Relationships and Occupations Underlying Regional Economic Transformation

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This report seeks to inform and catalyze ReImagine Jobs' goal to cultivate engagements across Southwestern Pennsylvania that will lead to systemic and transformational changes that make the region's economy greener, more equitable, and more sustainable in the decades ahead. It aims to provide insight into perspectives on relationships in the region and opportunities for developing metrics that can support efforts to have productive discussions about these changes. This report was commissioned by ReImagine Jobs; authored by Dr. Scott Kalafatis, Assistant Professor of Sustainability at Chatham University, and was overseen by Lou Leonard, Dean of the Falk School of Sustainability and Environment at Chatham University.

Section 1: Context and Introduction

The Club of Rome's 1972 *Limits to Growth* report became one of the major touchstones fueling increasing concern about sustainability (Meadows et al. 1972). The report utilized one of the first systems dynamic computer models ever developed to examine a wide array of ways that the future might play out. Focusing on twelve different scenarios, it famously warned that the business-as-usual pathway society was progressing on was unsustainable. Due to intensive resource use and/or pollution, economic and quality of life metrics would begin to decline in the 2020s and 2030s and societal collapse would possibly follow within decades. Attempts to track which scenario has been followed since the report was published have ominously found that society has continued on a business-as-usual pathway (Turner 2008, 2012). While the *Limits to Growth* underestimated the availability of resources, it was also written too early to account for climate change which is a major potential driver of pollution-driven collapse in the decades ahead (Randers 2000). Fifty years since the *Limits to Growth* amplified concerns about global sustainability, the most up-to-date assessment (Herrington 2022) still warns that aggressive social and technological change is needed to prevent the next few decades from featuring economic decline, decreasing quality of life, and potential societal collapse.

Like many metropolitan areas, Pittsburgh has already been exploring how it might help realize a more sustainable future. However, as the global perpetuation of the *Limits to Growth*'s business-as-usual pathways over the last five decades demonstrates, shifting out of a status quo setting is notoriously difficult. Even the first step of defining what differentiates a more desirable alternative future from the current path can be elusive. In relation to economic development specifically, as of 2019 there were over 140 different published definitions describing the "green economy" balancing economic development, equity, and environmental health (Merino-Saum et al. 2020). This wide array of interpretations of what a "green economy" would be reflects the reality that societal transitions like a green economy are highly circumstantial, emerging from complex interrelationships between people, institutions, and the contexts these people and institutions both inhabit and help produce.

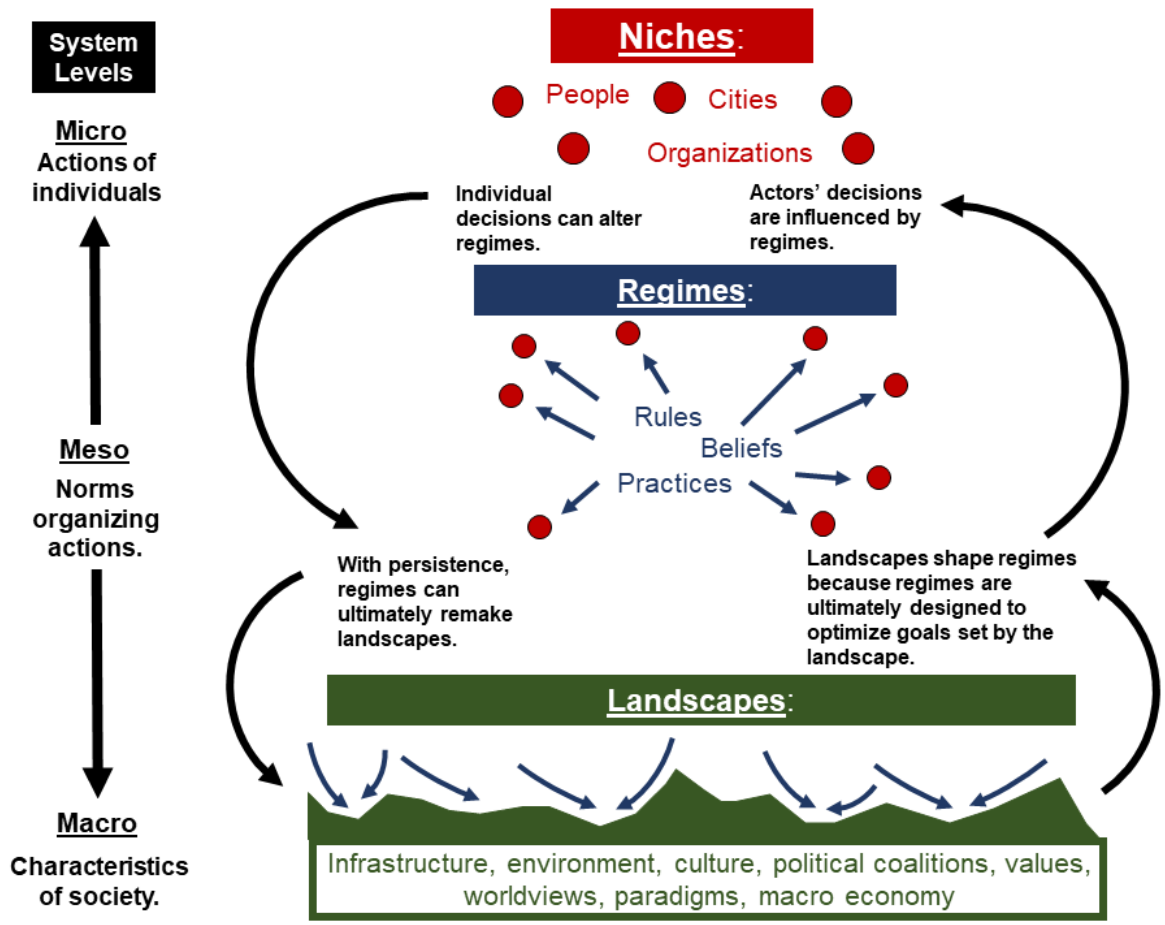
The goal of this report is to help better understand these relationships across the greater-Pittsburgh region and offer input on how that understanding can help contribute to discussions about facilitating this region's own socio-economic transitions in the decades ahead. There are already prominent efforts to bring together perspectives in the region regarding sustainability and economic development. This report seeks to inform ReImagine Jobs' efforts to facilitate engagements across the region that will catalyze the kind of systemic and transformational

