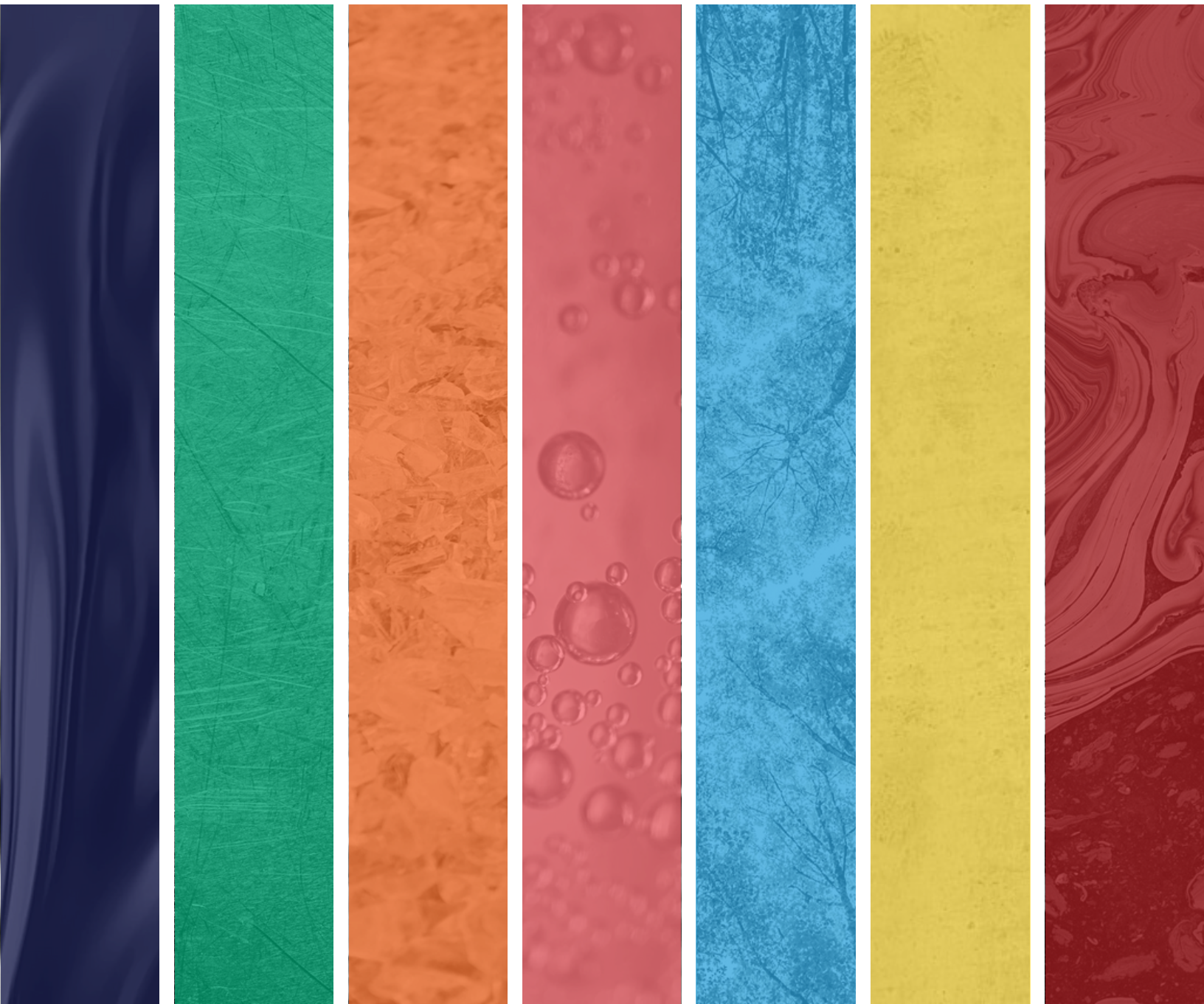
Supporting Policies & Actions



Supporting policies can lower the costs and boost the effectiveness of many policy types described above through improved information and economic assistance.[210] These policies can build an enabling knowledge infrastructure (e.g., disclosure and labeling programs, technical assistance, workforce training), create new markets (e.g., procurement policies, certification programs), and invest in physical infrastructure. Supporting policies may be designed to complement existing policies, reinforce positive outcomes, and avoid unintended negative consequences.

Low-carbon material procurement
States can help develop markets for industrial materials with lower embodied emissions through low-carbon procurement policies like “Buy Clean,” a concept pioneered in **California** and now taking hold in several other states and the federal government. Buy Clean policies leverage the purchasing power of public authorities and combine disclosure, incentives, and emissions standards to create a market for lower-carbon products and materials.[211] "Buy Fair" is an expansion of the concept that also incorporates working conditions, such as disclosure and standards around compensation, working hours, and collective bargaining. **Washington** is currently conducting pilot studies on both Buy Clean and Buy Fair.[212]

Five states (**California**,[213] **Colorado**,[214] **New Jersey**,[215] **New York**,[216] and **Oregon**[217]) have enacted embodied carbon legislation to date, although only California’s program is in effect as of July 2022. **Colorado** is developing its program to cover materials used in building and transportation projects, while **Oregon** is tasked with developing a program to reduce emissions from constructing and maintaining transportation infrastructure. **New Jersey** and **New York’s** bills focus only on concrete while the others cover multiple materials. Both **Minnesota**[218] and **Washington**[219] are conducting clean construction studies, pilot projects, and test databases, while **Maryland**[220] is evaluating policies to increase low-carbon concrete in state projects. Three states (**Louisiana,**[221] **Michigan,**[222] **Wisconsin**[223]) recommended adopting a Buy Clean policy in their 2022 climate or clean energy action plans, and at least three other states (**Connecticut**, **Hawaii**,

Massachusetts) have introduced—but not passed—embodied carbon legislation in recent years.[224]

State policies vary in their coverage of materials and expertise on embodied carbon data. The most commonly covered materials are steel, concrete, glass, asphalt, and wood products. Some state programs (**California, Colorado, Oregon, Washington**) target multiple material types while others (**Maryland, New Jersey, New York**) target only one. Buy Clean policies depend on a foundation of high-quality embodied carbon data, most commonly through environmental product declarations (EPDs) from industry. However, EPDs are not yet widely available across regions, or for all relevant materials, or at a level of consistency to compare materials effectively.[225] States—in coordination with each other, industry, and the federal government—can help harmonize data sources, material coverage, and standards to create a stronger and more-consistent market for lower-carbon materials.

Strategic energy management (SEM)
SEM provides a framework of practices and processes to identify and implement energy efficiency projects through systematic improvement. It emphasizes a focus on people and organizational change to enable persistent energy savings and related emissions reductions.[226] A recent study for Canada showed SEM could potentially achieve up to 20 percent of the country's emissions reduction goal for heavy industry.[227]

To accelerate SEM's growth and impact, policy support is needed for training, financial assistance, and developing improved reporting and monitoring for both energy and emissions. States can implement SEM programs on their own or in partnership with federal programs.[i] For example, the Energy Trust of **Oregon** supports industry through numerous programs, including SEM, which includes free training for industrial facilities and cash incentives for achieving energy saving milestones. Participating facilities typically see energy efficiency gains of 5–10 percent per year.[228] **Colorado's** Industrial Strategic Energy Management program offers similar services.[229] **New York's** SEM program is available to both commercial and industrial facilities, comprising a coaching and training program and "virtual treasure hunts" to identify energy-saving projects.[230]

However, many states do not fund SEM programs that target industrial facilities and current SEM programs tend to limit their focus on small manufacturers, thereby neglecting medium and large customers, especially those that have opted out of their utilities' energy efficiency programs. This trend may be changing, as at least three states (**Louisiana,**[231] **Washington,**[232] **Wisconsin**[233]) have recommended establishing SEM programs for industry as part of recent climate or clean energy action plans.

Technical assistance (TA)
Decarbonization is a daunting challenge for private-sector actors in the industrial sector to address alone. Government-funded TA can help companies overcome cost barriers for devising plans and projects to reduce GHG emissions. TA is particularly valuable for small- and medium-sized companies that are limited in personnel and experience. See ***Section: 2.7 Remaining Challenges***, where small and medium manufacturers and light industry are covered further, but it is important to note here as well as TA is a broad opportunity for state policy that connects with workforce development and current program offerings.

[i] DOE's Industrial Assessment Centers (IACs) are based in dozens of universities across the United States. IACs expand the energy-saving workforce and reduce emissions by training students and performing energy use assessments for small industrials at no cost to the customer.

States can leverage existing federal programs (e.g., DOE's Better Plants Program, DOE's Industrial Assessment Centers, EPA's ENERGY STAR Program) or deploy their own, such as **New York's** FlexTech Program [234] and **Washington's** Efficiency Services for Manufacturing and Industrial Facilities. [235] Other states like **Maine**, [236] **Oregon**, [237] and **Wisconsin** [238] offer TA through their industrial incentive programs.

Labeling and certification
As a complement or alternative to procurement policies, labeling and certification schemes can help expand the market for low-carbon industrial goods. These programs not only help educate consumers of industrial goods, but they also give public recognition to companies for taking steps to reduce their environmental impact. EPA has already developed robust set of *Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing*, covering a variety of commonly procured goods, [239] and the EPA ENERGY STAR certification recognizes buildings and industrial plants for superior energy performance. [240]

For industrial decarbonization, this is a nascent policy area. Green building certifications and standards have driven EPD development and use to date, helping to increase understanding of construction materials' embodied GHG emissions. [241] **Oregon** partnered with its local concrete industry to expand the labeling and use of EPDs, for example. [242] In recent climate and clean energy plans, **Louisiana** [243] and **Wisconsin** [244] proposed developing voluntary industrial certification programs to incentivize and recognize facilities for implementing GHG or energy reduction measures.

Emissions disclosure and monitoring
Designing effective decarbonization policy depends on a foundation of robust energy and GHG emissions data. In the United States, the Greenhouse Gas Reporting Program (GHGRP) requires facilities emitting over 25,000 metric tons CO_2e per year to report their emissions to the EPA. This threshold applies to about 7,600 electric and industrial facilities and 1,000 fuel/gas suppliers, accounting for nearly 90 percent of total national GHG emissions. [245] Industrial data is also tracked or consolidated by EIA, [246] the National Renewable Energy Laboratory (NREL), [247] and other sources. While these national datasets are useful for state policymakers to understand major industrial sources of emissions within their own borders, federal data have several limitations on their level of granularity, timing of disclosure, and scope of facility coverage.

Some states have developed their own compulsory disclosure schemes to meet specific policy needs. For example, **California's** Regulation for the Mandatory Reporting of Greenhouse Gas Emissions [248] complements and expands on EPA's GHGRP by requiring more-detailed emissions monitoring and disclosure, which inform the state's cap-and-trade program and GHG emissions inventory. All facilities are subject to a lower reporting threshold (10,000 metric tons CO_2e per year) and certain activities like cement and nitric acid production, lime manufacturing, and petroleum refining must report regardless of emissions level. [249] **Colorado** has also adopted a GHG Reporting Requirement (Regulation 22, Part A) that complements EPA's GHGRP, for use in inventory and regulation development as well as compliance for existing regulations. [250] **Louisiana,** [251] **New York**, [252] and **Washington** [253] have all proposed developing GHG reporting programs to build datasets that help decarbonize industry in recent climate or clean energy action plans.

Low-carbon infrastructure investment
Infrastructure investments are going to be vital to allow for low-carbon electricity and hydrogen delivery and the transportation and storage aspects of CCUS. Given state authorities and responsibilities on resource planning and infrastructure—such as

permitting, rights of way, and other regulations—states can take action to ensure that the infrastructure needs across all five decarbonization pillars are met. Revenues from existing state programs like carbon markets (where/when available) or gasoline taxes can be used to help accelerate infrastructure deployment.

Equity and environmental justice
Industrial facilities emit air, water, and soil pollutants that disproportionately contaminate low-income and BIPOC (Black, Indigenous, People of Color) communities,[254] and major sources of industrial GHG emissions can sometimes be the biggest sources of air pollutants.[255] **California** has found that communities of color received the majority of the health benefits of its GHG reduction policies targeting industrial and heavy-duty vehicle emissions.[256] Advancing industrial decarbonization thus offers a strong opportunity to address environmental damages, injustice, and public health.

Going forward, states should aim to direct the benefits of industrial decarbonization, while minimizing any further impacts (See ***2.7 Remaining Challenges***), to disproportionately impacted communities. To help achieve this outcome, states should ensure that their equity and environmental justice (EJ) policies include:

- Acknowledgment of the disproportionate impacts across historically underserved and vulnerable populations;
- Identification of solutions for pollution reduction from industrial sources;
- Creation of mapping tools that communities can access and data visualization options to support communication;
- Establishment of easy-to-access communication portals and processes for engaging with communities early and often on pertinent issues like infrastructure siting and just transition;
- Articulation of EJ priorities in budgets and spending plans;
- Designation of a lead agency, council, or commission and personnel to support EJ activities within the state government; and
- Establishment of advisory panels to advise on and guide EJ efforts at the accountable agency or council.[j]

Diverse workforce development
As industry decarbonizes, a talented, diverse, and committed workforce will be essential to overcome the numerous technical, economic, business, and culture change hurdles that are currently in place. States should ensure a just transition for workers whose industries are being replaced in the new low-carbon economy while creating jobs for and offering skilled training to a diverse range of workers from disadvantaged communities. Approaches for facilitating such a transition include:

- Developing just transition roadmaps;
- Setting aside economic resilience funds for workers and their communities;
- Creating and using stakeholder communication platforms to share information with affected workers and collect their input on the just transition process; and
- Proposing timelines and sequencing pathways for the transition process.

