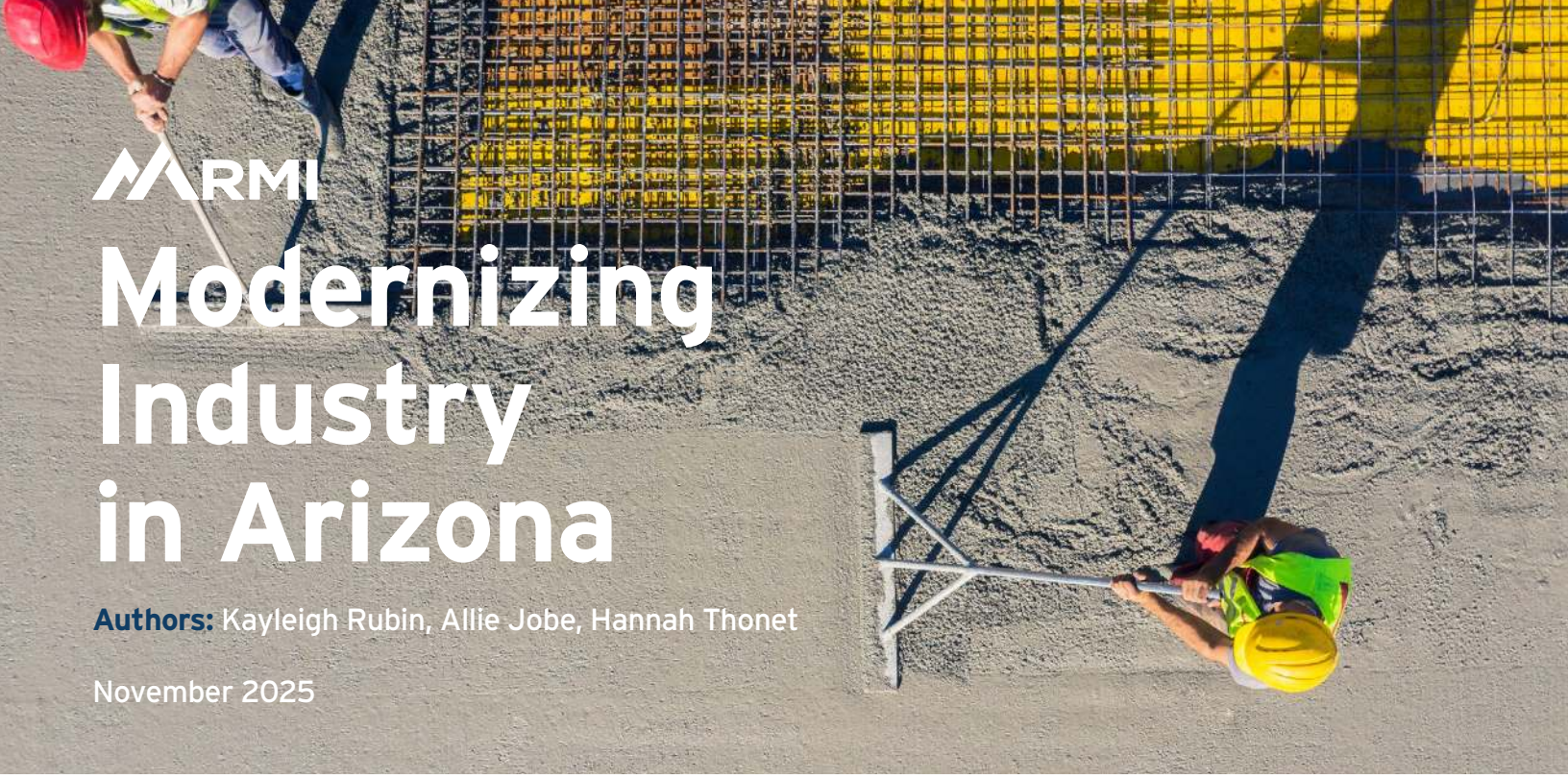

Modernizing Industry in Arizona

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Key takeaways

1. **The Grand Canyon State's manufacturing sector** heavily **relies on chemical** and **cement** production. Arizona's chemical sector recently experienced 17% employment growth, and the state ranks among the top five for highest employment levels in cement.

