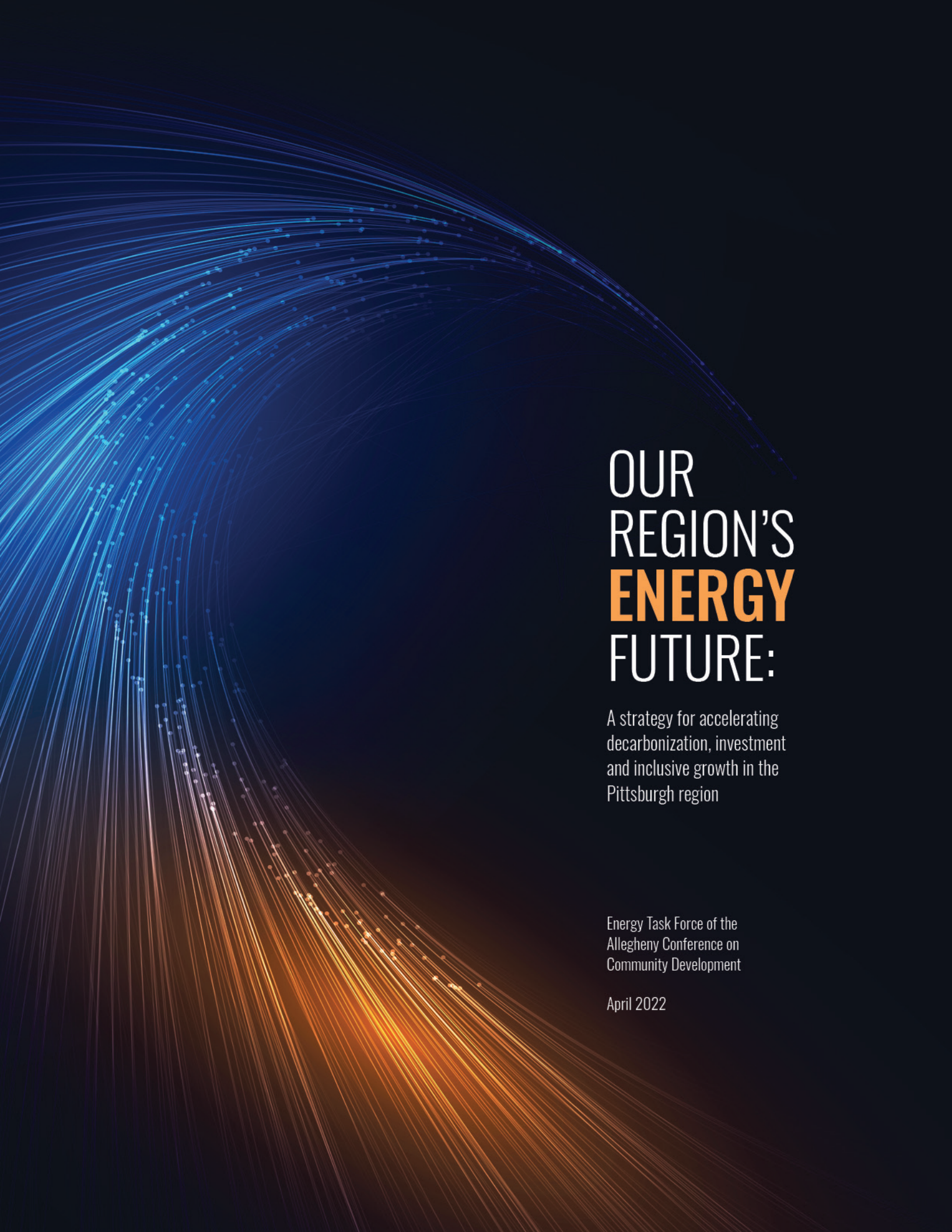

OUR REGION'S **ENERGY** FUTURE:

A strategy for accelerating decarbonization, investment and inclusive growth in the Pittsburgh region

Energy Task Force of the
Allegheny Conference on
Community Development

April 2022

Contents

Introduction

The global energy industry – pioneered in no small way in the Pittsburgh region – is changing rapidly as the world pursues a low-carbon future. The challenge: to improve prosperity for all, maximize the Pittsburgh region's strengths and meet the growing demand for energy and clean products while at the same time reducing greenhouse gas (GHG) emissions. The Pittsburgh region is rich in natural resources, including natural gas production, and has strengths in commercial nuclear energy innovation and distribution of electricity. We are an innovator in conservation and sustainability through green building and smart technologies. As such, we are not only well-positioned to compete but to lead the Energy Transition that is already underway.

To better understand the challenge and the opportunity, in 2021 the Allegheny Conference on Community Development convened an energy working group led by Greater Pittsburgh Chamber of Commerce Chair Bryan Salesky. The working group led to the creation of the Energy Task Force with a focus on developing a regional strategy to accelerate decarbonization and at the same time drive investment, employment and inclusive growth. The Task Force set out to define the baseline, the pre-pandemic state of the region's energy and energy-intensive sectors and determine where southwestern Pennsylvania has a competitive advantage and is positioned to achieve transformational impact.

We discovered that if we do nothing, we are likely to fall far short of what is required to avoid dangerous climate changes while making our region increasingly less attractive for global investment. Fortunately, we have identified six "levers" and a like number of "enablers" at our disposal that make it possible to attract investment, grow employment and improve our environment in the years to come. Now is the time to align a regional vision, define the action plan and work together to realize our full potential.

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Co-Chair, Allegheny Conference Energy Task Force
Chairman, President and Chief Executive Officer
The PNC Financial Services Group, Inc.

