



# Modernizing Industry in Michigan

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## Key takeaways

1. Michigan is one of the [largest manufacturing states](#) in the nation. The Great Lakes State's leading industries, in terms of both manufacturing output and climate pollution, are chemicals, iron and steel, and cement and other nonmetallic minerals.
2. **Michigan can** leverage its specialized [workforce](#) and existing infrastructure to **establish an early-mover advantage in emerging markets**, such as low-emissions chemicals and cement, and green steel.
3. The **strategies with the greatest potential** for reducing manufacturing emissions in Michigan are **electrifying thermal processes** and **converting coal-based steel facilities to hydrogen**.
4. Michigan can **support industrial modernization and economic competitiveness through enabling state policies**, such as a production tax credit for clean industrial heat and public procurement of low-carbon products.

The Great Lakes State shows economic momentum and strength in manufacturing. It's the fourteenth-largest [chemical-producing state](#) and [seventh-largest cement-producing state](#). Michigan also ranks among the top ten states in terms of [crude steel production](#).

But global changes necessitate a new strategy to keep Michigan 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.

Meanwhile, between 2022 and 2023, low-carbon cement technology companies garnered more than [\\$729 million from over 100 unique investors](#), representing 9% of total investment in the built environment. As these markets transition, Michigan has significant assets it can leverage to establish an early-mover advantage.

Supporting industrial decarbonization will also reduce climate pollution. For Michigan to achieve its economy-wide goals of a [50%–52% emissions reduction by 2030 and 100% by 2050](#) from 2005 levels, it must reduce pollution from industry. In 2024, Michigan's manufacturing sector collectively released 22.3 million metric tons (MMT) of carbon dioxide equivalent (CO<sub>2</sub>e), according to data from the [Energy Policy Simulator](#). If the state does not take action, by 2050, the manufacturing sector is forecast to emit similar levels of pollution as today. However, if the state incorporates the strategies outlined below, it could reduce manufacturing emissions to 6.5 MMT CO<sub>2</sub>e.

## Health impact from Michigan's iron and steel, chemicals, food and beverage, and refining facilities

Current levels of air pollution from Michigan's cement and mineral, chemical, and iron and steel facilities adversely impact public health and economic activity.

| Health Event              | Estimated Annual Incidents from Facilities |                 |                 |               |
|---------------------------|--------------------------------------------|-----------------|-----------------|---------------|
|                           | Cement and minerals*                       | Chemicals       | Iron and Steel  | Total         |
| Premature deaths          | 38-65                                      | 3-5             | 76-118          | 76-118        |
| ER Visits, respiratory    | 50                                         | 4               | 118             | 172           |
| Asthma symptoms           | 23,089                                     | 1,694           | 51,965          | 76,748        |
| Work loss days            | 2,799                                      | 231             | 4,170           | 7,200         |
| School loss days          | 8,018                                      | 525             | 22,808          | 31,351        |
| Total health costs**      | \$586M-\$987M                              | \$44.6M-\$78.5M | \$1.2 B-\$1.7 B | \$1.8B-\$2.8B |
| Lost economic activity*** | \$16.6M                                    | \$1.1 M         | \$43.2 M        | \$60.9M       |

\*Excludes glass production

\*\*Includes health costs incurred from additional incidents not listed like cardiac arrests, stroke, and hospital admits

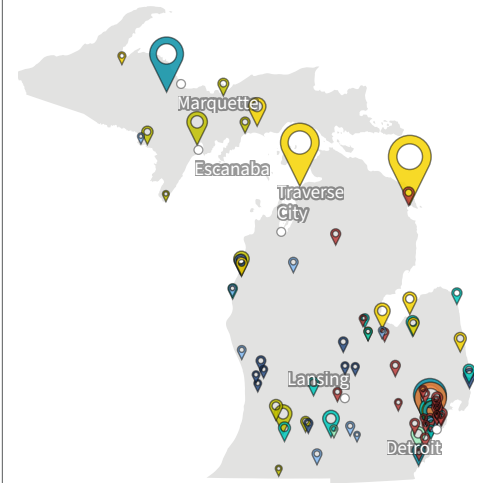
\*\*\*Includes economic impact of minor restricted activity days, in addition to school and work loss days

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.

## Michigan's industrial facilities



### Facilities by industry

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

### Metric tons CO<sub>2</sub>e



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 Michigan are electrifying thermal processes across facilities, especially those requiring heat below 400°C, and converting coal-based steel facilities to hydrogen direct reduction.