States can also initiate training programs and engage with IACs and other programs where new or retrained workers can participate in overcoming decarbonization

[j] For additional information on this topic, see *A 50-State Survey of State Policies and Decision Makers to Help Ensure Federal Investments Go to "Disadvantaged Communities" Under Biden's J40 Initiative* here.

challenges. These programs allow states to leverage technical assistance to help establish a path to well-paying jobs and improve the competitiveness of industry.[k]

Targeting industry clusters

Industry tends to "cluster" in concentrations of companies providing specialized goods or services. Clusters form around access to specific natural resources (e.g., energy sources, water, raw materials), transportation options, a similar customer base, and skilled pools of labor. Examples include biotech companies clustered around three nearby universities in North Carolina's Research Triangle Park, wind energy R&D and manufacturing in the Great Lakes region, and petrochemical companies clustered around the Houston Ship Channel and the Mississippi River in Louisiana. Ports are another common example of industrial clusters (***Box 2***). [257]

Clusters of companies have great potential to collaborate on the step changes needed to reduce GHG emissions. "Net-zero clusters" are a high investment priority in the UK, the Netherlands, and other countries in the European Union, [258] and have been studied in the United States. [259] For example, an industry cluster could work together and with supply chain partners to:

- Quickly implement programs focused on accelerating energy efficiency improvements, reducing both energy use and GHG emissions.
- Develop methods and track data to help quantify and reduce the embodied carbon of products.
- Support low-carbon electricity generation (e.g., wind, solar, micro-nuclear) at brownfield sites near the cluster, which would facilitate beneficial electrification.
- Cost-effectively build out infrastructure for LCFF (e.g., hydrogen and carbon dioxide for CCUS), in partnership with pipeline companies and government agencies. For example, an estimated $28 billion in infrastructure costs is needed to reduce 25 million tons of carbon dioxide per year in the Houston port area, highlighting a role for public policy support to attract private investment. [260, 261]

Clusters can also be crucial for job creation and workforce training. Industry can partner with nearby institutions of higher learning to actively train the future workforce while improving diversity, equity, and inclusion. At the same time, environmental justice groups need to be engaged to understand how clusters can best help reduce the environmental impact of industry.

[k] For additional information on this topic, see *The Just and Equitable Transition State Policy Framework* and its accompanying *Resource Guide* here and here.

Box 2: Ports as Industrial Hubs

Ports, including both marine and airport facilities managed by the same "port authority," provide hubs of infrastructure, skilled labor pools, and often large concentrations of industrial facilities. These areas present opportunities for focused innovation, investment, and policy aimed towards decarbonization. GHG emissions reductions can be achieved by connecting infrastructure and decarbonization approaches at ports and other industrial hubs by applying technologies and practices such as emissions controls, electrification, energy management, low-carbon fuels (e.g., green hydrogen), and CCUS. Ports are also essential for connecting local, regional, national, and international markets to low-carbon energy and goods. A combination of state policy, federal policy, corporate engagement, and regional cooperation are needed to further develop low-carbon or net-zero industrial hubs at ports. Engagement with port authorities, local governments, and environmental justice communities will be critical.

The EU and UK have already accelerated decarbonization of industrial clusters as primary components of their industrial decarbonization strategies. The Port of Rotterdam, for example, is working with the local port authority and community to create a port where business and trade continue to grow sustainably through shared infrastructure, waste heat reuse, electrification, green hydrogen, and other strategies.[262]

In the United States, several prominent ports are exploring decarbonization approaches that leverage shared infrastructure and other cluster characteristics. For example:

- The Port of Seattle is evaluating the potential role of green hydrogen for maritime industrial uses.[263]
- The Port of Houston is evaluating the costs associated with an ammonia export terminal that would include carbon dioxide capture infrastructure, green hydrogen infrastructure, and renewable power supply.[264]
- At the Port of Baton Rouge, Grön Fuels is developing a $9.2 billion carbon-negative renewable fuel complex that will produce renewable diesel, sustainable aviation fuels, green hydrogen, and bio-plastic feedstocks.[265]
- The Port of Los Angeles opened two hydrogen fueling stations in mid-2021 and debuted five new hydrogen fuel cell Class 8 trucks.[266]

The *Inflation Reduction Act* includes $3 billion to reduce air pollution in ports, complementing another $1 billion for low-emissions, heavy-duty vehicles and $17 billion for port upgrades in the *Infrastructure and Investment Jobs Act.*[267]

Collaboration with state and federal partners
Both the U.S. Climate Alliance [268] and the Biden Administration [269] have highlighted the need to decarbonize industry, making this sector ripe for multi-state collaboration and state-federal policy alignment. States and the federal government can play complementary roles in implementing best practices, developing new markets for cleaner products, and providing financial and technical support to decarbonize existing facilities. As in other sectors, such as transportation and refrigerant management, industry is most amenable when regulations are consistent across markets and cognizant of their needs. States working together and with the federal government to develop substantially similar policies can ensure efficient knowledge-sharing, stakeholder engagement, rule development, and enforcement.

There are multiple ways in which policymakers can join forces to increase leverage (of financial impact, workforce development, infrastructure deployment, etc.). For example, several states established regional partnerships to develop clean hydrogen hubs in this past year, including in the Intermountain West, [270] the Northeast, [271] and the Gulf South. [272]

New federal programs and investments enabled by recent legislation offer significant opportunities for states to share information, collaborate on best practices, and implement and scale technologies to decarbonize their industries. A DOE analysis found that the combination of programs and incentives in the *Inflation Reduction Act* (IRA) and *Infrastructure Investment and Jobs Act* (IIJA) will reduce national GHG emissions by almost 1,150 MMT CO_2e by 2030, with industrial emissions reductions representing the second-largest driver of the reductions. [273]

Each law contains significant provisions for industrial emissions abatement, with the IRA projected to drive impacts in the next decade and the IIJA making a down-payment on technologies that will drive deeper emissions cuts after 2030. ***Table 4*** and ***Table 5*** below map these industrial-focused programs against the five decarbonization pillars.

Table 4: Industrial decarbonization provisions in the Inflation Reduction Act of 2022.

Decarbonization Pillar	Specific Programs
Efficiency	• Advanced Industrial Facilities Deployment Program ($5.812B – efficiency projects eligible) • 48C Advanced Energy Project Tax Credit (extension and expansion – energy and material efficiency projects that reduce GHGs eligible)
Electrification	• PTC, ITC for renewable energy (extension and expansion) • Advanced Industrial Facilities Deployment Program ($5.812B – electrification and low/zero-carbon heating projects eligible) • 48C Advanced Energy Project Tax Credit (extension and expansion – low/zero-carbon heating projects that reduce GHGs eligible)
Low Carbon Fuels & Feedstocks	• Clean Hydrogen Production Tax Credit (new)

Decarbonization Pillar	Specific Programs
	• Advanced Industrial Facilities Deployment Program ($5.812B – low/zero-carbon fuels and low/zero-carbon heating projects eligible) • 48C Advanced Energy Project Tax Credit (extension and expansion – low/zero-carbon heating projects that reduce GHGs eligible)
Carbon Capture	• 45Q Carbon Capture and Storage Tax Credit (extension and expansion) • Advanced Industrial Facilities Deployment Program ($5.812B – CCUS projects eligible) • 48C Advanced Energy Project Tax Credit (extension and expansion – CCUS projects that reduce GHGs eligible)
Procurement	• Environmental product declaration assistance ($250M) • Low-embodied carbon labeling for construction materials for transportation projects ($100M) • GSA Use of Low-Carbon Materials ($2.15B) • DOT Low-Carbon Transportation Materials Grants ($2B) • FEMA Building Materials Program
Other Industrial Provisions	• Advanced Manufacturing Production Credit (for solar and wind components, batteries, and critical minerals) • Advanced technology vehicle manufacturing ($3B) • Domestic Manufacturing Conversion Grants ($2B) • Alternative Fuel and Low-Emission Aviation Technology Program ($297M) • Methane Emissions Reduction Program ($1.55B, incl. waste methane fee, starting at $900/ton up to $1500/ton in 2026) • HFCs reduction via implementation of the American Innovation and Manufacturing Act ($38.5M)

Table 5: Industrial decarbonization provisions in the Infrastructure Investment and Jobs Act of 2021.

Decarbonization Pillar	Specific Programs
Efficiency	• Advanced Energy Manufacturing and Recycling Grant Program ($750M – energy and material efficiency projects eligible) • Industrial Emission Demonstration Projects ($500M – energy and material efficiency projects eligible)
Electrification	• Advanced Energy Manufacturing and Recycling Grant Program ($750M –low/zero-carbon process heat, renewables, fuel cells, grid modernization, electrolyzer projects eligible) • Industrial Emission Demonstration Projects ($500M – low-GHG medium/high-temperature process heat projects eligible)

Decarbonization Pillar	Specific Programs
Low Carbon Fuels & Feedstocks	• Advanced Energy Manufacturing and Recycling Grant Program ($750M –low/zero-carbon process heat and electrolyzer projects eligible) • Industrial Emission Demonstration Projects ($500M – low-GHG medium/high-temperature process heat and chemical production projects eligible) • Regional Clean Hydrogen Hubs ($8B) • Clean Hydrogen Electrolysis Program ($1B) • Clean Hydrogen Manufacturing and Recycling Program ($500M)
Carbon Capture	• Advanced Energy Manufacturing and Recycling Grant Program ($750M – CCUS projects eligible) • Industrial Emission Demonstration Projects ($500M – CCUS projects eligible) • Carbon Storage Validation and Testing ($2.5B) • Carbon Capture Demonstration Projects Program ($2.54B) • Carbon Capture Large-Scale Pilot Projects ($937M) • CO_2 Transportation Infrastructure Finance and Innovation ($2.1B) • Carbon Utilization Program ($310M) • Carbon Capture Technology Program ($100M) • Underground Injection Control Grants ($50M)
Procurement	• All manufactured products and construction materials used in infrastructure projects financed by the bill must be domestically produced
Other Industrial Provisions	• Industrial Research and Assessment Centers ($150M) • Smart Manufacturing Leadership Grants ($50M) • Battery Materials Processing Grants ($3B) • Battery Manufacturing and Recycling Grants ($3B) • Critical Material Innovation, Efficiency, and Alternatives R&D ($600M) • Battery and Critical Mineral Recycling R&D ($125M)

See ***Appendix A: New Federal Investments and Programs*** for more detail.

Learning from international approaches

As industry's direct GHG emissions are responsible for 24 percent of emissions globally, industrial decarbonization is one of the leading priorities of countries all over the world to reach climate goals.[274] Although the barriers to industrial decarbonization vary by the economic status, intensity of industry, energy mix, available trained workforce, and political climate of different countries and regions, states can learn from international approaches taken to address industrial emissions.

Several countries are leveraging innovative, cross-cutting policy approaches both within their own borders and in collaboration with other countries and the private sector. Leading countries in addressing emissions reductions across all sectors—including Canada, the UK, the EU, and Japan—are also in the process of developing industrial decarbonization guides. The guides identify the decarbonization challenges that need to be addressed, as well as timelines, coordination goals, sector targets, and

establish funding and budget programs for R&D. Some common approaches include innovation funds, grant funding, tax incentives, regulatory reform (including standardization), legislative support, data infrastructure, and transparency.[275, 276, 277] Specific examples include Manitoba's Sustainable Development and the Expert Advisory Commission, which considers best steps towards developing decarbonization plans for individual sectors, and action 4.6 in the UK's *Industrial Decarbonization Strategy,* which outlines how to engage the cement industry to decarbonize sites at dispersed locations. These international approaches are summarized in ***Table 6***.

In terms of plans for specific industrial sectors, examples include the EU's *New Industrial Strategy* and its plans to decarbonize steel, chemicals, and textiles, while Canada is developing a roadmap to net-zero carbon concrete, and Manitoba and Ontario have developed province-based initiatives towards reducing food waste.

Table 6: International policy approaches to enable industrial decarbonization. Click examples in the table to view more information.