Hilary Mercer

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Allegheny Conference Energy Task Force

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SECTION
01

Establishing the Baseline

The Pittsburgh region closed out the second decade of the 21st century with a diverse economic foundation across traditional and emerging industries, all of them technology-intensive, with innovation driven by entrepreneurs and academic and corporate research and development. We set out to make sure our strategy is anchored by our region's unique assets and specific opportunities. To better understand these, we began by assessing the baseline in terms of economics, emissions and strengths:

- the employment base and economic impact of the energy sector on the region;
- the current GHG emissions and potential decarbonization pathways and initiatives; and
- potential areas of strength in expanding sustainability and decarbonization markets that could drive regional employment and economic expansion.

Where We Are Today – Greenhouse Gas Emissions and Employment

Energy and Energy-Intensive Sectors are significant contributors to the diverse economy of the Pittsburgh region. In 2019, the Energy Sector[1] and Energy-Intensive Sectors[2] represented 24% of gross regional product (GRP) and 14% of regional employment.[3]

These industries are more concentrated here than in competing regions. For much of our history, the region has been a net exporter of energy. Even today, we export about 40% of the power produced here. We generate baseload electricity that others consume.

[1] The Energy Sector includes coal extraction and distribution; oil and gas extraction and distribution; and power generation and transmission.
[2] Energy-Intensive Sectors include mining (except coal); manufacturing; transportation; construction materials such as concrete and asphalt; data storage; and crop and animal production.
[3] Source: Moody's Analytics, Bureau of Labor Statistics 2019; PA Department of Labor and Industry Center For Workforce Information and Analysis 2019.

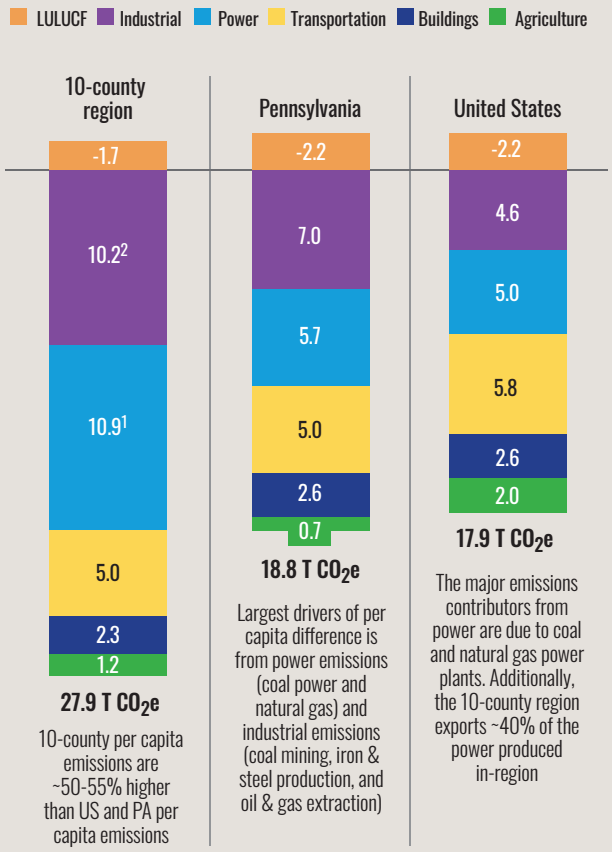
Where We Are Today – Greenhouse Gas Emissions and Employment (continued)

All of this contributes significantly to GHG emissions. On a per capita basis, emissions are approximately 50-55% higher in southwestern Pennsylvania than in the state or the nation as a whole.[4] The largest drivers of the per capita difference are **power emissions** (coal and natural gas) **and industrial emissions** (coal mining, iron and steel production and oil and gas extraction). Like other energy-producing and industrial regions, our GHG footprint trends higher than most others but is comparable to our similarly situated neighboring states including West Virginia, Ohio, Indiana and Kentucky.

CHART 1

The 10-county region emits ~10 T CO_2e annually per capita more than Pennsylvania or the United States

Per capita emissions (2019), T CO_2e



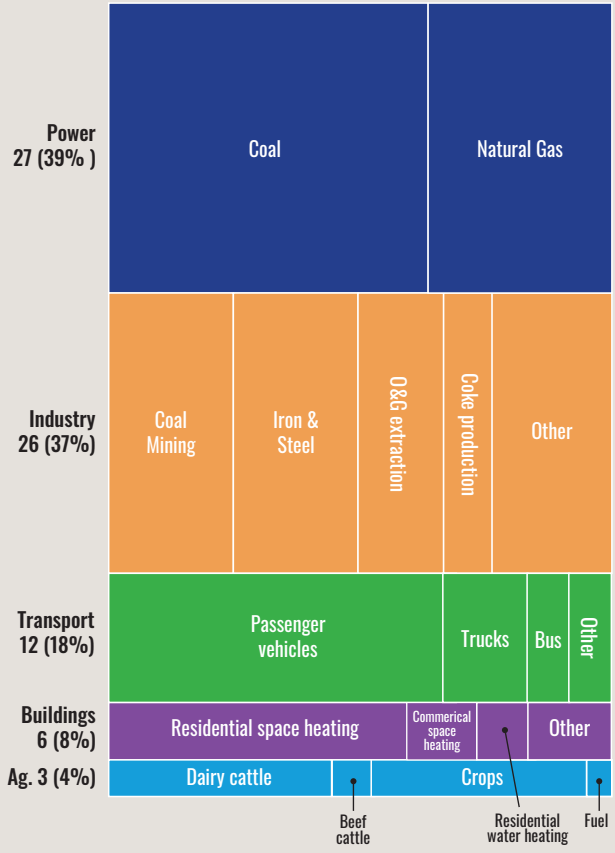
1. Concentration of coal power production and net power export results in higher than average per capita power emissions
2. Industrial exports (e.g., natural gas, coal and steel) contribute to the GHG concentration for industrial emission / capita

Source: Decarbonization Scenario Explorer Tool, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, IPCC

CHART 2

10-county region's sources of emissions

Emissions, MT CO_2e



The region's 2019[5] GHG footprint was 70 MT CO_2e.[6,7] The industrial and power sectors make up 76% of emissions. The top five sources of total emissions were: coal power (25%); natural gas power (14%); passenger vehicles (11%); coal mining (9%); and iron and steel manufacturing (9%).

