

MARSHALL PLAN FOR MIDDLE AMERICA ROADMAP

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University of
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Center for Sustainable Business
Joseph M. Katz Graduate School of Business
and College of Business Administration

AUTHORS:

Leslie Marshall, University of Pittsburgh
(lead & corresponding author: lrn51@pitt.edu)

Mirko Armiento, Enel Foundation

Michael Blackhurst, University of Pittsburgh

Chris Briem, University of Pittsburgh

Thomas Croft, Steel Valley Authority & Heartland Capital Strategies

Grant Ervin, City of Pittsburgh

Hersh Merenstein, City of Pittsburgh

Giuseppe Montesano, Enel Foundation

Carlo Papa, Enel Foundation

Robert Pollin, University of Massachusetts–Amherst

Ernest Rajakone, City of Pittsburgh

WITH ADDITIONAL CONTRIBUTIONS FROM:

SMART Columbus

Sustainable Columbus

United Nations Sustainable Development Solutions Network USA

CONTACT US:

Center for Sustainable Business

University of Pittsburgh

5207 Sennott Square

210 S. Bouquet Street

Pittsburgh, PA 15260

412-383-4079

csb@katz.pitt.edu

www.sustainablebusiness.pitt.edu

About the Roadmap:

The Marshall Plan for Middle America (MP4MA) Roadmap is a non-partisan, data-driven research document created through the joint scientific efforts of academic and policy researchers based at the University of Pittsburgh, the University of Massachusetts Amherst, the City of Pittsburgh, the Steel Valley Authority and the Heartland Capital Strategies Network, and the Enel Foundation.

[Enel Foundation](#) is an independent non-profit organization, founded by Enel S.p.A, focusing on the crucial role of clean energy to ensure a sustainable future for all. By developing partnerships with pre-eminent experts and institutions across the globe, Enel Foundation conducts research to explore the implications of global challenges in the energy domain and offers education programs in the scientific, business and institutional realms. Enel Foundation's contributions to the MP4MA Roadmap included financial support for the Center for Sustainable Business's research and the Foundation's own scientific research as a Roadmap co-author.

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Heartland
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MARSHALL PLAN FOR MIDDLE AMERICA SNAPSHOT



University of
Pittsburgh

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The Marshall Plan for Middle America (MP4MA) Roadmap is a non-partisan, data-driven research document created through the joint scientific efforts of academic and policy researchers based at the University of Pittsburgh, the University of Massachusetts Amherst, the City of Pittsburgh, the Steel Valley Authority, the Heartland Capital Strategies Network, and the Enel Foundation. The MP4MA Roadmap is intended to provide a platform for regional cooperation across the Ohio Valley without regard for the political party or institutional affiliation of any specific stakeholder.

Transitioning the regional economy from one built on fossil fuels to one built on renewable energy and innovations in infrastructure and manufacturing requires bringing together five critical pieces: **(1)** reliable research and evidence to help chart the path forward; **(2)** governing institutions with identifiable infrastructure needs and community ties; **(3)** companies to invest in long-term market development and support the transition to more sustainable business practices; **(4)** capital to finance development; and, **(5)** community oversight, transparency, and accountability.

1

INTRODUCTION

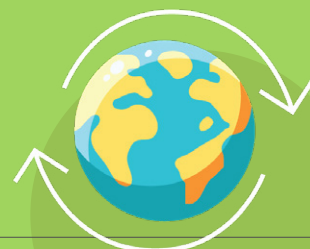


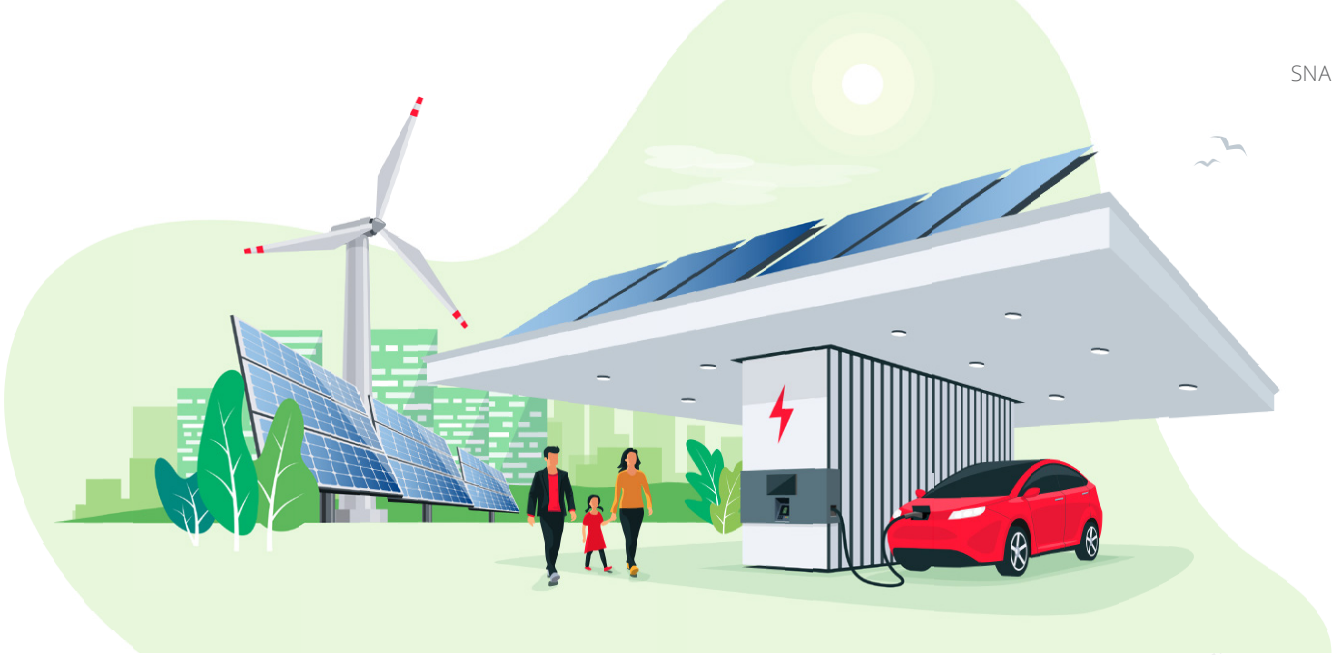
The global market for energy demand and consumption is shifting as the opportunity presented by renewables and electrification continues to grow. Meanwhile, the confluence of climate change and growing gaps in social equity and economic well-being places Middle American communities—historically reliant on fossil fuels—at risk of falling further behind. The MP4MA Roadmap envisions a strategy for *cross-sectoral collaboration* to drive public and private investment in *more equitable and sustainable* economic development strategies that will transform our region and create opportunities to lead in the new global energy economy.

Middle America’s overreliance on fossil fuels has stifled economic diversity, resulting in brittle *regional economies* less robust to changing broader domestic and global energy and economic trends. However, major metropolitan areas across the Ohio River Valley are already moving toward economic development strategies that are less reliant on legacy manufacturing and extractive industries.

REGIONAL CONTEXT

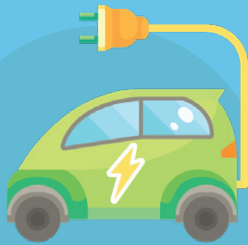
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3

RESILIENCY THROUGH CLEAN ENERGY DEVELOPMENT



Preliminary results suggest *public and private investments* in energy efficiency and renewable energy supply expansion will need to total \$60 billion per year over the next 10 years to meet IPCC targets for climate change reduction. If implemented successfully, these investments could result in 410,000 new jobs annually and reduce household energy costs across the four-state region.

ENABLING SYSTEM-WIDE IMPACTS

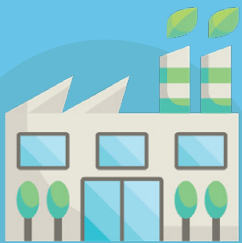
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Generating energy with more renewables and less fossil fuels is at the basis of the *energy transition*. When all of the other economic processes within the region come to rely on and demand more sustainable energy resources, the impact is magnified and felt across the system. A number of regional examples showcase this opportunity to scale impact across urban and rural areas.



5

COMMUNITY ENGAGEMENT FRAMEWORKS



While we have much to gain from investing in more *sustainable regional development*, it is important to make sure we are transparent about the potential impacts of this shift. Embedding community engagement frameworks, oversight, and accountability are all critical to building both public and private trust in this effort.

Read the full Marshall Plan for Middle America Roadmap at <https://www.sustainablebusiness.pitt.edu/research/marshall-plan-middle-america>

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1. Introduction

1.1 Motivation

We are in the midst of a great transition; one taking place around the world as we reckon with the harsh reality of climate change and its impact on our communities. In the United States, existing gaps in social equity and economic well-being—shaped by the entrenchment of racist and discriminatory institutions—are widening due to the compounding effects of environmental and public health crises.² Environmental justice movements continue to press for recognition of the link between “the unequal distribution of environmental burdens and benefits between different social groups,”³ and some scholars point to an explicit link between fossil fuel extraction, climate change and displacement, and racial injustice that resonates in marginalized communities around the world.⁴ These existing inequities have been magnified by the global COVID-19 crisis. Research shows that women, people of color, immigrants, workers without a college education, and lower income Americans are more likely than members of other

groups to suffer job disruptions and financial hardship as a result of the pandemic.⁵ For many, this period represents the culmination of political, economic, environmental, public health, and social justice crises.

The urgency of climate change has spurred investment and innovation in new technologies designed to hasten our transition toward clean resources and reduced dependence on fossil fuels. The global market for energy demand and consumption is shifting as the opportunity presented by renewables and electrification continues to grow. In Europe, for example, this growth is fueled by massive public and private investment (one trillion euros) in economic development initiatives designed to turn the European Union into a climate neutral economy by 2050.⁶ As these more sustainable energy technologies develop, dependence on fossil fuels will continue to decline, reducing carbon emissions and staving off the more catastrophic impacts of climate change.

In the U.S., while this push toward renewable energy infrastructure is critical to slowing the progress of climate change and reducing the unequal burden of its effects on the most vulnerable among us, this shift from a fossil fuel-based economy to one built on renewable energy infrastructure also has the potential to widen existing gaps in economic development between regions. Relative to coastal areas, many Middle American communities—such as Appalachia and the Ohio River Valley—are still heavily reliant on fossil fuel energy infrastructure and legacy manufacturing and extractive sectors. Defined by fewer major metropolitan areas, and much more by mid-size metropolitan areas, suburban areas, and rural communities, this region experienced rapid population and economic growth in the early 20th century, followed by subsequent economic declines, particularly in rural areas. Many communities—

across Appalachia and the Ohio River Valley (see **Figure 1**)—have also borne the greater share of the costs of environmental degradation and the rapidly changing economic landscape. They have higher than average poverty and unemployment rates, and lower rates of educational attainment⁷; they lack the same growth in private sector employment opportunities⁸; and, they have declining infrastructure, and physical and human capital.⁹ These socioeconomic symptoms coincide with myriad negative health outcomes, including increased rates of depression, suicide, diabetes, obesity, substance abuse, and premature deaths from pollution exposure.¹⁰ As the Appalachian Regional Commission notes in its research on health disparities in the region, “the socioeconomic and health spheres are often interrelated, if not interdependent, and much work remains.”¹¹

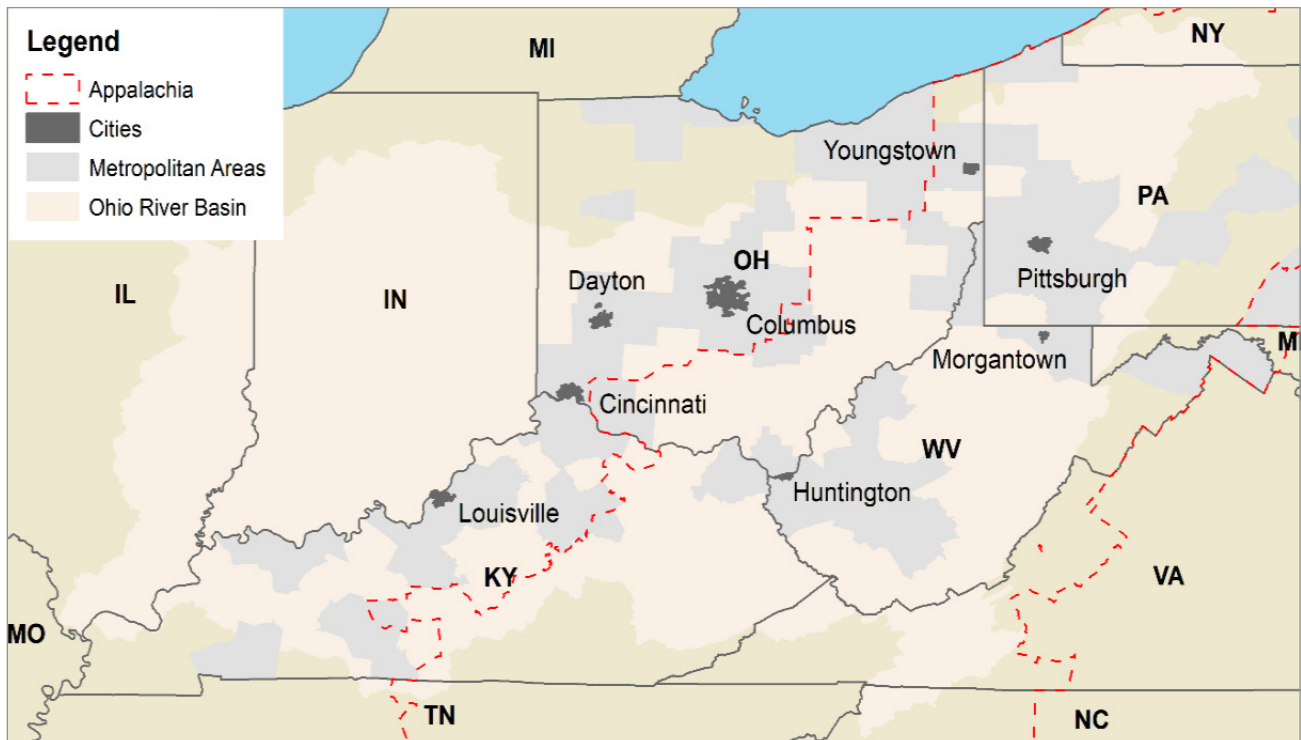


Figure 1: A map of the Ohio River Valley and Upper Appalachia areas. Appalachia is defined by county designations from the Appalachian Regional Commission.¹²

A combination of boom-bust cycling and long-term decline in the extractive and manufacturing sectors has exacerbated unemployment and underscored the need for structural economic change that provides alternative employment opportunities better aligned with globally growing markets. Adopting a national economic transition strategy that does not take into account these regional disparities and work to intentionally target investments for more equitable and sustainable growth risks exponentially increasing the impact of the social and economic crisis present in many of these communities.

Yet, in the Ohio River Valley, there is an unprecedented opportunity now—in the midst of this pandemic—to drive transformative investment in the region that will not only stimulate the economy and allow it to compete nationally and internationally, it will also create avenues to redress long-standing injustices. In catalyzing the development of more sustainable energy infrastructure through cross-sectoral regional collaboration, it is possible to build on historic and emerging strengths in these communities. Massive public and private investment is needed to address infrastructure deficits that will help correct existing inequities in both urban and rural environments, such as broadband access, clean and efficient transportation solutions, and improved public

education and healthcare systems. If developed in consideration of existing needs and persistent injustices, these investments could create more sustainable and more equitable economic opportunities in the very communities that otherwise risk being left even further behind by the global shift away from a fossil fuel-based economy. In essence, there is a need for a “Marshall Plan for Middle America.”