change that will be necessary to realize visions of a greener, more equitable, and more sustainable economy.

The second section provides some background from the academic literature on how such systemic, transformational changes can happen. The third section summarizes findings from ten interviews conducted with key informants in the region that provided perspective on existing considerations surrounding the economy of the region and what could be done to make it more sustainable and successful in the years ahead. The results of the interviews are framed so that they can help illustrate concepts from the academic literature from the second section. The fourth section provides insight into the development of publicly available data that can be used as trackable metrics for assessing progress in the years ahead. The fifth section briefly summarizes recommendations and conclusions from this research.

Section 2: Understanding Societal Change and Sustainability

Figure 1. Visualization of Levels Underlying Transformational Change



Recognition that achieving sustainability goals was going to require challenging and fundamental changes in how society operated has led to a large academic literature on sustainability transitions (for reviews see Köhler et al. 2019, Loorbach et al. 2017, Markard et al.

2012). Especially in its early stages (Loorbach et al. 2017), this literature emphasizes the extent to which the kind of systems that are the focus of sustainability efforts are constructed around relationships between society and technology (Rip and Kemp 1998). Transformational changes in these relationships can occur over years through a continuous, but gradual process of conscious structural modification that is characterized by evolution and stabilization rather than revolution and disruption (Rotmans and Kemp 2001). Figure 1 provides an adapted visualization of the multilevel model of societal transitions (adapted from van der Brugge et al. 2005). It can be applied at any geographic scale though this white paper will specifically apply it to the greater-Pittsburgh region in Southwestern Pennsylvania. This model describes three levels of interconnected systems that shape the society we live in. There is the micro-level of niches – individual people and organizations where these who make decisions and take actions. Established, consistent patterns in the decisions and actions give rise to the meso-level of regimes – rules, beliefs, and practices that influence what individual actors do. These rules, beliefs, practices are adapted to achieve goals that are defined by macro-level landscapes – underlying characteristics of a society like infrastructure, worldviews, politics, values, and the external environment that encourage or restrict what happens within them. This model helps describe why the status quo is so persistent – landscapes represent established conditions, regimes prevail through leading to individual success in the midst of these conditions, and individual actors make choices that are shaped by these regimes. In Figure 1, the landscape is visualized literally as a series of hills and valleys where even if individual people or institutions attempt to avoid established pathways, they will be challenged by established grooves in how society operates that push them towards conformity. A feedback loop forms where individual decisions and actions that conform to the status quo reinforce the social relevance of regimes and deepen established grooves in the landscape.

However, the multi-level transitions model also emphasizes that this feedback loop offers insight into how transformational change can emerge over time. Individual people and organizations often don't conform to expectations. Certain individuals, organizations, or communities represent particularly innovative niches where experimentation can take place. Over time, if other actors perceive that these experimental activities are more successful (however they define success), they will adopt these innovations themselves, eventually altering the prevailing regimes and reshaping the landscape. In the next section, this model is applied to analyze ten key-informant interviews to gain insight into how such feedback loops supporting a transformation in the regional economy might be supported.

