



# MN Iron Ore & the Green Economy

A one-day virtual forum focusing on the role of Minnesota iron in the decarbonized steel of tomorrow.

**Wednesday, March 16, 2022 | 9:00am-2:30pm**

## Greetings & Introductions

Today's forum is the first of 3 learning sessions sponsored by The Society for Mining, Metallurgy & Exploration (SME) and Mineland Vision Partnership (MVP). The forum emerged out of questions on how the green steel movement will affect Minnesota iron ore. Hoping to get the group discussing how Minnesota can stay relevant and impactful on the global scale.

## Introduction to Greenhouse Gas Emissions

**Frank Kohlasch, Climate Director, MPCA**

Frank provided an overview of Minnesota's Greenhouse Gas Emissions including information by sectors, trends, and scope and highlighted the state's efforts. Minnesota is currently not on track to hit any of emissions related goals established in 2007. By industry, the electric generation is the sole sector on track to meet goals.

In 2019, Governor Walz issued an Executive Order, creating a climate change subcabinet in Minnesota. The subcabinet was tasked with identifying policies and strategies to meet or exceed GHG reduction goals and enhance the climate resiliency of natural resources. The EO also created the advisory council on climate change, which is made up of 15 members of various sectors across the state to help identify opportunities & barriers for policies and strategies, promote equity, and promote a just transition for impacted workers and communities.

The state's [Draft climate action framework](#) organizes and shares thinking around climate change to engage Minnesotans in conversation and provides a tool for accountability and catalyst for action. The framework identifies immediate, near-term actions to support long-term goals.

## Sustainability in the American Steel Industry

**Kevin Dempsey, President and CEO, American Iron and Steel Institute (AISI)**

Kevin began by sharing that globally, the United States' steel industry is the cleanest and most energy efficient of all the major steel producing countries. He provided a high-level overview of shifts in the industry that have resulted greener production, such as pelletized iron ore in place of sintered iron, natural gas instead of coal as an energy source, and the increased use of electric arc furnaces (EAFs). Furthermore, between 60-80 million tons of steel scrap is recycled annually into new steel products.

Kevin highlighted opportunities and challenges the steel industry is facing, noting that federal proposals for greening the US economy involve major infrastructure investments, which in turn will require more steel production. With a focus on US steel production, rather than imported, the industry seeks to have more impact on the production process which will aid in reducing carbon emissions throughout the production lifecycle.

## Steel in a Greener World

**Lynn Lupori, Head of Consulting, CRU**

**CRU Consulting** specializes in mining, metal, and fertilizer commodities delivering business intelligence through analysis, consulting and events. Lynn began with an overview of industry trends, noting that in the last two decades there has been a critical shift in US steelmaking capacity and operations. On a global scale, policy announcements from the EU, China and the US are showing an increasing urgency to act on emission reduction, but the solutions to reach these targets are varied and require creativity.

Policy changes abroad will have big impacts on domestic commodity demand and global metal balances. First, China and their Net Zero by 2060 initiative, will likely lead to increases in prices, changes in supply and demand and increase of scrap use domestically. China has met peak demand for construction steel, while we'll likely see demand grow for other steel production within emerging markets. This is a shift that will reduce China's production to less than 50% of the global share.

Beyond China, the global industry will have to make substantial changes to meet decarbonization targets. In 2020, the steel industry represented around 8% of all CO2 emissions. Consumer demand has pushed for reductions and will require steel producers to demonstrate how they are managing their environmental impacts. There are three scopes used as metrics when assessing greenhouse gas (GHG) emissions. Scope 1 is classified as on site, direct GHG emissions that occur from sources that are owned or controlled by the company. Scope 2 relates to indirect GHG emissions, occurring from the generation of purchased electricity consumed by the company. Finally, Scope 3 emissions occur from sources not owned or controlled by the company, such as trucking, and purchased goods & services.