2. As demand for chemicals and cement shifts to low-emissions products, **Arizona can** leverage its specialized workforce and existing infrastructure to **establish an early-mover advantage in green markets**.

3. **Electrifying thermal processes** and **deploying carbon capture and sequestration** have the largest potential to reduce emissions across all of Arizona's manufacturing facilities by 2050.

4. Arizona can **support industrial modernization and economic competitiveness through enabling state policies,** such as a production tax credit for clean industrial heat and green product certifications.

Arizona shows economic momentum and strength in the chemicals and cement industries. The chemical manufacturing sector experienced 17% employment growth over the last five years, and Arizona ranks among the top five states with highest employment levels in cement.

But global changes necessitate a new strategy to keep Arizona competitive. Chemical markets are shifting to low-emissions products. Between 2022 and 2023, low-carbon cement companies globally garnered more than $729 million from over 100 unique investors, representing 9% of total investment in the built environment. As the chemicals and cement markets transition, Arizona has significant assets it can leverage to establish an early-mover advantage.

Supporting development of green chemicals and green cement industries will also reduce climate pollution. Chemicals, miscellaneous manufacturing[1], and cement and nonmetallic minerals are the leading sources of statewide manufacturing emissions. For Arizona to achieve its economy-wide goals of a 26% emissions reduction by 2025 and 50% by 2030 from 2005 levels, it must reduce climate pollution from industry. In 2024, Arizona's manufacturing sector collectively released 8.45 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, by 2050, the manufacturing sector is forecast to emit similar levels of

[1] Miscellaneous manufacturing includes construction, nonroad vehicles, other machinery, and wood products.

Health impact from Arizona's chemicals and cement and mineral facilities

Current levels of air pollution from Arizona's chemicals and cement and mineral facilities adversely impact public health and economic activity.

Health Event	*Estimated Annual Incidents from Facilities*		
	Chemicals	**Cement and Minerals***	**Total**
Premature deaths	.02-.035	31-64	32-65
ER visits, respiratory	0.028	31	32
Asthma symptoms	15	19,170	19,185
Work loss days	5	3,757	3,763
School loss days	2	3,167	3,169
Total health costs**	$0.3 M-$0.5M	$486M-$954M	$487M-$955M
Lost economic activity***	$10k	$9.3M	$9.3M

**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)

pollution as today. However, if the state incorporates the strategies outlined below, it could reduce manufacturing emissions to 3.6 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.

Arizona's industrial facilities

Facilities by industry

- Cement and other nonmetallic minerals
- Computers and electronics
- Chemicals
- Other metals
- Iron and steel
- Food and beverage
- Other manufacturing