In the post-World War II recovery period, the European “Marshall Plan” was a \$13 billion¹³ (\$142.8 billion in 2020 U.S. dollars¹⁴) investment strategy to utilize American labor and capital to rebuild Europe and foster economic and democratic institutions. Like post-war Europe, Middle America faces similar issues of decline and the need and desire to rebuild. Middle American communities have shared needs and challenges in facing crises of aging infrastructure, economic obsolescence, ineffective public policy, and the need for upskilling and reskilling of workforce. However, Middle America lacks a common regional voice, shared vision, and coordination strategy to catalyze economic transformation across the region. A comprehensive roadmap is needed to illuminate the path toward increased social equity and community well-being, new business and economic opportunities, and reduced climate change.

1.2 Strategy

In this vein, Mayor William Peduto of Pittsburgh, PA—a city redefining itself through a Fourth Industrial Revolution—recently proposed the idea of adopting a “Marshall Plan for Middle America” (MP4MA) to address the challenges of climate, economic prosperity, and equitable development facing Middle America.¹⁵ Mayor William Peduto’s idea is not new—other policymakers, academics, and analysts have been researching and advocating for a “Just Transition” for the region for some time.¹⁶ Like the European Marshall Plan, these stakeholders recognize and capitalize on the great pride Middle Americans have in their legacy of manufacturing and innovation that has shaped the world as we know it today.

This Roadmap envisions the Ohio River Valley as a subregion of Middle America that can lead the plan to invest in renewable energy infrastructure to drive more equitable and sustainable economic development into the future. The watersheds that connect these communities also create a shared ecosystem that is both natural and economic. There is a long history of leveraging collective strengths in raw materials and energy production and manufacturing, but now there is a need to renew these ties and be intentional about efforts to collaborate and scale positive impacts across the region. There is a need for a common regional agenda, a regional voice, and an aggregated vision to reimagine and rebuild these communities, so that they are more resilient and more just for all.

A primary challenge involved in realizing this transformation is one of coordination. Transitioning the regional economy from one built on fossil fuels to one built on renewable energy and innovations in infrastructure and manufacturing requires bringing together five critical pieces: (1) reliable research and evidence to help chart the path forward; (2) governing institutions with identifiable infrastructure needs

and community ties; (3) companies to invest in long-term market development and support the transition to more sustainable business practices; (4) capital to finance development; and, (5) community oversight, transparency, and accountability. To fit each of these puzzle pieces together into a cohesive picture, we created a small-scale version of the regional cross-sectoral coalition we hope to build. This “Task Force” includes representatives from each of the five main stakeholder groups illustrated in **Figure 2**: researchers, community organizations, government, investors, and companies.

On the research side, the Task Force is led by the Center for Sustainable Business at the University of Pittsburgh (CSB)¹⁷ with support from researchers at the University Center for Social and Urban Research and the PERI Institute at the University of Massachusetts at Amherst. Additional content was provided by policy analysts from the City of Pittsburgh. This initial research was made possible through the generous support of the Enel Foundation¹⁸, which also served as a scientific partner throughout the research process. The United

Nations Sustainable Development Solutions Network (SDSN USA)¹⁹ brought additional research expertise as well as the perspective of an international organization to the process. The Steel Valley Authority and Heartland Capital Strategies Network²⁰ also contributed from the perspective of labor unions and responsible investor coalitions. On the business side, a number of companies active in the region were central to making many of the examples in this report possible. Finally, Mayor William Peduto of the City of Pittsburgh is leading efforts to build government support for the MP4MA Roadmap across the Ohio River Valley. Together, we have leveraged our skills and resources toward the shared end of crafting a vision for the MP4MA.

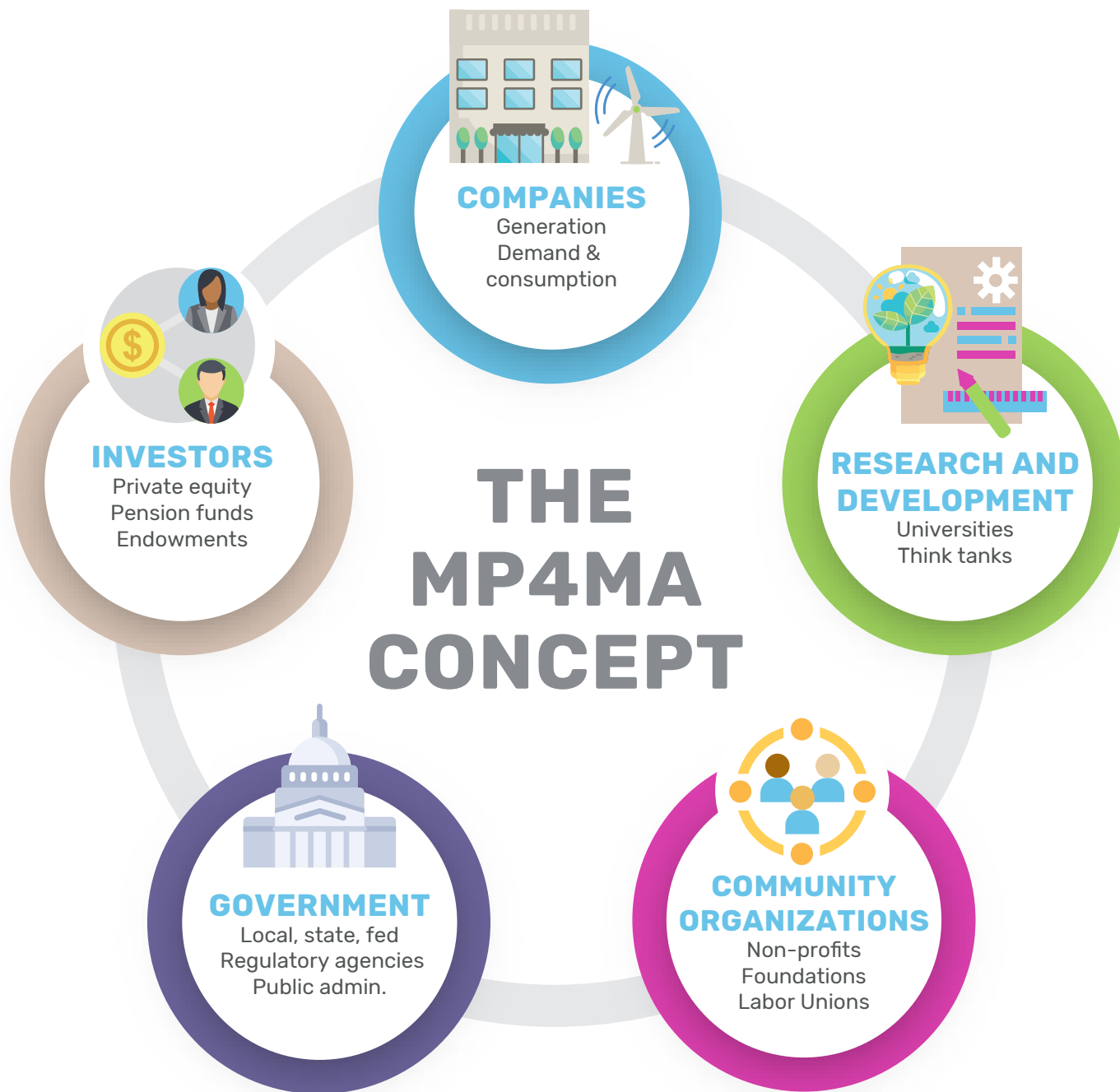


Figure 2: The MP4MA Concept – Enabling sustainable regional economic development through collaboration & partnership across sectors, industries, and communities.

1.3 Roadmap Content & Intended Audiences

This Roadmap was produced on a short timeline, from July 1–October 31, 2020. The authors conducted desk research (reviews of existing reports, media, etc.), some original data analysis, conducted semi-structured interviews using convenience sampling of key stakeholders, and integrated comments from participants in a regional conference proceeding focused on regional sustainable finance policy to enable infrastructure development across the region.²¹ Much of the original analysis of both qualitative and quantitative data should be taken as preliminary and subject to change given new information. For instance, the estimated cost of investment and related jobs impact provided in **Section 3** is a high-level summary of the state-level analysis presented in a series of white papers commissioned by the Reimagine Appalachia Campaign.²² To the extent that this analysis is still ongoing, there may be slight adjustments to the estimates presented here, though notable changes are not anticipated.

The finished product, this publicly available document, provides a vision for how to realize an equitable and sustainable economic transition in Middle American communities across four states in the Ohio River Valley and Upper Appalachian Region: Kentucky, Ohio, Pennsylvania, and West Virginia (as shown in **Figure 1**).²³ This is intended to be a starting point for conversation and innovation. It is meant to inspire investment and action given a picture of what could be, recognizing that a much broader set of contributors must be engaged to begin turning this vision into reality.

To that end, this MP4MA Roadmap aims to show how regional economic development for a sustainable future is possible through strategic coalition-building across sectors, starting with significant public and private investment in diversifying our regional energy infrastructure through the lens of social, environmental, and economic justice. The Roadmap proceeds in sections. **Section 2** provides a brief history

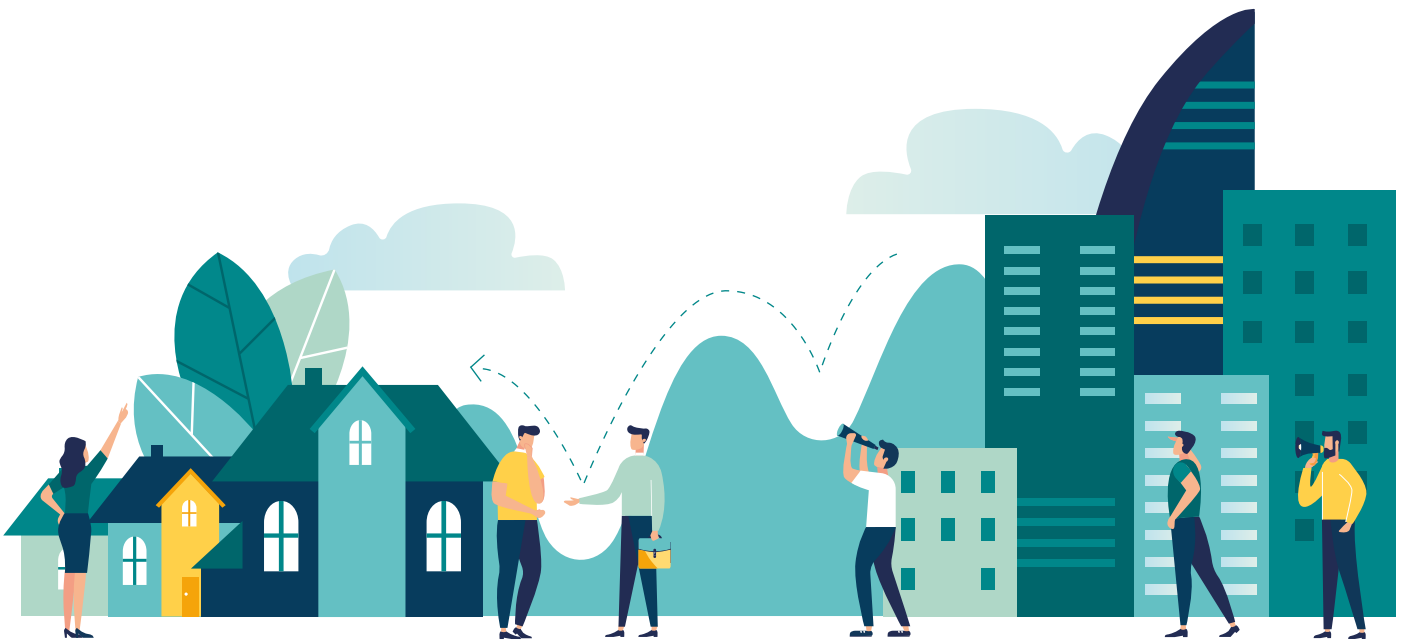
and overview of the regional economy to contextualize the current opportunity. Then, **Section 3** makes the case for economic resiliency through energy diversification, the estimated cost for the four-state region, and the potential jobs impact, while showcasing multisectoral cleaner energy resource efforts already underway in the Ohio River Valley.

Section 3 also discusses financing and policies that could help catalyze these efforts. **Section 4** shows how rebuilding our energy infrastructure could be coupled with new opportunities for more sustainable economic development in other sectors and industries across the region. By leveraging existing strengths and coordinating new efforts to realize more sustainable supply chains and more equitable workforce and community development, the MP4MA effort could yield positive system-wide impacts. Part of this discussion focuses on the concept of circularity as a way to build mutually beneficial economic loops across sectors throughout the region. Concrete examples showcase projects adopting this mindset that are already underway in the Ohio River Valley. Realizing this vision of economic transformation will require massive public and private investment across the four-state region. Most importantly, none of this will be possible without community engagement and a sense of ownership over the project.

Section 5 reviews potential models for community oversight, transparency, and accountability to ensure that projects funded under the MP4MA concept are designed and implemented through an equity-based lens that actively seeks to redress current and past injustices rather than replicating or further entrenching them as part of this transition. The Roadmap concludes with suggestions regarding next steps in **Section 6**.

Drawing on existing research and evidence from fields as far ranging as economics, business, sociology, anthropology, environmental science, public health, and law (among others), this document should be useful to a number of audiences. For policymakers, it will highlight examples of the types of policies that would enable this transition and the potential impact

of these changes on residents' well-being and economic opportunities. For investors, it will identify types of infrastructure projects that represent a mutually beneficial opportunity for socially responsible community investment and for sustainable and equitable development. For residents and community organizations, it will act as a platform for conversation surrounding what is possible in a green economic transition, where the likely gaps are, and what kinds of supporting infrastructure, engagement, and accountability practices will need to be in place to ensure community ownership of and support for the projects that emerge. For academics and researchers, it will highlight areas where we need more research and evidence to support the benefits (and costs) of a just transition for the region. Finally, for companies, it will help identify opportunities for business growth, innovation, and investment with the potential to yield significant new business and societal value.



2. Regional Context

2.1 A Brief History of Appalachian Economic Development

The Appalachian economy emerged as a leader in American energy and natural resources production by the middle of the 19th century. By the beginning of the 20th century, much of the Appalachian economy shifted from subsistence farming and local manufacturing to primarily being driven by extractive industries. Coal resources in particular were in high demand due to national growth and rapid industrialization. There is ongoing debate about the degree to which Appalachia's extractive economy produced prosperity or has sustained poverty. Lack of local reinvestment has been ascribed to many factors but often continued extra-local corporate control has been blamed for the exporting of locally generated profits. Appalachia could be a prime example of the hypothesized "Resource Curse" facing regions rich in natural resources, where depressed investment in new industries inhibits economic diversification and leads to lower growth and more brittle economies in the long run.

In the early 1960s, profound poverty across Appalachia prompted President Kennedy and Congress to commission a region-wide study to evaluate social and economic conditions of Appalachia. Professor Ben Chinitz and the Center for Regional Economic Studies at the University of Pittsburgh were the prime consultants for the resulting 1964 report, which described Appalachia as "a region apart—both geographically and statistically" from the rest of the nation. The report documented Appalachia's relatively low income, lack of urbanization, deficits in education, and lower living standards that were ascribed to a "legacy of neglect" from the federal government in the region. The report spurred congress to pass the Appalachian Regional Development Act and catalyzed the creation of the Appalachian Regional Commission (ARC). The ARC's goals were to enhance the productivity and competitiveness of Appalachia

through investments in infrastructure and transportation, including large-scale projects such as highways, airports, water resources, housing, and workforce development, all at scales that could shift the economic trajectory of the multi-state region.