Iron making is the most carbon intensive step of steel productions with the energy injections required. The transition to scrap based EAFs and utilizing natural gas has helped, but steelmaking raw materials remain both a strength and challenge in the move towards decarbonization. Additionally, the strength of the US manufacturing and overall economic growth will also be a key factor in the industry's shift towards a greener future. We have witnessed a strong bounce back in industrial activity since Q1 2021, with long term reshoring in fabricated metal and value-added manufacturing operations.

## Company Climate Strategies

The next three presentations featured leaders from Cleveland-Cliffs, Inc., US Steel, and Minnesota Power to discuss their companies' shift toward cleaner production and greenhouse gas emission reduction strategies.

### **Jim Kochevar, Vice President, Iron Ore Operations**

**Cleveland-Cliffs, Inc.** is a fully integrated steel producer, with facilities ranging from Minnesota east to the Atlantic. The company currently employs around 26,000 people and is a fully integrated steel producer. Cleveland-Cliffs manages the full production process including:

- Raw materials – pellets, HBI, and prime scrap
- Steel making and rolling – 16 million tons shipped annually
- Finishing & coating – leading the automotive sector, around 25% of business is with automakers
- Downstream – tubing and other diverse opportunities

Jim discussed closed-loop steel recycling, which is a strategic direction undertaken in the past few years, and one the company is hoping to build upon. With the heavy client base in the automotive sector, recycling provides a compelling scrap offtake proposition. Today, 100% of Cliffs' produced steel contains recycled scrap. With pig iron imports significantly more CO2 intensive than US blast furnace steel, Cliffs has integrated HBI production into their portfolio to mitigate impacts. Their natural gas based HBI facility has a production capacity of 1.9 million metric tons.

Internally, Cliffs has committed to annual reporting aligning with global sustainability indicators and have achieved Energy Star partner status with the US EPA. They also are focusing efforts on carbon capture and resource efficiencies and are partnering with the Department of Energy to assess carbon emissions and recapture in the Burns Harbor steel plant. Additionally, Cliffs is working with private and academic sector partners to build knowledge around hydrogen in the steel industry.

**Rich Fruehauf, Senior Vice President, Chief Strategy & Sustainability Officer**

**US Steel's "Best for All"** initiative is focused on developing and maintaining its sustainability strategy. They have set the goal to be net zero in GHG emissions by 2050 and are working toward reduction of their 2018 levels by 20% by 2030. They have deployed two EAFs to support facilities and are working to expand the fleets of EAFs, as well as looking at process changes and improvements to existing facilities.

Global steel production has exponentially grown since introduced in 1875, producing 1877.5 million metric tons in 2020. In 1974, most steel production was based on heavy carbon furnaces compared to 2019, when EAF usage had grown to representing nearly 70% of steel production in the US. Challenges and opportunities for the industry as a whole looking are the unknowns of technology improvements, the continued need for iron, and the abundance and cost of renewable energy.

**Kurt Anderson, Director, Environmental and Land Management**

**Minnesota Power (MP)** is a utility serving 26,000 square miles across Northeastern Minnesota. A unique feature of MP is that 67% of its customer base is represented by mining and forestry clients. MP is also the first in the state to achieve 50% of energy generated from renewable sources and has a goal to deliver 100% carbon-free energy by 2050. Minnesota Power's renewable energy mix is helping industrial companies reduce carbon emissions. For example, between 2019-2020 MP was able to reduce Scope 2 carbon emissions by 39% per ton of taconite produced in Minnesota.

With a relative lack of solar or wind opportunities in Northeastern Minnesota, MP is looking toward forest and primary mill residues as renewable energy sources. This is where biochar emerges as a technology that can be used to stabilize carbon from forest biomass. Biochar is the conversion of biomass into charcoal under heat and low to no oxygen. There are multiple end uses for biochar ranging from agricultural to wastewater and air emission controls. Minnesota Power has partnered with the University of Minnesota Duluth's Natural Resources Research Institute (NRRI) to pilot a study to evaluate the effectiveness of biochar to use in generation facilities while phasing out coal.