Policy Approach	International Policy Examples
Planning & Governance	• UK's Industrial Decarbonization Strategy • EU's New Industrial Strategy • Japan's National-level Carbon Neutral Society Framework • EU's Circular Economy Action Plan
RDD&D	• UK's Industrial Decarbonization Challenges • UK's Industrial Decarbonization Research and Innovation Centre
Finance and Incentives	• Japan's Guidelines for Climate Transition Finance • Alberta's Sector-Specific Industrial Energy Efficiency Grant Program
Standards	• Alberta's Technology Innovation and Emissions Reduction Regulation • Ontario's Emissions Performance Standards • Manitoba's Carbon Pricing for Large Emitters
Supporting Policies	• UK's Industrial Clusters Mission • EU's Industrial Cluster • EU's Observatory for Clusters and Industrial Change • EU's Strategy for Smart Sector Integration • Canada's Buy Clean • EU Structural and Investment Funds • EU's Territorial Just Transition Plans • EU's Skills Agenda for Europe

There have been many international strategies toward decarbonization with crosscutting approaches. The clusters approach is one that is being employed by both the EU and the UK. For example, the UK's plan includes up to £170 million, matched by £261 million from industry, to invest in developing technologies such as carbon capture and storage and hydrogen fuel switching and to deploy and scale up these technologies within the UK's largest industrial clusters.[278] The EU's European Industrial Cluster aims to generate joint actions for collaboration on industrial modernization and Industry 4.0 to foster

sustainability and emissions reductions.[279] The EU has also established several financing programs such as public-private partnerships for energy (EU PPP-e 2020),[280] the European Clusters Alliance,[281] the European Observatory for Clusters and Industrial Change (EU Clusters 2020),[282] and the EU Innovation Fund.[283]

Other crosscutting strategies of industrial decarbonization include demand-side approaches (e.g., Canada's Buy Clean), performance standards (e.g., Ontario's Emission Performance Standards), support for R&D (e.g., the UK's Industrial Decarbonization Research and Innovation Center), and workforce development (e.g., the EU's Skills Agenda for Europe).

Sufficient capital to accommodate low-carbon transitions is one of the most significant barriers for industrials in pursuing decarbonization at every level. To overcome this barrier, some international strategies include loan guarantees (e.g., Alberta's Climate Change Innovation and Technology Framework, which provides $400 million worth of backstopped financing for qualified companies that are investing in industrial efficiency).[284] Other strategies include emissions reduction funds (e.g., the Ontario Carbon Trust) and carbon pricing (e.g., the Manitoba output-based carbon pricing system for large emitters). Countries have also implemented strategies including rebates and tax credits to incentivize improved energy efficiency and emissions savings. One example of this is in Germany, where since 2012 large energy users are eligible to apply for a 90 percent reduction in energy taxes if they prove that they have implemented a high standard of energy management system.[285]

REFERENCES

[1] Intergovernmental Panel on Climate Change, *Climate Change 2022: Mitigation of Climate Change | Summary for Policymakers*, 2022, https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf.
[2] U.S. Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020*, 2022, https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020.
[3] Ben King et al., *Taking Stock 2022: US Greenhouse Gas Emissions Outlook in an Uncertain World*, Rhodium Group, July 14, 2022, https://rhg.com/research/taking-stock-2022/.
[4] U.S. Energy Information Administration (EIA), "Energy Use in Industry," accessed September 8, 2022, https://www.eia.gov/energyexplained/use-of-energy/industry.php.
[5] U.S. EIA, "Six subsectors account for nearly 90% of manufacturing energy consumption," April 19, 2021, https://www.eia.gov/todayinenergy/detail.php?id=47596.
[6] U.S. Department of Energy (DOE), *Manufacturing Energy and Carbon Footprints (2018 MECS)*, 2021, https://www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2018-mecs.
[7] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022, https://www.energy.gov/eere/doe-industrial-decarbonization-roadmap.
[8] Intergovernmental Panel on Climate Change, "The evidence is clear: the time for action is now. We can halve emissions by 2030," [Press Release] April 4, 2022, https://www.ipcc.ch/report/ar6/wg3/resources/press/press-release.
[9] Intergovernmental Panel on Climate Change, *Climate Change 2022*, 2022.
[10] U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, 2022.
[11] U.S. EPA, "Greenhouse Gas Inventory Data Explorer," accessed September 8, 2022, https://cfpub.epa.gov/ghgdata/inventoryexplorer/index.html - allsectors/allsectors/allgas/econsect/all.
[12] U.S. EPA, "Greenhouse Gas Inventory Data Explorer," accessed September 8, 2022.
[13] U.S. EPA, "Sources of Greenhouse Gas Emissions: Industry Sector Emissions," accessed September 8, 2022, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions - industry.
[14] U.S. EIA, "Energy Use in Industry," accessed September 8, 2022, https://www.eia.gov/energyexplained/use-of-energy/industry.php.
[15] U.S. EIA, "Six subsectors account for nearly 90% of manufacturing energy consumption," 2021.
[16] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS)*, 2021.
[17] King, *Taking Stock 2022*, 2022.
[18] Andrew Reamer, "Industrial Decarbonization Priorities – DOE Seeks Information (by 2/28)," American Economic Association, January 28, 2022, https://www.aeaweb.org/forum/2335/industrial-decarbonization-priorities-seeks-information.
[19] United States Climate Alliance, accessed September 8, 2022, http://www.usclimatealliance.org/.
[20] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022.
[21] The White House Statements and Releases, "Fact Sheet: Biden-Harris Administration Rallies States, Cities, and Companies to Boost Clean American Manufacturing," [Press release] October 20, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/10/20/fact-sheet-biden-harris-administration-rallies-states-cities-and-companies-to-boost-clean-american-manufacturing/.
[22] International Energy Agency (IEA) et al., *Technology Roadmap: Energy and GHG Reductions in the Chemical Industry via Catalytic Processes*, 2013, https://www.iea.org/reports/technology-roadmap-energy-and-ghg-reductions-in-the-chemical-industry-via-catalytic-processes.
[23] Simon Moser and Horst Steinmüller, "RDI Roadmaps on Industrial Decarbonization," European Council for an Energy Efficient Economy, June 13, 2018, https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2018/1-policies-and-programmes-to-drive-transformation/rdi-roadmaps-on-industrial-decarbonization/.

[24] Manfred Fischedick et al., "Chapter 10: Industry," in *AR5 Climate Change 2014: Mitigation of Climate Change*, Working Group III, Intergovernmental Panel on Climate Change, 2014, https://www.ipcc.ch/report/ar5/wg3/.
[25] Eric Larson et al., *Net-Zero America: Potential Pathways, Infrastructure, and Impacts*, Princeton University, December 15, 2020, https://environmenthalfcentury.princeton.edu/sites/g/files/toruqf331/files/2020-12/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf.
[26] Sarang D. Supekar and Steven J. Skerlos, "Market-Driven Emissions from Recovery of Carbon Dioxide Gas," *Environmental Science & Technology* 48, no. 24 (November 20, 2014): 14615–23, https://doi.org/10/f6t656.
[27] James Williams et al., "The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity," *Science* 335, no. 6064 (November 24, 2011): 53-59, http://www.sciencemag.org/content/335/6064/53.abstract.
[28] The National Academies of Sciences, Engineering, Medicine, "Industrial Efficiency," accessed September 8, 2022, http://needtoknow.nas.edu/energy/energy-efficiency/industrial-efficiency/.
[29] Takahiro Oki and Hugo Salamanca, "Driving Energy Efficiency in Heavy Industries: Global energy efficiency benchmarking in cement, iron & steel," IEA (International Energy Agency), March 17, 2021, https://www.iea.org/articles/driving-energy-efficiency-in-heavy-industries.
[30] U.S. Department of Energy (DOE), *Better Plants Progress Update Report: A Year of Innovation and Industrial Leadership*, 2020, https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/2020%20Better%20Plants%20Progress%20Update%20-%20FINAL.pdf.
[31] U.S. DOE, "Advanced Manufacturing: Waste Heat Resource Recovery Page," January 24, 2017, https://www.energy.gov/eere/amo/articles/waste-heat-recovery-resource-page.
[32] Amelia Elson, Rick Tidball, and Anne Hampson, *Waste Heat to Power Market Assessment*, ICF International, March 2015, https://info.ornl.gov/sites/publications/files/Pub52953.pdf.
[33] U.S. DOE, How Much Energy is a Gigawatt, 2022, https://www.energy.gov/eere/articles/how-much-power-1-gigawatt.
[34] U.S. DOE, "Advanced Manufacturing: Waste Heat Resource Recovery Page," accessed September 8, 2022, https://www.energy.gov/eere/amo/articles/waste-heat-recovery-resource-page.
[35] IEA, *Material Efficiency in Clean Energy Transitions*, 2019, https://www.iea.org/reports/material-efficiency-in-clean-energy-transitions.
[36] U.S. EIA, "Energy Use in Industry," accessed September 8, 2022, https://www.eia.gov/energyexplained/use-of-energy/industry.php.
[37] Aidan Tuohy and Niall Mac Dowell, *Increasing Electric Power System Flexibility: The Role of Industrial Electrification and Green Hydrogen Production*, Energy Systems Integration Group, January 2022, https://www.esig.energy/wp-content/uploads/2022/01/ESIG-Industrial-Elec-Hydrogen-report-2022.pdf.
[38] Ali Hasanbeigi et al., *Electrifying U.S. Industry: A Technology- and Process-Based Approach to Decarbonization*, Global Efficiency Intelligence, January 2021, https://www.globalefficiencyintel.com/electrifying-us-industry.
[39] E. Worrell, "Industrial Energy Use, Status and Trends," *Encyclopedia of the Anthropocene* 1 (November 29, 2017): 421-430, https://www.sciencedirect.com/science/article/pii/B9780128096659090455?via%3Dihub.
[40] Chris Battaile et al., "A review of technology and policy deep decarbonization pathway options for making energy-intensive industry production consistent with the Paris Agreement," *Journal of Cleaner Production* 187 (June 20, 2018): 960-973, https://www.sciencedirect.com/science/article/abs/pii/S0959652618307686?via%3Dihub.
[41] Mariësse van Sluisveld et al., *EU decarbonisation scenarios for industry*, ReInvent PROJECT NR 730053, July 4, 2018, https://static1.squarespace.com/static/59f0cb986957da5faf64971e/t/5b3fdf266d2a73e319355e0c/1530912585721/D4.2+EU+decarbonisation+scenarios+for+industry.pdf.
[42] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022.
[43] Ed Rightor, Paul Scheihing, Andrew Hoffmeister, Riyaz Papar, Industrial Heat Pumps; Electrifying Industry's Process Heat Supply, March 30, 2022, https://www.aceee.org/research-report/ie2201

[44] Tobias Naegler et al., "Quantification of the European Industrial Heat Demand by Branch and Temperature Level," *International Journal of Energy Research* 39, No. 15 (October 19, 2015): 2019–2030, https://onlinelibrary.wiley.com/doi/abs/10.1002/er.3436.
[45] Ed Rightor et al., "Industrial Heat Pumps; Electrifying Industry's Process Heat Supply", March 30, 2022.
[46] Ed Rightor et al., "Industrial Heat Pumps; Electrifying Industry's Process Heat Supply", March 30, 2022.
[47] Oliver Sartor, Chris Bataille, Decarbonizing Basic Materials in Europe: How Carbon Contracts for Differences Could Help Bring Breajkthrough Technologies to Market, IDDRI, 2019, https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Etude/201910-ST0619-CCfDs_0.pdf.
[48] Dan Starman, *Addressing the Cost of Electrification: Decarbonizing Heat for Energy Intensive Sectors*, Cornwall Insight, February 2022, https://www.cornwall-insight.com/wp-content/uploads/2022/02/Addressing-the-costs-of-electrification__final.pdf.
[49] U.S. EIA, "Energy Use in Industry," accessed September 8, 2022.
[50] Gregory P. Thiel and Addison K. Stark, "To decarbonize industry, we must decarbonize heat," *Joule* 5, Issue 3 (March 17, 2021): 531-550, https://www.sciencedirect.com/science/article/pii/S2542435120305754#bib46.
[51] Green Car Congress, "CF Industries to Build Green Ammonia Plant in Louisiana," November 6, 2020, https://www.greencarcongress.com/2020/11/20201106-cf.html.
[52] J. van de Loosdrecht and J.W. Niemantsverdriet, "Synthesis Gas Chemistry and Synthetic Fuels,"
in *Chemical Energy Storage* ed. R. Schloegl (Berlin: De Gruyter, 2013), https://www.syngaschem.com/the-chemistry/.
[53] Leigh Krietsch Boerner, "Industrial ammonia production emits more CO_2 than any other chemical-making reaction. Chemists want to change that," *Chemical & Engineering News,* June 15, 2019, https://cen.acs.org/environment/green-chemistry/Industrial-ammonia-production-emits-CO2/97/i24.
[54] National Grid, "The hydrogen colour spectrum," accessed September 8, 2022, https://www.nationalgrid.com/stories/energy-explained/hydrogen-colour-spectrum.
https://www.nationalgrid.com/stories/energy-explained/hydrogen-colour-spectrum
[55] Sara Baldwin, Dan Esposito, and Hadley Tallackson, "Assessing the Viability of Hydrogen Proposals: Considerations for State and Utility Regulators and Policymakers," Energy Innovation, 2022, https://energyinnovation.org/wp-content/uploads/2022/03/Assessing-the-Viability-of-Hydrogen-Proposals.pdf.
[56] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022.
[57] IEA, *CCUS in Clean Energy Transitions: A New Era for CCUS*, accessed September 8, 2022, https://www.iea.org/reports/ccus-in-clean-energy-transitions/a-new-era-for-ccus.
[58] Carbon Leadership Forum, "What is a Buy Clean Policy?," accessed September 8, 2022, https://carbonleadershipforum.org/what-is-a-buy-clean-policy/.
[59] BlueGreen Alliance, "Buy Clean," accessed September 8, 2022, https://www.bluegreenalliance.org/site/buy-clean/.
[60] Ali Hasanbeigi, Dinah Shi, and Navdeep Bhadbhade, *Federal Buy Clean for Cement and Steel: Policy Design and Impact on Industrial Emissions and Competitiveness*, Global Efficiency Intelligence, September 2021, https://www.globalefficiencyintel.com/federal-buy-clean-for-cement-and-steel.
[61] Tuohy, *Increasing Electric Power System Flexibility*, 2022.
[62] Tessa Weiss and Thomas Koch Blank, "Hydrogen Reality Check: We Need Hydrogen — But Not for Everything," RMI, June 27, 2022, https://rmi.org/we-need-hydrogen-but-not-for-everything/.
[63] Igor Alexeyevich Bashmakov and Lars J. Nilsson, "Chapter 11: Industry," in *Climate Change, 2022: Mitigation of Climate Change, Sixth Assessment*, Working Group III, Intergovernmental Panel on Climate Change (2022): Figure 11.13, 2022, https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter11.pdf.
[64] Tamaryn Brown et al., "Reducing CO2 Emissions from Heavy Industry: A Review of Technologies and Considerations for Policy Makers," Imperial College, Grantham Institute for Climate Change, 2012: Figure 8, https://perma.cc/6MDH-LPVZ.
[65] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022