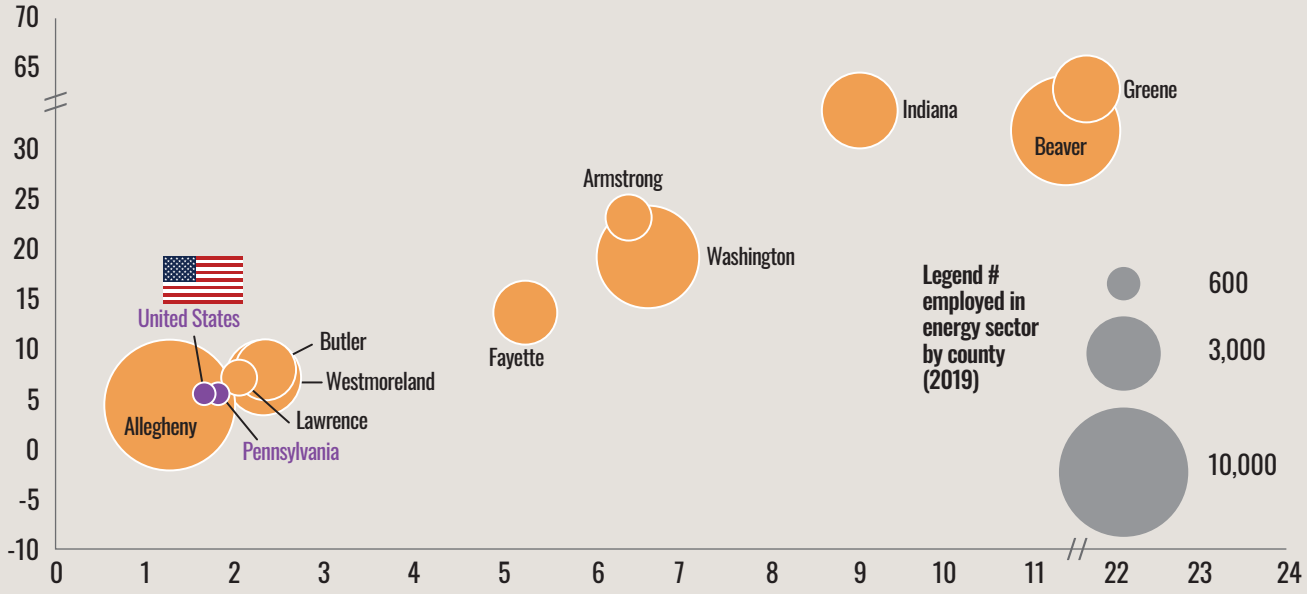
[4] Source: Decarbonization Scenario Explorer Tool, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, IPCC.
[5] 2019 is used as the baseline year as it is the most recent year of available data and was not skewed by effects of the COVID-19 pandemic.
[6] MT CO_2e – Million tons of CO_2 equivalent.
[7] Source: Decarbonization Scenario Explorer Tool, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, IPCC.

Where We Are Today – Greenhouse Gas Emissions and Employment (continued)

The energy, industrial and transportation activity that produces much of our region's GHG emissions also provides employment and economic opportunity, especially outside Allegheny County. Beaver, Greene and Indiana counties rely the most on the energy sector for jobs and GRP. Beaver County hosts a nuclear power plant. Greene County remains an important source of coal. Indiana County has three coal fired power plants and one plant that turns waste coal into electricity. Additionally, Washington County has the second highest oil and gas extraction revenues in Pennsylvania, accounting for 13% of total oil and gas production value in Pennsylvania.[8]

CHART 3

2019 Energy Sector GDP (% of county GDP)[1]



1. Energy Sector: Coal (extraction + distribution), Oil & Gas (extraction + distribution), Utility (power generation and transmission) industrial emission / capita

Source: Moody's Analytics, Bureau of Labor Statistics 2019; PA Department of Labor and Industry Center For Workforce Information and Analysis 2019

As we think about the Energy Transition, we must address the impacts of the economic and workforce transition at the same time. **It is critical that no one and no community be left behind. Success will require public policy interventions, significant investment in upskilling and improved connectivity to make sure workers and communities can access new opportunities being created.**

[8] Source: Moody's Analytics, Bureau of Labor Statistics 2019; PA Department of Labor and Industry Center For Workforce Information and Analysis 2019.