## **Emerging Research**

The final forum presenters joined us from the United States Department of Energy Advanced Manufacturing Office and Advanced Research Projects Agency, and the University of Minnesota Duluth's Natural Resources Research Institute to share emerging research, as well as highlighting partnerships between government, industry, and academia for a greener future.

### **Nick Lalena, R&D Projects Technology Manager, Advanced Manufacturing Office**

The **US Department of Energy's Advanced Manufacturing Office** partners with industry, academia, states, and national laboratories to catalyze R&D and the adoption of advanced manufacturing technologies and practices. Key goals of the office include: improving domestic manufacturing productivity, efficiency, and security; reducing life-cycle energy and resource impacts of manufactured goods; transitioning innovative technologies into U.S. manufacturing capability; and accelerating development of transformative technologies needed to approach net-zero GHG emissions from the industrial sector by 2050.

AMO works to increase energy and material efficiency in manufacturing, driving energy productivity, economic growth, and decarbonization. It has supported several projects to advance energy efficiency and low-carbon technology in iron ore and steel. In FY20, they provided \$20.8 million in federal funding to support innovation in iron and steelmaking processes, of which \$2.1 M was awarded to NRRI for research to enhance iron ore pellet chemistry for more efficient natural gas based DRI. Last December, the office held an Industrial Decarbonization Roundtable: Iron and Steel and released an RFI to gather industry perspectives on opportunities and challenges, both near and long term, for decarbonization of iron and steel processes.

### **Katharine Greco, Fellow, Advanced Research Projects Agency (ARPA)**

**US Department of Energy's Advanced Research Projects Agency (ARPA-E)** was established in 2009 and has provided nearly \$2.93 billion in R&D funding to more than 1,270 projects focused on reducing energy and energy-related emissions. ARPA-E has investigated the technological whitespace for zero emissions ironmaking, and highlighted the following potentially disruptive solutions:

- Reducing ore with carbon from biomass
- Reducing ore electrochemically via low-temperature electrolysis
- Reducing ore with hydrogen or hydrogen plasma
- Utilizing alternative, abundant domestic iron sources, such as mine tailings

Are US iron resources viable to reach net-zero targets? An internal LCA showed that low-temperature electrolysis of domestic taconite ore can achieve very low costs and low emissions. Funding disruptive technologies will ensure that US iron ore resources remain competitive.

### **Rolf Weberg, Executive Director and Brett Spigarelli, Metallurgical Engineer**

The University of Minnesota Duluth's **Natural Resources Research Institute (NRRI)** was created by the legislature to foster the economic development of the state's natural resources in an environmentally sound manner to promote private sector development. Their mission is to deliver integrated research solutions that value our resources, environment, and economy for a sustainable and resilient future. NRRI has three main strategic initiatives: ecosystem resilience, future forest industries, and iron/minerals of the future.

Emerging research opportunities fall into three main categories: industry support, research for MN Iron & Steel and research related to diversifying iron products portfolio. NRRI dedicates research to fully understand the resources available in Northeastern Minnesota. For example, the iron ore in Minnesota is changing, becoming finer liberating. Finer ore requires longer grinding time and makes it harder to separate from the silica. Longer grind times tie back to increased energy costs and higher emissions. NRRI is also working to characterize alternative iron resources and analyzing potential future impacts. Another area of research is enhanced pellet chemistry to allow for higher reduction temperatures.

## **Recap & Adjourn**

The goal of the conference was to show the demand for MN Iron Ore in a decarbonizing world. The Society for Mining, Metallurgy & Exploration (SME) is hosting additional conferences this spring. The 2022 SME Minnesota Convention will be held April 11-13, 2022. You can register [HERE](#). During May 2022 (final date still TBD), SME will host another forum: Minnesota Non-Ferrous & Green Economy.

A feedback survey for the forum is available here: <https://www.surveymonkey.com/r/MNGreenSteel>