Since the creation of ARC, Appalachian regions have experienced some convergence with national economic conditions. When ARC was created, 212 of the original 399 ARC counties were designated as distressed—a federal definition for counties that had unemployment rates at least 150% of the national rate, poverty rates at least 150% above the national average, and per capita incomes less than 67% of the national average. In 2019, just 80 of the ARC counties are designated as distressed.

Still, continued dominance by extractive industries remains a core part of the Appalachian economy and virtually all economic development efforts in the region. During the 1970s, many federal programs were in response to the multiple energy crises that defined the decade. Likewise, in Appalachia, federal economic development efforts in the region focused on the development of energy and extractive industries. Some of those projects had impacts well into the future. Over a 16-year period beginning in 1976, the Department of Energy expended \$92 million exploring the potential of fracturing and horizontal drilling techniques to extract natural gas from Appalachian shale gas reserves. Initiated by the Morgantown Energy Research Laboratory, the Eastern Shale Gas Reserves (ESGR) program eventually wound down by 1992, but the program paved the way for future exploration efforts. The program advanced several of the technologies that later catalyzed unconventional shale gas production and documented the shale gas potential of Appalachia.²⁴

The concentration of jobs in extractive industries has remained a defining factor shaping the region's economic trajectory. When the United States experienced a sustained energy crisis during the 1970s, accelerating energy prices included jumps in the market prices

for Appalachian coal. Tight labor markets and demand for workers in extractive industries increased the earnings of high school dropouts relative to those of graduates.²⁵ As a result, high school enrollment rates in mining areas of Kentucky and Pennsylvania declined considerably in the 1970s. When the energy boom subsided, the earnings of dropouts declined relative to those of graduates, resulting in lower lifetime earnings.

Extractive industries concentrated in Appalachia continue to experience magnified business cycles compared to the nation. Research has shown that the loss of employment in Appalachia during periods of cyclical decline exceeds the gains experienced during growth periods, resulting in long term decline for many Appalachian regions. More significantly, growth during boom years does not translate into growth in other traded sectors that could have spurred economic diversity and new sources of growth.²⁶

Today, lack of growth in many Appalachian regions has generated a renewed interest in place-based economic development strategies at all levels of government. Most policies involve collaborations between federal, state, and local governments and cooperation between public institutions and the private sector in formal and informal public-private partnerships (PPP). Economist Timothy Bartik of the Upjohn Institute has advocated specifically for a renewed emphasis on federal and state policy targeting distressed places.²⁷ He advocates for fiscal incentives that are tailored to distressed places and limited to high-multiplier industries that have the potential create the most jobs for the money invested. He argues that economic development policies targeting distressed areas is more effective for both national and state economies than trying to lure corporations with unfocused incentives.

METRO	ANNUAL POPULATION GROWTH 2010–2019	ANNUAL EMPLOYMENT GROWTH 2010–2018	AVERAGE ANNUAL GDP GROWTH 2010–2018	MEDIAN HOUSEHOLD INCOME 2019	% OF JOBS IN MANUFACTURING 2018	% OF POP. AGE 25 AND OVER WITH A COLLEGE DEGREE	POVERTY RATE
Cincinnati	0.4%	1.5%	4.4%	\$66,825	8.9%	35.4%	11.3%
Columbus	1.3%	2.2%	5.4%	\$67,207	5.6%	37.9%	11.5%
Dayton	0.1%	1.0%	3.6%	\$58,169	9.2%	30.2%	13.6%
Huntington	-0.5%	0.0%	3.4%	\$48,329	6.9%	21.4%	16.9%
Louisville	0.6%	1.8%	4.3%	\$61,172	9.9%	30.7%	11.9%
Morgantown	0.7%	1.3%	3.7%	\$56,395	4.9%	37.9%	20.1%
Pittsburgh	-0.2%	0.9%	4.0%	\$62,638	6.1%	36.0%	10.9%
Youngstown	-0.6%	0.2%	2.3%	\$48,558	10.2%	22.8%	16.2%
United States	0.7%	2.0%	4.7%	\$65,712	6.7%	33.1%	12.3%

Table 1: Regional economic summaries; selected metropolitan areas.

2.2 Summarizing Economic Activity across the Ohio River Valley

Looking more broadly beyond Appalachia, patterns of economic development are evident in changes in the economic outlook of major metropolitan areas across the Ohio River Valley region. **Table 1** provides a summary of recent changes in population, employment, GDP, household income, jobs in manufacturing, educational attainment, and poverty rate for eight major metropolitan areas in the Ohio River Valley.

There is no one story that defines the emerging shifts across the region, but there is a stark contrast in the recent trends for areas that have greatly depressed their dependence on legacy industries and firms. For example, in recent years, metropolitan areas like Columbus, OH and Morgantown, WV have sustained population growth rates ahead of the national average despite significantly lower reliance on legacy manufacturing and mining industries.

Indeed, most areas within the industrial Midwest and Appalachia continue to experience a contraction in legacy manufacturing and mining industries. The eight major metropolitan areas illustrated in **Figure 3** showcase this decline. Between 2001 and 2018, manufacturing employment alone has declined by 6.3% in Louisville, KY and by more than 41% in Youngstown, OH. Only Morgantown, WV, which has a relatively small manufacturing sector, has experienced growth. Not all of these declines necessarily reflect a decline in production or output; some may have resulted from increasing labor force productivity, a critical factor for industries and regions seeking to retain competitiveness in national and international markets. Most regions can expect further contractions in these sectors going forward.

Unpacking the economic history of each of these cities is useful for understanding the potential for regional economic integration through investment in regional energy infrastructure. The city profiles below provide a brief summary of recent economic activity that helps explain the patterns visible in **Table 1** above, while the key traded sectors across all eight metropolitan areas are listed in **Table 2**.

CINCINNATI, OH

Cincinnati continues to evolve into a more diversified economy following economic losses. The city has had to overcome losses concentrated in automobile manufacturing in the 1980s; downsizing of General Electric in the region in the 1990s; and ongoing outsourcing by Proctor and Gamble in the 21st century. A regional Delta Airlines hub has created an air transportation cluster that has experienced both growth and decline over the last decade. Today, the city is home to the headquarters of Proctor and Gamble Company, founded in the city in 1837, and newer companies such as Mitsubishi America. Defense and aerospace industries make the area one of the major suppliers of goods and services to aerospace companies worldwide. The city has also fostered growth clusters in financial services, health, and education.

COLUMBUS, OH

The Columbus metropolitan area has developed a highly diversified economy across a range of growing industries. Ohio State University and other regional institutions of higher education bring in over 136 thousand students to the region, making educational services one of the area's core exports. The city of Columbus is also the state capital for Ohio which contributes to higher than average public sector employment. Among the benchmark cities, Columbus has the lowest reliance on manufacturing jobs (5.6%) and is the only metropolitan area to have sustained job growth (+2.2% annually since 2010) and GDP growth (+5.4% annually) that are higher than national averages.

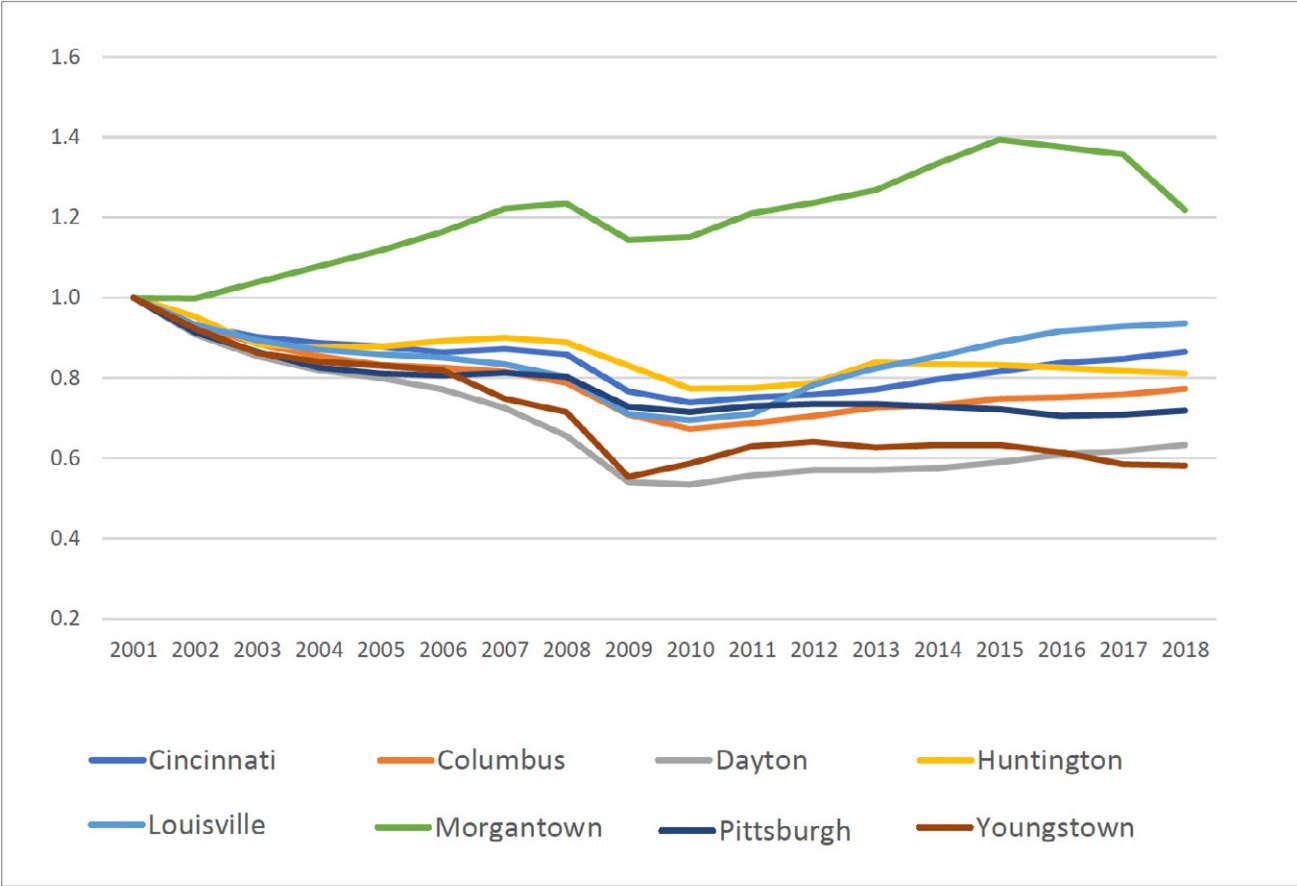


Figure 3: Relative shifts in manufacturing sector employment (2001= 1.0) since 2001; selected metropolitan areas.

DAYTON, OH

Once a highly diversified manufacturing center, Dayton continues a transition away from its legacy industries. While never defined by any one product or industry, the city was a leader across a broad range of products with strong linkages to the automobile and aerospace industries. The area has had to adjust since the National Cash Register (NCR)—which was founded in Dayton in 1884 and was once the city’s largest employer—moved to Atlanta in 2009. Today, Dayton is home to the Wright Patterson Air Force Base, the largest single-site employer in Ohio with over 27 thousand jobs or service members and one of the largest Air Force bases in the continental United States. Wright Patterson is also home to the Air Force Material Command and is designated as the new headquarters for the new National Air and Space Intelligence Center (NASIC).

HUNTINGTON, WV

As the largest inland port in the United States, the economy of the tri-state Huntington metropolitan area has always centered around river transportation. Located within the broader northern Appalachian coal region, Huntington serves as a major transshipment hub for coal and industrial coke mined across a broad region of Northern Appalachia.

LOUISVILLE, KY

The central location and temperate climate of the greater Louisville has made the region a national center for logistics and air freight operations. Louisville is home to the global headquarters of UPS, and the UPS Worldport operations center is located at Louisville International Airport. The University of Louisville has also had an impact on education, research and development, and medical industries in the area, while advanced manufacturing, healthcare, and health insurance represent potential growth areas.

MORGANTOWN, WV

The Morgantown regional economy stands out within West Virginia for its sustained population and employment growth. Today, Morgantown is a center for higher education and educational services. West Virginia University (WVU) was founded as a land grant university in Morgantown in 1867 and in 2020 enrolled over 27,000 students. WVU has invested \$25 million in the Outdoor Economic Development Collaborative to capitalize on West Virginia's outdoor recreation opportunities, develop new recreation assets, and create a remote working hub to attract new talent. The region is also home to one of three research sites for the Department of Energy's National Energy Technology Laboratory (NETL), which is a national asset focused on strategic initiatives in energy and manufacturing sectors.

PITTSBURGH, PA

Since the contraction of much of the region's heavy industries in the 1980s, Pittsburgh has continued diversification across a range of industries. Over recent decades, the region has sustained growth in higher education, health care and financial services. Public investment at the Pittsburgh International Airport catalyzed a regional air transportation hub at the end of the 1990s, but subsequent restrictions in the industry, 9/11, and industry consolidation, all contributed to reversing Pittsburgh's ascent as a transportation hub. A core of research in healthcare catalyzed the modern organ transplant industry in Pittsburgh while research in information technology has attracted global companies. A cluster of academic research hubs has attracted technology companies—including Google, Uber, Apple, Amazon, and others—to set up local operations in the city. These investments have spawned clusters of private sector employment in autonomous vehicles, robotics, and information technology, as well as innovations in advanced manufacturing. The city also benefits from its proximity to the bulk of new development in unconventional natural gas and is the location for a new ethane refinery being built by the Shell Corporation.

YOUNGSTOWN, OH

Once a major center of American steelmaking, Youngstown continues a difficult transition away from its legacy manufacturing industries. Much of the region’s historical steel output closed in the 1970s. General Motors closed its Lordstown Assembly Plant in 2019 which had operated since 1966. The plant has been sold to Lordstown Motors which is planning to produce electric trucks at the location. GM has also begun construction of a new battery plant in Lordstown. Youngstown is working to become a cluster for additive manufacturing and is home to the National Additive Manufacturing Innovation Institute.

Most importantly, each of these metropolitan areas has worked to adapt to changing economic conditions given the decline of legacy manufacturing and extractive industries. In the process, each has begun to specialize in new ways that are complementary to one another, creating the opportunity to catalyze far more transformative change through regional collaboration across industries and sectors. Targeted public and private investment that begins with rebuilding the region’s energy infrastructure could have ripple effects throughout the regional economy, drawing on and expanding recent efforts at the city- and state-levels to adapt to a changing global economic landscape.

REGION	KEY TRADED SECTORS
Cincinnati, OH	Consumer Goods Defense and Aerospace Financial Services
Columbus, OH	Higher Education Government Defense and Aerospace Financial Services
Dayton, OH	Aerospace R&D Human Sciences & Health Care Information Technology Advanced Materials and Manufacturing
Huntington, WV	Water Transportation Logistics
Louisville, KY	Logistics Air Transportation Health Insurance
Morgantown, WV	Higher Education Energy Research Health Care
Pittsburgh, PA	Higher Education Health Care Financial Services Information Technology
Youngstown, OH	Automobile Supplies Additive Manufacturing Electric Vehicles and Supplies

Table 2: Key traded sectors across metropolitan areas.

2.3 The Case for Investing in a New Energy Future

Much of Middle America's legacy is defined by shifts in energy markets. Where Appalachia once exported coal globally, coal production in Appalachia steadied starting in the 1970s, peaked in the 1990s, and has since declined 50% as a result of increased competition from other suppliers and primary energy sources.^{28,29} Beyond losing coal mining jobs, this decline has caused negative, indirect ripple effects on regional economies in Middle America, including the Ohio River Valley. Innovation in shale gas extraction has improved employment and economic outlooks for some communities, but many still have not benefited from these gains.

