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# MAKING THE MOST OF THE ENERGY TRANSITION

HOW THE GREAT LAKES CAN IDENTIFY  
PRIORITY INDUSTRIES AND OVERCOME  
WORKFORCE CHALLENGES

GREG WRIGHT, ALEXANDRIA CORDERO, AND  
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## **Making the most of the energy transition**

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## Executive Summary

As the world continues to decarbonize, demand for clean energy technologies is taking off. This presents a historic opportunity for state and local governments to harness this demand to generate equitable and sustainable local economic growth. Most notably, the Inflation Reduction Act of 2022 will inject hundreds of billions of dollars into dozens of energy transition projects around the country, and policymakers will need to ensure that their region is at the forefront of this new industrial revolution.

This report describes and applies a framework for evaluating local energy transition industrial strategies with a focus on the Great Lakes region. We begin by describing the current state of the energy transition economy nationally, providing a snapshot of differences across regions in their progress toward and specializations in specific energy transition products. We find that:

- Energy transition industries are responsible for 11.4 percent of national employment and have higher median wages than other industries. The fastest growing industries include storage battery manufacturing and solar electric power generation. Some examples of occupations in these industries include electrical assemblers, solar photovoltaic installers, and engineers. In addition to higher wages, a majority of these industries offers a share of “good jobs” above the economy-wide average.
- Energy transition occupations rarely require more than a high school diploma. In eight of the nine energy transition sectors that we identify, more than half of the jobs only require a high school diploma and over 70 percent require no more than a high school diploma.
- Racial diversity can be improved, especially within higher paid sectors. The distribution of white and non-white groups differs quite a bit across the sectors. The Transition Enabling sector has comparatively low levels of Hispanic and Black employment but offers the highest-paying jobs, both nationally and in the Great Lakes. Increasing diversity in this sector should be a priority. Additionally, the most diverse sector, Forestry, Land, and Agriculture (FLAG), offers virtually no upward mobility.
- The most seamless transitions are likely to occur in the manufacturing and utilities industries. The manufacturing and utilities sectors consist of industries that frequently lead to transitions into other related industries—i.e., they offer a range of growth opportunities, including in many of our identified clean transition industries.
- Transitions into technical or information industries will be more difficult. In contrast, some industries require specialized inputs and benefit from being geographically concentrated, such that in many parts of the country there are few opportunities to move into them. These include high-paid transition activities such as environmental consulting, engineering, and industrial design that are critical in the development of systems such as smart electrical grids. While some parts of the Great Lakes (e.g.,

Chicago) will be able to build out these activities, other parts of the region will need to focus their economic development strategies elsewhere.

- The Great Lakes is well-poised for the energy transition but will need to close significant workforce gaps. There are existing strengths within the Great Lakes region, such as a historical specialization in the manufacturing sector, that will serve as a good foundation during the transition. However, our analysis highlights the need for strategic planning to address significant workforce gaps—in particular, the region will want to develop workforce capabilities and economic development strategies that support job growth in the high-paying Transition Enabling sector.

## 1. Introduction

The energy transition presents an enormous opportunity for the Great Lakes region, one that the region is well-poised to exploit. To do so, local policymakers will need to build on existing economic strengths and anticipate the workforce needs that the transition will require. This report describes and applies a framework for evaluating local energy transition strategies, with a focus on the Great Lakes region. We begin by describing the current state of the energy transition economy nationally, providing a snapshot of differences across regions in their progress toward and specializations in specific energy transition products. We then outline a framework for identifying strategies for economic growth in a local area and apply the framework to identify energy transition strategies for the Great Lakes region.

Our analysis highlights several existing strengths within the region, including a specialization in manufacturing industries that will be instrumental to the energy transition. At the same time, our analysis highlights the need for strategic planning to address significant workforce gaps that will be associated with the transition. Moreover, the best jobs reside in what we call the “transition enabling” sector, a set of industries encompassing the science and engineering components of the transition. While the Great Lakes is relatively strong in this sector, diversity in the sector is lacking, both nationally and in the Great Lakes. Developing accessible education and skilling pipelines to this sector should be a policy priority. Finally, while many policymakers within the Great Lakes may be professing a desire to implement environmentally friendly policies, we show that the actual economic development policies that are implemented are not always consistent with those priorities.

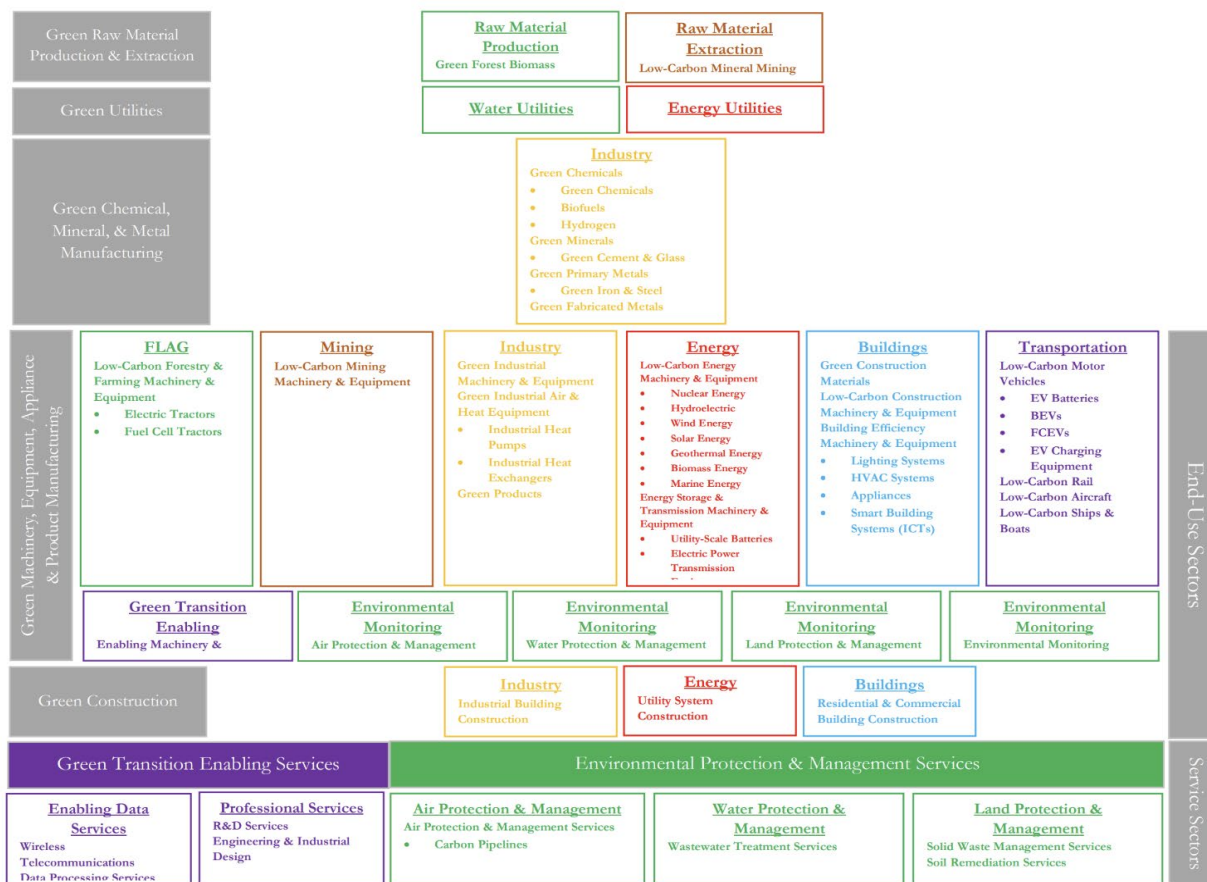
## 2. Energy transition industries at the national level

We define energy transition industries as those with the potential to participate in the energy transition technology supply chain. The diagram below illustrates how clean energy technologies and related services fit within the overall energy transition economy, and a formal list of all 283 six-digit energy transition industries<sup>1</sup> can be found in Appendix A below. Importantly, we note that our definition identifies industries that have the *capacity* to transition but may be at varying points along the path to decarbonization. This includes everything from raw materials extraction, through processing and technology manufacturing, to the enabling services and environmental management necessary to facilitate an economy-wide transition.

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<sup>1</sup> Analysis uses the North American Industry Classification System (NAICS) at the 6-digit level.

Figure A



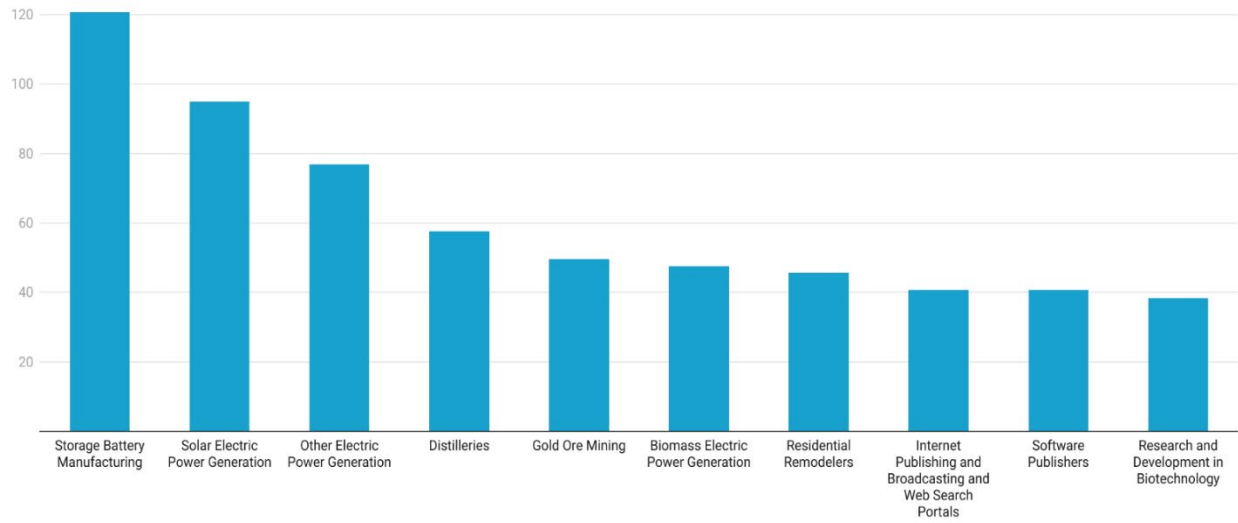
This at times produces counter-intuitive findings; for example, the mining sector often shows up as an important sector in the energy transition, primarily because it contains several industries related to the extraction and processing of minerals that are essential inputs into energy transition products like batteries and solar panels. It is important to include these industries because it provides powerful signals of where future growth is likely to occur. These industries could become more important as their production shifts more heavily towards these energy transition products to meet the increase in demand.

These 283 industries comprise 11.4 percent of current U.S. employment. Figures B and C show the fastest growing energy transition industries by employment and number of firms, respectively. Although job growth in the energy transition sector has been dominated by storage battery manufacturing and solar power generation, the growth in storage battery manufacturing is generated by a relatively small number of firms, as shown in Figure B. In comparison, the software industry may not create jobs at the scale of battery manufacturing or solar power generation, but it is an important input into the energy transition supply chain as it fosters relatively high rates of business formation.

Figure B

**Employment Growth in Clean Transition Industries**

Average employment growth rate (2017 - 2021)

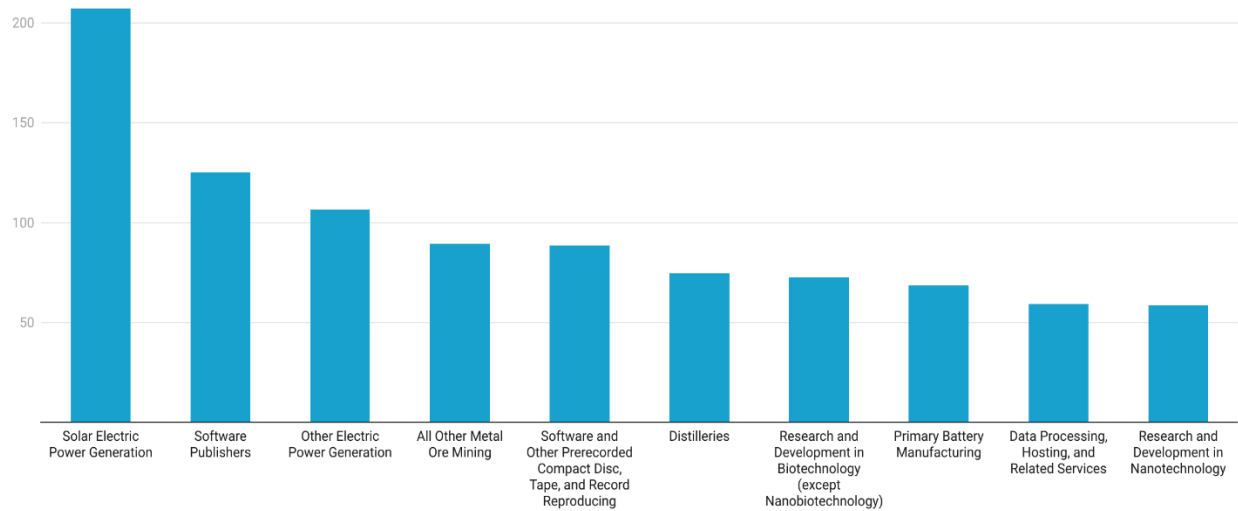


Source: Brookings' analysis of Lightcast Data - Created with Datawrapper

Figure C

**Growth in Number of Firms in Clean Transition Industries**

Average establishment growth rate (2017 - 2021)



Source: Brookings' analysis of Lightcast Data - Created with Datawrapper



An important feature of energy transition industries is that their output is typically tradeable, defined as the extent to which the industry output can be sold outside the region in which it is produced. In fact, 92 percent of the 283 energy transition industries are tradeable and therefore potentially able to serve multiple markets. This ability to scale production is typically associated with higher productivity and wages and, indeed, the median pay in these industries is approximately \$57,320, compared to the national median wage of \$52,300.

