Modernizing Industry in Illinois

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Key takeaways

1. **Illinois is one of the largest manufacturing states in the nation.** The Prairie State's top industries, in both manufacturing output and climate pollution, are chemicals, refined petroleum and coke, iron and steel, and food and beverage.

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

3. **The strategies with the greatest potential** for reducing manufacturing emissions in Illinois are **electrifying thermal processes** and **converting coal-based steel facilities to hydrogen**.

4. Illinois 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 Prairie State shows economic momentum and strength in manufacturing. It's among the top five states in both the greatest concentration of chemical manufacturing and food and beverage manufacturing facilities. Illinois is also a leader in the Midwest in crude oil refining and steel production.

But global changes necessitate a new strategy to keep Illinois competitive. Chemical markets are shifting to low-emissions products. 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.

Simultaneously, global demand for green steel is forecast to equal 35% of current crude steel production by 2050. As these markets emerge and transition, Illinois has significant assets it can leverage to establish an early-mover advantage.

Supporting industrial decarbonization will also reduce climate pollution. For Illinois to achieve its economy-wide goals of a 25% emissions reduction by 2025 and 100% by 2050 from 2005 levels, it must reduce pollution from industry. In 2024, Illinois' manufacturing sector collectively released 41 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), according to data from the Energy Policy Simulator.

Health impact from Illinois' iron and steel, chemicals, food and beverage, and refining facilities

Current levels of air pollution from Illinois' manufacturing facilities adversely impact public health and economic activity.

Health Event	*Estimated Annual Incidents from Facilities*				
	Iron and Steel	**Chemicals**	**Food and Beverage**	**Refined petrol and coke**	**Total**
Premature deaths	6-12	28-54	42-90	26-55	102-211
ER Visits, respiratory	5	32	45	25	107
Asthma symptoms	2,814	17,346	25,212	15,090	60,462
Work loss days	695	3,058	6,253	3,426	13,432
School loss days	152	3,837	1,799	1,651	7,439
Total health costs*	$84M-$175M	$432M-$812M	$652M-$1.4B	$405M-$820M	$1.6B-$3.2B
Lost economic activity**	$1M	$9.8M	$9.7M	$6.4M	$26.9M

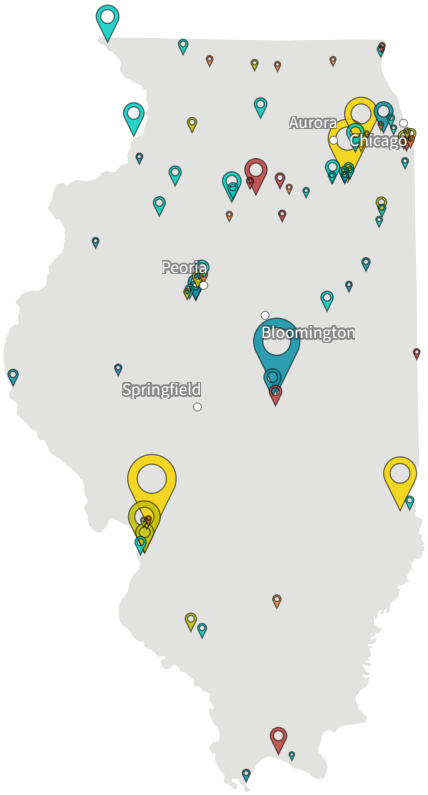
**Includes health costs incurred from additional incidents not listed like cardiac arrests, stroke, and hospital admits*
***Includes economic impact of minor restricted activity days, in addition to school and work loss days*

Source: EPA CO-Benefits Risk Assessment (COBRA)

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 11.3 MMT CO_2e.

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.

