Modernizing Industry in Ohio

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Key takeaways

1. Ohio is one of the largest manufacturing states in the nation. The Buckeye State's top industries, in terms of both manufacturing output and climate pollution, are chemicals, iron and steel, and refined petroleum and coke.

2. Ohio can leverage its specialized workforce and existing infrastructure to **establish an early-mover advantage in emerging markets,** such as green steel, low-emissions chemicals, and clean fuels.

3. **The strategies with the greatest potential** for reducing manufacturing emissions in Ohio are **electrifying thermal processes** and increasing **material efficiency**.

4. Ohio can **support industrial decarbonization and economic competitiveness through enabling state policy,** such as a production tax credit for clean industrial heat and a material efficiency standard.

The Buckeye State shows economic momentum and strength in manufacturing. It's among the top five states with the greatest concentration of chemical manufacturing facilities, and it's responsible for 12% of all US crude steel production. Ohio also has among the largest refining capacity of all states.

But global changes necessitate a new strategy to keep Ohio competitive. Chemical markets are shifting to low-emissions products. Global demand for green steel is forecast to equal 35% of current crude steel production by 2050.

Simultaneously, US refineries, which largely produce transportation fuels, are increasingly closing or converting to cleaner uses as global demand for renewable diesel and sustainable aviation fuel grows. By 2050, sustainable aviation fuels are expected to comprise 12% of global aviation energy demand. Ammonia and methanol will account for 37% of maritime energy demand. As these markets emerge and transition, Ohio has significant assets it can leverage to establish an early-mover advantage.

Supporting industrial decarbonization will also reduce climate pollution. In 2024, Ohio's manufacturing sector collectively released 42.8 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), according to data from the Energy Policy Simulator. If the state does not take action, the manufacturing sector is forecast to increase to 45.5 MMT CO_2e by 2050. However, if the state incorporates the strategies outlined below, it could reduce manufacturing emissions to 15.4 MMT CO_2e.

Health impacts from Ohio's refining, chemical, and iron and steel facilities

Current levels of air pollution from refineries and chemicals and iron and steel facilities adversely impact public health and economic activity.

Health Event	*Estimated Annual Incidents from Facilities*			
	Refineries	**Chemicals**	**Iron and Steel**	**Total**
Premature deaths	16-33	23-40	73-144	112-217
ER Visits, respiratory	15	30	68	113
Asthma symptoms	7,995	13,777	35,105	56,877
Work loss days	1,611	1,707	6,900	10,218
School loss days	1,258	4,688	6,138	12,084
Total health costs*	$251M-$493M	$359M-$609M	$1.1B-$2.1B	$1.8B-$3.2B
Lost economic activity**	$3.8M	$ 9.8M	$ 17.8M	$31.2M

**Includes health costs incurred from additional incidents not listed like cardiac arrests, stroke, and hospital admits*
***Includes economic impact of minor restricted activity days, in addition to school and work loss days*

Source: EPA CO-Benefits Risk Assessment (COBRA)

In addition to having a negative climate impact, industrial emissions harm public health. Certain industrial processes can release pollutants like particulate matter, nitrogen oxides, and sulfur dioxide, which are linked to adverse health conditions, ranging from asthma exacerbation to premature death and disease.

Curbing emissions from facilities is particularly critical to the health of local communities, which are disproportionately impacted by exposure to air pollution.

Ohio's industrial facilities

Facilities by industry

- Iron and steel
- Chemicals
- Refined petroleum and coke
- Cement and other nonmetallic minerals
- Other metals
- Other manufacturing
- Glass products
- Pulp and paper
- Food and beverage

Metric tons CO_2e

400K 1.5M 4M

Source: US EPA

Strategies for emissions reduction

Modernizing facilities can support competitiveness in emerging markets while reducing air and climate pollution. Based on the Energy Policy Simulator, an open-source model for estimating the impacts of energy policies, the strategies with the greatest potential for reducing emissions in Ohio are electrifying thermal processes, especially those requiring heat below 400°C, and increasing material efficiency.

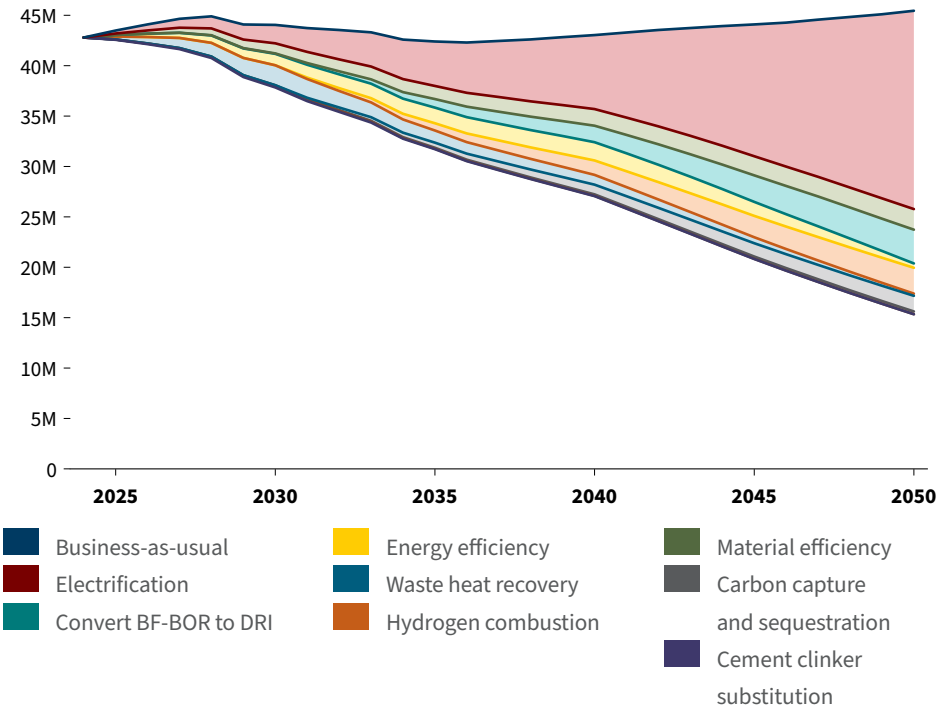
If nearly all industrial processes below 400°C are electrified by 2050, Ohio can reduce emissions from manufacturing by a cumulative 192.5 MMT CO_2e, or 51.4% of overall potential emissions reductions from the set of strategies. Electrification of thermal processes is an immediate opportunity to reduce emissions from on-site combustion of fossil fuels. Direct electrification for low- to medium-temperature heat has the greatest potential in light industries, including food and beverage, pulp and paper, and certain chemicals.