Section 3: Key-Informant Interviews

3.1: Interview Methodology

Ten key-informant interviews were conducted to better understand perspectives on economic development and the realization of a greener and more equitable and sustainable economy in the region. These interviews were conducted from May 31st to June 29th, 2022. Participants were identified through suggestions by the membership of ReImagine Jobs or were suggested by previous interview participants. Nine of the interviews were conducted via Zoom and one was conducted by phone. They lasted from 30-60 minutes. Table 1 provides a list of questions that participants were asked. These questions were developed by the author in consultation with

members of ReImagine Jobs. This list was designed to act as a semi-structured guide for a conversation that was open-ended, but progressively focused on gaining insight into prevailing challenges and opportunities, perspectives in the region on what success and sustainability mean, and potential ways to shift the regional economy towards more desirable outcomes. Specific focus was giving to training and occupations in part due to interest in developing assessment metrics described in Section 4.

Table 1. Interview Questions
From your perspective, what are the major challenges and opportunities associated with the economy of Southwestern Pennsylvania? How distinctive are these from other areas of the country?
Looking out on the next 10-20 years, what would it mean for the economy of Southwestern Pennsylvania to be successful?
What would it mean for it to be sustainable? What features would such an economy have and how might we measure it?
If you imagine that in 10 or 20 years, the economy of Southwestern Pennsylvania is successful and sustainable (however, you define that), what types of occupations are prevalent in the region?
What sort of training and skills do you anticipate people would need to cultivate to support this type of economy and succeed within it?
What role does different forms of postsecondary training like vocational or trade schools and colleges and universities play in cultivating these skills in the workforce?
How might we ensure that opportunities in such an economy are available to marginalized people and regions?
What strategies might there be to ensure that the regional economy is diversified and not overly dependent on particular industries?

Notes were taken during all of the interviews by the author and recordings were made for the nine interviews that were conducted on Zoom with the interviewee's permission. Quotes from the interviews used in this white paper were authorized and approved by the interviewee. Interview notes were coded to identify themes related to micro-, meso-, and macro- level considerations that provided perspectives on: the aspects of the existing landscapes and regimes that might be leading to an undesirable business as usual pathway in the region, what types of landscapes and regimes might be more consistent with a more desirable sustainable and equitable pathway for the region, and what opportunities there are for transitioning to a more sustainable and equitable pathway.

3.2: Interview Results

3.2.a. Landscape level

Interviewees described a number of landscape factors that impact the potential for the region to be greener and more equitable and sustainable. One common theme familiar to any resident was

the actual landscape itself defined by the constant variation of winding hills and valleys. While this is an environmental characteristic, it has become an infrastructural, political, and cultural characteristic that defines the region's landscape as well. Interviewees described that political fragmentation driven in part by the hills and valleys that divide individual communities throughout the region made collective action to address shared interests in the region more difficult. It also contributes to infrastructure being spread out across the region in ways that present challenges to efforts to reduce greenhouse gas emissions and enhance accessibility for residents and public transportation. Addressing marginalization challenges that this fragmentation has contributed to will require worldviews that are committed to confronting disparities.

The long-established and substantial role that extractive industries have played in the region's history, economy, and politics also shapes efforts to pursue an economy less dependent on those industries. This influence manifests in a more than one way. Importantly, it shapes regional politics, particularly in more rural areas where opposition to their interests is not seen as a viable option. It is also a well-known and familiar pathway for regional investment. However, it is probably most advantageous to generally classify it as worldview that influences how opportunities and challenges are interpreted. One particularly prominent example was how quickly the region embraced unrealistic promises made by the fracking industry because these promises conformed well with long-established assumptions and hopes related to extractive industries. The lament by one interviewee that these promises had led the region to abandon previously successful efforts to invest and expand other industries exemplifies that, like gravity, worldviews that make up the region's underlying landscape can draw it back into a pre-existing pathway even if another route has begun to be successful. Current skepticism about the development of the hydrogen industry draws from concern that the region is again following a well-trod path that has not been beneficial in the past. A couple interviewees emphasized that the issue was perhaps not so much the extractive industries themselves, but in how these industries have typically related to communities throughout the region. From that perspective, the more important underlying worldview to promote was one that put the interests of communities first where public investments are evaluated based on the extent to which companies and industries invest back in and contribute to communities located here. This same interviewee also mentioned that residents also had a responsibility to value the health of local businesses in their community as well by shopping there rather than at big box retail stores. Another dimension of this particular issue was the role of unions in the region. While a few interviewees emphasized that the extent to which unions represented a potential barrier to green jobs initiatives varied depending on the union, one interviewee emphasized that unions may be more proactive on these issues if union leaders had more opportunities to discuss these issues in an informed way with one another.

Four additional worldviews were also described that were focused more on how a greener, more sustainable and equitable future would be made possible. One interviewee echoed by others described that pursuing a sustainable economy would require focusing on building systems in society that support livelihoods where people make living wages and have strong benefits that allow them to raise families. To that end, another mentioned that economic development metrics should include considerations about environmental and social outcomes. The need to cultivate an entrepreneurial ethos in the region, particularly outside of Allegheny County, was also emphasized by several participants. Finally, several interviewees also mentioned that pursuing a

circular economy that minimizes waste as much as possible would be an important aspiration for the region to aim towards.