### *The geography of the energy transition*

To better understand where the energy transition is happening in the U.S., Figure D below shows each metropolitan statistical area's (MSA) most important clean sector according to its employment share within the region. These sectors could be used as a starting point for a clean energy transition strategy. Here we focus on the following ten clean sectors representing broad aggregates of industries:

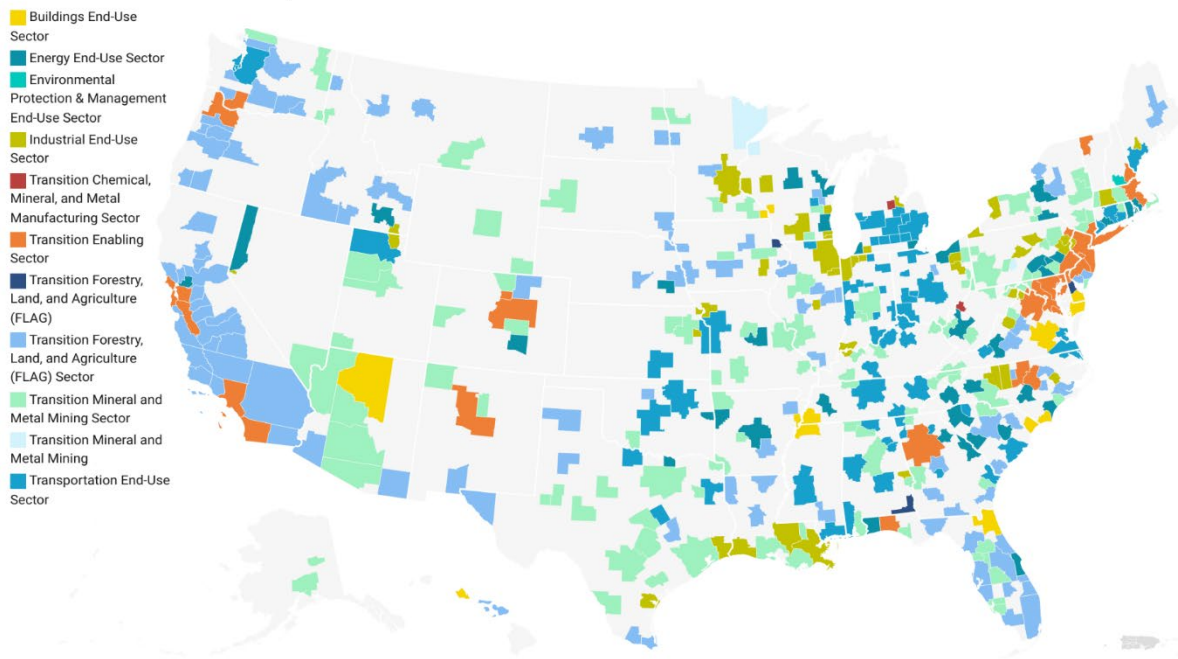
- Buildings End-Use
- Energy End-Use
- Environmental Protection and Management End-Use
- Industrial End-Use
- Transition Chemical, Mineral, and Metal Manufacturing
- Transition Enabling
- Transition Forestry, Land, and Agriculture (FLAG)
- Transition Mineral and Metal Mining
- Transportation End-Use

The Transportation End-Use sector contains auto manufacturing and is, unsurprisingly, highly concentrated in the Midwest. Also unsurprising is the concentration of Forestry, Land, and Agriculture as well as Energy End-Use sectors throughout the West. The other clean sectors are less geographically concentrated.

Of particular interest is the Transition Enabling sector, which includes Computers and Electronics manufacturing, Software, Data Processing, Engineering Services, and Research and Development, among other high-tech industries. This sector is at the frontier of technological change and, as a result, will play a crucial role in delivering high-quality clean jobs to regions, a topic that we discuss further below.

Figure D

**MSA-level clean sector specialization**



Source: Brookings' analysis of Lightcast data • Created with Datawrapper

*The energy transition industry space*

The physical location of energy transition industries can tell us something about how similar industries are in terms of their production processes. These observed similarities can then be used to identify new industries that are potential growth opportunities for a region. In Figure E below we apply this idea via a map of the U.S. “industry space.” The industry space highlights the “distance” between any two U.S. industries, where the distance is calculated as the likelihood that those two industries locate in the same geographic area. This measure serves as a useful proxy for shared industry capabilities, such as whether any two industries share similar inputs into production or are sequential in the overall production process. In Figure E this similarity is depicted as the literal distance between any two industry dots. For instance, in the economy at large, auto parts manufacturers may physically locate near machine shops since their workforces use similar skills and require similar inputs. In Figure D these two industries would be located very near one another in the industry space. One consequence of this is that industries in the densest parts of the industry space often share similar production capabilities with many other industries. For a city or region this is good: If your current mix of industries are in the dense part of the industry space, this means that there are many feasible industries that are untapped in your region—i.e., there are many opportunities for future growth.

As we can see from Figure E, energy transition industries are located throughout the industry space. Some are located within the central, dense part of the U.S. industry space, which is dominated by manufacturing and utilities industries (electric power generation, transmission, and distribution; industrial machinery manufacturing; and other general purpose machinery manufacturing), suggesting that the easiest transitions toward clean energy will occur in manufacturing and utilities. In contrast, the edges of the industry space tend to be where service-oriented energy transition industries are located (along with many specialized manufacturing industries as well). These industries may require specialized knowledge and skills and will likely only serve as growth opportunities for a limited number of U.S. regions.

Figure E

### Clean energy industry locations in the U.S. industry space



Source: Authors' analysis of Lightcast data

### Job quality and skill requirements

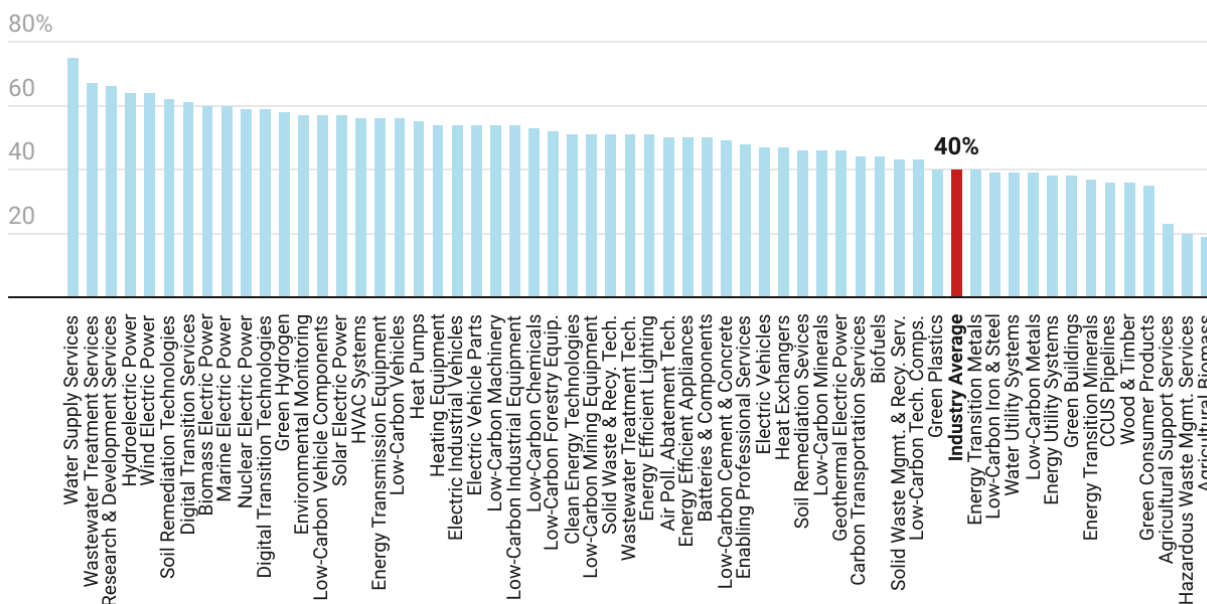
In developing an energy transition strategy, policymakers will be particularly focused on the quality of jobs that these industries will generate. Figure F below shows the average share of good jobs<sup>2</sup> in specific energy transition products (which are a more aggregate

<sup>2</sup> A job is considered 'good' if it pays above the median national wage and has healthcare benefits.

category than industries)<sup>3</sup> and compares them to the average share of good jobs across products nationally. Many clean products have a share of good jobs above the national average. It is important to note that the occupations required in the production of these products, and therefore the quality of jobs, may change as these industries change their processes towards cleaner production. For example, the Electric Vehicle (EV) product includes both EV and gasoline motor vehicle manufacturing because there is no way to disaggregate the two processes in the current (North American Industry Classification System) NAICS taxonomy. Although there may be similarities between gas-powered and electric manufacturing processes, it is not yet clear how similar the occupations will be. The Box below provides one case study comparing EV battery plant workforces to those in combustion engine plants. The main takeaway is that the EV workforce is more highly paid than traditional auto manufacturing.

Figure F

### Average share of good jobs in clean energy products



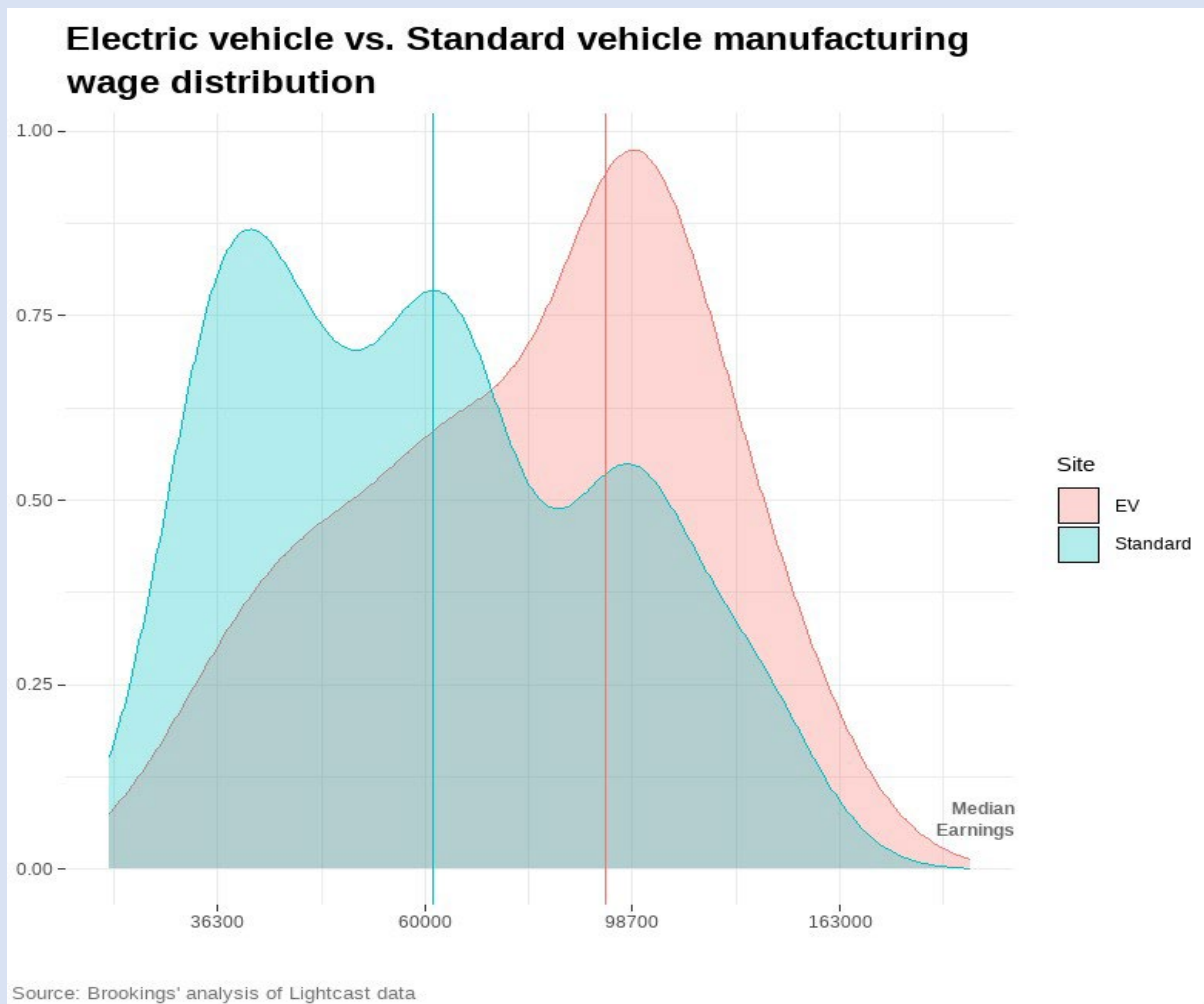
Industry average highlighted in red

Source: Brookings' analysis of Lightcast and Integrated Public Use Microdata Series (IPUMS), Census data • Created with Datawrapper

<sup>3</sup> All 60 products are included in Figure D. The products are typically fewer than 10 NAICS 6-digit industries, compared to the more encompassing sectors that are made up by 100s of 6-digit industries.