[66] National Association of Manufacturers (NAM), "2019 United States Manufacturing Facts," accessed September 8, 2022, https://www.nam.org/state-manufacturing-data/2019-united-states-manufacturing-facts/.
[67] HB21-1266 Environmental Justice Disproportionate Impacted Community, Colorado General Assembly, 2021, http://leg.colorado.gov/bills/hb21-1266.
[68] State of Massachusetts, *Massachusetts Clean Energy and Climate Plan for 2025 and 2030*, June 30, 2022, https://www.mass.gov/doc/clean-energy-and-climate-plan-for-2025-and-2030/download.
[69] State of Maine, Governor's Office of Innovation and the Future, "Industrial Innovation Task Force," accessed September 8, 2022, https://www.maine.gov/future/initiatives/climate/climate-council/industrial-task-force.
[70] SB-596 Greenhouse gases: cement sector: net-zero emissions strategy, State of California, September 23, 2021, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB596.
[71] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, February 2022, https://gov.louisiana.gov/assets/docs/CCI-Task-force/CAP/Climate_Action_Plan_FINAL_3.pdf.
[72] Michigan Department of Environment, Great Lakes, and Energy, *MI Healthy Climate Plan*, April 2022, https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Offices/OCE/MI-Healthy-Climate-Plan.pdf.
[73] State of Washington, "E. Industrial Transformation and Workforce Development," in *Washington 2021 State Energy Strategy* (2021): 84-113, https://www.commerce.wa.gov/wp-content/uploads/2021/01/WA_2021SES_Chapter-E-Industry.pdf.
[74] Wisconsin Office of Sustainability and Clean Energy, Great Plains Institute, and Slipstream, *State of Wisconsin Clean Energy Plan*, April 2022, https://osce.wi.gov/Documents/SOW-CleanEnergyPlan2022.pdf.
[75] California Air Resources Board, *Draft 22 Scoping Plan Update*, May 10, 2022, https://ww2.arb.ca.gov/sites/default/files/2022-05/2022-draft-sp.pdf.
[76] State of Minnesota, *Minnesota's Climate Action Framework [Draft]*, January 2021, https://climate.state.mn.us/sites/climate-action/files/2022-01/Climate Action Framework Draft_2.pdf.
[77] State of New York, *New York State Climate Action Council Draft Scoping Plan*, December 30, 2021, https://climate.ny.gov/-/media/Project/Climate/Files/Draft-Scoping-Plan.pdf.
[78] State of Michigan, Department of Environment, Great Lakes, and Energy, *Council on Climate Solutions: Workgroup Recommendations*, October 2021, https://www.michigan.gov/egle/about/Groups/Council-on-Climate-Solutions/Workgroup-Recommendations.
[79] State of Maine, "Industrial Innovation Task Force," accessed September 8, 2022.
[80] SB 5910 - 2021-22: Accelerating the availability and use of renewable hydrogen in Washington state, Washington State Legislature, June 9, 2022, https://app.leg.wa.gov/billsummary?BillNumber=5910&Year=2021&Initiative=false - documentSection.
[81] Bill Status of SB3613: Hydrogen Economy Task Force, Illinois General Assembly, June 10, 2022, https://ilga.gov/legislation/billstatus.asp?DocNum=3613&GAID=16&GA=102&DocTypeID=SB&LegID=138580&SessionID=110&SpecSess=.
[82] State of Colorado Energy Office, *Opportunities for Low-Carbon Hydrogen in Colorado: A Roadmap*, October 2021, https://drive.google.com/file/d/1wV2Xq1COF0BY77X_OSvkNSMKgPNeMfcU/view.
[83] State of New Mexico Economic Development Department et al., *Defining and Envisioning a Clean Hydrogen Hub for New Mexico*, January 2022, https://www.env.nm.gov/wp-content/uploads/2022/01/Defining-and-Envisioning-a-Clean-Hydrogen-Hub-for-NM.pdf.
[84] Oregon Department of Energy, "Renewable Hydrogen Study," accessed September 8, 2022, https://www.oregon.gov/energy/energy-oregon/Pages/rh2.aspx.
[85] State of Colorado, *Carbon Capture, Utilization, and Storage (CCUS) Task Force Subcommittee Recommendations*, February 2022, https://www.mines.edu/carboncapture/wp-content/uploads/sites/365/2022/02/Task-Force-Recommendations-Final.pdf.
[86] Carbon Leadership Forum, "Policy Resource: Buy Clean Buy Fair Washington Pilot Study," accessed September 8, 2022, https://carbonleadershipforum.org/bcbf-project/.
[87] HF 6: A bill for an act relating to commerce; establishing a biennial budget for Department of Commerce,

Public Utilities Commission, and energy activities; Minnesota Legislature, June 26, 2021, https://www.revisor.mn.gov/bills/text.php?number=HF6&type=bill&version=1&session=ls92&session_year=2021&session_number=1.
[88] Energy Policy Solutions, "Research and Development Support," accessed September 8, 2022, https://energypolicy.solutions/energy-policy-design/research-and-development/.
[89] Jeffrey Rissman et al., "Technologies and policies to decarbonize global industry: Review and assessment of mitigation drivers through 2070," *Applied Energy* 266 (May 15, 2020): 114848, https://www.sciencedirect.com/science/article/pii/S0306261920303603?via%3Dihub#s0155.
[90] California Energy Commission, "California's Clean Energy Research Program Funds $1 Billion of Innovative Projects, Attracts $7.8 Billion in Private Investment," [Press release] May 19, 2022, https://www.energy.ca.gov/news/2022-05/californias-clean-energy-research-program-funds-1-billion-innovative-projects?utm_medium=email&utm_source=govdelivery.
[91] Maine Technology Institute, "The Maine Clean Energy Innovation Challenge," accessed September 8, 2022, https://www.mainetechnology.org/mti-impact/the-maine-clean-energy-innovation-challenge/.
[92] Massachusetts Clean Energy Center, "InnovateMass," accessed September 8, 2022, https://www.masscec.com/program/innovatemass.
[93] Massachusetts Clean Energy Center, "IncubateMass," accessed September 8, 2022, https://www.masscec.com/program/incubatemass.
[94] Lawrence Technological University, "EGLE awards Centrepolis Accelerator $1.55M to advance cleantech, sustainability," [News release] July 26, 2021, https://www.ltu.edu/news/?_from=/entrepreneurship/index.asp&_opt=detail&_cid=3aea92d0-b56a-434b-b893-a1f55e57fb95.
[95] Minnesota Commerce Department, "Applied Research and Development," accessed September 8, 2022, https://mn.gov/commerce/industries/energy/utilities/cip/applied-research-development/.
[96] New York State Energy Research and Development Authority (NYSERDA), "NYSERDA Supports Business and Technology Growth Essentials," accessed September 8, 2022, https://www.nyserda.ny.gov/Partners-and-Investors/Clean-Energy-Startups/NYSERDA-Supports-Growth-Essentials.
[97] NYSERDA, "Governor Cuomo Announces $10 Million to Establish the Carbontech Development Initiative,"
," [Press release] April 7, 2021, https://www.nyserda.ny.gov/About/Newsroom/2021-Announcements/2021-04-07-Governor-Cuomo-Announces-10-Million-to-Establish-the-Carbontech-Development-Initiative.
[98] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022.
[99] New York State, "Climate Action Council Draft Scoping Plan," accessed September 8, 2022, https://climate.ny.gov/-/media/Project/Climate/Files/Draft-Scoping-Plan.pdf.
[100] Nadher Sobhani, *Decarbonizing the U.S. Industrial Sector: Regional, economic, and technical realities*, Niskenan Center, 2021, https://www.niskanencenter.org/wp-content/uploads/2021/04/Sobhani-Decarbonizing-the-Industrial-Sector.pdf.
[101] Rissman, "Technologies and policies to decarbonize global industry," 2020.
[102] California Air Resources Board, "Cap-and-Trade Program," accessed September 8, 2022, https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/about.
[103] State of Washington Department of Ecology, "Climate Commitment Act (CCA)," accessed September 8, 2022, https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/Climate-Commitment-Act.
[104] The Regional Greenhouse Gas Initiative, an Initiative of Eastern States of the US, "Welcome," accessed September 8, 2022, https://www.rggi.org/?msclkid=365364a3afa211ecb13c7f1d3910c9d4.
[105] State of Oregon, "Climate Protection Program," accessed September 8, 2022, https://www.oregon.gov/deq/ghgp/cpp/Pages/default.aspx.
[106] The World Bank, "Carbon Pricing Dashboard," accessed September 8, 2022, https://carbonpricingdashboard.worldbank.org/map_data.
[107] Hawai'i State Energy Office, *Carbon Pricing Assessment for Hawai'i: Economic and Greenhouse Gas Impacts*, April 23, 2021, https://energy.hawaii.gov/wp-content/uploads/2021/04/HawaiiCarbonPricingStudy_Final_Apr2021.pdf.

[108] RGGI (Regional Greenhouse Gas Initiative), *The Investment of RGGI Proceeds in 2019,* 2021, https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2019.pdf.
[109] NYSERDA, "Regional Greenhouse Gas Initiative (RGGI) Reports," accessed September 8, 2022, https://www.nyserda.ny.gov/About/Publications/Program-Planning-Status-and-Evaluation-Reports/RGGI-Reports.
[110] California Climate Investments, "Food Production Investment Program," accessed November 4, 2022, https://www.caclimateinvestments.ca.gov/fpip.
[111] New Jersey Department of Environmental Protection, New Jersey Board of Public Utilities, and New Jersey Economic Development Authority, *Regional Greenhouse Gas Initiative Strategic Funding Plan: Years 2020 through 2022,* accessed April 22, 2022, https://www.nj.gov/rggi/docs/rggi-strategic-funding-plan.pdf.
[112] Center for Climate and Energy Solutions, "Carbon Border Adjustments," accessed September 8, 2022, https://www.c2es.org/content/carbon-border-adjustments/.
[113] State of Washington Department of Ecology, "Emissions Intensive Trade Exposed industries (EITEs)," accessed September 8, 2022, https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/Climate-Commitment-Act/Emissions-Intensive-Trade-Exposed-industries#:~:text=EITE%20facilities%20are%20core%20industries,global%20competition%20for%20their%20products.
[114] W. Acworth et al., *Carbon Leakage and Deep Decarbonization*, International Carbon Action Partnership, October 2020, https://icapcarbonaction.com/system/files/document/icap_carbonleakagedeepdecarbonization_fullreport.pdf.
[115] Erin Campbell, Anne McDarris, and William Pizer, *Border Carbon Adjustments 101*, Resources for the Future, November 10, 2021, https://www.rff.org/publications/explainers/border-carbon-adjustments-101/.
[116] Chris Kardish et al., *Carbon Border Adjustments: Considerations for Policymakers*, Center for Climate and Energy Solutions, June 2022, https://www.c2es.org/wp-content/uploads/2022/06/carbon-border-adjustments-considerations-for-policymakers.pdf
[117] Darien Shanske, "State-Level Carbon Taxes and the Dormant Commerce Clause: Can Formulary Apportionment Save the World?" *Chapman Law Review* 18, September 27, 2014, https://www.chapman.edu/law/_files/publications/CLR-18-darien-shanske.pdf.
[118] David Gamage and Darien Shanske, "Why a State-Level Carbon Tax Can Include Border Adjustments," in *Articles by Maurer Faculty* (2017): 2549, https://www.repository.law.indiana.edu/cgi/viewcontent.cgi?article=3549&context=facpub#:~:text=Border%20tax%20adjustments%20are%20crucial,intensive%20products%20such%20as%20concrete.
[119] Energy Policy Solutions, "Economic Signals," accessed September 8, 2022, https://energypolicy.solutions/energy-policy-design/economic-signals/.
[120] State of Massachusetts, Department of Energy Resources, "Rebates/Incentives for your business or institution," accessed September 8, 2022, https://www.mass.gov/guides/massachusetts-energy-rebates-incentives - -rebates/incentives-for-your-business-or-institution-.
[121] New Jersey's Clean Energy Program, "Large Energy Users," accessed September 8, 2022, https://www.njcleanenergy.com/leup.
[122] Focus on Energy, Wisconsin, "Large Energy Users," accessed September 8, 2022, https://dev.focusonenergy.com/business/large-energy-users.
[123] NYSERDA, "On-site Energy Manager Program," accessed September 8, 2022, https://www.nyserda.ny.gov/All-Programs/On-Site-Energy-Manager.
[124] California Climate Investments, "Food Production Investment Program," accessed September 8, 2022, https://www.caclimateinvestments.ca.gov/fpip.
[125] Colorado Energy Office, "Clean Air Program (CAP) Grants," accessed September 8, 2022.
[126] State of Delaware, Department of Natural Resources and Environmental Control (DNREC), "E2I: Energy Efficiency Industrial," accessed September 8, 2022, https://dnrec.alpha.delaware.gov/climate-coastal-energy/efficiency/industrial/.

