# Memo Focus: Wisconsin

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**November 2023**

## Wisconsin overview

Wisconsin has only one steel production facility and currently does not generate any raw or intermediate steel materials (pellets, coke, or DRI). Charter Manufacturing owns and operates an electric arc furnace in Saukville. To the north, Minnesota is home to roughly 87% of all iron ore mining and pellet production in the US. To the south and east, the remaining Great Lakes states are responsible for roughly 60% of all US steel production capacity and 100% of all BF-BOF production capacity. Wisconsin's statewide climate strategy is framed by the 2022 Clean Energy Plan and facilitated by the Governor's Task Force on Climate Change. These initiatives will receive additional support moving forward now that Wisconsin has received funding through the Climate Pollution Reduction Grant Program. The program has awarded funding to the state of Wisconsin and city of Milwaukee to update climate action plans with focus on six key sectors, including industry.

**Figure 1: Wisconsin steel and related assets**


**Table 1: Steel supply chain production capacity**

| Product | Type | State production capacity (million tons) | Great Lakes production capacity (million tons) |
|---|---|---|---|
| Raw material | Iron ore pellets | 0 | 41 |
| Raw material | Coke | 0 | 11.6 |
| Intermediate material | Direct reduced iron (DRI) | 0 | 1.9 |
| Steel (recycled) | Electric arc furnace (EAF) | 0.6 | 28 |
| Steel | Blast furnace-basic oxygen furnace (BF-BOF) | 0 | 36 |

** State and Great Lakes production capacity reflect production volumes for 2022.*

## Current issues and impact

In 2021, Charter Steel completed a scrap preheat project to improve plant efficiency and reduce greenhouse gas emissions and is now in the implementation phase of the Saukville solar project that will provide 27 million kWh per year for use on-site. US Steel is pursuing a similar project at its EAF facility in Arkansas, indicating this may develop into a trend among EAF steel producers seeking to reduce emissions without relying on regional grid decarbonization. Wisconsin is one of the only two states in the Great Lakes to have a positive trend across market indicators included in Figure 2. Wisconsin has a healthy automotive manufacturing employment base that has grown considerably over the past decade, but unlike other Great Lakes states, there are no major vehicle assembly plants in the state. The industry is mostly disaggregated across small upstream suppliers.

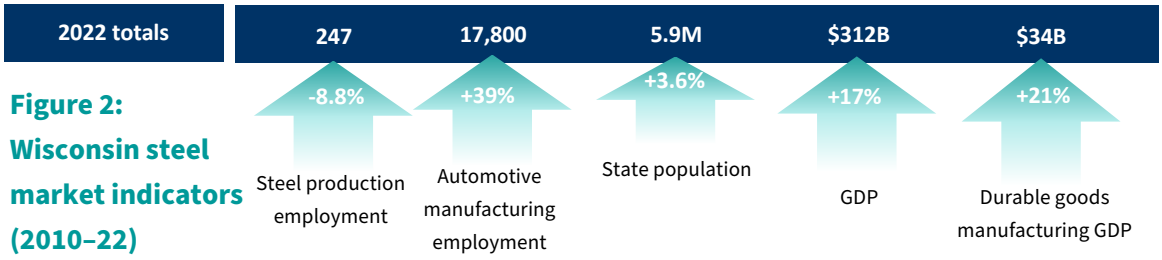



**Figure 2: Wisconsin steel market indicators (2010–22)**

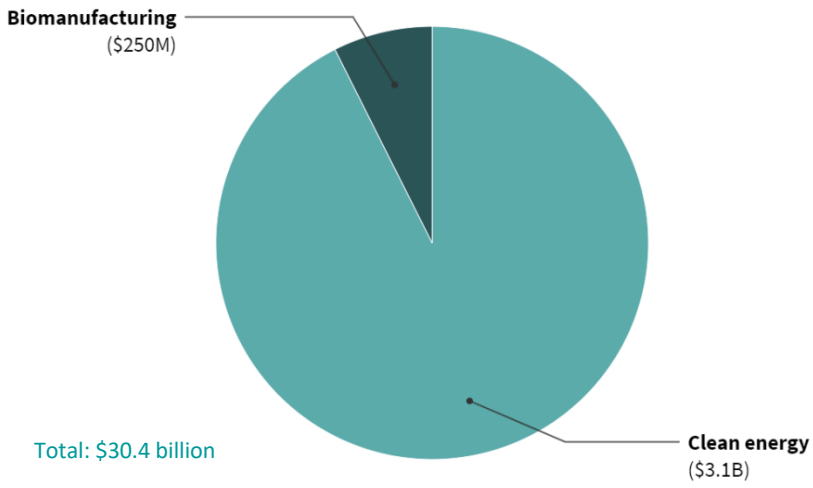
*Note: GDP metrics are measured in 2012 chained dollars*

*Data source: Bureau of Economic Analysis, United States Census Bureau. United States Regional Economic Analysis Project*

