

Executive Summary

Though the industrial sector has historically been deemed hard to abate, many of Michigan's industrial emissions — about 2.9 million tons (Mt) of CO₂¹ — come from burning natural gas in low and medium temperature ranges for which low-emissions technologies like industrial heat pumps, electric boilers, and thermal energy storage have already proven viable.² This roadmap provides a plan for Michigan policymakers to ease the transition to clean manufacturing and production methods as these next-generation technologies continue down the cost curve and improve in performance.

Manufacturing is a driving force of the Michigan economy: across the state, approximately 600,000 Michiganders are employed in manufacturing jobs, specializing in products ranging from paper and cardboard to chemicals and cars.³ The state was the seventh largest exporter of goods in the nation in 2024, and goods exports accounted for 9.1% of state gross domestic product in the same year.⁴ In addition to advancing the state economy, the industrial sector is a significant source of climate pollution, comprising 13% of Michigan's total emissions (or 27 Mt of CO₂e).⁵ To meet the climate and health targets mandated by the MI Healthy Climate Plan while maintaining Michigan's manufacturing might,⁶ the state must work to reduce emissions from its industrial sector in a way that allows businesses to stay regionally and globally competitive. The near-, mid-, and long-term actions contained in this roadmap are designed to achieve these dual ambitions.

Technical solutions

In this roadmap, we focus on solutions that are technologically and commercially ready (technology readiness level of 9 or higher,⁷ meaning the technology has successful full-scale deployment in an operational environment), can be deployed in the near-term, and fall into three main categories: energy efficiency, electrification, and geothermal heat.

- **Energy efficiency:** Many assume industrial facilities have already maximized energy efficiency, but a study from ENERGY STAR finds that energy efficiency still represents 34% of feasible carbon emission reductions in US manufacturing by 2050.⁸ This leaves a major opportunity for cost savings and emissions reductions, especially as technologies improve in efficiency. Michigan facilities can implement solutions like industrial heat pumps, low-carbon or geothermal combined heat and power, and energy management systems, which reduce waste without disrupting production.
- **Electrification:** A key strategy for reducing emissions in low- and medium-temperature industrial processes is electrification. Facilities like those in the food and beverage and chemicals sectors can adopt electric resistance heating and thermal energy storage to replace fossil-fueled systems. These technologies are reliable and can be tailored to specific heat and power needs.
- **Geothermal heat:** Advanced geothermal systems now allow heat extraction in regions without geologic activity, making them viable across Michigan. Geothermal is ideal for industrial use because it provides direct heat without needing conversion to electricity. Though still emerging, it is already being implemented in similar contexts to Michigan and offers strong potential for demonstration projects.⁹

Barriers to adoption

Despite the technological maturity of many of these technologies, nearly every facility in Michigan remains reliant on natural gas to fuel its operations. Where facilities consider adopting lower-emissions equipment, they face barriers including technology integration, equipment financing, and system-level capabilities. The following barriers were surfaced through informational interviews with facility owners and managers:

- **No one-size-fits-all solution:** Each facility has unique energy needs, making application of a universal electrified heating solution difficult. Long equipment lead times and potential production disruptions are major deterrents.
- **Limited capacity among smaller manufacturers:** Small and medium-sized manufacturers often lack the resources to conduct energy audits or evaluate alternative equipment investments.
- **High up-front and operating costs:** Efficient and electrified systems are more expensive than traditional gas boilers. In Michigan, industrial electricity is about 2.8 times more costly than gas.¹⁰
- **Grid and infrastructure constraints:** Facilities need reliable, affordable electricity, but grid capacity and transmission planning are still catching up. Long deployment cycles and a lack of commercial-scale demonstrations also slow adoption.