## EV Jobs Case Study

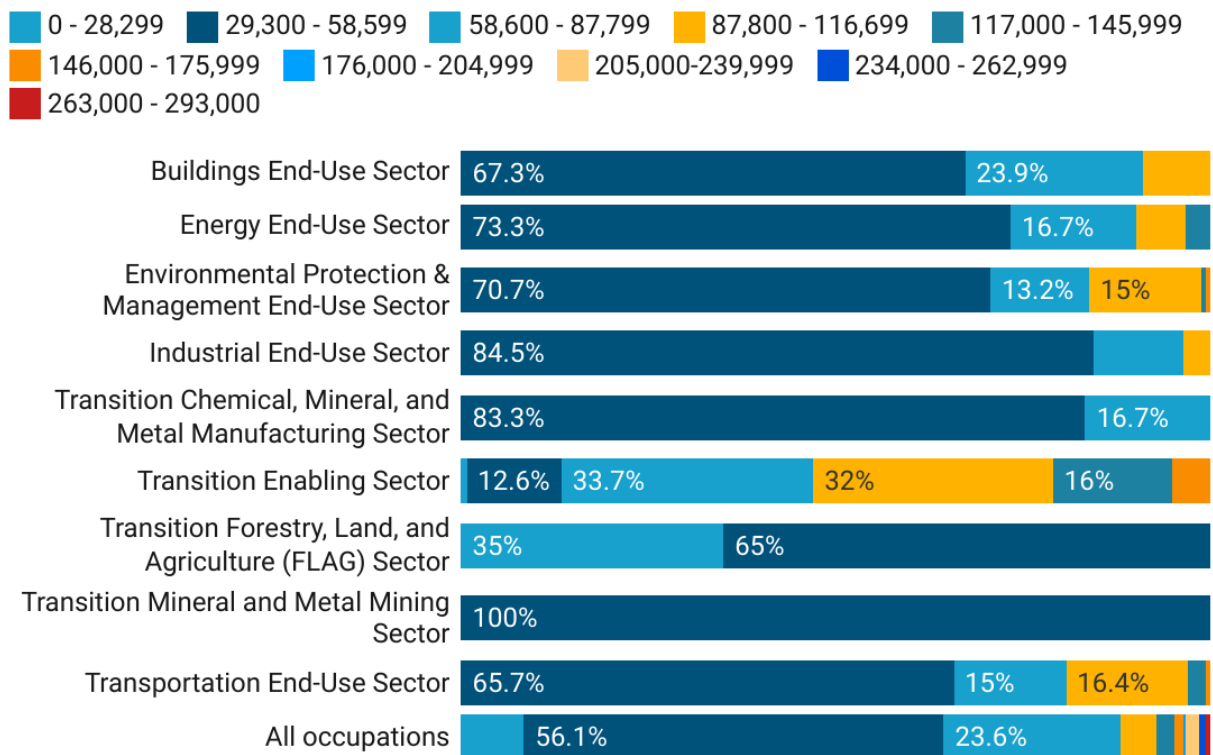
The figure below compares earnings for workers in EV battery plants with those from combustion engine plants. More specifically, it depicts the log median annual earnings listed in unique job postings from eight newly built U.S. battery plants with earnings listed in job postings from the industries Motor Vehicle Gasoline Engine and Engine Parts (the “reference” category). The EV earnings distribution is clearly distributed toward higher earnings with far fewer low-paying jobs relative to combustion manufacturing, with the most concentrated part of the distribution centered at around \$100,000.



The wage distribution across sectors is shown in Figure G below. Most occupations in each sector fall in the lower-middle income bracket, \$29,300-58,600, though the Transition Enabling sector is an exception. The occupations in this category tend to pay more because the category is composed of the most technical industries, such as software publishing or consulting services. The FLAG sector's distribution is also different than the others, with jobs mainly distributed across the two mid-range income brackets. Similarly, the Transition Mineral and Metal Mining sector offers few opportunities outside of lower-middle income jobs.

Figure G

## Wage Distribution by Sector

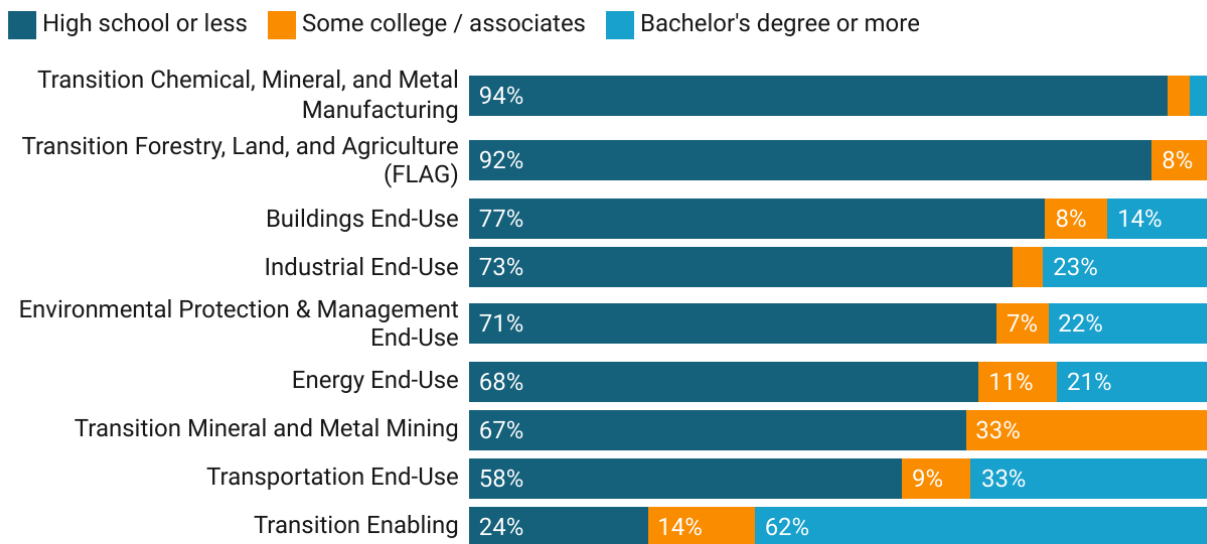


Source: Brookings' analysis of Lightcast and Integrated Public Use Microdata Series (IPUMS), Census data • Created with Datawrapper

The educational requirements associated with each energy transition sector are depicted in Figure H. The figure shows that energy transition jobs rarely require more than a high school diploma. The exception is the Transition Enabling sector which, again, includes a wide range of technology-oriented industries and many of the highest paid occupations. In that sector most occupations require a bachelor's degree or more.

Figure H

## Share of occupations requiring each level of education, by sector

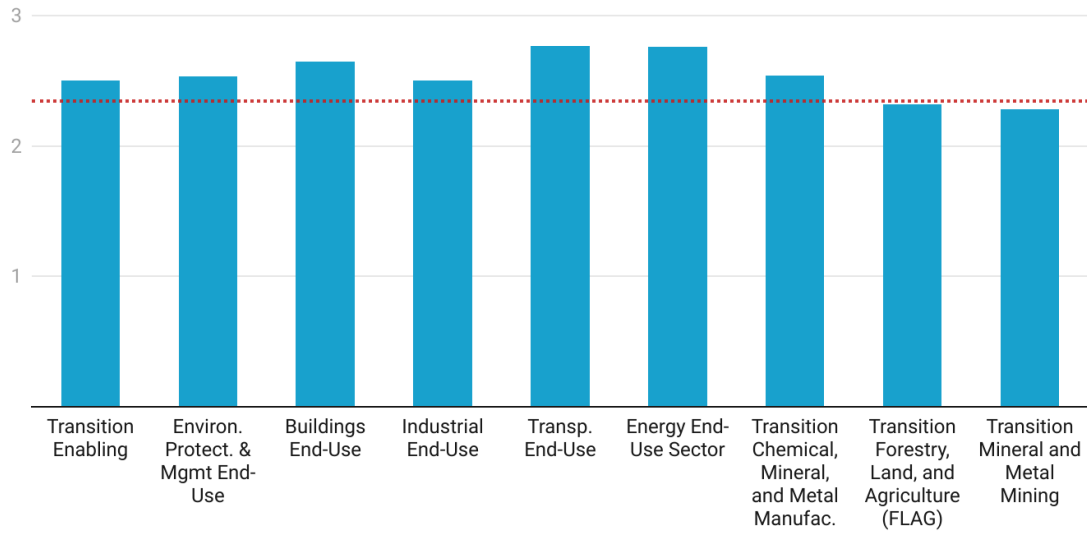


Source: Brookings' analysis of Lightcast and Integrated Public Use Microdata Series (IPUMS), Census data • Created with Datawrapper

Beyond formal education requirements, we can assess the specific skills that clean transition sectors require using the U.S. Department of Labor's O\*NET Knowledge scores. This dataset assigns a number (on a scale of 1-5) to each occupation reflecting the intensity with which a type of knowledge is used in that job. There are 33 knowledge areas, ranging from "Administration and Management" to "Design" and we aggregate these into broad categories of "hard" and "soft" knowledge requirements. As we see in Figure I, the occupations within clean transition sectors typically have higher average "hard skill" scores relative to the U.S. national average. Specifically, they are unusually intensive in "Engineering and Technology," "Manufacturing and Production," "Mathematics and Science," and "Transportation" skills. In contrast, as evident in Figure J, "soft skills," such as "Administration and Management" or "Sales and Marketing," are relatively less important for these sectors.