Middle America's overreliance on fossil fuels has stifled economic diversity, resulting in brittle regional economies less robust to

changing broader domestic and global energy and economic trends.^{30,31} While efforts to reinvigorate the coal industry have been met with mixed success in the short-run, overwhelming evidence suggests that policy interventions alone are unlikely to combat global competition from other energy sources and that "false promises" to restore extractive sectors may inhibit needed economic structure shifts.^{29, 32, 33}

The outlook for coal is expected to exacerbate these trends. **Figure 4** shows recent and forecasted consumption of U.S. energy by source. In the last decade alone, domestic coal consumption has halved from 2010 demands of 20.8 quads to current demands of 10.3 quads. By 2030, coal consumption is expected to decline to 8 quads. The global outlook is similar, where consumption of coal is expected to increase by only 4% by 2030.³⁵



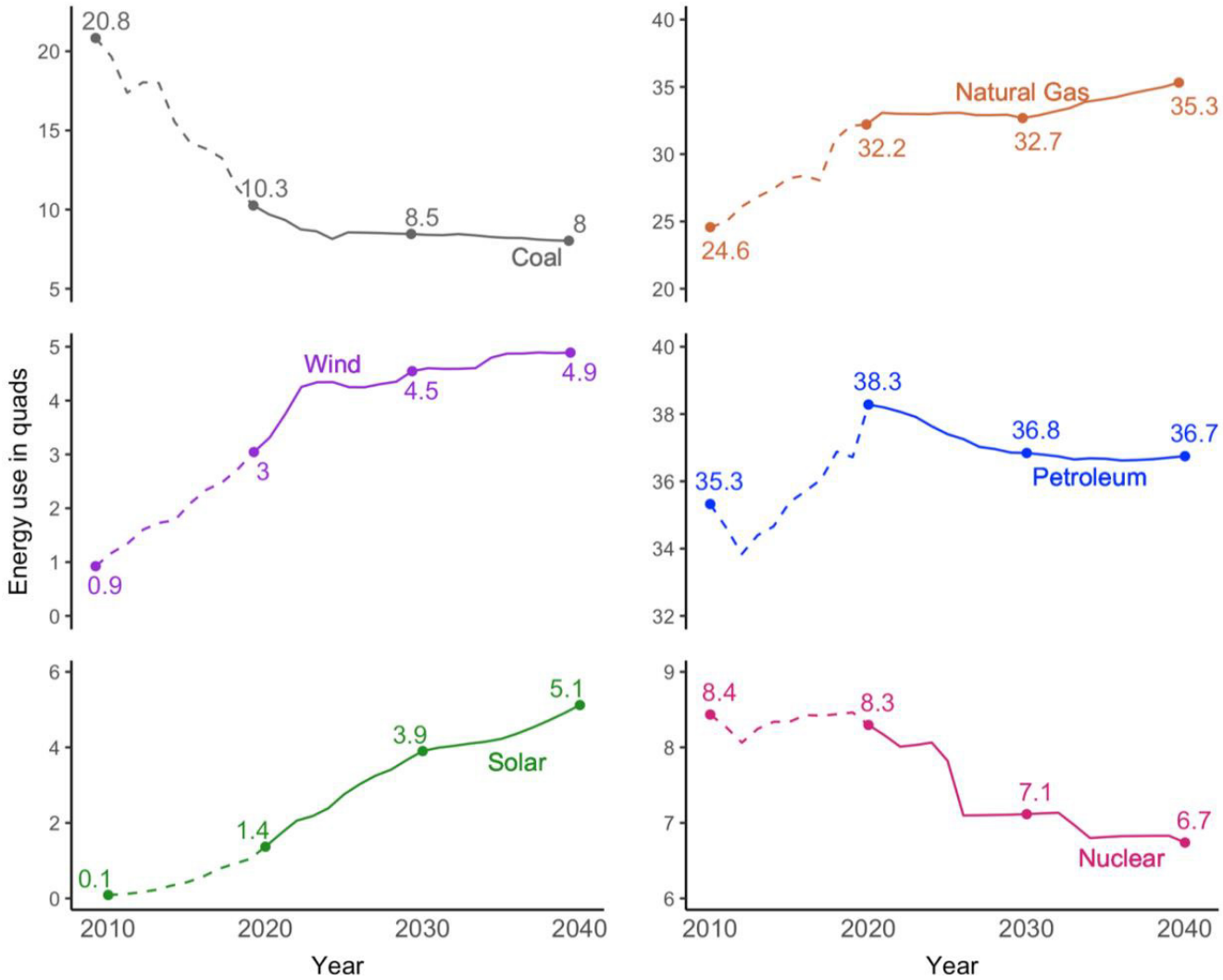


Figure 4: Historical (dashed lines) and forecasted (solid lines) changes in U.S. energy consumption by source.³⁴

In contrast, domestic and global energy demands for renewables present a growth opportunity. Domestic consumption of solar and wind is expected to surpass coal consumption in 10 years on their way to increases of 260% and 50% by 2040. Globally, consumption of wind and solar combined is expected to double by 2040.³⁶ These trends present an opportunity for the Ohio River Valley and Upper Appalachia

to again lead in meeting the world's energy needs. In the next section, we articulate a plan for investment in regional energy infrastructure with the potential to create hundreds of thousands of jobs across these four states while reducing carbon emissions, cleaning up polluted communities, and improving access and affordability of essential public goods and services.

3. Resiliency Through Clean Energy Development

The confluence of the climate crisis and the ongoing COVID-19 pandemic has created an urgent need for economic stimulus to stabilize our livelihoods and provide a clear route to more equitable and sustainable growth. In this section, we draw on economic analyses of the four-state Ohio River Valley region to estimate how much public and private investment is needed over the next 30 years to transition our energy infrastructure and make the region competitive nationally and internationally in the changing global economy. We also present the estimated impact of these investments in terms of jobs created, keeping in mind that global demand for fossil fuels is expected to decline given global pressure to reduce emissions, internal market adjustments, and pressure from environmental justice advocates.

3.1 Targeted Investment in Energy Efficiency & Cleaner Energy Sources

This subsection provides an outline for a viable climate stabilization program in the four Ohio River Valley states of Kentucky, Ohio, Pennsylvania, and West Virginia, all of which contain counties in the Appalachian Region. More specifically, the program aims to reduce carbon dioxide (CO₂) emissions across the four states by 50 percent as of 2030 and to achieve zero emissions across the region by 2050. These emissions reduction goals are fully aligned with the global climate stabilization program set out by the Intergovernmental Panel on Climate Change (IPCC).³⁷

As of the most recent 2017 data, CO₂ emissions in the four states were at about 640 million metric tons, generated by combusting primarily oil, natural gas and coal to produce energy, with a small additional contribution from burning wood

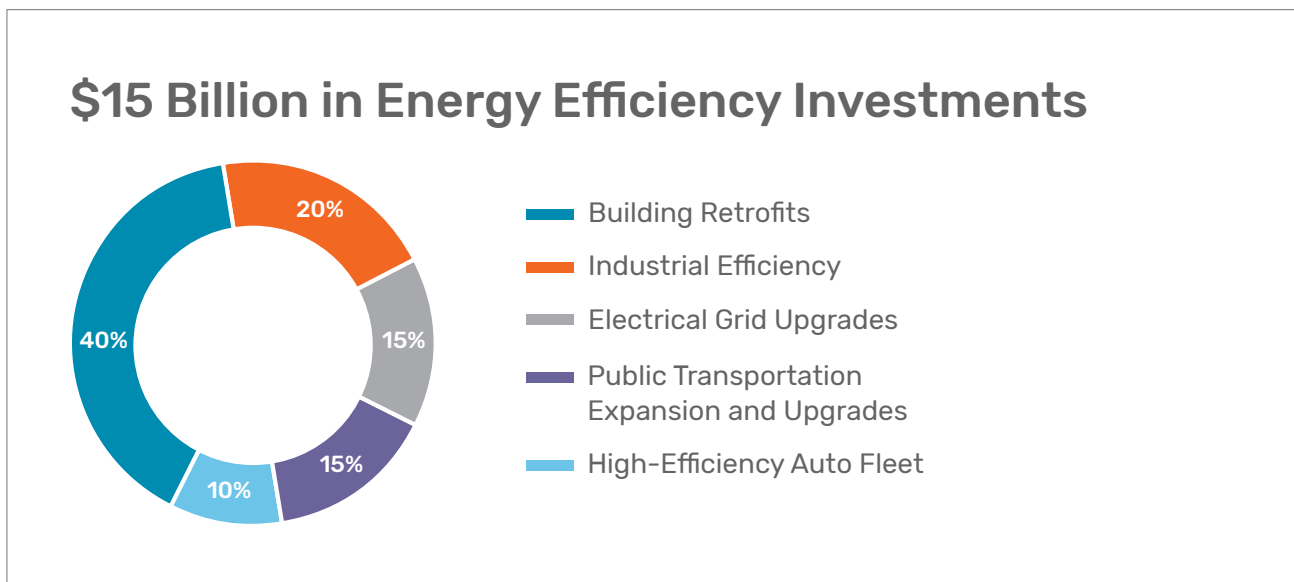


Figure 5: Estimated distribution of \$15 billion in energy efficiency investments per year from 2021–2030.

and other forms of bioenergy. For the region to be in alignment with the IPCC emissions reduction targets, fossil fuel consumption in the region will need to be cut roughly in half as of 2030, and to fall to near zero by 2050. That is, CO₂ emissions in the region will need to fall to about 320 million tons by 2030, then reach zero emissions by 2050. At present, CO₂ emissions produced by these four states account for about 12 percent of all emissions throughout the United States.

We assume that the regional Appalachian economy will grow through this 30-year period at an average annual rate of 1.5 percent per year. Working from this assumption, we estimate that over the first phase of the MP4MA project, from 2021–2030, a combination of public and private clean energy investments required to meet the demands of the growing economy will need to be about \$60 billion per year, equal to about 3 percent of the four-state GDP during this decade.

Of the \$60 billion total, about \$15 billion should be channeled into energy efficiency investments. These will include the following investment areas, along with initial shares of the overall spending budget: building retrofits (40 percent); industrial efficiency, including combined heat and power (20 percent); electrical grid upgrades

(15 percent); public transportation expansion and upgrades (15 percent); and expanding the high-efficiency auto fleet (10 percent). Through average investments in these areas totaling to \$15 billion per year, we calculate that overall energy consumption in the four states will be able to decline by 35 to 40 percent relative to what overall consumption would have been otherwise, assuming annual regional economic growth of 1.5 percent per year. If energy consumption in the four states were to grow at exactly the same 1.5 percent growth rate as the regional economy overall, that would mean that overall energy consumption in the region would rise from its 2018 level of 10.3 quadrillion British Thermal Units (Q-BTUs) to 12.2 Q-BTUs. Through investing \$15 billion per year in energy efficiency, overall energy consumption in the region would instead fall to 7.9 Q-BTUs by 2030.

To achieve the region's 2030 goal of a 50 percent emissions reduction would then mean that fossil fuel energy consumption in the state would have to also fall by roughly 50 percent, from its current level of about 9.1 Q-BTUs to 4.5 Q-BTUs. We assume that nuclear energy will continue to supply a total of 1.1 Q-BTUs of energy combined in Ohio and Pennsylvania, while Kentucky and West Virginia will continue to forego nuclear power.

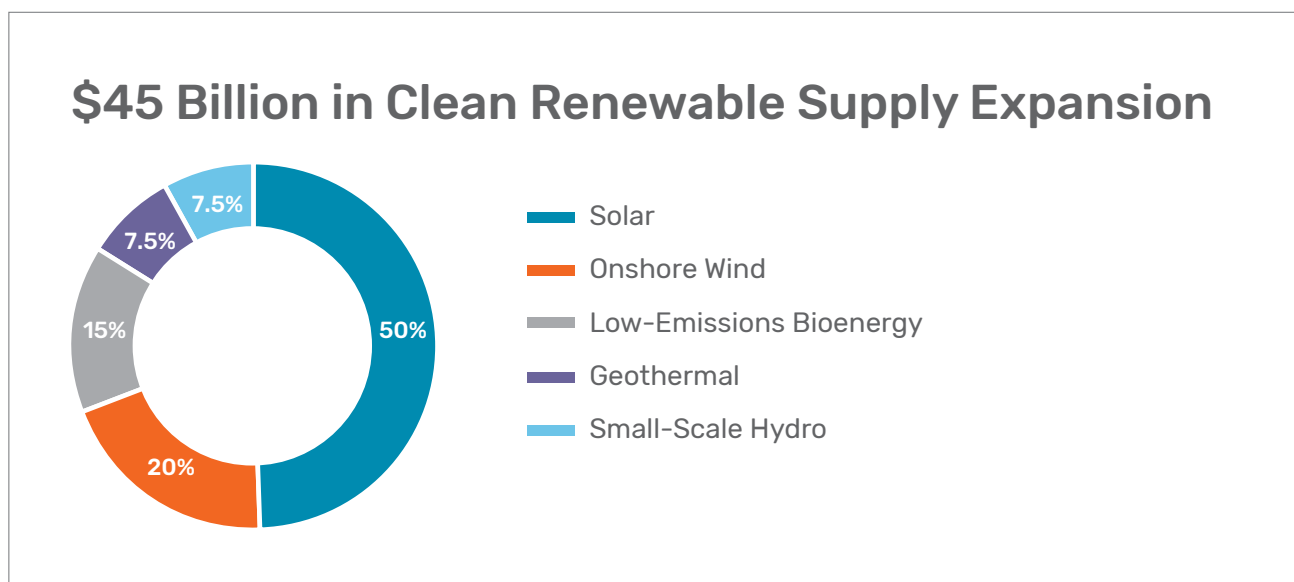


Figure 6: Estimated distribution of \$45 billion in energy efficiency investments per year from 2021–2030.

With fossil fuel supply at 4.5 Q-BTUs, nuclear at 1.1 Q-BTUs, and total regional consumption at 7.9 Q-BTUs, this means that clean renewable sources will need to supply a total of about 2.3 Q-BTUs (i.e. 7.9 Q-BTUs total—(4.5 Q-BTUs for fossil fuels and 1.1 Q-BTUs for nuclear)). At present, solar, wind, geothermal and hydro produce about 0.2 Q-BTUs of energy in the four states. The investment expansion will therefore entail a 10-fold increase in supply of 2.1 Q-BTUs. As a high-end figure, we estimate that \$450 billion over 10 years, or an average of \$45 billion per year in clean renewable supply expansion will be able to deliver the needed additional 2.1 Q-BTUs of energy to the region. As one illustrative configuration of this overall clean energy investment program, we assume the following components along with the initial shares in total spending: solar (50%); onshore wind (20%); low-emissions bioenergy (15%); geothermal (7.5%) and small-scale hydro (7.5%).

It is critical to recognize that this investment program in Appalachia will deliver lower energy costs for all consumers throughout the region. There are two straightforward reasons for this:

1. Raising energy efficiency standards will enable consumers to spend less for a given amount of energy services, such as heating, cooling, and lighting homes, operating industrial machinery, or driving cars a given distance.

2. The average costs of generating energy from clean renewable supplies are already at parity or lower than those for fossil fuels. Thus, the average levelized costs for various clean renewable energy sources include 6.8 cents per kilowatt hour for solar photovoltaic, 5.3 cents for onshore wind, 4.7 cents for hydro and 7.3 cents for geothermal. By comparison, the costs for fossil-fuel generated electricity range between 5.0–17.7 cents.

Overall, then, the average household or business in the Ohio River Valley region should be able to save nearly 40 percent on their overall annual energy bill, once they have paid off upfront investment costs.