Where We Are Today – Greenhouse Gas Emissions and Employment (continued)

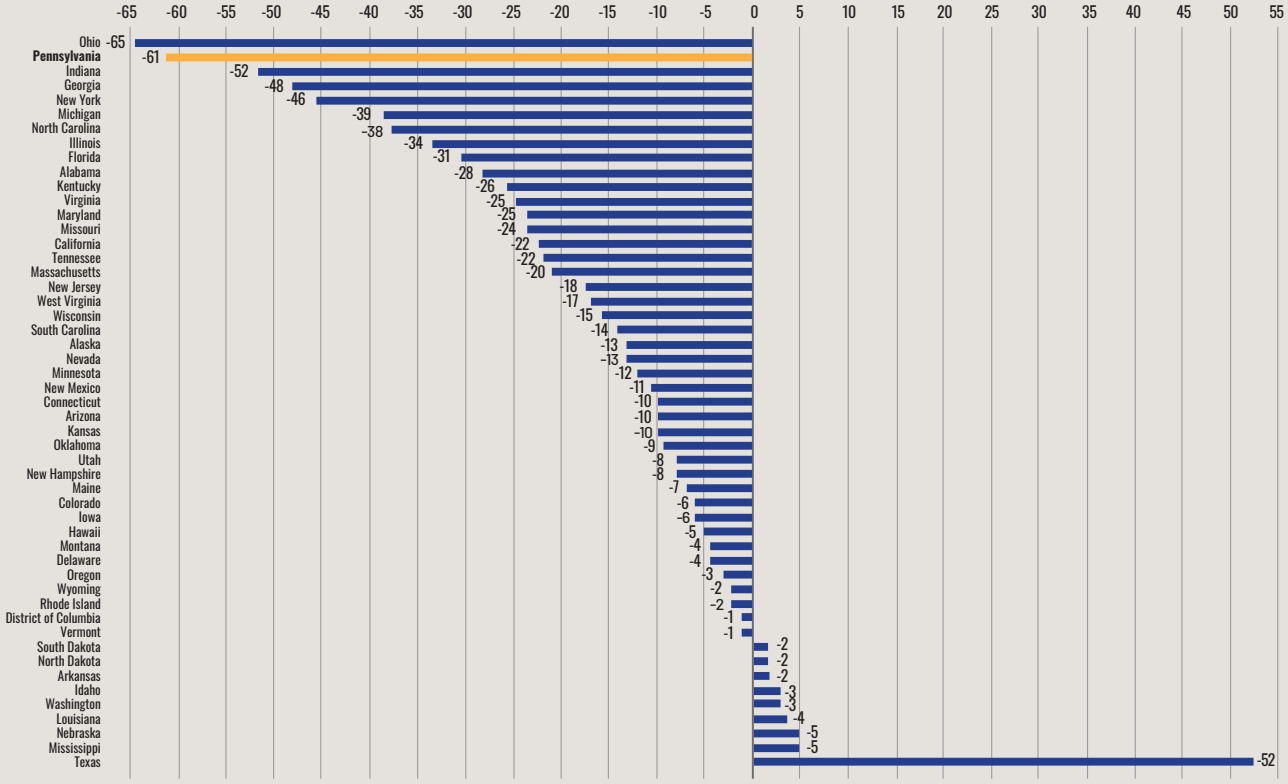
While the task is daunting, we should also recognize that ***progress is possible and is happening every day.***

From 2005 to 2016, Pennsylvania ranked second out of all fifty states in reduction of greenhouse gases, largely due to the shift from coal to natural gas-fired power production. In 2018, CO_2 emissions from fossil-fuel fired power sources were 33% below 2005 levels, and CO_2 emissions reductions from Pennsylvania power and industrial sources already have exceeded the Governor's goal of a 26% reduction from the 2005 baseline by 2025.[9] Still, we have much more work to do.

CHART 4

Emissions reduction by state

Absolute emissions reductions from 2005 to 2016 (Million metric tons of CO_2)



1 EIA report: Energy-Related Carbon Dioxide Emissions by State, 2005 – 2016

9 EPA Clean Air Markets Division data for 2018 and 2025.

SECTION 02

Where We Are Headed

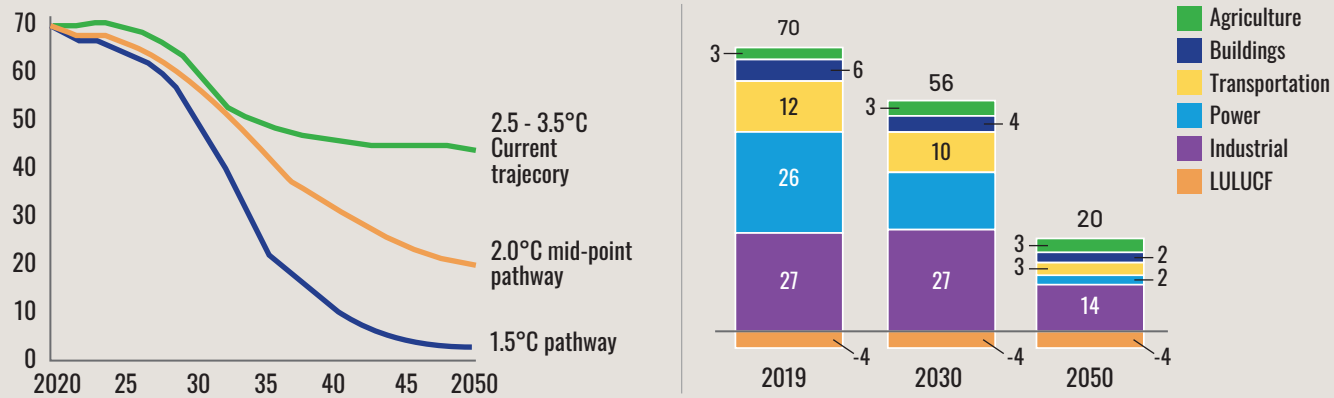
Decarbonization is one action we can take to maintain the economic competitiveness of the Pittsburgh region, improve our attractiveness to industries seeking solutions and meet the climate challenges posed by GHG emissions. **If the Pittsburgh region does nothing, we are likely to match the current U.S. trajectory, which will fall short of what has been estimated to be required in this country to avoid potentially dangerous global climate changes, making our region less and less attractive for global investment. Conversely, if we act now, we become more competitive for capital investment and job creation.**

We modeled decarbonization to identify three pathways forward:[10]

1. Current U.S. trajectory that points to a 2.5-3.5°C global warming by 2050;
2. A mid-point GHG emissions pathway that points to a 2°C warming; and
3. An intensive pathway as laid out in COP26 and other venues that points to a 1.5°C warming.