Figure I

### Averaged “Hard Skills” Knowledge Score by Clean Transition Sector

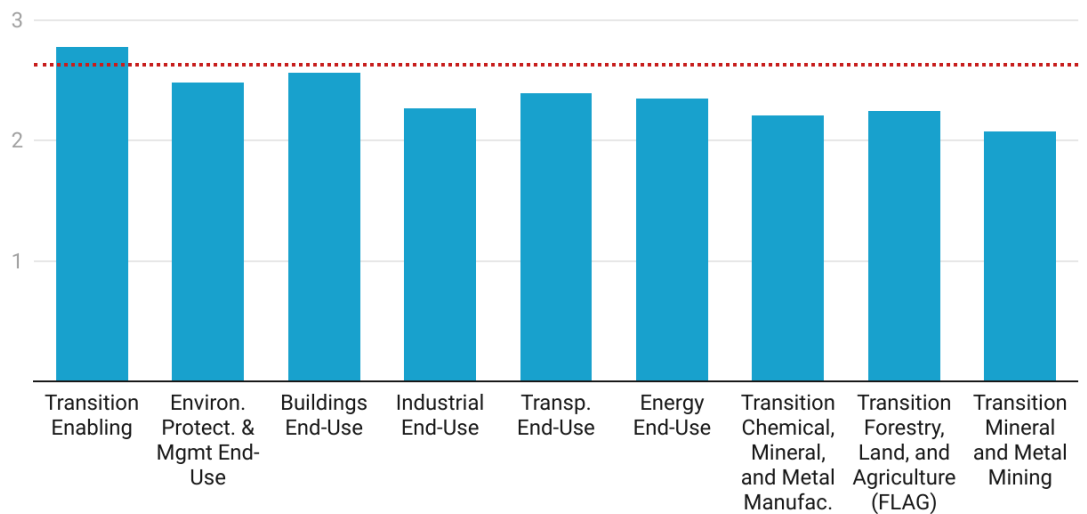


*Economy-wide average in red*

Source: Brookings’ analysis of O\*NET and Lightcast data • Created with Datawrapper

Figure J

### Averaged “Soft Skills” Knowledge Score by Clean Transition Sector



*Economy-wide average red*

Source: Brookings’ analysis of O\*NET and Lightcast data • Created with Datawrapper

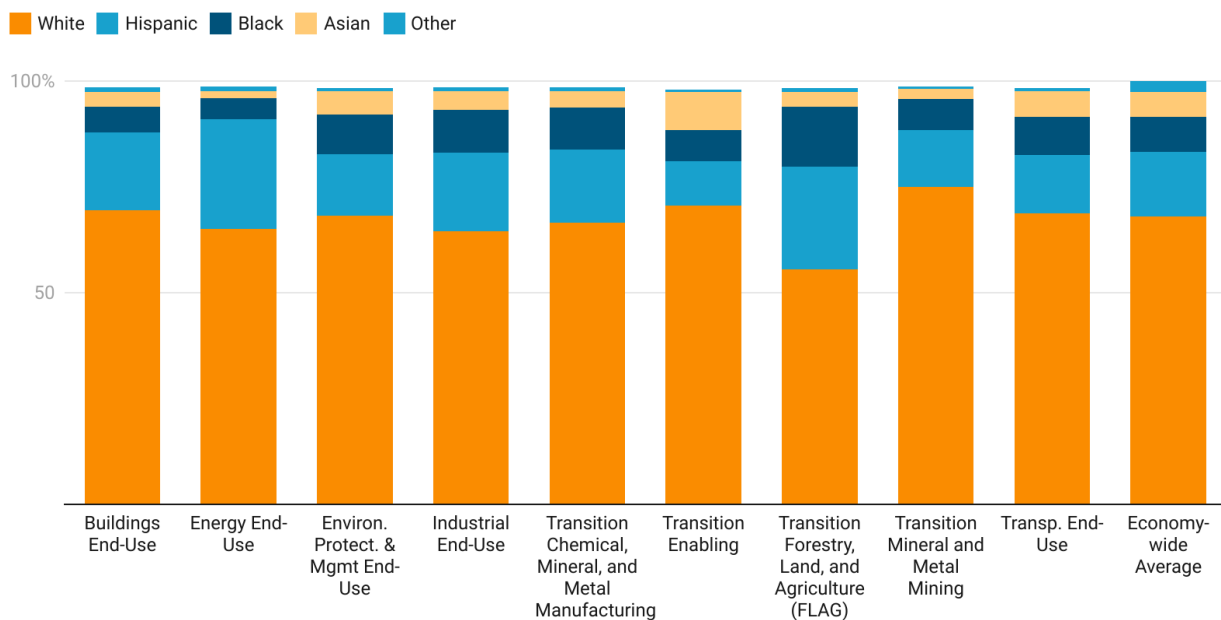


### Racial diversity in the clean transition economy

The racial diversity of U.S. clean transition sectors is shown in Figure K while Figure L repeats the exercise for only the Great Lakes’ MSAs. In both Figures we can see that there are indeed differences in the extent to which non-white groups are active across these sectors. There are several crucial takeaways. The Transition Enabling sector has relatively low levels of Hispanic and Black employment, both nationally and within the Great Lakes. Given that industries in this sector require relatively high rates of education and skill and create high-paying jobs, increasing diversity in this sector should be a priority to ensure the energy transition reduces, rather than exacerbates, current economic inequality. The Transition, Forestry, Land, and Agriculture (FLAG) sector is the most diverse—with higher levels of Black and Hispanic employment—and is reasonably well paid relative to other sectors. However, nearly all occupations fall within two income bands, implying that income mobility may be limited within the sector.

Figure K

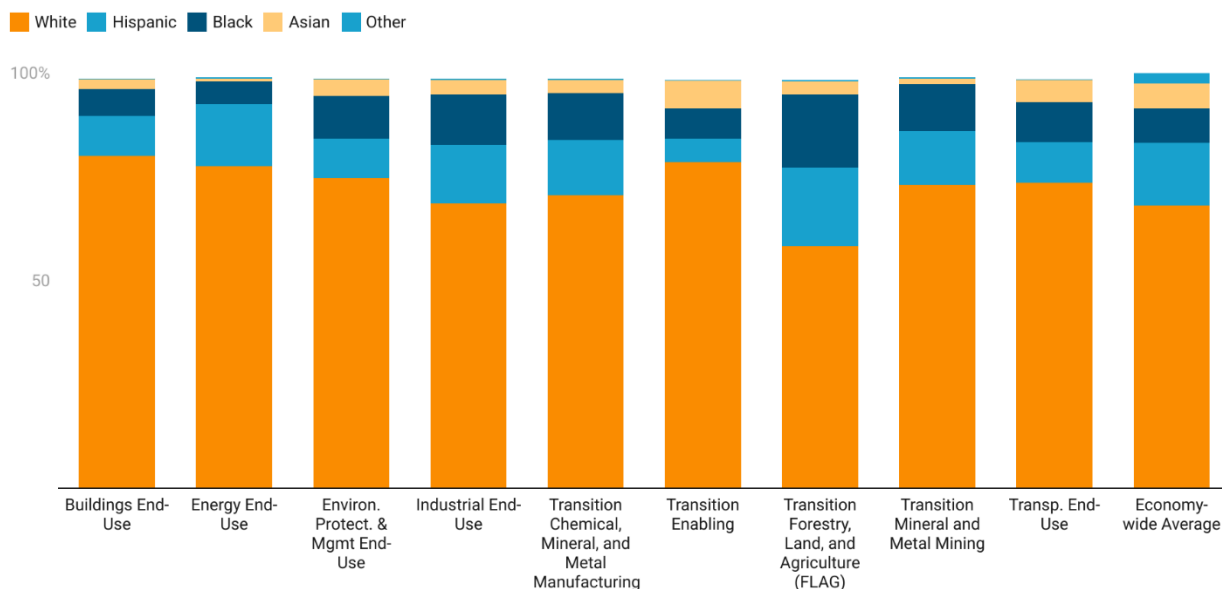
#### Racial diversity across energy transition sectors



Source: Brookings' analysis of Integrated Public Use Microdata Series (IPUMS), Census data · Created with Datawrapper

Figure L

### Racial diversity across energy transition sectors in the Great Lakes



Source: Brookings' analysis of Integrated Public Use Microdata Series (IPUMS), Census data • Created with Datawrapper

## 3. Methods for identifying local growth opportunities

The challenge for the Great Lakes region will be to increase economic growth while transitioning to energy transition industries. Here we extend our discussion of the industry space from the previous section to identify underdeveloped energy transition industries that are highly feasible for the Great Lakes region—i.e., energy transition industries that are “near” the region’s existing industries in the industry space (see Figure E).

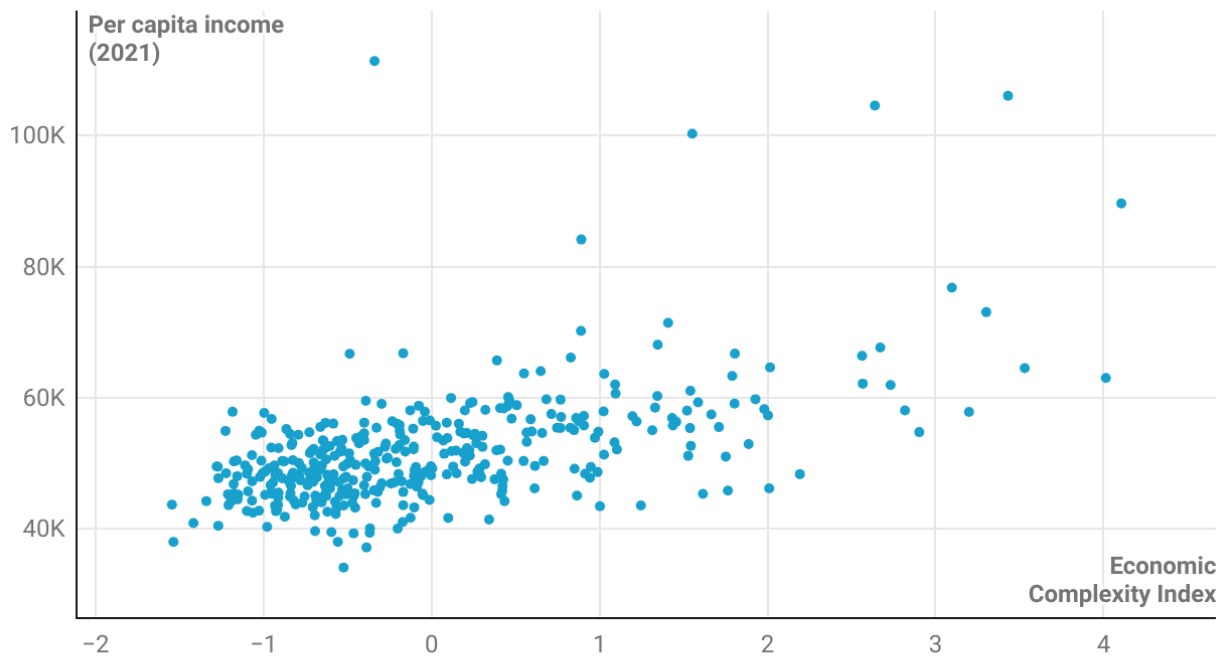
Once we have identified a set of feasible energy transition industries that could be developed, we can sort them according to their growth prospects. At the regional level, the growth prospects can be captured in a measure that we call the Economic Complexity Index (ECI).<sup>4</sup> The ECI measures the diversity (raises ECI) and ubiquity (lowers ECI) of the industries in which a region is active. Therefore, a more diverse economy (in terms of industry mix) comprised of relatively unique industries is a more “complex” economy. More fundamentally, a region’s complexity is the outgrowth of its production capabilities (e.g., human capital, natural resources, institutional quality, etc.). Importantly, this measure is strongly, positively correlated with per capita income (see Figure M), labor productivity, and population growth across regions. Overall, the Great

<sup>4</sup> To read more about Economic Complexity Theory and its applications, refer to *The building blocks of economic complexity theory* (Hidalgo, C.A., & Hausmann, R., 2009).

Lakes' MSAs have an average ECI of 0.497, which is just above the average for U.S. MSAs, which range from -1.55 (Rural Alabama) to 4.11 (SF Bay Area).

Figure M

## Per Capita Income vs. ECI



Source: Brookings' analysis of Lightcast data • Created with Datawrapper

Like the regional ECI measure, industries can also be measured in terms of their complexity. In this case, the most complex industries will be those that are located in diverse local economies and that are relatively rare. Unsurprisingly, the most complex energy transition sector is the high-tech Transition Enabling sector, with an ECI of 6.91. Next on the list is the Energy End-Use sector at 1.96 and the Transition Mineral and Metal Mining sector at 1.25. In Figure C above we can see that no MSA in the Great Lakes is most specialized in the highly complex Transition Enabling sector, although there are several regions whose most specialized industry is Energy End-Use or Transition Mineral and Metal Mining.

We can also break down the sectors into smaller sub-sectors and in Table 1 below we list the top ten sub-sectors in terms of their complexity.