To bring the clean energy investment project forward over the 20-year period, 2031–2050 will entail average annual investment levels at roughly half the proportions for 2021–2030, assuming that the overall rate of economic growth remains at 1.5 percent per year over this 20-year period. We also assume that productivity is growing at a 1 percent average rate, given steady improvements in the various types of clean energy technologies. Within this growth scenario, the average investment costs to build a zero emissions economy will be about \$32 billion per year, equal to an average of about 1.3 percent of the region's annual GDP.



- **50% Emissions Reduction**
- **40% Savings on Energy Bills**
- **410,000 New Jobs**

3.2 Forecasting Job Creation through Clean Energy Investments

The clean energy investment program in the four Ohio River Valley states, scaled at an average of about \$60 billion per year over 2021–2030, will advance both major gains in energy efficiency and an approximately 10-fold increase in the region’s supply of clean renewable energy. These investments will also produce a large-scale expansion of jobs in the region. There are three categories of jobs that will be generated through clean energy investments in the four states:

1. **Direct effects**—the jobs created, for example, by manufacturing electric vehicles or installing solar panels on roofs;
2. **Indirect effects**—the jobs associated with industries that supply intermediate goods for the electric vehicles or solar panels, such as glass, steel, and transportation;
3. **Induced effects**—the expansion of employment that results when people who are paid in the glass, steel, or transportation industries spend the money they have earned on other products in the economy. These are the multiplier effects within a standard macroeconomic model.

We note that estimates of the magnitude of induced employment effects are not as reliable as those for direct and indirect effects. We therefore report our employment estimate figures first for direct and indirect effects, then add the less reliable estimates for induced effects.

We estimate that the approximately \$60 billion in annual investments in the four states will generate an average of about 270,000 direct plus indirect jobs and an additional 140,000 induced jobs, for a total average annual increase of about 410,000 jobs.

We must take care to interpret these figures accurately. They mean that there will be, on average, about 270,000 more directly and indirectly generated jobs, and 410,000 more total jobs total in 2021, 2022, 2023, etc., than

there would have been otherwise. Note that these employment level increases should not be interpreted as cumulative. That is, it is not the case that there will be 410,000 more jobs in 2021, then 820,000 more jobs in 2022, 1,230,000 more in 2023 and so forth.

The average annual increase of 270,000 direct and indirect jobs would amount to an increase of about 1.8 percent of the regional labor force as of 2019. The total job expansion of 410,000 jobs, including the induced jobs, would come to about 2.7 percent of the region’s 2019 labor force. The impact of the clean energy investments, at roughly \$60 billion per year over 2021–2030, would then be to reduce the regional unemployment level, for example, from 8 percent to about 5.5–6 percent.

3.3 Providing Alternatives to Jobs Lost through Fossil Fuel Industry Contraction

While there is tremendous potential to create new jobs through investment in clean energy, it is important to recognize that—whether we make these investments or not—fossil fuel-related industries will continue to contract in the face of massive global shifts in energy markets and demands for cleaner resource alternatives. In many ways, investing to create those 410,000 jobs annually represents a way to get ahead of this shift, to create new job opportunities for the latent demand that will continue to grow as fossil fuel-related industries decline.

Simply put, the Ohio River Valley will experience job losses through the 50 percent contraction in the region’s fossil fuel-related activity over 2021–2030. However, there will be large differences in the extent of the negative employment impact within each of the four states, corresponding to the share of overall employment represented by the fossil fuel industry and ancillary sectors within each of the states. This is why it is essential that we coordinate our efforts locally and target our investments in those communities that will be most negatively affected.

West Virginia will experience the largest impact. As of the most recent 2018 data, the coal mining industry employed about 13,000 workers in the state while the oil and gas industry employed about 11,000. These two industries accounted for about 3.2 percent of overall employment in the state. When we add the range of fossil-fuel based ancillary industries—including support activities for oil/gas and coal respectively, along with fossil fuel-based electric power generation, drilling oil and gas wells, pipeline construction and transportation and natural gas distribution—total employment in all fossil fuel-based industries rises to about 40,000 jobs. This amounts to about 5.4 percent of overall employment in West Virginia.

The comparable figures are much lower in the other three states. In Kentucky, as of 2018, employment was at 6,935 in coal mining and 6,371 in oil and gas extraction. This totals to 13,306 jobs, equal to 0.7 percent of total employment in Kentucky. When we include all ancillary fossil fuel-based industries as well, the total comes to 23,710, amounting to about 1.2 percent of all employment in Kentucky. The overall fossil fuel-based employment figures, including in ancillary industries, come to 1.0 percent in Pennsylvania and 0.9 percent in Ohio.

While these statewide employment shares are relatively low, especially in Pennsylvania and Ohio, the contraction of the fossil fuel-based industries can still have a major negative impact on specific communities that are heavily dependent on the fossil fuel-based economy. For example, we estimate that there are 8 counties in Ohio which will experience private sector employment losses of 2 percent or more between 2021–2030 from the state's fossil fuel industry contraction, assuming oil and gas activity were to decline by 40 percent over the decade while coal declines by 70 percent. Monroe County would experience the most severe proportional employment losses, equal to about 14 percent of private employment in the county. At present, coal and oil/gas are the two largest employers in the county, so it follows that the county will be hard hit as these industries are phased down.

3.4 Steady versus Episodic Phase-Down

The scope and cost of any set of just transition policies will depend substantially on whether the contraction is steady or episodic. Under a pattern of steady contraction, there will be uniform annual employment losses between 2021–2030 in the affected industries. But it is not realistic to assume that the pattern of industry contraction will necessarily proceed at a steady rate. An alternative pattern would entail relatively large episodes of employment contraction, followed by periods in which no further employment losses are experienced. This type of pattern would occur if, for example, one or more relatively large firms were to undergo large-scale cutbacks at one point in time as the industry overall contracts, or even for such firms to shut down altogether.

The costs of a 10-year transition between 2021–2030 will be much lower if the transition is able to proceed steadily rather than through a series of episodes. It will therefore be critical for policymakers in the region to maintain a rate of contraction that is as steady as possible. One important reason is that, under a steady contraction rate, the proportion of workers who will retire voluntarily in any given year will be substantially greater than if several large businesses were to shut down abruptly and lay off their full work force at a given point in time. Another related factor is that it will be easier to find new jobs for displaced workers if the pool of displaced workers at any given time is smaller.

The case of West Virginia, in which the overall impacts of the fossil fuel shutdown will be most severe, illustrates this point clearly. That is, if the industry in West Virginia does contract by 50 percent between 2021–2030, that means that roughly 20,000 jobs will be lost by the end of the decade. However, under a steady phase-down, job losses would amount to only about 2,000 per year. Moreover, we estimate that about 650 workers in the industry will voluntarily retire over this time period once they reach age 65. That then implies that the number of

workers facing job displacement and requiring re-employment in West Virginia would be about 1,350. This figure is less than 0.2 percent of the current statewide workforce. The comparable figures would be much smaller still in the other Appalachian states—i.e. about 0.05 percent per year, or one-twentieth of one percent—of the overall workforce in Kentucky, 0.03 percent per year in Pennsylvania and 0.02 percent per year in Ohio under a steady contraction rate between 2021–2030.

“Communication, policy-making, and cross-sectoral regional collaboration are critical to reducing the potential for a disproportionately negative impact on vulnerable groups and displaced workers.”

3.5 Providing for an Equitable Economic Transition

Communication, policy-making, and cross-sectoral regional collaboration are critical to reducing the potential for a disproportionately negative impact on vulnerable groups and displaced workers. In general, a just transition is expected to entail costs in three areas: (1) guaranteed jobs and support for laid-off workers; (2) fully guaranteed pensions; and, (3) community transition.³⁸ All displaced workers should receive pension and re-employment guarantees, as well as generous income, retraining and relocation support. The combined overall cost of such a generous program will be modest. Even for West Virginia, we estimate the total costs would amount to well below 0.1 percent of the state’s average GDP. In addition, fossil-fuel dependent communities

should receive major federal and state-level support to reclaim and repurpose land and generate new investment projects, including in a range of clean energy areas.

As with the clean energy sectors, the composition of job categories in the fossil fuel-based industries is fairly wide-ranging. In fact, the highest percentages of jobs, at between about 15 to 20 percent of total employment depending on the state, are in various forms of management occupations. Other relatively heavily represented areas of employment include extraction, construction, transportation, and administrative support. Some of the workers now employed in the fossil fuel-based industries will have skills specific to the industry and will therefore face difficulties moving into new employment areas. But the majority of the workers will have jobs that should be transferable to new employment opportunities, in the clean energy economy or elsewhere. In any case, the transition program to support displaced workers in U.S. fossil fuel-related industries will need to be focused on the specific background and skills of each of the impacted workers.

In addition, public policy at all levels should commit to ensuring that that the jobs created through clean energy investments are high-quality in terms of wages, benefits, and working conditions. Strong labor unions and effective job training programs are both necessary to promote high-quality job opportunities. Additional policies are necessary to ensure that women and people of color have equal access to clean energy jobs. Both groups are currently underrepresented in all areas of the U.S. energy sector.

Once an effective just transition program is established for the initial 2021–2030 period, there should not be major additional challenges to maintaining the program through the next 20 years, 2031–2050, of the fossil fuel industry’s phase-down in the region. Indeed, the extent of the annual job losses will be roughly half that of the 2021–2030 period. This means that the proportional costs of financing just transition support for displaced workers will also fall correspondingly by about half.

Importantly, there are existing examples for how to cover these costs and transition displaced workers. One example, in the U.S. context, is the Redwood Employee Protection Plan (REPP) that provided income replacement wages and survival benefits to thousands of lumber industry families in a rural county in Northwest California in the late 1970s and 1980s. REPP provided an estimated \$110 million (several hundred million in today's dollars) in transitional assistance to over 6,000 lumber industry and other workers affected by the 1978 expansion of Redwood National Park (RNP) in Humboldt County, CA (see RNP Act of 1978, PL 95-25 and DOL 29 CFR Part 92 Regs). The expansion preserved 48,000 acres of old growth redwood timberland, large tracks which had been over-cut, clear-cut, and destroyed by some of the country's largest timber corporations. Had the park expansion not occurred, the tall trees inside the original park—including the tallest in the world—would have been at risk. Overall, workers were eligible for six years of wage replacement, health and education benefits, and a bridge to retirement for workers in the gap (which contributed supplements to workers' pension funds). REPP also provided funding for re-training of affected employees, as well as job search and relocation allowance. REPP was modeled after a rail workers' program, and it remains one of the best models of labor-driven just transition policy (Congress included it in the RNP bill at the urging of the Carpenters Union).

Community engagement and equitable transition strategies are further discussed in **Section 5** below.

3.6 Aggregating Capital to Fund Investment in Clean Energy

To summarize the above, there is a path to regional economic transformation that begins with investing about \$1.24 trillion in energy efficiency and clean energy infrastructure over the next 30 years, including about \$60 billion per year for the next 10 years (2021-2030). Under that scenario, we expect to be able to create about 270,000 direct and indirect jobs plus 140,000 induced jobs annually across the four states.

This increase will come at a time when the fossil fuel-reliant communities of our region will need new opportunities most, especially given the anticipated shifts in the global energy market.

The most immediate challenge, then, is to figure out how to raise \$60 billion per year for the next 10 years to support this effort. Most likely, this funding will have to come from a blend of public and private sources. Below, we identify several different models for financing this type of regional economic development. We expect that raising the necessary capital will require some distribution of financing across these various sources, not unlike the concept of "capital stacking" used in real estate.

FEDERAL SUPPORT

In the 20th Century, the United States has sustained only limited national programs to promote regional structural adjustment in specific regions. The largest exception to that rule was and remains the creation of the Tennessee Valley Authority (TVA), focused on the economic development of a broad region. During the Great Depression, the Tennessee Valley Authority (TVA) was formed to create economic and public works infrastructure in a multi-state region covering Tennessee and including portions of Alabama, Mississippi, and Kentucky, Georgia, North Carolina, and Virginia. The federal corporation was explicitly chartered to modernize the mostly agricultural economy of the broad region. TVA implemented flood control programs, built power plants, and even engaged in industrial targeting efforts promoting fertilizer production, collectively the most extensive federal involvement in regional economic planning.

Federal place-based economic development policies re-emerged in the early 1960s in response to a growing realization that unprecedented post-war economic growth did not extend to all areas of the country and, in particular, Appalachia. In 1961 the Area Redevelopment Act established an experimental Area Redevelopment Administration (ARA) within the Department of Commerce. Though sharing similar goals to the far broader TVA initiative, the

ARA was a far more limited four-year program targeting areas experiencing lagging income growth. However, the new agency's minimal funding was widely dispersed across the country, limiting its impact on specific regions. Over the four-year period, the resources allocated to the ARA were insufficient to address its ambitious goals.

“There is a path to regional economic transformation that begins with investing about \$1.24 trillion in energy efficiency and clean energy infrastructure over the next 30 years.”

Since the 1980s, there has been no significant shift in federal policies; the nation continues to lack any strategic plan to spur place-based economic development in chronically depressed regions. Efforts to create or sustain jobs are embedded across a range of programs administered by the Economic Development Administration (created in 1965) and other programs embedded within other federal agencies. Where the federal government has provided significant funding to create or retain existing jobs, it has been in reaction to very specific crises and focused on averting widespread but often short-term job-losses in legacy industries. Examples of these mostly ad-hoc efforts include two federal bailouts of the Chrysler Corporation to keep the company from entering bankruptcy in both 1979 and 2009, and similar examples, such as federal financing provided to the AIG Insurance Group to prevent the financial firm from collapsing in 2008 during the Great Recession. Outside of the TVA, there has been no coordinated strategy effort at the federal level to shift the economic trajectory of any particular region into new industries.

The tide may be shifting in this regard with the introduction of the 2020 “Biden Plan for a Clean Energy Revolution and Environmental Justice,” by U.S. Presidential candidate Joe Biden. The Biden Plan sets specific targets for federal investment in clean energy-related solutions: “Biden’s climate and environmental justice proposal will make a federal investment of \$1.7 trillion over the next ten years, leveraging additional private sector and state and local investments to total to more than \$5 trillion.”³⁹

The Biden Plan echoes developments taking place around the world as regional economies work to stimulate growth given the twin challenges of climate change and the COVID-19 pandemic. European Union leaders recently agreed on a stimulus package that will deliver \$860 billion USD in joint debt to member states to help them survive the economic downturn, of which, nearly a third is earmarked specifically for fighting climate change (nearly \$300 billion USD) in line with the Paris Agreement’s goal of cutting greenhouse gases. The package includes the use of grants and rebates to encourage investment in green infrastructure across the European continent.⁴⁰

Given the potential for federal support on this scale, the MP4MA Roadmap presents an important opportunity to attract federal dollars as part of the “capital stack” that would total \$600 billion over the next 10 years for the four Ohio River Valley states combined.

There are also other routes for federal funding to contribute to the amount needed. Interagency federal partnerships are a promising avenue for development. For example, the Partnership for Sustainable Communities, launched in 2010 during the Obama Administration, combined the resources and expertise of the EPA, HUD, and DOT to distribute hundreds of millions in grants to support local initiatives targeting brownfield development, sustainable community regional planning, transportation to generate economic recovery, housing and planning, as well as projects broadly related to the Partnership’s work on “climate change adaptation; coordination of sustainability policies; cities in transition; infrastructure financing; development code modernization; water quality

and green infrastructure; sustainable design and housing; and, historic preservation.⁴¹ Interagency federal partnerships like this one could be used to catalyze the projects that fall under the Marshall Plan for Middle America. The relevance to the combined missions of the EPA, HUD, DOT, DOE, and EDA are clear.