3.2.b. Regime level

Many observations that interviewees had describing the regime level of rules, beliefs, and practices addressed issues already addressed by landscapes. Consistent with cultivating an entrepreneurial ethos, several interviewees articulated that the region needed to pursue strategies to train students in entrepreneurship, offer coursework and certifications for small business owners to gain necessary management training and access available funding, and develop policies that protected and funded fledgling small businesses. A few also specifically connected small business development to the perceived need to focus on main street and downtown redevelopment throughout the region as well as companies acting as partners investing in that redevelopment. Relatedly, a few interviewees also emphasized the need to pursue planning and redevelopment policies that might help address transportation accessibility challenges throughout the region even to the point of companies offering shuttles to their facilities where public services are not yet available.

Perspectives interviewees gave about job training strategies can be considered practices consistent with a greener, more equitable and sustainable economy. Training the workforce starts with pre-K and elementary education. Essential soft-skills related to collaboration, team-building, and management start with lessons learned in the first years of school. Many of those with the most challenging job prospects in the region lack basic soft-skills to get available service jobs. Over time, a public school system in the region that provides strong training in math, science, computing, and working with technology not only prepares students for post-secondary education, but also increasingly for working as machinists or in other vocational professions that don't need those degrees but need these competencies at the entry-level. Currently employers have a high need for individuals with stackable credentials in machinery operations. This is providing a great demand for credentialing programs. Despite these opportunities, several interviewees expressed that the region still needed to do more to establish a dependable employment pipeline with on-ramps at a variety of different skill- and income-levels and built-in opportunities to test out and develop skills safely through apprenticeships or similar programs. Several explanations were given for why such a pipeline that connected to K-12 education did not exist. One was that the fragmentation described in the landscape section was undermining coordination efforts between governments, school-districts, higher education institutions, and businesses needed to make such an integrated pipeline operate as intended. External coordination through federal or state funding could help address this issue, but the lack of dependability of these funding sources makes creating a sustained program challenging. A perhaps more pessimistic opinion offered by one interviewee was that it was possible that the demand for skilled young workers was simply increasingly outpacing the supply as the region's demographics continue to skew older over time. Strategies to stem the brain drain of students attending the region's universities through internships and connections with area businesses and nonprofits as well as immigration would seem to be necessary to address that particular challenge.

Suggestions from interviewees about key industries for the region to focus on can also be considered as regime-level strategies. Not surprisingly, many interviewees expressed that renewable energy, artificial intelligence, and robotics should be a focus while there were critics and defenders of green hydrogen and carbon capture technologies. One interviewee emphasized that artificial intelligence and robotics may be particularly beneficial for efforts to create a circular economy. Another interviewee explicitly championed battery manufacturing as a promising area that the region could excel in given the right investments. Investments could also be made to support the development of the service and care economy, particularly in rural communities.

3.2.c. Niche level

Considerations that interviewees expressed about individual people, jobs, or companies were classified as niche level because they expressed perspectives related to individual actions or decisions that were being made within the larger systems described in the previous two sections. Regarding individual people, a number of challenges were described. One issue is that young people are less interested in working outdoors than they used to be even though there are many opportunities in potential green industries outdoors. The brain drain of postsecondary graduates or middle managers at companies deciding to leave the region mentioned in the previous section was another individual-level issue. A third challenge was that many people simply don't see environmental jobs as an opportunity open to them due to their training or the demographic categories they belong to. Opportunities related to individual people described included things like promoting informed guidance counseling to support the development of the job pipeline in K-12 education and training that helps young people see opportunities to build their careers in entry-level jobs that don't appear to be immediately making the most of their existing skills.

For companies, remote work has undermined their ability to retain some skilled employees as coastal companies able to pay higher salaries have offered to let these employees make New York or Los Angeles salaries while still enjoying the lower cost of living benefit of working remotely from home in Pittsburgh. At the same time, the region is also potentially missing out on opportunities to recruit companies. Companies that are attracted to the region because of its quality of life frequently often have ambitions or commitments related to using renewable energy and ultimately pass on locating here when they realize that will not be possible. The lack of solar power has become a limitation affecting the region's business recruitment.

Regarding individual jobs, a couple interviewees emphasized that there is a misperception that all green jobs are technical, when in reality there are many other types of jobs like accounting, asset managers, project managers, landowner relations, and paralegals. Many green jobs rely more on people skills than technical abilities. Automation will also make sustainability and productivity management positions more and more essential over time. An existing challenge to the development of a circular economy that was raised was that many essential jobs for it are currently very difficult jobs that pay poorly.

Section 4: Measuring and Tracking Change

4.1. Assessing the Greenness of the Economy

For success in any effort, it is advisable to set measurable goals that can be tracked over time and act as guideposts for developing strategies, identifying opportunities, and making adjustments. To that end, this report has also been tasked with identifying metrics of accessible publicly-available data that might be used to assess and track the development of the green economy over time. Ideally, these would be metrics that would be available for similar metropolitan areas throughout the country so that Pittsburgh's comparative performance relative to its peers can be assessed as well.