[127] Maryland Energy Administration, "FY22 Commercial, Industrial & Agricultural Grant Program," accessed September 8, 2022, https://energy.maryland.gov/business/Pages/incentives/empowermdcigp.aspx.
[128] Efficiency Maine, "Commercial and Industrial (C&I) Custom Program," accessed September 8, 2022, https://www.efficiencymaine.com/at-work/commercial-industrial-custom-program/.
[129] Mississippi Office of Energy, "Natural resources in Mississippi," accessed September 8, 2022, https://mississippi.org/community-resources/office-energy/.
[130] NYSERDA, "Commercial & Industrial (C&I) Carbon Challenge," accessed September 8, 2022, https://www.nyserda.ny.gov/All-Programs/CI-Carbon-Challenge.
[131] Minnesota Commerce Department, "Conservation Improvement Program," accessed September 8, 2022, https://mn.gov/commerce/industries/energy/utilities/cip/.
[132] Energy Trust of Oregon, "Industry," accessed September 8, 2022, https://www.energytrust.org/programs/industry/.
[133] State of Delaware DNREC, "Energy Efficiency Investment Fund," accessed September 8, 2022, https://dnrec.alpha.delaware.gov/climate-coastal-energy/efficiency/energy-efficiency-investment-fund/.
[134] Minnesota Commerce Department, "Financial Assistance," accessed September 8, 2022, https://mn.gov/commerce/industries/energy/financial-assistance/.
[135] Tennessee Department of Environment and Conservation, "Energy Efficiency and Renewable Energy Loan Program," accessed September 8, 2022, https://www.tn.gov/environment/program-areas/energy/state-energy-office--seo-/programs-projects/programs-and-projects/clean-energy-financing/clean-energy-financing/energy-efficiency-and-renewable-energy-loan-program.html. https://www.tn.gov/environment/program-areas/energy/state-energy-office--seo-/programs-projects/programs-and-projects/clean-energy-financing/clean-energy-financing/energy-efficiency-and-renewable-energy-loan-program.html
[136] New York State Solar Program, "Commercial Solar Incentives and Financing," accessed September 8, 2022, https://www.nyserda.ny.gov/All-Programs/NY-Sun/Solar-for-Your-Business/Financial-Support/Incentives-and-Financing.
[137] New Hampshire Public Utilities Commission, "Commercial & Industrial (C&I) Solar Incentive Program," accessed September 8, 2022, https://www.puc.nh.gov/Sustainable Energy/RenewableEnergyRebates-CI.html.
[138] Efficiency Maine, "Commercial and Industrial (C&I) Custom Program," accessed September 8, 2022, https://www.efficiencymaine.com/at-work/commercial-industrial-custom-program/.
[139] Massachusetts Department of Energy Resources, "Rebates/Incentives for your business or institution," accessed September 8, 2022, https://www.mass.gov/guides/massachusetts-energy-rebates-incentives - -rebates/incentives-for-your-business-or-institution-.
[140] MN Commerce Department, "Financial Assistance," accessed September 8, 2022.
[141] Colorado Energy Office, "Clean Air Program (CAP) Grants," accessed September 8, 2022, https://energyoffice.colorado.gov/clean-energy-programs/industrial-decarbonization-resources/clean-air-program-cap-grants.
[142] NYSERDA, "Commercial & Industrial (C&I) Carbon Challenge," accessed September 8, 2022.
[143] SB 5910 - 2021-22, Washington State Legislature, 2022.
[144] Colorado Energy Office, "Clean Air Program (CAP) Grants," accessed September 8, 2022.
[145] NYSERDA "Commercial & Industrial (C&I) Carbon Challenge," accessed September 8, 2022.
[146] Colorado Energy Office, "Clean Air Program (CAP) Grants," accessed September 8, 2022.
[147] NYSERDA "Commercial & Industrial (C&I) Carbon Challenge," accessed September 8, 2022
[148] Bill S3091 ScaScaSa (3R), New Jersey Legislature, November 8, 2021, https://www.njleg.state.nj.us/bill-search/2020/S3091.
[149] SB22-051: Policies To Reduce Emissions From Built Environment, Colorado General Assembly, 2022, http://leg.colorado.gov/bills/SB22-051.
[150] HB 4139: Relating to reductions of greenhouse gas emissions in the state's transportation system; and prescribing an effective date, Oregon State Legislature, 2022, https://olis.oregonlegislature.gov/liz/2022R1/Measures/Overview/HB4139.
[151] Rightor, E, Srinivasan, P., Elliott, RN., *Reimagining Program Design at DOE to Accelerate Transformative Industrial Technology Development at Scale*, White Paper, ACEEE, April 2022, https://www.aceee.org/white-paper/2022/04/reimagining-program-design-doe

[152] Delaware Sustainable Energy Authority (DESEU), "Energize Delaware," accessed September 8, 2022, https://www.energizedelaware.org/energize-delaware/deseu/.
[153] American Green Bank Consortium (AGBC) and Coalition for Green Capital (CGC). *Green Banks in the United States: 2021 U.S. Green Bank Annual Industry Report*, May 2021, https://greenbankconsortium.org/annual-industry-report.
[154] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[155] Michigan Department of Environment, Great Lakes, and Energy, *MI Healthy Climate Plan*, 2022.
[156] State of Washington, "E. Industrial Transformation and Workforce Development," 2021.
[157] National Association of State Energy Officials (NASEO), *Carbon Capture, Utilization, and Storage: Overview and Considerations for State Planning*, accessed September 8, 2022, https://naseo.org/data/sites/1/documents/publications/CCUS Report Final.pdf.
[158] Regional Carbon Capture Deployment Initiative, *Policy Approaches & Best Practices: State-Level Action to Support Economywide Deployment of Carbon Capture,* accessed September 8, 2022, https://carboncaptureready.betterenergy.org/wp-content/uploads/2020/03/Carbon-Capture-Ready-Best-Practices.pdf.
[159] Matt Bright, "The Inflation Reduction Act creates a whole new market for carbon capture," Clean Air Task Force, August 22, 2022, https://www.catf.us/2022/08/the-inflation-reduction-act-creates-a-whole-new-market-for-carbon-capture/.
[160] Carbon Leadership Forum, "Guidance on Embodied Carbon Disclosure," accessed September 8, 2022, https://carbonleadershipforum.org/guidance-on-embodied-carbon-disclosure/.
[161] John Milko, *We Can't Cut What We Can't Count: Using Environmental Product Declarations to Measure and Reduce Embodied Carbon*, Third Way, October 15, 2021, https://www.thirdway.org/report/we-cant-cut-what-we-cant-count-using-environmental-product-declarations-to-measure-and-reduce-embodied-carbon.
[162] State of Washington, "E. Industrial Transformation and Workforce Development," 2021.
[163] Energy Policy Solutions, "Performance Standards," accessed September 8, 2022, https://energypolicy.solutions/energy-policy-design/performance-standards/.
[164] Rissman, "Technologies and policies to decarbonize global industry," 2020: 6.3.
[165] U.S. EPA, "Air Quality - National Summary," accessed September 8, 2022, https://www.epa.gov/air-trends/air-quality-national-summary.
[166] U.S. DOE, "New Study: Renewable Energy for State Renewable Portfolio Standards Yield Sizable Benefits," [Press release] January 7, 2016, https://www.energy.gov/eere/articles/new-study-renewable-energy-state-renewable-portfolio-standards-yield-sizable-benefits.
[167] Alan Krupnick, *Federal Climate Policy 105: The Industrial Sector*, Resources for the Future, March 31, 2021, https://www.rff.org/publications/explainers/federal-climate-policy-105-the-industrial-sector/.
[168] Krupnick, *Federal Climate Policy 105*, 2021.
[169] Rissman, "Technologies and policies to decarbonize global industry," 2020.
[170] Colorado Department of Public Health and Environment, "Greenhouse Gas Emissions and Energy Management for Manufacturing in Colorado," accessed September 8, 2022, https://cdphe.colorado.gov/greenhouse-gas-emissions-and-energy-management-for-manufacturing-in-colorado.
[171] State of Oregon, "Climate Protection Program," accessed September 8, 2022, https://www.oregon.gov/deq/ghgp/cpp/Pages/default.aspx.
[172] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[173] Massachusetts Department of Environmental Protection, "Waste Ban Regulations & Policies," accessed September 8, 2022, https://www.mass.gov/guides/massdep-waste-disposal-bans#-waste-ban-regulations-&-policies-.
[174] House Bill 1541: An Act To Support and Improve Municipal Recycling Programs and Save Taxpayer Money, State of Maine, July 2, 2021, https://legiscan.com/ME/bill/LD1541/2021.
[175] Allyn Stern and Nicole Waxman, "Maine Becomes First State to Sign Extended Producer Responsibility Law for Packaging, Other States with Plastics and Packaging Bills May Follow Shortly," *National Law Review* XII, No. 251 (July 14, 2021), https://www.natlawreview.com/article/maine-becomes-first-state-to-sign-extended-producer-responsibility-law-packaging.
[176] SB 582: Relating to modernizing Oregon's recycling system, Oregon State Legislature, accessed September 8, 2022, https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/SB582.

[177] SB-54 Solid waste: reporting, packaging, and plastic food service ware, California State Legislature, June 30, 2022, https://leginfo.legislature.ca.gov/faces/billHistoryClient.xhtml?bill_id=202120220SB54.
[178] Stern, "Maine Becomes First State to Sign Extended Producer Responsibility Law for Packaging," 2021.
[179] California Air Resources Board, "Low Carbon Fuel Standard," accessed September 8, 2022, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about.
[180] State of Oregon, "Oregon Clean Fuels Program," accessed September 8, 2022, https://www.oregon.gov/deq/ghgp/cfp/Pages/default.aspx.
[181] State of Washington, Department of Ecology, "Clean Fuel Standard," accessed September 8, 2022, https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/Clean-Fuel-Standard.
[182] Peter Connors et al., *Review of Federal, State, and Regional Tax Strategies and Opportunities for CO2-EOR-Storage and the CCUS Value Chain*, for U.S. DOE, September 21, 2020, https://www.fticonsulting.com/~/media/Files/us-files/insights/reports/2020/sep/carbon-capture-utilization-storage.pdf.
[183] Regional Carbon Capture Deployment Initiative, *Policy Approaches & Best Practices*, 2022.
[184] NASEO, *Carbon Capture, Utilization, and Storage*, accessed September 8, 2022.
[185] House Bill 4491, West Virginia Legislature, March 1, 2022, http://www.wvlegislature.gov/Bill_Status/bills_text.cfm?billdoc=HB4491%20SUB%20ENR.htm&yr=2022&sesstype=RS&i=4491.
[186] State of California, "Carbon Capture and Sequestration Protocol Under the Low Carbon Fuel Standard," accessed September 8, 2022, https://ww2.arb.ca.gov/resources/documents/carbon-capture-and-sequestration-protocol-under-low-carbon-fuel-standard.
[187] State of California, "Buy Clean California Act," accessed September 8, 2022, https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act.
[188] HB21-1303: Global Warming Potential For Public Project Materials, Colorado General Assembly, July 6, 2021, https://leg.colorado.gov/bills/HB21-1303.
[189] Rissman, "Technologies and policies to decarbonize global industry," 2020.
[190] House Select Committee on the Climate Crisis, *Solving the Climate Crisis: The Congressional Action Plan for a Clean Energy Economy and a Healthy, Resilient, and Just America*, June 2020, https://climatecrisis.house.gov/sites/climatecrisis.house.gov/files/Climate Crisis Action Plan.pdf.
[191] State of Massachusetts, "Baker-Polito Administration Releases Final 2030 Solid Waste Master Plan," [Press release], October 18, 2021, https://www.mass.gov/news/baker-polito-administration-releases-final-2030-solid-waste-master-plan.
[192] Renewable Thermal Collaborative, *Low-Carbon Renewable Thermal Technology Solutions: Policies to Support Development and Deployment*, February 2021, https://www.renewablethermal.org/wp-content/uploads/2018/06/Low-Carbon-Renewable-Thermal-Technology-Solutions-3.1.21.pdf.
[193] House Select Committee on the Climate Crisis, *Solving the Climate Crisis*, 2020.
[194] New Hampshire Public Utilities Commission, "Class I Thermal Renewable Energy Certificate Program," accessed September 8, 2022, https://www.puc.nh.gov/Sustainable Energy/Class I Thermal Renewable Energy.html.
[195] State of Massachusetts, "APS Renewable Thermal Statement of Qualification Application," accessed September 8, 2022, https://www.mass.gov/guides/aps-renewable-thermal-statement-of-qualification-application.
[196] Wisconsin Office of Sustainability and Clean Energy, *State of Wisconsin Clean Energy Plan*, 2022.
[197] Anne Austin et al., "State-Level Permitting Primacy May Boost Carbon Capture and Storage," Pillsbury, August 11, 2021, https://www.pillsburylaw.com/en/news-and-insights/state-level-permitting-primacy-carbon-capture-and-storage.html.
[198] U.S. EPA, "Class VI - Wells used for Geologic Sequestration of Carbon Dioxide," accessed September 8, 2022, https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-carbon-dioxide.
[199] Austin, "State-Level Permitting Primacy May Boost Carbon Capture and Storage," 2021.

