

## Memo Focus: Indiana

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### Indiana Overview

Indiana leads the nation in crude steel production. Gary Works, Indiana Harbor, and Burns Harbor are the top three US BF-BOF facilities in terms of production capacity, collectively representing a workforce of approximately 12,000 full-time individuals. US Steel’s Gary Works shuttered its cokemaking operations in 2013 and now presumably receives supply from the Clairton coke plant in Pennsylvania. All three plants receive iron ore pellets from US Steel and Cleveland-Cliffs’ vertically integrated mines in Minnesota and Michigan. In the summer of 2023, the Indiana Department of Environmental Management and the Central Indiana Regional Development Authority were awarded grants under the federal [Climate Pollution Reduction Grant Program](#). These grants will help fund climate action strategies at the state and regional level for six key sectors identified by the EPA, including heavy industry. Indiana and Ohio are currently the only states in the Great Lakes without a legislatively supported climate action plan.

Figure 1: Indiana steel and related assets

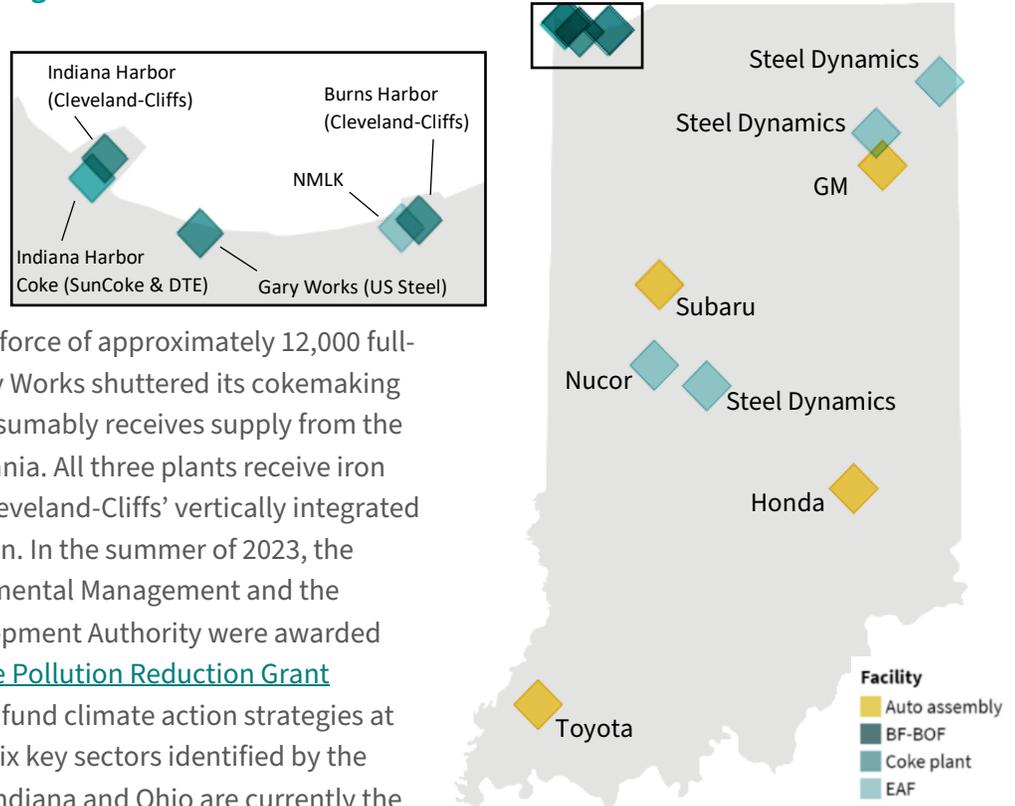


Table 1: Steel supply chain production capacity

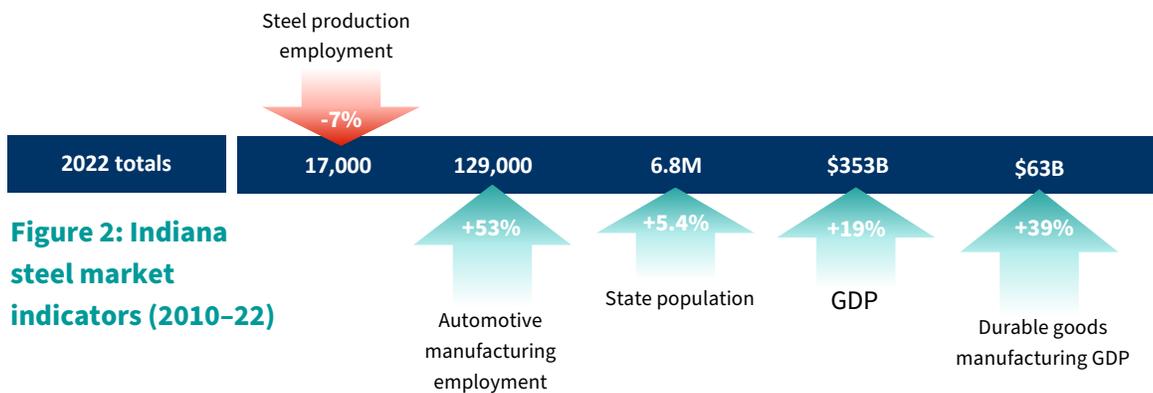
Product	Type	State production capacity (million tons)	Great Lakes production capacity (million tons)
Raw material	Iron ore pellets*	0	41
Raw material	Coke	3	11.6
Intermediate material	Direct reduced iron (DRI)	0	1.9
Steel (recycled)	Electric arc furnace (EAF)	8.8	28