Most of the efforts directed to measuring and tracking how green the economy of the United States is has been focused on identifying and counting "green jobs". This reflects a larger trend that data describing economies tends to emphasize activities that translate into market transactions rather than social or economic considerations (Giovannini 2008, p.12). This perspective on economic performance prominently manifests in the form of how much is produced – gross domestic product (GDP) – having been the most influential measure of the overall health of economies since World War II. From this perspective, how "green" an economy is depends on how much of what it produces is "green". Particularly in the wake of 2008 financial crisis, attention to moving the economy in a more sustainable direction focused on stimulating green industries and training a workforce that would have the skills to participate in the development of those industries. This led to many efforts to define what industries and jobs were "green" and assess how much of the economy was and potentially could be green made by groups like Pew, Brookings, and the Bureau of Labor Statistics (Headwaters Economics 2012).

The benefit of these approaches is that they correspond well to existing public economic data that is consistently and dependably collected. However, there are many problems this approach creates. Assessments will vary greatly depending on what gets included as "green". For example, is nuclear power green? Is agriculture green? These assessments feature controversial judgement calls about sustainability and simplify nuanced considerations about how production takes place into a strict binary of "green" and "not green". While most people can probably agree that solar panel and wind turbine production, installation, and maintenance are mostly consistent with cultivating a more sustainable future, for many jobs, how green it is depends on how it is done. This is closely related to the issue that focusing on production greatly limits the scope of what gets done and who gets to participate in a green economy. Ultimately, only a limited percentage of people can (and should) be concentrated in industries that produce explicitly green products. To be realized, the kind of widespread transformation sought by ReImagine Jobs would need to be far more integrated into work being done throughout the economy. It would not just be about green jobs, but about making existing jobs more green (Vona et al. 2018) – for example, making what an urban planner does in their job more consistent with a sustainable future.

4.2. Identifying Green Occupations

Efforts to improve on these limitations have often attempted to understand the nature of what people do in individual jobs. One means of doing this is through systematic assessment of

available job descriptions. This might be done like any other qualitative coding effort where an analyst defines things of interest to code for and then reads through and keeps track of what job descriptions include those things or not. More and more recently, these coding efforts are being augmented by machine learning ("Green Jobs Now: Pennsylvania" provides a strong example). While such analyses can be highly productive and can be as tailored and nuanced as desired, they are resource intensive, are often performed by private consultants, and need to be replicated to be able to compare different places.

Another strategy that has more potential to replicable using freely available public data is an analysis of occupations developed by Vona et al. (2018). In addition to employment information grouped by industries, the federal government also produces employment statistics based on occupations which has the advantage of being based on the tasks people consistently perform in their jobs. These official standards are maintained by the Occupational Information Network (O*NET) developed with sponsorship by the US Department of Labor. In 2010, O*NET published a list of 1,369 green tasks performed in occupations. Vona et al. (2018) calculated the potential greenness of an occupation based on the percentage of tasks performed in a job that are classified as "green tasks".

Translating this greenness of occupations to a metropolitan area requires some additional considerations that affect how the results should be interpreted (Vona et al. 2018). Public economic data frequently becomes simplified as the geography covered gets smaller, often to protect individual entities and individuals in these places. O*NET occupations at the national level have an 8-digit code that represents an increasing amount of specificity about that occupation. For example, a Chief Sustainability Officer code is 11-1011.03. The "11" includes all management occupations, the "1011" describes all "Chief Executive" occupations, and then the ".03" specifies that this is a "Chief Sustainability Officer". Occupation data available for specific metropolitan areas in the US only provides the first six digits of these codes (11-1011 in this example). Therefore, a Chief Sustainability Officer position is grouped in with all other Chief Executives in the greenness score of occupation 11-1011 in a metropolitan area. Unfortunately, this means that there is currently no way to know how many Chief Sustainability Officers there are in the Pittsburgh Metropolitan Area using federal public data.

With these challenges in mind, the author of this report has simplified Vona et al.'s (2018) approach to address the challenge of shifting codes over time while fulfilling the report's goals. A binary (yes or no) code was used for each occupation denoting whether it was an occupation category (based on the six-digit code) that contained at least one green task for at least one occupation within it as denoted by the Department of Labor. The Department of Labor classification further differentiates between occupations currently having tasks that were green (as of 2010) and ones where there was the potential to integrate green tasks into the occupation in the future. All of the green task occupations included in this analysis had potential future green tasks, but only some of those currently had green tasks. This is represented in the coding by the "Current" column with a "1" (yes) or "0" (no) in the tables that follow in this section.

In the analysis presented below, occupation data for each metropolitan area was retrieved from the Bureau of Labor Statistics' Metropolitan and Nonmetropolitan Area Occupational Employment and Wage website which is currently the best source for this data (Bowen et al.

