overviewed, placing electrolysis technology at the heart of operations, which would be essential for generating ammonia, storing hydrogen, and creating green products like iron, steel, and e-fuels.

Weberg again highlighted that the IRA incentivizes multi-sector engagement in green energy and decarbonization, and that while we may face challenges or competition from other regions, the path toward decarbonization is essential for Minnesota's future. He concluded with a call to action: Today, we must embrace conversation, and tomorrow, engage in comprehensive statewide planning and action.

Following his presentation, Weberg answered questions from the group.

SPECIAL ANNOUNCEMENT

Minnesota Center for Mineral Resources Education (MCMRE)

Sara Welna, MnDNR

Sara Welna, Geologist with the MnDNR, shared a brief promotion on behalf of the Minnesota Center for Mineral Resource Education (MCMRE). As a collaborative outreach with industry associations, Minnesota State Colleges and Universities, MnDNR, and other partners, MCMRE connects K-12 students with hands-on experience in geology and teaches mining history in the classroom, allowing them to experience relevant science and history topics. June 2024 will be the 25th anniversary of the MCMRE workshop, which is based in Chisholm's Discover Center and involves three days of field trips and a variety of activities. MCMRE provides teachers with materials and supplies, aligns with state science and social studies standards, and is offset by funding through 501cw. Learn more about MCMRE here: <http://www.mcmre.org>.

ADJOURN

The meeting was adjourned at 12:18 PM. Save the date of February 7, 2024, for our next MVP Partnership meeting.

Mineland Vision Partnership thanks its financial contributors:



CLIFFS



U. S. Steel