CHART 5

10-county regional emissions, MT CO_2e



As the graphic above shows, for the region to achieve the mid-point pathway by 2050, it requires reducing the 2019 GHG footprint from 70 MT CO_2e to 20 MT CO_2e, a 70% reduction in CO_2e emissions. Because they each contribute so much CO_2 to the total load, two critical areas of intervention to achieve this reduction will be decarbonizing industrial production (27 MT CO_2e) and decarbonizing power (26 MT CO_2e). Of the various decarbonization levers, as set forth later, that will be critical to achieving this mid-point pathway, industry emissions will be hardest to abate: many industrial processes require enormous amounts of heat (e.g., the steel production process). With that production of heat comes CO_2 emissions. The model projects that in 2050 industrial emissions (14 MT) will still be more than half the 2019 amount (27 MT). The reductions can be more dramatic in all other sectors because there are potentially more readily available alternatives to current practices (e.g., replacing gasoline-powered automobiles with electric vehicles (EVs)).

[10] Source: Decarbonization Scenario Explorer Tool, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, IPCC.

SECTION 03

A Strategic Vision to Meet the Challenge

The Task Force agreed that pursuit of the "mid-point pathway" makes the most sense for the Pittsburgh region within the projected timeframe, balancing carbon reductions and economic growth. The members agreed that the ultimate goal of the strategy should be decarbonization, but the deployment of the strategy should bring strong economic benefits to the region, making it more attractive for business investment and job creation across a variety of industries. The "intensive pathway" can and should remain an aspirational goal as advances in technology make it more feasible over time.

Three primary criteria informed development of the strategic vision:

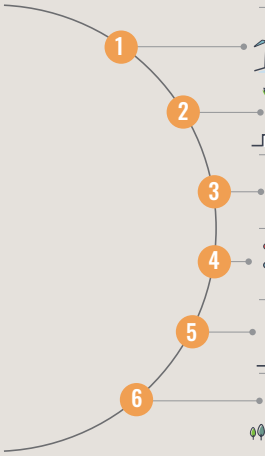
- **Equity:** Potential to stimulate sustainable, equitable economic and employment growth
- **GHG emissions reductions:** Potential to abate emissions from high-emitting sectors
- **Viability:** Potential to be financially attractive, physically feasible, deliver positive returns and public support.

Six Strategic Levers

To achieve decarbonization, the region will need to engage six strategic "levers" that will each contribute to reducing CO_2 emissions: developing low-carbon energy and grid improvements (Lever 1); deploying carbon capture and storage (Lever 2); preventing methane emissions (Lever 3); electrifying transportation (Lever 4); deploying hydrogen (Lever 5); and increasing building efficiency and electrification (Lever 6).

CHART 6

Delivering the vision requires executing six strategic levers



Lever	Lever description	Primary assumptions	% of total emissions reduction	MT CO_2e abated[1]
Develop low-carbon energy and grid improvements	Produce and maintain low-carbon electricity sources to provide majority of electric demand	Coal retirement by 2035; ~50 sq miles of utility solar; continued operation of Beaver nuclear plant	33%[2]	16.4
Deploy carbon capture and storage	Capture and store CO_2 emissions from hard-to-abate industrial and power emissions	Steel, ethylene, cement and natural gas power capture and store CO_2 starting in 2030	23%	11.5
Prevent methane emissions	Monitor methane leaks in industry and seal retired mines and wells that continue to leak	Capture fugitive emissions from active coal +NG extraction and transport; coal mining activity reduces by ~60%	13%[3]	6.4
Electrify transport	Adoption of electric vehicles for personal, public and heavy-duty transport	800k electric passenger vehicles (44%) in region by 2050; 25% uptake of electric trucks and buses by 2050	10%	5.2
Deploy hydrogen	Develop H_2 supply and utilize H_2 to decarbonize hard-to-abate technologies	Primarily blue H_2 supply deployed in 2030; H_2 used for fuel cell trucks and buses and industrial applications	10%	4.8
Increase building efficiency and electrification	Improve building efficiency and increase use of electric heating (space, cooking, water)	Uptake of electric heat pumps for home and commercial heating and cooling; district heating for certain urban cluster	7%	2.6

1. 2050 emissions vs. 2019 emissions
2. Does not consider emissions reductions from transition of natural gas power to natural gas with CCS power
3. Fugitive emissions from retired coal mines and O&G wells represent 9% of total methane emissions but are not addressed in the modeled pathway

The strategic levers are interdependent, and we will need to 'pull' all of them to meet the pathway we have laid out. But some of the related activities are of particular interest to the Pittsburgh region, which is better positioned than most to meet the challenge of decarbonization and the Energy Transition, and to prosper by doing so. In all cases, success will require strong public/private collaboration and material engagement from a variety of stakeholders.