PENSION FUNDS & RESPONSIBLE ALTERNATIVE INVESTMENTS⁴²

Globally, pension assets are valued at \$40 trillion USD across 22 major pension markets, including \$25 trillion in the U.S. In 2019, public pension funds, including municipal pension funds, owned \$4.3 trillion in “workers’ capital,” according to the Pew Foundation. Most public plans include labor union and municipal representatives as trustees, or capital stewards, on the trust board that makes pension decisions. Alternative investments have witnessed strong growth over the last number years. This is the part of the economy that is concerned with actually producing goods and services, as opposed to investing solely in stocks and bonds.

For decades, state and city pension fund leaders have made economically-targeted investments (ETIs) in the real economy—in strategic industries, SMEs, affordable housing, and community-scale infrastructure, for example—and for good reason. Such investments provide portfolio diversification benefits and higher return potential, and most importantly, because of their long-term nature, align with the long-term goals of pension fund investments. ETIs also provide “collateral benefits” to local communities—for example, low-cost housing units to residents. Along with multi-employer plans, public funds have capitalized hundreds of thousands of housing units, invested in innumerable companies, and saved or created hundreds of thousands of good jobs.

“Such investments provide portfolio diversification benefits and higher return potential, and most importantly, because of their long-term nature, align with the long-term goals of pension fund investments.”

Responsible alternative investments have the potential to offer solid financial returns as well as achieve positive environmental, social, and governance (ESG) impacts. While these investments are generally classified as “alternative” investments, they include fixed income investments such as green bonds and mortgage backed securities. Of particular interest in these times would be “special situations” fund managers who have successfully turned around companies of all sizes, saving tens of thousands of good jobs in recent years

Responsible investing is booming. The U.S. SIF: The Forum for Sustainable and Responsible Investment reported in its 2018 biennial “Report on US Sustainable, Responsible and Impact Investing Trends” that sustainable, responsible and impact investing (SRI) assets now account for \$12.0 trillion—or one in four dollars—of the \$46.6 trillion in total assets under professional management in the United States. This represents a 38 percent increase over 2016.

Capital stewards of cities, counties, and states may develop, implement, and monitor a responsible investment (RI) policy. Such a policy should be based on the ESG risks and opportunities expected to impact the financial value of plan assets, and consequently, the economic, social, and environmental well-being

of worker-owners. Capital stewards will then need to then build internal expertise and/or select external managers, execute on material ESG themes and engage, and monitor performance and fine-tune the policy.

In order to move toward a responsible investment platform, pension plans should adopt a responsible investment policy, part of an overall investment policy statement (IPS). To measure compliance, there are innumerable ESG ratings, rankings, and indices, as well as providers—a result of greater investor demand for the inclusion of ESG considerations in investment decision-making. The ESG data can be used to make comparisons between companies, select stock based on a best-in-class strategy, and engage with management on issues material to the investors, among other uses.

As universal owners, meaning that their “financial performance is tied to the overall health of the economy and to ESG practices and standards,” pension funds also have the capacity to hold corporations accountable. By wielding their collective clout as representatives of thousands of shareholders—the workers and retirees on whose behalf the investments are made—pension funds can have a say in affecting corporate change as active shareholders. In addition, pension funds should seek to integrate ESG considerations alongside financial indicators into the investment decision-making process for their investments. Responsible corporate governance should be in the interest of all stakeholders, not just shareholders. As such, trustees of pension funds can deploy such capital strategies as shareholder activism, proxy voting, screening, indexing, ESG integration, and divestment that can enable the plan to positively influence corporate behavior.

In the past few years, London, New York City, and San Francisco’s pension funds all made significant investments in climate solutions, including divestments from fossil fuels and investments in renewable energy efficiency, green workforce housing, and other areas. New York City has combined ESG and ETI investing strategies to generate risk-adjusted market rates-of-returns,

address climate change, and to promote economic development within New York City. The New York City pension funds have allocated 2% of pension assets towards their ETI program. It is designed to address market inefficiencies by providing capital or liquidity for low, moderate, and middle-income neighborhoods and populations in the five boroughs. These ETIs have helped to revitalize neighborhoods by returning distressed properties to the City’s tax rolls and by developing new housing that is affordable to working people. Since the ETI program began in the 1980s, \$3.8 billion has been invested in New York City’s five boroughs and the six surrounding New York counties. Case studies have measured the impacts of such investments, including wages, taxes, and further pension contributions, on the region’s economy.⁴³

In the Ohio Valley Region, the public pension fund of Pittsburgh recently adopted an ESG policy.⁴⁴ With the help of the Mayor’s Office of New York City, US-based responsible investing body Heartland Capital Strategies (HCS), and green cities network C40, the sustainability push at the Pittsburgh pension trust is part of a city-wide action plan to combat climate change, which includes generating 100% renewable energy for municipal operations, halving water use and carbon emissions, and a zero waste initiative.

CORPORATE INCENTIVES & ESG PERFORMANCE

In addition to shedding light on important ESG measures and sustainability rating organizations, trustees need to effectively navigate the plethora of ESG data by focusing on a the most critical for RI evaluation, including environmental impacts, labor standards, diversity and inclusion, just transition. Capital stewards must avoid pitfalls of investing in the wrong alternatives by posing tough questions about fees and increased ESG risks to any and all external managers.

An interesting perspective could also derive from future developments in the valuation of the financial impacts of social and environmental sustainability. Today, corporate leaders, analysts,

and investors must deal with two separate and entirely disconnected reporting systems: one for financial results and the other for environmental and social impact, or ESG performance.

Currently a standard method to integrate ESG performance data into earnings projections or valuation analysis does not exist. The result is two separate narratives, one telling how profitable a company is, the other highlighting whether it is good for people and the planet. There is no clear way to discern which company is most profitably doing the most good. A study recently conducted by Enel Foundation and FSG, in cooperation with HBS and SVI, shows how hybrid metrics could represent a possibility in this direction.⁴⁵ Hybrid metrics are composed of both financial and ESG indicators, and therefore can give a joint indication of performance. Those metrics are sector/industry- or even business-specific and can be adopted only if the causal relationship between its components is proved. For example, for the energy sector, the value of decarbonization strategies could be evaluated by analyzing the ratio between EBITDA and carbon intensity.⁴⁶

Once developed and vetted, such metrics could help companies, public institutions, and investors better orient their investment choices towards solutions bringing the maximum benefits to both the social and environmental dimension and to the economic one at the same time. In this scenario, we expect that initiatives like the projects falling under the MP4MA would be especially attractive and mutually beneficial across stakeholder groups.

Another way to raise capital through public-private partnerships is via new financial instruments, such as “SDG-linked” or “green” bonds. In 2019, Enel Group issued the first general-purpose SDG-linked bond, an innovative corporate financial instrument that aims to contribute to the achievement of the Sustainable Development Goals (SDGs). The real breakthrough innovation of the financial instrument is its capability to link financial performance and the SDGs target achievement. Enel Group strategy mainly focuses on four SDGs (7, 9, 11 and 13) and the revolutionary financial instrument is a \$1.5 billion (USD) bond directly related to the achievement of them through the increased generation of renewable energy and full decarbonization by 2050. Soon after the release, the bond was almost three times oversubscribed, signaling strong demand for SDG-related investment opportunities.⁴⁷ The bond is the first of its kind intended to meet a company's ordinary financing needs and its success on the markets is a clear signal of the value of sustainable finance.⁴⁸

SDG-linked bonds can also be issued at the country-level. In September 2020, Mexico announced a partnership with the United Nations Development Programme to issue a seven-year Sovereign SDGs Bond valued at \$890 million (USD).⁴⁹ The effort will help funnel private equity into SDG-related programs across the country, many of which tackle issues of climate change and environmental justice.

3.7 The Energy Infrastructure Transition is Practice

It is important to recognize that this transition is already underway in our regional communities. Even without the capital to fund large-scale change, cities and rural areas across the Ohio River Valley are already finding creative and innovative ways to adapt to the growing opportunities presented by renewables. Below, we highlight examples from around the region where communities are beginning to build out this clean energy infrastructure and to reap the benefits of more equitable and sustainable economic development.

CINCINNATI, OH

The City of Cincinnati is currently constructing the largest municipal solar array in the country with a completion date scheduled for December of 2021. Once complete, the 100 mega-watt solar array will reduce the region's annual carbon emissions by 158,000 tons, provide clean, renewable energy to all City facilities, and serve the City's residents through the Cincinnati Electric Aggregation Program. In partnership with Cincinnati State and IBEW Local 212, this solar development also includes a workforce skill and hiring program component for Cincinnati residents.



A photo illustration, created by the city of Cincinnati, of Lunken Airport covered in solar panels. Digital image. The Enquirer. November 21, 2019. <https://www.cincinnati.com/story/news/2019/11/21/solar-power-power-cincinnati-city-hall/4264286002/>.

For reference, see: "Cincinnati to Construct Nation's Largest City-Led Solar Project," City of Cincinnati, Office of the Mayor, November 21, 2019, <https://www.cincinnati.com/story/news/2019/11/21/solar-power-power-cincinnati-city-hall/4264286002/>.

COLUMBUS, OH

In 2016, the City of Columbus won the United States Department of Transportation's competitive \$50 million Smart Cities Challenge. Boosting electric vehicle (EV) ownership and usage is a primary goal in Ohio's capital city. Through partnerships with employers, a wide-ranging education campaign, and collaborating with vehicle dealerships, the Columbus region is on track to surpass its goal of increasing EV ownership by 500% in 2020.



Fisher, Shellee. "City of Cols Electric Fleet 5966 Charging Station." Digital image. Columbus Business First. September 11, 2018. <https://www.bizjournals.com/columbus/news/2018/09/11/smart-columbus-halfway-to-goal-of-300-government.html>.

For reference, see: Davis, Jordan, "Columbus Ohio's Bold Goal: Increasing EV Adoption," SMART Columbus, October 2, 2020, <https://www.cincinnati.com/story/news/2019/11/21/solar-power-power-cincinnati-city-hall/4264286002/>.

DAYTON, OH

In August 2020, under the leadership of Mayor Nan Whaley, the City of Dayton released its first ever sustainability plan entitled “Strategy for a Sustainable Dayton,” a commendable feat for a city with approximately 140,000 residents. The plan emphasizes five areas that are a part of the City of Dayton Sustainability Framework: equity, climate mitigation, infrastructure, economic development, and resilience. The plan leverages Dayton’s strengths as a national leader in water conservation and protection and highlights its potential for sustainable economic development.



For reference, see:

“Strategy for a Sustainable Dayton,” *City of Dayton*, August 26, 2020, <https://www.daytonohio.gov/DocumentCenter/View/9796/August-2020-Dayton-Sustainability-Strategy-Plan>.

YOUNGSTOWN, OH

In November of 2019, Lordstown Motors purchased the former GM Lordstown plant, which previously employed 4,500 workers in the region. Lordstown Motors plans to hire 400 unionized UAW workers next year to help build their all-wheel-drive fully electric pick-up, the Endurance. This effort represents a convergence between research and development, universities, and workforce and economic development efforts that aims to help develop the region into a manufacturing hub for electrification.



Endurance Electric Pickup Truck. Digital image. Electric Vehicle USA. Accessed December 10, 2020. <https://evusa.org/endurance-electric-pickup-truck/>

For references, see:

“Lordstown Motors Corp. Acquires Factory in Lordstown, Ohio,” Cision PR Newswire, November 7, 2019, <https://www.prnewswire.com/news-releases/lordstown-motors-corp-acquires-factory-in-lordstown-ohio-300954433.html>.

Boudette, Neal E. “Buyer of G.M. Lordstown Plant Promises Union Work and Wages,” *The New York Times*, November 7, 2019, <https://www.nytimes.com/2019/11/07/business/gm-lordstown-plant.html>.

PITTSBURGH, PA

Once a smoke-filled city solely reliant on the steel industry, Pittsburgh has since developed an international reputation for its commitment to sustainability and clean energy. Under the leadership of Mayor William Peduto, the City of Pittsburgh is combatting climate change and investing in the green energy future through Pensions, Policy, Planning, and Procurement.

In the summer of 2020 the City of Pittsburgh and its partners in Western Pennsylvania Energy Consortium, a collection of 30 local government and non-profit organizations, purchased 100 percent renewable electricity for their operations. The purchase of electricity, coupled with renewable energy credits, ensured the delivery of clean electrical power, but also saved the Consortium a combined \$700,000.

In September 2020, the City of Pittsburgh announced a groundbreaking pension divestment strategy that included a mandate to remove investment from fossil fuel industries and rather, invest millions in pension funds into companies that “undertake energy conservation initiatives and develop alternative renewable and clean energy resources.” Upon the announcement of this strategy, Mayor Peduto stated: “When we began our work to develop Pittsburgh’s third climate action plan, we realized that responsible investing by our pension fund is one of the most critical tools not only in advancing a just and clean energy transition, but a move that is simply a good economic investment strategy too.”

In addition to its trailblazing pension divestment, City of Pittsburgh is also driving the fight against climate change and advancing investment in green energy through policy, planning, and procurement. Pittsburgh’s ambitious Climate Action Plan 3.0 commits City government to a 50 percent reduction in greenhouse gas

emissions by 2030 and an 80 percent reduction by 2050 as well as a 100% renewable energy usage by 2030. Buildings account for 80% of the City’s carbon emissions, highlighting the need to invest in energy efficient buildings. Through an ordinance passed by City Council, all future City-owned buildings will commit to Net Zero Energy Standards to reduce City government’s impact on carbon emissions. Finally, the City has begun to transition to a 100% fossil fuel-free fleet, using its procurement ability to invest in electric vehicles powered by solar energy.



For references, see:

“Peduto Administration Legislation Requires New City Buildings to be Net Zero Energy Efficient,” Press Release, City of Pittsburgh, September 3, 2019, <https://pittsburghpa.gov/press-releases/press-releases/3274>.

“Pittsburgh Pension Fund Adopts Sustainable Investment Policy,” Press Release, City of Pittsburgh, September 17, 2020, <https://pittsburghpa.gov/press-releases/press-releases/4315>.

“City Council Approves Pittsburgh Climate Action Plan 3.0,” Press Release, City of Pittsburgh, May 22, 2018, <https://pittsburghpa.gov/press-releases/press-releases/1883>.

“City of Pittsburgh Debuts Solar Charging Stations for its Electric Vehicle Fleet,” Press Release, City of Pittsburgh, April 18, 2018, <https://pittsburghpa.gov/press-releases/press-releases/1717>.

LOUISVILLE, KY

In recognition of a rapidly warming climate and the role that cities can play in combating climate change, leaders in Louisville adopted an ambitious Greenhouse Reduction Emissions Reduction Plan (ERP), charting the course for an 80% reduction in greenhouse gas emissions by 2050. The plan contains wide-ranging efforts to achieve this lofty goal, including investments in solar technology, diverting waste from landfills, and overhaul of municipal code to provide incentives for green development. In addition to the ERP, the City of Louisville recently released a Prepare Louisville Climate Adaptation Plan, which presents strategies and actions to combat climate change and manage the shocks and stressors caused by the warming planet. This plan calls for increasing the city's tree canopy, investing in green stormwater infrastructure, incentivizing sustainable practices by residents and businesses, and more.



For references, see:

"Louisville Greenhouse Gas Emissions Reduction Plan," *City of Louisville* (April 2020), https://louisvilleky.gov/sites/default/files/sustainability/ghg_erp_final_draft_20200422_0.pdf.

"Prepare Louisville: Building a Climate Resilient City for All—Draft Plan," *City of Louisville* (April 2020), https://louisvilleky.gov/sites/default/files/sustainability/prepare_louisville_adaptation_plan_draft_for_public_comment.pdf.