[200] U.S. EPA, "Underground Injection Control Primacy Status for States, Territories, and Tribes," accessed September 8, 2022, https://www.epa.gov/uic/underground-injection-control-primacy-status-states-territories-and-tribes.
[201] Ruth Ivory-Moore, *Pore Space Rights – U.S. Overview*, Global CCS Institute, May 2022, https://www.globalccsinstitute.com/wp-content/uploads/2022/05/Brief-Pore-Space-Rights-5.25.pdf.
[202] Breakthrough Energy, *U.S. Federal Manufacturing Policies from the Climate Policy Playbook*, February 2021, https://www.breakthroughenergy.org/~/Media/Files/BEV/Playbooks/Federal/Manufacturing/USFedManuComplete.pdf.
[203] Ben King, *Clean Products Standard: A New Approach to Industrial Decarbonization*, Rhodium Group, December 9, 2020, https://rhg.com/research/clean-products-standard-industrial-decarbonization/.
[204] World Resources Institute (WRI) *Toward a Tradable Low-Carbon Cement Standard: Policy Design Considerations for the United States*, March 25, 2021, https://www.wri.org/research/toward-tradable-low-carbon-cement-standard-policy-design-considerations-united-states.
[205] WRI, *Toward a Tradable Low-Carbon Cement Standard*, 2021.
[206] Webley Bowles et al., *Lifecycle GHG Impacts in Building Codes*, New Buildings Institute (NBI), January 2022, https://newbuildings.org/wp-content/uploads/2022/02/NBI_LI1.pdf.
[207] Bowles, *Lifecycle GHG Impacts in Building Codes*, 2022.
[208] Rissman, "Technologies and policies to decarbonize global industry," 2020.
[209] Carbon Leadership Forum (CLF), "Carbon Policy Toolkit," accessed September 8, 2022, https://carbonleadershipforum.org/clf-policy-toolkit/.
[210] Energy Policy Solutions, "Supporting Policies," accessed September 8, 2022, https://energypolicy.solutions/energy-policy-design/supporting-policies/.
[211] CLF, "What is a buy clean policy?" accessed September 8, 2022.
[212] CLF, *Buy Clean Buy Fair Washington Project Progress Report,* December 27, 2021, https://carbonleadershipforum.org/wp-content/uploads/2022/04/UW-CLF-SEEP-BCBF-Progress-Report-2021-12-27.pdf.
[213] State of California, "Buy Clean California Act," accessed September 8, 2022.
[214] HB21-1303, Colorado, 2021.
[215] Bill S3091, New Jersey, 2021.
[216] SB 542A: Relates to provisions in state procurement contracts involving the use of low embodied carbon concrete, New York State, December 22, 2021, https://www.nysenate.gov/legislation/bills/2021/S542.
[217] HB 4139, Oregon, 2022.
[218] HF 6, Minnesota, 2021.
[219] Substitute House Bill 1080, State of Washington, May 18, 2021, https://lawfilesext.leg.wa.gov/biennium/2021-22/Pdf/Bills/Session Laws/House/1080-S.SL.pdf?q=20211005131326.
[220] Climate Solutions Now Act of 2022, State of Maryland, June 1, 2022, https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/SB0528?ys=2022RS.
[221] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[222] Michigan Department of Environment, Great Lakes, and Energy, *MI Healthy Climate Plan*, 2022.
[223] Wisconsin Office of Sustainability and Clean Energy, *State of Wisconsin Clean Energy Plan*, 2022.
[224] CLF, "Carbon Policy Toolkit," accessed September 8, 2022.
[225] Milko, *We Can't Cut What We Can't Count*, 2021.
[226] U.S. Office of Energy Efficiency and Renewable Energy, "Data-Driven, Strategic Energy Management: State and Local Solution Center," accessed September 8, 2022, https://www.energy.gov/eere/slsc/data-driven-strategic-energy-management.
[227] Andrew Whitlock, Ed Rightor, and Andrew Hoffmeister, *Canadian Strategic Energy Management Market Study*, ACEEE, November 1, 2021, https://www.aceee.org/research-report/ie2102.
[228] Energy Trust of Oregon, "Industrial Strategic Energy Management," accessed September 8, 2022, https://www.energytrust.org/industry-agriculture/industry-strategic-energy-management/.
[229] Colorado Energy Office, "Industrial Strategic Energy Management," accessed September 8, 2022, https://energyoffice.colorado.gov/clean-energy-programs/industrial-strategic-energy-management.

[230] NYSERDA, "Strategic Energy Management Program," accessed September 8, 2022, https://www.nyserda.ny.gov/All-Programs/Strategic-Energy-Management.
[231] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[232] State of Washington, "E. Industrial Transformation and Workforce Development," 2021.
[233] Wisconsin Office of Sustainability and Clean Energy, *State of Wisconsin Clean Energy Plan*, 2022.
[234] NYSERDA, "Flexible Technical Assistance (Flex Tech) Program," accessed September 8, 2022, https://www.nyserda.ny.gov/All-Programs/FlexTech-Program.
[235] State of Washington, Department of Ecology, "Efficiency services for manufacturing and industrial facilities," accessed September 8, 2022, https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Toxics-reduction-assistance/Efficiency-services-for-manufacturing-industries.
[236] Efficiency Maine, "Commercial and Industrial (C&I) Custom Program," accessed September 8, 2022.
[237] Energy Trust of Oregon, "Industry," accessed September 8, 2022.
[238] Focus on Energy, Wisconsin, "Large Energy Users," accessed September 8, 2022, https://dev.focusonenergy.com/business/large-energy-users.
[239] U.S. EPA, "Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing," accessed September 8, 2022, https://www.epa.gov/greenerproducts/recommendations-specifications-standards-and-ecolabels-federal-purchasing.
[240] Energy Star, "Registry of Energy Star Certified Buildings and Plants," accessed September 8, 2022, https://www.energystar.gov/buildings/certified_buildings_and_plants.
[241] CLF, "Guidance on Embodied Carbon Disclosure," accessed September 8, 2022.
[242] Oregon Concrete and Aggregate Providers, "Oregon Concrete EPDs," accessed September 8, 2022, https://www.ocapa.net/index.php?option=com_content&view=article&id=247:oregon-concrete-epds&catid=20:site-content&Itemid=201s - epdresources.
[243] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[244] Wisconsin Office of Sustainability and Clean Energy, *State of Wisconsin Clean Energy Plan*, 2022.
[245] U.S. EPA, "Learn About the Greenhouse Gas Reporting Program (GHGRP)," accessed September 8, 2022, https://www.epa.gov/ghgreporting/learn-about-greenhouse-gas-reporting-program-ghgrp.
[246] U.S. EIA, "Manufacturing Energy Consumption Survey (MECS): 2018 MECS Survey Data 2018," accessed September 8, 2022, https://www.eia.gov/consumption/manufacturing/data/2018/ - r14.
[247] National Renewable Energy Laboratory (NREL), "2018 Industrial Energy Data Book," November 14, 2019, https://data.nrel.gov/submissions/122.
[248] California Air Resources Board, "Mandatory Greenhouse Gas Emissions Reporting," accessed September 8, 2022, https://ww2.arb.ca.gov/our-work/programs/mandatory-greenhouse-gas-emissions-reporting/about.
[249] California Air Resources Board, *Reporting Guidance for Determining Rule Applicability for California's Mandatory GHG Reporting Program*, February 1, 2019, https://www.arb.ca.gov/cc/reporting/ghg-rep/guidance/applicability-general.pdf.
[250] https://drive.google.com/file/d/18jS7Aq193ZPVb46EVZDnDEyeZBZfJ6kG/view
[251] Climate Initiatives Task Force, *Louisiana Climate Action Plan*, 2022.
[252] New York State, *Climate Action Council Draft Scoping Plan*, 2021.
[253] State of Washington, "E. Industrial Transformation and Workforce Development," 2021.
[254] Ihab Mikati et al., "Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status," *American Journal of Public Health* 108, no. 4, (March 7, 2018): 480-485, https://ajph.aphapublications.org/doi/10.2105/AJPH.2017.304297.
[255] Apte, J. S., Chambliss, S. E., Tessum, C. W., Marshall, J.D. "A Method to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California." California Air Resources Board and California Environmental Protection Agency, November 21, 2019, https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/17rd006.pdf.
[256] Lauren Zeise et al., *Impacts of Greenhouse Gas Emission Limits Within Disadvantaged Communities: Progress Towards Reducing Inequities*, California Office of Environmental Health

Hazard Assessment, February 2022, https://oehha.ca.gov/media/downloads/environmental-justice/impactsofghgpoliciesreport020322.pdf.
[257] Ed Rightor, "U.S. Can Cut Emissions by Helping Transform Industrial Clusters," ACEEE, July 15, 2021, https://www.aceee.org/blog-post/2021/07/us-can-cut-emissions-helping-transform-industrial-clusters.
[258] Mika Naumanen, European Panorama of Clusters and Industrial Change, European Union, 2019, https://single-market-economy.ec.europa.eu/industry/strategy_en
[259] Julio Friedmann, Mahak Agrawal, and Amar Bhardwaj, "Evaluating Net-Zero Industrial Hubs in the United States: A Case Study of Houston," Columbia | SIPA: Center on Global Energy Policy, June 30, 2021, https://www.energypolicy.columbia.edu/research/report/evaluating-net-zero-industrial-hubs-united-states-case-study-houston.
[260] Elizabeth Abramson, Emma Thomley, and Dane McFarlane, *An Atlas of Carbon and Hydrogen Hubs for United States Decarbonization*, Great Plains Institute, February 2022, https://scripts.betterenergy.org/CarbonCaptureReady/GPI_Carbon_and_Hydrogen_Hubs_Atlas.pdf .
[261] Friedmann, *Evaluating Net-Zero Industrial Hubs in the United States*, 2021.
[262] Port of Rotterdam, "Energy Transition: Towards a CO2 Neutral Port," accessed September 8, 2022, https://www.portofrotterdam.com/en/port-future/energy-transition.
[263] Port of Seattle, "Seattle City Light Explores Renewable Hydrogen Fuel at the Port with Department of Energy Awards," [Press release] November 9, 2021, https://www.portseattle.org/news/seattle-city-light-explores-renewable-hydrogen-fuel-port-department-energy-awards.
[264] Friedmann, *Evaluating Net-Zero Industrial Hubs in the United States*, 2021.
[265] Baton Rouge Area Chamber, "Grön Fuels' $9.2 Billion Carbon Negative Renewable Fuel Complex Achieves Major Milestone with Air Permit Approval," [Press release] April 22, 2021, wire.com/news-releases/gron-fuels-9-2-billion-carbon-negative-renewable-fuel-complex-achieves-major-milestone-with-air-permhttps://www.prnewsit-approval-301275389.html
[266] The Port of Los Angeles, "Port of Los Angeles Rolls out Hydrogen Fuel Cell Electric Freight Demonstration," [Press release] June 7, 2021, https://www.portoflosangeles.org/references/2021-news-releases/news_060721_zanzeff.
[267] Maria Gallucci, "https://www.canarymedia.com/articles/sea-transport/3 -ways -the -new -climate -law -will -help -clean -up -dirty US -us-ports," *Canary Media*, August 23, 2022, https://www.canarymedia.com/articles/sea-transport/3-ways-the-new-climate-law-will-help-clean-up-dirty-us-ports.
[268] U.S. Climate Alliance, "U.S. Climate Alliance States Commit to New High-Impact Actions to Achieve Climate Goals and Go Further, Faster, Together," [Press release] November 7, 2021, https://www.usclimatealliance.org/publications/2021/11/7/us-climate-alliance-states-commit-to-new-high-impact-actions-to-achieve-climate-goals-and-go-further-faster-together.
[269] The White House, "Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing," [News release] February 15, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/15/fact-sheet-biden-harris-administration-advances-cleaner-industrial-sector-to-reduce-emissions-and-reinvigorate-american-manufacturing/.
[270] State of New Mexico Office of the Governor, "New Mexico, coalition of mountain west states sign MOU to develop a regional clean hydrogen hub," [Press release] February 24, 2022, https://www.governor.state.nm.us/2022/02/24/new-mexico-coalition-of-mountain-west-states-sign-mou-to-develop-a-regional-clean-hydrogen-hub/.
[271] New York State, "Governor Hochul Announces Multi-State Agreement Signed with Major Hydrogen Ecosystem Partners to Propose a Regional Clean Energy Hydrogen Hub," [Press release] March 24, 2022, https://www.governor.ny.gov/news/governor-hochul-announces-multi-state-agreement-signed-major-hydrogen-ecosystem-partners.
[272] State of Louisiana Office of the Governor, "Louisiana, Oklahoma, and Arkansas Announce Hydrogen Partnership," [Press release] March 10, 2022, https://gov.louisiana.gov/index.cfm/newsroom/detail/3587.
[273] U.S. DOE Office of Policy, *The Inflation Reduction Act Drives Significant Emissions Reductions and Positions America to Reach Our Climate Goals*, August https://www.energy.gov/sites/default/files/2022, https://www.energy.gov/sites/default/files/2022-