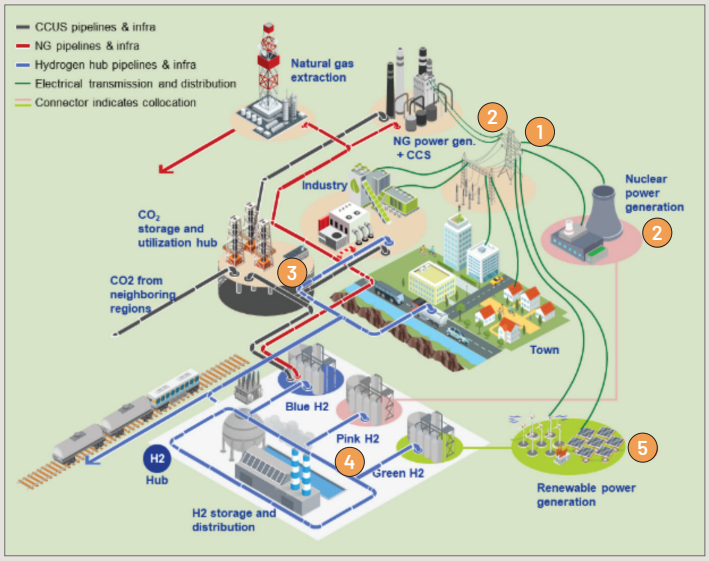
Six Strategic Levers (continued)

Energy Task Force members were surveyed to understand which levers they saw as having the highest priority when considering both the benefits of decarbonization as well as the potential to drive employment and economic benefits for the region. The highest priorities were (a) deploying hydrogen (b) decarbonization of industry and power through carbon capture and storage and (c) deployment of low-carbon power generation sources, specifically nuclear. These are markets where our region has competitive advantage and can "win" the market (see appendix for full Task Force survey results).[11]

CHART 7

The strategic levers are interdependent on each other to achieve full GHG and economic outcomes of the regional decarbonization pathway

The energy transition in 2050: a potential vision



Key interdependencies

1. **Grid upgrades** enable electrification and EV deployment and renewable power supply
2. **Natural gas and nuclear power** supply baseload electricity for industrial, commercial and residential applications
3. **CCUS hub** captures carbon from industrial, blue H2, and fossil fuel power sources, initially for storage, but will attract new manufacturing facilities & provide hub for utilization innovation
4. **Hydrogen hub** creates H2 and other low-GHG fuels for industrial and transport use (initially blue from NG + CCUS, then shifting over time to green/pink), for local and exported use
5. **Renewable power including sufficient storage capacity** to ensure system reliability, supports electrification demand from industry, building and vehicles

We have long-standing and, in some cases, globally leading expertise in each of these areas. Two may provide unique comparative advantages for the Pittsburgh region that can propel our economy as well as improve our environment.

- Our geology and natural resources provide opportunities to create carbon capture, utilization and storage (CCUS) and hydrogen hubs essential to low-carbon manufacturing and transportation.
- Almost 150 years of innovation in electrical distribution and commercial nuclear energy position the region to provide solutions to improve the resilience of the electric grid and deploy low-carbon power generation sources.

[11] Source: Decarbonization Scenario Explorer Tool, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, IPCC.

SECTION
04

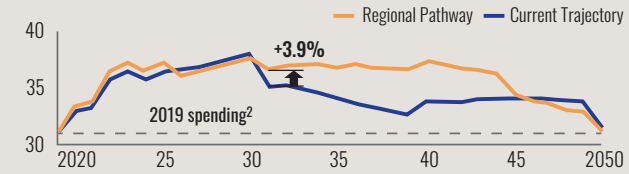
A Positive Impact on Employment and the Economy

Decarbonization can make the Pittsburgh region more attractive to investment by industry. The GRP, value chain and workforce impacts along the mid-point path will have a stronger job and economic impact than the current trajectory. The mid-point pathway will produce 60,000 jobs,[12] and the average wage for new jobs will meet or exceed that of lost jobs. This job growth is driven by the capital investment necessary to realize the transition. As the chart below shows, $40 billion would be invested in the local economy to build out the mid-point pathway infrastructure.

CHART 8

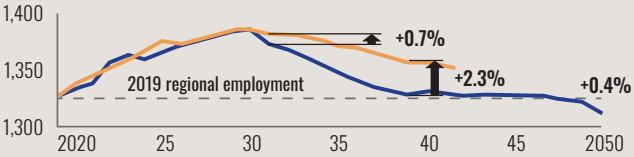
Regional Pathway shows positive jobs and economic impacts relative to current trajectory for modeled sectors

Spending of current trajectory and Regional Pathway scenarios[1], billion USD



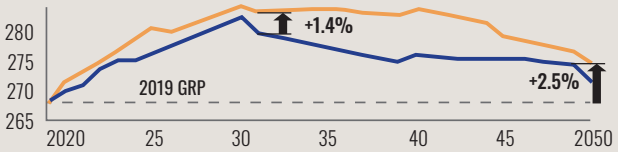
- Regional Pathway has **$40 billion of additional spending** relative to current trajectory
- For both pathways, **spending increases as infrastructure is built out** (solar panels, charging stations, etc.) and then declines as assets enter steady-state operation
- Regional Pathway assumes more infrastructure spending (e.g., CCUS hub) than current trajectory

Employment of current trajectory and Regional Pathway scenarios[1], thousand job years



- After 2030, employment for the regional decarbonization pathway is higher than the current trajectory
- Above current trajectory spending, each **$1 billion creates ~10k job years**

GVA of current trajectory and Regional Pathway scenarios[1], billion USD



- Regional Pathway provides higher GVA than current trajectory at all modeled years
- Above current trajectory spending, each **$1 of spending creates $3.3 of GVA growth**

1. Shows impacts to the modeled sectors: agriculture, buildings, transport, industry, power and LULUCF
2. Only shows spending in modeled sectors

Source: Economic Scenario Explorer Tool

[12] Source: Economic Scenario Explorer Tool.