HUNTINGTON, WV

In West Virginia, the non-profit Solar Holler that focuses on utilizing solar energy development to help bring jobs in renewable energy to communities hard hit by the decline of the coal industry. In March 2019, Solar Holler installed a 54 kilo-watt roof-mounted solar energy system for the Huntington Area Habitat for Humanity's ReStore and Administrative Office building, providing for it to run entirely on solar energy.



Huntington Solar Panels. Digital Image. Solar Holler. March 14, 2019. <https://www.solarholler.com/2019/03/14/huntington-habitat/>.

For reference, see:

"Huntington Habitat Hosts Largest Non-Profit Solar Project in West Virginia," Solar Holler, March 14, 2019, <https://www.solarholler.com/2019/03/14/huntington-habitat/>.

4. Enabling System-Wide Impacts

4.1 Laying the Foundation for Renewable Energy Generation and Consumption

As noted above, producing energy sustainably is just one aspect of the region's economic ecosystem. However, when all of the other economic processes within the region come to rely on and demand more sustainable energy resources, the impact is magnified and felt across the system.

Indeed, a recent study⁵⁰ carried out by Enel Foundation and The European House Ambrosetti showed how the rapidly ongoing processes of electrification (with an increasing generation by renewables) and digitalization driving the energy transition in Europe will enable decarbonization of the most polluting sectors of the economy, improving air quality and saving thousands of lives. At the same time, substituting thermal

technologies with electric ones and offering new digital services to “prosumers”—who are increasingly key players in the electricity system—will also create great opportunities and value in new ways. Using an innovative model, the study estimated that to achieve the European Union's decarbonization targets by 2030,⁵¹ the energy transition will generate a net increase in the value of industrial production up to 145 billion euros and a positive impact on employment, forecasting a net growth of up to 1.4 million jobs in the European Union.

Generating energy with more renewables and less fossil fuels is at the basis of the energy transition. Nevertheless, to broaden the perspective to the entire electricity value chain, it is important to go further, focusing also on consumption patterns and grids. The so-called electricity triangle^{53,54} (see **Figure 7**) is a paradigm that can bring remarkable benefits. It is based on clean generation by renewables, electrification of final uses in all sectors (buildings, industry and mobility), and electricity exchange through efficient smart grids.

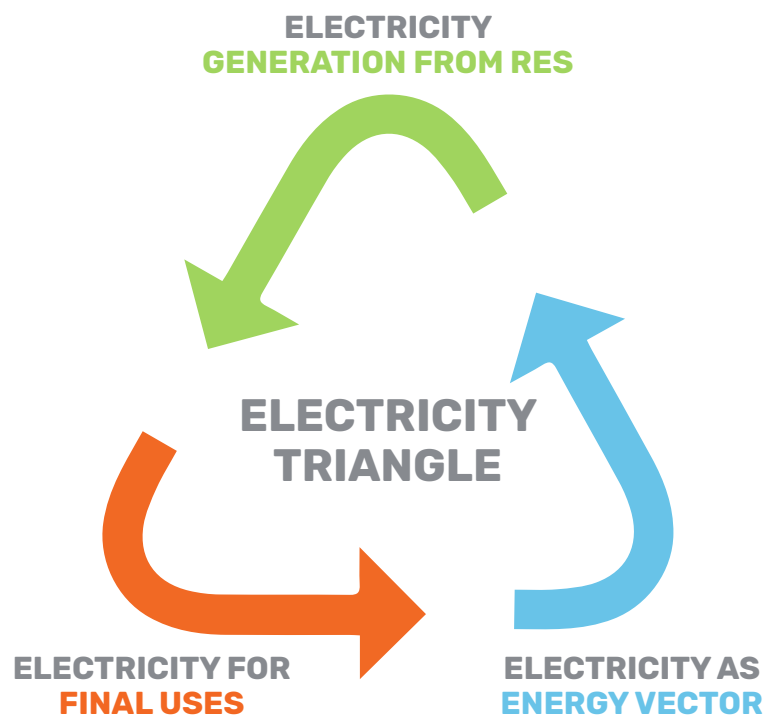


Figure 7: Graphical scheme of the electricity triangle as the basis of the electrification strategies (adapted from **Figure 1** in the book *Electrify Italy* with permission of the Enel Foundation).

4.2 Expanding Impact through Circular Economy Frameworks

To magnify the impact of a regional investment in renewable energy infrastructure, we can look to the potential to build out circular economic frameworks that further reduce waste and enhance sustainability within our regional supply chains. The Ellen MacArthur Foundation defines a circular economy as one that “is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.”⁵⁵ Essentially, a circular economy is one defined by multisectoral collaborations designed to create mutually beneficial feedback loops. In the Ohio River Valley, this concept is not new; for example, waste byproducts from coal production and steel manufacturing have been used in a number of applications across the region. Still, as we rebuild our energy foundation, we have an opportunity to create new feedback loops across industries, and to do so in a more environmentally just way as we seek to redress past harms to people and the environment.

In fact, clean energy is an essential input into any sustainable circular economy framework. Very recently, Enel Foundation and The European House Ambrosetti (2020) released a study⁵⁶ that defined an operational framework for the transition towards a circular economy model, assessing the level of development and the benefits of circular economy in Europe across its four main pillars: (1) sustainable inputs, (2) end-of-life, (3) extension of useful life, and (4) increase of the intensity of use. The study showed how circular economy is linked to 300–380 billion euros in GDP (2-3%) in Europe. As well, the transition towards a circular development model was associated with improvements of around 650 euros of GDP per capita in the European Union during 2018. The shift from a linear to a circular paradigm in Europe was associated with almost 2.5 million jobs, about 90–110 billion euros of investment, and an increase in labor productivity of 570–940 euros per employee (corresponding to 1%–2% of current annual productivity) in 2018.

In addition, circular solutions can positively affect the environment by extending the useful life of products and services and/or increasing their intensity of use. Several examples from Europe help illustrate the potential impact of designing an economic system with circularity in mind:

- Using recycled iron, aluminum, zinc, and lead can save 73.5% CO₂eq with respect to using virgin material.
- One percentage point of additional renewables can, in Europe, save up to 72.6 million metric tons of CO₂eq.
- Closing the loop for batteries would cut out 51% of the environmental impact of their manufacturing process.
- Replacing five 2,000 cycle machines with one 10,000 cycle machine can save about 180 kg of steel and more than 2.5 tons of CO₂eq.
- It is reasonable to extrapolate that related innovations in our regional economy could also result in these monumental gains. However, to effectively reap the economic, social and environmental benefits of circular economy, it is necessary to further advance the shift from a linear to a circular development model.

Based on their work in Europe, Enel Foundation finds that there are ten policy matters, entailing specific policy actions, that could be applied to the Ohio River Valley and Upper Appalachian regions:

1. Circular economy involves all sectors of production and services and there is a need for cross-cutting measures coordinated in the framework of a general strategy. In particular, it is important to set comprehensive and ambitious strategies and roadmaps at national and at local levels, with measurable objectives focused on circular economy to be achieved in a specific timeframe.

2. Companies and public administrations are not fully aware of the benefits of circular economy. An effective governance model including all the departments (both at the national government level and at the corporate level) should be defined/redefined to avoid limiting the reach of circular economy principles to environmental department activities.
3. Supporting a strategic and cross-sectoral successful transition to enhance the development of circular business models, leveraging legislative processes.
4. Implementing circular economy requires transformative investments that need to be sustained and incentivized. Leveling the playing field by giving incentives to circular business models (e.g. reducing the taxation on circular factors such as human labor) instead of linear models can be a starting point.
5. Supporting companies' investments in circular economy research and development and practices with adequate financial tools, in addition to promoting circular public procurement, can further accelerate innovation.
6. The meaning of being circular is unclear and, subsequently, there is a lack of adequate tools for measuring and monitoring circular economy. Therefore, addressing the lack of a clear definition and of comprehensive and homogenous metrics at both the macro and the micro level is essential. An example is the lack of indicators for the fraction of recycled waste that is actually recovered. This parameter is generally not disclosed or estimated.
7. Turning waste-oriented business models into circular ones. Some concrete examples are: incentivizing the approach of "circular by design", extending the warranty time, making repair easier, creating financial incentives for reparability and ensuring availability of information on durability and reparability of products.
8. Promoting cross-cutting and coordinated measures for all sectors involved in the circular economy transition: sustaining the creation of districts and clusters to maximize synergies at local and national levels and creating an ecosystem for innovation by identifying some strategic sectors.
9. Leveraging circular economy as a framework to reimagine cities and urban areas: promoting cooperation among different stakeholders and coordinating different contributions towards a more circular territory.
10. Promoting culture and awareness of the benefits associated with circular economy. Some examples: clarifying the value of circular economy, raising public awareness and promoting communication on circular economy benefits among consumers, promoting circular economy playbooks, addressing the issue of skill mismatch, and strengthening the commitment towards lifelong learning programs.

4.3 Regional Examples Showcase Opportunities for Expanded Impact

The interrelated nature of investing in renewable energy expansion, reducing emissions, and laying the foundation for a more circular regional economy is evident in the projects that Sustainability Managers and Economic Development Teams are articulating in cities all over our region. These teams are actively engaged in identifying critical need areas where more sustainable infrastructure solutions could replace traditional methods. Examples exist in urban and rural communities alike, and all of them showcase the importance of cross-sectoral collaboration to realize mutually beneficial gains for all stakeholders. While many of the examples highlighted below begin with investment in renewable energy infrastructure, they all also demonstrate that implementing these projects requires inputs and cooperation across the supply chain.

MORGANTOWN, WV

One of Morgantown's greatest strengths is the outdoor recreation opportunities provided by the Monongahela River that runs through this West Virginia town. A popular riverfront trail lacks lighting, and a goal of City officials is to harness the power of the river and the federally owned locks and dams to provide lighting powered by hydroelectricity and solar panels.

Despite having a population of approximately 30,000 residents, Morgantown benefits from a Personal Rapid Transit (PRT) system that runs through the West Virginia University campus and around the city. Officials see a bright future for the PRT, which with additional investment, could reduce single occupancy vehicle trips and provide a clean and safe way to get around town.

In the next ten years, a privately-owned coal-turned-natural gas burning power plant that provides steam heat to the majority of WVU buildings will be decommissioned. With capital investment and creative partnerships, there exists a significant opportunity to convert this eyesore in the heart of Morgantown into a beautiful renewable energy facility.

For reference, see:

"West Virginia University Personal Rapid Transit," West Virginia University, last updated August 18, 2020, <https://prt.wvu.edu/>.

LOUISVILLE, KY

Its location within the Commonwealth of Kentucky where the energy market is vertically integrated and where there are not many options for programs and policies that do not require participation by a local utility can be an obstacle for Louisville to achieve some of its climate and renewable energy goals. This has forced the City of Louisville to develop creative policies and programs, including the Energy Project Assessment District (EPAD) program, which provides funding to commercial and industrial facilities to complete renewable energy projects without tying up their credit by attaching the loan to the property rather than the owner. Recently, the City's Department of Advanced Planning and Sustainability joined the Rocky Mountain Institute's Residential Solar Cohort to explore the best ways to navigate the complex regulatory landscape and support small-scale community solar projects.

For reference, see:

"EPAD Program," City of Louisville, <https://louisvilleky.gov/government/sustainability/epad-program>.

CINCINNATI, OH

As one of 22 cities nationwide developing 2030 Districts, Cincinnati is taking an innovative approach to intentionally transforming built environments to better mitigate and adapt to climate change. In Cincinnati, thus far, 25 property owners, developers, and commercial tenants have signed onto the 2030 District initiative, committing roughly 20 million square feet to the goal. This initiative takes the form of a membership organization, facilitated by the region's leading sustainability alliance, the Green Umbrella, collaborating towards a goal of reducing energy use, water consumption, and transportation emissions within the district by 50% within the next ten years.

For reference, see:

Stankorb, Sarah, "How Cincinnati Is Punching Above Its Weight in the Climate Fight," *Natural Resources Defense Council*, October 24, 2019, <https://www.nrdc.org/stories/how-cincinnati-punching-above-its-weight-climate-fight>.

COLUMBUS, OH

The City of Columbus is pursuing the largest in-state community choice aggregation program in the nation, with a goal to implement a program providing 100% clean, renewable energy by 2022. By bringing residents together, the City can provide an opt-out program with competitive rates that won't raise bills, and demand the utilization of Ohio-based wind & solar to power homes and small businesses. The program will support an additional 700 MW of Ohio wind & solar, estimated by the City's preferred energy supplier to support over 4,000 Ohio jobs in areas such as manufacturing, construction, operations & maintenance. By supporting a large and rapid transition to clean energy, the program's displacement of fossil fuels could result in \$210 million dollars of avoided healthcare costs in Ohio over 20 years. The inclusion of community grant funding built into the program rate ensures energy bills are working on behalf of residents, allowing for reinvestment in the local community around sustainability and the City's climate goals.

For reference, see:

"Mayor Ginther, City and Partners Kick-off Community Choice Aggregation," Press Release, City of Columbus, August 26, 2020, <https://www.columbus.gov/Templates/Detail.aspx?id=2147516598>.

DAYTON, OH

As discussed in the City of Dayton's Sustainability Plan, two recently closed municipal golf courses present both a challenge and a remarkable opportunity to advance an impactful renewable energy project. The proximity of these golf courses to water plants that consume a large amount of energy creates an opening for the installation of solar panels to power this City facility. The City of Dayton is seeking capital to proceed with this solar installation, representing its ongoing transition to a 21st century city.

For reference, see:

"Strategy for a Sustainable Dayton," *City of Dayton*, August 26, 2020, <https://www.daytonohio.gov/DocumentCenter/View/9796/August-2020-Dayton-Sustainability-Strategy-Plan>.

These projects represent just a few examples of the important work that needs investment all across the Ohio River Valley. At the same time, targeting investment and collaborating across sectors and industries would help enable these projects to scale across the region. In fact, some of the more ambitious projects to develop essential infrastructure are far more feasible when cities and communities work together. For instance, broadband expansion is a critical equity issue in urban and rural areas across the Ohio River Valley. Access to broadband networks can also hasten the development of digitalization which, as noted above, has intrinsic linkages to electrification and clean energy production. In other words, we can find ways to draw connections between developing clean energy infrastructure and revitalizing other essential infrastructure—such as communications and transportation—across our region. By working together across sectors, we can tackle larger projects and expand the impact of those projects we do invest in.

5. Community Engagement Frameworks

While we have much to gain from investing in more sustainable regional development, it is important to make sure we are transparent about the potential impacts of this shift. Embedding community engagement frameworks, oversight, and accountability is critical to building both public and private trust in the effort. In this section, we revisit some of the anticipated community impacts given the decline of fossil fuels, discuss opportunities to direct the narrative, highlight policies that can mitigate negative impacts, and talk about the potential role of specific community stakeholder groups in ensuring an equitable process.

5.1 Potential Community Impacts

The decline of Appalachia's fossil fuel-based industries industry will be occurring in conjunction with the rapid expansion of its clean energy economy. The region should also concurrently mount parallel investment programs in the areas of manufacturing, public infrastructure, land restoration and agriculture. This combination of investment programs should provide a strong supportive foundation for advancing effective community transition policies.

Within this broader clean energy investment program, policies can be designed so that regions and communities that are heavily dependent on fossil fuel industries will receive disproportionate support to advance regionally appropriate clean energy projects. Previous federal programs can serve as useful models on how to leverage this wave of clean energy investments to also support fossil-fuel dependent communities facing transition. There are both positive and negative lessons on which to build.