Steel	Blast furnace–basic oxygen furnace (BF-BOF)	20	36

Note: While not indicated on the map, the Burns Harbor facility has on-site cokemaking operations.

\*State and Great Lakes production capacity figures reflect production totals for 2022.

## Current issues and impact

Gary Works is the single largest emitter of CO<sub>2</sub>e in the state of Indiana, [with emissions of approximately 10mt in 2022](#). In August 2019, an equipment malfunction at Burns Harbor led to [a discharge of ammonia and cyanide above the EPA discharge pollution limits](#). Cleveland-Cliffs was ultimately ordered to pay \$3 million in civil penalties for the release that killed thousands of fish in the adjacent Little Calumet River. Figure 2 displays market indicators for the steel sector and how they have changed over the past decade. The nearly 7% decline in steel manufacturing employment can be partly attributed to US Steel idling its tin mill in East Chicago and partly to minor employment reductions across multiple sites.<sup>1</sup> The growth rates for GDP, population, and automotive manufacturing employment are among the highest across the Great Lakes states, providing strong downstream signals for steel producers. Indiana also has the highest percent of total GDP coming from durable good manufacturing of all the states in the region, at roughly 18%.



**Figure 2: Indiana 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*

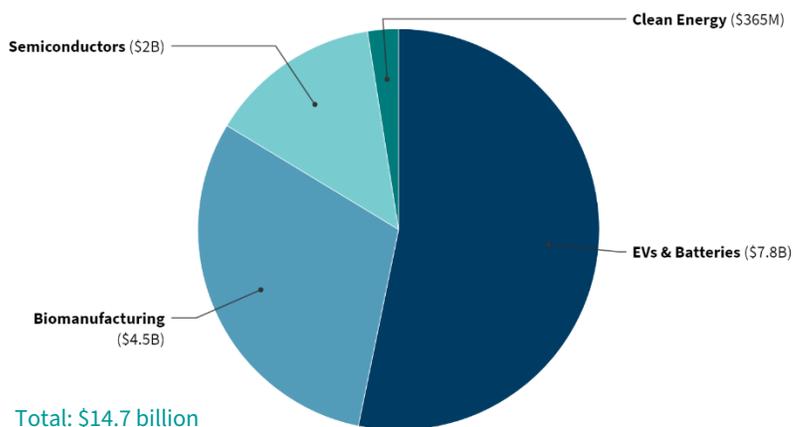
## Steel development opportunities in Indiana