Metric tons CO_2e

80K 300K 800K

Source: US EPA

Strategies for emissions reduction

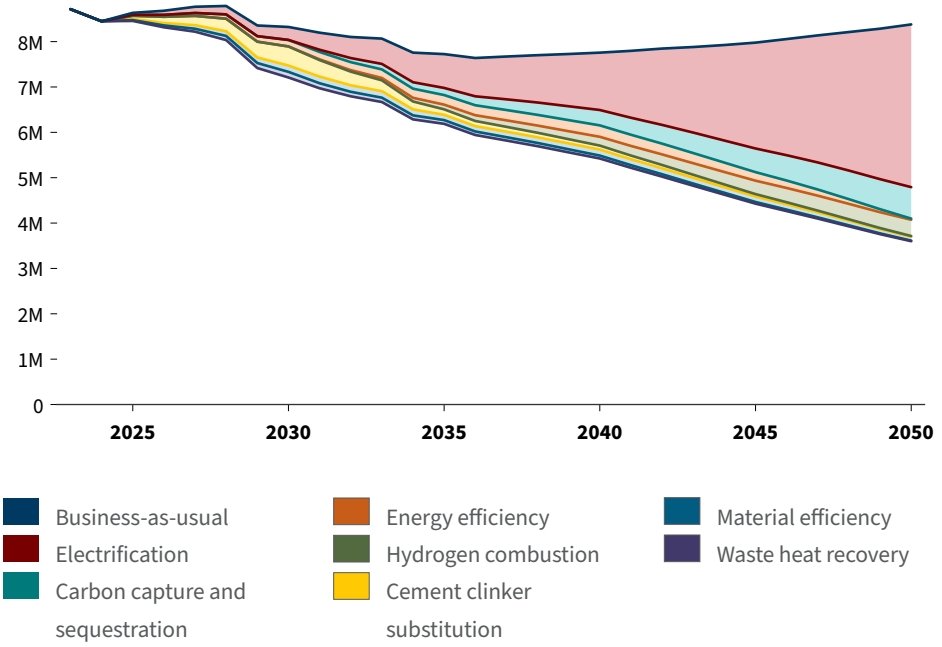
Modernizing facilities can support competitiveness in emerging markets while reducing air and climate pollution. Based on the Energy Policy Simulator, an open-source model for estimating the impacts of energy policies, the strategies with the greatest potential for reducing emissions in Arizona are electrifying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

If nearly all industrial processes below 400°C are electrified by 2050, Arizona can reduce emissions from manufacturing by a cumulative 33.8 MMT CO_2e, or 59% 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.

Facilities that have transitioned to clean energy release a purer CO_2 stream of process emissions, which makes carbon capture more affordable and effective for residual emissions. Though it should not be deployed singularly, CCS plays a long-term critical role in decarbonization, particularly in cement manufacturing. CCS has the largest emissions saving potential among all technological interventions in cement production. If deployed beginning in 2031, at which time there are projected to be significant technological advancements, CCS has a cumulative emissions saving potential of 7.3 MMT of CO_2e in Arizona by 2050.

Industrial emissions in Arizona

Emissions from manufacturing have the potential to decline by 4.8 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 were calculated using the Energy Policy Simulator (EPS).The business-as-usual scenario corresponds to the Federal Policy Repeal and Rollback scenario in the EPS, which is more representative of today's policy landscape, and assumes that Arizona takes no further action to reduce 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	1.0	33.8	59.0%
Carbon capture and sequestration	0.0	7.3	13.0%
Energy efficiency	0.5	4.2	7.0%
Hydrogen combustion	0.0	4.0	7.0%
Cement clinker substitution	1.5	3.6	6.0%
Material efficiency	0.5	3.0	5.0%
Waste heat recovery	0.5	1.6	3.0%

These values were calculated using the Arizona Energy Policy Simulator (EPS), and they assume both stringent implementation and carbon capture and sequestration and hydrogen combustion reaching technological readiness by 2031.

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.
- Substituting clinker with other cementitious materials, such as such as coal fly ash or blast furnace slag.
- Using smarter design materials to reduce demand for new cement, food and beverage, and other products, 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. Arizona's policymakers can support industrial competitiveness and decarbonization through policies that establish certainty, which involves setting standards and providing support, including reducing the costs of technical interventions and increasing the value of low-emissions products.

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

Creating standards

- **State target setting** or mandates to direct emissions reductions in the industry sector.
- **Performance-based GWP standard** to drive development and deployment of low-carbon cement and concrete.

Providing support

- **Technical assistance grants** to assist facilities in transitioning to low-emissions production. Technical assistance can help facilities overcome financial barriers, capacity constraints, or knowledge gaps in modernizing.
- **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 increases clean fuel's cost competitiveness.
- **Government procurement for low-emissions products** to create the offtake certainty required for capital expenditures, such as retrofitting a facility with carbon capture equipment.
- **Labels for green products** based on an established certification process provide credible assurance to buyers. The use of labels helps manufacturers capitalize on emerging markets and partnerships that prioritize environmental responsibility.

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