RECLAMATION

Reclamation of abandoned coal mines as well as oil and gas production sites is one major category of community reinvestment that should be pursued as the fossil fuel industry contracts. Moreover, the federal government already has extensive experience financing and managing reclamation projects, beginning with the passage of the Abandoned Mine Land (AML) program in 1977, as one part of the broader Surface Mine Control and Reclamation Act. That program has been funded through fees charged to U.S. mining companies, with the fees having been set as a percentage of market prices for coal. In the early years of the program, the fees amounted to about 1.6 percent of the average price of a ton of surface coal and 0.7 percent of underground coal. However, the fee rates have declined sharply over time, to less than half their initial value as of 2013. Since its inception, the program has generated around \$9 billion in total fees.

There are no comparable federal reclamation projects for abandoned oil and gas extraction production sites. However, in June 2020, the U.S. Congress began considering legislation to plug so-called orphaned oil and gas wells. Orphaned wells are abandoned oil and gas wells for which no viable responsible party can be located. Idle oil and gas wells emit pollutants into the air, including hydrogen sulfide and organic compounds that contribute to ground-level ozone.

At the same time, while recognizing the imperative of reclamation projects, it is also important to not overstate their potential as an engine of long-run community development. For one thing, beyond the clean-up work itself, even when such projects are substantial, one cannot expect that a broader set of community-based development projects will inevitably emerge as spillover effects tied to the reclamation projects. In addition, reclamation projects are generally highly capital intensive. As such, on their own, they are not likely to produce large numbers of new job opportunities for workers laid off through declining fossil fuel production. It is therefore critical to also examine experiences and prospects for repurposing beyond reclamation in the current fossil fuel-dependent communities.

REPURPOSING

One important example of a federal government-directed repurposing project was the Worker and Community Transition program that operated through the Department of Energy from 1994–2004. Its mission was “to minimize the impacts on workers and communities caused by changing Department of Energy missions.” This program, along with related initiatives, was targeted at 13 communities which had been heavily dependent on federal government-operated nuclear power and weapons facilities but subsequently faced retrenchment due to nuclear decommissioning.

The conditions faced by the nuclear power-dependent communities and the aims of the repurposing program for them have useful parallels with the challenges that will be faced by many fossil fuel dependent communities. To begin with, for security reasons, the nuclear facilities were located in rural areas. Most fossil fuel extraction sites are also in rural areas, as determined by the location of the fossil fuel deposits. As a result, in most cases, with both the nuclear weapons facilities and the fossil fuel production sites, the surrounding communities and economies became heavily dependent on these single activities. Finally, both with the nuclear and fossil fuel-dependent communities, the opportunities are limited to directly repurpose much of the physical infrastructure in place, since that infrastructure was built to meet the specific needs of each of the industries.

The experience in Piketon, Ohio provides a good case study of how this program has operated in one community. Piketon had been the home of a plant producing weapons-grade uranium that closed in 2001. The workers in the plant were represented by the Oil Chemical and Atomic Workers union (OCAW—which merged in 1999 with the United Steel Workers). The union leadership was active in planning the plant’s repurposing project. The closure could have been economically devastating for the region, but the federal government provided funding to clean up the 3,000-acre complex. The clean-up operation began in 2002 and is scheduled to take 40 years to complete. Currently, 1,900 workers are employed decontaminating the site at

a cost of \$300–\$400 million a year. The contractor hired to clean up the site employs union workers and the president of the USW local union is enthusiastic about the long-term prospects for the project and the site.⁵⁷

Despite the positive achievements with projects such as Piketon, a 2000 study by Lynch and Kirshenbergh noted that “The most serious problem facing the energy-impacted communities...was the lack of a basic regional economic development and industrial diversification capacity for most of the regions affected by the cutbacks...”⁵⁸ To address this problem directly, community assistance initiatives could encourage the formation of new clean energy businesses in the affected areas. One example of a successful diversification program was the repurposing of a nuclear test site in Nevada to what is now a solar proving ground. More than 25 miles of the former nuclear site are now used to demonstrate concentrated solar power technologies and help bring them to commercialization.

There are also important cases of successful repurposing projects in other countries. Most prominent has been the experience in Germany’s Ruhr Valley, which has been the traditional home for its coal, steel and chemical industries. Since the 1990s, the region has advanced industrial policies to develop new clean energy industries. As one important example of this repurposing project in the Ruhr region, RAG AG, a German coal-mining firm, is in the process of converting its Prosper-Haniel coal mine into a 200-megawatt pumped-storage hydroelectric reservoir that acts like a giant battery. The capacity is enough to power more than 400,000 homes in North-Rhine Westphalia. In addition to hydroelectric power storage, the company is also erecting wind turbines on the top of tall waste heaps and installing solar panels on the slopes. Other firms in the region have branched into producing wind and water turbines. This regional transition project has succeeded through mobilizing the support of the large coal, steel and chemical companies and their suppliers, along with universities, trade unions and government support at all levels.

It is not realistic to expect that transitional programs will, in all cases, lead to developing new economic bases that support a region's previous level of population and community income. In some cases, the role of community assistance will be to enable communities, moving forward, to shrink to a size that a new economic base can support. As we have seen in some cases with repurposing nuclear waste sites and in the experiences in Germany's Ruhr Valley, one central challenge for the Ohio River Valley and Upper Appalachian region will be to effectively integrate transition programs with the coming wave of public and private investments in energy efficiency, clean renewable energy, manufacturing development, public infrastructure, land restoration and agriculture, and the roughly 400,000 jobs per year that will be generated by these investments.

5.2 Mitigating Negative Impacts: Some Policy Examples

Decarbonization policies vary according to the geographical area and social group they target, but we can draw on examples from other settings to develop policies that would suit our regional and national context.

For instance, the European Union has set itself the goal of becoming carbon neutral by 2050.⁵⁹ Achieving this goal will require the introduction of ambitious and stringent climate policies. The costs associated with these policies will need to be minimized and distributed across different sectors to ensure that low-income population and vulnerable communities do not carry an unequitable share of the financial burden. As shown in a recent study⁶⁰ conducted by Eurelectric and Enel Foundation, in collaboration with Guidehouse and Cambridge Econometrics (2020), suitable counter measures should be put in place to avoid the increase of inequality and to ensure a broader support for the energy transition.

The study suggested a menu of mitigation policies which can be introduced to counteract the regressive effects of climate policies:

1. The recycling of the revenues raised from revenue-generating decarbonization policies, such as carbon pricing, can be used to offset reductions in taxes such as value added tax (VAT) or electricity taxes; alternatively, the revenues can be used for lump-sum direct rebates.
2. Energy efficiency measures targeted to low-income groups (e.g. through programs including upfront subsidies to help overcome the initial investments which are often barriers for the most vulnerable households) can reduce inequality, ensuring future energy savings.
3. Other important preventive options aiming to avoid people falling into poverty are the programs to reskill and upskill workers, in particular job retraining programs focused on industrial sectors most affected by decarbonization.
4. Low-carbon innovative technologies can benefit from subsidies funded via general taxation (e.g. increasing income tax rates for high incomes) or using carbon revenues; on the contrary, if subsidies are funded by a surcharge on electricity users, the policy would not be progressive.

Such policies are not mutually exclusive, and the menu should be adapted to the ingredients that are available in different contexts. In any case, the study clearly shows that if policy makers pay attention to how they design the mechanisms, a response can be located. It is also worth noting that many policy options identified by the study do not face significant legislative barriers in their implementation, as they are administratively straightforward to implement, and the infrastructure and institutional capacity required are often already in place.

5.3 Organized Labor & Labor Protections

Labor unions have long fought for more than workplace rights and collective benefits for their members. Through their pooled assets, trade unions and civil society have worked together to build housing, finance banks, credit unions and insurance companies, and capitalize companies. They were among the pioneers of long-term investment in the real economy and in ensuring greater responsible corporate governance. Advancing untold financial design innovations, labor's financial institutions successfully deploy capital to revitalize cities and industries, and, acting as responsible shareholders, lead the charge toward good corporate governance in the United States.

While American know-how pioneered the early development of modern solar energy, American workers' pension funds, along with research dollars from U.S. taxpayers, have, for decades, helped finance innumerable sustainable technologies. In so doing, workers' capital—the pension assets and savings of teachers, steelworkers, firefighters, pilots, engineers - everyday working people—has seeded and grown innumerable innovative industries that have far-reaching, earth-changing impacts.

But labor's role in the energy transition is not only a financial one; for projects initiated under the MP4MA umbrella to realize equitable and sustainable impacts, they need to include essential labor protections, ensuring dignified work and pathways to economic mobility and wealth creation for all individuals, recognizing that historic inequities may necessitate specialized programs that target the advancement of women, people of color, members of indigenous groups, and other individuals.

As a starting point, projects under the MP4MA must make it a priority to engage labor unions and embed workplace practices that protect workers' rights, engage and empower workers, and facilitate productivity and better bottom line results. In terms of labor union recognition,

the Trade Union Advisory Committee (TUAC) to the OECD spells out the following fundamental commitments:

- Recognizing workers' right to information, consultation, representation and negotiation based on the OECD Guidelines for MNEs and the UN Guiding Principles on Business and Human Rights;
- Protecting workers' creditor claims⁶¹; and,
- Promoting sustainability and tax reporting.

“...ensuring dignified work and pathways to economic mobility and wealth creation for all individuals, recognizing that historic inequities may necessitate specialized programs that target the advancement of women, people of color, members of indigenous groups, and other individuals.”

From the perspective of equitable workplace practices, Croft and Malhotra (2016) recommend the following:

- **Responsible Employment Relations:** Employers should adopt provisions such as responsible contractor policies, card check neutrality, best value contracting, prevailing wages and other practices, and should provide a safe harbor for good labor-relations for their worker stakeholders. This outcome gives workers a voice on the job, leads to

better labor-management co-operation, and allows for improved wages, benefits, education and working conditions (often a proxy for improved productivity).

- **Workforce Participation and Ownership:** Employers should support “high road,” high performance business practices, which include positive labor-management relationships and other workforce participation approaches. Some corporations have achieved this by adding employee representatives to their board of directors. Employers can also share profits with their workers by utilizing mainstream employee ownership programs, such as ESOPs and worker co-operatives, and profit sharing. Good governance approaches engage workers and labor representatives from the shop floor to the boardroom. So-called “participatory firms” have long exhibited improved productivity and higher performance.
- **Workforce Training and Knowledge Sharing:** Employers should think of their employees as “knowledge workers,” not as production costs. Well-governed firms provide extensive training on team approaches, operations and overall corporate affairs. Smart companies share more financial information with and provide financial literacy training for their workers. These boost workers’ understanding of businesses and the economy, improve labor-management co-operation, and increase job security.
- **Empowerment and Diversity Strategies:** Employers should provide greater employment opportunities to women and minority populations. This approach benefits organizational decision-making by including diverse points of view, fosters goodwill in the community by signaling that companies are partners with their community neighbors, and creates new economic ladders that reinforce workforce diversity. Many unions are working with the community to build pre-apprenticeship pipelines for young people of color.

- **Project Labor Agreements:** Defined by the Laborers Union⁶² as, “Family-supporting Project Labor Agreements, otherwise known as Community Workforce Agreements or PLAs, are a tried and true way of building the basics of America from the Hoover Dam to the Washington Nationals baseball stadium. These agreements benefit working men and women, contractors, communities and taxpayers by ensuring projects are completed on time and on budget, requiring employee training, and encouraging that public investment benefits local communities.” Some cities have linked PLAs to minority and women worker apprenticeship pipelines, to ensure diversity and local hiring on the job-site.”

5.4 Models for Community Engagement, Monitoring, and Oversight

One of the highest priorities for the next stage of the MP4MA development process is to create a sustainable model for community engagement, monitoring, and oversight that facilitates communication and collaboration across stakeholder groups while being intentional about ensuring that underrepresented and marginal groups are explicitly brought into the decision-making process. What exactly this framework will look like is still in development and we welcome suggestions from the community. Some examples proposed to date include deliberative forums, appointed task forces, and tools like America Speaks and the Power of 32 convening. Models that speak to training and capacity building include existing organizations like the 100 Resilient Cities initiative or the U.S. Department of Transportation’s Smart Cities Challenge. Of those with a more geographical focus, the Ten Across model has been suggested as a way to bring in communities all across the Ohio River watershed.

6. Next Steps for the MP4MA Roadmap

This MP4MA Roadmap is a starting point for discussion and ingenuity in regional development. It represents an opportunity to reimagine and reshape our existing economy so that we become the drivers of a global energy future that is built on renewables and circularity, rather than on fossil fuels. We propose to galvanize \$1.24 trillion in public and private investments over the next 30 years to make our energy usage more efficient and cleaner, reducing emissions and staving off catastrophic climate change while creating 410,000 new jobs per year and targeting impacts and policies to redress historic environmental and social injustices that persist in our communities. While none of our cities or towns or states can realize this effort alone, we can if we work together across the region. Using this Roadmap as a starting point for discussion, we see a number of “next steps” on the horizon.

“We have a unique opportunity to change the entire trajectory of the Ohio River Valley during a period where the timing could not be more critical.”

First, as noted in **Section 5.4**, establishing a model for community engagement across stakeholder groups throughout the region is paramount. In addition to creating the infrastructure to collaborate with companies, researchers, investors, governments, and community organizations, we also need to create a plan for repeated, systematic engagement with regional residents regarding the content of the Roadmap and its implementation.

This includes:

- Vetting the ideas in the Roadmap with residents and community organizations active in the affected region;
- Building grassroots support for investment in green infrastructure development;
- Creating sustainable pathways for residents to voice concerns about new investments in their communities;
- Incorporating community feedback into revised versions of the MP4MA Roadmap and/or associated policy documents or policy recommendations;
- Building mutual understanding of economic opportunities and trade-offs associated with transitioning to a renewable energy forward regional economy; and,
- Implementing accountability mechanisms that require investors, companies, and non-elected officials to engage with, respond to, and integrate solutions that address concerns identified by local residents.

Second, we need policies that will support this work, whether that is from a financial perspective or by breaking down regulatory barriers to the expansion of renewable energy technologies. Policymakers and related stakeholder groups must lead the way to identify and support local, state, and federal policy efforts that could help with implementing the MP4MA vision. Coalitions may form to draft legislation and regulations to support regional investment.

Third, as shown in **Section 4.3**, our communities already have lists of projects they would like to finance to increase energy efficiency and the availability of renewables. We hope to work with responsible investor networks to schedule “investor roundtables” that bring together capital owners with those who have sustainable projects scoped out and waiting for financing. Key stakeholders will work to facilitate “matchmaking” between companies, communities, investors, and government (elected officials and bureaucrats) that leads to large-scale infrastructural development, new manufacturing facilities, or related projects.

Fourth, we want to expand the organizations and companies that belong to the MP4MA Task Force. We need support from companies to enable this transition, but we also need more research and development, including partnerships that bridge public and private sectors. Along these lines, we want to involve the higher educational institutions and research think tanks all across our region. Academic partners will be essential for conducting research in each of the areas above to further our understanding of the impact of investing in a more sustainable regional economy.

With respect to all of the above, we invite feedback from everyone—individuals, companies, organizations, institutions, elected officials, potential collaborators, and more. We have a unique opportunity to change the entire trajectory of the Ohio River Valley during a period where the timing could not be more critical. Let us use these investments to create the energy economy of the future, expand dignified employment opportunities, clean up decades of damage, correct environmental injustices that fall disproportionately along racial and socioeconomic class lines, and build toward a new future where Middle American communities are leading by example in the area of equitable and sustainable economic development.

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University of
Pittsburgh

Center for Sustainable Business
Joseph M. Katz Graduate School of Business
and College of Business Administration