Figure 3 categorizes the clean manufacturing industries receiving private investment in Indiana since the Inflation Reduction Act (IRA) was passed in November 2022. Indiana has been particularly successful in securing EV and battery manufacturing investments with more than half of the \$15 billion total being spent within that sector. US automotive companies lead the way in terms of the domestic demand for low-emissions steel products, with approximately [3.2mt projected by 2030](#). Figure 3 also shows that Indiana has recently secured private investment of \$365 million in clean energy manufacturing. Barring Pennsylvania, all Great Lakes states have secured higher investment totals in this sector. IRA incentives supporting clean energy manufacturing, use, and production are projected to increase steel demand within the sector by 85% or [roughly 40mt](#).

<sup>1</sup> In 2022 individual blast furnaces at Gary Works and Indiana Harbor were indefinitely idled. In both cases the operating company claimed that employment levels were unaffected.

Indiana has the potential to lead the Great Lakes and the United States into a [near-zero-emissions future](#) with multiple sites available for redevelopment. The three BF-BOF facilities are the most logical choices to start when considering investment opportunities and technology transitions. Based on the historical investment cycle, Burns Harbor is next up to reline both its blast furnaces. Cleveland-Cliffs announced that a reline of its blast furnace C is scheduled for 2026 instead of 2025 due to [public pressure against reline investment](#). Reline investments are critical junctures for steel producers deciding between locking in the current coal-based production methods or investing capital in new emissions reduction technologies. Although Burns Harbor is the first to face this upcoming decision point, all three BF-BOF facilities can divert production away from coal by substituting the current technology for cleaner technology, such as direct reduced iron (DRI). If producers choose to reline their furnaces, carbon capture and sequestration systems (CCS) can be used to lower emissions from the facility. However, the abatement potential is limited to approximately 60% and the infrastructural complexities of retrofitting CCS technology on-site may bring this percentage down considerably. The relative cost and timelines associated with these types of asset transitions are included in Table 2.

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



Data source: Climate Power, US White House.

Note: data sources leverage information from public announcements, investment totals may not be comprehensive

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

Production pathway (2 mt/year)	Investment capital (\$billion)		Emissions reduction potential		Projected Timeline (years)
	H <sub>2</sub>	CCS	H <sub>2</sub>	CCS*	
CCS development at a BF-BOF facility	N/A	1.3	N/A	48-59%	2
BF-BOF → DRI-EAF asset conversion	1.9	2.1	68-86%	57-79%	3+
DRI-EAF development at new site	2.1	2.4	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 tCO<sub>2</sub>/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.

\*BF-BOF with CCS range reflects the option of applying capture technology to applicable coke batteries.

Converting BF-BOF assets to hydrogen-based DRI-EAF production methods has the greatest potential to reduce greenhouse gas and local pollution. [It can also retain supply chain and individual site employment](#) so

long as some of the upstream energy entities are collocated. Achieving consistently high emissions reduction will be crucial for steel producers seeking to capitalize on the [green premiums developing in the market](#).

## Environmental pollution

Sinter is an iron-bearing material commonly used around the globe for BF-BOF steel production. US producers predominantly rely on pellets for iron input into their BF-BOFs, which helps to reduce greenhouse gas emissions and local air pollution. Sinter production by itself is a considerable emitter of hazardous air pollutants (HAP). A 2011 memo from the EPA showed that more than 90% of HAP emissions from the all-US BF-BOF steelmaking (not just in Indiana) was attributable to the three sinter plants operating on the shores of Lake Michigan. Despite conflicting public statements about these sinter plants from Cleveland-Cliffs and US Steel, it appears their operation primarily serves to recycle iron material, thus helping reduce raw material costs. The EPA is currently reviewing [more stringent national monitoring and control standards](#) for HAP emitted from sinter production at BF-BOF facilities. Idling these sinter facilities appears to be a way to significantly reduce HAP and other harmful air pollutants without significantly disrupting current production methods in Indiana.