## Steel development opportunities in Wisconsin

In the wake of the Inflation Reduction Act (IRA) passed in 2022, Wisconsin recorded a wave of private investments, predominantly in clean energy manufacturing (approximately $3.4 billion). The IRA has spurred growth in this sector, which is expected to increase domestic steel demand by approximately 40mt by 2030. Clean energy manufacturers are among those indicating the desire to purchase low-emissions steel products. Roughly 10% of the 6.2mt of domestic low-emissions steel demand projected by 2030 is expected to come from the clean energy sector. In the Great Lakes, states such as Michigan and Ohio have been uniquely successful in attracting private investment in electric vehicle (EV) and battery manufacturing. These states have incumbent blast furnace steel production capacity to supply ore-based steel products that automakers demand in high volumes. The automotive market is the second largest downstream steel market in the US, representing approximately 25% of the domestic steel demand. Automotive companies are also among the leaders in terms of emissions reduction targets and specific commitments for purchasing low-emissions steel, accounting for roughly 50% of the projected 6.2mt. Wisconsin will have the opportunity to attract investment in the burgeoning EV market but can also lean on the regional automotive manufacturing capacity and support the industry through upstream near-zero-emissions steel production.

**Figure 3: Post-IRA clean manufacturing investments in Wisconsin**




*Data source: Climate Power, US White House.*
*Note: data sources leverage information form public announcements, investment totals may not be comprehensive*

As indicated in Table 2, developers can expand the existing EAF facility by adding a DRI or developing new steelmaking capacity at a greenfield site. Brownfield DRI construction on or adjacent to the Charter Steel footprint may be an attractive possibility for investors and developers as electing this location would help reduce costs associated with permitting and material transport infrastructure. The facility is located within the Milwaukee metro area, providing access to an existing strong industrial workforce. Adding a DRI on-site would allow for the EAF facility to produce ore-based products, expanding their downstream market potential into the automotive sector. Near-zero-emissions DRI production pathways can operate using natural gas paired with carbon capture and sequestration (CCS) technologies or use hydrogen. Each comes with certain risks and benefits.

**Table 2: Potential near-zero-emissions steel production pathways in Wisconsin**

| Production pathway (2 mt/year) | Investment capital ($billion) | | Emissions reduction potential | | Projected Timeline (years) |
|---|---|---|---|---|---|
| | $H_2$ | CCS | $H_2$ | CCS | |
| DRI construction at Charter Steel EAF* | 0.8 | 1.2 | 68–86% | 57–79% | 2 |
| DRI-EAF (inc of new casting & rolling) | 1.8 | 2.3 | 68-86% | 57–79% | 3+ |

*Note: Emissions reduction potential relative to unabated BF-BOF steel production. Emissions reduction potential based on scope 1, 2, and 3 emissions for hot rolled coil production. Range is a product of varying scope 2 emissions from US grid average (0.37 tCO2/MWh) to dedicated renewable energy, varying pellet-making fuel from natural gas to pyrolysis oil and varying natural gas methane leakage rate from 1.2% to 2.5%. Assumed capture rate for all CCS technology is 90%, conservative figure yet to be proven at scale. Capital for hydrogen production pathways do not include upstream renewable energy or hydrogen assets. Classification as near-zero-emissions production is dependent on actual system configuration and realized emissions abatement.*

**This pathway includes investment in a DRI and a $100 million investment to increase EAF production capacity to 1.8mt per year.*

A natural gas DRI with CCS would need to achieve high capture rates (90% or greater) and certified low upstream methane leakage to meet many of the new industry standards arising for near-zero emissions steel. A electrolytic hydrogen-based DRI offers certainty of emissions reductions but requires considerable upstream renewable power to generate the zero-emission hydrogen. For both greenfield and brownfield DRI construction significant capital investment will be required, although unlike a retrofit, when constructing a new facility, the capital cost of the DRI's themselves are not meaningfully different for natural gas and hydrogen.

As for greenfield projects, Superior could be an attractive location as it is right across the border from and connected to Minnesota's iron ore mines. The greater Milwaukee and Green Bay areas also have port access, upcoming renewable energy projects, and available workforce and material transport infrastructure. Although a greenfield location allows for designing and incorporating infrastructure for CCS and hydrogen systems from scratch, the additional costs and time for permitting and siting may be less attractive for developers. Adding/restarting EAF capacity in the state is another option for developers, but given the limited availability of high-quality scrap and the tight market for supplemental metallics, it may be difficult to justify without the addition of new DRI assets.