Illinois' industrial facilities



Facilities by industry

- Refined petroleum and coke
- Food and beverage
- Chemicals
- Other metals
- Cement and other nonmetallic minerals
- Other manufacturing

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 Illinois are electrifying thermal processes, especially those requiring heat below 400°C, and converting coal-based steel facilities to hydrogen.**

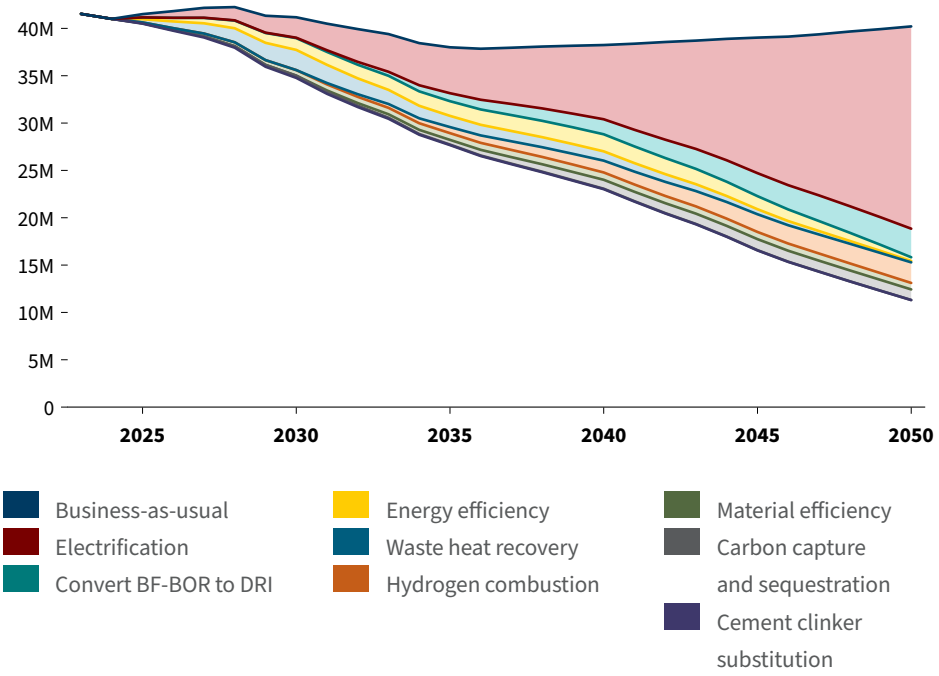
If nearly all industrial processes below 400°C are electrified by 2050, Illinois can reduce emissions from manufacturing by a cumulative 210.3 MMT CO_2e, or 58% of overall potential emissions reductions from the set of strategies. Electrification of thermal processes is an immediate opportunity to reduce emissions from on-site combustion of fossil fuels. Direct electrification of thermal processes has the greatest potential in light industries, including food and beverage, and certain chemicals.

Illinois can also reduce emissions from iron and steel, its third most polluting industry, by shifting 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_2e by 2030 and 33.6 MMT CO_2e 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.[1]

[1] 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 Illinois

Emissions from manufacturing have the potential to decline by 28.9 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 & Rollback scenario in the EPS, which is more representative of today's policy landscape, and assumes that Illinois does not take additional 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	7.4	210.3	58.0%
Convert BF-BOF to DRI	0.1	33.6	9.0%
Energy efficiency	4.2	32.3	9.0%
Waste heat recovery	7.6	25.5	7.0%
Hydrogen combustion	0.0	25.5	7.0%
Material efficiency	2.1	16.8	5.0%
Carbon capture and sequestration	0.0	16.7	5.0%
Cement clinker substitution	0.8	2.0	1.0%

These values were calculated using the Illinois 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.
- **Recovering waste heat** using economizers and heat exchangers and converting it into usable energy.
- **Using smarter design to reduce demand** for new steel, cement, and other manufactured goods – i.e., material efficiency.
- **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. Illinois' 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 Illinois can take to modernize its industrial sector. Examples include:

Creating standards

- **State target setting** or mandate to direct the industry sector's emissions reductions.
- **Energy efficiency standards for industry** to drive development and deployment of energy-saving equipment, such as electric Haber-Bosch processes and electric coking or boiler technology.

Providing support

- **Develop hydrogen infrastructure,** including pipelines, storage facilities, and liquification plants. Transitioning to green hydrogen as a fuel source requires the availability of robust and resilient quality infrastructure.
- **Shift any remaining fossil fuel demand towards low methane intensity resources** by incentivizing the use of oil and gas that was produced with lower upstream emissions over other sources.

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 can increase clean fuel's cost competitiveness.
- **Support offtake agreements** that enable refineries to shift production toward heavy non-fuel products, such as asphalt, lubricants, and metals recovery. This can improve industry resilience to fuel market shocks while reducing emissions.
- **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