Table 1

## Top 10 Most Complex Sub-Sectors

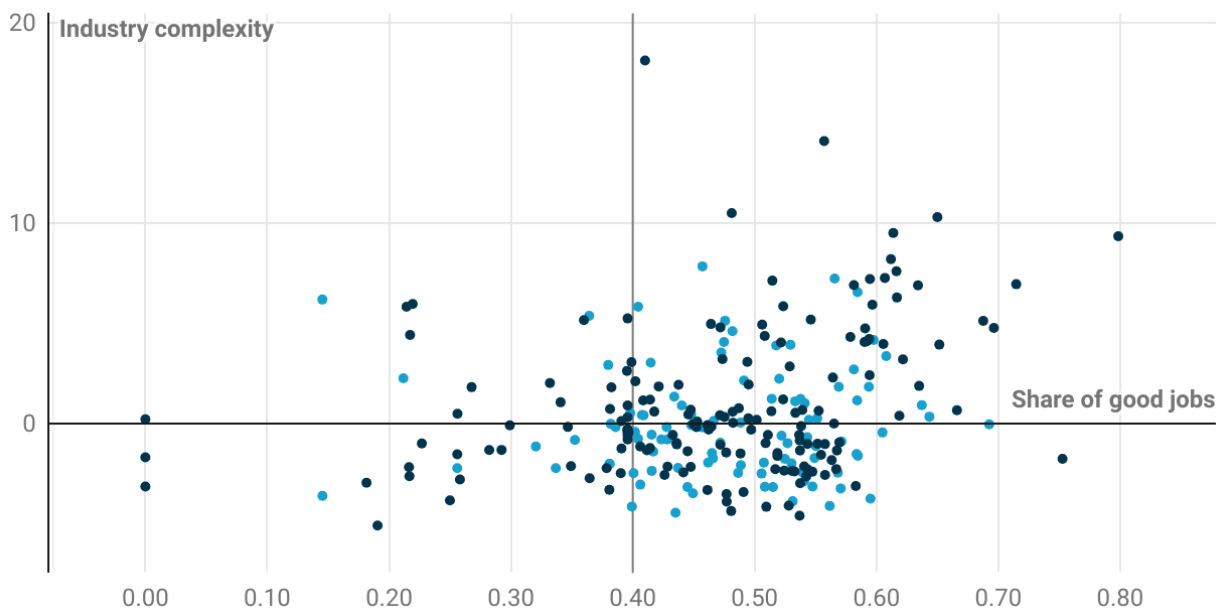
Sub-sector	Average complexity
Transition Enabling Machinery & Equipment Manufacturing	6.91
Environmental Monitoring Machinery & Equipment Manufacturing	3.97
Low-Carbon Energy Production	3.13
Low-Carbon Metal Mining	3.01
Building Efficiency Machinery & Equipment Manufacturing	2.97
Low-Carbon Energy Machinery & Equipment Manufacturing	2.01
Energy Storage & Transmission Machinery & Equipment Manufacturing	1.73
Water Protection & Management Machinery & Equipment Manufacturing	1.25
Residential & Commercial Green Building Construction	0.68
Low-Carbon Mineral Mining	0.47

Source: Brookings' analysis of Lightcast data • Created with Datawrapper

Figure N below highlights the fact that the energy transition economy produces good jobs across industries with varying degrees of complexity. Thus, while the priority would be to pursue complex, faster growing industries, we can see that there are many options for generating good jobs in the energy transition sector outside of the most complex. In the figure, the axes are centered around the U.S. average industry complexity and the U.S. average share of good jobs. We can see that while there are many energy transition industries that lie below the average level of complexity, energy transition industries overwhelmingly generate good jobs—i.e., energy transition industries tend to lie to the right of the y-axis. The abundance of opportunities for generating good jobs provides optimism for regional growth since highly complex industries, which are by definition rare, can be difficult to develop.

Figure N

### Energy transition industries tend to have good jobs



*Energy transition industries highlighted in blue*

Source: Brookings' analysis of Lightcast and Integrated Public Use Microdata Series (IPUMS), Census Data • Created with Datawrapper

## 4. The energy transition economy in the Great Lakes region

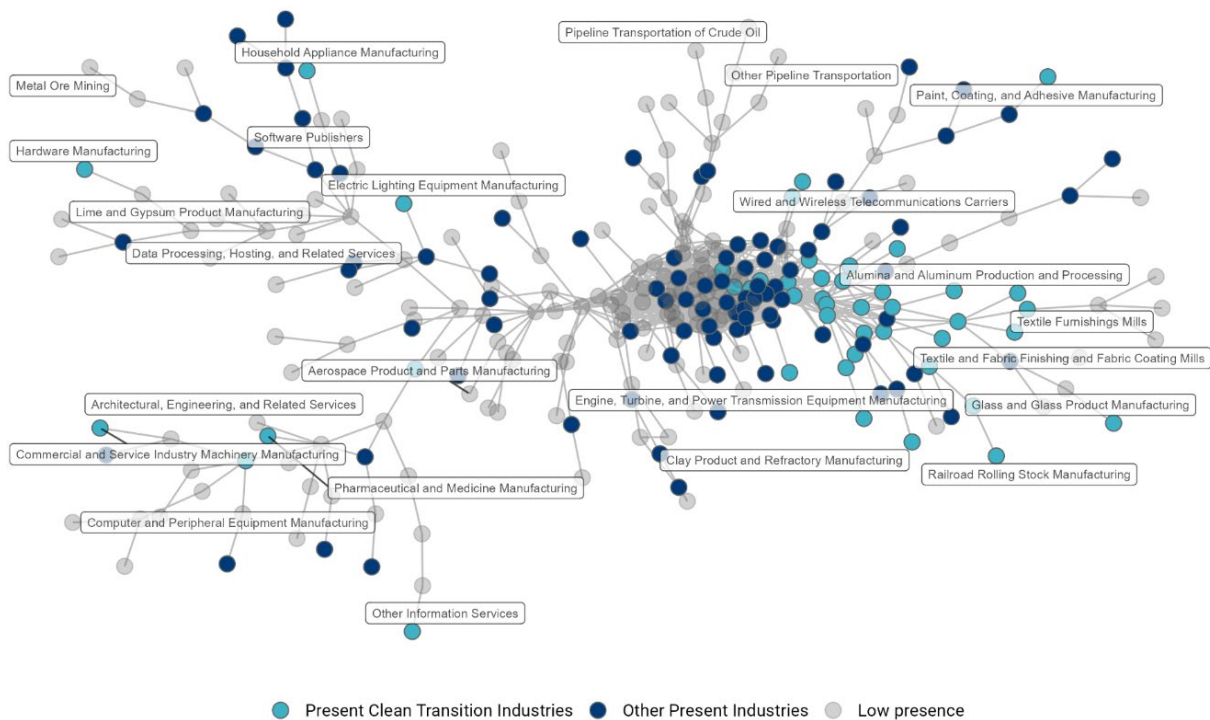
Overall, the Great Lakes region has a higher employment concentration than the national average in energy transition industries. This suggests that the region is well equipped to continue the energy transition relative to the rest of the country. These industries are currently responsible for 12.3 percent of jobs in the region and have a

31.6 percent higher median income relative to the national average (\$68,880 compared to \$52,344). This is in part due to certain region’s relative focus on the higher paying Transportation End-Use sector (see Figure G).

To visualize the current and potential clean industry composition of the region, we can map out the industry space for the Great Lakes, as we did for the U.S. in Figure D above. Figure O depicts the Great Lakes industry space and highlights the industries that are currently present in the region, both clean and other. We see that the Great Lakes tends to specialize in manufacturing industries—e.g., machine shops, forging and stamping, and other fabricated metal product manufacturing. Importantly, many of the clean industries are located in the dense, central part of the industry space, implying that the region is already active in industries that are good jumping-off points for future growth.

Figure O

### Clean energy transition industries present in the Great Lakes Region



Source: Authors’ analysis of Lightcast data

We can go further in identifying opportunities for energy transition growth in the region by adding additional priorities for growth. For instance, out of the 283 energy transition industries there are a total of 258 that are currently underdeveloped (i.e., have below-average employment) in the region. Separately, there are 196 industries that have a high share of good jobs (above the national average share) and there are 236 industries that

are tradeable (produce output that can be sold beyond the local market). At the intersection of these three sets are 186 “strategic” clean transition industries that are underdeveloped in the region, have a high share of good jobs, and are tradeable. These industries are energy transition growth opportunities for the region. Our Great Lakes Clean Development tool<sup>5</sup> explores these strategic industries for the individual Great Lakes MSAs. The tool gives a more granular look at the clean transition in the individual MSAs and allows users to explore the clean, underdeveloped, and well-paying industries within their area.

Of course, not every one of these industries is feasible for every Great Lakes MSA. For example, Chicago can feasibly grow most of these strategic industries, including many of those in the high-paying, complex Transition Enabling sector. This indicates that Chicago is relatively well-equipped to tackle the energy transition. In contrast, Fort Wayne, Indiana is the least complex of the Great Lakes MSAs and can feasibly grow only a small subset of the 181 industries. In fact, only 10 industries in Fort Wayne have levels of feasibility above the national average. This indicates that MSAs like Fort Wayne will need to be particularly targeted in their energy transition development strategies and focus on other industries they are more equipped for.

At the regional level, we can also consider the workforce that would be needed to support the Great Lakes’ 186 strategic industries. Among these industries, the Great Lakes already has a significant presence (above the national average) in over 700 occupations that would be required to grow them. Crucially, however, there are nearly 800 occupations that would need to be scaled up to meet these industries’ workforce needs. The Great Lakes is likely to miss out on opportunities if it does not plan for these occupational gaps as part of the region’s economic development strategy. Table 2 lists the top ten occupational gaps that the region faces to build out its 186 strategic industries.

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<sup>5</sup> The tool can be accessed [here](#).

Table 2

## Top 10 Occupations Needed for Transition

<b>Occupation</b>	<b>Top Industry</b>
Helpers--Roofers	Roofing Contractors
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	Plumbing, Heating, and Air-Conditioning Contractors
Pourers and Casters, Metal	Iron and Steel Mills and Ferroalloy Manufacturing
Helpers--Electricians	Electrical Contractors and Other Wiring Installation Contractors
Semiconductor Processing Technicians	Semiconductor and Related Device Manufacturing
Roofers	Roofing Contractors
Farm Labor Contractors	Farm Labor Contractors and Crew Leaders
Engine and Other Machine Assemblers	Other Motor Vehicle Parts Manufacturing
Metal-Refining Furnace Operators and Tenders	Iron and Steel Mills and Ferroalloy Manufacturing
Timing Device Assemblers and Adjusters	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing

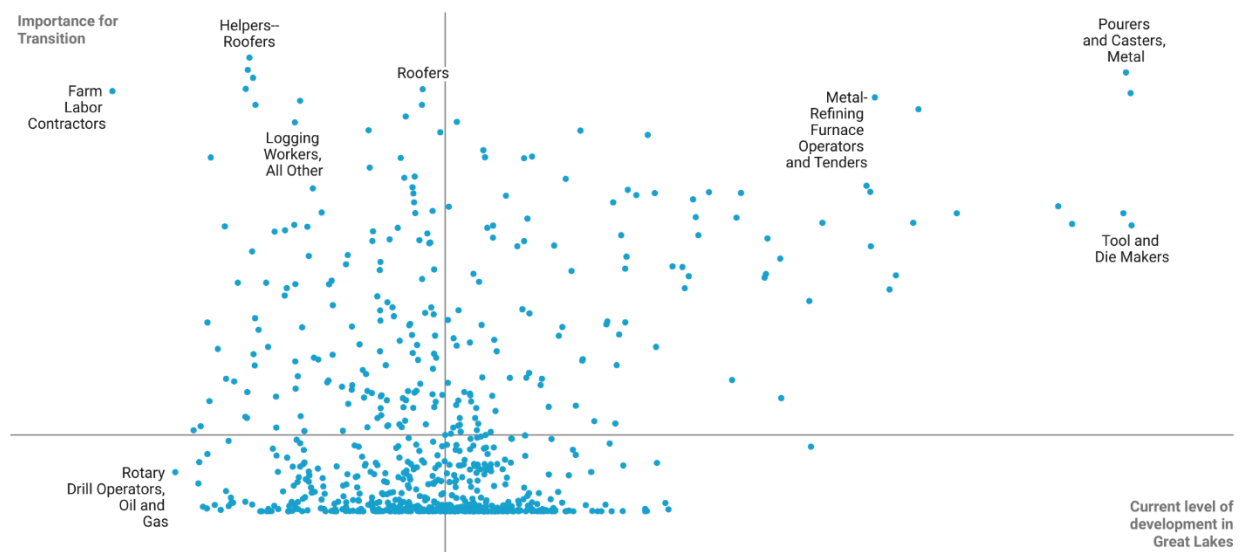
Source: Brookings' analysis of Lightcast data and Integrated Public Microdata Series (IPUMS), Census data • Created with Datawrapper



Figure P presents an alternative way to view these workforce gaps. The y-axis indicates how instrumental each occupation is to the set of energy transition industries, while the x-axis measures the extent to which each occupation currently exists in the Great Lakes region. The y-axis is centered around 1—occupations to the left are considered underdeveloped and those to the right are developed. The x-axis is centered around the average importance of the occupation to the set of energy transition industries. As a result, occupations in the top-left quadrant are both instrumental to the energy transition and are relatively scarce in the Great Lakes region.<sup>6</sup> Examples of these occupations include "Roofers" and "Farm Labor Contractors," and a variety of occupations related to Building and Manufacturing industries.

Figure P

### Occupational requirements for clean energy transition in Great Lakes



Source: Brookings' analysis of Lightcast and Integrated Public Use Microdata Series (IPUMS), Census data • Created with Datawrapper

## 5. CEDS analysis

In this final section we explore the extent to which economic development planners are accounting for—and striving for—an energy transition. To do this, we analyze the texts of 363 Comprehensive Economic Development Strategies (CEDS) since 2015, which are economic planning documents that Economic Development Districts (EDDs) are required to produce every five years and update annually. Broadly, our objective is to identify the importance of specific energy transition industries by counting mentions of these industries in the documents. We can then define the “importance” of an industry

<sup>6</sup> For a link to additional occupations that will be required for the energy transition, see the clean growth toolkit [here](#).