Table 2. Top 25 Pittsburgh MSA Occupations with Green Tasks based on Number of Jobs

SOC 2021	Occupation Title (2021)	Current	Jobs	Income
11-1021	General and Operations Managers	1	23,690	97,740
53-3032	Heavy and Tractor-Trailer Truck Drivers	0	14,950	48,320
49-9071	Maintenance and Repair Workers, General	0	10,000	39,680
47-2061	Construction Laborers	1	9,890	47,050
49-3023	Automotive Service Technicians and Mechanics	1	6,390	46,920
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	0	6,130	74,810
43-5071	Shipping, Receiving, and Traffic Clerks	0	4,220	36,980
17-2141	Mechanical Engineers	1	4,130	96,400
41-3031	Securities, Commodities, and Financial Services Sales Agents	0	4,060	62,160
13-1199	Business Operations Specialists, All Other	1	3,760	66,560
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	0	3,330	48,100
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	0	2,980	46,210
13-1020	Buyers and Purchasing Agents	1	2,940	62,970
47-2152	Plumbers, Pipefitters, and Steamfitters	0	2,870	61,810
11-9199	Managers, All Other	1	2,770	127,660
17-2051	Civil Engineers	1	2,590	97,090
13-2052	Personal Financial Advisors	1	2,410	120,820
13-1041	Compliance Officers	0	2,390	69,680
13-2051	Financial Analysts	0	2,370	77,750
51-4041	Machinists	0	2,340	47,890
17-2071	Electrical Engineers	1	2,190	100,290
11-2021	Marketing Managers	0	1,980	127,690
13-1151	Training and Development Specialists	0	1,970	61,850
11-9041	Architectural and Engineering Managers	0	1,650	151,730
11-1011	Chief Executives	0	1,610	NA

2018). While it is the May 2021 data, this is a considered a six-month estimate from November 2020-May 2021. The Pittsburgh Metropolitan Statistical Area (MSA) includes the following counties: Allegheny, Armstrong, Beaver, Butler, Fayette, Washington, and Westmoreland. Some changes have been made to occupation classifications and codes since the Department of Labor produced their list of green tasks, therefore efforts were made to identify where codes had changed for the same occupation or where new occupations were added. After this reconciliation, there were 634 occupations in the region (at the six-digit level of description). 72 (11.4%) of these had at least one potential green task associated with them and 38 (6.0%) had at least one current green task. There were 1,043,000 total jobs in the region. Potential green task occupations represented 146,520 jobs (14.0%) in the region and current green task occupations represented 75,380 jobs (7.2%) in the region. Table 1 provides a summary of the twenty-five potential green task occupations with the most jobs in the region. Taken together, these twenty-five occupations represent 11.9% of the region's jobs. The median income of each of these occupations in the Pittsburgh MSA is also provided for reference.

4.3. Comparisons

To get a better sense of how Pittsburgh stacks up to other places in the United States and a potential peer metropolitan area, this assessment of Pittsburgh MSA jobs in potential and current

Table 3. Top 25 Most Concentrated Green Task Occupations in the Pittsburgh MSA based on Location Quotient

SOC 2021	Occupation Title (2021)	Current	Jobs	LQ	Income
19-4051	Nuclear Technicians	1	300	7.560	78,990
19-5012	Occupational Health and Safety Technicians	1	1,170	7.266	77,750
47-5013	Service Unit Operators, Oil, Gas, and Mining	0	880	3.616	38,680
17-3024	Electro-Mechanical Technicians	0	270	3.147	48,920
17-2161	Nuclear Engineers	1	220	2.345	102,880
17-2141	Mechanical Engineers	1	4,130	2.005	96,400
19-2042	Geoscientists, Except Hydrologists and Geographers	1	340	1.944	71,510
17-2081	Environmental Engineers	1	580	1.837	100,290
17-2071	Electrical Engineers	1	2,190	1.590	100,290
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	1	780	1.432	59,330
19-4042	Environmental Science and Protection Technicians, Including Health	1	350	1.386	45,770
47-2061	Construction Laborers	1	9,890	1.379	47,050
47-4011	Construction and Building Inspectors	1	1,200	1.376	60,400
47-5041	Continuous Mining Machine Operators	0	150	1.375	48,180
49-3023	Automotive Service Technicians and Mechanics	1	6,390	1.371	46,920
41-3031	Securities, Commodities, and Financial Services Sales Agents	0	4,060	1.285	62,160
17-3023	Electrical and Electronic Engineering Technologists and Technicians	0	950	1.265	61,730
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	0	3,330	1.260	48,100
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	0	6,130	1.244	74,810
13-2052	Personal Financial Advisors	1	2,410	1.238	120,820
11-9041	Architectural and Engineering Managers	0	1,650	1.191	151,730
17-2051	Civil Engineers	1	2,590	1.150	97,090
47-4041	Hazardous Materials Removal Workers	1	370	1.130	47,820
13-2051	Financial Analysts	0	2,370	1.097	77,750
11-1011	Chief Executives	0	1,610	1.085	NA

green task occupations is compared to both the nation as a whole and the Cincinnati MSA. The percentage of Pittsburgh MSA's jobs that are current green task jobs (7.2%) is higher than both the nation as a whole (7.1%) and Cincinnati (6.2%). However, the percentage of the nation's jobs that are potential green task jobs (15.2%) is higher than both the Pittsburgh (14.0%) and Cincinnati (13.8%) MSAs.