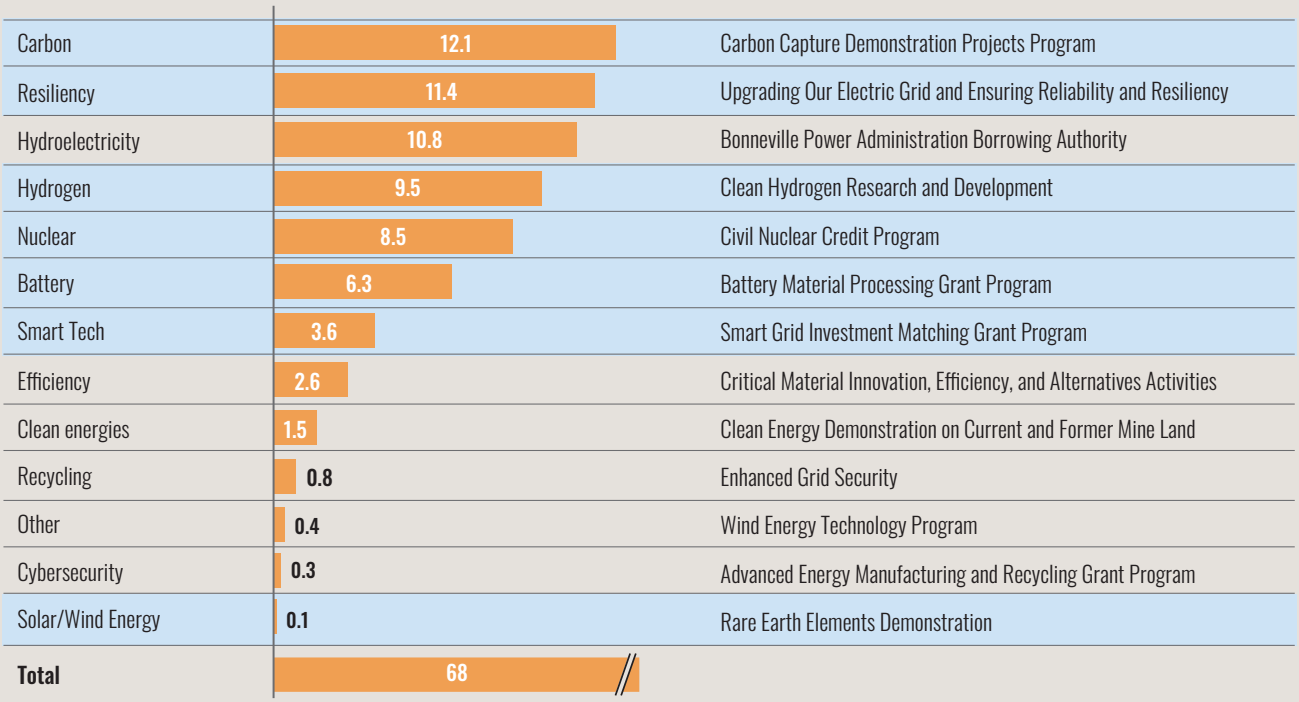
A Positive Impact on Employment and the Economy (continued)

Industrial sector employment will grow as global demand rises for materials and machinery needed to transition to a net zero economy. Installation and maintenance and sales occupations will be in demand. In the power sector, the ongoing reduction in coal power jobs will be partially offset by increased jobs in other types of power production. Job and investment growth projected for 2030 will decline towards 2050 as the investments and transition effects of the decarbonization pathway approach a steady state.

The recently passed Infrastructure Investment and Jobs Act (IIJA) will provide at least some of the funding needed for these investments. The IIJA will make $68 billion[13] available in the years to come from the Department of Energy (see Appendix for more details).[14]

CHART 9

Power funding by theme, $Bn



[13] As much as $7 billion in additional funding may become available as the full IIJA plays out.
[14] Source: US Senate H.R. 3684, Infrastructure Investment and Jobs Act.

SECTION
05

What We Must Do Next

The Task Force identified six primary enablers, individuals, organizations, policies and investments needed to accelerate the region's energy transition: First Movers; Stakeholder Education and Support; Regulation and Policy; Funding; Workforce; and Physical Infrastructure. Some of these enablers will occur with or without action by the Allegheny Conference, while others may require the organization's leadership and involvement.

- First movers are the regional leaders who will drive implementation of decarbonization levers at scale (e.g., CCUS, hydrogen and nuclear power). They will influence regional stakeholders to take critical enabling actions.
- Stakeholder education and support will be needed to gain support for decarbonization levers and the associated infrastructure footprint. Messaging and communications must be developed with stakeholders across diverse interests.
- Competitive statutes, policies and regulations at local, state and federal levels must be implemented to aid safe, equitable and expedited deployment of decarbonization solutions, particularly regarding hydrogen generation and transport and CCUS.
- Government funding will be essential to finance build-out of critical decarbonization infrastructure (e.g., CCUS hub).
- New workforce development initiatives are required to develop talent and transfer regional skills from legacy industries to emerging opportunities.
- Finally, an interdependent network of infrastructure across multiple technologies (e.g., CO_2 pipeline, CCS, EV charging and solar installations) must be built.

The Allegheny Conference has an essential role to play to accelerate the Energy Transition. We must:

- Compile the list of first movers; identify leadership gaps; engage with first movers' near/mid-term investment plans; and convene periodic check-ins with the Energy Task Force and first movers to assess progress.
- Engage in stakeholder identification, education and support to determine the various roles (e.g., assistance, consultation, information) in the development of an education strategy.
- Work with our member companies and regional experts to assist in developing a list of critical regulatory and policy actions.
- Identify funding sources and application deadlines (IIJA, etc.), especially those with limited windows of opportunity for chosen technologies.