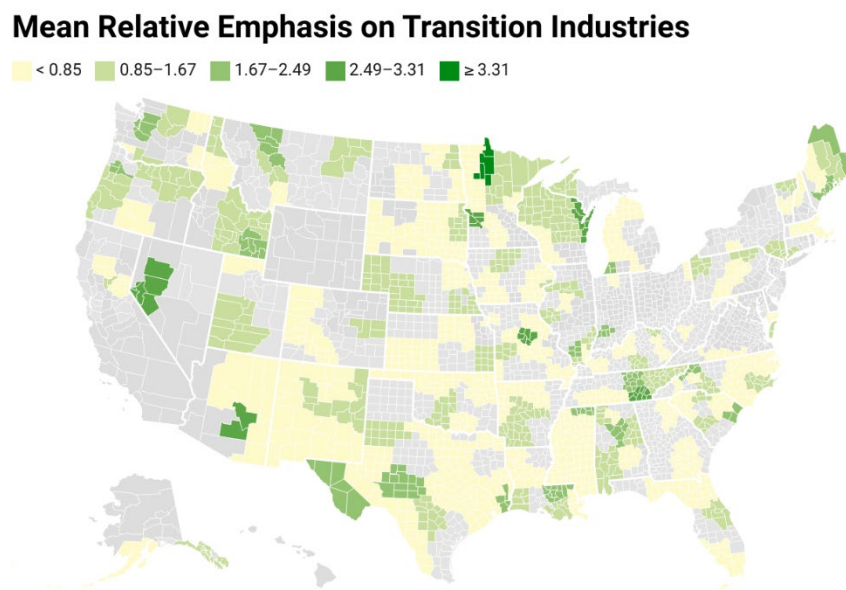
as the number of “meaningful” mentions of that industry as a proportion of the document’s size. This process is described in more detail in Appendix B.

A perhaps more informative measure is the degree to which an industry is emphasized in a CEDS relative to other CEDS. For example, reference to “public safety” industries appear in almost every CEDS but appear most often in the 2012 CEDS of a northern Mississippi EDD. By comparison, reference to “wood products” industries appear in only half of CEDS, and most often in the 2020 CEDS of a north-central Idaho EDD. To capture this idea more formally, we construct a measure of the *Relative Emphasis* (RE) of an industry.<sup>7</sup> Taking the above example, the RE of Justice, Public Order, and Safety Activities in northern Mississippi is 0.8 whereas the RE of Sawmills and Wood Preservation in the north-central Idaho EDD is 18.9. This difference reflects the fact that “public safety” industries are simply more common in all regions, so that any regional concentration in them is less significant.

### Energy transition emphasis across the Great Lakes

Figure Q below shows the relative emphasis of energy transition industries across the U.S. We can see that most EDDs in the Great Lakes Region strongly emphasize energy transition industries in their CEDS. In fact, the top five EDDs—in terms of relative emphasis on energy transition industries—are all located in the Great Lakes Region.

Figure Q



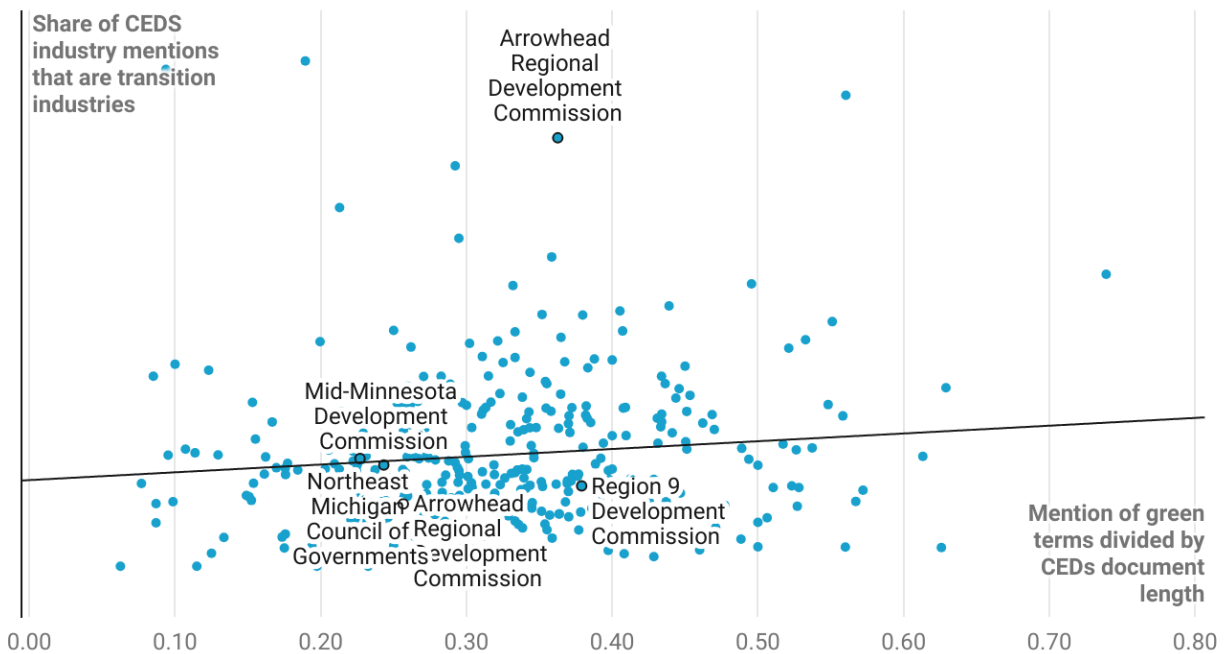
Source: Brookings’ analysis of CEDS Resource Library; StatsAmerica • Created with Datawrapper

<sup>7</sup> Formally, the RE is the meaningful mentions (mm) of an industry in a CEDS divided by the mm of all industries in that CEDS, all over the mm of that industry in all CEDS divided by mm of all industries in all CEDS.

Unsurprisingly, EDDs that emphasize energy transition industries also tend to use environmentally friendly terms throughout their CEDS, though not always. In fact, there are quite a few EDDs that proclaim an interest in environmentally friendly *policies* and yet are not pursuing growth in environmentally friendly *industries*, and vice versa. To see this, we compare the frequency with which CEDS emphasize energy transition industries against their mention of a range of terms related to environmentalism.<sup>8</sup> Figure R plots the relationship, where we see that it is positive (though statistically insignificant) but with quite a bit of dispersion around the linear fit. This suggests that, as part of the planning process, regions may want to ensure that their development strategies are aligned with their stated priorities.

Figure R

### Transition Industries vs. Environmentally Friendly Mentions



Source: Brookings' analysis of CEDS Resource Library: StatsAmerica • Created with Datawrapper

<sup>8</sup> Terms include green, greener, beauty, beautiful, clean, cleaner, cleanly, environmental, environment, environmentally, renewable, renewably, reuse, circular, decarbon, decarbonization, and decarbonizing.

## 6. Conclusion

The coming energy transition presents an enormous opportunity for the Great Lakes region, one that the region is well-poised to utilize. To do so, local policymakers will need to build on existing economic strengths and anticipate the workforce needs that the transition will require. Fortunately, the Great Lakes region, with its current above-average employment concentration in energy transition industries, is well-positioned for the energy transition. Our analysis simultaneously highlights the need for strategic planning to address significant workforce gaps that will be associated with the transition—for instance, the region will need to increase the number of roofers, farmers, and logging workers because they are in low supply and instrumental to several of the transition industries. And while many policymakers within the Great Lakes may be professing a desire to implement environmentally friendly policies, it is essential that the actual economic development policies that are implemented are consistent with those priorities.

Finally, the best jobs in energy transition reside in what we call the Transition Enabling sector, a set of industries encompassing the science and engineering components of the transition. While the Great Lakes is relatively strong in this sector, the diversity of the sector is lacking, both nationally and in the Great Lakes. Developing accessible education and skilling pipelines to this sector should be a policy priority.

## Appendix A

Hierarchy and definitions of Transition Sector & Subsector categories.

<b>Transition Sector &amp; Subsector Categories</b>	
<b>Raw Materials Production and Extraction</b>	
<b>Transition Forestry, Land, and Agriculture (FLAG)</b>	
Agricultural & Forest Biomass Production	Includes the production of biomass materials used in the production of biofuels and biomass energy.
Sustainable Livestock Production	Includes a few livestock production industries that had very high Transition technology scores associated with climate mitigation technology patents (too high to ignore).
Transition Farming & Forestry Machinery & Equipment Manufacturing	Includes farming machinery and lawn and garden equipment manufacturing industries that could potentially transition to Transition technologies.
<b>Transition Mineral and Metal Mining</b>	
Transition Mineral Mining	Includes mining of limestone, industrial sand, phosphate, etc.
Transition Metal Mining	Includes mining of iron ore, lead, copper, nickel, zinc, etc.
Transition Mining Machinery & Equipment Manufacturing	Includes mining machinery and equipment manufacturers that could potentially transition to Transition technologies.
<b>Upstream Manufacturing</b>	
<b>Transition Chemical, Mineral, and Metal Manufacturing</b>	
Transition Chemical Manufacturing	Includes most of the chemical manufacturing industry as, much like the steel industry, has significant decarbonization potential Also includes biofuels and hydrogen.
Transition Mineral Manufacturing	Includes the manufacturing of cement, concrete, glass, industrial sand, etc.
Transition Primary Metal Manufacturing	Includes the manufacturing of iron, steel, aluminum, copper, and other metals used to manufacture many of the other Transition products.

Transition Fabricated Metal Manufacturing	Includes the manufacture of metal parts and components that are used to manufacture many of the other Transition products.
<b>End-Use Sectors</b>	
<b>Buildings</b>	
Building Construction	Includes the building construction industries that will need to transition to Transition technologies and practices
Transition Construction Machinery & Equipment Manufacturing	Includes the manufacturing of construction machinery and equipment
Building Efficiency Machinery & Equipment Manufacturing	Include the manufacturing of energy efficient end-use products such as lighting systems, HVAC systems, appliances, etc.
<b>Energy Sector</b>	
Transition Energy Machinery & Equipment Manufacturing	Includes the manufacturing of key components, machinery, and equipment used to produce hydroelectric, wind, solar, geothermal, biomass, and marine energy
Electrical Grid Machinery & Equipment Manufacturing	Includes the manufacturing of machinery and equipment used to build and operate the electrical grid
Energy Utility Construction	Includes the utility system construction industry
Transition Energy Production	Includes the industries that generate electricity from Transition sources, such as hydroelectric, wind, solar, geothermal, biomass, and marine energy
Energy Transmission	Includes the electric bulk transmission industry
<b>Industrial Sector</b>	
Transition Industrial Air & Heating Equipment Manufacturing	Includes the manufacturing of industrial air and heating equipment such as industrial heat pumps and exchangers
Transition Industrial Machinery & Equipment Manufacturing	Includes the manufacturing of other types of industrial machinery and equipment used to generate mechanical power, etc.
Transition Product Manufacturing	Includes the manufacturing of the many other types of Transition products listed on the GTN such as food and beverage products, Transition textiles and apparel, plastics and rubber products, etc.

<b>Transportation Sector</b>	
Transition Motor Vehicle Manufacturing	Includes the manufacturing of various types of Transition motor vehicles, such as BEVs, FCEVs, electric light and heavy-duty vehicles, etc.
Transition Aircraft Manufacturing	Includes the manufacturing of Transition aircraft, aircraft parts, etc.
Transition Rail Manufacturing	Includes the manufacturing of Transition locomotives, railroad stock, parts, etc.
Transition Ship & Boat Manufacturing	Includes the manufacturing of Transition ships, boats, parts, etc.
<b>Environmental Management</b>	
Air Protection & Management	Includes industries identified as important for the manufacturing of air pollution abatement and carbon pollution abatement technologies (e.g., CCUS).
Water Protection & Management	Includes the water supply and wastewater management industries as well as manufacturers of wastewater treatment and water pollution abatement technologies.
Land Protection & Management	Includes the solid waste management industries and manufacturers of machinery and equipment used by the waste management industries.
Environmental Monitoring, Assessment, & Analysis	Includes the manufacturing of technologies used for environmental monitoring, assessment, and analysis.
<b>Transition Enabling Industries</b>	
Enabling Machinery & Equipment Manufacturing	Includes the manufacturing of key transition enabling technologies such as electronic computers, data processing technologies, communication technologies, etc.
Enabling Services	Includes several transition enabling services, such as research and development professionals, engineering and industrial design services, telecommunications and data processing services, etc.

The formal list of 283 six-digit NAICS energy transition industries and their corresponding sector, sub-sector and primary transition product/technology is outlined below.