## Developing hydrogen and CCS infrastructure

In October 2023, the Midwest Alliance for Clean Hydrogen (MachH2) was announced as one of the seven awardees of the [Regional Clean Hydrogen Hubs Program](#) supported by the US Department of Energy. The hub can receive up to \$1 billion in cost share funding for development activities. It covers three states (Michigan, Indiana, and Illinois) and includes two major steel companies as lead members of the coalition (ArcelorMittal and Cleveland-Cliffs). Although much of the hub strategy and layout remains in flux, multiple refineries across northern Illinois and one in northwest Indiana are indicated to be included as hydrogen production facilities. The BP Whiting Refinery is nearly adjacent to Cleveland-Cliffs' Indiana Harbor facility, which announced it intends to construct a hydrogen pipeline to blend hydrogen in its blast furnace. This type of blending was trialed at Cleveland-Cliffs' Middletown BF-BOF facility in recent years and was deemed to be a viable path forward. However, the emissions reduction potential associated with this strategy is [limited to roughly 21%](#), assuming zero additional emissions from hydrogen production.<sup>2</sup> Beyond the refineries and other abated fossil fuel production methods, MachH2 will include hydrogen production from renewable energy and nuclear resources.

Abated fossil hydrogen production typically implies the use of CCS. Two of the largest CCS projects currently under development in the state include Wabash Valley Resources LLC, sequestering 1.75mt of CO<sub>2</sub> near Terre Haute from hydrogen production, and Heidelberg Materials, sequestering 2mt near Paoli at its Mitchell cement plant. [Indiana has abundant geologic sequestration options](#) between saline formations and former fossil storage locations. In March of 2023, US Steel signed an MOU with CarbonFree to pilot its capture

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<sup>2</sup> Based on public comments from BP representatives, hydrogen at the Whiting Refinery will be produced using steam methane reforming paired with carbon capture (blue hydrogen). This method will carry upstream greenhouse gas emissions that must be accounted for.

technology on-site at Gary Works. This pilot is projected to capture [less than 1% of the total emissions from Gary Works](#), and the sequestration logistics of the captured CO<sub>2</sub> are unknown.

### Supporting policy

State policy will be critical to help bolster tax incentives and loan programs included in recent federal legislation. Indiana enacted multiple legislative tools to help manage and regulate the developing CCS infrastructure in the state. [HB 1209](#), [SB 442](#), and [SB 451](#) provide support or guidance for pilot projects, CO<sub>2</sub> transmission, and CO<sub>2</sub> storage. Indiana has yet to enact any legislation to regulate or support hydrogen development. Now that the state is central to one of the federally funded hydrogen hubs, legislation in this sector will be essential. Other areas requiring legislative support are highlighted in Figure 4.

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

Domains	Example Policy Instruments	Federal	MN	WI	MI	IN	IL	OH	PA
Strategic Coordination	Technology Roadmaps	Strong	Moderate	Moderate	Moderate	Weak	Moderate	Weak	Moderate
Production Instruments	R&D/Jobs/Production Tax Credits	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
Demand-Pull Mechanisms	Public Procurement/Product Standards	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
Cross-Sectoral Integration	Hydrogen support	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Clean Electricity support	Strong	Weak	Moderate	Moderate	Moderate	Moderate	Weak	Weak
	CCS support	Strong	Weak	Weak	Weak	Moderate	Weak	Weak	Weak
	Land availability	Moderate	Moderate	Moderate	Moderate	Weak	Moderate	Weak	Weak
	Workforce development	Moderate	Moderate	Moderate	Moderate	Weak	Strong	Weak	Moderate

Weak
  Moderate
  Strong

**Moving forward** to retain and expand the steel industry within Indiana, policymakers, economic development offices, and project developers should target investments in near-zero-emissions production technologies. To help facilitate investment, these entities should focus on the following:

1. **Leverage existing BF-BOF infrastructure for DRI-EAF development.**
2. **Support stringent regulatory mandates designed to eliminate sintering activities at BF-BOF facilities.**
3. **Avoid large capital investments that extend the life of the BF-BOF facilities in northwest Indiana (relines, CCS, etc.).**
4. **Continue to advance policies that facilitate industrial access to cost-competitive renewable energy resources.**