08/8.18%20InflationReductionAct_Factsheet_Final.pdf. -
08/8.18%20InflationReductionAct_Factsheet_Final.pdf
[274] Intergovernmental Panel on Climate Change, *Climate Change 2022*, 2022.
[275] U.K. Government, *Industrial Decarbonisation Strategy*, March 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970229/Industrial_Decarbonisation_Strategy_March_2021.pdf.
[276] European Commission, *Updating the 2020 New Industrial Strategy: Building a stronger single market for Europe's recovery, European industrial strategy*, 2021, https://ec.europa.eu/info/sites/default/files/communication-industrial-strategy-update-2020_en.pdf.
[277] Japan's Ministry of Economy, Trade, and Industry (METI), "Japan's Roadmap to 'Beyond-Zero' Carbon" accessed September 8, 2022, https://www.meti.go.jp/english/policy/energy_environment/global_warming/roadmap/.
[278] U.K. Research and Innovation (UKRI), "Industrial decarbonisation challenge," accessed September 8, 2022, https://www.ukri.org/what-we-offer/our-main-funds/industrial-strategy-challenge-fund/clean-growth/industrial-decarbonisation-challenge/.
[279] EIC, "European Industrial Cluster: Connecting the European Industry," accessed September 8, 2022, https://industrialcluster.eu/en/home/.
[280] European Commission, "Public-private partnerships in energy," accessed September 8, 2022, https://ec.europa.eu/info/research-and-innovation/research-area/energy-research-and-innovation/public-private-partnerships-energy_en.
[281] European Clusters Alliance, *Industrial Clusters for an innovative and competitive Europe*, Debruary 2021, https://clustersalliance.eu/-cms/wp-content/uploads/2021/02/20200102-ECA-Position-Paper-v15.pdf.
[282] European Commission, "European Observatory for Clusters and Industrial Change," accessed September 8, 2022, https://ec.europa.eu/growth/industry/strategy/industrial-cluster-policy/observatory_en.
[283] European Commission, "What is the Innovation Fund?," accessed September 8, 2022, https://ec.europa.eu/clima/eu-action/funding-climate-action/innovation-fund/policy-development_en.
[284] Alberta Government, *Climate Change Innovation and Technology Framework 2017*, 2017, https://open.alberta.ca/dataset/59ff9a2e-da93-4f8e-8c91-e8610ad4c1d2/resource/222449d1-60d9-49d6-a47c-4086c350ea25/download/climate-change-innovation-and-technology-framework-2017.pdf
[285] David Goldstein and Peter Therkelsen, "A Structure for Incentivizing Greater Achievements in Strategic Energy Management," Natural Resources Defense Council, Lawrence Berkeley National Lab, 2017, https://www.aceee.org/files/proceedings/2017/data/polopoly_fs/1.3687931.1501159107!/fileserver/file/790291/filename/0036_0053_000022.pdf.
[286] King, *Clean Products Standard*, 2020.
[287] Washington Utilities and Transportation Commission, "Clean Energy Transformation Act," accessed September 8, 2022, https://www.utc.wa.gov/regulated-industries/utilities/energy/conservation-and-renewable-energy-overview/clean-energy-transformation-act.
[288] Ed Rightor et al., "Industrial Heat Pumps; Electrifying Industry's Process Heat Supply", March 30, 2022.
[289] Sobhani, *Decarbonizing the U.S. Industrial Sector*, 2021.
[290] Baldwin, "Assessing the Viability of Hydrogen Proposals," 2022, https://energyinnovation.org/wp-content/uploads/2022/03/Assessing-the-Viability-of-Hydrogen-Proposals.pdf.
[291] Ilissa B. Ocko and Steven P. Hamburg, "Climate consequences of hydrogen emissions," *Atmospheric Chemistry and Physics* 22, No. 14, (July 20, 2022): 9349–9368, https://acp.copernicus.org/articles/22/9349/2022/.
[292] Science-based Targets, "Ambitious Corporate Climate Action," accessed September 8, 2022, https://sciencebasedtargets.org/.
[293] Ben King et al., *Clean Products Standard: A New Approach to Industrial Decarbonization*, Rhodium Group, December 9, 2020, https://rhg.com/wp-content/uploads/2020/12/Clean-Products-Standard-A-New-Approach-to-Industrial-Decarbonization.pdf.

[294] National Association of Manufacturers (NAM), "2019 U.S. Manufacturing Facts," accessed September 8, 2022, https://www.nam.org/state-manufacturing-data/2019-united-states-manufacturing-facts/.
[295] Ernst Worrell and Gale Boyd, "Bottom-up estimates of deep decarbonization of U.S. manufacturing in 2050,", *Journal of Cleaner Production* 330 (January 1, 2022): 129758, https://www.sciencedirect.com/science/article/pii/S0959652621039342.
[296] Worrell, "Bottom-up estimates of deep decarbonization of U.S. manufacturing in 2050," 2022.
[297] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS)*, 2021, https://www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2018-mecs.
[298] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 5.2*, 2021, https://www.eia.gov/consumption/manufacturing/data/2018/pdf/Table5_2.pdf.
[299] Worrell, "Bottom-up estimates of deep decarbonization of U.S. manufacturing in 2050," 2022.
[300] Tuohy, *Increasing Electric Power System Flexibility*, 2022.
[301] U.S. Department of Homeland Security, CISA, "Chemical Sector Profile," accessed September 8, 2022, https://www.cisa.gov/sites/default/files/publications/Chemical-Sector-Profile_Final%20508.pdf.
[302] ACC, *2021 Guide to the Business of Chemistry*, August 12, 2021, https://www.americanchemistry.com/chemistry-in-america/data-industry-statistics/resources/2021-guide-to-the-business-of-chemistry.
[303] U.S. EIA, *Annual Energy Outlook 2021 with Projections to 2050*, January 29, 2020, https://www.eia.gov/outlooks/aeo/pdf/AEO2020 Full Report.pdf.
[304] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021, https://www.eia.gov/consumption/manufacturing/data/2018/pdf/Table1_2.pdf.
[305] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Chemicals*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_chemicals_energy_carbon_footprint_0.pdf.
[306] U.S. EPA, Greenhouse Gas Reporting Program (GHGRP), "GHGRP Chemicals," accessed September 8, 2022, https://www.epa.gov/ghgreporting/ghgrp-chemicals.
[307] U.S. DOE, *Manufacturing Energy and Carbon Footprint | Sector: Chemicals*, 2010, https://www.energy.gov/sites/prod/files/2018/11/f57/2010_chemicals_energy_carbon_footprint.pdf.
[308] Colin McMillan and Mark Ruth, *Industrial Process Heat Demand Characterization*, NREL, July 5, 2015, https://data.nrel.gov/submissions/91.
[309] IEA, *Technology Roadmap: Energy and GHG Reductions in the Chemical Industry via Catalytic Processes*, 2013.
[310] U.S. EPA, "Facility Level Information on GreenHouse gases Tool (FLIGHT)," accessed September 8, 2022, https://ghgdata.epa.gov/ghgp/main.do.
[311] U.S. DOE, *Industrial Decarbonization Roadmap*, 2022.
[312] Arnout De Pee, et al., *Decarbonization of Industrial Sectors: The Next Frontier*, McKinsey and Company, June 2018, https://www.mckinsey.com/~/media/mckinsey/business functions/sustainability/our insights/how industry can move toward a low carbon future/decarbonization-of-industrial-sectors-the-next-frontier.pdf.
[313] IEA, *Technology Roadmap: Energy and GHG Reductions in the Chemical Industry via Catalytic Processes*, 2013.
[314] U.K. Department for Business, Energy & Industrial Strategy Chemicals Sector, *Industrial Decarbonization and Energy Efficiency Roadmap Action Plan*, October 2017, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/651230/chemicals-decarbonisation-action-plan.pdf.
[315] Ecofys and Berenschot, *Chemistry for Climate: Acting on the Need for Speed | Roadmap for the Dutch Chemical Industry Towards 2050*, VNCI, 2018. https://www.vnci.nl/Content/Files/file/Downloads/VNCI_Routekaart-2050.pdf
[316] VCI, *Working towards a GHG Neutral Chemical Industry in Germany*, 2019, https://www.vci.de/langfassungen/langfassungen-pdf/2019-10-09-greenhouse-gas-neutral-chemistry-is-technically-feasible.pdf.
[317] Science-Based Targets, "Companies Taking Action," accessed September 8, 2022, https://sciencebasedtargets.org/companies-taking-action.
[318] Craig Bettenhausen, "Chemical Firms Aim for More Ambitious Climate Goals," *Chemical and Engineering News* 99, No. 2 (January 11, 2021): 33, https://pubs.acs.org/doi/10.1021/cen-09902-cover2.

[319] Thomas Nonnast, "BASF Presents Roadmap to Carbon Neutrality," BASF, [News release] March 26, 2021, https://www.basf.com/global/en/media/news-releases/2021/03/p-21-166.html.
[320] Adam Duckett, "Dow Plans Zero Emissions Ethylene Complex," *The Chemical Engineer*, October 18, 2021, https://www.thechemicalengineer.com/news/dow-plans-zero-emissions-ethylene-complex/.
[321] "Dow and Shell Team up to Develop Electric Cracking Technology," Dow, [Press release] accessed September 8, 2022, https://corporate.dow.com/en-us/news/press-releases/dow-shell-electric-cracking-technology.html.
[322] ACC, "Shale Gas is Driving New Chemical Industry Investment in the U.S.," American Chemistry Council, August 11, 2022, https://www.americanchemistry.com/better-policy-regulation/energy/resources/shale-gas-is-driving-new-chemical-industry-investment-in-the-us.
[323] U.S. EIA, "Number and Capacity of Petroleum Refineries," accessed September 8, 2022, https://www.eia.gov/dnav/pet/PET_PNP_CAP1_A_(NA)_8D0_BPCD_A.htm.
[324] U.S. EIA, "Oil and Petroleum Products Explained," accessed September 8, 2022, https://www.eia.gov/https://www.eia.gov/energyexplained/oil-and-petroleum-products/.
[325] U.S. EIA, "U.S. Energy Facts Explained," accessed September 8, 2022, https://www.eia.gov/energyexplained/us-energy-facts/.
[326] U.S. Census Bureau, "2018-2020 Annual Survey of Manufacturers: ASM (Tables)," December 2021, https://www.census.gov/data/tables/time-series/econ/asm/2018-2020-asm.html.
[327] U.S. Bureau of Labor Statistics, *Employment for Manufacturing: Petroleum Refineries (NAICS 324110) in the United States*, retrieved from FRED, Federal Reserve Bank of St. Louis, August 15, 2022, https://fred.stlouisfed.org/series/IPUEN324110W200000000.
[328] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[329] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Petroleum Refining*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_petroleum_refining_energy_carbon_footprint.pdf.
[330] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[331] ExxonMobil, *Sustainability Report Highlights*, 2020, https://corporate.exxonmobil.com/-/media/Global/Files/sustainability-report/publication/Sustainability-Report.pdf.
[332] Motiva, *Fueling our World, 2020 Sustainability Report*, 2020, https://motiva.com/-/media/Files/About/2020-Sustainability-Report/FINAL-2020SustainabilityReport_2.ashx.
[333] Marathon Oil, "Emissions Management Committee," accessed September 8, 2022, https://www.marathonoil.com/sustainability/highlights/emissions-management-committee/.
[334] Valero Energy, "Environmental Stewardship," accessed September 8, 2022, https://www.valero.com/responsibility/environmental-stewardship.
[335] U.S. EIA, *International Energy Outlook | IEO2021 Issues in Focus: Energy Implications of Potential Iron- and Steel-Sector Decarbonization Pathways*, February 24, 2022, https://www.eia.gov/outlooks/ieo/IIF_industrial/.
[336] U.S. Geological Survey (USGS), "Iron and Steel Salient Statistics," January 2022, https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-iron-steel.pdf.
[337] USGS, "Minerals Yearbook - Metals and Minerals," accessed September 8, 2022, https://www.usgs.gov/centers/national-minerals-information-center/minerals-yearbook-metals-and-minerals.
[338] USGS, "Iron and Steel Salient Statistics," 2022.
[339] IEA, *Iron and Steel Technology Roadmap*, October 2020, https://www.iea.org/reports/iron-and-steel-technology-roadmap.
[340] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[341] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Iron and Steel*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_iron_steel_energy_carbon_footprint.pdf.
[342] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[343] ArcelorMittal, *Climate Action Report 2*, July 2021, https://corporate-media.arcelormittal.com/media/ob3lpdom/car_2.pdf.
[344] U.S. Steel (USS), *Roadmap to 2050*, accessed September 8, 2022, https://www.ussteel.com/roadmap-to-2050#:~:text=In%20April%202021%2C%20U.%20S.%20Steel,compared%20to%20a%202018%20baseline.