A common measure of the relative economic concentrations in regions is their location quotient. The location quotient compares the proportion of jobs that are a particular type in a regional economy with the proportion of jobs that are that particular type in the nation's economy as a whole. A score of 1 means that a place has the same proportion of a particular type of job as the nation as whole. Table 3 provides a summary of the 25 occupations with potential green tasks that are the most concentrated in the Pittsburgh MSA based on their location quotient. Whether these occupations have current green tasks, the number of jobs they represent in the Pittsburgh MSA, and their median income in the Pittsburgh MSA is also included. Table 4 provides the same information about the 25 potential green task occupations that are the least concentrated in the Pittsburgh MSA. Seven additional potential green task occupations had zero jobs associated with them in the region (and a corresponding location quotient of zero). It was not clear whether this meant that there were zero people employed in these occupations or whether this was just missing data from Department of Labor. Therefore, these occupations were removed from this table and are instead listed below along with their current occupation code:

- Farmers, Ranchers, and Other Agricultural Managers (11-9013)

- Aerospace Engineers (17-2011)
- Atmospheric and Space Scientists (19-2021)
- Agricultural Technicians (19-4012)
- Solar Photovoltaic Installers (47-2231)
- Aircraft Structure, Surfaces, Rigging, and Systems Assemblers (51-2011)
- Nuclear Power Reactor Operators (51-8011)

Table 4. Top 25 Least Concentrated Green Task Occupations in the Pittsburgh MSA based on Location Quotient

SOC 2021	Occupation Title (2021)	Current	Jobs	LQ	Income
51-4041	Machinists	0	2,340	0.16606	47,890
11-9021	Construction Managers	1	710	0.33681	100,940
51-8099	Plant and System Operators, All Other	0	40	0.3504	59,740
51-9199	Production Workers, All Other	0	680	0.44916	36,980
43-5011	Cargo and Freight Agents	1	290	0.45682	48,220
17-2072	Electronics Engineers, Except Computer	1	370	0.46635	100,190
49-9099	Installation, Maintenance, and Repair Workers, All Other	0	570	0.46928	39,080
13-1199	Business Operations Specialists, All Other	1	3,760	0.49294	66,560
13-2099	Financial Specialists, All Other	0	450	0.49339	76,640
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scie	1	980	0.49736	78,100
19-3099	Social Scientists and Related Workers, All Other	1	130	0.51151	66,560
23-1022	Arbitrators, Mediators, and Conciliators	0	30	0.5536	69,640
51-8013	Power Plant Operators	0	130	0.60636	81,100
17-3025	Environmental Engineering Technicians	1	70	0.63417	61,620
47-2181	Roofers	1	610	0.63436	39,300
19-1031	Conservation Scientists	1	110	0.65892	60,380
43-5071	Shipping, Receiving, and Traffic Clerks	0	4,220	0.71669	36,980
53-7081	Refuse and Recyclable Material Collectors	1	680	0.7287	30,550
27-3031	Public Relations Specialists	1	1,310	0.72907	61,930
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	0	2,980	0.73005	46,210
47-2211	Sheet Metal Workers	0	670	0.73801	75,790
11-3071	Transportation, Storage, and Distribution Managers	1	800	0.74711	100,190
11-9199	Managers, All Other	1	2,770	0.7515	127,660
19-4099	Life, Physical, and Social Science Technicians, All Other	1	360	0.78142	45,570
17-3026	Industrial Engineering Technicians	0	360	0.78394	59,330

A few observations from Tables 3 and 4 particularly resonated with comments made by interviewees. The sense that the region has expertise related to battery development is reflected in its concentration of electrical engineers and electrical technologists. Comments about the potential for building up green skills within the construction industry in the region is reflected in the presence of those jobs as well. On the other hand, the concern raised by interviewees that the region faces a shortage of machinists that not only limit development opportunities today but represents a barrier to a potential greener economy is reflected in the low concentration of people employed in that occupation in the region.

For further comparative perspective, Table 5 provides a comparison of the relative concentration of potential green task occupations in the Pittsburgh and Cincinnati MSAs. In this table the "LQ Diff" column describes the location quotient of that occupation in Cincinnati subtracted from the location quotient of that occupation in Pittsburgh. A positive value therefore indicates that the Pittsburgh MSA has a relatively higher concentration of jobs in that occupation compared to the

Cincinnati MSA, while a negative value indicates the Pittsburgh MSA has a lower concentration. Again, whether the occupation currently has at least one green task associated with it and the median income of that occupation in the Pittsburgh MSA is included.