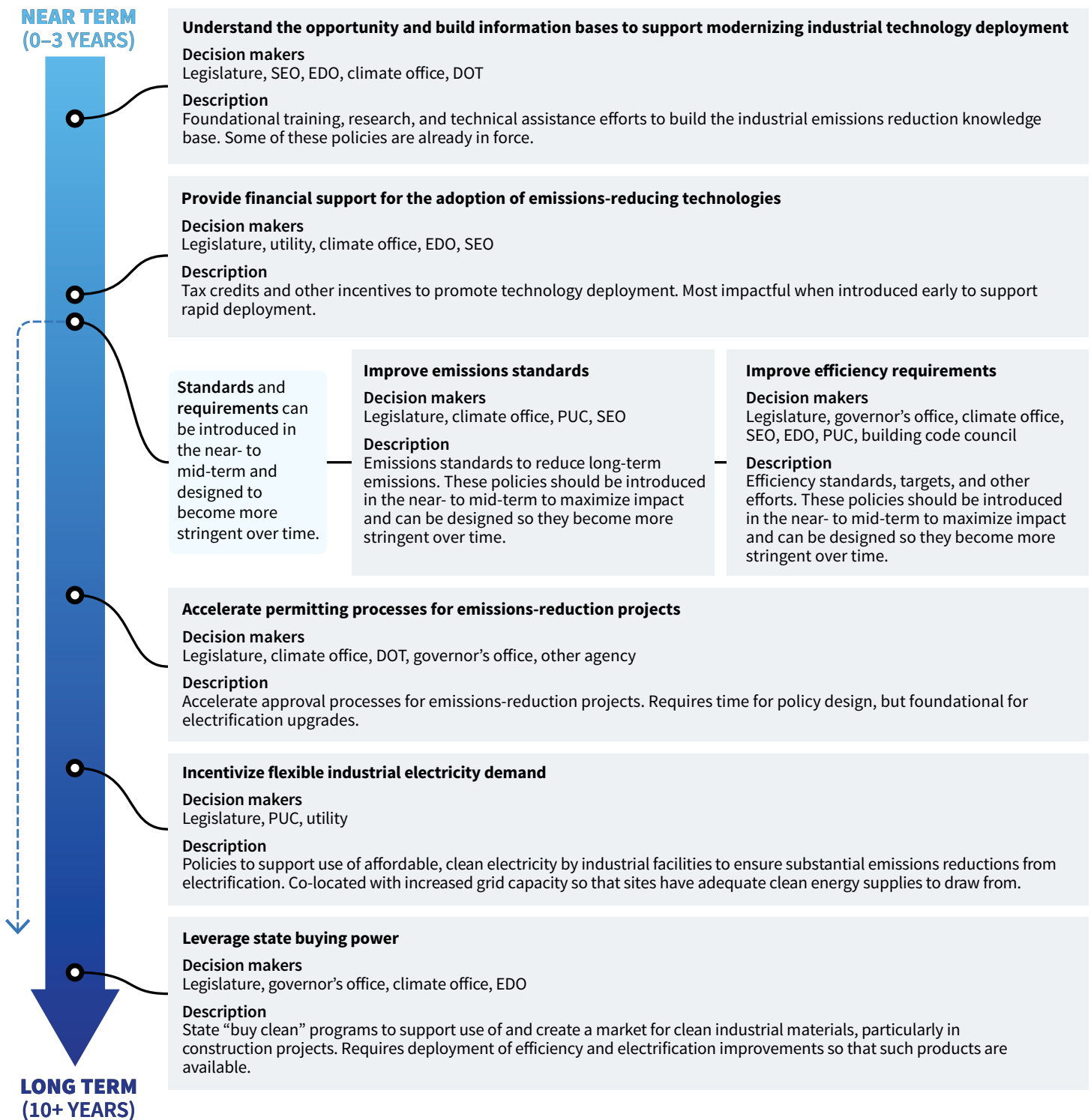
Enabling policies

To overcome these barriers and unlock the clean manufacturing potential, Michigan can enact targeted policies and programs. We focus on eight key strategies, many with specific subpolicies, discussed in detail in the [State Interventions](#) section of the report:

1. Support the adoption of emissions-reducing technologies financially
2. Improve efficiency requirements
3. Increase grid clean capacity
4. Incentivize flexible industrial electricity demand
5. Streamline permitting processes for emissions reduction projects
6. Improve emissions standards
7. Leverage state buying power
8. Understand the opportunity and build information bases to support modernizing industrial technology deployment

There is no silver bullet to achieve low-emissions industry, so the state should consider its funding resources, administrative capacity, and input from industrials to unlock the greatest emissions reduction potential. In concert, a number of these strategies (depicted in Exhibit ES1) can be powerful levers to change Michigan's industrial emissions landscape and drive private investment in clean technology.

Exhibit ES1 Timeline of policy interventions to aid industrial emissions reductions



RMI Graphic. Source RMI analysis

How will the people of Michigan benefit?

Improving efficiency and electrifying operations in the industrial sector create ripple effects beyond the borders of the facilities themselves.

First, there are tangible air quality benefits to industrial electrification, especially to communities near the facilities. A new report from the American Lung Association found that “the transition to zero-emission technology for low- and mid-temperature industrial boilers would generate substantial reductions in both climate-forcing emissions and local air pollutants that threaten public health.”¹¹ In Michigan specifically, the report estimates the cumulative health benefits of switching low- and medium-temperature boilers to heat pumps to be \$42.8 billion.¹² The analysis uses the US Environmental Protection Agency’s Co-Benefits Risk Analysis (COBRA) tool to assess the frequency of health incidents like asthma and premature mortality caused by industrial pollutant emissions and evaluates the monetary benefit of avoiding those incidents.

Beyond the state’s stated ambition to reduce emissions and the obligation to deliver clean air to its residents, Michigan has the opportunity to lead the United States in industrial decarbonization and produce goods with lower emissions for global markets, which are increasingly willing to pay premiums for green products. Given that \$5.8 billion of goods produced in the state were exported to the European Union in 2024,¹³ the state can consider tightening regulations and supporting Michigan businesses to compete in low-carbon global markets with a carbon border adjustment mechanism.¹⁴