[345] Stena Recycling, "The Value of Recycling Metals," accessed September 8, 2022, https://www.stenarecycling.com/insights/archive/the-value-of-recycling-metals/
[346] USGS, *Mineral Industry Survey: Cement in October 2021*, January 2022, https://d9-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/media/files/mis-202110-cemen.pdf.
[347] USGS, *Mineral Industry Survey: Cement in October 2021*, 2022.
[348] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS)*, 2021.
[349] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Cement*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_cement_energy_carbon_footprint_0.pdf.
[350] PCA, *Environmental Product Declaration*, 2021.
[351] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[352] U.S. EIA, "Coal Explained: Coal Prices and Outlook," accessed September 8, 2022, https://www.eia.gov/energyexplained/coal/prices-and-outlook.php#:~:text=Coal%20explained%20Coal%20prices%20and%20outlook%201%20The,subbituminous%20%2414.01%204%20lignite%20%2419.86%205%20anthracite%20%24102.22.
[353] U.S. EPA, "Cement Kilns Burning Hazardous Waste as Supplemental Fuel: Guidance," accessed September 8, 2022, https://ordspub.epa.gov/ords/guideme_ext/f?p=guideme:gd:::::gd:dioxin_4_5_3.
[354] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[355] U.S. EPA, *Carbon Intensity for the Cement Sector (2019)*, October 2021, https://www.epa.gov/system/files/documents/2021-10/cement-carbon-intensities-fact-sheet.pdf.
[356] Ernst Worrell et al., "Carbon Dioxide Emissions from the Global Cement Industry," *Annual Review of Energy and the Environment* 26, No. 1 (November 2001): 303-329, https://www.annualreviews.org/doi/full/10.1146/annurev.energy.26.1.303.
[357] IEA, *Cement: Not on Track*, November 2021, https://www.iea.org/reports/cement.
[358] USGS *Mineral Commodity Summary: Cement,* January 2021, https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-cement.pdf.
[359] Holcim, *Holcim's Net Zero Journey*, February 2022, https://www.holcim.com/sites/holcim/files/atoms/files/holcim_net_zero_journey_booklet.pdf.
[360] CEMEX, "Our 2030 Targets," https://www.cemex.com/sustainability/esg-reporting-center/our-2030-targets.
[361] HeidelbergCement, *Sustainability Report 2020*, June 14, 2021, https://www.heidelbergcement.com/en/pr-14-06-2021.
[362] U.S. DOE, *Bandwidth Study on Energy Use and Potential Energy Savings Opportunities in U.S. Glass Manufacturing*, September 2017, https://www.energy.gov/sites/default/files/2019/05/f62/Glass_bandwidth_study_2017.pdf.
[363] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Glass*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_glass_energy_carbon_footprint.pdf.
[364] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[365] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[366] Gentex Corporation, *Gentex Sustainability Report*, 2021, https://www.gentex.com/2021-Sustainability-Report.pdf.
[367] Pella, "Energy Efficiency," accessed September 8, 2022, https://www.pella.com/performance/energy-efficiency/.
[368] State of California, "Buy Clean California Act," accessed September 8, 2022.
[369] Colorado Energy Office, "Colorado adopts nation-leading policies to reduce GHG pollution from buildings," [Press release] June 8, 2021, https://energyoffice.colorado.gov/press-releases/colorado-adopts-nation-leading-policies-to-reduce-ghg-pollution-from-buildings.
[370] State of Delaware, DNREC, "E2I: Energy Efficiency Industrial," accessed September 8, 2022.
[371] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Forest Products*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_forest_products_energy_carbon_footprint_0.pdf.
[372] USDA Research, Education and Economics Information System, Economic Analysis of the Forest Products Industry in the United States. 2013. https://portal.nifa.usda.gov/web/crisprojectpages/0231316-economic-analysis-of-the-forest-products-industry-in-the-united-states.html
[373] U.S. EPA, FLIGHT tool, accessed September 8, 2022.

[374] Matt Russell, "Economic contribution of forestry employees across US states," Arbor Analytics, December 12, 2020, https://arbor-analytics.com/post/economic-contribution-of-forestry-employees-across-us-states/.
[375] Alliance for Pulp and Paper Technology Innovation (APPTI), "Forest Products: Industry Overview," accessed September 8, 2022, https://www.appti.org/forest-products.html.
[376] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[377] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Forest Products*, 2021.
[378] AF&PA, "Energy and the Environment," accessed September 8, 2022.
[379] AF&PA, "Energy and the Environment," accessed September 8, 2022.
[380] U.S. DOE "Forest Products Industry Profile: Advanced Manufacturing," accessed September 8, 2022, https://www.energy.gov/eere/amo/forest-products-industry-profile.
[381] U.S. EIA, "2018 MECS Release Schedule, Table 3.2 Fuel Consumption, 2018," and "Table 3.6 Selected Wood and Wood-Related Products in Fuel Consumption, 2018," 2021, https://www.eia.gov/consumption/manufacturing/data/2018/ - r1.
[382] U.S. EIA, Manufacturing Energy Consumption Survey 2018: Table 1.2, 2021.
[383] AF&PA, "Does Paper Actually Get Recycled?," accessed September 8, 2022, https://www.afandpa.org/priorities/recycling/does-paper-actually-get-recycled.
[384] U.S. DOE, Department of Energy Efficiency and Renewable Energy, *Pulp and Paper Industry Bandwidth Study*, June 2015, https://www.energy.gov/sites/default/files/2015/08/f26/pulp_and_paper_bandwidth_report.pdf.
[385] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[386] International Paper, *Vision 2030: Building a Better Future for People, the Planet and Our Company*, accessed September 8, 2022, https://www.internationalpaper.com/vision-2030.
[387] Kimberly Clark, *2020 Global Sustainability Report*, accessed September 8, 2022, https://www.kimberly-clark.com/-/media/kimberly/pdf/sustainability-reports/2020/k-c-2020-global-sustainability-report.pdf.
[388] Weyerhaeuser, "3 by 30 Impact Areas: Demonstrating Positive Impact," accessed September 8, 2022, https://www.weyerhaeuser.com/sustainability/3by30/?msclkid=7f8dd502b17c11ecaaa94d51e5dcb993.
[389] AF&PA, *Better Practices, Better Planet 2030: Sustainable Products For A Sustainable Future*, accessed September 8, 2022, https://www.afandpa.org/sites/default/files/2021-08/AFPA_BPBP2030_brochure_print_final.pdf.
[390] Government of the United Kingdom, *Pulp and Paper Industry Decarbonization Roadmap to 2050: Pulp and Paper,* March 2015, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416673/Pulp_and_Paper_Report.pdf.
[391] Paul Griffin, Geoffrey Hammond, and Jonathan Norman, "Industrial decarbonisation of the pulp and paper sector: A UK perspective," *Applied Thermal Engineering* 134 (April 2018): 152-162, https://www.sciencedirect.com/science/article/pii/S1359431117358210?via%3Dihub.
[392] U.S. Department of Agriculture (USDA) Economic Research Service, "Manufacturing: Food and Beverage Manufacturing," accessed September 8, 2022: https://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/manufacturing/.
[393] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS): Food and Beverage*, 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_food_beverage_energy_carbon_footprint.pdf.
[394] U.S. EIA, *Manufacturing Energy Consumption Survey 2018: Table 1.2*, 2021.
[395] U.S. EPA, FLIGHT tool, accessed September 8, 2022.
[396] U.S. EPA, "Sector-Based Information and Resources – Agribusiness: Location of U.S. Facilities," accessed September 8, 2022, https://archive.epa.gov/sectors/web/html/map.html.
[397] Nestlé, "Focusing on regenerative agriculture and moving to renewable electricity, Nestlé redoubles efforts to combat climate change," [Press release] December 3, 2020, https://www.nestle.com/media/pressreleases/allpressreleases/nestle-efforts-combat-climate-change.
[398] Science Based Targets, "Case Study: PepsiCo," accessed September 8, 2022, https://sciencebasedtargets.org/companies-taking-action/case-studies/pepsico.

[399] JBS Foods, "JBS Makes Global Commitment to Achieve Net-Zero Greenhouse Gas Emissions by 2040," [Press release] March 23, 2021, https://jbsfoodsgroup.com/articles/jbs-makes-global-commitment-to-achieve-net-zero-greenhouse-gas-emissions-by-2040.
[400] Tyson, "Tyson Foods Targets 2050 to Achieve Net Zero Greenhouse Gas Emissions," [Press release] June 9, 2021, https://www.tysonfoods.com/news/news-releases/2021/6/tyson-foods-targets-2050-achieve-net-zero-greenhouse-gas-emissions.
[401] ADM (Archer Daniels Midland), "ADM Sets Scope 3 Emissions Reduction Target," [Press release] accessed September 8, 2022, https://www.adm.com/en-us/news/adm-stories/adm-sets-scope-3-emissions-reduction-target/.
[402] NYSERDA, *Potential for Carbon Capture, Utilization, and Storage Technologies in New York State*, July 2020, https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Publications/Research/Environmental/20-13-Carbon-Capture-Utilization-and-Storage-Technologies.pdf.
[403] Energize Delaware, *2018 Annual Report*, 2019, https://www.energizedelaware.org/wp-content/uploads/2019/12/DESEU_Annual_Report_2018_FINAL2.pdf.
[404] Maryland Energy Administration, "Kathleen A. P. Mathias Agriculture Energy Efficiency Program," accessed September 8, 2022, www.energy.maryland.gov/business/Pages/incentives/mathiasag.aspx.
[405] Washington State Department of Commerce, *Washington 2021 State Energy Strategy*, December 2020, https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf.
[406] Manitoba Sustainable Development, "Made-in-Manitoba Climate and Green Plan," accessed September 8, 2022, https://www.gov.mb.ca/climateandgreenplan/index.html.
[407] Ontario Ministry of the Environment, Conservation and Parks, *Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan*, 2018, https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf.
[408] European Commission, "A New Circular Economy Action Plan," November 3, 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN.
[409] European Commission, "Green Public Procurement," accessed September 8, 2022, https://ec.europa.eu/environment/gpp/index_en.htm.
[410] U.S. DOE, *Industrial Decarbonization Roadmap,* September 2022.
[411] Senate Committee on Energy and Natural Resources, *Energy Act of 2020 | Section-by-Section*, accessed September 8, 2022, https://www.energy.senate.gov/services/files/32B4E9F4-F13A-44F6-A0CA-E10B3392D47A.
[412] U.S. DOE, "DOE Announces $42.3 million and New Industry Partnerships to Decarbonize American Manufacturing," [Press release] July 29, 2021, https://www.energy.gov/articles/doe-announces-423-million-and-new-industry-partnerships-decarbonize-american-manufacturing.
[413] S.4355 - Clean Competition Act, U.S. Congress, June 7, 2022, https://www.congress.gov/bill/117th-congress/senate-bill/4355?q=%7B%22search%22%3A%5B%22whitehouse%22%2C%22whitehouse%22%5D%7D&s=4&r=3.
[414] U.S. General Services Administration (GSA), "GSA Lightens the Environmental Footprint of its Building Materials," [Press release] March 30, 2022, https://www.gsa.gov/about-us/newsroom/news-releases/gsa-lightens-the-environmental-footprint-of-its-building-materials-03302022.
[415] H.R. 4534 – 117th Congress (2021-2022): FAIR Transition and Competition Act, July 19, 2021, https://www.congress.gov/bill/117th-congress/house-bill/4534?s=1&r=9.
[416] The White House Statements and Releases, "Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing," [Press release] February 15, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/15/fact-sheet-biden-harris-administration-advances-cleaner-industrial-sector-to-reduce-emissions-and-reinvigorate-american-manufacturing/.
[417] Office of the Federal Chief Sustainability Officer, Federal Buy Clean Initiative, accessed September 15, 2022, https://www.sustainability.gov/buyclean/.
[418] U.S. DOE, *Manufacturing Energy and Carbon Footprints (2018 MECS),* 2021.
[419] U.S. DOE, "2018 Manufacturing Energy and Carbon Footprints: Definitions and Assumptions," March 2022, https://www.energy.gov/sites/default/files/2022-03/2018_mecs_footprint_definitions.pdf.