What We Must Do Next (continued)

CHART 10

	WHAT IS IT	WHY IT MATTERS	""
 **First movers**	**Identify regional leader(s) to drive implementation of decarbonization levers at scale** (e.g., CCUS, hydrogen, nuclear power) and influence regional stakeholders to take critical enabling actions	An owner wanting to deploy capital to build energy transition assets will spur action among other private, public, social and academic-sector stakeholders	**Without a major corporation leading the effort for carbon sequestration, nothing will ever get done here** – Private sector leader
 **Stakeholder education and support**	Gain support for decarbonization levers and associated infrastructure footprint by **developing messaging and communicating with stakeholders across diverse interests**	Unified voices advocating for within the region can enable structural and policy changes to accelerate transition	**People in the region have to say, "we want this." The vision has not been articulated well. We need to describe an energy ecosystem and how it all fits together** – Social sector leader
 **Regulation and policy**	Design and support **policies and regulations at local, state and federal levels to aid safe, equitable and expedient deployment** of decarbonization solutions	Clear policy & regulation needed to enable permitting, help stakeholders make confident assumptions about risk and return over time and incentivize asset build-out	**The government can play a heavy hand in providing incentives to make green energy projects profitable and more likely to occur, especially in energy as a service model** – Private sector leader
 **Funding**	**Pursue government funding to finance build-out of critical decarbonization infrastructure** e.g., CCUS Hub. Collaborate with adjacent states to create more compelling case for the region	Projects will proceed with positive business cases; IIJA funding provides opportunities to create hubs + improves economics to allow for prioritized capital allocation	**No one wants to commit the capital unless others take the lead. This is where federal funding can be an unlock** – Private sector leader
 **Workforce**	**Develop new talent and transfer regional skills** from legacy industries to new roles in energy transition	Filling decarbonization-lever jobs is essential to regional transition; greater regional economic benefit if filled by local workforce	**We need to do the right thing by growing jobs in our region. Then companies can work towards making sure those jobs and positions are filled in an equitable way. We have not done that well in the past** – Social sector leader
 **Physical infrastructure**	**Build interdependent network of infrastructure across multiple technologies** (e.g., CO_2 pipeline, CCS, EV charging, solar installations, etc.)	Energy transition relies on timely and coordinated capital project execution. Critical path items include siting, designing, planning, permitting, etc.	**We have the existing infrastructure to transport carbon. However, sequestration is where the states and federal government need to come together** – Private sector leader

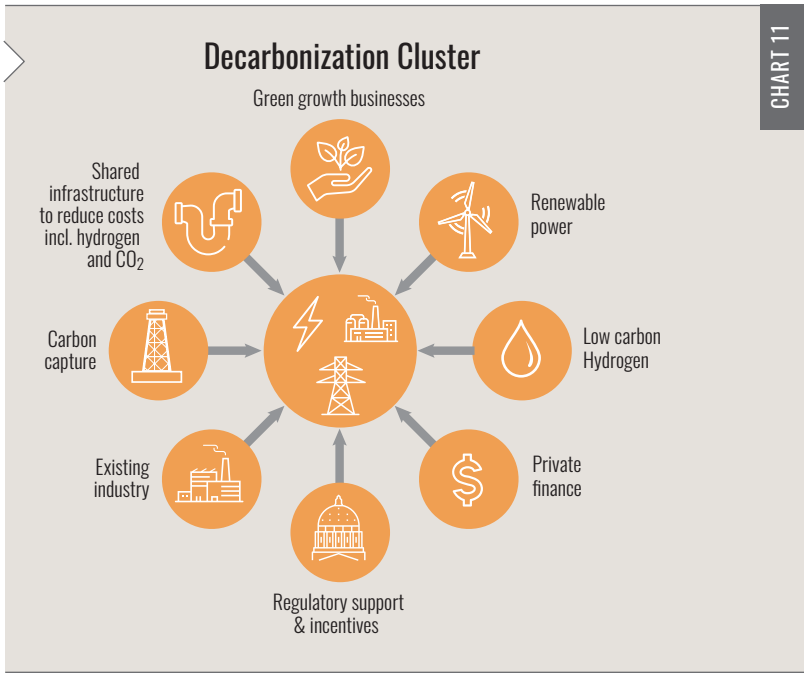
SECTION
06

Conclusion

The Energy Transition is critical to the future competitiveness of the Pittsburgh region, and it will require collaboration among government, industry and academia to fully realize our potential. As detailed in the graphic to the right, among the many elements required to develop a decarbonization cluster are incorporating technology, infrastructure, financing and regulatory support. All the elements must be brought together and sequenced to allow for build-out over time. New business models and delivery vehicles will also need to be established.

Much as our region became known worldwide for environmental transformation in the middle of the 20th century and economic transformation soon after the turn of the century, we can establish leadership in energy transformation in the 21st century, and position ourselves to compete in the cleaner, lower-carbon world to come.

CHART 11



Appendix

Prioritizing the strategic levers: Allegheny Conference Energy Task Force survey responses

Survey question #1 – Most important outcomes for a Regional Energy Transition Strategy?

#1 Reduction in GHG emissions

#1 Economic growth

#3 Job creation

Survey question #2 - What are highest priority levers for regional decarbonization? [select top 3]

#1 Hydrogen production

#2 Decarbonization of power via CCUS

#2 Decarbonization of power via nuclear

#3 Industrial process decarbonization

Survey question #3 - What are the biggest decarbonization-enabling markets we can win? [select top 5]

#1 Hydrogen

#2 Nuclear energy

#3 Detection & reduction of methane leaks

#3 Microgrids & resiliency

#4 CO_2 capture infrastructure

#5 Building energy efficiency

Allegheny Conference on Community Development

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