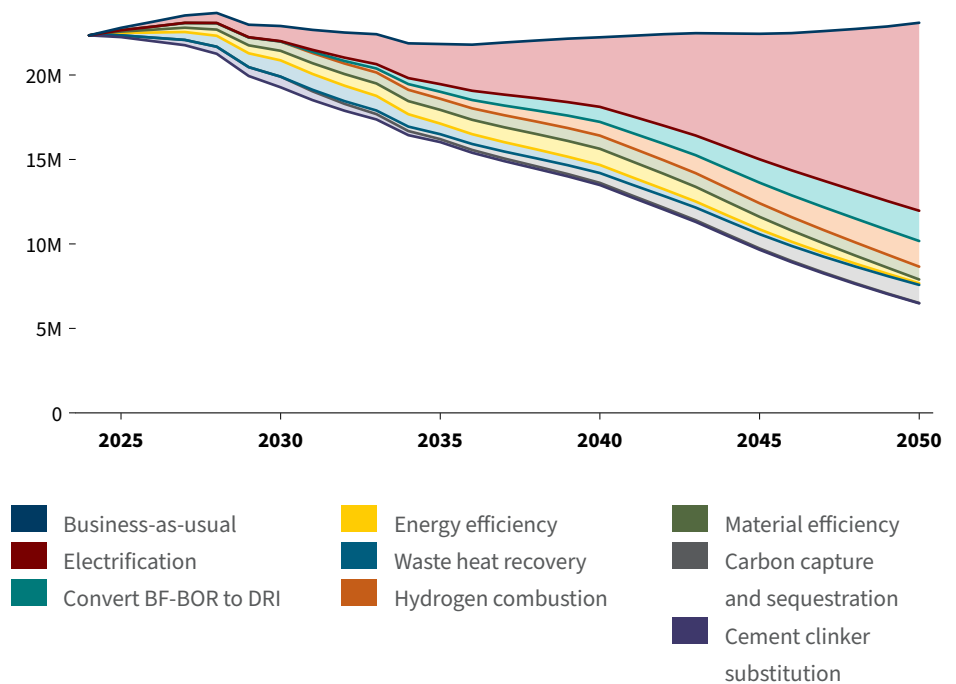
If nearly all industrial processes below 400°C are electrified by 2050, Michigan can reduce emissions from manufacturing by a cumulative 107 MMT CO<sub>2</sub>e, or 52% of overall potential emissions reductions from the set of strategies. Electrification of thermal processes is an immediate opportunity 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, and certain [chemicals](#).

Michigan can also shift to [direct reduced iron \(DRI\) facilities in lieu of relining blast furnace–basic oxygen furnace \(BF-BOF\) steel plants](#). If the transition begins promptly, this is expected to result in cumulative emissions reductions of 0.1 MMT CO<sub>2</sub>e by 2030 and 19.1 MMT CO<sub>2</sub>e by 2050. DRIs operating on natural gas can produce 50% fewer emissions than BF-BOF steel plants, and DRIs operating on clean hydrogen can produce 90% fewer emissions.<sup>1</sup>

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

## Industrial emissions in Michigan

Emissions from manufacturing have the potential to decline by 16.6 million metric tons of CO<sub>2</sub>e 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 & Rollback scenario in the EPS, which is more representative of today's policy landscape, and assumes Michigan takes no further action to reduce industrial emissions.

Source: RMI Analysis, [Energy Policy Simulator](#)

## Cumulative emissions reduction by strategy

| Strategy                         | cumulative MMT CO <sub>2</sub> e reductions through 2030 | cumulative MMT CO <sub>2</sub> e reductions through 2050 | ▼ % of cumulative industrial emissions reductions |
|----------------------------------|----------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------|
| Electrification                  | 3.1                                                      | 107.5                                                    | 52.0%                                             |
| Transition BF-BOF to DRI         | 0.1                                                      | 19.1                                                     | 9.2%                                              |
| Hydrogen combustion              | 0.0                                                      | 16.8                                                     | 8.1%                                              |
| Material efficiency              | 1.9                                                      | 16.7                                                     | 8.1%                                              |
| Energy efficiency                | 1.9                                                      | 16.6                                                     | 8.0%                                              |
| Waste heat recovery              | 3.3                                                      | 12.7                                                     | 6.2%                                              |
| Carbon capture and sequestration | 0.0                                                      | 12.0                                                     | 5.8%                                              |
| Cement clinker substitution      | 2.2                                                      | 5.3                                                      | 2.6%                                              |

These values were calculated using the Michigan 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

Additional 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.
- Using smarter design to reduce demand for new steel, cement, and other manufactured goods – i.e., material efficiency.
- Recovering waste heat using economizers and heat exchangers and converting it into usable energy.
- Prioritizing the use of [low-carbon intensity methane](#) in industries relying on high-heat processes while the infrastructure and supply for cleaner low-carbon fuels is developed.



## 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. Michigan’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 Michigan can take to modernize its industrial sector. Examples include:

### Creating standards

- **State target setting** or mandates to direct the industry sector’s transition to green products.
- **Performance-based GWP standard** to drive development and deployment of low-carbon cement and concrete.
- **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 assist facilities transitioning to low-carbon production 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 green hydrogen, instead of fossil fuels. The credit can be structured per unit of clean heat delivered to an industrial process and increases clean fuel’s cost competitiveness.
- **Government procurement for low-carbon products** to create the offtake certainty required for capital expenditures, such as redevelopment of BF-BOF facilities.

For more information about industrial decarbonization, please email [USAnalysis@rmi.org](mailto:USAnalysis@rmi.org)