Ohio can also reduce emissions from new manufacturing by increasing the material efficiency of steel and cement. Material efficiency strategies exist across the value chain and include lightweighting in design, substituting lower carbon materials in fabrication, and recycling at end-of-life. If these strategies are adopted promptly, Ohio can experience cumulative emissions reductions of 3.5 MMT CO_2e by 2030 and 36.2 MMT CO_2e by 2050.

To further address emissions from iron and steel, Ohio can shift to direct reduced iron (DRI) facilities in lieu of relining blast furnace–basic oxygen furnace (BF-BOF) steel plants. DRIs operating on natural gas can produce 50% fewer emissions than BF-BOF steel plants, and DRIs operating

Industrial emissions in Ohio

Emissions from manufacturing have the potential to decline by 30.1 million metric tons of CO_2e by 2050, compared to a business-as-usual scenario.



The wedges show each strategy's annual impact towards emissions reductions and was calculated using the Energy Policy Simulator (EPS). The conversion of BF-BOF to hydrogen-ready DRI facilities is estimated in the EPS by pairing the feedstock shifting and electrification levers. The business-as-usual scenario corresponds to the Federal Policy Repeal and Rollback scenario in the EPS, which better represents today's policy landscape, and assumes that Ohio does not take further action on industrial emissions.

Source: RMI Analysis, Energy Policy Simulator

Cumulative emissions reduction by strategy

Strategy	cumulative MMT CO_2e reductions through 2030	cumulative MMT CO_2e reductions through 2050	▼ % of cumulative industrial emissions reductions
Electrification	6.3	192.5	51.0%
Material efficiency	3.5	36.2	10.0%
Transition BF-BOF to DRI	0.1	35.7	10.0%
Energy efficiency	3.8	31.8	8.0%
Hydrogen combustion	0.0	29.2	8.0%
Waste heat recovery	7.0	25.3	7.0%
Carbon capture and sequestration	0.0	18.9	5.0%
Feedstock shifting	0.2	3.4	1.0%

These values were calculated using the Ohio Energy Policy Simulator (EPS), and they assume both stringent implementation and carbon capture and sequestration and hydrogen combustion reaching technological readiness by 2031. The conversion of BF-BOF to hydrogen-ready DRI facilities is estimated in the EPS by pairing the feedstock shifting and electrification levers.

Source: RMI Analysis, Energy Policy Simulator

on clean hydrogen can produce 90% fewer emissions.[1]

Additional cross-cutting interventions that can be deployed in the near term include:

- **Increasing the efficiency** of industrial equipment, including updating heat pumps and compressors, and integrating advanced process control systems. Energy efficiency is the quickest and most cost-effective mitigation strategy.
- **Recovering waste heat** using economizers and heat exchangers and converting it into usable energy.
- **Reducing fugitive and flaring emissions** across oil and gas production, gas transport, oil refining, and chemicals equipment through enhanced leak detection and repair and upgrades to flare gas systems.
- **Lowering the threshold** for defining a methane leak to mitigate emissions from natural gas transportation and petroleum refining.

[1] Estimates of relative emissions reductions are based on a global warming potential factor of 100, which understates the short-term impacts of methane.

Supporting policies

With recent changes in federal policy causing market uncertainty, state leadership is critical to maintaining the interest and energy of its investors and project developers. Ohio's policymakers can support industrial competitiveness and decarbonization through policies that establish certainty, which involves setting standards, and providing support, including reducing costs of technical interventions and increasing the value of low-emissions products.

There are several actions that Ohio can take to modernize its industrial sector. Examples include:

Creating standards

- **State target setting** to direct the industry sector's transition to green products.
- **Material efficiency standards** — which require using smart design to reduce the amount of material in manufacturing — result in the same goods made with less material.
- **Improve transparency around upstream methane emissions** associated with the production and transmission of natural gas and petroleum by requiring measurement-informed, independently verified, facility-specific emission data.

Providing support

- **Developing hydrogen infrastructure,** including pipelines, storage facilities, and liquification plants, can provide the robust and resilient quality infrastructure needed to transition to green hydrogen as a fuel source.
- **Technical assistance grants** to facilities transitioning to low-emissions production to overcome financial barriers, capacity constraints, or knowledge gaps in modernizing.

Adding value

- **A production tax credit (PTC) for clean industrial heat** would reward industrial facilities for meeting thermal energy needs with clean fuel sources, like electricity or hydrogen, instead of fossil fuels. The credit can be structured per unit of clean heat delivered to an industrial process and increase clean fuel's cost-competitiveness.
- **Government procurement for low-emissions products** to create the offtake certainty required for capital expenditures, such as redevelopment of BF-BOF facilities or deploying novel membrane separations or catalyst upgrades at refineries.

For more information about industrial decarbonization, please email USAnalysis@rmi.org