Table 5. Green Task Occupation Location Quotient Comparison Pittsburgh and Cincinnati MSAs

SOC 2021	Occupation Title (2021)	Current	Income	LQ Diff
	Pittsburgh MSA Top 15 Higher Concentration			
19-4051	Nuclear Technicians	1	78,990	7.560
19-5012	Occupational Health and Safety Technicians	1	77,750	6.254
47-5013	Service Unit Operators, Oil, Gas, and Mining	0	38,680	3.616
17-2161	Nuclear Engineers	1	102,880	2.345
17-3024	Electro-Mechanical Technicians	0	48,920	2.316
19-2042	Geoscientists, Except Hydrologists and Geographers	1	71,510	1.537
19-4043	Geological Technicians, Except Hydrologic Technicians	1	48,060	1.027
47-5041	Continuous Mining Machine Operators	0	48,180	1.001
17-2081	Environmental Engineers	1	100,290	0.933
17-2071	Electrical Engineers	1	100,290	0.806
17-3023	Electrical and Electronic Engineering Technologists and Technicians	0	61,730	0.709
19-3011	Economists	0	104,920	0.684
19-2041	Environmental Scientists and Specialists, Including Health	0	63,220	0.680
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	1	59,330	0.628
17-2051	Civil Engineers	1	97,090	0.621
	Pittsburgh MSA Top 15 Lower Concentration			
43-5011	Cargo and Freight Agents	1	48,220	-2.721
17-3026	Industrial Engineering Technicians	0	59,330	-1.102
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	0	46,210	-0.785
43-5071	Shipping, Receiving, and Traffic Clerks	0	36,980	-0.740
11-3051	Industrial Production Managers	0	102,740	-0.732
13-1151	Training and Development Specialists	0	61,850	-0.674
17-3025	Environmental Engineering Technicians	1	61,620	-0.658
19-2099	Physical Scientists, All Other	0	106,270	-0.576
11-3071	Transportation, Storage, and Distribution Managers	1	100,190	-0.528
53-7081	Refuse and Recyclable Material Collectors	1	30,550	-0.527
51-9199	Production Workers, All Other	0	36,980	-0.486
49-9099	Installation, Maintenance, and Repair Workers, All Other	0	39,080	-0.470
11-9021	Construction Managers	1	100,940	-0.407
17-2072	Electronics Engineers, Except Computer	1	100,190	-0.381
13-2099	Financial Specialists, All Other	0	76,640	-0.355

Section 5: Brief Recommendations and Conclusion

At the outset of developing this report, the analysis of occupations covered in Section 4 was considered a potential key baseline for analyzing success in cultivating a greener, more vibrant, and more inclusive economy in the years ahead. The approach described and the results do provide a starting point for consideration about what occupations hold the most potential to represent large numbers of jobs in which employees complete tasks that are part of a greener economy. However, the analysis process and the interviews provided a richer picture of the challenges and opportunities the region faces that underscored the need to continue exploring and discussing a wider range of metrics to assess moving forward.

First, regarding the occupations discussed above, to really make sense of how to cultivate opportunities associated with these positions, a more detailed analysis of tasks involved in these jobs, how the necessary skills can be cultivated, and how that relates to creating accessible job pipelines in the region might need to be completed. Focused research on the green tasks themselves and how they relate to targeted occupations might be beneficial. Second, while occupations can give you some sense of tasks in jobs in general, they can't provide the whole picture of the role that a job plays in the economy – especially because the detail of the job is more limited at the six-digit code of detail that is available at the metropolitan level. Therefore, analysis of occupations and tasks should be complimented with other datasets as appropriate. For example, interviewees emphasized the importance of entrepreneurship and small business ownership. Occupation data doesn't provide immediate insight into this, but the Statistics of US Businesses provided by the US Census can provide annual insight into the number of small businesses for MSAs. Third, unfortunately, this focus on occupations does repeat a limitation that the focus on industries has: it also does not necessarily address social or environmental measures of wellbeing. Determining what metrics of social, individual, and environmental wellbeing should accompany economic metrics should be a fundamental part of making larger discussions about cultivating a greener, more sustainable, and more inclusive economy more tangible and accountable over time. Determining and agreeing on such metrics can help cultivate a sense of community and buy-in from participants in the process.

The literature on sustainability transitions emphasizes that transformational change is a highly social process where perspectives across regions must persistently come together to acknowledge the need for changes, create a vision to strive towards, identify opportunities to build on, and determine collective strategies for making and sustaining those changes over time. Unfortunately, the interviews conducted for this report emphasized how limited that sort of collective action has been in region and how challenging it can be to achieve. The hope is that this report has provided a summary of perspectives and occupations in the region that can contribute background and stimulus for ReImagine Jobs' efforts to reverse that trend and catalyze future collaborations in the region.

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