6-Digit Code	6-Digit Description	Transition Sector Category	Transition Subsector Category	Primary Transition Products / Technologies
111110	Soybean Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111120	Oilseed (except Soybean) Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111130	Dry Pea and Bean Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111140	Wheat Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111150	Corn Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111160	Rice Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111191	Oilseed and Grain Combination Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111199	All Other Grain Farming	Transition Forestry, Land, and	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass



		Agriculture (FLAG) Sector		
111320	Citrus (except Orange) Groves	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111411	Mushroom Production	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111920	Cotton Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111930	Sugarcane Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111940	Hay Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111991	Sugar Beet Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111992	Peanut Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
111998	All Other Miscellaneous Crop Farming	Transition Forestry, Land, and	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass

		Agriculture (FLAG) Sector		
113110	Timber Tract Operations	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Wood & Timber
113210	Forest Nurseries and Gathering of Forest Products	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Wood & Timber
113310	Logging	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Wood & Timber
115111	Cotton Ginning	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Biomass
115112	Soil Preparation, Planting, and Cultivating	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services
115113	Crop Harvesting, Primarily by Machine	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services
115114	Postharvest Crop Activities (except Cotton Ginning)	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services

115115	Farm Labor Contractors and Crew Leaders	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services
115116	Farm Management Services	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services
115310	Support Activities for Forestry	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forest & Agricultural Biomass Production	Agricultural Support Services
112210	Hog and Pig Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Livestock Production	Low-Carbon Livestock
112410	Sheep Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Livestock Production	Low-Carbon Livestock
112420	Goat Farming	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Livestock Production	Low-Carbon Livestock
112519	Other Aquaculture	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Livestock Production	Low-Carbon Livestock
112990	All Other Animal Production	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Livestock Production	Low-Carbon Livestock

212210	Iron Ore Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Metal Mining	Low-Carbon Iron & Steel
212221	Gold Ore Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Metal Mining	Energy Transition Metals
212230	Copper, Nickel, Lead, and Zinc Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Metal Mining	Energy Transition Metals
212291	Uranium-Radium-Vanadium Ore Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Metal Mining	Energy Transition Metals
212299	All Other Metal Ore Mining	The	Low-Carbon Metal Mining	Energy Transition Metals
212311	Dimension Stone Mining and Quarrying	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Energy Transition Minerals
212312	Crushed and Broken Limestone Mining and Quarrying	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Low-Carbon Cement & Concrete
212319	Other Crushed and Broken Stone Mining and Quarrying	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Energy Transition Minerals
212321	Construction Sand and Gravel Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Low-Carbon Cement & Concrete
212322	Industrial Sand Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Low-Carbon Cement & Concrete

212392	Phosphate Rock Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Energy Transition Minerals
212393	Other Chemical and Fertilizer Mineral Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Energy Transition Minerals
213114	Support Activities for Metal Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Low-Carbon Cement & Concrete
213115	Support Activities for Nonmetallic Minerals (except Fuels) Mining	Transition Mineral and Metal Mining Sector	Low-Carbon Mineral Mining	Low-Carbon Cement & Concrete
221330	Steam and Air-Conditioning Supply	Buildings End-Use Sector	Low-Carbon Heating & Cooling Machinery & Equipment Manufacturing	HVAC Systems
221121	Electric Bulk Power Transmission and Control	Energy End-Use Sector	Energy Storage & Transmission	Energy Transmission Equipment
221111	Hydroelectric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Hydroelectric Power
221113	Nuclear Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Nuclear Electric Power
221114	Solar Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Solar Electric Power
221115	Wind Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Wind Electric Power
221116	Geothermal Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Geothermal Electric Power
221117	Biomass Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Biomass Electric Power
221118	Other Electric Power Generation	Energy End-Use Sector	Low-Carbon Energy Production	Marine Electric Power

221310	Water Supply and Irrigation Systems	Environmental Protection & Management End-Use Sector	Water Protection & Management Services	Water Supply Services
221320	Sewage Treatment Facilities	Environmental Protection & Management End-Use Sector	Water Protection & Management Services	Wastewater Treatment Services
236115	New Single-Family Housing Construction (except For-Sale Builders)	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
236116	New Multifamily Housing Construction (except For-Sale Builders)	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
236117	New Housing For-Sale Builders	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
236118	Residential Remodelers	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
236220	Commercial and Institutional Building Construction	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
238120	Structural Steel and Precast Concrete Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
238160	Roofing Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
238210	Electrical Contractors and Other Wiring Installation Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings

238220	Plumbing, Heating, and Air-Conditioning Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
238290	Other Building Equipment Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
238910	Site Preparation Contractors	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
237130	Power and Communication Line and Related Structures Construction	Energy End-Use Sector	Energy Utility System Construction	Energy Utility Systems
237120	Oil and Gas Pipeline and Related Structures Construction	Environmental Protection & Management End-Use Sector	Air Protection & Management Utility Construction	Carbon Capture, Utilization, & Storage (CCUS) Pipelines
237110	Water and Sewer Line and Related Structures Construction	Environmental Protection & Management End-Use Sector	Water Utility System Construction	Water Utility Systems
236210	Industrial Building Construction	Industrial End-Use Sector	Industrial Green Building Construction	Green Buildings
312112	Bottled Water Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
313230	Nonwoven Fabric Mills	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
313320	Fabric Coating Mills	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
314120	Curtain and Linen Mills	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
316992	Women's Handbag and Purse Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products

316998	All Other Leather Good and Allied Product Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
312140	Distilleries	Transition Chemical, Mineral, and Metal Manufacturing Sector	Green Hydrogen & Sustainable Fuels	Biofuels
321991	Manufactured Home (Mobile Home) Manufacturing	Buildings End-Use Sector	Residential & Commercial Green Building Construction	Green Buildings
322211	Corrugated and Solid Fiber Box Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
323111	Commercial Printing (except Screen and Books)	Environmental Protection & Management End-Use Sector	Water Protection & Management Machinery & Equipment Manufacturing	Wastewater Treatment Technologies
325414	Biological Product (except Diagnostic) Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
326111	Plastics Bag and Pouch Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
326160	Plastics Bottle Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
326199	All Other Plastics Product Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics



326220	Rubber and Plastics Hoses and Belting Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
326291	Rubber Product Manufacturing for Mechanical Use	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
326299	All Other Rubber Product Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
325110	Petrochemical Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325120	Industrial gas manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Green Hydrogen & Sustainable Fuels	Green Hydrogen
325130	Synthetic Dye and Pigment Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325180	Other Basic Inorganic Chemical Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Green Hydrogen & Sustainable Fuels	Low-Carbon Chemicals
325193	Ethyl Alcohol Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Green Hydrogen & Sustainable Fuels	Biofuels
325194	Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals

325199	All Other Basic Organic Chemical Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325211	Plastics Material and Resin Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325212	Synthetic Rubber Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325220	Artificial and Synthetic Fibers and Filaments Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325311	Nitrogenous Fertilizer Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325312	Phosphatic Fertilizer Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325314	Fertilizer (Mixing Only) Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325510	Paint and Coating Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals

325520	Adhesive Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
325612	Polish and Other Sanitation Good Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Chemical Manufacturing	Low-Carbon Chemicals
327110	Pottery, Ceramics, and Plumbing Fixture Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
327211	Flat Glass Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
327215	Glass Product Manufacturing Made of Purchased Glass	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
327310	Cement Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete
327320	Ready-Mix Concrete Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete
327331	Concrete Block and Brick Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete

327332	Concrete Pipe Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete
327390	Other Concrete Product Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete
327410	Lime Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Cement & Concrete
327991	Cut Stone and Stone Product Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
327993	Mineral Wool Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
327999	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Mineral Manufacturing	Low-Carbon Minerals
336310	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing			
336415	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing			

335110	Electric Lamp Bulb and Part Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Lighting
335121	Residential Electric Lighting Fixture Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Lighting
335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Lighting
335129	Other Lighting Equipment Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Lighting
335210	Small Electrical Appliance Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Appliances
335220	Major Household Appliance Manufacturing	Buildings End-Use Sector	Building Efficiency Machinery & Equipment Manufacturing	Energy Efficient Appliances
333120	Construction Machinery Manufacturing	Buildings End-Use Sector	Low-Carbon Construction Machinery & Equipment Manufacturing	Low-Carbon Construction Machinery
332410	Power Boiler and Heat Exchanger Manufacturing	Buildings End-Use Sector	Low-Carbon Heating & Cooling Machinery & Equipment Manufacturing	Heat Exchangers
333413	Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing	Buildings End-Use Sector	Low-Carbon Heating & Cooling Machinery & Equipment Manufacturing	HVAC Systems
333414	Heating Equipment (except Warm Air	Buildings End-Use Sector	Low-Carbon Heating & Cooling Machinery & Equipment Manufacturing	Heating Equipment

	Furnaces) Manufacturing			
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	Buildings End-Use Sector	Low-Carbon Heating & Cooling Machinery & Equipment Manufacturing	Heat Pumps
334416	Capacitor, Resistor, Coil, Transformer, and Other Inductor Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Batteries & Components
334417	Electronic Connector Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
335311	Power, Distribution, and Specialty Transformer Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
335313	Switchgear and Switchboard Apparatus Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
335314	Relay and Industrial Control Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
335911	Storage Battery Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Batteries & Components
335912	Primary Battery Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Batteries & Components
335929	Other Communication and Energy Wire Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment

335931	Current-Carrying Wiring Device Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
335991	Carbon and Graphite Product Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Batteries & Components
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	Energy End-Use Sector	Energy Storage & Transmission Machinery & Equipment Manufacturing	Energy Transmission Equipment
333244	Printing Machinery and Equipment Manufacturing	Energy End-Use Sector	Low-Carbon Energy Machinery & Equipment Manufacturing	Clean Energy Technologies
333314	Optical Instrument and Lens Manufacturing	Energy End-Use Sector	Low-Carbon Energy Machinery & Equipment Manufacturing	Clean Energy Technologies
333611	Turbine and Turbine Generator Set Units Manufacturing	Energy End-Use Sector	Low-Carbon Energy Machinery & Equipment Manufacturing	Clean Energy Technologies
335312	Motor and Generator Manufacturing	Energy End-Use Sector	Low-Carbon Energy Machinery & Equipment Manufacturing	Clean Energy Technologies
333132	Oil and Gas Field Machinery and Equipment Manufacturing	Environmental Protection & Management End-Use Sector	Air Protection & Management Machinery & Equipment Manufacturing	Air Pollution Abatement Technologies
333618	Other Engine Equipment Manufacturing	Environmental Protection & Management End-Use Sector	Air Protection & Management Machinery & Equipment Manufacturing	Air Pollution Abatement Technologies
333912	Air and Gas Compressor Manufacturing	Environmental Protection & Management End-Use Sector	Air Protection & Management Machinery & Equipment Manufacturing	Air Pollution Abatement Technologies

333316	Photographic and Photocopying Equipment Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
333997	Scale and Balance Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334419	Other Electronic Component Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334514	Totalizing Fluid Meter and Counting Device Manufacturing	Environmental Protection &	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies



		Management End-Use Sector		
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334516	Analytical Laboratory Instrument Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
334519	Other Measuring and Controlling Device Manufacturing	Environmental Protection & Management End-Use Sector	Environmental Monitoring Machinery & Equipment Manufacturing	Environmental Monitoring Technologies
333249	Other Industrial Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333517	Machine Tool Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333519	Rolling Mill and Other Metalworking Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333922	Conveyor and Conveying Equipment Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies

333993	Packaging Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333994	Industrial Process Furnace and Oven Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Soil Remediation Technologies
333243	Sawmill, Woodworking, and Paper Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333318	Other Commercial and Service Industry Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Water Protection & Management Machinery & Equipment Manufacturing	Wastewater Treatment Technologies
333911	Pump and Pumping Equipment Manufacturing	Environmental Protection & Management End-Use Sector	Air Protection & Management Machinery & Equipment Manufacturing	Air Pollution Abatement Technologies
333995	Fluid Power Cylinder and Actuator Manufacturing	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
333996	Fluid Power Pump and Motor Manufacturing	Environmental Protection & Management End-Use Sector	Water Protection & Management Machinery & Equipment Manufacturing	Wastewater Treatment Technologies

333999	All Other Miscellaneous General Purpose Machinery Manufacturing	Environmental Protection & Management End-Use Sector	Water Protection & Management Machinery & Equipment Manufacturing	Wastewater Treatment Technologies
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	Environmental Protection & Management End-Use Sector	Water Protection & Management Machinery & Equipment Manufacturing	Wastewater Treatment Technologies
333220	Plastics and Rubber Industry Machinery Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Plastics
333241	Food Product Machinery Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
333991	Power-Driven Handtool Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
334614	Software and Other Prerecorded Compact Disc, Tape, and Record Reproducing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
339991	Gasket, Packing, and Sealing Device Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
339992	Musical Instrument Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
339994	Broom, Brush, and Mop Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
339995	Burial Casket Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products