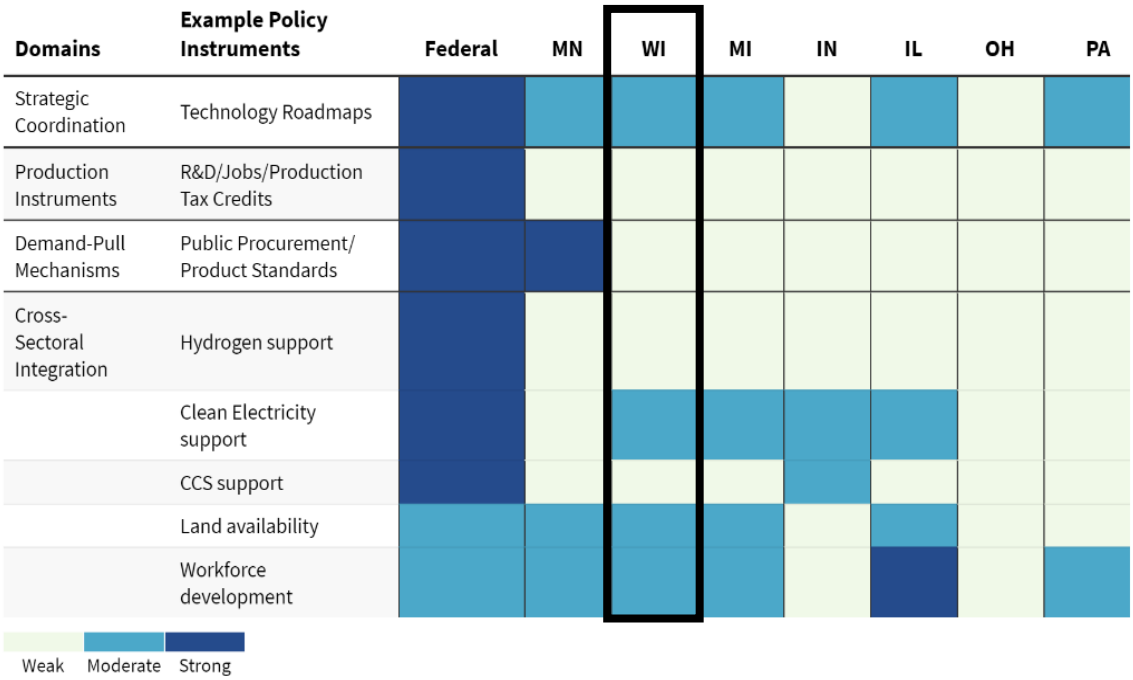
## Developing hydrogen and CCS infrastructure

Wisconsin is not considered to have optimal saline, oil and gas, or coal seam reservoirs suitable for $CO_2$ sequestration. Although a portion of the Michigan basin extends under the southeastern portion of the state, the feasibility of sequestering $CO_2$ there remains unproven. In 2009, Alstom, in conjunction with the Electric Power Research Institute, conducted a carbon capture pilot project at the Pleasant Prairie coal power plant. The pilot project, although successful in its intent to capture high rates of $CO_2$ from the flue gas stream of the plant, did not sequester any of the captured carbon, but instead vented into the atmosphere. Minnesota has a similar lack of suitable geologic storge options for sequestering $CO_2$, but numerous carbon capture projects have started to take hold in the state. These projects, most of which are in development, intend to join a pipeline network that feeds concentrated $CO_2$ streams into a storage basin near Bismark North Dakota. The Summit Carbon Solutions project targets 31 ethanol production facilities across five states and has the opportunity to grow further into neighboring states such as Wisconsin. In terms of hydrogen infrastructure, Wisconsin is the only state in the Great Lakes that is not included in a DOE-funded hydrogen hub. Even so, Wisconsin and developers seeking to build hydrogen assets in the state can leverage the hydrogen production tax credit included in the IRA (45V) as well as the numerous other subsidy programs included in recent federal legislation.

## Supporting policy

Thus far, major investments in near-zero-emissions steel production in Europe and Canada have received public funding support from national and local governments. The US federal government has provided multiple cost share, tax incentive, and loan-based programs targeted at near-zero-emissions steel production, but more incentives and infrastructural support from states is needed to expedite asset development. States should seek to fill the policy gaps highlighted in Figure 4. For example, permitting and regulatory frameworks for CCS and hydrogen infrastructure are essential for expediting projects and ensuring the health and safety of workers and community members.

**Figure 4: Great Lakes near-zero-emissions steel policy gap analysis**




**Historically**, Wisconsin has had the smallest steel industry footprint of all the Great Lakes states. The absence of blast furnaces and coke production facilities has helped shield Wisconsin citizens from air pollution commonly released from these types of assets but limited the economic development potential associated with a robust steel value chain. **Moving forward**, Wisconsin can leapfrog traditional steelmaking technologies and develop hydrogen-based production assets that can help foster strong economic growth with a much smaller environmental footprint. Policymakers, economic development offices, and project developers should focus on these areas to help bring near-zero-emissions steel production to Wisconsin.

1. **Identifying methods to support industrial-scale hydrogen production by either expanding neighboring hub infrastructure or offering state-specific incentives to hydrogen producers or off-takers.**
2. **Advancing policies and projects that facilitate cost-competitive renewable energy access for industrial facilities.**
3. **Introducing public buy-clean programs for clean building materials such as steel and cement to facilitate green demand and reduce embodied carbon in construction projects.**