339999	All Other Miscellaneous Manufacturing	Industrial End-Use Sector	Green Product Manufacturing	Green Consumer Products
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	Industrial End-Use Sector	Low-Carbon Industrial Machinery & Equipment Manufacturing	Low-Carbon Industrial Equipment
333613	Mechanical Power Transmission Equipment Manufacturing	Industrial End-Use Sector	Low-Carbon Industrial Machinery & Equipment Manufacturing	Low-Carbon Industrial Equipment
333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	Industrial End-Use Sector	Low-Carbon Industrial Machinery & Equipment Manufacturing	Electric Industrial Vehicles
332216	Saw Blade and Handtool Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332312	Fabricated Structural Metal Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332313	Plate Work Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332322	Sheet Metal Work Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components

332323	Ornamental and Architectural Metal Work Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332420	Metal Tank (Heavy Gauge) Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332431	Metal Can Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332439	Other Metal Container Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332510	Hardware Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332722	Bolt, Nut, Screw, Rivet, and Washer Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332911	Industrial Valve Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332912	Fluid Power Valve and Hose Fitting Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components

332913	Plumbing Fixture Fitting and Trim Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332919	Other Metal Valve and Pipe Fitting Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332991	Ball and Roller Bearing Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Fabricated Metal Manufacturing	Low-Carbon Technology Components
331110	Iron and Steel Mills and Ferroalloy Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
331222	Steel Wire Drawing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
331313	Alumina Refining and Primary Aluminum Production	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals

331314	Secondary Smelting and Alloying of Aluminum	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331315	Aluminum Sheet, Plate, and Foil Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331318	Other Aluminum Rolling, Drawing, and Extruding	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331410	Nonferrous Metal (except Aluminum) Smelting and Refining	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331420	Copper Rolling, Drawing, Extruding, and Alloying	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331511	Iron Foundries	Transition Chemical, Mineral, and Metal	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel

		Manufacturing Sector		
331512	Steel Investment Foundries	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
331513	Steel Foundries (except Investment)	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
331523	Nonferrous Metal Die-Casting Foundries	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331524	Aluminum Foundries (except Die-Casting)	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
331529	Other Nonferrous Metal Foundries (except Die-Casting)	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
332111	Iron and Steel Forging	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Iron & Steel
332112	Nonferrous Forging	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Energy Transition Metals
332114	Custom Roll Forming	Transition Chemical, Mineral, and Metal	Low-Carbon Primary Metal Manufacturing	Low-Carbon Metals



		Manufacturing Sector		
332117	Powder Metallurgy Part Manufacturing	Transition Chemical, Mineral, and Metal Manufacturing Sector	Low-Carbon Primary Metal Manufacturing	Low-Carbon Metals
333242	Semiconductor Machinery Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334111	Electronic Computer Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334112	Computer Storage Device Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334210	Telephone Apparatus Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334290	Other Communications Equipment Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
334413	Semiconductor and Related Device Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies

335921	Fiber Optic Cable Manufacturing	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies
333111	Farm Machinery and Equipment Manufacturing	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forestry & Farming Machinery & Equipment Manufacturing	Low-Carbon Forestry & Farming Equipment
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	Transition Forestry, Land, and Agriculture (FLAG) Sector	Low-Carbon Forestry & Farming Machinery & Equipment Manufacturing	Low-Carbon Forestry & Farming Equipment
333131	Mining Machinery and Equipment Manufacturing	Transition Mineral and Metal Mining Sector	Low-Carbon Mining Machinery & Equipment Manufacturing	Low-Carbon Mining Equipment
336111	Automobile Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicles
336112	Light Truck and Utility Vehicle Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicles
336120	Heavy Duty Truck Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicles
336211	Motor Vehicle Body Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336212	Truck Trailer Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336213	Motor Home Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicles
336320	Motor Vehicle Electrical and Electronic Equipment Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components

336330	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336340	Motor Vehicle Brake System Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336350	Motor Vehicle Transmission and Power Train Parts Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336360	Motor Vehicle Seating and Interior Trim Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336370	Motor Vehicle Metal Stamping	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336390	Other Motor Vehicle Parts Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336991	Motorcycle, Bicycle, and Parts Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicles
336999	All Other Transportation Equipment Manufacturing	Transportation End-Use Sector	Electric Vehicle & Component Manufacturing	Electric Vehicle Components
336411	Aircraft Manufacturing	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicles
336412	Aircraft Engine and Engine Parts Manufacturing	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicle Components

336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicle Components
336510	Railroad Rolling Stock Manufacturing	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicles
336611	Ship Building and Repairing	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicles
336612	Boat Building	Transportation End-Use Sector	Low-Carbon Vehicle & Component Manufacturing	Low-Carbon Vehicles
486110	Pipeline Transportation of Crude Oil	Environmental Protection & Management End-Use Sector	Air Protection & Management Services	Carbon Transportation Services
486210	Pipeline Transportation of Natural Gas	Environmental Protection & Management End-Use Sector	Air Protection & Management Services	Carbon Transportation Services
486910	Pipeline Transportation of Refined Petroleum Products	Environmental Protection & Management End-Use Sector	Air Protection & Management Services	Carbon Transportation Services
486990	All Other Pipeline Transportation	Environmental Protection & Management End-Use Sector	Air Protection & Management Services	Carbon Transportation Services
487110	Scenic and Sightseeing Transportation, Land	Environmental Protection & Management End-Use Sector	Land Protection & Management Machinery & Equipment Manufacturing	Solid Waste Management & Recycling Technologies
511210	Software Publishers	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Technologies

517311	Wired Telecommunications Carriers	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Services
517312	Wireless Telecommunications Carriers (except Satellite)	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Services
518210	Data Processing, Hosting, and Related Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Services
519130	Internet Publishing and Broadcasting and Web Search Portals	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Services
541330	Engineering Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Enabling Professional Services
541420	Industrial Design Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Enabling Professional Services
541513	Computer Facilities Management Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Digital Transition Services
541620	Environmental Consulting Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Enabling Professional Services
541713	Research and Development in Nanotechnology	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Research & Development Services
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Research & Development Services
541715	Research and Development in the Physical, Engineering,	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Research & Development Services

	and Life Sciences (except Nanotechnology and Biotechnology)			
541990	All Other Professional, Scientific, and Technical Services	Transition Enabling Sector	Transition Enabling Machinery & Equipment Manufacturing	Enabling Professional Services
562111	Solid Waste Collection	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562112	Hazardous Waste Collection	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Hazardous Waste Management Services
562119	Other Waste Collection	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562211	Hazardous Waste Treatment and Disposal	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Hazardous Waste Management Services
562212	Solid Waste Landfill	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562213	Solid Waste Combustors and Incinerators	Environmental Protection & Management End- Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services

562219	Other Nonhazardous Waste Treatment and Disposal	Environmental Protection & Management End-Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562910	Remediation Services	Environmental Protection & Management End-Use Sector	Land Protection & Management Services	Soil Remediation Services
562920	Materials Recovery Facilities	Environmental Protection & Management End-Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562991	Septic Tank and Related Services	Environmental Protection & Management End-Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services
562998	All Other Miscellaneous Waste Management Services	Environmental Protection & Management End-Use Sector	Land Protection & Management Services	Solid Waste Management & Recycling Services

## Appendix B

This Appendix describes the textual analysis of Comprehensive Economic Development Strategies (CEDs) discussed in the final section of the report. CEDs are produced by Economic Development Districts (EDDs) every five years and updated annually.

### Methods

We downloaded 363 CEDs from StatsAmerica. Their publication years range from 1998 to 2021. The corpus is not the full universe of CEDs, nor does it cover all EDDs. Only about 75 percent of EDDs have a CED in the sample, and several EDDs have multiple CEDs.

The first step in the textual analysis of the CED corpus is to create a variable for relative concentration of meaningful industry term mentions at the NAICS 4-digit level. We take a reference list of all NAICS industry titles as well as a reference text of all NAICS industry descriptions at all sub-levels (i.e., NAICS 5- and 6-digit.) We parse two-word terms from the reference list and text and search for those two-word terms in CEDs.

Broadly, a two-word term is associated with an industry if it is in the name or description of the industry or if it is in the name or description of any of the industry's subsectors. However, many terms appear in multiple industry titles or descriptions. For example, the term "motion picture" appears in the NAICS industry title Motion Picture and Video Industries, but it also appears in the description of a subsector of the industry Employment Services, as in, "Casting agencies (i.e., motion picture, theatrical, video)."

In order for every two-word term to uniquely identify a 4-digit NAICS industry, we count the appearances of a two-word term in all the subsector branches (i.e., all the 5- and 6-digit NAICS industries with the same first four digits,) then associate the term with the industry in which the term appears most.

In effect, we assume that if a CED were to mention "motion picture" they are most likely referring to the NAICS industry Motion Picture and Video Industries because the term "motion picture" occurs most often in the descriptions and titles of that industry and that industry's subindustries.

Many CEDs contain summary tables describing employment, wages, or growth of dozens or more industries. These industry mentions can be distinguished from more meaningful industry mentions in the CED by identifying only the mentions of two-word terms that are not immediately preceded or followed by terms associated with another different industry.

The text processing procedure described above can be performed using terms of various word lengths as well as at various levels of NAICS specificity (NAICS level of 2-, 3-, 4-digit, etc.) To validate the process and to determine the most suitable level of analysis, we compare the log number of meaningful mentions of an industry with the national log employment of the industry, with the relationship depicted in Figure B.1. Intuitively, and in general, larger EDDs ought to be mentioning industries more often. The

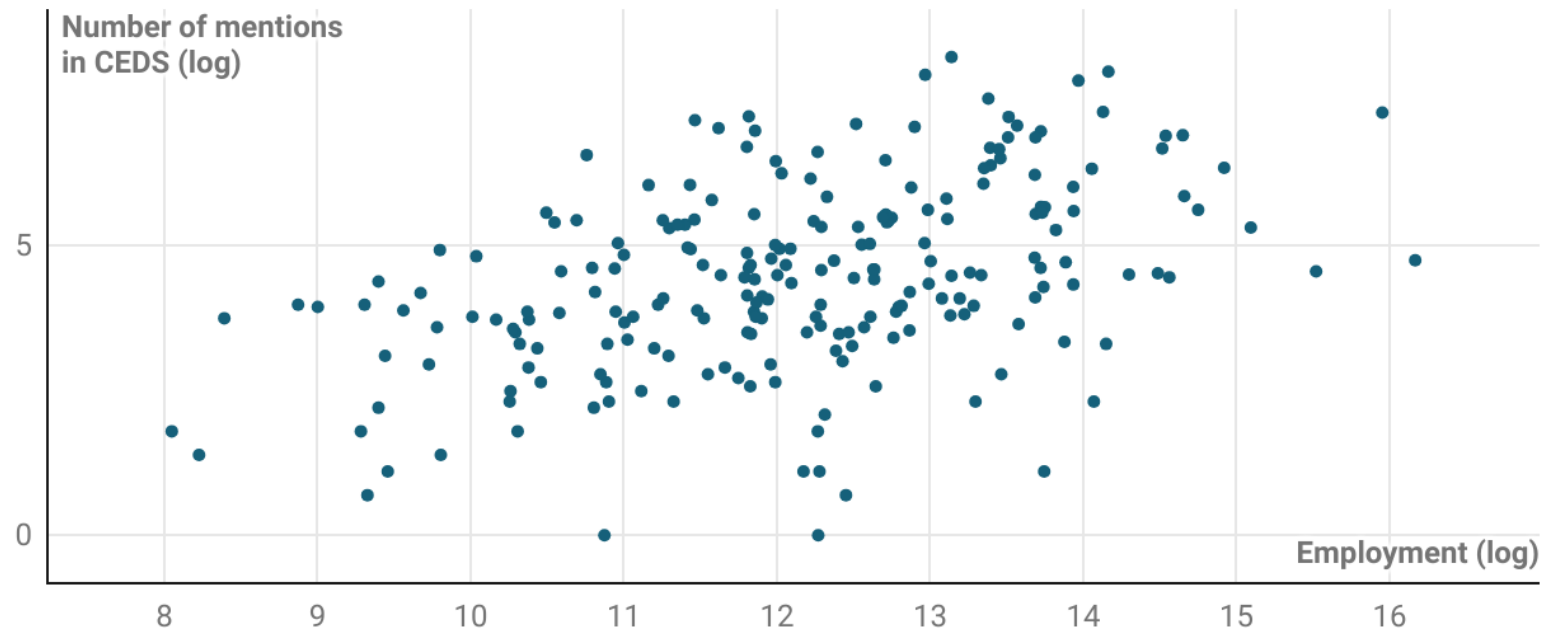


correlation is highest using two-word terms at the NAICS 4-digit level.

Figure B.1

## Industry emphasis correlated with employment growth

Mentions in Comprehensive Economic Development Strategies (CEDS) produced by Economic Development Districts (EDDs)



$n = 221, r = 0.45$

Source: Authors' analysis of CEDS Resource Library: StatsAmerica and Occupational Employment and Wage Statistics (OWES), BLS data • Created with Datawrapper

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